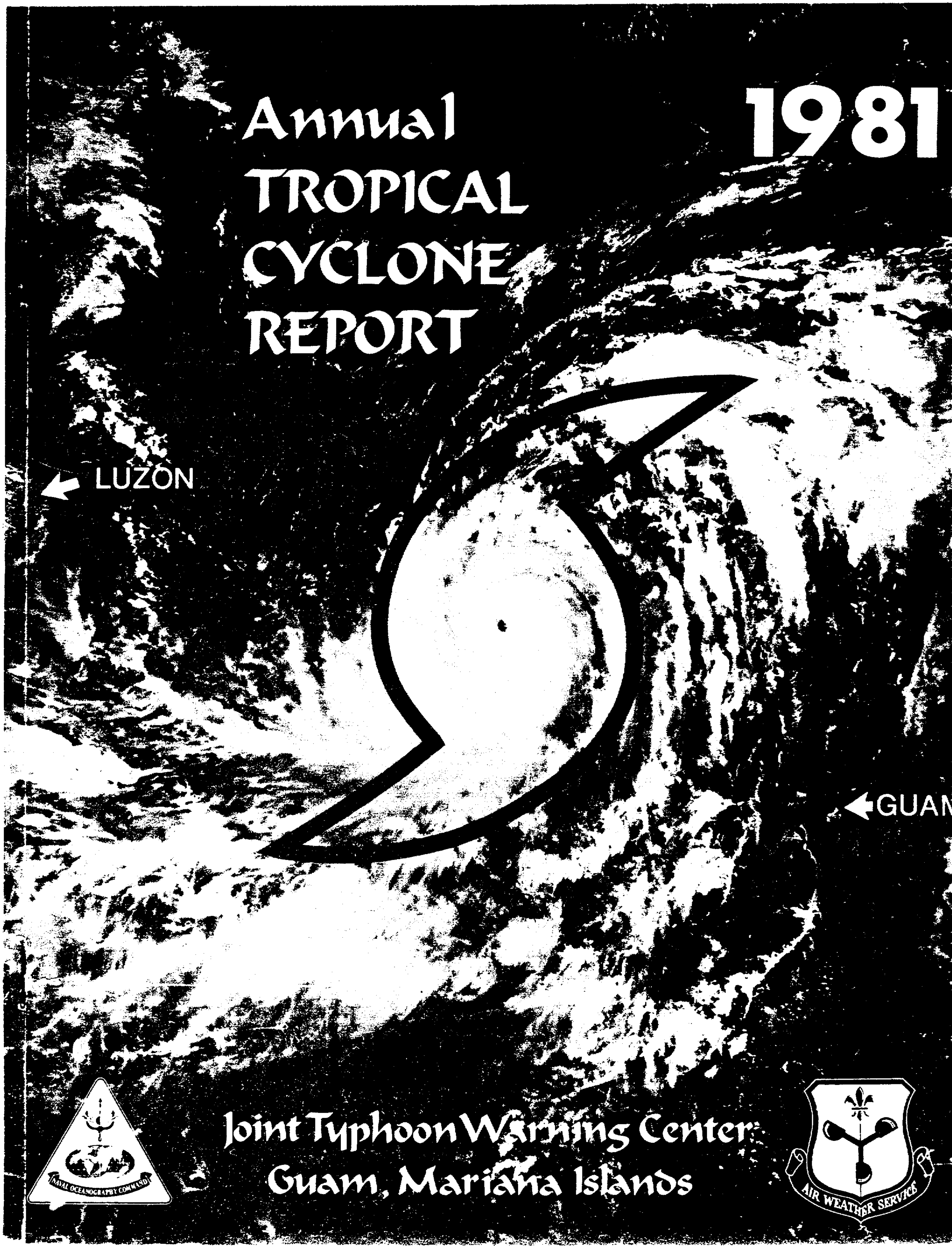
Annual TROPICAL CYCLONE REPORT

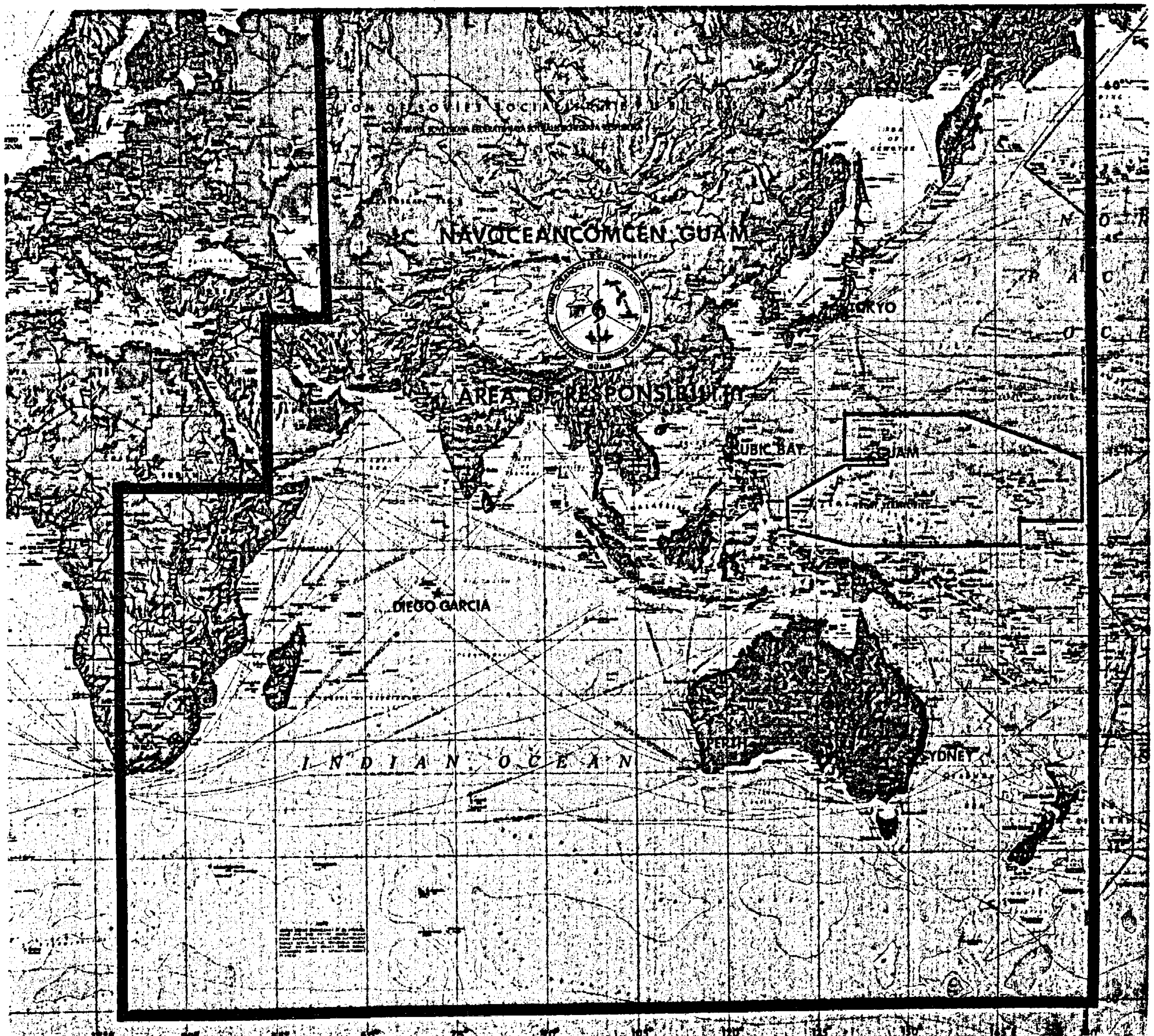
1981



Joint Typhoon Warning Center
Guam, Mariana Islands

NAVAL OCEANOGRAPHY COMMAND

AIR WEATHER SERVICE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FOREWORD

The Annual Tropical Cyclone Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a combined USAF/USN support organization operating under the command of the U. S. Naval Oceanography Command Center, Guam. JTWC was established in April 1959 when CINCPAC directed CINCPACFLT to provide a single tropical cyclone warning center for the Pacific area. The operations of JTWC are guided by CINCPACINST 3140.1(P).

The mission of the Joint Typhoon Warning Center is multifaceted and includes:

1. Continuous meteorological monitoring of all tropical activity in the northern and southern hemispheres, from the International Date Line westward to the east coast of Africa, to anticipate tropical cyclone development.

2. Issuing warnings for all significant tropical cyclones in the above area of responsibility.

3. Determination of reconnaissance requirements for tropical cyclone surveillance and assignment of appropriate priorities.

4. In depth post-analysis of all tropical cyclones occurring within the WESTPAC/Northern Indian Ocean for publication in this report.

5. Cooperation with NAVENVPREDRSCHFAC, Monterey on the operational evaluation of tropical cyclone models and forecast aids, and independent technique development to support operational forecast scenarios.

Should JTWC become incapacitated, the Alternate JTWC (AJTWC), located at the U. S. Naval Western Oceanography Center, Pearl Harbor, Hawaii, assumes warning responsibilities. Assistance in determining tropical cyclone reconnaissance requirements, and in obtaining the resultant data, is provided by Detachment 4, 1WW, Hickam AFB, Hawaii.

In line with the proposals to implement metric units of measurement within the United States over the next few years, various civilian and military organizations have begun extensive educational programs through use of metric equivalents in their publications. This report will include metric unit equivalent measures whenever possible.

Satellite imagery used throughout this report represents data obtained by the Satellite Selective Reconnaissance Program network of stations. The personnel of Det 1, 1WW, co-located with JTWC at Nimitz Hill, Guam, direct the satellite acquisitions and tropical cyclone surveillance of units at:

Det 5, 1WW Clark AB, RP;
Det 8, 1WW, Kadena AB, Japan;
Det 15, 30WS, Osan AB, Korea;
Det 4, 1WW, Hickam AFB, Hawaii, and
Air Force Global Weather Center, Offutt AFB, Nebraska

In addition, the Naval Oceanography Command Detachment, Diego Garcia and DMSP equipped U. S. Navy aircraft carriers have been instrumental in providing vital satellite position fixes for tropical disturbances in the Arabian Sea and the Bay of Bengal.

The staff of JTWC is indebted to Captain Jesus B. Tupaz, USN for his many valuable suggestions and insightful comments throughout the preparation of the 1981 Annual Tropical Cyclone Report. A special thanks is extended to the men and women of the Fleet Air Photographic Laboratory, Naval Air Station, Agana, Guam for their assistance in the reproduction of satellite and graphics data for this report.

NOTE: Appendix 4 contains information on how to obtain past issues of the Annual Typhoon Report (redesignated Annual Tropical Cyclone Report in 1980).

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CHAPTER I - OPERATIONAL PROCEDURES

1. GENERAL

The Joint Typhoon Warning Center (JTWC) provides a variety of routine services to the organizations within its area of responsibility, including:

a. Significant Tropical Weather Advisories: issued daily, this product describes all tropical disturbances and assesses their potential for further development;

b. Tropical Cyclone Formation Alerts: issued when synoptic, satellite and/or aircraft reconnaissance data indicate development of a significant tropical cyclone in a specified area is likely;

c. Tropical Cyclone Warnings: issued periodically throughout each day for significant tropical cyclones, giving forecasts of position and intensity of the system; and

d. Prognostic Reasoning Messages: issued twice daily for systems in WESTPAC only, these messages discuss the rationale behind the most recent warnings.

The recipients of the services of JTWC essentially determine the content of JTWC's products according to their ever-changing requirements. Thus, the spectrum of the routine services is subject to change from year to year; such changes are usually the result of deliberations held at the Annual Tropical Cyclone Conference.

2. DATA SOURCES

a. COMPUTER PRODUCTS:

The standard array of synoptic-scale computer analyses and prognostic charts are available from the Fleet Numerical Oceanography Center (FLENUMOCEANCEN) at Monterey, California. These products are provided through the capabilities of the Naval Environmental Data Network (NEDN).

b. CONVENTIONAL DATA:

This data set is comprised of surface and upper-air observations from island, ship, and land stations plus weather observations from commercial and military aircraft (AIREPS). Conventional data charts are prepared daily at 0000Z and 1200Z for the surface/gradient, 500 mb, and 200 mb levels. The upper-level charts use rawinsonde data, AIREPS within 6 hours of the synoptic times and especially on the 200 mb chart, satellite blow-off winds.

c. AIRCRAFT RECONNAISSANCE:

Aircraft weather reconnaissance data are invaluable for the positioning of the center of developing systems and essential for the accurate determination of numerous parameters, e.g.

eye/center
maximum intensity
minimum sea-level pressure
horizontal wind distribution

In addition, wind and pressure-height data at the 500 and/or 400 mb level, provided by the aircraft while enroute to, or from fix missions, provides a valuable supplement to the all-too sparse data fields of JTWC's area of responsibility. A comprehensive discussion of aircraft weather reconnaissance is presented in Chapter II.

d. SATELLITE RECONNAISSANCE:

Meteorological satellite data obtained from Defense Meteorological Satellite Program (DMSP) and National Oceanic and Atmospheric Administration (NOAA) spacecraft played a major role in the early detection and tracking of tropical cyclones in 1981. A discussion of the role of these programs is presented in Chapter II.

e. RADAR RECONNAISSANCE:

During 1981, as in previous years, land radar coverage was utilized extensively when available. Once a storm moved within the range of land radar sites, their reports were very critical for determination of small scale movement. Use of radar reports during 1981 is discussed in Chapter II.

3. COMMUNICATIONS

a. JTWC currently has access to three primary communications circuits.

(1) The Automated Digital Network (AUTODIN) is used for dissemination of warnings and other related bulletins to Department of Defense installations. These messages are relayed for further transmission over U. S. Navy Fleet Broadcasts, U. S. Coast Guard CW (continuous wave Morse code) and voice broadcasts. Inbound message traffic for JTWC is received via AUTODIN addressed to NAVOCEANCOMCEN GUAM.

(2) The Air Force Automated Weather Network (AWN) provides weather data to JTWC through a dedicated circuit from the Automated Digital Weather Switch (ADWS) at Hickam AFB, Hawaii. The ADWS selects and routes the large volume of meteorological reports necessary to satisfy JTWC requirements for the right data at the right time. Weather bulletins prepared by JTWC are inserted into the AWN circuit via the NEDS and the Nimitz Hill Naval Telecommunication Center (NTCC) of the Naval Communications Area Master Station Western Pacific.

(3) The Naval Environmental Data Network (NEDN) is the communications link with the computers at FLENUMOCEANCEN. JTWC is able to receive environmental data from FLENUMOCEANCEN and access the computers directly to run various programs.

Manual streamline analysis of the 500 mb level is accomplished on the 0000Z and 1200Z data. This analysis is used to delineate the mid-tropospheric steering currents, which are extremely important to the TDO.

b. The Naval Environmental Display Station (NEDS) has become the backbone of the JTWC communications system; it is the terminal that provides a direct interface with the NEDN and AWN. It is also capable of preparing messages for indirect AUTODIN transmission. NTCC supports JTWC communications by transmitting back-up AWN messages using message tapes from the NEDS as well as transmitting the AUTODIN message tapes. The NEDS is also used extensively by the Typhoon Duty Officer (TDO) to request a multitude of forecast aids which are processed by the FLENUMOCEANCEN computers and transmitted to the TDO over the NEDN circuit.

4. ANALYSES

A composite surface/gradient level (3000 ft) manual analysis of the JTWC area of responsibility is accomplished on the 0000Z and 1200Z conventional data. Analysis of the wind field using streamlines is stressed for tropical and subtropical regions. Analysis of the pressure field is accomplished routinely by the NOCC Operations watch-team and may be used in conjunction with JTWC's analysis of tropical wind fields.

Manual streamline analysis of the 500 mb level is accomplished on the 0000Z and 1200Z data. This analysis is used to delineate the mid-tropospheric steering currents, which are extremely important to the TDO.

A composite upper-tropospheric manual streamline analysis is accomplished daily for the 0000Z and 1200Z data fields utilizing rawinsonde data from 300 mb through 100 mb, wind directions extracted from satellite data by Det 1, 1WW, winds derived from cloud motion analysis, and AIREPS (plus or minus 6 hours) at or above 29,000 feet. Wind and height data are used to arrive at a representative analysis of tropical cyclone outflow patterns, of steering currents, and of areas that may indicate tropical cyclone intensity change. All charts are hand plotted over areas of tropical cyclone activity to provide all available data as soon as possible to the TDO. These charts are augmented by the computer-plotted charts for the final analyses.

Additional sectional charts at intermediate synoptic times and auxiliary charts such as station-time plot diagrams and pressure-change charts are also analyzed during periods of significant tropical cyclone activity.

5. FORECAST AIDS

a. CLIMATOLOGY:

Climatological publications utilized during the 1981 typhoon season include previous JTWC Annual Typhoon Reports and climatic publications from local sources, Naval Environmental Prediction Research Facility, Naval Postgraduate School, Air Weather Service, First Weather Wing and Chanute Technical Training Center. Publications from other Air Force and Navy activities, various universities and foreign countries are also used by the JTWC.

b. OBJECTIVE TECHNIQUES:

The following objective techniques were employed in tropical cyclone forecasting during 1981. A description of these techniques is presented in Chapter IV.

(1) 12 HR EXTRAPOLATION

(2) CLIMATOLOGY

(3) HPAC (Combined extrapolation and climatology)

(4) TROPICAL CYCLONE MODEL (Dynamic)

(5) CYCLOPS (Steering)

(6) TYAN78 (Analog)

(7) NESTED TROPICAL CYCLONE MODEL (Dynamic)

(8) BPAC (Blended extrapolation and climatology)

6. FORECASTING PROCEDURES

a. INITIALIZATION:

In the preparation of each warning, the actual surface location (fix) of the tropical cyclone eye/center just prior to (within three hours of) warning time is of prime importance. JTWC uses the Selective Reconnaissance Program (SRP) to levy an optimum mix of resources to obtain fix information. When tropical cyclones are either poorly defined or the actual surface location cannot be determined, or when conflicting fix information is received, the "best estimate" of the surface location is subjectively determined from the analysis of all available data. If fix data are not available due to reconnaissance platform malfunctions or communication problems, synoptic data or extrapolation from previous fixes are used. The initial forecast (warning time) position is then obtained by extrapolation using the latest fix and a "best track" of the cyclone movement to date.

b. TRACK FORECASTING:

An initial forecast track is developed based on the previous forecast and the objective techniques. This initial track is subjectively modified based on the following:

(1) The prospects for recurvature are evaluated. This evaluation is based primarily on present and forecast positions and amplitude of middle tropospheric mid-latitude troughs from the latest 500 mb analysis and numerical prognoses.

(2) Determination of steering level is partly influenced by maturity and vertical extent of the system. For mature cyclones located south of the 500 mb subtropical ridge, forecast changes in speed of movement are closely correlated with forecast changes in the intensity of the ridge. When steering currents are very weak, the tendency for cyclones to move northward due to their internal forces is an important consideration.

(3) The proximity of the tropical cyclone to other tropical cyclones is evalu-

ated to determine if there is a possibility of Fujiwhara interaction.

(4) Over the 12- to 72-hour forecast spectrum, speed of movement during the early time frame is biased toward persistence (12-hr extrapolation), while that near the end of the time frame is biased towards objective techniques and climatology.

(5) A final check is made against climatology to determine whether the forecast track is reasonable. If the forecast deviates greatly from climatology, the forecast rationale is reappraised.

c. INTENSITY FORECASTING:

In forecasting intensity, heavy reliance is placed on aircraft reconnaissance reports, the Dvorak satellite interpretation model, wind and pressure data from ships and land stations in the vicinity of the cyclone, and the objective techniques. Additional considerations are the position and intensity of the tropical upper-tropospheric trough (TUTT), extent and intensity of upper-level outflow, sea-surface temperature terrain influences, vertical wind shear and proximity to an extratropical environment.

7. WARNINGS

Tropical cyclone warnings are issued when a definite closed circulation is evident and maximum sustained wind speeds are forecast to increase to 34 or more knots within 48 hours, or the cyclone is in such a position that life or property may be endangered within 72 hours. Warnings are also issued in other situations if it is determined that there is a need to alert military and civil interests to conditions which may become hazardous in a short period of time. Each tropical cyclone warning is numbered sequentially and includes the initial warning time, eye-center position, intensity, the radial extent of 30, 50 and 100 knot surface winds (when applicable), the levied reconnaissance platform used, the instantaneous speed and direction of movement of the cyclone's surface center at warning time and the forecast information. The forecast intervals for all Northern Hemisphere tropical cyclones, regardless of intensity, are 12, 24, 48, and 72 hr.

Warnings within the JTWC North Pacific area are issued within two hours of 0000Z, 0600Z, 1200Z, and 1800Z with the constraint that consecutive warnings may not be more than seven hours apart. Warnings in the JTWC North Indian Ocean area are issued within two hours of 0200Z, 0800Z, 1400Z, and 2000Z, again with the constraint that consecutive warnings may not be more than seven hours apart. Warning forecast positions are verified against the corresponding "best track" positions. A summary of the verification results from 1981 is presented in Chapter IV.

As of 1 January 1980, JTWC issued tropical cyclone warnings in an ADP (Automated Data Processing) format. The format allows commands with ADP equipment to enter tropical cyclone warning data directly into ADP equipment data bases. The format also possesses readability for users without ADP equipment.

8. PROGNOSTIC REASONING MESSAGE

For tropical cyclones in warning status in the North Pacific area, prognostic reasoning messages are transmitted following the 0000Z and 1200Z warnings, or whenever the previous reasoning is no longer valid. This plain language message is intended to provide meteorologists with the reasoning behind the latest JTWC forecast. Prognostic reasoning messages are not normally prepared for tropical depressions nor for cyclones in the North Indian Ocean area.

For the 1981 season, JTWC included confidence statements for the 24- and 48-hour forecasts. The confidence values were percentage probabilities that the 24-hour forecast position error would be less than 100 nm and less than 150 nm, respectively, and that the 48-hour error would be less than 200 nm and less than 300 nm, respectively. These probabilities were based on objective data from error analysis studies of past cyclones and were a function of latitude, longitude, storm intensity, organization and the number of western Pacific cyclone in existence.

Prognostic reasoning information applicable to all customers is provided in the remarks section of warnings when significant forecast changes are made or when deemed appropriate by the TDO.

9. SIGNIFICANT TROPICAL WEATHER ADVISORY

This plain language message, contains a detailed, non-technical description of all significant tropical cyclone development within the 24-hour forecast period. It is issued by 0600Z daily.

10. TROPICAL CYCLONE FORMATION ALERT

Alerts are issued whenever interpretation of satellite imagery and other meteorological data indicates significant tropical cyclone formation is likely. These alerts will specify a valid period not to exceed 24 hours and must either be cancelled, reissued or superseded by a warning prior to expiration of the valid period.

CHAPTER II - RECONNAISSANCE AND FIXES

1. GENERAL

The Joint Typhoon Warning Center depends on reconnaissance to provide necessary, accurate, and timely meteorological information in support of each warning. JTWC relies primarily on three reconnaissance platforms: aircraft, satellite, and radar. In data rich areas synoptic data is also used to supplement the above. Optimum utilization of all available reconnaissance resources is obtained through the Selective Reconnaissance Program (SRP), whereby various factors are considered in selecting a specific reconnaissance platform to support each warning. These factors include: cyclone location and intensity, reconnaissance platform capabilities and limitations, and the cyclone's threat to life/property afloat and ashore. A summary of reconnaissance fixes received during 1981 is included in Section 6 of this Chapter.

2. RECONNAISSANCE AVAILABILITY

a. Aircraft:

Aircraft weather reconnaissance in the JTWC area of responsibility is performed by the 54th Weather Reconnaissance Squadron (54th WRS) located at Andersen Air Force Base, Guam. Presently equipped with six WC-130 aircraft, the 54th WRS, from July through October, is augmented by the 53rd WRS from Keesler Air Force Base, Mississippi, bringing the total number of available aircraft to nine. The JTWC reconnaissance requirements, provided daily throughout the year to the Tropical Cyclone Aircraft Reconnaissance Coordinator (TCARC), include area(s) to be investigated, tropical cyclone(s) to be fixed, fix times, and forecast positions for fixes. The following priorities are utilized in acquiring meteorological data from aircraft, satellite, and land-based radar in accordance with CINCPACINST 3140.1P:

"(1) Investigative flights and vortex or center fixes for each scheduled warning in the Pacific area of responsibility. One aircraft fix per day of each cyclone of tropical storm or typhoon intensity is desirable.

(2) Supplementary fixes.

(3) Synoptic data acquisition."

As in previous years, aircraft reconnaissance provided direct measurements of height, temperature, flight-level winds, sea-level pressure, estimated surface winds (when observable), and numerous additional parameters. The meteorological data are gathered by the Aerial Reconnaissance Weather Officers (ARWO) and dropsonde operators of Detachment 4, Hq AWS, who fly with the 54th WRS. These data provide the Typhoon Duty Officer (TDO) indications of changing cyclone characteristics, radius of cyclone associated winds, and present cyclone position and intensity. Another important aspect is the availability of the data for research on tropical cyclone analysis and forecasting.

b. Satellite

Satellite fixes from USAF/USN ground sites and USN ships provide day and night coverage in the JTWC area of responsibility. Interpretation of this satellite imagery provides cyclone positions and estimates of storm intensities through the Dvorak technique (for daytime passes).

Detachment 1, 1st Weather Wing, which receives and processes polar orbiting satellite data, is the primary fix site for the western Pacific. Satellite fix positions received at JTWC from the Air Force Global Weather Central (AFGWC), Offutt Air Force Base, Nebraska and the Naval Oceanography Command Detachment at Diego Garcia were the major sources of satellite data for the Indian Ocean. GOES fixes were also provided by the National Environmental Satellite Service, Honolulu, Hawaii for tropical cyclones near the dateline.

c. Radar

Land radar provides positioning data on well developed cyclones when in the proximity (usually within 175 nm (324 km)) of the radar sites in the Republic of the Philippines, Taiwan, Hong Kong, Japan, the Republic of Korea, Kwajalein, and Guam.

d. Synoptic

In 1981, JTWC also determined tropical cyclone positions based on the analysis of the surface/gradient level synoptic data. These positions were helpful in situations where the vertical structure of the tropical cyclone was weak or accurate surface positions from aircraft were not available due to flight restrictions.

3. AIRCRAFT RECONNAISSANCE SUMMARY

During the 1981 tropical season, the JTWC levied 201 six-hourly vortex fixes and 78 investigative missions of which 21 were flown into disturbances which did not develop. In addition to the levied fixes, 106 supplemental fixes were also obtained. The number of levied investigative missions has increased steadily over the past five years in response to JTWC's increased efforts to detect initial tropical cyclone development. The average vector error for all aircraft fixes received at the JTWC during 1981 was 13 nm (24 km).

Aircraft reconnaissance effectiveness is summarized in Table 2-1 using the criteria as set forth in CINCPACINST 3140.1P.

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

EFFECTIVENESS	NUMBER OF LEVIED FIXES	PERCENT
COMPLETED ON TIME	184	91.5
EARLY	3	1.5
LATE	11	5.5
MISSED	3	1.5
TOTAL	201	100.0

LEVIED VS. MISSED FIXES

	LEVIED	MISSED	PERCENT
AVERAGE 1965-1970	507	10	2.0
1971	802	61	7.6
1972	624	126	20.2
1973	227	13	5.7
1974	358	30	8.4
1975	217	7	3.2
1976	317	11	3.5
1977	203	3	1.5
1978	290	2	0.7
1979	289	14	4.8
1980	213	4	1.9
1981	201	3	1.5

4. SATELLITE RECONNAISSANCE SUMMARY

The Air Force provides satellite reconnaissance support to JTWC using imagery data from DMSP and NOAA polar-orbiting spacecraft. In addition, geostationary satellite data is also available.

The DMSP cyclone surveillance network consists of both tactical and centralized facilities. Tactical DMSP sites are located at Nimitz Hill, Guam; Clark AB, Philippines; Kadena AB, Japan; Osan AB, Korea; and Hickam AFB, Hawaii. These sites provide a combined coverage that includes the JTWC area of responsibility in the western North Pacific from near the dateline westward to the Malay Peninsula. The Navy tactical site at Diego Garcia continues to provide NOAA polar-orbiting coverage in the central South Indian Ocean. Their reconnaissance supplements the Air Force Global Weather Central (AGWC) support in this data sparse region.

AFGWC, located at Offutt AFB, Nebraska is the centralized member of the satellite cyclone surveillance network. In support to JTWC, AFGWC processes imagery from DMSP and NOAA spacecraft. Imagery processed at AFGWC is recorded on-board the spacecraft as it passes over the earth. Later, these data are downlinked to AFGWC via a network command/readout sites and communications satellites. This enables AFGWC to obtain the coverage necessary to fix all cyclones of interest to JTWC. AFGWC has the primary responsibility to provide cyclone surveillance over the entire Indian Ocean and a small portion of the western North Pacific near the dateline. Additionally, AFGWC can be tasked to provide storm positions in the western North Pacific and South Pacific as backup to coverage routinely available in this region.

The hub of the network is Det 1, 1WW colocated with JTWC, Nimitz Hill, Guam. Based on available satellite coverage, Det 1 coordinates satellite reconnaissance requirements with JTWC and tasks the individual network sites for the necessary storm fixes. Therefore, when a position from a polar-orbiting satellite is required as the basis for a warning, called a levied fix, a dual sight tasking concept is applied. Under this concept two sites are tasked to fix the cyclone off the same satellite pass. This provides the necessary redundancy to virtually guarantee JTWC a successful satellite fix on the cyclone. Using this dual-site concept, the satellite reconnaissance network was able to meet all of JTWC's levied satellite fix requirements. Dual-site tasking is applied in the Indian Ocean as well by using AFGWC and the Navy weather detachment site at Diego Garcia.

The network provides JTWC with several products and services. The main service is one of surveillance. Each site reviews its daily satellite coverage for indications of tropical cyclone development. If an area exhibits the potential for development, JTWC is notified. Once JTWC issues either an alert or warning, the network is tasked to provide three products: cyclone positions, cyclone intensity estimates, and 24-hour cyclone intensity forecasts. Satellite cyclone positions are assigned position code numbers (PCN) depending on the availability of geography for precise gridding and the degree of organization of the cyclone's circulation center (Table 2-2). During 1981 the network provided JTWC with over 1200 satellite fixes on WESTPAC tropical disturbances. Another 110 fixes were made by Det 1 for tropical disturbances in the North Indian Ocean. A comparison of those fixes made on WESTPAC numbered tropical cyclones with their corresponding JTWC best track positions is shown in Table 2-3. Estimates of the cyclone's current intensity and a 24-hour intensity forecast are made once each day by applying the Dvorak technique (NOAA Technical Memorandum NESS 45 as revised) to daylight visual data.

The availability of polar-orbiting meteorological satellites improved since the end of 1980. At that time only NOAA 6 and F-3 (FTV 14537), both sunrise orbiters, were available. However, in June NOAA 7 was successfully launched with the network able to use visual imagery by orbit 25 and IR data by orbit number 210. NOAA 7 replaced TIROS-N and is in a mid-afternoon orbit. NOAA 6 continued to function normally throughout the year except for a brief 3

TABLE 2-2. POSITION CODE NUMBERS

PCN	METHOD OF CENTER DETERMINATION/GRIDDING
1	EYE/GEOGRAPHY
2	EYE/EPHEMERIS
3	WELL DEFINED CC/GEOGRAPHY
4	WELL DEFINED CC/EPHEMERIS
5	POORLY DEFINED CC/GEOGRAPHY
6	POORLY DEFINED CC/EPHEMERIS

CC=Circulation Center

TABLE 2-3. MEAN DEVIATION (NM) OF ALL SATELLITE DERIVED TROPICAL CYCLONE POSITIONS FROM THE JTWC BEST TRACK POSITIONS. NUMBER OF CASES IN PARENTHESIS.

PCN	WESTPAC 1974-1980 AVERAGE (ALL SITES)	WESTPAC 1981 (ALL SITES)	INDIAN OCEAN 1980 (ALL SITES)	INDIAN OCEAN 1981 (ALL SITES)
1	13.1 (269)	14.6 (159)	-	17.0 (9)
2	18.0 (80)	16.6 (5)	-	9.5 (2)
3	20.5 (435)	17.5 (217)	-	29.7 (6)
4	23.8 (107)	38.3 (13)	-	-
5	38.1 (725)	35.2 (789)	35.7 (8)	29.9 (14)
6	42.6 (278)	55.1 (39)	44.6 (12)	32.7 (21)
1&2	14.2 (349)	14.7 (164)	-	15.6 (11)
3&4	21.2 (542)	18.7 (230)	-	29.7 (6)
5&6	39.3 (1003)	36.1 (828)	41.0 (20)	31.6 (35)

week period in August and September. During that time a data anomaly developed rendering the visual and IR data unusable. However, the problem corrected itself and despite over 13,000 orbits by the end of 1981, the spacecraft is functioning normally. While most network sites use NOAA 6 on a routine basis, Det 1 now uses NOAA 7 as its primary surveillance and reconnaissance satellite. Higher sun angle giving clearer visual imagery and more timely nodal crossings makes NOAA 7 more conducive to Det 1 operations. On the DMSP side, no new launches were attempted in 1981. F-3 is still providing ascending daylight coverage despite 19,000 orbits. In summary, NOAA 6, NOAA 7 and F-3 were being used at years end.

Besides fixes from the network, JTWC also received satellite-derived cyclone positions from several secondary sources during 1981. These included: U. S. Navy ships equipped for direct readout; the National Environmental Satellite Service (NESS) using NOAA and GOES data; and the Naval Polar Oceanography Center, Suitland, Maryland using stored DMSP and NOAA data. Fixes from these secondary sources are not included in the network statistics.

5. RADAR RECONNAISSANCE SUMMARY

Seventeen of the 29 significant tropical cyclones occurring over the western North Pacific during 1981 passed within range of land based radars with sufficient cloud pattern organization to be fixed. The hourly and oftentimes, half-hourly land radar fixes that were obtained and transmitted to JTWC totaled 584.

The WMO radar code defines three categories of accuracy: good (within 10 km (5.4 nm)), fair within 10-30 km (5.4-16.2 nm)), and poor (within 30-50 km (16.2-2.27 nm)). This year, 584 radar fixes were coded in this manner; 254 were good, 172 fair, and 158 poor. Compared to the JTWC best track, the mean vector deviation for land radar sites was 18 nm (33 km). Excellent support through timely and accurate radar fix positioning allowed JTWC to track and forecast tropical cyclone movement through even the most difficult and erratic tracks.

No radar fixes were made by 54th WRS aircraft during the WESTPAC tropical cyclone season and, as in previous years, no radar reports were received on Indian Ocean cyclones.

6. TROPICAL CYCLONE FIX DATA

A total of 2230 fixes on 29 northwest Pacific tropical cyclones and 111 fixes on 3 northern Indian Ocean tropical cyclones were received at JTWC. Table 2-4, Fix Platform Summary, delineates the number of fixes per platform for each individual tropical cyclone. Season totals and percentages are also indicated.

Annex A includes individual fix data for each tropical cyclone. Fix data are divided into four categories: Satellite, Aircraft, Radar, and Synoptic. Those fixes labelled with an asterisk (*) were determined to be unrepresentative of the surface center and were not used in determining the best tracks. Within each category, the first three columns are as follows:

FIX NO. - Sequential fix number

TIME (Z) - GMT time in day, hours and minutes

FIX POSITION - Latitude and longitude to the nearest tenth of a degree

Depending upon the category, the remainder of the format varies as follows:

a. Satellite

(1) ACCRY - Position Code Number (PCN) is used to indicate the accuracy of the fix position. A "1" indicates relatively high accuracy and a "6" relatively low accuracy.

(2) DVORAK CODE - Intensity evaluation and trend utilizing visual satellite data. (For specifics, refer to NOAA TM; NESS-45) (Table 2-5).

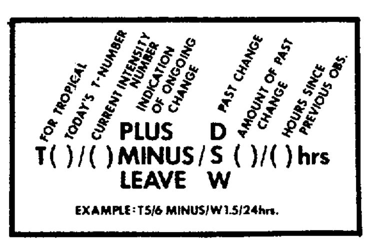


TABLE 2-4. FIX SUMMARY FOR 1981

FIX SUMMARY

	AIRCRAFT	DMSP	NOAA 6&7	OTHER SAT	RADAR	SYNOPTIC	TOTAL
WESTERN PACIFIC							
TY FREDA	11	1	10	28	0	4	54
TS GERALD	17	1	12	37	10	0	77
TS HOLLY	22	2	20	48	0	0	92
TS IKE	1	1	14	39	3	2	60
TY JUNE	11	0	18	35	23	0	87
TY KELLY	7	0	24	32	7	1	71
TS LYNN	4	0	18	28	78	6	134
TS MAURY	3	0	9	8	0	11	31
TS NINA	0	0	5	7	0	3	15
TY OGDEN	11	0	11	23	73	0	118
TD 11	0	0	5	10	0	3	18
TS PHYLLIS	3	0	4	14	0	0	21
TS ROY	5	0	17	31	4	0	57
TS SUSAN	2	0	16	32	0	0	50
TY THAD	26	2	16	42	9	11	106
TS VANESSA	2	0	2	19	0	0	23
TS WARREN	0	0	5	19	0	1	25
TY AGNES	17	1	16	49	140	2	225
TY BILL	12	0	9	26	0	0	47
TY CLARA	19	0	18	42	45	0	124
TY DOYLE	0	0	10	26	0	0	36
ST ELSIE	29	1	20	47	9	1	107
TS FABIAN	1	0	7	12	0	2	22
TY GAY	30	0	24	43	49	1	147
TY HAZEN	19	0	17	53	50	2	141
ST IRMA	18	0	20	50	70	13	171
TS JEFF	9	0	7	33	1	0	50
TY KIT	32	0	30	43	2	0	108
TY LEE	12	0	11	38	11	0	72
TOTAL	324	9	395	914	584	63	2289
% OF TOTAL NO. OF FIXES	14.2	0.4	17.3	39.9	25.5	2.7	100

	NOAA 6&7	OTHER	SYNOPTIC	TOTAL
INDIAN OCEAN				
TC 27-81	27	0	0	27
TC 29-81	18	16	0	34
TC 31-81	23	26	0	49
TOTAL	68	42	0	110
% OF TOTAL NO. OF FIXES	61.8	38.2		100

TABLE 2-5. MAXIMUM SUSTAINED WIND SPEED (KT) AS A FUNCTION OF DVORAK T NUMBER AND MINIMUM SEA LEVEL PRESSURE (MSLP)

TROPICAL CYCLONE INTENSITY	WIND SPEED	MSLP (NW PACIFIC)
T 1.0	25	--
T 1.5	25	--
T 2.0	30	1003
T 2.5	35	999
T 3.0	45	994
T 3.5	55	988
T 4.0	65	981
T 4.5	77	973
T 5.0	90	964
T 5.5	102	954
T 6.0	115	942
T 6.5	127	929
T 7.0	140	915
T 7.5	155	900
T 8.0	170	884

(3) SAT - Specific satellite used for fix position (DMSP 37 or NOAA 6, NOAA 7, or Other).

(4) COMMENTS - For explanation of abbreviations, see Appendix.

(5) SITE - ICAO call sign of the specific satellite tracking station.

b. Aircraft

(1) FLT LVL - The constant pressure surface level, in mb, maintained during the penetration. Seven hundred mb is the normal level flown in developed cyclones due to turbulence factors. Low-level missions are flown at 1500 ft.

(2) 700 MB HGT - Minimum height of the 700 mb pressure surface within the vortex recorded in meters.

