

## 2003

## Annual Tropical Cyclone Report

U.S. Naval Pacific Meteorology and Oceanography Center/ Joint Typhoon Warning Center

Pearl Harbor, Hawaii


Stiched MODIS true color image of four tropical cyclones in the South Indian Ocean on 12 February 2003 taken between 0400 Z and 1010Z. From west to east, TC 16S (Gerry), TC 17S (Hape), TC 18S (Isha) and TC 14S (Fiona). Image courtesy of MODIS Rapid Response Team, NASA Goddard Space Flight Center.

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file:///C|/Documents\%20and\%20Settings/All\%20Users/Documents/ATCR_2003\%20GoLive/ATCR_2003\%20folder/ATCR_2003/index.html (1 of 3) [4/10/2005 11:18:58 AM]

2003 Annual Tropical Cyclone Report


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| :---: | :---: |
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| Director, Joint Typhoon Warning Center |  |
| LT A.C. (Christy) Bryant, USN - Editor |  | OCEAN TROPICAL CYCLONES



2003 Annual Tropical Cyclone Report

| TC 12P Beni TC 13P Cilla TC 14S Fiona TC 15P Dovi TC 16S Gerry TC 17S Hape TC 18S Isha TC 19S Japhet TC 20S Graham TC 21S Harriet TC 22P Erica TC 23S Kalunde TC 24S Craig TC 25P Eseta TC 26S Inigo TC 27P Fili TC 28S Manou TC 29P Gina |  |
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| 3.12003 SEASON |  |
| 4. SUMMARY OF FORECAST |  |
| VERIFICATION | 甲 |
| 4.1 ANNUAL FORECAST VERIFICATION |  |
| 4.2 TESTING AND RESULTS |  |

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## Completed by Direction of:

## Peter Furze

## Captain, United States Navy

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## Amanda Preble

## Director, Joint Typhoon Warning Center

LT A. C. (Christy) Bryant, USN - Editor

## EDITOR'S NOTE

The production of the Annual Tropical Cyclone Report (ATCR) has always been a time and resource intensive project and, with 2003, the time has come for this to change. In a time of decreasing budgets and fewer personnel, the ATCR may have become a thing of the past. In an effort to continue to provide this information to the customers and researchers that use it, several changes have been made that reflect changing technology while meeting the needs of the user. This is the first step towards a more streamlined ATCR that can be updated quickly and reach the user sooner.

First, the format is new and different. Our previous format was based on the premise that a final product would be a printed version. Since our users primarily use electronic format, we have taken a major step towards a primarily electronic finished product. Depending on the feedback we receive from those who use this year's document, this format may change even further.

Expanding menus indicated by plus (+) and minus (-) signs in the frame on the left side of the screen should make navigation of the ATCR easier for most users. Simply click any (+) sign to open a menu another level.

Updates to the ATCR will be relatively frequent and occur whenever a storm review is complete or when new data is made available. To communicate updates, there is a banner on the cover page that will indicate the latest update and the date of the update.

All the chapters that our users have become familiar with still exist, with the exception of Chapter 6: Research, however they have been re-organized and combined. Instead of a Chapter 5: TC Verification, the verification information for each storm has been included on an expanded storm summary page.

We understand that there is still a need to print the ATCR, but less frequently the entire book. More often, a single storm is needed or a specific selection of data. To maximize the ease with which this is done, print friendly icons will exist on every storm page that will open a .pdf file of that page, ready for print. You can download Adobe Acrobat Reader, free of charge, from the Adobe website.

By starting over, from the ground up, JTWC hopes to provide our users with what they need in a timely manner and in a format that is convenient for the largest percentage of users. During the coding for this, I deliberately left the html code unconcealed in any way. If you like any part of it, please feel free to adapt the basic html code for your own purposes. Feedback is much appreciated and significant feedback may help shape this product in future years. You can

Special thanks for this ATCR go to Captain S. Vilpors, who passed on much guidance on what was really needed and provided statistics, TSgt R. Jacobs, who provided most of the graphics used for the storms, and AG2 L. Kelsey, who created best track images for every storm.

LT A. C. Bryant, USN
Editor, 2003 ATCR

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| TROPICAL CYCLONES |
| 1.2 NORTH INDIAN OCEAN TROPICAL |
| CYCLONES |
| PACIFIC AND NORTH INDIAN OCEAN |
| TROPICAL CYCLONES |

TS 01W Yanyan
TY 02W Kujira
TD 03W
TY 04W Chan-Hom
TS 05W Linfa
TS 06W Nangka
TY 07W Soudelor
TY 08W Koni
STY 09W Imbudo
TY 10W Morakot
TY 11W Etau
TY 12W Krovanh
TS 13W Vamco
TY 14W Dujuan


| TC 14S Fiona TC 15P Dovi TC 16S Gerry TC 17S Hape TC 18S Isha TC 19S Japhet TC 20S Graham TC 21S Harriet TC 22P Erica TC 23S Kalunde TC 24S Craig TC 25P Eseta TC 26S Inigo TC 27P Fili TC 28S Manou TC 29P Gina |
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## 1. SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

### 1.1 WESTERN NORTH PACIFIC OCEAN TROPICAL CYCLONES

## All Information for Northwestern Pacific Not Yet Complete

Tropical cyclone genesis regions compared to the 15-year average are shown in Figure 1-1. This year's tropical cyclones are listed in Table 1-1. Table 1-2 shows the monthly distribution of tropical cyclones for each year since 1959 and Table 1-3 shows the monthly average occurrence of tropical storms separated into: (1) typhoons only; and (2) tropical storms and typhoons. A summary of this year's Tropical Cyclone Formation Alerts is shown in Table 1-4. The annual number of tropical cyclones of tropical storm strength and higher appear in Figure 1-2, while the number of super typhoons are shown in Figure 1-3. Figure 1-4 represents a composite of the 45 year average for tropical cyclones. Composites of the tropical cyclone best tracks for the western North Pacific appear following Figure 1-4.


Figure 1-1. Comparison of the number of tropical cyclones that developed within 3 designated areas for 2000 through 2003 and the 15-year average.

| Table 1-1 <br> WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES FOR 2003 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| (01 JAN 2003-31 DEC 2003) |  |  |  |  |  |
| TC | NAME * | PERIOD | WARNINGS ISSUED | EST MAX SFC WINDS KTS (M/SEC) | $\begin{aligned} & \text { MSLP } \\ & (\mathrm{MB})^{* *} \end{aligned}$ |
| TS 01W | YanYan | 15JAN-21JAN | 22 | 50 (25) | 987 |
| STY 02W | Kujira | 09APR-22APR | 66 | 135 (68) | 904 |
| TD 03W |  | 17MAY-20MAY | 11 | 30 (15) | 1000 |
| TY 04W | Chan-hom | 19MAY-27MAY | 33 | 115 (58) | 927 |
| TS 05W | Linfa | 25MAY-30MAY | 24 | 60 (30) | 980 |
| TS 06W | Nangka | 31MAY-03JUN | 11 | 50 (25) | 987 |
| TY 07W | Soudelor | 11JUN-18JUN | 33 | 115 (58) | 927 |
| TY 08W | Koni | 15JUL-22JUL | 30 | 65 (33) | 976 |
| STY 09W | Imbudo | 16JUL-24JUL | 32 | 130 (65) | 910 |
| TY 10W | Morakot | 01AUG-05AUG | 15 | 65 (33) | 976 |
| TY 11W | Etau | 02AUG-09AUG | 28 | 110 (55) | 933 |
| TY 12W | Krovanh | 15AUG-26AUG | 40 | 90 (45) | 954 |
| TS 13W | Vamco | 19AUG-20AUG | 7 | 35 (18) | 997 |
| TY 14W | Dujuan | 28AUG-03SEP | 24 | 125 (63) | 916 |
| STY 15W | Maemi | 05SEP-13SEP | 31 | 150 (75) | 885 |
| TY 16W | Choi-Wan | 17SEP-22SEP | 21 | 95 (48) | 949 |
| TY 17W | Koppu | 24SEP-30SEP | 24 | 90 (45) | 954 |
| TD 18W |  | 06OCT-100CT | 15 | 25 (13) | 1002 |
| TD 19W |  | 120CT-130CT | 5 | 30 (15) | 1000 |
| TY 20W | Ketsana | 180CT-260CT | 30 | 125 (63) | 916 |
| TY 21W | Parma | 200CT-310CT | 44 | 130 (65) | 910 |
| TD 22W |  | 220CT-230CT | 7 | 25 (13) | 1002 |
| TS 23W |  | 230CT-280CT | 14 | 35 (18) | 997 |
| TY 24W | Melor | 300CT-04NOV | 20 | 70 (35) | 972 |
| TY 25W | Nepartak | 12NOV-19NOV | 29 | 75 (38) | 967 |


| STY 26W | Lupit | 20NOV-01DEC | 47 | $145(73)$ | 891 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| TS 27W |  | 24DEC-27DEC | 15 | $35(18)$ | 997 |
|  |  |  |  |  |  |
|  |  | TOTAL \# | 678 |  |  |
|  |  |  |  |  |  |
| * As Designated by WMO authorized RSMC |  |  |  |  |  |
| ** MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure <br> relationship |  |  |  |  |  |



|  | 000 | 000 | 000 | 100 | 200 | 100 | 310 | 531 | 532 | 112 | 122 | 101 | 20108 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1967 | 1 | 0 | 2 | 1 | 1 | 1 | 8 | 10 | 8 | 4 | 4 | 1 | 41 |
|  | 010 | 000 | 110 | 100 | 010 | 100 | 332 | 343 | 530 | 211 | 400 | 10 | 20156 |
| 1968 | 0 | 1 | 0 | 1 | 0 | 4 | 3 | 8 | 4 |  | 4 |  | 31 |
|  | 00 | 00 | 00 | 10 | 000 | 20 | 12 | 34 | 40 | 51 | 400 | 000 | 20 |
| 1969 | 1 | 0 | 1 | 1 | 0 | 0 | 3 | 3 | 6 | 5 | 2 | 1 | 23 |
|  | 100 | 000 | 01 | 100 | 000 | 00 | 21 | 210 | 20 | 10 | 11 | 010 | 13 |
| 1970 | 0 | 1 | 0 | 0 | 0 | 2 | 3 |  | 4 | 6 | 4 | 0 | 27 |
|  | 000 | 10 | 00 | 000 | 000 | 11 | 02 | 42 | 22 | 32 | 13 | 000 | 12 |
| 1971 | 1 | 0 | 1 | 2 | 5 | 2 | 8 | 5 | 7 | 4 | 2 | 0 | 37 |
|  | 01 | 000 | 010 | 200 | 230 | 200 | 620 | 31 | 511 | 310 | 110 | 000 | 241 |
| 1972 | 1 | 0 | 1 | 0 | 0 | 4 | 5 | 5 | 6 | 5 | 2 | 3 | 32 |
|  | 100 | 000 | 001 | 00 | 000 | 22 | 41 | 32 | 41 | 41 | 200 | 210 | 22 |
| 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 6 | 3 | 4 | 3 | 0 | 23 |
|  | 000 | 000 | 000 | 000 | 000 | 000 | 430 | 23 | 20 | 400 | 030 | 000 | 1292 |
| 1974 | 1 | 0 | 1 | 1 | 1 | 4 | 5 | 7 | 5 | 4 | 4 | 2 | 35 |
|  | 010 | 00 | 10 | 010 | 100 | 12 | 3 | 23 | 32 | 400 | 20 | 020 | 51 |
| 1975 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 6 | 5 | 6 | 3 | 2 | 25 |
|  | 10 | 000 | 000 | 001 | 000 | 000 | 01 | 41 | 41 | 32 | 21 | 020 | 146 |
| 1976 | 1 | 1 | 0 | 2 | 2 | 2 | 4 | 4 | 5 | 0 | 2 | 2 | 25 |
|  | 100 | 010 | 000 | 110 | 200 | 200 | 220 | 130 | 410 | 000 | 110 | 020 | 141 |
| 1977 | 0 | 0 | 1 | 0 | 1 | 1 | 4 | 2 | 5 | 4 | 2 | 1 | 21 |
|  | 00 | 000 | 010 | 000 | 001 | 010 | 30 | 02 | 230 | 310 | 200 | 100 | 118 |
| 1978 | 1 | 0 | 0 | 1 | 0 | 3 | 4 | 8 | 4 | 7 | 4 | 0 | 32 |
|  | 01 | 00 | 00 | 10 | 000 | 03 | 31 | 341 | 310 | 41 | 12 | 000 | 15 |
| 1979 | 1 | 0 | 1 | 1 | 2 | 0 | 5 | 4 | 6 | 3 | 2 | 3 | 28 |
|  | 10 | 000 | 100 | 100 | 011 | 00 | 22 | 20 | 33 | 210 | 110 | 11 | 1495 |
| 1980 | 0 | 0 | 1 | 1 | 4 | 1 | 5 | 3 | 7 | 4 | 1 | 1 | 28 |
|  | 000 | 000 | 00 | 010 | 220 | 010 | 31 | 20 | 51 | 220 | 10 | 01 | 1594 |
| 1981 | 0 | 0 | 1 | 1 | 1 | 2 | 5 | 8 | 4 | 2 | 3 | 2 | 29 |
|  | 000 | 00 | 100 | 10 | 010 | 200 | 230 | 25 | 400 | 110 | 21 | 00 | 1612 |
| 1982 | 0 | 0 | 3 | 0 | 1 | 3 | 4 | 5 | 6 | 4 | 1 | 1 | 28 |
|  | 000 | 000 | 210 | 000 | 100 | 120 | 220 | 500 | 321 | 301 | 100 | 100 | 197 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 3 | 5 | 5 | 2 | 25 |
|  | 0 | 000 | 000 | 000 | 00 | 01 | 30 | 23 | 11 | 320 | 320 | 020 | 1211 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 7 | 4 | 8 | 3 | 1 | 30 |
|  | 000 | 000 | 000 | 000 | 000 | 020 | 410 | 232 | 130 | 521 | 300 | 100 | 161 |
| 1985 | 2 | 0 | 0 | 0 | 1 | 3 | 1 | 7 | 5 | 5 | 1 | 2 | 27 |
|  | 020 | 000 | 00 | 0 | 0 | 201 | 100 | 520 | 320 | 410 | 010 | 110 | 1791 |


| 1986 | 0 | 1 | 0 | 1 | 2 | 2 | 2 | 5 | 2 | 5 | 4 | 3 | 27 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 000 | 100 | 000 | 100 | 110 | 110 | 200 | 410 | 200 | 320 | 220 | 210 | 1980 |
| 1987 | 1 | 0 | 0 | 1 | 0 | 2 | 4 | 4 | 7 | 2 | 3 | 1 | 25 |
|  | 100 | 000 | 000 | 010 | 000 | 110 | 400 | 310 | 511 | 200 | 120 | 100 | 1861 |
| 1988 | 1 | 0 | 0 | 0 | 1 | 3 | 2 | 5 | 8 | 4 | 2 | 1 | 27 |
|  | 100 | 000 | 000 | 000 | 100 | 111 | 110 | 230 | 260 | 400 | 200 | 010 | 14121 |
| 1989 | 1 | 0 | 0 | 1 | 2 | 2 | 6 | 8 | 4 | 6 | 3 | 2 | 35 |
|  | 010 | 000 | 000 | 100 | 200 | 110 | 231 | 332 | 220 | 600 | 300 | 101 | 21104 |
| 1990 | 1 | 0 | 0 | 1 | 2 | 4 | 4 | 5 | 5 | 5 | 4 | 1 | 32 |
|  | 100 | 000 | 000 | 010 | 110 | 211 | 220 | 500 | 410 | 230 | 310 | 100 | 21101 |
| 1991 | 0 | 0 | 2 | 1 | 1 | 1 | 4 | 8 | 6 | 3 | 6 | 0 | 32 |
|  | 000 | 000 | 110 | 010 | 100 | 100 | 400 | 332 | 420 | 300 | 330 | 000 | 20102 |
| 1992 | 1 | 1 | 0 | 0 | 0 | 3 | 4 | 8 | 5 | 6 | 5 | 0 | 33 |
|  | 100 | 010 | 000 | 000 | 000 | 210 | 220 | 440 | 410 | 510 | 311 | 000 | 21111 |
| 1993 | 0 | 0 | 2 | 2 | 1 | 2 | 5 | 8 | 5 | 6 | 4 | 3 | 38 |
|  | 000 | 000 | 011 | 002 | 010 | 101 | 320 | 611 | 410 | 321 | 112 | 300 | 2198 |
| 1994 | 1 | 0 | 1 | 0 | 2 | 2 | 9 | 9 | 8 | 7 | 0 | 2 | 41 |
|  | 001 | 000 | 100 | 000 | 101 | 020 | 342 | 630 | 440 | 511 | 000 | 110 | 21155 |
| 1995 | 1 | 0 | 0 | 0 | 1 | 2 | 3 | 7 | 7 | 8 | 2 | 3 | 34 |
|  | 001 | 000 | 000 | 000 | 010 | 020 | 210 | 421 | 412 | 512 | 020 | 012 | 15118 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 0 | 7 | 10 | 7 | 5 | 6 | 3 | 43 |
|  | 001 | 001 | 000 | 011 | 110 | 000 | 610 | 433 | 610 | 212 | 132 | 111 | 211210 |
| 1997 | 1 | 0 | 0 | 2 | 3 | 3 | 4 | 8 | 4 | 6 | 1 | 1 | 33 |
|  | 010 | 000 | 000 | 110 | 120 | 300 | 310 | 611 | 310 | 411 | 100 | 100 | 2382 |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 8 | 6 | 3 | 4 | 27 |
|  | 000 | 000 | 000 | 000 | 000 | 000 | 012 | 210 | 413 | 213 | 030 | 112 | 9810 |
| 1999 | 1 | 1 | 0 | 3 | 0 | 1 | 5 | 9 | 6 | 2 | 3 | 3 | 34 |
|  | 010 | 010 | 000 | 210 | 000 | 100 | 113 | 423 | 240 | 110 | 111 | 003 | 121210 |
| 2000 | 0 | 0 | 0 | 0 | 4 | 0 | 8 | 9 | 6 | 3 | 3 | 1 | 34 |
|  | 000 | 000 | 000 | 000 | 112 | 000 | 233 | 432 | 411 | 210 | 111 | 100 | 15109 |
| 2001 | 0 | 1 | 0 | 1 | 1 | 2 | 6 | 7 | 5 | 3 | 3 | 4 | 33 |
|  | 000 | 001 | 000 | 001 | 010 | 200 | 411 | 331 | 500 | 300 | 120 | 220 | 2094 |
| 2002 | 1 | 1 | 1 | 1 | 2 | 3 | 6 | 8 | 3 | 5 | 1 | 1 | 33 |
|  | 010 | 100 | 001 | 001 | 101 | 300 | 321 | 431 | 120 | 302 | 100 | 100 | 1887 |
| 2003 | 1 | 0 | 0 | 1 | 3 | 2 | 2 | 5 | 3 | 6 | 3 | 1 | 27 |
|  | 010 | 000 | 000 | 100 | 111 | 110 | 200 | 410 | 300 | 213 | 300 | 010 | 1764 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (1959-2003) |  |  |  |  |  |  |  |  |  |  |  |  |  |


| MEAN | 0.6 | 0.3 | 0.5 | 0.8 | 1.3 | 2.0 | 4.6 | 6.6 | 5.6 | 4.7 | 2.9 | 1.6 | 31.7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| CASES | 26 | 14 | 24 | 37 | 60 | 90 | 209 | 299 | 254 | 213 | 130 | 72 | 1427 |

The criteria used in TABLE 12 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

| Table 1-2 Legend: |  |  |
| :--- | :---: | :---: |
| Total month/year |  |  |
| GTE 64 knots <br> (Typhoon) | 35 to 63 knots <br> (Tropical Storm) | LTE 34 knots <br> (Tropical <br> Depression) |

## TABLE 1-3 WESTERN NORTH PACIFIC TROPICAL CYCLONES

## TYPHOONS (1945-1959)

|  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| MEAN | 0.3 | 0.1 | 0.3 | 0.4 | 0.7 | 1 | 2.9 | 3.1 | 3.3 | 2.4 | 2 | 0.9 | 16.4 |
| CASES | 5 | 1 | 4 | 6 | 10 | 15 | 29 | 46 | 49 | 36 | 30 | 14 | 245 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TYPHOONS (1960-2003) |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |
| MEAN | 0.2 | 0.1 | 0.2 | 0.4 | 0.7 | 1.1 | 2.7 | 3.5 | 3.4 | 3.1 | 1.6 | 0.7 | 17.6 |
| CASES | 10 | 3 | 8 | 19 | 30 | 48 | 119 | 153 | 148 | 137 | 70 | 31 | 776 |


|  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| MEAN | 0.4 | 0.1 | 0.5 | 0.5 | 0.8 | 1.6 | 2.9 | 4 | 4.2 | 3.3 | 2.7 | 1.2 | 22.2 |
| CASES | 6 | 2 | 7 | 8 | 11 | 22 | 44 | 60 | 64 | 49 | 41 | 18 | 332 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TROPICAL STORMS AND TYPHOONS (1960-2003) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTALS |  |
| MEAN | 0.5 | 0.2 | 0.4 | 0.7 | 1.1 | 1.8 | 4.1 | 5.6 | 5 | 4.1 | 2.6 | 1.3 | 27.5 |
| CASES | 23 | 10 | 17 | 30 | 50 | 78 | 182 | 246 | 221 | 181 | 116 | 56 | 1210 |

## TABLE 1-4

TROPICAL CYCLONE FORMATION ALERTS FOR THE
WESTERN NORTH PACIFIC OCEAN FOR 1976-2003

| YEAR | INITIAL <br> TCFAS | TROPICAL <br> CYCLONES <br> WITH <br> TCFAS | TOTAL <br> TROPICAL <br> CYCLONES | PROBABILITY <br> OF TCFA <br> WITHOUT <br> WARNING* | PROBABILITY <br> OF TCFA <br> BEFORE <br> WARNING |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 1976 | 34 | 25 | 25 | $26 \%$ | $100 \%$ |
| 1977 | 26 | 20 | 21 | $23 \%$ | $95 \%$ |
| 1978 | 32 | 27 | 32 | $16 \%$ | $84 \%$ |
| 1979 | 27 | 23 | 28 | $15 \%$ | $82 \%$ |
| 1980 | 37 | 28 | 28 | $24 \%$ | $100 \%$ |
| 1981 | 29 | 28 | 29 | $3 \%$ | $96 \%$ |
| 1982 | 36 | 26 | 28 | $28 \%$ | $93 \%$ |
| 1983 | 31 | 25 | 25 | $19 \%$ | $100 \%$ |
| 1984 | 37 | 30 | 30 | $19 \%$ | $100 \%$ |
| 1985 | 39 | 26 | 27 | $33 \%$ | $96 \%$ |

1. SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

| 1986 | 38 | 27 | 27 | 29\% | 100\% |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1987 | 31 | 24 | 25 | 23\% | 96\% |
| 1988 | 33 | 26 | 27 | 21\% | 96\% |
| 1989 | 51 | 32 | 35 | 37\% | 91\% |
| 1990 | 33 | 30 | 31 | 9\% | 97\% |
| 1991 | 37 | 29 | 31 | 22\% | 94\% |
| 1992 | 36 | 32 | 32 | 11\% | 100\% |
| 1993 | 50 | 35 | 38 | 30\% | 92\% |
| 1994 | 50 | 40 | 40 | 20\% | 100\% |
| 1995 | 54 | 33 | 35 | 39\% | 94\% |
| 1996 | 41 | 39 | 43 | 5\% | 91\% |
| 1997 | 36 | 30 | 33 | 17\% | 91\% |
| 1998 | 38 | 18 | 27 | 53\% | 67\% |
| 1999 | 39 | 29 | 33 | 26\% | 88\% |
| 2000 | 40 | 31 | 34 | 23\% | 91\% |
| 2001 | 34 | 28 | 33 | 18\% | 82\% |
| 2002 | 39 | 31 | 33 | 21\% | 94\% |
| 2003 | 31 | 27 | 27 | 1\% | 100\% |
| $\begin{array}{\|l\|} \hline(1976- \\ 2003) \end{array}$ |  |  |  |  |  |
| MEAN: | 37.1 | 28.5 | 30.6 | 21.82\% | 93.21\% |
| TOTALS: | 1039 | 779 | 857 |  |  |
| * Percentage of initial TCFAs not followed by warnings. |  |  |  |  |  |



Figure 1-2. Tropical cyclones of tropical storm or greater intensity in the western North Pacific (19592003).


Figure 1-3. Number of western North Pacific super typhoons (1959-2003).

NWPAC Monthly Tropical Cyclone Climatology (1959-2003)


Figure 1-4. Average monthly tropical cyclones of all strengths (1959-2003).





## Go To: Chapter 1.2 North Indian Tropical Cyclones

### 1.2 NORTH INDIAN OCEAN TROPICAL CYCLONES

Tropical cyclone genesis regions are compared to the overall 25-year average in Figure 1-4. This year's North Indian Ocean tropical cyclones are listed in Table 1-5. The monthly distribution of tropical cyclones for each year since 1975 is shown in Table 1-6. Composites of the tropical cyclone best tracks for the Northern Indian Ocean appear following Table 1-6.


Figure 1-5. Comparison of the number of tropical cyclones that developed in Bay of Bengal and Arabian Sea for 2000 through 2003 and the 25 -year average.

Table 1-5
NORTH INDIAN OCEAN SIGNIFICANT TROPICAL CYCLONES FOR 2003
(01 JAN 2003-31 DEC 2003)

| TC | NAME | PERIOD | WARNINGS <br> ISSUED | EST MAX SFC <br> WINDS <br> KTS (M/SEC) | MSLP <br> $(\text { MB })^{*}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 01B | - | 10 May - 19 May | 15 | $65(33)$ | 976 |
| 02A | - | 12 Nov - 15 Nov | 11 | $85(44)$ | 958 |
| 03B | - | 12 Dec - 15 Dec | 5 | $55(28)$ | 984 |
|  |  |  |  |  |  |
|  |  | JTWC Total | 33 |  |  |
| *MSLP Converted from estimated maximum surface winds using Atkinson/Holiday <br> wind-pressure relationship |  |  |  |  |  |



|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 010 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 010 | 000 | 110 | 140 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1978 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 4 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 010 | 200 | 000 | 220 |
| 1979 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 2 | 0 | 7 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 100 | 010 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 011 | 010 | 011 | 000 | 142 |
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 010 | 020 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 3 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 010 | 000 | 100 | 100 | 210 |
| 1982 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 5 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 100 | 010 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 020 | 100 | 000 | 230 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 3 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 010 | 000 | 010 | 010 | 000 | 030 |
| 1984 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 4 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 010 | 200 | 000 | 220 |
| 1985 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 6 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 020 | 000 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 020 | 010 | 010 | 060 |


| 1986 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & 01 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 020 | 000 | 030 |
| 1987 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 2 | 8 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 010 | 000 | 000 | 000 | 020 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 020 | 010 | 020 | 080 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 5 |
|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 000 | 010 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 010 | 110 | 010 | 140 |
| 1989 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 010 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 100 | 000 | 120 |
| 1990 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 001 | 100 | 000 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 001 | 010 | 112 |
| 1991 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
|  | $\begin{aligned} & 01 \\ & 0 \end{aligned}$ | 000 | 000 | 100 | 000 | 010 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 100 | 000 | 220 |
| 1992 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 3 | 3 | 2 | 13 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 100 | 020 | $\begin{aligned} & 01 \\ & 0 \end{aligned}$ | 000 | 001 | 021 | 210 | 020 | 382 |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 200 | 000 | 200 |
| 1994 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 5 |


|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 010 | 100 | 000 | 010 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 010 | 010 | 000 | 140 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 4 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 000 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 010 | 010 | 200 | 000 | 220 |
| 1996 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 2 | 2 | 0 | 8 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 010 | 120 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 110 | 200 | 000 | 440 |
| 1997 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 4 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 100 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 100 | 010 | 010 | 000 | 220 |
| 1998 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 2 | 1 | 8 |
|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 110 | 100 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 010 | 010 | 200 | 100 | 530 |
| 1999 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 5 |
|  | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 010 | 000 | 000 | 100 | 010 | $\begin{aligned} & 00 \\ & 0 \end{aligned}$ | 000 | 000 | 200 | 000 | 000 | 320 |
| 2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 4 |
|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 000 | 000 | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 020 | 100 | 010 | 130 |
| 2001 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 4 |
|  | $\begin{array}{ll} 0 & 0 \\ 0 \end{array}$ | 000 | 000 | 000 | 100 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 010 | 010 | 001 | 000 | 121 |
| 2002 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 5 |
|  | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 020 | 000 | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | 000 | 000 | 000 | 020 | 010 | 050 |


| 2003 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | 00 <br> 0 | 000 | 000 | 000 | 100 | 000 | 00 <br> 0 | 000 | 000 | 000 | 100 | 010 | 210 |
| (1975-2003) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MEAN | 0.1 | 0.1 | 0 | 0.1 | 0.7 | 0.6 | 0 | 0 | 0.3 | 1 | 1.3 | 0.6 | 5 |
| CASES | 3 | 2 | 1 | 4 | 21 | 17 | 1 | 1 | 9 | 28 | 39 | 16 | 142 |

The criteria used in TABLE 1-6 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

## Table 1-6 Legend:

Total month/year
GTE 64 knots
(Typhoon)

35 to 63 knots (Tropical Storm)

LTE 34 knots
(Tropical Depression)



## Tropical Storm (TS) 01W (Yan-Yan)

First Poor : 0600Z 11 Jan 03
First Fair : 2330Z 12 Jan 03
First TCFA : 1600Z Jan 03
First Warning : 1800Z 15 Jan 03
Last Warning : 0000Z Jan 03
Max Intensity : 50 kts, gusts to 65 kts
Landfall : None
Total Warnings : 22
Remarks:

1) The first Northwest Pacific Ocean significant tropical cyclone of 2003, Tropical Storm (TS) 01W, developed in the near-equatorial trough east of Tarawa Island. After an initial westward track at 5 to 7 knots, the cyclone accelerated northwestwards towards Guam at speeds of 15 to 21 knots and slowly intensified. The first warning was issued on 15 January at $1800 Z$ when the cyclone was located approximately 150 nm east of Pohnpei Island.

For approximately 72 hours after the initial warning, the cyclone continued on a west-northwestward course, with a track speed between 13 and 18 knots. Around 000Z on 18 January, 01W slowed in track as a mid-latitude cyclone over Japan weakened the subtropical ridge allowing the cyclone to sharply recurve to the northeast and attain a maximum intensity of 50 knots.

Around $0000 Z$ on 20 January, satellite data indicated that the low level circulation center was becoming decoupled from the convection. Subsequently, TS 01W quickly weakened over water due to strong vertical wind shear and cool sea surface temperatures and the final warning was issued at 1200Z, just 12 hours later.
2) No damage reports were received, with closest point of approach to Guam being 115 nm to the eastnortheast and 85 nm to the southeast of Saipan.
*Named by WMO designated RSMC

Statistics for JTWC on TS01W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03011106 |  | 1.9 N | 179.8W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011112 |  | 1.9 N | 179.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011118 |  | 1.9 N | 179.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011200 |  | 1.8 N | 178.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011206 |  | 1.6 N | 178.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011212 |  | 1.3 N | 177.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011218 |  | 1.6 N | 177.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011300 |  | 1.9 N | 176.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011306 |  | 2.4 N | 176.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011312 | 1 | 3.1 N | 175.1E | 15 | 102 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011318 | 2 | 4.1 N | 173.4E | 20 | 123 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |
| 03011400 | 3 | 5.1 N | 171.5E | 25 | 61 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011406 | 4 | 5.7 N | 169.7E | 25 | 69 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011412 | 5 | 5.8N | 168.2E | 25 | 224 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011418 | 6 | 5.6N | 166.8E | 25 | 204 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011500 | 7 | 5.4N | 165.6E | 25 | 23 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011506 | 8 | 6.0 N | 164.1E | 25 | 45 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011512 | 9 | 6.7 N | 162.5E | 25 | 46 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011518 | 10 | 7.3N | 160.8E | 30 | 8 | 8 | 24 | 43 | 88 | 221 |  |  | 0 | 5 | 10 | 10 | 15 | 10 |  |  |
| 03011600 | 11 | 7.9N | 159.2E | 30 | 26 | 22 | 49 | 84 | 114 | 207 |  |  | 0 | 5 | 5 | 10 | 5 | 0 |  |  |
| 03011606 | 12 | 8.5N | 157.8E | 30 | 21 | 12 | 31 | 48 | 69 | 211 |  |  | 5 | 0 | 0 | 5 | 0 | - 10 |  |  |
| 03011612 | 13 | 8.8N | 156.3E | 30 | 37 | 35 | 48 | 69 | 21 |  |  |  | 0 | -5 | -5 | - 15 | - 20 |  |  |  |
| 03011618 | 14 | 9.4 N | 154.7E | 30 | 33 | 83 | 103 | 122 | 69 | 216 |  |  | 0 | -5 | -5 | $10$ | - | 0 |  |  |
| 03011700 | 15 | 10.0N | 153.0E | 35 | 5 | 27 | 59 | 25 | 123 | 197 | 206 |  | 0 | 5 | 0 | 0 | 0 | 15 | 15 |  |
| 03011706 | 16 | 10.9 N | 151.4E | 35 | 18 | 25 | 41 | 55 | 183 | 430 |  |  | 0 | 0 | -5 | - | 0 | 15 |  |  |
| 03011712 | 17 | 11.7 N | 149.9E | 30 | 26 | 65 | 63 | 65 | 180 | 471 | 559 |  | 0 | -5 | - | - | 0 | 10 | 0 |  |
| 03011718 | 18 | 12.4 N | 148.5E | 35 | 5 | 19 | 61 | 168 | 266 | 411 |  |  | 0 | $10$ | - 15 | -5 | 0 | 15 |  |  |
| 03011800 | 19 | 13.2 N | 147.4E | 40 | 18 | 89 | 188 | 246 | 267 | 290 |  |  | 0 | 0 | 5 | 10 | 5 | 15 |  |  |


| 03011806 | 20 | 13.7 N | 146.7E | 45 | 16 | 52 | 136 | 171 | 224 | 205 |  | 0 | 0 | 5 | 5 | 5 | 15 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03011812 | 21 | 14.1 N | 146.8E | 45 | 13 | 93 | 139 | 168 | 212 | 69 |  | 0 | $10$ | -5 | $10$ | $10$ | 5 |  |  |
| 03011818 | 22 | 14.3 N | 147.4E | 50 | 8 | 17 | 55 | 112 | 127 |  |  | -5 | -5 | -5 | -5 | -5 |  |  |  |
| 03011900 | 23 | 14.5 N | 148.2E | 50 | 8 | 42 | 108 | 169 | 146 |  |  | 0 | 5 | 0 | 0 | 5 |  |  |  |
| 03011906 | 24 | 14.8 N | 149.0E | 45 | 13 | 79 | 164 | 229 | 199 |  |  | 0 | 0 | 0 | 0 | 5 |  |  |  |
| 03011912 | 25 | 15.4 N | 149.9E | 40 | 5 | 63 | 118 | 80 | 13 |  |  | 0 | -5 | -5 | 0 | 0 |  |  |  |
| 03011918 | 26 | 16.1 N | 150.9E | 40 | 0 | 55 | 99 | 46 |  |  |  | 0 | 0 | 0 | 5 |  |  |  |  |
| 03012000 | 27 | 16.7 N | 152.0E | 40 | 0 | 57 | 49 | 49 |  |  |  | 0 | 0 | 5 | 5 |  |  |  |  |
| 03012006 | 28 | 17.2 N | 153.4E | 35 | 12 | 47 | 24 |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03012012 | 29 | 17.6N | 154.8E | 35 | 28 | 25 | 62 |  |  |  |  | -5 | 0 | 0 |  |  |  |  |  |
| 03012018 | 30 | 18.0 N | 155.9E | 30 | 18 | 105 |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03012100 | 31 | 18.2 N | 156.3E | 25 | 12 | 19 |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03012106 |  | 18.4 N | 156.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012112 |  | 18.5 N | 156.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 40 | 47 | 81 | 108 | 144 | 266 | 383 | 1 | 3 | 5 | 7 | 6 | 10 | 8 |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | 0 | -1 | -1 | -1 | -1 | 8 | 8 |  |
|  |  |  | \# CASES |  | 31 | 22 | 20 | 18 | 16 | 11 | 2 | 31 | 22 | 20 | 18 | 16 | 11 | 2 |  |



Figure 1-01W-1. $182230 Z$ January 2003 GMS-5 color composite SSM/I imagery of TY 01W (Yanyan), located 120 nm east of the Guam, with an estimated intensity of 50 knots.

TROPICAL STORM 01W (YAN-YAN)
15-21 JANUARY 2003


## Time Intensity for 01W

Intensity (kts)


Fix Date (Zulu)

## Super Typhoon (STY) 02W (Kujira)

First Poor : $2100 Z 06$ Apr 03
First Fair : 1600Z 08 Apr 03
First TCFA : 2200Z 08 Apr 03
First Warning : 0000Z 09 Apr 03
Last Warning : 0600Z 22 Apr 03
Max Intensity : 135 kts, gusts to 165 kts
Landfall : Ushibuka, Japan
Total Warnings : 66
Remarks:

1) Super Typhoon (STY) 02W was initially detected as a broad area of convection on 06 April, 2003 south of Pohnpei and very close to the equator. Multiple convection centers were monitored in this region for almost 48 hours before significant development began. The initial warning was issued within 8 hours after JTWC designated the suspect area as having fair potential for development.

Although cross equatorial upper level outflow was noted for STY 02W from the first warning, the cyclone intensified slowly while the low level circulation center (LLCC) remained exposed to the east of the deep convection during this period. The cyclone tracked slowly northward until 0000Z on 11 April, an then began to move westward under the steering influence of the subtropical ridge north of the cyclone. Concurrently, the cyclone became more vertically stacked, and began to intensify at a higher rate.

By $1800 Z$ on 12 April, STY 02W was classified as a typhoon with a banding eye. Radial outflow was very pronounced at this time and a period of greater than climatological development (> 1 Dvorak Tnumber/day) ensued, with an increase of 2 Dvorak T-number in the 36 hour period between 0600 Z on 13 April and $1800 Z$ on 14 April.

After 1800 Z on 14 April, a shortwave trough moving east from China altered the steering flow allowing the cyclone to move more west-northwestward. The cyclone also attained maximum intensity of 135 knots during this period of nowrthest movement with concentric eyewall formation noted in microwave and infrared satellite data.

After 1200 Z on 16 April, STY 02W begun weaken in an apparent response to increasing vertical wind shear. After 1800 Z on 18 April, the cyclone began to reintensify after it turned more west and it reached a peak intensity of 125 knots between $0600 Z$ and $1200 Z$ on 18 April before weakening again.

The cyclone once again began to move more poleward and weaken as outflow became restricted in both the equatorward and poleward directions. A third reintensification which occurred after 0000 Z on 20 April was caused by temporarily improved poleward outflow, and produced a tertiary peak intensity of 100 knots. After 0000 Z on 21 April, the cyclone then began to rapidly weaken while moving poleward into a region of increased vertical wind shear.

By 0000Z on 22 April, track speed for STY 02W began to decrease, eventually causing the system to become quasistationary within a break in the subtropical ridge. 36 hour later the cyclone began to accelerate toward the northeast in an environment of strong vertical wind shear causing the LLCC to become fully exposed to the southwest of the rapidly moving upper level circulation. Extratropical transition occurred during this northeast movement and the final warning on STY 02W was issued on $0600 Z$ on 25 April.
2) Reports indicated two casualties on Pohnpei due to STY 02W. All other damage reports received indicated only minor damage to buildings and crops.
*Named by WMO designated RSMC


| 03040918 | 4 | 5.4 N | 160.6E | 35 | 8 | 60 | 48 | 63 | 85 | 143 | 150 | 108 | 5 | 10 | 15 | 20 | 15 | 10 | 20 | -5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03041000 | 5 | 6.5 N | 160.4E | 40 | 18 | 819 | 32 | 53 | 77 | 128 | 127 | 113 | 0 | 5 | 10 | 15 | 5 | 10 | 5 | 15 |
| 03041006 | 6 | 7.5 N | 159.7E | 40 | 8 | 21 | 35 | 55 | 84 | 114 | 173 | 317 | 0 | 5 | 10 | 5 | 5 | 5 | 30 | -65 |
| 03041012 | 7 | 8.1 N | 159.0E | 40 | 0 | 8 | 19 | 38 | 68 | 81 | 152 | 338 | 0 | 5 | 10 | 0 | 5 | -5 | 40 | -65 |
| 03041018 | 8 | 8.6 N | 158.3E | 40 | 21 | 135 | 51 | 83 | 96 | 103 | 189 | 306 | 0 | 5 | 0 | 0 | -5 | $10$ | $45$ | -45 |
| 03041100 | 9 | 9.1 N | 157.6E | 40 | 33 | 51 | 66 | 84 | 93 | 119 | 219 | 324 | 0 | 5 | -5 | 5 | 5 | 15 | $35$ | -30 |
| 03041106 | 10 | 9.6 N | 156.8E | 40 | 5 | 6 | 18 | 25 | 18 | 6 | 82 | 164 | 0 | -5 | -5 | -5 | 5 | $25$ | 50 | -65 |
| 03041112 | 11 | 10.0 N | 156.0E | 40 | 5 | 6 | 8 | 18 | 17 | 19 | 104 | 155 | 0 | $10$ | -5 | -5 | -5 | $35$ | 50 | -60 |
| 03041118 | 12 | 10.2N | 155.2E | 50 |  | 122 | 38 | 36 | 35 | 30 | 138 | 158 | $10$ | $10$ | $15$ | -5 | 0 | $30$ | $35$ | -15 |
| 03041200 | 13 | 10.2 N | 154.3E | 55 | 8 | 22 | 30 | 22 | 19 | 65 | 158 | 135 | 0 | 5 | 5 | 5 | 0 | $20$ | $25$ | 0 |
| 03041206 | 14 | 10.2 N | 153.4E | 55 | 6 | 13 | 32 | 25 | 31 | 43 | 67 | 51 | 0 | -5 | 5 | 5 | $10$ | $20$ | $30$ | -5 |
| 03041212 | 15 | 10.2N | 152.5E | 55 | 8 | 56 | 56 | 38 | 36 | 38 |  |  | 0 | -5 | -5 | - 10 | 20 | 25 |  |  |
| 03041218 | 16 | 10.1 N | 151.6E | 65 | 16 | 617 | 25 | 22 | 25 | 46 | 41 | 49 | 0 | 5 | 5 | 10 | 20 | - 25 | -5 | 5 |
| 03041300 | 17 | 10.1N | 150.7E | 65 |  | 118 | 8 | 21 | 24 | 18 | 47 | 48 | 0 | -5 | $10$ | $25$ | $35$ | $40$ | $20$ | 20 |
| 03041306 | 18 | 10.2N | 149.8E | 65 | 0 | 24 | 36 | 37 | 24 | 29 | 76 | 160 | 0 | -5 | $20$ | $35$ | $35$ | $30$ | -5 | 20 |
| 03041312 | 19 | 10.2N | 149.0E | 75 | 8 | 30 | 32 | 26 | 13 | 25 | 132 | 170 | 0 | 10 | $20$ | 30 | 25 | $20$ | 15 | -15 |
| 03041318 | 20 | 10.3N | 148.2E | 75 | 8 | 8 | 6 | 6 | 6 | 35 | 163 | 159 | 0 | 20 | 30 | 30 | 30 | -5 | 10 | 5 |
| 03041400 | 21 | 10.4N | 147.3E | 90 | 5 | 13 | 3 | 21 | 19 | 41 | 167 | 121 | 0 | 15 | $20$ | $15$ | - 20 | 10 | 10 | 10 |
| 03041406 | 22 | 10.6 N | 146.3E | 100 | 0 | 0 | 6 | 13 | 12 | 60 | 138 | 138 | 0 | $15$ | $10$ | $10$ | $10$ | 15 | 0 | 20 |
| 03041412 | 23 | 10.7N | 145.2E | 110 | 8 | 8 | 18 | 30 | 8 | 59 | 146 | 155 | 0 | 0 | 5 | 0 | 5 | 25 | 0 | 25 |
| 03041418 | 24 | 11.1 N | 143.9E | 120 | 5 | 17 | 38 | 43 | 27 | 78 |  |  | 0 | 5 | 5 | 0 | 15 | 25 |  |  |
| 03041500 | 25 | 11.4 N | 142.5E | 125 | 11 | 117 | 70 | 25 | 42 | 105 | 102 | 74 | 0 | 5 | 0 | 10 | 20 | 15 | 20 | 45 |
| 03041506 | 26 | 11.9N | 141.1E | 125 | 11 | 125 | 31 | 31 | 72 | 108 | 93 | 72 | 0 | 0 | 0 | 20 | 20 | 0 | 15 | 20 |
| 03041512 | 27 | 12.3 N | 139.6E | 125 | 5 | 19 | 25 | 46 | 69 | 104 | 69 | 67 | 0 | -5 | 0 | 15 | 20 | -5 | 20 | 10 |
| 03041518 | 28 | 12.6 N | 138.3E | 130 | 5 | 19 | 35 | 81 | 108 | 144 |  |  | 0 | -5 | 15 | 15 | 20 | 0 |  |  |
| 03041600 | 29 | 13.0N | 137.0E | 135 | 0 | 13 | 17 | 72 | 114 | 138 | 161 | 216 | 0 | 0 | 10 | 20 | 10 | 5 | 35 | 25 |


| 03041606 | 30 | 13.4 N | 136.1E | 135 | 0 |  |  | 45 | 73 | 115 | 121 | 130 | 222 | 0 | 15 | 15 | 20 | 0 | 15 | 10 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03041612 | 31 | 13.8 N | 135.2E | 130 | 5 |  | 317 | 71 | 106 | 136 | 139 | 102 | 220 | 0 | 10 | 15 | 0 | 15 | 10 | -5 | -10 |
| 03041618 | 32 | 14.0 N | 134.4E | 115 | 5 |  | 48 | 80 | 107 | 139 | 125 | 138 | 288 | 0 | 0 | 0 | $25$ | 45 | $25$ | 45 | -20 |
| 03041700 | 33 | 14.0 N | 133.6E | 115 | 0 |  | 365 | 57 | 81 | 105 | 94 | 89 | 222 | $10$ | 0 | $\overline{15}$ | $45$ | $50$ | 30 | $35$ | 0 |
| 03041706 | 34 | 13.7 N | 132.8E | 110 | 11 |  | 45 | 59 | 69 | 72 | 70 | 96 | 120 | -5 | -5 | $35$ | $45$ | $40$ | $40$ | $30$ | 5 |
| 03041712 | 35 | 13.6 N | 132.0E | 105 | 5 |  | 305 | 54 | 78 | 81 | 46 |  |  | 0 | $15$ | $35$ | $35$ | 25 | $45$ |  |  |
| 03041718 | 36 | 13.5 N | 131.2E | 105 | 6 |  | 26 | 47 | 64 | 61 | 61 | 206 | 2760 | 0 | $30$ | 30 | 30 | $25$ | $45$ | 30 | 5 |
| 03041800 | 37 | 13.5 N | 130.6E | 115 | 8 |  | 26 | 41 | 35 | 18 | 67 | 166 | 2180 | 0 | $20$ | 20 | $15$ | $20$ | 45 | 10 | 15 |
| 03041806 | 38 | 13.5 N | 130.0E | 125 | 6 |  | 18 | 38 | 35 | 36 | 74 | 170 | 1950 | 0 | 5 | 10 | 10 | -5 | $20$ | 25 | 10 |
| 03041812 | 39 | 13.6 N | 129.5E | 125 | 6 |  |  | 31 | 13 | 27 | 74 |  |  | 0 | 10 | 15 | 10 | 20 | 20 |  |  |
| 03041818 | 40 | 13.9 N | 129.1E | 120 | 0 |  |  | 17 | 17 | 35 | 62 | 144 | 1790 | 0 | 0 | 5 | $20$ | $35$ | $25$ | -5 | -5 |
| 03041900 | 41 | 14.2 N | 128.7E | 115 | 8 | 6 | - 1 | 18 | 34 | 70 | 96 | 143 | 214 | 0 | 5 | 0 | $30$ | 40 | -5 | 0 | -10 |
| 03041906 | 42 | 14.7N | 128.3E | 105 | 0 | 0 | 1 | 17 | 38 | 54 | 87 | 123 | 331 | 0 | 0 | 20 | 35 | 40 | -5 | 0 | -5 |
| 03041912 | 43 | 15.2 N | 127.8E | 95 | 8 |  | 121 | 18 | 46 | 48 | 91 | 165 | 417 | 0 | 0 | 30 | 40 | 35 | -5 | -5 | -10 |
| 03041918 | 44 | 15.7N | 127.3E | 90 | 5 |  |  | 21 | 32 | 62 | 80 | 178 | 5370 | 0 | $20$ | $35$ | $40$ | 30 | 10 | 10 | -15 |
| 03042000 | 45 | 16.2 N | 126.6E | 85 |  | 18 |  | 32 | 48 | 57 | 74 | 198 | 6770 | 0 | $25$ | $35$ | $30$ | 10 | 0 | $10$ | -15 |
| 03042006 | 46 | 16.7 N | 126.1E | 95 | 0 |  |  | 21 | 64 | 69 | 98 | 229 | 8190 | 0 | $15$ | $20$ | $15$ | 0 | 5 | 5 | 5 |
| 03042012 | 47 | 17.2N | 125.6E | 100 | 6 |  | 55 | 54 | 67 | 115 | 123 | 309 | 9910 | 0 | -5 | 0 | 20 | 15 | 10 | 5 | 0 |
| 03042018 | 48 | 17.9 N | 125.1E | 100 | 5 |  | 26 | 6 | 13 | 36 | 51 | 298 |  | 0 | 5 | 15 | 25 | 15 | 10 | 0 |  |
| 03042100 | 49 | 18.4 N | 124.6E | 100 | 6 |  | 31 | 26 | 64 | 50 | 91 | 463 |  | 0 | 5 | 25 | 25 | 20 | 10 | 0 |  |
| 03042106 | 50 | 18.7 N | 124.3E | 95 | 0 |  | 41 | 43 | 62 | 54 | 152 | 723 |  |  | 10 | 25 | 15 | 20 | 5 | 5 |  |
| 03042112 | 51 | 19.2 N | 124.4E | 85 | 11 | 16 |  | 38 | 17 | 30 | 182 | 835 |  | 0 | 20 | 15 | 15 | 10 | 0 | 0 |  |
| 03042118 | 52 | 19.7N | 124.0E | 75 | 8 |  | 43 | 59 | 90 | 94 | 69 |  |  | 0 | 10 | 10 | 10 | 5 | 0 |  |  |
| 03042200 | 53 | 19.9 N | 123.5E | 55 | 16 |  | 39 | 37 | 57 | 78 | 240 |  |  | 0 | -5 | -5 | $10$ |  | 15 |  |  |
| 03042206 | 54 | 20.3 N | 123.2E | 50 | 5 | 0 | 3 | 31 | 55 | 53 | 391 |  |  | 5 | 0 | 5 | 0 | 10 | - 10 |  |  |


| 03042212 | 55 | 20.7N | 123.3E | 45 | 0 | 53 | 95 | 88 | 79 | 239 |  |  | 10 | 10 | 5 | 0 | -5 | -5 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03042218 | 56 | 20.8N | 122.9E | 45 | 11 | 40 | 48 | 81 | 64 |  |  |  | -5 | 0 | -5 | $10$ | $10$ |  |  |  |
| 03042300 | 57 | 20.8N | 122.5E | 35 | 5 | 29 | 51 | 142 | 355 |  |  |  | 0 | -5 | $10$ | $10$ | $15$ |  |  |  |
| 03042306 | 58 | 20.9N | 122.4E | 35 | 13 | 38 | 73 | 246 |  |  |  |  | 0 | -5 | $10$ | $15$ |  |  |  |  |
| 03042312 | 59 | 21.1 N | 122.4E | 35 | 8 | 25 | 133 | 358 |  |  |  |  | 0 | -5 | $10$ | $15$ |  |  |  |  |
| 03042318 | 60 | 21.6N | 122.5E | 35 | 11 | 50 | 229 | 540 |  |  |  |  | 0 | -5 | $10$ | $10$ |  |  |  |  |
| 03042400 | 61 | 22.1 N | 122.8E | 35 | 0 | 58 | 189 | 404 |  |  |  |  | 0 | 5 | 0 | 0 |  |  |  |  |
| 03042406 | 62 | 23.0 N | 123.2E | 35 | 5 | 89 | 231 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 03042412 | 63 | 24.8 N | 124.0E | 35 | 0 | 34 | 139 |  |  |  |  |  | 0 | 0 | 10 |  |  |  |  |  |
| 03042418 | 64 | 26.8N | 125.4E | 35 | 0 | 55 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03042500 | 65 | 29.0 N | 127.3E | 35 | 0 | 60 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03042506 | 66 | 32.1 N | 130.1E | 30 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03042512 |  | 34.2 N | 134.0E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 8 | 28 | 50 | 73 | 64 | 96 | 184 | 250 | 1 | 7 | 12 | 16 | 17 | 16 | 17 | 19 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -1 | -3 | -6 | -7 | -8 | -7 | -9 |
|  |  |  | \# CASES |  | 66 | 65 | 63 | 61 | 57 | 55 | 45 | 41 | 66 | 65 | 63 | 61 | 57 | 55 | 45 | 41 |



Figure 1-02W-3. 150350Z April 2003 MODIS true-color image of TY 02W (Kujira), located 180nm southwest of Guam, with an intensity of 125 knots.


Figure 1-02W-1. $181049 Z$ April 2003 GMS-5 enhanced infrared imagery of TY 02W (Kujira), located 480 nm east of the Luzon, with an peak intensity of 125 knots.

## SUPER TYPHOON 02W (KUJRA)

09-25 APRLL 2003


## Time Intensity for 02W

## Intensity (kts)



Fix Date (Zulu)

## Super Typhoon (STY) 02W (Kujira)

$\square$
First Poor : 2100Z 06 Apr 03
First Fair : 1600Z 08 Apr 03
First TCFA : 2200Z 08 Apr 03
First Warning : 0000Z 09 Apr 03
Last Warning : 0600Z 22 Apr 03
Max Intensity : 135 kts, gusts to 165 kts
Landfall : Ushibuka, Japan
Total Warnings : 66
Remarks:

1) Super Typhoon (STY) 02W was initially detected as a broad area of convection on 06 April, 2003 south of Pohnpei and very close to the equator. Multiple convection centers were monitored in this region for almost 48 hours before significant development began. Subsequently, the initial warning was issued within 8 hours after JTWC designated the suspect area of having fair potential for development.

Although cross equatorial upper level outflow was noted for STY 02W from the first warning, the cyclone intensified slowly while the low level circulation center (LLCC) remained exposed to the east of the deep convection during this period. The cyclone tracked slowly northward until 0000 Z on 11 April, an then began to move westward under the steering influence of the subtropical ridge north of the cyclone. Concurrently, the cyclone became more vertically stacked, and began to intensify at a higher rate.

By 1800 Z on 12 April, STY 02W was classified as a typhoon with a banding eye. Radial outflow was very pronounced at this time and a period of greater than climatological development (> 1 Dvorak Tnumber/day) ensued, with an increase of 2 Dvorak T-number in the 36 hour period between $0600 Z$ on 13 April and 1800 Z on 14 April.

After 1800 Z on 14 April, a shortwave trough moving east from China altered the steering flow allowing the cyclone to move more west-northwestward. The cyclone also attained maximum intensity of 135 knots during this period of nowrthest movement with concentric eyewall formation noted in microwave and infrared satellite data.

After 1200 Z on 16 April, STY 02W begun weaken in an apparent response to increasing vertical wind shear. After $1800 Z$ on 18 April, the cyclone began to reintensify after it turned more west and it reached a peak intensity of 125 knots between $0600 Z$ and $1200 Z$ on 18 April before weakening again.

Subsequently, the cyclone once again began to move more poleward and weaken as outflow became restricted in both the equatorward and poleward directions. A third reintensification which occurred after $0000 Z$ on 20 April was caused by temporarily improved poleward outflow, and produced a tertiary peak intensity of 100 knots. After $0000 Z$ on 21 April, the cyclone then began to rapidly weaken while moving poleward into a region of increased vertical wind shear.

By 0000Z on 22 April, track speed for STY 02W began to decrease, eventually causing the system to become quasistationary within a break in the subtropical ridge. 36 hour later the cyclone began to accelerate toward the northeast in an environment of strong vertical wind shear causing the LLCC to remain fully exposed to the southwest of the rapidly moving upper level circulation. Extratropical transition occurred during this northeast movement and the final warning on STY 02W was issued on $0600 Z$ on 25 April.
2) Reports indicated two casualties on Pohnpei due to STY 02W. All other damage reports received indicated only minor damage to buildings and crops.
*Named by WMO designated RSMC

| Statistics for JTWC on STY02W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SIT | TION | ERR | RORS |  |  |  |  | ND | RR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03040806 |  | 2.6 N | 158.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040812 |  | 3.0 N | 159.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040818 |  | 3.4 N | 160.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040900 | 1 | 3.7 N | 160.2E | 30 | 48 | 99 | 135 | 137 | 102 | 122 |  |  | 0 | 0 | 0 | 5 | 15 | 10 |  |  |
| 03040906 | 2 | 4.1 N | 160.4E | 35 | 23 | 48 | 63 | 51 | 55 | 126 | 260 | 354 | 0 | 5 | 5 | 10 | 20 | 15 | 20 | 5 |
| 03040912 | 3 | 4.6 N | 160.6E | 35 | 5 | 35 | 42 | 36 | 54 | 136 | 222 | 390 | 0 | 0 | 5 | 10 | 20 | 15 | 0 | -30 |
| 03040918 | 4 | 5.4 N | 160.6E | 35 | 8 | 60 | 48 | 63 | 85 | 143 | 150 | 108 | 5 | 10 | 15 | 20 | 15 | 10 | 20 | -5 |
| 03041000 | 5 | 6.5 N | 160.4E | 40 | 18 | 19 | 32 | 53 | 77 | 128 | 127 | 113 | 0 | 5 | 10 | 15 | 5 | 10 | 5 | -15 |


| 03041006 | 6 | 7.5N | 159.7E | 40 | 8 | 21 | 35 | 55 | 84 | 114 | 173 | 317 | 0 | 5 | 10 | 5 | 5 | 5 | $\overline{30}$ | -65 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03041012 | 7 | 8.1 N | 159.0E | 40 | 0 | 8 | 19 | 38 | 68 | 81 | 152 | 338 | 0 | 5 | 10 | 0 | 5 | -5 | $40$ | -65 |
| 03041018 | 8 | 8.6N | 158.3E | 40 | 21 | 35 | 51 | 83 | 96 | 103 | 189 | 306 | 0 | 5 | 0 | 0 | -5 | $10$ | $45$ | -45 |
| 03041100 | 9 | 9.1 N | 157.6E | 40 | 33 | 51 | 66 | 84 | 93 | 119 | 219 | 324 | 0 | 5 | -5 | 5 | 5 | $15$ | $35$ | -30 |
| 03041106 | 10 | 9.6 N | 156.8E | 40 | 5 | 6 | 18 | 25 | 18 | 6 | 82 | 164 | 0 | -5 | -5 | -5 | 5 | $25$ | $50$ | -65 |
| 03041112 | 11 | 10.0 N | 156.0E | 40 | 5 | 6 | 8 | 18 | 17 | 19 | 104 | 155 | 0 | $10$ | -5 | -5 | -5 | $35$ | $50$ | -60 |
| 03041118 | 12 | 10.2 N | 155.2E | 50 | 11 | 22 | 38 | 36 | 35 | 30 | 138 | 158 | $10$ | $10$ | $15$ | -5 | 0 | $30$ | $35$ | -15 |
| 03041200 | 13 | 10.2 N | 154.3E | 55 | 8 | 22 | 30 | 22 | 19 | 65 | 158 | 135 | 0 | 5 | 5 | 5 | 0 | $20$ | $25$ | 0 |
| 03041206 | 14 | 10.2 N | 153.4E | 55 | 6 | 13 | 22 | 25 | 31 | 43 | 67 | 51 | 0 | -5 | 5 | 5 | $10$ | $20$ | $30$ | -5 |
| 03041212 | 15 | 10.2 N | 152.5E | 55 | 8 | 56 | 56 | 38 | 36 | 38 |  |  | 0 | -5 | -5 | $10$ | $20$ | $25$ |  |  |
| 03041218 | 16 | 10.1 N | 151.6E | 65 | 16 | 17 | 25 | 22 | 25 | 46 | 41 | 49 | 0 | 5 | 5 | $10$ | $20$ | $25$ | -5 | 5 |
| 03041300 | 17 | 10.1 N | 150.7E | 65 | 11 | 8 | 8 | 21 | 24 | 18 | 47 | 48 | 0 | -5 | $10$ | $25$ | $35$ | $40$ | $20$ | -20 |
| 03041306 | 18 | 10.2 N | 149.8E | 65 | 0 | 24 | 36 | 37 | 24 | 29 | 76 | 160 | 0 | -5 | $20$ | $35$ | $35$ | $30$ | -5 | -20 |
| 03041312 | 19 | 10.2 N | 149.0E | 75 | 8 | 30 | 32 | 26 | 13 | 25 | 132 | 170 | 0 | $10$ | $20$ | $30$ | $25$ | $20$ | 15 | -15 |
| 03041318 | 20 | 10.3 N | 148.2E | 75 | 8 | 8 | 6 | 6 | 6 | 35 | 163 | 159 | 0 | $20$ | $30$ | $30$ | $30$ | -5 | 10 | -15 |
| 03041400 | 21 | 10.4 N | 147.3E | 90 | 5 | 13 | 0 | 21 | 19 | 41 | 167 | 121 | 0 | $15$ | $20$ | $15$ | $20$ | 10 | 10 | 10 |
| 03041406 | 22 | 10.6N | 146.3E | 100 | 0 | 0 | 6 | 13 | 12 | 60 | 138 | 138 | 0 | $15$ | $10$ | $10$ | $10$ | 15 | 0 | 20 |
| 03041412 | 23 | 10.7 N | 145.2E | 110 | 8 | 8 | 18 | 30 | 8 | 59 | 146 | 155 | 0 | 0 | 5 | 0 | 5 | 25 | 0 | 25 |
| 03041418 | 24 | 11.1 N | 143.9E | 120 | 5 | 17 | 38 | 43 | 27 | 78 |  |  | 0 | 5 | 5 | 0 | 15 | 25 |  |  |
| 03041500 | 25 | 11.4 N | 142.5E | 125 | 11 | 17 | 40 | 25 | 42 | 105 | 102 | 74 | 0 | 5 | 0 | 10 | 20 | 15 | 20 | 45 |
| 03041506 | 26 | 11.9 N | 141.1E | 125 | 11 | 25 | 31 | 31 | 72 | 108 | 93 | 72 | 0 | 0 | 0 | 20 | 20 | 0 | 15 | 20 |
| 03041512 | 27 | 12.3 N | 139.6E | 125 | 5 | 19 | 25 | 46 | 69 | 104 | 69 | 67 | 0 | -5 | 0 | 15 | 20 | -5 | 20 | 10 |
| 03041518 | 28 | 12.6 N | 138.3E | 130 | 5 | 19 | 35 | 81 | 108 | 144 |  |  | 0 | -5 | 15 | 15 | 20 | 0 |  |  |
| 03041600 | 29 | 13.0 N | 137.0E | 135 | 0 | 13 | 17 | 72 | 114 | 138 | 161 | 216 | 0 | 0 | 10 | 20 | 10 | 5 | 35 | 25 |
| 03041606 | 30 | 13.4 N | 136.1E | 135 | 0 | 12 | 45 | 73 | 115 | 121 | 130 | 222 | 0 | 15 | 15 | 20 | 0 | 15 | 10 | -10 |
| 03041612 | 31 | 13.8 N | 135.2E | 130 | 5 | 31 | 71 | 106 | 136 | 139 | 102 | 220 | 0 | 10 | 15 | 0 | $15$ | 10 | -5 | -10 |


| 03041618 | 32 | 14.0 N | 134.4E | 115 | 5 |  | 48 | 80 | 107 | 139 | 125 | 138 | 288 | 0 | 0 | 0 | $25$ | $45$ | $25$ | $45$ | -20 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03041700 | 33 | 14.0N | 133.6E | 115 | 0 |  | 36 | 57 | 81 | 105 | 94 | 89 | 222 | $10$ | 0 | $15$ | $45$ | $50$ | $30$ | $35$ | 0 |
| 03041706 | 34 | 13.7N | 132.8E | 110 | 11 |  | 24 | 59 | 69 | 72 | 70 | 96 | 120 | -5 | -5 | $35$ | $45$ | $40$ | $40$ | $30$ | 5 |
| 03041712 | 35 | 13.6N | 132.0E | 105 | 5 |  | 30 | 54 | 78 | 81 | 46 |  |  | 0 | $15$ | $35$ | $35$ | $25$ | $45$ |  |  |
| 03041718 | 36 | 13.5N | 131.2E | 105 | 6 |  | 26 | 47 | 64 | 61 | 61 | 206 | 276 | 0 | $30$ | $30$ | $30$ | $25$ | $45$ | $30$ | 5 |
| 03041800 | 37 | 13.5N | 130.6E | 115 | 8 |  | 26 | 41 | 35 | 18 | 67 | 166 | 218 | 0 | $20$ | $20$ | $15$ | $20$ | $45$ | $10$ | 15 |
| 03041806 | 38 | 13.5N | 130.0E | 125 | 6 |  | 8 | 38 | 35 | 36 | 74 | 170 | 195 | 0 | 5 | 10 | 10 | -5 | $20$ | 25 | 10 |
| 03041812 | 39 | 13.6N | 129.5E | 125 | 6 |  | 24 | 31 | 13 | 27 | 74 |  |  | 0 | 10 | 15 | 10 | $20$ | $20$ |  |  |
| 03041818 | 40 | 13.9 N | 129.1E | 120 | 0 |  | 8 | 17 | 17 | 35 | 62 | 144 | 179 | 0 | 0 | 5 | $20$ | $35$ | $25$ | -5 | -5 |
| 03041900 | 41 | 14.2N | 128.7E | 115 | 8 | 6 |  | 18 | 34 | 70 | 96 | 143 | 214 | 0 | 5 | 0 | $30$ | $40$ | -5 | 0 | -10 |
| 03041906 | 42 | 14.7N | 128.3E | 105 | 0 | 0 |  | 17 | 38 | 54 | 87 | 123 | 331 | 0 | 0 | $20$ | $35$ | $40$ | -5 | 0 | -5 |
| 03041912 | 43 | 15.2N | 127.8E | 95 | 8 |  | 12 | 18 | 46 | 48 | 91 | 165 | 417 | 0 | 0 | $30$ | $40$ | $35$ | -5 | -5 | -10 |
| 03041918 | 44 | 15.7N | 127.3E | 90 | 5 |  | 3 | 21 | 32 | 62 | 80 | 178 | 537 | 0 | $20$ | $35$ | $40$ | $30$ | $10$ | $10$ | -15 |
| 03042000 | 45 | 16.2N | 126.6E | 85 | 11 | 8 | 8 | 32 | 48 | 57 | 74 | 198 | 677 | 0 | $25$ | $35$ | $30$ | $10$ | 0 | $10$ | -15 |
| 03042006 | 46 | 16.7N | 126.1E | 95 | 0 |  | 7 | 21 | 64 | 69 | 98 | 229 | 819 | 0 | $15$ | $20$ | $15$ | 0 | 5 | 5 | 5 |
| 03042012 | 47 | 17.2N | 125.6E | 100 | 6 |  | 25 | 54 | 67 | 115 | 123 | 309 | 991 | 0 | -5 | 0 | 20 | 15 | 10 | 5 | 0 |
| 03042018 | 48 | 17.9N | 125.1E | 100 | 5 |  | 26 | 6 | 13 | 36 | 51 | 298 |  | 0 | 5 | 15 | 25 | 15 | 10 | 0 |  |
| 03042100 | 49 | 18.4N | 124.6E | 100 | 6 |  | 31 | 26 | 64 | 50 | 91 | 463 |  | 0 | 5 | 25 | 25 | 20 | 10 | 0 |  |
| 03042106 | 50 | 18.7 N | 124.3E | 95 | 0 |  | 41 | 43 | 62 | 54 | 152 | 723 |  |  | 10 | 25 | 15 | 20 | 5 | 5 |  |
| 03042112 | 51 | 19.2N | 124.4E | 85 | 11 | 6 |  | 38 | 17 | 30 | 182 | 835 |  | 0 | 20 | 15 | 15 | 10 | 0 | 0 |  |
| 03042118 | 52 | 19.7N | 124.0E | 75 | 8 |  | 43 | 59 | 90 | 94 | 69 |  |  | 0 | 10 | 10 | 10 | 5 | 0 |  |  |
| 03042200 | 53 | 19.9N | 123.5E | 55 | 16 |  | 39 | 37 | 57 | 78 | 240 |  |  | 0 | -5 | -5 | $10$ | $10$ | $15$ |  |  |
| 03042206 | 54 | 20.3N | 123.2E | 50 | 5 | 0 |  | 31 | 55 | 53 | 391 |  |  | 5 | 0 | 5 | 0 | $10$ | $10$ |  |  |
| 03042212 | 55 | 20.7 N | 123.3E | 45 | 0 |  | 53 | 95 | 88 | 79 | 239 |  |  | 10 | 10 | 5 | 0 | -5 | -5 |  |  |
| 03042218 | 56 | 20.8 N | 122.9E | 45 | 11 |  | 40 | 48 | 81 | 64 |  |  |  | -5 | 0 | -5 | - 10 | $10$ |  |  |  |
| 03042300 | 57 | 20.8N | 122.5E | 35 | 5 |  | 29 | 51 | 142 | 355 |  |  |  | 0 | -5 | - 10 | - 10 | - 15 |  |  |  |


| 03042306 | 58 | 20.9 N | 122.4 E | 35 | 13 | 38 | 73 | 246 |  |  |  |  | 0 | -5 | - | - |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03042312 | 59 | 21.1 N | 122.4 E | 35 | 8 | 25 | 133 | 358 |  |  |  |  | 0 | -5 | - | - | - |  |  |  |



Figure 1-02W-3. 150350Z April 2003 MODIS true-color image of TY 02W (Kujira), located 180 nm southwest of Guam, with an intensity of 125 knots.


Figure 1-02W-1. $181049 Z$ April 2003 GMS-5 enhanced infrared imagery of TY 02W (Kujira), located 480 nm east of the Luzon, with an peak intensity of 125 knots.

## SUPER TYPHOON 02W (KUJRA)

09-25 APRL 2003


## Time Intensity for 02W

Intensity (kts)


Fix Date (Zulu)

## Tropical Depression (TD) 03W

First Poor : 1730Z 16 May 03

First Fair : 0600Z 17 May 03

First TCFA : $1400 Z 17$ May 03

First Warning : 1800Z 17 May 03

Last Warning : 0600Z 20 May 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : NONE

Total Warnings : 11
Remarks:

1) Tropical Depression (TD) 03W was initially classified as a tropical disturbance in the Philippine Sea on 16 May, 2003. The first warning was issued at $1800 Z$ on 17 May and the final warning was issued less than 72 hours later at $0600 Z$ on 20 May. The cyclone was classified as a tropical storm in forecasts issued by JTWC but post analysis of satellite data indicates that this cyclone did not attain tropical storm intensity.

The cyclone initially meandered in the Philippine Sea then tracked generally poleward. The cyclone only attained a 30 knot intensity for approximately 48 hours before dissipating as a significant tropical cyclone due to marginal upper level synoptic flow patterns.
2) No reports of damage associated with this system were received.

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03051700 |  | 7.3 N | 130.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051706 |  | 7.5 N | 130.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051712 |  | 7.7 N | 130.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051718 | 1 | 7.8 N | 130.4E | 25 | 151 | 188 | 239 | 308 | 321 |  |  |  | 0 | 5 | 0 | -5 | -5 |  |  |  |
| 03051800 | 2 | 7.8 N | 130.2E | 25 | 130 | 146 | 226 | 266 | 259 |  |  |  | 0 | 0 | 5 | 10 | 20 |  |  |  |
| 03051806 | 3 | 7.9 N | 130.0E | 30 | 13 | 38 | 93 | 122 | 179 |  |  |  | 0 | 5 | 10 | 15 | 25 |  |  |  |
| 03051812 | 4 | 8.1 N | 130.0E | 30 | 0 | 42 | 62 | 72 | 129 |  |  |  | 0 | 5 | 10 | 15 | 25 |  |  |  |
| 03051818 | 5 | 8.6 N | 130.4E | 30 | 23 | 60 | 60 | 84 |  |  |  |  | 0 | 5 | 10 | 20 |  |  |  |  |
| 03051900 | 6 | 9.1 N | 130.9E | 30 | 5 | 21 | 12 | 60 |  |  |  |  | 5 | 10 | 15 | 25 |  |  |  |  |
| 03051906 | 7 | 9.6 N | 131.2E | 30 | 24 | 41 | 51 |  |  |  |  |  | 5 | 10 | 20 |  |  |  |  |  |
| 03051912 | 8 | 10.2 N | 131.3E | 30 | 82 | 118 | 137 |  |  |  |  |  | 0 | 5 | 15 |  |  |  |  |  |
| 03051918 | 9 | 10.8 N | 131.1E | 30 | 6 | 51 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03052000 | 10 | 11.6 N | 131.0E | 30 | 13 | 27 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03052006 | 11 | 12.6 N | 130.8E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03052012 |  | 13.5 N | 130.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 42 | 73 | 110 | 152 | 222 |  |  |  | 1 | 6 | 11 | 15 | 19 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  |  | 6 | 11 | 13 | 16 |  |  |  |
|  |  |  | \# CASES |  | 11 | 10 | 8 | 6 | 4 |  |  |  | 11 |  | 8 | 6 | 4 |  |  |  |



Figure 1-03W-1. $182331 Z$ May 2003 GMS-5 visible image of TY 03W, located 290 nm east of the Davao, Philippines. The partially exposed low level circulation to the east of the deep convection had an estimated intensity of 35 knots.

TROPICAL DEPRESSION 03W
17-20 MAY 2003


## Intensity (kts)

|  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

[^0]Fix Date (Zulu)

## Tropical Depression (TD) 03W

First Poor : 1730Z 16 May 03
First Fair : 0600Z 17 May 03

First TCFA : 1400Z 17 May 03
First Warning : 1800Z 17 May 03

Last Warning : 0600Z 20 May 03, Dissipated
Max Intensity : 35 kts , gusts to 45 kts
Landfall : NONE
Total Warnings : 11
Remarks:

1) Tropical Depression (TD) 03W was initially classified as a tropical disturbance in the Philippine Sea on 16 May, 2003. The first warning was issued at $1800 Z$ on 17 May and the final warning was issued less than 72 hours later at 0600Z on 20 May. The cyclone was classified as a tropical storm in forecasts issued by JTWC but post analysis of satellite data indicates that this cyclone did not attain tropical storm intensity.

The cyclone initially meandered in the Philippine Sea then tracked generally poleward. The cyclone only attained a 30 knot intensity for approximately 48 hours before dissipating as a significant tropical cyclone due to marginal upper level synoptic flow patterns.
2) No reports of damage associated with this system were received.

| Statistics for JTWC on TD03W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  | POS | SITIO | N ER | RROR |  |  |  |  |  | IND | ERR | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03051700 |  | 7.3 N | 130.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051706 |  | 7.5N | 130.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051712 |  | 7.7 N | 130.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051718 | 1 | 7.8N | 130.4E | 25 | 151 | 188 | 239 | 308 | 321 |  |  |  | 0 | 5 | 0 | -5 | -5 |  |  |  |
| 03051800 | 2 | 7.8 N | 130.2E | 25 | 130 | 146 | 226 | 266 | 259 |  |  |  | 0 | 0 | 5 | 10 | 20 |  |  |  |
| 03051806 | 3 | 7.9 N | 130.0E | 30 | 13 | 38 | 93 | 122 | 179 |  |  |  | 0 | 5 | 10 | 15 | 25 |  |  |  |
| 03051812 | 4 | 8.1 N | 130.0E | 30 | 0 | 42 | 62 | 72 | 129 |  |  |  | 0 | 5 | 10 | 15 | 25 |  |  |  |
| 03051818 | 5 | 8.6 N | 130.4E | 30 | 23 | 60 | 60 | 84 |  |  |  |  | 0 | 5 | 10 | 20 |  |  |  |  |
| 03051900 | 6 | 9.1 N | 130.9E | 30 | 5 | 21 | 12 | 60 |  |  |  |  | 5 | 10 | 15 | 25 |  |  |  |  |
| 03051906 | 7 | 9.6 N | 131.2E | 30 | 24 | 41 | 51 |  |  |  |  |  | 5 | 10 | 20 |  |  |  |  |  |
| 03051912 | 8 | 10.2 N | 131.3E | 30 | 82 | 118 | 137 |  |  |  |  |  | 0 | 5 | 15 |  |  |  |  |  |
| 03051918 | 9 | 10.8 N | 131.1E | 30 | 6 | 51 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03052000 | 10 | 11.6 N | 131.0E | 30 | 13 | 27 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03052006 | 11 | 12.6 N | 130.8E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03052012 |  | 13.5 N | 130.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 42 | 73 | 110 | 152 | 222 |  |  |  | 1 | 6 | 11 | 15 | 19 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 6 | 11 | 13 | 16 |  |  |  |
|  |  |  | \# CASES |  | 11 | 10 | 8 | 6 | 4 |  |  |  | 11 | 10 | 8 | 6 | 4 |  |  |  |



Figure 1-03W-1. $182331 Z$ May 2003 GMS-5 visible image of TY 03W, located 290 nm east of the Davao, Philippines. The partially exposed low level circulation to the east of the deep convection had an estimated intensity of 35 knots.

## TROPICAL DEPRESSION 03W

17-20 MAY 2003


Time Intensity for 03W
Intensity (kts)


Fix Date (Zulu)

## Typhoon (TY) 04W (Chan-Hom)*

First Poor : 0600Z 18 May 03
First Fair : 1000Z 18May 03
First TCFA : $1500 Z$ 18May 03
First Warning : 0000Z 19 May 03
Last Warning : 0000Z 27 May 03
Max Intensity : 115 kts, gusts to 140 kts
Landfall : NONE
Total Warnings : 33
Remarks:

1) Typhoon (TY) 04W was initially detected as persistent deep convection over a broad low level circulation center (LLCC) and reached warning criteria within 18 hours, at 0000Z on 19 May. An Air Force weather reconnaissance flight was flown into this cyclone just after the first warning was issued while the cyclone was still broad and difficult to locate with satellite fixes. This flight provided center fix and wind information with 40 knot winds near the center on a 30 second average.

TY 04W tracked poleward towards a weakness in the low to mid-level steering ridge by a migratory shortwave trough. Intensification for this cyclone was very close to one Dvorak T-number/day from the initial warning until approximately 1800 Z on 23 May, when TY 04W reached maximum intensity. Maximum intensity was maintained for 30 hours as the system passed the ridge axis moved more northnortheastward while accelerating.

After 0000Z on 25 May, TY 04W began to decrease in intensity rapidly as it increased track speed towards a shortwave trough to the northeast. Dry air entrainment was noted by 0600 Z on 26 May in microwave satellite imagery as the cyclone began extratropical transition. TY 04W completed extratropical transition by 0000 Z on 27 May , at which time a final warning was issued.
2) FEMA damage assessments indicated Chuuk sustained some damage to homes and food crops due to heavy rain as TY 04W passed near the island. Storm intensity was approximately 35 to 45 knots, with Chuuk experiencing winds of 35 to 38 knots as the system moved northwest of the island.

## Statistics for JTWC on TY04W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03051800 |  | 4.0 N | 147.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051806 |  | 4.6 N | 148.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051812 |  | 5.2 N | 148.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051818 |  | 5.8 N | 149.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051900 | 1 | 6.3 N | 149.3E | 25 | 26 | 88 | 147 | 132 | 112 | 160 | 197 | 290 | 0 | -5 | 5 | 5 | 0 | 0 | 30 | 50 |
| 03051906 | 2 | 6.7 N | 149.8E | 35 | 8 | 49 | 27 | 30 | 27 | 128 | 231 | 313 | 0 | 10 | 20 | 5 | 15 | 15 | -5 | 20 |
| 03051912 | 3 | 6.8 N | 150.4E | 35 | 26 | 38 | 6 | 13 | 58 | 179 | 251 | 394 | 0 | 10 | 10 | 5 | 15 | 10 | $20$ | 25 |
| 03051918 | 4 | 6.9 N | 150.8E | 35 | 66 | 61 | 66 | 104 | 160 | 257 | 338 | 516 | 0 | 10 | 0 | 10 | 15 | 25 | - 40 | 25 |
| 03052000 | 5 | 7.3N | 151.0E | 35 | 0 | 8 | 19 | 86 | 132 | 249 | 336 | 512 | 0 | 5 | 5 | 15 | 15 | 5 | $35$ | 25 |
| 03052006 | 6 | 7.7N | 150.8E | 35 | 18 | 18 | 19 | 80 | 118 | 185 | 282 | 495 | 0 | $10$ | 0 | 5 | 10 | $15$ | - 40 | 0 |
| 03052012 | 7 | 8.0 N | 150.6E | 45 | 5 | 0 | 69 | 119 | 164 | 242 | 322 | 573 | 10 | 10 | 20 | 25 | 35 | 10 | 0 | 10 |
| 03052018 | 8 | 8.4 N | 150.4E | 55 | 26 | 71 | 133 | 179 | 218 | 288 | 474 | 765 | 0 | 10 | 20 | 30 | 50 | 10 | 0 | 60 |
| 03052100 | 9 | 8.8 N | 150.3E | 55 | 11 | 93 | 143 | 182 | 212 | 299 | 520 | 794 | 0 | 15 | 25 | 45 | 35 | 10 | 5 | 60 |
| 03052106 | 10 | 9.4 N | 150.6E | 55 | 21 | 76 | 110 | 144 | 166 | 287 | 516 | 816 | 0 | 10 | 25 | 40 | 20 | 0 | 25 | 60 |
| 03052112 | 11 | 10.3 N | 150.9E | 55 | 23 | 30 | 54 | 84 | 141 | 247 | 489 | 722 | 0 | 0 | 15 | 10 | 10 | $10$ | 15 | 50 |
| 03052118 | 12 | 11.1 N | 151.0E | 60 | 5 | 18 | 37 | 64 | 126 | 260 | 453 | 729 | 0 | 10 | 20 | 10 | -5 | $\overline{10}$ | 45 | 60 |
| 03052200 | 13 | 11.8 N | 151.1E | 65 | 5 | 35 | 65 | 114 | 163 | 289 | 486 | 830 | 0 | 10 | 5 | 0 | 0 | 10 | 50 | 60 |
| 03052206 | 14 | 12.6N | 151.2E | 65 | 8 | 21 | 55 | 98 | 133 | 249 | 523 | 931 | 0 | 10 | 10 | $20$ | 15 | 10 | 35 | 30 |
| 03052212 | 15 | 13.3 N | 151.3E | 65 | 8 | 21 | 64 | 103 | 148 | 298 | 462 |  | 0 | $10$ | $20$ | $25$ | - 20 | 0 | 20 |  |


| 03052218 | 16 | 14.2 N | 151.3E | 65 | 0 | 17 | 46 | 64 | 129 | 239 | 411 |  | 5 | $\overline{-}$ | 45 | 40 | 30 | 20 | 40 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03052300 | 17 | 14.9 N | 151.2E | 85 | 0 | 48 | 57 | 79 | 144 | 273 |  |  | 0 | 15 | 15 | $15$ | 25 | 20 |  |  |
| 03052306 | 18 | 15.6 N | 151.2E | 95 | 0 | 44 | 74 | 112 | 172 | 244 |  |  | 0 | -5 | 5 | -5 | 10 | 35 |  |  |
| 03052312 | 19 | 16.4 N | 151.4E | 105 | 0 | 13 | 46 | 111 | 174 | 296 |  |  | 0 | 0 | 0 | -5 | 10 | 30 |  |  |
| 03052318 | 20 | 17.3 N | 151.5E | 115 | 8 | 27 | 50 | 57 | 69 | 197 |  |  | 0 | 10 | 5 | 10 | 20 | 15 |  |  |
| 03052400 | 21 | 18.2 N | 151.6E | 115 | 0 | 21 | 65 | 85 | 127 | 283 |  |  | 0 | $10$ | $15$ | $10$ | -5 | 15 |  |  |
| 03052406 | 22 | 19.1 N | 152.1E | 115 | 17 | 53 | 49 | 79 | 166 |  |  |  | 0 | $\overline{15}$ | -5 | 5 | 0 |  |  |  |
| 03052412 | 23 | 20.0 N | 152.6E | 115 | 8 | 39 | 44 | 60 | 188 |  |  |  | 0 | $15$ | -5 | 5 | 0 |  |  |  |
| 03052418 | 24 | 21.0 N | 153.8E | 115 | 6 | 20 | 32 | 16 | 44 |  |  |  | 0 | 5 | 15 | 10 | 10 |  |  |  |
| 03052500 | 25 | 22.4 N | 154.7E | 115 | 5 | 16 | 41 | 27 | 46 |  |  |  | 0 | 0 | 10 | 5 | 10 |  |  |  |
| 03052506 | 26 | 23.8 N | 155.6E | 90 | 13 | 32 | 21 | 78 | 57 |  |  |  | 0 | 10 | 10 | 10 | 0 |  |  |  |
| 03052512 | 27 | 25.2 N | 156.6E | 90 | 0 | 27 | 66 | 91 |  |  |  |  | 0 | 5 | 0 | 10 |  |  |  |  |
| 03052518 | 28 | 26.8 N | 157.5E | 65 | 8 | 25 | 78 | 47 |  |  |  |  | 0 | -5 | 10 | 10 |  |  |  |  |
| 03052600 | 29 | 28.3 N | 158.6E | 65 | 5 | 53 | 90 |  |  |  |  |  | 0 | 0 | 10 |  |  |  |  |  |
| 03052606 | 30 | 29.7 N | 160.4E | 55 | 7 | 5 | 121 |  |  |  |  |  | 0 | 5 | 5 |  |  |  |  |  |
| 03052612 | 31 | 31.0 N | 162.3E | 55 | 31 | 134 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03052618 | 32 | 32.4 N | 164.5E | 45 | 28 | 209 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03052700 | 33 | 33.9 N | 166.9E | 45 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03052706 |  | 36.1 N | 170.9E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 44 | 63 | 87 | 131 | 245 | 393 | 620 | 0 | 9 | 12 | 14 | 15 | 13 | 25 | 38 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | 4 | 5 | 7 | 9 | 4 | 18 |
|  |  |  | \# CASES |  | 33 | 32 | 30 | 28 | 26 | 21 | 16 | 14 | 33 | 32 | 30 | 28 | 26 | 21 | 16 | 14 |



Figure 1-04W-1. 230315Z May 2003 MODIS true-color image of TY 04W (Chan-Hom), located 390 nm east-northeast of Guam, with an intensity of 85 knots.


Figure 1-04W-2. $241519 Z$ May 200385 GHz TRMM image of TY 04W (Chan-hom), the eye was located 560 nm northeast of the Saipan, with a peak intensity of 115 knots.

## TYPHOON 04W (CHAN-HOM) <br> 18-27 MAY 2003



## Intensity (kts)



- KGWC
- PGTW
- KWBC
- T-Numbers
- Best Track

Fix Date (Zulu)

# Typhoon (TY) 04W (Chan-Hom)* 

First Poor : 0600Z 18 May 03

First Fair : 1000Z 18May 03
First TCFA : 1500Z 18May 03
First Warning : 0000Z 19 May 03
Last Warning : 0000Z 27 May 03
Max Intensity : 115 kts, gusts to 140 kts
Landfall : NONE

Total Warnings : 33
Remarks:

1) Typhoon (TY) 04W was initially detected as persistent deep convection over a broad low level circulation center (LLCC) and reached warning criteria within 18 hours, at 0000Z on 19 May. An Air Force weather reconnaissance flight was flown into this cyclone just after the first warning was issued while the cyclone was still broad and difficult to locate with satellite fixes. This flight provided center fix and wind information with 40 knot winds near the center on a 30 second average.

TY 04W tracked provided poleward towards a weakness in the low to mid-level steering ridge by a migratory shortwave trough. Intensification for this cyclone was very close to one Dvorak T-number/day from the initial warning until approximately $1800 Z$ on 23 May, when TY 04W reached maximum intensity. Subsequently, maximum intensity was maintained for 30 hours as the system passed the ridge axis moved more north-northeastward while accelerating.

After 0000Z on 25 May, TY 04W began to decrease in intensity rapidly as it increased track speed towards a shortwave trough to the northeast. Dry air entrainment was noted by 0600Z on 26 May in microwave satellite imagery as the cyclone began extratropical transition. TY 04W completed extratropical transition by 0000 Z on 27 May, at which time a final warning was issued.
2) FEMA damage assessments indicated Chuuk sustained some damage to homes and food crops due to heavy rain as TY 04W passed near the island. Storm intensity was approximately 35 to 45 knots, with Chuuk experiencing winds of 35 to 38 knots as the system moved northwest of the island.
*Named by WMO designated RSMC

| Statistics for JTWC on TY04W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | OSIT | ON | RRO | RS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03051800 |  | 4.0 N | 147.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051806 |  | 4.6 N | 148.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051812 |  | 5.2 N | 148.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051818 |  | 5.8 N | 149.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051900 | 1 | 6.3 N | 149.3E | 25 | 26 | 88 | 147 | 132 | 112 | 160 | 197 | 290 | 0 | -5 | 5 | 5 | 0 | 0 | - 30 | -50 |
| 03051906 | 2 | 6.7 N | 149.8E | 35 | 8 | 49 | 27 | 30 | 27 | 128 | 231 | 313 | 0 | 10 | 20 | 5 | 15 | 15 | -5 | -20 |
| 03051912 | 3 | 6.8 N | 150.4E | 35 | 26 | 38 | 6 | 13 | 58 | 179 | 251 | 394 | 0 | 10 | 10 | 5 | 15 | 10 | $20$ | -25 |
| 03051918 | 4 | 6.9 N | 150.8E | 35 | 66 | 61 | 66 | 104 | 160 | 257 | 338 | 516 | 0 | 10 | 0 | 10 | 15 | 25 | - 40 | -25 |
| 03052000 | 5 | 7.3N | 151.0E | 35 | 0 | 8 | 19 | 86 | 132 | 249 | 336 | 512 | 0 | 5 | 5 | 15 | 15 | 5 | $35$ | -25 |
| 03052006 | 6 | 7.7N | 150.8E | 35 | 18 | 18 | 19 | 80 | 118 | 185 | 282 | 495 | 0 | $10$ | 0 | 5 | 10 | $15$ | $40$ | 0 |
| 03052012 | 7 | 8.0 N | 150.6E | 45 | 5 | 0 | 69 | 119 | 164 | 242 | 322 | 573 | 10 | 10 | 20 | 25 | 35 | 10 | 0 | 10 |
| 03052018 | 8 | 8.4 N | 150.4E | 55 | 26 | 71 | 133 | 179 | 218 | 288 | 474 | 765 | 0 | 10 | 20 | 30 | 50 | 10 | 0 | 60 |
| 03052100 | 9 | 8.8 N | 150.3E | 55 | 11 | 93 | 143 | 182 | 212 | 299 | 520 | 794 | 0 | 15 | 25 | 45 | 35 | 10 | 5 | 60 |
| 03052106 | 10 | 9.4 N | 150.6E | 55 | 21 | 76 | 110 | 144 | 166 | 287 | 516 | 816 | 0 | 10 | 25 | 40 | 20 | 0 | 25 | 60 |
| 03052112 | 11 | 10.3 N | 150.9E | 55 | 23 | 30 | 54 | 84 | 141 | 247 | 489 | 722 | 0 | 0 | 15 | 10 | 10 | $10$ | 15 | 50 |
| 03052118 | 12 | 11.1 N | 151.0E | 60 | 5 | 18 | 37 | 64 | 126 | 260 | 453 | 729 | 0 | 10 | 20 | 10 | -5 | $10$ | 45 | 60 |
| 03052200 | 13 | 11.8 N | 151.1E | 65 | 5 | 35 | 65 | 114 | 163 | 289 | 486 | 830 | 0 | 10 | 5 | 0 | 0 | $10$ | 50 | 60 |
| 03052206 | 14 | 12.6 N | 151.2E | 65 | 8 | 21 | 55 | 98 | 133 | 249 | 523 | 931 | 0 | 10 | $10$ | $20$ | $15$ | 10 | 35 | 30 |
| 03052212 | 15 | 13.3 N | 151.3E | 65 | 8 | 21 | 64 | 103 | 148 | 298 | 462 |  | 0 | $10$ | $20$ | $25$ | 20 | 0 | 20 |  |
| 03052218 | 16 | 14.2 N | 151.3E | 65 | 0 | 17 | 46 | 64 | 129 | 239 | 411 |  | 5 | $30$ | $45$ | $40$ | $30$ | 20 | 40 |  |
| 03052300 | 17 | 14.9 N | 151.2E | 85 | 0 | 48 | 57 | 79 | 144 | 273 |  |  | 0 | $15$ | $15$ | $15$ | $25$ | 20 |  |  |
| 03052306 | 18 | 15.6N | 151.2E | 95 | 0 | 44 | 74 | 112 | 172 | 244 |  |  | 0 | -5 | 5 | -5 | 10 | 35 |  |  |
| 03052312 | 19 | 16.4 N | 151.4E | 105 | 0 | 13 | 46 | 111 | 174 | 296 |  |  | 0 | 0 | 0 | -5 | 10 | 30 |  |  |


| 03052318 | 20 | 17.3N | 151.5E | 115 | 8 | 27 | 50 | 57 | 69 | 197 |  |  | 0 | 10 | 5 | 10 | 20 | 15 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03052400 | 21 | 18.2N | 151.6E | 115 | 0 | 21 | 65 | 85 | 127 | 283 |  |  | 0 | $10$ | $15$ | $10$ | -5 | 15 |  |  |
| 03052406 | 22 | 19.1 N | 152.1E | 115 | 17 | 53 | 49 | 79 | 166 |  |  |  | 0 | $15$ | -5 | 5 | 0 |  |  |  |
| 03052412 | 23 | 20.0 N | 152.6E | 115 | 8 | 39 | 44 | 60 | 188 |  |  |  | 0 | $15$ | -5 | 5 | 0 |  |  |  |
| 03052418 | 24 | 21.0N | 153.8E | 115 | 6 | 20 | 32 | 16 | 44 |  |  |  | 0 | 5 | 15 | 10 | 10 |  |  |  |
| 03052500 | 25 | 22.4 N | 154.7E | 115 | 5 | 16 | 41 | 27 | 46 |  |  |  | 0 | 0 | 10 | 5 | 10 |  |  |  |
| 03052506 | 26 | 23.8 N | 155.6E | 90 | 13 | 32 | 21 | 78 | 57 |  |  |  | 0 | 10 | 10 | 10 | 0 |  |  |  |
| 03052512 | 27 | 25.2 N | 156.6E | 90 | 0 | 27 | 66 | 91 |  |  |  |  | 0 | 5 | 0 | 10 |  |  |  |  |
| 03052518 | 28 | 26.8 N | 157.5E | 65 | 8 | 25 | 78 | 47 |  |  |  |  | 0 | -5 | 10 | 10 |  |  |  |  |
| 03052600 | 29 | 28.3 N | 158.6E | 65 | 5 | 53 | 90 |  |  |  |  |  | 0 | 0 | 10 |  |  |  |  |  |
| 03052606 | 30 | 29.7N | 160.4E | 55 | 7 | 5 | 121 |  |  |  |  |  | 0 | 5 | 5 |  |  |  |  |  |
| 03052612 | 31 | 31.0 N | 162.3E | 55 | 31 | 134 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03052618 | 32 | 32.4 N | 164.5E | 45 | 28 | 209 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03052700 | 33 | 33.9 N | 166.9E | 45 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03052706 |  | 36.1 N | 170.9E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 44 | 63 | 87 | 131 | 245 | 393 | 620 | 0 | 9 | 12 | 14 | 15 | 13 | 25 | 38 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | 4 | 5 | 7 | 9 | 4 | 18 |
|  |  |  | \# CASES |  | 33 | 32 | 30 | 28 | 26 | 21 | 16 | 14 | 33 | 32 | 30 | 28 | 26 | 21 | 16 | 14 |



Figure 1-04W-1. $230315 Z$ May 2003 MODIS true-color image of TY 04W (Chan-Hom), located 390nm east-northeast of Guam, with an intensity of 85 knots.


Figure 1-04W-2. $241519 Z$ May 200385 GHz TRMM image of TY 04W (Chan-hom), the eye was located 560 nm northeast of the Saipan, with a peak intensity of 115 knots.

TYPHOON 04W (CHAN-HOM)
18-27 MAY 2003


## Time Intensity for 04W

Intensity (kts)


## Tropical Storm (TS) 05W (Linfa)*

First Poor : 1900Z 23 May 03
First Fair : 0600Z 24 May 03
First TCFA : 1900Z 24 May 03
First Warning : 0000Z 25 May 03
Last Warning : 1800Z 30 May 03
Max Intensity : 60 kts, gusts to 75 kts
Landfall : Near Dagupan, Philippines
Total Warnings : 24
Remarks:

1) Tropical Storm (TS) 05W formed west of Luzon, Philippines and intensified slowly as it looped counter-clockwise in the South China Sea. Subsequently, the cyclone began to move east, toward Luzon island, in response to westerly steering flow.

The cyclone made landfall near Dagupan, Philippines, weakened due to land effects and then moved east into the Philippine Sea. After moving back over water, the cyclone began to move north-northeast with most of the heavy convection stripped from the cyclone. Subsequently, the cyclone began to slowly intensify reaching maximum intensity of 55 knots as it tracked north, along the eastern periphery of the Ryuku Islands.

Of note, one U. S. Air Force weather reconnaissance mission with a WC-130 aircraft was flown into this cyclone and an aircraft fix was made at $0446 Z$ on 30 May 2003. Data from this mission supported available radar and satellite data for the same period.

After 0000 Z on the 30th, extratropical influences began to affect this cyclone and transition for an extratropical cyclone occurred shortly after $1800 Z$ on 30 May in the Bungo Strait region between Kyushu and Shikoku.
2) No damage reports were received associated with this system.
*Named by WMO designated RSMC

Statistics for JTWC on TS 05W

|  | WRN BEST TRACK |  |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 729 | 120 |
| 03052406 |  | 15.5N | 118.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052412 |  | 16.0N | 118.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052418 |  | 16.3 N | 118.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052500 | 1 | 16.5 N | 118.6E | 25 | 0 | 29 | 57 | 30 | 29 | 187 |  |  | 0 | 0 | 10 | 0 | -5 | 10 |  |
| 03052506 | 2 | 16.5N | 118.3E | 30 | 8 | 18 | 6 | 19 | 62 | 185 |  |  | 0 | -5 | 5 | 0 | 0 | 10 |  |
| 03052512 | 3 | 16.4 N | 118.1E | 30 | 8 | 8 | 12 | 24 | 24 | 187 |  |  | 0 | -5 | 0 | 10 | 10 |  |  |
| 03052518 | 4 | 16.1 N | 118.1E | 45 | 18 | 6 | 8 | 25 | 71 | 181 | 238 | 420 | 0 | 5 | 10 | 10 | -5 | 10 | -10 |
| 03052600 | 5 | 16.0N | 118.4E | 45 | 13 | 31 | 50 | 107 | 179 | 292 | 251 |  | 0 | 10 | 10 | 25 | 0 | $10-$ |  |
| 03052606 | 6 | 16.1 N | 118.7E | 45 | 11 | 26 | 70 | 145 | 200 | 346 | 619 |  | 0 | 0 | 20 | 5 | -5 | 25 |  |
| 03052612 | 7 | 16.1 N | 119.0E | 45 | 8 | 6 | 58 | 119 | 194 | 268 | 482 |  | 0 | 0 | -5 | -5 | 5 | 0 |  |
| 03052618 | 8 | 16.1 N | 119.4E | 55 | 0 | 34 | 91 | 141 | 210 | 316 | 566 |  | 0 | 0 | 0 | 5 | 20 | 1030 |  |
| 03052700 | 9 | 16.1 N | 119.8E | 55 | 0 | 59 | 97 | 172 | 244 | 345 |  |  | 0 | 10 | 10 | 25 | 35 | 30 |  |
| 03052706 | 10 | 16.1 N | 120.8E | 45 | 17 | 48 | 98 | 178 | 235 | 368 |  |  | 0 | 0 | 10 | 20 | 25 | 20 |  |
| 03052712 | 11 | 16.3 N | 121.8E | 35 | 8 | 37 | 131 | 206 | 251 | 405 |  |  | 0 | 10 | 15 | 20 | 20 | 20 |  |
| 03052800 | 12 | 17.4 N | 123.7E | 30 | 62 | 142 | 209 | 230 | 281 |  |  |  | -5 | 0 | 0 | 0 | 0 |  |  |
| 03052806 | 13 | 18.8 N | 124.0E | 30 | 85 | 122 | 156 | 160 | 169 |  |  |  | -5 | 0 | 0 | - 10 | 0 |  |  |
| 03052812 | 14 | 19.7N | 125.0E | 30 | 101 | 175 | 203 | 234 | 266 |  |  |  | -5 | -5 | 10 | - 15 | 15 |  |  |
| 03052818 | 15 | 20.8 N | 125.6E | 30 | 161 | 167 | 187 | 254 | 331 |  |  |  | -5 | 0 | - 15 | - | 15 |  |  |
| 03052900 | 16 | 21.8 N | 126.3E | 35 | 40 | 73 | 80 | 21 |  |  |  |  | 10 | 10 | 15 | 25 |  |  |  |
| 03052906 | 17 | 22.6 N | 127.2E | 35 | 12 | 57 | 51 | 19 |  |  |  |  | 0 | 10 | 10 | 5 |  |  |  |


| 03052912 | 18 | 23.4 N | 128.1 E | 45 | 18 | 36 | 22 |  |  |  |  |  |  |  | -5 | - | - |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |




Figure 1-05W-1. $270016 Z$ May 2003 multi-sensor satellite images of TY 05W (Linfa), located along the west coast of Luzon, with a peak intensity of 55 knots.

## TROPICAL STORM 05W (LINFA)

 25-30 MAY 2003

## Time Intensity for 05W

## Intensity (kts)



[^1]
## Tropical Storm (TS) 05W (Linfa)

First Poor : 1900Z 23 May 03
First Fair : 0600Z 24 May 03
First TCFA : 1900Z 24 May 03
First Warning : 0000Z 25 May 03
Last Warning : 1800Z 30 May 03
Max Intensity : 60 kts, gusts to 75 kts
Landfall : Near Dagupan, Philippines
Total Warnings : 24
Remarks:

1) Tropical Storm (TS) 05W formed west of Luzon, Philippines and intensified slowly as it looped counter-clockwise in the South China Sea. Subsequently, the cyclone began to move east, toward Luzon island, in apparent response to westerly steering flow.

The cyclone made landfall near Dagupan, Philippines, weakened due to land effects and then moved east into the Philippine Sea. After moving back over water, the cyclone began to move north-northeast with most of the heavy convection stripped from the cyclone. Subsequently, the cyclone began to slowly intensify reaching maximum intensity of 55 knots as it tracked north, along the eastern periphery of the Ryuku Islands.

Of note, one U. S. Air Force weather reconnaissance mission with a WC-130 aircraft was flown into this cyclone and an aircraft fix was made at $0446 Z$ on 30 May 2003. Data from this mission supported available radar and satellite data for the same period.

After 0000 Z on the 30th, extratropical influences began to affect this cyclone and transition for an extratropical cyclone occurred shortly after 1800Z on 30 May in the Bungo Strait region between Kyushu and Shikoku.
2) No damage reports were received associated with this system.

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03052406 |  | 15.5 N | 118.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052412 |  | 16.0N | 118.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052418 |  | 16.3 N | 118.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03052500 | 1 | 16.5 N | 118.6E | 25 | 0 | 29 | 57 | 30 | 29 | 187 |  |  | 0 | 0 | 10 | 0 | -5 | $10$ |  |  |
| 03052506 | 2 | 16.5 N | 118.3E | 30 | 8 | 18 | 6 | 19 | 62 | 185 |  |  | 0 | -5 | 5 | 0 | 0 | $10$ |  |  |
| 03052512 | 3 | 16.4 N | 118.1E | 30 | 8 | 8 | 12 | 24 | 24 | 187 |  |  | 0 | -5 | 0 | $10$ | - 10 | 5 |  |  |
| 03052518 | 4 | 16.1 N | 118.1E | 45 | 18 | 6 | 8 | 25 | 71 | 181 | 238 | 420 | 0 | 5 | 10 | 10 | -5 | 10 | $25$ | -10 |
| 03052600 | 5 | 16.0N | 118.4E | 45 | 13 | 31 | 50 | 107 | 179 | 292 | 251 |  | 0 | 10 | 10 | 25 | 0 | 10 | $25$ |  |
| 03052606 | 6 | 16.1 N | 118.7E | 45 | 11 | 26 | 70 | 145 | 200 | 346 | 619 |  | 0 | 0 | 20 | 5 | -5 | 0 | $25$ |  |
| 03052612 | 7 | 16.1 N | 119.0E | 45 | 8 | 6 | 58 | 119 | 194 | 268 | 482 |  | 0 | 0 | -5 | -5 | 5 | 0 | 0 |  |
| 03052618 | 8 | 16.1 N | 119.4E | 55 | 0 | 34 | 91 | 141 | 210 | 316 | 566 |  | 0 | 0 | 0 | 5 | 20 | 10 | 30 |  |
| 03052700 | 9 | 16.1 N | 119.8E | 55 | 0 | 59 | 97 | 172 | 244 | 345 |  |  | 0 | 10 | 10 | 25 | 35 | 30 |  |  |
| 03052706 | 10 | 16.1 N | 120.8E | 45 | 17 | 48 | 98 | 178 | 235 | 368 |  |  | 0 | 0 | 10 | 20 | 25 | 20 |  |  |
| 03052712 | 11 | 16.3N | 121.8E | 35 | 8 | 37 | 131 | 206 | 251 | 405 |  |  | 0 | 10 | 15 | 20 | 20 | 20 |  |  |
| 03052800 | 12 | 17.4 N | 123.7E | 30 | 62 | 142 | 209 | 230 | 281 |  |  |  | -5 | 0 | 0 | 0 | 0 |  |  |  |
| 03052806 | 13 | 18.8N | 124.0E | 30 | 85 | 122 | 156 | 160 | 169 |  |  |  | -5 | 0 | 0 | $10$ | 0 |  |  |  |
| 03052812 | 14 | 19.7N | 125.0E | 30 | 101 | 175 | 203 | 234 | 266 |  |  |  | -5 | -5 | $10$ | $15$ | $15$ |  |  |  |
| 03052818 | 15 | 20.8N | 125.6E | 30 | 161 | 167 | 187 | 254 | 331 |  |  |  | -5 | 0 | - 15 | - | $15$ |  |  |  |
| 03052900 | 16 | 21.8 N | 126.3E | 35 | 40 | 73 | 80 | 21 |  |  |  |  | $10$ | $10$ | $15$ | $25$ |  |  |  |  |
| 03052906 | 17 | 22.6 N | 127.2E | 35 | 12 | 57 | 51 | 19 |  |  |  |  | 0 | - 10 | - 10 | -5 |  |  |  |  |
| 03052912 | 18 | 23.4 N | 128.1E | 45 | 18 | 36 | 22 |  |  |  |  |  | -5 | $10$ | $10$ |  |  |  |  |  |
| 03052918 | 19 | 24.4 N | 129.3E | 55 | 6 | 20 | 54 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 03053000 | 20 | 25.8 N | 130.1E | 55 | 13 | 48 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03053006 | 21 | 27.8 N | 131.0E | 55 | 28 | 68 |  |  |  |  |  |  | 5 | 10 |  |  |  |  |  |  |
| 03053012 | 22 | 29.9 N | 131.6E | 55 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03053018 | 23 | 32.0 N | 132.0E | 50 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |


|  |  |  | AVERAGE |  | 28 | 58 | 86 | 123 | 183 | 280 | 431 | 420 | 2 | 4 | 8 | 11 | 11 | 11 | 21 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-05W-1. 270016 Z May 2003 multi-sensor satellite images of TY 05W (Linfa), located along the west coast of Luzon, with a peak intensity of 55 knots.

TROPICAL STORM 05W (LINFA)
25-30 MAY 2003


## Time Intensity for 05W



## Tropical Storm (TS) 06W (Nangka)*



First Poor : 2200Z 29 May 03

First Fair : 0130Z 31 May 03

First TCFA : 0500Z 31 May 03

First Warning : 1200Z 31 May 03
Last Warning : 0000Z 03 Jun 03, Extratropical
Max Intensity : 40 kts, gusts to 50 kts
Landfall : NA

Total Warnings : 11
Remarks:

1) Tropical Storm (TS) 06W was initially detected as a tropical disturbance in the South China Sea on 29 May, 2003. The first warning was issued at $1200 Z$ on 31 May. Moderate vertical wind shear was present throughout the life of the cyclone, resulting in an intensification rate lower than a Dvorak Tnumber/day.

TS 06W reached a maximum intensity of 45 knots during northeast movement through the Luzon Strait and passage east of Taiwan. After approximately $1800 Z$ on 02 May, the cyclone encountered increased vertical wind shear associated with the mid-latitude westerly winds, weakened to tropical depression strength and transitioned to an extratropical cyclone after 03 June at 0000Z.
2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03053100 |  | 17.1 N | 117.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03053106 |  | 17.1 N | 117.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03053112 | 1 | 17.2N | 117.0E | 25 | 37 | 59 | 88 | 113 | 203 | 621 |  |  | 0 | 0 | -5 | -10 | 0 | 20 |  |  |
| 03053118 | 2 | 17.4 N | 117.0E | 30 | 16 | 52 | 133 | 239 | 315 | 668 |  |  | 0 | 0 | -5 | 0 | 0 | 25 |  |  |
| 03060100 | 3 | 17.6N | 117.2E | 30 | 12 | 75 | 153 | 234 | 265 | 644 |  |  | 0 | -5 | -5 | 0 | 10 | 20 |  |  |
| 03060106 | 4 | 17.9N | 117.5E | 35 | 24 | 88 | 187 | 260 | 428 |  |  |  | 0 | -5 | 0 | 5 | 20 |  |  |  |
| 03060112 | 5 | 18.5N | 118.2E | 40 | 49 | 91 | 133 | 205 | 403 |  |  |  | -5 | -5 | 0 | 10 | 25 |  |  |  |
| 03060118 | 6 | 19.2N | 118.9E | 45 | 22 | 46 | 81 | 144 | 270 |  |  |  | -5 | 5 | 10 | 20 | 25 |  |  |  |
| 03060200 | 7 | 20.0N | 119.6E | 45 | 23 | 66 | 101 | 217 | 283 |  |  |  | 0 | 5 | 15 | 20 | 25 |  |  |  |
| 03060206 | 8 | 20.8N | 120.8E | 45 | 46 | 80 | 172 | 312 |  |  |  |  | 5 | 10 | 20 | 25 |  |  |  |  |
| 03060212 | 9 | 21.5N | 122.0E | 45 | 30 | 56 | 88 | 200 |  |  |  |  | 5 | 10 | 15 | 15 |  |  |  |  |
| 03060218 | 10 | 22.2N | 123.3E | 45 | 16 | 78 | 185 |  |  |  |  |  | -15 | -5 | 5 |  |  |  |  |  |
| 03060300 | 11 | 23.0 N | 125.3E | 40 | 5 | 66 | 154 |  |  |  |  |  | -10 | 0 | 0 |  |  |  |  |  |
| 03060306 |  | 24.1 N | 127.9E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060312 |  | 25.6 N | 130.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060318 |  | 27.4 N | 133.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060400 |  | 29.4 N | 136.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 26 | 69 | 134 | 214 | 309 | 645 |  |  | 4 | 5 | 7 | 12 | 15 | 22 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | 1 | 5 | 9 | 15 | 22 |  |  |
|  |  |  | \# CASES |  | 11 | 11 | 11 | 9 | 7 | 3 |  |  | 11 | 11 | 11 | 9 | 7 | 3 |  |  |



Figure 1-06W-1. 010630 Z June 2003 Goes-9 visible imagery of TS 06W (Nangka), located in the south china sea northwest of Luzon with an estimated intensity of 35 knots.

## TROPICAL STORM 06W (NANGKA) <br> 31 MAY - 03 JUNE 2003



## Time Intensity for 06W

## Intensity (kts)



## Tropical Storm (TS) 06W (Nangka)

First Poor : 2200Z 29 May 03
First Fair : 0130Z 31 May 03
First TCFA : 0500Z 31 May 03
First Warning : 1200Z 31 May 03
Last Warning : 0000Z 03 Jun 03, Extratropical
Max Intensity : 40 kts, gusts to 50 kts
Landfall : NA
Total Warnings : 11
Remarks:

1) Tropical Storm (TS) 06W was initially detected as a tropical disturbance in the South China Sea on 29 May, 2003 and, approximately 36 hours later, the first warning was issued at $1200 Z$ on 31 May. Moderate vertical wind shear was present throughout the life of the cyclone, resulting in an intensification rate lower than a Dvorak T-number/day.

TS 06W reached a maximum intensity of 45 knots during northeast movement through the Luzon Strait and passage east of Taiwan. After approximately $1800 Z$ on 02 May, the cyclone encountered increased vertical winds shear associated with the mid-latitude westerly winds, weakened to tropical depression strength and transitioned to an extratropical cyclone after 03 June at 0000Z.
2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

Statistics for JTWC on TS 06W

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03053100 |  | 17.1 N | 117.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03053106 |  | 17.1 N | 117.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03053112 | 1 | 17.2N | 117.0E | 25 | 37 | 59 | 88 | 113 | 203 | 621 |  |  | 0 | 0 | -5 | -10 | 0 | 20 |  |  |
| 03053118 | 2 | 17.4N | 117.0E | 30 | 16 | 52 | 133 | 239 | 315 | 668 |  |  | 0 | 0 | -5 | 0 | 0 | 25 |  |  |
| 03060100 | 3 | 17.6N | 117.2E | 30 | 12 | 75 | 153 | 234 | 265 | 644 |  |  | 0 | -5 | -5 | 0 | 10 | 20 |  |  |
| 03060106 | 4 | 17.9 N | 117.5E | 35 | 24 | 88 | 187 | 260 | 428 |  |  |  | 0 | -5 | 0 | 5 | 20 |  |  |  |
| 03060112 | 5 | 18.5 N | 118.2E | 40 | 49 | 91 | 133 | 205 | 403 |  |  |  | -5 | -5 | 0 | 10 | 25 |  |  |  |
| 03060118 | 6 | 19.2N | 118.9E | 45 | 22 | 46 | 81 | 144 | 270 |  |  |  | -5 | 5 | 10 | 20 | 25 |  |  |  |
| 03060200 | 7 | 20.0 N | 119.6E | 45 | 23 | 66 | 101 | 217 | 283 |  |  |  | 0 | 5 | 15 | 20 | 25 |  |  |  |
| 03060206 | 8 | 20.8N | 120.8E | 45 | 46 | 80 | 172 | 312 |  |  |  |  | 5 | 10 | 20 | 25 |  |  |  |  |
| 03060212 | 9 | 21.5 N | 122.0E | 45 | 30 | 56 | 88 | 200 |  |  |  |  | 5 | 10 | 15 | 15 |  |  |  |  |
| 03060218 | 10 | 22.2 N | 123.3E | 45 | 16 | 78 | 185 |  |  |  |  |  | -15 | -5 | 5 |  |  |  |  |  |
| 03060300 | 11 | 23.0 N | 125.3E | 40 | 5 | 66 | 154 |  |  |  |  |  | -10 | 0 | 0 |  |  |  |  |  |
| 03060306 |  | 24.1 N | 127.9E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060312 |  | 25.6 N | 130.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060318 |  | 27.4 N | 133.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060400 |  | 29.4 N | 136.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 26 | 69 | 134 | 214 | 309 | 645 |  |  | 4 | 5 | 7 | 12 | 15 | 22 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | 1 | 5 | 9 | 15 | 22 |  |  |
|  |  |  | \# CASES |  | 11 | 11 | 11 | 9 | 7 | 3 |  |  | 11 | 11 | 11 | 9 | 7 | 3 |  |  |



Figure 1-06W-1. 010630Z June 2003 Goes-9 visible imagery of TS 06W (Nangka), located in the south china sea northwest of Luzon with an estimated intensity of 35 knots.

## TROPICAL STORM 06W (NANGKA) <br> 31 MAY - 03 JUNE 2003



Time Intensity for 06W
Intensity (kts)


Fix Date (Zulu)

# Typhoon (TY) 07W (Soudelor)* 

First Poor : 0600Z 09 Jun 03
First Fair : 1600Z 09 Jun 03
First TCFA : $2100 Z 09$ Jun 03
First Warning : 1800Z 11 Jun 03
Last Warning : $1800 Z 18$ Jun 03
Max Intensity : 115 kts, gusts to 140 kts
Landfall : None
Total Warnings : 33

## Remarks:

(1) Typhoon (TY) 07W was first noted on 09 June as an area of heavy convection; within 15 hours a Tropical Cyclone Formation Alert had been issued for this area. Over the next 45 hours the cyclone developed very slowly due to vertical wind shear inhibiting development. After $1200 Z$ on 11 June, vertical wind shear had decreased, which allowed the cyclone to develop at a climatological rate for 48 hours, intensifying to 50 knots as it tracked west, south of the subtropical ridge. By 0000 Z on 14 June, the cyclone began to move more poleward, into a weakness in the subtropical ridge associated with a mid-latitude longwave trough. During the intial poleward movement, the low level circulation center (IIcc) had become partially exposed and intensity decreased to 45 knots. After 24 hours, the llcc moved under the deep convection, however the rate of intensification was slightly below 1 Dvorak T-number / day as the cyclone moved toward the Ryukyu Islands.

At around $1200 Z$ on 17 June, when TY 07W was east of Taiwan, it began to rapidly intensify at a rate of 1.5 Dvorak T-numbers in 18 hours, then attained peak intensity of 115 knots around 0600 Z on 18 June. Intensification was enhanced by upper level outflow into the mid-latitude longwave trough while TY 07W was moving north-northeastward, poleward of the subtropical ridge axis. After peak intensity was attained, the cyclone experienced vertical wind shear, associated with the mid-latitude westerlies, and began to rapidly weaken and transition to an extratropical system.
(2) Although TY 07W came close to several land masses, reports of damage were noted from only one region. Damage reports from the Philippines indicated there were 11 casualties and thousands of persons temporarily displaced by flooding due to heavy rains associated with this cyclone.

## *Named by WMO Designated RSMC

## Statistics for JTWC on TY07W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03060700 |  | 8.2 N | 155.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060706 |  | 8.2 N | 153.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060712 |  | 8.1 N | 152.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060718 |  | 8.2 N | 151.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060800 |  | 8.2 N | 150.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060806 |  | 8.3N | 150.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060812 |  | 8.4 N | 149.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060818 |  | 8.6N | 149.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060900 |  | 8.7N | 148.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060906 |  | 8.8 N | 147.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060912 |  | 8.9 N | 146.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060918 |  | 9.1 N | 145.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061000 |  | 9.4 N | 144.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061006 |  | 9.5 N | 143.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061012 |  | 9.6 N | 142.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061018 |  | 9.6 N | 141.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061100 |  | 9.6 N | 140.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061106 |  | 9.6 N | 139.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061112 |  | 9.4 N | 138.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061118 | 1 | 9.4 N | 137.2E | 25 | 5 | 48 | 62 | 118 | 147 | 60 |  |  | 0 | 0 | 5 | -5 | -5 | 20 |  |  |
| 03061200 | 2 | 9.5 N | 135.9E | 25 | 0 | 49 | 88 | 60 | 117 | 254 |  |  | 0 | 0 | 0 | -5 | 0 | 20 |  |  |
| 03061206 | 3 | 9.8 N | 134.7E | 30 | 31 | 89 | 88 | 111 | 190 | 295 |  |  | 0 | 5 | -5 | -5 | 10 | 15 |  |  |
| 03061212 | 4 | 10.1 N | 133.8E | 30 | 13 | 19 | 80 | 114 | 102 | 225 | 186 | 181 | 0 | 0 | -5 | -5 | 15 | 20 | 0 | 0 |
| 03061218 | 5 | 10.4 N | 132.9E | 30 | 35 | 106 | 147 | 131 | 81 | 13 | 61 | 134 | 0 | - | - | 20 | 40 | 35 | 40 | 15 |
| 03061300 | 6 | 10.8 N | 131.7E | 35 | 11 | 86 | 141 | 123 | 58 | 21 | 84 | 147 | 0 | -5 | 5 | 30 | 45 | 40 | 30 | 5 |


| 03061306 | 7 | 11.3 N | 130.4E | 45 | 24 | 100 | 135 | 117 | 102 | 134 | 209 | 208 | 0 | 5 | 25 | 45 | 50 | 45 | 20 | -40 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03061312 | 8 | 11.5 N | 129.1E | 45 | 41 | 111 | 118 | 89 | 98 | 138 | 254 | 345 | 0 | 5 | 30 | 50 | 45 | 45 | 15 | 50 |
| 03061318 | 9 | 11.5 N | 128.2E | 50 | 18 | 76 | 133 | 185 | 221 | 103 | 105 | 161 | 0 | 15 | 25 | 30 | 10 | 0 | 30 | -30 |
| 03061400 | 10 | 11.4 N | 127.4E | 50 | 23 | 84 | 141 | 143 | 141 | 132 | 281 | 336 | 0 | 15 | 0 | $15$ | $15$ | $35$ | 55 | 25 |
| 03061406 | 11 | 12.0 N | 127.0E | 45 | 13 | 30 | 71 | 75 | 73 | 29 | 100 | 242 | 0 | 5 | 0 | -5 | 5 | $10$ | $60$ | 25 |
| 03061412 | 12 | 12.4 N | 126.6E | 45 | 5 | 55 | 58 | 46 | 32 | 16 | 147 | 362 | 0 | 5 | -5 | -5 | 5 | $15$ | $65$ | -20 |
| 03061418 | 13 | 13.1 N | 126.4E | 45 | 5 | 24 | 76 | 112 | 151 | 175 | 239 | 321 | 0 | 5 | 0 | 10 | 10 | $35$ | 40 | -15 |
| 03061500 | 14 | 13.8 N | 126.2E | 45 | 33 | 97 | 133 | 185 | 217 | 262 | 245 | 235 | 0 | 0 | 0 | 10 | 0 | $50$ | 30 | -10 |
| 03061506 | 15 | 14.4 N | 125.9E | 50 | 21 | 67 | 92 | 144 | 163 | 267 | 284 |  | -5 | $10$ | 0 | 0 | $10$ | $70$ | $30$ |  |
| 03061512 | 16 | 14.9 N | 125.4E | 55 | 18 | 37 | 88 | 117 | 152 | 250 | 187 |  | 0 | 0 | 15 | 0 | $10$ | $65$ | - |  |
| 03061518 | 17 | 15.6 N | 124.9E | 60 | 6 | 23 | 72 | 87 | 115 | 108 | 163 |  | 0 | 10 | 10 | 0 | $25$ | $35$ | - 10 |  |
| 03061600 | 18 | 16.5 N | 124.5E | 60 | 17 | 59 | 90 | 109 | 122 | 84 | 327 |  | 0 | 10 | 0 | 5 | 40 | $25$ | 10 |  |
| 03061606 | 19 | 17.3 N | 124.0E | 60 | 16 | 51 | 53 | 18 | 34 | 236 |  |  | 0 | 5 | 5 | $20$ | 5 | - 20 |  |  |
| 03061612 | 20 | 18.1 N | 123.4E | 60 | 8 | 13 | 17 | 34 | 16 | 230 |  |  | 0 | -5 | 0 | $30$ | $60$ | $\overline{15}$ |  |  |
| 03061618 | 21 | 19.0 N | 123.0E | 65 | 5 | 29 | 35 | 16 | 57 | 152 |  |  | 0 | 10 | -5 | $45$ | $\overline{3}$ | 5 |  |  |
| 03061700 | 22 | 20.0 N | 123.1E | 75 | 8 | 8 | 40 | 16 | 93 | 174 |  |  | 0 | 15 | $20$ | $50$ | - 20 | 5 |  |  |
| 03061706 | 23 | 20.8 N | 123.2E | 75 | 5 | 24 | 25 | 75 | 151 |  |  |  | 0 | 15 | - 5 | - | 25 |  |  |  |
| 03061712 | 24 | 22.1 N | 123.6E | 75 | 8 | 100 | 225 | 198 | 175 |  |  |  | 0 | 10 | - 45 | $20$ | 15 |  |  |  |
| 03061718 | 25 | 23.6 N | 123.8E | 90 | 0 | 67 | 41 | 74 | 63 |  |  |  | 0 | $30$ | $\overline{-}$ | - 15 | -5 |  |  |  |
| 03061800 | 26 | 25.2 N | 123.9E | 100 | 18 | 34 | 57 | 109 | 118 |  |  |  | 0 | -5 | 5 | 0 | 5 |  |  |  |
| 03061806 | 27 | 26.2 N | 124.5E | 115 | 17 | 62 | 120 | 159 |  |  |  |  | 0 | 30 | 20 | 20 |  |  |  |  |
| 03061812 | 28 | 27.8 N | 125.4 E | 115 | 8 | 73 | 157 | 147 |  |  |  |  | 0 | 20 | 10 | 0 |  |  |  |  |
| 03061818 | 29 | 30.4 N | 127.1E | 85 | 18 | 42 | 70 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03061900 | 30 | 32.5 N | 128.5E | 70 | 0 | 52 | 60 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03061906 | 31 | 35.4 N | 130.1E | 65 | 36 | 84 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03061912 | 32 | 37.4 N | 132.5E | 55 | 7 | 33 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |


| 03061918 | 33 | $39.2 N$ | 134.9 E | 45 | 30 |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-07W-1. $180225 Z$ June 2003 MODIS true-color image of TY 07W (Soudelor), located 105nm east of Taiwan, with an intensity of 100 knots.


Figure 1-07W-2. $180644 Z$ June 2003 Goes-9 infrared imagery of TY 07W (Soudelor), located 175 nm west-southwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.


Figure 1-07W-3. $181120 Z$ June 200385 GHz SSM/I imagery of TY 07W (Soudelor), located 150 nm west-northwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

## TYPHOON 07W (SOUDELOR)



## Time Intensity for 07 W

Intensity (kts)


# Typhoon (TY) 07W (Soudelor)* 

First Poor : 0600Z 09 Jun 03

First Fair : 1600Z 09 Jun 03

First TCFA : $2100 Z 09$ Jun 03

First Warning : 1800Z 11 Jun 03
Last Warning : 1800Z 18 Jun 03
Max Intensity : 115 kts, gusts to 140 kts
Landfall : None

Total Warnings : 33
Remarks:
(1) Typhoon (TY) 07W was first noted on 09 June as an area of heavy convection and within 15 hours a Tropical Cyclone Formation Alert had been issued for this area. Over the next 45 hours the cyclone developed very slowly due to vertical wind shear limiting development. After $1200 Z$ on 11 June, vertical wind shear had decreased, which allowed the cyclone to develop at a climatological rate for 48 hours, intensifying to 50 knots as it tracked west, south of the subtropical ridge. By 0000 Z on 14 June, the cyclone began to move more poleward, into a weakness in the subtropical ridge associated with a midlatitude longwave trough. During the intial poleward movement, the low level circulation center (Ilcc) had become partially exposed and intensity decreased to 45 knots. After 24 hours, the llcc moved under the deep convection, however the rate of intensification was slightly below 1 Dvorak T-number / day as the cyclone moved toward the Ryukyu Islands.

At around $1200 Z$ on 17 June, when TY 07W was east of Taiwan, it began to rapidly intensify at a rate of 1.5 Dvorak T-numbers in 18 hours, then attained peak intensity of 115 knots around $0600 Z$ on 18 June. Intensification was enhanced by upper level outflow into the mid-latitude longwave trough while TY 07W was moving north-northeastward, poleward of the subtropical ridge axis. After peak intensity was attained, the cyclone experienced vertical wind shear, associated with the mid-latitude westerlies, and began to rapidly weaken and transition to an extratropical system.
(2) Although TY 07W came close to several land masses, reports of damage were noted from only one region. Damage reports from the Philippines indicated there were 11 casualties and thousands of persons temporarily displaced by flooding due to heavy rains associated with this cyclone.
*Named by WMO Designated RSMC

| Statistics for JTWC on TY07W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | OSITI | ON E | RRO | RS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03060700 |  | 8.2 N | 155.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060706 |  | 8.2 N | 153.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060712 |  | 8.1 N | 152.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060718 |  | 8.2 N | 151.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060800 |  | 8.2 N | 150.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060806 |  | 8.3 N | 150.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060812 |  | 8.4 N | 149.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060818 |  | 8.6 N | 149.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060900 |  | 8.7 N | 148.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060906 |  | 8.8 N | 147.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060912 |  | 8.9 N | 146.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060918 |  | 9.1 N | 145.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061000 |  | 9.4 N | 144.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061006 |  | 9.5 N | 143.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061012 |  | 9.6 N | 142.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061018 |  | 9.6 N | 141.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061100 |  | 9.6 N | 140.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061106 |  | 9.6 N | 139.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061112 |  | 9.4 N | 138.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03061118 | 1 | 9.4 N | 137.2E | 25 | 5 | 48 | 62 | 118 | 147 | 60 |  |  | 0 | 0 | 5 | -5 | -5 | 20 |  |  |
| 03061200 | 2 | 9.5 N | 135.9E | 25 | 0 | 49 | 88 | 60 | 117 | 254 |  |  | 0 | 0 | 0 | -5 | 0 | 20 |  |  |
| 03061206 | 3 | 9.8 N | 134.7E | 30 | 31 | 89 | 88 | 111 | 190 | 295 |  |  | 0 | 5 | -5 | -5 | 10 | 15 |  |  |
| 03061212 | 4 | 10.1 N | 133.8E | 30 | 13 | 19 | 80 | 114 | 102 | 225 | 186 | 181 | 0 | 0 | -5 | -5 | 15 | 20 | 0 | 0 |
| 03061218 | 5 | 10.4 N | 132.9E | 30 | 35 | 106 | 147 | 131 | 81 | 13 | 61 | 134 | 0 | $10$ | $10$ | 20 | 40 | 35 | 40 | 15 |
| 03061300 | 6 | 10.8 N | 131.7E | 35 | 11 | 86 | 141 | 123 | 58 | 21 | 84 | 147 | 0 | -5 | 5 | 30 | 45 | 40 | 30 | 5 |
| 03061306 | 7 | 11.3 N | 130.4E | 45 | 24 | 100 | 135 | 117 | 102 | 134 | 209 | 208 | 0 | 5 | 25 | 45 | 50 | 45 | 20 | -40 |
| 03061312 | 8 | 11.5 N | 129.1E | 45 | 41 | 111 | 118 | 89 | 98 | 138 | 254 | 345 | 0 | 5 | 30 | 50 | 45 | 45 | 15 | -50 |
| 03061318 | 9 | 11.5 N | 128.2E | 50 | 18 | 76 | 133 | 185 | 221 | 103 | 105 | 161 | 0 | 15 | 25 | 30 | 10 | 0 | - | -30 |
| 03061400 | 10 | 11.4 N | 127.4E | 50 | 23 | 84 | 141 | 143 | 141 | 132 | 281 | 336 | 0 | 15 | 0 | $15$ | - | - | - 5 | -25 |


| 03061406 | 11 | 12.0 N | 127.0E | 45 | 13 | 30 | 71 | 75 | 73 | 29 | 100 | 242 | 0 | 5 | 0 | -5 | 5 | - 10 | $60$ | -25 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03061412 | 12 | 12.4 N | 126.6E | 45 | 5 | 55 | 58 | 46 | 32 | 16 | 147 | 362 | 0 | 5 | -5 | -5 | 5 | $15$ | $65$ | -20 |
| 03061418 | 13 | 13.1 N | 126.4E | 45 | 5 | 24 | 76 | 112 | 151 | 175 | 239 | 321 | 0 | 5 | 0 | 10 | 10 | $35$ | $40$ | -15 |
| 03061500 | 14 | 13.8 N | 126.2E | 45 | 33 | 97 | 133 | 185 | 217 | 262 | 245 | 235 | 0 | 0 | 0 | 10 | 0 | $50$ | $30$ | -10 |
| 03061506 | 15 | 14.4 N | 125.9E | 50 | 21 | 67 | 92 | 144 | 163 | 267 | 284 |  | -5 | $10$ | 0 | 0 | $10$ | $70$ | $30$ |  |
| 03061512 | 16 | 14.9 N | 125.4E | 55 | 18 | 37 | 88 | 117 | 152 | 250 | 187 |  | 0 | 0 | 15 | 0 | $10$ | $65$ | $15$ |  |
| 03061518 | 17 | 15.6 N | 124.9E | 60 | 6 | 23 | 72 | 87 | 115 | 108 | 163 |  | 0 | 10 | 10 | 0 | $25$ | $35$ | $10$ |  |
| 03061600 | 18 | 16.5 N | 124.5E | 60 | 17 | 59 | 90 | 109 | 122 | 84 | 327 |  | 0 | 10 | 0 | 5 | $40$ | $25$ | $10$ |  |
| 03061606 | 19 | 17.3N | 124.0E | 60 | 16 | 51 | 53 | 18 | 34 | 236 |  |  | 0 | 5 | 5 | $20$ | $55$ | $20$ |  |  |
| 03061612 | 20 | 18.1 N | 123.4E | 60 | 8 | 13 | 17 | 34 | 16 | 230 |  |  | 0 | -5 | 0 | $30$ | $60$ | $15$ |  |  |
| 03061618 | 21 | 19.0 N | 123.0E | 65 | 5 | 29 | 35 | 16 | 57 | 152 |  |  | 0 | 10 | -5 | $45$ | $30$ | -5 |  |  |
| 03061700 | 22 | 20.0 N | 123.1E | 75 | 8 | 8 | 40 | 16 | 93 | 174 |  |  | 0 | 15 | $20$ | $50$ | $20$ | -5 |  |  |
| 03061706 | 23 | 20.8 N | 123.2E | 75 | 5 | 24 | 25 | 75 | 151 |  |  |  | 0 | $15$ | $50$ | $35$ | $25$ |  |  |  |
| 03061712 | 24 | 22.1 N | 123.6E | 75 | 8 | 100 | 225 | 198 | 175 |  |  |  | 0 | $10$ | $45$ | $20$ | $15$ |  |  |  |
| 03061718 | 25 | 23.6N | 123.8E | 90 | 0 | 67 | 41 | 74 | 63 |  |  |  | 0 | $\overline{-}$ | $20$ | $15$ | -5 |  |  |  |
| 03061800 | 26 | 25.2 N | 123.9E | 100 | 18 | 34 | 57 | 109 | 118 |  |  |  | 0 | -5 | 5 | 0 | -5 |  |  |  |
| 03061806 | 27 | 26.2N | 124.5E | 115 | 17 | 62 | 120 | 159 |  |  |  |  | 0 | 30 | 20 | 20 |  |  |  |  |
| 03061812 | 28 | 27.8 N | 125.4E | 115 | 8 | 73 | 157 | 147 |  |  |  |  | 0 | 20 | 10 | 0 |  |  |  |  |
| 03061818 | 29 | 30.4 N | 127.1E | 85 | 18 | 42 | 70 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03061900 | 30 | 32.5 N | 128.5E | 70 | 0 | 52 | 60 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03061906 | 31 | 35.4 N | 130.1E | 65 | 36 | 84 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03061912 | 32 | 37.4 N | 132.5E | 55 | 7 | 33 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03061918 | 33 | 39.2 N | 134.9E | 45 | 30 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03062000 |  | 40.5 N | 137.2E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 16 | 57 | 90 | 104 | 115 | 153 | 191 | 243 | 0 | 8 | 11 | 17 | 21 | 28 | 30 | 21 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | -1 | -1 | -3 | -7 | $16$ | -18 |
|  |  |  | \# CASES |  | 33 | 32 | 30 | 28 | 26 | 22 | 15 | 11 | 33 | 32 | 30 | 28 | 26 | 22 | 15 | 11 |



Figure 1-07W-1. $180225 Z$ June 2003 MODIS true-color image of TY 07W (Soudelor), located 105 nm east of Taiwan, with an intensity of 100 knots.


Figure 1-07W-2. $180644 Z$ June 2003 Goes-9 infrared imagery of TY 07W (Soudelor), located 175 nm west-southwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.


Figure 1-07W-3. $181120 Z$ June 200385 GHz SSM/I imagery of TY 07W (Soudelor), located 150 nm west-northwest of Okinawa, Japan, with an estimated peak intensity of 115 knots.

TYPHOON 07W (SOUDELOR)


## Time Intensity for 07W

Intensity (kts)


| - KGWC |
| :--- |
| - PGTW |
| - KWBC |
| - ODT |
| - T-Numbers |
| - Best Track |

Fix Date (Zulu)

## Typhoon (TY) 08W (Koni)*

First Poor : 0600 Z 11 Jul 03
First Fair : 060013 Jul 03
First TCFA : 020015 Jul 03
First Warning : $1200 Z 15$ Jul 03
Last Warning : 1800Z 22 Jul 03
Max Intensity : 65 kts, gusts to 80 kts
Landfall : Central Philippines, Hainan Island and North Vietnam
Total Warnings : 30
Remarks:

1) Typhoon (TY) 08W was first detected as a tropical disturbance northwest of Yap around $1200 Z$ on 11 July. The first warning on this circulation was issed at $1200 Z$ on 15 July.

The subtropical ridge situated to the north of the system provided the primary steering for TY 08W. As TY 08W tracked westward over the Philippines, land effects caused a brief period of weakening, which was eased as the system again tracked over open water in the South China Sea.

Subsequent to making landfall on Hainan Island, the cyclone tracked more westward and weakened as the ridge to the north began to build. TY 08W again made landfall, near Hanoi, Vietnam where it quickly dissipated over land. A final warning was issued at 1800Z on 22 July.

Although TY 08W had maximum winds of 65 knots, no well-formed eye was ever noted in any meteorological satellite data. Rather, the well-defined banding features of this cyclone was the reason TY 08W was designated as a typhoon.
2) Damages reported on Hainan Islands were moderate, with interruptions in air and maritime service being primary. Vietnam indicated three casualties and 18 injured. Approximately 1,000 homes destroyed with significant damage to agricultural interests.

## *Named by WMO designated RSMC

## Statistics for JTWC on TY 08W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03071412 |  | 10.5 N | 136.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071418 |  | 10.5 N | 135.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071500 |  | 10.4 N | 134.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071506 |  | 10.2 N | 133.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071512 | 1 | 10.0 N | 132.1E | 25 | 30 | 54 | 60 | 87 | 135 | 213 | 196 | 189 | 0 | 0 | 5 | -5 | 5 | 0 | 0 | -20 |
| 03071518 | 2 | 10.0 N | 130.9E | 25 | 6 | 13 | 54 | 104 | 190 | 284 | 306 | 334 | 0 | 0 | -5 | 0 | 5 | 0 | - | 20 |
| 03071600 | 3 | 10.1 N | 129.8E | 30 | 13 | 30 | 47 | 109 | 192 | 245 | 255 | 305 | 0 | 10 | 0 | 5 | 0 | -5 | - | -25 |
| 03071606 | 4 | 10.3 N | 128.8E | 30 | 13 | 24 | 87 | 164 | 240 | 285 | 263 | 268 | 5 | 0 | 5 | 5 | 0 | -5 | 20 | 5 |
| 03071612 | 5 | 10.6 N | 127.8E | 30 | 26 | 54 | 130 | 219 | 259 | 267 | 221 | 238 | 10 | 0 | 5 | 0 | -5 | -5 | - 20 | 5 |
| 03071618 | 6 | 10.9 N | 126.8E | 40 | 35 | 100 | 179 | 247 | 264 | 289 | 354 | 422 | 5 | 10 | 5 | 0 | 0 | 15 | 15 | 0 |
| 03071700 | 7 | 11.0 N | 125.7E | 45 | 6 | 85 | 180 | 218 | 238 | 253 | 241 | 289 | 0 | 0 | -5 | -5 | 10 | $\overline{20}$ | 15 | 0 |
| 03071706 | 8 | 11.0 N | 124.5E | 40 | 6 | 71 | 149 | 174 | 171 | 121 | 173 | 247 | 0 | 0 | -10 | - 10 | 0 | - 10 | 0 | 10 |
| 03071712 | 9 | 11.3 N | 123.2E | 40 | 11 | 67 | 100 | 120 | 109 | 62 | 121 | 231 | 0 | $10$ | 10 | 0 | 10 | -5 | 10 | 25 |
| 03071718 | 10 | 11.5 N | 121.9E | 40 | 35 | 29 | 45 | 55 | 59 | 17 | 93 | 166 | 0 | 0 | 10 | 20 | 20 | 5 | 5 | 10 |
| 03071800 | 11 | 11.8 N | 120.5E | 45 | 48 | 34 | 30 | 34 | 17 | 13 | 62 |  | 0 | 5 | 15 | 20 | 10 | 5 | 0 |  |
| 03071806 | 12 | 12.4 N | 119.4E | 45 | 8 | 18 | 36 | 42 | 30 | 21 | 119 |  | -5 | 0 | 10 | 10 | -5 | 0 | - 10 |  |
| 03071812 | 13 | 13.0 N | 118.6E | 45 | 18 | 42 | 48 | 42 | 13 | 62 | 141 |  | -5 | 0 | 10 | 0 | -5 | 0 | 5 |  |
| 03071818 | 14 | 13.4 N | 117.9E | 45 | 21 | 34 | 23 | 34 | 50 | 97 | 210 |  | 0 | 5 | 5 | -5 | 0 | 10 | 10 |  |
| 03071900 | 15 | 13.9 N | 117.3E | 45 | 13 | 8 | 6 | 31 | 27 | 114 |  |  | 0 | 5 | -5 | -5 | 0 | -5 |  |  |
| 03071906 | 16 | 14.5N | 116.7E | 45 | 8 | 17 | 24 | 21 | 8 | 102 |  |  | 0 | -5 | - 15 | - 10 | 0 | $\overline{10}$ |  |  |


| 03071912 | 17 | 15.1 N | 116.2 E | 45 | 5 | 21 | 26 | 33 | 48 | 138 |  |  |  | 0 | - | - | - | - | -5 | 15 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03071918 | 18 | 15.7 N | 115.6 E | 50 | 5 | 13 | 19 | 24 | 83 | 198 |  |  | 0 | -5 | -5 | 5 | - | 15 | 15 |  |



Figure 1-08W-1. 200001 Z July 2003 GOES-9 visible satellite imagery of TY 08W (Koni), located 310 nm west of Luzon, Philippines in the south china sea at its peak intensity of 65 knots.


Figure 1-08W-2. $200530 Z$ July 2003 MODIS true-color image of TY 08W (Koni), located in the South China Sea, with a maximum intensity of 65 knots.

## TYPHOON 08W (KONT)

15-22 JULY 2003


## LEGEND

24-HR BEST TRACK POSITION O- TROPICAL DISTURBANCE TROPICAL DEPRESSION
$\xi \xi \xi$ TROPICAL STORM
$5 \xi\}$ TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION IDENTIFICATION
DTG SPD(KT) INT(KT)
$\operatorname{xxxz} \quad \mathrm{XX} \quad \mathrm{xx}$

## Time Intensity for 08W

Intensity (kts)


- KGWC
- PGTW
- KWBC
- CIRA
- ODT
- OTHER
- T-Numbers
- Best Track


## Typhoon (TY) 08W (Koni)

First Poor : 0600Z 11 Jul 03
First Fair : 060013 Jul 03

First TCFA : 020015 Jul 03

First Warning: 1200Z 15 Jul 03
Last Warning: 1800Z 22 Jul 03
Max Intensity : 65 kts, gusts to 80 kts
Landfall : Central Philippines, Hainan Island and North Vietnam
Total Warnings : 30
Remarks:

1) Typhoon (TY) 08W was first detected as a tropical disturbance northwest of Yap around $1200 Z$ on 11 July. Subsequently, the first warning on this circulation was issed at 1200 Z on 15 July.

Primary steering for the system was provided by the subtropical ridge situated to the north of the system. As TY 08W tracked westward over the Philippines, land effects caused a brief period of weakening, which was eased as the system again tracked over open water in the South China Sea.

Subsequent to making landfall on Hainan Island, the cyclone tracked more westward and weakened as the ridge to the north began to build. TY 08W again made landfall, near Hanoi, Vietnam where it quickly dissipated over land. A final warning was issued at $1800 Z$ on 22 July.

Although TY 08W had maximum winds of 65 knots, no well-formed eye was ever noted in any meteorological satellite data. Rather, the well-defined banding features of this cyclone was the reason TY 08W was designated as a typhoon.
2) Damages reported on Hainan Islands were moderate, with interruptions in air and maritime service being primary. Vietnam indicated three casualties and 18 injured. Approximately 1,000 homes destroyed with significant damage to agricultural interests.

## Statistics for JTWC on TY 08W

| Statistics for JTWC on TY 08W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITI | ON | RRO | RS |  |  |  |  | IND | ERR | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03071412 |  | 10.5 N | 136.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071418 |  | 10.5 N | 135.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071500 |  | 10.4 N | 134.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071506 |  | 10.2 N | 133.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071512 | 1 | 10.0 N | 132.1E | 25 | 30 | 54 | 60 | 87 | 135 | 213 | 196 | 189 | 0 | 0 | 5 | -5 | 5 | 0 | 0 | -20 |
| 03071518 | 2 | 10.0N | 130.9E | 25 | 6 | 13 | 54 | 104 | 190 | 284 | 306 | 334 | 0 | 0 | -5 | 0 | 5 | 0 | -5 | -20 |
| 03071600 | 3 | 10.1 N | 129.8E | 30 | 13 | 30 | 47 | 109 | 192 | 245 | 255 | 305 | 0 | 10 | 0 | 5 | 0 | -5 | - | -25 |
| 03071606 | 4 | 10.3 N | 128.8E | 30 | 13 | 24 | 87 | 164 | 240 | 285 | 263 | 268 | 5 | 0 | 5 | 5 | 0 | -5 | $20$ | 5 |
| 03071612 | 5 | 10.6 N | 127.8E | 30 | 26 | 54 | 130 | 219 | 259 | 267 | 221 | 238 | 10 | 0 | 5 | 0 | -5 | -5 | $20$ | 5 |
| 03071618 | 6 | 10.9 N | 126.8E | 40 | 35 | 100 | 179 | 247 | 264 | 289 | 354 | 422 | 5 | 10 | 5 | 0 | 0 | $15$ | - | 0 |
| 03071700 | 7 | 11.0 N | 125.7E | 45 | 6 | 85 | 180 | 218 | 238 | 253 | 241 | 289 | 0 | 0 | -5 | -5 | $10$ | $20$ | - 15 | 0 |
| 03071706 | 8 | 11.0 N | 124.5E | 40 | 6 | 71 | 149 | 174 | 171 | 121 | 173 | 247 | 0 | 0 | $10$ | $10$ | 0 | $10$ | 0 | 10 |
| 03071712 | 9 | 11.3 N | 123.2E | 40 | 11 | 67 | 100 | 120 | 109 | 62 | 121 | 231 | 0 | $10$ | $10$ | 0 | 10 | -5 | 10 | 25 |
| 03071718 | 10 | 11.5N | 121.9E | 40 | 35 | 29 | 45 | 55 | 59 | 17 | 93 | 166 | 0 | 0 | 10 | 20 | 20 | 5 | 5 | 10 |
| 03071800 | 11 | 11.8 N | 120.5E | 45 | 48 | 34 | 30 | 34 | 17 | 13 | 62 |  | 0 | 5 | 15 | 20 | 10 | 5 | 0 |  |
| 03071806 | 12 | 12.4 N | 119.4E | 45 | 8 | 18 | 36 | 42 | 30 | 21 | 119 |  | -5 | 0 | 10 | 10 | -5 | 0 | - 10 |  |
| 03071812 | 13 | 13.0 N | 118.6E | 45 | 18 | 42 | 48 | 42 | 13 | 62 | 141 |  | -5 | 0 | 10 | 0 | -5 | 0 | 5 |  |
| 03071818 | 14 | 13.4 N | 117.9E | 45 | 21 | 34 | 23 | 34 | 50 | 97 | 210 |  | 0 | 5 | 5 | -5 | 0 | 10 | 10 |  |
| 03071900 | 15 | 13.9 N | 117.3E | 45 | 13 | 8 | 6 | 31 | 27 | 114 |  |  | 0 | 5 | -5 | -5 | 0 | -5 |  |  |
| 03071906 | 16 | 14.5N | 116.7E | 45 | 8 | 17 | 24 | 21 | 8 | 102 |  |  | 0 | -5 | $15$ | $\overline{-}$ | 0 | - 10 |  |  |
| 03071912 | 17 | 15.1 N | 116.2E | 45 | 5 | 21 | 26 | 33 | 48 | 138 |  |  | 0 | $15$ | $15$ | $10$ | - 10 | -5 |  |  |
| 03071918 | 18 | 15.7N | 115.6E | 50 | 5 | 13 | 19 | 24 | 83 | 198 |  |  | 0 | -5 | -5 | 5 | - 15 | 15 |  |  |
| 03072000 | 19 | 16.3 N | 115.0E | 60 | 13 | 13 | 13 | 25 | 103 |  |  |  | 5 | 10 | 15 | 15 | -5 |  |  |  |


| 03072006 | 20 | 17.0 N | 114.3 E | 65 | 6 | 6 | 17 | 78 | 79 |  |  |  | 0 | 10 | 20 | 10 | 0 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03072012 | 21 | 17.6 N | 113.6 E | 65 | 0 | 24 | 40 | 99 | 100 |  |  |  | 0 | 10 | 20 | -5 | 15 |  |  |  |
| 03072018 | 22 | 18.0 N | 112.8 E | 65 | 0 | 6 | 66 | 84 | 138 |  |  |  |  | 0 | 5 | 5 | 0 | 5 |  |  |
| 03072100 | 23 | 18.3 N | 112.0 E | 65 | 0 | 21 | 96 | 110 |  |  |  |  |  | 0 | 10 | - | 0 |  |  |  |



Figure 1-08W-1. 200001Z July 2003 GOES-9 visible satellite imagery of TY 08W (Koni), located 310 nm west of Luzon, Philippines in the south china sea at its peak intensity of 65 knots.


Figure 1-08W-2. 200530Z July 2003 MODIS true-color image of TY 08W (Koni), located in the South China Sea, with a maximum intensity of 65 knots.

## TYPHOON 08W (KONT)

## 15-22 JULY 2003



LEGEND
24-HR BEST TRACK POSITION 00 TROPICAL DISTURBANCE TROPICAL DEPRESSION $\xi \Leftarrow \Leftarrow$ TROPICAL STORM 595 TYPHOON/SUPER TYPHOON

24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XxxXz $\quad \mathrm{Xx}$ XX

Time Intensity for 08W


## Super Typhoon (STY) 09W (Imbudo)*

First Poor : 0600Z 14Jul 03
First Fair : $0600 Z 15$ Jul 03
First TCFA : 0930Z 16 Jul 03
First Warning : 1800Z 16 Jul 03
Last Warning : $1200 Z 24$ Jul 03
Max Intensity : 130 kts, gusts to 160 kts
Landfall : Yangjiang, China
Total Warnings : 32
Remarks:

1) Super Typhoon (STY) 09W was initially detected and monitored as an area of heavy convection very near Chuuk on 13 July 2003. Subsequently, another area of convection developed southwest of Chuuk around 15 July. For the next 48 hours this second area increased in organization and a first warning was issued by $1800 Z$ on 16 July. The cyclone began to rapidly organize and track northwest along the southwestern periphery of the mid-level steering ridge. Favorable upper tropospheric synoptic flow and warm sea temperatures allowed for a steady rate of intensification slightly greater than climatological. A period of rapid development caused by an increase in equatorward outflow and increased outflow towards a TUTT cell to the northeast occurred from 0000Z on 19 July to 1200 Z on 20 July resulted in an intensity increase of 2.5 Dvorak T-Numbers in just 36 hours.

The system then tracked northwest over Luzon, making landfall near 0300Z on 22 July with an estimated intensity of 110 knots and weakened only slightly over central Luzon. After emerging into the South China Sea, STY 09W tracked west-northwest at a rapid 15 knots and reintensified to 90 knots. The cyclone made landfall for a second time on the coast of China at approximately 0000 Z on 24 July with an intensity of 85 knots. STY 09W then weakened over land and dissipated within 24 hours.
2) International news agencies reported 21 persons killed in the Philippines and as many as 20 casualties were reported in southern China. In the Philippines, crop damages were estimated at \$37 million. In Southern China, reports indicated that several small coastal reservoirs were damaged, many homes damaged or destroyed and significant losses in livestock experienced in some locations.
*Named by WMO Designated RSMC

Statistics for JTWC on STY09W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 001 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03071500 |  | 3.6N | 150.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071506 |  | 3.6 N | 148.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071512 |  | 3.6 N | 147.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071518 |  | 3.7 N | 146.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071600 |  | 4.3 N | 145.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071606 |  | 5.1 N | 144.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071612 |  | 5.8 N | 144.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071618 | 1 | 6.6 N | 143.2E | 25 | 33 | 731 | 113 | 161 | 205 | 253 |  |  | 0 | 5 | -5 | 0 | 5 | 5 |  |  |
| 03071700 | 2 | 7.4N | 142.2E | 30 | 8 | 48 | 101 | 148 | 173 | 204 |  |  | 0 | 0 | 0 | 5 | 10 | $15$ |  |  |
| 03071706 | 3 | 8.2N | 141.1E | 30 | 16 | 34 | 95 | 148 | 175 | 200 |  |  | 0 | -5 | -5 | -5 | -5 | $25$ |  |  |
| 03071712 | 4 | 8.8N | 140.2E | 40 | 21 | 36 | 90 | 129 | 149 | 188 | 278 | 488 | 0 | 0 | 5 | 5 | -5 | $35$ | $30$ | 15 |
| 03071718 | 5 | 9.3 N | 139.4E | 45 | 5 | 48 | 77 | 118 | 128 | 183 | 347 | 503 | 0 | 0 | 0 | 0 | -5 | $35$ | $25$ | 5 |
| 03071800 | 6 | 9.7N | 138.6E | 50 | 31 | 427 | 70 | 88 | 72 | 129 | 253 | 406 | 0 | 5 | 5 | -5 | 15 | $40$ | $20$ | 5 |
| 03071806 | 7 | 9.9N | 137.7E | 55 | 371 | 125 | 51 | 53 | 51 | 135 | 231 | 336 | 0 | 0 | 0 | 10 | 25 | $30$ | 5 | 5 |
| 03071812 | 8 | 10.1 N | 136.9E | 55 | 8 | 30 | 43 | 47 | 82 | 174 | 299 | 385 | 0 | 0 | $\overline{10}$ | 15 | 40 | $30$ | 15 | 5 |
| 03071818 | 9 | 10.4 N | 136.1E | 65 | 8 | 221 | 17 | 24 | 71 | 225 | 337 | 390 | 0 | -5 | $15$ | $\overline{30}$ | 40 | $15$ | 25 | 40 |
| 03071900 | 10 | 10.4 N | 135.3E | 65 | 8 | 81 | 12 | 39 | 105 | 265 | 372 | 434 | 0 | - 15 | $25$ | - | 40 | -5 | 25 | 20 |
| 03071906 | 11 | 10.5 N | 134.6E | 75 | 5 | 136 | 6 | 39 | 102 | 213 | 281 | 389 | 0 | $\overline{-}$ | $25$ | - 40 | 25 | 30 | 30 | 30 |
| 03071912 | 12 | 10.7 N | 133.9E | 85 | 11 | 17 | 18 | 60 | 117 | 234 | 296 | 361 | 10 | $\overline{20}$ | - 4 | 35 | 25 | 30 | 5 | 35 |


| 03071918 | 13 | 11.1 N | 133.2E | 90 | 21 | 38 | 69 | 103 | 152 | 280 | 329 | 380 | $10$ | $20$ | $35$ | $20$ | $10$ | 25 | 30 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03072000 | 14 | 11.6 N | 132.4E | 100 | 13 | 41 | 82 | 112 | 168 | 304 | 314 | 402 | $10$ | 25 | $15$ | -5 | 10 | 10 | 30 | 20 |
| 03072006 | 15 | 12.1 N | 131.5E | 110 | 0 | 30 | 75 | 110 | 173 | 271 | 316 | 501 | 5 | 0 | 10 | 20 | 45 | 35 | -5 | -10 |
| 03072012 | 16 | 12.6 N | 130.5E | 130 | 13 | 45 | 83 | 133 | 201 | 265 | 309 | 480 | 0 | 15 | 20 | 30 | 55 | 30 | 5 | -10 |
| 03072018 | 17 | 13.1 N | 129.4E | 130 | 13 | 38 | 78 | 142 | 192 | 263 | 331 |  | 0 | 15 | 20 | 40 | 25 | 35 | 15 |  |
| 03072100 | 18 | 13.7 N | 128.2E | 130 | 5 | 23 | 75 | 151 | 218 | 259 | 374 |  | 0 | 5 | 0 | 20 | 10 | 0 | 15 |  |
| 03072106 | 19 | 14.3 N | 127.0E | 125 | 8 | 37 | 102 | 152 | 205 | 258 | 310 |  | 5 | 10 | 35 | 10 | 10 | 5 | 15 |  |
| 03072112 | 20 | 15.0N | 125.8E | 125 | 0 | 29 | 87 | 143 | 179 | 238 | 266 |  | 5 | 15 | 20 | 10 | 20 | 5 | $\overline{10}$ |  |
| 03072118 | 21 | 15.7 N | 124.4E | 120 | 5 | 42 | 92 | 149 | 181 | 249 |  |  | 10 | 30 | 0 | 15 | 5 | $15$ |  |  |
| 03072200 | 22 | 16.4 N | 123.0E | 115 | 5 | 46 | 100 | 128 | 137 | 239 |  |  | 15 | 10 | 15 | 5 | 0 | 10 |  |  |
| 03072206 | 23 | 17.0N | 121.3E | 90 | 16 | 53 | 88 | 107 | 139 | 306 |  |  | 0 | 15 | 5 | 0 | - 10 | -5 |  |  |
| 03072212 | 24 | 17.6N | 119.8E | 80 | 8 | 54 | 83 | 75 | 155 | 295 |  |  | 0 | 0 | 10 | $25$ | $25$ | -5 |  |  |
| 03072218 | 25 | 18.1 N | 118.3E | 90 | 20 | 50 | 74 | 76 | 130 |  |  |  | 0 | 5 | 15 | - 20 | $10$ |  |  |  |
| 03072300 | 26 | 18.5 N | 116.8E | 90 | 16 | 42 | 36 | 70 | 147 |  |  |  | 0 | 5 | $10$ | $15$ | $20$ |  |  |  |
| 03072306 | 27 | 18.9 N | 115.4E | 90 | 5 | 31 | 18 | 53 |  |  |  |  | 0 | -5 | $30$ | 20 |  |  |  |  |
| 03072312 | 28 | 19.4 N | 114.2E | 90 | 13 | 25 | 37 | 81 |  |  |  |  | -5 | $\overline{10}$ | - 20 | 20 |  |  |  |  |
| 03072318 | 29 | 19.8 N | 113.0E | 85 | 8 | 85 | 81 | 100 |  |  |  |  | 5 | 10 | 0 | 15 |  |  |  |  |
| 03072400 | 30 | 21.2N | 111.9E | 85 | 6 | 56 | 89 | 101 |  |  |  |  | 5 | -5 | -5 | $10$ |  |  |  |  |
| 03072406 | 31 | 22.0 N | 110.2E | 75 | 5 | 17 | 50 |  |  |  |  |  | 5 | -5 | -5 |  |  |  |  |  |
| 03072412 | 32 | 22.8 N | 108.9E | 55 | 12 | 79 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03072418 |  | 23.3N | 107.5E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03072500 |  | 23.5 N | 106.1E | 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03072506 |  | 23.8 N | 104.7E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03072512 |  | 24.7 N | 103.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 39 | 67 | 101 | 146 | 235 | 308 | 420 | 3 | 9 | 13 | 17 | 19 | 20 | 18 | 19 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 0 | -4 | -6 | -5 | -3 | 6 | 16 |
|  |  |  | \# CASES |  | 32 | 32 | 31 | 30 | 26 | 24 | 17 | 13 | 32 | 32 | 31 | 30 | 26 | 24 | 17 | 13 |



Figure 1-09W-1. $202025 Z$ July 2003 GOES-9 enhanced infrared imagery of STY 09W (Imbudo), the small eye was located 155 nm east of Luzon, Philippines in the south china sea at its peak intensity of 130 knots.


Figure 1-09W-2. $212206 Z$ July 2003 GOES-9 SSM/I color composite imagery of STY 09W (Imbudo), the system was undergoing a concentric eyewall cycle. Located 440 nm east southeast of Luzon, Philippines at its peak intensity of 130 knots.


Figure 1-09W-3. $230255 Z$ July 2003 MODIS true-color image of STY 09W (Imbudo), located in the South China Sea, with an intensity of 90 knots.

SUPER TYPHOON 09W (IMBUDO)
15-25 JULY 2003


Intensity (kts)


## Super Typhoon (STY) 09W (Imbudo)*

First Poor : 0600Z 14Jul 03
First Fair : 0600Z 15 Jul 03
First TCFA : 0930Z 16 Jul 03
First Warning: 1800Z 16 Jul 03
Last Warning: 1200Z 24 Jul 03
Max Intensity : 130 kts, gusts to 160 kts
Landfall : Yangjiang, China
Total Warnings : 32
Remarks:

1) Super Typhoon (STY) 09W was initially detected and monitored as an area of heavy convection very near Chuuk on 13 July 2003. Subsequently, another area of convection developed southwest of Chuuk around 15 July. For the next 48 hours this second area increased in organization and a first warning was issued by $1800 Z$ on 16 July. The cyclone began to rapidly organize and track northwest along the southwestern periphery of the mid-level steering ridge. Favorable upper tropospheric synoptic flow and warm sea temperatures allowed for a steady rate of intensification slightly greater than climatological. A period of rapid development caused by an increase in equatorward outflow and increased outflow towards a TUTT cell to the northeast occurred from 0000Z on 19 July to $1200 Z$ on 20 July resulted in an intensity increase of 2.5 Dvorak T-Numbers in just 36 hours.

The system then tracked northwest over Luzon, making landfall near 0300Z on 22 July with an estimated intensity of 110 knots and weakened only slightly over central Luzon. After emerging into the South China Sea, STY 09W tracked west-northwest at a rapid 15 knots and reintensified to 90 knots. The cyclone made landfall for a second time on the coast of China at approximately 0000 Z on 24 July with an intensity of 85 knots. STY 09W then weakened over land and dissipated within 24 hours.
2) International news agencies reported 21 persons killed in the Philippines and as many as 20 casualties were reported in southern China. In the Philippines, crop damages were estimated at \$37 million. In Southern China, reports indicated that several small coastal reservoirs were damaged, many homes damaged or destroyed and significant losses in livestock experienced in some locations.
*Named by WMO Designated RSMC

## Statistics for JTWC on STY09W

| Statistics for JTWC on STY09W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SIT | IION | ERR | ORS |  |  |  | WIN | ND | ERR | ORS |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03071500 |  | 3.6 N | 150.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071506 |  | 3.6N | 148.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071512 |  | 3.6 N | 147.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071518 |  | 3.7 N | 146.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071600 |  | 4.3 N | 145.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071606 |  | 5.1 N | 144.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071612 |  | 5.8 N | 144.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03071618 | 1 | 6.6 N | 143.2E | 25 | 33 | 73 | 113 | 161 | 205 | 253 |  |  | 0 | 5 | -5 | 0 | 5 | -5 |  |  |
| 03071700 | 2 | 7.4 N | 142.2E | 30 | 8 | 48 | 101 | 148 | 173 | 204 |  |  | 0 | 0 | 0 | 5 | 10 | $15$ |  |  |
| 03071706 | 3 | 8.2N | 141.1E | 30 | 16 | 34 | 95 | 148 | 175 | 200 |  |  | 0 | -5 | -5 | -5 | -5 | $25$ |  |  |
| 03071712 | 4 | 8.8 N | 140.2E | 40 | 21 | 36 | 90 | 129 | 149 | 188 | 278 | 488 | 0 | 0 | 5 | 5 | -5 | $35$ | $30$ | 15 |
| 03071718 | 5 | 9.3 N | 139.4E | 45 | 5 | 48 | 77 | 118 | 128 | 183 | 347 | 503 | 0 | 0 | 0 | 0 | -5 | $35$ | $25$ | 5 |
| 03071800 | 6 | 9.7 N | 138.6E | 50 | 31 | 42 | 70 | 88 | 72 | 129 | 253 | 406 | 0 | 5 | 5 | -5 | $15$ | $40$ | $20$ | 5 |
| 03071806 | 7 | 9.9 N | 137.7E | 55 | 37 | 12 | 51 | 53 | 51 | 135 | 231 | 336 | 0 | 0 | 0 | $10$ | $25$ | $30$ | 5 | 5 |
| 03071812 | 8 | 10.1 N | 136.9E | 55 | 8 | 30 | 43 | 47 | 82 | 174 | 299 | 385 | 0 | 0 | $10$ | $15$ | $40$ | $30$ | 15 | 5 |
| 03071818 | 9 | 10.4 N | 136.1E | 65 | 8 | 22 | 17 | 24 | 71 | 225 | 337 | 390 | 0 | -5 | $15$ | $30$ | $40$ | $15$ | 25 | 40 |
| 03071900 | 10 | 10.4 N | 135.3E | 65 | 8 | 8 | 12 | 39 | 105 | 265 | 372 | 434 | 0 | $15$ | $25$ | $50$ | $40$ | -5 | 25 | 20 |
| 03071906 | 11 | 10.5 N | 134.6E | 75 | 5 | 13 | 6 | 39 | 102 | 213 | 281 | 389 | 0 | $10$ | $25$ | $40$ | $25$ | 30 | 30 | 30 |
| 03071912 | 12 | 10.7 N | 133.9E | 85 | 11 | 17 | 18 | 60 | 117 | 234 | 296 | 361 | $10$ | $20$ | $45$ | $35$ | $25$ | 30 | 5 | 35 |
| 03071918 | 13 | 11.1 N | 133.2E | 90 | 21 | 38 | 69 | 103 | 152 | 280 | 329 | 380 | $10$ | $20$ | $35$ | $20$ | $10$ | 25 | 30 | 45 |
| 03072000 | 14 | 11.6 N | 132.4E | 100 | 13 | 41 | 82 | 112 | 168 | 304 | 314 | 402 | $10$ | $25$ | $15$ | -5 | 10 | 10 | 30 | 20 |
| 03072006 | 15 | 12.1 N | 131.5E | 110 | 0 | 30 | 75 | 110 | 173 | 271 | 316 | 501 | 5 | 0 | 10 | 20 | 45 | 35 | -5 | -10 |
| 03072012 | 16 | 12.6 N | 130.5E | 130 | 13 | 45 | 83 | 133 | 201 | 265 | 309 | 480 | 0 | 15 | 20 | 30 | 55 | 30 | 5 | -10 |
| 03072018 | 17 | 13.1 N | 129.4E | 130 | 13 | 38 | 78 | 142 | 192 | 263 | 331 |  | 0 | 15 | 20 | 40 | 25 | 35 | 15 |  |


| 03072100 | 18 | 13.7 N | 128.2 E | 130 | 5 | 23 | 75 | 151 | 218 | 259 | 374 |  | 0 | 5 | 0 | 20 | - | 0 | 15 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03072106 | 19 | 14.3 N | 127.0 E | 125 | 8 | 37 | 102 | 152 | 205 | 258 | 310 |  | 5 | 10 | 35 | 10 | 10 | 5 | - |  |
| 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03072112 | 20 | 15.0 N | 125.8 E | 125 | 0 | 29 | 87 | 143 | 179 | 238 | 266 |  | 5 | 15 | 20 | 10 | 20 | 5 | - | 10 |
| 03072118 | 21 | 15.7 N | 124.4 E | 120 | 5 | 42 | 92 | 149 | 181 | 249 |  |  | 10 | 30 | 0 | 15 | 5 | - |  | 15 |
| 03072200 | 22 | 16.4 N | 123.0 E | 115 | 5 | 46 | 100 | 128 | 137 | 239 |  |  | 15 | 10 | 15 | 5 | 0 | - |  |  |
| 03072206 | 23 | 17.0 N | 121.3 E | 90 | 16 | 53 | 88 | 107 | 139 | 306 |  |  | 0 | 15 | 5 | 0 | - | 10 | -5 |  |



Figure 1-09W-1. $202025 Z$ July 2003 GOES-9 enhanced infrared imagery of STY 09W (Imbudo), the small eye was located 155 nm east of Luzon, Philippines in the south china sea at its peak intensity of 130 knots.


Figure 1-09W-2. $212206 Z$ July 2003 GOES-9 SSM/I color composite imagery of STY 09W (Imbudo), the system was undergoing a concentric eyewall cycle. Located 440 nm east southeast of Luzon, Philippines at its peak intensity of 130 knots.


Figure 1-09W-3. $230255 Z$ July 2003 MODIS true-color image of STY 09W (Imbudo), located in the South China Sea, with an intensity of 90 knots.

## SUPER TYPHOON 09W (IMBUDO)

15-25.JULY 2003


## Time Intensity for 09W



## Typhoon (TY) 10W (Morakot)*

First Poor : N/A
First Fair : N/A
First TCFA : 1400Z 31 Jul 03
First Warning : 1200Z 01 Aug 03
Last Warning : 0000Z 05 Aug 03, Dissipated
Max Intensity : 65 kts, gusts to 80 kts
Landfall : T'aitung, Taiwan \& Quanzhou, China
Total Warnings : 15
Remarks:

1) Typhoon (TY) 10W was initially designated as a tropical disturbance in the Philippine Sea on 30 July, 2003, with a first warning issued at $1200 Z$ on 31 July. The system was classified as a tropical depression as it began to organize and track northwest along the western periphery of the mid-level steering ridge northeast of the system. Outflow associated with a col in the upper ridge axis permitted the cyclone to reach marginal typhoon strength just prior to landfall, at approximately 1500 Z on 03 August, on the southeast coast of Taiwan.

TY 10W weakened slightly before emerging in the Taiwan Strait near T'ainan, at approximately $1800 Z$ on 03 Aug. The cyclone then tracked west-northwestward under the influence of the building mid-level ridge to the east until making landfall for a second time, near Quanzhou, China, at approximately $1000 Z$ on 4 Aug with an estimated intensity of 55 knots. TY 10W dissipated in less than 12 hours.
2) Taiwan news agencies reported torrential rains and damaging mudslides but no fatalities. No fatality or significant damage reports were received for the Quanzhou region.
*Named by WMO designated RSMC

## Statistics for JTWC on TY 10W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03073018 |  | 11.8 N | 130.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073100 |  | 12.8 N | 129.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073106 |  | 13.9 N | 128.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073112 |  | 14.9 N | 127.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073118 |  | 15.6 N | 126.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080100 |  | 16.1 N | 126.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080106 |  | 16.5 N | 126.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080112 | 1 | 16.9 N | 125.9E | 30 | 29 | 53 | 78 | 92 | 144 | 240 |  |  | 0 | 0 | 0 | 0 | -10 | 5 |  |  |
| 03080118 | 2 | 17.4 N | 125.8E | 35 | 30 | 85 | 148 | 167 | 147 | 194 |  |  | -5 | -5 | 5 | -10 | 5 | 35 |  |  |
| 03080200 | 3 | 18.3 N | 125.6E | 35 | 8 | 58 | 113 | 105 | 102 | 177 |  |  | 0 | 0 | 5 | 0 | 15 | 10 |  |  |
| 03080206 | 4 | 18.9N | 124.9E | 45 | 11 | 50 | 75 | 66 | 102 |  |  |  | 0 | 10 | 0 | 15 | -5 |  |  |  |
| 03080212 | 5 | 19.6N | 124.1E | 45 | 26 | 64 | 77 | 86 | 111 |  |  |  | 0 | 5 | 0 | 15 | 5 |  |  |  |
| 03080218 | 6 | 20.4 N | 123.2E | 45 | 8 | 21 | 11 | 28 | 19 |  |  |  | 0 | -10 | -5 | -5 | 5 |  |  |  |
| 03080300 | 7 | 20.7N | 122.1E | 50 | 8 | 46 | 33 | 21 | 12 |  |  |  | -5 | -15 | -10 | 0 | 20 |  |  |  |
| 03080306 | 8 | 21.4 N | 121.4E | 65 | 12 | 71 | 80 | 62 |  |  |  |  | 0 | 5 | -5 | 10 |  |  |  |  |
| 03080312 | 9 | 22.4 N | 121.1E | 65 | 30 | 24 | 48 | 32 |  |  |  |  | 0 | 5 | 0 | 15 |  |  |  |  |
| 03080318 | 10 | 22.8 N | 120.5E | 60 | 21 | 28 | 37 |  |  |  |  |  | 5 | 5 | 15 |  |  |  |  |  |
| 03080400 | 11 | 23.3 N | 119.7E | 60 | 24 | 53 | 37 |  |  |  |  |  | 5 | 0 | 10 |  |  |  |  |  |
| 03080406 | 12 | 24.1 N | 119.1E | 60 | 20 | 16 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |
| 03080412 | 13 | 24.8 N | 118.4E | 55 | 10 | 18 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03080418 | 14 | 25.2 N | 117.9E | 35 | 13 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |
| 03080500 | 15 | 25.5 N | 117.4E | 30 | 20 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 45 | 67 | 73 | 91 | 204 |  |  | 2 | 6 | 5 | 8 | 9 | 17 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | 1 | 4 | 5 | 17 |  |  |
|  |  |  | \# CASES |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  |



Figure 1-10W-1. 030952 Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 10W (Morakot), the large eye was located on the southern coast of Taiwan at its peak intensity of 65 knots.

## TYPHOON 10W (MORAKOT) <br> 01-05 AUGUST 2003



## Time Intensity for 10 W

## Intensity (kts)



$$
\begin{aligned}
& \text { - KGWC } \\
& \text { - PGTW } \\
& \text { - KWBC } \\
& \text { - CIRA } \\
& \text { - ODT } \\
& \text { - OTHER } \\
& \text { - T-Numbers } \\
& \text { - Best Track }
\end{aligned}
$$

## Typhoon (TY) 10W (Morakot)

First Poor: N/A
First Fair : N/A

First TCFA : 1400Z 31 Jul 03
First Warning : 1200Z 01 Aug 03
Last Warning : 0000Z 05 Aug 03, Dissipated
Max Intensity : 65 kts, gusts to 80 kts
Landfall : T'aitung, Taiwan \& Quanzhou, China
Total Warnings : 15
Remarks:

1) Typhoon (TY) 10W was initially designated as a tropical disturbance in the Philippine Sea on 30 July, 2003, with a first warning being issued at $1200 Z$ on 31 July. The system was classified as a tropical depression as it began to organize and track northwest along western periphery of the mid-level steering ridge northeast of the system. Outflow associated with a col in the upper ridge axis permitted the cyclone to reach marginal typhoon strength just prior to landfall, at approximately 1500 Z on 03 August, on the southeast coast of Taiwan.

Subsequently, TY 10W weakened slightly before emerging in the Taiwan Strait, near T'ainan, at approximately 1800 Z on 03 Aug. The cyclone then tracked west-northwestward under the influence of the building mid-level ridge to the east until making landfall for a second time, near Quanzhou, China, at approximately 1000 Z on 4 Aug with an estimated intensity of 55 knots and dissipated in less than 12 hours.
2) Taiwan news agencies reported torrential rains and damaging mudslides but no fatalities. No fatality or significant damage reports were received for the Quanzhou region.

Statistics for JTWC on TY 10W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03073018 |  | 11.8 N | 130.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073100 |  | 12.8N | 129.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073106 |  | 13.9 N | 128.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073112 |  | 14.9N | 127.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073118 |  | 15.6N | 126.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080100 |  | 16.1 N | 126.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080106 |  | 16.5N | 126.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080112 | 1 | 16.9N | 125.9E | 30 | 29 | 53 | 78 | 92 | 144 | 240 |  |  | 0 | 0 | 0 | 0 | -10 | 5 |  |  |
| 03080118 | 2 | 17.4 N | 125.8E | 35 | 30 | 85 | 148 | 167 | 147 | 194 |  |  | -5 | -5 | 5 | -10 | 5 | 35 |  |  |
| 03080200 | 3 | 18.3 N | 125.6E | 35 | 8 | 58 | 113 | 105 | 102 | 177 |  |  | 0 | 0 | 5 | 0 | 15 | 10 |  |  |
| 03080206 | 4 | 18.9 N | 124.9E | 45 | 11 | 50 | 75 | 66 | 102 |  |  |  | 0 | 10 | 0 | 15 | -5 |  |  |  |
| 03080212 | 5 | 19.6N | 124.1E | 45 | 26 | 64 | 77 | 86 | 111 |  |  |  | 0 | 5 | 0 | 15 | 5 |  |  |  |
| 03080218 | 6 | 20.4 N | 123.2E | 45 | 8 | 21 | 11 | 28 | 19 |  |  |  | 0 | -10 | -5 | -5 | 5 |  |  |  |
| 03080300 | 7 | 20.7N | 122.1E | 50 | 8 | 46 | 33 | 21 | 12 |  |  |  | -5 | -15 | -10 | 0 | 20 |  |  |  |
| 03080306 | 8 | 21.4 N | 121.4E | 65 | 12 | 71 | 80 | 62 |  |  |  |  | 0 | 5 | -5 | 10 |  |  |  |  |
| 03080312 | 9 | 22.4 N | 121.1E | 65 | 30 | 24 | 48 | 32 |  |  |  |  | 0 | 5 | 0 | 15 |  |  |  |  |
| 03080318 | 10 | 22.8 N | 120.5E | 60 | 21 | 28 | 37 |  |  |  |  |  | 5 | 5 | 15 |  |  |  |  |  |
| 03080400 | 11 | 23.3 N | 119.7E | 60 | 24 | 53 | 37 |  |  |  |  |  | 5 | 0 | 10 |  |  |  |  |  |
| 03080406 | 12 | 24.1 N | 119.1E | 60 | 20 | 16 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |
| 03080412 | 13 | 24.8 N | 118.4E | 55 | 10 | 18 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03080418 | 14 | 25.2 N | 117.9E | 35 | 13 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |
| 03080500 | 15 | 25.5 N | 117.4E | 30 | 20 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 45 | 67 | 73 | 91 | 204 |  |  | 2 | 6 | 5 | 8 | 9 | 17 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | 1 | 4 | 5 | 17 |  |  |
|  |  |  | \# CASES |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  |



Figure 1-10W-1. 030952 Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 10W (Morakot), the large eye was located on the southern coast of Taiwan at its peak intensity of 65 knots.

TYPHOON 10W (MORAKOT)
01-05 AUGUST 2003


Time Intensity for 10W
Intensity (kts)


# Typhoon (TY) 11W (Etau)* 

First Poor : 0600Z 30 Jul 03
First Fair : $2330 Z 31$ Jul 03
First TCFA : $2230 Z 01$ Aug 03
First Warning : 0000Z 02 Aug 03
Last Warning : $1800 Z 09$ Aug 03, Extratropical
Max Intensity : 110 kts, gusts to 135 kts
Landfall : Multiple Events
Total Warnings : 28
Remarks:

1) Typhoon (TY) 11 W developed approximately 140 nm northwest of Chuuk on 31 July, 2003. The first warning was issued at $0000 Z$ on 02 August. The cyclone remained a tropical depression for the first 24 hours and then rapidly developed at greater than a Dvorak T-number per day over the next 48 hours as a result of of the presence of dual outflow channels. In addition to synoptic equatorward outflow, an upper level cyclone to the northeast provided the second enhanced outflow path.

TY 11 W tracked steadily northwestward along the subtropical ridge located east of Japan for the first 96 hours. The cyclone then turned poleward and tracked over Naha, Okinawa at 0000Z on August 7 while at peak intensity of 110 knots. Available synoptic reports from Kadena, Okinawa estimated surface winds at 60 knots gusting to 98 knots just prior to eyewall passage. The lowest pressure reported for this cyclone was 949 mb over Naze, Amami O Shima.

TY 11W maintained 110 knot intensity for approximately 18 hours while tracking northeastward along the northwest periphery of the subtropical ridge. After TY 11W tracked over the Ryukus Island chain, it began to slowly weaken as it encountered increasing vertical wind shear, cool air and the mountainous terrain of Shikoku and Honshu. The cyclone transitioned into an extra-tropical cyclone just north of Misawa, Japan and was subsequently finaled.
2) Reports indicated 10 fatalities, 10 injuries and 11 missing persons in Japan resulting from heavy rains and landslides. Other damage reports indicated there were grounded flights, disrupted train

## service, and loss of power to 22,500 homes in mainland Japan.

## *Named by WMO Designated RSMC

## Statistics for JTWC on TY11W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03073106 |  | 8.6 N | 150.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073112 |  | 8.6 N | 149.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073118 |  | 8.6 N | 148.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080100 |  | 8.6 N | 147.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080106 |  | 8.6 N | 146.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080112 |  | 8.7N | 145.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080118 |  | 9.1 N | 144.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080200 |  | 9.7 N | 143.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080206 |  | 10.2 N | 142.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080212 |  | 10.9 N | 141.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080218 |  | 11.6 N | 140.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080300 | 1 | 12.4 N | 139.9E | 30 | 0 | 8 | 59 | 120 | 120 | 127 |  |  | -5 | -10 | -10 | -5 | -20 | 30 |  |  |
| 03080306 | 2 | 13.2 N | 139.1E | 35 | 0 | 24 | 97 | 166 | 207 | 216 | 298 | 377 | 0 | 0 | 0 | 0 | -5 | 5 | -35 | 35 |
| 03080312 | 3 | 14.0 N | 138.6E | 45 | 5 | 64 | 150 | 188 | 215 | 219 | 230 | 256 | 0 | 0 | 15 | 0 | 10 | 20 | -5 | -15 |
| 03080318 | 4 | 14.9 N | 137.8E | 45 | 18 | 86 | 133 | 178 | 208 | 207 | 327 | 389 | 0 | 15 | 25 | 25 | 25 | 20 | -5 | 5 |
| 03080400 | 5 | 15.7 N | 136.6E | 55 | 13 | 81 | 107 | 143 | 169 | 205 | 265 | 320 | 0 | 20 | 15 | 20 | 20 | 10 | -10 | -5 |
| 03080406 | 6 | 16.4 N | 135.3 E | 55 | 16 | 19 | 70 | 107 | 130 | 144 | 289 | 384 | 0 | 10 | 10 | 10 | 15 | 10 | -40 | 10 |
| 03080412 | 7 | 17.1 N | 134.0E | 55 | 0 | 36 | 73 | 75 | 75 | 146 | 255 | 420 | 0 | -10 | 0 | 0 | 10 | 10 | -35 | 5 |
| 03080418 | 8 | 17.7 N | 133.2E | 65 | 12 | 37 | 70 | 85 | 93 | 130 | 170 | 87 | 5 | 10 | 15 | 25 | 25 | 5 | -35 | 10 |
| 03080500 | 9 | 18.3 N | 132.3E | 80 | 0 | 25 | 33 | 30 | 65 | 61 | 227 | 177 | 5 | 15 | 20 | 35 | 15 | 0 | -20 | 15 |
| 03080506 | 10 | 18.8 N | 131.5E | 80 | 0 | 17 | 28 | 44 | 77 | 39 | 200 |  | 5 | 25 | 20 | 30 | 15 | 10 | 5 |  |
| 03080512 | 11 | 19.5 N | 130.8E | 85 | 13 | 37 | 45 | 76 | 64 | 63 | 92 |  | 0 | 5 | 25 | 20 | 15 | 10 | 0 |  |
| 03080518 | 12 | 20.6 N | 130.0E | 90 | 5 | 21 | 24 | 49 | 37 | 144 |  |  | 0 | 10 | 20 | 15 | -5 | -30 |  |  |
| 03080600 | 13 | 21.7 N | 129.3E | 95 | 0 | 13 | 22 | 20 | 19 | 147 |  |  | 0 | 15 | 15 | 5 | -10 | -20 |  |  |


| 03080606 | 14 | 22.9 N | 128.8 E | 95 | 0 | 6 | 16 | 26 | 20 | 228 |  |  | 0 | 10 | 15 | 5 | 5 | -10 |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03080612 | 15 | 24.1 N | 128.6 E | 95 | 8 | 25 | 24 | 12 | 82 | 211 |  |  | 0 | 0 | 0 | -10 | -15 | -10 |  |  |
| 03080618 | 16 | 25.3 N | 128.4 E | 100 | 0 | 22 | 16 | 18 | 71 | 105 |  |  | 0 | 5 | 5 | 15 | -5 | 5 |  |  |
| 03080700 | 17 | 26.5 N | 128.2 E | 110 | 0 | 29 | 32 | 12 | 36 | 147 |  |  | 0 | 5 | 10 | 15 | 0 | 5 |  |  |
| 03080706 | 18 | 27.4 N | 128.5 E | 110 | 5 | 27 | 35 | 54 | 170 |  |  |  | 0 | 10 | 15 | -20 | -10 |  |  |  |
| 03080712 | 19 | 28.3 N | 129.5 E | 110 | 5 | 32 | 37 | 43 | 103 |  |  |  | 0 | 0 | -10 | -25 | -5 |  |  |  |
| 03080718 | 20 | 29.3 N | 130.8 E | 105 | 0 | 32 | 24 | 53 | 89 |  |  |  | 0 | 0 | -10 | -5 | 10 |  |  |  |
| 03080800 | 21 | 30.7 N | 132.0 E | 100 | 0 | 25 | 51 | 84 | 110 |  |  |  | 0 | 0 | -5 | -5 | 10 |  |  |  |
| 03080806 | 22 | 32.0 N | 133.0 E | 90 | 5 | 23 | 57 | 42 |  |  |  |  | 0 | 0 | 0 | 5 |  |  |  |  |
| 03080812 | 23 | 33.2 N | 134.0 E | 90 | 5 | 28 | 20 | 60 |  |  |  |  | 0 | -15 | -10 | 15 |  |  |  |  |
| 03080818 | 24 | 34.4 N | 134.9 E | 80 | 4 | 43 | 25 |  |  |  |  |  | 0 | 5 | 10 |  |  |  |  |  |
| 03080900 | 25 | 35.5 N | 136.2 E | 65 | 0 | 37 | 76 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 03080906 | 26 | 36.8 N | 138.3 E | 45 | 12 | 44 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03080912 | 27 | 38.9 N | 140.7 E | 45 | 5 | 117 |  |  |  |  |  |  | 0 | 20 |  |  |  |  |  |  |
| 03080918 | 28 | 41.2 N | 143.3 E | 30 | 7 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03081000 |  | 43.6 N | 147.1 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERA | GE | 5 | 35 | 53 | 73 | 103 | 149 | 235 | 301 | 1 | 9 | 12 | 13 | 12 | 12 | 19 | 13 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 6 | 8 | 7 | 5 | 1 | -18 | -1 |
|  | \# CAS | ES | 28 | 27 | 25 | 23 | 21 | 17 | 10 | 8 | 28 | 27 | 25 | 23 | 21 | 17 | 10 | 8 |  |  |



Figure 1-11W-1. $062213 Z$ August 2003 GOES-9 visible imagery of TY 11W (Etau), located 45 nm southeast of Okinawa, Japan at its peak intensity of 110 knots.