(3) OBS MSLP - If the surface center can be visually detected (e.g., in the eye), the minimum sea-level pressure is obtained by a dropsonde released above the surface vortex center. If the fix is made at the 1500-foot level, the sea-level pressure is extrapolated from that level.

(4) MAX-SFC-WND - The maximum surface wind (knots) is an estimate made by the ARWO based on sea state. This observation is limited to the region of the flight path and may not be representative of the entire cyclone. Availability of data is also dependent upon the absence of undercast conditions and the presence of adequate illumination. The positions of the maximum flight level wind and the maximum observed surface wind do not necessarily coincide.

(5) MAX-FLT-LVL-WND - Wind speed (knots) at flight level is measured by the AN/APN 147 doppler radar system aboard the WC-130 aircraft. Values entered in this category represent the maximum wind measured prior to obtaining a scheduled fix. This measurement may not represent the maximum flight level wind associated with the tropical cyclone because the aircraft only samples those portions of the tropical cyclone along the flight path. In most instances, the flight path is through the weak sector of the cyclone. In areas of heavy rainfall, the doppler radar may track energy reflected from precipitation rather than from the sea surface, thus, preventing accurate wind speed measurement. In obvious cases, such erroneous wind data will not be reported. In addition, the doppler radar system on the WC-130 restricts wind measurements to drift angles less than or equal to 27 degrees if the wind is normal to the aircraft heading.

(6) ACCRY - Fix position accuracy. Both navigational (OMEGA and LORAN) and meteorological (by the ARWO) estimates are given in nautical miles.

(7) EYE SHAPE - Geometrical representation of the eye based on the aircraft radar presentation. The eye shape is reported only if the center is 50% or more surrounded by wall cloud.

(8) EYE DIAM/ORIENTATION - Diameter of the eye in nautical miles. In case of an elliptical eye, the lengths of the major and minor axes and the orientation of the major axis are respectively listed. In the case of concentric eye walls, both diameters are listed.

c. Radar

(1) RADAR - Specific type of platform utilized for fix (land radar site, aircraft, or ship).

(2) ACCRY - Accuracy of fix position (good, fair, or poor) as given in the WMO ground radar weather observation code (FM20-V)

(3) EYE SHAPE - Geometrical representation of the eye given in plain language (circular, elliptical, etc.).

(4) EYE DIAM - Diameter of eye given in kilometers.

(5) RADOB CODE - Taken directly from WMO ground weather radar observation code FM20-V. The first group specifies the vortex parameters, while the second group describes the movement of the vortex center.

(6) RADAR POSITION - Latitude and longitude of tracking station given in tenths of a degree.

(7) SITE - WMO station number of the specific tracking station.

d. Synoptic

(1) INTENSITY ESTIMATE - TDO's analysis of low-level synoptic data to determine a cyclone's maximum sustained surface wind (knots).

(2) NEAREST DATA - Accuracy of fix based on distance (nautical miles) from the fix position to the nearest synoptic report or to the average distance of reports in data sparse cases.

CHAPTER III - SUMMARY OF TROPICAL CYCLONES

1. WESTERN NORTH PACIFIC TROPICAL CYCLONES

During 1981, the western North Pacific experienced the third consecutive year of below normal tropical cyclone activity. Twenty-nine tropical cylones occurred in 1981, one more than the previous two years but three less than the annual average. Only one significant tropical cyclone failed to develop beyond the tropical depression (TD) stage and 11 tropical storms (TS) failed to reach typhoon intensity. Of the 16 tropical cyclones that developed to typhoon (TY) intensity, only two reached the 130 kt (67 m/sec) intensity necessary to be classified as super typhoons (ST). Tropical cyclones reaching tropical storm intensity or greater are assigned names in alphabetical order from a list of alternating male/female names found in CINCPACINST 3140.1P. Table 3-1 provides a summary of key statistics for western North Pacific cyclones. Each tropical cyclone's maximum surface winds (MAX SFC WND), in knots, and minimum observed sea level pressure (MIN OBS SLP), in millibars, were obtained from best estimates based on all available data. The distance travelled, in nautical miles, was calculated from the JTWC official best track (see Annex A).

Tables 3-2 through 3-5 provide further information on the monthly distribution of tropical cyclones and statistics on Tropical Cyclone Formation Alerts and Warnings.

TABLE 3-1 WESTERN NORTH PACIFIC

1981 SIGNIFICANT TROPICAL CYCLONES

CYCLONE	TYPE	NAME	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	MAX SFC WIND(KT)	MIN OBS SLP	NUMBER OF WARNINGS	DISTANCE TRAVELLED(NM)
01	TY	FREDA	12 MAR-17 MAR	6	100	940	22	1912
02	TS	GERALD	15 APR-19 APR	5	60	982	18	1659
03	TS	HOLLY	29 APR-07 MAY	9	45	997	31	1711
04	TY	IKE	09 JUN-14 JUN	6	65	967	21	1386
05	TY	JUNE	17 JUN-22 JUN	6	75	965	22	1569
06	TY	KELLY	30 JUN-04 JUL	5	75	966	20	1159
07	TS	LYNN	02 JUL-07 JUL	6	55	983	18	1992
08	TS	MAURY	18 JUL-20 JUL	3	55	990	9	741
09	TS	NINA	22 JUL-23 JUL	2	35	995	4	120
10	TY	OGDEN	27 JUL-01 AUG	6	65	975	20	1542
11	TD	TD-11	31 JUL-02 AUG	3	20	994	7	161
12	TS	PHYLLIS	03 AUG-04 AUG	2	45	978	7	318
13	TS	ROY	03 AUG-09 AUG	7	50	986	20	838
14	TS	SUSAN	08 AUG-13 AUG	6	60	975	19	1180
15	TY	THAD	16 AUG-23 AUG	8	85	965	29	1928
16	TS	VANESSA	17 AUG-19 AUG	3	55	983	8	1299
17	TS	WARREN	18 AUG-20 AUG	3	45	991	10	497
18	TY	AGNES	26 AUG-03 SEP	9	95	947	31	1717
19	TY	BILL	03 SEP-07 SEP	5	85	959	17	1583
20	TY	CLARA	17 SEP-22 SEP	8	120	924	29	2129
21	TY	DOYLE	20 SEP-23 SEP	4	80	964	14	2301
22	STY	ELSIE	23 SEP-02 OCT	8	150	893	33	2447
23	TS	FABIAN	13 OCT-14 OCT	2	45	990	6	1479
24	TY	GAY	14 OCT-23 OCT	10	95	947	35	3390
25	TY	HAZEN	14 NOV-23 NOV	10	100	956	37	2956
26	STY	IRMA	19 NOV-27 NOV	9	135	902	34	2732
27	TS	JEFF	23 NOV-26 NOV	4	35	999	14	1754
28	TY	KIT	11 DEC-21 DEC	11	115	924	40	1902
29	TY	LEE	23 DEC-29 DEC	7	95	948	24	1710
			1981 TOTALS	144*				

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

TABLE 3-2

1981 SIGNIFICANT TROPICAL CYCLONE STATISTICS

WESTERN NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	(1959-80) AVERAGE
TROPICAL DEPRESSIONS	0	0	0	0	0	0	1	0	0	0	0	0	1	4.8
TROPICAL STORMS	0	0	0	2	0	0	3	5	0	1	1	0	12	10.0
TYPHOONS	0	0	1	0	0	3	1	2	4	1	2	2	(14) 16	17.7
ALL CYCLONES	0	0	1	2	0	3	5	7	4	2	3	2	29	32.3
(1959-80) AVERAGE	.6	.4	.6	.9	1.5	2.0	5.2	6.5	6.0	4.7	2.6	1.4	32.3	1959-1982 31.9

FORMATION ALERTS

28 of 29 Formation Alert Events developed into Tropical Cyclones. Tropical Cyclone Formation Alerts were issued for all but 1 significant tropical cyclones that developed during 1981.

WARNINGS

Number of warning days: 144

Number of warning days with 2 cyclones: 23

Number of warning days with 3 or more cyclones: 3

TABLE 3-3

FREQUENCY OF TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.3	0.4	0.7	1.1	2.0	2.9	3.2	2.4	2.0	0.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
1974	0	0	0	0	1	2	1	2	3	4	2	0	14
1975	1	0	0	0	0	0	1	3	4	3	2	0	15
1976	1	0	0	1	2	2	2	1	4	1	1	0	15
1977	0	0	0	0	0	0	3	0	2	3	2	1	11
1978	0	0	0	1	0	0	3	2	4	3	2	0	15
1979	1	0	1	1	0	0	2	2	3	2	1	1	14
1980	0	0	0	0	2	0	3	2	5	2	1	0	15
1981	0	0	1	0	0	2	2	2	4	1	2	2	16
AVERAGE (1959-81)	.3	0.04	.2	.7	.8	1.0	2.8	3.3	3.3	3.0	1.6	.6	17.6

TABLE 3-4

FREQUENCY OF TROPICAL STORMS AND TYPHOONS BY MONTH AND YEAR

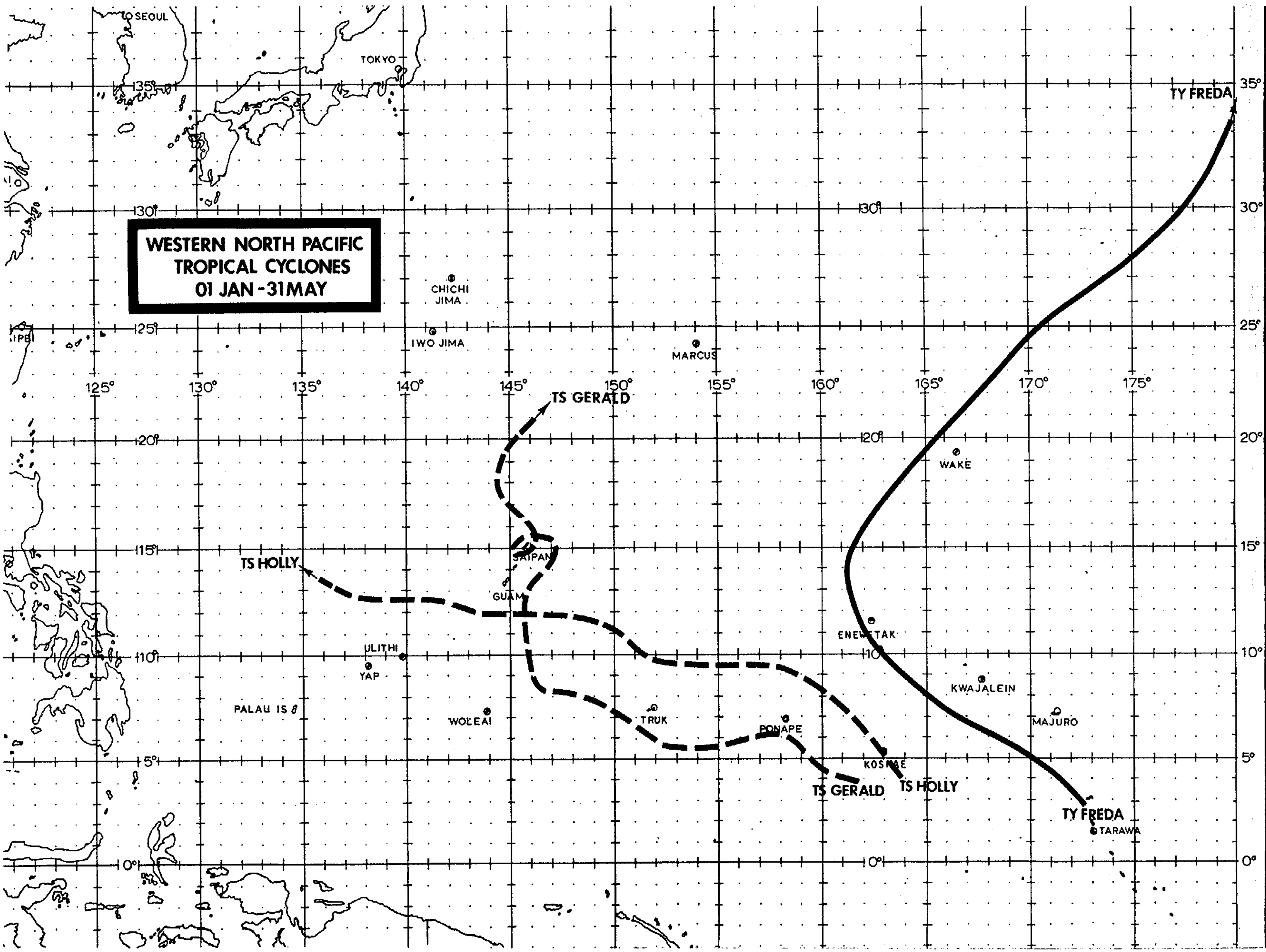
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.4	0.5	0.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
1974	1	0	1	1	1	4	4	5	5	4	4	2	32
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	2	1	19
1978	1	0	0	1	0	3	4	7	5	4	3	0	28
1979	1	0	1	1	1	0	4	2	7	3	2	2	24
1980	0	0	0	1	4	1	4	2	6	4	1	1	24
1981	0	0	1	2	0	2	5	7	4	2	3	2	28
AVERAGE (1959-81)	.5	.3	.5	.9	1.2	1.6	4.5	5.4	5.0	4.0	2.4	1.2	27.6

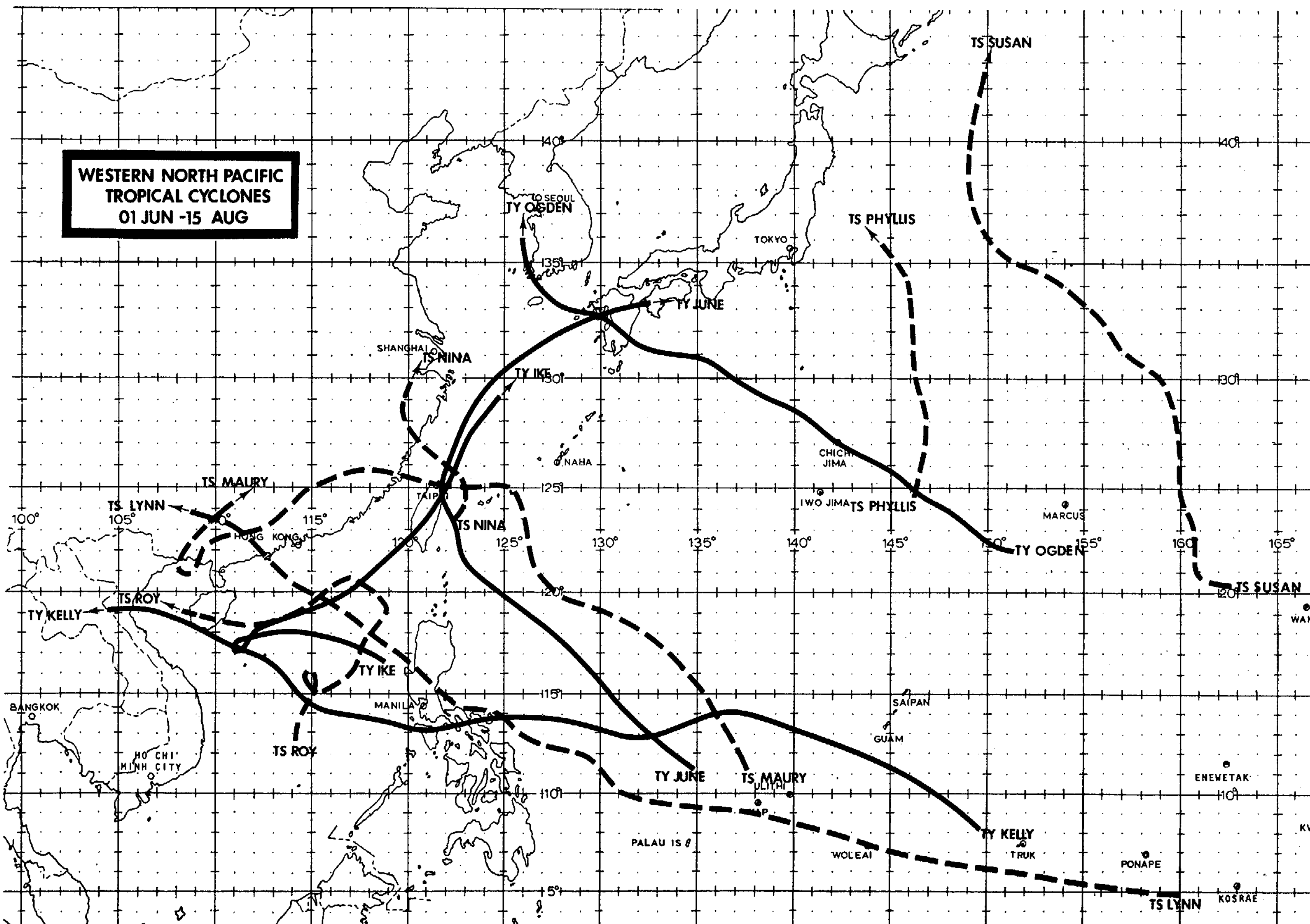
TABLE 3-5

FORMATION ALERT SUMMARY

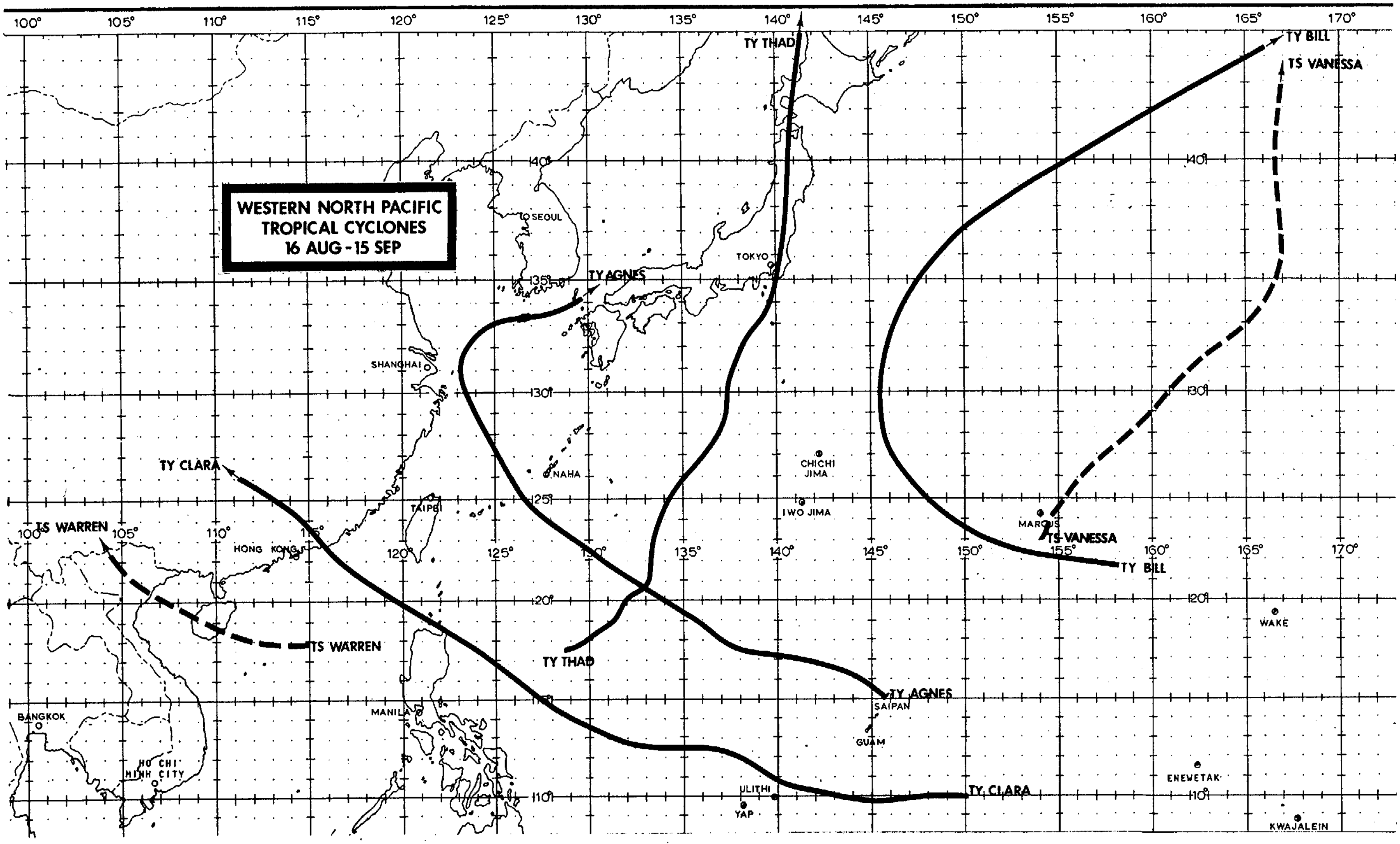
WESTERN NORTH PACIFIC

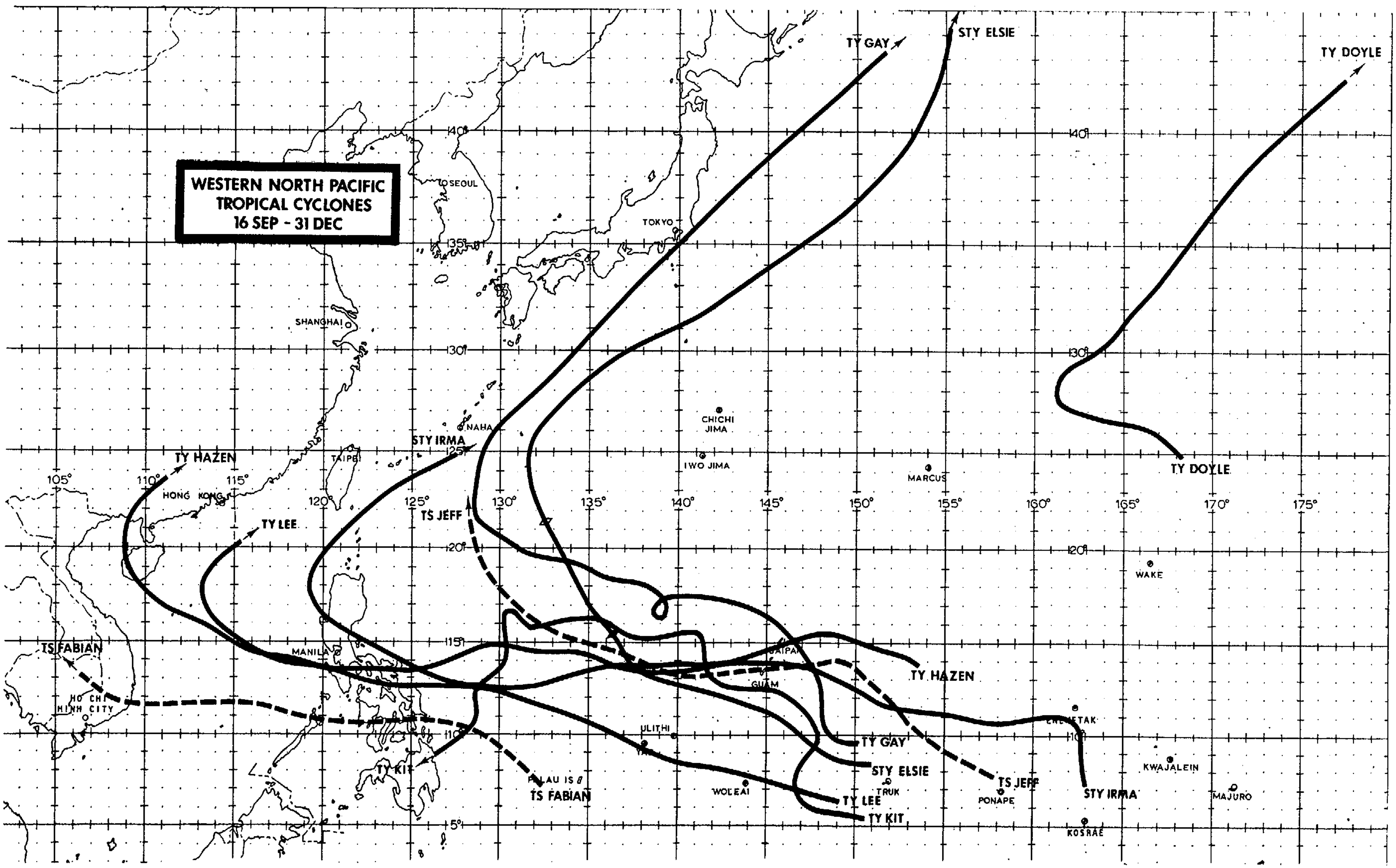
YEAR	NUMBER OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE
1972	41	29	32	71%
1973	26	22	23	85%
1974	35	30	36	86%
1975	34	25	25	74%
1976	34	25	25	74%
1977	26	20	21	77%
1978	32	27	32	84%
1979	27	23	28	85%
1980	37	28	28	76%
1981	29	28	29	97%


WESTERN NORTH PACIFIC
TROPICAL CYCLONES
01 JAN - 31 MAY
TY FREDA
TS GERALD
TS HOLLY
TS GERALD
TS HOLLY
TY FREDA
SEOUL
TOKYO
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO
TARAWA
125°
130°
135°
140°
145°
150°
155°
160°
165°
170°
175°
35°
30°
25°
20°
15°
10°
5°
0°



WESTERN NORTH PACIFIC
TROPICAL CYCLONES
01 JUN -15 AUG
TS SUSAN
TS PHYLLIS
TY OGDEN
TY JUNE
TY IKE
TS NINA
TS MAURY
TS LYNN
TS ROY
TY KELLY
SEOUL
TOKYO
SHANGHAI
TAIPEI
HONG KONG
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
BANGKOK
HO CHI MINH CITY
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE


WESTERN NORTH PACIFIC
TROPICAL CYCLONES
16 AUG - 15 SEP
TY THAD
TY BILL
TS VANESSA
TY AGNES
TY CLARA
TS WARREN
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
MANILA
BANGKOK
HO CHI MINH CITY
ULITHI
YAP
ENEWETAK
KWAJALEIN


WESTERN NORTH PACIFIC
TROPICAL CYCLONES
16 SEP - 31 DEC
TY GAY
STY ELSIE
TY DOYLE
SEOUL
TOKYO
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
TAIPEI
HONG KONG
STY IRMA
TY HAZEN
TY LEE
TS JEFF
TY DOYLE
WAKE
MANILA
SAIPAN
GUAM
TY HAZEN
TS FABIAN
HO CHI MINH CITY
ULITHI
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PALAU IS
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MAJURO
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STY ELSIE
TY LEE
TY KIT
TS JEFF
STY IRMA
105°
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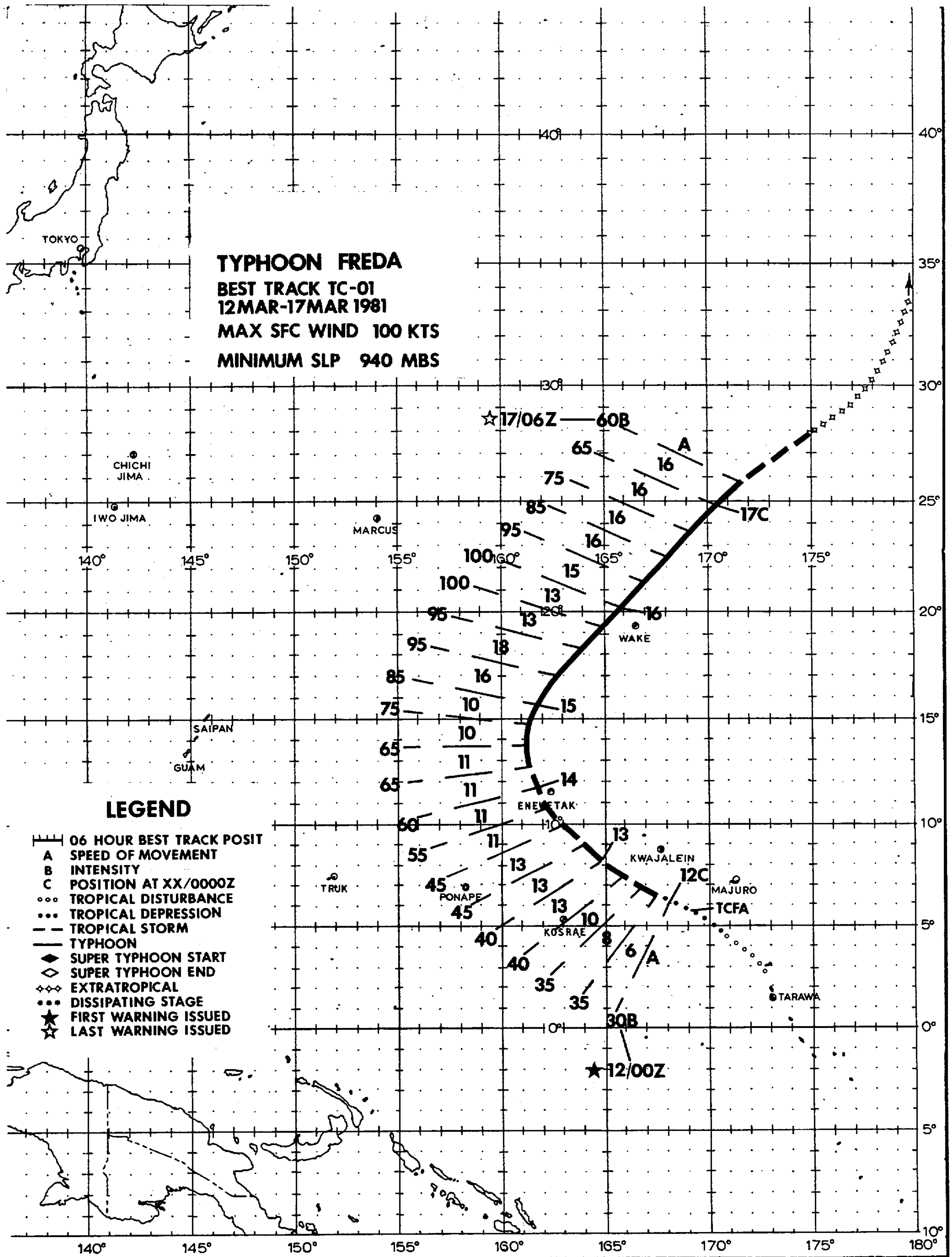
35°
40°



TYPHOON FREDA
BEST TRACK TC-01
12MAR-17MAR 1981
MAX SFC WIND 100 KTS
MINIMUM SLP 940 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO
WAKE
TARAWA
17/06Z
60B
17C
12C
TCFA
30B
12/00Z

Typhoon Freda, the first tropical cyclone of 1981 and only the fourth typhoon since 1959 to occur in March, developed very slowly within the near-equatorial trough that shifted briefly north of the equator in early March.

Remaining quasi-stationary near the Gilbert Islands just north of the equator for nearly three days, the disturbance finally began to move northwestward and developed slowly as it reached higher latitudes. Although the upper-level synoptic pattern with strong unidirectional southeast flow (Fig. 3-01-1) was unfavorable for development, noticeable improvement in the satellite signature led to the issuance of a Tropical Cyclone Formation Alert at 111900Z. The first warning on TD 01 was issued six hours later as the disturbance approached the southern Marshall Islands when synoptic reports and satellite imagery indicated further development.

Beginning with the first warning, JTWC forecasts were consistent in predicting recurvature west of Enewetak Atoll. This track was based on an apparent break in the mid-tropospheric subtropical ridge along 160E between the mid-Pacific high and a large high pressure cell over the Philippine Islands. This break was later confirmed by valuable synoptic data received from reconnaissance aircraft flying to and from the developing cyclone.

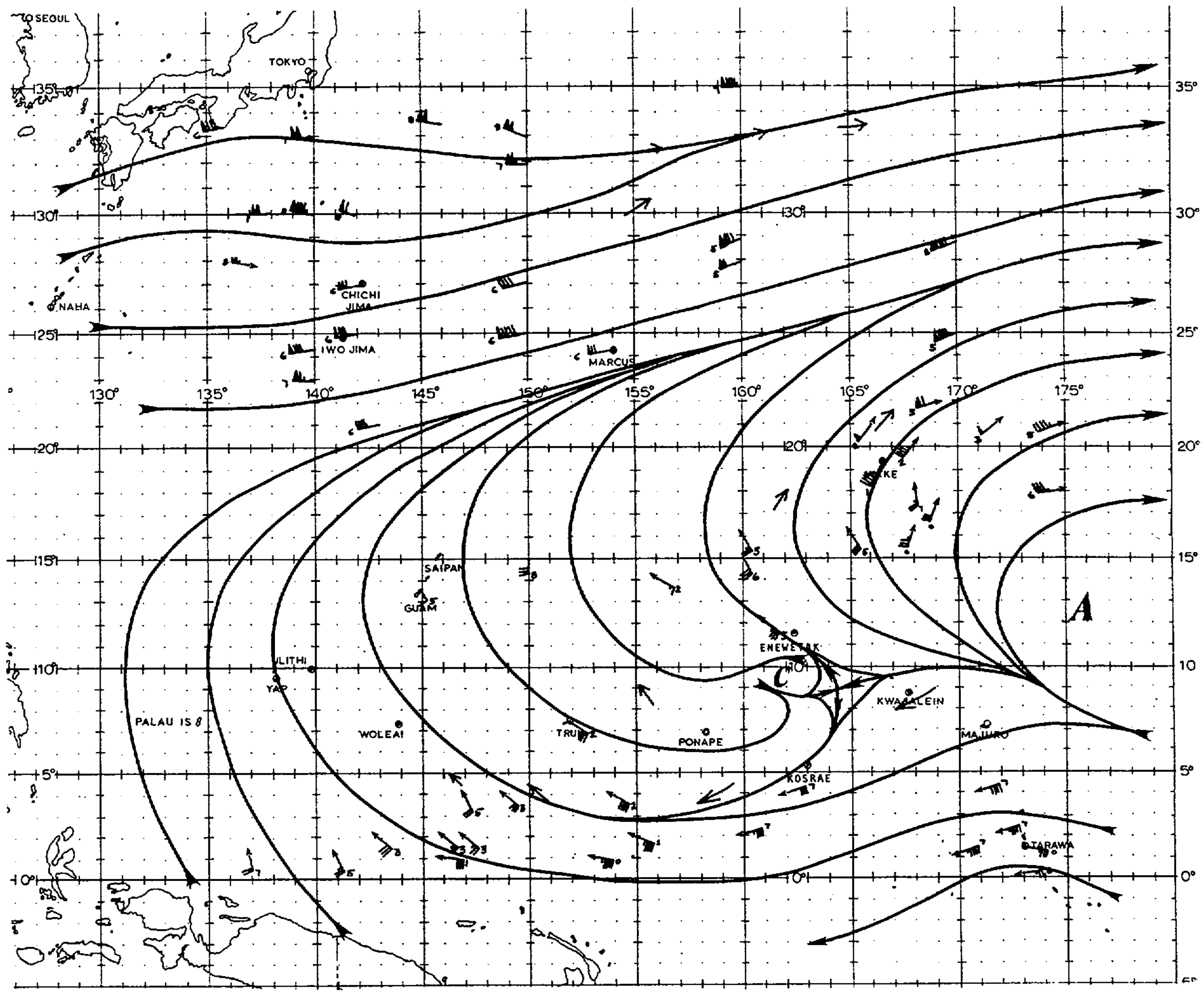


FIGURE 3-01-1. 200-mb streamline analysis at 131200Z. At this time, the flow pattern was still primarily associated with the mid-Pacific ridge with little indication of large-scale outflow over Freda at this level. Wind data are a combination of RAOBS, AIREPS, and satellite derived winds (⟵) and blow-off wind directions (⟵). Wind speeds are in knots.

The strong southeasterly flow aloft resulted in considerable vertical tilt during Freda's northwest track. The 700-mb center was consistently observed 15 to 25 nm (28 to 46 km) north-northwest of the surface center. This poor vertical alignment combined with the absence of strong upper-level outflow channels resulted in her extremely slow intensification. This proved fortunate for Enewetak Atoll which lay directly in Freda's path. Freda passed 15 nm (28 km) west of the Atoll with 55 kt (28 m/sec) sustained winds, considerably less than normal for a disturbance that had developed to tropical storm intensity 48 hours earlier. Although no synoptic observations or damage reports were received from Enewetak, the situation could have been far more disastrous.

In contrast to the extremely slow development during the first three days of her existence, Freda intensified rapidly once north of the ridge axis and in a more favorable upper-level environment (Fig. 3-01-2). Contact with the southwest-

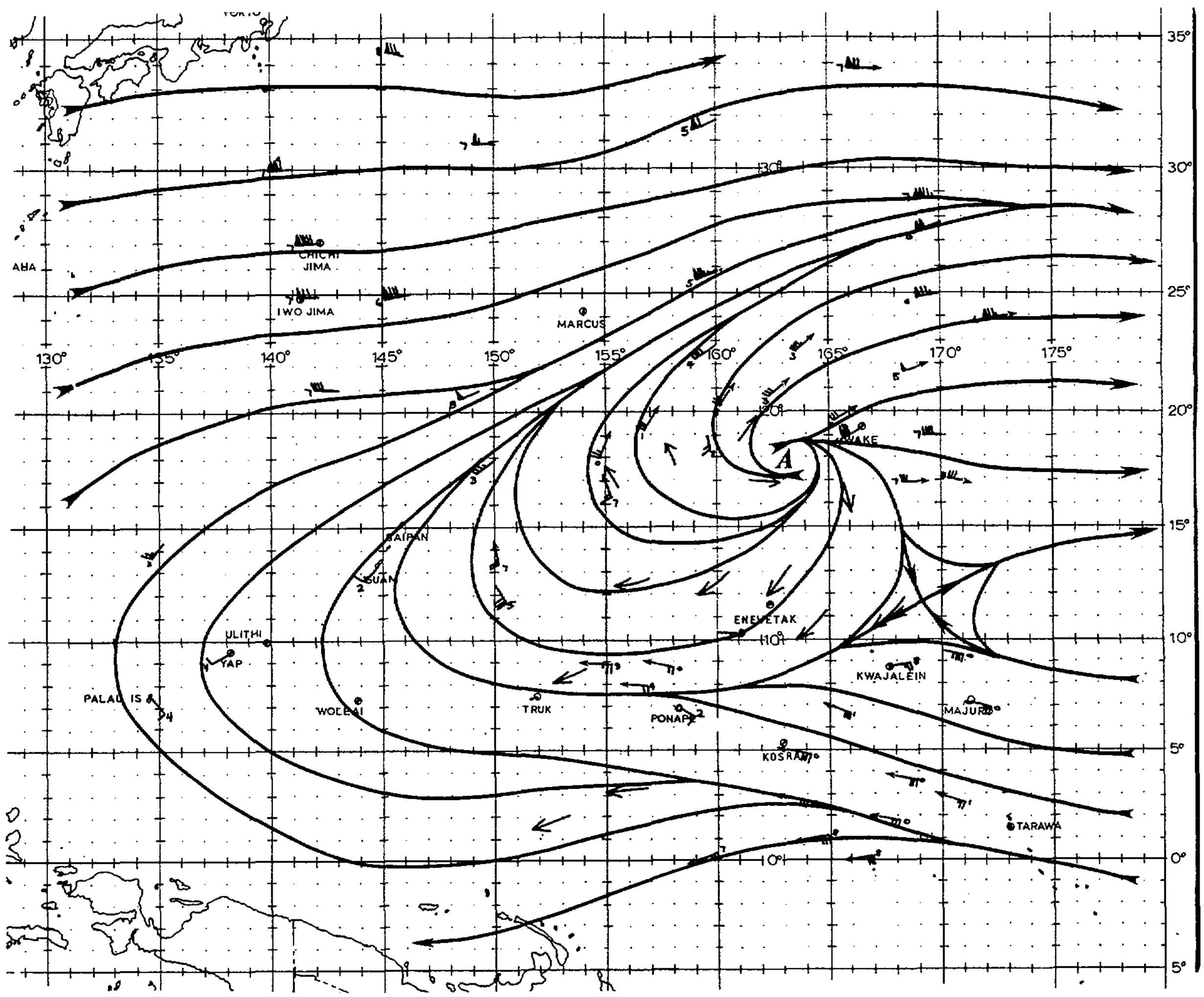


FIGURE 3-01-2. 200-mb streamline analysis at 150000Z depicting a dramatic change in the upper-level flow pattern with the outflow over Freda now the primary feature. The westerly jet has dipped as far south as 25N providing a vigorous outflow channel to the northeast for Freda. Wind data are a combination of RAOBS, AIREPS, and satellite derived winds (◄——ˎ) and blow-off wind directions (←—). Wind speeds are in knots.

erly jet north of her provided a vigorous outflow channel to the north. With multiple outflow channels to the environmental flow, Freda intensified from 65 kt (33 m/sec) to 100 kt (51 m/sec) and deepened from 975 mb to 940 mb within 30 hours (Fig. 3-01-3).

Unlike Enewetak, Freda was at her maximum intensity of 100 kt (51 m/sec) when she passed within 65 nm (120 km) of Wake Island. Wake reported maximum sustained winds of 50 kt (26 m/sec) with gusts to 75 kt (39 m/sec) at 152300Z. Damage to the island's runway and support equipment was extensive, caused primarily by the high surf, estimated to be over 20 feet, generated by Freda's close passage.

As Freda moved further north and approached the core of the jetstream, the strong mid-latitude westerlies responsible for her rapid intensification also caused her eventual weakening. Forty-eight hours after reaching maximum intensity, Freda's convection was sheared off and the low-level circulation moved quickly northward and was absorbed into a developing extratropical low pressure system.

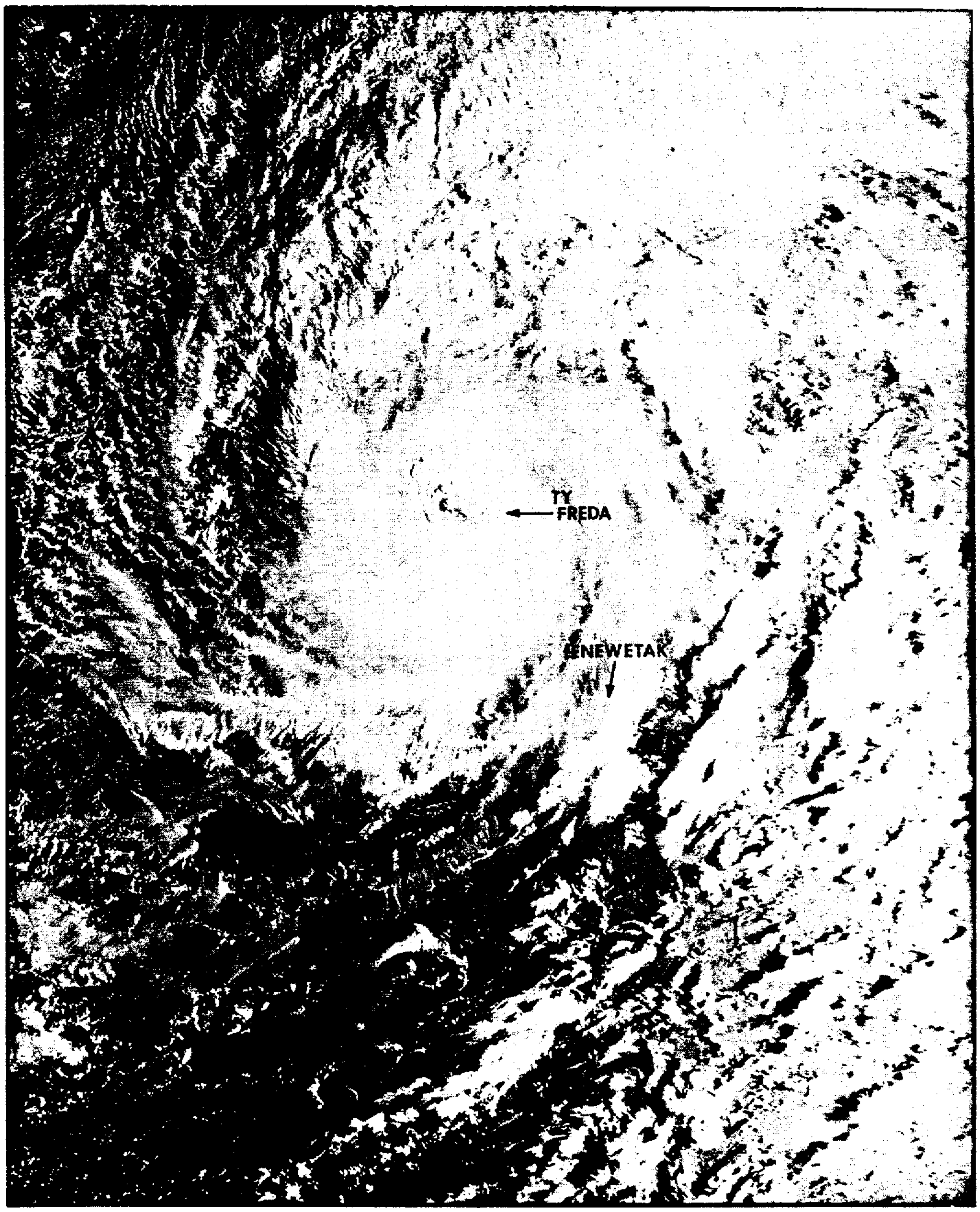
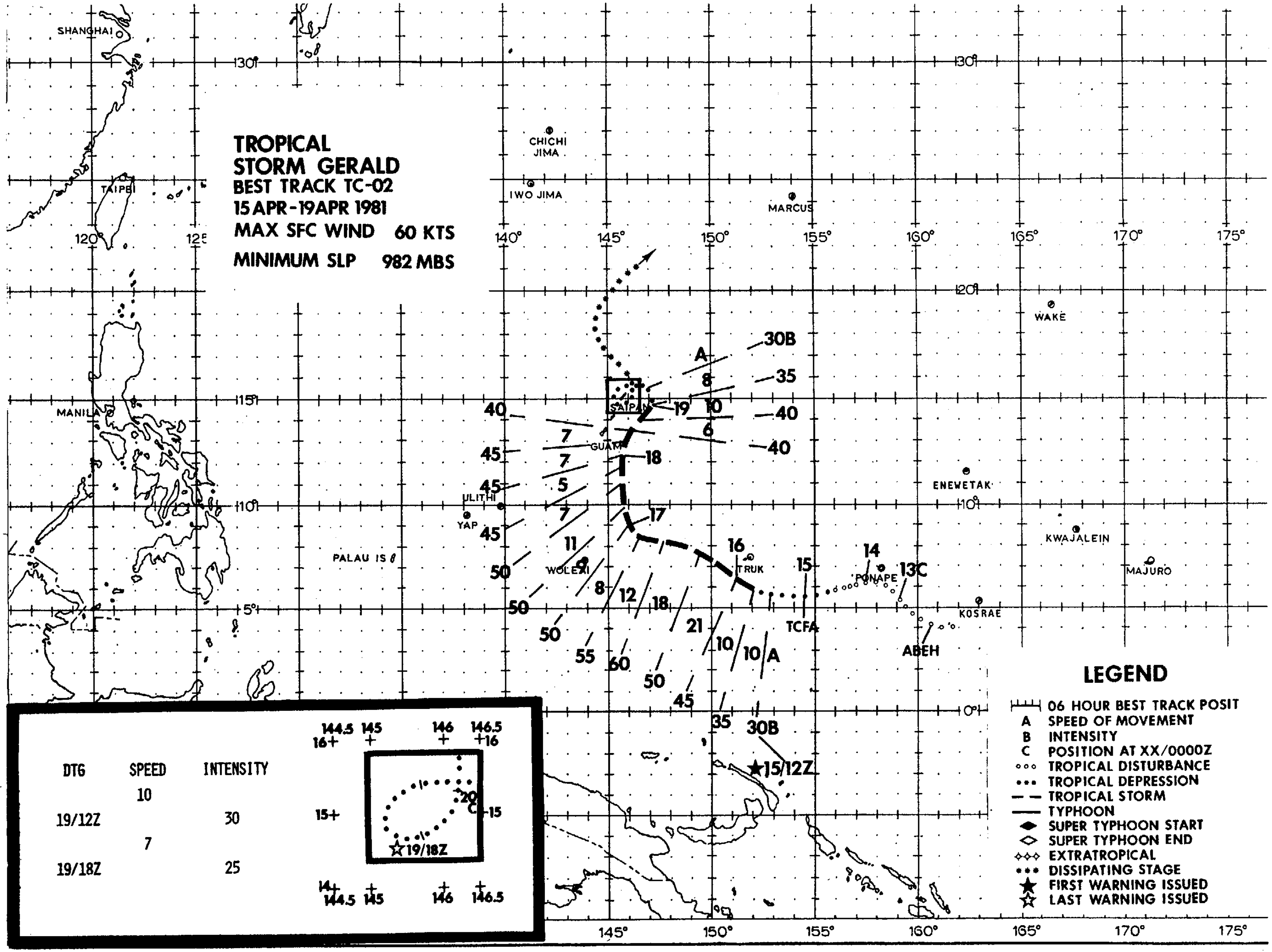


FIGURE 3-01-3. Typhoon Freda at 80-kt (41 m/sec) intensity 390 nm (722 km) southwest of Wake Island, 14 March 1981, 2120Z. (NOAA 6 visual imagery)



TROPICAL
STORM GERALD
BEST TRACK TC-02
15 APR-19 APR 1981
MAX SFC WIND 60 KTS
MINIMUM SLP 982 MBS
SHANGHAI
TAIPEI
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO
TCFA
ABEH
30°
20°
15°
10°
5°
0°
120°
125
140°
145°
150°
155°
160°
165°
170°
175°
30B
35
40
40
A
8
10
19
6
18
17
16
15
14
13C
40
45
45
45
50
50
50
55
60
50
45
35
30B
21
10
10 A
7
7
5
7
11
8
12
18
★15/12Z
DTG
SPEED
INTENSITY
10
19/12Z
30
7
19/18Z
25
144.5
145
146
146.5
16
15
14
20
C
☆19/18Z
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

A developing mid- to uppper-level circulation southeast of Ponape became evident on satellite imagery on 12 April. At this time, the cirrus outflow pattern was extensive and the cloud system displayed good curvature. A surface circulation, however, was not apparent until the 15th following further significant improvement of the satellite signature. A Tropical Cyclone Formation Alert was issued, vice a warning, at 150000Z because island stations in the vicinity of the circulation reported that the minimum sea-level pressure was a still relatively high 1009 mb. Eight hours later a reconnaissance aircraft observed a very tight surface circulation with maximum winds of 30 kt (15m/sec) and a minimum sea-level pressure of 1000 mb. Based on this new information, the first warning on Tropical Depression 02 was issued at 151200Z.

Several factors influenced JTWC to forecast that Gerald would reach typhoon strength. First, upper-level wind analyses showed an extensive upper-level outflow pattern assocated with Gerald. An anticyclone was located near the system's center and outflow was unrestricted and extended well into the Southern Hemisphere. Second, low-level cross-equatorial inflow became fully established by the 15th. Third, reconnaissance aircraft reported 700-mb center temperatures of 21°C. This observation was 11° higher than the environment and higher than temperatures normally observed in a tropical cyclone at Gerald's stage of development. The high amount of latent heat was being released, which usually indicates impending intensification.

The reason that Gerald did not develop as forecast appears to be rooted in a radical change which occurred in the upper-level flow pattern. As previously mentioned, Gerald began with a well-defined upper-level anticyclone that afforded excellent outflow channels in all directions. Steady intensification did occur until 170000Z when a synoptic-scale upper-level anticyclone began developing east of Gerald near 10N 155E. This anticyclone continued to intensify and increase in areal extent as it shifted slowly to the southeast. Gerald's outflow channel to the east became restricted as the south and southeasterly shearing winds aloft increased in strength. As a result, Gerald began weakening as he passed about 70 nm (130 km) to the east of Guam at 180900Z. The Island received between 3 - 5 inches of rain. Andersen Air Force Base reported a minimum sea-level pressure of 1005.7 mb and a maximum wind of 49 kt (25 m/sec) in gusts.

After passing Guam, Gerald's convection continued to shear off to the northeast as the exposed low-level circulation center (Fig. 3-02-1) meandered northwestward where it was eventually absorbed by an extratropical trough moving eastward across the Pacific.

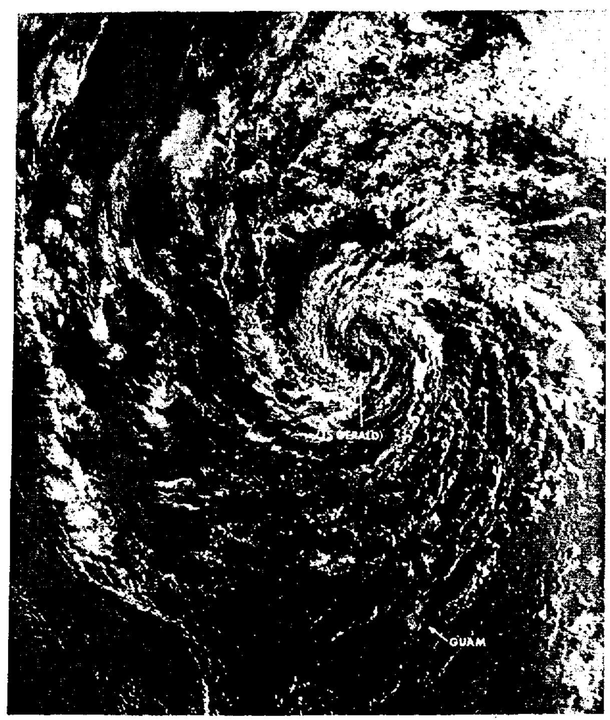


FIGURE 3-02-1. Tropical Storm Gerald as an exposed low-level circulation center north of Guam, 20 April 1981, 2228Z. (NOAA 6 visual imagery)

JTWC's better than average forecasting of Gerald's track was due in no small part to the extensive 500-mb synoptic track data provided by the 54th Weather Reconnaissance Squadron. Figures 3-02-2 through 3-03-5 show the evolution that occurred in the mid-level steering flow as indicated by aircraft data.

Available synoptic data, although sparse, suggested that the subtropical mid-tropospheric ridge was weak north of the developing Gerald. Thus, the initial forecast track called for recurvature well to the west of Guam. Aircraft data on the 15th defined a small anticyclone north of Guam (Fig. 3-02-2) which supported the subsequent forecast of passage southwest of Guam before recurvature. Because this was the first time this cell had been analyzed, there was no way to determine if the cell was moving or quasi-stationary. The 500-mb data 24 hours later (Fig. 3-02-3) showed that the major break in the ridge still existed to the west of Guam; thus, recurva-

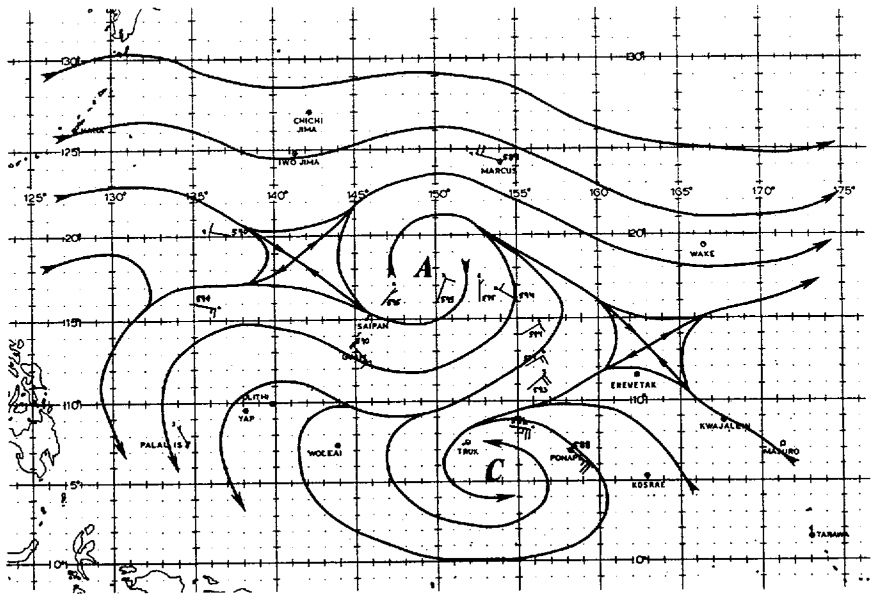


FIGURE 3-02-2. The 151200Z April 1981 500 mb streamline analysis. Wind data are a combination of RAOBS, AIREPS, and satellite derived winds (←⟍). Wind speeds are in knots.

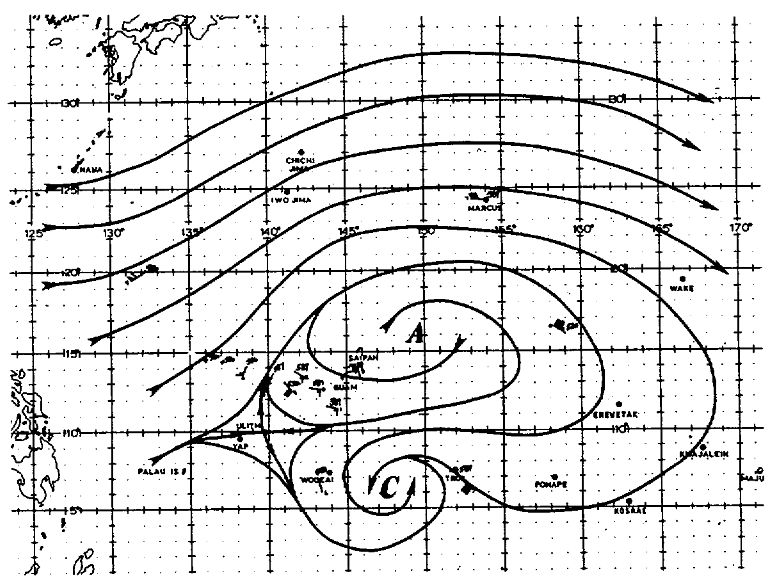


FIGURE 3-02-3. The 161200Z April 1981 500-mb streamline analysis. Wind data are a combination of RAOBS, AIREPS, and satellite derived winds [←⟍]. Wind speeds are in knots.

ture west of Guam still appeared to be the best forecast. By 171200Z, however, it became apparent that the anticyclone north of Guam had shifted farther to the east, allowing the break in the ridge to re-orient itself north of Guam (Fig. 3-02-4). At that time, the forecast track was altered to call for passage east of Guam, and, indeed, post-analysis shows that Gerald had actually begun to follow a more northward track about 12 hours earlier. The mid-level analysis at 181200Z, which combines both 400 and 500-mb aircraft data, shows Gerald's mid-level circulation being absorbed by the long wave trough (Fig. 3-02-5).

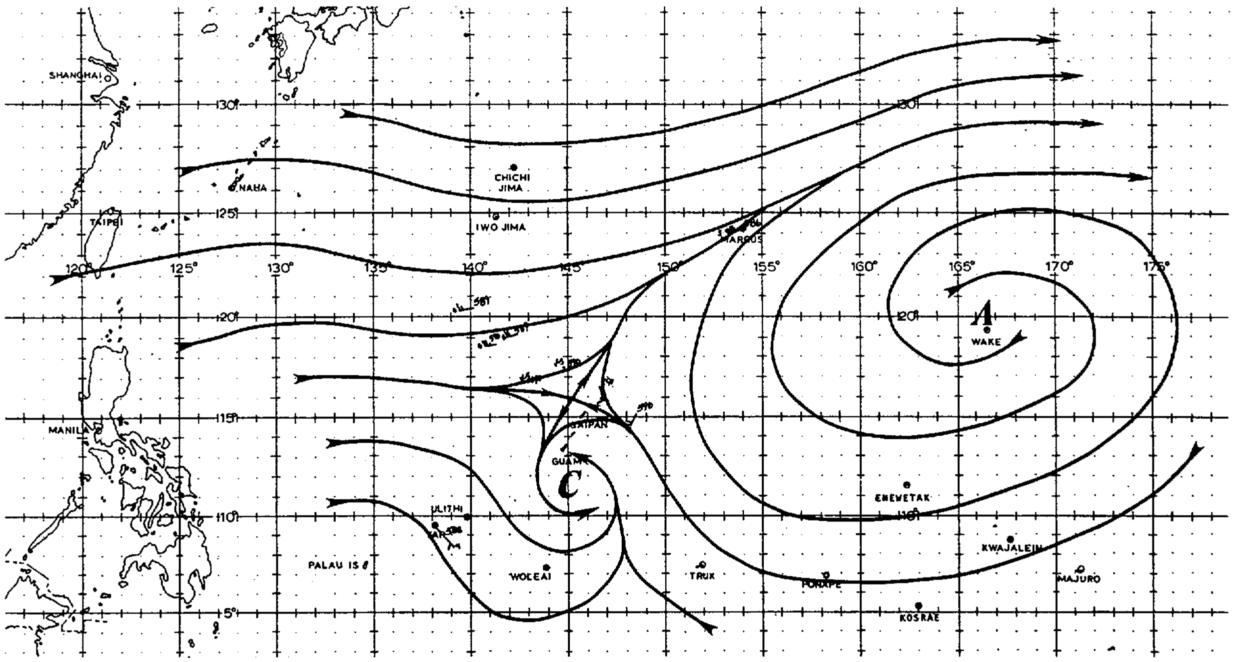


FIGURE 3-02-4. The 171200Z April 1981 500-mb streamline analysis. Wind data are a combination of RAOBS, AIREPS, and satellite derived winds (◄──). Wind speeds are in knots.

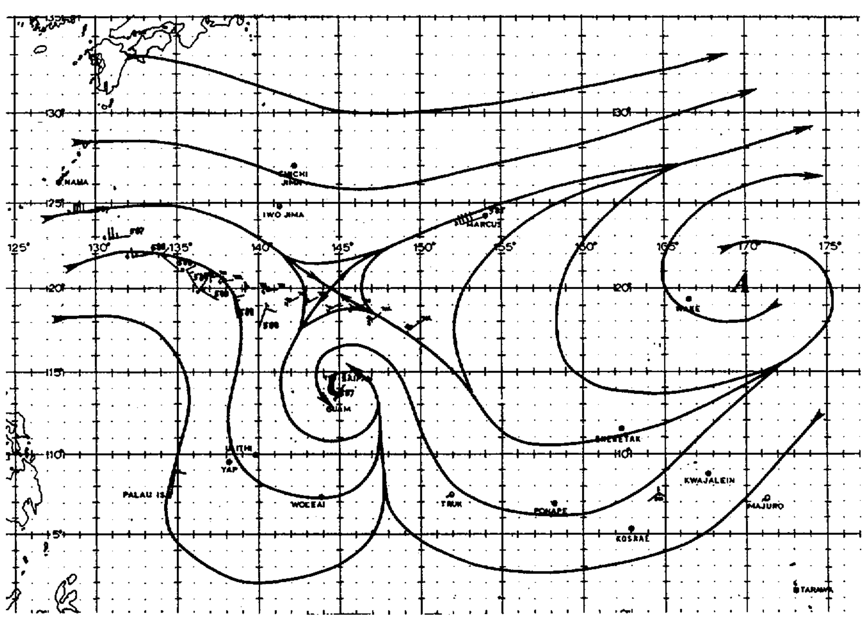
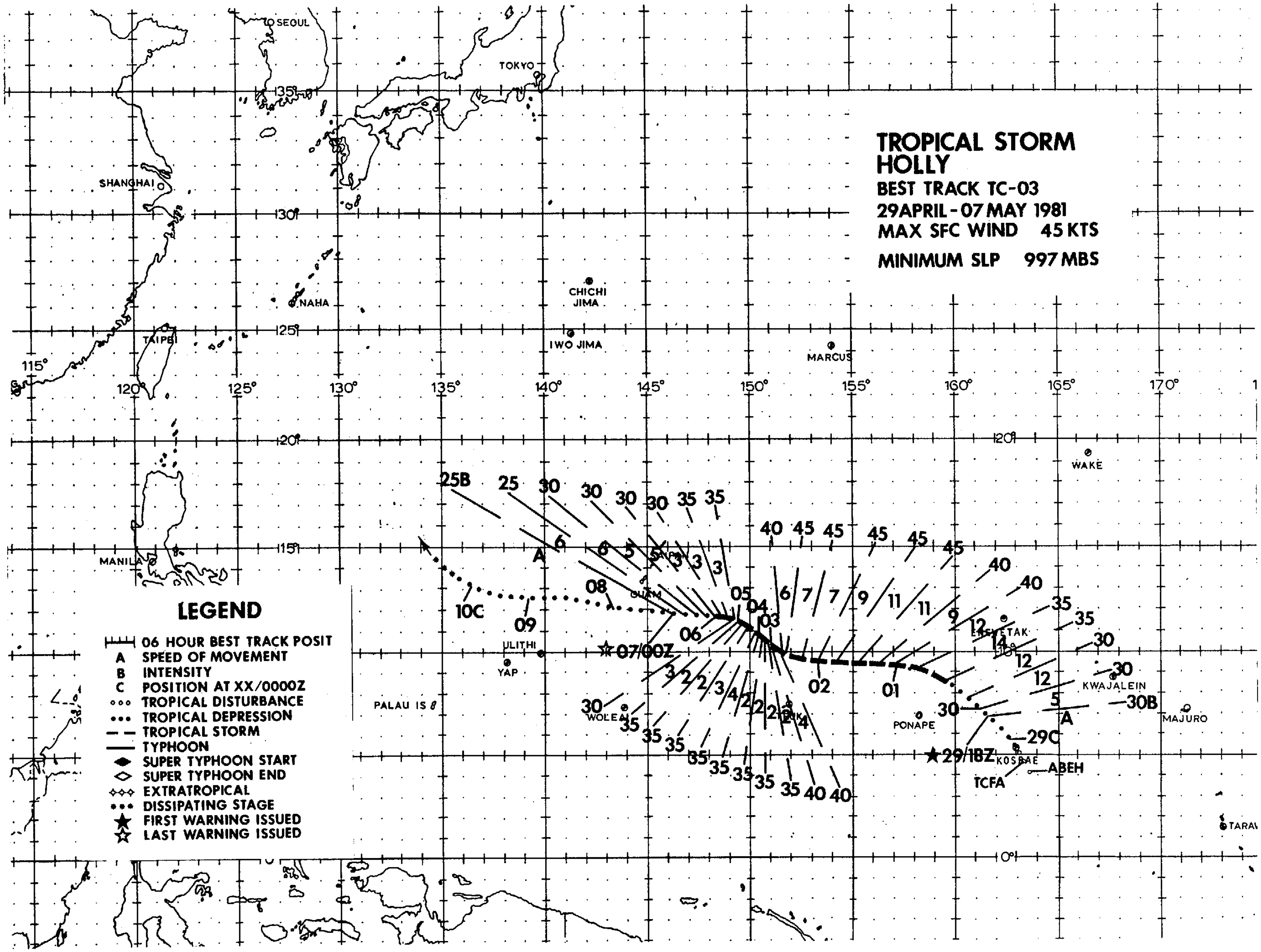


FIGURE 3-02-5. The 181200Z April 1981 mid-level streamline analysis based on 400- and 500-mb aircraft reconnaissance data.



TROPICAL STORM
HOLLY
BEST TRACK TC-03
29APRIL - 07 MAY 1981
MAX SFC WIND 45 KTS
MINIMUM SLP 997 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
TAIPEI
MANILA
WAKE
ULITHI
YAP
PALAU IS
GUAM
WOLEAI
PONAPE
KWAJALEIN
MAJURO
KOSRAE
TARAWA
07/00Z
29/18Z
TCFA
ABEH
115°
120°
125°
130°
135°
140°
145°
150°
155°
160°
165°
170°

Development of Tropical Storm Holly followed a ten-day period of relative calm in the tropical northwest Pacific Ocean. Holly was interesting in several ways during her lifetime. Southern Hemisphere interaction, intensity fluctuations, weak mid-level steering flow, and strong upper-level shear will be discussed in relation to Holly's development and dissipation.

The source for the initial energy impulse in the development of TD-03 is an interesting point for speculation. A review of satellite imagery back to 21 April showed that varying amounts of convection existed almost continuously in the region of 5.0N from 160.0E to 165.0E from 211200Z to 260000Z. Satellite data suggest that this convection was related to a fairly active convective region just south of the equator (5.0-10.0S, 160.0E-175.0W). By 230000Z, satellite imagery showed that the southern hemisphere tropical system was interacting vigorously with a rather strong mid-latitude system. At the same time, the northern hemisphere convection increased. Although again weaker, some curvature in the convective pattern was noted by 250000Z, and a weak, broad low-level circulation developed by 251200Z near 4.0N 169.0E. This circulation was not analyzed consistently prior to Holly's formation. Sparsity of data and weakness of the circulation may have prevented detection of the circulation in synoptic data. Undisturbed easterlies existed in the area prior to development of the low-level circulation center. The surface/gradient level analysis showed cross-equatorial interaction, and with the evidence from satellite data, it appears that TD-03 was initiated through interaction with a southern hemisphere system.

The initial satellite alert by Det 1, 1WW on the disturbance which produced Holly was issued at 260000Z. Continued improvement of the convective signature led to issuance of a Tropical Cyclone Formation Alert 280255Z. At 290153Z, the first reconnaissance aircraft investigative mission was flown into TD-03. TD-03 was well defined at this time, and the circulation was closed easily at the surface and 1500-ft (457 m) level. The extrapolated central pressure was 1003 mb, while the maximum observed surface wind was 25 kt (13 m/sec). By 282106Z, the circulation was also evident on satellite imagery as an exposed low-level circulation (Fig. 3-03-1). A Dvorak satellite intensity analysis showed a weakening trend for the past 24 hours and forecast the trend to continue.

Early fluctuations in the satellite-derived intensity analysis produced the first interesting characteristic associated with TD-03. By 300000Z, a steady trend toward intensification was established. By 010300Z May 1981, both aircraft and satellite data suggested possible development of a banding-type eye. It certainly appeared that Holly was on the verge of becoming a major tropical cyclone; however, during the next 24 hours, Holly's satellite signature again weakened. A maximum intensity of 45 kt (23 m/sec) was reached at 011200Z and was maintained for 24 hours before the final weakening trend started (Fig. 3-03-2). From this point, Holly gradually weakened although there were continued fluctuations in the amount and intensity of convection.

Figure 3-03-1. Exposed low-level circulation of TD 03 approximately 5 hours prior to aircraft investigative mission, 28 April 1981, 2106Z. (NOAA 6 visual imagery)

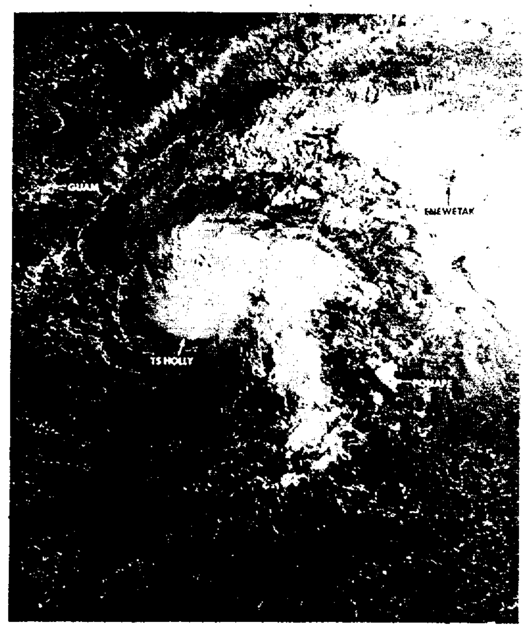


Figure 3-03-2. Tropical Storm Holly during the period of maximum intensity, 1 May 1981, 1238Z. (NOAA 6 visual imagery)

A second interesting characteristic associated with Holly was her extremely slow movement. From 300000Z through 020000Z, Holly averaged a forward speed of 11 kt (20 km/hr); from 020000Z through 030000Z, the average speed was 6 kt (11 km/hr); and from 030000Z through 060000Z, Holly's average speed was slightly less than 3 kt (6 km/hr). Due to sparseness of data, it is impossible to state with complete certainty why Holly slowed so dramatically. The surface/gradient level and 500 mb analysis, however, offer possible explanations. At the surface/gradient level, Holly's path was across the main stream of the northeast trade regime. The stream was significantly stronger on the north side of Holly, and this "crosswind" apparently helped in the retardation of forward speed as far as the lower tropospheric steering was concerned. When Holly finally began to accelerate, the trade winds were deflected more easterly and more toward a direction parallel to Holly (Fig. 3-03-3).

The second possible explanation for the sudden deceleration and extremely slow movement lies in the mid-troposphere. Wind analyses at 500 mb consistently showed weak steering surrounding the cyclone's environment. The weak flow was due in part to a cut-off low which was located near 30N and between 155E and 165E during the period of Holly's slow movement. The gradient between this cut-off low and the ridge placed major wind currents well northeast and northwest of Holly's 500 mb cyclone. This gradient slackened just north of Holly and winds that were not considered storm induced generally were 10 kt (5 m/s) or less. This was clearly evidenced by reconnaissance tracks flown

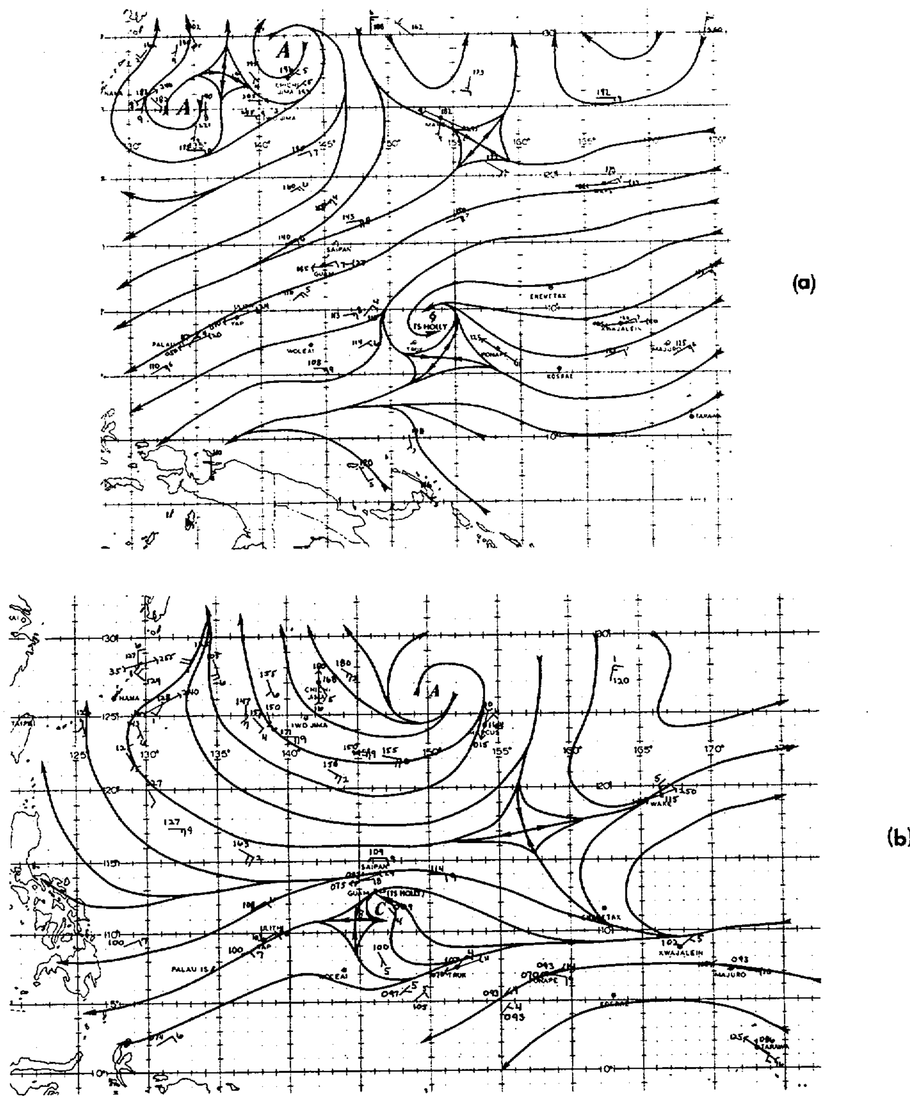


Figure 3-03-3. Surface (⟶)/gradient (⟵) level analyses: (a) at 020000Z which was typical during Holly's period of slow movement and (b) at 070000Z showing the pattern as Holly began to accelerate. Winds are in knots.

north of Holly. Furthermore, these same analyses showed Holly remained south of the ridge in the weak easterly current. A break in the ridge never occurred in suitable position to allow Holly any other possibility (Fig. 3-03-4).

The final interesting characteristic was Holly's failure to develop a significant outflow pattern. At 010000Z and again at 040900Z, Holly appeared to be developing a good outflow channel to the northeast. On each occasion, however, the outflow was not maintained and a southwest outflow channel never developed. The 200 mb wind pattern was fairly strong throughout Holly's lifetime with a large amplitude ridge anchored off the Asian coast. The position of this ridge forced additional pressure on the preexisting southwesterly subtropical jet which had been lying just west of Holly. Convergence of the two upper level wind streams induced a 40 to 60 kt (21-31 m/s) wind maximum just northwest of Holly's upper level center (Fig. 3-03-5). This persistent feature eroded Holly's convective organization and 062125Z satellite imagery showed a totally exposed low level circulation with the formerly associated convective 50 nm (93 km) east of the center. Once this shearing took place, Holly eventually spun down and dissipated over open tropical water.

Tropical Storm Holly never reached typhoon strength as originally expected. The intensity fluctuations, weak mid-level steering, and shearing flow at both low- and upper-tropospheric levels all contributed to Holly's eventual demise.

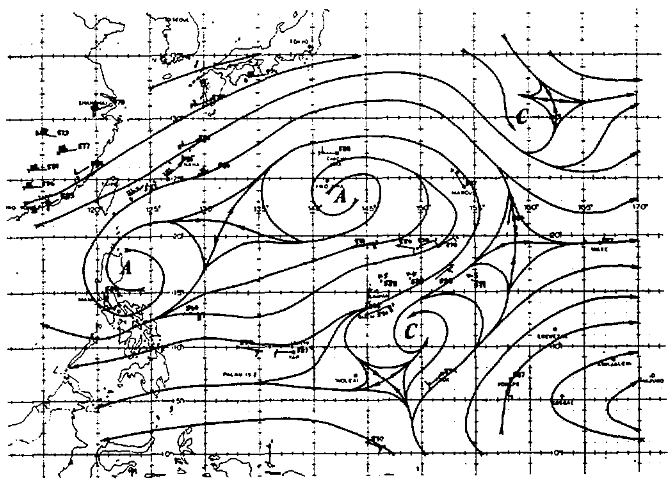


Figure 3-03-4. 500 mb streamline analysis at 051200Z. This analysis was typical of the pattern existing during Holly's lifetime. Wind data are a combination of RAOBS, RECON, and satellite-derived winds (←). Wind speeds are in knots.