Figure 1-11W-2. $071116 Z$ August 2003 GOES-9 85 GHz SSM/I imagery of TY 11W (Etau), located on over Amami Shima island, Japan at its peak intensity of 110 knots.


Figure 1-11W-3. $080425 Z$ August 2003 MODIS true-color image of TC 11W (Etau), located off the Japanese coast, with an intensity of 90 knots.

## TYPHOON 11W (ETAU)

31 JULY - 09 AUGUST 2003



| - KGWC |
| :--- |
| - PGTW |
| - KWBC |
| CIRA |
| - ODT |
| - T-Numbers |
| - Best Track |

Fix Date (Zulu)

# Typhoon (TY) 11W (Etau)* 

First Poor : 0600Z 30 Jul 03
First Fair : 2330Z 31 Jul 03
First TCFA : $2230 Z 01$ Aug 03
First Warning : 0000Z 02 Aug 03
Last Warning : 1800Z 09 Aug 03, Extratropical
Max Intensity : 110 kts, gusts to 135 kts
Landfall : Multiple Events
Total Warnings : 28
Remarks:

1) Typhoon (TY) 11W initially developed approximately 140 nm northwest of Chuuk on 31 July, 2003. The first warning was issued at 0000 Z on 02 August. The cyclone remained a tropical depression for the first 24 hours and then rapidly developed at greater than a Dvorak T-number per day over the next 48 hours as a result of of the presence of dual outflow channels. In addition to synoptic equatorward outflow, an upper level cyclone to the northeast provided the second enhanced outflow path.

TY 11W tracked steadily northwestward along the subtropical ridge located east of Japan for the first 96 hours. The cyclone then turned poleward and tracked over Naha, Okinawa at 0000Z on August 7 while at peak intensity of 110 knots. Available synoptic reports from Kadena, Okinawa estimated surface winds at 60 knots gusting to 98 knots just prior to eyewall passage. The lowest pressure reported for this cyclone was 949 mb over Naze, Amami O Shima.

TY 11W maintained 110 knot intensity for approximately 18 hours while tracking northeastward along the northwest periphery of the subtropical ridge. After TY 11W tracked over the Ryukus Island chain, it began to slowly weaken as it encountered increasing vertical wind shear, cool air and the mountainous terrain of Shikoku and Honshu. The cyclone transitioned into an extra-tropical cyclone just north of Misawa, Japan and was subsequently finaled.
2) Reports indicated 10 fatalities, 10 injuries and 11 missing persons in Japan resulting from heavy rains and landslides. Other damage reports indicated there were grounded flights, disrupted train service, and loss of power to 22,500 homes in mainland Japan.
*Named by WMO Designated RSMC


Figure 1-11W-1. 062213 Z August 2003 GOES-9 visible imagery of TY 11W (Etau), located 45 nm southeast of Okinawa, Japan at its peak intensity of 110 knots.


Figure 1-11W-2. 071116Z August 2003 GOES-9 85 GHz SSM/I imagery of TY 11W (Etau), located on over Amami Shima island, Japan at its peak intensity of 110 knots.


Figure 1-11W-3. 080425Z August 2003 MODIS true-color image of TC 11W (Etau), located off the Japanese coast, with an intensity of 90 knots.

TYPHOON 11W (ETAU)
31 JULY - 09 AUGUST 2003


Time Intensity for 11W
Intensity (kts)


|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03073106 |  | 8.6 N | 150.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073112 |  | 8.6N | 149.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03073118 |  | 8.6 N | 148.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080100 |  | 8.6 N | 147.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080106 |  | 8.6 N | 146.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080112 |  | 8.7 N | 145.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080118 |  | 9.1 N | 144.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080200 |  | 9.7 N | 143.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080206 |  | 10.2 N | 142.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080212 |  | 10.9N | 141.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080218 |  | 11.6N | 140.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03080300 | 1 | 12.4 N | 139.9E | 30 | 0 | 8 | 59 | 120 | 120 | 127 |  |  | -5 | -10 | -10 | -5 | -20 | -30 |  |  |
| 03080306 | 2 | 13.2 N | 139.1E | 35 | 0 | 24 | 97 | 166 | 207 | 216 | 298 | 377 | 0 | 0 | 0 | 0 | -5 | 5 | -35 | -35 |
| 03080312 | 3 | 14.0N | 138.6E | 45 | 5 | 64 | 150 | 188 | 215 | 219 | 230 | 256 | 0 | 0 | 15 | 0 | 10 | 20 | -5 | -15 |
| 03080318 | 4 | 14.9 N | 137.8E | 45 | 18 | 86 | 133 | 178 | 208 | 207 | 327 | 389 | 0 | 15 | 25 | 25 | 25 | 20 | -5 | 5 |
| 03080400 | 5 | 15.7 N | 136.6E | 55 | 13 | 81 | 107 | 143 | 169 | 205 | 265 | 320 | 0 | 20 | 15 | 20 | 20 | 10 | -10 | -5 |
| 03080406 | 6 | 16.4 N | 135.3E | 55 | 16 | 19 | 70 | 107 | 130 | 144 | 289 | 384 | 0 | 10 | 10 | 10 | 15 | 10 | -40 | 10 |
| 03080412 | 7 | 17.1 N | 134.0E | 55 | 0 | 36 | 73 | 75 | 75 | 146 | 255 | 420 | 0 | -10 | 0 | 0 | 10 | 10 | -35 | 5 |
| 03080418 | 8 | 17.7 N | 133.2E | 65 | 12 | 37 | 70 | 85 | 93 | 130 | 170 | 87 | 5 | 10 | 15 | 25 | 25 | 5 | -35 | 10 |
| 03080500 | 9 | 18.3N | 132.3E | 80 | 0 | 25 | 33 | 30 | 65 | 61 | 227 | 177 | 5 | 15 | 20 | 35 | 15 | 0 | -20 | 15 |
| 03080506 | 10 | 18.8 N | 131.5E | 80 | 0 | 17 | 28 | 44 | 77 | 39 | 200 |  | 5 | 25 | 20 | 30 | 15 | 10 | 5 |  |
| 03080512 | 11 | 19.5N | 130.8E | 85 | 13 | 37 | 45 | 76 | 64 | 63 | 92 |  | 0 | 5 | 25 | 20 | 15 | 10 | 0 |  |
| 03080518 | 12 | 20.6 N | 130.0E | 90 | 5 | 21 | 24 | 49 | 37 | 144 |  |  | 0 | 10 | 20 | 15 | -5 | -30 |  |  |
| 03080600 | 13 | 21.7 N | 129.3E | 95 | 0 | 13 | 22 | 20 | 19 | 147 |  |  | 0 | 15 | 15 | 5 | -10 | -20 |  |  |
| 03080606 | 14 | 22.9 N | 128.8E | 95 | 0 | 6 | 16 | 26 | 20 | 228 |  |  | 0 | 10 | 15 | 5 | 5 | -10 |  |  |
| 03080612 | 15 | 24.1 N | 128.6E | 95 | 8 | 25 | 24 | 12 | 82 | 211 |  |  | 0 | 0 | 0 | -10 | -15 | -10 |  |  |
| 03080618 | 16 | 25.3 N | 128.4E | 100 | 0 | 22 | 16 | 18 | 71 | 105 |  |  | 0 | 5 | 5 | 15 | -5 | 5 |  |  |
| 03080700 | 17 | 26.5N | 128.2E | 110 | 0 | 29 | 32 | 12 | 36 | 147 |  |  | 0 | 5 | 10 | 15 | 0 | 5 |  |  |
| 03080706 | 18 | 27.4 N | 128.5E | 110 | 5 | 27 | 35 | 54 | 170 |  |  |  | 0 | 10 | 15 | -20 | -10 |  |  |  |
| 03080712 | 19 | 28.3 N | 129.5E | 110 | 5 | 32 | 37 | 43 | 103 |  |  |  | 0 | 0 | -10 | -25 | -5 |  |  |  |
| 03080718 | 20 | 29.3 N | 130.8E | 105 | 0 | 32 | 24 | 53 | 89 |  |  |  | 0 | 0 | -10 | -5 | 10 |  |  |  |
| 03080800 | 21 | 30.7 N | 132.0E | 100 | 0 | 25 | 51 | 84 | 110 |  |  |  | 0 | 0 | -5 | -5 | 10 |  |  |  |
| 03080806 | 22 | 32.0 N | 133.0E | 90 | 5 | 23 | 57 | 42 |  |  |  |  | 0 | 0 | 0 | 5 |  |  |  |  |
| 03080812 | 23 | 33.2 N | 134.0E | 90 | 5 | 28 | 20 | 60 |  |  |  |  | 0 | -15 | -10 | 15 |  |  |  |  |


| 03080818 | 24 | 34.4 N | 134.9 E | 80 | 4 | 43 | 25 |  |  |  |  |  |  | 0 | 5 | 10 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03080900 | 25 | 35.5 N | 136.2 E | 65 | 0 | 37 | 76 |  |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |

First Poor : N/A
First Fair : 2300Z 13 Aug 03
First TCFA : $2030 Z 14$ Aug 03
First Warning : 0600Z 15 Aug 03
Last Warning : 0000Z 26 Aug 03; Dissipated over land
Max Intensity : 90 kts, gusts to 110 kts
Landfall : Cam Pha, China
Total Warnings : 40
Remarks:

1) Typhoon (TY) 12 W developed in the monsoon trough approximately 200 nm east of Chuuk on 13 Aug, 2003 and the first warning was issued at $0600 Z$ on 15 August. This cyclone remained a tropical depression until 20 August as it tracked northwestward in response to flow from a mid-level steering ridge centered to the northeast. TY 12W rapidly developed and moved more southwest over the next 24 hours, achieving typhoon strength by $0600 Z$ on 21 August.

Subsequently, TY 12W tracked westward along the southern periphery of sub-tropical ridge to the north until dissipation. The cyclone achieved peak intensity of 90 knots around 0000Z on 22 August prior to making landfall, for the first time, north of Palanan, Philippines. TY 12W weakened to approximately 70 knots as it tracked across Luzon, then began moving over the South China Sea at approximately 2000 Z on 22 August.

TY 12W steadily intensified over the next three days as it moved west-northwestward and passed between Hainan Island and the Luichow Peninsula, China around 0000Z on 25 August. TY 12W reintensified to 90 knots around $0600 Z$ on 25 August while moving through the Gulf of Tonkin, and made landfall at approximately 1500 Z on 25 August just north of Cam Pha, Vietnam and dissipated inland.
2) Reports indicated that the Hainan provincial capital city of Haikou lost electricity in many locations. Reports further indicate that five people were hospitalized in Hong Kong and numerous airline flights in the region were delayed.
*Named by WMO Designated RSMC

## Statistics for JTWC on TY12W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03081400 |  | 7.0N | 155.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081406 |  | 7.4 N | 154.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081412 |  | 8.0 N | 153.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081418 |  | 8.7 N | 152.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081500 |  | 9.2 N | 151.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081506 | 1 | 9.6 N | 150.7E | 25 | 43 | 71 | 79 | 64 | 49 | 162 |  |  | 0 | 10 | 15 | 20 | 30 | 40 |  |  |
| 03081512 | 2 | 10.0 N | 150.1E | 25 | 24 | 42 | 56 | 66 | 102 | 151 |  |  | 0 | 5 | 15 | 20 | 25 | 35 |  |  |
| 03081518 | 3 | 10.4 N | 149.5E | 25 | 0 | 0 | 55 | 77 | 123 | 170 | 232 | 286 | 0 | 5 | 15 | 20 | 25 | 35 | 40 | 35 |
| 03081600 | 4 | 10.8 N | 148.9E | 25 | 13 | 67 | 101 | 138 | 178 | 233 | 266 | 213 | 0 | 5 | 10 | 15 | 25 | 35 | 30 | -10 |
| 03081606 | 5 | 11.6 N | 148.0E | 25 | 0 | 50 | 71 | 94 | 131 | 190 |  |  | 0 | 5 | 10 | 20 | 25 | 30 |  |  |
| 03081612 | 6 | 12.5 N | 147.0E | 25 | 24 | 52 | 76 | 104 | 127 | 171 |  |  | 0 | 5 | 10 | 20 | 25 | 30 |  |  |
| 03081618 | 7 | 13.3 N | 145.9E | 25 | 34 | 61 | 72 | 104 | 149 | 175 | 256 | 423 | 0 | 5 | 10 | 20 | 25 | 30 | 45 | 35 |
| 03081700 | 8 | 13.7 N | 144.8E | 25 | 16 | 13 | 17 | 67 | 70 | 111 | 252 | 376 | 0 | 5 | 15 | 20 | 30 | 40 | -5 | 20 |
| 03081706 | 9 | 14.2 N | 143.7E | 25 | 25 | 61 | 87 | 98 | 128 | 120 |  |  | 0 | 0 | 10 | 15 | 20 | 25 |  |  |
| 03081712 | 10 | 15.2 N | 142.8E | 25 | 32 | 66 | 50 | 80 | 87 | 138 |  |  | 0 | 0 | 0 | 0 | -5 | $25$ |  |  |
| 03081718 | 11 | 16.1 N | 141.9E | 25 | 45 | 76 | 98 | 166 | 144 | 149 |  |  | 0 | 0 | 0 | -5 | -5 | $25$ |  |  |
| 03081800 | 12 | 17.0N | 140.9E | 25 | 11 | 47 | 64 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03081906 | 13 | 20.3 N | 135.4E | 30 | 36 | 79 | 125 | 172 | 164 | 179 |  |  | 0 | 5 | 10 | 5 | 10 | $\overline{-}$ |  |  |
| 03081912 | 14 | 20.3 N | 134.3E | 30 | 22 | 50 | 126 | 146 | 159 | 173 |  |  | 0 | 5 | 0 | $10$ | 10 | - |  |  |
| 03081918 | 15 | 20.2 N | 133.5E | 30 | 8 | 80 | 162 | 183 | 249 | 297 |  |  | 0 | 0 | -5 | 20 | $25$ | - 10 |  |  |
| 03082000 | 16 | 20.0 N | 132.7E | 30 | 30 | 119 | 157 | 193 | 242 | 326 |  |  | 0 | 10 | 20 | 20 | - 40 | 15 |  |  |
| 03082006 | 17 | 19.5N | 132.1E | 35 | 29 | 68 | 72 | 126 | 142 | 202 | 252 | 342 | 0 | -5 | - 20 | $25$ | - | $10$ | - 15 | -20 |


| 03082012 | 18 | 19.0 N | 131.4E | 45 | 6 | 40 | 46 | 59 | 67 | 231 | 396 | 570 | -5 | $15$ | $15$ | $35$ | $20$ | $15$ | $20$ | -20 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03082018 | 19 | 18.7 N | 130.4E | 45 | 5 | 28 | 55 | 85 | 145 | 198 | 339 | 569 | 0 | -5 | -5 | $15$ | 10 | 10 | 30 | -25 |
| 03082100 | 20 | 18.6 N | 129.3E | 60 | 6 | 19 | 51 | 84 | 158 | 206 | 354 | 582 | 0 | 5 | $10$ | 5 | 10 | 5 | $25$ | -20 |
| 03082106 | 21 | 18.5 N | 128.2E | 65 | 8 | 49 | 72 | 142 | 173 | 209 | 358 |  | 0 | 0 | -5 | 10 | 10 | 0 | $45$ |  |
| 03082112 | 22 | 18.2 N | 127.1E | 65 | 0 | 38 | 59 | 105 | 118 | 157 | 260 |  | 0 | $10$ | 0 | 5 | 5 | $10$ | $50$ |  |
| 03082118 | 23 | 17.8 N | 125.9E | 75 | 8 | 18 | 72 | 77 | 85 | 170 | 396 |  | 0 | -5 | 5 | 5 | 10 | $40$ | $45$ |  |
| 03082200 | 24 | 17.7N | 124.5E | 90 | 6 | 8 | 46 | 59 | 61 | 151 | 412 |  | 0 | 0 | 5 | 10 | 10 | $35$ | $30$ |  |
| 03082206 | 25 | 17.7N | 123.3E | 90 | 22 | 42 | 42 | 42 | 61 | 185 |  |  | 0 | 5 | 10 | 15 | 5 | 45 |  |  |
| 03082212 | 26 | 17.6N | 122.1E | 80 | 0 | 60 | 62 | 46 | 62 | 152 |  |  | 0 | 10 | 15 | 10 | 0 | 50 |  |  |
| 03082218 | 27 | 17.1 N | 120.6E | 70 | 12 | 17 | 13 | 18 | 34 | 96 |  |  | 0 | 10 | 15 | 10 | $10$ | -5 |  |  |
| 03082300 | 28 | 17.5 N | 119.2E | 70 | 13 | 26 | 24 | 49 | 56 | 148 |  |  | 0 | 10 | 10 | 5 | -5 | $\overline{10}$ |  |  |
| 03082306 | 29 | 17.6 N | 117.9E | 70 | 0 | 0 | 6 | 25 | 54 |  |  |  | 0 | 10 | 10 | 10 | - 40 |  |  |  |
| 03082312 | 30 | 17.9 N | 116.8E | 70 | 11 | 27 | 12 | 8 | 19 |  |  |  | 0 | 5 | 0 | 20 | - 40 |  |  |  |
| 03082318 | 31 | 18.3 N | 115.8E | 70 | 13 | 29 | 26 | 39 | 58 |  |  |  | 0 | -5 | $\overline{20}$ | - 35 | - 20 |  |  |  |
| 03082400 | 32 | 18.8 N | 114.7E | 75 | 12 | 34 | 41 | 59 | 96 |  |  |  | 0 | -5 | $10$ | $30$ | $15$ |  |  |  |
| 03082406 | 33 | 19.2 N | 113.4E | 80 | 0 | 12 | 31 | 62 |  |  |  |  | 0 | 0 | - 25 | - 3 |  |  |  |  |
| 03082412 | 34 | 19.6 N | 112.2E | 85 | 8 | 11 | 21 | 29 |  |  |  |  | 0 | 15 | - 40 | $25$ |  |  |  |  |
| 03082418 | 35 | 20.0N | 111.1E | 85 | 6 | 6 | 25 |  |  |  |  |  | 0 | 20 | - 15 |  |  |  |  |  |
| 03082500 | 36 | 20.4 N | 110.0E | 80 | 12 | 38 | 84 |  |  |  |  |  | 0 | 25 | $10$ |  |  |  |  |  |
| 03082506 | 37 | 20.8 N | 108.9E | 90 | 0 | 29 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03082512 | 38 | 21.2 N | 107.8E | 90 | 5 | 13 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03082518 | 39 | 21.5 N | 106.7E | 65 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03082600 | 40 | 22.3 N | 105.2E | 50 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 15 | 41 | 63 | 87 | 113 | 180 | 314 | 420 | 0 | 6 | 11 | 16 | 18 | 24 | 32 | 23 |


|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | -1 | 0 | -1 | - | 13 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-12W-1. $220353 Z$ August 2003 SSMI/GOES-9 visible imagery of TY 12W (Krovanh), located 110 nm east of Luzon, Philippines prior to landfall at its peak intensity of 90 knots.


Figure 1-12W-2. 240300 Z January 2003 MODIS true-color image of TY 12W (Krovanh), located in the South China Sea, with an intensity of 75 knots.

## TYPHOON 12W (KROVANH)



Time Intensity for 12 W
Intensity (kts)


## Typhoon (TY) 12W (Krovanh)*

First Poor : N/A

First Fair : 2300Z 13 Aug 03
First TCFA : 2030Z 14 Aug 03

First Warning : 0600Z 15 Aug 03
Last Warning : 0000Z 26 Aug 03; Dissipated over land
Max Intensity : 90 kts, gusts to 110 kts
Landfall : Cam Pha, China

Total Warnings : 40
Remarks:

1) Typhoon (TY) 12W developed in the monsoon trough approximately 200 nm east of Chuuk on 13 Aug, 2003 and the first warning was issued at $0600 Z$ on 15 August. This cyclone remained a tropical depression until 20 August as it tracked northwestward in response to flow from a mid-level steering ridge centered to the northeast. TY 12W rapidly developed and moved more southwest over the next 24 hours, achieving typhoon strength by $0600 Z$ on 21 August.

Subsequently, TY 12W tracked westward along the southern periphery of sub-tropical ridge to the north until dissipation. The cyclone achieved peak intensity of 90 knots around 0000Z on 22 August prior to making landfall, for the first time, north of Palanan, Philippines. TY 12W weakened to approximately 70 knots as it tracked across Luzon, then began moving over the South China Sea at approximately 2000 Z on 22 August.

TY 12W steadily intensified over the next three days as it moved west-northwestward and passed between Hainan Island and the Luichow Peninsula, China around 0000Z on 25 August. TY 12W reintensified to 90 knots around $0600 Z$ on 25 August while moving through the Gulf of Tonkin, and made landfall at approximately $1500 Z$ on 25 August just north of Cam Pha, Vietnam and dissipated inland.
2) Reports indicated that the Hainan provincial capital city of Haikou lost electricity in many locations. Reports further indicate that five people were hospitalized in Hong Kong and delays to numerous airline flights in the region.
*Named by WMO Designated RSMC

## Statistics for JTWC on TY12W

| Statistics for JTWC on TY12W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITIO | ON E | RRR | RS |  |  |  |  | ND | ER | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03081400 |  | 7.0N | 155.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081406 |  | 7.4 N | 154.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081412 |  | 8.0 N | 153.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081418 |  | 8.7 N | 152.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081500 |  | 9.2 N | 151.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081506 | 1 | 9.6 N | 150.7E | 25 | 43 | 71 | 79 | 64 | 49 | 162 |  |  | 0 | 10 | 15 | 20 | 30 | 40 |  |  |
| 03081512 | 2 | 10.0 N | 150.1E | 25 | 24 | 42 | 56 | 66 | 102 | 151 |  |  | 0 | 5 | 15 | 20 | 25 | 35 |  |  |
| 03081518 | 3 | 10.4 N | 149.5E | 25 | 0 | 0 | 55 | 77 | 123 | 170 | 232 | 286 | 0 | 5 | 15 | 20 | 25 | 35 | 40 | 35 |
| 03081600 | 4 | 10.8 N | 148.9E | 25 | 13 | 67 | 101 | 138 | 178 | 233 | 266 | 213 | 0 | 5 | 10 | 15 | 25 | 35 | 30 | -10 |
| 03081606 | 5 | 11.6 N | 148.0E | 25 | 0 | 50 | 71 | 94 | 131 | 190 |  |  | 0 | 5 | 10 | 20 | 25 | 30 |  |  |
| 03081612 | 6 | 12.5 N | 147.0E | 25 | 24 | 52 | 76 | 104 | 127 | 171 |  |  | 0 | 5 | 10 | 20 | 25 | 30 |  |  |
| 03081618 | 7 | 13.3 N | 145.9E | 25 | 34 | 61 | 72 | 104 | 149 | 175 | 256 | 423 | 0 | 5 | 10 | 20 | 25 | 30 | 45 | 35 |
| 03081700 | 8 | 13.7 N | 144.8E | 25 | 16 | 13 | 17 | 67 | 70 | 111 | 252 | 376 | 0 | 5 | 15 | 20 | 30 | 40 | -5 | -20 |
| 03081706 | 9 | 14.2N | 143.7E | 25 | 25 | 61 | 87 | 98 | 128 | 120 |  |  | 0 | 0 | 10 | 15 | 20 | 25 |  |  |
| 03081712 | 10 | 15.2 N | 142.8E | 25 | 32 | 66 | 50 | 80 | 87 | 138 |  |  | 0 | 0 | 0 | 0 | -5 | $25$ |  |  |
| 03081718 | 11 | 16.1 N | 141.9E | 25 | 45 | 76 | 98 | 166 | 144 | 149 |  |  | 0 | 0 | 0 | -5 | -5 | $25$ |  |  |
| 03081800 | 12 | 17.0N | 140.9E | 25 | 11 | 47 | 64 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03081906 | 13 | 20.3 N | 135.4E | 30 | 36 | 79 | 125 | 172 | 164 | 179 |  |  | 0 | 5 | 10 | 5 | $10$ | $30$ |  |  |
| 03081912 | 14 | 20.3 N | 134.3E | 30 | 22 | 50 | 126 | 146 | 159 | 173 |  |  | 0 | 5 | 0 | $10$ | $10$ | $15$ |  |  |
| 03081918 | 15 | 20.2N | 133.5E | 30 | 8 | 80 | 162 | 183 | 249 | 297 |  |  | 0 | 0 | -5 | - 20 | $25$ | $10$ |  |  |
| 03082000 | 16 | 20.0N | 132.7E | 30 | 30 | 119 | 157 | 193 | 242 | 326 |  |  | 0 | $10$ | - 20 | - 20 | $40$ | - 15 |  |  |
| 03082006 | 17 | 19.5N | 132.1E | 35 | 29 | 68 | 72 | 126 | 142 | 202 | 252 | 342 | 0 | -5 | $20$ | - | $35$ | $10$ | - 15 | -20 |
| 03082012 | 18 | 19.0N | 131.4E | 45 | 6 | 40 | 46 | 59 | 67 | 231 | 396 | 570 | -5 | - 15 | 15 | - 35 | $20$ | $15$ | 20 | -20 |
| 03082018 | 19 | 18.7N | 130.4E | 45 | 5 | 28 | 55 | 85 | 145 | 198 | 339 | 569 | 0 | -5 | -5 | $15$ | 10 | 10 | - 30 | -25 |
| 03082100 | 20 | 18.6N | 129.3E | 60 | 6 | 19 | 51 | 84 | 158 | 206 | 354 | 582 | 0 | 5 | - 10 | 5 | 10 | 5 | - 25 | -20 |


| 03082106 | 21 | 18.5 N | 128.2E | 65 | 8 | 49 | 72 | 142 | 173 | 209 | 358 |  | 0 | 0 | -5 | 10 | 10 | 0 | $45$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03082112 | 22 | 18.2 N | 127.1E | 65 | 0 | 38 | 59 | 105 | 118 | 157 | 260 |  | 0 | $10$ | 0 | 5 | 5 | $10$ | $50$ |  |
| 03082118 | 23 | 17.8N | 125.9E | 75 | 8 | 18 | 72 | 77 | 85 | 170 | 396 |  | 0 | -5 | 5 | 5 | 10 | $40$ | $45$ |  |
| 03082200 | 24 | 17.7 N | 124.5E | 90 | 6 | 8 | 46 | 59 | 61 | 151 | 412 |  | 0 | 0 | 5 | 10 | 10 | $35$ | $30$ |  |
| 03082206 | 25 | 17.7N | 123.3E | 90 | 22 | 42 | 42 | 42 | 61 | 185 |  |  | 0 | 5 | 10 | 15 | 5 | $45$ |  |  |
| 03082212 | 26 | 17.6N | 122.1E | 80 | 0 | 60 | 62 | 46 | 62 | 152 |  |  | 0 | 10 | 15 | 10 | 0 | $50$ |  |  |
| 03082218 | 27 | 17.1 N | 120.6E | 70 | 12 | 17 | 13 | 18 | 34 | 96 |  |  | 0 | 10 | 15 | 10 | $10$ | -5 |  |  |
| 03082300 | 28 | 17.5 N | 119.2E | 70 | 13 | 26 | 24 | 49 | 56 | 148 |  |  | 0 | 10 | 10 | 5 | -5 | $10$ |  |  |
| 03082306 | 29 | 17.6N | 117.9E | 70 | 0 | 0 | 6 | 25 | 54 |  |  |  | 0 | 10 | 10 | - 10 | $40$ |  |  |  |
| 03082312 | 30 | 17.9 N | 116.8E | 70 | 11 | 27 | 12 | 8 | 19 |  |  |  | 0 | 5 | 0 | $20$ | - 40 |  |  |  |
| 03082318 | 31 | 18.3 N | 115.8E | 70 | 13 | 29 | 26 | 39 | 58 |  |  |  | 0 | -5 | $20$ | $35$ | $20$ |  |  |  |
| 03082400 | 32 | 18.8 N | 114.7E | 75 | 12 | 34 | 41 | 59 | 96 |  |  |  | 0 | -5 | $10$ | $30$ | $15$ |  |  |  |
| 03082406 | 33 | 19.2N | 113.4E | 80 | 0 | 12 | 31 | 62 |  |  |  |  | 0 | 0 | $25$ | $35$ |  |  |  |  |
| 03082412 | 34 | 19.6 N | 112.2E | 85 | 8 | 11 | 21 | 29 |  |  |  |  | 0 | $15$ | $40$ | $25$ |  |  |  |  |
| 03082418 | 35 | 20.0 N | 111.1E | 85 | 6 | 6 | 25 |  |  |  |  |  | 0 | $20$ | $15$ |  |  |  |  |  |
| 03082500 | 36 | 20.4 N | 110.0E | 80 | 12 | 38 | 84 |  |  |  |  |  | 0 | $25$ | $10$ |  |  |  |  |  |
| 03082506 | 37 | 20.8 N | 108.9E | 90 | 0 | 29 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03082512 | 38 | 21.2 N | 107.8E | 90 | 5 | 13 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03082518 | 39 | 21.5 N | 106.7E | 65 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03082600 | 40 | 22.3 N | 105.2E | 50 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 15 | 41 | 63 | 87 | 113 | 180 | 314 | 420 | 0 | 6 | 11 | 16 | 18 | 24 | 32 | 23 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | 0 | -1 | 0 | -1 | - 13 | -6 |
|  |  |  | \# CASES |  | 40 | 38 | 36 | 33 | 31 | 27 | 12 | 8 | 40 | 38 | 36 | 33 | 31 | 27 | 12 | 8 |



Figure 1-12W-1. $220353 Z$ August 2003 SSMI/GOES-9 visible imagery of TY 12W (Krovanh), located 110 nm east of Luzon, Philippines prior to landfall at its peak intensity of 90 knots.


Figure 1-12W-2. 240300Z January 2003 MODIS true-color image of TY 12W (Krovanh), located in the South China Sea, with an intensity of 75 knots.

## TYPHOON 12W (KROVANH)

## 15-26 AUGUST 2003



## Time Intensity for 12W

Intensity (kts)


## Tropical Storm (TS) 13W (Vamco)*

First Poor : $2130 Z$ 17Aug 03
First Fair : 0600Z 18 Aug 03
First TCFA : 0000Z 19 Aug 03
First Warning : 0000Z 19 Aug 03
Last Warning : $1200 Z 20$ Aug 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : Fanshan, China
Total Warnings : 07
Remarks:
(1) The tropical disturbance that became the short-lived Tropical Storm (TS) 13W was first detected off the east coast of Luzon as a disturbance in the monsoon trough. This disturbance intensified, lifted northward out of the monsoon trough at 3 to 4 knots and consolidated into a depression, with the first warning being issued on 19 August at 0000Z. As the cyclone tracked northward and increased slowly in intensity, a low to mid level ridge to the northeast caused the cyclone to move more northwestward and accelerate towards mainland China. Continuous moderate vertical shear prevented the cyclone from intensifying into more than a weak tropical storm. The final warning for TS 13W was issued on 20 August at 1200Z, approximately 11 hours after landfall near Fanshan, China, where the cyclone rapidly dissipated over land.
2) No damage reports were received for this cyclone.
*Named by WMO Designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03081818 |  | 18.8N | 125.2E 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081900 | 1 | 20.8N | 125.4E 25 | 50 | 171 | 272 | 360 |  |  |  |  | 0 | 0 | 0 | 20 |  |  |  |  |  |
| 03081906 | 2 | 22.8 N | 124.8E 30 | 0 | 62 | 126 | 211 |  |  |  |  | 0 | 0 | 20 | 15 |  |  |  |  |  |
| 03081912 | 3 | 24.3N | 123.4E 30 | 6 | 36 | 146 |  |  |  |  |  | 0 | 5 | 10 |  |  |  |  |  |  |
| 03081918 | 4 | 25.8 N | 122.2E 35 | 17 | 69 | 104 |  |  |  |  |  | 0 | 15 | 10 |  |  |  |  |  |  |
| 03082000 | 5 | 27.2N | 120.9E 35 | 16 | 34 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |  |
| 03082006 | 6 | 28.3 N | 119.5E 25 | 0 | 19 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |
| 03082012 | 7 | 29.8N | 118.3E 20 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 03082018 |  | 30.5 N | 117.5E 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE | 13 | 65 | 162 | 285 |  |  |  |  | 0 | 4 | 10 | 18 |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | 0 | 4 | 10 | 18 |  |  |  |  |  |
|  |  |  | \# CASES | 7 | 6 | 4 | 2 |  |  |  |  | 7 | 6 | 4 | 2 |  |  |  |  |  |



Figure 1-13W-1. 190931Z August 2003 GOES-9 multi-sensor satellite imagery of TY 13W (Vamco), located 180 nm east of Taiwan at its peak intensity of 35 knots.

## TROPICAL STORM 13W (VAMCO) <br> 19-20 AUGUST 2003



## Time Intensity for 13W

## Intensity (kts)



Fix Date (Zulu)

## Tropical Storm (TS) 13W (Vamco)*



First Poor : $2130 Z$ 17Aug 03
First Fair : 0600Z 18 Aug 03

First TCFA : 0000Z 19 Aug 03
First Warning : 0000Z 19 Aug 03
Last Warning : 1200Z 20 Aug 03, Dissipated

Max Intensity : 35 kts, gusts to 45 kts
Landfall : Fanshan, China
Total Warnings : 07
Remarks:
(1) The tropical disturbance that became the short-lived Tropical Storm (TS) 13W was first detected off the east coast of Luzon as a disturbance in the monsoon trough. This disturbance intensified, lifted northward out of the monsoon trough at 3 to 4 knots and consolidated into a depression, with the first warning being issued on 19 August at 0000Z. As the cyclone tracked northward and increased slowly in intensity, a low to mid level ridge to the northeast caused the cyclone to move more northwestward and accelerate towards mainland China. Continuous moderate vertical shear prevented the cyclone from intensifying into more than a weak tropical storm. The final warning for TS 13W was issued on 20 August at 1200Z, approximately 11 hours after landfall near Fanshan, China, where the cyclone rapidly dissipated over land.
2) No damage reports were received for this cyclone.
*Named by WMO Designated RSMC

| Statistics for JTWC on TS13W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | TRACK |  | POS | ITIO | N ER | RO |  |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03081818 |  | 18.8 N | 125.2E 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03081900 | 1 | 20.8N | 125.4E 25 | 50 | 171 | 272 | 360 |  |  |  |  | 0 | 0 | 0 | 20 |  |  |  |  |  |
| 03081906 | 2 | 22.8 N | 124.8E 30 | 0 | 62 | 126 | 211 |  |  |  |  | 0 | 0 | 20 | 15 |  |  |  |  |  |
| 03081912 | 3 | 24.3N | 123.4E 30 | 6 | 36 | 146 |  |  |  |  |  | 0 | 5 | 10 |  |  |  |  |  |  |
| 03081918 | 4 | 25.8 N | 122.2E 35 | 17 | 69 | 104 |  |  |  |  |  | 0 | 15 | 10 |  |  |  |  |  |  |
| 03082000 | 5 | 27.2N | 120.9E 35 | 16 | 34 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |  |
| 03082006 | 6 | 28.3 N | 119.5E 25 | 0 | 19 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |
| 03082012 | 7 | 29.8N | 118.3E 20 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 03082018 |  | 30.5 N | 117.5E 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE | 13 | 65 | 162 | 285 |  |  |  |  | 0 | 4 | 10 | 18 |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | 0 | 4 | 10 | 18 |  |  |  |  |  |
|  |  |  | \# CASES | 7 | 6 | 4 | 2 |  |  |  |  | 7 | 6 | 4 | 2 |  |  |  |  |  |



Figure 1-13W-1. 190931Z August 2003 GOES-9 multi-sensor satellite imagery of TY 13W (Vamco), located 180 nm east of Taiwan at its peak intensity of 35 knots.

## TROPICAL STORM 13W (VAMCO)

19-20 AUGUST 2003


Time Intensity for 13W
Intensity (kts)


Fix Date (Zulu)

## Typhoon (TY) 14W (Dujuan)*

First Poor : 0600Z 27 Aug 03
First Fair : 2300Z 27 Aug 03
First TCFA : 0000Z 28 Aug 03
First Warning : 0600Z 28 Aug 03
Last Warning : 0000Z 03 Sep 03, Dissipated
Max Intensity : 125 kts, gusts to 145 kts
Landfall : China, East of Hong Kong
Total Warnings : 24
Remarks:
(1) Typhoon (TY) 14W developed in the Philippine Sea, approximately 280 nm northwest of Guam, on 27 August 2003. TY 14 W tracked southwestward for about 30 hours, under the influence of low to mid-level steering flow associated with a ridge to the north. From 0600 Z on 29 August to 0600 Z on 30 August, TY 14 W underwent rapid intensification (2 Dvorak T-numbers) due to an upper level low northwest of the system which enhanced poleward outflow.

After 0000 Z on 30 August, a mid-level ridge building eastward from Asian produced a northwestward track change, followed by a westward track change toward Hong Kong. Track speed also increased to 12 to 15 knots and intensification during this period was near the climatological mean of 1 Dvorak T-number/day.

By $2200 Z$ on 31 August, microwave imagery indicated the presence of a concentric eyewalls and the cyclone attained maximum intensity of 125 knots shortly thereafter. TY 14W then slowly weakened as it tracked toward China and made landfall at typhoon strength around 1500 Z on 02 September, just east of Hong Kong. The cyclone then rapidly decreased in intensity over China and the final warning was issued at $0000 Z$ on 03 September.
(2) TY 14 W passed 25 nm south of Taiwan, with an intensity of 120 knots on 01 September. Reports from Taiwan indicated rain and wind damage, flooding, and one missing person. Hong Kong shut the airport down during storm passage. Subsequent reports indicate 36 fatalities and 10 missing from areas near Hong Kong.

## *Named by WMO designated RSMC

Statistics for JTWC on TY 14W

|  | WRN BEST TRACK |  |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03082712 |  | 19.6 N | 139.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082718 |  | 19.0N | 138.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082800 |  | 18.4 N | 138.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082806 | 1 | 17.6 N | 137.5E | 30 | 0 | 32 | 42 | 69 | 110 | 135 |  |  | 0 | 5 | 15 | 0 | 10 | 20 |  |  |
| 03082812 | 2 | 16.8 N | 136.7E | 35 | 5 | 19 | 50 | 79 | 146 | 181 | 156 | 347 | 0 | 10 | 10 | -5 | 0 | 15 | 40 | -10 |
| 03082818 | 3 | 16.5 N | 136.0E | 35 | 12 | 30 | 71 | 108 | 160 | 144 | 197 | 408 | 0 | 10 | -5 | 10 | 10 | $25$ | 40 | 20 |
| 03082900 | 4 | 16.3N | 135.5E | 35 | 16 | 37 | 82 | 104 | 127 | 134 | 254 | 462 | 0 | 0 | 15 | 15 | 15 | 50 | 45 | 40 |
| 03082906 | 5 | 16.1 N | 135.1E | 35 | 13 | 47 | 52 | 62 | 54 | 102 | 206 | 318 | 0 | $15$ | $25$ | $20$ | 25 | $45$ | $25$ | 55 |
| 03082912 | 6 | 16.0 N | 134.8E | 45 | 42 | 94 | 126 | 125 | 103 | 140 | 254 |  | 0 | -5 | 0 | 10 | 0 | $20$ | 5 |  |
| 03082918 | 7 | 16.0N | 134.6E | 60 | 46 | 64 | 83 | 97 | 93 | 173 | 289 |  | 0 | 10 | 20 | 15 | 10 | -5 | 45 |  |
| 03083000 | 8 | 16.1 N | 134.3E | 70 | 0 | 48 | 91 | 140 | 148 | 272 | 385 |  | 0 | 20 | 25 | 15 | 10 | -5 | 70 |  |
| 03083006 | 9 | 16.7 N | 133.7E | 75 | 5 | 32 | 62 | 92 | 135 | 245 | 329 |  | 0 | 10 | 25 | 10 | 10 | 10 | 60 |  |
| 03083012 | 10 | 17.6 N | 133.1E | 75 | 8 | 34 | 80 | 93 | 160 | 226 |  |  | 0 | 10 | 5 | 15 | 20 | 15 |  |  |
| 03083018 | 11 | 18.4 N | 132.2E | 80 | 0 | 23 | 46 | 67 | 86 | 156 |  |  | 0 | -5 | -5 | - 20 | - | 5 |  |  |
| 03083100 | 12 | 19.2 N | 131.1E | 80 | 0 | 33 | 51 | 74 | 90 | 208 |  |  | 0 | 10 | 25 | 25 | 30 | 25 |  |  |
| 03083106 | 13 | 19.8N | 129.6E | 90 | 0 | 30 | 45 | 73 | 88 | 188 |  |  | 0 | -5 | - 15 | - | 35 | 25 |  |  |
| 03083112 | 14 | 20.2 N | 128.1E | 95 | 0 | 33 | 30 | 33 | 50 |  |  |  |  | 20 | 20 | $\overline{35}$ | 25 |  |  |  |


| 03083118 | 15 | 20.4 N | 126.7 E | 100 | 0 | 6 | 29 | 39 | 94 |  |  |  | 0 | - | - | - | 15 | 15 | 20 | 10 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-14W-1. 0122007 Z September 2003 Taiwan Radar image showing the eye feature as the system passed south of Taiwan with an intensity of 120 knots.


Figure 1-14W-2. 012232 Z September 2003 GOES-9 85 GHz TRMM satellite imagery of TY 14 W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.


Figure 1-14W-3. $012325 Z$ September 2003 GOES-9 visible imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.


Figure 1-14W-4. 020250Z September 2003 MODIS true-color image of TY 14W (Dujuan), located in the South China Sea, with an intensity of 120 knots.

## TYPHOON 14W (DUJUAN)

## 28 AUGUST - 03 SEPTEMBER 2003



## Time Intensity for 14 W

## Intensity (kts)



## Typhoon (TY) 14W (Dujuan)*

First Poor : 0600Z 27 Aug 03
First Fair : 2300Z 27 Aug 03
First TCFA : 0000Z 28 Aug 03
First Warning : 0600Z 28 Aug 03
Last Warning : 0000Z 03 Sep 03, Dissipated
Max Intensity : 125 kts, gusts to 145 kts
Landfall : China, East of Hong Kong
Total Warnings : 24
Remarks:
(1) Typhoon (TY) 14W developed in the Philippine Sea, approximately 280 nm northwest of Guam, on 27 August 2003. TY 14W tracked southwestward for about 30 hours, under the influence of low to mid-level steering flow associated with a ridge to the north. From 0600Z on 29 August to $0600 Z$ on 30 August, TY 14 W underwent rapid intensification (2 Dvorak T-numbers) due to an upper level low northwest of the system which enhanced poleward outflow.

After $0000 Z$ on 30 August, a mid-level ridge building eastward from Asian produced a northwestward track change, followed by a westward track change toward Hong Kong. Track speed also increased to 12 to 15 knots and intensification during this period was near the climatological mean of 1 Dvorak T-number/day.

By 2200 Z on 31 August, microwave imagery indicated the presence of a concentric eyewalls and the cyclone attained maximum intensity of 125 knots shortly thereafter. TY 14 W then slowly weakened as it tracked toward China and made landfall at typhoon strength around $1500 Z$ on 02 September, just east of Hong Kong. The cyclone then rapidly decreased in intensity over China and the final warning was issued at 0000 Z on 03 September.
(2) TY 14W passed 25 nm south of Taiwan, with an intensity of 120 knots on 01 September. Reports from Taiwan indicated rain and wind damage, flooding, and one missing person. Hong Kong shut the airport down during storm passage. Subsequent reports indicate 36 fatalities and 10 missing from areas near Hong Kong.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03082712 |  | 19.6 N | 139.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082718 |  | 19.0N | 138.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082800 |  | 18.4 N | 138.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03082806 | 1 | 17.6N | 137.5E | 30 | 0 | 32 | 42 | 69 | 110 | 135 |  |  | 0 | 5 | 15 | 0 | $10$ | $20$ |  |  |
| 03082812 | 2 | 16.8 N | 136.7E | 35 | 5 | 19 | 50 | 79 | 146 | 181 | 156 | 347 | 0 | 10 | 10 | -5 | 0 | $15$ | $40$ | -10 |
| 03082818 | 3 | 16.5N | 136.0E | 35 | 12 | 30 | 71 | 108 | 160 | 144 | 197 | 408 | 0 | 10 | -5 | $10$ | $10$ | $25$ | $40$ | 20 |
| 03082900 | 4 | 16.3 N | 135.5E | 35 | 16 | 37 | 82 | 104 | 127 | 134 | 254 | 462 | 0 | 0 | $15$ | $15$ | $15$ | $50$ | $45$ | 40 |
| 03082906 | 5 | 16.1 N | 135.1E | 35 | 13 | 47 | 52 | 62 | 54 | 102 | 206 | 318 | 0 | $15$ | $25$ | $20$ | $25$ | $45$ | $25$ | 55 |
| 03082912 | 6 | 16.0 N | 134.8E | 45 | 42 | 94 | 126 | 125 | 103 | 140 | 254 |  | 0 | -5 | 0 | 10 | 0 | $20$ | 5 |  |
| 03082918 | 7 | 16.0N | 134.6E | 60 | 46 | 64 | 83 | 97 | 93 | 173 | 289 |  | 0 | 10 | 20 | 15 | 10 | -5 | 45 |  |
| 03083000 | 8 | 16.1 N | 134.3E | 70 | 0 | 48 | 91 | 140 | 148 | 272 | 385 |  | 0 | 20 | 25 | 15 | $10$ | -5 | 70 |  |
| 03083006 | 9 | 16.7N | 133.7E | 75 | 5 | 32 | 62 | 92 | 135 | 245 | 329 |  | 0 | 10 | 25 | 10 | $10$ | $10$ | 60 |  |
| 03083012 | 10 | 17.6 N | 133.1E | 75 | 8 | 34 | 80 | 93 | 160 | 226 |  |  | 0 | 10 | 5 | - 15 | $20$ | $15$ |  |  |
| 03083018 | 11 | 18.4 N | 132.2E | 80 | 0 | 23 | 46 | 67 | 86 | 156 |  |  | 0 | -5 | -5 | 20 | $20$ | 5 |  |  |
| 03083100 | 12 | 19.2 N | 131.1E | 80 | 0 | 33 | 51 | 74 | 90 | 208 |  |  | 0 | $10$ | $25$ | $25$ | $30$ | 25 |  |  |
| 03083106 | 13 | 19.8N | 129.6E | 90 | 0 | 30 | 45 | 73 | 88 | 188 |  |  | 0 | -5 | $15$ | $20$ | $35$ | 25 |  |  |
| 03083112 | 14 | 20.2 N | 128.1E | 95 | 0 | 33 | 30 | 33 | 50 |  |  |  | -5 | 20 | $20$ | - | $25$ |  |  |  |
| 03083118 | 15 | 20.4 N | 126.7E | 100 | 0 | 6 | 29 | 39 | 94 |  |  |  | 0 | $15$ | $15$ | - 20 | 10 |  |  |  |
| 03090100 | 16 | 20.6 N | 125.4E | 120 | 6 | 34 | 57 | 73 | 155 |  |  |  | 0 | -5 | $10$ | -5 | 35 |  |  |  |
| 03090106 | 17 | 20.9 N | 123.6E | 120 | 12 | 41 | 49 | 96 | 98 |  |  |  | 0 | 5 | 0 | 20 | 35 |  |  |  |
| 03090112 | 18 | 21.2N | 121.8E | 125 | 0 | 21 | 29 | 78 |  |  |  |  | 0 | 10 | - 10 | 25 |  |  |  |  |
| 03090118 | 19 | 21.6 N | 120.0E | 120 | 0 | 8 | 46 | 96 |  |  |  |  | 0 | 10 | 15 | 5 |  |  |  |  |
| 03090200 | 20 | 22.0 N | 118.2E | 120 | 0 | 17 | 89 |  |  |  |  |  | 0 | 5 | 5 |  |  |  |  |  |
| 03090206 | 21 | 22.2 N | 116.6E | 105 | 5 | 56 | 90 |  |  |  |  |  | 0 | 20 | 15 |  |  |  |  |  |
| 03090212 | 22 | 22.5 N | 114.7E | 100 | 6 | 65 |  |  |  |  |  |  | 0 | 25 |  |  |  |  |  |  |


| 03090218 | 23 | $22.6 N$ | 112.6 E | 65 | 0 | 16 |  |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03090300 | 24 | 22.6 N | 110.5 E | 40 | 0 |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |

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Figure 1－14W－1．0122007Z September 2003 Taiwan Radar image showing the eye feature as the system passed south of Taiwan with an intensity of 120 knots．


Figure 1-14W-2. 012232 Z September 2003 GOES-9 85 GHz TRMM satellite imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.


Figure 1-14W-3. 012325Z September 2003 GOES-9 visible imagery of TY 14W (Dujuan), located 110 nm southwest of Taiwan at an intensity of 120 knots.


Figure 1-14W-4. 020250Z September 2003 MODIS true-color image of TY 14W (Dujuan), located in the South China Sea, with an intensity of 120 knots.

## TYPHOON 14W (DUJUAN)

## 28 AUGUST - 03 SEPTEMBER 2003



Time Intensity for 14W
Intensity (kts)


## Super Typhoon (STY) 15W (Maemi)*

First Poor : 0600Z 02 Sep 03
First Fair : 0600Z 03 Sep 03
First TCFA : $0200 Z 05$ Sep 03
First Warning : 1800Z 05 Sep 03
Last Warning : $0600 Z 13$ Sep 03
Max Intensity : 150 kts, gusts to 180 kts
Landfall : Kosong, South Korea
Total Warnings : 31
Remarks:

1) Super Typhoon (STY) 15W formed in the monsoon trough approximately sixty nautical miles eastsoutheast of Guam. This cyclone tracked northwestward over Guam as a suspect area before being warned on. The cyclone initially intensified at a less than climatological rate as it tracked in an environment of moderate upper level outflow and low to moderate vertical windshear and attained typhoon strength at 1200 Z on September 7th.

As STY 15W moved northwestward 300 to 400 miles southeast of Okinawa, a mid-latitude trough tracking east off China weakened the mid-level subtropical ridge, which allowed the cyclone to move poleward after 1200 Z on 10 September. STY 15W experienced rapid intensification (two T-numbers / 24 hours) beginning around 1800 Z on 8 September due to enhanced upper level outflow. The rapid rate of intensification allowed the cyclone to reach super typhoon strength by $091200 Z$ and attain maximum intensity of 150 knots 12 hours later.

STY 15W passed approximately 120NM west of Okinawa between 0600 z and 1200 Z on 11 September, then made landfall at Konsong, South Korea near 1300Z on 12 September and, subsequently, tracked along the southeastern coast of Korea. STY 15W then moved into the Sea of Japan and became an extratropical system at around $0600 Z$ on 13 September.
2) One fatality was reported and a further 93 injuries as STY 15W tracked over the islands of Miyakojima and Kumejima in the Okinawa prefecture, approximately 200 nautical miles southwest of Naha, Okinawa. These islands sustained property damage, flight cancellations and extensive loss of
electricity. Peak sustained winds of 33 knots gusting to 47 knots were measured at Kadena Air Base. Southern Japan received significant precipitation and 48 people were evacuated from their homes in Nagasaki prefecture where landslides were reported. STY 15 W was one of the most intense cyclones to strike Korea according to available records. STY 15W made landfall in Kosong, South Korea at an intensity of approximately 90 knots and caused over 120 fatalities, with thousands evacuated and approximately 1.2 billion dollars in damage reported.

*Named by WMO Designated RSMC

| Statistics for JTWC on STY15W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | OSI | TIO | N | ERR | ORS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 |  | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03090406 |  | 9.6 N | 150.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090412 |  | 10.3 N | 149.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090418 |  | 11.3 N | 148.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090500 |  | 12.6 N | 147.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090506 |  | 13.0 N | 146.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090512 |  | 13.5 N | 144.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090518 | 1 | 14.1 N | 143.3E | 35 | 26 | 85 | 12 |  | 171 | 167 | 132 |  |  | -5 | 0 | 0 | 0 | 0 | 0 |  |  |
| 03090600 | 2 | 14.6 N | 142.1E | 40 | 13 | 13 | 66 |  | 115 | 98 | 127 | 204 | 244 | 0 | 5 | 5 | 10 | 10 | 0 | $50$ | -15 |
| 03090606 | 3 | 15.2 N | 141.0E | 40 | 11 | 51 | 74 |  | 66 | 48 | 57 | 169 | 257 | 0 | 0 | 5 | 5 | 15 | 20 | - 45 | -20 |
| 03090612 | 4 | 15.9 N | 140.0E | 45 | 26 | 38 | 54 |  | 43 | 21 | 99 | 207 | 248 | 0 | -5 | 5 | 5 | 15 | $\overline{-}$ | - 45 | -20 |
| 03090618 | 5 | 16.7 N | 138.9E | 50 | 8 | 41 | 58 |  | 62 | 70 | 106 | 110 | 120 | 0 | 5 | 10 | 15 | 30 | 15 | $\overline{10}$ | 0 |
| 03090700 | 6 | 17.4 N | 137.7E | 60 | 13 | 49 | 49 |  | 54 | 85 | 118 | 125 | 76 | 0 | 15 | 15 | 20 | 20 | 30 | 0 | 0 |
| 03090706 | 7 | 18.3 N | 136.7E | 60 | 8 | 21 | 12 |  | 13 | 30 | 20 | 103 | 112 | 0 | 5 | 15 | 20 | -5 | $\overline{-}$ | - 10 | 15 |
| 03090712 | 8 | 19.0 N | 135.8E | 60 | 26 | 25 | 13 |  | 31 | 48 | 16 | 8 | 271 | 5 | 5 | 15 | 10 | $20$ | $\overline{-}$ | $\bar{\square}$ | 20 |
| 03090718 | 9 | 19.4 N | 134.8E | 65 | 12 | 13 | 13 |  | 25 | 21 | 44 | 96 | 133 | 0 | 5 | 15 | 15 | 25 | - 20 | - 20 | 10 |


| 03090800 | 10 | 19.9 N | 134.0E | 70 | 8 | 18 | 16 | 33 | 38 | 73 | 62 | 207 | 0 | 5 | 0 | $25$ | $40$ | $10$ | $30$ | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03090806 | 11 | 20.2 N | 133.0E | 70 | 16 | 13 | 19 | 33 | 33 | 126 | 50 | 235 | 0 | 5 | $25$ | $30$ | $40$ | $20$ | $10$ | 25 |
| 03090812 | 12 | 20.6N | 132.0E | 75 | 12 | 25 | 43 | 41 | 55 | 51 | 181 | 416 | 0 | -5 | $35$ | $45$ | $40$ | $20$ | 0 | 30 |
| 03090818 | 13 | 21.1 N | 131.1E | 75 | 12 | 25 | 18 | 25 | 56 | 60 | 333 |  | 0 | 30 | 35 | 45 | $20$ | -5 | 15 |  |
| 03090900 | 14 | 21.8 N | 130.3E | 90 | 11 | 30 | 58 | 81 | 107 | 89 | 329 |  | 0 | $25$ | 35 | $\overline{3}$ | 0 | 0 | 10 |  |
| 03090906 | 15 | 22.4 N | 129.5E | 115 | 5 | 25 | 62 | 110 | 128 | 74 | 239 |  | 0 | -5 | $20$ | -5 | 0 | 15 | 25 |  |
| 03090912 | 16 | 22.9 N | 128.7E | 130 | 5 | 42 | 65 | 96 | 104 | 91 | 214 |  | 0 | $10$ | $10$ | 0 | $15$ | 15 | 20 |  |
| 03090918 | 17 | 23.3 N | 127.8E | 130 | 6 | 30 | 60 | 82 | 47 | 135 |  |  | 0 | $10$ | 5 | $10$ | -5 | 20 |  |  |
| 03091000 | 18 | 23.6 N | 127.2E | 150 | 5 | 23 | 57 | 48 | 30 | 192 |  |  | 0 | 0 | 10 | $10$ | - 10 | 0 |  |  |
| 03091006 | 19 | 24.0N | 126.7E | 150 | 8 | 25 | 24 | 16 | 49 | 98 |  |  | 0 | 5 | -5 | -5 | -5 | 5 |  |  |
| 03091012 | 20 | 24.3 N | 126.1E | 150 | 0 | 30 | 43 | 48 | 49 | 125 |  |  | 0 | 15 | $10$ | $10$ | 0 | 10 |  |  |
| 03091018 | 21 | 24.7N | 125.6E | 135 | 8 | 25 | 22 | 70 | 118 |  |  |  | 0 | - 10 | 0 | -5 | $10$ |  |  |  |
| 03091100 | 22 | 25.2N | 125.3E | 125 | 8 | 32 | 43 | 104 | 121 |  |  |  | 5 | 15 | - 10 | - 10 | $15$ |  |  |  |
| 03091106 | 23 | 25.9N | 125.3E | 135 | 13 | 36 | 83 | 125 | 187 |  |  |  | 0 | 5 | 0 | 5 | 0 |  |  |  |
| 03091112 | 24 | 27.0N | 125.5E | 135 | 13 | 60 | 87 | 114 | 154 |  |  |  | 0 | 0 | 5 | 0 | 0 |  |  |  |
| 03091118 | 25 | 28.6 N | 125.8E | 120 | 12 | 52 | 74 | 103 |  |  |  |  | 0 | 5 | -5 | 0 |  |  |  |  |
| 03091200 | 26 | 30.6 N | 126.5E | 120 | 5 | 13 | 22 | 82 |  |  |  |  | 0 | 5 | 0 | 0 |  |  |  |  |
| 03091206 | 27 | 32.7 N | 127.1E | 105 | 5 | 19 | 58 |  |  |  |  |  | 0 | 10 | 0 |  |  |  |  |  |
| 03091212 | 28 | 34.8 N | 128.3E | 95 | 0 | 15 | 75 |  |  |  |  |  | -5 | 15 | -5 |  |  |  |  |  |
| 03091218 | 29 | 36.9 N | 129.7E | 80 | 0 | 29 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03091300 | 30 | 38.9 N | 131.5E | 75 | 12 | 45 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03091306 | 31 | 40.6 N | 134.7E | 60 | 7 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03091312 |  | 42.2 N | 137.9E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 32 | 50 | 69 | 78 | 92 | 162 | 211 | 1 | 8 | 11 | 13 | 14 | 15 | 20 | 15 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -2 | -3 | -6 | -7 | -8 | $11$ | 5 |
|  |  |  | \# CASES |  | 31 | 30 | 28 | 26 | 24 | 20 | 15 | 11 | 31 | 30 | 28 | 26 | 24 | 20 | 15 | 11 |



Figure 1-15W-1. 100200Z September 2003 MODIS true-color image of STY 15W (Maemi), located 330nm east of Taiwan, with a maximum intensity of 150 knots.


Figure 1-15W-2. 111251 Z September 2003 color composite SSM/I imagery of STY 15W (Maemi), the system was undergoing a concentric eyewall cycle. located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.


Figure 1-15W-3. 111251Z September 200385 GHz multi-sensor imagery of STY 15W (Maemi), located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

## SUPER TYPHOON 15W (MAEMI) <br> 05-13 SEPTEMBER 2003



## Time Intensity for 15 W

Intensity (kts)


## Super Typhoon (STY) 15W (Maemi)*

First Poor : 0600Z 02 Sep 03

First Fair : $0600 Z 03$ Sep 03
First TCFA : 0200Z 05 Sep 03

First Warning : 1800Z 05 Sep 03
Last Warning : 0600Z 13 Sep 03
Max Intensity : 150 kts, gusts to 180 kts
Landfall : Kosong, South Korea
Total Warnings : 31
Remarks:

1) Super Typhoon (STY) 15W formed in the monsoon trough approximately sixty nautical miles eastsoutheast of Guam. This cyclone tracked northwestward over Guam as a suspect area before being warned on. The cyclone initially intensified at a less than climatological rate as it tracked in an environment of moderate upper level outflow and low to moderate vertical windshear and attained typhoon strength at 1200 Z on September 7th.

As STY 15W moved northwestward 300 to 400 miles southeast of Okinawa, a mid-latitude trough tracking east off China weakened the mid-level subtropical ridge, which allowed the cyclone to move poleward track after 1200 Z on 10 September. STY 15 W experienced rapid intensification (two Tnumbers / 24 hours) beginning around $1800 Z$ on 8 September due to enhanced upper level outflow. The rapid rate of intensification allowed the cyclone to reach super typhoon strength by 091200 Z and attain maximum intensity of 150 knots 12 hours later.

STY 15W passed approximately 120NM west of Okinawa between 0600 z and $1200 Z$ on 11 September, then made landfall at Konsong, South Korea near $1300 Z$ on 12 September and, subsequently, tracked along the southeastern coast of Korea. STY 15W then moved into the Sea of Japan and became an extratropical system at around 0600Z on 13 September.
2) One fatality was reported and a further 93 injuries as STY 15W tracked over the islands of Miyakojima and Kumejima in Okinawa prefecture, approximately 200 nautical miles southwest of Naha, Okinawa. These islands sustained property damage, flight cancellations and extensive loss of electricity. Peak sustained winds of 33 knots gusting to 47 knots were measured at Kadena Air Base. Southern Japan received significant precipitation and 48 people were evacuated from their homes in Nagasaki prefecture where landslides were reported. STY 15 W was one of the most intense cyclones
|to strike Korea according to available records. STY 15W made landfall in Kosong, South Korea at an intensity of approximately 90 knots and caused over 120 fatalities, with thousands evacuated and approximately 1.2 billion dollars in damage reported.

## *Named by WMO Designated RSMC

Statistics for JTWC on STY15W

| Statistics for JTWC on STY15W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SIT | ION | ERR | ORS |  |  |  |  | IND | ER | RR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 2 | 4 | 36 | 48 | 72 | 96 | 120 |
| 03090406 |  | 9.6 N | 150.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090412 |  | 10.3N | 149.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090418 |  | 11.3N | 148.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090500 |  | 12.6 N | 147.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090506 |  | 13.0 N | 146.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090512 |  | 13.5 N | 144.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03090518 | 1 | 14.1 N | 143.3E | 35 | 26 | 85 | 125 | 171 | 167 | 132 |  |  | -5 | 0 | 0 |  | 0 | 0 | 0 |  |  |
| 03090600 | 2 | 14.6N | 142.1E | 40 | 13 | 13 | 66 | 115 | 98 | 127 | 204 | 244 | 0 | 5 | 5 |  | 10 | 10 | 0 | $50$ | -15 |
| 03090606 | 3 | 15.2N | 141.0E | 40 | 11 | 51 | 74 | 66 | 48 | 57 | 169 | 257 | 0 | 0 | 5 |  | 5 | 15 | $20$ | $45$ | -20 |
| 03090612 | 4 | 15.9N | 140.0E | 45 | 26 | 38 | 54 | 43 | 21 | 99 | 207 | 248 | 0 | -5 | 5 |  | 5 | 15 | $30$ | $45$ | -20 |
| 03090618 | 5 | 16.7N | 138.9E | 50 | 8 | 41 | 58 | 62 | 70 | 106 | 110 | 120 | 0 | 5 | 10 | 0 | 15 | 30 | $15$ | $10$ | 0 |
| 03090700 | 6 | 17.4 N | 137.7E | 60 | 13 | 49 | 49 | 54 | 85 | 118 | 125 | 76 | 0 | 15 | 15 | 5 | 20 | 20 | $30$ | 0 | 0 |
| 03090706 | 7 | 18.3N | 136.7E | 60 | 8 | 21 | 12 | 13 | 30 | 20 | 103 | 112 | 0 | 5 | 15 | 5 | 20 | -5 | $30$ | $10$ | 15 |
| 03090712 | 8 | 19.0N | 135.8E | 60 | 26 | 25 | 13 | 31 | 48 | 16 | 8 | 271 | 5 | 5 | 15 |  | 10 | $20$ | $30$ | $10$ | 20 |
| 03090718 | 9 | 19.4 N | 134.8E | 65 | 12 | 13 | 13 | 25 | 21 | 44 | 96 | 133 | 0 | 5 | 15 | 5 | $15$ | $25$ | $20$ | $20$ | 10 |
| 03090800 | 10 | 19.9N | 134.0E | 70 | 8 | 18 | 16 | 33 | 38 | 73 | 62 | 207 | 0 | 5 | 0 |  | $25$ | $40$ | $10$ | $30$ | 10 |
| 03090806 | 11 | 20.2N | 133.0E | 70 | 16 | 13 | 19 | 33 | 33 | 126 | 50 | 235 | 0 | 5 | 25 |  | $30$ | $40$ | $20$ | $10$ | 25 |


| 03090812 | 12 | 20.6N | 132.0E | 75 | 12 | 25 | 43 | 41 | 55 | 51 | 181 | 416 | 0 | -5 | $35$ | $45$ | $40$ | $20$ | 0 | 30 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03090818 | 13 | 21.1 N | 131.1E | 75 | 12 | 25 | 18 | 25 | 56 | 60 | 333 |  | 0 | $30$ | $35$ | $45$ | $20$ | -5 | 15 |  |
| 03090900 | 14 | 21.8 N | 130.3E | 90 | 11 | 30 | 58 | 81 | 107 | 89 | 329 |  | 0 | $25$ | $35$ | $30$ | 0 | 0 | 10 |  |
| 03090906 | 15 | 22.4 N | 129.5E | 115 | 5 | 25 | 62 | 110 | 128 | 74 | 239 |  | 0 | -5 | $20$ | -5 | 0 | 15 | 25 |  |
| 03090912 | 16 | 22.9 N | 128.7E | 130 | 5 | 42 | 65 | 96 | 104 | 91 | 214 |  | 0 | $10$ | $10$ | 0 | $15$ | 15 | 20 |  |
| 03090918 | 17 | 23.3 N | 127.8E | 130 | 6 | 30 | 60 | 82 | 47 | 135 |  |  | 0 | $10$ | 5 | $10$ | -5 | 20 |  |  |
| 03091000 | 18 | 23.6N | 127.2E | 150 | 5 | 23 | 57 | 48 | 30 | 192 |  |  | 0 | 0 | 10 | $10$ | $10$ | 0 |  |  |
| 03091006 | 19 | 24.0N | 126.7E | 150 | 8 | 25 | 24 | 16 | 49 | 98 |  |  | 0 | 5 | -5 | -5 | -5 | 5 |  |  |
| 03091012 | 20 | 24.3 N | 126.1E | 150 | 0 | 30 | 43 | 48 | 49 | 125 |  |  | 0 | 15 | $10$ | $10$ | 0 | 10 |  |  |
| 03091018 | 21 | 24.7N | 125.6E | 135 | 8 | 25 | 22 | 70 | 118 |  |  |  | 0 | $10$ | 0 | -5 | $10$ |  |  |  |
| 03091100 | 22 | 25.2N | 125.3E | 125 | 8 | 32 | 43 | 104 | 121 |  |  |  | 5 | $15$ | $10$ | $10$ | $15$ |  |  |  |
| 03091106 | 23 | 25.9N | 125.3E | 135 | 13 | 36 | 83 | 125 | 187 |  |  |  | 0 | 5 | 0 | 5 | 0 |  |  |  |
| 03091112 | 24 | 27.0N | 125.5E | 135 | 13 | 60 | 87 | 114 | 154 |  |  |  | 0 | 0 | 5 | 0 | 0 |  |  |  |
| 03091118 | 25 | 28.6N | 125.8E | 120 | 12 | 52 | 74 | 103 |  |  |  |  | 0 | 5 | -5 | 0 |  |  |  |  |
| 03091200 | 26 | 30.6 N | 126.5E | 120 | 5 | 13 | 22 | 82 |  |  |  |  | 0 | 5 | 0 | 0 |  |  |  |  |
| 03091206 | 27 | 32.7 N | 127.1E | 105 | 5 | 19 | 58 |  |  |  |  |  | 0 | $10$ | 0 |  |  |  |  |  |
| 03091212 | 28 | 34.8 N | 128.3E | 95 | 0 | 15 | 75 |  |  |  |  |  | -5 | $15$ | -5 |  |  |  |  |  |
| 03091218 | 29 | 36.9 N | 129.7E | 80 | 0 | 29 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03091300 | 30 | 38.9 N | 131.5E | 75 | 12 | 45 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03091306 | 31 | 40.6N | 134.7E | 60 | 7 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03091312 |  | 42.2 N | 137.9E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 32 | 50 | 69 | 78 | 92 | 162 | 211 | 1 | 8 | 11 | 13 | 14 | 15 | 20 | 15 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -2 | -3 | -6 | -7 | -8 | $11$ | 5 |
|  |  |  | \# CASES |  | 31 | 30 | 28 | 26 | 24 | 20 | 15 | 11 | 31 | 30 | 28 | 26 | 24 | 20 | 15 | 11 |



Figure 1-15W-1. 100200 Z September 2003 MODIS true-color image of STY 15W (Maemi), located 330nm east of Taiwan, with a maximum intensity of 150 knots.


Figure 1-15W-2. $111251 Z$ September 2003 color composite SSM/I imagery of STY 15W (Maemi), the system was undergoing a concentric eyewall cycle. located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.


Figure 1-15W-2. $111251 Z$ September 200385 GHz multi-sensor imagery of STY 15W (Maemi), located 120 nm northwest of Okinawa, Japan at an intensity of 135 knots.

## SUPER TYPHOON 15W (MAEMI) <br> 05-13 SEPTEMBER 2003



## Time Intensity for 15W

## Intensity (kts)



## Typhoon (TY) 16W (Choi-Wan)*



First TCFA : 1300Z 17 Sep 03
First Warning : $1800 Z 17$ Sep 03
Last Warning : 1800Z 22 Sep 03
Max Intensity : 95 kts, gusts to 115 kts
Landfall : Okinawa, Japan
Total Warnings : 21
Remarks:

1) Typhoon (TY) 16W was first noted as a rapidly developing low level circulation in a reverse oriented monsoon trough on 17 September. Within 18 hours, a first warning was issued for this cyclone as it tracked poleward under the influence of the subtropical ridge to the east-northeast.

Once TY 16W passed the axis of the steering ridge on 19 September, the cyclone began to move more poleward while still intensifying. By $1800 Z$ on 21 September, interaction with the mid-latitude westerlies began to weaken the cyclone as it tracked northeastward to east-northeastward while undergoing extratropical transition. Extratropical transition was complete within 24 hours and a final warning was issued.
2) No reports of significant damage are associated with this system.
*Named by WMO Designated RSMC

|  | WRN BEST TRACK |  |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03091706 |  | 19.4 N | 130.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03091712 |  | 20.0N | 129.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03091718 | 1 | 20.7 N | 129.2E | 25 | 12 | 50 | 72 | 154 | 229 | 391 | 614 | 968 | 0 | 0 | $10$ | 10 | $10$ | -5 | 45 |  |
| 03091800 | 2 | 21.4 N | 128.5E | 30 | 12 | 16 | 101 | 188 | 264 | 452 | 690 | 1220 | 0 | 10 | 10 | -5 | 5 | -5 | 25 | 30 |
| 03091806 | 3 | 21.7 N | 127.4E | 30 | 24 | 99 | 186 | 254 | 307 | 453 | 729 |  | 0 | -5 | $10$ | $\overline{10}$ | 5 | $15$ | 20 |  |
| 03091812 | 4 | 22.7 N | 127.2E | 30 | 20 | 110 | 190 | 248 | 265 | 429 | 737 |  | 0 | $15$ | $15$ | 10 | -5 | $30$ | 10 |  |
| 03091818 | 5 | 23.7 N | 127.5E | 45 | 8 | 79 | 149 | 211 | 247 | 432 | 761 |  | 0 | 0 | 10 | 20 | 20 | 25 | -5 |  |
| 03091900 | 6 | 24.9N | 127.7E | 55 | 17 | 24 | 58 | 88 | 150 | 328 | 797 |  | 0 | 10 | 25 | 25 | 0 | -5 | 20 |  |
| 03091906 | 7 | 26.0 N | 128.0E | 55 | 5 | 21 | 13 | 49 | 98 | 215 |  |  | 0 | 5 | 25 | 25 | 10 | $20$ |  |  |
| 03091912 | 8 | 27.0N | 128.2E | 60 | 6 | 6 | 48 | 105 | 120 | 130 |  |  | 5 | 10 | 25 | 5 | - 15 | $\overline{-}$ |  |  |
| 03091918 | 9 | 27.8N | 128.8E | 65 | 8 | 18 | 65 | 78 | 97 | 106 |  |  | 0 | 15 | 15 | - 15 | 25 | $10$ |  |  |
| 03092000 | 10 | 28.4 N | 129.7E | 65 | 6 | 45 | 79 | 94 | 99 | 184 |  |  | 0 | 10 | -5 | 25 | - 3 | $10$ |  |  |
| 03092006 | 11 | 28.8 N | 130.7E | 65 | 12 | 68 | 86 | 92 | 101 |  |  |  | 5 | 10 | 20 | $30$ | $35$ |  |  |  |
| 03092012 | 12 | 29.0 N | 132.1E | 70 | 16 | 58 | 93 | 120 | 158 |  |  |  | 0 | 10 | - 20 | - 25 | $25$ |  |  |  |
| 03092018 | 13 | 29.4 N | 133.7E | 70 | 24 | 67 | 90 | 119 | 182 |  |  |  | 5 | $\overline{-}$ | $\overline{35}$ | - 40 | 25 |  |  |  |
| 03092100 | 14 | 30.0 N | 135.6E | 90 | 11 | 24 | 13 | 18 | 186 |  |  |  | -5 | 25 | $\overline{30}$ | - 20 | - 10 |  |  |  |
| 03092106 | 15 | 31.1 N | 137.2E | 100 | 10 | 31 | 58 | 117 |  |  |  |  | -5 | $10$ | $\overline{10}$ | -5 |  |  |  |  |
| 03092112 | 16 | 32.1 N | 139.0E | 100 | 15 | 30 | 53 | 226 |  |  |  |  | -5 | 10 | -5 | 0 |  |  |  |  |
| 03092118 | 17 | 33.2 N | 140.8E | 100 | 5 | 10 | 13 |  |  |  |  |  | 10 | - 15 | -5 |  |  |  |  |  |
| 03092200 | 18 | 34.4 N | 142.8E | 95 | 6 | 26 | 123 |  |  |  |  |  | $\overline{10}$ | -5 | -5 |  |  |  |  |  |


| 03092206 | 19 | $35.9 N$ | 145.0 E | 90 | 0 | 50 |  |  |  |  |  |  |  |  |  | - | 0 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-16W-1. 210140 Z September 2003 MODIS true-color image of TY 16W (ChoiWan), located 220nm south of Japan, with an intensity of 85 knots.


Figure 1-16W-2. $210544 Z$ September 2003 color composite TRMM imagery of TY 16W (Choi-wan), the large eye was located 160 nm southeast mainland Japan at its peak intensity of 95 knots.

## TYPHOON 16W (CHOI-WAN)

17-22 SEPTEMBER 2003


## Time Intensity for 16 W

Intensity (kts)


## Typhoon (TY) 16W (Choi-Wan)*

First Poor: N/A

First Fair : $0130 Z 17$ Sep 03
First TCFA : 1300Z 17 Sep 03
First Warning : 1800Z 17 Sep 03

Last Warning : 1800Z 22 Sep 03
Max Intensity : 95 kts, gusts to 115 kts

Landfall : Okinawa, Japan
Total Warnings : 21
Remarks:

1) Typhoon (TY) 16W was first noted as a rapidly developing low level circulation in a reverse oriented monsoon trough on 17 September. Within 18 hours, a first warning was issued for this cyclone as it tracked poleward under the influence of the subtropical ridge to the east-northeast.

Once TY 16W passed the axis of the steering ridge on 19 September, the cyclone began to move more poleward while still intensifying. By $1800 Z$ on 21 September, interaction with the mid-latitude westerlies began to weaken the cyclone as it tracked northeastward to east-northeastward while undergoing extratropical transition. Extratropical transition was complete within 24 hours and a final warning was issued.
2) No reports of significant damage are associated with this system.
*Named by WMO Designated RSMC

| Statistics for JTWC on TY16W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  | PO | SITIO | ON E | RRO | RS |  |  |  |  | ND | ER | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03091706 |  | 19.4 N | 130.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03091712 |  | 20.0 N | 129.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03091718 | 1 | 20.7 N | 129.2E | 25 | 12 | 50 | 72 | 154 | 229 | 391 | 614 | 968 | 0 | 0 | $10$ | $10$ | $10$ | -5 | 45 | 0 |
| 03091800 | 2 | 21.4 N | 128.5E | 30 | 12 | 16 | 101 | 188 | 264 | 452 | 690 | 1220 | 0 | 10 | $10$ | -5 | 5 | -5 | 25 | 30 |
| 03091806 | 3 | 21.7 N | 127.4E | 30 | 24 | 99 | 186 | 254 | 307 | 453 | 729 |  | 0 | -5 | $10$ | - 10 | 5 | $15$ | $20$ |  |
| 03091812 | 4 | 22.7 N | 127.2E | 30 | 20 | 110 | 190 | 248 | 265 | 429 | 737 |  | 0 | $15$ | $15$ | $10$ | -5 | $30$ | $10$ |  |
| 03091818 | 5 | 23.7 N | 127.5E | 45 | 8 | 79 | 149 | 211 | 247 | 432 | 761 |  | 0 | 0 | 10 | 20 | 20 | $25$ | -5 |  |
| 03091900 | 6 | 24.9 N | 127.7E | 55 | 17 | 24 | 58 | 88 | 150 | 328 | 797 |  | 0 | 10 | 25 | 25 | 0 | -5 | 20 |  |
| 03091906 | 7 | 26.0 N | 128.0E | 55 | 5 | 21 | 13 | 49 | 98 | 215 |  |  | 0 | 5 | 25 | 25 | - | $20$ |  |  |
| 03091912 | 8 | 27.0N | 128.2E | 60 | 6 | 6 | 48 | 105 | 120 | 130 |  |  | 5 | 10 | 25 | 5 | - | $10$ |  |  |
| 03091918 | 9 | 27.8 N | 128.8E | 65 | 8 | 18 | 65 | 78 | 97 | 106 |  |  | 0 | 15 | 15 | - | $25$ | $10$ |  |  |
| 03092000 | 10 | 28.4 N | 129.7E | 65 | 6 | 45 | 79 | 94 | 99 | 184 |  |  | 0 | 10 | -5 | - 25 | - 3 | $10$ |  |  |
| 03092006 | 11 | 28.8 N | 130.7E | 65 | 12 | 68 | 86 | 92 | 101 |  |  |  | 5 | 10 | - 20 | - | - |  |  |  |
| 03092012 | 12 | 29.0 N | 132.1E | 70 | 16 | 58 | 93 | 120 | 158 |  |  |  | 0 | - 10 | - 20 | - | $25$ |  |  |  |
| 03092018 | 13 | 29.4 N | 133.7E | 70 | 24 | 67 | 90 | 119 | 182 |  |  |  | 5 | $30$ | $35$ | $40$ | $25$ |  |  |  |
| 03092100 | 14 | 30.0 N | 135.6E | 90 | 11 | 24 | 13 | 18 | 186 |  |  |  | -5 | $25$ | - 30 | $20$ | - 10 |  |  |  |
| 03092106 | 15 | 31.1 N | 137.2E | 100 | 10 | 31 | 58 | 117 |  |  |  |  | -5 | - 10 | - 10 | -5 |  |  |  |  |
| 03092112 | 16 | 32.1 N | 139.0E | 100 | 15 | 30 | 53 | 226 |  |  |  |  | -5 | - 10 | -5 | 0 |  |  |  |  |
| 03092118 | 17 | 33.2 N | 140.8E | 100 | 5 | 10 | 13 |  |  |  |  |  | - 10 | - 15 | -5 |  |  |  |  |  |


| 03092200 | 18 | 34.4 N | 142.8 E | 95 | 6 | 26 | 123 |  |  |  |  |  |  | - | -5 | -5 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03092206 | 19 | 35.9 N | 145.0 E | 90 | 0 | 50 |  |  |  |  |  |  |  | - | - | 0 |  |  |  |  |  |



Figure 1-16W-1. 210140 Z September 2003 MODIS true-color image of TY 16W (ChoiWan), located 220 nm south of Japan, with an intensity of 85 knots.


Figure 1-16W-2. $210544 Z$ September 2003 color composite TRMM imagery of TY 16W (Choi-wan), the large eye was located 160 nm southeast mainland Japan at its peak intensity of 95 knots.

## TYPHOON 16W (CHOI-WAN)

## 17-22 SEPTEMBER 2003



Time Intensity for 16W


## Typhoon (TY) 17W (Koppu)*

First Poor : 0600Z 22 Sep 03
First Fair : 2130Z 23 Sep 03
First TCFA : 0230Z 24 Sep 03
First Warning : 1200Z 24 Sep 03
Last Warning : 0600Z 30 Sep 03, Extratropical
Max Intensity : 90 kts gusts to 110 kts
Landfall : None
Total Warnings : 24
Remarks:
(1) Typhoon (TY) 11 W was initially described as a disturbance developing out of a broad monsoon trough, approximately 220 NM east-northeast of Yap. The first warning was issued at $1200 Z$ on 24 September. The cyclone initially tracked northwestward along the southern periphery of a mid-level steering ridge anchored east of Japan. Intensification of TY 17W was suppressed by a TUTT cell located to the northeast of the system that hindered upper level diffluence. This same TUTT cyclone appears to have caused the cyclone to loop before $1200 Z$ on 25 September.

TY 17W turned to the north-northeast after 25 September in response to a shortwave trough in the midlatitude westerlies. Subsequently, the outflow from the cyclone improved due to this interaction with the shortwave trough and the dissipation of the TUTT cyclone.

After 25 September, another trough in the mid-latitude westerly flow caused the cyclone to accelerate east-northeastward and begin transition into an extratropical system. The final warning was issued at $0600 Z$ on 30 September.
(2) No casualties or damage were reported.
*Named by WMO Designated RSMC

## Statistics for JTWC on TY17W

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03092318 |  | 14.5 N | 139.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092400 |  | 15.1 N | 138.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092406 |  | 15.6 N | 138.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092412 | 1 | 15.9 N | 137.1E | 25 | 11 | 12 | 133 | 135 | 156 | 172 | 148 | 240 | 0 | 0 | 5 | 25 | 30 | 20 | $10$ | -5 |
| 03092418 | 2 | 16.6 N | 136.2E | 30 | 12 | 122 | 133 | 133 | 166 | 150 |  |  | 0 | 10 | 20 | 35 | 35 | 15 |  |  |
| 03092500 | 3 | 16.6 N | 135.4E | 30 | 23 | 67 | 45 | 51 | 62 | 38 |  |  | 0 | 10 | 25 | 30 | 15 | 10 |  |  |
| 03092506 | 4 | 15.8 N | 135.6E | 30 | 42 | 47 | 52 | 90 | 115 | 140 |  |  | 0 | 10 | 25 | 25 | 5 | 20 |  |  |
| 03092512 | 5 | 16.4 N | 136.1E | 30 | 36 | 21 | 38 | 78 | 120 | 144 |  |  | 0 | 10 | 15 | 5 | 0 | 5 |  |  |
| 03092518 | 6 | 17.2 N | 136.2E | 30 | 17 | 33 | 62 | 103 | 109 | 84 |  |  | 0 | 10 | 10 | 10 | 0 | 15 |  |  |
| 03092600 | 7 | 17.9 N | 136.4E | 25 | 111 | 154 | 207 | 258 | 281 | 266 |  |  | 0 | 0 | - 15 | 15 | -5 | 20 |  |  |
| 03092606 | 8 | 18.5 N | 136.7E | 25 | 23 | 21 | 81 | 108 | 126 | 120 |  |  | 0 | 0 | $15$ | 10 | -5 | 25 |  |  |
| 03092612 | 9 | 19.3 N | 137.4E | 30 | 17 | 43 | 97 | 126 | 110 | 81 |  |  | 0 | $10$ | 15 | 10 | 15 | $20$ |  |  |
| 03092618 | 10 | 20.1 N | 138.1E | 35 | 16 | 43 | 48 | 50 | 57 | 83 |  |  | -5 | $20$ | $15$ | 10 | $25$ | $10$ |  |  |
| 03092700 | 11 | 21.2 N | 138.7E | 50 | 25 | 39 | 75 | 110 | 172 | 122 |  |  | 0 | -5 | 5 | 0 | -10 | 10 |  |  |
| 03092706 | 12 | 22.3 N | 139.3E | 60 | 17 | 42 | 76 | 144 | 219 | 118 |  |  | 0 | 10 | 20 | 5 | -5 | 25 |  |  |
| 03092712 | 13 | 23.3 N | 139.7E | 60 | 12 | 42 | 96 | 163 | 227 |  |  |  | 0 | 5 | 0 | 10 | - 10 |  |  |  |
| 03092718 | 14 | 24.1 N | 140.0E | 60 | 18 | 48 | 112 | 213 | 283 |  |  |  | 0 | 5 | -5 | 15 | $10$ |  |  |  |
| 03092800 | 15 | 25.0 N | 140.3E | 60 | 0 | 34 | 95 | 182 | 139 |  |  |  | 0 | -5 | 15 | 25 | $10$ |  |  |  |
| 03092806 | 16 | 25.7 N | 140.6E | 60 | 0 | 11 | 89 | 183 | 108 |  |  |  | 0 | $10$ | 25 | 20 | 5 |  |  |  |
| 03092812 | 17 | 26.3N | 140.9E | 70 | 26 | 28 | 103 | 119 |  |  |  |  | 0 | -5 | 10 | 0 |  |  |  |  |


| 03092818 | 18 | 27.0 N | 141.2E | 80 | 24 | 32 | 71 | 72 |  |  |  |  | 0 | - 10 | $10$ | 10 |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03092900 | 19 | 27.7N | 141.5E | 85 | 16 | 32 | 39 |  |  |  |  |  | -5 | - | 0 |  |  |  |  |  |
| 03092906 | 20 | 28.5N | 141.9E | 90 | 12 | 49 | 92 |  |  |  |  |  | 0 | 5 | 20 |  |  |  |  |  |
| 03092912 | 21 | 29.4 N | 142.6E | 85 | 13 | 59 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03092918 | 22 | 30.7 N | 144.2E | 75 | 16 | 64 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03093000 | 23 | 32.7 N | 147.1E | 60 | 13 |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |
| 03093006 | 24 | 35.0 N | 150.1E | 45 | 34 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 23 | 47 | 87 | 129 | 153 | 127 | 148 | 240 | 1 | 8 | 14 | 14 | 12 | 16 | 10 | 5 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | 1 | 1 | 0 | 1 | - 10 | -5 |
|  |  |  | \# CASES |  | 24 | 22 | 20 | 18 | 16 | 12 | 1 | 1 | 24 | 22 | 20 | 18 | 16 | 12 | 1 | 1 |



Figure 1-17W-1. 290225 Z September 2003 GOES-9 visible imagery of TY 17W (Koppu), located 200 nm north-northeast of Iwo Jima island at an intensity of 80 knots.


Figure 1-17W-2. $290400 Z$ September 2003 MODIS true-color image of TY 17W (Koppu), located 210nm north of Iwo Jima, with an intensity of 90 knots.

## TYPHOON 17W (KOPPU)

24-30 SEPTEMBER 2003


## Time Intensity for 17W

## Intensity (kts)



## Typhoon (TY) 17W (Koppu)*

First Poor : 0600Z 22 Sep 03
First Fair : $2130 Z 23$ Sep 03
First TCFA : 0230Z 24 Sep 03
First Warning : 1200Z 24 Sep 03
Last Warning : 0600Z 30 Sep 03, Extratropical
Max Intensity : 90 kts gusts to 110 kts
Landfall : None

Total Warnings : 24
Remarks:
(1) Typhoon (TY) 11W was initially described as a disturbance developing out of a broad monsoon trough, approximately 220 NM east-northeast of Yap and the first warning was issued at $1200 Z$ on 24 September. The cyclone initially tracked northwestward along the southern periphery of a mid-level steering ridge anchored east of Japan. Intensification of TY 17W was suppressed by a TUTT cell located to the northeast of the system that hindered upper level diffluence. This same TUTT cyclone appears to have caused the cyclone to loop before $1200 Z$ on 25 September.

TY 17W turned to the north-northeast after 25 September in response to a shortwave trough in the midlatitude westerlies. Subsequently, the outflow from the cyclone improved due to this interaction with the shortwave trough and the dissipation of the TUTT cyclone.