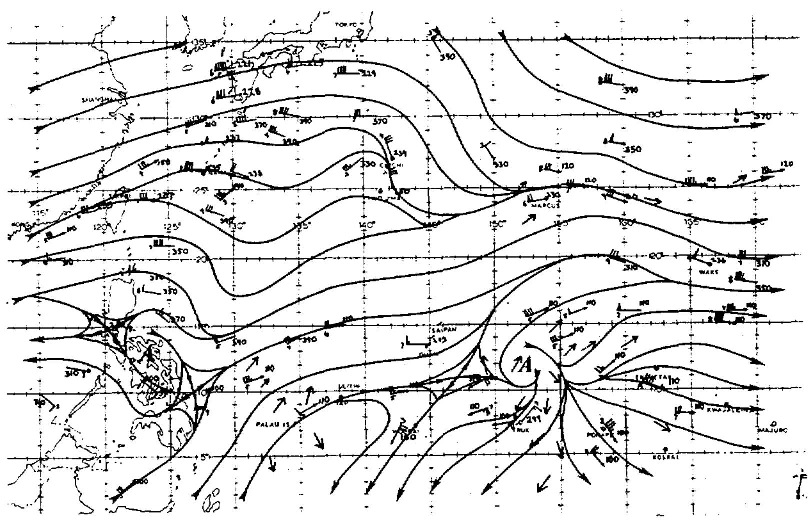
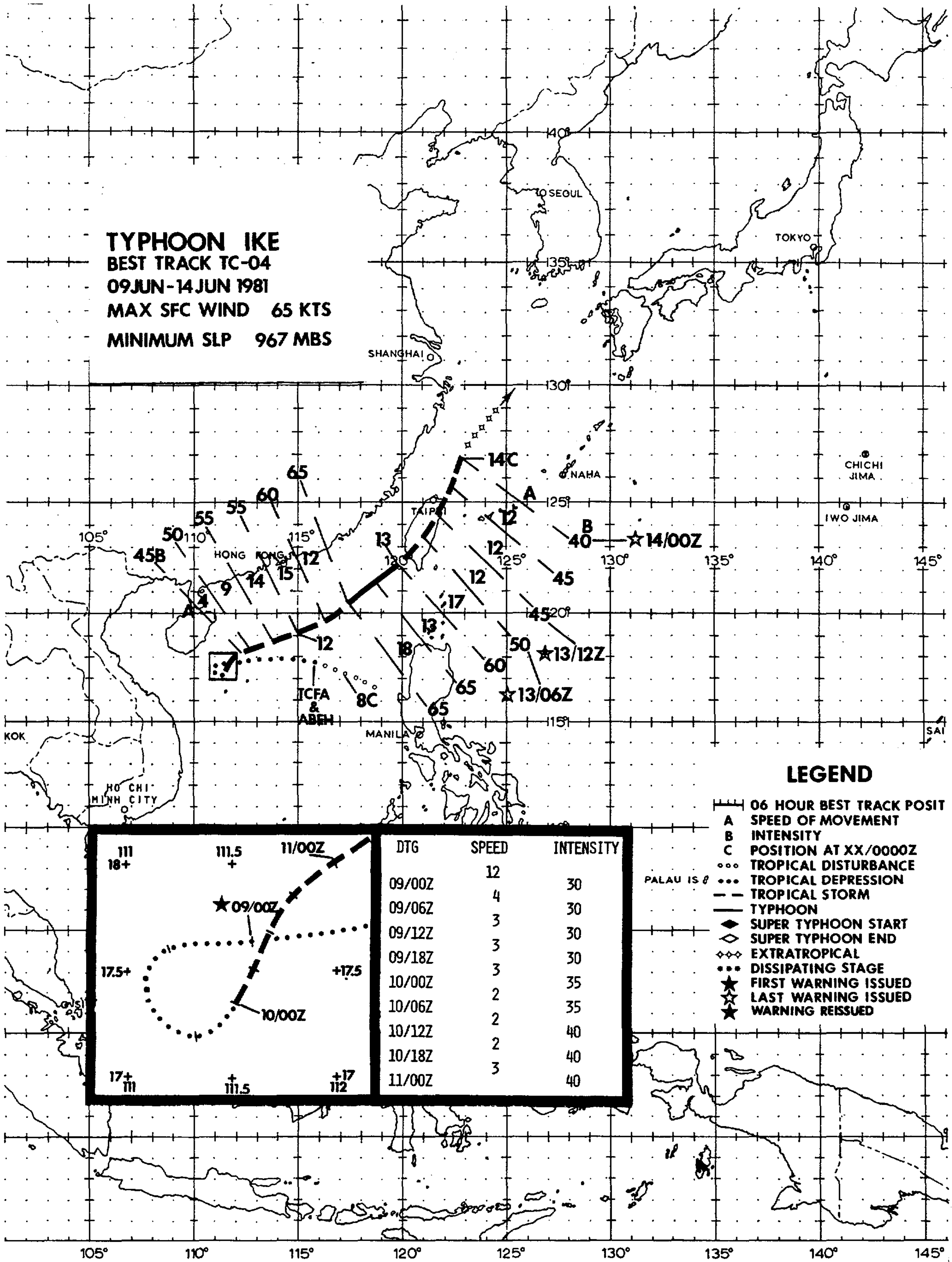


Figure 3-03-5. 200 mb streamline analysis at 031200Z. Wind data are a combination of RAOBS, AIREPS, and satellite-derived winds (←) and blow-off wind directions (←). Wind speeds are in knots.


TYPHOON IKE
BEST TRACK TC-04
09JUN-14JUN 1981
MAX SFC WIND 65 KTS
MINIMUM SLP 967 MBS
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MANILA
HO CHI MINH CITY
PALAU IS
TCFA & ABEH
14/00Z
13/12Z
13/06Z
8C
14C
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
WARNING REISSUED
09/00Z
10/00Z
11/00Z
DTG SPEED INTENSITY
09/00Z 12 30
09/06Z 4 30
09/12Z 3 30
09/18Z 3 30
10/00Z 3 35
10/06Z 2 35
10/12Z 2 40
10/18Z 2 40
11/00Z 3 40
105° 110° 115° 120° 125° 130° 135° 140° 145°

Typhoon Ike was one of several recent examples of tropical cyclone development over the South China Sea during the end of the monsoonal transition season. Several characteristic features have often been observed by JTWC forecastörs. Both in the tropical cyclogenesis and during the lifetime of the system as a tropical storm and typhoon, These include:

1) The system becomes initially evident on satellite imagery as a mid-tropospheric monsoonal depression with fluctuating associated convection.

2) The system is often initially slow to develop a closed surface circulation, despite persistent associated convection.

3) The system is also slow to intensify, even after evidence of surface development.

4) The system frequently maintains a broad asymmetrical wind distribution throughout its life cycle.

5) The system is usually short-lived, with repeated interactions with nearby land masses.

Ike was typical of this pattern and displayed all the above characteristics during his development. The first evidence that Ike may develop occurred on June 8th, as the 080000Z surface analysis indicated relatively lower surface pressures just west of the Philippine Islands. Based on this data, and satellite imagery which indicated continued convective support, a Tropical Cyclone Formation Alert (TCFA) was issued at 080600Z.

Ike had a difficult time persisting as a tropical cyclone as steady upper-level shear displaced Ike's 700 mb center as much as 60 nm (111 km) southwest of the surface circulation. Finally, on 9 June, Ike moved into an area of decreased shear aloft, which allowed vertical alignment to intensify the system. The first warning was issued at 090000Z and Ike reached tropical storm intensity at 100000Z (Figure 3-04-1). In the meantime, a mid-latitude, mid-tropospheric trough over Asia continued propagating eastward, and Ike accelerated to the northeast, steered by the increasingly strong southwesterly flow. Intensification continued during the acceleration process.

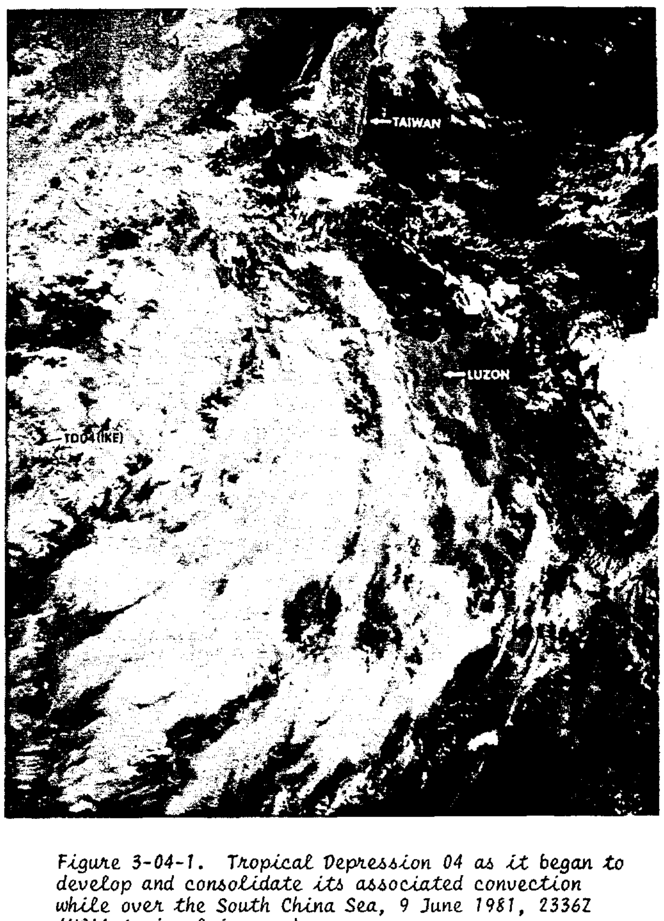


Figure 3-04-1. Tropical Depression 04 as it began to develop and consolidate its associated convection while over the South China Sea, 9 June 1981, 2336Z (NOAA 6 visual imagery).

Only one aircraft reconnaissance mission was able to penetrate Ike due to geographical and political constraints. This aircraft fixed Ike near the storm's peak intensity just prior to landfall over Taiwan. The crew reported that Ike's minimum sea-level pressure had decreased to 967 mb, 700 mb winds of over 60 kts (111 km/hr) were measured, and aircraft radar indicated partial eyewall formation. Based on the above data, it was concluded in post-analysis that Ike reached minimal typhoon intensity near this time. Less than 12 hours later, Ike moved ashore over southwestern Taiwan.

Ike weakened significantly while traversing Taiwan but emerged over open water north of Taipei around 131500Z with a small, persistent knot of central convection. This area of convection dissipated as Ike became an extratropical low at 140000Z (Figure 3-04-2).

Subsequent press releases reported minor damage over Taiwan due to heavy rains and flooding which accompanied Ike. Eight storm-related fatalities were reported, four from Taiwan and four from the Philippine Islands.

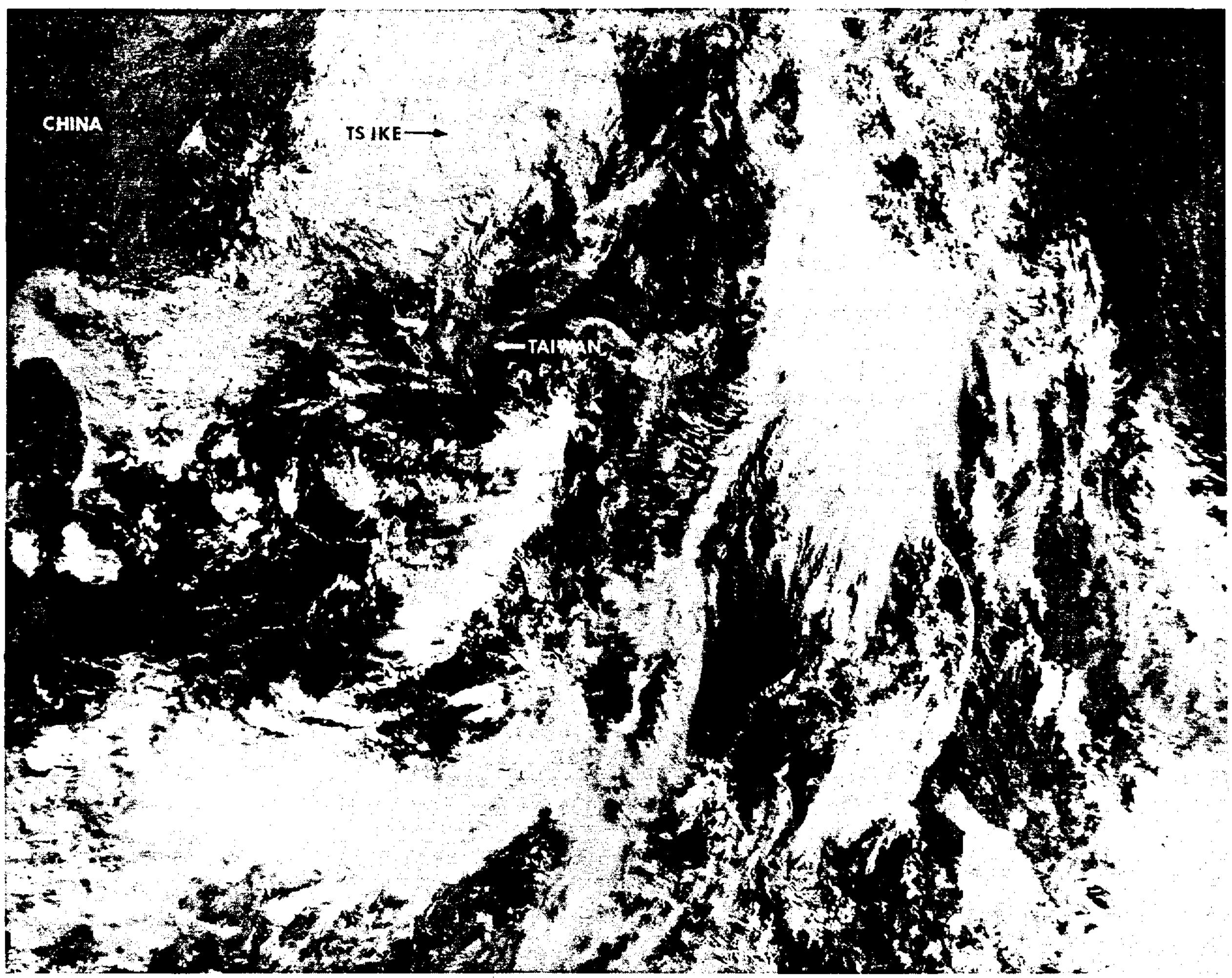


Figure 3-04-2. Tropical Storm Ike as a partially exposed low-level circulation as he began extratropical transition, 13 June 2245Z (NOAA 6 visual imagery).

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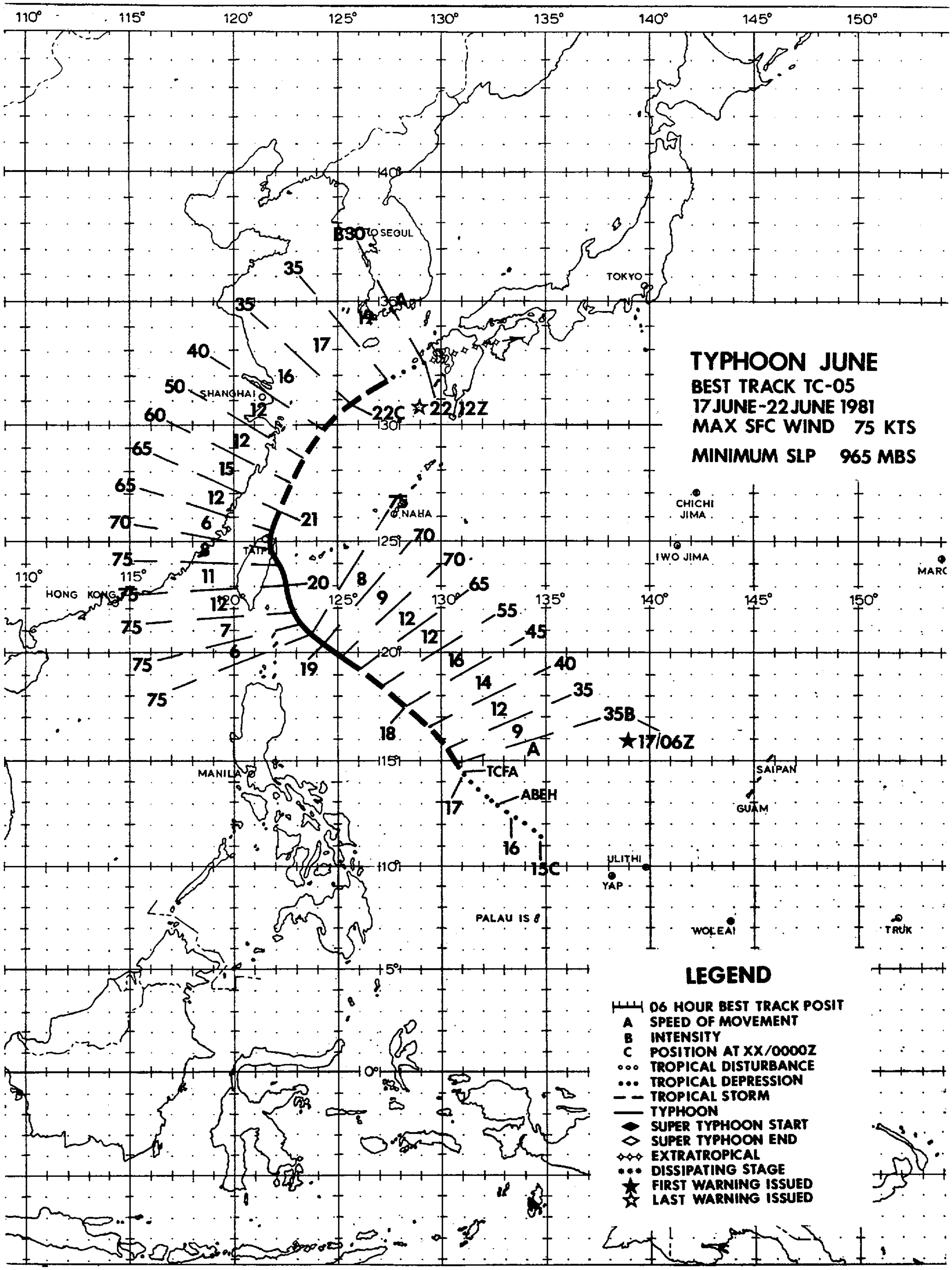

TYPHOON JUNE
BEST TRACK TC-05
17 JUNE-22 JUNE 1981
MAX SFC WIND 75 KTS
MINIMUM SLP 965 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
TCFA
ABEH
★17/06Z
☆22/12Z
22C
15C
35B

The process for genesis of tropical cyclones through interaction with a tropical upper tropospheric trough (TUTT), (Sadler, 1976), was evident during the early development stages of Typhoon June. A TUTT was established over the Philippine Sea early in June leading to the generation of a tropical disturbance over the Palau Islands.

On the 13th of June a cell within the TUTT was observed on satellite imagery northeast of the disturbance resulting in improved organization of the disturbance as the TUTT cell tracked westward. Surface synoptic reports indicated no pre-existing circulation on the surface associated with this disturbance. The general flow pattern was converging in the area of the disturbance, then continuing northwestward into Typhoon Ike.

By the 15th the TUTT cell was northwest of the disturbed area and the potential for development of a tropical cyclone was greatly improved. The area of disturbance was optimally positioned with respect to the TUTT cell, i.e. under an upper level divergent area which served initially as an outflow mechanism. Nevertheless, progress in the development of the cyclone was very slow. Aircraft reconnaissance on the 15th indicated that a weak circulation was located 200 nm north of the Palau Islands.

Late on the 16th satellite data indicated an outflow center was beginning to form which prompted JTWC to issue a formation alert at 170100Z. The disturbance then developed its outflow aloft and banding features were evident on satellite imagery of 170600Z. At that same time aircraft reconnaissance also found that the disturbance had tropical storm strength winds. Subsequently, the first warning on Tropical Storm June was issued.

A 500 mb anticyclone was positioned over the Ryuku Islands with the ridge axis extending over much of China at the time the first warning was issued. The anti-cyclone remained virtually stationary as June tracked northwestward toward Taiwan. During the first 24 hours after the initial warning June did accelerate, but slowed again to her original speed the following 24 hours. The area in which the acceleration occurred was practically void of wind data at the 500 mb level and therefore no suitable explanation can be made for this occurrence.

It is interesting to note that the TUTT cell which helped form June moved ahead of her along a parallel track until she hit Taiwan. June maintained a position southeast of the TUTT cell throughout this period. Further, June intensified to a maximum of 75 kt (39 m/s) while tracking behind the TUTT cell. Satellite imagery at 191029Z (Fig. 3-05-1) showed Typhoon June at her maximum intensity.

FIGURE 3-05-1. *Satellite imagery at 191029Z of Typhoon June after attaining a maximum intensity of 75 kt (39 m/sec). (NOAA 6 infrared imagery)*

June hit Taiwan with winds of 75 kt (39 m/sec). Radar observations at Hua-Lien (WMO 47918) provided essential information to JTWC when June began to deviate from a northward direction toward a point 40 nm (74 km) southeast of Taipei. Figure 3-05-2 is a picture of the radar presentation taken at Hua-Lien at 0500Z on the 20th (photograph courtesy of the Central Weather Bureau, Taipei, Taiwan), when June had an intensity of 75 kt (39 m/sec) 9 hours before landfall.

June was forecast to recurve in all but two warnings. The initial reason for recurvature was based on a 500 mb trough that was expected to move over Eastern China, with the anticyclone over the Ryuku Islands moving eastward. As June neared Taiwan it was apparent that these forecast upper air movements had not taken place. June's forecast track was then changed, for two warnings, to reflect the strength of the anticyclone north of her and indicating a more westward track with landfall over China.

Another reason for the change in the forecast track was the lack of a large cirrus plume extending to the northeastward from June. Typically, several hours, or days, in advance of the event, a cirrus plume is seen to extend northwestward from a tropical cyclone that will soon recurve. The plume generally extends far downstream in the direction of the upper level winds, which greatly influence the direction and speed of the tropical cyclone after recurvature. June did not exhibit a cirrus plume either before or after recurvature.

Later upper air data indicated that a new anticyclone formed over China at 500 mb with a resultant weakening in the ridge between the anticyclones over China and the Ryukyu Islands. Recurvature was again forecast because of this change at 500 mb.

June began to weaken gradually after recurvature. The 500 mb anticyclone that had formed over China and allowed June to recurve, moved southward as a trough approached China's coast. As June neared Japan, she began to interact with a weak frontal system extending southwestward and entrain cold air supplied by the trough. At 1200Z on the 22nd the final warning was issued on June as she became extratropical before tracking over Kyushu.

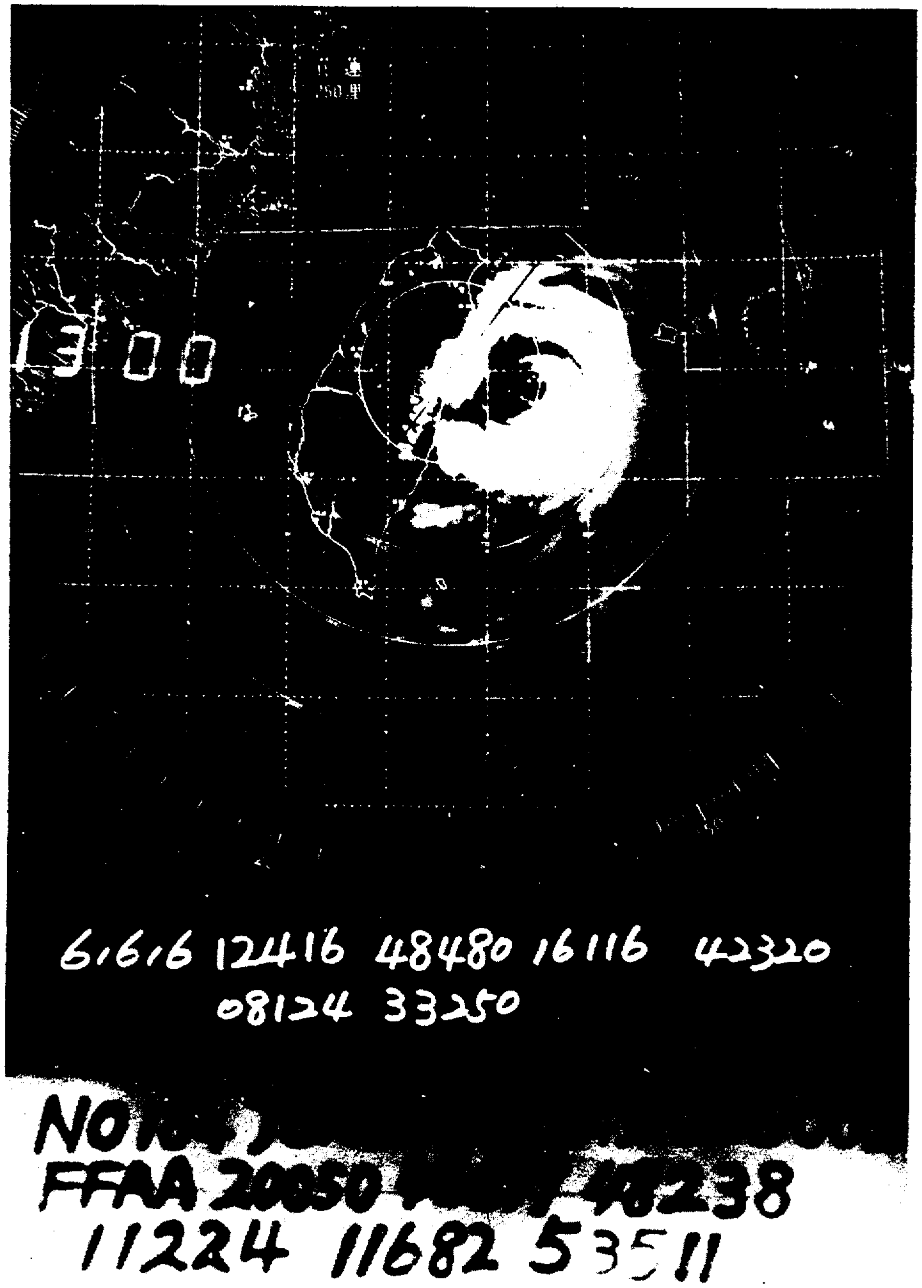
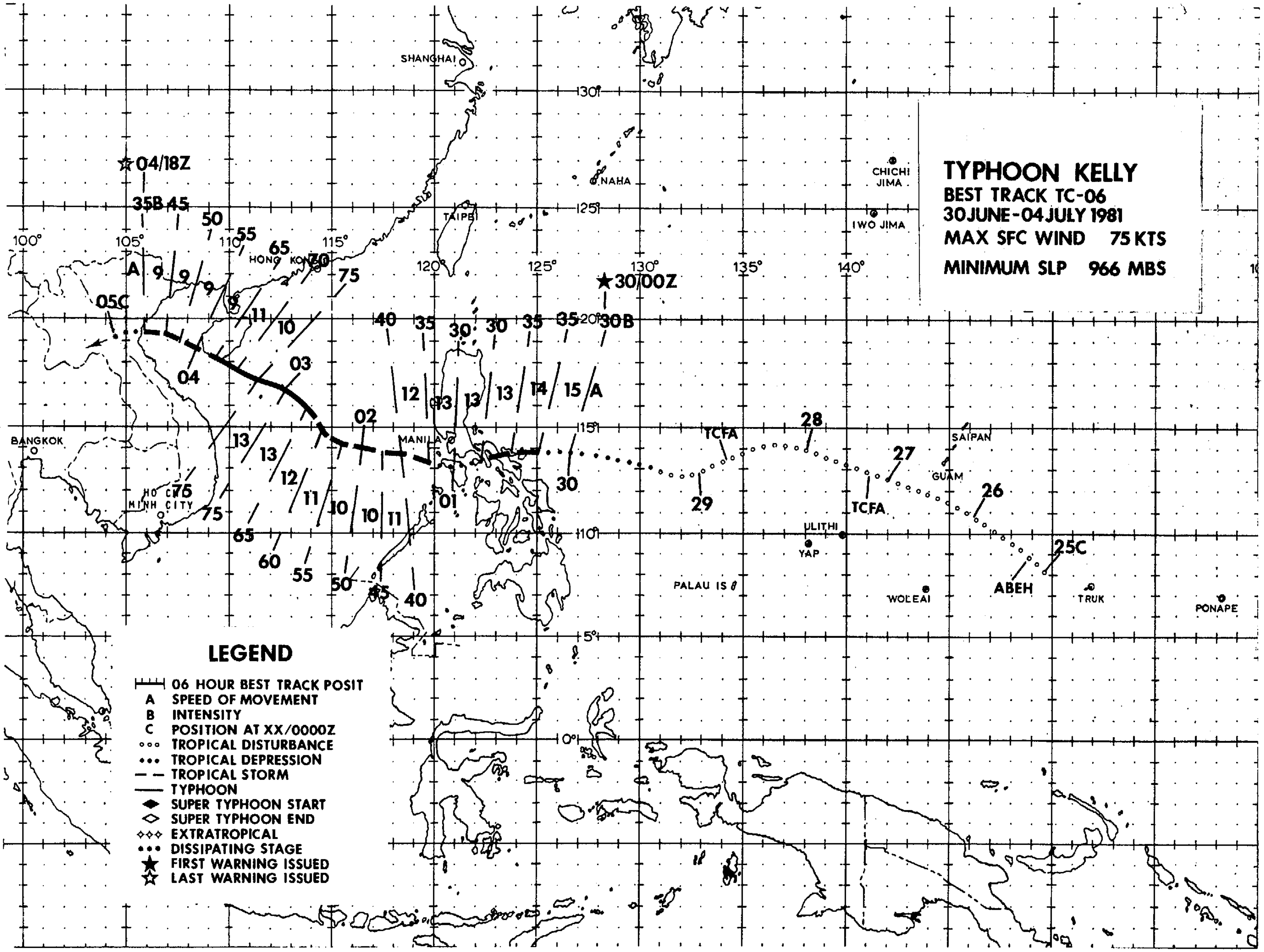


FIGURE 3-05-2. *Typhoon June as seen by radar at Hua-Lien, 20 June 1981, 0500Z. (Photograph courtesy of the Central Weather Bureau, Taipei, Taiwan.)*


TYPHOON KELLY
BEST TRACK TC-06
30 JUNE - 04 JULY 1981
MAX SFC WIND 75 KTS
MINIMUM SLP 966 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
04/18Z
30/00Z
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
TCFA
ABEH
100°
105°
110°
115°
120°
125°
130°
135°
140°

The disturbance which became Typhoon Kelly was first detected by satellite imagery on 25 June northwest of Truk Atoll (WMO 91334). During the four-day period which followed, three tropical cyclone formation alerts were issued. This period was marked by often impressive organization on satellite imagery with little or no evidence of a surface circulation center. However, with synoptic data at 291200Z, it became increasingly evident that a surface center had established itself and at 300000Z, the first warning was issued on Tropical Depression 06.

The successful launch of NOAA 7 in June 1981 afforded JTWC the opportunity to receive local afternoon surveillance from a high resolution polar-orbiting satellite platform. At 250447Z, while NOAA 7 was in its 17th orbit, a disturbance was located just northwest of Truk. During the next two days, satellite imagery showed a continued developing trend. The 270424Z visual imagery from NOAA 7, yielded a Dvorak intensity classification of T2.5 (2.5 is equivalent to 35 kt or 18 m/sec in the classification system). Based on the later data, a Tropical Cyclone Formation Alert was issued at 270800Z for an area north of Ulithi Atoll (WMO 91203). However, during the 16 hours which followed, satellite imagery showed a rapid weakening of the disturbance, and at 280000Z the formation alert was cancelled.

Figure 3-06-1 shows a composite surface streamline analysis of 0000Z data from 25 to 28 June. There was very little evidence of a discernible low-level center near the disturbance which had been observed on satellite imagery during this period. However, the composite analysis does suggest a weak, but pre-existing, low-level center located well west of Ulithi.

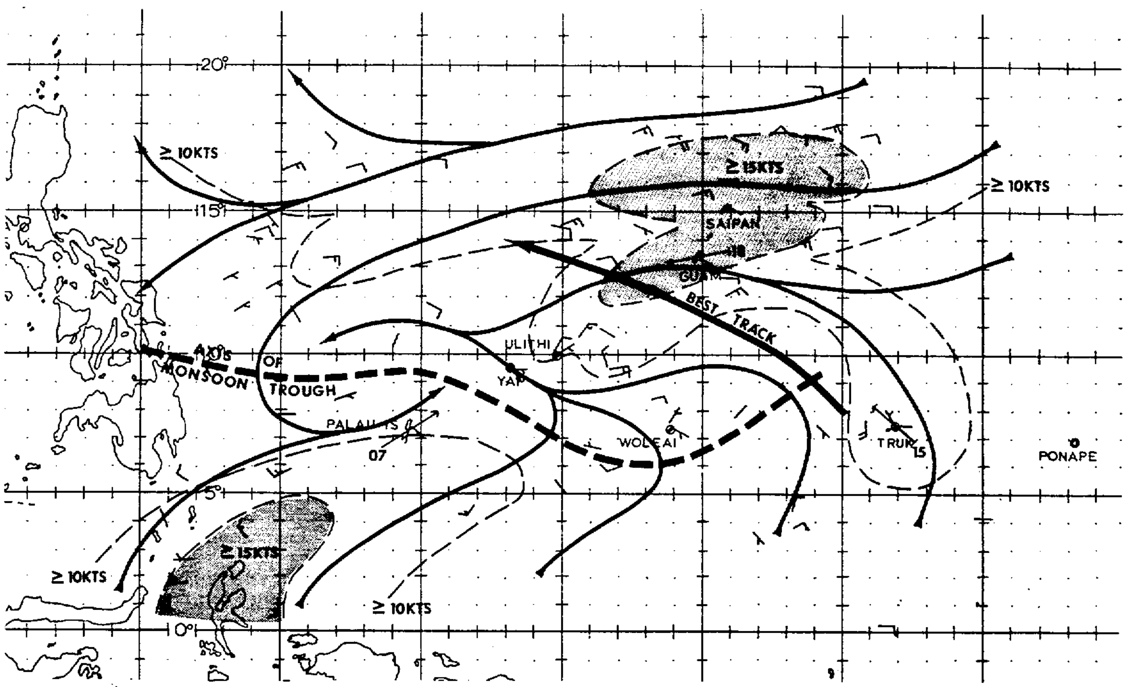


Figure 3-06-1. A composite streamline analysis from surface reports received for 0000Z from 25 to 28 June. During this period, the disturbance which became Kelly moved westward through the Philippine Sea. A lack of organized low-level inflow into the disturbance delayed its development until reaching the area west of 135 east longitude, where a possible pre-existing low-level circulation pattern induced Kelly's subsequent development.

At 281200Z, satellite imagery once again showed an area of increased convection, this time centered near 14N 135E. The 281200Z synoptic reports and subsequent satellite imagery showed improved organization, thus at 282000Z, a Tropical Cyclone Formation Alert was reissued. Figure 3-06-2 is a NOAA 6 image of the disturbance near the time the formation alert was issued. During the following 28 hours, further development was evident and the alert was repositioned. At 292241Z, a Dvorak intensity classification of T2.5 was provided by the Det 1, 1WW Nimitz Hill, Guam, and the first warning on TD-06 followed at 300000Z.

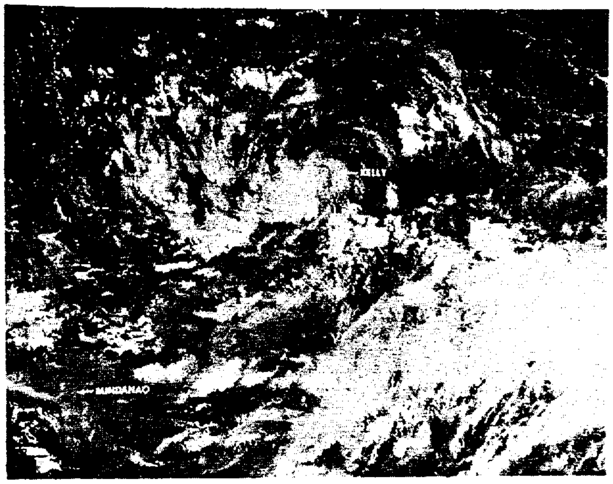


Figure 3-06-2. A weak cloud system center was seen redeveloping on this satellite imagery for 282304Z June. (NOAA 6 visual imagery)

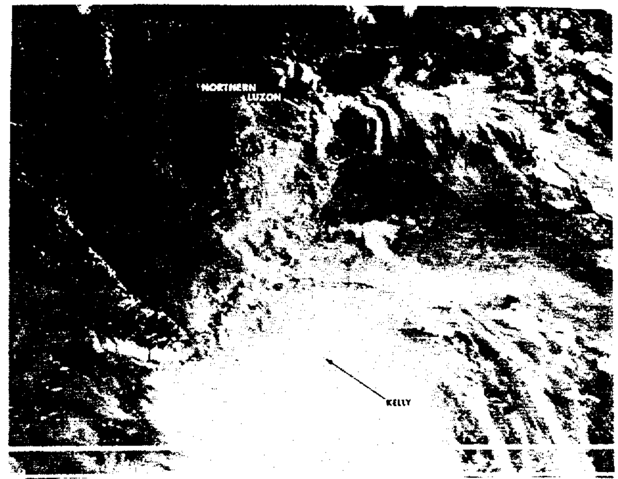


Figure 3-06-3. A weakened Kelly (TD-06) moving through the central Philippines (302359Z June). Although Kelly had lost some of his earlier intensity, the release of energy in heavy precipitation caused extensive flooding and human suffering which cannot be correlated to observed surface winds and pressures. (NOAA 6 visual imagery)

Synoptic observations from reporting stations along the southeastern coast of Luzon and Catanduanes Island (WMO 98447) indicated that TD-06 made landfall at, or near, tropical storm strength, at 301200Z. Thus, at that time TD-06 was upgraded to Tropical Storm Kelly. As Kelly tracked over the central Philippines, the low-level circulation pattern became distrupted and the observed wind speeds lessened, so that by 310000Z, Kelly was downgraded to TD-06. TD-06 tracked directly over Mindoro Island and despite having lost some of its earlier intensity, the combined effects of heavy rains, flooding and mudslides left thousands homeless and nearly 200 dead, Figure 3-06-3 shows TD-06 (Kelly) over Mindoro Island.

Within hours after TD-06 moved into the South China Sea, it regained its low-level circulation pattern and resumed its interrupted intensification trend. At 011800Z, TD-06 was upgraded to Tropical Storm Kelly. (In post-analysis, Kelly first attained tropical storm strength at 300600Z, was downgraded at 301800Z and was upgraded at 010600Z. This is fairly typical of post-storm analysis since the supporting synoptic data are received at JTWC after the warning has been issued for the synoptic hour; thus, the upgrading and downgrading usually follow on the next warning).

From the first warning on TD-06, an eventual track towards the north was anticipated once the system entered the South China Sea. The 500 mb pattern over Asia was fairly weak and the numerical model forecast series indicated a rather deep trough moving into the region. As Kelly approached the South China Sea, the 010000Z 500 mb hand-analysis (Fig. 3-06-4) showed Kelly in a favorable location for movement to the north. What followed in the first 24 hours, however, was a virtually westward track. Figure 3-06-5 shows the 500 mb pattern just 12 hours later (011200Z). In reconstructing the situation it is evident that the northward current moving around Kelly's eastern periphery actually aided in building the ridge to the north, such that the ridge line kept moving west with Kelly. Eventually this process abated and near 021200Z, Kelly began moving towards the

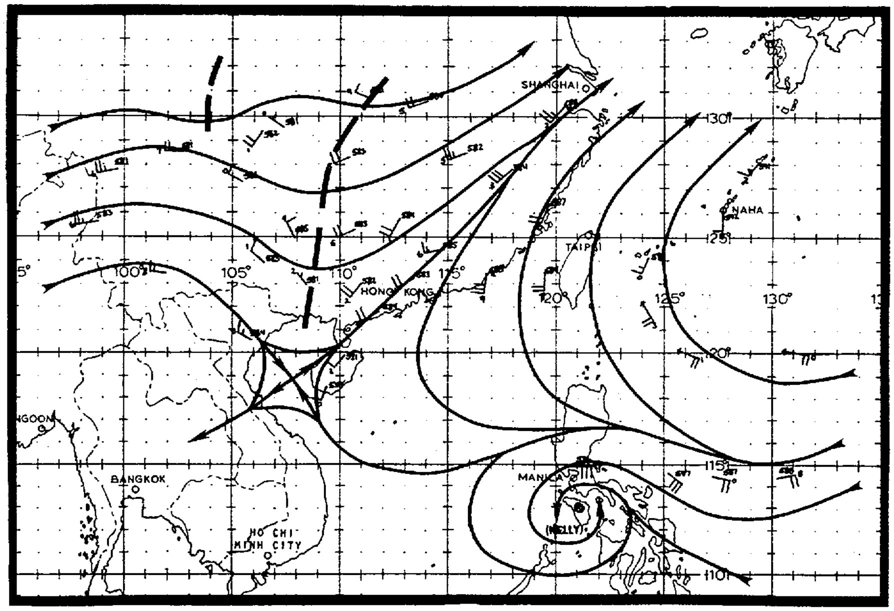


Figure 3-06-4. At 010000Z, a short wave trough is evident extending southward into the Gulf of Tonkin and a southerly flow is well established north of Kelly westward to the trough. Analyzed wind data are a combination of rawinsonde and aircraft reports at the 500 mb level.

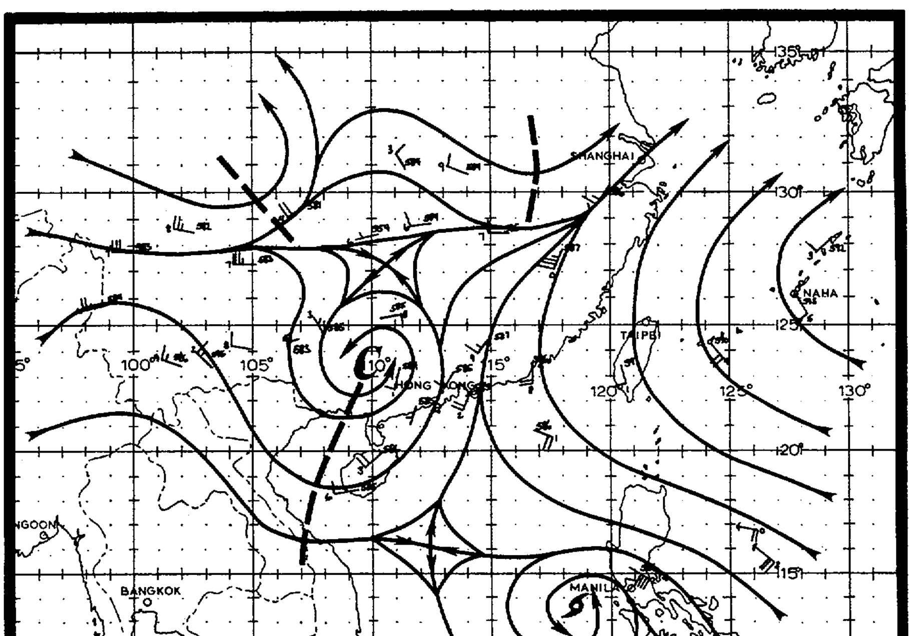


***Figure 3-06-5.** By 011200Z, the 500 mb analysis shows a fracturing of the short wave northwest of Kelly. Height rises of 20 to 30 meters are common throughout the region. This 12 hour change is striking, however subsequent forecasts continued to forecast eventual northward movement (see Figure 3-06-6).*

northwest. Figure 3-06-6 depicts the official JTWC forecasts for Kelly. Note, the persistent trend in virtually every warning issued of Kelly having an increasing northward movement.

At 020000Z (in post-analysis, 021800Z), while moving to the northwest, Kelly was upgraded to typhoon strength. The 030300Z surface observation from the Paracel Islands (WMO 59981) indicated a windshift to southeasterly winds of 74 kt (38 m/sec) and a sea level pressure of 970.8 mb. It was during this period that Kelly is assumed to have reached his maximum intensity of 75 kt (39 m/sec). Subsequent satellite imagery indicated weakening convection with cirrus occasionally masking the eye. By 031800Z, Kelly had reached the southeastern portion of Hai-nan Island and the eye was no longer evident on satellite imagery. After skirting along its southern coastline, Kelly moved away from Hai-nan and lost much of his strength, resulting in downgrading to tropical storm strength at 040000Z. From Hai-nan to the coast of Vietnam, surface reports were sparse but there is little doubt that Kelly no longer had the low-level winds which were evidenced the preceding day. Interestingly, at 040629Z (Fig. 3-06-7), Kelly briefly displayed a large ragged eye which was observed to be opening to the west at 040900Z. There remains a possibility that Kelly may have regained some strength in the Gulf of Tonkin. However, if Kelly did, it must have been short-lived because hourly reports from Vietnam never indicated any significant or well-organized winds prior to, or after, landfall, which occurred about 100 nm (185 km) south of Hanoi at 041800Z. The last satellite fix received for the remnants of Kelly was at 050000Z, positioned along the Vietnam-Laos border.

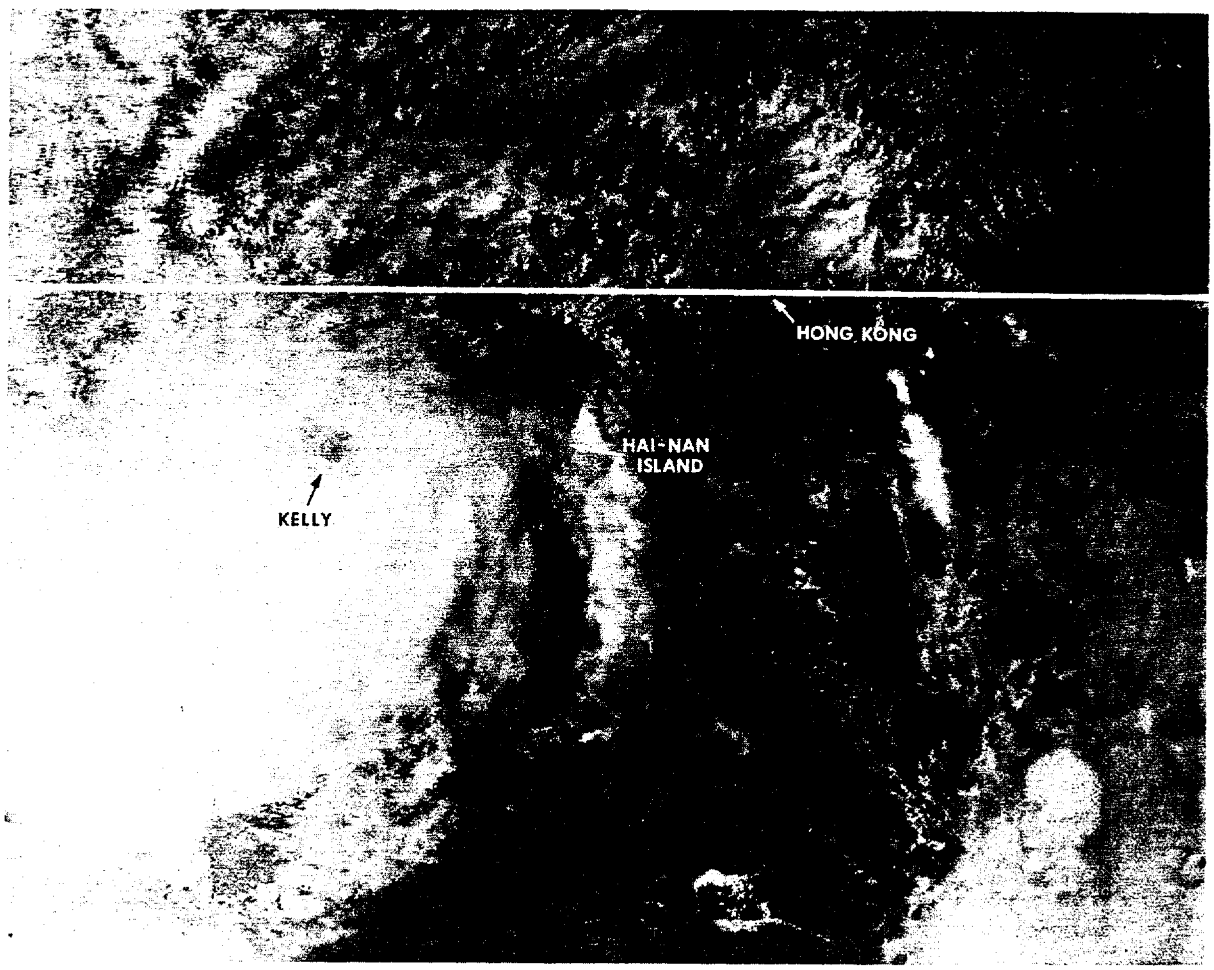


Figure 3-06-7. A ragged eye is apparent on 040629Z July satellite imagery as Kelly moves westward in the Gulf of Tonkin. This eye feature was short-lived and observed winds did not increase during this phase. (NOAA 7 visual imagery)

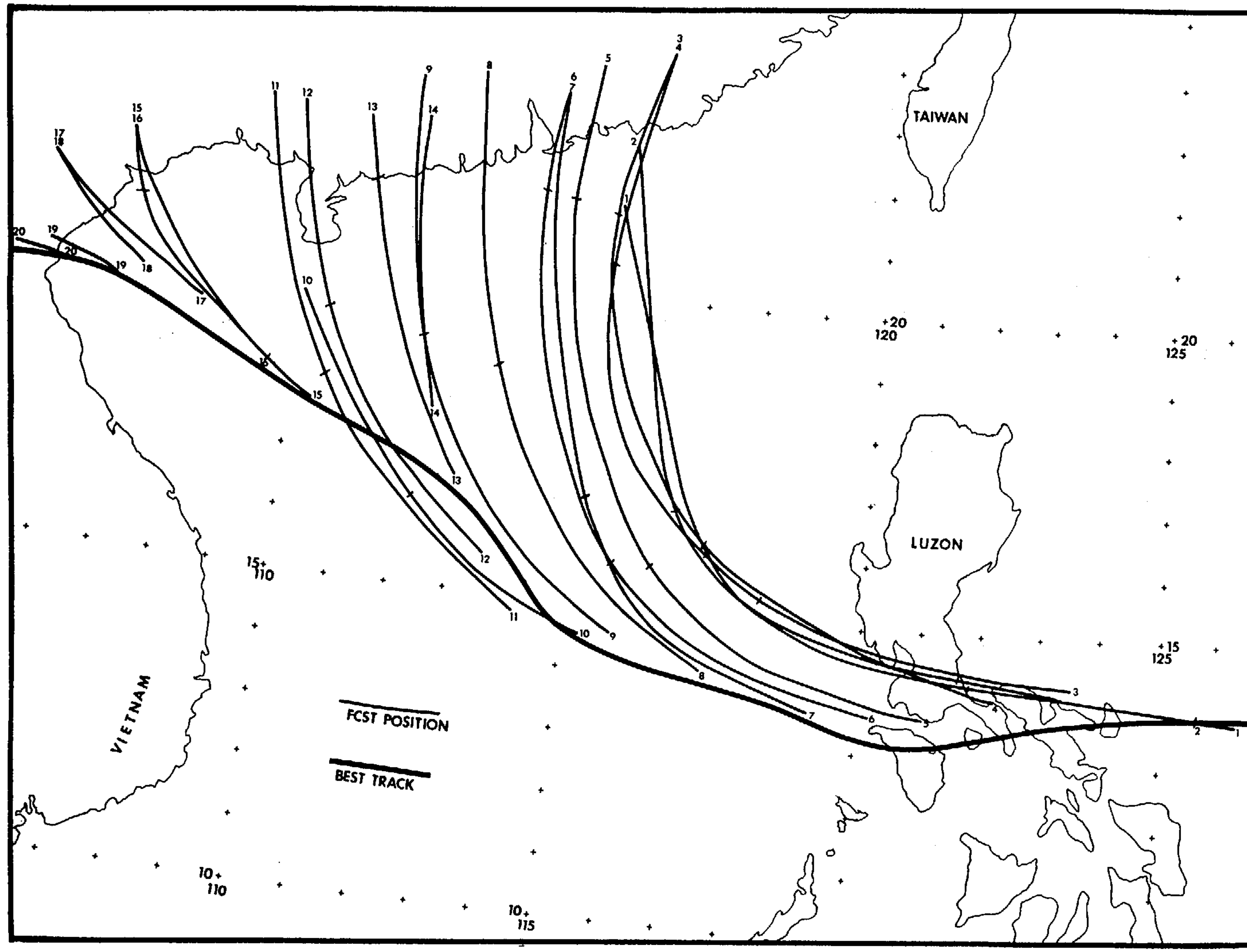
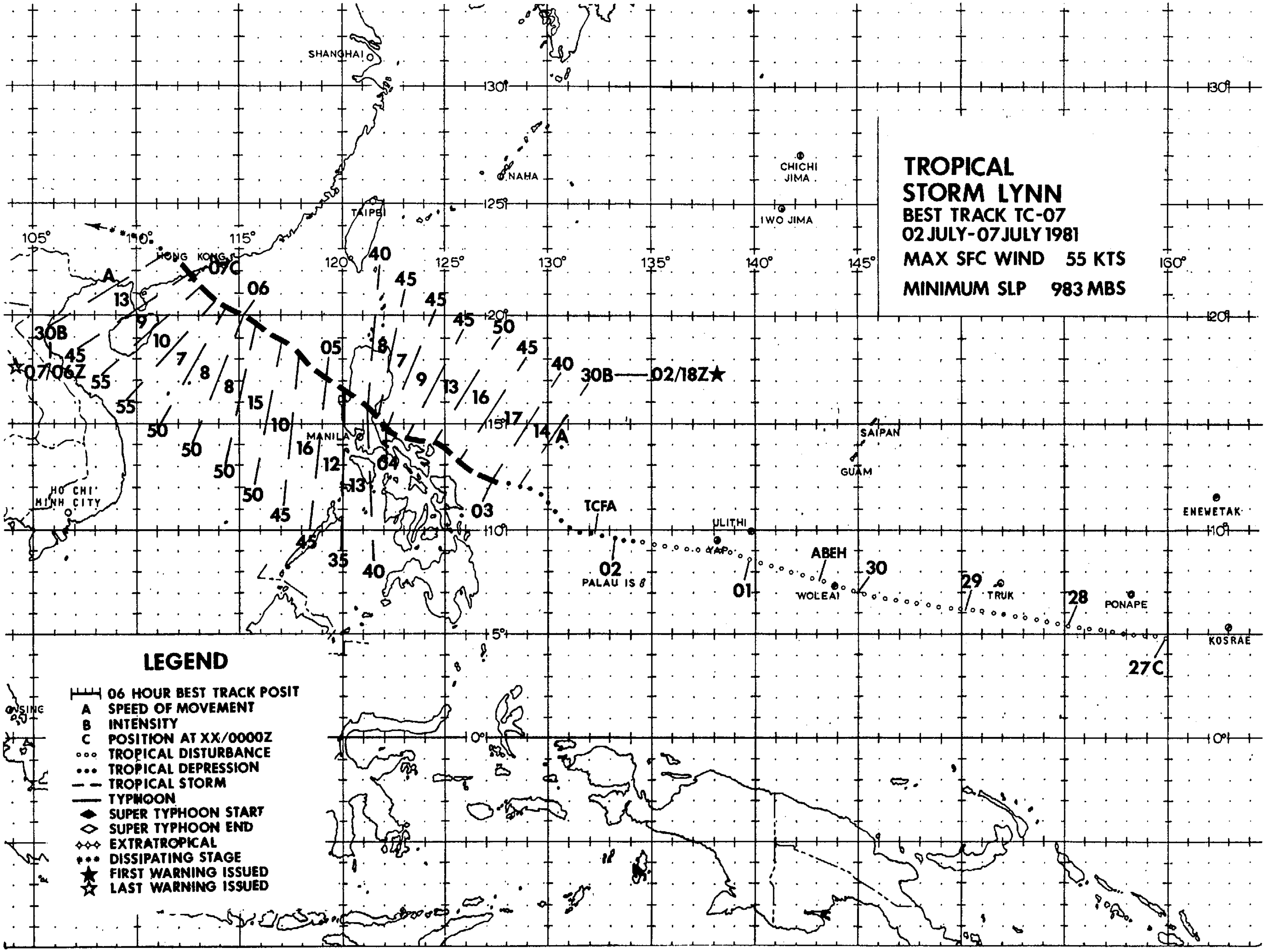


Figure 3-06-6. Official JTWC forecasts versus the final best track for Kelly. Note the obvious inclination to forecast a northward movement throughout Kelly's warning period.



TROPICAL
STORM LYNN
BEST TRACK TC-07
02 JULY-07 JULY 1981
MAX SFC WIND 55 KTS
MINIMUM SLP 983 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
TAIPEI
HONG KONG
MANILA
HO CHI MINH CITY
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
TCFA
ABEH
07/06Z
02/18Z
30B
07C
06
05
04
03
02
01
30
29
28
27C

Following on the heels of Typhoon Kelly, Tropical Storm Lynn was the second storm in three days to devastate the Philippine Islands. Packing winds of 45-50 kt (23-26 m/sec), Lynn's 30 hour track across the northern Philippine Islands brought torrential rains and accompanying mud slides leaving 18 persons dead and some tens of thousands homeless.

Lynn was first detected on satellite imagery at 270000Z as an area of enhanced convection just south of Ponape. This area was part of a weak equatorial trough that extended from Ponape northwestward to just southwest of Guam, where a second active convection area existed that later became Typhoon Kelly. A broad scale upper level divergent pattern existed over the entire region south of a Tropical Upper Tropospheric Trough (TUTT) located near 15N 160E.

During the next several days both disturbances tracked westward under the influence of the mid-to-lower-tropospheric westerly current south of the subtropical ridge. While the disturbance near Guam eventually intensified to Tropical Storm Kelly, the disturbance near Ponape continued to show marked variations in its convective activity, due in part to the degree of vertical wind shear that existed over the disturbance. Although synoptic data indicated a 1010 mb surface low as early as 291200Z, an analysis of 200 mb satellite-derived winds between 270000Z June and 020000Z July indicated that the north-south flow across the disturbance varied from as little as 10 kt (5 m/sec) to as great as 35 kt (18 m/sec). This large shearing effect appeared to prevent any significant development of the disturbance during this period.

By 020000Z the upper trough had extended westward to a position just to the northeast of Kelly in the South China Sea and a TUTT cell observed near 20N 128E finally blocked the strong shearing pattern (Fig. 3-07-1). A Tropical Cyclone Formation Alert (TCFA) was issued at 020300Z when an upper-level anticyclone could finally be identified over the disturbance. Development was still expected to continue slowly since satellite imagery did not indicate a strong central convective region. Aircraft reconnaissance at 020530Z could only detect a weakly organized 1005 mb circulation pattern.

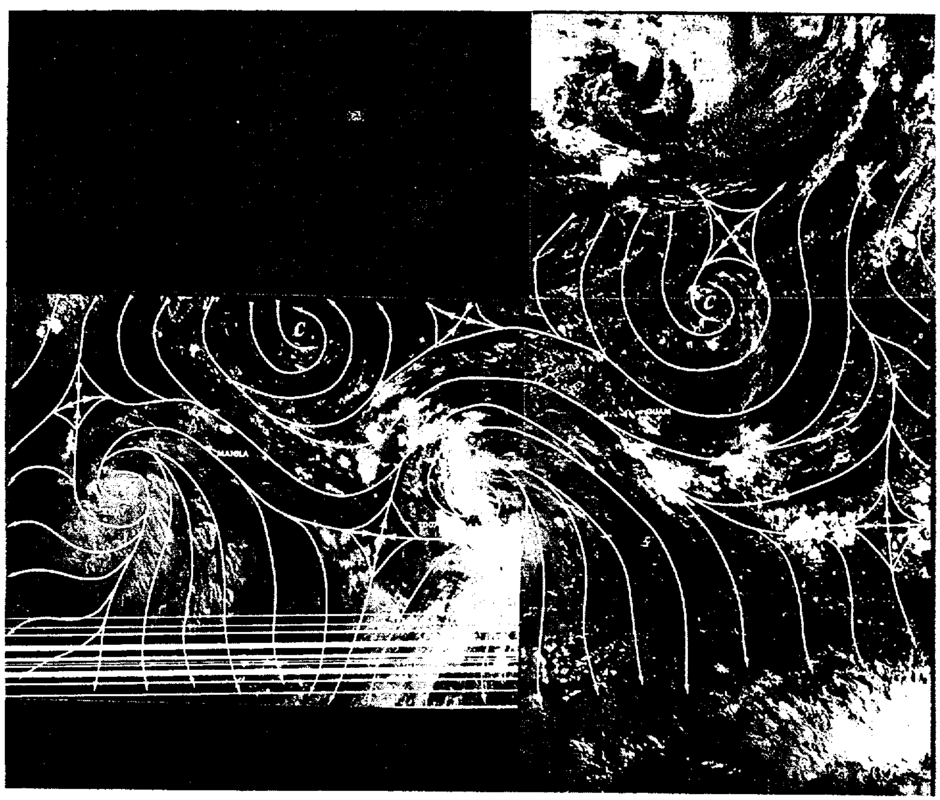


Figure 3-07-1. 020000Z July 1981, 200 mb streamline analysis superimposed on satellite pictures at 012155Z and 012336Z. This figure depicts the TUTT cells in relationship to the developing storms Kelly and Lynn. (NOAA 6 visual imagery)

By 021800Z satellite imagery indicated a much improved central convective region and the first warning was issued. Seven hours later at 030100Z aircraft reconnaissance found that Lynn had already reached tropical storm strength with 40 kt (21 m/sec) surface winds and a minimum sea level pressure of 998 mb.

As Lynn skirted the northern edge of the eastern Philippine Islands, she abruptly slowed from 16 to 7 kt (30-13 km/hr). This was partially due to the disruption of Lynn's circulation pattern over the mountainous terrain of the Philippines and the slight northern retreat of the 500 mb high which temporarily slackened the steering flow across the storm. Also during this time, a large influx of moisture from the South China Sea caused a massive build-up a tropical depression, with an intensity of 30 kts (15 m/sec) and a central pressure of 997 mb, and the final warning was issued.

of cloudiness along Lynn's southern periphery which, in turn, caused Lynn's circular convective pattern to become distorted. This made it very difficult to locate Lynn with satellite imagery. It was not until 040600Z, when a strong central dense overcast (CDO) had developed (Arnold, 1974) just east of Luzon, that Lynn could again be tracked reliably. Figure 3-07-2 shows Tropical Storm Lynn and her CDO just after she made landfall near Baler, Luzon (WMO 98333).

With the formation of the CDO, Lynn appeared to have gained back some of the organization that she had prior to reaching the Philippines. This seems to have enabled the storm to be more easily advected in the steering flow as Lynn quickly increased her speed to 13 kt (24 km/hr).

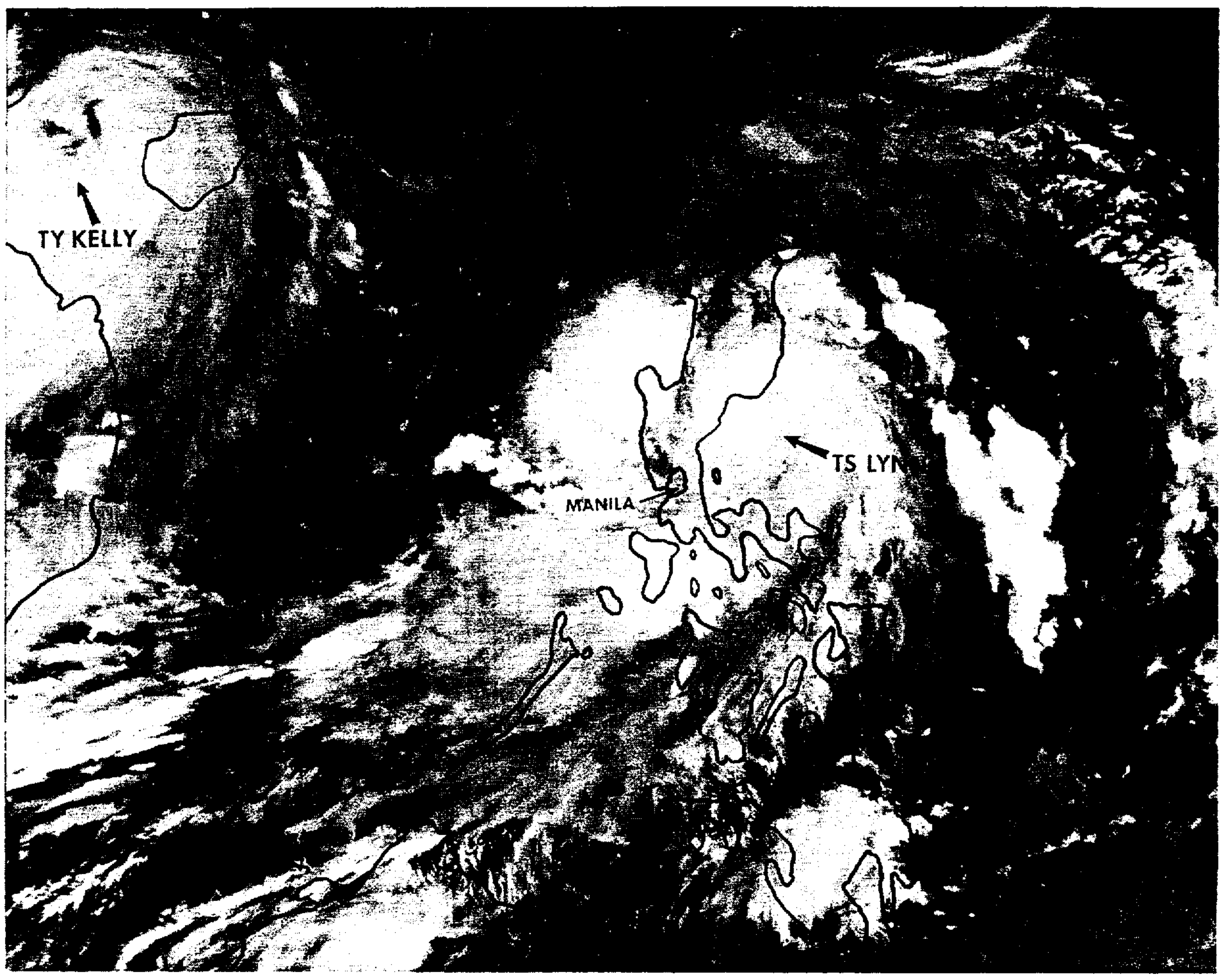


Figure 3-07-2. Tropical Storm Lynn just after reaching the coast of Luzon at 4 July 1981, 1129Z. Note Lynn's strong central convective area as well as the deep layer of cloudiness along her southern periphery. Typhoon Kelly can be seen approaching the coast of Vietnam. (NOAA 6 infrared imagery)

With her speed increased, Lynn lost little of her intensity while crossing the island of Luzon in less than six hours. From Luzon, Lynn followed a fairly climatological northwest track across the South China Sea. JTWC had very little trouble predicting her direction of movement as the 500 mb high over Asia was now 100 m higher than it had been a week prior with Typhoon Kelly.

Like Kelly before her, Lynn was predicted to become a minimum strength typhoon once she reached the central South China Sea. However, with the increase in strength of the Asiatic high, the flow at 200 mb also increased. By 051200Z, Lynn had reached a position just north of where Kelly obtained typhoon strength. As can be seen in Figure 3-07-3, Lynn's outflow was restricted in her northwest quadrant as 70 kt (36 m/sec) easterlies were observed only 420 nm (778 km) north of the storm. It was not until just prior to making landfall on the south China coast that the easterly winds north of the storm abated to only 20 kt (10 m/sec) and satellite imagery indicated that Lynn's outflow had improved. By this time there was little room for much intensificantion.

Lynn finally made landfall near Shang-Chuan-Tao, China (WMO 59673) at 062200Z 90 nm (167 km) west-southwest of Hong Kong. Maximum sustained surface winds at landfall were estimated to be near 55 kt (28 m/sec) with a central pressure of 983 mb.

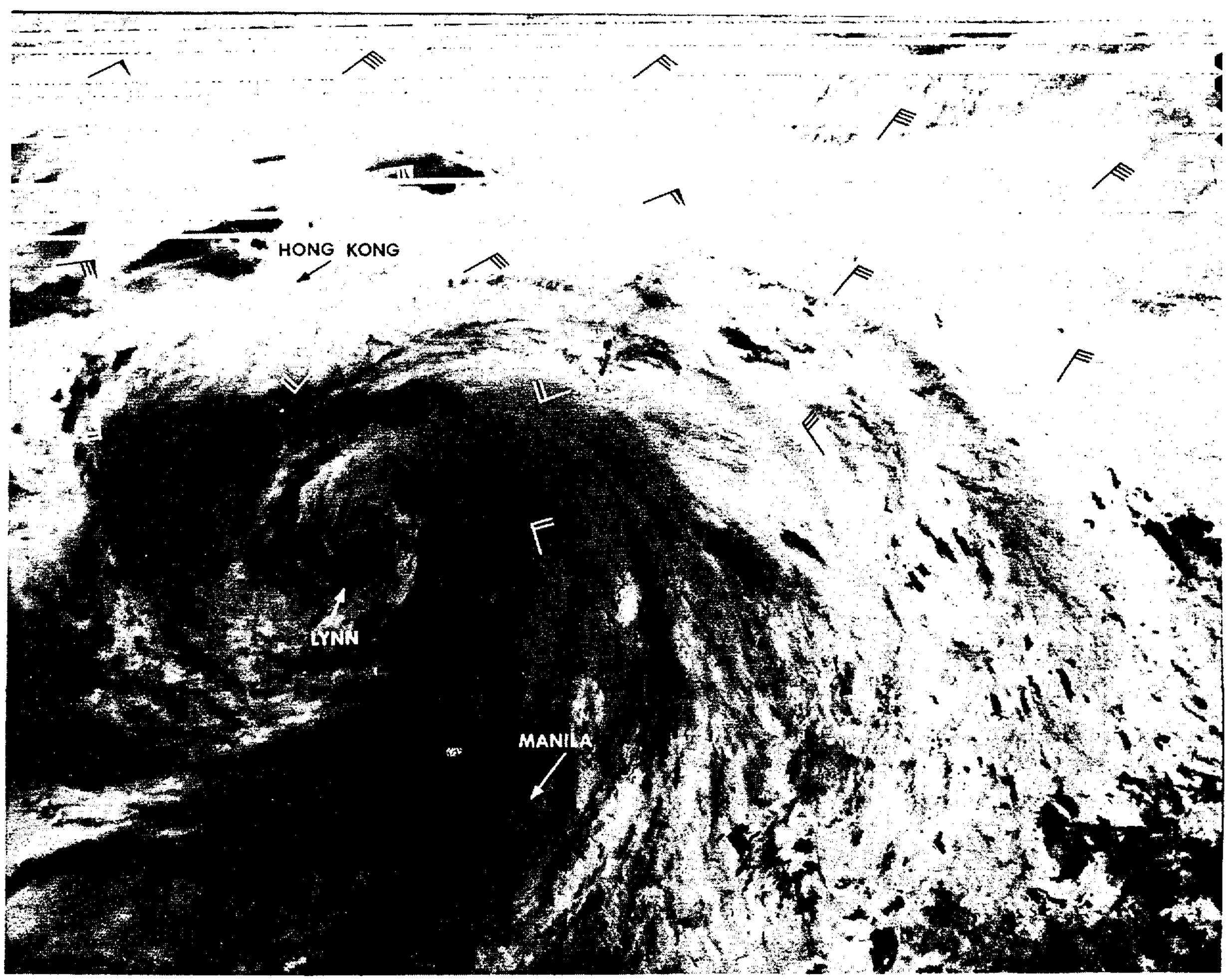
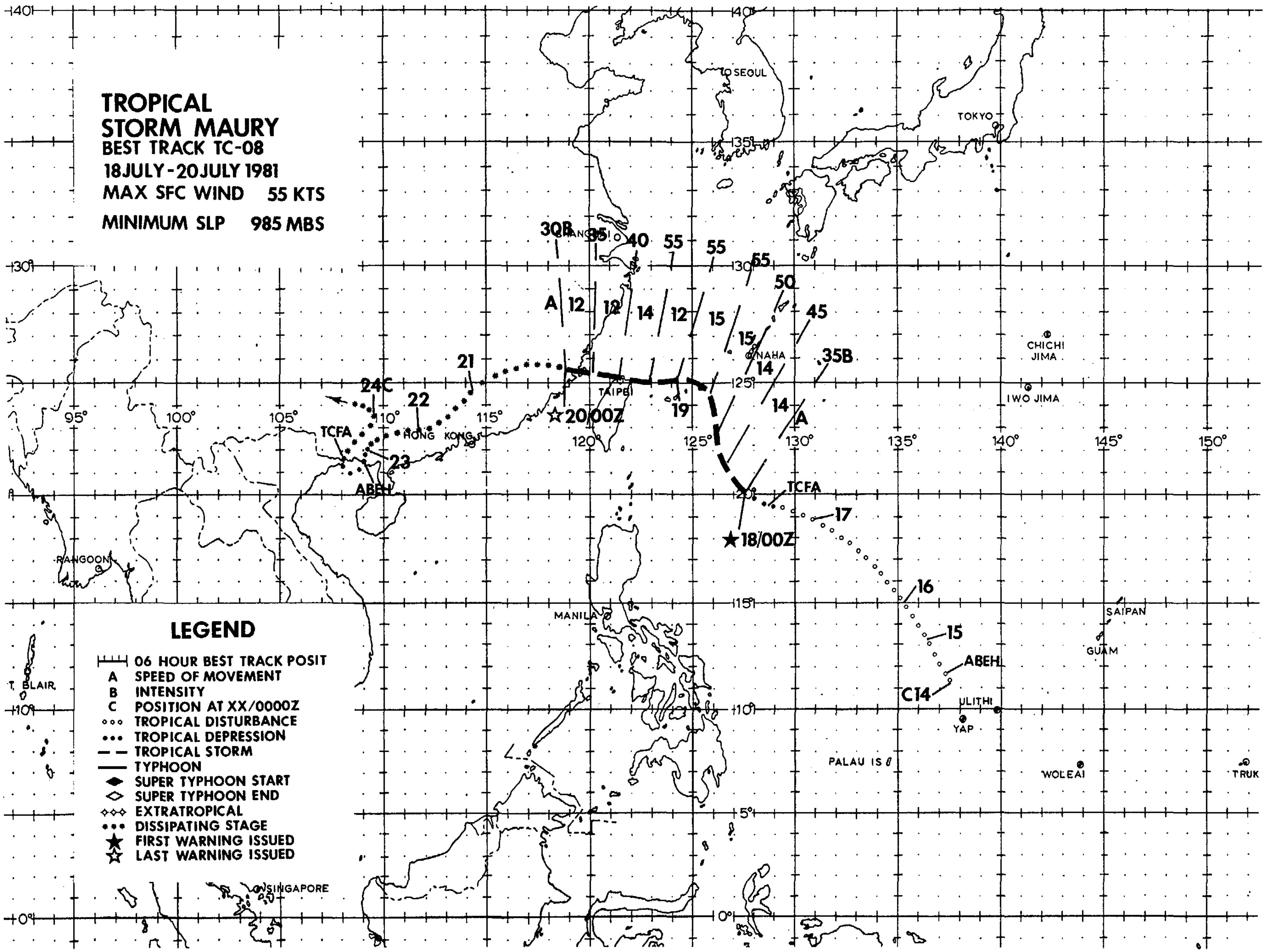


Figure 3-07-3. Tropical Storm Lynn in the South China Sea at 5 July, 1106Z. Strong upper-level flow north of the storm has restricted Lynn's outflow in her northwest quadrant. Wind barbs represent aircraft and rawinsonde reports near the 200 mb level at 051200Z. (NOAA 6 infrared imagery)


TROPICAL
STORM MAURY
BEST TRACK TC-08
18 JULY - 20 JULY 1981
MAX SFC WIND 55 KTS
MINIMUM SLP 985 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
CHICHI JIMA
IWO JIMA
NAHA
TAIPEI
HONG KONG
MANILA
RANGOON
T. BLAIR
SINGAPORE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
30B
35
40
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55
50
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35B
A
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12
14
12
15
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14
A
21
24C
22
19
TCFA
23
ABEH
20/00Z
18/00Z
TCFA
17
16
15
ABEH
C14
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
150°
40°
35°
30°
25°
20°
15°
10°
5°
0°

At 0000Z on 14 July, satellite imagery revealed what was to become Tropical Storm Maury within a convective area near 11N 137E, about 110 nm (204 km) north-northwest of the island of Yap (WMO 91413). Southwesterly low-level flow moved the disturbance at 05 kt (09 km/hr) during the initial 48 hour period. A 500 mb ridge influenced the system thereafter and accelerated it to 14 kt (26 km/hr) by 170000Z. A mid-level circulation was identified on 161200Z satellite imagery and could also be analyzed on the 500 mb charts. The disturbance slowed and moved west-northwest under the influence of the 500 mb ridge located to the northeast while south-southwesterly monsoonal flow continued near the surface.

A Tropical Cyclone Formation Alert was issued at 171600Z when synoptic data indicated winds associated with the disturbance, then located near 20N 128E, had reached 25 kts (13 m/sec). Pressures within the disturbance and the surrounding environment were 1003 mb.

The first warning on Tropical Storm Maury was issued at 180000Z based on several ship reports in the area at 171800Z. Once the disturbance became enhanced by the monsoonal flow, and the central pressure dropped to 999 mb, the system began rapid movement; once again being totally steered by the 500 mb flow.

Aircraft reconnaissance of the storm shortly after the first warning found the 700 mb center displaced to the north-northeast of the surface center by 50 nm (93 km), indicating the storm was tilted in that direction. Figure 3-08-1 depicts the exposed low level circulation, near 21N 128E, to the southwest of the main convection. The exposed low level circulation and displaced convection gave the appearance that Maury was moving to the northwest of his previous positions. The vertical alignment of the system eventually improved and the entire system moved northward under the influence of the 500 mb ridge, as Figure 3-08-2 indicates. The 181816Z position was near 24N 127E.