After 25 September, another trough in the mid-latitude westerly flow caused the cyclone to accelerate east-northeastward and begin transition into an extratropical system. The final warning was issued at 0600Z on 30 September.
(2) No casualties or damage were reported.
*Named by WMO Designated RSMC

## Statistics for JTWC on TY17W

| Statistics for JTWC on TY17W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  | POS | ITIO | N ER | RROR |  |  |  |  |  | ND | ERR | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03092318 |  | 14.5 N | 139.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092400 |  | 15.1 N | 138.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092406 |  | 15.6 N | 138.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03092412 | 1 | 15.9N | 137.1E | 25 | 11 | 12 | 133 | 135 | 156 | 172 | 148 | 240 | 0 | 0 | 5 | 25 | 30 | 20 | $10$ | -5 |
| 03092418 | 2 | 16.6 N | 136.2E | 30 | 12 | 122 | 133 | 133 | 166 | 150 |  |  | 0 | 10 | 20 | 35 | 35 | 15 |  |  |
| 03092500 | 3 | 16.6 N | 135.4E | 30 | 23 | 67 | 45 | 51 | 62 | 38 |  |  | 0 | 10 | 25 | 30 | 15 | 10 |  |  |
| 03092506 | 4 | 15.8 N | 135.6E | 30 | 42 | 47 | 52 | 90 | 115 | 140 |  |  | 0 | 10 | 25 | 25 | 5 | 20 |  |  |
| 03092512 | 5 | 16.4 N | 136.1E | 30 | 36 | 21 | 38 | 78 | 120 | 144 |  |  | 0 | 10 | 15 | 5 | 0 | 5 |  |  |
| 03092518 | 6 | 17.2N | 136.2E | 30 | 17 | 33 | 62 | 103 | 109 | 84 |  |  | 0 | 10 | 10 | 10 | 0 | $15$ |  |  |
| 03092600 | 7 | 17.9N | 136.4E | 25 | 111 | 154 | 207 | 258 | 281 | 266 |  |  | 0 | 0 | $15$ | - 15 | -5 | $20$ |  |  |
| 03092606 | 8 | 18.5 N | 136.7E | 25 | 23 | 21 | 81 | 108 | 126 | 120 |  |  | 0 | 0 | $15$ | - 10 | -5 | $25$ |  |  |
| 03092612 | 9 | 19.3 N | 137.4E | 30 | 17 | 43 | 97 | 126 | 110 | 81 |  |  | 0 | $10$ | $15$ | $10$ | $15$ | $20$ |  |  |
| 03092618 | 10 | 20.1 N | 138.1E | 35 | 16 | 43 | 48 | 50 | 57 | 83 |  |  | -5 | $20$ | $15$ | $10$ | $25$ | $10$ |  |  |
| 03092700 | 11 | 21.2N | 138.7E | 50 | 25 | 39 | 75 | 110 | 172 | 122 |  |  | 0 | -5 | 5 | 0 | $10$ | 10 |  |  |
| 03092706 | 12 | 22.3N | 139.3E | 60 | 17 | 42 | 76 | 144 | 219 | 118 |  |  | 0 | 10 | 20 | 5 | -5 | 25 |  |  |
| 03092712 | 13 | 23.3N | 139.7E | 60 | 12 | 42 | 96 | 163 | 227 |  |  |  | 0 | 5 | 0 | - 10 | $10$ |  |  |  |
| 03092718 | 14 | 24.1 N | 140.0E | 60 | 18 | 48 | 112 | 213 | 283 |  |  |  | 0 | 5 | -5 | - 15 | $10$ |  |  |  |
| 03092800 | 15 | 25.0N | 140.3E | 60 | 0 | 34 | 95 | 182 | 139 |  |  |  | 0 | -5 | - 15 | - 25 | $10$ |  |  |  |
| 03092806 | 16 | 25.7N | 140.6E | 60 | 0 | 11 | 89 | 183 | 108 |  |  |  | 0 | $10$ | - 25 | - 20 | 5 |  |  |  |
| 03092812 | 17 | 26.3N | 140.9E | 70 | 26 | 28 | 103 | 119 |  |  |  |  | 0 | -5 | $\overline{-}$ | 0 |  |  |  |  |
| 03092818 | 18 | 27.0N | 141.2E | 80 | 24 | 32 | 71 | 72 |  |  |  |  | 0 | $10$ | - 10 | 10 |  |  |  |  |
| 03092900 | 19 | 27.7N | 141.5E | 85 | 16 | 32 | 39 |  |  |  |  |  | -5 | 15 | 0 |  |  |  |  |  |
| 03092906 | 20 | 28.5N | 141.9E | 90 | 12 | 49 | 92 |  |  |  |  |  | 0 | 5 | 20 |  |  |  |  |  |
| 03092912 | 21 | 29.4N | 142.6E | 85 | 13 | 59 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |


| 03092918 | 22 | 30.7 N | 144.2 E | 75 | 16 | 64 |  |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-17W-1. $290225 Z$ September 2003 GOES-9 visible imagery of TY 17W (Koppu), located 200 nm north-northeast of Iwo Jima island at an intensity of 80 knots.


Figure 1-17W-2. 290400 Z September 2003 MODIS true-color image of TY 17W (Koppu), located 210nm north of Iwo Jima, with an intensity of 90 knots.

## TYPHOON 17W (KOPPU)

## 24-30 SEPTEMBER 2003



Time Intensity for 17W
Intensity (kts)


## Tropical Depression (TD) 18W

First Poor: 0600Z 06 Oct 03

First Fair : 0800Z 06 Oct 03

First TCFA : 1130Z 06 Oct 03

First Warning : 1800Z 06 Oct 03
Last Warning : 0600Z 10 Oct 03, Dissipated
Max Intensity : 25 kts, gusts to 35 kts
Landfall : None

Total Warnings : 15
Remarks:

1) Tropical Depression (TD) 18W developed and dissipated within 96 hours in the South China Sea.

Weak steering flow in the region caused this cyclone to initially move southwest, then loop anticyclonically, before moving poleward toward southern China. TD 18W never exceeded 25 knots in maximum intensity and dissipated over the South China Sea just before making landfall southwest of Hong Kong.
2) No damage was reported in association with Tropical Depression 18W.


| 03100612 |  | 18.2N | 116.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03100618 | 1 | 18.0N | 116.2E | 25 | 28 | 70 | 39 | 48 | 134 | 327 |  | 0 |  | 10 | 15 | 20 | 20 | 30 |  |  |
| 03100700 | 2 | 17.7N | 115.7E | 25 | 5 | 21 | 92 | 153 | 205 | 332 |  | 0 |  | 10 | 15 | 20 | 20 | 30 |  |  |
| 03100706 | 3 | 17.3N | 115.2E | 25 | 5 | 63 | 118 | 163 | 221 | 277 |  | 0 | 5 |  | 10 | 15 | 20 | 25 |  |  |
| 03100712 | 4 | 17.0N | 115.0E | 25 | 12 | 91 | 142 | 186 | 250 | 281 |  | 0 |  | 01 | 15 | 20 | 25 | 25 |  |  |
| 03100718 | 5 | 17.1 N | 115.3E | 25 | 31 | 96 | 154 | 230 | 299 | 325 |  | 0 | 0 |  | 0 | 5 | 10 | 10 |  |  |
| 03100800 | 6 | 17.4 N | 115.4E | 25 | 13 | 34 | 91 | 171 | 198 | 207 |  | 0 | 0 |  | 0 | 5 | 5 | 5 |  |  |
| 03100806 | 7 | 17.7N | 115.4E | 25 | 8 | 44 | 109 | 178 | 198 |  |  | 0 | 0 |  | 5 | 10 | 10 |  |  |  |
| 03100812 | 8 | 18.0 N | 115.4E | 25 | 17 | 49 | 111 | 148 | 152 |  |  | 0 | 0 |  | 5 | 10 | 15 |  |  |  |
| 03100818 | 9 | 18.3N | 115.3E | 25 | 8 | 25 | 51 | 70 | 41 |  |  | 0 | 0 |  | 0 | 5 | 5 |  |  |  |
| 03100900 | 10 | 18.7 N | 115.2E | 25 | 18 | 70 | 100 | 103 | 87 |  |  | 0 | 0 |  | 0 | 0 | -5 |  |  |  |
| 03100906 | 11 | 19.1 N | 115.3E | 25 | 5 | 45 | 62 | 32 |  |  |  | 0 | 0 | 0 | 0 | -5 |  |  |  |  |
| 03100912 | 12 | 19.5 N | 115.3E | 25 | 8 | 13 | 25 | 74 |  |  |  | 0 | 0 | 0 | 0 | -5 |  |  |  |  |
| 03100918 | 13 | 19.7N | 115.2E | 25 | 13 | 40 | 87 |  |  |  |  | 0 | 0 | 0 | 0 |  |  |  |  |  |
| 03101000 | 14 | 19.9N | 115.0E | 25 | 6 | 58 | 129 |  |  |  |  | 0 | 0 | 0 | 0 |  |  |  |  |  |
| 03101006 | 15 | 20.2N | 114.6E | 25 | 0 | 75 |  |  |  |  |  | 0 | -5 | 5 |  |  |  |  |  |  |
| 03101012 |  | 20.8 N | 113.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101018 |  | 21.0 N | 112.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101100 |  | 21.7 N | 112.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 53 | 94 | 130 | 179 | 292 |  | 0 | 3 |  | 5 | 10 | 14 | 21 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | 0 | 2 | 5 | 5 | 8 | 13 | 21 |  |  |
|  |  |  | \# CASES |  | 15 | 15 | 14 | 12 | 10 | 6 |  |  | 51 | 51 | 14 | 12 | 10 | 6 |  |  |



Figure 1-18W-1. $080436 Z$ October 2003 multi-sensor satellite imagery of TY 18W, the partially exposed low level circulation center was located in the south china sea 295 nm east of Hainan island at its peak intensity of 25 knots.

## TROPICAL DEPRESSION 18W

## 06-10 OCTOBER 2003



## Time Intensity for 18 W

## Intensity (kts)



## Tropical Depression (TD) 18W



First Poor : 0600Z 06 Oct 03
First Fair : 0800Z 06 Oct 03

First TCFA : $1130 Z 06$ Oct 03

First Warning : 1800Z 06 Oct 03
Last Warning : 0600Z 10 Oct 03, Dissipated
Max Intensity : 25 kts, gusts to 35 kts
Landfall : None

Total Warnings : 15
Remarks:

1) Tropical Depression (TD) 18W developed and dissipated within 96 hours in the South China Sea. Weak steering flow in the region caused this cyclone to initially move southwest, then loop anticyclonically, before moving poleward toward southern China. TD 18W never exceeded 25 knots in maximum intensity and dissipated over the South China Sea just before making landfall southwest of Hong Kong.
2) No damage was reported in association with Tropical Depression 18W.

| Statistics for JTWC on TD18W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | RACK |  |  | SIT | ION | ER | OR |  |  |  |  |  | ND | ER | R |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 |  | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03100600 |  | 18.4 N | 117.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03100606 |  | 18.4 N | 117.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03100612 |  | 18.2N | 116.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03100618 | 1 | 18.0 N | 116.2 E | 25 | 28 | 70 | 39 | 48 | 134 | 327 |  |  | 0 | 10 | 15 | 20 | 20 | 30 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03100700 | 2 | 17.7 N | 115.7 E | 25 | 5 | 21 | 92 | 153 | 205 | 332 |  |  | 0 | 10 | 15 | 20 | 20 | 30 |  |  |  |
| 03100706 | 3 | 17.3 N | 115.2 E | 25 | 5 | 63 | 118 | 163 | 221 | 277 |  |  | 0 | 5 | 10 | 15 | 20 | 25 |  |  |  |
| 03100712 | 4 | 17.0 N | 115.0 E | 25 | 12 | 91 | 142 | 186 | 250 | 281 |  |  | 0 | 10 | 15 | 20 | 25 | 25 |  |  |  |
| 03100718 | 5 | 17.1 N | 115.3 E | 25 | 31 | 96 | 154 | 230 | 299 | 325 |  |  | 0 | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03100800 | 6 | 17.4 N | 115.4 E | 25 | 13 | 34 | 91 | 171 | 198 | 207 |  |  | 0 | 0 | 0 | 5 | 5 | 5 |  |  |  |
| 03100806 | 7 | 17.7 N | 115.4 E | 25 | 8 | 44 | 109 | 178 | 198 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |  |
| 03100812 | 8 | 18.0 N | 115.4 E | 25 | 17 | 49 | 111 | 148 | 152 |  |  |  | 0 | 0 | 5 | 10 | 15 |  |  |  |  |
| 03100818 | 9 | 18.3 N | 115.3 E | 25 | 8 | 25 | 51 | 70 | 41 |  |  |  | 0 | 0 | 0 | 5 | 5 |  |  |  |  |
| 03100900 | 10 | 18.7 N | 115.2 E | 25 | 18 | 70 | 100 | 103 | 87 |  |  |  | 0 | 0 | 0 | 0 | -5 |  |  |  |  |
| 03100906 | 11 | 19.1 N | 115.3 E | 25 | 5 | 45 | 62 | 32 |  |  |  |  |  | 0 | 0 | 0 | -5 |  |  |  |  |
| 03100912 | 12 | 19.5 N | 115.3 E | 25 | 8 | 13 | 25 | 74 |  |  |  |  |  | 0 | 0 | 0 | -5 |  |  |  |  |
| 03100918 | 13 | 19.7 N | 115.2 E | 25 | 13 | 40 | 87 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |  |
| 03101000 | 14 | 19.9 N | 115.0 E | 25 | 6 | 58 | 129 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |  |
| 03101006 | 15 | 20.2 N | 114.6 E | 25 | 0 | 75 |  |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03101012 |  | 20.8 N | 113.8 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101018 |  | 21.0 N | 112.8 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101100 |  | 21.7 N | 112.0 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 53 | 94 | 130 | 179 | 292 |  |  | 0 | 3 | 5 | 10 | 14 | 21 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | 5 | 8 | 13 | 21 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



Figure 1-18W-1. $080436 Z$ October 2003 multi-sensor satellite imagery of TY 18W, the partially exposed low level circulation center was located in the south china sea 295 nm east of Hainan island at its peak intensity of 25 knots.

## TROPICAL DEPRESSION 18W

06-10 OCTOBER 2003


Time Intensity for 18 W
Intensity (kts)


## Tropical Depression (TD) 19W



First Poor : N/A
First Fair : 0330Z 10 Oct 03
First TCFA : 0200Z 12 Oct 03
First Warning : 0000Z 12 Oct 03
Last Warning : 0000Z 13 Oct 03, Dissipated
Max Intensity : 30 kts, gusts to 40 kts
Landfall : Multiple events, Kyushu and Honshu, Japan
Total Warnings : 5
Remarks:

1) Tropical Depression (TD) 19 W was first noted as a disturbance on 09 October, east of Okinawa, and was monitored as a suspect area for about 48 hours before the first warning was issued. The cyclone moved slowly poleward toward Kyushu while intensifying. TD 19W reached maximum intensity of 30 knots while east of Ryukyu Island around 1800 Z on 10 October. The cyclone maintained maximum intensity of 30 knots while moving over Kyushu on a northeastward heading, then dissipated over the Kii peninsula on 13 October.
2) No reports of damage were received for this cyclone.


Tropical Depression (TD) 19W

| 03101006 |  | 25.9N | 131.0E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03101012 |  | 26.2N | 131.3E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101018 |  | 26.9N | 131.5E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101100 |  | 27.7 N | 131.1E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101106 |  | 28.4 N | 130.5E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101112 |  | 29.1 N | 129.8E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101118 |  | 29.6N | 129.6E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101200 | 1 | 30.3 N | 129.8E 30 | 13 | 109 | 245 |  |  |  |  |  | -5 | 0 | -5 |  |  |  |  |  |  |
| 03101206 | 2 | 31.1 N | 130.1E 30 | 7 | 32 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |
| 03101212 | 3 | 32.1 N | 131.5E 30 | 0 | 5 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |  |
| 03101218 | 4 | 33.0 N | 133.5E 30 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 03101300 | 5 | 34.0 N | 135.8E 30 | 0 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE | 7 | 49 | 245 |  |  |  |  |  | 2 | 2 | 5 |  |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | -2 | -2 | -5 |  |  |  |  |  |  |
|  |  |  | \# CASES | 5 | 3 | 1 |  |  |  |  |  | 5 | 3 | 1 |  |  |  |  |  |  |



Figure 1-19W-1. $110125 Z$ October 2003 Goes-9 visible satellite imagery of TY 19W, the partially exposed low level circulation center was located 175 nm northeast of Okinawa, Japan at its peak intensity of 30 knots.

## TROPICAL DEPRESSION 19W

12-13 OCTOBER 2003


## Time Intensity for 19W

## Intensity (kts)



| - KGWC |  |
| ---: | :--- |
| - PGTW |  |
| - | KWBC |
| CIRA |  |
| - CIMS |  |
| - T-Numbers |  |
| - Best Track |  |

Fix Date (Zulu)

## Tropical Depression (TD) 19W



First Poor : N/A
First Fair : 0330Z 10 Oct 03

First TCFA : 0200Z 12 Oct 03
First Warning : 0000Z 12 Oct 03
Last Warning : 0000Z 13 Oct 03, Dissipated
Max Intensity : 30 kts, gusts to 40 kts
Landfall : Multiple events, Kyushu and Honshu, Japan
Total Warnings : 5
Remarks:

1) Tropical Depression (TD) 19W was first noted as a disturbance on 09 October, east of Okinawa, and was monitored as a suspect area for about 48 hours before the first warning was issued. The cyclone moved slowly poleward toward Kyushu while intensifying. TD 19W reached maximum intensity of 30 knots while east of Ryukyu Island around $1800 Z$ on 10 October. The cyclone maintained maximum intensity of 30 knots while moving over Kyushu on a northeastward heading, then dissipated over the Kii peninsula on 13 October.
2) No reports of damage were received for this cyclone.

| Statistics for JTWC on TD19W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | RACK |  | POS | ITIO | N E | RRO | RS |  |  |  | WIN | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101000 |  | 25.7 N | 130.7E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101006 |  | 25.9 N | 131.0E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101012 |  | 26.2 N | 131.3E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101018 |  | 26.9N | 131.5E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101100 |  | 27.7N | 131.1E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101106 |  | 28.4 N | 130.5E 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101112 |  | 29.1 N | 129.8E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101118 |  | 29.6N | 129.6E 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101200 | 1 | 30.3 N | 129.8E 30 | 13 | 109 | 245 |  |  |  |  |  | -5 | 0 | -5 |  |  |  |  |  |  |
| 03101206 | 2 | 31.1 N | 130.1E 30 | 7 | 32 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |
| 03101212 | 3 | 32.1 N | 131.5E 30 | 0 | 5 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |  |
| 03101218 | 4 | 33.0 N | 133.5E 30 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 03101300 | 5 | 34.0 N | 135.8E 30 | 0 |  |  |  |  |  |  |  | -5 |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE | 7 | 49 | 245 |  |  |  |  |  | 2 | 2 | 5 |  |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | -2 | -2 | -5 |  |  |  |  |  |  |
|  |  |  | \# CASES | 5 | 3 | 1 |  |  |  |  |  | 5 | 3 | 1 |  |  |  |  |  |  |



Figure 1-19W-1. $110125 Z$ October 2003 Goes-9 visible satellite imagery of TY 19W, the partially exposed low level circulation center was located 175 nm northeast of Okinawa, Japan at its peak intensity of 30 knots.

TROPICAL DEPRESSION 19W
12-13 OCTOBER 2003


Time Intensity for 19W
Intensity (kts)


Fix Date (Zulu)

## Typhoon (TY) 20W (Ketsana)*

First Poor : 0600Z 15 Oct 03
First Fair : 0930Z 18 Oct 03
First TCFA : 1300Z 18 Oct 03
First Warning : 1800Z 18 Oct 03
Last Warning : 0000Z 26 Oct 03, Extratropical
Max Intensity : 125kts
Landfall : None
Total Warnings : 30
Remarks:

1) Typhoon (TY) 20W was first detected as a tropical disturbance approximately 700 NM east of Luzon Island around $0600 Z$ on 15 October and was monitored for approximately 84 hours before first warning was issued. Of note was the near simultaneous development of TY 21W in the Northern Marianas Islands during the development of TY 20W. First warning for TY 21W was issued some 18 hours after the initial warning on TY 20W.

Development for TY 20W was noted as being initially slow, with abrupt consolidation less than 10 hours after being determined a fair suspect area with subsequent issuance of the first warning. Movement of this cyclone was initially very slow as it was located south of a weakness in the subtropical ridge.

The cyclone reached typhoon strength around $1200 Z$ on 20 October due to dual channel upper level poleward and equatorward outflow. The continued weak steering flow caused TY 20 W to move slowly poleward as it rapidly intensified over the next 24 hours to maximum intensity of 125 knots by 1200 Z on 21 October. This rapid intensification phase (3.0 Dvorak T-numbers in 36 hours) ended after this time and the cyclone began shifting to a more northeastward track temporarily while slightly weakening.

By $1200 Z$ on 23 October, TY 20W began to move more northeastward, pass the ridge axis increase track speed to 17 knots due to interaction with the mid-latitude westerlies. Vertical wind shear also increased and extratropical transition commenced. A pronounced dry slot was noted in microwave imagery by $1800 Z$ on 24 October, with an extratropical final warning was issued at $0000 Z$ on 26 October.
2) No damage reports were received for this cyclone.

## *Named by WMO Designated RSMC

| Statistics for JTWC on TY20W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITI | TION | ERR | ORS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101812 |  | 14.7 N | 130.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101818 | 1 | 14.9 N | 130.2E | 30 | 13 | 42 | 76 | 114 | 133 | 158 |  |  | 0 | - | -5 | - 10 | 30 | $65$ |  |  |
| 03101900 | 2 | 15.2 N | 130.2E | 35 | 25 | 6 | 26 | 42 | 45 | 80 | 87 | 73 | 0 | 0 | 0 | -5 | $25$ | $50$ | 30 | -10 |
| 03101906 | 3 | 15.3N | 130.3E | 40 | 11 | 29 | 41 | 17 | 21 | 122 | 177 | 2620 | 0 | 5 | 0 | $15$ | 45 | $45$ | 15 | 0 |
| 03101912 | 4 | 15.4 N | 130.4E | 40 | 11 | 21 | 26 | 6 | 49 | 130 | 184 | 3010 | 0 | -5 | $15$ | $35$ | $60$ | $55$ | $25$ | -5 |
| 03101918 | 5 | 15.5N | 130.6E | 45 | 18 | 40 | 36 | 48 | 79 | 110 | 210 | 3050 | 0 | -5 | $20$ | $50$ | $55$ | $40$ | $20$ | 5 |
| 03102000 | 6 | 15.6N | 130.8E | 50 | 17 | 25 | 33 | 71 | 111 | 201 | 281 | 2590 | 0 | $10$ | $30$ | $50$ | $40$ | $20$ | $20$ | -15 |
| 03102006 | 7 | 15.7N | 131.0E | 55 | 11 | 12 | 12 | 26 | 55 | 56 | 111 | 49 | 0 | $20$ | $45$ | $50$ | 40 | - | -5 | -10 |
| 03102012 | 8 | 15.9N | 131.0E | 65 | 5 |  | 29 | 52 | 69 | 41 | 98 | 17 | 0 | 25 | - | $35$ | 30 | 15 | - | -10 |
| 03102018 | 9 | 16.2N | 131.0E | 80 | 0 | 0 | 24 | 60 | 90 | 127 | 267 | 1290 | 0 | 20 | - | - 10 | 5 | 5 | -5 | -10 |
| 03102100 | 10 | 16.4 N | 131.1E | 95 | 6 | 21 | 50 | 82 | 120 | 233 | 307 | 1920 | 0 | $15$ | -5 | 0 | 15 | 5 | -5 | -15 |
| 03102106 | 11 | 16.6N | 131.2E | 115 | 0 | 13 | 36 | 46 | 78 | 165 | 228 | 152 | 5 | 5 | 15 | 25 | 30 | 25 | 0 | 20 |
| 03102112 | 12 | 16.8 N | 131.1E | 125 | 18 | 27 | 33 | 40 | 64 | 159 | 233 | 150 | 0 | 10 | 15 | 25 | 25 | 20 | -5 | 20 |
| 03102118 | 13 | 17.1 N | 131.1E | 125 | 8 | 13 | 19 | 56 | 70 | 121 | 121 |  | 0 | 5 | 20 | 20 | 15 | 5 | 5 |  |
| 03102200 | 14 | 17.4 N | 131.1E | 125 | 5 | 11 | 12 | 29 | 54 | 115 | 140 |  | 0 | 5 | 10 | 5 | -5 | $10$ | 15 |  |
| 03102206 | 15 | 17.8N | 131.1E | 125 | 8 | 24 | 23 | 23 | 19 | 94 | 440 |  | 0 | 15 | 20 | 10 | 5 | -5 | - 15 |  |
| 03102212 | 16 | 18.2N | 131.3E | 125 | 8 |  | 27 | 32 | 30 | 173 | 498 |  | 0 | 5 | 0 | -5 | -5 | - 20 | 30 |  |


| 03102218 | 17 | 18.5N | 131.7E | 115 | 6 | 31 | 30 | 34 | 24 | 222 |  |  | 0 | 0 | 0 | 10 | - 10 | 15 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03102300 | 18 | 18.7N | 132.1 E | 110 | 18 | 31 | 43 | 67 | 86 | 309 |  |  | 0 | 0 | 0 | -5 | 15 | 15 |  |  |
| 03102306 | 19 | 19.0N | 132.4E | 105 | 5 | 19 | 26 | 55 | 98 | 407 |  |  | 0 | 5 | 5 | 0 | -5 | 10 |  |  |
| 03102312 | 20 | 19.5N | 132.8E | 105 | 16 | 8 | 23 | 38 | 105 | 402 |  |  | 0 | 0 | 5 | -5 | -5 | 10 |  |  |
| 03102318 | 21 | 20.0 N | 133.2E | 100 | 5 | 331 | 17 | 26 | 99 |  |  |  | 0 | 5 | -5 | $\overline{-}$ | -5 |  |  |  |
| 03102400 | 22 | 20.4 N | 133.5E | 100 | 8 | 505 | 58 | 92 | 187 |  |  |  | 0 | 5 | -5 | -5 | -5 |  |  |  |
| 03102406 | 23 | 21.0 N | 133.7E | 90 | 0 | 34 | 37 | 72 | 108 |  |  |  | 0 | -5 | -5 | -5 | $20$ |  |  |  |
| 03102412 | 24 | 21.9 N | 134.0E | 85 | 5 | 25 | 34 | 56 | 91 |  |  |  | 0 | 10 | 10 | $15$ | 25 |  |  |  |
| 03102418 | 25 | 23.0 N | 134.8E | 85 | 16 | 8 | 44 | 73 |  |  |  |  | 0 | $15$ | 15 | $25$ |  |  |  |  |
| 03102500 | 26 | 24.5 N | 135.7E | 85 | 5 | 38 | 95 | 155 |  |  |  |  | 0 | $10$ | 15 | $20$ |  |  |  |  |
| 03102506 | 27 | 25.9N | 137.1E | 80 | 5 | 53 | 79 |  |  |  |  |  | 0 | -5 | $15$ |  |  |  |  |  |
| 03102512 | 28 | 27.8N | 139.1E | 75 | 12 | 59 | 106 |  |  |  |  |  | 0 | 10 | $15$ |  |  |  |  |  |
| 03102518 | 29 | 29.8 N | 141.7E | 70 | 35 | 50 |  |  |  |  |  |  | 0 | - 10 |  |  |  |  |  |  |
| 03102600 | 30 | 31.9 N | 144.2E | 70 | 0 | 42 |  |  |  |  |  |  | 0 | - 10 |  |  |  |  |  |  |
| 03102606 |  | 34.1 N | 147.0E | 70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102612 |  | 36.1 N | 150.3E | 65 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 27 | 39 | 54 | 79 | 171 | 226 | 172 | 0 | 8 | 13 | 17 | 22 | 23 | 13 | 11 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -4 | -6 | - 11 | 14 | 17 | $13$ | -11 |
|  |  |  | \# CASES |  | 30 | 30 | 28 | 26 | 24 | 20 | 15 | 11 | 30 | 30 | 28 | 26 | 24 | 20 | 15 | 11 |



Figure 1-20W-1. $210155 Z$ October 2003 MODIS true color image of 20W (Ketsana), northeast of the Philippines, with a peak intensity of 125 knots.


Figure 1-20W-2. $211246 Z$ October 2003 Goes-9 enhanced infrared satellite imagery of TY 20W (Ketsana), located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.


Figure 1-20W-3. $220120 Z$ October 2003 Goes-9 visible satellite imagery of TY 20W (Ketsana), the eye was located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

TYPHOON 20W (KETSANA)
18-26 OCTOBER 2003


## Time Intensity for 20W

Intensity (kts)


# Typhoon (TY) 20W (Ketsana)* 

First Poor : 0600Z 15 Oct 03

First Fair : 0930Z 18 Oct 03
First TCFA : 1300Z 18 Oct 03

First Warning : 1800Z 18 Oct 03
Last Warning : 0000Z 26 Oct 03, Extratropical
Max Intensity : 125kts
Landfall : None

Total Warnings : 30
Remarks:

1) Typhoon (TY) 20W was first detected as a tropical disturbance approximately 700 NM east of Luzon Island around $0600 Z$ on 15 October and was monitored for approximately 84 hours before first warning was issued. Of note was the near simultaneous development of TY 21W in the Northern Marianas Islands during the development of TY 20W. First warning for TY 21W was issued some 18 hours after the initial warning on TY 20W.

Development for TY 20W was noted as being initially slow, with abrupt consolidation less than 10 hours after being determined a fair suspect area with subsequent issuance of the first warning. Movement of this cyclone was initially very slow as it was located south of a weakness in the subtropical ridge.

The cyclone reached typhoon strength around $1200 Z$ on 20 October due to dual channel upper level poleward and equatorward outflow. The continued weak steering flow caused TY 20W to move slowly poleward as it rapidly intensified over the next 24 hours to maximum intensity of 125 knots by 1200 Z on 21 October. This rapid intensification phase (3.0 Dvorak T-numbers in 36 hours) ended after this time and the cyclone began shifting to a more northeastward track temporarily while slightly weakening.

By 1200 Z on 23 October, TY 20W began to move more northeastward, pass the ridge axis increase track speed to 17 knots due to interaction with the mid-latitude westerlies. Vertical wind shear also increased and extratropical transition commenced. A pronounced dry slot was noted in microwave imagery by $1800 Z$ on 24 October, with an extratropical final warning was issued at 0000 Z on 26 October.
2) No damage reports were received for this cyclone.
*Named by WMO Designated RSMC

Statistics for JTWC on TY20W

| DTG | $\begin{array}{\|l\|} \hline \text { WRN } \\ \hline \text { NO. } \\ \hline \end{array}$ | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101812 |  | 14.7N | 130.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101818 | 1 | 14.9 N | 130.2E | 30 | 13 | 42 | 76 | 114 | 133 | 158 |  |  | 0 | -5 | -5 | $10$ | $30$ | $65$ |  |  |
| 03101900 | 2 | 15.2 N | 130.2E | 35 | 25 | 6 | 26 | 42 | 45 | 80 | 87 | 73 | 0 | 0 | 0 | -5 | $25$ | $50$ | $30$ | -10 |
| 03101906 | 3 | 15.3 N | 130.3E | 40 | 11 | 29 | 41 | 17 | 21 | 122 | 177 | 262 | 0 | 5 | 0 | $15$ | $45$ | - 45 | $15$ | 0 |
| 03101912 | 4 | 15.4 N | 130.4E | 40 | 11 | 21 | 26 | 6 | 49 | 130 | 184 | 301 | 0 | -5 | $15$ | $35$ | $60$ | $55$ | $25$ | -5 |
| 03101918 | 5 | 15.5 N | 130.6E | 45 | 18 | 40 | 36 | 48 | 79 | 110 | 210 | 305 | 0 | -5 | $20$ | $50$ | $55$ | $40$ | $20$ | -5 |
| 03102000 | 6 | 15.6N | 130.8E | 50 | 17 | 25 | 33 | 71 | 111 | 201 | 281 | 259 | 0 | $10$ | $30$ | $50$ | $40$ | $20$ | $20$ | -15 |
| 03102006 | 7 | 15.7N | 131.0E | 55 | 11 | 12 | 12 | 26 | 55 | 56 | 111 | 49 | 0 | $20$ | $45$ | $50$ | $40$ | $15$ | -5 | -10 |
| 03102012 | 8 | 15.9 N | 131.0E | 65 | 5 | 12 | 29 | 52 | 69 | 41 | 98 | 17 | 0 | $25$ | $45$ | $35$ | $30$ | $15$ | -5 | -10 |
| 03102018 | 9 | 16.2N | 131.0E | 80 | 0 | 0 | 24 | 60 | 90 | 127 | 267 | 129 | 0 | $20$ | $15$ | $10$ | 5 | 5 | -5 | -10 |
| 03102100 | 10 | 16.4 N | 131.1E | 95 | 6 | 21 | 50 | 82 | 120 | 233 | 307 | 192 | 0 | $15$ | -5 | 0 | 15 | 5 | -5 | -15 |
| 03102106 | 11 | 16.6 N | 131.2E | 115 | 0 | 13 | 36 | 46 | 78 | 165 | 228 | 152 | 5 | 5 | 15 | 25 | 30 | 25 | 0 | -20 |
| 03102112 | 12 | 16.8 N | 131.1E | 125 | 18 | 27 | 33 | 40 | 64 | 159 | 233 | 150 | 0 | 10 | 15 | 25 | 25 | 20 | -5 | -20 |
| 03102118 | 13 | 17.1 N | 131.1E | 125 | 8 | 13 | 19 | 56 | 70 | 121 | 121 |  | 0 | 5 | 20 | 20 | 15 | 5 | -5 |  |
| 03102200 | 14 | 17.4 N | 131.1E | 125 | 5 | 11 | 12 | 29 | 54 | 115 | 140 |  | 0 | 5 | 10 | 5 | -5 | $10$ | $15$ |  |
| 03102206 | 15 | 17.8N | 131.1E | 125 | 8 | 24 | 23 | 23 | 19 | 94 | 440 |  | 0 | 15 | 20 | 10 | 5 | -5 | $15$ |  |
| 03102212 | 16 | 18.2N | 131.3E | 125 | 8 | 25 | 27 | 32 | 30 | 173 | 498 |  | 0 | 5 | 0 | -5 | -5 | $20$ | $30$ |  |
| 03102218 | 17 | 18.5N | 131.7E | 115 | 6 | 31 | 30 | 34 | 24 | 222 |  |  | 0 | 0 | 0 | $10$ | $10$ | - |  |  |
| 03102300 | 18 | 18.7N | 132.1E | 110 | 18 | 31 | 43 | 67 | 86 | 309 |  |  | 0 | 0 | 0 | -5 | $15$ | - |  |  |
| 03102306 | 19 | 19.0N | 132.4E | 105 | 5 | 19 | 26 | 55 | 98 | 407 |  |  | 0 | 5 | 5 | 0 | -5 | - |  |  |


| 03102312 | 20 | 19.5 N | 132.8 E | 105 | 16 | 8 | 23 | 38 | 105 | 402 |  |  | 0 | 0 | 5 | -5 | -5 | - | 10 |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03102318 | 21 | 20.0 N | 133.2 E | 100 | 5 | 33 | 17 | 26 | 99 |  |  |  | 0 | 5 | -5 | - | -5 |  |  |  |  |
| 03102400 | 22 | 20.4 N | 133.5 E | 100 | 8 | 50 | 58 | 92 | 187 |  |  |  | 0 | 5 | -5 | -5 | -5 |  |  |  |  |
| 03102406 | 23 | 21.0 N | 133.7 E | 90 | 0 | 34 | 37 | 72 | 108 |  |  |  | 0 | -5 | -5 | -5 | - |  |  |  |  |
| 03102412 | 24 | 21.9 N | 134.0 E | 85 | 5 | 25 | 34 | 56 | 91 |  |  |  | 0 | - | - | - | - | -10 |  |  |  |
| 03102418 | 25 | 23.0 N | 134.8 E | 85 | 16 | 8 | 44 | 73 |  |  |  |  | 0 | - | - | - | - | 15 |  |  |  |



Figure 1-20W-1. $210155 Z$ October 2003 MODIS true color image of 20W (Ketsana), northeast of the Philippines, with a peak intensity of 125 knots.


Figure 1-20W-2. 211246Z October 2003 Goes-9 enhanced infrared satellite imagery of TY 20W (Ketsana), located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.


Figure 1-20W-3. 220120Z October 2003 Goes-9 visible satellite imagery of TY 20W (Ketsana), the eye was located 500 nm east of Luzon, Philippines at its peak intensity of 125 knots.

## TYPHOON 20W (KETSANA)

18-26 OCTOBER 2003


Time Intensity for 20W
Intensity (kts)


## Typhoon (TY) 21W (Parma)*

First Poor : 0300Z 18 Oct 03

First Fair : 0730Z 18 Oct 03
First TCFA : $1100 Z 19$ Oct 03
First Warning : 1200Z 20 Oct 03
Last Warning : 0600Z 31 Oct 03
Max Intensity : 130 kts, gusts to 160 kts
Landfall : N/A
Total Warnings : 44
Remarks:

1) Super Typhoon (STY) 21 W developed in the monsoon trough around 18 October, approximately 220 nautical miles north-northeast of Guam. Subsequently, the circulation became more organized and tracked slowly northnorthwestward along the south-western periphery of the subtropical ridge. As the cyclone approached the ridge axis, it rapidly intensified with radial outflow evident in metsat data.

At $0000 Z$ on 23 October, a well defined poleward outflow channel developed due to a passing shortwave trough causing a second rapid intensification phase as the cyclone tracked quickly along the northwestern periphery of the building steering ridge. Intensification slowed 18 hours later as the poleward outflow channel diminshed briefly, but after a short weakening trend, the cyclone re-intensified in a weak vertical wind shear environment and attained a maximum intensity of 130 knots as it tracked eastward along the northern periphery of the subtropical ridge.

STY 21W began tracking equatorward along the eastern periphery of the steering anticyclone and weakened to 80 knots in an environment of marginal vertical wind shear and confluence aloft. As STY 21 W rounded the southeastern quadrant of the steering anticyclone moving westward, it continued to weaken, reaching a minimum intensity of 65 knots approximately 185 nautical miles north of Wake Island.

As STY 21 W tracked rapidly along the equatorward side of the steering anti-cyclone, it re-intensified after 18 hours in an environment of weak vertical wind shear. A mid-latitude trough exiting Asia allowed the cyclone to turn poleward. As the cyclone again crested the western periphery of the subtropical ridge, it reached a second peak in intensity of 115 knots around $1200 Z$ on 29 October. Following this last intensification period, the cyclone began weakening rapidly as it entered an environment of moderate vertical wind shear.

By 0000Z on 30 October, STY 21W began the initial stages of extratropical transition as it interacted with the baroclinic zone and the mid-latitude westerlies while weakening and tracking rapidly northeastward. Within 24 hours, the rapidly weakening cyclone had decoupled from the upper level convection and completed transition into an extratropical low approximately 820 nautical miles north of Wake Island.
2) No reports of damage were received for this cyclone.

## *Named by WMO Designated RSMC

Statistics for JTWC on TY21W

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101806 |  | 16.8 N | 146.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101812 |  | 17.2N | 146.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101818 |  | 17.6 N | 146.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101900 |  | 18.0N | 145.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101906 |  | 18.5 N | 145.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101912 |  | 19.0N | 144.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101918 |  | 19.4 N | 143.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102000 |  | 19.7N | 143.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102006 |  | 20.1 N | 143.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102012 | 1 | 20.5 N | 142.8E | 25 | 8 | 68 | 106 | 123 | 134 | 56 |  |  | 0 | -5 | - | $10$ | $\overline{20}$ | $55$ |  |  |
| 03102018 | 2 | 21.0 N | 143.2E | 30 | 51 | 140 | 169 | 151 | 147 | 70 |  |  | 0 | 15 | 15 | 5 | 10 | 55 |  |  |
| 03102100 | 3 | 21.3 N | 143.8E | 35 | 62 | 124 | 133 | 113 | 97 | 65 | 183 |  | 0 | 0 | 5 | 0 | 20 | 70 | $90$ |  |
| 03102106 | 4 | 21.7 N | 144.5E | 35 | 12 | 41 | 58 | 71 | 51 | 34 | 128 |  | 0 | -5 | $10$ | $10$ | $30$ | $80$ | 85 |  |
| 03102112 | 5 | 22.0 N | 145.2E | 45 | 16 | 31 | 32 | 8 | 34 | 138 | 156 |  | 0 | 5 | -5 | -5 | - | - 80 | $80$ |  |
| 03102118 | 6 | 22.3 N | 145.8E | 45 | 12 | 33 | 28 | 37 | 73 | 279 | 350 |  | 0 | 0 | 5 | $25$ | 50 | $85$ | $75$ |  |
| 03102200 | 7 | 22.6 N | 146.4E | 50 | 5 | 13 | 42 | 91 | 141 | 259 |  |  | 0 | -5 | - | $55$ | $\overline{70}$ | $90$ |  |  |
| 03102206 | 8 | 23.2N | 146.8E | 60 | 18 | 38 | 90 | 133 | 190 | 303 | 479 |  | 0 | 5 | - 10 | $20$ | - | $65$ | $55$ |  |
| 03102212 | 9 | 23.7 N | 147.4E | 65 | 13 | 52 | 72 | 119 | 155 | 248 |  |  | 0 | 10 | - | - | - 75 | $80$ |  |  |
| 03102218 | 10 | 24.3 N | 148.1E | 65 | 13 | 42 | 77 | 126 | 195 | 321 |  |  | 0 | $15$ | $35$ | $65$ | $75$ | $65$ |  |  |
| 03102300 | 11 | 25.2N | 149.0E | 75 | 36 | 62 | 88 | 141 | 180 | 360 |  |  | 0 | $20$ | - 35 | $60$ | - 70 | - |  |  |
| 03102306 | 12 | 26.2N | 149.8E | 90 | 0 | 24 | 80 | 175 | 232 | 451 |  |  | 0 | -5 | - 30 | - | 50 | $45$ |  |  |


| 03102312 | 13 | 27.1N | 150.9E | 110 | 0 |  | 32 | 81 | 111 | 222 | 773 |  |  | 0 | -5 | 45 | - 6 | $\overline{7}$ | $\overline{-}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03102318 | 14 | 28.2N | 152.3E | 105 | 0 |  | 33 | 109 | 232 | 414 |  |  |  | 0 | $25$ | - 45 | $60$ | $60$ |  |  |  |
| 03102400 | 15 | 29.2N | 154.2E | 115 | 13 |  | 45 | 131 | 314 | 545 |  |  |  | 0 | $25$ | - 40 | $50$ | $50$ |  |  |  |
| 03102406 | 16 | 30.1 N | 156.3E | 125 | 0 |  | 69 | 217 | 429 | 570 |  |  |  | 0 | $15$ | $30$ | $35$ | $40$ |  |  |  |
| 03102412 | 17 | 30.8 N | 158.7E | 130 | 0 |  | 102 | 271 | 392 | 506 |  |  |  | $-5$ | $15$ | $25$ | $30$ | $35$ |  |  |  |
| 03102418 | 18 | 30.8 N | 161.6E | 130 | 15 |  | 147 | 278 | 452 | 710 | 1206 |  |  | 0 | $10$ | $15$ | $20$ | $15$ | $40$ |  |  |
| 03102500 | 19 | 30.1 N | 163.6E | 125 | 0 |  | 66 | 129 | 271 | 549 | 1093 |  |  | 0 | $10$ | $10$ | $15$ | $15$ | $40$ |  |  |
| 03102506 | 20 | 28.8N | 165.5E | 120 | 0 |  | 48 | 87 | 261 | 463 | 897 |  |  | 0 | 5 | 0 | 5 | $10$ | $40$ |  |  |
| 03102512 | 21 | 27.6N | 167.1E | 115 | 17 |  | 42 | 170 | 381 | 549 | 796 |  |  | 0 | 5 | 0 | 0 | $\overline{25}$ | - 45 |  |  |
| 03102518 | 22 | $26.4 N$ | 168.5E | 105 | 0 |  | 73 | 257 | 426 | 585 | 807 |  |  | 0 | 0 | 10 | -5 | $\overline{3}$ | $65$ |  |  |
| 03102600 | 23 | 25.1 N | 169.3E | 95 | 0 |  | 85 | 299 | 473 | 624 | 804 |  |  | 0 | 0 | 0 | $25$ | $\overline{35}$ | $70$ |  |  |
| 03102606 | 24 | 24.0N | 169.4E | 90 | 16 |  | 78 | 119 | 135 | 147 | 240 | 286 | 765 | 0 | 20 | 10 | -5 | $\overline{-}$ | $50$ | $40$ | 5 |
| 03102612 | 25 | 23.0N | 168.8E | 80 | 24 |  | 46 | 78 | 105 | 119 | 164 | 230 | 694 | 0 | 10 | $10$ | $15$ | $\overline{25}$ | $65$ | $40$ | 5 |
| 03102618 | 26 | 22.4 N | 167.3E | 65 | 11 |  | 51 | 51 | 84 | 121 | 141 | 255 |  | 0 | -5 | $20$ | - | $\overline{35}$ | $50$ | $15$ |  |
| 03102700 | 27 | 22.2 N | 165.8E | 65 | 0 |  | 13 | 73 | 106 | 156 | 94 | 262 |  | 0 | $15$ | $15$ | $15$ | - | $45$ | $10$ |  |
| 03102706 | 28 | 22.2 N | 164.5E | 65 | 5 |  | 39 | 57 | 107 | 72 | 176 | 635 |  | $0-$ | $10$ | $10$ | $25$ | $30$ | $20$ | 20 |  |
| 03102712 | 29 | 22.0 N | 162.6E | 75 | 17 |  | 51 | 68 | 130 | 87 | 151 | 570 |  | 0 | 0 | 0 | - | - | 0 | 35 |  |
| 03102718 | 30 | 22.0 N | 160.4E | 75 | 6 |  | 29 | 66 | 67 | 50 | 175 |  |  | 0 | 5 | $10$ | $20$ | $\overline{25}$ | 5 |  |  |
| 03102800 | 31 | 21.9N | 158.2E | 75 | 8 |  | 38 | 37 | 53 | 30 | 165 |  |  | 0 | -5 | $15$ | - | $\overline{30}$ | 10 |  |  |
| 03102806 | 32 | 21.9N | 156.2E | 75 | 8 |  | 30 | 53 | 52 | 16 | 233 |  |  | 0 | $20$ | $30$ | $30$ | $\overline{20}$ | 20 |  |  |
| 03102812 | 33 | 22.0 N | 154.2E | 80 | 0 |  | 23 | 22 | 26 | 46 | 339 |  |  | 0 | $15$ | $30$ | $30$ | $\overline{-}$ | 25 |  |  |
| 03102818 | 34 | 22.6 N | 152.1E | 95 | 0 |  | 13 | 17 | 57 | 132 |  |  |  | 10 | $20$ | $20$ | - 10 | 0 |  |  |  |
| 03102900 | 35 | 23.1 N | 150.6E | 95 | 12 |  | 16 | 42 | 116 | 171 |  |  |  | 0 | - 15 | - 15 | 0 | 10 |  |  |  |
| 03102906 | 36 | 23.8 N | 149.4E | 110 | 8 |  | 25 | 76 | 157 | 258 |  |  |  | $15$ | $15$ | - 10 | 0 | 20 |  |  |  |
| 03102912 | 37 | 24.8N | 148.9E | 115 | 5 |  | 49 | 121 | 200 | 336 |  |  |  | -5 0 | 0 | 10 | 15 | 25 |  |  |  |


| 03102918 | 38 | 25.7 N | 149.2 E | 115 | 0 | 38 | 122 | 201 |  |  |  |  |  | 0 | 0 | 10 | 20 |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03103012 | 39 | 28.9 N | 153.9 E | 90 | 0 | 57 | 209 |  |  |  |  |  |  | 0 | 5 | 15 |  |  |  |  |  |
| 03103018 | 40 | 29.7 N | 156.7 E | 80 | 0 | 43 |  |  |  |  |  |  |  | 5 | 15 |  |  |  |  |  |  |
| 03103100 | 41 | 30.5 N | 159.5 E | 70 | 0 | 59 |  |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03103106 | 42 | 31.4 N | 163.1 E | 55 | 0 |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03103112 |  | 32.3 N | 167.0 E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |




Figure 1-21W-1. 230310 Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an increasing intensity of 90 knots.


Figure 1-21W-2. $240449 Z$ October 2003 Goes-9 visible satellite imagery of TY 21 W (Parma), the eye was located 840 nm northeast of Iwo Jima at its peak intensity of 125 knots.



Figure 1-21W-3. $300315 Z$ October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an intensity of 100 knots.

TYPHOON 21W (PARMA) 20-31 OCTOBER 2003


## Time Intensity for 21W

## Intensity (kts)



| - KGWC |
| :---: |
| - PGTW |
| KWBC |
| CIRA |
| CIVS |
| ODT |
| - T-Numbers |
| - Best Track |

## Typhoon (TY) 21W (Parma)*

First Poor : 0300Z 18 Oct 03
First Fair : 0730Z 18 Oct 03
First TCFA : $1100 Z 19$ Oct 03
First Warning : 1200Z 20 Oct 03
Last Warning : 0600Z 31 Oct 03
Max Intensity : 130 kts, gusts to 160 kts
Landfall : N/A
Total Warnings : 44
Remarks:

1) Super Typhoon (STY) 21W developed in the monsoon trough around 18 October, approximately 220 nautical miles north-northeast of Guam. Subsequently, the circulation became more organized and tracked slowly northnorthwestward along the south-western periphery of the subtropical ridge. As the cyclone approached the ridge axis, it rapidly intensified with radial outflow evident in metsat data.

At $0000 Z$ on 23 October, a well defined poleward outflow channel developed due to a passing shortwave trough causing a second rapid intensification phase as the cyclone tracked quickly along the northwestern periphery of the building steering ridge. Intensification slowed 18 hours later as the poleward outflow channel diminshed briefly, but after a short weakening trend, the cyclone re-intensified in a weak vertical wind shear environment and attained a maximum intensity of 130 knots as it tracked eastward along the northern periphery of the subtropical ridge.

STY 21W began tracking equatorward along the eastern periphery of the steering anticyclone and weakened to 80 knots in an environment of marginal vertical wind shear and confluence aloft. As STY 21 W rounded the southeastern quadrant of the steering anticyclone moving westward, it continued to weaken, reaching a minimum intensity of 65 knots approximately 185 nautical miles north of Wake Island.

As STY 21W tracked rapidly along the equatorward side of the steering anti-cyclone, it re-intensified after 18 hours in an environment of weak vertical wind shear. A mid-latitude trough exiting Asia allowed the cyclone to turn poleward. As the cyclone again crested the western periphery of the subtropical ridge, it reached a second peak in intensity of 115 knots around $1200 Z$ on 29 October. Following this last intensification period, the cyclone began weakening rapidly as it entered an environment of moderate vertical wind shear.

By 0000Z on 30 October, STY 21W began the initial stages of extratropical transition as it interacted with the baroclinic zone and the mid-latitude westerlies while weakening and tracking rapidly northeastward. Within 24 hours, the rapidly weakening cyclone had decoupled from the upper level convection and completed transition into an extratropical low approximately 820 nautical miles north of Wake Island.
2) No reports of damage were received for this cyclone.
*Named by WMO Designated RSMC

| Statistics for JTWC on TY21W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITI | ON | RRO | RS |  |  |  |  | ND | ER | RO |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03101806 |  | 16.8 N | 146.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101812 |  | 17.2N | 146.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101818 |  | 17.6 N | 146.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101900 |  | 18.0 N | 145.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101906 |  | 18.5 N | 145.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101912 |  | 19.0N | 144.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03101918 |  | 19.4 N | 143.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102000 |  | 19.7N | 143.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102006 |  | 20.1 N | 143.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102012 | 1 | 20.5 N | 142.8E | 25 | 8 | 68 | 106 | 123 | 134 | 56 |  |  | 0 | -5 | 10 | 10 | 20 | 55 |  |  |
| 03102018 | 2 | 21.0 N | 143.2E | 30 | 51 | 140 | 169 | 151 | 147 | 70 |  |  | 0 | 15 | 15 | 5 | - | $55$ |  |  |
| 03102100 | 3 | 21.3 N | 143.8E | 35 | 62 | 124 | 133 | 113 | 97 | 65 | 183 |  | 0 | 0 | 5 | 0 | - 20 | 70 | $90$ |  |
| 03102106 | 4 | 21.7N | 144.5E | 35 | 12 | 41 | 58 | 71 | 51 | 34 | 128 |  | 0 | -5 | 10 | 10 | 30 | $80$ | 85 |  |
| 03102112 | 5 | 22.0 N | 145.2E | 45 | 16 | 31 | 32 | 8 | 34 | 138 | 156 |  | 0 | 5 | -5 | -5 | - 40 | - 80 | 80 |  |
| 03102118 | 6 | 22.3 N | 145.8E | 45 | 12 | 33 | 28 | 37 | 73 | 279 | 350 |  | 0 | 0 | 5 | 25 | - | 85 | 75 |  |
| 03102200 | 7 | 22.6 N | 146.4E | 50 | 5 | 13 | 42 | 91 | 141 | 259 |  |  | 0 | -5 | - 10 | - | $\overline{70}$ | -90 |  |  |
| 03102206 | 8 | 23.2 N | 146.8E | 60 | 18 | 38 | 90 | 133 | 190 | 303 | 479 |  | 0 | 5 | 10 | 20 | - | 65 | 55 |  |
| 03102212 | 9 | 23.7N | 147.4E | 65 | 13 | 52 | 72 | 119 | 155 | 248 |  |  | 0 | 10 | $\overline{-}$ | 50 | - 75 | 80 |  |  |
| 03102218 | 10 | 24.3 N | 148.1E | 65 | 13 | 42 | 77 | 126 | 195 | 321 |  |  | 0 | $15$ | - 35 | - 65 | $\overline{75}$ | 65 |  |  |
| 03102300 | 11 | 25.2N | 149.0E | 75 | 36 | 62 | 88 | 141 | 180 | 360 |  |  | 0 | $20$ | - 35 | $\overline{60}$ | - 70 | - 5 |  |  |
| 03102306 | 12 | 26.2N | 149.8E | 90 | 0 | 24 | 80 | 175 | 232 | 451 |  |  | 0 | -5 | 30 | 45 | 50 | 45 |  |  |
| 03102312 | 13 | 27.1 N | 150.9E | 110 | 0 | 32 | 81 | 111 | 222 | 773 |  |  | 0 | -5 | 45 | - 65 | $\overline{70}$ | 35 |  |  |
| 03102318 | 14 | 28.2N | 152.3E | 105 | 0 | 33 | 109 | 232 | 414 |  |  |  | 0 | 25 | 45 | 60 | - 60 |  |  |  |
| 03102400 | 15 | 29.2N | 154.2E | 115 | 13 | 45 | 131 | 314 | 545 |  |  |  | 0 | $25$ | - 40 | - | - |  |  |  |
| 03102406 | 16 | 30.1 N | 156.3E | 125 | 0 | 69 | 217 | 429 | 570 |  |  |  | 0 | - 15 | $\overline{-}$ | - | - 40 |  |  |  |


| 03102412 | 17 | 30.8 N | 158.7E | 130 | 0 | 102 | 271 | 392 | 506 |  |  |  | -5 | 15 | - 25 | - 30 | 35 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03102418 | 18 | 30.8 N | 161.6E | 130 | 15 | 147 | 278 | 452 | 710 | 1206 |  |  | 0 | $10$ | $15$ | $5 \overline{20}^{-}$ | $0 \text { - }$ | $540$ |  |  |
| 03102500 | 19 | 30.1 N | 163.6E | 125 | 0 | 66 | 129 | 271 | 549 | 1093 |  |  | 0 | $10$ | $\overline{-}$ | $0 \overline{15}$ | $5{ }_{5}^{-}$ | $540$ |  |  |
| 03102506 | 20 | 28.8N | 165.5E | 120 | 0 | 48 | 87 | 261 | 463 | 897 |  |  | 0 | 5 | 0 | 5 | 10 | $0-40$ |  |  |
| 03102512 | 21 | 27.6N | 167.1E | 115 | 17 | 42 | 170 | 381 | 549 | 796 |  |  | 0 | 5 | 0 | 0 | - | $545$ |  |  |
| 03102518 | 22 | 26.4 N | 168.5E | 105 | 0 | 73 | 257 | 426 | 585 | 807 |  |  | 0 | 0 | 10 | -5 | $30$ | $65$ |  |  |
| 03102600 | 23 | 25.1 N | 169.3E | 95 | 0 | 85 | 299 | 473 | 624 | 804 |  |  | 0 | 0 | 0 | $25$ | $5 \overline{35}$ | $5 \overline{70}$ |  |  |
| 03102606 | 24 | 24.0 N | 169.4E | 90 | 16 | 78 | 119 | 135 | 147 | 240 | 286 | 765 | 0 | 20 | 10 | -5 | $10$ | $0 \overline{50}$ | $40$ | 5 |
| 03102612 | 25 | 23.0 N | 168.8E | 80 | 24 | 46 | 78 | 105 | 119 | 164 | 230 | 694 | 0 | 10 | 10 | $015$ | $525$ | $565$ | 40 | 5 |
| 03102618 | 26 | 22.4 N | 167.3E | 65 | 11 | 51 | 51 | 84 | 121 | 141 | 255 |  | 0 | -5 | $20$ | $020$ | $035$ | $5 \overline{-} 50$ | $15$ |  |
| 03102700 | 27 | 22.2 N | 165.8E | 65 | 0 | 13 | 73 | 106 | 156 | 94 | 262 |  | 0 | $15$ | $\overline{5}$ | $5 \overline{-}_{15}$ | $5 \overline{25}$ | $545$ | $5 \overline{10}$ |  |
| 03102706 | 28 | 22.2 N | 164.5E | 65 | 5 | 39 | 57 | 107 | 72 | 176 | 635 |  | 0 | 10 | $\overline{10}$ | $0-\overline{25}$ | $530$ | $20$ | 20 |  |
| 03102712 | 29 | 22.0 N | 162.6E | 75 | 17 | 51 | 68 | 130 | 87 | 151 | 570 |  | 0 | 0 | 0 | 10 | - 15 | ${ }^{0}$ | 35 |  |
| 03102718 | 30 | 22.0 N | 160.4E | 75 | 6 | 29 | 66 | 67 | 50 | 175 |  |  | 0 | 5 | $\overline{-}$ | $0 \overline{20}$ | - 25 | $5^{5}$ |  |  |
| 03102800 | 31 | 21.9 N | 158.2E | 75 | 8 | 38 | 37 | 53 | 30 | 165 |  |  | 0 | -5 | 15 | $5 \overline{30}$ | - 30 | 10 |  |  |
| 03102806 | 32 | 21.9 N | 156.2E | 75 | 8 | 30 | 53 | 52 | 16 | 233 |  |  | 0 | 20 | $030$ | $0-\overline{30}$ | $0-$ | 20 |  |  |
| 03102812 | 33 | 22.0 N | 154.2E | 80 | 0 | 23 | 22 | 26 | 46 | 339 |  |  | 0 | $15$ | $5 \overline{30}$ | $0 \overline{30}$ | - 10 | 25 |  |  |
| 03102818 | 34 | 22.6 N | 152.1E | 95 | 0 | 13 | 17 | 57 | 132 |  |  |  |  | 20 | $20$ | - 10 | 0 |  |  |  |
| 03102900 | 35 | 23.1 N | 150.6E | 95 | 12 | 16 | 42 | 116 | 171 |  |  |  | 0 | - | - 15 |  | 10 |  |  |  |
| 03102906 | 36 | 23.8 N | 149.4E | 110 | 8 | 25 | 76 | 157 | 258 |  |  |  | $15$ | $15$ |  | 0 | 20 |  |  |  |
| 03102912 | 37 | 24.8N | 148.9E | 115 | 5 | 49 | 121 | 200 | 336 |  |  |  | -5 | 0 | 10 | 15 | 25 |  |  |  |
| 03102918 | 38 | 25.7N | 149.2E | 115 | 0 | 38 | 122 | 201 |  |  |  |  | 0 | 0 | 10 | 120 |  |  |  |  |
| 03103012 | 39 | 28.9 N | 153.9E | 90 | 0 | 57 | 209 |  |  |  |  |  | 0 | 5 | 15 |  |  |  |  |  |
| 03103018 | 40 | 29.7N | 156.7E | 80 | 0 | 43 |  |  |  |  |  |  | 5 | 15 |  |  |  |  |  |  |
| 03103100 | 41 | 30.5 N | 159.5E | 70 | 0 | 59 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03103106 | 42 | 31.4 N | 163.1E | 55 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03103112 |  | 32.3 N | 167.0E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 51 | 108 | 174 | 246 | 374 | 321 | 729 | 1 | 10 | 17 | 724 | 33 | 50 | 50 | 5 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -4 |  |  |  | - 46 | - 40 | 5 |
|  |  |  | \# CASES |  | 42 | 41 | 39 | 38 | 37 | 29 | 11 | 2 |  | 41 | 39 | 38 | 37 | 29 | 11 | 2 |



Figure 1-21W-1. 230310 Z October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an increasing intensity of 90 knots.


Figure 1-21W-2. $240449 Z$ October 2003 Goes-9 visible satellite imagery of TY 21W (Parma), the eye was located 840 nm northeast of lwo Jima at its peak intensity of 125 knots.


Figure 1-21W-3. $300315 Z$ October 2003 MODIS true-color image of TY 21W (Parma), north of the Mariana Islands, with an intensity of 100 knots.

TYPHOON 21W (PARMA) 20-31 OCTOBER 2003


Time Intensity for 21W


## Tropical Depression (TD) 22W

First Poor : 1130Z 21 Oct 03
First Fair : 2300Z 21 Oct 03
First TCFA : 0600Z 22 Oct 03
First Warning : 0600Z 22 Oct 03
Last Warning : 1800Z 23 Oct 03, Dissipated
Max Intensity : 30 kts, gusts to 40 kts
Landfall : Near Iloilo, Philippines
Total Warnings : 07
Remarks:

1) Tropical Depression (TD) 22 W was first identified as a well defined low level circulation center in the South China Sea and was rapidly upgraded to warning status 18 hours later. The cyclone tracked eastward into an environment of increasing vertical wind shear, failed to develop further and was finaled over land in the Philippines 36 hours after the first warning was issued.
2) No damage reports were received associated with this system.


| 03102118 |  | 11.9 N | 113.3 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03102200 |  | 11.9 N | 114.1 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |$|$



Figure 1-22W-1. 220031 Z October 2003 color composite SSM/I satellite imagery of TY 22 W , the partially exposed low level circulation center was located 330 nm southwest of Luzon, Philippines at its peak intensity of 25 knots.

## TROPICAL DEPRESSION 22W

22-23 OCTOBER 2003


## Time Intensity for 22W

Intensity (kts)

|  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |

## Tropical Depression (TD) 22W



First Poor : 1130Z 21 Oct 03
First Fair : 2300Z 21 Oct 03

First TCFA : 0600Z 22 Oct 03
First Warning : 0600Z 22 Oct 03
Last Warning : 1800Z 23 Oct 03, Dissipated

Max Intensity : 30 kts, gusts to 40 kts
Landfall : Near Iloilo, Philippines
Total Warnings : 07
Remarks:

1) Tropical Depression (TD) 22 W was first identified as a well defined low level circulation center in the South China Sea and was rapidly upgraded to warning status 18 hours later. The cyclone tracked eastward into an environment of increasing vertical wind shear, failed to develop further and was finaled over land in the Philippines 36 hours after the first warning was issued.
2) No damage reports were received associated with this system.

Statistics for JTWC on TD22W

| Statistics for JTWC on TD22W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | TRACK |  |  | SITI | ON | RR |  |  |  |  |  | ND | ER | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03102100 |  | 11.4 N | 112.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102106 |  | 11.7N | 112.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102112 |  | 12.0N | 112.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102118 |  | 11.9N | 113.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03102200 |  | 11.9 N | 114.1 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-22W-1. 220031 Z October 2003 color composite SSM/I satellite imagery of TY 22W, the partially exposed low level circulation center was located 330 nm southwest of Luzon, Philippines at its peak intensity of 25 knots.

## TROPICAL DEPRESSION 22W

## 22-23 OCTOBER 2003



## Time Intensity for 22W



## Tropical Storm (TS) 23W

First Poor : N/A
First Fair : 1700Z 21 Oct 03
First TCFA : 2330Z 21 Oct 03

First Warning : 0600Z 23 Oct 03
Last Warning : 0600Z 08 Nov 03
Max Intensity : 35 kts, gusts to 45 kts
Landfall : N/A
Total Warnings : 14
Remarks:

1) Tropical Storm (TS) $23 W$ developed in the monsoon trough in the Gulf of Thailand, then crossed the Isthmus of Kra to move through the Bay of Bengal with tropical storm intensity, following an unusual course of development and tracking. The cyclone subsequently made landfall northwest of Visakhaptnam, India.

Weather observations from oil platforms in the Gulf of Thailand were instrumental in determining the presence and intensity fo the cyclone during the initial period of development.
2) No damage reports were received for this cyclone.

| Statistics for JTWC on TS23W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SI | TIO |  | RR | ORS |  |  |  |  | ND | ER | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 2 |  | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03102112 |  | 9.1 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102118 |  | 9.4 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102200 |  | 9.5 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102206 |  | 9.6 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102212 |  | 9.7 N | 101.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102218 |  | 9.9 N | 101.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |




Figure 1-23W-1. $261452 Z$ October 2003 multi-sensor satellite imagery of TY 23W, the partially exposed low level circulation center was located 20 nm west of Maldive island at an intensity of 25 knots.

## 23-28 OCTOBER 2003



## Time Intensity for 23W

## Intensity (kts)



## Tropical Storm (TS) 23W


#### Abstract

First Poor : N/A First Fair : 1700Z 21 Oct 03 First TCFA : 2330Z 21 Oct 03 First Warning : 0600Z 23 Oct 03 Last Warning : 0600Z 08 Nov 03 Max Intensity : 35 kts, gusts to 45 kts Landfall : N/A Total Warnings : 14 Remarks: 1) Tropical Storm (TS) 23W developed in the monsoon trough in the Gulf of Thailand, then crossed the Isthmus of Kra to move through the Bay of Bengal with tropical storm intensity, following an unusual course of development and tracking. The cyclone subsequently made landfall northwest of Visakhaptnam, India.

Weather observations from oil platforms in the Gulf of Thailand were instrumental in determining the presence and intensity fo the cyclone during the initial period of development. 2) No damage reports were received for this cyclone.


| Statistics for JTWC on TS23W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SI | ITIO | ON | ERR | ORS |  |  |  |  | ND | ER | ROR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 2 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03102112 |  | 9.1 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102118 |  | 9.4 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102200 |  | 9.5 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102206 |  | 9.6 N | 101.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102212 |  | 9.7 N | 101.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102218 |  | 9.9 N | 101.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102300 |  | 10.1 N | 101.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03102306 | 1 | 10.4 N | 101.0 E | 25 | 31 | 50 | 106 | 139 | 88 | 91 |  |  | 0 | 5 | 10 | 15 | 20 | 25 |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03102312 | 2 | 10.7 N | 101.0 E | 25 | 29 | 46 | 73 | 67 | 48 | 26 |  |  | 0 | 5 | 10 | 15 | 20 | 25 |  |  |
| 03102318 | 3 | 11.0 N | 101.1 E | 25 | 8 | 34 | 51 | 48 | 89 | 112 |  |  | 0 | 5 | 10 | 15 | 20 | 20 |  |  |
| 03102400 | 4 | 11.4 N | 101.0 E | 25 | 11 | 38 | 18 | 61 | 74 | 125 |  |  | 0 | 5 | 5 | 15 | 20 | 15 |  |  |
| 03102406 | 5 | 11.7 N | 100.8 E | 25 | 18 | 42 | 60 | 93 | 123 | 214 |  |  | 0 | 5 | 10 | 15 | 20 | 15 |  |  |
| 03102412 | 6 | 12.1 N | 100.3 E | 25 | 8 | 23 | 82 | 111 | 121 | 256 |  |  | 0 | 5 | 10 | 15 | 20 | 15 |  |  |
| 03102418 | 7 | 12.5 N | 99.6 E | 25 | 6 | 63 | 96 | 114 | 155 |  |  |  | 0 | 5 | 10 | 15 | 15 |  |  |  |
| 03102506 | 8 | 12.5 N | 97.4 E | 25 | 0 | 39 | 36 | 63 | 104 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03102518 | 9 | 13.2 N | 95.1 E | 25 | 8 | 35 | 68 | 74 | 100 |  |  |  | 0 | 5 | 5 | 5 | 10 |  |  |  |
| 03102606 | 10 | 13.3 N | 93.3 E | 25 | 24 | 36 | 50 | 86 | 84 |  |  |  | 0 | 0 | 0 | 5 | 15 |  |  |  |
| 03102618 | 11 | 13.6 N | 91.4 E | 30 | 0 | 30 | 81 | 100 |  |  |  |  | 0 | 0 | 10 | 15 |  |  |  |  |
| 03102706 | 12 | 14.6 N | 88.9 E | 35 | 0 | 71 | 117 |  |  |  |  |  |  | 0 | 5 | 15 |  |  |  |  |
| 03102718 | 13 | 16.3 N | 86.0 E | 35 | 37 | 12 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03102806 | 14 | 18.2 N | 84.0 E | 30 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03102812 |  | 18.7 N | 83.4 E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 40 | 70 | 87 | 99 | 137 |  |  | 0 | 4 | 8 | 13 | 17 | 19 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 4 | 8 | 13 | 17 | 19 |  |  |
|  |  |  | \# CASES |  | 14 | 13 | 12 | 11 | 10 | 6 |  |  | 14 | 13 | 12 | 11 | 10 | 6 |  |  |



Figure 1-23W-1. $261452 Z$ October 2003 multi-sensor satellite imagery of TY 23W, the partially exposed low level circulation center was located 20 nm west of Maldive island at an intensity of 25 knots.

## TROPICAL STORM 23W

Time Intensity for 23W
Intensity (kts)


## Typhoon (TY) 24W (Melor)*

First Poor : 0600Z 28 Oct 03
First Fair : 1430Z 28 Oct 03
First TCFA : 0330Z 30 Oct 03
First Warning : 0300Z 30 Oct 03
Last Warning : 0000Z 04 Nov 03, Extratropical
Max Intensity : 70 kts, gusts to 85 kts
Landfall : Luzon
Total Warnings : 20

## Remarks:

1) Typhoon (TY) 24 W was noted as a tropical disturbance north-northeast of Palau on the tropical weather advisory on 28 October, 2003. Located in an area of moderate vertical wind shear and relatively weak upper level diffluence, the cyclone developed slowly for 48 hours. The vertical wind shear decreased by 0000 Z on 30 October, at which time the rate of development increased and a first warning was issued by 0300 Z on 30 October.

TY 24W steering was influenced by a low to mid-level ridge to the east of the system, creating a westnorthwestward track. Intensification was slightly greater than the climatological mean, with 1.5 Dvorak Tnumber/day intensification rate for approximately 48 hours after the first warning.

At approximately 0000 Z on 01 November, TY 24 W made landfall south of Palanan, Luzon, Philippines with maximum intensity of 75 knots. TY 24 W subsequently weakened due to land interaction and altered track toward the northwest. The cyclone moved over open water, north of Luzon, along the western periphery of the mid-level ridge to the east.

By 0000 Z on 2 November, TY 24W began to move more northward as it passed the axis of the steering ridge. After 12 hours of north movement, the cyclone began extratropical transition, which was completed by $0000 Z$ on 4 November, when the final warning was issued.
2) No reports of damage were received on this cyclone.
*Named by WMO Designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03102818 |  | 11.4 N | 133.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102900 |  | 11.6 N | 132.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102906 |  | 11.8 N | 131.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102912 |  | 12.1 N | 130.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03102918 |  | 12.3 N | 130.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03103000 |  | 12.6 N | 129.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03103006 | 1 | 13.0 N | 128.7E | 25 | 8 | 25 | 68 | 86 | 67 | 19 |  |  | 0 | -5 | $15$ | $25$ | $25$ | $15$ |  |  |
| 03103012 | 2 | 13.5 N | 127.8E | 35 | 11 | 46 | 94 | 63 | 51 | 67 | 212 |  | 0 | $10$ | $25$ | $30$ | 20 | 25 | $20$ |  |
| 03103018 | 3 | 14.0N | 126.9E | 35 | 5 | 6 | 13 | 31 | 51 | 272 | 528 |  | 0 | -5 | $15$ | $15$ | 0 | $10$ | $20$ |  |
| 03103100 | 4 | 14.7N | 125.9E | 45 | 13 | 48 | 32 | 0 | 91 | 337 | 566 |  | 0 | -5 | - 10 | 5 | 15 | 20 | 15 |  |
| 03103106 | 5 | 15.3 N | 124.7E | 50 | 5 | 38 | 36 | 38 | 103 | 319 |  |  | 0 | 0 | 10 | 0 | 10 | 15 |  |  |
| 03103112 | 6 | 15.9N | 123.6E | 65 | 13 | 31 | 13 | 54 | 100 | 296 |  |  | 0 | 0 | 0 | 15 | 10 | 15 |  |  |
| 03103118 | 7 | 16.4 N | 122.9E | 65 | 6 | 29 | 83 | 127 | 215 | 432 |  |  | 0 | $15$ | -5 | 5 | 5 | 5 |  |  |
| 03110100 | 8 | 16.8 N | 122.4E | 75 | 0 | 55 | 106 | 177 | 295 | 495 |  |  | -5 | -5 | 5 | 10 | 15 | 10 |  |  |
| 03110106 | 9 | 17.6 N | 121.8E | 70 | 26 | 84 | 127 | 214 | 338 |  |  |  | 5 | 0 | 10 | 15 | 15 |  |  |  |
| 03110112 | 10 | 18.7N | 121.0E | 65 | 6 | 54 | 130 | 264 | 378 |  |  |  | 10 | 10 | 15 | 20 | 10 |  |  |  |
| 03110118 | 11 | 19.5 N | 120.8E | 65 | 0 | 18 | 92 | 223 | 328 |  |  |  | 0 | 5 | 5 | 10 | 0 |  |  |  |
| 03110200 | 12 | 20.1 N | 120.7E | 60 | 8 | 29 | 121 | 224 | 295 |  |  |  | 0 | -5 | 5 | 0 | 0 |  |  |  |
| 03110206 | 13 | 20.7N | 120.6E | 60 | 5 | 66 | 162 | 235 |  |  |  |  | 0 | 0 | 5 | -5 |  |  |  |  |
| 03110212 | 14 | 21.3 N | 120.8E | 60 | 11 | 86 | 180 | 264 |  |  |  |  | 0 | 10 | 0 | 5 |  |  |  |  |
| 03110218 | 15 | 22.0 N | 121.3E | 55 | 5 | 50 | 74 |  |  |  |  |  | 0 | 0 | - 10 |  |  |  |  |  |
| 03110300 | 16 | 22.7 N | 121.9E | 45 | 11 | 53 | 95 |  |  |  |  |  |  | - 10 | - 10 |  |  |  |  |  |


| 03110306 | 17 | 23.1 N | 122.6 E | 45 | 16 | 47 |  |  |  |  |  |  |  |  | 0 | - |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-24W-1. $312325 Z$ October 2003 multi-spectral satellite imagery of TY 24W, the eye was located on the coast of Luzon, Philippines at its peak intensity of 75 knots.

## TYPHOON 24W (MELOR) 30 OCTOBER - 04 NOVEMBER 2003



## Time Intensity for 24 W

Intensity (kts)


Fix Date (Zulu)

# Typhoon (TY) 24W (Melor)* 

First Poor : 0600Z 28 Oct 03
First Fair : 1430Z 28 Oct 03
First TCFA : 0330Z 30 Oct 03
First Warning : 0300Z 30 Oct 03
Last Warning : 0000Z 04 Nov 03, Extratropical
Max Intensity : 70 kts, gusts to 85 kts
Landfall : Luzon

Total Warnings : 20
Remarks:

1) Typhoon (TY) 24 W was noted as a tropical disturbance north-northeast of Palau on the tropical weather advisory on 28 October, 2003. Located in an area of moderate vertical wind shear and relatively weak upper level diffluence, the cyclone developed slowly for 48 hours. The vertical wind shear decreased by $0000 Z$ on 30 October, at which time the rate of development increased and a first warning was issued by 0300 Z on 30 October.

TY 24 W steering was influenced by a low to mid-level ridge to the east of the system, creating a westnorthwestward track. Intensification was slightly greater than the climatological mean, with 1.5 Dvorak Tnumber/day intensification rate for approximately 48 hours after the first warning.

At approximately 0000 Z on 01 November, TY 24W made landfall south of Palanan, Luzon, Philippines with maximum intensity of 75 knots. TY 24 W subsequently weakened due to land interaction and altered track toward the northwest. The cyclone moved over open water, north of Luzon, along the western periphery of the mid-level ridge to the east.

By 0000Z on 2 November, TY 24W began to move more northward as it passed the axis of the steering ridge. After 12 hours of north movement, the cyclone began extratropical transition, which was completed by 0000Z on 4 November, when the final warning was issued.
2) No reports of damage were received on this cyclone.
*Named by WMO Designated RSMC


|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | -3 | -3 | 1 | 3 | 2 | -8 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  | \# CASES |  | 20 | 18 | 16 | 14 | 12 | 8 | 3 |  | 20 | 18 | 16 | 14 | 12 | 8 | 3 |  |



Figure 1-24W-1. $312325 Z$ October 2003 multi-spectral satellite imagery of TY 24W, the eye was located on the coast of Luzon, Philippines at its peak intensity of 75 knots.

## TYPHOON 24W (MELOR)

30 OCTOBER - 04 NOVEMBER 2003


Time Intensity for 24W
Intensity (kts)


Fix Date (Zulu)

## Typhoon (TY) 25W (Nepartak)*

First Poor : 0000Z 11 Nov 03
First Fair : $1130 Z 11$ Nov 03
First TCFA : 2030Z 11 Nov 03
First Warning : 1200Z 12 Nov 03
Last Warning : $1200 Z 19$ Nov 03, Dissipated
Max Intensity : 75 kts , gusts to 90 kts
Landfall : Central Philippines, Hainan Island and Beihai, China
Total Warnings : 29
Remarks:

1) Typhoon (TY) 25W was first noted as an area of deep convection over broad surface troughing around 11 November northeast of Yap. After the cyclone developed and the first warning was issued, the cyclone began moving westward in response to the subtropical ridge situated to the north. As TY 08W tracked westward over the Philippines, land effects resulted in a brief period of weakening, however re-intensification occurred over open water in the South China Sea.

By $0600 Z$ on 16 November, TY 25W began tracking more poleward, along the western periphery of the steering ridge, subsequently making landfall a second time along the southwest coast of Hainan Island. A third and final landfall occurred on the south coast of China at around 1100 Z on 19 November. The cyclone dissipated rapidly and a final warning was issued by 1200 Z on 19 November.

While TY 25W attained a maximum intensity of 75 knots, no well-formed eye was ever evident, though indications of a weak eye were noted in microwave satellite imagery. Typhoon classification came from the well-developed banding features rather than any eye feature.
2) Damages reported in the Philippines included report of four casualties, On Hainan Island reports indicated significant crop destruction, loss of livestock and approximately 800 homes destroyed.
Damages on Hainan were estimated at near 197 million U.S. dollars. Rains brought by the cyclone filled resevoirs and helped to relive the summer drought, reported as the worst since 1939.
*Named by WMO Designated RSMC

|  | WRN BEST TRACK |  |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111112 |  | 10.7 N | 141.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111118 |  | 11.2 N | 139.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111200 |  | 11.5 N | 137.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111206 |  | 11.8 N | 135.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111212 | 1 | 12.0 N | 134.0E | 35 | 24 | 36 | 59 | 101 | 138 | 122 |  |  | -5 | $10$ | -5 | 5 | 10 | 10 |  |  |
| 03111218 | 2 | 12.2 N | 132.1E | 40 | 33 | 12 | 43 | 76 | 49 | 48 | 68 | 70 | 0 | 10 | 15 | 0 | 0 | 15 | 20 | 45 |
| 03111300 | 3 | 12.3 N | 130.2E | 45 | 24 | 30 | 17 | 21 | 56 | 100 | 104 | 158 | 0 | 5 | 5 | -5 | 0 | 5 | 25 | 35 |
| 03111306 | 4 | 12.3 N | 128.3E | 45 | 11 | 30 | 38 | 34 | 78 | 114 | 89 | 148 | 0 | 5 | 0 | 0 | 5 | 5 | 25 | 25 |
| 03111312 | 5 | 12.3 N | 126.4E | 50 | 13 | 26 | 37 | 65 | 105 | 126 | 96 | 149 | 0 | 5 | 5 | 5 | 10 | 10 | 5 | 0 |
| 03111318 | 6 | 12.2 N | 124.5E | 50 | 18 | 27 | 65 | 84 | 118 | 149 | 137 | 208 | 0 | 0 | 5 | 0 | 0 | $30$ | $30$ | -25 |
| 03111400 | 7 | 12.1 N | 122.7E | 50 | 16 | 53 | 97 | 126 | 128 | 108 | 141 | 255 | 0 | $10$ | -5 | 5 | 0 | $10$ | $45$ | -25 |
| 03111406 | 8 | 12.1 N | 121.1E | 55 | 18 | 73 | 134 | 149 | 130 | 129 | 220 | 360 | 0 | 5 | 5 | 5 | $10$ | $\overline{-}$ | $40$ | -10 |
| 03111412 | 9 | 12.2 N | 119.9E | 60 | 8 | 71 | 130 | 138 | 148 | 154 | 261 | 450 | 5 | 10 | 10 | 5 | 10 | 15 | - | 0 |
| 03111418 | 10 | 12.4 N | 118.9E | 60 | 16 | 75 | 118 | 121 | 154 | 166 | 240 |  | 0 | 0 | 5 | 0 | 10 | - 15 | $20$ |  |
| 03111500 | 11 | 12.9 N | 117.8E | 65 | 26 | 60 | 51 | 72 | 84 | 145 | 221 |  | 0 | 5 | 0 | -5 | -5 | $30$ | - 15 |  |
| 03111506 | 12 | 13.5N | 116.8E | 65 | 0 | 21 | 51 | 71 | 99 | 133 | 155 |  | 0 | 5 | 0 | -5 | -5 | - 30 | -5 |  |
| 03111512 | 13 | 13.9N | 115.9E | 65 | 0 | 48 | 54 | 66 | 110 | 183 | 227 |  | 0 | -5 | 0 | 0 | $10$ | $25$ | 0 |  |
| 03111518 | 14 | 14.1N | 114.9E | 65 | 23 | 54 | 68 | 104 | 135 | 207 |  |  | 0 | -5 | -5 | 0 | - 20 | $20$ |  |  |
| 03111600 | 15 | 14.3 N | 113.9E | 75 | 37 | 48 | 74 | 129 | 165 | 240 |  |  | 0 | 5 | 5 | -5 | $30$ | 20 |  |  |
| 03111606 | 16 | 14.7N | 112.9E | 75 | 0 | 17 | 29 | 17 | 26 | 33 |  |  | 0 | 5 | 10 | 0 | - 20 | 5 |  |  |


| 03111612 | 17 | 15.2 N | 112.0E | 75 | 8 | 12 | 19 | 29 | 46 | 137 |  |  | 0 | 5 | 0 | $20$ | $10$ | 10 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03111618 | 18 | 15.7N | 111.1E | 75 | 0 | 13 | 42 | 63 | 103 |  |  |  | 0 | 5 | 0 | $10$ | 5 |  |  |  |
| 03111700 | 19 | 16.1 N | 110.3E | 70 | 16 | 47 | 81 | 112 | 173 |  |  |  | 0 | 0 | $15$ | 0 | -5 |  |  |  |
| 03111706 | 20 | 16.4 N | 109.7E | 65 | 0 | 26 | 50 | 86 | 132 |  |  |  | 0 | $10$ | $20$ | -5 | 5 |  |  |  |
| 03111712 | 21 | 16.9N | 109.3E | 65 | 11 | 37 | 58 | 112 | 170 |  |  |  | 0 | $15$ | 0 | 0 | 15 |  |  |  |
| 03111718 | 22 | 17.5N | 109.0E | 65 | 6 | 13 | 56 | 107 |  |  |  |  | 0 | $10$ | 5 | 15 |  |  |  |  |
| 03111800 | 23 | 18.1N | 108.8E | 75 | 0 | 11 | 16 | 49 |  |  |  |  | 0 | 20 | 20 | 25 |  |  |  |  |
| 03111806 | 24 | 18.7N | 108.6E | 70 | 5 | 6 | 38 |  |  |  |  |  | 0 | 10 | 20 |  |  |  |  |  |
| 03111812 | 25 | 19.2N | 108.5E | 55 | 5 | 42 | 104 |  |  |  |  |  | 0 | 5 | 20 |  |  |  |  |  |
| 03111818 | 26 | 19.8 N | 108.6E | 50 | 12 | 48 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03111900 | 27 | 20.4 N | 108.9E | 45 | 13 | 40 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03111906 | 28 | 21.0 N | 109.3E | 30 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03111912 | 29 | 21.7 N | 109.7E | 20 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 36 | 61 | 84 | 112 | 135 | 163 | 225 | 0 | 7 | 7 | 5 | 9 | 16 | 21 | 21 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | 3 | 0 | -5 | $10$ | -9 | 6 |
|  |  |  | \# CASES |  | 29 | 27 | 25 | 23 | 21 | 17 | 12 | 8 | 29 | 27 | 25 | 23 | 21 | 17 | 12 | 8 |



Figure 1-25W-1. $160125 Z$ November 2003 GOES-9 visible satellite image of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.


Figure 1-25W-2. $160145 Z$ November 2003 multi-sensor satellite images of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.


Figure 1-25W-3. $170320 Z$ November 2003 MODIS true-color image of TY 25W (Nepartak), located off Vietnam, with an intensity of 65 knots.

## TYPHOON 25W (NEPARTAK)

## 12-19 NOVEMBER 2003



Time Intensity for 25 W
Intensity (kts)


## Typhoon (TY) 25W (Nepartak)*

First Poor : 0000Z 11 Nov 03

First Fair : $1130 Z 11$ Nov 03

First TCFA : 2030Z 11 Nov 03

First Warning : 1200Z 12 Nov 03
Last Warning : 1200Z 19 Nov 03, Dissipated
Max Intensity : 75 kts, gusts to 90 kts
Landfall : Central Philippines, Hainan Island and Beihai,China
Total Warnings : 29
Remarks:

1) Typhoon (TY) 25 W was first noted as an area of deep convection over broad surface troughing around 11 November northeast of Yap. After the cyclone developed and the first warning was issued, the cyclone began moving westward in response to the subtropical ridge situated to the north. As TY 08W tracked westward over the Philippines, land effects resulted in a brief period of weakening, however re-intensification occurred over open water in the South China Sea.

By $0600 Z$ on 16 November, TY 25W began tracking more poleward, along the western periphery of the steering ridge, subsequently making landfall a second time along the southwest coast of Hainan Island. A third and final landfall occurred on the south coast of China at around 1100 Z on 19 November. The cyclone dissipated rapidly and a final warning was issued by 1200 Z on 19 November.

While TY 25W attained a maximum intensity of 75 knots, no well-formed eye was ever evident, though indications of a weak eye were noted in microwave satellite imagery. Typhoon classification came from the well-developed banding features rather than any eye feature.
2) Damages reported in the Philippines included report of four casualties, On Hainan Island reports indicated significant crop destruction, loss of livestock and approximately 800 homes destroyed. Damages on Hainan were estimated at near 197 million U.S. dollars. Rains brought by the cyclone filled resevoirs and helped to relive the summer drought, reported as the worst since 1939.
*Named by WMO Designated RSMC

| Statistics for JTWC on TY25W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | TRACK |  |  | SIT | TION | ERR | RORS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111112 |  | 10.7 N | 141.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111118 |  | 11.2 N | 139.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111200 |  | 11.5 N | 137.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111206 |  | 11.8 N | 135.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111212 | 1 | 12.0N | 134.0E | 35 | 24 | 36 | 59 | 101 | 138 | 122 |  |  | -5 | $10$ | -5 | 5 | $10$ | $10$ |  |  |
| 03111218 | 2 | 12.2 N | 132.1E | 40 | 33 | 12 | 43 | 76 | 49 | 48 | 68 | 70 | 0 | 10 | 15 | 0 | 0 | 15 | 20 | 45 |
| 03111300 | 3 | 12.3 N | 130.2E | 45 | 24 | 30 | 17 | 21 | 56 | 100 | 104 | 158 | 0 | 5 | 5 | -5 | 0 | 5 | 25 | 35 |
| 03111306 | 4 | 12.3 N | 128.3E | 45 | 11 | 30 | 38 | 34 | 78 | 114 | 89 | 148 | 0 | 5 | 0 | 0 | 5 | 5 | 25 | 25 |
| 03111312 | 5 | 12.3 N | 126.4E | 50 | 13 | 26 | 37 | 65 | 105 | 126 | 96 | 149 | 0 | 5 | 5 | 5 | 10 | 10 | 5 | 0 |
| 03111318 | 6 | 12.2N | 124.5E | 50 | 18 | 27 | 65 | 84 | 118 | 149 | 137 | 208 | 0 | 0 | 5 | 0 | 0 | $30$ | $30$ | -25 |
| 03111400 | 7 | 12.1 N | 122.7E | 50 | 16 | 53 | 97 | 126 | 128 | 108 | 141 | 255 | 0 | $10$ | -5 | 5 | 0 | $10$ | - | -25 |
| 03111406 | 8 | 12.1 N | 121.1E | 55 | 18 | 73 | 134 | 149 | 130 | 129 | 220 | 360 | 0 | 5 | 5 | 5 | $10$ | $10$ | - 40 | -10 |
| 03111412 | 9 | 12.2N | 119.9E | 60 | 8 | 71 | 130 | 138 | 148 | 154 | 261 | 450 | 5 | 10 | 10 | 5 | $10$ | $15$ | $25$ | 0 |
| 03111418 | 10 | 12.4 N | 118.9E | 60 | 16 | 75 | 118 | 121 | 154 | 166 | 240 |  | 0 | 0 | 5 | 0 | $10$ | $15$ | $20$ |  |
| 03111500 | 11 | 12.9N | 117.8E | 65 | 26 | 60 | 51 | 72 | 84 | 145 | 221 |  | 0 | 5 | 0 | -5 | -5 | $30$ | $15$ |  |
| 03111506 | 12 | 13.5N | 116.8E | 65 | 0 | 21 | 51 | 71 | 99 | 133 | 155 |  | 0 | 5 | 0 | -5 | -5 | $30$ | -5 |  |
| 03111512 | 13 | 13.9N | 115.9E | 65 | 0 | 48 | 54 | 66 | 110 | 183 | 227 |  | 0 | -5 | 0 | 0 | $10$ | $25$ | 0 |  |
| 03111518 | 14 | 14.1 N | 114.9E | 65 | 23 | 54 | 68 | 104 | 135 | 207 |  |  | 0 | -5 | -5 | 0 | - 20 | $20$ |  |  |
| 03111600 | 15 | 14.3N | 113.9E | 75 | 37 | 48 | 74 | 129 | 165 | 240 |  |  | 0 | 5 | 5 | -5 | $30$ | $20$ |  |  |
| 03111606 | 16 | 14.7N | 112.9E | 75 | 0 | 17 | 29 | 17 | 26 | 33 |  |  | 0 | 5 | 10 | 0 | - 20 | 5 |  |  |
| 03111612 | 17 | 15.2N | 112.0E | 75 | 8 | 12 | 19 | 29 | 46 | 137 |  |  | 0 | 5 | 0 | - 20 | - 10 | 10 |  |  |
| 03111618 | 18 | 15.7N | 111.1E | 75 | 0 | 13 | 42 | 63 | 103 |  |  |  | 0 | 5 | 0 | - 10 | 5 |  |  |  |
| 03111700 | 19 | 16.1 N | 110.3E | 70 | 16 | 47 | 81 | 112 | 173 |  |  |  | 0 |  | - 15 | 0 | -5 |  |  |  |


| 03111706 | 20 | 16.4 N | 109.7 E | 65 | 0 | 26 | 50 | 86 | 132 |  |  |  | 0 | - | - | -5 | 5 |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03111712 | 21 | 16.9 N | 109.3 E | 65 | 11 | 37 | 58 | 112 | 170 |  |  |  | 0 | - | 0 | 0 | 15 |  |  |  |  |
| 03111718 | 22 | 17.5 N | 109.0 E | 65 | 6 | 13 | 56 | 107 |  |  |  |  | 0 | - | -10 | 5 | 15 |  |  |  |  |
| 03111800 | 23 | 18.1 N | 108.8 E | 75 | 0 | 11 | 16 | 49 |  |  |  |  | 0 | 20 | 20 | 25 |  |  |  |  |  |
| 03111806 | 24 | 18.7 N | 108.6 E | 70 | 5 | 6 | 38 |  |  |  |  |  | 0 | 10 | 20 |  |  |  |  |  |  |
| 03111812 | 25 | 19.2 N | 108.5 E | 55 | 5 | 42 | 104 |  |  |  |  |  | 0 | 5 | 20 |  |  |  |  |  |  |
| 0311818 | 26 | 19.8 N | 108.6 E | 50 | 12 | 48 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |  |
| 03111900 | 27 | 20.4 N | 108.9 E | 45 | 13 | 40 |  |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |  |
| 03111906 | 28 | 21.0 N | 109.3 E | 30 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 03111912 | 29 | 21.7 N | 109.7 E | 20 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 36 | 61 | 84 | 112 | 135 | 163 | 225 | 0 | 7 | 7 | 5 | 9 | 16 | 21 | 21 |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 2 | 3 | 0 | -5 | - | -9 | 6 |  |
|  |  |  | \# CASES |  | 29 | 27 | 25 | 23 | 21 | 17 | 12 | 8 | 29 | 27 | 25 | 23 | 21 | 17 | 12 | 8 |  |



Figure 1-25W-1. $160125 Z$ November 2003 GOES-9 visible satellite image of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.