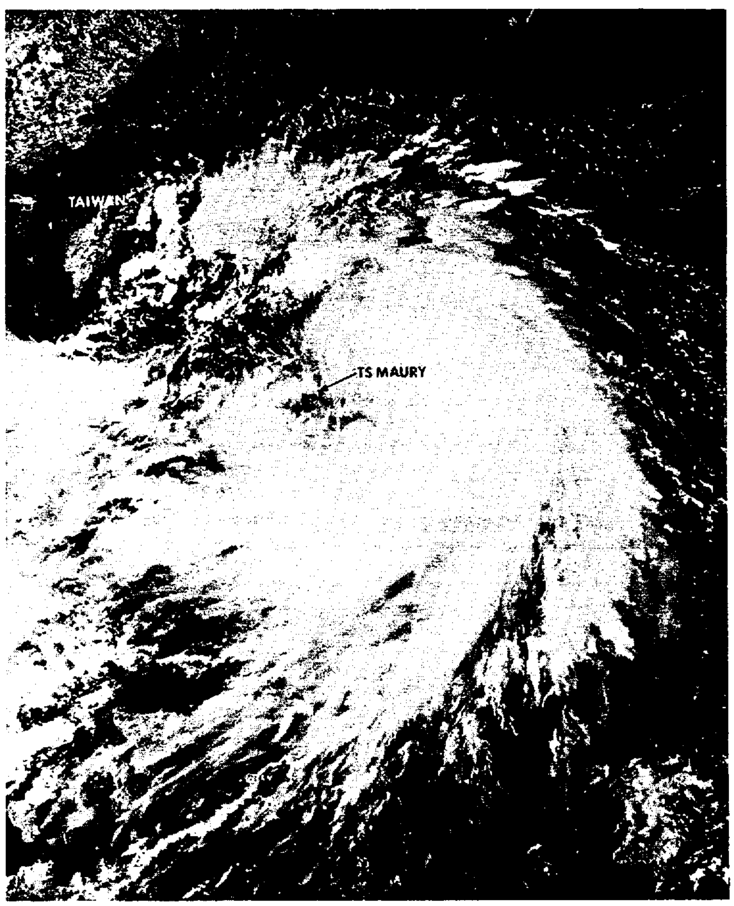


FIGURE 3-08-1. *Tropical Storm Maury at 35 kts (18 m/sec) intensity, 18 July 1981, 0513Z. Maury's low-level center was exposed to the southwest of the main convection. (NOAA 7 visual imagery)*

FIGURE 3-08-2. Tropical Storm Maury at 55 kts (28 m/sec) intensity, 18 July 1981, 1816Z. This imagery showed Maury had moved north during the preceding six hours instead of the forecasted northwestward movement. (NOAA 7 infrared imagery)

Following this northward movement, the system was forecast to track to the northwest, toward China, as indicated by steering aids from Fleet Numerical Oceanography Center, Montery, California. An apparent weak ridge over China turned out to be much stronger than originally believed and Maury was diverted toward Taiwan, as shown in Figure 3-08-3, when the position was analyzed to be 25.5N 124E. Aircraft reconnaissance of the storm at 190543Z found the 700 mb center continued to be displaced from the surface position, but now by 45 nm (83 km) to the west-southwest. This precession of the 700 mb center and erratic motion of the surface center presented a great deal of difficulty in forecasting the movement of the storm.

The Storm center made landfall on the northern tip of Taiwan at approximately 191000Z. Maury caused heavy flooding in the northern and central portions of Taiwan, leaving 27 dead and many others missing or injured. The flooding was the worst of this year in Taipei City, according to Taiwan press reports.

Maury then moved into the Formosa Strait, still maintaining tropical storm strength, but the intensity was now reduced to 35 kts (18 m/sec) following its interaction with the orographic features of Taiwan. Maury made its second landfall approximately 30 nm (56 km) south-southwest of Fu-chou, China, at 192100Z. Three hours later, at 200000Z, Maury was downgraded to

The remanents of Maury did not completely dissipate over China as expected, but continued inland and began tracking towards the southwest, eventually re-emerging in the Gulf of Tonkin. The remanents were identified as being over water based upon synoptic data at 230600Z, at which time the system was again discussed in the Significant Tropical Weather Advisory. The convective activity lagged behind the surface circulation until the surface circulation moved into the Gulf of Tonkin. A Tropical Cyclone Formation Alert was issued at 231200Z; synoptic data indicated the low level system had recurved northward to make final landfall, approximately 30 nm (56 km) southwest of Yin-chou, while the convective activity continued to move to the southwest. The remanents of the surface circulation then followed orographic features inland and could no longer be distinguished after 241200Z. The convective activity went over land south of Nam Dinh, Vietnam at 240000Z. These cells finally dissipated in the mountains of Laos at 241200Z.

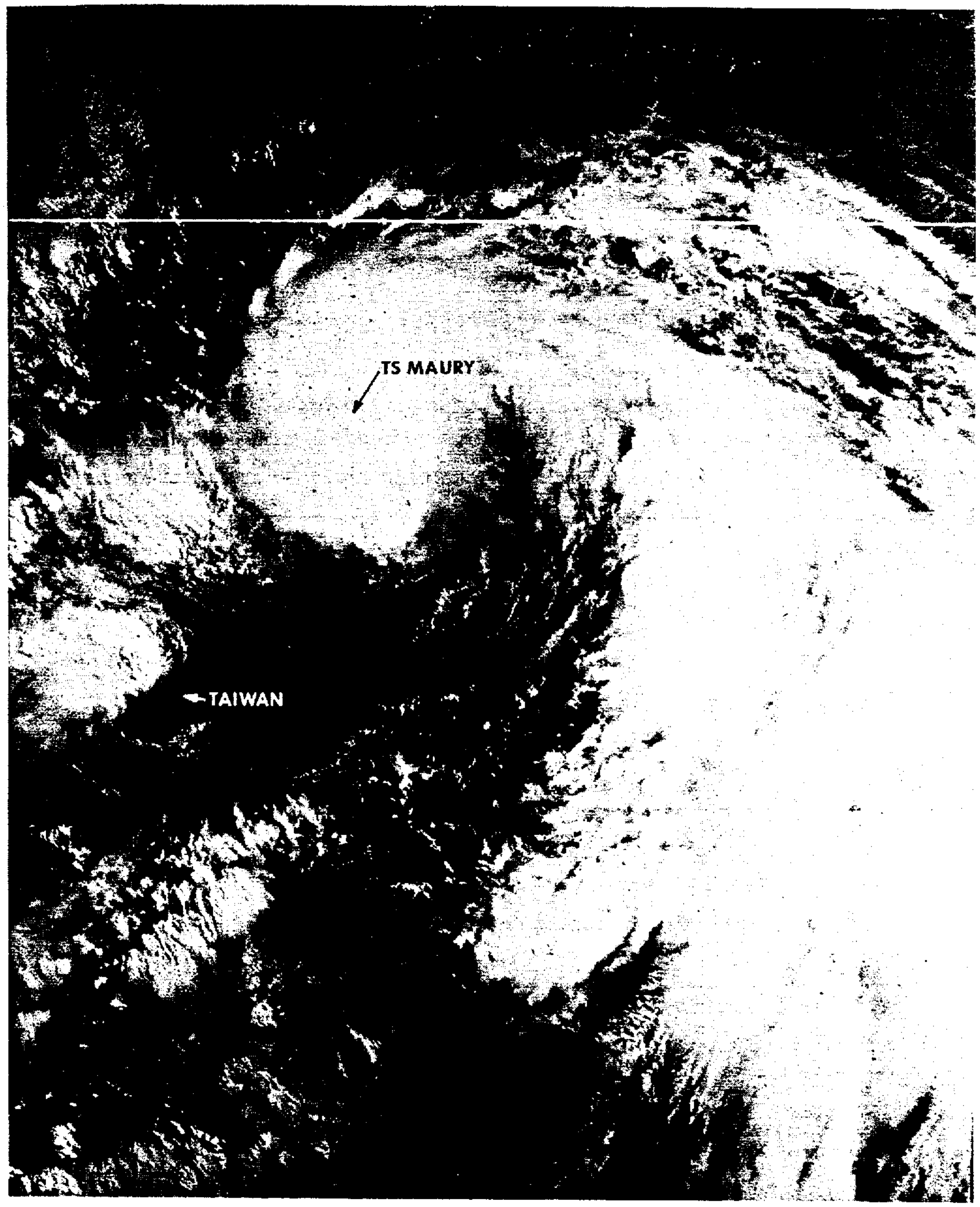
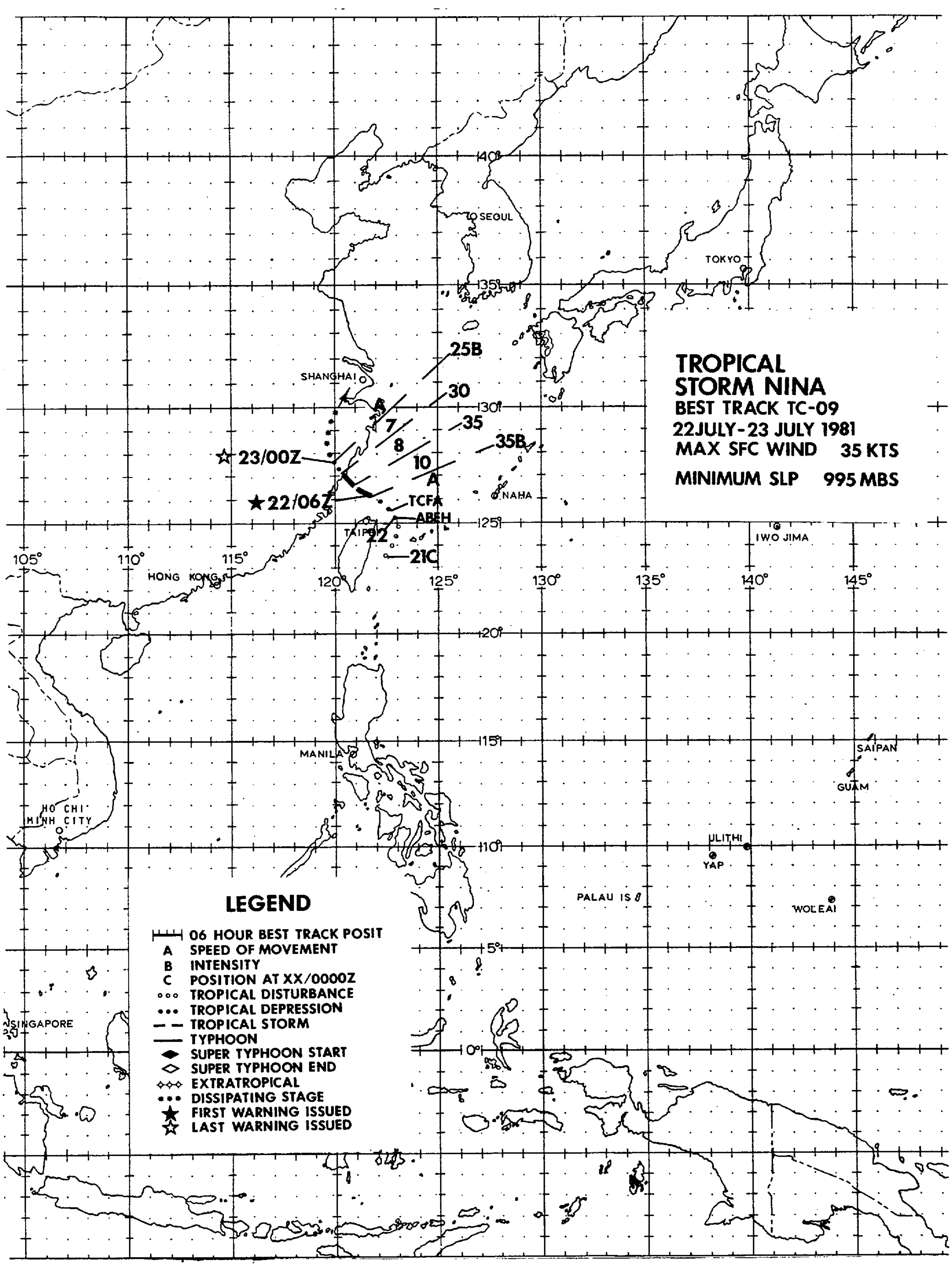


FIGURE 3-08-3. Tropical Storm Maury showed westward movement at the time of this imagery, 18 July 1981, 2305Z. Maury 10 hours before making landfall at the northern tip of Taiwan. (NOAA 6 visual imagery)

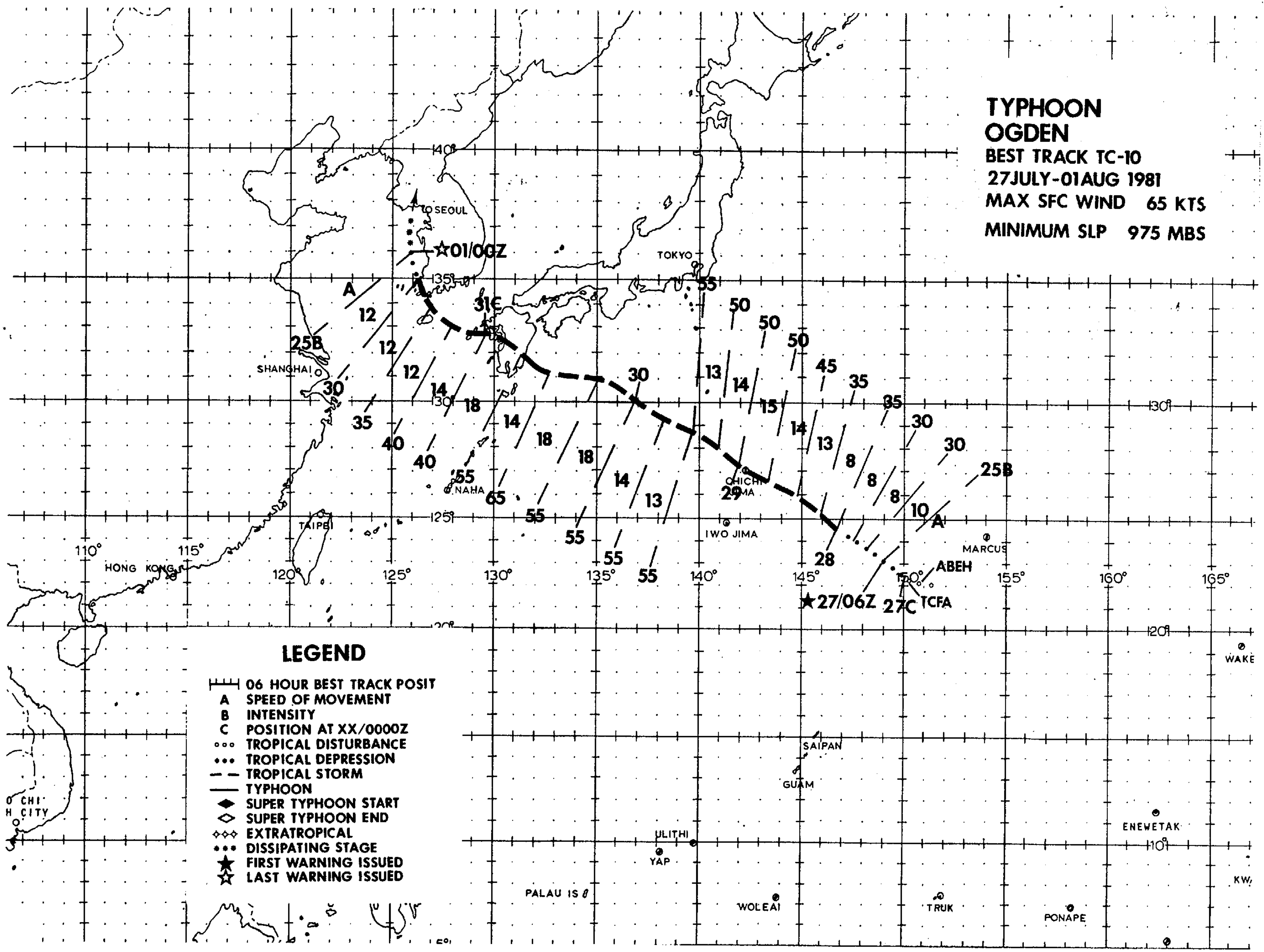

TROPICAL
STORM NINA
BEST TRACK TC-09
22JULY-23 JULY 1981
MAX SFC WIND 35 KTS
MINIMUM SLP 995 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
23/00Z
22/06Z
25B
30
35
35B
7
8
10
A
TCFA
ABEH
22
21C
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
IWO JIMA
HONG KONG
MANILA
SAIPAN
GUAM
HO CHI MINH CITY
ULITHI
YAP
PALAU IS
WOLEAI
SINGAPORE
105°
110°
115°
120°
125°
130°
135°
140°
145°
40°
35°
30°
25°
20°
15°
10°
5°
0°

Tropical Storm Nina eventually formed from a leeside surface low in the wake of Tropical Storm Maury (08). The disturbance was first detected on 210000Z July synoptic charts near 24N 122E; to the east of Taiwan. The disturbance moved within the monsoonal flow from the southwest until the vertical development became entrained into the westward flow around a mid-level anticyclone to the east.

When the system began to drift northwestward around the northern tip of Taiwan, a Significant Tropical Weather Advisory was issued at 220003Z. The Tropical Cyclone Formation Alert was then transmitted at 220100Z when synoptic data indicated a surface circulation was located near 25N 123E. The first warning on Tropical Depression 09 was subsequently issued at 220600Z.

Nina maintained a northwest track throughout the warning period. Initially moving at 12 kts (22 km/hr) as it rounded Taiwan, the storm slowed as it approached land. Nina had weakened to tropical depression strength when landfall was made at 221800Z, 30 nm (56 km) northwest of Hsia-p'u, China. The final warning was issued at 230000Z, when the system was 35 nm (65 km) inland and orographic effects were rapidly dissipating the system.

Nina started out as an exposed low-level circulation with convective activity to the east. During the warning process this tropical cyclone was not forecast to reach tropical storm strength; however, in post-analysis Nina was upgraded to tropical storm strength for the initial 12 hour period. A 35 kt (18 m/sec) ship report originally considered suspect was later verified by several other ship reports of similar wind speed, but not in time to be included on the second warning.


TYPHOON
OGDEN
BEST TRACK TC-10
27JULY-01AUG 1981
MAX SFC WIND 65 KTS
MINIMUM SLP 975 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
01/00Z
TOKYO
31C
29
28
27/06Z
27C
TCFA
ABEH
25B
25B
A
A
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
110°
115°
120°
125°
130°
135°
140°
145°
150°
155°
160°
165°

Typhoon Ogden developed near 23N 151E when a circulation formed under a pre-existing convective area. Development of this circulation triggered TCFA issuance at 262200Z Aug 81, however, the area had been convectively active during the previous forty-eight hours. Once the circulation formed, very gradual intensification followed. A well-behaved storm track ensued that posed no significant forecast problems.

The initial warning on TD 10 (270600Z) carried a gradually recurving track to the east of Japan. This forecast was based on the apparent existence of a break in the 500 mb ridge to the northwest and the approach of an apparently significant trough in the westerlies. Forecast aids were in disagreement on the forecast track. Climatology and the current synoptic situation influenced the choice of the recurve track over a northwest to westerly straight track. Three warnings were issued with the recurve forecast before a change to straight northwest movement was decided upon. The change was precipitated by two things; synoptic data showed the approaching trough was not as strong as anticipated, and the ridge to the north was building westward ahead of TD 10. No further changes in track were required as TD 10 responded well to the steering currents on the south side of the ridge.

Favorable outflow conditions were never established for TD 10 and this perhaps explains the very gradual intensification. Twenty-four hours after TD 10 formed, tropical storm strength was reached, however, it took another sixty hours for then Tropical Storm Ogden to reach its maximum intensity of 65 kt (33 m/s) thus becoming a minimal typhoon (Fig. 3-10-1). Ogden was upgraded to typhoon in post-analysis based on a combination of aircraft and land synoptic data.

Ogden crossed southern Kyushu between 301600Z and 302100Z and weakened significantly. Ogden still possessed tropical storm strength winds when it emerged into the East China Sea. Weakening continued as Ogden headed northwest toward Cheju-Do Island and the Korean Peninsula. Succumbing to upper and mid-level shear, Ogden finally dissipated as a significant tropical cyclone over the Yellow Sea along the west coast of Korea.

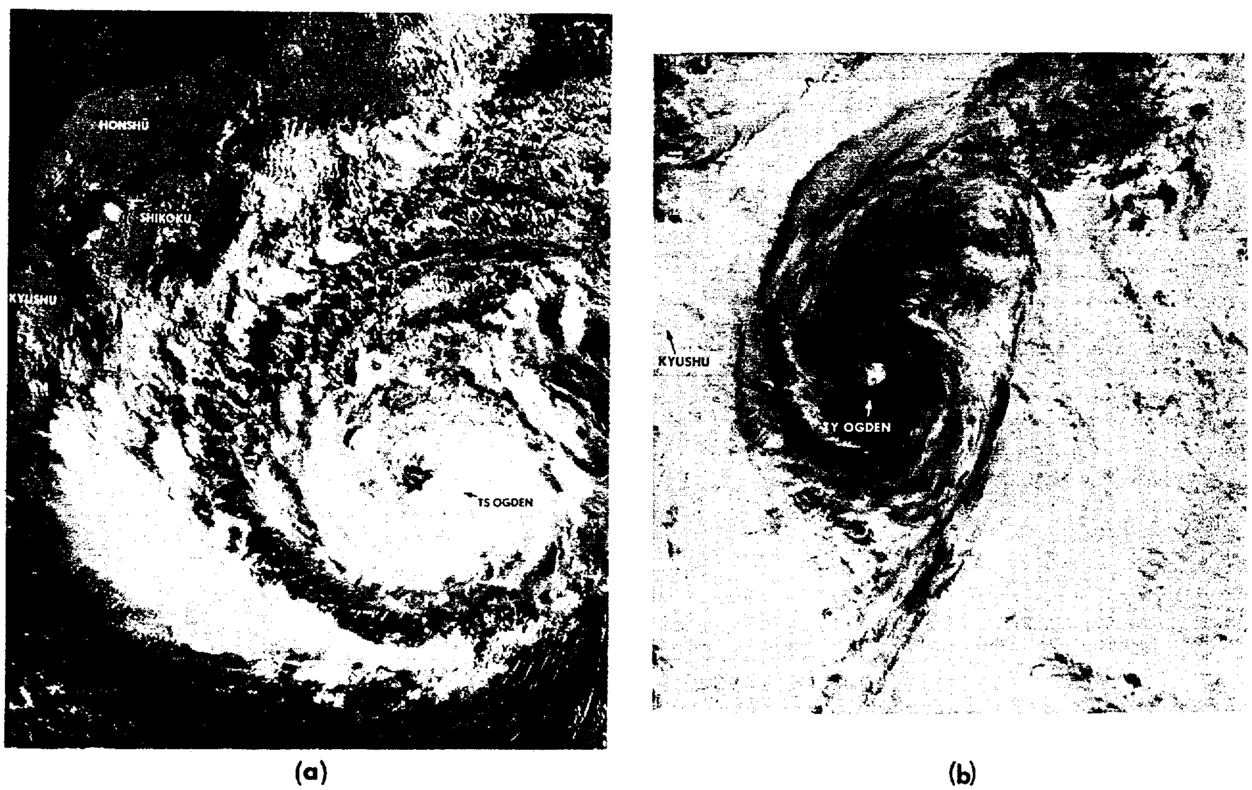
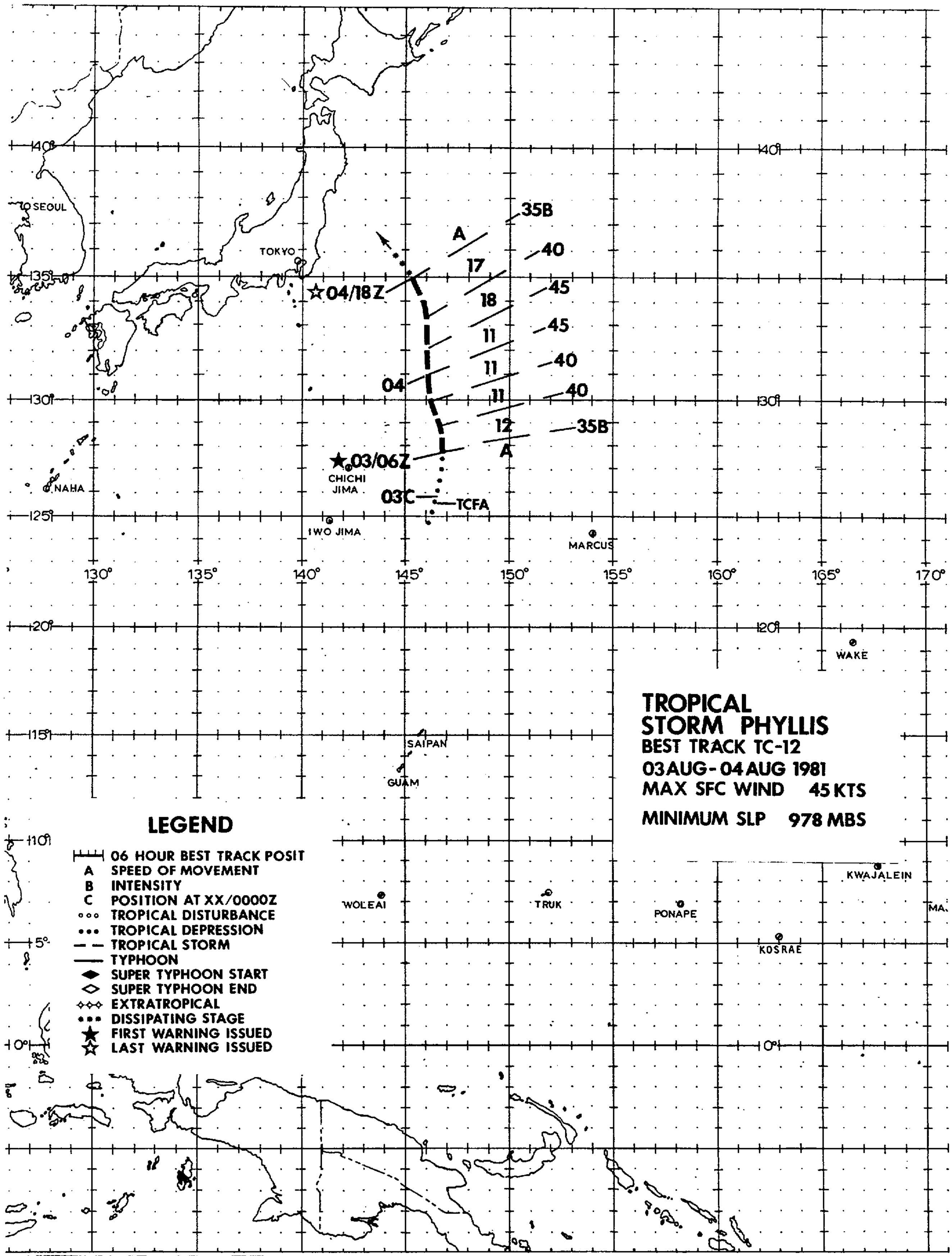


FIGURE 3-10-1. a) Tropical Storm Ogden at 292259Z approximately twelve hours prior to reaching typhoon strength. Intensity at this time was 55 kt (28 m/s). (NOAA 6 visual imagery) b) Typhoon Ogden at 300957Z near the time of maximum intensity, 65 kt (33 m/s). (NOAA 6 infrared imagery)



TROPICAL STORM PHYLLIS
BEST TRACK TC-12
03 AUG - 04 AUG 1981
MAX SFC WIND 45 KTS
MINIMUM SLP 978 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
04/18Z
03/06Z
03C
04
TCFA
35B
40
45
45
40
40
35B
A
17
18
11
11
11
12
A
SEOUL
TOKYO
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
WOLEAI
TRUK
PONAPE
KWAJALEIN
KOSRAE
130°
135°
140°
145°
150°
155°
160°
165°
170°

The genesis of TD-11 and Tropical Storm Phyllis were associated with one synoptic feature, but the extent of development of each was significantly different. The systems are being discussed together to contrast their early development and thereby come to some understanding as to the inability of TD-11 to mature into a significant tropical cyclone. A brief discussion of Tropical Storm Phyllis will then follow.

On 30 July a monsoon trough developed that extended from the Northern Marianas Islands southwestward toward the Palau Islands. Two surface circulations were embedded at opposite ends of the trough. A mid-level cyclonic circulation was located over the northeastern portion of the trough while upper-level data had been indicating the presence of an anticyclone over the area.

Development of a significant tropical cyclone was potentially high because of the vertical relationship of the upper level anticyclone to the mid-level and surface circulation centers. Consequently, a formation alert was issued at 310300Z for the Northern Marianas area. During the ensuing nine hours, satellite imagery showed evidence of strong upper-level outflow and ship data near the circulation center reported pressures of 997mb; thus JTWC issued the first warning on TD-11 (Fig. 3-11-1).

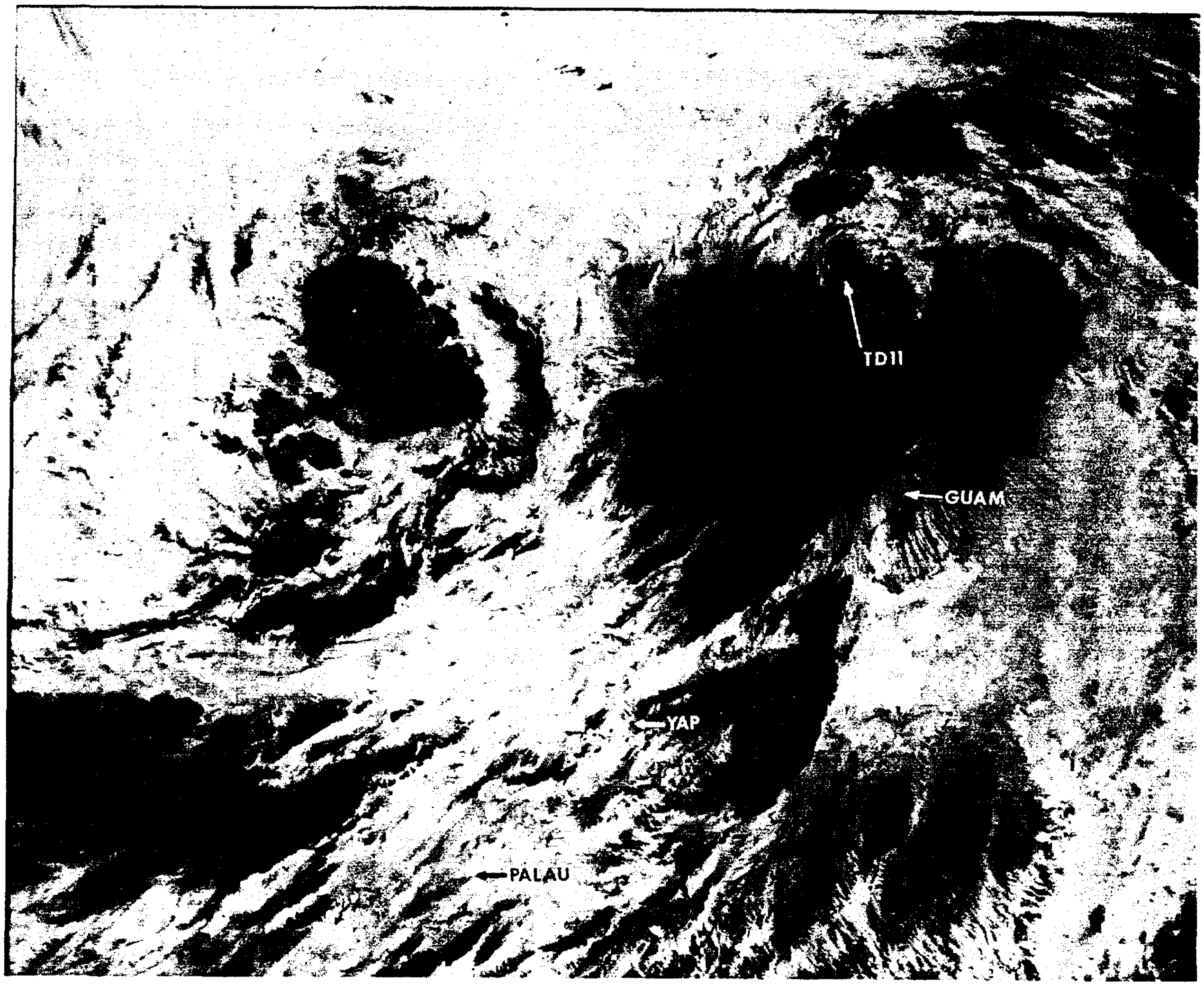


FIGURE 3-11-1. TD-11 early in its development on 30 July 1981, 2236Z. (NOAA 6 infrared imagery)

A decrease in the upper level organization was evident on satellite imagery as the anticyclone receded slowly northeastward. Although the mid and upper level features that helped form TD-11 were still present, by 1 August they appeared to be displaced from the vertical axis of the depression. TD-11 was tracking northeastward at a slower rate than the upper level anticyclone and eventually encountered upper level wind shear caused by the anticyclone which disassociated from TD-11 on the 2nd of August and moved well to the northeast. The final warning on TD-11 was issued at 020000Z.

Aircraft reconnaissance observations on the 1st of August (Fig. 3-11-2) revealed TD-11 was not as well organized as when the first warning was issued. A circulation center was evident at 1500 ft. but the surface winds were indicative of only an elongated trough extending from TD-11 to the second circulation north of the Palau Islands. Throughout the trough in general, surface pressures were low with weak pressure gradients, thus accounting for the weak wind field about TD-11 whose central pressure could have supported much higher winds had it not been embedded in the trough.

While attention had been focused on TD-11, another surface circulation, located in the eastern-most portion of the monsoon trough continued to persist. The upper-level anticyclone was now providing the outflow mechanism required for further development. A formation alert was issued at 022300Z for the area northeast of the Marianas Islands. By 030600Z aircraft and satellite reconnaissance provided evidence that the circulation had already attained tropical storm intensity and the first warning on Phyllis was subsequently issued at that time.

The two features most directly respons-

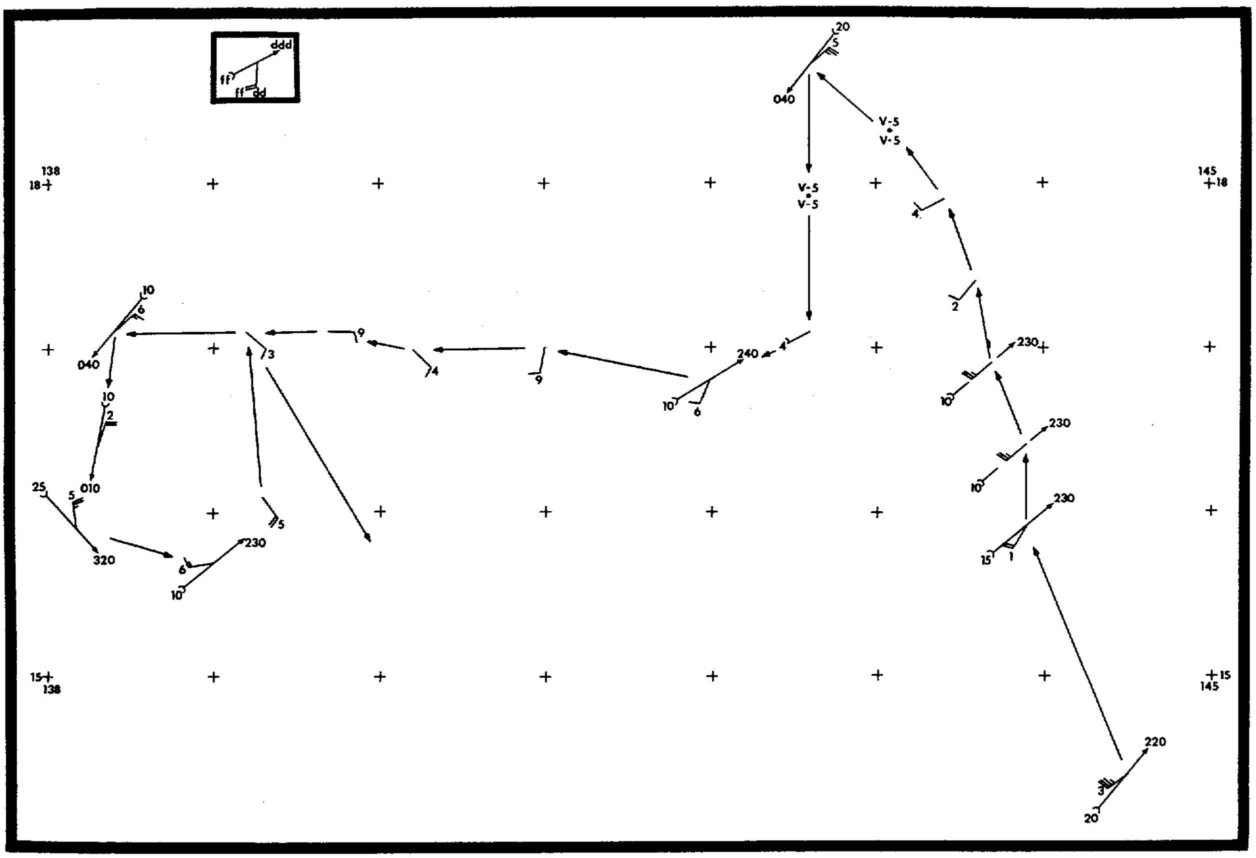


FIGURE 3-11-2. Plot of aircraft reconnaissance data at the 1500 ft. level and surface of TD-11 on the 1st of August.

ible for the lack of development of TD-11 and the intensification to Tropical Storm Phyllis were the location of the upper-level anticyclone and the elongation of the monsoon trough as the anticyclone moved northeastward. Initially both circulations were favorably positioned under the upper level anticyclone. The intensification of TD-11 was retarded because the monsoon trough elongated, thereby restricting strong surface inflow from the east. Further, TD-11 did not have the advantage of a strong mid-level steering current and was thus unable to maintain its favorable position with respect to the upper level anticyclone. This resulted in an increased vertical wind shear and eventual dissipation.

Phyllis, on the other hand, was able to maintain a favorable position with respect to the anticyclone aloft. Located within the monsoon trough and exposed to strong surface inflow in three quadrants, Phyllis was able to mature into a significant tropical cyclone.

Phyllis initially tracked northward at 11 kt (20 km/hr) and intensified slowly. An interesting feature in the vertical structure of Phyllis after she attained tropical storm intensity was that the convection was mostly limited to the eastern periphery of her circulation center, (Fig. 3-12-1). Typically, this is suggestive of the cyclone having a tilted vertical axis.

The convective activity decreased as Phyllis advanced northward toward colder water and encountered increased vertical wind shear. By 041800Z Phyllis began to weaken rapidly and the final warning was issued. The remnants of Phyllis continued to track northwestward and later merged with an extratropical low pressure system off the east coast of Japan.