Figure 1-25W-2. $160145 Z$ November 2003 multi-sensor satellite images of TY 25W (Nepartak), located in the south China sea, with a peak intensity of 75 knots.


Figure 1-25W-3. $170320 Z$ November 2003 MODIS true-color image of TY 25W (Nepartak), located off Vietnam, with an intensity of 65 knots.

## TYPHOON 25W (NEPARTAK)

## 12-19 NOVEMBER 2003



Time Intensity for 25W
Intensity (kts)


| - KGWC |
| :---: |
| - |
| PGTW |
| KWBC |
| CIRA |
| - CIMS |
| - T-Numbers |
| - Best Track |

Fix Date (Zulu)

## Super Typhoon (STY) 26W (Lupit)*

First Poor : 0900Z 15 Nov 03
First Fair : 2100Z 17 Nov 03

First TCFA : $0230 Z 17$ Nov 03
First Warning : 1800Z 20 Nov 03
Last Warning : 0600Z 01 Dec 03, Extratropical
Max Intensity : 145 kts, gusts to 175 kts
Landfall : N/A
Total Warnings : 47
Remarks:

1) Super typhoon (STY) 26W developed in the monsoon trough around 14 November, approximately 360 nautical miles northeast of Kwajalein atoll; first warning was issued at 1800 Z on 19 November. The cyclone remained below tropical storm strength for 24 hours while moving southwestward along the southeastern periphery of a mid-level steering ridge centered to the north-northwest. STY 26W subsequently tracked westward along the southern periphery of the subtropical ridge over the next three days passing within 90 nautical miles of Chuuk at approximately $0800 Z$ on 22 November.

The cyclone intensified steadily after 20 November and attained super typhoon intensity at 0000 Z on 26 November. STY 26W began to move more northwestward early on 24 November, along the southwestern quadrant of the mid-level steering ridge, and achieved maximum intensity of 145 knots at $1200 Z$ on 27 Novermber in the Philippine Sea.

STY 26W begand tracking poleward toward a weakness in the subtropical ridge produced by a midlatitude trough in the westerlies. The cyclone began to weaken as it approached the ridge axis in response to increased vertical wind shear. After STY 26W crested the ridge axis at around 0600 Z on 29 November, it continued to weaken as it encountered cooler sea surface temperatures, drier air, and increased vertical wind shear associated with a mid-latitude baroclinic zone. The cyclone started to undergo extratropical transition, while accelerating northeastward, and completed extratropical transition around $0600 Z$ on 01 December, approximately 340 nautical miles south of Tokyo, Japan.
2) No casualties were reported for this cyclone, but severe damage was reported to trees and crops on Yap and Ulithi atoll.
*Named by WMO Designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111412 |  | 12.8 N | 172.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111418 |  | 13.3 N | 171.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111500 |  | 13.7 N | 171.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111506 |  | 14.0 N | 171.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111512 |  | 14.2 N | 170.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111518 |  | 14.2 N | 170.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111600 |  | 14.2 N | 169.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111606 |  | 14.2 N | 168.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111612 |  | 13.9 N | 167.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111618 |  | 13.3 N | 167.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111700 |  | 12.7 N | 167.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111706 |  | 12.1 N | 166.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111712 |  | 11.5 N | 166.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111718 |  | 11.0 N | 166.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111800 |  | 10.9 N | 165.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111806 |  | 10.9 N | 165.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111812 |  | 10.9 N | 164.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111818 |  | 10.9N | 163.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111900 |  | 10.6N | 163.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111906 |  | 10.0N | 162.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111912 |  | 9.5 N | 162.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111918 | 1 | 9.1 N | 162.0E | 25 | 18 | 65 | 130 | 142 | 122 | 80 | 178 | 193 | 0 | 0 | 0 | 10 | 10 | 0 | 0 | 0 |
| 03112000 | 2 | 9.0 N | 161.6E | 25 | 8 | 36 | 91 | 71 | 43 | 110 | 145 | 65 | 0 | 0 | 0 | 5 | -5 | -5 | 0 | 0 |
| 03112006 | 3 | 8.9 N | 161.2E | 30 | 8 | 21 | 40 | 56 | 88 | 156 | 92 | 107 | -5 | -5 | 0 | 0 | - 10 | - | - 10 | -15 |
| 03112012 | 4 | 8.9 N | 160.8E | 30 | 5 | 24 | 24 | 62 | 85 | 166 | 160 | 148 | 0 | 5 | 5 | -5 | -5 | - 10 | -5 | -5 |


| 03112018 | 5 | 8.9N | 160.2E | 35 | 5 | 12 | 72 | 117 | 154 | 201 | 114 | 110 | 0 | 5 | 10 | -5 | 0 | 10 | 20 | 20 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03112100 | 6 | 9.0 N | 159.4E | 35 | 36 | 113 | 163 | 213 | 250 | 228 | 127 | 115 | 0 | 5 | -5 | -5 | -5 | 10 | 20 | 15 |
| 03112106 | 7 | 9.1 N | 158.2E | 35 | 17 | 1774 | 133 | 175 | 211 | 155 | 116 | 96 | 0 | -5 | $15$ | $15$ | $10$ | 10 | 10 | 5 |
| 03112112 | 8 | 9.0 N | 156.8E | 40 | 16 | 654 | 85 | 128 | 153 | 156 | 144 | 316 | -5 | $20$ | $20$ | $15$ | $10$ | 5 | 10 | 5 |
| 03112118 | 9 | 8.8 N | 155.4E | 45 | 5 | 42 | 60 | 88 | 102 | 131 | 176 | 272 | 0 | -5 | 0 | 0 | 5 | 10 | 5 | 15 |
| 03112200 | 10 | 8.8 N | 153.9E | 60 | 13 | 13 | 32 | 68 | 97 | 95 | 97 | 149 | 0 | 5 | 15 | 15 | 20 | 15 | -5 | -10 |
| 03112206 | 11 | 8.8N | 152.3E | 65 | 5 | 30 | 84 | 112 | 136 | 77 | 106 | 109 | 0 | 5 | 10 | 10 | 20 | 5 | $15$ | 10 |
| 03112212 | 12 | 8.8N | 150.7E | 70 | 13 | 363 | 121 | 175 | 202 | 130 | 169 | 134 | 0 | 0 | 0 | 5 | 10 | 5 | $15$ | 15 |
| 03112218 | 13 | 8.8N | 149.1E | 75 | 8 | 75 | 118 | 181 | 198 | 166 | 216 | 186 | 0 | 0 | 0 | 10 | 10 | 0 | $15$ | 5 |
| 03112300 | 14 | 8.2N | 147.8E | 80 | 18 | 875 | 139 | 187 | 171 | 152 | 169 | 139 | 0 | 0 | 5 | 10 | 10 | -5 | $10$ | -5 |
| 03112306 | 15 | 7.9N | 146.6E | 85 | 0 | 13 | 79 | 89 | 64 | 74 | 55 | 58 | 5 | 5 | 15 | 15 | 10 | $10$ | -5 | -5 |
| 03112312 | 16 | 7.8N | 145.5E | 90 | 0 | 19 | 54 | 51 | 54 | 60 | 35 | 42 | 5 | 10 | 15 | 15 | 10 | $10$ | 10 | -10 |
| 03112318 | 17 | 7.8N | 144.5E | 95 | 18 | 877 | 55 | 30 | 36 | 50 | 75 | 93 | 0 | 15 | 10 | 5 | 10 | $15$ | $15$ | -10 |
| 03112400 | 18 | 8.1 N | 143.8E | 95 | 25 | 55 | 61 | 76 | 71 | 87 | 122 | 147 | 0 | 5 | 10 | 5 | 0 | $15$ | $25$ | -10 |
| 03112406 | 19 | 8.5N | 143.1E | 95 | 18 | 849 | 88 | 113 | 107 | 134 | 163 | 179 | 0 | 0 | -5 | 0 | $15$ | $25$ | $30$ | -5 |
| 03112412 | 20 | 9.1 N | 142.2E | 100 | 0 | 48 | 95 | 82 | 64 | 122 | 138 | 120 | -5 | 0 | -5 | $10$ | $20$ | $35$ | $30$ | -5 |
| 03112418 | 21 | 9.9N | 141.1E | 105 | 8 | 36 | 46 | 30 | 25 | 52 | 58 | 136 | -5 | 5 | 10 | 0 | 5 | 10 | 20 | 40 |
| 03112500 | 22 | 10.7 N | 139.9E | 105 | 13 | 324 | 19 | 30 | 13 | 38 | 120 | 273 | 0 | 5 | 0 | -5 | 0 | 5 | 25 | 35 |
| 03112506 | 23 | 11.4 N | 138.7E | 115 | 13 | 21 | 29 | 26 | 13 | 42 | 108 | 324 | 0 | 5 | -5 | 0 | 0 | 0 | 20 | 15 |
| 03112512 | 24 | 12.0 N | 137.7E | 115 | 16 | 635 | 45 | 46 | 39 | 46 | 133 | 404 | 0 | -5 | 10 | -5 | $10$ | 10 | 10 | 10 |
| 03112518 | 25 | 12.2 N | 137.1E | 120 | 0 | 30 | 46 | 42 | 40 | 78 | 177 | 403 | 0 | 10 | 0 | 5 | 10 | 15 | 30 | 25 |
| 03112600 | 26 | 12.6 N | 136.7E | 130 | 12 | 246 | 35 | 48 | 45 | 120 | 177 | 364 | 0 | 5 | 10 | 10 | 20 | 35 | 40 | 35 |
| 03112606 | 27 | 13.1 N | 136.3E | 140 | 13 | 13 | 21 | 30 | 18 | 97 | 188 | 358 | 0 | 5 | 10 | 20 | 15 | 40 | 35 | 30 |
| 03112612 | 28 | 13.6 N | 136.0E | 140 | 13 | 8 | 6 | 25 | 24 | 59 | 183 | 348 | 5 | 10 | 10 | 15 | 10 | 30 | 30 | 20 |
| 03112618 | 29 | 13.8 N | 135.4E | 140 | 5 | 25 | 38 | 34 | 60 | 21 | 130 | 207 | 0 | 5 | 15 | 10 | 5 | 20 | 20 | 20 |
| 03112700 | 30 | 14.1 N | 134.9E | 140 | 0 | 12 | 33 | 41 | 74 | 51 | 152 | 204 | 5 | 0 | 15 | 15 | 15 | 15 | 25 | 20 |
| 03112706 | 31 | 14.5 N | 134.3E | 140 | 5 | 23 | 29 | 53 | 81 | 78 | 156 | 291 | 5 | 15 | 10 | 10 | 20 | 15 | 15 | 15 |
| 03112712 | 32 | 15.0 N | 133.8E | 145 | 0 | 24 | 8 | 40 | 45 | 110 | 132 |  | 0 | 10 | 0 | 15 | 15 | 10 | 5 |  |


| 03112718 | 33 | 15.3N | 133.2E | 135 | 0 | 6 | 26 | 58 | 25 | 130 | 150 |  | 5 | 5 | 5 | 15 | 10 | 10 | 0 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03112800 | 34 | 15.6N | 132.8E | 135 | 8 | 35 | 66 | 75 | 73 | 181 | 193 |  | 5 | 0 | 10 | 10 | 0 | 15 | 5 |  |
| 03112806 | 35 | 16.4 N | 132.3E | 135 | 11 | 21 | 47 | 21 | 33 | 84 | 158 |  | 5 | 10 | 10 | 0 | $15$ | 5 | 5 |  |
| 03112812 | 36 | 17.1 N | 131.9E | 135 | 12 | 29 | 40 | 13 | 23 | 77 |  |  | 5 | 10 | 0 | $15$ | $20$ | 0 |  |  |
| 03112818 | 37 | 17.7N | 131.3E | 125 | 0 | 26 | 18 | 48 | 81 | 101 |  |  | 0 | 5 | $10$ | $25$ | $20$ | $15$ |  |  |
| 03112900 | 38 | 18.4 N | 130.8E | 115 | 11 | 21 | 89 | 188 | 234 | 175 |  |  | 0 | $10$ | $20$ | $30$ | $20$ | $15$ |  |  |
| 03112906 | 39 | 19.2N | 130.5E | 105 | 5 | 34 | 68 | 117 | 84 | 113 |  |  | 0 | $10$ | $25$ | $15$ | $15$ | $10$ |  |  |
| 03112912 | 40 | 20.1 N | 130.9E | 105 | 13 | 49 | 75 | 101 | 72 |  |  |  | -5 | $15$ | $25$ | $10$ | $10$ |  |  |  |
| 03112918 | 41 | 21.1 N | 131.7E | 100 | 21 | 28 | 66 | 73 | 36 |  |  |  | -5 | $15$ | $10$ | $10$ | $15$ |  |  |  |
| 03113000 | 42 | 22.1 N | 132.6E | 100 | 26 | 49 | 80 | 82 | 66 |  |  |  | $10$ | $20$ | -5 | $10$ | $10$ |  |  |  |
| 03113006 | 43 | 23.3N | 134.0E | 100 | 28 | 76 | 73 | 35 | 69 |  |  |  | $10$ | -5 | 0 | -5 | -5 |  |  |  |
| 03113012 | 44 | 24.6N | 135.4E | 95 | 13 | 37 | 36 | 24 |  |  |  |  | $10$ | 0 | 0 | -5 |  |  |  |  |
| 03113018 | 45 | 25.8N | 137.5E | 80 | 16 | 89 | 138 | 250 |  |  |  |  | $10$ | - 10 | $15$ | $10$ |  |  |  |  |
| 03120100 | 46 | 27.7N | 138.8E | 70 | 36 | 68 | 117 |  |  |  |  |  | $10$ | - 15 | $15$ |  |  |  |  |  |
| 03120106 | 47 | 29.6N | 140.0E | 65 | 31 | 57 | 90 |  |  |  |  |  | -5 | $10$ | $10$ |  |  |  |  |  |
| 03120112 |  | 30.9 N | 142.0E | 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03120118 |  | 32.2 N | 144.3E | 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03120200 |  | 34.0 N | 146.3E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03120206 |  | 35.7 N | 148.6E | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 40 | 66 | 83 | 86 | 107 | 138 | 196 | 3 | 7 | 9 | 10 | 11 | 13 | 15 | 14 |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 0 | 0 | 1 | 0 | 3 | 5 | 6 |
|  |  |  | \# CASES |  | 47 | 47 | 47 | 45 | 43 | 39 | 35 | 31 | 47 | 47 | 47 | 45 | 43 | 39 | 35 | 31 |



Figure 1-26W-1. $260135 Z$ November 2003 MODIS true color image of 26W (Lupit), north of Yap, with an intensity of 130 knots.


Figure 1-26W-2. 260702 Z November 2003 GOES-9 visible satellite image of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.


Figure 1-26W-3. 261202 Z November 2003 multi-sensor satellite images of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

## SUPER TYPHOON 26W (LUPIT) <br> 20 NOVEMBER - 01 DECEMBER 2003



## Time Intensity for 26W

## Intensity (kts)



| - KGWC |
| :--- |
| - |
| - PGTW |
| - KWBC |
| CIRA |
| - CIMS |
| - ODT |
| - T-Numbers |
| - Best Track |

Fix Date (Zulu)

## Super Typhoon (STY) 26W (Lupit)*

First Poor : 0900Z 15 Nov 03
First Fair : 2100Z 17 Nov 03
First TCFA : 0230Z 17 Nov 03

First Warning : 1800Z 20 Nov 03
Last Warning : 0600Z 01 Dec 03, Extratropical
Max Intensity : 145 kts, gusts to 175 kts
Landfall : N/A

Total Warnings : 47
Remarks:

1) Super typhoon (STY) 26W developed in the monsoon trough around 14 November, approximately 360 nautical miles northeast of Kwajalein atoll; first warning was issued at 1800 Z on 19 November. The cyclone remained below tropical storm strength for 24 hours while moving southwestward along the southeastern periphery of a mid-level steering ridge centered to the north-northwest. STY 26W subsequently tracked westward along the southern periphery of the subtropical ridge over the next three days passing within 90 nautical miles of Chuuk at approximately $0800 Z$ on 22 November.

The cyclone intensified steadily after 20 November and attained super typhoon intensity at 0000Z on 26 November. STY 26W began to move more northwestward early on 24 November, along the southwestern quadrant of the mid-level steering ridge, and achieved maximum intensity of 145 knots at 1200 Z on 27 Novermber in the Philippine Sea.

STY 26W begand tracking poleward toward a weakness in the subtropical ridge produced by a midlatitude trough in the westerlies. The cyclone began to weaken as it approached the ridge axis in response to increased vertical wind shear. After STY 26W crested the ridge axis at around 0600Z on 29 November, it continued to weaken as it encountered cooler sea surface temperatures, drier air, and increased vertical wind shear associated with a mid-latitude baroclinic zone. The cyclone started to undergo extratropical transition, while accelerating northeastward, and completed extratropical transition around $0600 Z$ on 01 December, approximately 340 nautical miles south of Tokyo, Japan.
2) No casualties were reported for this cyclone, but severe damage was reported to trees and crops on Yap and Ulithi atoll.
*Named by WMO Designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111412 |  | 12.8 N | 172.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111418 |  | 13.3 N | 171.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111500 |  | 13.7 N | 171.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111506 |  | 14.0N | 171.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111512 |  | 14.2 N | 170.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111518 |  | 14.2 N | 170.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111600 |  | 14.2 N | 169.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111606 |  | 14.2N | 168.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111612 |  | 13.9 N | 167.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111618 |  | 13.3N | 167.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111700 |  | 12.7 N | 167.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111706 |  | 12.1 N | 166.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111712 |  | 11.5 N | 166.8E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111718 |  | 11.0N | 166.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111800 |  | 10.9 N | 165.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111806 |  | 10.9N | 165.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111812 |  | 10.9 N | 164.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111818 |  | 10.9N | 163.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111900 |  | 10.6N | 163.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111906 |  | 10.0N | 162.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111912 |  | 9.5 N | 162.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111918 | 1 | 9.1 N | 162.0E | 25 | 18 | 65 | 130 | 142 | 122 | 80 | 178 | 193 | 0 | 0 | 0 | 10 | 10 | 0 | 0 | 0 |
| 03112000 | 2 | 9.0 N | 161.6E | 25 | 8 | 36 | 91 | 71 | 43 | 110 | 145 | 65 | 0 | 0 | 0 | 5 | -5 | -5 | 0 | 0 |
| 03112006 | 3 | 8.9 N | 161.2E | 30 | 8 | 21 | 40 | 56 | 88 | 156 | 92 | 107 | -5 | -5 | 0 | 0 | - 10 | - | $\overline{-}$ | -15 |
| 03112012 | 4 | 8.9 N | 160.8E | 30 | 5 | 24 | 24 | 62 | 85 | 166 | 160 | 148 | 0 | 5 | 5 | -5 | -5 | - 10 | -5 | -5 |
| 03112018 | 5 | 8.9 N | 160.2E | 35 | 5 | 12 | 72 | 117 | 154 | 201 | 114 | 110 | 0 | 5 | 10 | -5 | 0 | 10 | 20 | 20 |
| 03112100 | 6 | 9.0 N | 159.4E | 35 | 36 | 113 | 163 | 213 | 250 | 228 | 127 | 115 | 0 | 5 | -5 | -5 | -5 | 10 | 20 | 15 |
| 03112106 | 7 | 9.1 N | 158.2E | 35 | 17 | 74 | 133 | 175 | 211 | 155 | 116 | 96 | 0 | -5 | - | - 15 | - 10 | 10 | 10 | 5 |


| 03112112 | 8 | 9.0 N | 156.8 E | 40 | 16 | 54 | 85 | 128 | 153 | 156 | 144 | 316 | -5 | 20 | 20 | 15 | 10 | 5 | 10 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03112118 | 9 | 8.8 N | 155.4 E | 45 | 5 | 42 | 60 | 88 | 102 | 131 | 176 | 272 | 0 | -5 | 0 | 0 | 5 | 10 | 5 | -15 |
| 03112200 | 10 | 8.8 N | 153.9 E | 60 | 13 | 13 | 32 | 68 | 97 | 95 | 97 | 149 | 0 | 5 | 15 | 15 | 20 | 15 | -5 | -10 |
| 03112206 | 11 | 8.8 N | 152.3 E | 65 | 5 | 30 | 84 | 112 | 136 | 77 | 106 | 109 | 0 | 5 | 10 | 10 | 20 | 5 | - | -10 |
| 03112212 | 12 | 8.8 N | 150.7 E | 70 | 13 | 63 | 121 | 175 | 202 | 130 | 169 | 134 | 0 | 0 | 0 | 5 | 10 | 5 | - | -15 |
| 03112218 | 13 | 8.8 N | 149.1 E | 75 | 8 | 75 | 118 | 181 | 198 | 166 | 216 | 186 | 0 | 0 | 0 | 10 | 10 | 0 | -15 | -5 |
| 03112300 | 14 | 8.2 N | 147.8 E | 80 | 18 | 75 | 139 | 187 | 171 | 152 | 169 | 139 | 0 | 0 | 5 | 10 | 10 | -5 | - | -5 |
| 03112306 | 15 | 7.9 N | 146.6 E | 85 | 0 | 13 | 79 | 89 | 64 | 74 | 55 | 58 | 5 | 5 | 15 | 15 | 10 | - | -5 | -5 |
| 03112312 | 16 | 7.8 N | 145.5 E | 90 | 0 | 19 | 54 | 51 | 54 | 60 | 35 | 42 | 5 | 10 | 15 | 15 | 10 | - | - | -10 |
| 03112318 | 17 | 7.8 N | 144.5 E | 95 | 18 | 77 | 55 | 30 | 36 | 50 | 75 | 93 | 0 | 15 | 10 | 5 | 10 | - | - | -15 |


| 03112818 | 37 | 17.7 N | 131.3 E | 125 | 0 | 26 | 18 | 48 | 81 | 101 |  |  | 0 | 5 | - | - | - | - | - |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Figure 1-26W-1. $260135 Z$ November 2003 MODIS true color image of 26W (Lupit), north of Yap, with an intensity of 130 knots.


Figure 1-26W-2. $260702 Z$ November 2003 GOES-9 visible satellite image of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.


Figure 1-26W-3. $261202 Z$ November 2003 multi-sensor satellite images of TY 26W (Lupit), located 625 nm east of the Philippines, with a peak intensity of 145 knots.

## SUPER TYPHOON 26W (LUPIT) <br> 20 NOVEMBER - 01 DECEMBER 2003



## Time Intensity for 26W

## Intensity (kts)



Fix Date (Zulu)

## Tropical Storm (TS) 27W

First Poor : N/A

First Fair : 0600Z 21 Sep 03

First TCFA : 0230Z 24 Dec 03

First Warning : 0600Z 24 Dec 03
Last Warning : 1800Z 27 Dec 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : Surigao, Philippines
Total Warnings : 15
Remarks:

1) Tropical Storm (TS) 27 W developed in the monsoon trough on 21 December, 2003, approximately 150 NM west-southwest of Chuuk and tracked generally westward over the next 6 days as a weak system that intensified to only 35 knots.

The cyclone made landfall near Surigao, Philippines at approximately $1500 Z$ on 27 December and subsequently dissipated in the Bohol Sea.
2) No damage or significant operational impacts were reported for this cyclone.

| Statistics for JTWC on TS27W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BES | RACK |  |  | SIT | TION | ERR | ORS |  |  |  |  | ND | RR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |


| 03122300 |  | 11.1 N | 142.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03122306 |  | 11.6N | 140.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122312 |  | 12.1 N | 139.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122318 |  | 12.6N | 138.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122400 |  | 13.1 N | 137.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122406 | 1 | 13.3N | 135.8E | 25 | 13 | 42 | 102 | 173 | 241 | 449 |  |  | 0 | 0 | 5 | 10 | 20 | 10 |  |  |
| 03122412 | 2 | 13.5N | 134.6E | 30 | 26 | 75 | 146 | 197 | 262 | 372 |  |  | -5 | 0 | 0 | 5 | 10 | 0 |  |  |
| 03122418 | 3 | 13.7N | 133.4E | 30 | 8 | 44 | 68 | 83 | 104 | 179 |  |  | 0 | 5 | 5 | 10 | 10 | 0 |  |  |
| 03122500 | 4 | 13.7N | 132.2E | 30 | 31 | 64 | 76 | 112 | 152 |  |  |  | 0 | 0 | 5 | 5 | 0 |  |  |  |
| 03122506 | 5 | 13.7 N | 131.0E | 30 | 11 | 31 | 47 | 93 | 142 |  |  |  | 0 | 0 | 5 | 0 | -5 |  |  |  |
| 03122512 | 6 | 13.8 N | 130.0E | 35 | 13 | 12 | 77 | 147 | 197 |  |  |  | 0 | 5 | 10 | 10 | 5 |  |  |  |
| 03122518 | 7 | 13.8N | 129.3E | 35 | 18 | 27 | 70 | 133 | 180 |  |  |  | 0 | 5 | 10 | 0 | 5 |  |  |  |
| 03122600 | 8 | 13.7 N | 128.6E | 35 | 5 | 42 | 95 | 150 |  |  |  |  | 0 | 5 | 0 | 0 |  |  |  |  |
| 03122606 | 9 | 13.4 N | 128.0E | 35 | 21 | 59 | 105 | 145 |  |  |  |  | 0 | 0 | -5 | 5 |  |  |  |  |
| 03122612 | 10 | 13.0N | 127.4E | 35 | 41 | 83 | 133 |  |  |  |  |  | -5 | -10 | -5 |  |  |  |  |  |
| 03122618 | 11 | 12.3N | 127.1E | 35 | 48 | 98 | 84 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03122700 | 12 | 11.5N | 126.9E | 35 | 13 | 42 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03122706 | 13 | 10.6 N | 126.8E | 35 | 16 | 18 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03122712 | 14 | 9.8 N | 126.4E | 30 | 53 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03122718 | 15 | 9.4N | 125.5E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 22 | 49 | 91 | 137 | 183 | 333 |  |  | 1 | 3 | 5 | 5 | 8 | 3 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 1 | 3 | 5 | 6 | 3 |  |  |
|  |  |  | \# CASES |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  |



Figure 1-27W-1. $262213 Z$ December 2003 multi-sensor satellite images of TY 27W, revealing a partially exposed low level circulation center 120 nm east of the Philippines, with a peak intensity of 35 knots.

## TROPICAL STORM 27W

24-27 DECEMBER 2003


Time Intensity for 27W

## Intensity (kts)



## Tropical Storm (TS) 27W



First Poor: N/A
First Fair : 0600Z 21 Sep 03
First TCFA : 0230Z 24 Dec 03
First Warning : 0600Z 24 Dec 03
Last Warning : 1800Z 27 Dec 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : Surigao, Philippines
Total Warnings : 15
Remarks:

1) Tropical Storm (TS) 27W developed in the monsoon trough on 21 December, 2003, approximately 150 NM west-southwest of Chuuk and tracked generally westward over the next 6 days as a weak system that intensified to only 35 knots.

The cyclone made landfall near Surigao, Philippines at approximately $1500 Z$ on 27 December and subsequently dissipated in the Bohol Sea.
2) No damage or significant operational impacts were reported for this cyclone.

| Statistics for JTWC on TS27W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | TRACK |  |  | SIT | TION | ERR | ORS |  |  |  |  | ND E | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03122300 |  | 11.1 N | 142.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122306 |  | 11.6N | 140.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122312 |  | 12.1 N | 139.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122318 |  | 12.6N | 138.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122400 |  | 13.1 N | 137.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03122406 | 1 | 13.3 N | 135.8E | 25 | 13 | 42 | 102 | 173 | 241 | 449 |  |  | 0 | 0 | 5 | 10 | 20 | 10 |  |  |
| 03122412 | 2 | 13.5N | 134.6E | 30 | 26 | 75 | 146 | 197 | 262 | 372 |  |  | -5 | 0 | 0 | 5 | 10 | 0 |  |  |
| 03122418 | 3 | 13.7N | 133.4E | 30 | 8 | 44 | 68 | 83 | 104 | 179 |  |  | 0 | 5 | 5 | 10 | 10 | 0 |  |  |
| 03122500 | 4 | 13.7N | 132.2E | 30 | 31 | 64 | 76 | 112 | 152 |  |  |  | 0 | 0 | 5 | 5 | 0 |  |  |  |
| 03122506 | 5 | 13.7 N | 131.0E | 30 | 11 | 31 | 47 | 93 | 142 |  |  |  | 0 | 0 | 5 | 0 | -5 |  |  |  |
| 03122512 | 6 | 13.8 N | 130.0E | 35 | 13 | 12 | 77 | 147 | 197 |  |  |  | 0 | 5 | 10 | 10 | 5 |  |  |  |
| 03122518 | 7 | 13.8 N | 129.3E | 35 | 18 | 27 | 70 | 133 | 180 |  |  |  | 0 | 5 | 10 | 0 | 5 |  |  |  |
| 03122600 | 8 | 13.7 N | 128.6E | 35 | 5 | 42 | 95 | 150 |  |  |  |  | 0 | 5 | 0 | 0 |  |  |  |  |
| 03122606 | 9 | 13.4 N | 128.0E | 35 | 21 | 59 | 105 | 145 |  |  |  |  | 0 | 0 | -5 | 5 |  |  |  |  |
| 03122612 | 10 | 13.0 N | 127.4E | 35 | 41 | 83 | 133 |  |  |  |  |  | -5 | -10 | -5 |  |  |  |  |  |
| 03122618 | 11 | 12.3 N | 127.1E | 35 | 48 | 98 | 84 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03122700 | 12 | 11.5 N | 126.9E | 35 | 13 | 42 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03122706 | 13 | 10.6 N | 126.8E | 35 | 16 | 18 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03122712 | 14 | 9.8 N | 126.4E | 30 | 53 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03122718 | 15 | 9.4 N | 125.5E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 22 | 49 | 91 | 137 | 183 | 333 |  |  | 1 | 3 | 5 | 5 | 8 | 3 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 1 | 3 | 5 | 6 | 3 |  |  |
|  |  |  | \# CASES |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  | 15 | 13 | 11 | 9 | 7 | 3 |  |  |



Figure 1-27W-1. $262213 Z$ December 2003 multi-sensor satellite images of TY 27W, revealing a partially exposed low level circulation center 120 nm east of the Philippines, with a peak intensity of 35 knots.

## TROPICAL STORM 27W

24-27 DECEMBER 2003


Time Intensity for 27W
Intensity (kts)


## Tropical Cyclone (TC) 01B



First Poor : 0300Z 08 May 03
First Fair : 1300Z 08 May 03

First TCFA : 1730Z 08 May 03

First Warning: 1200Z 10 May 03
Last Warning : 1800Z 19 May 03
Max Intensity : 60 kts, gusts to 75 kts
Landfall : Ramree Island, Myanmar
Total Warnings : 15
Remarks:

1) Tropical Cyclone (TC) 01B, the first significant North Indian Ocean tropical cyclone of 2003, developed out of a broad surface trough approximately 260 NM west of the north tip of Sumatra. The area initially tracked northwestward in a moderately favorable environment of diffluence aloft and low vertical wind shear. The first warning was issued on 10 May at $1200 Z$.

For approximately 36 hours after the initial warning, the cyclone continued on a northwestward course, with a track speed between 6 and 12 knots. Around 1800 Z on 11 May, the cyclone slowed and started moving more northward as a mid-level ridge northeast of the system began building.

By $1800 Z$ on 13 May, satellite imagery revealed a fully exposed low level circulation center to the east of the deep convection. By 0000 Z on 16 May, the system entered into a weak steering environment as the mid level steering ridge east of the system began to weaken. The system then shifted to a more northeastward track by 0000 Z on 18 May under the influence of a mid-level ridge east of the system and the low to mid-level buffer southeast of the system. TC 01B made landfall with an intensity of 40 knots over Ramree Island, Myanmar, and then quickly dissipated over land.
2) No reports were received of any damage from this cyclone.

Statistics for JTWC on TC01B

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03050812 |  | 5.0 N | 91.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050818 |  | 4.8 N | 91.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050900 |  | 4.5 N | 91.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050906 |  | 4.2 N | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050912 |  | 4.4 N | 90.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050918 |  | 5.1 N | 90.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051000 |  | 6.0 N | 90.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051006 |  | 6.9 N | 89.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051012 | 1 | 7.8 N | 89.5E | 30 | 8 | 34 | 44 | 45 | 136 |  |  |  | 0 | -10 | -15 | -5 | 10 |  |  |  |
| 03051100 | 2 | 9.6 N | 88.0E | 45 | 30 | 40 | 87 | 158 | 185 |  |  |  | 5 | 0 | 10 | 25 | 35 |  |  |  |
| 03051112 | 3 | 10.6 N | 86.8E | 60 | 5 | 70 | 119 | 148 | 170 |  |  |  | 0 | 5 | 20 | 25 | 40 |  |  |  |
| 03051200 | 4 | 10.4 N | 86.4E | 60 | 38 | 100 | 138 | 156 | 193 |  |  |  | 0 | 5 | 10 | 20 | 30 |  |  |  |
| 03051206 | 5 | 10.9 N | 86.4E | 55 | 18 | 71 | 69 | 87 | 115 |  |  |  | 0 | 0 | 10 | 20 | 30 |  |  |  |
| 03051218 | 6 | 11.8 N | 86.8E | 55 | 0 | 38 | 55 | 63 | 118 |  |  |  | 10 | 25 | 35 | 50 | 70 |  |  |  |
| 03051306 | 7 | 12.6 N | 86.1E | 55 | 6 | 37 | 70 | 128 | 135 |  |  |  | 10 | 15 | 30 | 50 | 50 |  |  |  |
| 03051318 | 8 | 13.2 N | 85.9E | 55 | 5 | 8 | 56 | 126 | 170 |  |  |  | 0 | 5 | 10 | 10 | 5 |  |  |  |
| 03051406 | 9 | 14.2 N | 86.0E | 45 | 11 | 50 | 92 | 131 | 178 |  |  |  | 5 | 10 | 10 | 5 | -5 |  |  |  |
| 03051418 | 10 | 14.7 N | 86.7E | 35 | 8 | 64 | 85 | 133 | 183 |  |  |  | 0 | 10 | 10 | 10 | 15 |  |  |  |
| 03051506 | 11 | 14.4 N | 86.2E | 35 | 49 | 78 | 123 | 180 | 268 |  |  |  | 0 | 0 | -5 | 0 | 0 |  |  |  |
| 03051518 | 12 | 14.4 N | 86.8E | 35 | 24 | 49 | 99 | 150 | 167 |  |  |  | 0 | -5 | 5 | 0 | 10 |  |  |  |
| 03051606 | 13 | 14.2 N | 87.1E | 45 | 39 | 79 | 131 | 146 | 135 |  |  |  | 0 | 5 | 5 | 15 | 15 |  |  |  |
| 03051618 | 14 | 13.7 N | 86.8E | 40 | 48 | 134 | 184 | 180 | 179 |  |  |  | 0 | 0 | 5 | 5 | 5 |  |  |  |
| 03051706 | 15 | 13.1 N | 88.3E | 40 | 93 | 175 | 244 | 308 | 311 |  |  |  | 0 | 10 | 10 | 5 | -10 |  |  |  |
| 03051718 | 16 | 13.7N | 90.2E | 30 | 44 | 80 | 131 |  |  |  |  |  | 5 | 0 | -5 |  |  |  |  |  |
| 03051818 | 17 | 16.7N | 93.0E | 30 | 13 | 50 | 66 |  |  |  |  |  | 5 | 5 | -10 |  |  |  |  |  |
| 03051906 | 18 | 18.3N | 93.3E | 45 | 22 | 19 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03051918 | 19 | 19.9N | 94.1E | 40 | 6 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 25 | 65 | 105 | 143 | 176 |  |  |  | 2 | 6 | 12 | 16 | 22 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 2 | 4 | 8 | 16 | 20 |  |  |  |
|  |  |  | \# CASES |  | 19 | 18 | 17 | 15 | 15 |  |  |  | 19 | 18 | 17 | 15 | 15 |  |  |  |



Figure 1-01B-1. 140131 Z May 2003 MET-5 visible image of TC 01B, revealing an partially exposed low level circulation, located 360 nm west of the Andaman islands, with an estimated intensity of 50 knots.


Figure 1-01B-2. $140515 Z$ May 2003 MODIS true-color image of Tropical Cyclone (03B) east of India with an estimated intensity of 45 knots.

## TROPICAL CYCLONE 01B

10-19 MAY 2003


TROPICAL CYCLONE 01B
10-19 MAY 2003


## Time Intensity for 01B

## Intensity (kts)



## Tropical Cyclone (TC) 01B

First Poor : 0300Z 08 May 03
First Fair : 1300Z 08 May 03
First TCFA : $1730 Z 08$ May 03
First Warning : 1200Z 10 May 03
Last Warning : 1800Z 19 May 03
Max Intensity : 60 kts, gusts to 75 kts
Landfall : Ramree Island, Myanmar
Total Warnings : 15
Remarks:

1) Tropical Cyclone (TC) 01B, the first significant North Indian Ocean tropical cyclone of 2003, developed out of a broad surface trough approximately 260 NM west of the north tip of Sumatra. The area initially tracked northwestward in a moderately favorable environment of diffluence aloft and low vertical wind shear. The first warning was issued on 10 May at $1200 Z$.

For approximately 36 hours after the initial warning, the cyclone continued on a northwestward course, with a track speed between 6 and 12 knots. Around $1800 Z$ on 11 May, the cyclone slowed and started moving more northward as a mid-level ridge northeast of the system began building.

By 1800 Z on 13 May, satellite imagery revealed a fully exposed low level circulation center to the east of the deep convection. By 0000Z on 16 May, the system entered into a weak steering environment as the mid level steering ridge east of the system began to weaken. The system then shifted to a more northeastward track by 0000 Z on 18 May under the influence of a mid-level ridge east of the system and the low to mid-level buffer southeast of the system. TC 01B made landfall with an intensity of 40 knots over Ramree Island, Myanma, and then quickly dissipated over land.
2) No reports were received of any damage from this cyclone.

## Statistics for JTWC on TC01B

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03050812 |  | 5.0 N | 91.3E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050818 |  | 4.8 N | 91.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050900 |  | 4.5 N | 91.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050906 |  | 4.2 N | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050912 |  | 4.4 N | 90.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050918 |  | 5.1 N | 90.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051000 |  | 6.0 N | 90.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051006 |  | 6.9 N | 89.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03051012 | 1 | 7.8 N | 89.5E | 30 | 8 | 34 | 44 | 45 | 136 |  |  |  | 0 | -10 | -15 | -5 | 10 |  |  |  |
| 03051100 | 2 | 9.6 N | 88.0E | 45 | 30 | 40 | 87 | 158 | 185 |  |  |  | 5 | 0 | 10 | 25 | 35 |  |  |  |
| 03051112 | 3 | 10.6 N | 86.8E | 60 | 5 | 70 | 119 | 148 | 170 |  |  |  | 0 | 5 | 20 | 25 | 40 |  |  |  |
| 03051200 | 4 | 10.4N | 86.4E | 60 | 38 | 100 | 138 | 156 | 193 |  |  |  | 0 | 5 | 10 | 20 | 30 |  |  |  |
| 03051206 | 5 | 10.9 N | 86.4E | 55 | 18 | 71 | 69 | 87 | 115 |  |  |  | 0 | 0 | 10 | 20 | 30 |  |  |  |
| 03051218 | 6 | 11.8 N | 86.8E | 55 | 0 | 38 | 55 | 63 | 118 |  |  |  | 10 | 25 | 35 | 50 | 70 |  |  |  |
| 03051306 | 7 | 12.6 N | 86.1E | 55 | 6 | 37 | 70 | 128 | 135 |  |  |  | 10 | 15 | 30 | 50 | 50 |  |  |  |
| 03051318 | 8 | 13.2 N | 85.9E | 55 | 5 | 8 | 56 | 126 | 170 |  |  |  | 0 | 5 | 10 | 10 | 5 |  |  |  |
| 03051406 | 9 | 14.2 N | 86.0E | 45 | 11 | 50 | 92 | 131 | 178 |  |  |  | 5 | 10 | 10 | 5 | -5 |  |  |  |
| 03051418 | 10 | 14.7N | 86.7E | 35 | 8 | 64 | 85 | 133 | 183 |  |  |  | 0 | 10 | 10 | 10 | 15 |  |  |  |
| 03051506 | 11 | 14.4 N | 86.2E | 35 | 49 | 78 | 123 | 180 | 268 |  |  |  | 0 | 0 | -5 | 0 | 0 |  |  |  |
| 03051518 | 12 | 14.4N | 86.8E | 35 | 24 | 49 | 99 | 150 | 167 |  |  |  | 0 | -5 | 5 | 0 | 10 |  |  |  |
| 03051606 | 13 | 14.2 N | 87.1E | 45 | 39 | 79 | 131 | 146 | 135 |  |  |  | 0 | 5 | 5 | 15 | 15 |  |  |  |
| 03051618 | 14 | 13.7N | 86.8E | 40 | 48 | 134 | 184 | 180 | 179 |  |  |  | 0 | 0 | 5 | 5 | 5 |  |  |  |
| 03051706 | 15 | 13.1 N | 88.3E | 40 | 93 | 175 | 244 | 308 | 311 |  |  |  | 0 | 10 | 10 | 5 | -10 |  |  |  |
| 03051718 | 16 | 13.7N | 90.2E | 30 | 44 | 80 | 131 |  |  |  |  |  | 5 | 0 | -5 |  |  |  |  |  |
| 03051818 | 17 | 16.7N | 93.0E | 30 | 13 | 50 | 66 |  |  |  |  |  | 5 | 5 | -10 |  |  |  |  |  |
| 03051906 | 18 | 18.3N | 93.3E | 45 | 22 | 19 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03051918 | 19 | 19.9N | 94.1E | 40 | 6 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 25 | 65 | 105 | 143 | 176 |  |  |  | 2 | 6 | 12 | 16 | 22 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 2 | 4 | 8 | 16 | 20 |  |  |  |
|  |  |  | \# CASES |  | 19 | 18 | 17 | 15 | 15 |  |  |  | 19 | 18 | 17 | 15 | 15 |  |  |  |



Figure 1-01B-1. $140131 Z$ May 2003 MET-5 visible image of TC 01B, revealing an partially exposed low level circulation, located 360 nm west of the Andaman islands, with an estimated intensity of 50 knots.


Figure 1-01B-2. $140515 Z$ May 2003 MODIS true-color image of Tropical Cyclone (03B) east of India with an estimated intensity of 45 knots.

TROPICAL CYCLONE 01B
10 - 19 MAY 2003


## TROPICAL CYCLONE 01B



## Time Intensity for 01B



## Tropical Cyclone (TC) 02A

First Poor : 0900Z 11 Nov 03
First Fair : 1800Z 11 Nov 03
First TCFA : 0500Z 12 Nov 03
First Warning : 1200Z 12 Nov 03
Last Warning : $0600 Z 15$ Nov 03
Max Intensity : 80 kts, gusts to 100 kts
Landfall : N/A
Total Warnings : 11
Remarks:
(1) TC 02A was first noted as an area of developing convection, approximately 600 nm west of Cochin, India, in the Arabian Sea. The system quickly became more organized and the first warning was issued on 12 November. TC 02A continued to intensify, reaching a maximum intensity of 80 knots. TC 02A tracked along the southern periphery of a low to mid tropospheric subtropical ridge located north and west of the cyclone throughout the cyclone life span. By 0600 Z on the 15th, microwave imagery revealed that deep convection became decoupled from the low level circulation and a final warning was issued.

Subsequent to the final warning, the low level circulation center was tracked by satellite for a further 72 hours, at which time the cyclone dissipated completely over water.
(2) No damage reports were received associated with this system.

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111012 |  | 8.7 N | 67.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111018 |  | 8.5N | 66.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111100 |  | 8.3 N | 65.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111106 |  | 8.0 N | 65.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111112 |  | 7.6 N | 64.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111118 |  | 7.1 N | 63.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111200 |  | 6.5 N | 61.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111206 |  | 6.2 N | 60.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111212 | 1 | 6.1 N | 60.0E | 30 | 11 | 43 | 80 | 86 | 70 |  |  |  | 0 | -20 | -25 | -30 | -15 |  |  |  |
| 03111300 | 2 | 6.2 N | 58.8E | 55 | 18 | 38 | 36 | 46 | 103 |  |  |  | 0 | 0 | 0 | 20 | 55 |  |  |  |
| 03111306 | 3 | 6.2 N | 58.2E | 60 | 5 | 0 | 25 | 54 | 119 | 230 |  |  | 0 | 0 | 0 | 45 | 60 | 45 |  |  |
| 03111312 | 4 | 6.1 N | 57.6E | 65 | 5 | 8 | 32 | 90 | 173 | 280 |  |  | 0 | 0 | 15 | 45 | 50 | 35 |  |  |
| 03111318 | 5 | 6.1 N | 57.0E | 70 | 11 | 35 | 34 | 104 | 171 | 367 |  |  | 5 | 0 | 35 | 55 | 45 | -10 |  |  |
| 03111400 | 6 | 5.9N | 56.2E | 75 | 5 | 40 | 108 | 198 | 289 | 414 |  |  | 10 | 40 | 50 | 45 | 35 | -10 |  |  |
| 03111406 | 7 | 5.7 N | 55.7E | 80 | 13 | 48 | 131 | 203 | 276 | 435 |  |  | 5 | 35 | 45 | 35 | 25 | -5 |  |  |
| 03111412 | 8 | 5.8 N | 55.2E | 65 | 43 | 129 | 228 | 322 | 405 |  |  |  | 0 | 15 | 15 | 5 | -10 |  |  |  |
| 03111418 | 9 | 5.9 N | 54.8E | 50 | 5 | 101 | 191 | 258 | 376 |  |  |  | 0 | 10 | 0 | -5 | -10 |  |  |  |
| 03111500 | 10 | 6.0 N | 54.6E | 40 | 65 | 173 | 270 | 371 |  |  |  |  | 0 | 0 | -5 | -10 |  |  |  |  |
| 03111506 | 11 | 6.0 N | 54.4E | 30 | 30 | 102 | 208 | 326 |  |  |  |  | 0 | -5 | -10 | -15 |  |  |  |  |
| 03111512 |  | 6.0 N | 54.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111518 |  | 6.0 N | 53.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111600 |  | 5.9 N | 53.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111606 |  | 5.8 N | 53.2E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111612 |  | 5.6 N | 52.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111618 |  | 5.0 N | 52.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111700 |  | 4.4 N | 51.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111706 |  | 3.7 N | 51.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111712 |  | 3.2 N | 51.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111718 |  | 2.7 N | 51.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111800 |  | 2.5 N | 51.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111806 |  | 2.4 N | 52.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 20 | 65 | 122 | 187 | 220 | 345 |  |  | 2 | 11 | 18 | 28 | 34 | 21 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 2 | 7 | 11 | 17 | 26 | 11 |  |  |



Figure 1-02A-1. 140430Z November 2003 multi-sensor satellite images of TC 02A, located 650 nm northeast of the Mogadishu, with an peak intensity of 85 knots.

## TROPICAL CYCLONE 02A <br> 12-15 NOVEMBER 2003



## Time Intensity for 02A

## Intensity (kts)



## Tropical Cyclone (TC) 02A

First Poor : 0900Z 11 Nov 03
First Fair : 1800Z 11 Nov 03
First TCFA : 0500Z 12 Nov 03

First Warning : 1200Z 12 Nov 03
Last Warning : 0600Z 15 Nov 03
Max Intensity : 80 kts, gusts to 100 kts
Landfall : N/A

Total Warnings : 11
Remarks:
(1) TC 02A was first noted as an area of developing convection on 11 November, approximately 600 nm west of Cochin, India, in the Arabian Sea. The system quickly became more organized and the first warning was issued one day later by JTWC. TC 02A continued to intensify and reached a maximum intensity of 80 knots. TC 02A tracked along the southern periphery of a low to mid tropospheric subtropical ridge located north and west of the cyclone throughout the cyclone life span. By 0600Z on the 15th, microwave imagery revealed that deep convection became decoupled from the low level circulation and a final warning was issued.

Subsequent to the final warning, the low level circulation center was tracked by satellite for a further 72 hours, at which time the cyclone dissipated completely over water.
(2) No damage reports were received associated with this system.

## Statistics for JTWC on TC02A

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03111012 |  | 8.7 N | 67.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111018 |  | 8.5 N | 66.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111100 |  | 8.3 N | 65.7E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111106 |  | 8.0 N | 65.1E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111112 |  | 7.6 N | 64.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111118 |  | 7.1 N | 63.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111200 |  | 6.5 N | 61.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111206 |  | 6.2 N | 60.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111212 | 1 | 6.1 N | 60.0E | 30 | 11 | 43 | 80 | 86 | 70 |  |  |  | 0 | -20 | -25 | -30 | -15 |  |  |  |
| 03111300 | 2 | 6.2 N | 58.8E | 55 | 18 | 38 | 36 | 46 | 103 |  |  |  | 0 | 0 | 0 | 20 | 55 |  |  |  |
| 03111306 | 3 | 6.2 N | 58.2E | 60 | 5 | 0 | 25 | 54 | 119 | 230 |  |  | 0 | 0 | 0 | 45 | 60 | 45 |  |  |
| 03111312 | 4 | 6.1 N | 57.6E | 65 | 5 | 8 | 32 | 90 | 173 | 280 |  |  | 0 | 0 | 15 | 45 | 50 | 35 |  |  |
| 03111318 | 5 | 6.1 N | 57.0E | 70 | 11 | 35 | 34 | 104 | 171 | 367 |  |  | 5 | 0 | 35 | 55 | 45 | -10 |  |  |
| 03111400 | 6 | 5.9 N | 56.2E | 75 | 5 | 40 | 108 | 198 | 289 | 414 |  |  | 10 | 40 | 50 | 45 | 35 | -10 |  |  |
| 03111406 | 7 | 5.7N | 55.7E | 80 | 13 | 48 | 131 | 203 | 276 | 435 |  |  | 5 | 35 | 45 | 35 | 25 | -5 |  |  |
| 03111412 | 8 | 5.8N | 55.2E | 65 | 43 | 129 | 228 | 322 | 405 |  |  |  | 0 | 15 | 15 | 5 | -10 |  |  |  |
| 03111418 | 9 | 5.9 N | 54.8E | 50 | 5 | 101 | 191 | 258 | 376 |  |  |  | 0 | 10 | 0 | -5 | -10 |  |  |  |
| 03111500 | 10 | 6.0 N | 54.6E | 40 | 65 | 173 | 270 | 371 |  |  |  |  | 0 | 0 | -5 | -10 |  |  |  |  |
| 03111506 | 11 | 6.0 N | 54.4E | 30 | 30 | 102 | 208 | 326 |  |  |  |  | 0 | -5 | -10 | -15 |  |  |  |  |
| 03111512 |  | 6.0 N | 54.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111518 |  | 6.0 N | 53.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111600 |  | 5.9N | 53.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111606 |  | 5.8 N | 53.2E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111612 |  | 5.6 N | 52.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111618 |  | 5.0 N | 52.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111700 |  | 4.4 N | 51.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111706 |  | 3.7 N | 51.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111712 |  | 3.2 N | 51.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111718 |  | 2.7 N | 51.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111800 |  | 2.5 N | 51.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03111806 |  | 2.4 N | 52.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 20 | 65 | 122 | 187 | 220 | 345 |  |  | 2 | 11 | 18 | 28 | 34 | 21 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 2 | 7 | 11 | 17 | 26 | 11 |  |  |
|  |  |  | \# CASES |  | 11 | 11 | 11 | 11 | 9 | 5 |  |  | 11 | 11 | 11 | 11 | 9 | 5 |  |  |



Figure 1-02A-1. 140430Z November 2003 multi-sensor satellite images of TC 02A, located 650 nm northeast of the Mogadishu, with an peak intensity of 85 knots.

TROPICAL CYCLONE 02A


Time Intensity for 02A
Intensity (kts)


Fix Date (Zulu)

## Tropical Cyclone (TC) 03B

First Poor : 05300Z 10 Dec 03

First Fair : 0600Z 11 Dec 03

First TCFA : $1430 Z 12$ Dec 03
First Warning : 1800Z 12 Dec 03
Last Warning : $1800 Z 15$ Dec 03, Dissipation
Max Intensity : 55 kts , gusts to 70 kts
Landfall : Near False Divi Point, India
Total Warnings : 7
Remarks:
(1) Tropical Cyclone (TC) 03B formed off the northwest coast of Summatra and tracked northwestward along the periphery of the low to mid-level steering ridge while slowly intensifying. The cyclone reached a peak intensity of 55 knots before making landfall near False Divi Point, India on 15 December, 2003 at approximately $1430 Z$.
(2) Reports indicate that there were 27 fatalities and more than 5100 homes damaged by heavy flooding and high winds. Uprooted trees and damaged electrical tranformers created extensive power outages in India.

|  | Statistics for JTWC on TC03B |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITION | ERR | ROR |  |  |  |  | ND | ERRO | ORS |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 1224 | 36 | 48 | 72 | 96 | 120 |  | 12 | 24 | 3648 | 72 | 96 | 120 |


| 03121106 |  | 4.5 N | 91.7 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |



Naval Research Laboratory http://www.nrlmry navy mil/sat_products.html

```
190 200 210
240
250
260
270
```

Figure 1-03B-1. $150103 Z$ December 2003 SSM/I imagery of TC 03B, the banding eye was located 115 nm east of the Madras, with an intensity of 50 knots.


Figure 1-03B-2. $150520 Z$ December 2003 MODIS true-color image of TC 03B, located off the east coast of India, with an intensity of 55 knots.

## TROPICAL CYCLONE 03B

## 12-15 DECEMBER 2003



## Time Intensity for 03B

## Intensity (kts)



Fix Date (Zulu)

## Tropical Cyclone (TC) 03B

First Poor : 05300Z 10 Dec 03
First Fair : 0600Z 11 Dec 03
First TCFA : $1430 Z 12$ Dec 03

First Warning : 1800Z 12 Dec 03
Last Warning : 1800Z 15 Dec 03, Dissipation
Max Intensity : 55 kts, gusts to 70 kts
Landfall : Near False Divi Point, India
Total Warnings : 7
Remarks:
(1) Tropical Cyclone (TC) 03B formed off the northwest coast of Summatra and tracked northwestward along the periphery of the low to mid-level steering ridge while slowly intensifying. The cyclone reached a peak intensity of 55 knots before making landfall near False Divi Point, India on 15 December, 2003 at approximately $1430 Z$.
(2) Reports indicate that there were 27 fatalities and more than 5100 homes damaged by heavy flooding and high winds. Uprooted trees and damaged electrical tranformers created extensive power outages in India.

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03121106 |  | 4.5 N | 91.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121112 |  | 5.0 N | 90.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121118 |  | 5.6 N | 89.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121200 |  | 6.4 N | 89.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121206 |  | 7.3 N | 88.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121212 |  | 7.7 N | 88.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121218 | 1 | 7.9 N | 88.4E | 30 | 24 | 47 | 55 | 96 | 151 | 293 |  |  | 0 | 5 | 5 | 0 | 5 | -15 |  |  |
| 03121306 | 2 | 8.4 N | 87.5E | 30 | 8 | 42 | 109 | 182 | 276 | 458 |  |  | 0 | 0 | -5 | 0 | -10 | 0 |  |  |
| 03121318 | 3 | 9.3 N | 86.1E | 35 | 21 | 78 | 139 | 223 | 311 |  |  |  | 0 | -5 | 0 | -5 | 10 |  |  |  |
| 03121406 | 4 | 10.8 N | 84.7E | 45 | 11 | 36 | 99 | 150 | 212 |  |  |  | 0 | 5 | 0 | 5 | 10 |  |  |  |
| 03121418 | 5 | 12.4 N | 83.2E | 45 | 29 | 91 | 134 | 189 |  |  |  |  | 0 | -10 | 5 | 25 |  |  |  |  |
| 03121506 | 6 | 14.6N | 81.6E | 55 | 13 | 37 | 80 |  |  |  |  |  | 0 | 5 | 10 |  |  |  |  |  |
| 03121518 | 7 | 16.6 N | 81.1E | 45 | 12 | 12 |  |  |  |  |  |  | 5 | 0 |  |  |  |  |  |  |
| 03121600 |  | 17.7N | 81.3E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03121606 |  | 18.4N | 81.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 17 | 49 | 103 | 168 | 238 | 375 |  |  | 1 | 4 | 4 | 7 | 9 | 8 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 0 | 3 | 5 | 4 | -8 |  |  |
|  |  |  | \# CASES |  | 7 | 7 | 6 | 5 | 4 | 2 |  |  | 7 | 7 | 6 | 5 | 4 | 2 |  |  |



Figure 1-03B-1. $150103 Z$ December 2003 SSM/I imagery of TC 03B, the banding eye was located 115 nm east of the Madras, with an intensity of 50 knots.


Figure 1-03B-2. $150520 Z$ December 2003 MODIS true-color image of TC 03B, located off the east coast of India, with an intensity of 55 knots.

## TROPICAL CYCLONE 03B

## 12-15 DECEMBER 2003



Time Intensity for 03B
Intensity (kts)


| $=$ |
| :--- |
| - KGWC |
| - PGTW |
| - KWBC |
| CIRA |
| - T-Numbers |
| - Best Track |

## 2. SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

### 2.1 GENERAL

In accordance with CINCPACINST 3140.1 (series), Southern Hemisphere tropical cyclones are numbered sequentially from 01 July through 30 June to reflect the Southern Hemisphere tropical season.

For warning message delineation, the Southern Hemisphere Area of Responsibility (AOR) is divided into two basins: the South Indian (west of $135^{\circ}$ East longitude) and the South Pacific Ocean (east of $135^{\circ}$ East longitude). The suffixes "S" (South Indian Ocean) and "P" (South Pacific Ocean) are appended to the tropical cyclone number to differentiate warnings for these basins. For this report, the Southern Hemisphere AOR is broken down into three sub-basins, reflecting primary cyclogenesis areas: South Indian (west of $105^{\circ}$ East longitude), Australia ( $105^{\circ}$ East longitude to $165^{\circ}$ East longitude), and South Pacific (east of $165^{\circ}$ East longitude).

### 2.2 SUMMARY

Table 2-1 lists the significant tropical cyclones during the 2003 season and can be compared to the climatological mean presented in Table 2-2. Table 2-3 compares this year's tropical cyclone activity in the Southern Hemisphere sub-basins to previous years and climatology. Composites of the tropical cyclone best tracks for the Southern Hemisphere appear following Table 2-3.

## Table 2-1

## SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2003

(01 JULY 2002-30 JUNE 2003)

| TC | NAME | PERIOD | NUMBER ISSUED | EST MAX SFC WINDS KTS (M/SEC) | $\begin{aligned} & \text { MSLP } \\ & (\mathrm{MB})^{* *} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 01S | Abaimba | 06 Sep - 08 Sep | 4 | 35(18) | 997 |
| 02S | Atang | 06 Nov-13 Nov | 12 | 45(23) | 991 |
| 035 | Boura | 15 Nov-22 Nov | 22 | 75(39) | 967 |
| 04P | Yolande | 04 Dec - 05 Dec | 2 | 35(18) | 997 |
| 05S | Crystal | 23 Dec - 29 Dec | 12 | 90(46) | 954 |
| 06P | Zoe | 25 Dec - 01 Jan | 14 | 155(80) | 879 |
| 07S | - | 26 Dec - 28 Dec | 5 | 30(15) | 1000 |
| 08S | Delfina | 30 Dec - 01 Jan | 4 | 55(28) | 984 |
| 09S | Ebula | 08 Jan - 12 Jan | 9 | 65(33) | 976 |
| 10P | Ami | 11 Jan - 15 Jan | 9 | 110(57) | 933 |
| 11S | Fari | 23 Jan - 31 Jan | 9 | 55(28) | 984 |
| 12P | Beni | 25 Jan - 31 Jan | 14 | 125(64) | 916 |
| 13P | Cilla | 27-Jan | 2 | 35(18) | 997 |
| 14S | Fiona | 05 Feb-13 Feb | 19 | 110(57) | 933 |
| 15P | Dovi | 05 Feb - 10 Feb | 11 | 130(67) | 910 |
| 16 S | Gerry | 08 Feb-15 Feb | 15 | 105(54) | 938 |
| 17 S | Hape | 10 Feb - 14 Feb | 10 | 80(41) | 963 |
| 18 S | Isha | 11 Feb-14 Feb | 7 | 45(23) | 991 |
| 19 S | Japhet | 26 Feb-03 Mar | 12 | 115(59) | 927 |
| 20S | Graham | 27 Feb-01 Mar | 4 | 40(21) | 994 |
| 21 S | Harriet | 02 Mar - 09 Mar | 21 | 35(18) | 997 |
| 22P | Erica | 04 Mar - 15 Mar | 18 | 130(67) | 910 |
| 23 S | Kalunde | 05 Mar - 15 Mar | 23 | 140(72) | 898 |
| 24S | Craig | 08 Mar - 12 Mar | 9 | 35(18) | 997 |
| 25P | Eseta | 10 Mar - 14 Mar | 8 | 110(57) | 933 |
| 26 S | Inigo | 01 Apr - 08 Apr | 23 | 140(72) | 898 |
| 27P | Fili | 14-Apr | 1 | 45(23) | 991 |
| 28 S | Manou | 03 May - 10 May | 16 | 75(39) | 967 |


| 29P | Gina | 04 Jun - 08 Jun | 10 | $90(46)$ | 954 |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  | Total | 325 |  |  |
| **MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind pressure <br> relationship. Number of warnings issued includes Amended warnings. |  |  |  |  |  |



| 1989 | 0 | 0 | 0 | 0 | 2 | 1 | 5 | 8 | 6 | 4 | 2 | 0 | 28 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1990 | 2 | 0 | 1 | 1 | 2 | 2 | 4 | 4 | 10 | 2 | 1 | 0 | 29 |  |
| 1991 | 0 | 0 | 1 | 1 | 1 | 3 | 2 | 5 | 5 | 2 | 1 | 1 | 22 |  |
| 1992 | 0 | 0 | 1 | 1 | 2 | 5 | 4 | 11 | 3 | 2 | 1 | 0 | 30 |  |
| 1993 | 0 | 0 | 1 | 1 | 0 | 5 | 7 | 7 | 2 | 2 | 2 | 0 | 27 |  |
| 1994 | 0 | 0 | 0 | 0 | 2 | 4 | 8 | 4 | 9 | 3 | 0 | 0 | 30 |  |
| 1995 | 0 | 0 | 0 | 0 | 2 | 2 | 5 | 4 | 5 | 4 | 0 | 0 | 22 |  |
| 1996 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 6 | 6 | 4 | 1 | 0 | 28 |  |
| The criteria used in TABLE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

| Table 2-3 <br> ANNUAL VARIATION OF SOUTHERN HEMISPHERE TROPICAL CYCLONES BY OCEAN BASIN |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |
| YEAR | SOUTH INDIAN | AUSTRALIAN | SOUTH PACIFIC |  |
|  | $\begin{aligned} & \text { (WEST OF } \\ & \left.105^{\circ} \mathrm{E}\right) \end{aligned}$ | $\left(105^{\circ} \mathrm{E}-165^{\circ} \mathrm{E}\right)$ | $\begin{aligned} & \text { (EAST OF } \\ & \left.165^{\circ} \mathrm{E}\right) \end{aligned}$ | TOTAL |
| $\begin{aligned} & 1958-1977 \\ & \text { AVERAGE* } \end{aligned}$ | 8.4 | 10.3 | 5.9 | 24.6 |
| 1981 | 13 | 8 | 3 | 24 |
| 1982 | 12 | 11 | 2 | 25 |
| 1983 | 7 | 6 | 12 | 25 |
| 1984 | 14 | 14 | 2 | 30 |
| 1985 | 14 | 15 | 6 | 35 |
| 1986 | 14 | 16 | 3 | 33 |

2. SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

| 1987 | 9 | 8 | 11 | 28 |
| :---: | :---: | :---: | :---: | :---: |
| 1988 | 14 | 2 | 5 | 21 |
| 1989 | 12 | 9 | 7 | 28 |
| 1990 | 18 | 8 | 3 | 29 |
| 1991 | 11 | 10 | 1 | 22 |
| 1992 | 11 | 6 | 13 | 30 |
| 1993 | 10 | 16 | 1 | 27 |
| 1994 | 16 | 10 | 4 | 30 |
| 1995 | 11 | 7 | 4 | 22 |
| 1996 | 13 | 11 | 4 | 28 |
| 1997 | 17 | 5 | 16 | 38 |
| 1998 | 12 | 10 | 15 | 37 |
| 1999 | 13 | 16 | 4 | 33 |
| 2000 | 10 | 12 | 5 | 27 |
| 2001 | 10 | 8 | 3 | 21 |
| 2002 | 14 | 7 | 4 | 25 |
| 2003 | 14 | 6 | 9 | 29 |
| (1981-2003) |  |  |  |  |
| TOTAL | 289 | 221 | 137 | 647 |
| AVERAGE | 12.6 | 9.6 | 6.0 | 28.1 |
| * (Gray, 1978) |  |  |  |  |



## SOUTHEAST INDIAN OCEAN TROPICAL CYCLONES 06 NOV 2002－12 JAN 2003

## MAXIMUM SUSTAINED SURFACE WIND

 －64KT（33M／SEC）OR GREATER ーーーー 34 TO 63KT（ 18 TO 32M／SEC） ．．．．．．．．．．．．33KT（17M／SEC）OR LESS| TC 01S | $06 \mathrm{SEP}-08 \mathrm{SEP}$ |
| :--- | :---: |
| TC 02S（ATANG） | $06 \mathrm{NOV}-13 \mathrm{NOV}$ |
| TC 03S（BOURA） | $15 \mathrm{NOV}-22 \mathrm{NOV}$ |
| TC 05S（CRYSTAL） | $23 \mathrm{DEC}-29 \mathrm{DEC}$ |
| TC 08S（DELFINA） | $30 \mathrm{DEC}-01 \mathrm{JAN}$ |
| TC 09S（EBULA） | $08 \mathrm{JAN}-12 \mathrm{JAN}$ |



| SOUTHWEST INDIAN OCEAN |
| :---: |
| TROPICAL CYCLONES |
| 23 JAN 2003 - 10 MAY 2003 |

MAXTMUM SUSTAINED SURFACE WIND

- 64KT (33M/SEC) OR GREATER - - - - 34 TO 63 KT ( 18 TO 32M/SEC) $\ldots \ldots . . .$. 33KT (17M/SEC) OR LESS

| TC 11S (FARI) | 23 JAN - 31 JAN |
| :--- | :--- |
| TC 16S (GERRY) | $08 \mathrm{FEB}-14 \mathrm{FEB}$ |
| TC 17S (HAPE) | $10 \mathrm{FEB}-14 \mathrm{FEB}$ |
| TC 19S (JAPHET) | $14 \mathrm{FEB}-03 \mathrm{MAR}$ |
| TC 23S (KALUNDE) $05 \mathrm{MAR}-15 \mathrm{MAR}$ |  |
| TC 28S (MANOU) | $03 \mathrm{MAY}-10 \mathrm{MAY}$ |



SOUTHEAST INDIAN OCEAN TROPICAL CYCLONES 26 DEC 2002-09 MAR 2003

| MAXIMUM SUSTAINED SURFACE WIND |  |
| :--- | :--- |
|  | 64KT (33M/SEC) OR GREATER |
| ---- | 34 T0 $63 \mathrm{KT}(18$ TO 32M/SEC) |
| $\cdots \cdots \cdots \cdots$. | $33 \mathrm{KT}(17 M / S E C)$ OR LESS |

TC 07S
26 DEC - 28 DEC TC 14S (FIONA) 05 FEB - 13 FEB TC 18S (ISHA) 11 FEB - 14 FEB TC 21S (HARRIET) 02 MAR - 09 MAR


> | AUSTRALIA REGION |
| :---: |
| TROPCIAL CYCLONES |
| 27 FEB - 08 APR 2003 |

MAXTMUM SUSTAINED SURFACE WIND
－64KT（33M／SEC）OR GREATER
－ーーー 34 TO 63KT（ 18 TO 32M／SEC）
．．．．．．．．．．．33KT（17M／SEC）OR LESS


AUSTRALIA REGION TROPICAL CYCLONES 25 JAN 2003－08 JUN 2003

MAXTMUM SUSTAINED SURFACE WIND －64KT（33M／SEC）OR GREATER ーーーー 34 TO 63KT（ 18 TO 32M／SEC） $\ldots \ldots . . . .$. 33KT（17M／SEC）OR LESS



SOUTHERN PACIFIC OCEAN TROPICAL CYCLONES 04 DEC 2002－08 JUN 2003

MAXTMUM SUSTAINED SURFACE WIND －64KT（33M／SEC）OR GREATER
ーーーー 34 TO 63KT（18 TO 32M／SEC）
…．．．．．．．．33KT（17M／SEC）OR LESS

| TC 04P（YOLANDE） $04 \mathrm{DEC}-05 \mathrm{DEC}$ |  |
| :--- | :--- |
| TC 06P（ZOE） | $25 \mathrm{DEC}-01 \mathrm{JAN}$ |
| TC 10P（AMI） | $11 \mathrm{JAN}-15 \mathrm{JAN}$ |
| TC 13P（CILLA） | 27 JAN |
| TC 15P（DOVI） | $05 \mathrm{FEB}-10 \mathrm{FEB}$ |
| TC 25P（ESETA） | $10 \mathrm{MAR}-14 \mathrm{MAR}$ |
| TC 27P（FILI） | 14 APR |
| TC 29P（GINA） | $04 \mathrm{JUN}-08 \mathrm{JUN}$ |

TC 04P（YOLANDE） 04 DEC－ 05 DEC TC 06P（ZOE） $25 \mathrm{DEC}-01 \mathrm{JAN}$ TC 10P（AMI） $11 \mathrm{JAN}-15 \mathrm{JAN}$ TC 13P（CILLA） 27 JAN TC 15P（DOVI） $05 \mathrm{FEB}-10 \mathrm{FEB}$ TC 25P（ESETA）$\quad 10 \mathrm{MAR}-14 \mathrm{MAR}$ TC 27P（FILD） 14 APR TC 29P（GINA）04JUN－ 08 JUN

## Tropical Cyclone (TC) 01S

| First Poor : N/A |
| :--- |
| First Fair : 1500 Z 05 Sep 02 |
| First TCFA : N/A |
| First Warning : 1800Z 06 Sep 02 |
| Last Warning : 0600 Z 08 Sep 02, Dissipated |
| Max Intensity : 35 kts, gusts to 45 kts |
| Landfall : None |
| Total Warnings : 4 |
| Remarks: |
| (1) Tropical Cyclone (TC) 01S developed in a near-equatorial trough at approximately 5 |
| September, 2002 approximately 650 NM west-northwest of Diego Garcia. The cyclone tracked |
| westward over the next 3 days as a weak system that intensified to only 35 knots. No operational |
| impacts and no damage reported. |
| *Named by WMO designated RSMC |

September, 2002, approximately 650 NM west-northwest of Diego Garcia. The cyclone tracked westward over the next 3 days as a weak system that intensified to only 35 knots. No operational impacts and no damage reported.
*Named by WMO designated RSMC

Statistics for JTWC on TC01S

| 02090512 |  | 3.5S | 62.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 02090518 |  | 3.5S | 61.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090600 |  | 3.5S | 60.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090606 |  | 3.6S | 59.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090612 |  | 3.7S | 58.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090618 | 1 | 4.0S | 58.1E | 35 | 11 | 6 | 30 | 73 |  |  |  |  | 0 | 0 |  | 0 | 0 |  |  |  |  |
| 02090706 | 2 | 4.2 S | 56.3E | 35 | 11 | 18 | 68 |  |  |  |  |  | 0 | 0 |  | 0 |  |  |  |  |  |
| 02090718 | 3 | 4.2S | 54.9E | 30 | 11 | 24 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |
| 02090806 | 4 | 4.2 S | 53.9E | 25 | 8 |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 11 | 16 | 49 | 73 |  |  |  |  | 1 | 0 |  | 0 | 0 |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 0 |  | 0 | 0 |  |  |  |  |
|  |  |  | \# CASES |  | 4 | 3 | 2 | 1 |  |  |  |  | 4 | 3 |  | 2 | 1 |  |  |  |  |




Figure 2-01S-1. $061408 Z$ September 2003 multi-sensor satellite images of TC 01S, located 855 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

## TROPICAL CYCLONE 01S <br> 06-08 SEP 2002



## Time Intensity for 01S

## Intensity (kts)

|  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |

## Tropical Cyclone (TC) 01S

$\square$
First Poor : N/A
First Fair : 1500Z 05 Sep 02
First TCFA : N/A

First Warning : 1800Z 06 Sep 02
Last Warning : 0600Z 08 Sep 02, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : 4
Remarks:
(1) Tropical Cyclone (TC) 01S developed in a near-equatorial trough at approximately 5

September, 2002, approximately 650 NM west-northwest of Diego Garcia. The cyclone tracked westward over the next 3 days as a weak system that intensified to only 35 knots. No operational impacts and no damage reported.
*Named by WMO designated RSMC

| Statistics for JTWC on TC01S |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SI | TI | ON | ER | ROR |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 1 | 2 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02090512 |  | 3.5S | 62.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090518 |  | 3.5S | 61.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090600 |  | 3.5S | 60.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090606 |  | 3.6S | 59.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090612 |  | 3.7S | 58.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02090618 | 1 | 4.0S | 58.1E | 35 | 11 | 6 |  | 30 | 73 |  |  |  |  | 0 | 0 | 0 | 0 |  |  |  |  |
| 02090706 | 2 | 4.2 S | 56.3E | 35 | 11 | 18 | 8 | 68 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 02090718 | 3 | 4.2 S | 54.9E | 30 | 11 | 2 |  |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 02090806 | 4 | 4.2S | 53.9E | 25 | 8 |  |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 11 | 16 |  | 49 | 73 |  |  |  |  | 1 | 0 | 0 | 0 |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  |  | 1 | 0 | 0 | 0 |  |  |  |  |
|  |  |  | \# CASES |  | 4 | 3 |  |  | 1 |  |  |  |  | 4 | 3 | 2 | 1 |  |  |  |  |



Figure 2-01S-1. $061408 Z$ September 2003 multi-sensor satellite images of TC 01S, located 855 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.

## TROPICAL CYCLONE 01S

## 06-08 SEP 2002



Time Intensity for 01S
Intensity (kts)


## Tropical Cyclone (TC) 02S (Atang)*

First Poor : $1100 Z 03$ Nov 02

First Fair : 1800Z 03 Nov 02
First TCFA : $2100 Z 03$ Nov 02
First Warning : 0600Z 06 Nov 02
Last Warning : 0000Z 13 Nov 02, Dissipated
Max Intensity : 45 kts, gusts to 55 kts
Landfall : Southeastern coast of Tanzania

Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 02 S initially developed approximately 1,150 NM east-northeast of the northern tip of Madagascar. The system reached a maximum intensity of 45 kts on 06 November at 1800Z. A final warning was issued for TC 02S on 07 November and then the TC regenerated back into warning status on 09 November at 0600Z. The cyclone was finaled a second time on 10 November at 1800 Z when the system was located approximately 50 NM northwest of Madagascar. The cyclone regenerated again as it entered into the warmer waters of the Mozambique Channel and was subsequently finaled on 13 November at 00002.
(2) TC 02S made landfall on the southeastern coast of Tanzania, however no reports of damage were available.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02110306 |  | 6.6S | 69.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110312 |  | 6.85 | 68.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110318 |  | 6.95 | 67.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110400 |  | 7.25 | 66.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110406 |  | 7.5S | 64.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110412 |  | 7.6S | 63.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110418 |  | 7.65 | 62.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110500 |  | 7.6S | 61.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110506 |  | 7.8 S | 60.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110512 |  | 8.15 | 60.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110518 |  | 8.4S | 59.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110600 |  | 8.8S | 59.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110606 | 1 | 9.15 | 59.5E | 35 | 29 | 62 | 121 | 126 | 133 |  |  |  | 0 | -10 | 0 | 5 | 15 |  |  |  |
| 02110618 | 2 | 9.25 | 58.9E | 45 | 37 | 102 | 114 | 121 | 72 |  |  |  | 0 | 20 | 20 | 30 | 30 |  |  |  |
| 02110706 | 3 | 8.5S | 58.0E | 35 | 47 | 109 | 176 | 178 | 136 |  |  |  | 0 | 5 | 15 | 15 | 0 |  |  |  |
| 02110718 | 4 | 8.45 | 56.1E | 35 | 0 | 43 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 02110906 | 5 | 10.5S | 52.0E | 35 | 29 | 98 | 45 | 65 | 130 |  |  |  | 0 | 0 | 0 | 15 | 5 |  |  |  |
| 02110918 | 6 | 11.5S | 50.9E | 35 | 34 | 134 | 201 | 208 | 172 |  |  |  | 0 | -10 | 5 | -5 | -10 |  |  |  |
| 02111006 | 7 | 11.4S | 49.6E | 35 | 42 | 108 | 161 | 152 | 223 |  |  |  | 0 | 10 | -5 | -10 | -5 |  |  |  |
| 02111018 | 8 | 11.2S | 48.1E | 20 | 47 | 7113 |  |  |  |  |  |  | 0 | -15 |  |  |  |  |  |  |
| 02111112 | 9 | 11.6S | 44.8E | 35 | 17 | 138 | 129 | 151 |  |  |  |  | 0 | -5 | -5 | -5 |  |  |  |  |
| 02111200 | 10 | 11.5S | 42.7E | 35 | 18 | 108 | 104 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 02111212 | 11 | 10.2S | 41.1E | 30 | 21 | 170 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |
| 02111300 | 12 | 10.2S | 39.4E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 28 | 85 | 132 | 143 | 144 |  |  |  | 0 | 8 | 7 | 12 | 11 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | 3 | 6 | 6 |  |  |  |
|  |  |  | \# CASE |  | 12 | 1211 | 8 | 7 | 6 |  |  |  | 12 | 11 | 8 | 7 | 6 |  |  |  |



Figure 2-02S-1. 061200Z November 2002 met-5 visible satellite image of TC 02S (Atang), 705 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.


Figure 2-02S-2. 072256Z November 2002 multi-sensor satellite images of TC 02S (Atang), 975 nm west of Diego Garcia, with an estimated intensity of 45 knots.

## TROPICAL CYCLONE 02S (ATANG) <br> 06-13 NOV 2002



## Time Intensity for 02S

## Intensity (kts)



Fix Date (Zulu)

## Tropical Cyclone (TC) 02S (Atang)*



First Poor: 1100Z 03 Nov 02

First Fair : 1800Z 03 Nov 02
First TCFA : $2100 Z 03$ Nov 02
First Warning : 0600Z 06 Nov 02

Last Warning : 0000Z 13 Nov 02, Dissipated
Max Intensity : 45 kts, gusts to 55 kts
Landfall : Southeastern coast of Tanzania
Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 02 S initially developed approximately $1,150 \mathrm{NM}$ east-northeast of the northern tip of Madagascar. The system reached a maximum intensity of 45 kts on 06 November at 1800Z. A final warning was issued for TC 02 S on 07 November and then the TC regenerated back into warning status on 09 November at 0600Z. The cyclone was finaled a second time on 10 November at 1800 Z when the system was located approximately 50 NM northwest of Madagascar. The cyclone regenerated again as it entered into the warmer waters of the Mozambique Channel and was subsequently finaled on 13 November at 0000Z.
(2) TC 02S made landfall on the southeastern coast of Tanzania, however no reports of damage were available.

[^2]|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02110306 |  | 6.65 | 69.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110312 |  | 6.8S | 68.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110318 |  | 6.95 | 67.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110400 |  | 7.25 | 66.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110406 |  | 7.5S | 64.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110412 |  | 7.6S | 63.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110418 |  | 7.6S | 62.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110500 |  | 7.6S | 61.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110506 |  | 7.8S | 60.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110512 |  | 8.1S | 60.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110518 |  | 8.4S | 59.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110600 |  | 8.8S | 59.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02110606 | 1 | 9.1S | 59.5E | 35 | 29 | 62 | 121 | 126 | 133 |  |  |  | 0 | -10 | 0 | 5 | 15 |  |  |  |
| 02110618 | 2 | 9.25 | 58.9E | 45 | 37 | 102 | 114 | 121 | 72 |  |  |  | 0 | 20 | 20 | 30 | 30 |  |  |  |
| 02110706 | 3 | 8.5S | 58.0E | 35 | 47 | 109 | 176 | 178 | 136 |  |  |  | 0 | 5 | 15 | 15 | 0 |  |  |  |
| 02110718 | 4 | 8.4S | 56.1E | 35 | 0 | 43 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 02110906 | 5 | 10.5S | 52.0E | 35 | 29 | 48 | 45 | 65 | 130 |  |  |  | 0 | 0 | 0 | 15 | 5 |  |  |  |
| 02110918 | 6 | 11.5S | 50.9E | 35 | 34 | 134 | 201 | 208 | 172 |  |  |  | 0 | -10 | 5 | -5 | -10 |  |  |  |
| 02111006 | 7 | 11.4S | 49.6E | 35 | 42 | 108 | 161 | 152 | 223 |  |  |  | 0 | 10 | -5 | -10 | -5 |  |  |  |
| 02111018 | 8 | 11.2S | 48.1E | 20 | 47 | 113 |  |  |  |  |  |  | 0 | -15 |  |  |  |  |  |  |
| 02111112 | 9 | 11.6 S | 44.8E | 35 | 17 | 38 | 129 | 151 |  |  |  |  | 0 | -5 | -5 | -5 |  |  |  |  |
| 02111200 | 10 | 11.5 S | 42.7E | 35 | 18 | 108 | 104 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 02111212 | 11 | 10.2 S | 41.1E | 30 | 21 | 70 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |
| 02111300 | 12 | 10.2 S | 39.4E | 25 | 11 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 28 | 85 | 132 | 143 | 144 |  |  |  | 0 | 8 | 7 | 12 | 11 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | 3 | 6 | 6 |  |  |  |
|  |  |  | \# CASE |  | 12 | 11 | 8 | 7 | 6 |  |  |  | 12 | 11 | 8 | 7 | 6 |  |  |  |



Figure 2-02S-1. 061200Z November 2002 met-5 visible satellite image of TC 02S (Atang), 705 nm northwest of Diego Garcia, with an estimated intensity of 35 knots.


Figure 2-02S-2. $072256 Z$ November 2002 multi-sensor satellite images of TC 02S (Atang), 975 nm west of Diego Garcia, with an estimated intensity of 45 knots.

TROPICAL CYCLONE 02S (ATANG)
06-13 NOV 2002


Time Intensity for 02S
Intensity (kts)


[^3]Fix Date (Zulu)

## Tropical Cyclone (TC) 03 S (Boura)*

First Poor : 1800Z 14 Nov 02
First Fair : 2300Z 14 Nov 02
First TCFA : 0830Z 15 Nov 02
First Warning : $1200 Z 15$ Nov 02
Last Warning : 0000Z 22 Nov 02, Dissipated
Max Intensity : 75 kts, gusts to 90 kts
Landfall : None
Total Warnings : 22
Remarks:
(1) Tropical Cyclone (TC) 03 S was first noted as a tropical disturbance on 14 November 2002, as it developed in conjunction with an equatorial westerly wind-burst. TC 03S became a significant tropical cyclone approximately 205 nm east-southeast of Diego Garcia. TC 03S tracked southwestward towards Mauritius until 20 November at $18 Z$ under the steering influence of a midlevel subtropical ridge to the southeast. Subsequently, a migatory high moving eastward off of Madagascar caused the cyclone to move northwest until it dissipated under strong vertical wind shear. The remnant low level circulation center to tracked north of Madagascar and dissipated.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02111418 |  | 6.35 | 77.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111500 |  | 7.2S | 77.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111506 |  | 8.1S | 76.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111512 | 1 | 8.8S | 75.8E | 35 | 13 | 17 | 32 | 94 | 141 | 276 |  |  | 0 | 0 | -5 | -10 | -15 | -20 |  |  |
| 02111518 | 2 | 9.4S | 75.0E | 40 | 11 | 43 | 99 | 169 | 187 | 281 |  |  | 0 | 5 | 5 | -10 | -20 | -15 |  |  |
| 02111600 | 3 | 9.9S | 74.1E | 40 | 25 | 34 | 88 | 132 | 144 | 231 |  |  | 0 | 0 | -5 | -15 | -25 | -15 |  |  |
| 02111606 | 4 | 10.4 S | 73.3E | 40 | 5 | 42 | 77 | 89 | 106 | 151 |  |  | 0 | 0 | -15 | -25 | -20 | -15 |  |  |
| 02111612 | 5 | 10.8S | 72.5E | 45 | 0 | 42 | 51 | 42 | 72 | 153 |  |  | 0 | -5 | -10 | -15 | -10 | -10 |  |  |
| 02111618 | 6 | 11.3 S | 71.5E | 45 | 39 | 63 | 59 | 69 | 72 | 152 |  |  | 0 | -15 | -20 | -15 | -10 | -15 |  |  |
| 02111700 | 7 | 11.6 S | 70.4E | 55 | 67 | 77 | 64 | 88 | 71 | 159 |  |  | -5 | -10 | -15 | -10 | -10 | -15 |  |  |
| 02111706 | 8 | 12.1S | 69.5E | 65 | 5 | 24 | 26 | 70 | 59 | 112 |  |  | 0 | -5 | 0 | 0 | 0 | 5 |  |  |
| 02111712 | 9 | 12.7S | 68.8E | 65 | 0 | 36 | 23 | 47 | 49 | 116 |  |  | 0 | -5 | 0 | 0 | -5 | -10 |  |  |
| 02111718 | 10 | 13.1S | 68.2E | 75 | 11 | 42 | 59 | 67 | 27 | 103 |  |  | 0 | 5 | 5 | 5 | 0 | 10 |  |  |
| 02111800 | 11 | 13.4S | 67.5E | 75 | 12 | 44 | 54 | 31 | 43 | 117 |  |  | 0 | 5 | 0 | -5 | -5 | 15 |  |  |
| 02111806 | 12 | 13.6 S | 66.5E | 75 | 11 | 13 | 18 | 75 | 96 | 97 |  |  | 0 | 0 | 0 | -5 | 5 | 20 |  |  |
| 02111812 | 13 | 13.7S | 65.5E | 75 | 6 | 25 | 37 | 48 | 83 | 65 |  |  | 0 | -5 | -5 | -10 | -10 | 20 |  |  |
| 02111818 | 14 | 13.75 | 64.7E | 75 | 0 | 12 | 64 | 104 | 139 | 164 |  |  | 0 | -5 | -5 | 0 | 0 | 25 |  |  |
| 02111900 | 15 | 13.7S | 63.8E | 75 | 5 | 36 | 68 | 112 | 137 | 147 |  |  | 0 | -5 | -5 | -10 | 10 | 25 |  |  |
| 02111906 | 16 | 13.8 S | 62.8E | 75 | 6 | 61 | 92 | 122 | 106 | 101 |  |  | 0 | 0 | 5 | 0 | 20 | 25 |  |  |
| 02111912 | 17 | 14.4S | 62.0E | 75 | 5 | 13 | 42 | 63 | 76 | 88 |  |  | 0 | -5 | -5 | 15 | 20 | 25 |  |  |
| 02112000 | 18 | 15.0S | 59.9E | 75 | 6 | 54 | 76 | 83 | 89 |  |  |  | 0 | -5 | 15 | 25 | 30 |  |  |  |
| 02112012 | 19 | 15.6 S | 58.3E | 75 | 23 | 37 | 63 | 78 | 97 |  |  |  | -10 | 5 | 10 | 15 | 10 |  |  |  |
| 02112100 | 20 | 15.5S | 56.8E | 55 | 30 | 78 | 126 | 168 | 216 |  |  |  | 10 | 15 | 20 | 15 | 20 |  |  |  |
| 02112112 | 21 | 14.8S | 55.4E | 45 | 0 | 19 | 51 | 86 | 158 |  |  |  | 0 | 0 | 0 | 0 | 0 |  |  |  |
| 02112200 | 22 | 13.8S | 54.2E | 35 | 18 | 27 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 02112206 |  | 13.2S | 53.6E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112212 |  | 12.8S | 53.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112218 |  | 12.35 | 52.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112300 |  | 11.7S | 51.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112306 |  | 11.0S | 51.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112312 |  | 10.5S | 51.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 02112318 |  | 10.1 S | 50.9 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 02112400 |  | 9.5 S | 50.9 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



Figure 2-03S-1. $171657 Z$ November 2002 TRMM color composite of TC 03S (Boura), 410 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.


Figure 2-03S-2. $181407 Z$ November 2002 enhanced infrared image of TC 03S (Boura), 555 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.

TROPICAL CYCLONE 03S (BOURA)

## 15-22 NOV 2002



## Time Intensity for 03S

## Intensity (kts)



## Tropical Cyclone (TC) 03 (Boura)*

First Poor: 1800Z 14 Nov 02

First Fair : 2300Z 14 Nov 02
First TCFA : 0830Z 15 Nov 02

First Warning : 1200Z 15 Nov 02

Last Warning : 0000Z 22 Nov 02, Dissipated
Max Intensity : 75 kts, gusts to 90 kts
Landfall : None

Total Warnings : 22
Remarks:
(1) Tropical Cyclone (TC) 03S was first noted as a tropical disturbance on 14 November 2002, as it developed in conjunction with an equatorial westerly wind-burst. TC 03S became a significant tropical cyclone approximately 205 nm east-southeast of Diego Garcia. TC 03S tracked southwestward towards Mauritius until 20 November at $18 Z$ under the steering influence of a midlevel subtropical ridge to the southeast. Subsequently, a migatory high moving eastward off of Madagascar caused the cyclone to move northwest until it dissipated under strong vertical wind shear. The remnant low level circulation center to tracked north of Madagascar and dissipated.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

## Statistics for JTWC on TC03S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02111418 |  | 6.35 | 77.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111500 |  | 7.2S | 77.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111506 |  | 8.15 | 76.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02111512 | 1 | 8.8S | 75.8E | 35 | 13 | 17 | 32 | 94 | 141 | 276 |  |  | 0 | 0 | -5 | -10 | -15 | -20 |  |  |
| 02111518 | 2 | 9.45 | 75.0E | 40 | 11 | 43 | 99 | 169 | 187 | 281 |  |  | 0 | 5 | 5 | -10 | -20 | -15 |  |  |
| 02111600 | 3 | 9.95 | 74.1E | 40 | 25 | 34 | 88 | 132 | 144 | 231 |  |  | 0 | 0 | -5 | -15 | -25 | -15 |  |  |
| 02111606 | 4 | 10.4S | 73.3E | 40 | 5 | 42 | 77 | 89 | 106 | 151 |  |  | 0 | 0 | -15 | -25 | -20 | -15 |  |  |
| 02111612 | 5 | 10.8S | 72.5E | 45 | 0 | 42 | 51 | 42 | 72 | 153 |  |  | 0 | -5 | -10 | -15 | -10 | -10 |  |  |
| 02111618 | 6 | 11.3S | 71.5E | 45 | 39 | 63 | 59 | 69 | 72 | 152 |  |  | 0 | -15 | -20 | -15 | -10 | -15 |  |  |
| 02111700 | 7 | 11.6 S | 70.4E | 55 | 67 | 77 | 64 | 88 | 71 | 159 |  |  | -5 | -10 | -15 | -10 | -10 | -15 |  |  |
| 02111706 | 8 | 12.1S | 69.5E | 65 | 5 | 24 | 26 | 70 | 59 | 112 |  |  | 0 | -5 | 0 | 0 | 0 | 5 |  |  |
| 02111712 | 9 | 12.7S | 68.8E | 65 | 0 | 36 | 23 | 47 | 49 | 116 |  |  | 0 | -5 | 0 | 0 | -5 | -10 |  |  |
| 02111718 | 10 | 13.1S | 68.2E | 75 | 11 | 42 | 59 | 67 | 27 | 103 |  |  | 0 | 5 | 5 | 5 | 0 | 10 |  |  |
| 02111800 | 11 | 13.4S | 67.5E | 75 | 12 | 44 | 54 | 31 | 43 | 117 |  |  | 0 | 5 | 0 | -5 | -5 | 15 |  |  |
| 02111806 | 12 | 13.6S | 66.5E | 75 | 11 | 13 | 18 | 75 | 96 | 97 |  |  | 0 | 0 | 0 | -5 | 5 | 20 |  |  |
| 02111812 | 13 | 13.7S | 65.5E | 75 | 6 | 25 | 37 | 48 | 83 | 65 |  |  | 0 | -5 | -5 | -10 | -10 | 20 |  |  |
| 02111818 | 14 | 13.7S | 64.7E | 75 | 0 | 12 | 64 | 104 | 139 | 164 |  |  | 0 | -5 | -5 | 0 | 0 | 25 |  |  |
| 02111900 | 15 | 13.7S | 63.8E | 75 | 5 | 36 | 68 | 112 | 137 | 147 |  |  | 0 | -5 | -5 | -10 | 10 | 25 |  |  |
| 02111906 | 16 | 13.8S | 62.8E | 75 | 6 | 61 | 92 | 122 | 106 | 101 |  |  | 0 | 0 | 5 | 0 | 20 | 25 |  |  |
| 02111912 | 17 | 14.4S | 62.0E | 75 | 5 | 13 | 42 | 63 | 76 | 88 |  |  | 0 | -5 | -5 | 15 | 20 | 25 |  |  |
| 02112000 | 18 | 15.0S | 59.9E | 75 | 6 | 54 | 76 | 83 | 89 |  |  |  | 0 | -5 | 15 | 25 | 30 |  |  |  |
| 02112012 | 19 | 15.6S | 58.3E | 75 | 23 | 37 | 63 | 78 | 97 |  |  |  | -10 | 5 | 10 | 15 | 10 |  |  |  |
| 02112100 | 20 | 15.5S | 56.8E | 55 | 30 | 78 | 126 | 168 | 216 |  |  |  | 10 | 15 | 20 | 15 | 20 |  |  |  |
| 02112112 | 21 | 14.8S | 55.4E | 45 | 0 | 19 | 51 | 86 | 158 |  |  |  | 0 | 0 | 0 | 0 | 0 |  |  |  |
| 02112200 | 22 | 13.8S | 54.2E | 35 | 18 | 27 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 02112206 |  | 13.2 S | 53.6E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112212 |  | 12.8 S | 53.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112218 |  | 12.3S | 52.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112300 |  | 11.7S | 51.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112306 |  | 11.0S | 51.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112312 |  | 10.5S | 51.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112318 |  | 10.1S | 50.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 02112400 | 9.5 S | 50.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 02112406 | 9.15 | 50.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112412 | 8.7S | 50.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112418 | 8.4S | 49.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112500 | 8.15 | 49.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112506 | 7.85 | 48.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02112512 | 7.5S | 48.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | AVERAGE |  | 14 | 38 | 61 | 88 | 103 | 148 |  | 1 | 5 |  | 7 | 10 | 12 | 17 |  |  |
|  |  | BIAS |  |  |  |  |  |  |  |  | 0 |  | 2 | -1 | -3 | -1 | 3 |  |  |
|  |  | \# CASE |  | 22 | 22 | 21 | 21 | 21 | 17 |  | 22 |  | 22 | 21 | 21 | 21 | 17 |  |  |



Figure 2-03S-1. $171657 Z$ November 2002 TRMM color composite of TC $03 S$ (Boura), 410 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.


Figure 2-03S-2. $181407 Z$ November 2002 enhanced infrared image of TC $03 S$ (Boura), 555 nm southwest of Diego Garcia, with an estimated intensity of 75 knots.


Time Intensity for 03S


## Tropical Cyclone (TC) 04P (Yolande)*

First Poor : 0600Z 30 Nov 02

First Fair : 2300Z 03 Dec 02
First TCFA : $1130 Z 04$ Dec 02
First Warning : 1800Z 04 Dec 02
Last Warning : 0600Z 05 Dec 02, Extratropical
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : 2
Remarks:
(1) The first satellite fix for Tropical Cyclone (TC) 04P occurred on 30 November in a cluster of convective cells embedded within the South Pacific Convergence Zone northeast of Fiji. Only two warnings were issued by JTWC for this system as it quickly transitioned to an extratropical low. TC 04P was a short-lived system whose entire life cycle occurred over open water with no damage or operational impacts reported.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02120106 |  | 13.25 | 178.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120112 |  | 13.5S | 178.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120118 |  | 13.8 S | 177.6W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120200 |  | 14.1S | 177.2W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120206 |  | 14.7S | 177.2W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120212 |  | 15.1S | 177.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120218 |  | 15.35 | 177.5W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120300 |  | 15.5S | 177.6W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120306 |  | 15.65 | 177.8W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120312 |  | 15.7S | 178.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120318 |  | 16.05 | 178.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120400 |  | 16.7S | 178.1W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120406 |  | 17.8S | 177.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120412 |  | 19.1S | 176.3W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120418 | 1 | 19.8S | 175.1W | 35 | 0 | 57 |  |  |  |  |  |  | 5 | 0 |  |  |  |  |  |  |
| 02120506 | 2 | 21.15 | 172.7W | 35 | 12 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 02120512 |  | 21.2 S | 171.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  |  | 57 |  |  |  |  |  |  | 3 | 0 |  |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 3 | 0 |  |  |  |  |  |  |
|  |  |  | \# CASE |  |  | 1 |  |  |  |  |  |  |  | 1 |  |  |  |  |  |  |



Figure 2-04P-1. 040924Z December 2002 multi-sensor satellite images of TC 04P (Yolande), 385 nm southwest of Pago Pago, with an estimated peak intensity of 40 knots.

## TROPICAL CYCLONE 04P (YOLANDE) <br> 04-05 DEC 2002



## Time Intensity for 04P



## Tropical Cyclone (TC) 04P (Yolande)*



First Poor : 0600Z 30 Nov 02

First Fair : 2300Z 03 Dec 02
First TCFA : 1130Z 04 Dec 02

First Warning : 1800Z 04 Dec 02

Last Warning : 0600Z 05 Dec 02, Extratropical
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : 2
Remarks:
(1) The first satellite fix for Tropical Cyclone (TC) 04P occurred on 30 November in a cluster of convective cells embedded within the South Pacific Convergence Zone northeast of Fiji. Only two warnings were issued by JTWC for this system as it quickly transitioned to an extratropical low. TC 04P was a short-lived system whose entire life cycle occurred over open water with no damage or operational impacts reported.
*Named by WMO designated RSMC

## Statistics for JTWC on TC04P

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02120106 |  | 13.2S | 178.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120112 |  | 13.5S | 178.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120118 |  | 13.8S | 177.6W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120200 |  | 14.1S | 177.2W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120206 |  | 14.7S | 177.2W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120212 |  | 15.1S | 177.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120218 |  | 15.3S | 177.5W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120300 |  | 15.5S | 177.6W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120306 |  | 15.6S | 177.8W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120312 |  | 15.7S | 178.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120318 |  | 16.0S | 178.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120400 |  | 16.7S | 178.1W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120406 |  | 17.8S | 177.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120412 |  | 19.1S | 176.3W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02120418 | 1 | 19.8S | 175.1W | 35 | 0 | 57 |  |  |  |  |  |  | 5 | 0 |  |  |  |  |  |  |
| 02120506 | 2 | 21.1S | 172.7W | 35 | 12 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 02120512 |  | 21.2S | 171.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 6 | 57 |  |  |  |  |  |  | 3 | 0 |  |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 3 | 0 |  |  |  |  |  |  |
|  |  |  | \# CASE |  | 2 | 1 |  |  |  |  |  |  | 2 | 1 |  |  |  |  |  |  |



Figure 2-04P-1. $040924 Z$ December 2002 multi-sensor satellite images of TC 04P (Yolande), 385 nm southwest of Pago Pago, with an estimated peak intensity of 40 knots.

TROPICAL CYCLONE 04P (YOLANDE)


Time Intensity for 04P
Intensity (kts)


Fix Date (Zulu)

# Tropical Cyclone (TC) 05S (Crystal)* 

First Poor : 0500Z 21 Dec 02

First Fair : 1800Z 22 Dec 02
First TCFA : 0200Z 23 Dec 02
First Warning : 1200Z 23 Dec 02
Last Warning : 0000Z 29 Dec 02, Extratropical
Max Intensity : 90 kts, gusts to 110 kts
Landfall : None
Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 05S was initially described as an area of disturbed weather 145 nm west of Diego Garcia on 21 December, 2002. TC 05S tracked southwestward under the influence of the low to mid-level steering ridge located southeast of the system as it intensified at near a Dvorak Tnumber per day.

By 0000Z on 25 December, microwave satellite imagery indicated some minor dry air entrainment into the system from the west, with a banding eye feature present. A longwave trough in the midtropospheric westerlies began deepening over the Mozambique Channel, and tracking eastward. This trough began to weaken the steering ridge southeast of TC 05S, creating a more poleward track by $0000 Z$ on 26 December. At $1800 Z$ on 26 December, TC 05S reached a maximum intensity of 90 knots while tracking southward and at 0000Z on 27 December, TC 05S passed 118 nm east of Mauritius. By 0000Z on 28 December, there was no longer an eye feature visible and the cyclone had begun extratropical transition and was finaled 24 hours later as an extratropical system.
(2) Despite having passed within 50 nm of St . Brandon and 118 nm of Mauritius, there were no reports of significant damage caused by this system.

## *Named by WMO designated RSMC

## Statistics for JTWC on TC05S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02122206 |  | 7.9S | 69.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122212 |  | 8.4S | 68.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122218 |  | 9.0S | 68.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122300 |  | 9.6S | 67.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122306 |  | 10.3S | 67.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122312 | 1 | 11.0S | 66.5E | 35 | 5 | 21 | 42 | 42 | 26 |  |  |  | 0 | -5 | -10 | -15 | -10 |  |  |  |
| 02122400 | 2 | 12.3S | 65.0E | 45 | 11 | 8 | 33 | 50 | 55 |  |  |  | 0 | 0 | 0 | 5 | 20 |  |  |  |
| 02122412 | 3 | 13.5S | 63.4E | 55 | 11 | 8 | 6 | 32 | 72 |  |  |  | 0 | 0 | 0 | 15 | 15 |  |  |  |
| 02122500 | 4 | 14.5S | 62.2E | 65 | 17 | 25 | 42 | 60 | 38 |  |  |  | 0 | 0 | 15 | 10 | 5 |  |  |  |
| 02122512 | 5 | 15.6S | 61.2E | 75 | 6 | 38 | 61 | 77 | 84 |  |  |  | 0 | 15 | 5 | -15 | -20 |  |  |  |
| 02122600 | 6 | 16.95 | 60.2E | 70 | 12 | 6 | 25 | 43 | 69 |  |  |  | 0 | -10 | -30 | -30 | -25 |  |  |  |
| 02122612 | 7 | 18.4S | 59.7E | 80 | 8 | 6 | 8 | 20 | 36 |  |  |  | -10 | -25 | -30 | -25 | -20 |  |  |  |
| 02122700 | 8 | 19.95 | 59.5E | 90 | 5 | 8 | 12 | 42 | 25 |  |  |  | 0 | 0 | 0 | 5 | 30 |  |  |  |
| 02122712 | 9 | 21.5S | 59.9E | 90 | 8 | 22 | 26 | 43 |  |  |  |  | -10 | -10 | -10 | 15 |  |  |  |  |
| 02122800 | 10 | 23.2S | 60.6E | 80 | 33 | 80 | 72 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 02122812 | 11 | 25.0S | 61.1E | 70 | 8 | 20 |  |  |  |  |  |  | 0 | 20 |  |  |  |  |  |  |
| 02122900 | 12 | 26.6S | 62.9E | 40 | 20 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 22 | 33 | 46 | 51 |  |  |  | 2 | 8 | 12 | 15 | 18 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -1 | -5 | -4 | -1 |  |  |  |
|  |  |  | \# CASE |  | 12 | 11 | 10 | 9 | 8 |  |  |  | 12 | 11 | 10 | 9 | 8 |  |  |  |



Figure 2-05S-1. 270300 Z December 2002 MET-5 visible image of TC $05 S$ (Crystal), 135 nm east of Mauritius island, with an estimated peak intensity of 90 knots.


Figure 2-05S-2. 270630Z December 2002 MODIS true-color image of TC 05S (Crystal), located 125 nm east-southeast of Mauritius, with an maximum intensity of 90 knots.

## TROPICAL CYCLONE 05S (CRYSTAL) <br> 23-29 DEC 2002



## Time Intensity for 05S

## Intensity (kts)



# Tropical Cyclone (TC) 05S (Crystal)* 

First Poor : 0500Z 21 Dec 02

First Fair : 1800Z 22 Dec 02
First TCFA : 0200Z 23 Dec 02

First Warning : 1200Z 23 Dec 02
Last Warning : 0000Z 29 Dec 02, Extratropical
Max Intensity : 90 kts, gusts to 110 kts
Landfall : None
Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 05 S was initially described as an area of disturbed weather 145 nm west of Diego Garcia on 21 December, 2002. TC 05S tracked southwestward under the influence of the low to mid-level steering ridge located southeast of the system as it intensified at near a Dvorak Tnumber per day.

By 0000Z on 25 December, microwave satellite imagery indicated some minor dry air entrainment into the system from the west, with a banding eye feature present. A longwave trough in the midtropospheric westerlies began deepening over the Mozambique Channel, and tracking eastward. This trough began to weaken the steering ridge southeast of TC 05S, creating a more poleward track by $0000 Z$ on 26 December. At $1800 Z$ on 26 December, TC 05 S reached a maximum intensity of 90 knots while tracking southward and at 0000Z on 27 December, TC 05S passed 118 nm east of Mauritius. By $0000 Z$ on 28 December, there was no longer an eye feature visible and the cyclone had begun extratropical transition and was finaled 24 hours later as an extratropical system.
(2) Despite having passed within 50 nm of St. Brandon and 118 nm of Mauritius, there were no reports of significant damage caused by this system.

[^4]Statistics for JTWC on TC05S

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02122206 |  | 7.9S | 69.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122212 |  | 8.4S | 68.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122218 |  | 9.05 | 68.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122300 |  | 9.6 S | 67.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122306 |  | 10.3S | 67.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122312 | 1 | 11.0S | 66.5E | 35 | 5 | 21 | 42 | 42 | 26 |  |  |  | 0 | -5 | -10 | -15 | -10 |  |  |  |
| 02122400 | 2 | 12.3S | 65.0E | 45 | 11 | 8 | 33 | 50 | 55 |  |  |  | 0 | 0 | 0 | 5 | 20 |  |  |  |
| 02122412 | 3 | 13.5S | 63.4E | 55 | 11 | 8 | 6 | 32 | 72 |  |  |  | 0 | 0 | 0 | 15 | 15 |  |  |  |
| 02122500 | 4 | 14.5S | 62.2E | 65 | 17 | 25 | 42 | 60 | 38 |  |  |  | 0 | 0 | 15 | 10 | 5 |  |  |  |
| 02122512 | 5 | 15.6S | 61.2E | 75 | 6 | 38 | 61 | 77 | 84 |  |  |  | 0 | 15 | 5 | -15 | -20 |  |  |  |
| 02122600 | 6 | 16.9S | 60.2E | 70 | 12 | 6 | 25 | 43 | 69 |  |  |  | 0 | -10 | -30 | -30 | -25 |  |  |  |
| 02122612 | 7 | 18.4S | 59.7E | 80 | 8 | 6 | 8 | 20 | 36 |  |  |  | -10 | -25 | -30 | -25 | -20 |  |  |  |
| 02122700 | 8 | 19.9S | 59.5E | 90 | 5 | 8 | 12 | 42 | 25 |  |  |  | 0 | 0 | 0 | 5 | 30 |  |  |  |
| 02122712 | 9 | 21.5S | 59.9E | 90 | 8 | 22 | 26 | 43 |  |  |  |  | -10 | -10 | -10 | 15 |  |  |  |  |
| 02122800 | 10 | 23.2S | 60.6E | 80 | 33 | 80 | 72 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 02122812 | 11 | 25.0S | 61.1E | 70 | 8 | 20 |  |  |  |  |  |  | 0 | 20 |  |  |  |  |  |  |
| 02122900 | 12 | 26.6S | 62.9E | 40 | 20 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 22 | 33 | 46 | 51 |  |  |  | 2 | 8 | 12 | 15 | 18 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -1 | -5 | -4 | -1 |  |  |  |
|  |  |  | \# CASE |  | 12 | 11 | 10 |  | 8 |  |  |  | 12 | 11 | 10 | 9 | 8 |  |  |  |



Figure 2-05S-1. $270300 Z$ December 2002 MET-5 visible image of TC 05S (Crystal), 135 nm east of Mauritius island, with an estimated peak intensity of 90 knots.


Figure 2-05S-2. 270630Z December 2002 MODIS true-color image of TC 05 S (Crystal), located 125 nm east-southeast of Mauritius, with an maximum intensity of 90 knots.

## TROPICAL CYCLONE 05S (CRYSTAL)

23-29 DEC 2002


## Time Intensity for 05S

Intensity (kts)


# Tropical Cyclone (TC) 06P (Zoe)* 

First Poor : 0600Z 24 Dec 02

First Fair : 1930Z 24 Dec 02
First TCFA : 0830Z 25 Dec 02
First Warning : 1200Z 25 Dec 02
Last Warning : 0000Z 01 Jan 03, Extratropical
Max Intensity : 155 kts, gusts to 190 kts
Landfall : None
Total Warnings : 14
Remarks:
(1) Tropical Cyclone (TC) 06P was initially detected and described as a tropical disturbance in the South Pacific Convergence Zone on 24 December, 2002. Rapid development of the tropical disturbance due to an excellent poleward outflow channel caused JTWC to issue the first warning by $1200 Z$ on 25 December.

Metsat data indicated that within 24 hours after the initial warning, the cyclone intensified from 35 knots to 75 knots, a rate of 2 Dvorak T-numbers per day. By $1200 Z$ on 27 December, TC 06P had intensified to 155 knots, a rate of 3 Dvorak T-numbers per day. This rapid development occurred due to consistently decreasing vertical wind shear and excellent outflow in all quadrants, especially in the poleward direction. After reaching peak intensity, TC 06P began to slow in track speed, eventually stalling and maintaining an intensity at or above 100 knots. After 0000Z on 30 December, TC 06P recurved towards the southeast as a mid-level trough influenced a weakness in the ridge and the cyclone began rapid extratropical transition. Extratropical transition occurred south-southwest of the Fiji Islands.
(2) TC 06P is noted for its 155 knot maximum intensity and the damage caused when the TC passed near several small islands in the Temotu Province of the Solomon Islands. Damage done by passage of TC 06P was reported as relatively light on the island of Anuta, with most structures remaining intact. Early reports indicated damage was substantial on the island of Tikopia, though
there was no initial loss of life or serious injuries reported. The islands have a combined population of approximately 3,700 individuals. During the first fly-over by a humanitarian mission after communications were lost with the islands, the devastation to the islands was reported as "total". Much of the vegetation used for food or shelter was denuded. Most major structures were damaged or destroyed. All fresh water sources with the exception of a spring accessible only at low tide were contaminated by salt water according to early reports. Based on the traditional lives of the inhabitants, self-sufficiency was not considered likely for Tikopia for several years.

## *Named by WMO designated RSMC

## Statistics for JTWC on TC06P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02122412 |  | 9.0 S | 178.3W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122418 |  | 9.75 | 179.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122500 |  | 10.4S | 180.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122506 |  | 10.8S | 178.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122512 | 1 | 10.8S | 177.6E | 35 | 13 | 65 | 80 | 81 | 77 |  |  |  | 0 | -10 | -25 | -35 | -90 |  |  |  |
| 02122600 | 2 | 10.7S | 175.4E | 55 | 11 | 37 | 77 | 85 | 122 |  |  |  | 0 | -10 | -20 | -70 | -65 |  |  |  |
| 02122612 | 3 | 10.8S | 174.0E | 75 | 17 | 30 | 31 | 46 | 41 |  |  |  | 0 | 0 | -50 | -45 | -30 |  |  |  |
| 02122700 | 4 | 11.2S | 172.5E | 95 | 8 | 26 | 13 | 24 | 31 |  |  |  | 0 | -45 | -30 | -20 | 0 |  |  |  |
| 02122712 | 5 | 11.7S | 170.7E | 155 | 5 | 32 | 50 | 80 | 96 |  |  |  | 0 | 10 | 25 | 45 | 55 |  |  |  |
| 02122800 | 6 | 12.1S | 169.9E | 155 | 8 | 13 | 55 | 75 | 97 |  |  |  | 0 | 10 | 35 | 45 | 40 |  |  |  |
| 02122812 | 7 | 12.4 S | 169.2E | 145 | 6 | 59 | 71 | 77 | 91 |  |  |  | 0 | 20 | 30 | 25 | 40 |  |  |  |
| 02122900 | 8 | 12.7S | 169.5E | 120 | 0 | 13 | 6 | 23 | 58 |  |  |  | 0 | 10 | 5 | 10 | 20 |  |  |  |
| 02122912 | 9 | 13.5S | 170.4E | 100 | 8 | 21 | 50 | 56 | 54 |  |  |  | 0 | -5 | 5 | 10 | 0 |  |  |  |
| 02123000 | 10 | 14.4S | 171.5E | 95 | 8 | 25 | 55 | 41 | 36 |  |  |  | 0 | 5 | 20 | 5 | 0 |  |  |  |
| 02123012 | 11 | 15.5S | 172.3E | 75 | 57 | 70 | 29 | 41 |  |  |  |  | 0 | 10 | 5 | 0 |  |  |  |  |
| 02123100 | 12 | 16.8S | 173.4E | 55 | 26 | 79 | 111 |  |  |  |  |  | 0 | -10 | -10 |  |  |  |  |  |
| 02123112 | 13 | 18.6S | 174.8E | 50 | 38 | 62 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |


| 03010100 | 14 | 20.7S | 175.2E | 45 | 34 |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03010106 |  | 21.9S | 175.9E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 41 | 52 | 5 |  | 0 |  | 0 | 12 | 22 | 28 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  | 0 | -1 | -1 | -3 | -3 |  |  |  |
|  |  |  | \# CASE |  | 14 | 13 | 12 | 1 |  | 10 |  | 14 | 13 | 12 | 11 | 10 |  |  |  |



Figure 2-06P-1. $280400 Z$ December 2002 GMS-5 visible imagery of TC 06P (Zoe), 230 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 150 knots.



Figure 2-06P-2. $281013 Z$ December 200285 GHz SSM/I imagery of TC 06P (Zoe), 210 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 155 knots.


Figure 2-06P-3. 292240Z December 2002 MODIS true-color image of TC 06P (Zoe), located 240 nm east-northeast of Port Vila, Vanuatu, with an intensity of 100 knots.

TROPICAL CYCLONE 06P (ZOE) 25 DEC 2002--01 JAN 2003


Time Intensity for 06P

## Intensity (kts)



## Tropical Cyclone (TC) 06P (Zoe)*

First Poor : 0600Z 24 Dec 02

First Fair : 1930Z 24 Dec 02
First TCFA : 0830Z 25 Dec 02
First Warning : 1200Z 25 Dec 02
Last Warning : 0000Z 01 Jan 03, Extratropical
Max Intensity : 155 kts, gusts to 190 kts
Landfall : None
Total Warnings : 14
Remarks:
(1) Tropical Cyclone (TC) 06P was initially detected and described as a tropical disturbance in the South Pacific Convergence Zone on 24 December, 2002. Rapid development of the tropical disturbance due to an excellent poleward outflow channel caused JTWC to issue the first warning by $1200 Z$ on 25 December.

Metsat data indicated that within 24 hours after the initial warning, the cyclone intensified from 35 knots to 75 knots, a rate of 2 Dvorak T-numbers per day. By $1200 Z$ on 27 December, TC 06P had intensified to 155 knots, a rate of 3 Dvorak T-numbers per day. This rapid development occurred due to consistently decreasing vertical wind shear and excellent outflow in all quadrants, especially in the poleward direction. After reaching peak intensity, TC 06P began to slow in track speed, eventually stalling and maintaining an intensity at or above 100 knots. After 0000 Z on 30 December, TC 06P recurved towards the southeast as a mid-level trough influenced a weakness in the ridge and the cyclone began rapid extratropical transition. Extratropical transition occurred south-southwest of the Fiji Islands.
(2) TC 06P is noted for its 155 knot maximum intensity and the damage caused when the TC passed near several small islands in the Temotu Province of the Solomon Islands. Damage done by passage of TC 06P was reported as relatively light on the island of Anuta, with most structures remaining intact. Early reports indicated damage was substantial on the island of Tikopia, though there was no initial loss of life or serious injuries reported. The islands have a combined population of approximately 3,700 individuals. During the first fly-over by a humanitarian mission after communications were lost with the islands, the devastation to the islands was reported as "total". Much of the vegetation used for food or shelter was denuded. Most major structures were damaged or destroyed. All fresh water sources with the exception of a spring accessible only at low tide were contaminated by salt water according to early reports. Based on the traditional lives
of the inhabitants, self-sufficiency was not considered likely for Tikopia for several years.
*Named by WMO designated RSMC

| Statistics for JTWC on TC06P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | OSIT | ION | ERR | ROR |  |  |  |  | ND | ERR | RS |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02122412 |  | 9.0 S | 178.3W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122418 |  | 9.7S | 179.1W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122500 |  | 10.4S | 180.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122506 |  | 10.8S | 178.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122512 | 1 | 10.8 S | 177.6E | 35 | 13 | 65 | 80 | 81 | 77 |  |  |  | 0 | -10 | -25 | -35 | -90 |  |  |  |
| 02122600 | 2 | 10.7S | 175.4E | 55 | 11 | 37 | 77 | 85 | 122 |  |  |  | 0 | -10 | -20 | -70 | -65 |  |  |  |
| 02122612 | 3 | 10.8 S | 174.0E | 75 | 17 | 30 | 31 | 46 | 41 |  |  |  | 0 | 0 | -50 | -45 | -30 |  |  |  |
| 02122700 | 4 | 11.2S | 172.5E | 95 | 8 | 26 | 13 | 24 | 31 |  |  |  | 0 | -45 | -30 | -20 | 0 |  |  |  |
| 02122712 | 5 | 11.7S | 170.7E | 155 | 5 | 32 | 50 | 80 | 96 |  |  |  | 0 | 10 | 25 | 45 | 55 |  |  |  |
| 02122800 | 6 | 12.1S | 169.9E | 155 | 8 | 13 | 55 | 75 | 97 |  |  |  | 0 | 10 | 35 | 45 | 40 |  |  |  |
| 02122812 | 7 | 12.4S | 169.2E | 145 | 6 | 59 | 71 | 77 | 91 |  |  |  | 0 | 20 | 30 | 25 | 40 |  |  |  |
| 02122900 | 8 | 12.7S | 169.5E | 120 | 0 | 13 | 6 | 23 | 58 |  |  |  | 0 | 10 | 5 | 10 | 20 |  |  |  |
| 02122912 | 9 | 13.5S | 170.4E | 100 | 8 | 21 | 50 | 56 | 54 |  |  |  | 0 | -5 | 5 | 10 | 0 |  |  |  |
| 02123000 | 10 | 14.4S | 171.5E | 95 | 8 | 25 | 55 | 41 | 36 |  |  |  | 0 | 5 | 20 | 5 | 0 |  |  |  |
| 02123012 | 11 | 15.5S | 172.3E | 75 | 57 | 70 | 29 | 41 |  |  |  |  | 0 | 10 | 5 | 0 |  |  |  |  |
| 02123100 | 12 | 16.8S | 173.4E | 55 | 26 | 79 | 111 |  |  |  |  |  | 0 | -10 | -10 |  |  |  |  |  |
| 02123112 | 13 | 18.6S | 174.8E | 50 | 38 | 62 |  |  |  |  |  |  | 5 | 5 |  |  |  |  |  |  |
| 03010100 | 14 | 20.7S | 175.2E | 45 | 34 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03010106 |  | 21.9S | 175.9E | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 41 | 52 | 57 | 70 |  |  |  | 0 | 12 | 22 | 28 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -1 | -1 | -3 | -3 |  |  |  |
|  |  |  | \# CASE |  | 14 | 13 | 12 | 11 | 10 |  |  |  | 14 | 13 | 12 | 11 | 10 |  |  |  |



Figure 2-06P-1. 280400Z December 2002 GMS-5 visible imagery of TC 06P (Zoe), 230 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 150 knots.


Figure 2-06P-2. $281013 Z$ December 200285 GHz SSM/I imagery of TC 06P (Zoe), 210 nm northeast of Port Vila, Vanuatu, with an estimated peak intensity of 155 knots.


Figure 2-06P-3. $292240 Z$ December 2002 MODIS true-color image of TC 06P (Zoe), located 240 nm east-northeast of Port Vila, Vanuatu, with an intensity of 100 knots.

TROPICAL CYCLONE 06P (ZOE)
25 DEC 2002--01 JAN 2003


Time Intensity for 06P
Intensity (kts)


Fix Date (Zulu)

## Tropical Cyclone (TC) 07S

| First Poor : $1530 Z 25$ Dec 02 |
| :--- |
| First Fair : N/A |
| First TCFA : 1800 Z 25 Dec 02 |
| Last Warning : 1800 Z 28 Dec 02, Dissipated |
| Max Intensity : 30 kts, gusts to 40 kts |
| Landfall : None |
| Total Warnings : 5 |
| Remarks: |
| (1) Tropical Cyclone (TC) 07S was first noted as a tropical disturbance west of Sumatra on 25 |
| December 2002. The first warning was issued with an intensity of 30 knots on 26 December. TC |
| 07S initially tracked poleward toward the Cocos Islands, then turned eastward after 27 December |
| under the influence of a near equatorial ridge located north of the cyclone. The cyclone was |
| tracked as a 30 knot cyclone for more than 8 days before dissipating. |
| (2) No damage or casualties were reported for this tropical cyclone. |
| (2) 02 |

(1) Tropical Cyclone (TC) 07S was first noted as a tropical disturbance west of Sumatra on 25 December 2002. The first warning was issued with an intensity of 30 knots on 26 December. TC $07 S$ initially tracked poleward toward the Cocos Islands, then turned eastward after 27 December under the influence of a near equatorial ridge located north of the cyclone. The cyclone was tracked as a 30 knot cyclone for more than 8 days before dissipating.
(2) No damage or casualties were reported for this tropical cyclone.

Statistics for JTWC on TC07S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 2 | 96 | 120 |
| 02122500 |  | 2.8 S | 88.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122506 |  | 3.7S | 87.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122512 |  | 4.75 | 87.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122518 |  | 5.7S | 87.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122600 |  | 6.6 S | 88.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122606 |  | 7.4S | 88.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122612 |  | 8.1S | 88.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122618 | 1 | 8.7S | 89.1E | 30 | 11 | 34 | 94 | 197 | 297 |  |  |  | 0 | 5 | 10 | 15 | 15 |  |  |  |
| 02122706 | 2 | 9.2 S | 89.8E | 30 | 16 | 96 | 215 | 309 | 374 |  |  |  | 0 | 0 | 5 | 5 | 15 |  |  |  |
| 02122718 | 3 | 9.2 S | 91.0E | 30 | 13 | 78 | 112 | 150 | 166 |  |  |  | 0 | 5 | 5 | 10 | 10 |  |  |  |
| 02122806 | 4 | 9.35 | 92.7E | 30 | 24 | 13 | 54 | 95 |  |  |  |  | 0 | 0 | 5 | 5 |  |  |  |  |
| 02122818 | 5 | 9.8 S | 93.7E | 30 | 18 | 59 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 02122900 |  | 9.95 | 94.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122906 |  | 9.8 S | 94.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122912 |  | 9.5 S | 94.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122918 |  | 9.6 S | 93.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123000 |  | 9.85 | 93.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123006 |  | 9.95 | 92.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123012 |  | 10.0S | 92.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123018 |  | 10.0S | 92.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123100 |  | 9.95 | 91.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123106 |  | 9.8 S | 91.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123112 |  | 9.95 | 91.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123118 |  | 10.0S | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010100 |  | 10.0S | 91.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010106 |  | 9.8 S | 91.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010112 |  | 9.85 | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010118 |  | 9.9S | 91.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010200 |  | 9.95 | 91.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010206 |  | 9.7S | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010212 |  | 9.75 | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010218 |  | 9.7S | 90.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010300 |  | 9.8 S | 90.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010306 |  | 10.1S | 90.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


|  |  |  | AVERAGE |  | 17 | 56 | 119 | 188 | 279 |  |  |  | 0 | 3 | 6 | 9 | 13 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 3 | 6 | 9 | 13 |  |  |  |  |
|  |  |  | \# CASE |  | 5 | 5 | 4 | 4 | 3 |  |  |  | 5 | 5 | 4 | 4 | 3 |  |  |  |



Figure 2-07S-1. $261550 Z$ December 2002 color composite SSM/I image of TC 07S (No Name), 550 nm west-northwest of Cocos island. The system had an partially exposed low level circulation center with an estimated intensity of 25 knots.


Time Intensity for 07S

## Intensity (kts)



## Tropical Cyclone (TC) 07S

$\square$
First Poor : 1530Z 25 Dec 02
First Fair : N/A

First TCFA : 1800Z 25 Dec 02
First Warning : 1800Z 26 Dec 02
Last Warning : 1800Z 28 Dec 02, Dissipated
Max Intensity : 30 kts, gusts to 40 kts
Landfall : None

Total Warnings : 5
Remarks:
(1) Tropical Cyclone (TC) 07S was first noted as a tropical disturbance west of Sumatra on 25 December 2002. The first warning was issued with an intensity of 30 knots on 26 December. TC 07S initially tracked poleward toward the Cocos Islands, then turned eastward after 27 December under the influence of a near equatorial ridge located north of the cyclone. The cyclone was tracked as a 30 knot cyclone for more than 8 days before dissipating.
(2) No damage or casualties were reported for this tropical cyclone.

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02122500 |  | 2.8 S | 88.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122506 |  | 3.7S | 87.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122512 |  | 4.7S | 87.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122518 |  | 5.7S | 87.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122600 |  | 6.65 | 88.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122606 |  | 7.4S | 88.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122612 |  | 8.15 | 88.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122618 | 1 | 8.7S | 89.1E | 30 | 11 | 34 | 94 | 197 | 297 |  |  |  | 0 | 5 | 10 | 15 | 15 |  |  |  |
| 02122706 | 2 | 9.25 | 89.8E | 30 | 16 | 96 | 215 | 309 | 374 |  |  |  | 0 | 0 | 5 | 5 | 15 |  |  |  |
| 02122718 | 3 | 9.25 | 91.0E | 30 | 13 | 78 | 112 | 150 | 166 |  |  |  | 0 | 5 | 5 | 10 | 10 |  |  |  |
| 02122806 | 4 | 9.35 | 92.7E | 30 | 24 | 13 | 54 | 95 |  |  |  |  | 0 | 0 | 5 | 5 |  |  |  |  |
| 02122818 | 5 | 9.8S | 93.7E | 30 | 18 | 59 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 02122900 |  | 9.95 | 94.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122906 |  | 9.8S | 94.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122912 |  | 9.5S | 94.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02122918 |  | 9.6S | 93.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123000 |  | 9.8 S | 93.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123006 |  | 9.95 | 92.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123012 |  | 10.0S | 92.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123018 |  | 10.0S | 92.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123100 |  | 9.95 | 91.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123106 |  | 9.8 S | 91.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123112 |  | 9.95 | 91.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123118 |  | 10.0S | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010100 |  | 10.0S | 91.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010106 |  | 9.8S | 91.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010112 |  | 9.8 S | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010118 |  | 9.95 | 91.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010200 |  | 9.95 | 91.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010206 |  | 9.7S | 91.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010212 |  | 9.7S | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010218 |  | 9.7S | 90.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010300 |  | 9.8 S | 90.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010306 |  | 10.1S | 90.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 17 | 56 | 119 | 188 | 279 |  |  |  | 0 | 3 | 6 | 9 | 13 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 3 | 6 | 9 | 13 |  |  |  |
|  |  |  | \# CASE |  | 5 | 5 | 4 | 4 | 3 |  |  |  | 5 | 5 | 4 | 4 | 3 |  |  |  |



Figure 2-07S-1. $261550 Z$ December 2002 color composite SSM/I image of TC 07S (No Name), 550 nm west-northwest of Cocos island. The system had an partially exposed low level circulation center with an estimated intensity of 25 knots.

## TROPICAL CYCLONE 07S

26-28 DEC 2002


Time Intensity for 07S
Intensity (kts)


# Tropical Cyclone (TC) 08S (Delfina)* 

First Poor : 1100Z 30 Dec 02
First Fair : 1200Z 30 Dec 02
First TCFA : N/A
First Warning : 1800Z 30 Dec 02
Last Warning : 0600Z 01 Jan 03, Dissipated
Max Intensity : 55 kts, gusts to 70 kts
Landfall : Near Angoche, Mozambique on 31 December, 2002
Total Warnings : 4
Remarks:
(1) Tropical Cyclone (TC) 08S developed quickly in the Mozambique Channel and attained a maximum intensity of 55 knots just prior to making landfall in Mozambique. After landfall, the cyclone rapidly weakened. Over land, TC 08S continued to move westward and entered Malawi, entraining hot, desert air and continuing to interact with land. With the low level circulation center still identifiable, TC 08S then looped, headed southeast and re-entered the Mozambique Channel. After re-entering the Mozambique Channel, the cyclone tracked south for 72 hours before dissipating.
(2) Press reports indicated that TC 08S brought heavy rains and winds to Mozambique, causing a reported 58 fatalities. Reports further indicated that the cyclone left approximately 300,000 persons homeless, damaged crops, and causing infrastructure damage costing $\$ 3.5$ million.
*Named by WMO designated RSMC

| DTG |  | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 02123012 |  | 16.4S | 43.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123018 | 1 | 16.4S | 42.4E | 35 | 8 | 56 | 83 | 86 |  |  |  |  | 0 | 10 | 0 | -25 |  |  |  |  |
| 02123106 | 2 | 16.1S | 41.6E | 35 | 18 | 12 | 17 | 63 |  |  |  |  | 0 | -10 | -15 | -5 |  |  |  |  |
| 02123118 | 3 | 16.0S | 40.4E | 55 | 6 | 13 | 12 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03010106 | 4 | 15.8S | 39.2E | 45 | 5 | 40 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03010112 |  | 15.7S | 38.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010118 |  | 15.6 S | 37.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010200 |  | 15.5S | 36.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010206 |  | 15.4S | 35.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010212 |  | 15.3S | 35.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010218 |  | 15.1S | 35.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010300 |  | 15.1S | 35.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010306 |  | 15.1S | 35.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010312 |  | 15.1S | 36.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010318 |  | 15.0S | 36.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010400 |  | 14.9S | 36.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010406 |  | 14.9 S | 37.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010412 |  | 14.8S | 37.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010418 |  | 14.8 S | 37.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010500 |  | 14.7S | 38.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010506 |  | 14.8S | 38.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010512 |  | 15.1S | 39.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010518 |  | 15.4 S | 39.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010600 |  | 15.9 S | 39.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010606 |  | 16.5 S | 39.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010612 |  | 17.1S | 38.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010618 |  | 17.7S | 38.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010700 |  | 18.4S | 37.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010706 |  | 19.4S | 37.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010712 |  | 20.4 S | 37.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03010718 | 21.4S | 37.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03010800 | 22.1S | 38.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010806 | 22.9S | 38.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010812 | 23.7S | 38.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010818 | 24.5S | 38.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010900 | 25.5S | 38.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010906 | 26.5S | 38.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010912 | 27.5S | 39.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | AVERAGE |  | 10 | 30 | 37 | 74 |  |  |  |  | 0 | 9 | 5 | 5 | 15 |  |  |  |  |
|  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 |  | -5 | -15 |  |  |  |  |
|  |  | \# CASES |  | 4 | 4 | 3 | 2 |  |  |  |  | 4 | 4 |  | 3 | 2 |  |  |  |  |



Figure 2-08S-1. 312020 Z December 2002 multi-sensor satellite images of TC 08S (Delfina), located in the Mozambique channel, with an estimated intensity of 55 knots.


Figure 2-08S-2. $011105 Z$ January 2003 MODIS true-color image of TC 08S (Delfina), located over Mozambique, with an intensity of 30 knots.

## TROPICAL CYCLONE 08S (DELFINA)

30 DEC 2002-01 JAN 2003


Time Intensity for 08 S

## Intensity (kts)

|  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Tropical Cyclone (TC) 08S (Delfina)*

First Poor : 1100Z 30 Dec 02
First Fair : 1200Z 30 Dec 02
First TCFA : N/A

First Warning : 1800Z 30 Dec 02
Last Warning : 0600Z 01 Jan 03, Dissipated
Max Intensity : 55 kts , gusts to 70 kts
Landfall : Near Angoche, Mozambique on 31 December, 2002
Total Warnings : 4
Remarks:
(1) Tropical Cyclone (TC) 08 S developed quickly in the Mozambique Channel and attained a maximum intensity of 55 knots just prior to making landfall in Mozambique. After landfall, the cyclone rapidly weakened. Over land, TC 08S continued to move westward and entered Malawi, entraining hot, desert air and continuing to interact with land. With the low level circulation center still identifiable, TC 08S then looped, headed southeast and re-entered the Mozambique Channel. After re-entering the Mozambique Channel, the cyclone tracked south for 72 hours before dissipating.
(2) Press reports indicated that TC 08S brought heavy rains and winds to Mozambique, causing a reported 58 fatalities. Reports further indicated that the cyclone left approximately 300,000 persons homeless, damaged crops, and causing infrastructure damage costing $\$ 3.5$ million.
*Named by WMO designated RSMC

| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 02123012 |  | 16.4S | 43.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02123018 | 1 | 16.4S | 42.4E | 35 | 8 | 56 | 83 | 86 |  |  |  |  | 0 | 10 | 0 | -25 |  |  |  |  |
| 02123106 | 2 | 16.1S | 41.6E | 35 | 18 | 12 | 17 | 63 |  |  |  |  | 0 | -10 | -15 | -5 |  |  |  |  |
| 02123118 | 3 | 16.0S | 40.4E | 55 | 6 | 13 | 12 |  |  |  |  |  | 0 | -5 | 0 |  |  |  |  |  |
| 03010106 | 4 | 15.8S | 39.2E | 45 | 5 | 40 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03010112 |  | 15.7S | 38.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010118 |  | 15.6S | 37.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010200 |  | 15.5S | 36.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010206 |  | 15.4S | 35.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010212 |  | 15.3S | 35.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010218 |  | 15.1S | 35.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010300 |  | 15.1S | 35.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010306 |  | 15.1S | 35.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010312 |  | 15.1S | 36.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010318 |  | 15.0S | 36.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010400 |  | 14.9S | 36.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010406 |  | 14.9S | 37.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010412 |  | 14.8S | 37.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010418 |  | 14.8S | 37.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010500 |  | 14.7S | 38.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010506 |  | 14.8S | 38.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010512 |  | 15.1S | 39.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010518 |  | 15.4S | 39.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010600 |  | 15.9S | 39.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010606 |  | 16.5S | 39.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010612 |  | 17.1S | 38.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010618 |  | 17.7S | 38.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010700 |  | 18.4S | 37.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010706 |  | 19.4S | 37.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010712 |  | 20.4S | 37.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010718 |  | 21.4S | 37.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010800 |  | 22.1S | 38.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010806 |  | 22.9S | 38.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010812 |  | 23.7S | 38.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010818 |  | 24.5S | 38.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010900 |  | 25.5S | 38.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010906 |  | 26.5S | 38.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010912 |  | 27.5S | 39.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 30 | 37 | 74 |  |  |  |  | 0 | 9 | 5 | 15 |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | -5 | -15 |  |  |  |  |
|  |  |  | \# CASES |  | 4 | 4 | 3 | 2 |  |  |  |  | 4 | 4 | 3 | 2 |  |  |  |  |



Figure 2-08S-1. $312020 Z$ December 2002 multi-sensor satellite images of TC 08S (Delfina), located in the Mozambique channel, with an estimated intensity of 55 knots.


Figure 2-08S-2. $011105 Z$ January 2003 MODIS true-color image of TC $08 S$ (Delfina), located over Mozambique, with an intensity of 30 knots.

## TROPICAL CYCLONE 08S (DELFINA)

30 DEC 2002-01 JAN 2003


Time Intensity for 08S
Intensity (kts)


## Tropical Cyclone (TC) 09S (Ebula)*

| First Poor : N/A |
| :--- |
| First Fair : 0600Z 06 Jan 03 |
| First TCFA : $0330 Z 07$ Jan 03 |
| First Warning : 0000Z 08 Jan 03 |
| Last Warning : 0000 Z 12 Jan 03, Extratropical |
| Max Intensity : 65 kts, gusts to 80 kts |
| Landfall : None |
| Total Warnings : 9 |
| Remarks: |
| (1) Tropical cyclone (TC) 09S developed approximately 115 nm south of Diego Garcia on 06 |
| January 2003 . The cyclone initially drifted poleward and slowly intensified to 35 knots, then |
| increased speed as it intensified to 65 knots on 10 January. TC 09S maintained intensify for 48 |
| hours until a mid-latitude frontal system approached from the southwest and TC 09S began |
| extratropical transition. Once TC 09S linked up with the frontal boundary, it weakended rapidly and |
| tracked to the southeast, completing extratropical transition by 12 January at 0000Z, when the |
| final warning was issued. |
| *Named by WMO designated RSMC |

(1) Tropical cyclone (TC) 09S developed approximately 115 nm south of Diego Garcia on 06 January 2003. The cyclone initially drifted poleward and slowly intensified to 35 knots, then increased speed as it intensified to 65 knots on 10 January. TC 09S maintained intensify for 48 hours until a mid-latitude frontal system approached from the southwest and TC 09S began extratropical transition. Once TC 09S linked up with the frontal boundary, it weakended rapidly and tracked to the southeast, completing extratropical transition by 12 January at 0000Z, when the final warning was issued.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03010612 |  | 9.55 | 71.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010618 |  | 9.9S | 71.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010700 |  | 10.4S | 71.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010706 |  | 10.8S | 71.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010712 |  | 10.9S | 70.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010718 |  | 11.1S | 70.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010800 | 1 | 11.6S | 70.2E | 35 | 36 | 76 | 55 | 26 | 29 |  |  |  | 0 | 10 | 0 | 5 | 0 |  |  |  |
| 03010812 | 2 | 12.9S | 70.6E | 35 | 11 | 53 | 98 | 135 | 143 |  |  |  | 0 | -10 | -5 | -10 | -5 |  |  |  |
| 03010900 | 3 | 14.3S | 70.8E | 50 | 13 | 76 | 90 | 77 | 46 |  |  |  | 0 | 5 | 5 | 15 | 20 |  |  |  |
| 03010912 | 4 | 15.8S | 71.3E | 55 | 5 | 35 | 62 | 100 | 122 |  |  |  | -5 | -5 | 5 | 15 | 20 |  |  |  |
| 03011000 | 5 | 17.7S | 70.8E | 65 | 16 | 59 | 112 | 92 | 88 |  |  |  | 0 | 10 | 5 | 5 | 5 |  |  |  |
| 03011012 | 6 | 20.15 | 70.0E | 65 | 11 | 24 | 13 | 77 | 190 |  |  |  | 0 | 10 | 10 | 10 | 15 |  |  |  |
| 03011100 | 7 | 23.35 | 69.6E | 60 | 22 | 44 | 46 | 115 |  |  |  |  | 0 | 5 | 10 | 15 |  |  |  |  |
| 03011112 | 8 | 26.0S | 69.9E | 50 | 16 | 55 | 85 |  |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03011200 | 9 | 27.5S | 71.2E | 40 | 12 | 41 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03011206 |  | 28.1S | 72.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011212 |  | 28.4S | 73.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 16 | 51 | 70 | 89 | 103 |  |  |  | 1 | 6 | 6 | 11 | 11 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 3 | 4 | 8 | 9 |  |  |  |
|  |  |  | \# CASES |  | 9 | 9 | 8 | 7 | 6 |  |  |  | 9 | 9 | 8 | 7 | 6 |  |  |  |



Figure 2-09S-1. 100920Z January 2003 MODIS true-color image of TC 09S (Ebula), located 840 nm east of La Reunion, with a maximum intensity of 65 knots.


Figure 2-09S-2. 101030Z January 2003 MET-5 visible image of TC 09 S (Ebula), 770 nm south of Diego Garcia. The exposed low level circulation center to the north of the deep convection had a peak intensity of 65 knots.

TROPICAL CYCLONE 09S (EBULA)
08-12 JAN 2003


Time Intensity for 09S

## Intensity (kts)



## Tropical Cyclone (TC) 09S (Ebula)*

First Poor : N/A
First Fair : 0600Z 06 Jan 03

First TCFA : 0330Z 07 Jan 03
First Warning : 0000Z 08 Jan 03

Last Warning : 0000Z 12 Jan 03, Extratropical
Max Intensity : 65 kts, gusts to 80 kts

Landfall : None
Total Warnings : 9
Remarks:
(1) Tropical cyclone (TC) 09S developed approximately 115 nm south of Diego Garcia on 06 January 2003. The cyclone initially drifted poleward and slowly intensified to 35 knots, then increased speed as it intensified to 65 knots on 10 January. TC 09S maintained intensify for 48 hours until a mid-latitude frontal system approached from the southwest and TC 09S began extratropical transition. Once TC 09S linked up with the frontal boundary, it weakended rapidly and tracked to the southeast, completing extratropical transition by 12 January at 0000Z, when the final warning was issued.
*Named by WMO designated RSMC

Statistics for JTWC on TC09S

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03010612 |  | 9.5 S | 71.8 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010618 |  | 9.9S | 71.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010700 |  | 10.4 S | 71.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010706 |  | 10.8S | 71.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010712 |  | 10.9S | 70.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010718 |  | 11.1S | 70.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03010800 | 1 | 11.6 S | 70.2E | 35 | 36 | 76 | 55 | 26 | 29 |  |  |  | 0 | 10 | 0 | 5 | 0 |  |  |  |
| 03010812 | 2 | 12.9S | 70.6E | 35 | 11 | 53 | 98 | 135 | 143 |  |  |  | 0 | -10 | -5 | -10 | -5 |  |  |  |
| 03010900 | 3 | 14.3S | 70.8E | 50 | 13 | 76 | 90 | 77 | 46 |  |  |  | 0 | 5 | 5 | 15 | 20 |  |  |  |
| 03010912 | 4 | 15.8S | 71.3E | 55 | 5 | 35 | 62 | 100 | 122 |  |  |  | -5 | -5 | 5 | 15 | 20 |  |  |  |
| 03011000 | 5 | 17.7S | 70.8E | 65 | 16 | 59 | 112 | 92 | 88 |  |  |  | 0 | 10 | 5 | 5 | 5 |  |  |  |
| 03011012 | 6 | 20.1S | 70.0E | 65 | 11 | 24 | 13 | 77 | 190 |  |  |  | 0 | 10 | 10 | 10 | 15 |  |  |  |
| 03011100 | 7 | 23.3S | 69.6E | 60 | 22 | 44 | 46 | 115 |  |  |  |  | 0 | 5 | 10 | 15 |  |  |  |  |
| 03011112 | 8 | 26.0S | 69.9E | 50 | 16 | 55 | 85 |  |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03011200 | 9 | 27.5S | 71.2E | 40 | 12 | 41 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03011206 |  | 28.1S | 72.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011212 |  | 28.4S | 73.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 16 | 51 | 70 | 89 | 103 |  |  |  | 1 | 6 | 6 | 11 | 11 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 3 | 4 | 8 | 9 |  |  |  |
|  |  |  | \# CASES |  | 9 | 9 | 8 | 7 | 6 |  |  |  | 9 | 9 | 8 | 7 | 6 |  |  |  |



Figure 2-09S-1. 100920Z January 2003 MODIS true-color image of TC 09S (Ebula), located 840 nm east of La Reunion, with a maximum intensity of 65 knots.


Figure 2-09S-2. 101030Z January 2003 MET-5 visible image of TC 09 S (Ebula), 770 nm south of Diego Garcia. The exposed low level circulation center to the north of the deep convection had a peak intensity of 65 knots.

## TROPICAL CYCLONE 09S (EBULA)

08-12 JAN 2003


Time Intensity for 09S


## Tropical Cyclone (TC) 10P (Ami)*

First Poor : N/A
First Fair : 1300Z 10 Jan 03
First TCFA : 0930Z 11 Jan 03
First Warning : $1800 Z 11$ Jan 03
Last Warning : 0600Z 15 Jan 03
Max Intensity : 110 kts, gusts to 135 kts
Landfall : None
Total Warnings : 8 plus 1 Amended Warning
Remarks:
(1) Tropical Cyclone (TC) 10P developed north of Samoa and the Fiji Islands on 10 January 2003 within the South Pacific Convergence Zone. The cyclone drifted slowly south initially, then began to increase in speed and rapidly intensify, attaining a peak intensity of 110 knots at 0000 Z on 14 January. TC 10P passed just east of the Fiji Islands, with an intensity of 95 knots. An approaching frontal boundary then began interacting with the cyclone, causing an increase in track speed and a change in track direction to the southeast as it began extratropical transition. Transition was completed by 0600 Z on 15 January while still a 70 knot system at which time the final warning was issued.
(2) Fiji was reported as having extensive flood damage, with 500 villagers left homeless and two reported fatalities. Storm force winds also caused damage to power lines and buildings.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03011012 |  | 9.5 S | 177.6W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011018 |  | 9.6 S | 178.0W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011100 |  | 9.8 S | 178.5W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011106 |  | 10.1S | 179.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011112 |  | 10.7S | 179.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011118 | 1 | 11.1S | 179.4W | 35 | 13 | 57 | 83 | 114 | 162 |  |  |  | 0 | 0 | -15 | -25 | -30 |  |  |  |
| 03011206 | 2 | 11.5S | 179.7W | 45 | 13 | 8 | 30 | 89 | 192 |  |  |  | 0 | -10 | -30 | -45 | -65 |  |  |  |
| 03011218 | 3 | 12.5S | 179.8E | 65 | 6 | 6 | 31 | 106 | 219 |  |  |  | 0 | -10 | -20 | -55 | -50 |  |  |  |
| 03011306 | 4 | 14.3S | 179.7E | 85 | 5 | 29 | 64 | 138 | 187 |  |  |  | -5 | -5 | -20 | -20 | -5 |  |  |  |
| 03011318 | 5 | 17.0S | 180.0W | 95 | 18 | 104 | 176 | 217 |  |  |  |  | -5 | -20 | -20 | -5 |  |  |  |  |
| 03011400 | 5A | 19.2S | 179.2W | 110 | 16 | 24 | 96 | 186 |  |  |  |  | -5 | -5 | -5 | 0 |  |  |  |  |
| 03011406 | 6 | 21.1S | 177.9W | 110 | 6 | 35 | 75 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 03011418 | 7 | 25.2 S | 173.3W | 100 | 8 | 79 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03011506 | 8 | 28.7S | 166.0W | 70 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011512 |  | 29.0S | 161.7W | 70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 43 | 79 | 142 | 190 |  |  |  | 2 | 8 | 18 | 25 | 38 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -4 | -14 | -25 | -38 |  |  |  |
|  |  |  | \# CASES |  | 9 | 8 | 7 | 6 | 4 |  |  |  | 9 | 8 | 7 | 6 | 4 |  |  |  |



Figure 2-10P-1. $130933 Z$ January 2003 multi-sensor satellite images of TC 10P (Ami), 170 nm northeast of Suva, Fiji. The system had just begun intensification with an estimated intensity of 80 knots.


Figure 2-10P-2. $132200 Z$ January 2003 MODIS true-color image of TC 10P (Ami), located over the Fiji Islands, with an intensity of 95 knots.


Figure 2-10P-3. $140916 Z$ January 2003 enhanced infrared image of TC 10P (Ami), 150 nm northeast of Suva, Fiji. The system had its peak intensification with estimated intensity of 110 knots.

TROPICAL CYCLONE 10P (AMI)
11-15 JAN 2003


Time Intensity for 10P

## Intensity (kts)



Fix Date (Zulu)

## Tropical Cyclone (TC) 10P (Ami)*

First Poor : N/A
First Fair: 1300Z 10 Jan 03

First TCFA : 0930Z 11 Jan 03
First Warning : 1800Z 11 Jan 03
Last Warning : 0600Z 15 Jan 03
Max Intensity : 110 kts, gusts to 135 kts

Landfall : None
Total Warnings : 8 plus 1 Amended Warning
Remarks:
(1) Tropical Cyclone (TC) 10P developed north of Samoa and the Fiji Islands on 10 January 2003 within the South Pacific Convergence Zone. The cyclone drifted slowly south initially, then began to increase in speed and rapidly intensify, attaining a peak intensity of 110 knots at 0000 Z on 14 January. TC 10P passed just east of the Fiji Islands, with an intensity of 95 knots. An approaching frontal boundary then began interacting with the cyclone, causing an increase in track speed and a change in track direction to the southeast as it began extratropical transition. Transition was completed by 0600 Z on 15 January while still a 70 knot system at which time the final warning was issued.
(2) Fiji was reported as having extensive flood damage, with 500 villagers left homeless and two reported fatalities. Storm force winds also caused damage to power lines and buildings.
*Named by WMO designated RSMC

Statistics for JTWC on TC10P

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03011012 |  | 9.5S | 177.6W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011018 |  | 9.6 S | 178.0W | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011100 |  | 9.85 | 178.5W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011106 |  | 10.1S | 179.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011112 |  | 10.7S | 179.3W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03011118 | 1 | 11.1S | 179.4W | 35 | 13 | 57 | 83 | 114 | 162 |  |  |  | 0 | 0 | -15 | -25 | -30 |  |  |  |
| 03011206 | 2 | 11.5S | 179.7W | 45 | 13 | 8 | 30 | 89 | 192 |  |  |  | 0 | -10 | -30 | -45 | -65 |  |  |  |
| 03011218 | 3 | 12.5S | 179.8E | 65 | 6 | 6 | 31 | 106 | 219 |  |  |  | 0 | -10 | -20 | -55 | -50 |  |  |  |
| 03011306 | 4 | 14.3S | 179.7E | 85 | 5 | 29 | 64 | 138 | 187 |  |  |  | -5 | -5 | -20 | -20 | -5 |  |  |  |
| 03011318 | 5 | 17.0S | 180.0W | 95 | 18 | 104 | 176 | 217 |  |  |  |  | -5 | -20 | -20 | -5 |  |  |  |  |
| 03011400 | 5A | 19.2S | 179.2W | 110 | 16 | 24 | 96 | 186 |  |  |  |  | -5 | -5 | -5 | 0 |  |  |  |  |
| 03011406 | 6 | 21.1S | 177.9W | 110 | 6 | 35 | 75 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 03011418 | 7 | 25.2S | 173.3W | 100 | 8 | 79 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03011506 | 8 | 28.7S | 166.0W | 70 | 16 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03011512 |  | 29.0S | 161.7W | 70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 43 | 79 | 142 | 190 |  |  |  | 2 | 8 | 18 | 25 | 38 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -4 | -14 | -25 | -38 |  |  |  |
|  |  |  | \# CASES |  | 9 | 8 | 7 | 6 | 4 |  |  |  | 9 | 8 | 7 | 6 | 4 |  |  |  |



Figure 2-10P-1. $130933 Z$ January 2003 multi-sensor satellite images of TC 10P (Ami), 170 nm northeast of Suva, Fiji. The system had just begun intensification with an estimated intensity of 80 knots.


Figure 2-10P-2. 132200Z January 2003 MODIS true-color image of TC 10P (Ami), located over the Fiji Islands, with an intensity of 95 knots.


Figure 2-10P-3. $140916 Z$ January 2003 enhanced infrared image of TC 10P (Ami), 150 nm northeast of Suva, Fiji. The system had its peak intensification with estimated intensity of 110 knots.

TROPICAL CYCLONE 10P (AMI)
11-15 JAN 2003


Time Intensity for 10P


## Tropical Cyclone (TC) 11S (Fari)*

First Poor : 1800Z 20 Jan 03
First Fair : 0500Z 21 Jan 03
First TCFA : 1230Z 23 Jan 03
First Warning : 1800Z 23 Jan 03
Last Warning : 0000Z 31 Jan 03, Dissipated
Max Intensity : 55 kts, gusts to 70 kts
Landfall : None
Total Warnings : 9
Remarks:
(1) Tropical Cyclone (TC) 11S was first described as a tropical disturbance 20 January at 1800 Z . Initially, this system did not intensify and was finaled after only one warning. On 27 January, 2003 at 1800Z, another TCFA was issued for TC 11S. Six hours later, on January 28th 2003 at 00Z, JTWC issued the first warning following the second TCFA issuance. The cause of regeneration was due to TC 11S moving under the upper level ridge axis, improving upper level outflow conditions.

Approximately 24 hours after attaining warning status the cyclone made landfall near Mahanoro, Madagascar, with an intensity of 55 knots. After landfall, TC 11S tracked across Madagascar, and then into the Mozambique Channel. The movement of the system was towards the southwest into a weakness in the low to mid-level steering ridge. TC 11S dissipated 48 hours after it tracked back over the South Indian Ocean. Dissipation occurred as the system tracked into an environment of high vertical wind shear.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

## Statistics for JTWC on TC11S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03012100 |  | 11.2S | 81.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012106 |  | 11.6S | 81.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012112 |  | 12.0 S | 81.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012118 |  | 12.4S | 81.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012200 |  | 12.75 | 80.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012206 |  | 12.7S | 80.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012212 |  | 13.0S | 79.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012218 |  | 13.4S | 78.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012300 |  | 13.8S | 77.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012306 |  | 14.1S | 76.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012312 |  | 14.5S | 75.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012318 | 1 | 14.9S | 74.4E | 35 | 8 | 30 | 126 | 327 | 458 |  |  |  | 0 | 25 | 35 | 35 | 30 |  |  |  |
| 03012406 | 2 | 15.2S | 72.3E | 20 | 30 | 115 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03012800 | 3 | 18.65 | 52.0E | 35 | 16 | 13 | 34 | 135 | 205 |  |  |  | 0 | -5 | -20 | -5 | -5 |  |  |  |
| 03012812 | 4 | 19.6S | 50.2E | 45 | 0 | 12 | 67 | 152 | 130 |  |  |  | -5 | -10 | 0 | 0 | -5 |  |  |  |
| 03012900 | 5 | 20.3S | 48.6E | 55 | 0 | 34 | 101 | 67 | 69 |  |  |  | 0 | 0 | 0 | 5 | 10 |  |  |  |
| 03012912 | 6 | 21.1S | 45.8E | 35 | 30 | 73 | 66 | 30 | 16 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03013000 | 7 | 22.4S | 42.7E | 30 | 13 | 53 | 74 | 109 |  |  |  |  | 0 | 0 | 0 | -5 |  |  |  |  |
| 03013012 | 8 | 24.0S | 42.2E | 30 | 0 | 48 | 156 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03013100 | 9 | 26.3S | 42.7E | 25 | 31 | 85 | 186 |  |  |  |  |  | 0 | -5 | -5 |  |  |  |  |  |
| 03013106 |  | 27.6S | 43.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03013112 |  | 29.0S | 43.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03013118 |  | 30.5S | 44.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020100 |  | 31.9S | 44.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020106 |  | 33.2S | 45.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020112 |  | 34.65 | 47.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


|  |  |  | AVERAGE |  | 14 | 52 | 101 | 137 | 176 |  |  |  | 1 | 5 | 9 | 10 | 12 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 1 | 1 | 7 | 8 |  |  |  |  |
|  |  |  | \# CASES |  | 9 | 9 | 8 | 6 | 5 |  |  |  | 9 | 9 | 8 | 6 | 5 |  |  |  |



Figure 2-11S-1. 281050 Z January 2003 MODIS true-color image of TC 11S (Fari), located 70 nm east of Madagascar, with an intensity of 45 knots.


Figure 2-11S-2. $290446 Z$ January 2003 multi-sensor satellite images of TC 11S (Fari), located on the east coast of Madagascar, with a peak intensity of 55 knots.

## TROPICAL CYCLONE 11S (FARI)

23-31 JAN 2003


Time Intensity for 11 S
Intensity (kts)


## Tropical Cyclone (TC) 11S (Fari)*

First Poor : 1800Z 20 Jan 03
First Fair : 0500Z 21 Jan 03
First TCFA : 1230Z 23 Jan 03
First Warning : 1800Z 23 Jan 03
Last Warning : 0000Z 31 Jan 03, Dissipated
Max Intensity : 55 kts , gusts to 70 kts

Landfall : None
Total Warnings : 9
Remarks:
(1) Tropical Cyclone (TC) 11S was first described as a tropical disturbance 20 January at 1800 Z. Initially, this system did not intensify and was finaled after only one warning. On 27 January, 2003 at 1800Z, another TCFA was issued for TC 11S. Six hours later, on January 28th 2003 at 00Z, JTWC issued the first warning following the second TCFA issuance. The cause of regeneration was due to TC 11 S moving under the upper level ridge axis, improving upper level outflow conditions.

Approximately 24 hours after attaining warning status the cyclone made landfall near Mahanoro, Madagascar, with an intensity of 55 knots. After landfall, TC 11S tracked across Madagascar, and then into the Mozambique Channel. The movement of the system was towards the southwest into a weakness in the low to mid-level steering ridge. TC 11S dissipated 48 hours after it tracked back over the South Indian Ocean. Dissipation occurred as the system tracked into an environment of high vertical wind shear.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

Statistics for JTWC on TC11S

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03012100 |  | 11.2S | 81.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012106 |  | 11.6S | 81.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012112 |  | 12.0 S | 81.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012118 |  | 12.4 S | 81.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012200 |  | 12.7S | 80.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012206 |  | 12.7S | 80.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012212 |  | 13.0S | 79.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012218 |  | 13.4S | 78.6E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012300 |  | 13.8S | 77.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012306 |  | 14.1S | 76.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012312 |  | 14.5 S | 75.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012318 | 1 | 14.9S | 74.4E | 35 | 8 | 30 | 126 | 327 | 458 |  |  |  | 0 | 25 | 35 | 35 | 30 |  |  |  |
| 03012406 | 2 | 15.2S | 72.3E | 20 | 30 | 115 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03012800 | 3 | 18.6S | 52.0E | 35 | 16 | 13 | 34 | 135 | 205 |  |  |  | 0 | -5 | -20 | -5 | -5 |  |  |  |
| 03012812 | 4 | 19.6S | 50.2E | 45 | 0 | 12 | 67 | 152 | 130 |  |  |  | -5 | -10 | 0 | 0 | -5 |  |  |  |
| 03012900 | 5 | 20.3S | 48.6E | 55 | 0 | 34 | 101 | 67 | 69 |  |  |  | 0 | 0 | 0 | 5 | 10 |  |  |  |
| 03012912 | 6 | 21.15 | 45.8E | 35 | 30 | 73 | 66 | 30 | 16 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03013000 | 7 | 22.4 S | 42.7E | 30 | 13 | 53 | 74 | 109 |  |  |  |  | 0 | 0 | 0 | -5 |  |  |  |  |
| 03013012 | 8 | 24.0S | 42.2E | 30 | 0 | 48 | 156 |  |  |  |  |  | 0 | 0 | -5 |  |  |  |  |  |
| 03013100 | 9 | 26.3S | 42.7E | 25 | 31 | 85 | 186 |  |  |  |  |  | 0 | -5 | -5 |  |  |  |  |  |
| 03013106 |  | 27.6S | 43.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03013112 |  | 29.0S | 43.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03013118 |  | 30.5S | 44.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020100 |  | 31.9S | 44.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020106 |  | 33.2S | 45.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020112 |  | 34.6S | 47.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 14 | 52 | 101 | 137 | 176 |  |  |  | 1 | 5 | 9 | 10 | 12 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 1 | 1 | 7 | 8 |  |  |  |
|  |  |  | \# CASES |  | 9 | 9 | 8 | 6 | 5 |  |  |  | 9 | 9 | 8 | 6 | 5 |  |  |  |



Figure 2-11S-1. 281050Z January 2003 MODIS true-color image of TC 11S (Fari), located 70nm east of Madagascar, with an intensity of 45 knots.


Figure 2-11S-2. $290446 Z$ January 2003 multi-sensor satellite images of TC 11S (Fari), located on the east coast of Madagascar, with a peak intensity of 55 knots.

## TROPICAL CYCLONE 11S (FARI)

## 23-31 JAN 2003



## Time Intensity for 11 S



## Tropical Cyclone (TC) 12P (Beni)*

First Poor : N/A
First Fair : 1900Z 24 Jan 03
First TCFA : $2100 Z 24$ Jan 03
First Warning : 0000Z 25 Jan 03
Last Warning : $1200 Z 31$ Jan 03, Dissipation
Max Intensity : 125 kts, gusts to 150 kts
Landfall : None
Total Warnings : 14
Remarks:
(1) Tropical Cyclone (TC) 12P was initially described as a tropical disturbance north of Fiji on 24 January, 2003. Approximately 6 hours later, on 25 January at 0000Z, JTWC issued the first warning on this cyclone. Initial warning issuance occurred while the system was intensifying at a climatological rate and moving slowly west-southwest along the northwestern periphery of the low to mid level subtropical ridge.

TC 12P began to track southeastward along the western periphery of the steering ridge. At 0000Z on 29 January, TC 12P reached its peak intensification of 125 knots as it encountered a favorable environment of weak vertical wind shear and good outflow aloft. TC 12P then began to track southwestward as the system started its downward intensity trend and weakened.

Rapid dissipation started at approximately 1200 Z on 30 January due to TC 12P tracking into an environment of high vertical wind shear and decreasing outflow aloft.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

Statistics for JTWC on TC12P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03012412 |  | 12.9 S | 162.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012418 |  | 13.0S | 161.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012500 | 1 | 13.1S | 161.4E | 30 | 6 | 17 | 57 | 71 | 67 |  |  |  | 5 | 10 | 15 | 15 | 20 |  |  |  |
| 03012512 | 2 | 12.9S | 160.9E | 35 | 26 | 88 | 130 | 126 | 105 |  |  |  | 0 | 5 | 0 | 5 | 15 |  |  |  |
| 03012600 | 3 | 12.4 S | 161.0E | 40 | 11 | 21 | 46 | 38 | 42 |  |  |  | 0 | 0 | 5 | 20 | 5 |  |  |  |
| 03012612 | 4 | 12.7S | 161.3E | 50 | 5 | 6 | 29 | 27 | 12 |  |  |  | 0 | 5 | 10 | -5 | -10 |  |  |  |
| 03012700 | 5 | 13.0 S | 160.8E | 55 | 18 | 50 | 71 | 72 | 81 |  |  |  | 5 | 15 | 5 | -5 | -35 |  |  |  |
| 03012712 | 6 | 13.8S | 160.8E | 55 | 13 | 35 | 24 | 30 | 99 |  |  |  | 5 | -10 | -20 | -55 | -50 |  |  |  |
| 03012800 | 7 | 14.7S | 160.7E | 75 | 5 | 17 | 58 | 106 | 186 |  |  |  | 0 | -10 | -45 | -40 | -20 |  |  |  |
| 03012812 | 8 | 15.6S | 161.1E | 90 | 5 | 58 | 124 | 210 | 263 |  |  |  | -5 | -40 | -30 | -5 | 30 |  |  |  |
| 03012900 | 9 | 16.5S | 162.7E | 125 | 8 | 60 | 144 | 190 | 147 |  |  |  | 0 | 5 | 20 | 45 | 70 |  |  |  |
| 03012912 | 10 | 17.8S | 164.9E | 125 | 5 | 46 | 116 | 73 | 45 |  |  |  | 0 | 15 | 35 | 60 | 60 |  |  |  |
| 03013000 | 11 | 19.1S | 167.7E | 105 | 6 | 29 | 35 | 140 | 244 |  |  |  | 10 | 30 | 60 | 65 | 65 |  |  |  |
| 03013012 | 12 | 20.8S | 169.3E | 75 | 16 | 62 | 167 | 290 | 331 |  |  |  | 0 | 25 | 30 | 30 | 20 |  |  |  |
| 03013100 | 13 | 22.35 | 168.0E | 40 | 13 | 85 | 143 | 160 | 139 |  |  |  | 0 | 0 | 0 | 0 | -5 |  |  |  |
| 03013112 | 14 | 24.15 | 165.2E | 30 | 42 | 90 |  |  |  |  |  |  | -5 | -5 |  |  |  |  |  |  |
| 03013118 |  | 24.3 S | 163.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020100 |  | 23.8 S | 161.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020106 |  | 23.4 S | 160.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020112 |  | 23.15 | 159.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020118 |  | 22.6 S | 158.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020200 |  | 22.3 S | 158.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020206 |  | 22.0 S | 157.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020212 |  | 21.5 S | 156.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020218 |  | 21.15 | 155.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03020300 | 20.95 | 154.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03020306 | 20.5S | 153.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020312 | 20.3S | 153.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020318 | 20.5S | 152.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 | 20.75 | 152.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 | 20.6S | 151.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 | 20.25 | 150.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 | 19.9S | 150.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 | 20.15 | 149.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | AVERAGE |  | 13 | 47 | 88 | 118 | 135 |  |  | 3 |  | 13 | 21 | 27 | 31 |  |  |  |
|  |  | BIAS |  |  |  |  |  |  |  |  | 1 |  | 3 | 7 | 10 | 13 |  |  |  |
|  |  | \# CASES |  | 14 | 14 | 13 | 13 | 13 |  |  | 1 | 4 | 14 | 13 | 13 | 13 |  |  |  |



Figure 2-12P-1. 282112 Z January 2003 GMS-5 visible imagery of TC 12P (Beni), 160 nm north of New Caledonia, with a peak intensity of 125 knots.


Figure 2-12P-2. $290315 Z$ January 2003 MODIS true-color image of TC 12P (Beni), located 190nm north of New Caledonia, with a maximum intensity of 125 knots.


Figure 2-12P-3. 291034Z January 200385 GHz SSM/I imagery of TC 12P (Beni), 180 nm north of New Caledonia, with a peak intensity of 125 knots.

## TROPICAL CYCLONE 12P (BENI)

25-31 JAN 2003


## Time Intensity for 12P

Intensity (kts)


## Tropical Cyclone (TC) 12P (Beni)*

First Poor: N/A

First Fair : 1900Z 24 Jan 03
First TCFA : $2100 Z 24$ Jan 03

First Warning : 0000Z 25 Jan 03
Last Warning : 1200Z 31 Jan 03, Dissipation

Max Intensity : 125 kts, gusts to 150 kts
Landfall : None

Total Warnings : 14
Remarks:
(1) Tropical Cyclone (TC) 12P was initially described as a tropical disturbance north of Fiji on 24 January, 2003. Approximately 6 hours later, on 25 January at 0000Z, JTWC issued the first warning on this cyclone. Initial warning issuance occurred while the system was intensifying at a climatological rate and moving slowly west-southwest along the northwestern periphery of the low to mid level subtropical ridge.

TC 12P began to track southeastward along the western periphery of the steering ridge. At 0000Z on 29 January, TC 12P reached its peak intensification of 125 knots as it encountered a favorable environment of weak vertical wind shear and good outflow aloft. TC 12P then began to track southwestward as the system started its downward intensity trend and weakened.

Rapid dissipation started at approximately 1200 Z on 30 January due to TC 12P tracking into an environment of high vertical wind shear and decreasing outflow aloft.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03012412 |  | 12.9 S | 162.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012418 |  | 13.0S | 161.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012500 | 1 | 13.1S | 161.4E | 30 | 6 | 17 | 57 | 71 | 67 |  |  |  | 5 | 10 | 15 | 15 | 20 |  |  |  |
| 03012512 | 2 | 12.9 S | 160.9E | 35 | 26 | 88 | 130 | 126 | 105 |  |  |  | 0 | 5 | 0 | 5 | 15 |  |  |  |
| 03012600 | 3 | 12.4 S | 161.0E | 40 | 11 | 21 | 46 | 38 | 42 |  |  |  | 0 | 0 | 5 | 20 | 5 |  |  |  |
| 03012612 | 4 | 12.7S | 161.3E | 50 | 5 | 6 | 29 | 27 | 12 |  |  |  | 0 | 5 | 10 | -5 | -10 |  |  |  |
| 03012700 | 5 | 13.0S | 160.8E | 55 | 18 | 50 | 71 | 72 | 81 |  |  |  | 5 | 15 | 5 | -5 | -35 |  |  |  |
| 03012712 | 6 | 13.8S | 160.8E | 55 | 13 | 35 | 24 | 30 | 99 |  |  |  | 5 | -10 | -20 | -55 | -50 |  |  |  |
| 03012800 | 7 | 14.7S | 160.7E | 75 | 5 | 17 | 58 | 106 | 186 |  |  |  | 0 | -10 | -45 | -40 | -20 |  |  |  |
| 03012812 | 8 | 15.6S | 161.1E | 90 | 5 | 58 | 124 | 210 | 263 |  |  |  | -5 | -40 | -30 | -5 | 30 |  |  |  |
| 03012900 | 9 | 16.5S | 162.7E | 125 | 8 | 60 | 144 | 190 | 147 |  |  |  | 0 | 5 | 20 | 45 | 70 |  |  |  |
| 03012912 | 10 | 17.8S | 164.9E | 125 | 5 | 46 | 116 | 73 | 45 |  |  |  | 0 | 15 | 35 | 60 | 60 |  |  |  |
| 03013000 | 11 | 19.1S | 167.7E | 105 | 6 | 29 | 35 | 140 | 244 |  |  |  | 10 | 30 | 60 | 65 | 65 |  |  |  |
| 03013012 | 12 | 20.8S | 169.3E | 75 | 16 | 62 | 167 | 290 | 331 |  |  |  | 0 | 25 | 30 | 30 | 20 |  |  |  |
| 03013100 | 13 | 22.3 S | 168.0E | 40 | 13 | 85 | 143 | 160 | 139 |  |  |  | 0 | 0 | 0 | 0 | -5 |  |  |  |
| 03013112 | 14 | 24.15 | 165.2E | 30 | 42 | 90 |  |  |  |  |  |  | -5 | -5 |  |  |  |  |  |  |
| 03013118 |  | 24.3S | 163.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020100 |  | 23.8S | 161.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020106 |  | 23.4 S | 160.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020112 |  | 23.15 | 159.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020118 |  | 22.6 S | 158.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020200 |  | 22.3 S | 158.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020206 |  | 22.0 S | 157.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020212 |  | 21.5S | 156.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020218 |  | 21.15 | 155.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020300 |  | 20.95 | 154.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020306 |  | 20.5S | 153.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020312 |  | 20.3S | 153.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020318 |  | 20.5S | 152.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 |  | 20.75 | 152.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 |  | 20.6S | 151.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 |  | 20.2S | 150.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 |  | 19.9 S | 150.2E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 20.1S | 149.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 13 | 47 | 88 | 118 | 135 |  |  |  | 3 | 13 | 21 | 27 | 31 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 3 | 7 | 10 | 13 |  |  |  |
|  |  |  | \# CASES |  | 14 | 14 | 13 | 13 | 13 |  |  |  | 14 | 14 | 13 | 13 | 13 |  |  |  |



Figure 2-12P-1. $282112 Z$ January 2003 GMS-5 visible imagery of TC 12P (Beni), 160 nm north of New Caledonia, with a peak intensity of 125 knots.


Figure 2-12P-2. $290315 Z$ January 2003 MODIS true-color image of TC 12P (Beni), located 190 nm north of New Caledonia, with a maximum intensity of 125 knots.


Figure 2-12P-3. $291034 Z$ January 200385 GHz SSM/I imagery of TC 12P (Beni), 180 nm north of New Caledonia, with a peak intensity of 125 knots.

## TROPICAL CYCLONE 12P (BENI)

25-31 JAN 2003


Time Intensity for 12P
Intensity (kts)


## Tropical Cyclone (TC) 13P (Cilla)*

First Poor : 0600Z 25 Jan 03

First Fair : 1900Z 25 Jan 03
First TCFA : 1300Z 26 Jan 03
First Warning : 0600Z 27 Jan 03
Last Warning : 1800Z 27 Jan 03, Extratropical
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : $2+1$ Amended Warning
Remarks:
(1) Tropical Cyclone (TC) 13P developed in a broad monsoon trough on 25 January, 2003 approximately 380 nm west-northwest of Suva, Fiji and tracked eastward for one day and then southeastward over the next 5 days. The first warning was issued on the 27th of January at 0600Z with the final warning being issued as an amendment just 13 hours later. No operational impacts and no damage was reported.
*Named by WMO designated RSMC

| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03012506 |  | 15.5 S | 172.6 E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03012512 |  | 15.3 S | 173.6 E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



Figure 2-13P-1. $271833 Z$ January 2003 GOES-10 visible imagery of TC 13P (Cilla), shows a good convective band wrapping in from the north, 441 nm east-southeast of Suva, with a peak intensity of 35 knots.

TROPICAL CYCLONE 13P (CLLA)
27 JAN 2003


Time Intensity for 13P

## Intensity (kts)



## Tropical Cyclone (TC) 13P (Cilla)*





Figure 2-13P-1. $271833 Z$ January 2003 GOES-10 visible imagery of TC 13P (Cilla), shows a good convective band wrapping in from the north, 441 nm east-southeast of Suva, with a peak intensity of 35 knots.

TROPICAL CYCLONE 13P (CLLLA)
27 JAN 2003


Time Intensity for 13P
Intensity (kts)


## Tropical Cyclone (TC) 14S (Fiona)*

First Poor : 1000Z 03 Feb 03

First Fair : 2030Z 04 Feb 03
First TCFA : 0500Z 05 Feb 03
First Warning : 1200Z 05 Feb 03
Last Warning : 0000Z 13 Feb 03, Dissipated
Max Intensity : 110 kts, gusts to 135 kts
Landfall : None

Total Warnings : 19
Remarks:
(1) Tropical Cyclone (TC) 14S developed approximately 180 nm south of Java around 3 February 2003. The cyclone initially tracked slowly west to west-southwestward (4-6 knots) while intensifying at the climatological rate of one Dvorak T-number per day. While tracking westsouthwestward, TC 14S attained a maximum intensity of 110 knots briefly at approximately 0600 Z on 09 February and then quickly weakened back to 100 knots, which was maintained for a further 24 hours. Subsequently, the cyclone began to weaken and move poleward. Increasing vertical wind shear caused decoupling of the deep convection from the low level circulation pattern. The final warning was issued on 13 February as the cyclone dissipated over open water.
(2) No operational impacts damage was reported.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020306 |  | 11.7S | 115.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020312 |  | 11.7S | 114.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020318 |  | 11.7S | 114.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 |  | 11.7S | 114.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 |  | 11.7S | 113.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 |  | 11.7S | 113.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 |  | 11.7S | 112.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 11.7S | 112.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.7 S | 112.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 | 1 | 11.8S | 111.5E | 35 | 41 | 59 | 71 | 78 | 41 | 33 |  |  | 0 | 0 | 0 | 5 | -5 | -25 |  |  |
| 03020518 | 2 | 11.9 S | 110.8E | 35 | 6 | 19 | 32 | 13 | 19 | 30 |  |  | 0 | -5 | 0 | -5 | -15 | -30 |  |  |
| 03020600 | 3 | 12.0 S | 110.1E | 45 | 13 | 24 | 34 | 0 | 8 | 35 |  |  | 0 | 0 | 0 | -10 | -20 | -25 |  |  |
| 03020606 | 4 | 12.0 S | 109.4E | 50 | 0 | 6 | 17 | 29 | 32 | 76 |  |  | 0 | 0 | -5 | -15 | -20 | -35 |  |  |
| 03020612 | 5 | 12.0S | 108.7E | 55 | 11 | 13 | 35 | 30 | 41 | 105 |  |  | 0 | 0 | -10 | -20 | -25 | -25 |  |  |
| 03020618 | 6 | 12.0 S | 108.0E | 55 | 11 | 24 | 43 | 42 | 51 | 139 |  |  | 0 | -5 | -15 | -20 | -25 | -15 |  |  |
| 03020700 | 7 | 12.0 S | 107.2E | 60 | 18 | 43 | 56 | 64 | 81 |  |  |  | 0 | -10 | -20 | -25 | -20 |  |  |  |
| 03020712 | 8 | 12.6 S | 105.2E | 75 | 11 | 17 | 13 | 0 | 13 |  |  |  | 0 | -10 | -15 | -10 | -5 |  |  |  |
| 03020800 | 9 | 13.4S | 103.6E | 90 | 0 | 8 | 13 | 24 | 42 |  |  |  | 0 | 0 | 10 | 5 | -5 |  |  |  |
| 03020812 | 10 | 14.4S | 101.8E | 100 | 13 | 6 | 18 | 53 | 96 |  |  |  | 0 | 5 | 5 | -5 | -10 |  |  |  |
| 03020900 | 11 | 15.4 S | 99.9E | 100 | 5 | 21 | 42 | 72 | 67 |  |  |  | 0 | 0 | -10 | -10 | -10 |  |  |  |
| 03020912 | 12 | 16.4S | 97.7E | 100 | 11 | 31 | 85 | 124 | 152 |  |  |  | 0 | -10 | -10 | 0 | 5 |  |  |  |
| 03021000 | 13 | 16.7S | 95.3E | 100 | 5 | 60 | 122 | 180 | 254 |  |  |  | 0 | 0 | 0 | 0 | 10 |  |  |  |
| 03021012 | 14 | 16.8S | 93.4E | 90 | 5 | 42 | 70 | 112 | 193 |  |  |  | 0 | 0 | 5 | 10 | 5 |  |  |  |
| 03021100 | 15 | 17.6S | 91.9E | 80 | 16 | 25 | 62 | 82 | 93 |  |  |  | 0 | -5 | 0 | 0 | 20 |  |  |  |
| 03021112 | 16 | 18.6 S | 91.1E | 75 | 6 | 26 | 64 | 99 |  |  |  |  | 5 | 10 | 5 | 20 |  |  |  |  |
| 03021200 | 17 | 20.0S | 91.0E | 60 | 0 | 25 | 42 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 03021212 | 18 | 21.4 S | 91.8E | 55 | 0 | 21 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03021300 | 19 | 22.2 S | 92.4E | 30 | 13 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 26 | 48 | 63 | 79 | 70 |  |  | 0 | 4 | 7 | 10 | 13 | 26 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -1 | -3 | -5 | -8 | -26 |  |  |
|  |  |  | \# CASES |  | 19 | 18 | 17 | 16 | 15 | 6 |  |  | 19 | 18 | 17 | 16 | 15 | 6 |  |  |



Figure 2-14S-1. 081024Z February 2003 GMS-5 enhanced infrared imagery of TC 14S (Fiona), 325 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.


Figure 2-14S-2. 091124Z February 200385 GHz TRMM imagery of TC 14S (Fiona), 295 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

## TROPICAL CYCLONE 14S (FIONA) 05-13 FEB 2003



Time Intensity for 14 S


## Tropical Cyclone (TC) 14S (Fiona)*

First Poor : 1000Z 03 Feb 03
First Fair : 2030Z 04 Feb 03
First TCFA : 0500Z 05 Feb 03
First Warning : 1200Z 05 Feb 03
Last Warning : 0000Z 13 Feb 03, Dissipated
Max Intensity : 110 kts, gusts to 135 kts
Landfall : None
Total Warnings : 19
Remarks:
(1) Tropical Cyclone (TC) 14S developed approximately 180 nm south of Java around 3 February 2003. The cyclone initially tracked slowly west to west-southwestward ( $4-6$ knots) while intensifying at the climatological rate of one Dvorak T-number per day. While tracking westsouthwestward, TC 14S attained a maximum intensity of 110 knots briefly at approximately 0600 Z on 09 February and then quickly weakened back to 100 knots, which was maintained for a further 24 hours. Subsequently, the cyclone began to weaken and move poleward. Increasing vertical wind shear caused decoupling of the deep convection from the low level circulation pattern. The final warning was issued on 13 February as the cyclone dissipated over open water.
(2) No operational impacts damage was reported.
*Named by WMO designated RSMC

Statistics for JTWC on TC14S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020306 |  | 11.7S | 115.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020312 |  | 11.7S | 114.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020318 |  | 11.7 S | 114.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 |  | 11.7S | 114.1E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 |  | 11.7S | 113.7E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 |  | 11.7S | 113.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 |  | 11.7 S | 112.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 11.7S | 112.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.7S | 112.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 | 1 | 11.8S | 111.5E | 35 | 41 | 59 | 71 | 78 | 41 | 33 |  |  | 0 | 0 | 0 | 5 | -5 | -25 |  |  |
| 03020518 | 2 | 11.9 S | 110.8E | 35 | 6 | 19 | 32 | 13 | 19 | 30 |  |  | 0 | -5 | 0 | -5 | -15 | -30 |  |  |
| 03020600 | 3 | 12.0S | 110.1E | 45 | 13 | 24 | 34 | 0 | 8 | 35 |  |  | 0 | 0 | 0 | -10 | -20 | -25 |  |  |
| 03020606 | 4 | 12.0 S | 109.4E | 50 | 0 | 6 | 17 | 29 | 32 | 76 |  |  | 0 | 0 | -5 | -15 | -20 | -35 |  |  |
| 03020612 | 5 | 12.0S | 108.7E | 55 | 11 | 13 | 35 | 30 | 41 | 105 |  |  | 0 | 0 | -10 | -20 | -25 | -25 |  |  |
| 03020618 | 6 | 12.0 S | 108.0E | 55 | 11 | 24 | 43 | 42 | 51 | 139 |  |  | 0 | -5 | -15 | -20 | -25 | -15 |  |  |
| 03020700 | 7 | 12.0S | 107.2E | 60 | 18 | 43 | 56 | 64 | 81 |  |  |  | 0 | -10 | -20 | -25 | -20 |  |  |  |
| 03020712 | 8 | 12.6 S | 105.2E | 75 | 11 | 17 | 13 | 0 | 13 |  |  |  | 0 | -10 | -15 | -10 | -5 |  |  |  |
| 03020800 | 9 | 13.4S | 103.6E | 90 | 0 | 8 | 13 | 24 | 42 |  |  |  | 0 | 0 | 10 | 5 | -5 |  |  |  |
| 03020812 | 10 | 14.4S | 101.8E | 100 | 13 | 6 | 18 | 53 | 96 |  |  |  | 0 | 5 | 5 | -5 | -10 |  |  |  |
| 03020900 | 11 | 15.4S | 99.9E | 100 | 5 | 21 | 42 | 72 | 67 |  |  |  | 0 | 0 | -10 | -10 | -10 |  |  |  |
| 03020912 | 12 | 16.4 S | 97.7E | 100 | 11 | 31 | 85 | 124 | 152 |  |  |  | 0 | -10 | -10 | 0 | 5 |  |  |  |
| 03021000 | 13 | 16.7S | 95.3E | 100 | 5 | 60 | 122 | 180 | 254 |  |  |  | 0 | 0 | 0 | 0 | 10 |  |  |  |
| 03021012 | 14 | 16.8 S | 93.4E | 90 | 5 | 42 | 70 | 112 | 193 |  |  |  | 0 | 0 | 5 | 10 | 5 |  |  |  |
| 03021100 | 15 | 17.6S | 91.9E | 80 | 16 | 25 | 62 | 82 | 93 |  |  |  | 0 | -5 | 0 | 0 | 20 |  |  |  |
| 03021112 | 16 | 18.6S | 91.1E | 75 | 6 | 26 | 64 | 99 |  |  |  |  | 5 | 10 | 5 | 20 |  |  |  |  |
| 03021200 | 17 | 20.0S | 91.0E | 60 | 0 | 25 | 42 |  |  |  |  |  | 0 | 0 | 15 |  |  |  |  |  |
| 03021212 | 18 | 21.4 S | 91.8E | 55 | 0 | 21 |  |  |  |  |  |  | 0 | 15 |  |  |  |  |  |  |
| 03021300 | 19 | 22.2 S | 92.4E | 30 | 13 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 10 | 26 | 48 | 63 | 79 | 70 |  |  | 0 | 4 | 7 | 10 | 13 | 26 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | -1 | -3 | -5 | -8 | -26 |  |  |
|  |  |  | \# CASES |  | 19 | 18 | 17 | 16 | 15 | 6 |  |  | 19 | 18 | 17 | 16 | 15 | 6 |  |  |



Figure 2-14S-1. $081024 Z$ February 2003 GMS-5 enhanced infrared imagery of TC 14S (Fiona), 325 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.


Figure 2-14S-2. $091124 Z$ February 200385 GHz TRMM imagery of TC 14S (Fiona), 295 nm east-southeast of the Cocos island, with a maximum intensity of 100 knots.