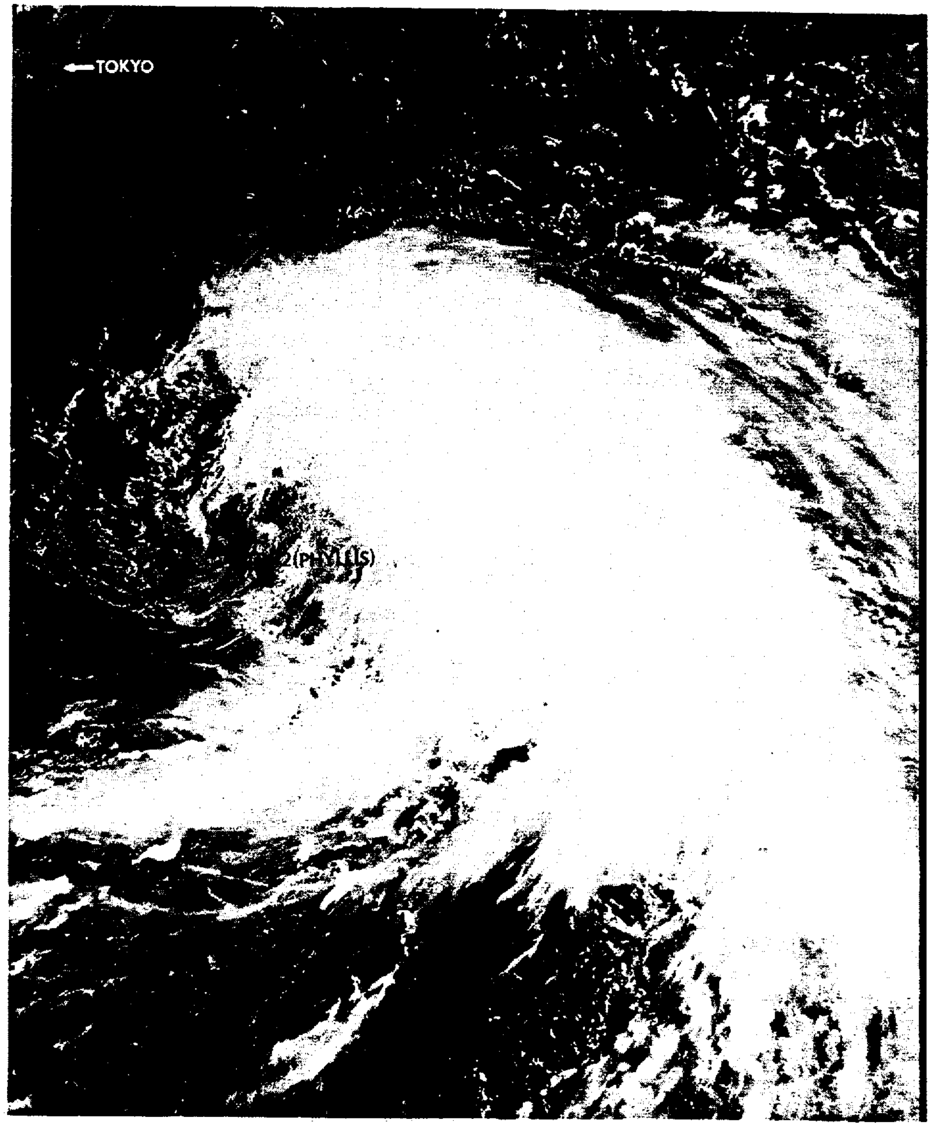
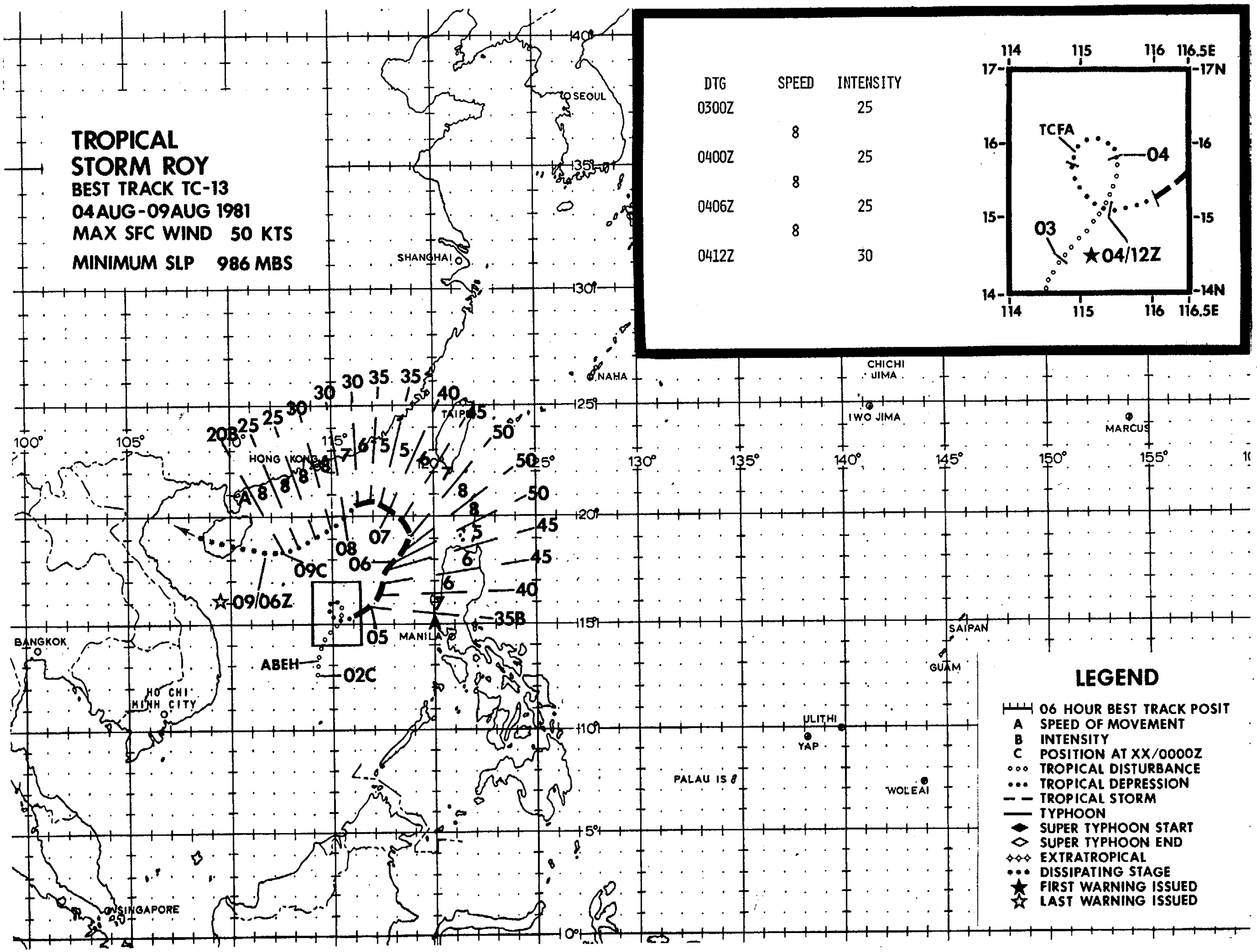


FIGURE 3-12-1. The exposed low level circulation center of Phyllis on 3 August 1981, 0410Z. The convective activity is limited to the east of her center of circulation. (NOAA 7 visual imagery)


TROPICAL
STORM ROY
BEST TRACK TC-13
04 AUG-09 AUG 1981
MAX SFC WIND 50 KTS
MINIMUM SLP 986 MBS
DTG SPEED INTENSITY
0300Z 25
8
0400Z 25
8
0406Z 25
8
0412Z 30
TCFA
04
03
★04/12Z
114 115 116 116.5E
17N 16 15 14N
☆09/06Z
09C
08
07
06
05
ABEH
02C
35B
20B
SEOUL
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
SINGAPORE
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

Tropical Storm Roy was spawned in the warm water east of Vietnam during the first few days of August. On 2 August, a low-level circulation center became evident from synoptic reports in the region. For the next two days, the disturbance tracked slowly northward and on 4 August, it acquired a noticeable central convective feature. At 040515Z, a tropical cyclone formation alert was issued and in the 13 hours which followed, the disturbance was upgraded to Tropical Depression 13 (041200Z) and Tropical Storm Roy (041800Z). Figure 3-13-01 shows the disturbance on infrared satellite imagery at the time the decision to upgrade to warning status was made.

For the next 36 hours, Roy slowly intensified and reached a peak intensity of 50 kt (26 m/sec) on 6 August. During this period of intensification, the upper level features associated with Roy began to move west of the surface center, under the influence of a moderate mid- and upper-tropospheric shearing current. Figure 3-13-02 shows Roy's low-level center emerging from the main convective feature. From 6 August to Roy's eventual dissipation on 9 August, the system existed as an exposed low-level center with most of the convection displaced well west of the low-level center.

Roy's track through the South China Sea was difficult to fully anticipate. From the beginning, Roy was expected to track slowly towards the north-northeast then turn to a more northwesterly heading. However, in the initial stages, Roy moved steadily northeastward. Roy's movement appeared to be related to the combined effects of the low-level monsoon flow east of Roy's center and the general alignment with a mid-tropospheric trough which extended southwest from Tropical Storm Phyllis. On 6 August, however, the mid-tropospheric trough closed-off northeast of Roy and the system gradually turned towards the west in response to the resetablishment of the Asian high pressure ridge over southern China. Eventually, Roy weakened as a significant tropical cyclone in the northwestern South China Sea prior to crossing Hai-nan.

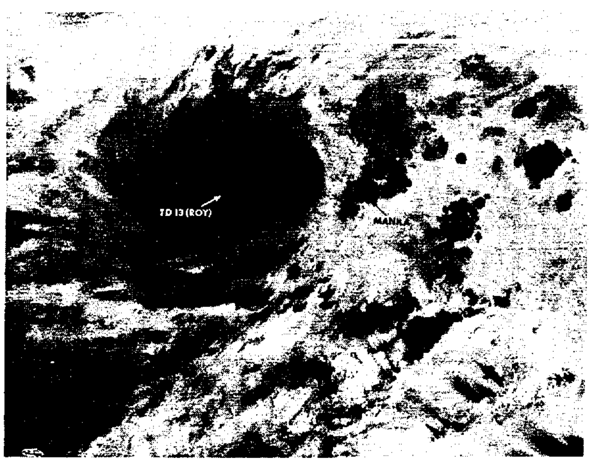


FIGURE 03-13-1. NOAA 6 IR 041124Z AUG 81
The central convective features over the developing Tropical Storm Roy. Based on this imagery (041124Z Aug 81) and some synoptic ship reports in the vicinity, the decision to issue tropical cyclone warnings was made. (NOAA 6 infrared imagery)

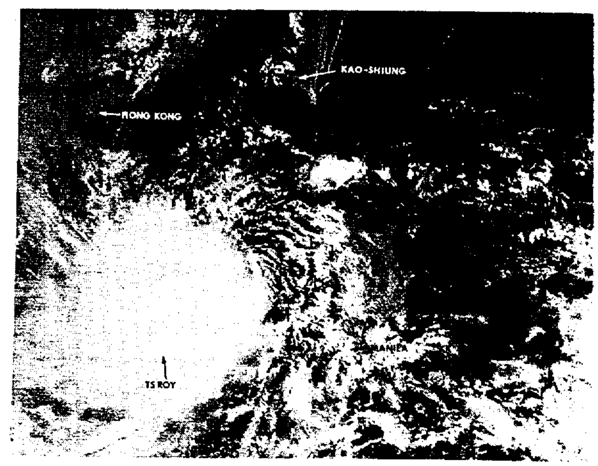
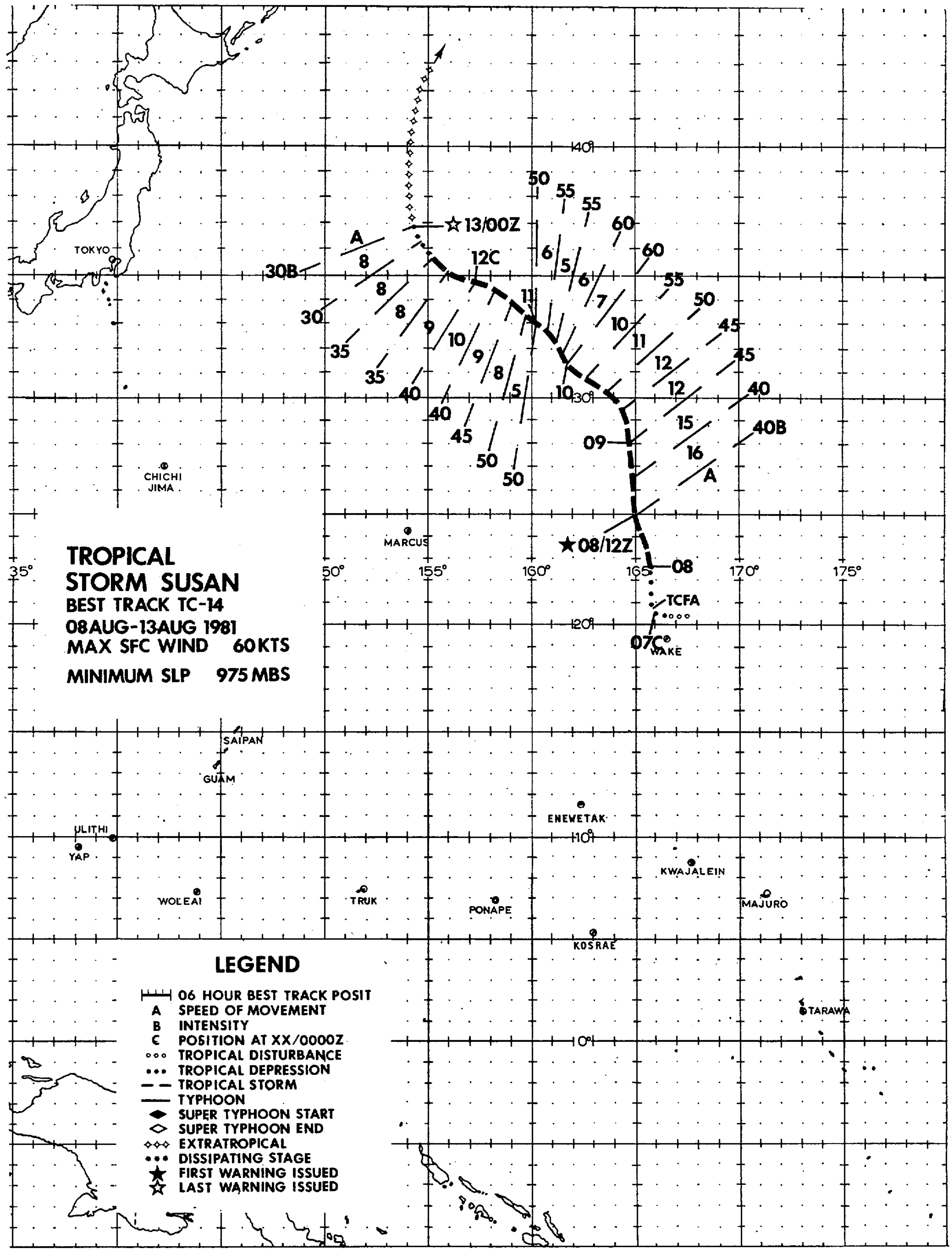


FIGURE 03-13-2. NOAA 6 VIS 052340Z AUG 81
Visual satellite imagery for the first time shows Roy as a partially exposed low-level circulation center. (052340Z Aug 81) During the 24 hours which followed, Roy would become fully exposed and would begin a gradual weakening trend. (NOAA 6 visual imagery)


TROPICAL
STORM SUSAN
BEST TRACK TC-14
08AUG-13AUG 1981
MAX SFC WIND 60KTS
MINIMUM SLP 975MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
13/00Z
08/12Z
TCFA
TOKYO
CHICHI JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
WOLEAI
TRUK
PONAPE
ENEWETAK
KWAJALEIN
MAJURO
KOSRAE
TARAWA

During the week (27 July-3 August) prior to the formation of Tropical Storm Susan, the monsoon trough had been well established in the West Pacific along 20N. When Tropical Storm Phyllis developed near 26N 147E on 3 August and subsequently moved north, the prevailing low-level southwest flow south of 20N diverged into two channels; one continued north moving with Phyllis, while the other pushed further east to help establish a weak trough in the vicinity of Wake Island (WMO 91245). Tropical Storm Susan formed in this weak trough.

The disturbance that was to become Tropical Storm Susan first appeared on satellite imagery at 062136Z as an exposed low-level circulation approximately 60 nm (111 km) north of Wake Island (Fig. 03-14-1). At the time, the separation of the convection from the surface circulation, due to vertical shear, suggested that only a weak disturbance existed in the area. During the early morning hours prior to this visual satellite sighting, Wake Island had been reporting heavy rainfall with southwest winds as high as 45 kt (23 m/sec); however, it was felt that these reports were more representative of the strong convection in the area than of the exposed surface circulation. When Wake's winds subsided during the next several hours to only 15 kt (8 m/sec), and there was little apparent movement of the circulation center, it was deemed unnecessary to immediately issue a warning of this disturbance. Instead at 0703192Z, a Tropical Cyclone Formation Alert (TCFA) was issued with the expectation that, providing the strong upper level flow across the region subsided, enough convection would develop around the surface circulation for a significant tropical cyclone to form.

During the next 24 hours little changed in the synoptic situation. Although new convection had begun to develop approximately 100 to 150 nm (185 to 278 km) to the north and east of the exposed low-level circulation, 200 mb satellite-derived winds over the region still indicated strong 40 kt (21 m/sec) flow from the north. When the 080015Z aircraft investigative mission could find only 20 kt (10 m/sec) winds in possibly "one of several circulations in the area"[1] (992 mb sea level pressure), it was decided to reissue the formation alert. However by 081200Z, the convection on the periphery of the surface low appeared to have strengthened while satellite imagery indicated that the strong vertical shear had weakened enough for an upper level anticyclone to develop; consequently, the first warning on Tropical Storm Susan was issued.

Initially, Susan tracked north along a trough induced by convection left behind from the passage of Tropical Storm Phyllis a week earlier. Once she reached 30N 164E at 091200Z, Susan did not recurve as originally forecast but turned toward the northwest in response to an approaching weak cold front. It was during this stage that Susan reached her greatest intensity of 60 kt (31 m/sec) (Fig. 3-14-2). By 101800Z the approaching frontal system weakened enough so that Susan no longer responded to its presence. However, cool dry air from the remnants of this front appeared to entrain into the circulation center and by 111200Z very little convection remained. Susan next turned toward the west-northwest in response to a new frontal system coming off Japan (also increasing its convective activity). This time, however, the frontal system did not weaken before reaching Susan; and by 130000Z Tropical Storm Susan had become completely entrained into the front and quickly made the transition into an extratropical system.

Figure 3-14-1. The initial stages of Tropical Storm Susan just north of Wake Island at 6 August 2136Z. (NOAA 6 visual imagery)

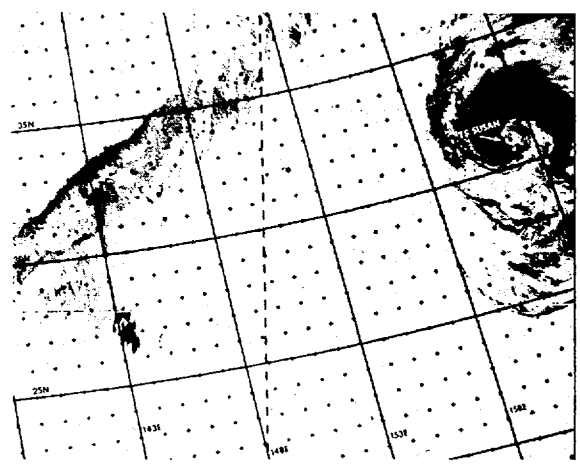
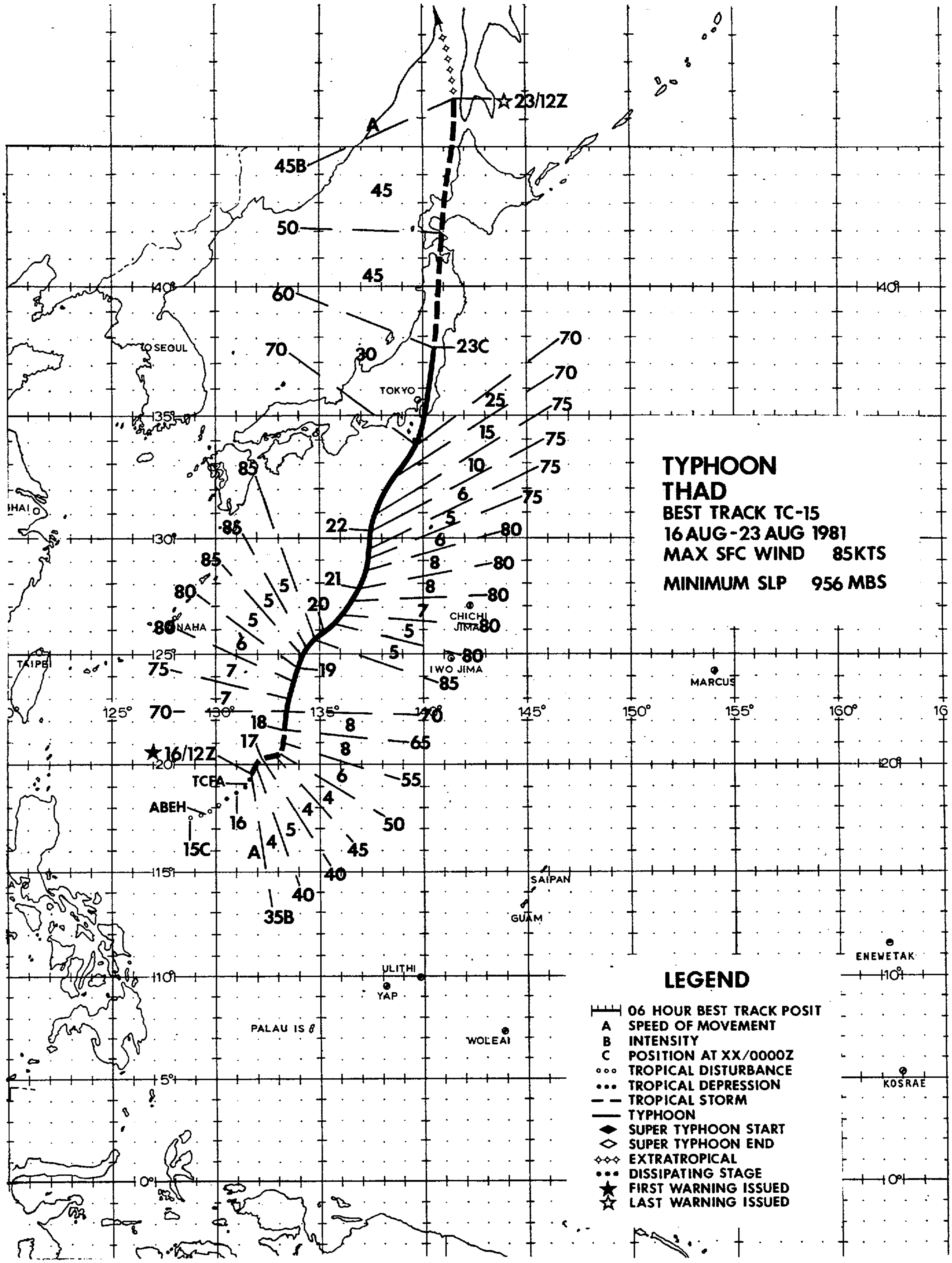


Figure 3-14-2. Tropical Storm Susan just prior to peak intensity on 9 August 2208Z. Note how the convection is displaced from the circulation center. A weak cold front can be seen approaching from the northwest. (NOAA 6 infrared imagery)

[1]RANDOLPH A. FIX, 1 Lt, USAF: Aerial Reconnaissance Weather Officer (ARWO).


TYPHOON
THAD
BEST TRACK TC-15
16 AUG - 23 AUG 1981
MAX SFC WIND 85KTS
MINIMUM SLP 956 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
23/12Z
16/12Z
TCFA
ABEH
15C
23C
SEOUL
TOKYO
NAHA
TAIPEI
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
ENEWETAK
KOSRAE

The monsoon trough was particularly active in mid-August, and within the 48 hour period beginning 16 August three tropical cyclones were spawned. Typhoon Thad, the first of the three, was initially evident on 10 August when surface synoptic data indicated a weak circulation was embedded in the trough near 18N 130E. The circulation was first cited in the Significant Tropical Weather Advisory on 15 August when satellite imagery indicated limited outflow had developed above the surface circulation. The outflow was initially the result of a 200 mb ridge that had built westward over the surface trough. Continued improvement in the outflow prompted the issuance of a Tropical Cyclone Formation Alert at 151800Z. Aircraft reconnaissance data, which located the circulation near 19N 132E, provided the basis for the alert area being moved northeast and reissued at 160530Z. Analysis of 160000Z 200 mb synoptic data showed that an anticyclone had developed in the ridge over the circulation, enhancing the outflow pattern necessary for further intensification of the disturbance.

Satellite imagery eventually indicated better organization of the system, thus the first warning on TD-15 was issued at 161200Z. TD-15 was initially forecast to move slowly northward then accelerate to the northwest as it came under the influence of easterly winds south of the 500 mb ridge. By 170600Z both aircraft and satellite data showed Thad's movement was to the northeast in response to a weakness in a 500 mb ridge which had developed over Japan (Fig. 3-15-1). Forecasts of this 500 mb feature maintained the weakness over Japan and the forecast track for Thad was adjusted from northwestward to northward to reflect the new steering pattern. Recurvature was expected east of Japan.

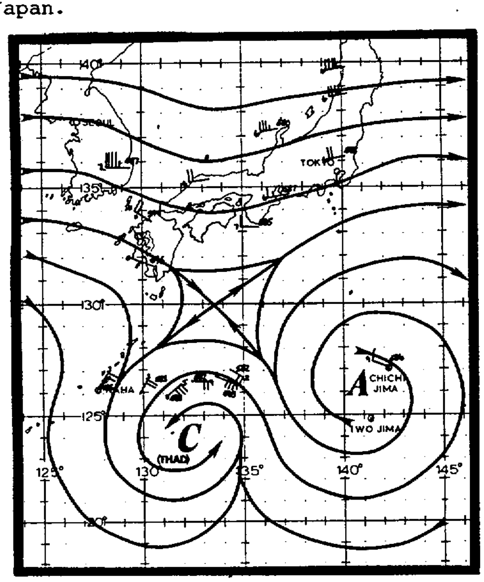


Figure 3-15-1. 500 mb streamline analysis for 181200Z showing the major synoptic features upon which the recurvature forecast was based. Wind data are a combination of rawinsonde and aircraft reconnaissance data. Wind speeds are in knots.

By 180000Z Thad had reached typhoon strength and developed a ragged eye that remained for 80 hours (Fig. 3-15-2).

As Thad neared 30N, analysis of 500 mb data established the likelihood that Thad would interact with a progressing long wave trough just south of Japan, where recurvature and subsequent acceleration were expected. Post-analysis has revealed several deficiencies in that conclusion: the trough did move eastward over the Sea of Japan late on 21 July; a rapidly building ridge east of Thad caused the trough to stall northwest of Thad; coincident with the stalling long wave, a weak short wave moved through the trough and caused a rapid, unforecast, deepening. The entire trough system generated 500 mb height drops of up to 100 meters in 12 hours. This rapid deepening, combined with high pressure in the ridge to the east, established an intense 500 mb pressure gradient over eastern Japan with resultant wind speeds as high as 65 kt (120 km/hr). Thad tracked northward under the influence of the 500 mb flow, was entrained into this area of high winds early on 22 August and accelerated very rapidly to the north over eastern Japan, rather than taking the expected recurvature path. Thad's speed of advance accelerated from 10 kt (19 km/hr) at 220000Z to 45 kt (83 km/hr) by 230000Z.

Post analysis has shown Thad started a very rapid extratropical transition near 32N that continued as the system accelerated along the eastern side of the trough. The rapid acceleration, and an associated rapid entrainment of cool dry air, completed the transition by 231200Z, at which time satellite imagery indicated Thad had merged with the trough over the Tatar Strait and was no longer discernible as a tropical entity.

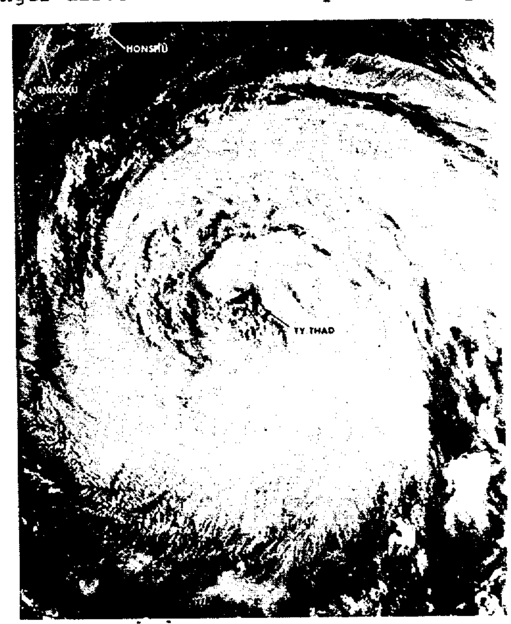
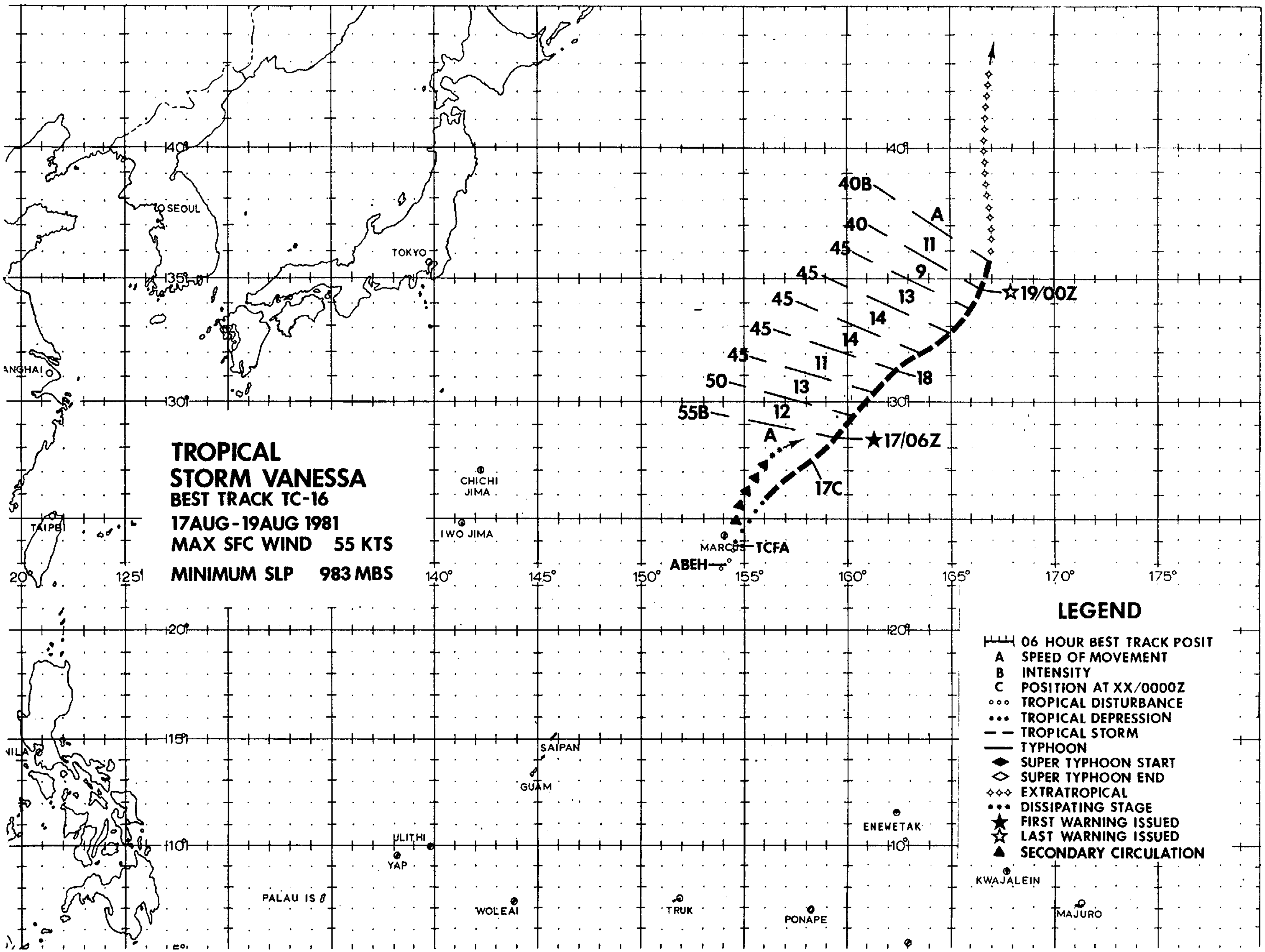


Figure 3-15-2. Visual satellite imagery from 202259Z Aug 81 showing Thad at 80 knots (41 m/sec) intensity, with ragged eye. (NOAA 6 visual imagery)


TROPICAL STORM VANESSA
BEST TRACK TC-16
17AUG-19AUG 1981
MAX SFC WIND 55 KTS
MINIMUM SLP 983 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SECONDARY CIRCULATION
19/00Z
17/06Z
17C
TCFA
ABEH
40B
40
45
45
45
45
45
50
55B
A
11
9
13
14
14
11
18
13
12
A
SEOUL
TOKYO
TAIPEI
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KWAJALEIN
MAJURO
40°
35°
30°
20°
15°
10°
125°
140°
145°
150°
155°
160°
165°
170°
175°

Tropical Storm Vanessa developed approximately 60 nm (111 km) south of Marcus Island (WMO #47991) during a period of enhanced convective activity within the monsoon trough. Despite diurnal fluctuations, the increased convective activity was evident on the satellite imagery of 12 August and continued to increase over the next several days. Furthermore, surface synoptic data and satellite data confirmed the merger of the monsoon trough with a pre-existing north-south oriented trough near 170E that had been in evidence since 7 August. This second trough was particularly intense due to prior passage of Tropical Storm Susan (14). Weak circulations and minor disturbances were detected along the entire length of the merged troughs and investigative missions were flown to several of them. The first disturbance to intensify significantly produced Typhoon Thad (15), while 18 hours later (170600Z) the first warning was issued on Tropical Storm Vanessa (Fig. 3-16-1).

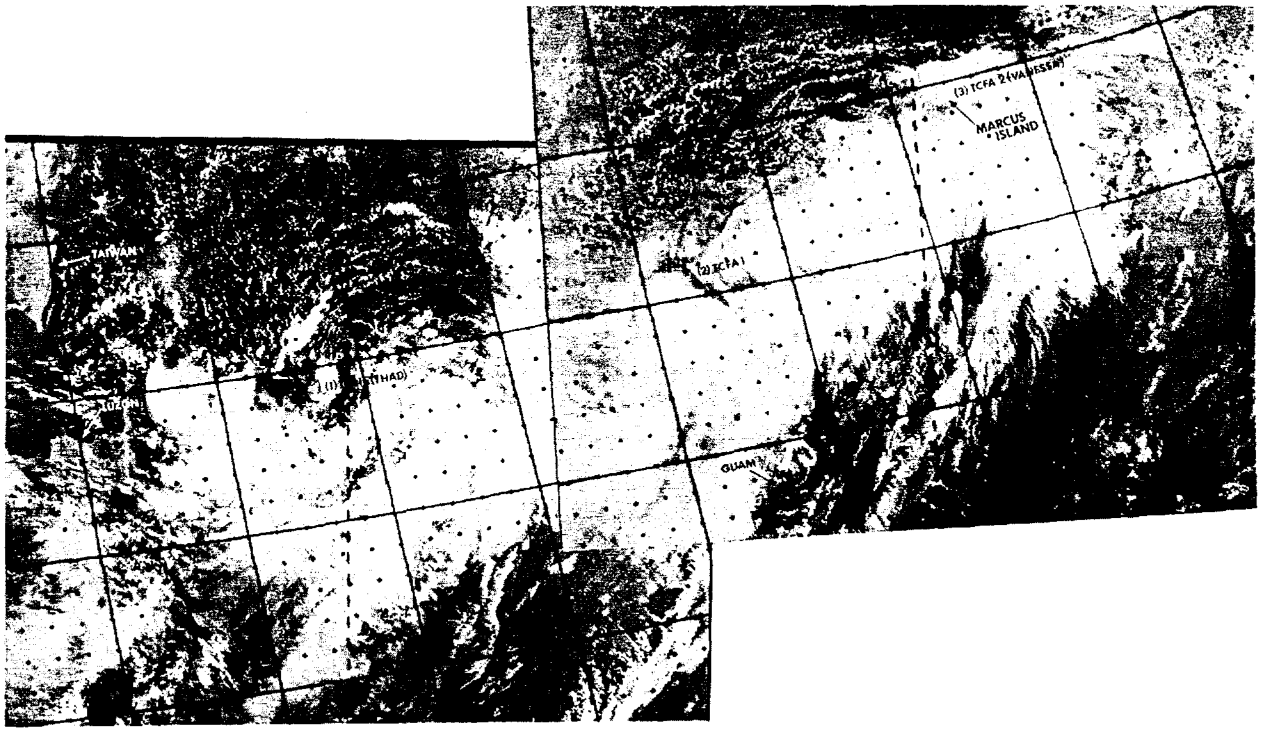


FIGURE 3-16-1a: Active monsoon trough as it appeared prior to development of Tropical Storm Vanessa. (1) TD-15(Thad), (2) initial TCFA and (3) area where TD-16(Vanessa) developed. Photo is mosaic using consecutive NOAA 6 passes for 152131Z and 152312Z, Aug 1981. (NOAA 6 visual imagery)

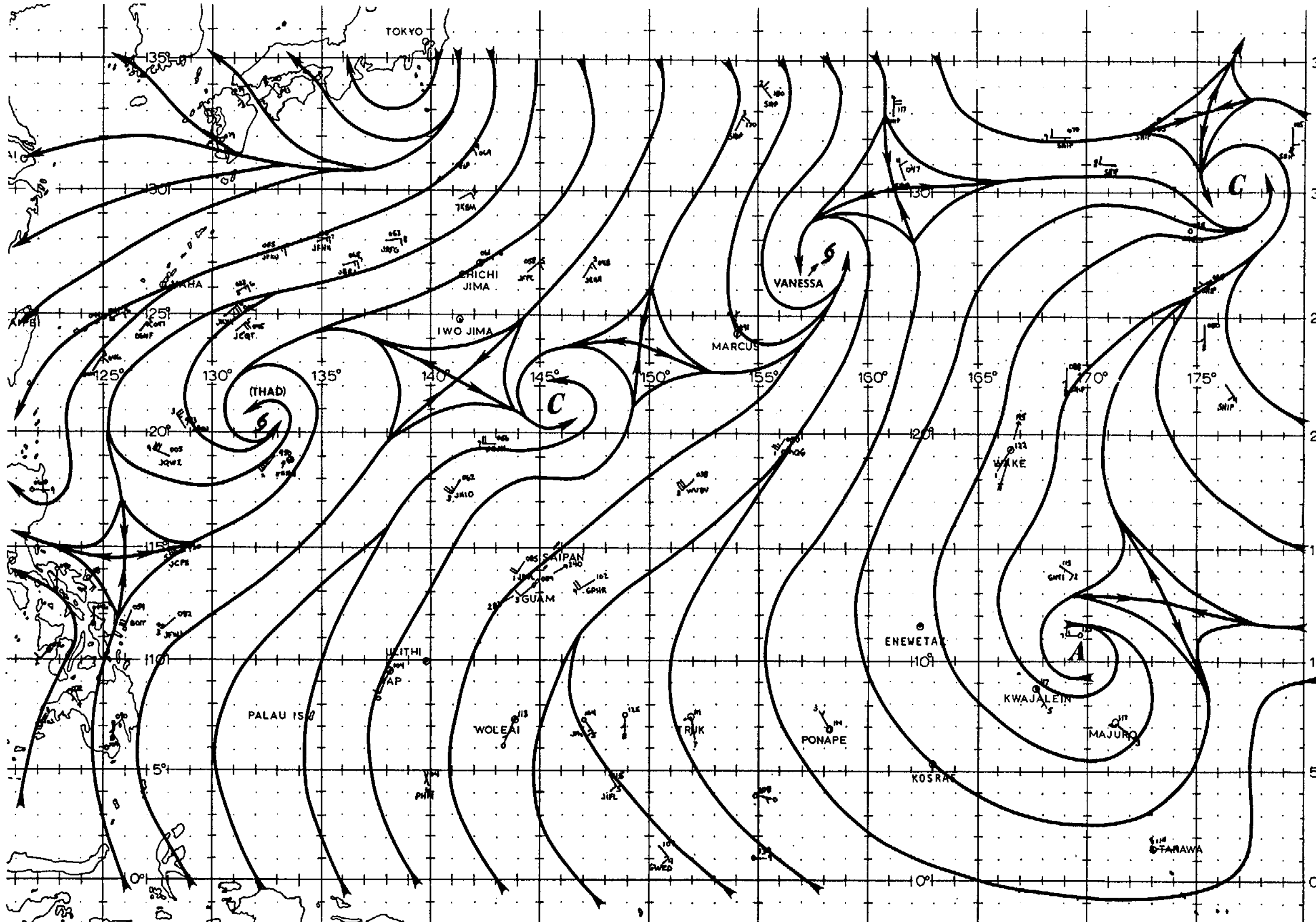


FIGURE 3-16-1b: The 170000Z, Aug 1981 surface (⟵┐)/gradient-level (ddd ⟵ ff) wind data and streamline analysis depicting the monsoon trough. Wind speeds are in knots.