TROPICAL CYCLONE 14S (FIONA)
05-13 FEB 2003


Time Intensity for 14S
Intensity (kts)


## Tropical Cyclone (TC) 15P (Dovi)*

First Poor : 2200Z 04 Feb 03
First Fair : 0230Z 05 Feb 03
First TCFA : 0700Z 05 Feb 03
First Warning : 1800Z 05 Feb 03
Last Warning : $1800 Z 10$ Feb 03, Extratropical
Max Intensity : 130 kts, gusts to 155 kts
Landfall : None
Total Warnings : 11
Remarks: None
*Named by WMO designated RSMC

Statistics for JTWC on TC15P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020418 |  | 10.2S | 162.9W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 10.7S | 162.9W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.35 | 163.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 |  | 12.0S | 163.0W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020518 | 1 | 12.8 S | 162.9W | 30 | 11 | 31 | 71 | 92 | 108 |  |  |  | 0 | -5 | -25 | -35 | -60 |  |  |  |


| 03020606 | 2 | 14.4 S | 162.6 W | 40 | 5 | 35 | 35 | 35 | 29 |  |  |  | -5 | -20 | -30 | -60 | -75 |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03020618 | 3 | 15.8 S | 163.3 W | 65 | 5 | 18 | 21 | 38 | 42 |  |  |  |  | 0 | 10 | -15 | -20 | -10 |  |  |  |
| 03020706 | 4 | 16.7 S | 164.4 W | 80 | 13 | 24 | 44 | 37 | 52 |  |  |  | -5 | -30 | -35 | -25 | -10 |  |  |  |  |
| 03020718 | 5 | 17.5 S | 165.5 W | 115 | 20 | 26 | 56 | 61 | 64 |  |  |  | 10 | 5 | 10 | 0 | 10 |  |  |  |  |
| 03020806 | 6 | 18.3 S | 166.6 W | 130 | 13 | 26 | 45 | 61 | 72 |  |  |  | 0 | 0 | -5 | 5 | 10 |  |  |  |  |
| 03020818 | 7 | 19.4 S | 168.0 W | 130 | 12 | 22 | 41 | 50 | 87 |  |  |  | 0 | -5 | 5 | 10 | 45 |  |  |  |  |
| 03020906 | 8 | 20.8 S | 168.9 W | 125 | 0 | 25 | 37 | 20 |  |  |  |  | 0 | 10 | 15 | 35 |  |  |  |  |  |
| 03020918 | 9 | 22.4 S | 169.2 W | 105 | 11 | 37 | 53 |  |  |  |  |  | 5 | 10 | 40 |  |  |  |  |  |  |
| 03021006 | 10 | 24.0 S | 168.8 W | 90 | 17 | 42 |  |  |  |  |  |  | -5 | 25 |  |  |  |  |  |  |  |
| 03021018 | 11 | 25.4 S | 168.7 W | 50 | 38 |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |  |
| 03021100 |  | 26.2 S | 169.0 W | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 14 | 29 | 45 | 49 | 65 |  |  |  | 3 | 12 | 20 | 24 | 31 |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | -4 | -11 | -13 |  |  |  |  |
|  |  |  | \# CASES |  | 11 | 10 | 9 | 8 | 7 |  |  |  | 11 | 10 | 9 | 8 | 7 |  |  |  |  |



Figure 2-15P-1. 080424Z February 2003 GMS-5 enhanced infrared imagery of TC 15P (Dovi), 388 nm southeast of Pago Pago island, with a peak intensity of 130 knots.


Figure 2-15P-2. 081800 Z February 2003 GOES-10 visible imagery of TC 15P (Dovi), 325 nm southeast of Pago Pago island, with a peak intensity of 130 knots.

TROPICAL CYCLONE 15P (DOVI)
05-10 FEB 2003


## Time Intensity for 15P

Intensity (kts)


## Tropical Cyclone (TC) 15P (Dovi)*

First Poor : 2200Z 04 Feb 03
First Fair : 0230Z 05 Feb 03
First TCFA : $0700 Z 05$ Feb 03

First Warning : 1800Z 05 Feb 03
Last Warning : 1800Z 10 Feb 03, Extratropical
Max Intensity : 130 kts, gusts to 155 kts
Landfall : None

Total Warnings : 11
Remarks: None
*Named by WMO designated RSMC

| Statistics for JTWC on TC15P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST T | TRACK |  |  | SIT | ION | V ER | ROR |  |  |  |  | ND | ERRO | RS |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020418 |  | 10.2 S | 162.9W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 10.7S | 162.9W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.35 | 163.0W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 |  | 12.0S | 163.0W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020518 | 1 | 12.8 S | 162.9W | 30 | 11 | 31 | 71 | 92 | 108 |  |  |  | 0 | -5 | -25 | -35 | -60 |  |  |  |
| 03020606 | 2 | 14.4S | 162.6W | 40 | 5 | 35 | 35 | 35 | 29 |  |  |  | -5 | -20 | -30 | -60 | -75 |  |  |  |
| 03020618 | 3 | 15.8S | 163.3W | 65 | 5 | 18 | 21 | 38 | 42 |  |  |  | 0 | 10 | -15 | -20 | -10 |  |  |  |
| 03020706 | 4 | 16.7S | 164.4W | 80 | 13 | 24 | 44 | 37 | 52 |  |  |  | -5 | -30 | -35 | -25 | -10 |  |  |  |
| 03020718 | 5 | 17.5S | 165.5W | 115 | 20 | 26 | 56 | 61 | 64 |  |  |  | 10 | 5 | 10 | 0 | 10 |  |  |  |
| 03020806 | 6 | 18.3S | 166.6W | 130 | 13 | 26 | 45 | 61 | 72 |  |  |  | 0 | 0 | -5 | 5 | 10 |  |  |  |
| 03020818 | 7 | 19.4 S | 168.0W | 130 | 12 | 22 | 41 | 50 | 87 |  |  |  | 0 | -5 | 5 | 10 | 45 |  |  |  |
| 03020906 | 8 | 20.8S | 168.9W | 125 | 0 | 25 | 37 | 20 |  |  |  |  | 0 | 10 | 15 | 35 |  |  |  |  |
| 03020918 | 9 | 22.4 S | 169.2W | 105 | 11 | 37 | 53 |  |  |  |  |  | 5 | 10 | 40 |  |  |  |  |  |
| 03021006 | 10 | 24.0S | 168.8W | 90 | 17 | 42 |  |  |  |  |  |  | -5 | 25 |  |  |  |  |  |  |
| 03021018 | 11 | 25.4S | 168.7W | 50 | 38 |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |
| 03021100 |  | 26.2S | 169.0W | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 14 | 29 | 45 | 49 | 65 |  |  |  | 3 | 12 | 20 | 24 | 31 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | -4 | -11 | -13 |  |  |  |
|  |  |  | \# CASES |  | 11 | 10 | 9 | 8 | 7 |  |  |  | 11 | 10 | 9 | 8 | 7 |  |  |  |



Figure 2-15P-1. 080424 Z February 2003 GMS-5 enhanced infrared imagery of TC 15P (Dovi), 388 nm southeast of Pago Pago island, with a peak intensity of 130 knots.


Figure 2-15P-2. 081800 Z February 2003 GOES-10 visible imagery of TC 15P (Dovi), 325 nm southeast of Pago Pago island, with a peak intensity of 130 knots.


Time Intensity for 15P
Intensity (kts)


# Tropical Cyclone (TC) 16S (Gerry)* 

First Poor : N/A
First Fair : 1800Z 07 Feb 03
First TCFA : 0630Z 08 Feb 03
First Warning : 1800Z 08 Feb 03
Last Warning : $1200 Z 15$ Feb 03, Dissipation
Max Intensity : 105 kts, gusts to 130 kts
Landfall : None
Total Warnings : 15
Remarks:
(1) Tropical Cyclone (TC) 16S developed approximately 430 Nm north-northwest of Mauritius within a well established monsoon trough consisting of 3 separate circulations that spanned across the South Indian Ocean. The other 2 circulations eventually became TCs 17S and 18S. Initially, TC 16S was caught in the weak equatorial steering flow of a low to mid level ridge to the southwest. TC 16S remained a weak system at the surface during this time, but maintained a well developed mid-level circulation. As the cyclone intensified, it made a quick turn south and curved towards the southeast as the steering ridge moved to the east of the system. TC 16S eventually went extratropical and JTWC issued the final warning on 15 February.

TC 16S reached a maximum intensity of 105 knots on 13 February when the upper level conditions improved and enhanced outflow into a mid-latitude trough. TC 16S passed within approximately 60 Nm northeast of Mauritius at its maximum intensity and weakened thereafter as it encountered increasing vertical wind shear.

TCs 16S, 17S, and 18S are an interesting case on how multiple TCs in one tropical basin behave and interact with each other in the open water. All systems developed at approximately the same latitude, yet displayed few signs of direct interaction through their life cycle.
(2) Reports indicated minimal damage on Mauritius with this system.

## *Named by WMO designated RSMC

Statistics for JTWC on TC16S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020718 |  | 14.9 S | 55.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020800 |  | 14.5S | 56.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020806 |  | 14.15 | 56.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020812 |  | 13.7S | 56.3E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020818 | 1 | 13.5S | 56.1E | 30 | 60 | 103 | 158 | 223 | 253 |  |  |  | 0 | 0 | 10 | 5 | 0 |  |  |  |
| 03020906 | 2 | 13.0S | 55.5E | 35 | 0 | 32 | 105 | 116 | 127 |  |  |  | 0 | 10 | 10 | 10 | 15 |  |  |  |
| 03020918 | 3 | 12.15 | 54.9E | 35 | 8 | 53 | 101 | 123 | 147 |  |  |  | 0 | 0 | -5 | 0 | 15 |  |  |  |
| 03021006 | 4 | 11.4 S | 54.4E | 45 | 13 | 60 | 118 | 168 | 189 |  |  |  | 0 | -5 | 0 | 15 | 30 |  |  |  |
| 03021018 | 5 | 12.15 | 53.9E | 55 | 50 | 113 | 193 | 200 | 171 |  |  |  | 0 | 5 | 20 | 25 | 15 |  |  |  |
| 03021106 | 6 | 13.35 | 53.7E | 60 | 0 | 44 | 38 | 19 | 57 |  |  |  | 0 | 15 | 20 | 0 | -25 |  |  |  |
| 03021118 | 7 | 15.5S | 53.8E | 60 | 21 | 34 | 49 | 91 | 123 |  |  |  | -5 | -5 | -20 | -40 | -40 |  |  |  |
| 03021206 | 8 | 16.7S | 54.6E | 65 | 8 | 29 | 85 | 125 | 146 |  |  |  | -10 | -30 | -50 | -45 | -40 |  |  |  |
| 03021218 | 9 | 18.0 S | 56.1E | 85 | 23 | 80 | 127 | 150 | 156 |  |  |  | -10 | -30 | -30 | -25 | 5 |  |  |  |
| 03021306 | 10 | 19.4S | 58.5E | 105 | 0 | 49 | 87 | 103 | 124 |  |  |  | 0 | 15 | 20 | 50 | 55 |  |  |  |
| 03021318 | 11 | 21.5S | 60.9E | 100 | 5 | 27 | 60 | 89 |  |  |  |  | 0 | 0 | 30 | 45 |  |  |  |  |
| 03021400 | 12 | 22.6 S | 61.8E | 100 | 0 | 27 | 64 | 106 |  |  |  |  | 0 | 10 | 45 | 45 |  |  |  |  |
| 03021412 | 13 | 24.7S | 63.4E | 75 | 12 | 20 | 48 |  |  |  |  |  | 0 | 25 | 15 |  |  |  |  |  |
| 03021500 | 14 | 26.4 S | 65.1E | 35 | 34 | 6 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03021512 | 15 | 27.9 S | 67.0E | 30 | 12 |  |  |  |  |  |  |  | 5 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 17 | 48 | 95 | 126 | 149 |  |  |  | 2 | 11 | 21 | 25 | 24 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | 1 | 5 | 7 | 3 |  |  |  |
|  |  |  | \# CASES |  | 15 | 14 | 13 | 12 | 10 |  |  |  | 15 | 14 | 13 | 12 | 10 |  |  |  |



Figure 2-16S-1. $131228 Z$ February 200385 GHz TRMM image of TC 16S (Gerry), 243 nm east of La Reunion island, with a peak intensity of 105 knots. The northern portion of the eye wall has just begun to weaken.

## TROPICAL CYCLONE 16S (GERRY)

08-14 FEB 2003


Time Intensity for 16 S
Intensity (kts)


## Tropical Cyclone (TC) 16S (Gerry)*

First Poor: N/A
First Fair : 1800Z 07 Feb 03
First TCFA : $0630 Z 08$ Feb 03

First Warning : 1800Z 08 Feb 03
Last Warning : 1200Z 15 Feb 03, Dissipation
Max Intensity : 105 kts, gusts to 130 kts
Landfall : None

Total Warnings : 15
Remarks:
(1) Tropical Cyclone (TC) 16S developed approximately 430 Nm north-northwest of Mauritius within a well established monsoon trough consisting of 3 separate circulations that spanned across the South Indian Ocean. The other 2 circulations eventually became TCs 17S and 18S. Initially, TC 16S was caught in the weak equatorial steering flow of a low to mid level ridge to the southwest. TC 16S remained a weak system at the surface during this time, but maintained a well developed mid-level circulation. As the cyclone intensified, it made a quick turn south and curved towards the southeast as the steering ridge moved to the east of the system. TC 16 S eventually went extratropical and JTWC issued the final warning on 15 February.

TC 16S reached a maximum intensity of 105 knots on 13 February when the upper level conditions improved and enhanced outflow into a mid-latitude trough. TC 16S passed within approximately 60 Nm northeast of Mauritius at its maximum intensity and weakened thereafter as it encountered increasing vertical wind shear.

TCs 16S, 17S, and 18S are an interesting case on how multiple TCs in one tropical basin behave and interact with each other in the open water. All systems developed at approximately the same latitude, yet displayed few signs of direct interaction through their life cycle.
(2) Reports indicated minimal damage on Mauritius with this system.
*Named by WMO designated RSMC



Figure 2-16S-1. 131228 February 200385 GHz TRMM image of TC 16S (Gerry), 243 nm east of La Reunion island, with a peak intensity of 105 knots. The northern portion of the eye wall has just begun to weaken.

## TROPICAL CYCLONE 16S (GERRY)

08-14 FEB 2003


Time Intensity for 16S
Intensity (kts)


## Tropical Cyclone (TC) 17S (Hape)*

First Poor : N/A
First Fair : 0630Z 09 Feb 03
First TCFA : 0530Z 10 Feb 03
First Warning : 1800Z 10 Feb 03
Last Warning : $1800 Z 14$ Feb 03, Dissipated
Max Intensity : 80 kts, gusts to 100 kts
Landfall : None

Total Warnings : 10
Remarks:
(1) Tropical Cyclone (TC) 17S was first detected as a tropical disturbance on 09 February 2003 and was initially forecast by JTWC to interact with TC 16S. Such interaction didn't take place and by the second warning the primary steering influence was a near equatorial ridge situated to the northeast. The system intensified at a Dvorak T-number a day and then stabilized near 80 knots as the system tracked eastward, south of the ridge. Outflow was enhanced by passing short-wave troughs, enabling the cyclone to attain and then maintain this intensity for approximately 48 hours. TC 17S subsequently moved equatorward as the near equatorial ridge weakened until 13 February at $1800 Z$. Thereafter, a subtropical ridge developed to the northeast and caused the cyclone to track poleward where it dissipated under strong vertical wind shear.
(2) No reports of damage caused by this cyclone were available.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020906 |  | 12.0 S | 65.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020912 |  | 12.4 S | 65.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020918 |  | 12.8 S | 65.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021000 |  | 13.4S | 64.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021006 |  | 14.0S | 64.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021012 |  | 14.6S | 64.5E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021018 | 1 | 15.3 S | 64.3E | 40 | 18 | 50 | 181 | 385 | 629 |  |  |  | 0 | 0 | -25 | -50 | -45 |  |  |  |
| 03021106 | 2 | 16.8S | 64.4E | 45 | 18 | 58 | 191 | 312 | 414 |  |  |  | 0 | -15 | -35 | -30 | -35 |  |  |  |
| 03021118 | 3 | 17.6 S | 66.0E | 75 | 8 | 79 | 170 | 276 | 382 |  |  |  | 0 | -15 | 5 | 10 | 10 |  |  |  |
| 03021206 | 4 | 17.0S | 68.0E | 100 | 5 | 32 | 66 | 96 | 85 |  |  |  | -20 | 0 | 15 | 10 | 20 |  |  |  |
| 03021218 | 5 | 16.15 | 69.9E | 90 | 34 | 66 | 74 | 36 | 31 |  |  |  | -15 | 0 | 5 | 25 | 30 |  |  |  |
| 03021306 | 6 | 15.1S | 71.0E | 80 | 5 | 25 | 62 | 66 | 130 |  |  |  | 0 | 0 | 25 | 30 | 65 |  |  |  |
| 03021318 | 7 | 14.7S | 72.0E | 80 | 5 | 78 | 127 | 207 |  |  |  |  | 0 | 20 | 15 | 35 |  |  |  |  |
| 03021406 | 8 | 15.8S | 73.2E | 65 | 26 | 57 | 144 |  |  |  |  |  | 0 | -15 | 5 |  |  |  |  |  |
| 03021418 | 9 | 17.3 S | 74.4E | 65 | 36 | 102 |  |  |  |  |  |  | -5 | 15 |  |  |  |  |  |  |
| 03021506 | 10 | 20.0 S | 76.4E | 35 | 18 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 61 | 127 | 197 | 279 |  |  |  | 4 | 9 | 16 | 27 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -4 | -1 | 1 | 4 | 8 |  |  |  |
|  |  |  | \# CASES |  | 10 | 9 | 8 | 7 | 6 |  |  |  | 10 | 9 | 8 | 7 | 6 |  |  |  |



Figure 2-17S-1. $120438 Z$ February 200385 GHz SSM/I imagery of TC 17S (Hape), 625 nm south-southwest of Diego Garcia, with a increasing intensity of 75 knots.

## TROPICAL CYCLONE 17S (HAPE)

## 10-14 FEB 2003



## Time Intensity for 17 S

Intensity (kts)


| - PGTW |
| :--- |
| - KGWC |
| - KWBC |
| - OTHER |
| - T-Numbers |
| - Best Track |

## Tropical Cyclone (TC) 17S (Hape)*

First Poor : N/A
First Fair : 0630Z 09 Feb 03
First TCFA : 0530Z 10 Feb 03

First Warning : 1800Z 10 Feb 03
Last Warning : 1800Z 14 Feb 03, Dissipated
Max Intensity : 80 kts, gusts to 100 kts
Landfall : None

Total Warnings : 10
Remarks:
(1) Tropical Cyclone (TC) 17S was first detected as a tropical disturbance on 09 February 2003 and was initially forecast by JTWC to interact with TC 16S. Such interaction didn't take place and by the second warning the primary steering influence was a near equatorial ridge situated to the northeast. The system intensified at a Dvorak T-number a day and then stabilized near 80 knots as the system tracked eastward, south of the ridge. Outflow was enhanced by passing short-wave troughs, enabling the cyclone to attain and then maintain this intensity for approximately 48 hours. TC 17S subsequently moved equatorward as the near equatorial ridge weakened until 13 February at 1800Z. Thereafter, a subtropical ridge developed to the northeast and caused the cyclone to track poleward where it dissipated under strong vertical wind shear.
(2) No reports of damage caused by this cyclone were available.
*Named by WMO designated RSMC

## Statistics for JTWC on TC17S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020906 |  | 12.0 S | 65.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020912 |  | 12.4 S | 65.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020918 |  | 12.8 S | 65.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021000 |  | 13.4S | 64.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021006 |  | 14.0S | 64.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021012 |  | 14.6S | 64.5E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021018 | 1 | 15.3S | 64.3E | 40 | 18 | 50 | 181 | 385 | 629 |  |  |  | 0 | 0 | -25 | -50 | -45 |  |  |  |
| 03021106 | 2 | 16.8S | 64.4E | 45 | 18 | 58 | 191 | 312 | 414 |  |  |  | 0 | -15 | -35 | -30 | -35 |  |  |  |
| 03021118 | 3 | 17.6S | 66.0E | 75 | 8 | 79 | 170 | 276 | 382 |  |  |  | 0 | -15 | 5 | 10 | 10 |  |  |  |
| 03021206 | 4 | 17.0S | 68.0E | 100 | 5 | 32 | 66 | 96 | 85 |  |  |  | -20 | 0 | 15 | 10 | 20 |  |  |  |
| 03021218 | 5 | 16.15 | 69.9E | 90 | 34 | 66 | 74 | 36 | 31 |  |  |  | -15 | 0 | 5 | 25 | 30 |  |  |  |
| 03021306 | 6 | 15.15 | 71.0E | 80 | 5 | 25 | 62 | 66 | 130 |  |  |  | 0 | 0 | 25 | 30 | 65 |  |  |  |
| 03021318 | 7 | 14.7S | 72.0E | 80 | 5 | 78 | 127 | 207 |  |  |  |  | 0 | 20 | 15 | 35 |  |  |  |  |
| 03021406 | 8 | 15.8S | 73.2E | 65 | 26 | 57 | 144 |  |  |  |  |  | 0 | -15 | 5 |  |  |  |  |  |
| 03021418 | 9 | 17.3S | 74.4E | 65 | 36 | 102 |  |  |  |  |  |  | -5 | 15 |  |  |  |  |  |  |
| 03021506 | 10 | 20.0S | 76.4E | 35 | 18 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 61 | 127 | 197 | 279 |  |  |  | 4 | 9 | 16 | 27 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -4 | -1 | 1 | 4 | 8 |  |  |  |
|  |  |  | \# CASES |  | 10 | 9 | 8 | 7 | 6 |  |  |  | 10 | 9 | 8 | 7 | 6 |  |  |  |



Figure 2-17S-1. $120438 Z$ February 200385 GHz SSM/I imagery of TC 17S (Hape), 625 nm south-southwest of Diego Garcia, with a increasing intensity of 75 knots.

TROPICAL CYCLONE 17S (HAPE)
10-14 FEB 2003


Time Intensity for 17S
Intensity (kts)


| - PGTW |
| :--- |
| - KGWC |
| - KWBC |
| - OTHER |
| - T-Numbers |
| - Best Track |

## Tropical Cyclone (TC) 18S (Isha)*

First Poor : 1800Z 03 Feb 03
First Fair : 0330Z 04 Feb 03
First TCFA : $2000 Z 04$ Feb 03
First Warning : 0000Z 11 Feb 03
Last Warning : 0000Z 14 Feb 03, Dissipated
Max Intensity : 45 kts, gusts to 55 kts
Landfall : None
Total Warnings : 7
Remarks:
(1) Tropical Cyclone (TC) 18 S developed approximately 200 nm northeast of Cocos Island on 03 February at 1800Z. The cyclone tracked westward until 09 February at $0600 Z$ and then altered track towards the southwest. The first warning was issued on 11 February at 0000 Z when TC 18S was approximately 900 nm west of Cocos Island. The cyclone then turned southeast as it passed poleward of the ridge axis.

TC 18 S reached a maximum intensity of only 45 kts by February 13 at 0000Z. The final warning for the cyclone was issued on February 14 as it dissipated over open ocean.
(2) No damage reports were received for TC 18 S .
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020318 |  | 9.8 S | 99.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 |  | 10.2S | 99.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 |  | 10.65 | 98.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 |  | 10.8S | 98.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 |  | 10.9S | 97.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 11.0S | 97.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.1S | 96.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 |  | 11.1S | 96.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020518 |  | 11.2S | 95.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020600 |  | 11.2S | 95.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020606 |  | 11.1S | 94.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020612 |  | 10.7S | 93.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020618 |  | 10.2S | 92.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020700 |  | 9.7S | 91.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020706 |  | 9.65 | 91.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020712 |  | 9.4S | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020718 |  | 9.45 | 90.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020800 |  | 9.4S | 90.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020806 |  | 9.5 S | 89.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020812 |  | 9.65 | 88.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020818 |  | 9.75 | 87.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020900 |  | 9.95 | 86.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020906 |  | 10.1S | 85.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020912 |  | 10.5S | 85.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020918 |  | 10.8S | 84.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021000 |  | 11.1S | 84.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021006 |  | 11.6 S | 83.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021012 |  | 12.3S | 82.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021018 |  | 13.1S | 81.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021100 | 1 | 14.0S | 81.2E | 30 | 0 | 65 | 139 | 185 | 201 |  |  |  | 0 | 10 | 5 | 10 | 10 |  |  |  |


| 03021112 | 2 | $15.5 S$ | 81.6 E | 30 | 21 | 73 | 114 | 158 | 215 |  |  |  | 0 | -5 | 0 | 0 | 5 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03021200 | 3 | 16.4 S | 82.7 E | 40 | 0 | 18 | 34 | 95 | 92 |  |  |  | 0 | 5 | 5 | 10 | 25 |  |  |  |
| 03021212 | 4 | 17.1 S | 83.6 E | 40 | 41 | 85 | 120 | 74 | 57 |  |  |  | 0 | 0 | 5 | 15 | 20 |  |  |  |
| 03021300 | 5 | $18.1 S$ | 84.4 E | 45 | 24 | 83 | 85 | 73 |  |  |  |  | 0 | 5 | 20 | 25 |  |  |  |  |
| 03021312 | 6 | $20.0 S$ | 85.4 E | 45 | 8 | 98 | 228 |  |  |  |  |  | 0 | 5 | -5 |  |  |  |  |  |
| 03021400 | 7 | $21.0 S$ | 85.2 E | 35 | 28 | 96 |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |  |
| 03021406 |  | $20.5 S$ | 84.5 E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



Figure 2-18S-1. $121730 Z$ February 2003 Met-5 enhanced infrared image of TC 18 S (Isha), 791 nm southwest of Cocos island, with a maximum intensity of 45 knots.

## TROPICAL CYCLONE 18S (ISHA)

## 11-14 FEB 2003



## Time Intensity for 18 S

Intensity (kts)


| - PGTW |
| :--- |
| - KGWC |
| - KWBC |
| - OTHER |
| - T-Numbers |
| - Best Track |

## Tropical Cyclone (TC) 18S (Isha)*

First Poor : 1800Z 03 Feb 03
First Fair : 0330Z 04 Feb 03

First TCFA : $2000 Z 04$ Feb 03
First Warning : 0000Z 11 Feb 03

Last Warning : 0000Z 14 Feb 03, Dissipated
Max Intensity : 45 kts, gusts to 55 kts
Landfall : None

Total Warnings : 7
Remarks:
(1) Tropical Cyclone (TC) 18S developed approximately 200 nm northeast of Cocos Island on 03 February at 1800Z. The cyclone tracked westward until 09 February at $0600 Z$ and then altered track towards the southwest. The first warning was issued on 11 February at 0000 Z when TC 18S was approximately 900 nm west of Cocos Island. The cyclone then turned southeast as it passed poleward of the ridge axis.

TC 18 S reached a maximum intensity of only 45 kts by February 13 at 0000Z. The final warning for the cyclone was issued on February 14 as it dissipated over open ocean.
(2) No damage reports were received for TC 18S.
*Named by WMO designated RSMC

| Statistics for JTWC on TC18S |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SIT | ION | ERRO | ORS |  |  |  |  | ND | ERR | OR |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03020318 |  | 9.8 S | 99.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020400 |  | 10.2 S | 99.0E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020406 |  | 10.6 S | 98.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020412 |  | 10.8S | 98.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020418 |  | 10.9S | 97.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020500 |  | 11.0S | 97.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020506 |  | 11.1S | 96.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020512 |  | 11.1S | 96.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020518 |  | 11.2S | 95.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020600 |  | 11.2S | 95.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020606 |  | 11.15 | 94.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020612 |  | 10.7S | 93.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020618 |  | 10.2 S | 92.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020700 |  | 9.7S | 91.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020706 |  | 9.6 S | 91.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020712 |  | 9.45 | 91.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020718 |  | 9.45 | 90.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020800 |  | 9.45 | 90.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020806 |  | 9.5S | 89.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020812 |  | 9.6 S | 88.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020818 |  | 9.7S | 87.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020900 |  | 9.9S | 86.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020906 |  | 10.1S | 85.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020912 |  | 10.5S | 85.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03020918 |  | 10.8 S | 84.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021000 |  | 11.15 | 84.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021006 |  | 11.6 S | 83.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021012 |  | 12.3 S | 82.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021018 |  | 13.1S | 81.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021100 | 1 | 14.0S | 81.2E | 30 | 0 | 65 | 139 | 185 | 201 |  |  |  | 0 | 10 | 5 | 10 | 10 |  |  |  |
| 03021112 | 2 | 15.5 S | 81.6E | 30 | 21 | 73 | 114 | 158 | 215 |  |  |  | 0 | -5 | 0 | 0 | 5 |  |  |  |
| 03021200 | 3 | 16.4S | 82.7E | 40 | 0 | 18 | 34 | 95 | 92 |  |  |  | 0 | 5 | 5 | 10 | 25 |  |  |  |
| 03021212 | 4 | 17.1S | 83.6E | 40 | 41 | 85 | 120 | 74 | 57 |  |  |  | 0 |  | 5 | 15 | 20 |  |  |  |
| 03021300 | 5 | 18.1S | 84.4E | 45 | 24 | 83 | 85 | 73 |  |  |  |  |  | 5 | 20 | 25 |  |  |  |  |


| 03021312 | 6 | $20.0 S$ | 85.4 E | 45 | 8 | 98 | 228 |  |  |  |  |  | 0 | 5 | -5 |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03021400 | 7 | 21.0 S | 85.2 E | 35 | 28 | 96 |  |  |  |  |  |  |  | 0 | -5 |  |  |  |  |  |
| 03021406 |  | 20.5 S | 84.5 E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03021412 |  | 20.5 S | 85.4 E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 74 | 120 | 117 | 141 |  |  |  | 0 | 5 | 7 | 12 | 15 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  |  | 0 | 2 | 5 | 12 | 15 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | \# CASES |  | 7 | 7 | 6 | 5 | 4 |  |  |  | 7 | 7 | 6 | 5 | 4 |  |  |  |



Figure 2-18S-1. $121730 Z$ February 2003 Met-5 enhanced infrared image of TC 18 S (Isha), 791 nm southwest of Cocos island, with a maximum intensity of 45 knots.

## TROPICAL CYCLONE 18S (ISHA)

11-14 FEB 2003


Time Intensity for 18 S
Intensity (kts)



## Tropical Cyclone (TC) 19 S (Japhet)*

First Poor : 1800Z 23 Feb 03

First Fair : 1800Z 24 Feb 03
First TCFA : $2100 Z 25$ Feb 03
First Warning : 0000Z 26 Feb 03
Last Warning : $1200 Z 03$ Mar 03, Dissipated
Max Intensity : 115 kts, gusts to 140 kts
Landfall : South of Vilanculos, Mozambique on 02 March at approx $1700 Z$ with intensity of 85 knots.

Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 19S formed off the southwestern coast of Madagascar in the warm tropical waters of the Mozambique Channel. Initially, the cyclone was located in a weak steering environment, drifting slowly southward as it consolidated. The approach of a transitory ridge from the southwest altered the track west, followed by a weakness in the ridge which altered the track southwestward and provided an improved upper level environment for intensification. TC 19S attained a maximum intensity of 115 knots by 01 March and maintained this intensity for almost 24 hours.

TC 19S made landfall on 02 March at approximately $1700 Z$ just south of Vilanculos, Mozambique with an intensity of 85 knots. They cyclone then weakened rapidly as it moved onto land on a westward track. The remnants of TC 19S then drifted into central Zimbabwe and dissipated.
(2) The intense winds and torrential rains caused by TC 19S damaged infrastructure across southern and central Mozambique and regions of southern and eastern Zimbabwe. News accounts reported a total of 19 fatalities. The heavy tropical rains brought widespread flooding to the Save River basin. On a positive note, remnants of TC 19S brought much needed moisture to many areas in the region that had been experiencing drought.

Statistics for JTWC on TC19S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03022412 |  | 21.4S | 42.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022418 |  | 21.2 S | 42.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022500 |  | 21.4S | 42.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022506 |  | 21.7 S | 42.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022512 |  | 22.15 | 42.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022518 |  | 22.4S | 42.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022600 | 1 | 22.35 | 41.5E | 30 | 40 | 95 | 88 | 77 | 81 |  |  |  | 0 | 0 | -5 | -20 | -15 |  |  |  |
| 03022612 | 2 | 21.6 S | 39.8E | 35 | 12 | 64 | 104 | 124 | 151 |  |  |  | 0 | 0 | -10 | -15 | -15 |  |  |  |
| 03022700 | 3 | 21.4S | 39.2E | 45 | 8 | 49 | 63 | 102 | 187 |  |  |  | 0 | -10 | -10 | -10 | -65 |  |  |  |
| 03022712 | 4 | 21.9 S | 38.7E | 65 | 8 | 11 | 8 | 77 | 162 |  |  |  | -5 | -5 | -10 | -45 | -65 |  |  |  |
| 03022800 | 5 | 22.5 S | 38.0E | 75 | 30 | 26 | 42 | 63 | 50 |  |  |  | 0 | 0 | -25 | -20 | -15 |  |  |  |
| 03022812 | 6 | 23.2S | 37.6E | 85 | 5 | 16 | 37 | 48 | 94 |  |  |  | 0 | -25 | -20 | -15 | 0 |  |  |  |
| 03030100 | 7 | 23.95 | 37.6E | 115 | 0 | 30 | 90 | 183 | 240 |  |  |  | 0 | 0 | 5 | 15 | 35 |  |  |  |
| 03030112 | 8 | 23.65 | 37.6E | 115 | 6 | 49 | 95 | 107 | 127 |  |  |  | 0 | 10 | 15 | 30 | 30 |  |  |  |
| 03030200 | 9 | 23.0 S | 36.9E | 105 | 8 | 57 | 86 | 110 | 130 |  |  |  | 0 | 5 | 25 | 20 | 10 |  |  |  |
| 03030212 | 10 | 22.15 | 35.7E | 90 | 8 | 19 | 37 | 66 |  |  |  |  | -5 | 10 | 5 | -5 |  |  |  |  |
| 03030300 | 11 | 21.35 | 34.7E | 65 | 8 | 17 | 48 |  |  |  |  |  | -5 | -15 | -20 |  |  |  |  |  |
| 03030312 | 12 | 20.8S | 33.4E | 60 | 11 | 42 |  |  |  |  |  |  | -5 | -15 |  |  |  |  |  |  |
| 03030318 |  | 20.35 | 32.9E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030400 |  | 19.8S | 32.5E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 40 | 63 | 96 | 136 |  |  |  | 2 | 8 | 14 | 20 | 28 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -4 | -5 | -7 | -11 |  |  |  |
|  |  |  | \# CASES |  | 12 | 12 | 11 | 10 | 9 |  |  |  | 12 | 12 | 11 | 10 | 9 |  |  |  |




Figure 2-19S-1. $281140 Z$ February 2003 MODIS true-color image of TC 19S (Japhet), located in the Mozambique Channel, with an intensity of 85 knots.


Figure 2-19S-2. 010600 Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, with a maximum intensity of 115 knots.


Figure 2-19S-3. $020630 Z$ March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, just prior to landfall with an intensity of 95 knots.

## TROPICAL CYCLONE 19S (JAPHET)

## 14 FEB - 03 MAR 2003



## Time Intensity for 195

Intensity (kts)



## Tropical Cyclone (TC) 19S (Japhet)*

First Poor : 1800Z 23 Feb 03

First Fair : 1800Z 24 Feb 03
First TCFA : $2100 Z 25$ Feb 03
First Warning : 0000Z 26 Feb 03
Last Warning : 1200Z 03 Mar 03, Dissipated
Max Intensity : 115 kts, gusts to 140 kts
Landfall : South of Vilanculos, Mozambique on 02 March at approx $1700 Z$ with intensity of 85 knots.

Total Warnings : 12
Remarks:
(1) Tropical Cyclone (TC) 19S formed off the southwestern coast of Madagascar in the warm tropical waters of the Mozambique Channel. Initially, the cyclone was located in a weak steering environment, drifting slowly southward as it consolidated. The approach of a transitory ridge from the southwest altered the track west, followed by a weakness in the ridge which altered the track southwestward and provided an improved upper level environment for intensification. TC 19S attained a maximum intensity of 115 knots by 01 March and maintained this intensity for almost 24 hours.

TC 19 S made landfall on 02 March at approximately $1700 Z$ just south of Vilanculos, Mozambique with an intensity of 85 knots. They cyclone then weakened rapidly as it moved onto land on a westward track. The remnants of TC 19S then drifted into central Zimbabwe and dissipated.
(2) The intense winds and torrential rains caused by TC 19S damaged infrastructure across southern and central Mozambique and regions of southern and eastern Zimbabwe. News accounts reported a total of 19 fatalities. The heavy tropical rains brought widespread flooding to the Save River basin. On a positive note, remnants of TC 19S brought much needed moisture to many areas in the region that had been experiencing drought.
*Named by WMO designated RSMC

Statistics for JTWC on TC19S

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03022412 |  | 21.4S | 42.3E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022418 |  | 21.2 S | 42.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022500 |  | 21.4 S | 42.9E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022506 |  | 21.7S | 42.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022512 |  | 22.15 | 42.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022518 |  | 22.4 S | 42.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022600 | 1 | 22.35 | 41.5E | 30 | 40 | 95 | 88 | 77 | 81 |  |  |  | 0 | 0 | -5 | -20 | -15 |  |  |  |
| 03022612 | 2 | 21.6 S | 39.8E | 35 | 12 | 64 | 104 | 124 | 151 |  |  |  | 0 | 0 | -10 | -15 | -15 |  |  |  |
| 03022700 | 3 | 21.4 S | 39.2E | 45 | 8 | 49 | 63 | 102 | 187 |  |  |  | 0 | -10 | -10 | -10 | -65 |  |  |  |
| 03022712 | 4 | 21.9 S | 38.7E | 65 | 8 | 11 | 8 | 77 | 162 |  |  |  | -5 | -5 | -10 | -45 | -65 |  |  |  |
| 03022800 | 5 | 22.5 S | 38.0E | 75 | 30 | 26 | 42 | 63 | 50 |  |  |  | 0 | 0 | -25 | -20 | -15 |  |  |  |
| 03022812 | 6 | 23.25 | 37.6E | 85 | 5 | 16 | 37 | 48 | 94 |  |  |  | 0 | -25 | -20 | -15 | 0 |  |  |  |
| 03030100 | 7 | 23.95 | 37.6E | 115 | 0 | 30 | 90 | 183 | 240 |  |  |  | 0 | 0 | 5 | 15 | 35 |  |  |  |
| 03030112 | 8 | 23.6 S | 37.6E | 115 | 6 | 49 | 95 | 107 | 127 |  |  |  | 0 | 10 | 15 | 30 | 30 |  |  |  |
| 03030200 | 9 | 23.0 S | 36.9E | 105 | 8 | 57 | 86 | 110 | 130 |  |  |  | 0 | 5 | 25 | 20 | 10 |  |  |  |
| 03030212 | 10 | 22.15 | 35.7E | 90 | 8 | 19 | 37 | 66 |  |  |  |  | -5 | 10 | 5 | -5 |  |  |  |  |
| 03030300 | 11 | 21.3 S | 34.7E | 65 | 8 | 17 | 48 |  |  |  |  |  | -5 | -15 | -20 |  |  |  |  |  |
| 03030312 | 12 | 20.85 | 33.4E | 60 | 11 | 42 |  |  |  |  |  |  | -5 | -15 |  |  |  |  |  |  |
| 03030318 |  | 20.35 | 32.9 E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030400 |  | 19.8S | 32.5E | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 40 | 63 | 96 | 136 |  |  |  | 2 | 8 | 14 | 20 | 28 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -2 | -4 | -5 | -7 | -11 |  |  |  |
|  |  |  | \# CASES |  | 12 | 12 | 11 | 10 | 9 |  |  |  | 12 | 12 | 11 | 10 | 9 |  |  |  |



Figure 2-19S-1. $281140 Z$ February 2003 MODIS true-color image of TC 19S (Japhet), located in the Mozambique Channel, with an intensity of 85 knots.


Figure 2-19S-2. 010600Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, with a maximum intensity of 115 knots.


Figure 2-19S-3. 020630Z March 2003 Met-5 visible imagery of TC 19S (Japhet), located in the Mozambique channel, just prior to landfall with an intensity of 95 knots.

## TROPICAL CYCLONE 19S (JAPHET)

14 FEB - 03 MAR 2003


Time Intensity for 19 S


## Tropical Cyclone (TC) 20S (Graham)*

First Poor : 1800Z 24 Feb 03 to 2300Z 26 Feb 03

First Fair : 0430Z 23 Feb 03 and 2300Z 26 Feb 03
First TCFA : 0230Z 27 Feb 03
First Warning : 1800Z 27 Feb 03
Last Warning : 0600Z 01 Mar 03, Dissipated
Max Intensity : 40 kts, gusts to 50 kts
Landfall : East of Mandora, Australia in the Eighty Mile Beach region
Total Warnings : 4
Remarks:
(1) Tropical Cyclone (TC) 20S was first noted as an exposed low level circulation displaced from the convective activity about 210 nm east-northeast of Port Hedland, Australia around 24 February 2003. This weak exposed tropical cyclone remained quasi-stationary for approximately 48 hours. After that period, the synoptic scale patterns changed and allowed for vertical recoupling and cyclone movement toward the southeast. Due to the close proximity to land and movement into the Joseph Bonaparte Gulf, only 4 warnings were issued before the cyclone made landfall and was finaled.
(2) No operational impacts and no damage was reported.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 |  | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03022412 |  | 17.3S | 118.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022418 |  | 17.1S | 118.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022500 |  | 16.95 | 118.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022506 |  | 16.7S | 118.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022512 |  | 16.6 S | 118.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022518 |  | 16.8S | 118.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022600 |  | 17.0S | 118.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022606 |  | 17.2S | 118.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022612 |  | 17.4S | 119.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022618 |  | 17.6S | 119.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022700 |  | 17.7S | 119.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022706 |  | 17.7S | 119.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022712 |  | 17.8S | 120.2E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03022718 | 1 | 18.0S | 120.5E | 30 | 8 | 29 | 62 | 66 |  |  |  |  |  | 0 | 10 | -10 | -5 |  |  |  |  |
| 03022806 | 2 | 18.6S | 120.7E | 30 | 21 | 42 | 51 | 90 |  |  |  |  |  | 5 | 5 | 0 | 5 |  |  |  |  |
| 03022818 | 3 | 19.6 S | 121.1E | 35 | 8 | 46 | 112 |  |  |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03030106 | 4 | 20.35 | 121.7E | 25 | 53 | 112 |  |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03030112 |  | 20.8 S | 122.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030118 |  | 21.5 S | 122.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 23 | 57 | 75 | 78 |  |  |  |  |  | 1 | 6 | 5 | 5 |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  |  | 1 | 6 | -2 | 0 |  |  |  |  |
|  |  |  | \# CASES |  | 4 | 4 | 3 | 2 |  |  |  |  |  |  | 4 | 3 | 2 |  |  |  |  |



Figure 2-20S-1. $281153 Z$ February 2003 multi-sensor satellite images of TC 20S (Graham), just off the northwest coast of Australia prior to landfall, with an intensity of 35 knots.

TROPICAL CYCLONE 20S (GRAHAM)
27 FEB-01 MAR 2003


## Time Intensity for 20 S

## Intensity (kts)



Fix Date (Zulu)

# Tropical Cyclone (TC) 20S (Graham)* 

First Poor : 1800Z 24 Feb 03 to $2300 Z 26$ Feb 03
First Fair : 0430Z 23 Feb 03 and 2300Z 26 Feb 03

First TCFA : 0230Z 27 Feb 03
First Warning : 1800Z 27 Feb 03
Last Warning : 0600Z 01 Mar 03, Dissipated
Max Intensity : 40 kts, gusts to 50 kts
Landfall : East of Mandora, Australia in the Eighty Mile Beach region
Total Warnings : 4
Remarks:
(1) Tropical Cyclone (TC) 20S was first noted as an exposed low level circulation displaced from the convective activity about 210 nm east-northeast of Port Hedland, Australia around 24 February 2003. This weak exposed tropical cyclone remained quasi-stationary for approximately 48 hours. After that period, the synoptic scale patterns changed and allowed for vertical recoupling and cyclone movement toward the southeast. Due to the close proximity to land and movement into the Joseph Bonaparte Gulf, only 4 warnings were issued before the cyclone made landfall and was finaled.
(2) No operational impacts and no damage was reported.
*Named by WMO designated RSMC



Figure 2-20S-1. $281153 Z$ February 2003 multi-sensor satellite images of TC 20S (Graham), just off the northwest coast of Australia prior to landfall, with an intensity of 35 knots.

TROPICAL CYCLONE 20S (GRAHAM)
27 FEB-01 MAR 2003


Time Intensity for 20 S
Intensity (kts)


- PGTW
KGWC
$-K W B C$
- T-Numbers
- Best Track

Fix Date (Zulu)

## Tropical Cyclone (TC) 21S (Harriet)*

First Poor : 0730Z 28 Feb 03

First Fair : 1800Z 01 Mar 03
First TCFA : $2100 Z 01$ Mar 03
First Warning : 0600Z 02 Mar 03
Last Warning : 0000Z 09 Mar 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : 21
Remarks:
(1) Tropical Cyclone (TC) 21S was first noted a a tropical disturbance on 28 February 2003. The cyclone tracked southwestward toward Australia, but development was hampered by dry air entrainment and moderate vertical wind shear. After crossing 110E, the cyclone slowed due to a developing sub-tropical ridge situated over western Australia. Subsequently and after 05 March, TC 21S adjusted to the steering environment and altered movement toward the southwest, well off the Australian coast and then dissipated approximately 295 nm west-northwest of Learmonth, Australia. Although JTWC issued 21 warnings on this tropical cyclone, it never intensified beyond 35 knots due to restrictive synoptic flow patterns.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030106 |  | 12.8 S | 102.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030112 |  | 13.1S | 103.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030118 |  | 13.4 S | 104.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030200 |  | 13.8S | 105.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030206 | 1 | 14.1S | 106.7E | 30 | 0 | 13 | 32 | 67 | 105 |  |  |  | 5 | 15 | 20 | 25 | 25 |  |  |  |
| 03030218 | 2 | 14.8S | 108.4E | 30 | 8 | 40 | 64 | 61 | 53 |  |  |  | 5 | 5 | 10 | 15 | 10 |  |  |  |
| 03030306 | 3 | 14.7S | 110.1E | 30 | 5 | 13 | 26 | 6 | 48 |  |  |  | 5 | 10 | 10 | 10 | 10 |  |  |  |
| 03030318 | 4 | 14.7S | 111.5E | 30 | 0 | 17 | 6 | 27 | 47 |  |  |  | 5 | 5 | 5 | 5 | 15 |  |  |  |
| 03030406 | 5 | 14.9 S | 112.5E | 30 | 18 | 65 | 94 | 156 | 185 |  |  |  | 5 | 5 | 10 | 15 | 15 |  |  |  |
| 03030418 | 6 | 15.2 S | 114.1E | 35 | 23 | 59 | 75 | 43 | 36 | 74 |  |  | 0 | 5 | 10 | 10 | 15 | 25 |  |  |
| 03030500 | 7 | 15.8S | 114.8E | 35 | 29 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03030506 | 8 | 16.35 | 115.3E | 35 | 13 | 46 | 48 | 13 | 72 | 117 |  |  | 0 | 5 | 5 | 10 | 15 | 20 |  |  |
| 03030512 | 9 | 16.8 S | 115.7E | 30 | 20 | 27 | 25 | 33 | 73 | 134 |  |  | 0 | -5 | 0 | 5 | 5 | 10 |  |  |
| 03030518 | 10 | 17.4S | 116.2E | 30 | 18 | 54 | 65 | 80 | 106 | 169 |  |  | 0 | 0 | 0 | 5 | 15 | 20 |  |  |
| 03030600 | 11 | 18.15 | 115.8E | 35 | 11 | 28 | 53 | 79 | 123 | 145 |  |  | 0 | 0 | 5 | 10 | 20 | 30 |  |  |
| 03030606 | 12 | 18.6 S | 115.5E | 35 | 46 | 74 | 129 | 166 | 210 | 190 |  |  | 0 | 0 | 5 | 15 | 15 | 25 |  |  |
| 03030612 | 13 | 19.0 S | 115.2E | 35 | 51 | 91 | 128 | 170 | 202 | 110 |  |  | 0 | 0 | 0 | 10 | 10 | 20 |  |  |
| 03030618 | 14 | 19.1S | 114.8E | 35 | 16 | 57 | 98 | 125 | 167 |  |  |  | 0 | 0 | 10 | 10 | 15 |  |  |  |
| 03030700 | 15 | 19.05 | 114.5E | 35 | 12 | 13 | 45 | 79 | 93 |  |  |  | 0 | 0 | 10 | 10 | 20 |  |  |  |
| 03030706 | 16 | 19.0S | 114.2E | 35 | 13 | 13 | 33 | 57 | 71 |  |  |  | 0 | 5 | 10 | 15 | 15 |  |  |  |
| 03030712 | 17 | 19.35 | 113.8E | 35 | 5 | 47 | 90 | 94 | 47 |  |  |  | 0 | 5 | 10 | 15 | 10 |  |  |  |
| 03030718 | 18 | 19.4S | 113.4E | 30 | 12 | 31 | 66 | 66 |  |  |  |  | 0 | 0 | 0 | 5 |  |  |  |  |
| 03030800 | 19 | 19.6S | 113.0E | 30 | 8 | 38 | 60 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 03030812 | 20 | 20.2 S | 112.4E | 30 | 0 | 26 | 74 |  |  |  |  |  | 0 | 5 | 0 |  |  |  |  |  |
| 03030900 | 21 | 21.15 | 110.8E | 25 | 28 | 96 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03030906 |  | 22.2 S | 109.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030912 |  | 23.7S | 108.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 16 | 42 | 64 | 78 | 102 | 134 |  |  | 1 | 4 | 6 | 11 | 14 | 21 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 3 | 6 | 11 | 14 | 21 |  |  |
|  |  |  | \# CASES |  | 21 | 20 | 19 | 17 | 16 | 7 |  |  | 21 | 20 | 19 | 17 | 16 | 7 |  |  |



Figure 2-21S-1. 022311Z March 2003 multi-sensor satellite images of TC 21S (Harriet), 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.


Figure 2-21S-2. 022311 Z March 2003 37GHz TRMM imagery of TC 21S (Harriet), The exposed low level circulation center is 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.

TROPICAL CYCLONE 21S (HARRIET)


Time Intensity for 21S

## Intensity (kts)



- PGTW

KGWC

- KWBC
- T-Numbers
- Best Track

Fix Date (Zulu)

## Tropical Cyclone (TC) 21S (Harriet)*

First Poor : 0730Z 28 Feb 03
First Fair : 1800Z 01 Mar 03

First TCFA : $2100 Z 01$ Mar 03
First Warning : 0600Z 02 Mar 03

Last Warning : 0000Z 09 Mar 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : None

Total Warnings : 21
Remarks:
(1) Tropical Cyclone (TC) 21 S was first noted a a tropical disturbance on 28 February 2003. The cyclone tracked southwestward toward Australia, but development was hampered by dry air entrainment and moderate vertical wind shear. After crossing 110E, the cyclone slowed due to a developing sub-tropical ridge situated over western Australia. Subsequently and after 05 March, TC 21S adjusted to the steering environment and altered movement toward the southwest, well off the Australian coast and then dissipated approximately 295 nm west-northwest of Learmonth, Australia. Although JTWC issued 21 warnings on this tropical cyclone, it never intensified beyond 35 knots due to restrictive synoptic flow patterns.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

## Statistics for JTWC on TC21S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030106 |  | 12.8 S | 102.8E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030112 |  | 13.1S | 103.6E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030118 |  | 13.4S | 104.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030200 |  | 13.8S | 105.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030206 | 1 | 14.1S | 106.7E | 30 | 0 | 13 | 32 | 67 | 105 |  |  |  | 5 | 15 | 20 | 25 | 25 |  |  |  |
| 03030218 | 2 | 14.8S | 108.4E | 30 | 8 | 40 | 64 | 61 | 53 |  |  |  | 5 | 5 | 10 | 15 | 10 |  |  |  |
| 03030306 | 3 | 14.7S | 110.1E | 30 | 5 | 13 | 26 | 6 | 48 |  |  |  | 5 | 10 | 10 | 10 | 10 |  |  |  |
| 03030318 | 4 | 14.7S | 111.5E | 30 | 0 | 17 | 6 | 27 | 47 |  |  |  | 5 | 5 | 5 | 5 | 15 |  |  |  |
| 03030406 | 5 | 14.9S | 112.5E | 30 | 18 | 65 | 94 | 156 | 185 |  |  |  | 5 | 5 | 10 | 15 | 15 |  |  |  |
| 03030418 | 6 | 15.2S | 114.1E | 35 | 23 | 59 | 75 | 43 | 36 | 74 |  |  | 0 | 5 | 10 | 10 | 15 | 25 |  |  |
| 03030500 | 7 | 15.8S | 114.8E | 35 | 29 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03030506 | 8 | 16.3S | 115.3E | 35 | 13 | 46 | 48 | 13 | 72 | 117 |  |  | 0 | 5 | 5 | 10 | 15 | 20 |  |  |
| 03030512 | 9 | 16.8S | 115.7E | 30 | 20 | 27 | 25 | 33 | 73 | 134 |  |  | 0 | -5 | 0 | 5 | 5 | 10 |  |  |
| 03030518 | 10 | 17.4S | 116.2E | 30 | 18 | 54 | 65 | 80 | 106 | 169 |  |  | 0 | 0 | 0 | 5 | 15 | 20 |  |  |
| 03030600 | 11 | 18.1S | 115.8E | 35 | 11 | 28 | 53 | 79 | 123 | 145 |  |  | 0 | 0 | 5 | 10 | 20 | 30 |  |  |
| 03030606 | 12 | 18.6S | 115.5E | 35 | 46 | 74 | 129 | 166 | 210 | 190 |  |  | 0 | 0 | 5 | 15 | 15 | 25 |  |  |
| 03030612 | 13 | 19.0S | 115.2E | 35 | 51 | 91 | 128 | 170 | 202 | 110 |  |  | 0 | 0 | 0 | 10 | 10 | 20 |  |  |
| 03030618 | 14 | 19.1S | 114.8E | 35 | 16 | 57 | 98 | 125 | 167 |  |  |  | 0 | 0 | 10 | 10 | 15 |  |  |  |
| 03030700 | 15 | 19.0S | 114.5E | 35 | 12 | 13 | 45 | 79 | 93 |  |  |  | 0 | 0 | 10 | 10 | 20 |  |  |  |
| 03030706 | 16 | 19.0S | 114.2E | 35 | 13 | 13 | 33 | 57 | 71 |  |  |  | 0 | 5 | 10 | 15 | 15 |  |  |  |
| 03030712 | 17 | 19.35 | 113.8E | 35 | 5 | 47 | 90 | 94 | 47 |  |  |  | 0 | 5 | 10 | 15 | 10 |  |  |  |
| 03030718 | 18 | 19.4S | 113.4E | 30 | 12 | 31 | 66 | 66 |  |  |  |  | 0 | 0 | 0 | 5 |  |  |  |  |
| 03030800 | 19 | 19.6S | 113.0E | 30 | 8 | 38 | 60 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 03030812 | 20 | 20.2S | 112.4E | 30 | 0 | 26 | 74 |  |  |  |  |  | 0 | 5 | 0 |  |  |  |  |  |
| 03030900 | 21 | 21.1S | 110.8E | 25 | 28 | 96 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03030906 |  | 22.2S | 109.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030912 |  | 23.75 | 108.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 16 | 42 | 64 | 78 | 102 | 134 |  |  | 1 | 4 | 6 | 11 | 14 | 21 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 3 | 6 | 11 | 14 | 21 |  |  |
|  |  |  | \# CASES |  | 21 | 20 | 19 | 17 | 16 | 7 |  |  | 21 | 20 | 19 | 17 | 16 | 7 |  |  |



Figure 2-21S-1. 022311 Z March 2003 multi-sensor satellite images of TC 21 S (Harriet), 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.


Figure 2-21S-2. 022311 Z March 2003 37GHz TRMM imagery of TC 21S (Harriet), The exposed low level circulation center is 502 nm northwest of Learmonth, Australia, with a maximum intensity of 35 knots.

TROPICAL CYCLONE 21S (HARRIET) 02-09 MAR 2003


## Time Intensity for 21S

Intensity (kts)


# Tropical Cyclone (TC) 22P (Erica)* 

First Poor : $2330 Z 03$ Mar 03

First Fair : 0600Z 04 Mar 03
First TCFA : 0630Z 04 Mar 03
First Warning : 1200Z 04 Mar 03
Last Warning : $0600 Z 15$ Mar 03, Extratropical
Max Intensity : 130 kts, gusts to 160 kts
Landfall : None

Total Warnings : 16 plus 2 Amended Warnings
Remarks:
(1) Tropical Cyclone (TC) 22 P was first noted as a tropical disturbance east-southeast of Cairns, Australia on 03 March, 2003. TC 22P formed and went to warning status within 14 hours of first official mention by JTWC. The cyclone weakened enough to final at 0000Z on 06 March. JTWC continued to monitor the remnants of TC 22P and when regeneration was detected the cyclone was warned on again by 10 March.

Over the next 48 hours the storm intensified at a climatological rate, attaining a 65 knot intensity, a rate of one Dvorak T-number per day. TC 22P then began to intensify rapidly, reaching the maximum intensity of 130 knots by 13 March, an increase of 2.5 Dvorak T-numbers in 18 hours. The rapid intensification was due to excellent outflow conditions combined with a weak vertical wind shear environment. During this period, TC 22P altered track toward New Caledonia, eventually skirting the entire southwestern coast of New Caledonia with an intensity of 130, 125 and 100 knots throughout. After passing New Caledonia, the cyclone encountered increased vertical wind shear and began extratropical transition.
(2) Reported damage to New Caledonia was significant, and included structural damage, power losses and flooding. Noumea was also damaged by the passage of the system according to news reports. Subsequent damage reports from New Caledonia indicated agricultural damage, water fouling and an increase in dengue fever. Two fatalities were also reported due to the passage of
the system, with many others injured.

## *Named by WMO designated RSMC

Statistics for JTWC on TC22P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030400 |  | 20.15 | 152.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030406 |  | 20.8S | 153.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030412 | 1 | 21.3 S | 154.0E | 30 | 18 | 103 | 130 | 155 | 187 |  |  |  | 5 | 5 | 5 | 10 | 5 |  |  |  |
| 03030500 | 2 | 20.35 | 155.0E | 30 | 51 | 108 | 135 | 187 | 277 |  |  |  | 0 | -5 | 5 | 0 | 0 |  |  |  |
| 03030512 | 3 | 19.0 S | 155.3E | 35 | 16 | 21 | 24 | 93 | 146 |  |  |  | 0 | 5 | 5 | 5 | 5 |  |  |  |
| 03030600 | 4 | 17.6S | 154.4E | 30 | 11 | 42 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031006 | 5 | 12.1S | 157.8E | 30 | 6 | 24 | 30 | 83 | 152 |  |  |  | 0 | 0 | -5 | -10 | -15 |  |  |  |
| 03031018 | 6 | 12.7S | 158.2E | 35 | 16 | 19 | 87 | 155 | 179 |  |  |  | 0 | -5 | -10 | -15 | -60 |  |  |  |
| 03031106 | 7 | 13.4S | 158.9E | 45 | 13 | 55 | 98 | 138 | 167 |  |  |  | 0 | -5 | -10 | -55 | -65 |  |  |  |
| 03031118 | 8 | 15.2 S | 159.6E | 55 | 0 | 33 | 64 | 103 | 130 |  |  |  | 0 | -5 | -45 | -60 | -60 |  |  |  |
| 03031206 | 9 | 17.1S | 159.9E | 65 | 16 | 67 | 113 | 140 | 317 |  |  |  | 0 | -45 | -65 | -60 | -30 |  |  |  |
| 03031212 | 10 | 17.95 | 160.4E | 90 | 0 | 66 | 96 | 176 | 364 |  |  |  | 5 | -35 | -35 | -10 | 5 |  |  |  |
| 03031218 | 11 | 18.8S | 160.8E | 115 | 18 | 32 | 87 | 227 | 377 |  |  |  | -15 | -35 | -35 | -10 | 0 |  |  |  |
| 03031300 | 11A | 19.6S | 161.3E | 130 | 22 | 32 | 120 | 287 | 421 |  |  |  | -5 | 5 | 25 | 30 | 35 |  |  |  |
| 03031306 | 12 | 20.2 S | 162.0E | 130 | 0 | 41 | 173 | 273 | 370 |  |  |  | 10 | 25 | 40 | 45 | 70 |  |  |  |
| 03031318 | 13 | 21.15 | 164.2E | 125 | 12 | 118 | 188 | 278 |  |  |  |  | -25 | -5 | 0 | 25 |  |  |  |  |
| 03031406 | 14 | 23.15 | 168.7E | 90 | 8 | 56 | 150 |  |  |  |  |  | -10 | 0 | 30 |  |  |  |  |  |
| 03031418 | 15 | 25.9 S | 173.5E | 70 | 17 | 98 |  |  |  |  |  |  | 0 | 35 |  |  |  |  |  |  |
| 03031506 | 16 | 28.8S | 179.0E | 30 | 19 |  |  |  |  |  |  |  | 15 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 15 | 57 | 107 | 177 | 257 |  |  |  | 5 | 13 | 23 | 26 | 29 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -4 | -7 | -8 | -9 |  |  |  |
|  |  |  | \# CASES |  | 17 | 16 | 14 | 13 | 12 |  |  |  | 17 | 16 | 14 | 13 | 12 |  |  |  |



Figure 2-22P-1. 130255Z March 2003 MODIS true-color image of TC 22P (Erica), located 165 nm west-northwest of New Caledonia, with a maximum intensity of 130 knots.


Figure 2-22P-2. 130501Z March 2003 GMS-5 visible satellite imagery of TC 22P (Erica), 945 nm east of Cairns, Australia, with an increasing intensity of 125 knots.


Figure 2-22P-3. 131850Z March 200385 GHz SSM/I imagery of TC 22P (Erica), 905 nm east of Cairns, Australia, with an increasing intensity of 100 knots.

## TROPICAL CYCLONE 22P (ERICA)

04-15 MAR 2003


## Time Intensity for 22P

Intensity (kts)


## Tropical Cyclone (TC) 22P (Erica)*

First Poor : 2330Z 03 Mar 03

First Fair : 0600Z 04 Mar 03
First TCFA : 0630Z 04 Mar 03

First Warning : 1200Z 04 Mar 03
Last Warning : 0600Z 15 Mar 03, Extratropical

Max Intensity : 130 kts, gusts to 160 kts
Landfall : None
Total Warnings : 16 plus 2 Amended Warnings
Remarks:
(1) Tropical Cyclone (TC) 22P was first noted as a tropical disturbance east-southeast of Cairns, Australia on 03 March, 2003. TC 22P formed and went to warning status within 14 hours of first official mention by JTWC. The cyclone weakened enough to final at 0000Z on 06 March. JTWC continued to monitor the remnants of TC 22P and when regeneration was detected the cyclone was warned on again by 10 March.

Over the next 48 hours the storm intensified at a climatological rate, attaining a 65 knot intensity, a rate of one Dvorak T-number per day. TC 22P then began to intensify rapidly, reaching the maximum intensity of 130 knots by 13 March, an increase of 2.5 Dvorak T-numbers in 18 hours. The rapid intensification was due to excellent outflow conditions combined with a weak vertical wind shear environment. During this period, TC 22P altered track toward New Caledonia, eventually skirting the entire southwestern coast of New Caledonia with an intensity of 130, 125 and 100 knots throughout. After passing New Caledonia, the cyclone encountered increased vertical wind shear and began extratropical transition.
(2) Reported damage to New Caledonia was significant, and included structural damage, power losses and flooding. Noumea was also damaged by the passage of the system according to news reports. Subsequent damage reports from New Caledonia indicated agricultural damage, water fouling and an increase in dengue fever. Two fatalities were also reported due to the passage of the system, with many others injured.
*Named by WMO designated RSMC

## Statistics for JTWC on TC22P

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030400 |  | 20.15 | 152.4E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030406 |  | 20.8S | 153.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030412 | 1 | 21.3 S | 154.0E | 30 | 18 | 103 | 130 | 155 | 187 |  |  |  | 5 | 5 | 5 | 10 | 5 |  |  |  |
| 03030500 | 2 | 20.35 | 155.0E | 30 | 51 | 108 | 135 | 187 | 277 |  |  |  | 0 | -5 | 5 | 0 | 0 |  |  |  |
| 03030512 | 3 | 19.0 S | 155.3E | 35 | 16 | 21 | 24 | 93 | 146 |  |  |  | 0 | 5 | 5 | 5 | 5 |  |  |  |
| 03030600 | 4 | 17.6S | 154.4E | 30 | 11 | 42 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031006 | 5 | 12.1S | 157.8E | 30 | 6 | 24 | 30 | 83 | 152 |  |  |  | 0 | 0 | -5 | -10 | -15 |  |  |  |
| 03031018 | 6 | 12.7S | 158.2E | 35 | 16 | 19 | 87 | 155 | 179 |  |  |  | 0 | -5 | -10 | -15 | -60 |  |  |  |
| 03031106 | 7 | 13.4 S | 158.9E | 45 | 13 | 55 | 98 | 138 | 167 |  |  |  | 0 | -5 | -10 | -55 | -65 |  |  |  |
| 03031118 | 8 | 15.2 S | 159.6E | 55 | 0 | 33 | 64 | 103 | 130 |  |  |  | 0 | -5 | -45 | -60 | -60 |  |  |  |
| 03031206 | 9 | 17.1S | 159.9E | 65 | 16 | 67 | 113 | 140 | 317 |  |  |  | 0 | -45 | -65 | -60 | -30 |  |  |  |
| 03031212 | 10 | 17.9S | 160.4E | 90 | 0 | 66 | 96 | 176 | 364 |  |  |  | 5 | -35 | -35 | -10 | 5 |  |  |  |
| 03031218 | 11 | 18.8S | 160.8E | 115 | 18 | 32 | 87 | 227 | 377 |  |  |  | -15 | -35 | -35 | -10 | 0 |  |  |  |
| 03031300 | 11A | 19.6S | 161.3E | 130 | 22 | 32 | 120 | 287 | 421 |  |  |  | -5 | 5 | 25 | 30 | 35 |  |  |  |
| 03031306 | 12 | 20.2 S | 162.0E | 130 | 0 | 41 | 173 | 273 | 370 |  |  |  | 10 | 25 | 40 | 45 | 70 |  |  |  |
| 03031318 | 13 | 21.15 | 164.2E | 125 | 12 | 118 | 188 | 278 |  |  |  |  | -25 | -5 | 0 | 25 |  |  |  |  |
| 03031406 | 14 | 23.15 | 168.7E | 90 | 8 | 56 | 150 |  |  |  |  |  | -10 | 0 | 30 |  |  |  |  |  |
| 03031418 | 15 | 25.9 S | 173.5E | 70 | 17 | 98 |  |  |  |  |  |  | 0 | 35 |  |  |  |  |  |  |
| 03031506 | 16 | 28.8S | 179.0E | 30 | 19 |  |  |  |  |  |  |  | 15 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 15 | 57 | 107 | 177 | 257 |  |  |  | 5 | 13 | 23 | 26 | 29 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -4 | -7 | -8 | -9 |  |  |  |
|  |  |  | \# CASES |  | 17 | 16 | 14 | 13 | 12 |  |  |  | 17 | 16 | 14 | 13 | 12 |  |  |  |



Figure 2-22P-1. $130255 Z$ March 2003 MODIS true-color image of TC 22P (Erica), located 165nm west-northwest of New Caledonia, with a maximum intensity of 130 knots.


Figure 2-22P-2. 130501Z March 2003 GMS-5 visible satellite imagery of TC 22P (Erica), 945 nm east of Cairns, Australia, with an increasing intensity of 125 knots.


Figure 2-22P-3. 131850 Z March 200385 GHz SSM/I imagery of TC 22P (Erica), 905 nm east of Cairns, Australia, with an increasing intensity of 100 knots.

TROPICAL CYCLONE 22P (ERICA)
04-15 MAR 2003


Time Intensity for 22P
Intensity (kts)


## Tropical Cyclone (TC) 23S (Kalunde)*

First Poor : 1800Z 03 Mar 03
First Fair : 0330Z 04 Mar 03
First TCFA : $2130 Z 04$ Mar 03
First Warning : 0600Z 05 Mar 03
Last Warning : $1200 Z 15$ Mar 03, Extratropical
Max Intensity : 140 kts, gusts to 170 kts
Landfall : None
Total Warnings : 21 plus 2 Amended Warnings
Remarks:
(1) Tropical Cyclone (TC) 23 S developed approximately 445 nm southeast of Diego Garcia around 03 March 2003. The cyclone remained quasi-stationary for 48 hours then began to track southwestward toward a weakness in the mid-level subtropical ridge. As it tracked it intensfied, developed and eye, then rapidly intensified to 140 knots in a favorable upper level environment, with excellent outflow aloft and very weak vertical wind shear. TC 23 S then began to track southwestward and weaken over the next 48 hours as the eye dissipated and the cyclone lost some outflow. Afterwards, the cyclone tracked poleward, rapidly weakened and transitioned into an extratropical system.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030318 |  | 10.7S | 78.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030400 |  | 10.9S | 78.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030406 |  | 11.2 S | 78.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030412 |  | 11.5S | 78.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030418 |  | 11.5 S | 78.4E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030500 |  | 11.5S | 78.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030506 | 1 | 11.3 S | 77.5E | 30 | 8 | 31 | 34 | 8 | 50 |  |  |  | 5 | 5 | 10 | 10 | 0 |  |  |  |
| 03030518 | 2 | 10.9 S | 76.7E | 40 | 11 | 40 | 35 | 12 | 48 |  |  |  | 0 | 5 | 5 | -5 | -25 |  |  |  |
| 03030600 | 2A | 11.15 | 76.5E | 40 | 37 | 62 | 116 | 178 | 245 |  |  |  | 0 | -5 | -5 | -30 | -50 |  |  |  |
| 03030606 | 3 | 11.2 S | 76.2E | 45 | 8 | 19 | 59 | 124 | 192 |  |  |  | 0 | 0 | -10 | -30 | -60 |  |  |  |
| 03030618 | 4 | 11.8 S | 75.0E | 55 | 0 | 13 | 34 | 71 | 99 |  |  |  | -5 | -10 | -30 | -55 | -40 |  |  |  |
| 03030706 | 5 | 12.5 S | 73.6E | 75 | 8 | 29 | 47 | 52 | 52 |  |  |  | 5 | -15 | -40 | -25 | -10 |  |  |  |
| 03030718 | 6 | 13.4S | 72.0E | 105 | 8 | 47 | 59 | 37 | 76 |  |  |  | 10 | -15 | 0 | 15 | 25 |  |  |  |
| 03030800 | 6A | 13.7S | 71.2E | 130 | 8 | 29 | 8 | 25 | 152 |  |  |  | 10 | 15 | 30 | 40 | 45 |  |  |  |
| 03030812 | 7 | 14.4S | 69.7E | 130 | 0 | 12 | 8 | 12 | 24 |  |  |  | 10 | 30 | 30 | 25 | 40 |  |  |  |
| 03030900 | 8 | 15.3 S | 68.8E | 120 | 5 | 33 | 58 | 73 | 122 |  |  |  | 0 | 5 | 0 | 15 | 10 |  |  |  |
| 03030912 | 9 | 16.1S | 67.9E | 115 | 0 | 8 | 25 | 21 | 47 |  |  |  | 0 | -5 | 0 | -5 | -10 |  |  |  |
| 03031000 | 10 | 16.7S | 67.1E | 115 | 0 | 13 | 18 | 54 | 112 |  |  |  | -15 | -10 | -15 | -20 | -30 |  |  |  |
| 03031012 | 11 | 17.4 S | 66.4E | 100 | 6 | 17 | 24 | 46 | 72 |  |  |  | -5 | -10 | -15 | -25 | -30 |  |  |  |
| 03031100 | 12 | 17.9S | 65.6E | 100 | 0 | 25 | 39 | 44 | 51 |  |  |  | 0 | -5 | -15 | -25 | -20 |  |  |  |
| 03031112 | 13 | 18.4 S | 64.9E | 100 | 0 | 6 | 8 | 29 | 75 |  |  |  | 0 | -5 | -10 | 5 | 5 |  |  |  |
| 03031200 | 14 | 18.8S | 64.3E | 105 | 0 | 6 | 41 | 84 | 115 |  |  |  | 0 | -5 | 10 | 10 | 25 |  |  |  |
| 03031212 | 15 | 19.5S | 63.9E | 105 | 8 | 13 | 36 | 69 | 115 |  |  |  | 0 | 10 | 15 | 30 | 30 |  |  |  |
| 03031300 | 16 | 20.5 S | 64.1E | 90 | 6 | 32 | 53 | 69 | 97 |  |  |  | -15 | -15 | 0 | 5 | 10 |  |  |  |
| 03031312 | 17 | 21.8S | 64.5E | 85 | 12 | 30 | 51 | 73 | 127 |  |  |  | -10 | 0 | 0 | 5 | 10 |  |  |  |
| 03031400 | 18 | 23.2 S | 64.9E | 65 | 28 | 53 | 55 | 111 | 130 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03031412 | 19 | 24.8S | 65.2E | 55 | 16 | 32 | 92 | 104 |  |  |  |  | -5 | 0 | 5 | 5 |  |  |  |  |
| 03031500 | 20 | 26.5 S | 65.6E | 40 | 30 | 60 | 13 |  |  |  |  |  | 0 | 5 | 5 |  |  |  |  |  |
| 03031512 | 21 | 28.7 S | 66.2E | 30 | 0 | 36 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031518 |  | 29.6 S | 66.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031600 |  | 30.4 S | 66.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


|  |  |  | AVERAGE |  | 9 | 28 | 41 | 62 | 100 |  |  |  | 4 | 8 | 12 | 19 | 24 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -1 | -1 | -2 | -3 |  |  |  |
|  |  |  | \# CASES |  | 23 | 23 | 22 | 21 | 20 |  |  |  | 23 | 23 | 22 | 21 | 20 |  |  |  |



Figure 2-23S-1. 080117 Z March 2003 multi-sensor satellite images of TC 23S (Kalunde), The eye is 400 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.


Figure 2-23S-2. 080600Z March 2003 met-5 visible image of TC 23S (Kalunde), The eye is 380 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.


Figure 2-23S-3. 090535Z March 2003 MODIS true-color image of TC 23S (Kalunde), located 670 nm east-northeast of Mauritius, with an intensity of 120 knots.

## TROPICAL CYCLONE 23S (KALUNDE) <br> 05-15 MAR 2003



Time Intensity for 23 S
Intensity (kts)


## Tropical Cyclone (TC) 23S (Kalunde)*

First Poor : 1800Z 03 Mar 03
First Fair : 0330Z 04 Mar 03

First TCFA : $2130 Z 04$ Mar 03
First Warning : 0600Z 05 Mar 03

Last Warning : 1200Z 15 Mar 03, Extratropical
Max Intensity : 140 kts, gusts to 170 kts

Landfall : None
Total Warnings: 21 plus 2 Amended Warnings
Remarks:
(1) Tropical Cyclone (TC) 23S developed approximately 445 nm southeast of Diego Garcia around 03 March 2003. The cyclone remained quasi-stationary for 48 hours then began to track southwestward toward a weakness in the mid-level subtropical ridge. As it tracked it intensfied, developed and eye, then rapidly intensified to 140 knots in a favorable upper level environment, with excellent outflow aloft and very weak vertical wind shear. TC 23S then began to track southwestward and weaken over the next 48 hours as the eye dissipated and the cyclone lost some outflow. Afterwards, the cyclone tracked poleward, rapidly weakened and transitioned into an extratropical system.
(2) No damage was reported for this system.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030318 |  | 10.7S | 78.4E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030400 |  | 10.9S | 78.5E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030406 |  | 11.2S | 78.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030412 |  | 11.5S | 78.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030418 |  | 11.5 S | 78.4E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030500 |  | 11.5S | 78.0E | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030506 | 1 | 11.3S | 77.5E | 30 | 8 | 31 | 34 | 8 | 50 |  |  |  | 5 | 5 | 10 | 10 | 0 |  |  |  |
| 03030518 | 2 | 10.9S | 76.7E | 40 | 11 | 40 | 35 | 12 | 48 |  |  |  | 0 | 5 | 5 | -5 | -25 |  |  |  |
| 03030600 | 2A | 11.15 | 76.5E | 40 | 37 | 62 | 116 | 178 | 245 |  |  |  | 0 | -5 | -5 | -30 | -50 |  |  |  |
| 03030606 | 3 | 11.2S | 76.2E | 45 | 8 | 19 | 59 | 124 | 192 |  |  |  | 0 | 0 | -10 | -30 | -60 |  |  |  |
| 03030618 | 4 | 11.8 S | 75.0E | 55 | 0 | 13 | 34 | 71 | 99 |  |  |  | -5 | -10 | -30 | -55 | -40 |  |  |  |
| 03030706 | 5 | 12.5S | 73.6E | 75 | 8 | 29 | 47 | 52 | 52 |  |  |  | 5 | -15 | -40 | -25 | -10 |  |  |  |
| 03030718 | 6 | 13.4 S | 72.0E | 105 | 8 | 47 | 59 | 37 | 76 |  |  |  | 10 | -15 | 0 | 15 | 25 |  |  |  |
| 03030800 | 6A | 13.7S | 71.2E | 130 | 8 | 29 | 8 | 25 | 152 |  |  |  | 10 | 15 | 30 | 40 | 45 |  |  |  |
| 03030812 | 7 | 14.4 S | 69.7E | 130 | 0 | 12 | 8 | 12 | 24 |  |  |  | 10 | 30 | 30 | 25 | 40 |  |  |  |
| 03030900 | 8 | 15.3S | 68.8E | 120 | 5 | 33 | 58 | 73 | 122 |  |  |  | 0 | 5 | 0 | 15 | 10 |  |  |  |
| 03030912 | 9 | 16.1S | 67.9E | 115 | 0 | 8 | 25 | 21 | 47 |  |  |  | 0 | -5 | 0 | -5 | -10 |  |  |  |
| 03031000 | 10 | 16.7S | 67.1E | 115 | 0 | 13 | 18 | 54 | 112 |  |  |  | -15 | -10 | -15 | -20 | -30 |  |  |  |
| 03031012 | 11 | 17.4S | 66.4E | 100 | 6 | 17 | 24 | 46 | 72 |  |  |  | -5 | -10 | -15 | -25 | -30 |  |  |  |
| 03031100 | 12 | 17.9S | 65.6E | 100 | 0 | 25 | 39 | 44 | 51 |  |  |  | 0 | -5 | -15 | -25 | -20 |  |  |  |
| 03031112 | 13 | 18.4S | 64.9E | 100 | 0 | 6 | 8 | 29 | 75 |  |  |  | 0 | -5 | -10 | 5 | 5 |  |  |  |
| 03031200 | 14 | 18.8S | 64.3E | 105 | 0 | 6 | 41 | 84 | 115 |  |  |  | 0 | -5 | 10 | 10 | 25 |  |  |  |
| 03031212 | 15 | 19.5S | 63.9E | 105 | 8 | 13 | 36 | 69 | 115 |  |  |  | 0 | 10 | 15 | 30 | 30 |  |  |  |
| 03031300 | 16 | 20.5S | 64.1E | 90 | 6 | 32 | 53 | 69 | 97 |  |  |  | -15 | -15 | 0 | 5 | 10 |  |  |  |
| 03031312 | 17 | 21.8 S | 64.5E | 85 | 12 | 30 | 51 | 73 | 127 |  |  |  | -10 | 0 | 0 | 5 | 10 |  |  |  |
| 03031400 | 18 | 23.2 S | 64.9E | 65 | 28 | 53 | 55 | 111 | 130 |  |  |  | 0 | 0 | 5 | 10 | 10 |  |  |  |
| 03031412 | 19 | 24.8 S | 65.2E | 55 | 16 | 32 | 92 | 104 |  |  |  |  | -5 | 0 | 5 | 5 |  |  |  |  |
| 03031500 | 20 | 26.5S | 65.6E | 40 | 30 | 60 | 13 |  |  |  |  |  | 0 | 5 | 5 |  |  |  |  |  |
| 03031512 | 21 | 28.7S | 66.2E | 30 | 0 | 36 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031518 |  | 29.6 S | 66.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031600 |  | 30.4S | 66.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 9 | 28 | 41 | 62 | 100 |  |  |  | 4 | 8 | 12 | 19 | 24 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -1 | -1 | -2 | -3 |  |  |  |
|  |  |  | \# CASES |  | 23 | 23 | 22 | 21 | 20 |  |  |  | 23 | 23 | 22 | 21 | 20 |  |  |  |



Figure 2-23S-1. $080117 Z$ March 2003 multi-sensor satellite images of TC 23S (Kalunde), The eye is 400 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.


Figure 2-23S-2. 080600Z March 2003 met-5 visible image of TC 23S (Kalunde), The eye is 380 nm south-southwest of Diego Garcia, with a maximum intensity of 140 knots.


Figure 2-23S-3. 090535Z March 2003 MODIS true-color image of TC 23S (Kalunde), located 670 nm east-northeast of Mauritius, with an intensity of 120 knots.

## TROPICAL CYCLONE 23S (KALUNDE)

05-15 MAR 2003


## Time Intensity for 23S



## Tropical Cyclone (TC) 24S (Craig)*

First Poor : N/A

First Fair : 0300Z 08 Mar 03
First TCFA : $1000 Z 08$ Mar 03
First Warning : 1800Z 08 Mar 03
Last Warning : $1800 Z 12$ Mar 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : Multiple Events (see below)
Total Warnings : 9
Remarks:
(1) Tropical Cyclone (TC) 24S developed approximately 100 nm northwest of Darwin, Australia on 08 March, 2003 in a near equatorial trough. The cyclone initially drifted northward, then eastward, increasing speed as it tracked across northern Arnhem Land and intensified to 35 knots. TC 24S maintained 35 knots as it tracked into the Gulf of Carpentaria and then dissipated after moving onto the Cape York Peninsula.
(2) Reports indicated damage from storm-force winds and fallen trees.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030800 |  | 12.0 S | 129.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030806 |  | 11.8S | 128.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030812 |  | 11.5 S | 128.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030818 | 1 | 11.2 S | 128.8E | 25 | 5 | 45 | 78 | 93 | 88 |  |  |  | 0 | 5 | 5 | 5 | 10 |  |  |  |
| 03030906 | 2 | 10.6 S | 129.6E | 25 | 13 | 36 | 77 | 130 | 129 |  |  |  | 5 | 5 | 5 | 10 | 15 |  |  |  |
| 03030918 | 3 | 10.8S | 130.5E | 30 | 25 | 69 | 116 | 118 | 47 |  |  |  | 0 | 0 | 5 | 10 | 15 |  |  |  |
| 03031006 | 4 | 11.1S | 131.0E | 35 | 13 | 34 | 19 | 108 | 284 |  |  |  | 0 | 0 | 0 | -5 | -5 |  |  |  |
| 03031018 | 5 | 11.6S | 131.5E | 35 | 18 | 35 | 155 | 331 | 443 |  |  |  | 0 | 0 | 0 | -5 | 0 |  |  |  |
| 03031106 | 6 | 11.9 S | 132.8E | 35 | 5 | 101 | 263 | 309 |  |  |  |  | 0 | -5 | -10 | -5 |  |  |  |  |
| 03031118 | 7 | 12.6 S | 135.8E | 35 | 58 | 197 | 279 |  |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03031206 | 8 | 14.15 | 139.8E | 35 | 21 | 90 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031218 | 9 | 16.4S | 142.2E | 30 | 13 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03031300 |  | 17.8S | 142.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 19 | 76 | 141 | 182 | 198 |  |  |  | 1 | 2 | 4 | 7 | 9 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 2 | 7 |  |  |  |
|  |  |  | \# CASES |  | 9 | 8 | 7 | 6 | 5 |  |  |  |  | 8 |  | 6 | 5 |  |  |  |



Figure 2-24S-1. 110231Z March 2003 GMS-5 infrared image of TC 24S (Craig), 100 nm northeast of Darwin, Australia, prior to landfall, with a maximum intensity of 40 knots.

TROPICAL CYCLONE 24S (CRAIG)
08-12 MAR 2003


Time Intensity for 24 S

## Intensity (kts)



## Tropical Cyclone (TC) 24S (Craig)*

$\square$
First Poor : N/A

First Fair : 0300Z 08 Mar 03
First TCFA : $1000 Z 08$ Mar 03

First Warning : 1800Z 08 Mar 03
Last Warning : 1800Z 12 Mar 03, Dissipated
Max Intensity : 35 kts, gusts to 45 kts
Landfall : Multiple Events (see below)
Total Warnings : 9
Remarks:
(1) Tropical Cyclone (TC) 24S developed approximately 100 nm northwest of Darwin, Australia on 08 March, 2003 in a near equatorial trough. The cyclone initially drifted northward, then eastward, increasing speed as it tracked across northern Arnhem Land and intensified to 35 knots. TC 24S maintained 35 knots as it tracked into the Gulf of Carpentaria and then dissipated after moving onto the Cape York Peninsula.
(2) Reports indicated damage from storm-force winds and fallen trees.
*Named by WMO designated RSMC

Statistics for JTWC on TC24S

|  | WRN | BEST TRACK |  | wind | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG |  | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030800 |  | 12.0S | 129.0E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030806 |  | 11.8S | 128.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030812 |  | 11.5S | 128.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030818 | 1 | 11.2S | 128.8E | 25 | 5 | 45 | 78 | 93 | 88 |  |  |  | 0 | 5 | 5 | 5 | 10 |  |  |  |
| 03030906 | 2 | 10.6S | 129.6E | 25 | 13 | 36 | 77 | 130 | 129 |  |  |  | 5 | 5 | 5 | 10 | 15 |  |  |  |
| 03030918 | 3 | 10.8S | 130.5E | 30 | 25 | 69 | 116 | 118 | 47 |  |  |  | 0 | 0 | 5 | 10 | 15 |  |  |  |
| 03031006 | 4 | 11.1S | 131.0E | 35 | 13 | 34 | 19 | 108 | 284 |  |  |  | 0 | 0 | 0 | -5 | -5 |  |  |  |
| 03031018 | 5 | 11.6S | 131.5E | 35 | 18 | 35 | 155 | 331 | 443 |  |  |  | 0 | 0 | 0 | -5 | 0 |  |  |  |
| 03031106 | 6 | 11.9S | 132.8E | 35 | 5 | 101 | 263 | 309 |  |  |  |  | 0 | -5 | -10 | -5 |  |  |  |  |
| 03031118 | 7 | 12.6S | 135.8E | 35 | 58 | 197 | 279 |  |  |  |  |  | 0 | 0 | 5 |  |  |  |  |  |
| 03031206 | 8 | 14.1S | 139.8E | 35 | 21 | 90 |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |
| 03031218 | 9 | 16.4S | 142.2E | 30 | 13 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03031300 |  | 17.8S | 142.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 19 | 76 | 141 | 182 | 198 |  |  |  | 1 | 2 | 4 | 7 | 9 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 2 | 7 |  |  |  |
|  |  |  | \# CASES |  | 9 | 8 | 7 | 6 | 5 |  |  |  | 9 | 8 | 7 | 6 | 5 |  |  |  |



Figure 2-24S-1. $110231 Z$ March 2003 GMS-5 infrared image of TC 24S (Craig), 100 nm northeast of Darwin, Australia, prior to landfall, with a maximum intensity of 40 knots.

TROPICAL CYCLONE 24S (CRAIG)
08-12 MAR 2003


Time Intensity for 24 S
Intensity (kts)


# Tropical Cyclone (TC) 25P (Eseta)* 

First Poor : 0100Z 09 Mar 03

First Fair : 0600Z 09 Mar 03
First TCFA : 0030Z 10 Mar 03
First Warning : $1200 Z 10$ Mar 03
Last Warning : 0000 Z 14 Mar 03, Extratropical
Max Intensity : 110 kts, gusts to 135 kts
Landfall : None

Total Warnings : 8
Remarks:
(1) Tropical Cyclone (TC) 25P was initially described as a tropical disturbance in the North Fiji Basin on 10 March, 2003. Approximately 12 hours later JTWC issued the first warning on this cyclone. The system was intensifying at a less than climatological rate and moving south along the western periphery low to mid tropospheric subtropical ridge.

Approximately 36 hours after the initial warning the cyclone began to move east-southeast just south of Fiji, in response to steering flow associated with a mid level ridge to the east-northeast of the cyclone. By 13 March at 1200Z, TC 25P attained maximum intensity of 110 kts due to increased diffluence aloft and then began to track east-southeastward. Rapid weakening occured as TC 25P underwent extratropical transition as a result of the interaction with a developing midlatitude low north of New Zealand.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

## Statistics for JTWC on TC25P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030818 |  | 14.0 S | 171.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030900 |  | 13.9S | 171.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030906 |  | 14.1S | 172.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030912 |  | 14.3S | 172.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030918 |  | 14.6S | 172.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031000 |  | 15.1S | 172.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031006 |  | 15.6S | 172.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031012 | , | 16.2S | 172.4E | 35 | 13 | 83 | 133 | 228 | 284 |  |  |  | -5 | -10 | -15 | -20 | -20 |  |  |  |
| 03031100 | 2 | 18.05 | 172.2E | 45 | 6 | 42 | 115 | 205 | 349 |  |  |  | 0 | -5 | -10 | -10 | -35 |  |  |  |
| 03031112 | 3 | 19.6S | 173.2E | 55 | 16 | 66 | 121 | 173 | 265 |  |  |  | 0 | -10 | -20 | -50 | -65 |  |  |  |
| 03031200 | 4 | 21.4S | 175.0E | 65 | 8 | 29 | 73 | 144 | 303 |  |  |  | 0 | 0 | -35 | -55 | -15 |  |  |  |
| 03031212 | 5 | 21.8S | 178.1E | 70 | 11 | 29 | 97 |  |  |  |  |  | 0 | -35 | -50 |  |  |  |  |  |
| 03031300 | 6 | 21.95 | 177.8W | 100 | 0 | 58 | 182 | 371 |  |  |  |  | 0 | -20 | 5 | 20 |  |  |  |  |
| 03031312 | 7 | 22.9 S | 172.5W | 110 | 0 | 50 | 120 |  |  |  |  |  | 0 | 25 | 35 |  |  |  |  |  |
| 03031400 | 8 | 25.3 S | 165.6W | 65 | 97 | 217 |  |  |  |  |  |  | -5 | 0 |  |  |  |  |  |  |
| 03031406 |  | 27.5S | 161.1W | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031412 |  | 30.5S | 156.9W | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 19 | 72 | 120 | 224 | 300 |  |  |  | 1 | 13 | 24 | 31 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -7 | -13 | -23 | -34 |  |  |  |
|  |  |  | \# CASES |  | 8 | 8 | 7 | 5 | 4 |  |  |  | 8 | 8 | 7 | 5 | 4 |  |  |  |



Figure 2-25P-1. 120215Z March 2003 MODIS true-color image of TC 25P (Eseta), located 250 nm southwest of the Fiji Islands, with an intensity of 65 knots.


Figure 2-25P-2. $130133 Z$ March 2003 GOES-10 visible imagery of TC 25P (Eseta), 378 nm southeast of Suva, Fiji, with an increasing intensity of 100 knots.


Figure 2-25P-3. $131708 Z$ March 200385 GHz SSM/I imagery of TC 25P (Eseta), 340 nm southeast of Suva, Fiji, with an increasing intensity of 80 knots.

## TROPICAL CYCLONE 25P (ESETA)

10-14 MAR 2003


Time Intensity for 25P
Intensity (kts)


# Tropical Cyclone (TC) 25P (Eseta)* 



First Poor : 0100Z 09 Mar 03

First Fair : 0600Z 09 Mar 03
First TCFA : 0030Z 10 Mar 03

First Warning : 1200Z 10 Mar 03
Last Warning : 0000Z 14 Mar 03, Extratropical
Max Intensity : 110 kts, gusts to 135 kts
Landfall : None

Total Warnings : 8
Remarks:
(1) Tropical Cyclone (TC) 25P was initially described as a tropical disturbance in the North Fiji Basin on 10 March, 2003. Approximately 12 hours later JTWC issued the first warning on this cyclone. The system was intensifying at a less than climatological rate and moving south along the western periphery low to mid tropospheric subtropical ridge.

Approximately 36 hours after the initial warning the cyclone began to move east-southeast just south of Fiji, in response to steering flow associated with a mid level ridge to the east-northeast of the cyclone. By 13 March at 1200Z, TC 25P attained maximum intensity of 110 kts due to increased diffluence aloft and then began to track east-southeastward. Rapid weakening occured as TC 25P underwent extratropical transition as a result of the interaction with a developing midlatitude low north of New Zealand.
(2) Available reports indicate no casualties or damage were associated with this cyclone.
*Named by WMO designated RSMC

| Statistics for JTWC on TC25P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | WRN | BEST | TRACK |  |  | SITIO | ON E | RRO | RS |  |  |  |  | ND | ERR | ORS |  |  |  |  |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03030818 |  | 14.0S | 171.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030900 |  | 13.9S | 171.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030906 |  | 14.1S | 172.1E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030912 |  | 14.3 S | 172.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03030918 |  | 14.6S | 172.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031000 |  | 15.15 | 172.6E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031006 |  | 15.6S | 172.5E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031012 | 1 | 16.2 S | 172.4E | 35 | 13 | 83 | 133 | 228 | 284 |  |  |  | -5 | -10 | -15 | -20 | -20 |  |  |  |
| 03031100 | 2 | 18.0S | 172.2E | 45 | 6 | 42 | 115 | 205 | 349 |  |  |  | 0 | -5 | -10 | -10 | -35 |  |  |  |
| 03031112 | 3 | 19.6S | 173.2E | 55 | 16 | 66 | 121 | 173 | 265 |  |  |  | 0 | -10 | -20 | -50 | -65 |  |  |  |
| 03031200 | 4 | 21.4 S | 175.0E | 65 | 8 | 29 | 73 | 144 | 303 |  |  |  | 0 | 0 | -35 | -55 | -15 |  |  |  |
| 03031212 | 5 | 21.8 S | 178.1E | 70 | 11 | 29 | 97 |  |  |  |  |  | 0 | -35 | -50 |  |  |  |  |  |
| 03031300 | 6 | 21.9S | 177.8W | 100 | 0 | 58 | 182 | 371 |  |  |  |  | 0 | -20 | 5 | 20 |  |  |  |  |
| 03031312 | 7 | 22.9 S | 172.5W | 110 | 0 | 50 | 120 |  |  |  |  |  | 0 | 25 | 35 |  |  |  |  |  |
| 03031400 | 8 | 25.3 S | 165.6W | 65 | 97 | 217 |  |  |  |  |  |  | -5 | 0 |  |  |  |  |  |  |
| 03031406 |  | 27.5S | 161.1W | 55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03031412 |  | 30.5S | 156.9W | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 19 | 72 | 120 | 224 | 300 |  |  |  | 1 | 13 | 24 | 31 | 34 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -1 | -7 | -13 | -23 | -34 |  |  |  |
|  |  |  | \# CASES |  | 8 | 8 | 7 | 5 | 4 |  |  |  | 8 | 8 | 7 | 5 | 4 |  |  |  |



Figure 2-25P-1. 120215Z March 2003 MODIS true-color image of TC 25P (Eseta), located 250 nm southwest of the Fiji Islands, with an intensity of 65 knots.


Figure 2-25P-2. $130133 Z$ March 2003 GOES-10 visible imagery of TC 25P (Eseta), 378 nm southeast of Suva, Fiji, with an increasing intensity of 100 knots.


Figure 2-25P-3. $131708 Z$ March 200385 GHz SSM/I imagery of TC 25P (Eseta), 340 nm southeast of Suva, Fiji, with an increasing intensity of 80 knots.

## TROPICAL CYCLONE 25P (ESETA)

10-14 MAR 2003


Time Intensity for 25P
Intensity (kts)


## Tropical Cyclone (TC) 26S (Inigo)*

First Poor : 0230Z 29 Mar

First Fair : 1400Z 30 Mar 03
First TCFA : $1400 Z 31$ Mar 03
First Warning : 1200Z 01 Apr 03

Last Warning : 1200Z 08 Apr 03, Dissipated
Max Intensity : 140 kts, gusts to 170 kts
Landfall : Near Port Hedland, Australia
Total Warnings : 23
Remarks:
(1) Tropical Cyclone (TC) 26S was initially a very poorly organized surface circulation with cycling convection in the Banda Sea, off the northeast coast of Timor. As it slowly tracked westward over East Timor into the Suva Sea, it became more organized. JTWC issued the first warning on 01 April as the system showed signs of developing banding features in the satellite imagery. Throughout its developing stage, TC 26S was equatorward of the upper level ridge axis which hampered intensification.

On 06 April, under the steering influence of the subtropical ridge to the east, TC 26S turned poleward and tracked underneath the 200 mb ridge axis. In less than 24 hours following that event, TC 26S explosively intensified from a 75 knot system to a maximum intensity of 140 knots. On 08 April, TC 26S passed approximately 150 Nm northeast of Learmonth, Australia and made landfall approximately 135 mm west-southwest of Port Hedland, Australia.
(2) TC 26S dissipated soon after landfall. Minimal damage was reported with this system due to the sparse population near the landfall location.
*Named by WMO designated RSMC

## Statistics for JTWC on TC26S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03032906 |  | 7.0 S | 130.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03032912 |  | 7.1S | 129.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03032918 |  | 7.35 | 129.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033000 |  | 7.6S | 128.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033006 |  | 7.95 | 127.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033012 |  | 8.25 | 126.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033018 |  | 8.5S | 126.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033100 |  | 8.85 | 124.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033106 |  | 9.05 | 123.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033112 |  | 9.45 | 122.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033118 |  | 9.5 S | 121.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040100 |  | 9.45 | 121.2E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040106 |  | 9.75 | 120.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040112 | 1 | 10.1S | 120.3E | 35 | 6 | 34 | 72 | 103 | 103 |  |  |  | 0 | 0 | 0 | -10 | -35 |  |  |  |
| 03040200 | 2 | 10.8S | 119.3E | 45 | 8 | 37 | 101 | 112 | 94 |  |  |  | 0 | 0 | -10 | -35 | -55 |  |  |  |
| 03040212 | 3 | 11.4S | 118.5E | 55 | 5 | 35 | 54 | 74 | 65 |  |  |  | 0 | -5 | -30 | -50 | -40 |  |  |  |
| 03040300 | 4 | 11.7S | 117.9E | 75 | 16 | 34 | 43 | 65 | 81 |  |  |  | 5 | -10 | -30 | -35 | -30 |  |  |  |
| 03040312 | 5 | 12.1S | 116.9E | 110 | 0 | 12 | 26 | 30 | 33 |  |  |  | 5 | -5 | -5 | 0 | 0 |  |  |  |
| 03040400 | 6 | 12.6S | 115.8E | 140 | 8 | 21 | 21 | 24 | 21 | 29 |  |  | 0 | 0 | 10 | 10 | 25 | 55 |  |  |
| 03040412 | 7 | 13.5S | 114.6E | 140 | 6 | 18 | 38 | 62 | 85 | 77 |  |  | 0 | 10 | 10 | 25 | 25 | 50 |  |  |
| 03040518 | 8* | 14.0S | 113.9E | 140 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040500 | 9 | 14.3S | 113.6E | 130 | 0 | 18 | 36 | 44 | 64 | 137 |  |  | 5 | 5 | 15 | 20 | 25 | 5 |  |  |
| 03040506 | 10 | 14.5S | 113.2E | 125 | 0 | 12 | 21 | 31 | 50 | 133 |  |  | 0 | 0 | 5 | 15 | 15 | 5 |  |  |
| 03040512 | 11 | 14.7S | 113.0E | 125 | 5 | 12 | 21 | 54 | 54 | 106 |  |  | -5 | 0 | 5 | 20 | 20 | 15 |  |  |
| 03040518 | 12 | 14.9S | 112.8E | 115 | 8 | 8 | 6 | 21 | 31 | 65 |  |  | -5 | -5 | 10 | 15 | 10 | 5 |  |  |
| 03040600 | 13 | 15.1S | 112.7E | 105 | 8 | 12 | 8 | 39 | 49 |  |  |  | -5 | -5 | 0 | 5 | 0 |  |  |  |




Figure 2-26S-1. 020555Z April 2003 MODIS true-color image of TC 26S (Inigo), located 440nm west-northwest of Port Warrender, Australia, with an intensity of 45 knots as it began a phase of rapid intensification.


Figure 2-26S-2. $041531 Z$ April 2003 color composite TRMM image of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.


Figure 2-26S-3. 041531Z April 2003 enhanced infrared imagery of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

## TROPICAL CYCLONE 26P (INIGO) <br> 01-08 APR 2003



Time Intensity for 26 S

## Intensity (kts)



## Tropical Cyclone (TC) 26S (Inigo)*

First Poor : 0230Z 29 Mar

First Fair : 1400Z 30 Mar 03
First TCFA : 1400Z 31 Mar 03
First Warning : 1200Z 01 Apr 03
Last Warning : 1200Z 08 Apr 03, Dissipated
Max Intensity : 140 kts, gusts to 170 kts
Landfall : Near Port Hedland, Australia
Total Warnings : 23
Remarks:
(1) Tropical Cyclone (TC) 26S was initially a very poorly organized surface circulation with cycling convection in the Banda Sea, off the northeast coast of Timor. As it slowly tracked westward over East Timor into the Suva Sea, it became more organized. JTWC issued the first warning on 01 April as the system showed signs of developing banding features in the satellite imagery.
Throughout its developing stage, TC 26S was equatorward of the upper level ridge axis which hampered intensification.

On 06 April, under the steering influence of the subtropical ridge to the east, TC 26S turned poleward and tracked underneath the 200mb ridge axis. In less than 24 hours following that event, TC 26S explosively intensified from a 75 knot system to a maximum intensity of 140 knots. On 08 April, TC 26 S passed approximately 150 Nm northeast of Learmonth, Australia and made landfall approximately 135 mm west-southwest of Port Hedland, Australia.
(2) TC 26S dissipated soon after landfall. Minimal damage was reported with this system due to the sparse population near the landfall location.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03032906 |  | 7.0 S | 130.6E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03032912 |  | 7.1S | 129.9E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03032918 |  | 7.35 | 129.2E | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033000 |  | 7.6S | 128.5E | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033006 |  | 7.95 | 127.8E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033012 |  | 8.25 | 126.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033018 |  | 8.5S | 126.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033100 |  | 8.85 | 124.9E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033106 |  | 9.0 S | 123.8E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033112 |  | 9.4S | 122.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03033118 |  | 9.5 S | 121.9E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040100 |  | 9.45 | 121.2E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040106 |  | 9.75 | 120.7E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040112 | 1 | 10.1S | 120.3E | 35 | 6 | 34 | 72 | 103 | 103 |  |  |  | 0 | 0 | 0 | -10 | -35 |  |  |  |
| 03040200 | 2 | 10.8S | 119.3E | 45 | 8 | 37 | 101 | 112 | 94 |  |  |  | 0 | 0 | -10 | -35 | -55 |  |  |  |
| 03040212 | 3 | 11.4 S | 118.5E | 55 | 5 | 35 | 54 | 74 | 65 |  |  |  | 0 | -5 | -30 | -50 | -40 |  |  |  |
| 03040300 | 4 | 11.7S | 117.9E | 75 | 16 | 34 | 43 | 65 | 81 |  |  |  | 5 | -10 | -30 | -35 | -30 |  |  |  |
| 03040312 | 5 | 12.1S | 116.9E | 110 | 0 | 12 | 26 | 30 | 33 |  |  |  | 5 | -5 | -5 | 0 | 0 |  |  |  |
| 03040400 | 6 | 12.6S | 115.8E | 140 | 8 | 21 | 21 | 24 | 21 | 29 |  |  | 0 | 0 | 10 | 10 | 25 | 55 |  |  |
| 03040412 | 7 | 13.5S | 114.6E | 140 | 6 | 18 | 38 | 62 | 85 | 77 |  |  | 0 | 10 | 10 | 25 | 25 | 50 |  |  |
| 03040518 | $8^{*}$ | 14.0S | 113.9E | 140 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03040500 | 9 | 14.35 | 113.6E | 130 | 0 | 18 | 36 | 44 | 64 | 137 |  |  | 5 | 5 | 15 | 20 | 25 | 5 |  |  |
| 03040506 | 10 | 14.5S | 113.2E | 125 | 0 | 12 | 21 | 31 | 50 | 133 |  |  | 0 | 0 | 5 | 15 | 15 | 5 |  |  |
| 03040512 | 11 | 14.7S | 113.0E | 125 | 5 | 12 | 21 | 54 | 54 | 106 |  |  | -5 | 0 | 5 | 20 | 20 | 15 |  |  |
| 03040518 | 12 | 14.95 | 112.8 E | 115 | 8 | 8 | 6 | 21 | 31 | 65 |  |  | -5 | -5 | 10 | 15 | 10 | 5 |  |  |
| 03040600 | 13 | 15.1S | 112.7E | 105 | 8 | 12 | 8 | 39 | 49 |  |  |  | -5 | -5 | 0 | 5 | 0 |  |  |  |
| 03040606 | 14 | 15.4S | 112.7E | 100 | 5 | 51 | 91 | 104 | 34 |  |  |  | 0 | 5 | 5 | 5 | 5 |  |  |  |
| 03040612 | 15 | 15.8 S | 112.8E | 90 | 11 | 42 | 38 | 58 | 102 |  |  |  | 0 | 5 |  |  | 10 |  |  |  |
| 03040618 | 16 | 16.4S | 113.0E | 80 | 5 | 6 | 42 | 102 | 127 |  |  |  | 0 | 0 | -5 | -5 | -5 |  |  |  |
| 03040700 | 17 | 17.0S | 113.3E | 70 | 0 | 25 | 69 | 83 |  |  |  |  | 0 | 5 | 0 | 10 |  |  |  |  |
| 03040706 | 18 | 17.6S | 113.9E | 65 | 8 | 21 | 98 | 133 |  |  |  |  | 0 | -5 | -10 | -5 |  |  |  |  |
| 03040712 | 19 | 18.3S | 114.8E | 55 | 0 | 62 | 84 |  |  |  |  |  | 5 | -5 | 0 |  |  |  |  |  |
| 03040718 | 20 | 19.0S | 115.1E | 55 | 29 | 72 | 101 |  |  |  |  |  | 0 | 0 | 0 |  |  |  |  |  |
| 03040800 | 21 | 19.9S | 115.5E | 50 | 17 | 129 |  |  |  |  |  |  | 0 | 10 |  |  |  |  |  |  |
| 03040806 | 22 | 20.9S | 116.2E | 40 | 8 | 73 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03040812 | 23 | 21.9S | 117.7E | 25 | 5 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03040818 |  | 23.4S | 118.2E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 8 | 35 | 51 | 67 | 66 | 91 |  |  | 2 | 4 | 8 | 16 | 20 | 23 |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 0 | -1 | -1 | -2 | 23 |  |  |
|  |  |  | \# CASES |  | 22 | 21 | 19 | 17 | 15 | 6 |  |  | 22 | 21 | 19 | 17 | 15 | 6 |  |  |

[^5]

Figure 2-26S-1. 020555Z April 2003 MODIS true-color image of TC 26S (Inigo), located 440nm west-northwest of Port Warrender, Australia, with an intensity of 45 knots as it began a phase of rapid intensification.


Figure 2-26S-2. $041531 Z$ April 2003 color composite TRMM image of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.


Figure 2-26S-3. 041531Z April 2003 enhanced infrared imagery of TC 26S (Inigo), 495 nm north of Learmonth, Australia, with a peak intensity of 140 knots.

01-08 APR 2003


Time Intensity for 26S
Intensity (kts)


## Tropical Cyclone (TC) 27P (Fili)*

First Poor : 0230Z 12 Apr 03
First Fair : 1630Z 13 Apr 03
First TCFA : $2330 Z 13$ Apr 03
First Warning : 0600Z 14 Apr 03
Last Warning : 0600Z 14 Apr 03, Extratropical
Max Intensity : 45 kts, gusts to 55 kts
Landfall : None
Total Warnings : 1
Remarks: None
*Named by WMO designated RSMC

Statistics for JTWC on TC27P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03041300 |  | 13.5S | 179.6W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041306 |  | 13.8S | 179.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041312 |  | 14.2 S | 178.9W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041318 |  | 14.6S | 178.2W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03041400 |  | 15.3S | 177.0W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 03041406 | 1 | 16.0S | 175.7W | 35 | 18 | 80 | 246 |  |  |  |  |  | 0 |  | 15 | 30 |  |  |  |  |  |
| 03041412 |  | 17.6S | 174.0W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041418 |  | 20.2S | 172.2W | 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041500 |  | 24.4S | 170.6W | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041506 |  | 29.3S | 169.7W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 80 | 246 |  |  |  |  |  | 0 |  | 15 | 30 |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 |  | 15 | 30 |  |  |  |  |  |
|  |  |  | \# CASES |  | 1 | 1 | 1 |  |  |  |  |  | 1 | 1 | 1 | 1 |  |  |  |  |  |



Figure 2-27P-1. 140531Z April 2003 enhanced infrared satellite image of TC 27P (Fili), 625 nm southeast of Suva, Fiji, with an intensity of 35 knots.


Figure 2-27P-2. 141910Z April 2003 multi-sensor satellite images of TC 27P (Fili), 575 nm southeast of Suva, Fiji, with an intensity of 35 knots.

## TROPICAL CYCLONE 27P (FLI) <br> 14 APR 2003



Time Intensity for 27P

## Intensity (kts)

|  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |

Fix Date (Zulu)

## Tropical Cyclone (TC) 27P (Fili)*

First Poor : 0230Z 12 Apr 03
First Fair : 1630Z 13 Apr 03
First TCFA : 2330Z 13 Apr 03
First Warning : 0600Z 14 Apr 03
Last Warning : 0600Z 14 Apr 03, Extratropical
Max Intensity : 45 kts, gusts to 55 kts
Landfall : None
Total Warnings : 1
Remarks: None
*Named by WMO designated RSMC

Statistics for JTWC on TC27P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03041300 |  | 13.5S | 179.6W | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041306 |  | 13.8S | 179.3W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041312 |  | 14.2S | 178.9W | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041318 |  | 14.6S | 178.2W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041400 |  | 15.3S | 177.0W | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041406 | 1 | 16.0S | 175.7W | 35 | 18 | 80 | 246 |  |  |  |  |  | 0 | 15 | 30 |  |  |  |  |  |
| 03041412 |  | 17.6S | 174.0W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |


| 03041418 | $20.2 S$ | 172.2 W | 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 03041500 | 24.4 S | 170.6 W | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03041506 | $29.3 S$ | 169.7 W | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 18 | 80 | 246 |  |  |  |  |  | 0 | 15 | 30 |  |  |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 15 | 30 |  |  |  |  |  |
|  |  |  | \# CASES |  | 1 | 1 | 1 |  |  |  |  |  | 1 | 1 | 1 |  |  |  |  |  |



Figure 2-27P-1. 140531Z April 2003 enhanced infrared satellite image of TC 27P (Fili), 625 nm southeast of Suva, Fiji, with an intensity of 35 knots.


Figure 2-27P-2. 141910Z April 2003 multi-sensor satellite images of TC 27P (Fili), 575 nm southeast of Suva, Fiji, with an intensity of 35 knots.

TROPICAL CYCLONE 27 P (FLI)
14 APR 2003


Time Intensity for 27P


## Tropical Cyclone (TC) 28S (Manou)*

First Poor : 1800Z 28 Apr 03
First Fair : 1400Z 01 May 03
First TCFA : 0400Z 03 May 03
First Warning : 1200Z 03 May 03
Last Warning : $1800 Z 10$ May 03, Dissipated
Max Intensity : 75 kts, gusts to 90 kts
Landfall : None

Total Warnings : 15 plus 1 Amended Warning
Remarks:
(1) Tropical cyclone (TC) 28 S developed approximately 240 nm southwest of Diego Garcia on 28 April, 2003 and cyclone intensified slowly during the first 48 hours after the initial warning. It peaked at 45 knots, then weakened to 35 knots around 0000 Z on 06 May. TC 28 S then slowly tracked southwestward, toward Madagascar, and reached a maximum intensity of 75 knots and maintained this intensity for 24 hours as it approached the mountainous coastline. It slowed drastically as it approached Madagascar and then turned poleward.

While it did not make landfall, TC 28S spent more than 12 hours within a few miles of the coast of Madagascar as it moved slowly southward along the coast at intensities from 65 to 75 knots. TC 28S finally dissipated over open water and the last warning was issued at 1800 Z on 10 May, 2003.
(2) Reports indicated that there were70 fatalities, 19 persons were missing, and 85 were injured. Further reports indicated 24,500 homes were destroyed, leaving 47,500 people homeless, with damage to infrastructure on Madagascar as a result of this cyclone.
*Named by WMO designated RSMC

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03050200 |  | 11.0 S | 65.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050206 |  | 11.1S | 65.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050212 |  | 11.3 S | 65.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050218 |  | 11.6 S | 64.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050300 |  | 12.1S | 64.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050306 |  | 12.8 S | 64.0E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050312 | 1 | 13.7S | 63.4E | 35 | 25 | 61 | 55 | 74 | 108 |  |  |  | 0 | 0 | 15 | 30 | 45 |  |  |  |
| 03050400 | 2 | 15.0 S | 61.8E | 45 | 25 | 63 | 111 | 127 | 156 |  |  |  | 5 | 15 | 25 | 40 | 60 |  |  |  |
| 03050412 | 3 | 15.6 S | 60.7E | 45 | 0 | 26 | 55 | 73 | 129 |  |  |  | 0 | 10 | 25 | 40 | 50 |  |  |  |
| 03050500 | 4 | 16.1S | 59.4E | 45 | 335 | 50 | 82 | 95 | 137 |  |  |  | 0 | 15 | 30 | 35 | 40 |  |  |  |
| 03050512 | 5 | 16.2 S | 58.1E | 40 | 17 | 32 | 69 | 123 | 174 |  |  |  | 0 | 5 | 0 | 0 | -10 |  |  |  |
| 03050600 | 6 | 16.8S | 56.9E | 35 | 0 | 21 | 48 | 85 | 118 |  |  |  | 0 | 0 | 0 | -10 | -20 |  |  |  |
| 03050612 | 7 | 17.5S | 55.2E | 35 | 18 | 55 |  |  |  |  |  |  | -5 | -10 |  |  |  |  |  |  |
| 03050618 | 7A | 17.9 S | 54.3E | 35 | 5 | 27 | 60 | 92 | 103 |  |  |  | 5 | -5 | -20 | -30 | -40 |  |  |  |
| 03050706 | 8 | 18.3 S | 52.6E | 45 | 11 | 21 | 38 | 28 | 94 |  |  |  | 0 | -5 | -15 | -35 | -50 |  |  |  |
| 03050718 | 9 | 18.7S | 51.2E | 55 | 5 | 34 | 23 | 8 | 54 |  |  |  | 0 | -5 | -20 | -25 | -25 |  |  |  |
| 03050806 | 10 | 19.1S | 49.8E | 65 | 5 | 49 | 82 | 81 | 66 |  |  |  | 0 | 0 | -30 | -5 | 20 |  |  |  |
| 03050818 | 11 | 19.3S | 49.2E | 75 | 0 | 34 | 72 | 93 | 123 |  |  |  | 0 | -15 | -10 | 20 | 35 |  |  |  |
| 03050906 | 12 | 19.5S | 49.0E | 75 | 0 | 13 | 13 | 90 |  |  |  |  | 0 | 10 | 35 | 45 |  |  |  |  |
| 03050918 | 13 | 20.0S | 48.9E | 60 | 5 | 31 | 102 |  |  |  |  |  | -5 | 0 | 20 |  |  |  |  |  |
| 03051006 | 14 | 21.0 S | 48.9E | 40 | 12 | 23 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03051018 | 15 | 22.9 S | 48.9E | 30 | 26 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 36 | 62 | 81 | 115 |  |  |  | 1 | 7 | 19 | 26 | 36 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | 4 | 9 | 10 |  |  |  |
|  |  |  | \# CASES |  | 16 | 15 | 13 | 12 | 11 |  |  |  | 16 | 15 | 13 | 12 | 11 |  |  |  |



Figure 2-28S-1. $071753 Z$ May 2003 multi-sensor satellite images of TC 28S (Manou), located off the east coast of Madagascar, with a maximum intensity of 75 knots.


Figure 2-28S-2. 081020Z May 2003 MODIS true-color image of TC 28S (Manou), located off the coast of Madagascar, with a maximum intensity of 75 knots.

## TROPICAL CYCLONE 28S (MANOU) <br> 03-10 MAY 2003



Time Intensity for 28 S
Intensity (kts)


## Tropical Cyclone (TC) 28S (Manou)*

First Poor : 1800Z 28 Apr 03
First Fair : 1400Z 01 May 03
First TCFA : 0400Z 03 May 03
First Warning : 1200Z 03 May 03
Last Warning : $1800 Z 10$ May 03, Dissipated
Max Intensity : 75 kts, gusts to 90 kts
Landfall : None
Total Warnings: 15 plus 1 Amended Warning
Remarks:
(1) Tropical cyclone (TC) 28S developed approximately 240 nm southwest of Diego Garcia on 28 April, 2003 and cyclone intensified slowly during the first 48 hours after the initial warning. It peaked at 45 knots, then weakened to 35 knots around 0000Z on 06 May. TC 28S then slowly tracked southwestward, toward Madagascar, and reached a maximum intensity of 75 knots and maintained this intensity for 24 hours as it approached the mountainous coastline. It slowed drastically as it approached Madagascar and then turned poleward.

While it did not make landfall, TC 28S spent more than 12 hours within a few miles of the coast of Madagascar as it moved slowly southward along the coast at intensities from 65 to 75 knots. TC $28 S$ finally dissipated over open water and the last warning was issued at 1800 Z on 10 May, 2003.
(2) Reports indicated that there were 70 fatalities, 19 persons were missing, and 85 were injured. Further reports indicated 24,500 homes were destroyed, leaving 47,500 people homeless, with damage to infrastructure on Madagascar as a result of this cyclone.
*Named by WMO designated RSMC

Statistics for JTWC on TC28S

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03050200 |  | 11.0S | 65.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050206 |  | 11.1S | 65.3E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050212 |  | 11.35 | 65.0E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050218 |  | 11.6S | 64.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050300 |  | 12.1S | 64.4E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050306 |  | 12.8S | 64.0E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03050312 | 1 | 13.7S | 63.4E | 35 | 25 | 61 | 55 | 74 | 108 |  |  |  | 0 | 0 | 15 | 30 | 45 |  |  |  |
| 03050400 | 2 | 15.0S | 61.8E | 45 | 25 | 63 | 111 | 127 | 156 |  |  |  | 5 | 15 | 25 | 40 | 60 |  |  |  |
| 03050412 | 3 | 15.6S | 60.7E | 45 | 0 | 26 | 55 | 73 | 129 |  |  |  | 0 | 10 | 25 | 40 | 50 |  |  |  |
| 03050500 | 4 | 16.1S | 59.4E | 45 | 33 | 50 | 82 | 95 | 137 |  |  |  | 0 | 15 | 30 | 35 | 40 |  |  |  |
| 03050512 | 5 | 16.2S | 58.1E | 40 | 17 | 32 | 69 | 123 | 174 |  |  |  | 0 | 5 | 0 | 0 | -10 |  |  |  |
| 03050600 | 6 | 16.8S | 56.9E | 35 | 0 | 21 | 48 | 85 | 118 |  |  |  | 0 | 0 | 0 | -10 | -20 |  |  |  |
| 03050612 | 7 | 17.5S | 55.2E | 35 | 18 | 55 |  |  |  |  |  |  | -5 | -10 |  |  |  |  |  |  |
| 03050618 | 7A | 17.9S | 54.3E | 35 | 5 | 27 | 60 | 92 | 103 |  |  |  | 5 | -5 | -20 | -30 | -40 |  |  |  |
| 03050706 | 8 | 18.3 S | 52.6E | 45 | 11 | 21 | 38 | 28 | 94 |  |  |  | 0 | -5 | -15 | -35 | -50 |  |  |  |
| 03050718 | 9 | 18.7S | 51.2E | 55 | 5 | 34 | 23 | 8 | 54 |  |  |  | 0 | -5 | -20 | -25 | -25 |  |  |  |
| 03050806 | 10 | 19.1S | 49.8E | 65 | 5 | 49 | 82 | 81 | 66 |  |  |  | 0 | 0 | -30 | -5 | 20 |  |  |  |
| 03050818 | 11 | 19.35 | 49.2E | 75 | 0 | 34 | 72 | 93 | 123 |  |  |  | 0 | -15 | -10 | 20 | 35 |  |  |  |
| 03050906 | 12 | 19.5 S | 49.0E | 75 | 0 | 13 | 13 | 90 |  |  |  |  | 0 | 10 | 35 | 45 |  |  |  |  |
| 03050918 | 13 | 20.0S | 48.9E | 60 | 5 | 31 | 102 |  |  |  |  |  | -5 | 0 | 20 |  |  |  |  |  |
| 03051006 | 14 | 21.0 S | 48.9E | 40 | 12 | 23 |  |  |  |  |  |  | 0 | 5 |  |  |  |  |  |  |
| 03051018 | 15 | 22.9S | 48.9E | 30 | 26 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 12 | 36 | 62 | 81 | 115 |  |  |  | 1 | 7 | 19 | 26 | 36 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | 0 | 1 | 4 | 9 | 10 |  |  |  |
|  |  |  | \# CASES |  | 16 | 15 | 13 | 12 | 11 |  |  |  | 16 | 15 | 13 | 12 | 11 |  |  |  |



Figure 2-28S-1. $071753 Z$ May 2003 multi-sensor satellite images of TC 28 S (Manou), located off the east coast of Madagascar, with a maximum intensity of 75 knots.


Figure 2-28S-2. $081020 Z$ May 2003 MODIS true-color image of TC 28 (Manou), located off the coast of Madagascar, with a maximum intensity of 75 knots.

TROPICAL CYCLONE 28S (MANOU)
03-10 MAY 2003


## Time Intensity for 28 S

Intensity (kts)


[^6]Fix Date (Zulu)

## Tropical Cyclone (TC) 29P (Gina)*

First Poor : N/A
First Fair : 2300Z 03 Jun 03
First TCFA : 0200Z 04 Jun 03
First Warning : $1800 Z 04$ Jun 03
Last Warning : 1800Z 08 Jun 03, Extratropical
Max Intensity : 90 kts, gusts to 110 kts
Landfall : None
Total Warnings : 9 plus 1 amended
Remarks:
(1) Tropical Cyclone (TC) 29P was first noted as a tropical disturbance east of the Solomon Islands on 03 June, 2003 and described as a partially exposed low level circulation center associated with rapidly organizing deep convection. A Tropical Cyclone Formation Alert was issued within a few hours based on the rapid organization of the tropical cyclone, with the cyclone gaining warning status by $1800 Z$ on 04 June.

TC 29P tracked southwestward under the influence of a low to mid-level steering ridge to the east for approximately 72 hours after the initial warning. Intensification was near the climatological average for most of this period, reaching a maximum intensity of 90 knots around 1200 z on 07 June. Afterwards, an approaching shortwave trough created a weakness in the ridge, causing a sharp recurvature and extratropical transition.
(2) No reports of damages were received for this system.
*Named by WMO designated RSMC

## Statistics for JTWC on TC29P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03060400 |  | 10.0S | 171.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060406 |  | 10.1S | 171.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060412 |  | 10.3 S | 170.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060418 | 1 | 10.6 S | 169.9E | 30 | 16 | 32 | 76 | 123 | 152 |  |  |  | 0 | -10 | -20 | -15 | -25 |  |  |  |
| 03060506 | 2 | 11.7S | 168.8E | 45 | 17 | 43 | 95 | 168 | 201 |  |  |  | 0 | 0 | 15 | 5 | -5 |  |  |  |
| 03060518 | 3 | 13.0 S | 167.7E | 55 | 0 | 33 | 55 | 76 | 100 |  |  |  | 0 | 10 | 10 | 0 | 5 |  |  |  |
| 03060606 | 4 | 14.4S | 166.1E | 55 | 13 | 53 | 66 | 96 | 58 |  |  |  | 0 | 0 | -30 | -50 | -40 |  |  |  |
| 03060618 | 5 | 15.3 S | 164.0E | 65 | 29 | 41 | 71 | 140 | 228 |  |  |  | 0 | -25 | -45 | -35 | -20 |  |  |  |
| 03060700 | 5A | 15.7S | 163.1E | 75 | 0 | 33 | 70 | 131 |  |  |  |  | -10 | 0 | 15 | 25 |  |  |  |  |
| 03060712 | 6 | 16.8S | 162.1E | 90 | 0 | 24 | 121 |  |  |  |  |  | 0 | 0 | 25 |  |  |  |  |  |
| 03060800 | 7 | 17.6S | 161.9E | 90 | 13 | 71 |  |  |  |  |  |  | 0 | 20 |  |  |  |  |  |  |
| 03060812 | 8 | 18.3 S | 163.3E | 65 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03060818 | 9 | 18.7S | 165.0E | 55 | 0 |  |  |  |  |  |  |  | -15 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 9 | 41 | 79 | 122 | 148 |  |  |  | 3 | 8 | 23 | 22 | 19 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -3 | -1 | -4 | -12 | -17 |  |  |  |
|  |  |  | \# CASES |  | 10 | 8 | 7 | 6 | 5 |  |  |  | 10 | 8 | 7 | 6 | 5 |  |  |  |



Figure 2-28P-1. 062340Z June 2003 MODIS true-color image of TC 29P (Gina), located northwest of New Caledonia, with an intensity of 65 knots.


Figure 2-29P-2. $071849 Z$ June 2003 TRMM color composite image of TC 29P (Gina), located 320 nm west of Vila, with an estimated intensity of 90 knots.

TROPICAL CYCLONE 29S (GINA)
04-08 JUN 2003


## Time Intensity for 29P

## Intensity (kts)



## Tropical Cyclone (TC) 29S (Gina)*

First Poor : N/A

First Fair : 2300Z 03 Jun 03
First TCFA : $0200 Z 04$ Jun 03
First Warning : 1800Z 04 Jun 03
Last Warning : 1800Z 08 Jun 03, Extratropical
Max Intensity : 90 kts, gusts to 110 kts
Landfall : None

Total Warnings : 9 plus 1 amended
Remarks:
(1) Tropical Cyclone (TC) 29P was first noted as a tropical disturbance east of the Solomon Islands on 03 June, 2003 and described as a partially exposed low level circulation center associated with rapidly organizing deep convection. A Tropical Cyclone Formation Alert was issued within a few hours based on the rapid organization of the tropical cyclone, with the cyclone gaining warning status by $1800 Z$ on 04 June.

TC 29P tracked southwestward under the influence of a low to mid-level steering ridge to the east for approximately 72 hours after the initial warning. Intensification was near the climatological average for most of this period, reaching a maximum intensity of 90 knots around 1200 z on 07 June. Afterwards, an approaching shortwave trough created a weakness in the ridge, causing a sharp recurvature and extratropical transition.
(2) No reports of damages were received for this system.
*Named by WMO designated RSMC

Statistics for JTWC on TC29P

|  | WRN | BEST TRACK |  |  | POSITION ERRORS |  |  |  |  |  |  |  | WIND ERRORS |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTG | NO. | LAT | LONG | wind | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 | 00 | 12 | 24 | 36 | 48 | 72 | 96 | 120 |
| 03060400 |  | 10.0S | 171.7E | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060406 |  | 10.1S | 171.1E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060412 |  | 10.35 | 170.5E | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03060418 | 1 | 10.6S | 169.9E | 30 | 16 | 32 | 76 | 123 | 152 |  |  |  | 0 | -10 | -20 | -15 | -25 |  |  |  |
| 03060506 | 2 | 11.7S | 168.8E | 45 | 17 | 43 | 95 | 168 | 201 |  |  |  | 0 | 0 | 15 | 5 | -5 |  |  |  |
| 03060518 | 3 | 13.0S | 167.7E | 55 | 0 | 33 | 55 | 76 | 100 |  |  |  | 0 | 10 | 10 | 0 | 5 |  |  |  |
| 03060606 | 4 | 14.4 S | 166.1E | 55 | 13 | 53 | 66 | 96 | 58 |  |  |  | 0 | 0 | -30 | -50 | -40 |  |  |  |
| 03060618 | 5 | 15.3S | 164.0E | 65 | 29 | 41 | 71 | 140 | 228 |  |  |  | 0 | -25 | -45 | -35 | -20 |  |  |  |
| 03060700 | 5A | 15.7S | 163.1E | 75 | 0 | 33 | 70 | 131 |  |  |  |  | -10 | 0 | 15 | 25 |  |  |  |  |
| 03060712 | 6 | 16.8S | 162.1E | 90 | 0 | 24 | 121 |  |  |  |  |  | 0 | 0 | 25 |  |  |  |  |  |
| 03060800 | 7 | 17.6S | 161.9E | 90 | 13 | 71 |  |  |  |  |  |  | 0 | 20 |  |  |  |  |  |  |
| 03060812 | 8 | 18.3 S | 163.3E | 65 | 0 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 03060818 | 9 | 18.7S | 165.0E | 55 | 0 |  |  |  |  |  |  |  | -15 |  |  |  |  |  |  |  |
|  |  |  | AVERAGE |  | 9 | 41 | 79 | 122 | 148 |  |  |  | 3 | 8 | 23 | 22 | 19 |  |  |  |
|  |  |  | BIAS |  |  |  |  |  |  |  |  |  | -3 | -1 | -4 | -12 | -17 |  |  |  |
|  |  |  | \# CASES |  | 10 | 8 | 7 | 6 | 5 |  |  |  | 10 | 8 | 7 | 6 | 5 |  |  |  |



Figure 2-28P-1. $062340 Z$ June 2003 MODIS true-color image of TC 29P (Gina), located northwest of New Caledonia, with an intensity of 65 knots.


Figure 2-29P-2. $071849 Z$ June 2003 TRMM color composite image of TC 29P (Gina), located 320 nm west of Vila, with an estimated intensity of 90 knots.

## TROPICAL CYCLONE 29S (GINA)

## 04-08 JUN 2003



## Time Intensity for 29P



## 3. TROPICAL CYCLONE FIX DATA

### 3.1 2003 SEASON

Tables 3-1 to 3-3 list the number of tropical cyclone center "fixes", or locations, made using satellite (visible, infrared, and microwave), scatterometer, radar, and synoptic data. Fixes made by the DOD tropical cyclone reconnaissance network sites are included in the tables as well as those fixes received from other sources (e.g., Japanese Meteorological Agency, Australian Bureau of Meteorology, and U.S. National Weather Service National Environmental Satellite Data and Information Service).

| TABLE 3-1SOUTH PACIFIC \& SOUTH INDIAN OCEAN FIX SUMMARY FOR 2003 |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Tropical Cyclone |  | Satellite | Scatt | Radar | Synoptic | Total |
| TC 01S |  | 51 | 0 | 0 | 0 | 51 |
| TC 02S | Atang | 180 | 3 | 0 | 0 | 183 |
| TC 03S | Boura | 214 | 8 | 0 | 0 | 222 |
| TC 04P | Yolande | 68 | 3 | 0 | 1 | 72 |
| TC 05S | Crystal | 179 | 6 | 0 | 0 | 185 |
| TC 06P | Zoe | 219 | 7 | 0 | 0 | 226 |
| TC 07S | - | 109 | 8 | 0 | 0 | 117 |
| TC 08S | Delfina | 119 | 1 | 0 | 0 | 120 |
| TC 09S | Ebula | 141 | 5 | 0 | 0 | 146 |
| TC 10P | Ami | 131 | 1 | 1 | 0 | 133 |
| TC 11S | Fari | 204 | 4 | 0 | 0 | 208 |


| TC 12P | Beni | 267 | 8 | 0 | 0 | 275 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| TC 13P | Cilla | 110 | 5 | 0 | 0 | 115 |
| TC 14S | Fiona | 234 | 5 | 1 | 0 | 240 |
| TC 15P | Dovi | 203 | 7 | 0 | 0 | 210 |
| TC 16S | Gerry | 167 | 8 | 0 | 0 | 175 |
| TC 17S | Hape | 139 | 2 | 0 | 0 | 141 |
| TC 18S | Isha | 169 | 3 | 0 | 0 | 172 |
| TC 19S | Japhet | 184 | 0 | 0 | 0 | 184 |
| TC 20S | Graham | 56 | 2 | 0 | 2 | 60 |
| TC 21S | Harriet | 170 | 9 | 0 | 0 | 179 |
| TC 22P | Erica | 223 | 6 | 0 | 0 | 229 |
| TC 23S | Kalunde | 291 | 7 | 0 | 0 | 298 |
| TC 24S | Craig | 91 | 1 | 0 | 1 | 93 |
| TC 25P | Eseta | 121 | 2 | 0 | 0 | 123 |
| TC 26S | Inigo | 238 | 3 | 0 | 1 | 242 |
| TC 27P | Fili | 54 | 0 | 0 | 0 | 54 |
| TC 28S | Manou | 234 | 6 | 0 | 0 | 240 |
| TC 29P | Gina | 169 | 5 | 0 | 0 | 174 |
|  | Totals | 4735 | 125 | 2 | 5 | 4867 |
| Percentage |  | 97.3 | 2.6 | 0.04 | 0.1 | 100 |
| of Total |  |  |  | 0 |  |  |


| WESTERN NORTH PACIFIC OCEAN FIX SUMMARY FOR 2003 |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :---: |
|  | Satellite | Scatt | Radar | Synoptic | Total |  |  |
| Tropical Cyclone |  |  |  |  |  |  |  |
| TS 01W | Yanyan | 213 | 3 | 12 | 0 | 228 |  |
| TY 02W | Kujira | 591 | 15 | 11 | 3 | 620 |  |
| TD 03W | - | 70 | 1 | 0 | 0 | 71 |  |
| TY 04W | Chan-Hom | 259 | 10 | 0 | 0 | 269 |  |


| TS 05W | Linfa | 200 | 6 | 26 | 2 | 234 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| TS 06W | Nangka | 102 | 3 | 0 | 0 | 105 |
| TY 07W | Soudelor | 324 | 7 | 50 | 0 | 381 |
| TY 08W | Koni | 263 | 6 | 0 | 1 | 270 |
| STY 09W | Imbudo | 330 | 7 | 0 | 3 | 340 |
| TY 10W | Morakot | 139 | 0 | 50 | 0 | 189 |
| TY 11W | Etau | 287 | 6 | 117 | 0 | 410 |
| TY 12W | Krovanh | 349 | 1 | 0 | 3 | 353 |
| TS 13W | Vamco | 56 | 0 | 37 | 0 | 93 |
| TY 14W | Dujuan | 204 | 4 | 0 | 0 | 208 |
| STY 15W | Maemi | 309 | 5 | 60 | 1 | 375 |
| TY 16W | Choi-Wan | 190 | 7 | 97 | 0 | 294 |
| TY 17W | Koppu | 236 | 9 | 0 | 0 | 245 |
| TD 18W | - | 116 | 6 | 0 | 0 | 122 |
| TD 19W | - | 68 | 1 | 0 | 0 | 69 |
| TY 20W | Ketsana | 290 | 8 | 0 | 0 | 298 |
| TY 21W | Parma | 440 | 10 | 0 | 0 | 450 |
| TD 22W | - | 62 | 3 | 0 | 0 | 65 |
| TS 23W | - | 148 | 2 | 0 | 0 | 150 |
| TY 24W | Melor | 173 | 4 | 18 | 0 | 195 |
| TY 25W | Nepartak | 266 | 3 | 0 | 0 | 269 |
| STY 26W | Lupit | 528 | 9 | 0 | 0 | 537 |
| TS 27W | - | 127 | 2 | 0 | 0 | 129 |
| - | Totals | 6340 | 138 | 478 | 13 | 6969 |
| Percentage of Total |  | 90.97 | 1.98 | 6.86 | 0.19 | 100 |


| NORTHERN INDIAN OCEAN FIX SUMMARY FOR 2003 |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :---: |

## TABLE 3-4 <br> FIXES BY OCEANIC BASIN FOR 2003

| Oceanic Basin | Total Fixes |
| :--- | :--- |
| Northwest Pacific | 6969 |
| Southern Hemisphere | 4867 |
| Northern Indian Ocean | 568 |
| Total | 12404 |

## 4. SUMMARY OF FORECAST VERIFICATION

### 4.1 ANNUAL FORECAST VERIFICATION

Verification of warning positions and intensities at initial, 12-, 24-, 48-, and 72-hour forecast periods are made against the final best track. The (scalar) track forecast, along-track and cross-track errors (illustrated in Figure 4-1) were calculated for each verifying JTWC forecast. These data, in addition to a detailed summary for each tropical cyclone, are included as Chapter 4. This section summarizes verification data this year and contrasts it with annual verification statistics from previous years.


Figure 4-1. Definition of cross-track error (XTE), along-track error (ATE), and forecast track error (FTE). In this example, the forecast position is ahead of and to the right of the verifying best track position. Therefore, the XTE is positive (to the right of the best track) and the ATE is positive (ahead or faster than the best track). Adapted from Tsui and Miller, 1988.

### 4.1.1 WESTERN NORTH PACIFIC OCEAN

Table 4-1 includes mean track, along-track and cross-track errors from 1959, when JTWC was founded, until the present. Figure 4-2 shows mean track errors and a 5-year running mean of track errors at 24-, 48- and 72-hours since 1974.

|  | Table 4-1 <br> MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2003 |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 24-HOU |  |  |  | 48-HO |  |  |  | 72-HOU |  |  |  |
| YEAR (Notes) | TY (1) | TC (3) | CROSS TRACK (2) | ALONG TRACK (2) | TY (1) | TC (3) | CROSS TRACK (2) | ALONG TRACK (2) | TY (1) | TC (3) | CROSS TRACK (2) | ALONG TRACK (2) |
| 1959 | 117* |  |  |  | 267* |  |  |  |  |  |  |  |
| 1960 | 177* |  |  |  | 354* |  |  |  |  |  |  |  |
| 1961 | 136 |  |  |  | 274 |  |  |  |  |  |  |  |
| 1962 | 144 |  |  |  | 287 |  |  |  | 476 |  |  |  |
| 1963 | 127 |  |  |  | 246 |  |  |  | 374 |  |  |  |
| 1964 | 133 |  |  |  | 284 |  |  |  | 429 |  |  |  |
| 1965 | 151 |  |  |  | 303 |  |  |  | 418 |  |  |  |
| 1966 | 136 |  |  |  | 280 |  |  |  | 432 |  |  |  |
| 1967 | 125 |  |  |  | 276 |  |  |  | 414 |  |  |  |
| 1968 | 105 |  |  |  | 229 |  |  |  | 337 |  |  |  |


| 1969 | 111 |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |


| 1999 | 88 | 106 | 59 | 74 | 150 | 176 | 102 | 119 | 225 | 234 | 139 | 155 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 2000 | 75 | 81 | 45 | 57 | 136 | 142 | 80 | 98 | 205 | 209 | 118 | 144 |
| 2001 | 66 | 73 | 42 | 49 | 114 | 122 | 75 | 78 | 169 | 180 | 110 | 120 |
| 2002 | 50 | 66 | 37 | 47 | 94 | 116 | 67 | 79 | 144 | 166 | 88 | 120 |
| 2003 | 59 | 73 | 41 | 52 | 119 | 128 | 68 | 94 | 186 | 186 | 89 | 147 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Averages <br> $(1978-$ <br> $2003)$ | 100 | 108 | 61 | 75 | 195 | 204 | 116 | 143 | 303 | 306 | 174 | 214 |

1. Track errors were calculated for typhoons when intensities were at least 65 kts at warning times
2. Cross-track and along-track errors were adopted by the JTWC in 1986. Right angle errors (used prior to 1986) were recomputed as cross-track errors after-the fact to extend the data base. See Figure 3-1 for the definitions of cross-track and along-track.
3. Mean forecast errors for all warned systems in Northwest Pacific.
*Forecast positions north of 35 degrees North latitude were not verified.
${ }^{* *} 1994$ statistics were recalculated to resolve earlier Along and Cross-Track discrepancies.

## 24, 48, 72-Hour Mean Error (nm)



Figure 4-2a. Mean track forecast error ( nm ) and 5-year running mean for 24, 48 and 72 hours for Western North Pacific Ocean tropical cyclones from 1985-2003.


Figure 4-2b. Mean track forecast error (nm) and 5-year running mean for 12 hours for western North Pacific Ocean tropical cyclones from 1992-2003.


Figure 4-2c. Mean track forecast error (nm) and 5-year running mean for 24 hours for western North Pacific Ocean tropical cyclones from 1985-2003.

48-Hour Mean Error ( nm )


Figure 4-2d. Mean track forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1985-2003.

72-Hour Mean Error (nm)


Figure 4-2e. Mean track forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1985-2003.


Figure 4-3a. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for western North Pacific Ocean tropical cyclones from 1987-2003.


Figure 4-3b. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1987-2003.


Figure 4-3c. Mean intensity forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1987-2003.

### 4.1.2 NORTH INDIAN OCEAN

## Table 4-2 <br> JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE NORTH INDIAN OCEAN <br> 1985-2003

| 1985 | 53 | 31 | 30 | 122 | 102 | 53 | 8 | 242 | 119 | 194 | 0 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1986 | 28 | 52 | 16 | 134 | 118 | 53 | 7 | 168 | 131 | 80 | 5 | 269 | 189 | 180 |
| 1987 | 83 | 42 | 54 | 144 | 97 | 100 | 25 | 205 | 125 | 140 | 21 | 305 | 219 | 188 |
| 1988 | 44 | 34 | 30 | 120 | 89 | 63 | 18 | 219 | 112 | 176 | 12 | 409 | 227 | 303 |
| 1989 | 44 | 19 | 33 | 88 | 62 | 50 | 17 | 146 | 94 | 86 | 12 | 216 | 164 | 11 |
| 1990 | 46 | 31 | 36 | 101 | 85 | 43 | 24 | 146 | 117 | 67 | 17 | 185 | 130 | 104 |
| 1991 | 56 | 38 | 43 | 129 | 107 | 54 | 27 | 235 | 200 | 89 | 14 | 450 | 356 | 178 |
| 1992 | 191 | 35 | 149 | 128 | 73 | 86 | 100 | 244 | 141 | 166 | 62 | 398 | 276 | 218 |
| 1993 | 36 | 27 | 28 | 125 | 87 | 79 | 20 | 198 | 171 | 74 | 12 | 231 | 176 | 116 |
| 1994 | 60 | 25 | 44 | 97 | 80 | 44 | 28 | 153 | 124 | 63 | 13 | 213 | 177 | 92 |
| 1995 | 54 | 30 | 47 | 138 | 119 | 58 | 32 | 262 | 247 | 77 | 20 | 342 | 304 | 109 |
| 1996 | 135 | 33 | 123 | 134 | 94 | 80 | 85 | 238 | 181 | 127 | 58 | 311 | 172 | 237 |
| 1997 | 56 | 29 | 42 | 119 | 87 | 49 | 29 | 201 | 168 | 92 | 17 | 228 | 195 | 110 |
| 1998 | 80 | 20 | 55 | 106 | 84 | 51 | 34 | 198 | 135 | 106 | 17 | 262 | 188 | 144 |
| 1999 | 49 | 8 | 41 | 79 | 59 | 38 | 22 | 184 | 130 | 116 | 10 | 374 | 309 | 177 |
| 2000 | 31 | 15 | 24 | 61 | 47 | 26 | 16 | 85 | 69 | 37 | 1 | 401 | 399 | 38 |
| 2001 | 50 | 12 | 41 | 61 | 40 | 37 | 31 | 115 | 71 | 71 | 22 | 166 | 44 | 154 |
| 2002 | 42 | 18 | 26 | 79 | 63 | 38 | 11 | 120 | 95 | 55 | 3 | 132 | 86 | 89 |
| 2003 | 40 | 22 | 37 | 108 | 66 | 69 | 31 | 196 | 115 | 132 | 7 | 354 | 210 | 252 |
| (1985-2002) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Avg | 63 | 29 | 48 | 110 | 82 | 57 | 30 | 188 | 135 | 103 | 19 | 291* | 213* | 146* |
| *17 year average (1985 not available) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 4-2 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-6 shows mean track errors and a 5-year running mean of track errors at 24-and 48-hours since 1985, and at 72-hours since 1986.

24, 48, 72-Hour Mean Error (nm)


Figure 4-4a. Mean track forecast error ( nm ) and 5-year running mean for 24,48 and 72 hours for North Indian Ocean tropical cyclones from 1985-2003.


Figure 4-4b. Mean track forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1985-2003.

## 48-Hour Mean Error (nm)



Figure 4-4c. Mean track forecast error (nm) and 5-year running mean for 48 hours for North Indian Ocean tropical cyclones from 1985-2003.


Figure 4-4d. Mean track forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1987-2003.

## 24, 48, 72-Hour Intensity Error (kts)



Figure 4-5a. Mean intensity forecast error (nm) and 5-year running mean for 24,48 and 72 hours for North Indian Ocean tropical cyclones from 1995-2003.

## 24-Hour Intensity Error (kts)



Figure 4-5b. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1995-2003.

48-Hour Intensity Error (kts)


Figure 4-5c. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for North Indian Ocean tropical cyclones from 1995-2003.

72-Hour Intensity Error (kts)


Figure 4-5d. Mean intensity forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1995-2003.

### 4.1.3 SOUTH PACIFIC AND SOUTH INDIAN OCEANS (SOUTHERN HEMISPHERE)



| Avg | 296 | 26 | 252 | 116 | 82 | 65 | 199 | 220 | 155 | 124 | $58^{*}$ | $253^{*}$ | $177^{*}$ | $151^{*}$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

*8-year average

Table 4-3 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-7 shows mean track errors and a 5-year running mean of track errors at 24-and 48-hours since 1981, and at 72-hours since 1995.

## 24, 48, 72-Hour Mean Error (nm)



Figure 4-6a. Mean track forecast error ( nm ) and 5-year running mean for 24,48 and 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.


Figure 4-6b. Mean track forecast error ( nm ) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.


Figure 4-6c. Mean track forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1985-2003.


Figure 4-6d. Mean track forecast error (nm) at 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1995-2003.

## 24, 48, 72-Hour Intensity Error (kts)



Figure 4-7a. Mean intensity forecast error (nm) and 5-year running mean for 24,48 and 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.


Figure 4-7b. Mean intensity forecast error (nm) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.


Figure 4-7c. Mean intensity forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.


Figure 4-7d. Mean track forecast error (nm) and 5-year running mean for 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1996-2003.

## Go To: 4.2 TESTING AND RESULTS

### 4.2 TESTING AND RESULTS

A comparison of selected techniques is included in Table 4-4 for all western North Pacific tropical cyclones, Table 4-5 for North Indian Ocean tropical cyclones, and Table 4-6 for Southern Hemisphere tropical cyclones.

For example, in Table 4-4 for the homogeneous comparison of the 12-hour mean forecast error between JTWC and NGPS, 611 cases were available. The average forecast error at 12 hours was 55 nm for NGPS and 42 nm for JTWC. The difference of 13 nm is shown in the lower right. Due to computational round-off, differences are not always exact.

| Table 4-4 <br> Error Statistics for Selected Objective Techniques Western North Pacific Ocean |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12-HOUR MEAN FORECAST ERROR (NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JGSM |  | JTYM |  | JAVN |  | CLIP |  | CONU |  | CONW |  |
| JTWC | 648 | 43 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 43 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 611 | 42 | 662 | 61 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 55 | 13 | 61 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 304 | 44 | 305 | 55 | 329 | 69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 64 | 20 | 63 | 8 | 69 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 252 | 42 | 257 | 752 | 241 | 161 | 259 | 85 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 86 | 44 | 85 | 33 | 87 | 26 | 85 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GFNI | 436 | 40 | 430 | 52 | 214 | 462 | 201 | 82 | 440 | 53 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 52 | 12 | 52 | 0 | 52 | -10 | 51 | -31 | 53 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| JGSM | 251 | 42 | 248 | 85 | 245 | 57 | 215 | 83 | 191 | 51 | 256 | 57 |  |  |  |  |  |  |  |  |  |  |
|  | 56 | 14 | 56 | 3 | 57 | 0 | 55 | -28 | 54 | 3 | 57 | 0 |  |  |  |  |  |  |  |  |  |  |
| JTYM | 464 | 42 | 454 | 454 | 218 | 86 | 186 | 84 | 347 | 52 | 214 | 58 | 471 | 57 |  |  |  |  |  |  |  |  |
|  | 55 | 13 | 53 | -1 | 54 | -6 | 52 | -32 | 49 | -3 | 58 | 0 | 57 | 0 |  |  |  |  |  |  |  |  |
| JAVN | 576 | 42 | 597 | 75 | 290 | 06 | 228 | 83 | 392 | 51 | 224 | 52 | 418 | 55 | 706 | 68 |  |  |  |  |  |  |
|  | 60 | 18 | 60 | 1 | 59 | -9 | 55 | -28 | 55 | 4 | 52 | 0 | 57 | 2 | 68 | 0 |  |  |  |  |  |  |
| CLIP | 644 | 43 | 653 | 36 | 323 | 368 | 256 | 86 | 440 | 53 | 255 | 57 | 470 | 57 | 662 | 66 | 753 | 59 |  |  |  |  |
|  | 54 | 11 | 54 | -6 | 56 | -12 | 53 | -33 | 52 | -1 | 53 | -4 | 54 | -3 | 58 | -8 | 59 | 0 |  |  |  |  |
| CONU | 620 | 42 | 618 | 87 | 305 | 566 | 254 | 86 | 440 | 53 | 249 | 57 | 460 | 56 | 589 | 61 | 663 | 55 | 663 | 45 |  |  |
|  | 43 | 1 | 42 | -15 | 45 | -21 | 42 | -44 | 40 | -13 | 43 | -14 | 42 | -14 | 44 | -17 | 45 | -10 | 45 | 0 |  |  |
| CONW | 493 | 43 | 499 | 60 | 243 | 371 | 196 | 83 | 338 | 53 | 197 | 57 | 385 | 57 | 490 | 63 | 553 | 56 | 517 | 45 | 553 | 45 |
|  | 41 | -2 | 42 | -18 | 44 | -27 | 41 | -42 | 38 | -15 | 42 | -15 | 39 | -18 | 44 | -19 | 45 | -11 | 44 | -1 | 45 | 0 |

[^7]

| JGSM | 219 | 102 | 213 | 115 | 210 | 120 | 189 | 167 | 168 | 142 | 222 | 108 |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 104 | 2 | 104 | -11 | 107 | -13 | 106 | -61 | 100 | -42 | 108 | 0 |  |  |  |  |  |  |  |  |  |  |
| JTYM | 406 | 102 | 395 | 117 | 189 | 125 | 162 | 173 | 302 | 142 | 185 | 108 | 413 | 114 |  |  |  |  |  |  |  |  |
|  | 109 | 7 | 109 | -8 | 115 | -10 | 105 | -68 | 99 | -43 | 115 | 7 | 114 | 0 |  |  |  |  |  |  |  |  |
| JAVN | 491 | 99 | 508 | 119 | 249 | 124 | 196 | 167 | 332 | 133 | 197 | 103 | 367 | 109 | 612 | 117 |  |  |  |  |  |  |
|  | 107 | 8 | 107 | -12 | 106 | -18 | 95 | -72 | 99 | -34 | 99 | -4 | 107 | -2 | 117 | 0 |  |  |  |  |  |  |
| CLIP | 547 | 102 | 553 | 120 | 273 | 126 | 219 | 173 | 370 | 141 | 221 | 108 | 412 | 114 | 573 | 113 | 655 | 169 |  |  |  |  |
|  | 165 | 63 | 163 | 43 | 162 | 36 | 168 | -5 | 171 | 30 | 166 | 58 | 170 | 56 | 165 | 52 | 169 | 0 |  |  |  |  |
| CONU | 525 | 102 | 523 | 117 | 256 | 124 | 217 | 172 | 370 | 141 | 217 | 107 | 403 | 112 | 506 | 108 | 568 | 167 | 568 | 106 |  |  |
|  | 101 | -1 | 100 | -17 | 106 | -18 | 101 | -71 | 95 | -46 | 103 | -4 | 103 | -9 | 102 | -6 | 106 | -61 | 106 | 0 |  |  |
| CONW | 414 | 105 | 420 | 122 | 202 | 130 | 167 | 175 | 280 | 140 | 168 | 107 | 332 | 112 | 427 | 113 | 474 | 166 | 439 | 110 | 474 | 102 |
|  | 97 | -8 | 96 | -26 | 103 | -27 | 96 | -79 | 88 | -52 | 98 | -9 | 95 | -17 | 98 | -15 | 102 | -64 | 102 | -8 | 102 | 0 |
| 48-HOUR | UR M | EAN | FORE | ECAS | ST ER | RRO | ( N |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTW |  | NGP |  | EGR |  | AFW |  | GFD |  | JGS |  | JTYM |  | JAVN |  | CLIP |  | CON |  | CON |  |
| JTWC | 495 | 128 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 128 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 464 | 127 | 514 | 156 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 149 | 22 | 156 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 229 | 125 | 231 | 146 | 252 | 151 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 146 | 21 | 146 | 0 | 151 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 194 | 133 | 199 | 148 | 183 | 149 | 200 | 225 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 223 | 90 | 222 | 74 | 218 | 69 | 225 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GFNI | 321 | 121 | 324 | 145 | 160 | 140 | 154 | 224 | 328 | 179 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 176 | 55 | 179 | 34 | 170 | 30 | 180 | -44 | 179 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| JGSM | 197 | 130 | 195 | 150 | 191 | 148 | 169 | 217 | 149 | 176 | 200 | 138 |  |  |  |  |  |  |  |  |  |  |
|  | 133 | 3 | 134 | -16 | 135 | -13 | 135 | -82 | 128 | -48 | 138 | 0 |  |  |  |  |  |  |  |  |  |  |
| JTYM | 368 | 131 | 363 | 155 | 174 | 155 | 148 | 236 | 271 | 183 | 167 | 141 | 377 | 145 |  |  |  |  |  |  |  |  |
|  | 139 | 8 | 137 | -18 | 148 | -7 | 139 | -97 | 129 | -54 | 151 | 10 | 145 | 0 |  |  |  |  |  |  |  |  |
| JAVN | 447 | 125 | 468 | 155 | 226 | 147 | 179 | 216 | 300 | 175 | 179 | 135 | 338 | 140 | 568 | 144 |  |  |  |  |  |  |
|  | 135 | 10 | 138 | -17 | 130 | -17 | 127 | -89 | 130 | -45 | 130 | -5 | 139 | -1 | 144 | 0 |  |  |  |  |  |  |
| CLIP | 493 | 128 | 507 | 155 | 246 | 152 | 198 | 226 | 328 | 179 | 199 | 138 | 376 | 144 | 530 | 141 | 604 | 231 |  |  |  |  |
|  | 228 | 100 | 228 | 73 | 221 | 69 | 239 | 13 | 242 | 63 | 233 | 95 | 237 | 93 | 226 | 85 | 231 | 0 |  |  |  |  |
| CONU | 471 | 128 | 477 | 153 | 229 | 149 | 196 | 224 | 328 | 179 | 195 | 136 | 367 | 142 | 464 | 138 | 517 | 231 | 517 | 135 |  |  |
|  | 128 | 0 | 130 | -23 | 130 | -19 | 132 | -92 | 121 | -58 | 133 | -3 | 134 | -8 | 132 | -6 | 135 | -96 | 1350 | 0 |  |  |
| CONW | 371 | 133 | 384 | 160 | 182 | 155 | 150 | 233 | 246 | 182 | 152 | 140 | 302 | 144 | 391 | 145 | 430 | 227 | 398 | 141 | 430 | 129 |
|  | 124 | -9 | 126 | -34 | 128 | -27 | 126 | $107$ | 115 | -67 | 130 | -10 | 125 | -19 | 127 | -18 | 129 | -98 | 131 | -10 | 129 | 0 |


|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JGSM |  | JTYM |  | JAVN |  | CLIP |  | CONU |  | CONW |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 397 | 186 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 186 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 361 | 184 | 406 | 221 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 212 | 28 | 221 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 179 | 184 | 178 | 207 | 199 | 213 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 208 | 24 | 207 | 0 | 213 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 153 | 189 | 157 | 202 | 138 | 208 | 158 | 334 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 324 | 135 | 331 | 129 | 303 | 95 | 334 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GFNI | 247 | 178 | 251 | 210 | 123 | 204 | 120 | 337 | 256 | 253 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 250 | 72 | 252 | 42 | 243 | 39 | 244 | -93 | 253 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| JGSM | 150 | 192 | 150 | 214 | 143 | 213 | 125 | 324 | 112 | 250 | 155 | 202 |  |  |  |  |  |  |  |  |  |  |
|  | 194 | 2 | 195 | -19 | 191 | -22 | 193 | 131 | 190 | -60 | 202 | 0 |  |  |  |  |  |  |  |  |  |  |
| JTYM | 285 | 190 | 282 | 220 | 128 | 230 | 113 | 366 | 207 | 256 | 126 | 212 | 297 | 213 |  |  |  |  |  |  |  |  |
|  | 206 | 16 | 205 | -15 | 223 | -7 | 213 | $153$ | 195 | -61 | 231 | 19 | 213 | 0 |  |  |  |  |  |  |  |  |
| JAVN | 345 | 178 | 356 | 216 | 177 | 210 | 137 | 326 | 230 | 241 | 139 | 199 | 256 | 207 | 450 | 220 |  |  |  |  |  |  |
|  | 210 | 32 | 216 | 0 | 201 | -9 | 200 | $126$ | 196 | -45 | 211 | 12 | 223 | 16 | 220 | 0 |  |  |  |  |  |  |
| CLIP | 397 | 186 | 401 | 220 | 195 | 214 | 157 | 336 | 256 | 253 | 155 | 202 | 297 | 213 | 422 | 218 | 504 | 343 |  |  |  |  |
|  | 339 | 153 | 348 | 128 | 329 | 115 | 369 | 33 | 375 | 122 | 353 | 151 | 358 | 145 | 334 | 116 | 343 | 0 |  |  |  |  |
| CONU | 374 | 185 | 376 | 214 | 177 | 205 | 155 | 333 | 256 | 253 | 150 | 199 | 287 | 211 | 360 | 216 | 416 | 348 | 416 | 197 |  |  |
|  | 187 | 2 | 191 | -23 | 186 | -19 | 189 | $144$ | 182 | -71 | 194 | -5 | 199 | -12 | 191 | -25 | 197 | $151$ | 197 | 0 |  |  |
| CONW | 293 | 190 | 296 | 224 | 140 | 213 | 116 | 353 | 188 | 255 | 117 | 206 | 236 | 218 | 305 | 230 | 347 | 338 | 315 | 208 | 347 | 186 |
|  | 179 | -11 | 184 | -40 | 186 | -27 | 184 | $169$ | 173 | -82 | 189 | -17 | 181 | -37 | 180 | -50 | 186 | - 152 | 189 | -19 | 186 | 0 |

96-HOUR MEAN FORECAST ERROR (NM)

JTWC NGPS EGRR JAVN CLIP CONU CONW

| JTWC | 242 | 242 |
| :--- | :--- | :--- |

2420
NGPS $227 \quad 239311299$

| 274 | 35 | 299 | 0 |
| :--- | :--- | :--- | :--- |


| EGRR | 114 | 237 | 131 | 275 | 148 | 291 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

$\begin{array}{lllllll}283 & 46 & 285 & 10 & 291 & 0\end{array}$

| JAVN | 210 | 236 | 266 | 285 | 127 | 276 | 352 | 290 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |


|  | 288 | 52 | 293 | 8 | 277 | 1 | 290 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CLIP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 960 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 960 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| CONU | 231 | 240 | 278 | 294 | 128 | 284 | 264 | 289 | 2 | 960 | 309 | 259 |  |  |  |  |  |  |  |  |  |  |
|  | 242 | 2 | 259 | -35 | 249 | -35 | 246 | -43 | 447 | $513$ | 259 | 0 |  |  |  |  |  |  |  |  |  |  |
| CONW | 164 | 234 | 204 | 304 | 90 | 276 | 193 | 314 | 0 | 0 | 225 | 264 | 225 | 264 |  |  |  |  |  |  |  |  |
|  | 238 | 4 | 266 | -38 | 251 | -25 | 250 | -64 | 0 | 0 | 264 | 0 | 264 | 0 |  |  |  |  |  |  |  |  |
| 120-HO | UR | AN | FO | RECA | AST | ERR | R | NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTW |  | NGP |  | EGR |  | JAV |  | CON |  | CON | NW |  |  |  |  |  |  |  |  |  |  |
| JTWC | 176 | 304 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 304 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 160 | 303 | 230 | 403 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 349 | 46 | 403 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 78 | 310 | 87 | 360 | 102 | 372 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 359 | 49 | 366 | 6 | 372 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| JAVN | 146 | 308 | 183 | 377 | 89 | 366 | 261 | 363 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 364 | 56 | 367 | -10 | 348 | -18 | 363 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CONU | 169 | 296 | 196 | 370 | 86 | 351 | 181 | 355 | 224 | 316 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 296 | 0 | 317 | -53 | 293 | -58 | 310 | -45 | 316 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| CONW | 114 | 276 | 138 | 388 | 56 | 343 | 129 | 366 | 158 | 320 | 158 | 320 |  |  |  |  |  |  |  |  |  |  |
|  | 284 | 8 | 319 | -69 | 286 | -57 | 301 | -65 | 320 | 0 | 320 | 0 |  |  |  |  |  |  |  |  |  |  |

## Table 4-5 Error Statistics for Selected Objective Techniques

North Indian Ocean

12-HOUR MEAN FORECAST ERROR (NM)

|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN | JAVN | CLIP | CONU |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 38 | 58 |  |  |  |  |  |  |  |  |  |  |  |
|  | 58 | 0 |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 35 | 58 | 63 | 78 |  |  |  |  |  |  |  |  |  |
|  | 67 | 9 | 78 | 0 |  |  |  |  |  |  |  |  |  |
| EGRR | 11 | 54 | 27 | 82 | 29 | 92 |  |  |  |  |  |  |  |
|  | 68 | 14 | 87 | 5 | 92 | 0 |  |  |  |  |  |  |  |
| AFW1 | 7 | 65 | 21 | 71 | 18 | 79 | 22 | 72 |  |  |  |  |  |


|  | 59 | -6 | 75 | 4 | 74 | -5 | 72 | 0 |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| GFDN | 18 | 55 | 22 | 69 | 0 | 0 | 0 | 0 | 22 | 63 |  |  |  |  |  |  |
|  | 62 | 7 | 63 | -6 | 0 | 0 | 0 | 0 | 63 | 0 |  |  |  |  |  |  |
| JAVN | 0 | 0 | 1 | 130 | 1 | 224 | 0 | 0 | 0 | 0 | 1 | 155 |  |  |  |  |
|  | 0 | 0 | 155 | 25 | 155 | -69 | 0 | 0 | 0 | 0 | 155 | 0 |  |  |  |  |
| CLIP | 38 | 58 | 61 | 76 | 28 | 91 | 21 | 70 | 22 | 63 | 1 | 155 | 73 | 72 |  |  |
|  | 70 | 12 | 72 | -4 | 74 | -17 | 81 | 11 | 61 | -2 | 121 | -34 | 72 | 0 |  |  |
| CONW | 17 | 60 | 24 | 78 | 11 | 62 | 8 | 58 | 7 | 56 | 0 | 0 | 27 | 71 | 27 | 68 |
|  | 59 | -1 | 69 | -9 | 70 | 8 | 72 | 14 | 36 | -20 | 0 | 0 | 68 | -3 | 68 | 0 |
| 24-HOUR MEAN FORECAST ERROR (NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | CLIP |  | CONU |  |
| JTWC | 36 | 107 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 107 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 32 | 106 | 57 | 112 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 105 | -1 | 112 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 11 | 96 | 27 | 116 | 29 | 120 |  |  |  |  |  |  |  |  |  |  |
|  | 108 | 12 | 120 | 4 | 120 | 0 |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 7 | 128 | 19 | 100 | 18 | 121 | 20 | 103 |  |  |  |  |  |  |  |  |
|  | 108 | -20 | 98 | -2 | 104 | -17 | 103 | 0 |  |  |  |  |  |  |  |  |
| GFDN | 15 | 100 | 18 | 84 | 0 | 0 | 0 | 0 | 19 | 108 |  |  |  |  |  |  |
|  | 108 | 8 | 108 | 24 | 0 | 0 | 0 | 0 | 108 | 0 |  |  |  |  |  |  |
| JAVN | 0 | 0 | 1 | 107 | 1 | 220 | 0 | 0 | 0 | 0 | 1 | 114 |  |  |  |  |
|  | 0 | 0 | 114 | 7 | 114 | -106 | 0 | 0 | 0 | 0 | 114 | 0 |  |  |  |  |
| CLIP | 36 | 107 | 55 | 109 | 28 | 119 | 19 | 104 | 19 | 108 | 1 | 114 | 69 | 134 |  |  |
|  | 142 | 35 | 134 | 25 | 133 | 14 | 161 | 57 | 128 | 20 | 123 | 9 | 134 | 0 |  |  |
| CONW | 16 | 116 | 22 | 126 | 11 | 75 | 7 | 108 | 5 | 87 | 0 | 0 | 25 | 135 | 25 | 129 |
|  | 124 | 8 | 129 | 3 | 130 | 55 | 137 | 29 | 76 | -11 | 0 | 0 | 129 | -6 | 129 | 0 |
| 36-HOUR MEAN FORECAST ERROR (NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | CLIP |  | CONU |  |
| JTWC | 33 | 154 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 154 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 30 | 154 | 54 | 148 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 145 | -9 | 148 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 11 | 144 | 26 | 148 | 27 | 160 |  |  |  |  |  |  |  |  |  |  |
|  | 141 | -3 | 160 | 12 | 160 | 0 |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 7 | 188 | 18 | 145 | 16 | 169 | 18 | 128 |  |  |  |  |  |  |  |  |
|  | 166 | -22 | 128 | -17 | 129 | -40 | 128 | 0 |  |  |  |  |  |  |  |  |


| GFDN | 14 | 140 | 17 | 111 | 0 | 0 | 0 | 0 | 18 | 153 |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 164 | 24 | 155 | 44 | 0 | 0 | 0 | 0 | 153 | 0 |  |  |  |  |  |  |
| JAVN | 0 | 0 | 1 | 118 | 1 | 167 | 0 | 0 | 0 | 0 | 1 | 110 |  |  |  |  |
|  | 0 | 0 | 110 | -8 | 110 | -57 | 0 | 0 | 0 | 0 | 110 | 0 |  |  |  |  |
| CLIP | 33 | 154 | 52 | 144 | 26 | 160 | 17 | 135 | 18 | 153 | 1 | 110 | 65 | 192 |  |  |
|  | 210 | 56 | 196 | 52 | 197 | 37 | 244 | 109 | 186 | 33 | 108 | -2 | 192 | 0 |  |  |
| CONW | 15 | 180 | 20 | 170 | 10 | 130 | 6 | 176 | 4 | 139 | 0 | 0 | 23 | 206 | 23 | 195 |
|  | 190 | 10 | 195 | 25 | 200 | 70 | 217 | 41 | 119 | -20 | 0 | 0 | 195 | -11 | 195 | 0 |
| 48-HOUR MEAN FORECAST ERROR (NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | CLIP |  | CONU |  |
| JTWC | 30 | 192 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 192 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 28 | 196 | 51 | 191 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 188 | -8 | 191 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 11 | 190 | 24 | 184 | 25 | 184 |  |  |  |  |  |  |  |  |  |  |
|  | 162 | -28 | 188 | 4 | 184 | 0 |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 6 | 223 | 16 | 180 | 14 | 208 | 16 | 184 |  |  |  |  |  |  |  |  |
|  | 175 | -48 | 184 | 4 | 185 | -23 | 184 | 0 |  |  |  |  |  |  |  |  |
| GFDN | 13 | 180 | 16 | 157 | 0 | 0 | 0 | 0 | 16 | 199 |  |  |  |  |  |  |
|  | 210 | 30 | 199 | 42 | 0 | 0 | 0 | 0 | 199 | 0 |  |  |  |  |  |  |
| JAVN | 0 | 0 | 1 | 124 | 1 | 43 | 0 | 0 | 0 | 0 | 1 | 124 |  |  |  |  |
|  | 0 | 0 | 124 | 0 | 124 | 81 | 0 | 0 | 0 | 0 | 124 | 0 |  |  |  |  |
| CLIP | 30 | 192 | 50 | 185 | 25 | 184 | 16 | 184 | 16 | 199 | 1 | 124 | 62 | 260 |  |  |
|  | 280 | 88 | 264 | 79 | 264 | 80 | 334 | 150 | 267 | 68 | 77 | -47 | 260 | 0 |  |  |
| CONW | 12 | 223 | 18 | 229 | 9 | 181 | 5 | 228 | 3 | 172 | 0 | 0 | 21 | 295 | 21 | 263 |
|  | 234 | 11 | 263 | 34 | 249 | 68 | 308 | 80 | 185 | 13 | 0 | 0 | 263 | -32 | 263 | 0 |
| 72-HOUR MEAN FORECAST ERROR (NM) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | CLIP |  | CONU |  |
| JTWC | 6 | 338 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 338 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 5 | 348 | 43 | 278 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 417 | 69 | 278 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 0 | 0 | 14 | 222 | 16 | 224 |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 239 | 17 | 224 | 0 |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 2 | 349 | 13 | 299 | 7 | 293 | 13 | 195 |  |  |  |  |  |  |  |  |
|  | 95 - | 254 | 195 | -104 | 262 | -31 | 195 | 0 |  |  |  |  |  |  |  |  |
| GFDN | 2 | 292 | 14 | 243 | 0 | 0 | 0 | 0 | 14 | 283 |  |  |  |  |  |  |


|  | 384 | 92 | 283 | 40 | 0 | 0 | 0 | 0 | 283 | 0 |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| JAVN | 0 | 0 | 1 | 270 | 1 | 145 | 0 | 0 | 0 | 0 | 1 | 276 |  |  |  |  |
|  | 0 | 0 | 276 | 6 | 276 | 131 | 0 | 0 | 0 | 0 | 276 | 0 |  |  |  |  |
| CLIP | 6 | 338 | 42 | 276 | 16 | 224 | 13 | 195 | 14 | 283 | 1 | 276 | 54 | 416 |  |  |
|  | 610 | 272 | 425 | 149 | 349 | 125 | 536 | 341 | 386 | 103 | 229 | -47 | 416 | 0 |  |  |
| CONW | 6 | 338 | 13 | 390 | 2 | 195 | 4 | 85 | 2 | 384 | 0 | 0 | 16 | 593 | 16 | 453 |
|  | 411 | 73 | 461 | 71 | 270 | 75 | 650 | 565 | 369 | -15 | 0 | 0 | 453 | -140 | 453 | 0 |

Table 4-6
Error Statistics for Selected Objective Techniques Southern Hemisphere

12-HOUR MEAN FORECAST ERROR (NM)

|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | TCLP |  | TLAP |  | CLIP |  | CONW |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 311 | 45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 45 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 283 | 43 | 563 | 63 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 54 | 11 | 63 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 162 | 40 | 253 | 58 | 302 | 80 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 54 | 14 | 75 | 17 | 80 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 124 | 37 | 167 | 48 | 167 | 54 | 179 | 108 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 100 | 63 | 104 | 56 | 103 | 49 | 108 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| GFDN | 100 | 47 | 211 | 53 | 3 | 1568 | 0 | 0 | 214 | 48 |  |  |  |  |  |  |  |  |  |  |
|  | 51 | 4 | 47 | -6 | 66 | $1502$ | 0 | 0 | 48 | 0 |  |  |  |  |  |  |  |  |  |  |
| JAVN | 230 | 43 | 418 | 62 | 162 | 83 | 107 | 115 | 195 | 47 | 523 | 89 |  |  |  |  |  |  |  |  |
|  | 74 | 31 | 78 | 16 | 76 | -7 | 73 | -42 | 67 | 20 | 89 | 0 |  |  |  |  |  |  |  |  |
| TCLP | 61 | 38 | 82 | 50 | 81 | 53 | 65 | 107 | 1 | 30 | 53 | 75 | 87 | 79 |  |  |  |  |  |  |
|  | 78 | 40 | 79 | 29 | 81 | 28 | 81 | -26 | 104 | 74 | 91 | 16 | 79 | 0 |  |  |  |  |  |  |
| TLAP | 62 | 38 | 84 | 50 | 84 | 53 | 68 | 107 | 1 | 30 | 52 | 74 | 77 | 80 | 89 | 137 |  |  |  |  |
|  | 137 | 99 | 138 | 88 | 139 | 86 | 144 | 37 | 76 | 46 | 138 | 64 | 128 | 48 | 137 | 0 |  |  |  |  |
| CLIP | 309 | 45 | 555 | 63 | 286 | 78 | 174 | 105 | 212 | 48 | 484 | 84 | 86 | 79 | 88 | 137 | 690 | 191 |  |  |
|  | 124 | 79 | 157 | 94 | 133 | 55 | 72 | -33 | 114 | 66 | 187 | 103 | 128 | 49 | 118 | -19 | 191 | 0 |  |  |
| CONW | 8 | 41 | 12 | 67 | 7 | 94 | 5 | 228 | 3 | 17 | 15 | 159 | 3 | 45 | 3 | 163 | 17 | 123 | 17 | 51 |
|  | 48 | 7 | 56 | -11 | 45 | -49 | 58 | $170$ | 35 | 18 | 52 - | 107 | 61 | 16 | 61 | $102$ | 51 | -72 | 51 | 0 |


|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | TCLP |  | TLAP |  | CLIP |  | CONW |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 278 | 74 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 74 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 258 | 73 | 526 | 95 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 82 | 9 | 95 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 150 | 65 | 239 | 90 | 287 | 111 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 87 | 22 | 108 | 18 | 111 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 115 | 63 | 156 | 79 | 156 | 87 | 168 | 134 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 120 | 57 | 128 | 49 | 128 | 41 | 134 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| GFDN | 92 | 83 | 195 | 83 | 3 | 1606 | 0 | 0 | 198 | 78 |  |  |  |  |  |  |  |  |  |  |
|  | 87 | 4 | 78 | -5 | 132 | $1474$ | 0 | 0 | 78 | 0 |  |  |  |  |  |  |  |  |  |  |
| JAVN | 209 | 72 | 386 | 94 | 155 | 109 | 101 | 138 | 181 | 79 | 489 | 127 |  |  |  |  |  |  |  |  |
|  | 105 | 33 | 115 | 21 | 112 | 3 | 101 | -37 | 100 | 21 | 127 |  |  |  |  |  |  |  |  |  |
| TCLP | 58 | 65 | 76 | 81 | 76 | 83 | 58 | 122 | 1 | 6 | 50 | 110 | 81 | 123 |  |  |  |  |  |  |
|  | 115 | 50 | 122 | 41 | 127 | 44 | 110 | -12 | 39 | 33 | 129 | 19 | 123 | 0 |  |  |  |  |  |  |
| TLAP | 58 | 64 | 77 | 80 | 78 | 83 | 61 | 123 | 1 | 6 | 48 | 101 | 71 | 123 | 82 | 192 |  |  |  |  |
|  | 188 | 124 | 185 | 105 | 196 | 113 | 194 | 71 | 30 | 24 | 224 | 123 | 182 | 59 | 192 | 0 |  |  |  |  |
| CLIP | 276 | 75 | 518 | 95 | 271 | 110 | 163 | 129 | 196 | 78 | 452 | 121 | 80 | 122 | 81 | 193 | 646 | 240 |  |  |
|  | 172 | 97 | 207 | 112 | 180 | 70 | 120 | -9 | 160 | 82 | 226 | 105 | 183 | 61 | 172 | -21 | 240 | 0 |  |  |
| CONW | 7 | 79 | 10 | 99 | 7 | 140 | 4 | 260 | 3 | 18 | 13 | 236 | 2 | 37 | 2 | 635 | 15 | 234 | 15 | 82 |
|  | 83 | 4 | 89 | -10 | 80 | -60 | 84 | $176$ | 54 | 36 | 83 - | 153 | 78 | 41 | 78 | - 557 | 82 | -152 | 82 | 0 |

36-HOUR MEAN FORECAST ERROR (NM)

|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | TCLP | TLAP | CLIP | CONW |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 250 | 101 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 101 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 232 | 99 | 484 | 127 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 110 | 11 | 127 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 134 | 89 | 217 | 123 | 262 | 126 |  |  |  |  |  |  |  |  |  |  |
|  | 119 | 30 | 122 | -1 | 126 | 0 |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 100 | 86 | 137 | 112 | 135 | 119 | 148 | 165 |  |  |  |  |  |  |  |  |
|  | 146 | 60 | 157 | 45 | 157 | 38 | 165 | 0 |  |  |  |  |  |  |  |  |
| GFDN | 81 | 111 | 177 | 114 | 1 | 230 | 0 | 0 | 179 | 109 |  |  |  |  |  |  |
|  | 121 | 10 | 109 | -5 | 18 | -212 | 0 | 0 | 109 | 0 |  |  |  |  |  |  |
| JAVN | 186 | 102 | 347 | 123 | 138 | 111 | 89 | 158 | 160 | 110 | 444 | 162 |  |  |  |  |


|  | 133 | 31 | 149 | 26 | 149 | 38 | 142 | -16 | 120 | 10 | 162 | 0 |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| TCLP | 53 | 94 | 69 | 116 | 67 | 115 | 51 | 146 | 1 | 12 | 44 | 162 | 73 | 152 |  |  |  |  |  |  |
|  | 148 | 54 | 153 | 37 | 157 | 42 | 148 | 2 | 18 | 6 | 158 | -4 | 152 | 0 |  |  |  |  |  |  |
| TLAP | 53 | 89 | 70 | 111 | 69 | 116 | 53 | 139 | 1 | 12 | 44 | 160 | 63 | 149 | 74 | 244 |  |  |  |  |
|  | 239 | 150 | 237 | 126 | 248 | 132 | 235 | 96 | 55 | 43 | 300 | 140 | 216 | 67 | 244 | 0 |  |  |  |  |
| CLIP | 249 | 101 | 479 | 127 | 247 | 125 | 143 | 159 | 179 | 109 | 412 | 153 | 72 | 152 | 73 | 245 | 602 | 332 |  |  |
|  | 232 | 131 | 295 | 168 | 249 | 124 | 170 | 11 | 220 | 111 | 323 | 170 | 236 | 84 | 218 | -27 | 332 | 0 |  |  |
| CONW | 6 | 122 | 8 | 146 | 6 | 182 | 3 | 267 | 3 | 29 | 10 | 262 | 2 | 73 | 2 | 646 | 13 | 338 | 13 | 120 |
|  | 117 | -5 | 131 | -15 | 109 | -73 | 115 | - | 152 | 80 | 51 | 120 | 142 | 141 | 68 | 141 | - | 120 | 120 | -218 |

48-HOUR MEAN FORECAST ERROR (NM)

|  | JTWC |  | NGPS |  | EGRR |  | AFW1 |  | GFDN |  | JAVN |  | TCLP |  | TLAP |  | CLIP |  | CONW |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 220 | 128 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 128 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NGPS | 204 | 124 | 441 | 156 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 137 | 13 | 156 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EGRR | 121 | 114 | 196 | 152 | 238 | 160 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 150 | 36 | 155 | 3 | 160 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AFW1 | 86 | 117 | 116 | 140 | 116 | 144 | 127 | 212 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 183 | 66 | 203 | 63 | 197 | 53 | 212 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| GFDN | 69 | 135 | 157 | 147 | 2 | 288 | 0 | 0 | 159 | 142 |  |  |  |  |  |  |  |  |  |  |
|  | 149 | 14 | 142 | -5 | 78 | -210 | 0 | 0 | 142 | 0 |  |  |  |  |  |  |  |  |  |  |
| JAVN | 164 | 131 | 315 | 155 | 125 | 143 | 79 | 200 | 144 | 141 | 408 | 198 |  |  |  |  |  |  |  |  |
|  | 162 | 31 | 184 | 29 | 178 | 35 | 176 | -24 | 157 | 16 | 198 | 0 |  |  |  |  |  |  |  |  |
| TCLP | 49 | 115 | 61 | 151 | 60 | 143 | 45 | 175 | 1 | 12 | 38 | 172 | 65 | 185 |  |  |  |  |  |  |
|  | 184 | 69 | 187 | 36 | 188 | 45 | 170 | -5 | 24 | 12 | 209 | 37 | 185 | 0 |  |  |  |  |  |  |
| TLAP | 48 | 110 | 59 | 138 | 58 | 136 | 44 | 164 | 1 | 12 | 36 | 169 | 56 | 180 | 63 | 289 |  |  |  |  |
|  | 289 | 179 | 284 | 146 | 284 | 148 | 267 | 103 | 110 | 98 | 357 | 188 | 290 | 110 | 289 | 0 |  |  |  |  |
| CLIP | 219 | 128 | 435 | 156 | 224 | 160 | 122 | 205 | 159 | 142 | 379 | 191 | 64 | 185 | 62 | 291 | 552 | 450 |  |  |
|  | 277 | 149 | 390 | 234 | 325 | 165 | 225 | 20 | 274 | 132 | 447 | 256 | 280 | 95 | 266 | -25 | 450 | 0 |  |  |
| CONW | 5 | 148 | 6 | 164 | 5 | 276 | 2 | 472 | 3 | 55 | 8 | 319 | 1 | 67 | 1 | 901 | 11 | 572 | 11 | 148 |
|  | 157 | 9 | 151 | -13 | 134 | -142 | 102 | $\overline{3} \overline{-}$ | 116 | 61 | 143 | 176 | 84 | 17 | 84 | $\overline{817}$ | 148 | -424 | 148 | 0 |

72-HOUR MEAN FORECAST ERROR (NM)

|  | JTWC |  | NGPS | EGRR | AFW1 | GFDN | JAVN | TCLP | TLAP | CLIP | CONW |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JTWC | 37 | 123 |  |  |  |  |  |  |  |  |  |
|  | 123 | 0 |  |  |  |  |  |  |  |  |  |


| NGPS | 37 | 123 | 357 | 222 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

96-HOUR MEAN FORECAST ERROR (NM)

|  | NGPS |  | EGRR |  | JAVN |  | TCLP |  | TLAP |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| NGPS | 274 | 288 |  |  |  |  |  |  |  |  |
|  | 288 | 0 |  |  |  |  |  |  |  |  |
| EGRR | 106 | 283 | 141 | 260 |  |  |  |  |  |  |
|  | 243 | -40 | 260 | 0 |  |  |  |  |  |  |
| JAVN | 186 | 282 | 74 | 244 | 259 | 327 |  |  |  |  |
|  | 303 | 21 | 293 | 49 | 327 | 0 |  |  |  |  |
| TCLP | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 303 |  |  |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 303 | 0 |  |  |
| TLAP | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 303 | 1 | 334 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 334 | 31 | 334 | 0 |

120-HOUR MEAN FORECAST ERROR (NM)

|  | NGPS | EGRR |  |  | JAVN |  | TCLP | TLAP |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| NGPS | 206 | 347 |  |  |  |  |  |  |  |  |
|  | 347 | 0 |  |  |  |  |  |  |  |  |
| EGRR | 69 | 340 | 90 | 260 |  |  |  |  |  |  |
|  | 274 | -66 | 260 | 0 |  |  |  |  |  |  |


| JAVN | 130 | 348 | 48 | 268 | 176 | 384 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 362 | 14 | 361 | 93 | 384 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TCLP | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 459 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 459 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| TLAP | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 459 | 1 | 463 |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 463 | 4 | 463 | 0 |  |  |  |  |  |  |  |  |  |  |





 ,


[^0]:    - KGWC
    - PGTW

    KWBC

    - OTHER
    - T-Numbers
    - Best Track

[^1]:    - KGWC
    - PGTW
    - KWBC
    - OTHER
    - T-Numbers
    - Best Track

[^2]:    *Named by WMO designated RSMC

[^3]:    - PGTW
    - KGWC
    - KWBC
    - OTHER
    - T-Numbers
    - Best Track

[^4]:    *Named by WMO designated RSMC

[^5]:    Verification Statistics missing for warning number 8

[^6]:    - PGTW
    - KGWC
    - KWBC
    - RODN
    - RJTD
    - OTHER
    - T-Numbers
    - Best Track

[^7]:    file:///C|/Documents\%20and\%20Settings/All\%20Us...03\%20folder/ATCR_2003/chapter4/chapter4_2.html (1 of 12) [4/10/2005 11:24:24 AM]