An initial Tropical Cyclone Formation Alert (TCFA) was issued at 150525Z for a circulation near 20N 149E which, in the ensuing 24 hours, weakened. This TCFA was superseded by a second TCFA at 160617Z for a circulation near 24N 155E. Re-analysis of all available satellite data for the period shows that the circulations were separate entities and were related only because they developed within the same trough. Furthermore, re-analysis also reveals that there was a primary and a secondary circulation present when the second TCFA was issued. The primary circulation was totally obscured by dense overcast and was not initially apparent. Initial satellite fixes were based on the partially exposed secondary circulation. In actuality, the primary circulation was located approximately 60 nm (111 km) to the south of the satellite fixes (Fig. 3-16-2). The troublesome secondary circulation was no longer discernible after approximately 12 hours and satellite analysts were able to locate the primary circulation.

Enhanced convection and the intense trough were the key low level features contributing to the genesis of Vanessa. Two other contributory features were a mid-tropospheric trough and an upper level anticyclone, both of which were in positions favorable for tropical cyclone development.

The mid-tropospheric trough approximated the position of the surface trough. Several circulations were embedded within this trough, including one over the surface position where Vanessa formed. In the upper troposphere, an anticyclone had existed over the area since 15 August. Vanessa, therefore, possessed the vertical alignment of a mature tropical cyclone from her inception. (Similar conditions existed during the formation of Tropical Storm Phyllis (12)).

It is interesting to note that although Vanessa was vertically aligned, little further development took place after Vanessa was completely free of the surface trough. Two factors probably contributed to non-development:

a. Initially, Vanessa had outflow to the southwest and the northeast. The wind currents exiting the Asian landmass split with the major current being diverted north of the ridge while the weaker current passed south. This weaker southern current was not sufficiently strong enough to maintain the northeast outflow channel and no other outlets were available to connect Vanessa to the westerlies. Thus, only southwest outflow was maintained.

b. In addition to the loss of an outflow channel, Vanessa's northeastward progression was blocked by strong ridging associated with a large 500 mb anticyclone over the Marshall Islands. The ridge forced Vanessa to steer due north. Since Vanessa initially formed at a rather high latitude subsequent northward movement brought her rapidly into contact with upper level shearing currents.

By 190000Z, Vanessa was devoid of convection and the extratropical transition was completed. The completely exposed low level circulation continued to be visible on the satellite imagery for sometime as it continued to track north and eventually merged with a mid-latitude system near 40N 165E. It was finally no longer discernible as a separate entity by 210000Z.

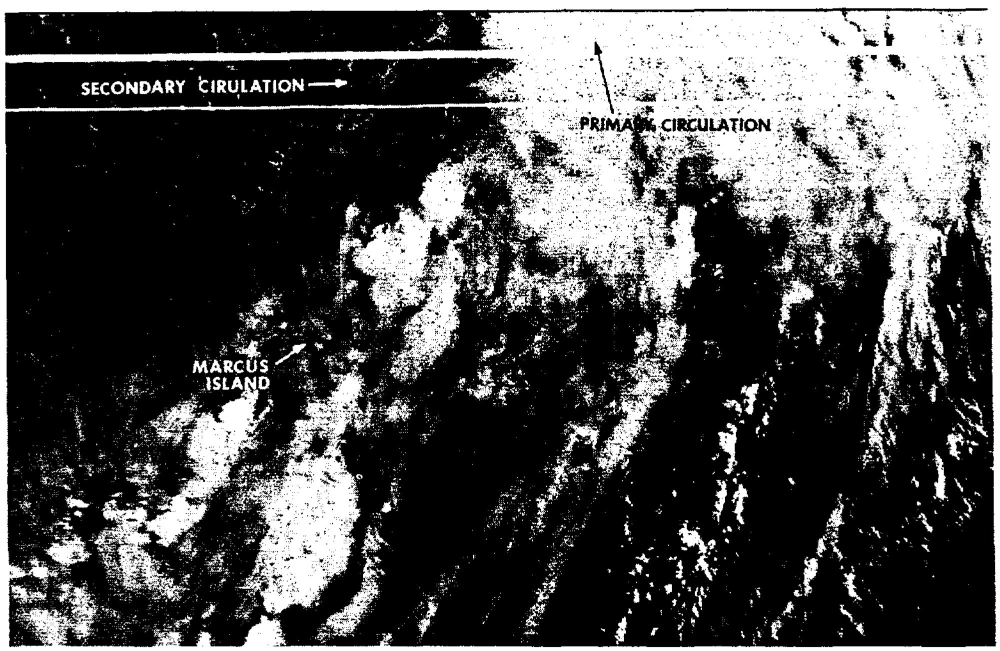
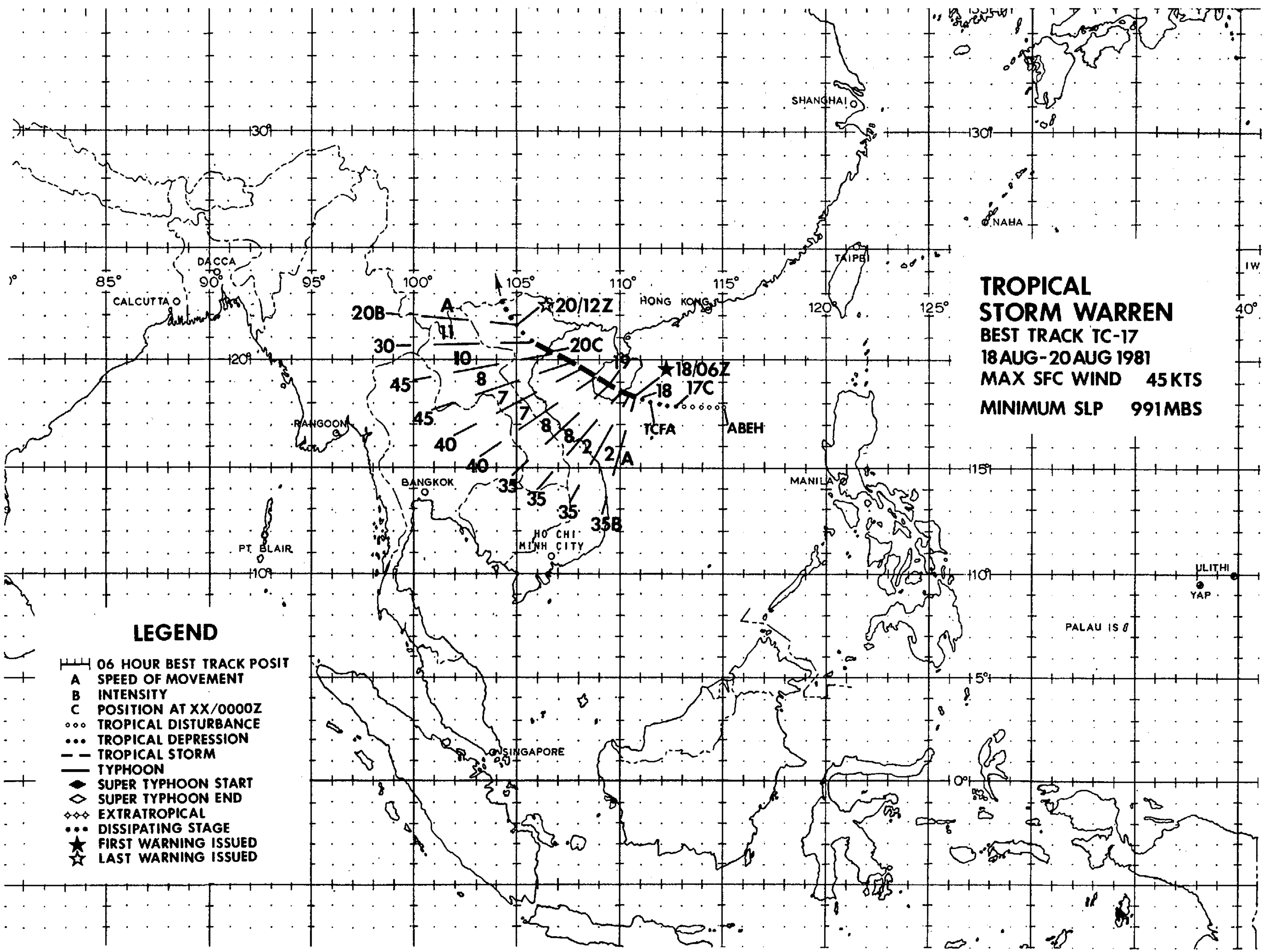


FIGURE 3-16-2. Satellite imagery for 162108Z, Aug 81 showing the exposed secondary circulation and the convective area associated with the developing TD-16 (Vanessa). (NOAA 6 visual imagery)


TROPICAL STORM WARREN
BEST TRACK TC-17
18 AUG-20 AUG 1981
MAX SFC WIND 45 KTS
MINIMUM SLP 991 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
20/12Z
20C
19
18/06Z
18
17C
TCFA
ABEH
20B
A
11
30
10
45
8
7
45
7
8
40
8
2
2
A
40
35
35
35
35B
SHANGHAI
NAHA
TAIPEI
HONG KONG
DACCA
CALCUTTA
RANGOON
BANGKOK
HO CHI MINH CITY
PT. BLAIR
MANILA
ULITHI
YAP
PALAU IS
SINGAPORE
30°
20°
15°
10°
5°
0°
85°
90°
95°
100°
105°
110°
115°
120°
125°

The disturbance that eventually became Warren developed within a monsoon trough that extended across the South China Sea on the 14th of August. Strong vertical wind shear, caused by northeasterly flow at the 200 mb level, inhibited development of the circulation for the next three days. By the 17th of August the 200 mb wind field weakened, allowing upper level features to develop, surface pressures dropped below 1000 mb, and convective activity south of the disturbance center increased. Consequently a Tropical Cyclone Formation Alert was issued at 171500Z.

The system was initially tracking westward at 05 kt (9 km/hr) under the influence of mid-level easterlies generated by a stationary 500 mb anticyclone positioned over Southeast China. This anticyclone persisted throughout Warren's life cycle and its intensity changes were responsible for the variable speed of movement (between 2 kt (4 km/hr) and 5 kt (9 km/hr)) seen prior to the storm striking Hai-nan Island.

By 180600Z satellite imagery showed that Warren had developed an upper level outflow center and the first tropical storm warning was issued. Most of the convective activity was located south of the surface center as were the maximum surface winds. Synoptic and satellite data also indicated that Warren's vertical axis was tilted southward as he tracked over Hai-nan.

After passing over Hai-nan, Warren emerged into the Gulf of Tonkin. Warren continued to show indications of increased organization and intensification as he tracked over the warm water in the Gulf of Tonkin. At 1800Z on the 19th Warren reached his maximum intensity of 45 kt (23 m/sec) while over the Gulf (Fig. 3-17-1), a typical occurrence for most tropical cyclones that move into the Gulf of Tonkin. During the summer months the gulf water becomes extremely warm and thus provides excellent source of energy for transiting tropical cyclones.

Warren made landfall near Nam Dinh, Vietnam, on the 20th of August and weakened rapidly. The final warning on Warren was issued at 1200Z on the 20th as it began to dissipate over Vietnam.

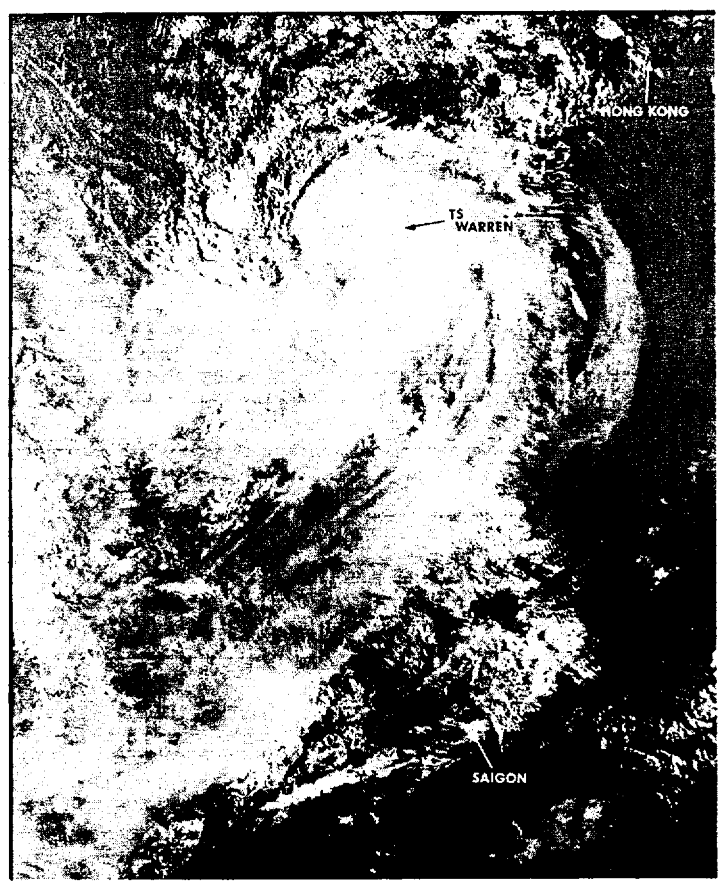
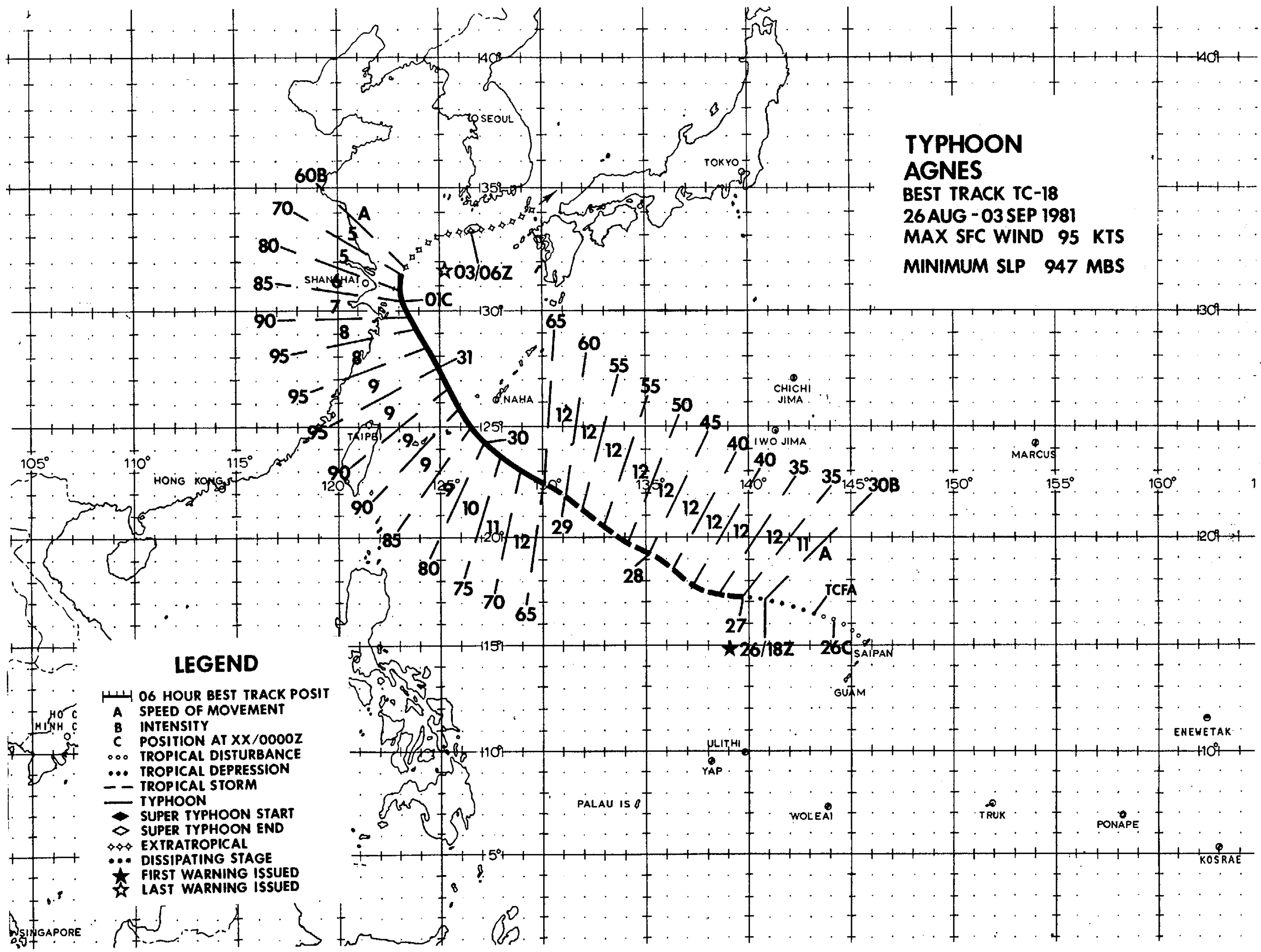


FIGURE 3-17-1. Tropical Storm Warren with maximum surface winds of 45 kt (23 m/sec) prior to landfall of 20 August, 0102Z. (NOAA 6 visual imagery)



TYPHOON
AGNES
BEST TRACK TC-18
26 AUG - 03 SEP 1981
MAX SFC WIND 95 KTS
MINIMUM SLP 947 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE
SINGAPORE
HO CHI MINH C
03/06Z
01C
31
30
29
28
27
26/18Z
26C
TCFA
60B
30B

In mid-August, after several weeks of active cyclogenesis near Wake Island (WMO 91366) which spawned Tropical Storm Susan (14) and Vanessa (16), an upper-level ridge built over the latitudes north of the Marshall Islands and further activity was suppressed for several days. At 230000Z, satellite and upper-level wind reports showed evidence of an upper-level trough building westward from the dateline and during the next 36 hours, a well-defined Tropical Upper Tropospheric Trough (TUTT) cyclone developed in the vicinity of Wake Island. This upper cyclone induced an area of extensive, but yet unorganized, convection southwest of the TUTT cyclone. Gradually, as the convective area moved westward, a weak upper-level anticyclone became evident northeast of Guam. Concurrently, at 251200Z, the mid-tropospheric winds reported from Guam became northerly, and 12 hours later, shifted to southeasterly as the system moved just north of Guam. On 26 August, while a reconnaissance aircraft conducted the initial investigation of the developing system, the 260000Z synoptic data indicated a possible low-level center approximately 150 nm (278 km) northwest of Guam. Based on these data, a Tropical Cyclone Formation Alert was issued at 260500Z and, at 260807Z, the investigating aircraft located a 1006 mb surface center 215 nm (398 km) northwest of Guam. During the subsequent period, satellite imagery showed improving convective organization and, at 261800Z, the first warning was issued for Tropical Depression 18. (Figure 3-18-1 shows TD-18 shortly after the first warning was issued).

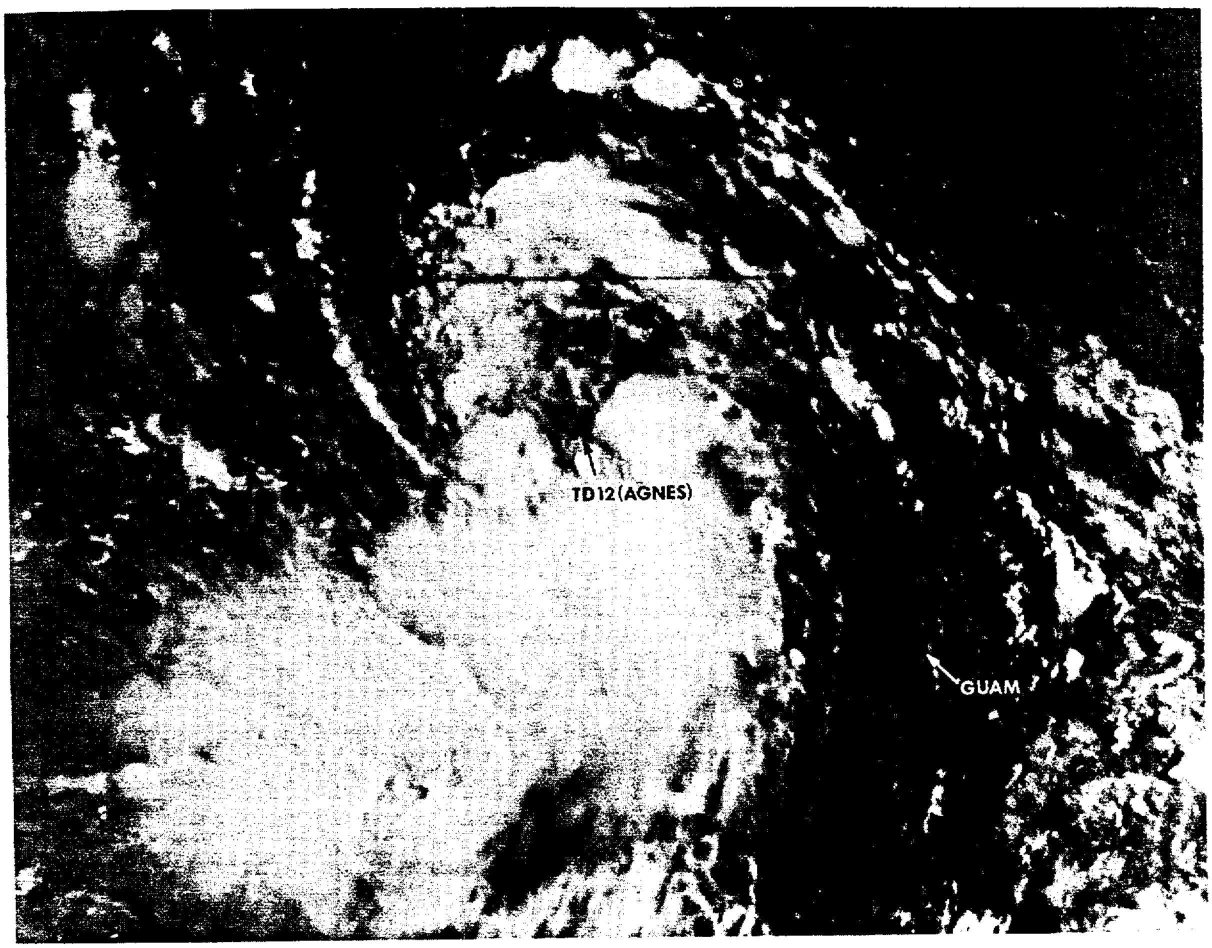


Figure 3-18-1. Tropical Depression 16 at 262221Z AUG located 360 nm (667 km) west-northwest of Guam. This imagery shows a partially exposed low-level circulation on the north side of an extensive area of convection. (NOAA 6 visual imagery)

At 270600Z, TD-18 was upgraded to Tropical Storm Agnes when aircraft reconnaissance data showed a 994 mb sea level pressure at the center and measured winds of 46 kt (24 m/sec) at flight level (1500 ft (472 m)). The first three warnings on Agnes (TD-18) forecast a westward trajectory toward the Bashi Channel, south of Taiwan. However, by 271200Z, the analyses and numerical prognostic series indicated that the 500 mb ridge north of Agnes had not built, and would not build as far west as originally thought. Thus, the forecast track was changed to a more northwestward direction toward Okinawa. While moving toward the west-northwest and intensifying along climatological norms, Agnes was upgraded to a typhoon on the 290000Z warning. At 300600Z, Agnes passed 90 nm (167 km) southwest of Okinawa and then began a turn toward the north along the western periphery of the subtropical ridge. (Figure 3-18-2 shows Agnes south of Okinawa with maximum winds of 85 kt (44 m/sec) and intensifying). At 310000Z, 170 nm (315 km) northwest of Okinawa, Agnes reached a peak intensity of 95 kt (49 m/sec) which was maintained for 12 hours then, after 311200Z, all available data indicated that Agnes had begun a weakening trend.

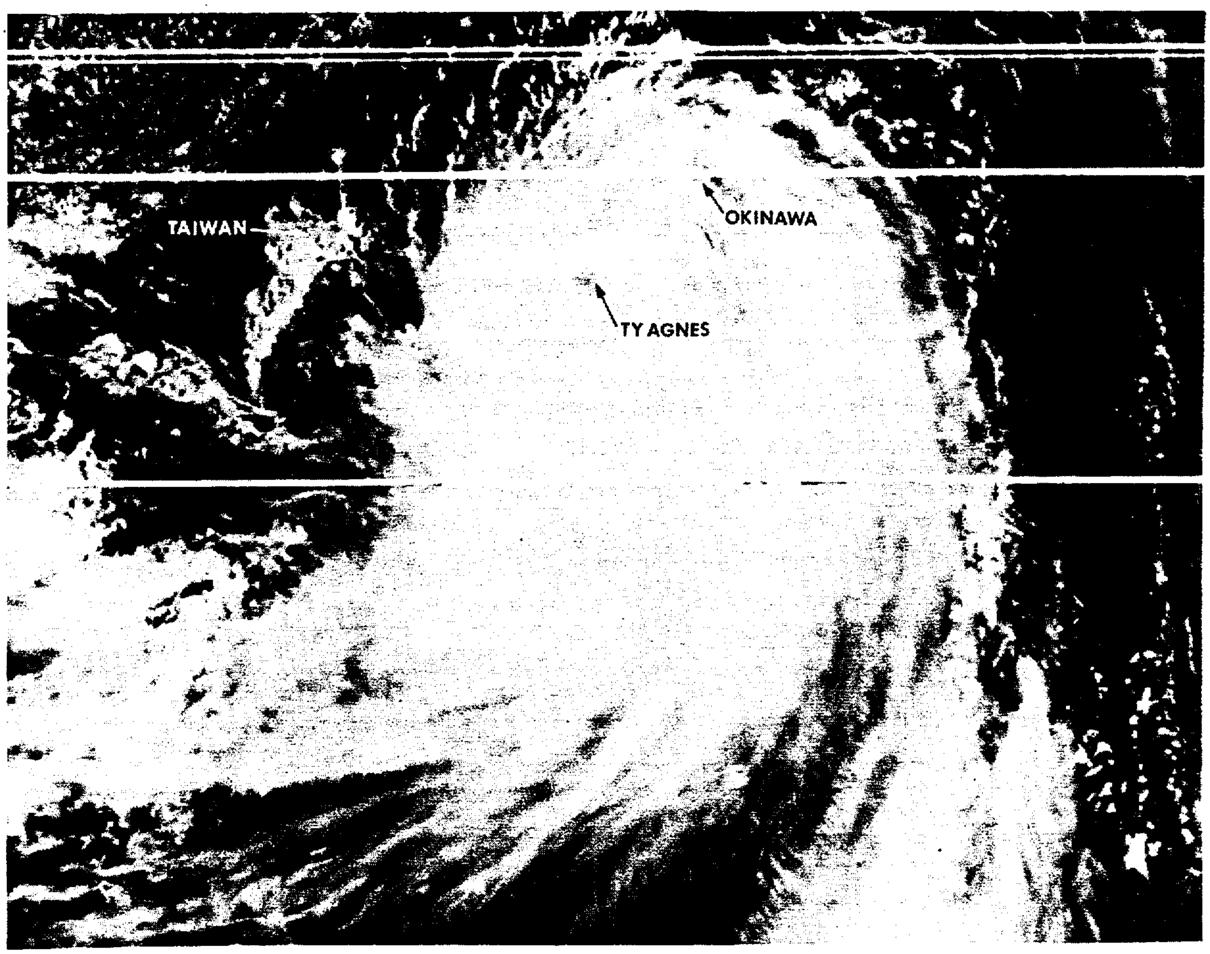


Figure 3-18-2. Typhoon Agnes (200548Z AUG), located just south of Okinawa, with maximum winds of 85 kt (44 m/sec) and approaching her maximum intensity of 95 kt (49 m/sec). Agnes had developed a large banding eye which later imagery and aircraft data would show as a much more compact central feature. (NOAA 7 visual imagery)

Prior to 020600Z September, the forecast scenario had anticipated Agnes would interact with a mid-latitude trough south of Korea and then accelerate northeastward. However, as Agnes moved north of 30N, there was no evidence of the anticipated acceleration; instead, there was increasing evidence that Agnes was losing much of her deep-layered convection and a premature extra-tropical transition was underway. (Figure 3-18-3 shows the 010000Z September 200 mb and 500 mb streamline pattern near Agnes). As Figure 3-18-3 indicates, there were significant opposing mid- and upper-level currents over Agnes and by 01C900Z, satellite imagery showed the last evidence of an upper-level circulation pattern over Agnes. In post-analysis it was determined that Agnes had lost much of her tropical characteristics by 011800Z. However, since there were no aircraft or synoptic data close to Agnes to confirm this apparent transition, warnings were maintained until 030600Z at which time synoptic data from Jeju-Do (WMO 47184) confirmed Agnes' character and that the threat as a significant tropical cyclone to Korea and Japan had passed. Although the system remained well south of Korea until 3 September, much of the southern portion of South Korea was being inundated with the heaviest recorded rainfalls in this century, up to 28 inches (approximately 71 cm). This adverse weather preceded the low-level center as the heavy rains and thunderstorms were sheared northeastward over Korea. Because most of the earlier forecasts had predicted Agnes moving over this region by this time, much of the potential damage from these rains may have been averted by the precautions taken well before the heavy rainfalls and flooding began. Finally, as a relatively weak wind system, the extratropical remains of Agnes passed through the Korea Straits and into the Sea of Japan on 3 and 4 September without any known reports of significant wind or sea damage in the region.

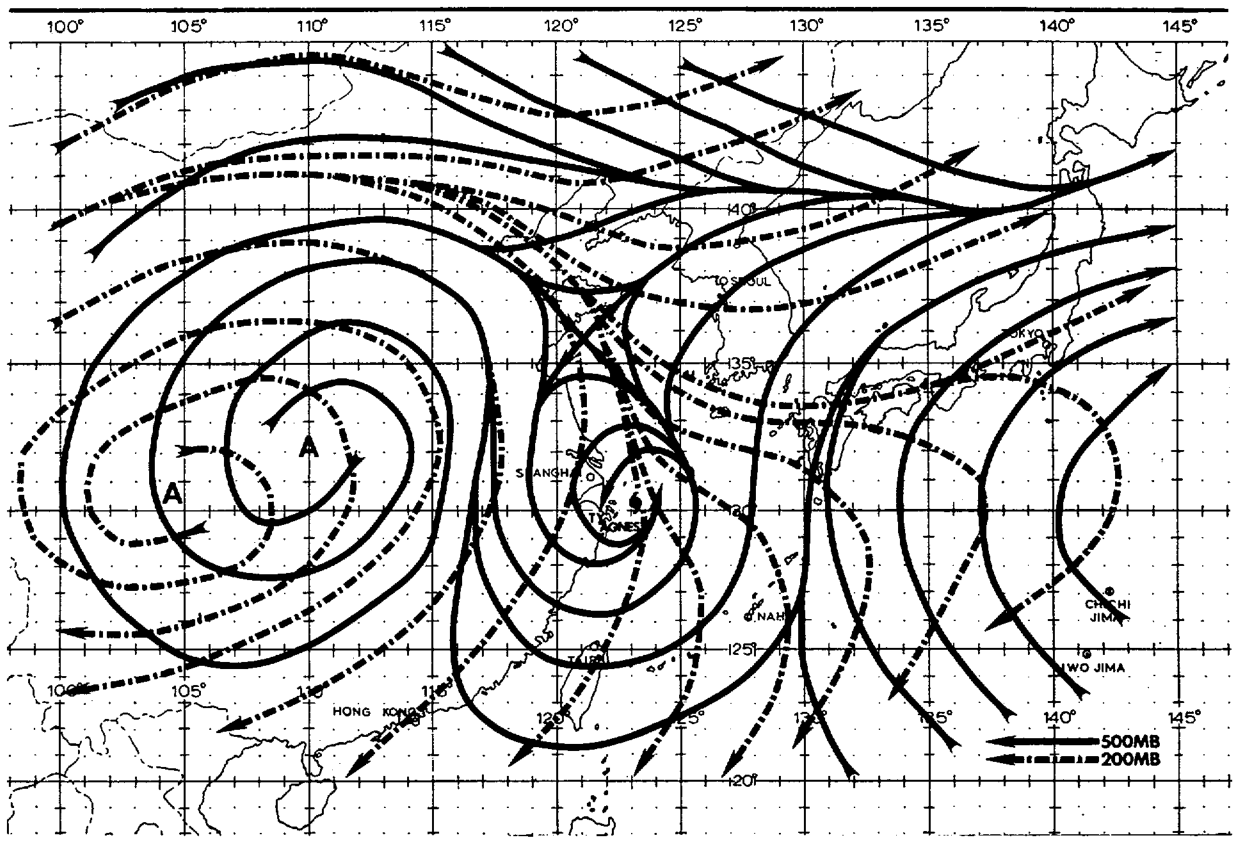
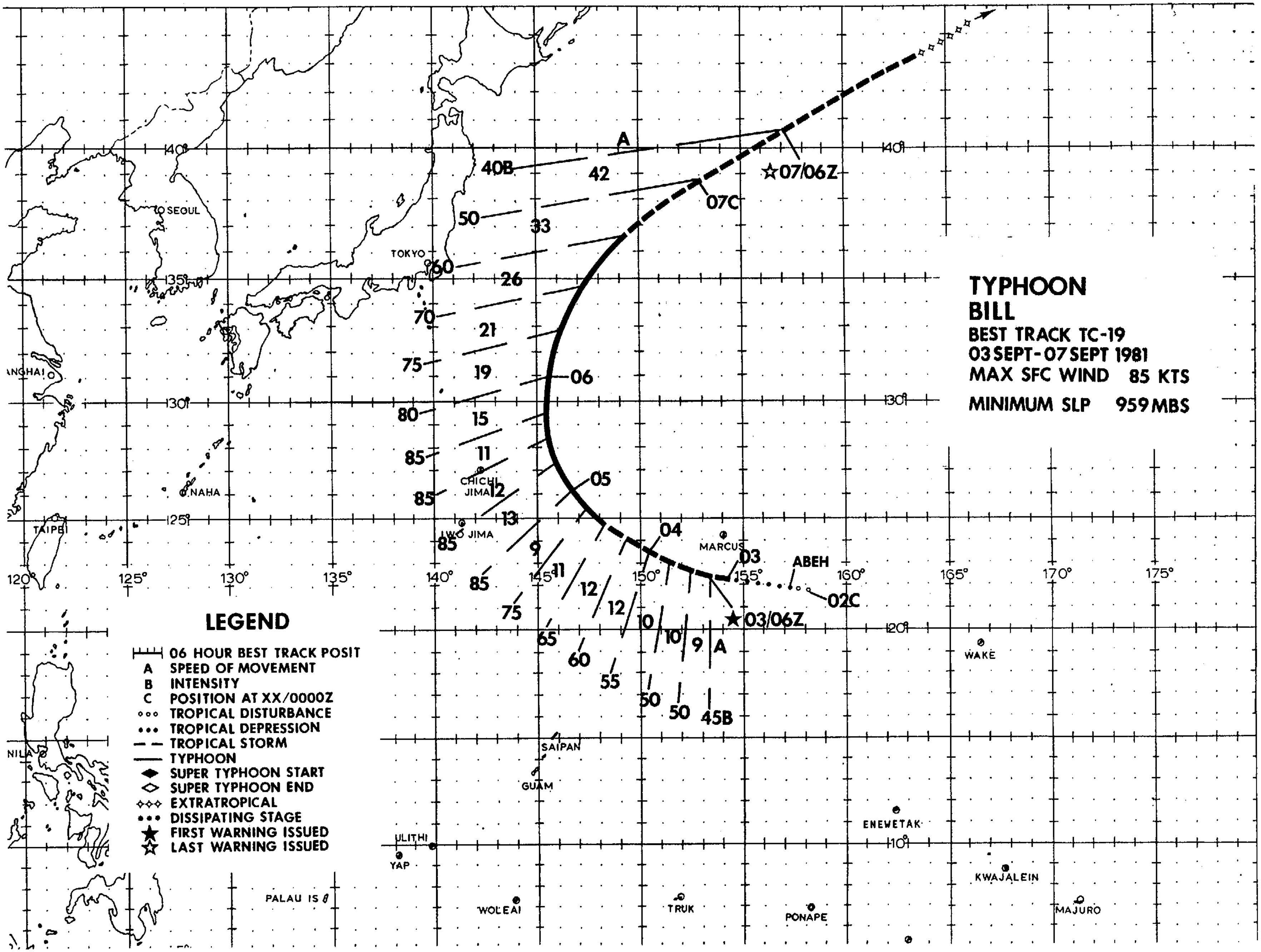


Figure 3-18-3. At 010000Z SEP, Typhoon Agnes was located near 30.2N 123.2E with maximum winds of 85 kt (44 m/sec). However, a strong 200 mb flow of 40 to 50 kt (21 to 31 m/sec) was evident over the 500 mb circulation. This pattern, already underway for 24 hours, continued for the next 36 hours during which Agnes lost her tropical characteristics and weakened to a weak extratropical cyclone.


TYPHOON
BILL
BEST TRACK TC-19
03 SEPT - 07 SEPT 1981
MAX SFC WIND 85 KTS
MINIMUM SLP 959 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
07/06Z
07C
06
05
04
03
02C
ABEH
03/06Z
SEOUL
TOKYO
NAHA
TAIPEI
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ENEWETAK
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KWAJALEIN
MAJURO

Without the benefit of satellite data Typhoon Bill may have gone undetected since the initial disturbance formed 295 nm (546 km) east-southeast of Marcus Island (WMO 47991) and only came within 120 nm (222 km) of that island at 0600Z on 3 September. The disturbance was never discernible in the synoptic data observations from Marcus Island.

Bill remained a compact system throughout its duration. Figures 3-19-1 thru 3-19-4 illustrate the life cycle of Bill from a time near the first warning until its final hours.

The steering for Bill was provided by the flow around the mid-tropospheric sub-tropical anticyclone to the east. Speed of advance (SOA) forecasts were particularly good during the period of Bill's recurvature and eventual extratropical transition when Bill gradually entrained into the mid-latitude mid- and upper-level westerlies. Using a method developed by Burroughs and Brand (1973), operational SOA forecasts were extremely close to the post-storm analysis values.

Unlike larger storms which tend to create their own environment and move sub-tropical systems out of their way, Bill reacted to the environment and maintained a tight gradient between himself and the anticyclone until he was north of 28N at 051200Z, where weakening began. Once this occurred, the maximum observed wind speeds correlated quite well with the wind/pressure relationship of Atkinson and Holliday until extratropical transition occurred.

First detected at 010000Z September, Bill's convection covered a small area, approximately 150 nm (278 km) in diameter, and had an associated small mid-level cyclonic circulation. This mid-level system slowly built down to the surface and then deepened rapidly. Environmental pressures were generally near 1009 mb; however, aircraft reconnaissance at 030807Z found a 993 mb central pressure and winds of 70 kt (36 m/sec) northeast of the center. The Atkinson and Holliday (1977) wind/pressure relationship indicates that a 993 mb central pressure would support a mean maximum wind of 45 kt (23 m/sec). The higher wind speed in Bill was the result of an extremely tight pressure gradient between the storm and a subtropical ridge to the northeast.

FIGURE 3-19-1. Tropical Storm Bill at 50 kt (26 m/sec) intensity, 3 September 1981, 1605Z. This imagery shows that Bill was a compact system in the early stages. (NOAA 7 infrared imagery)

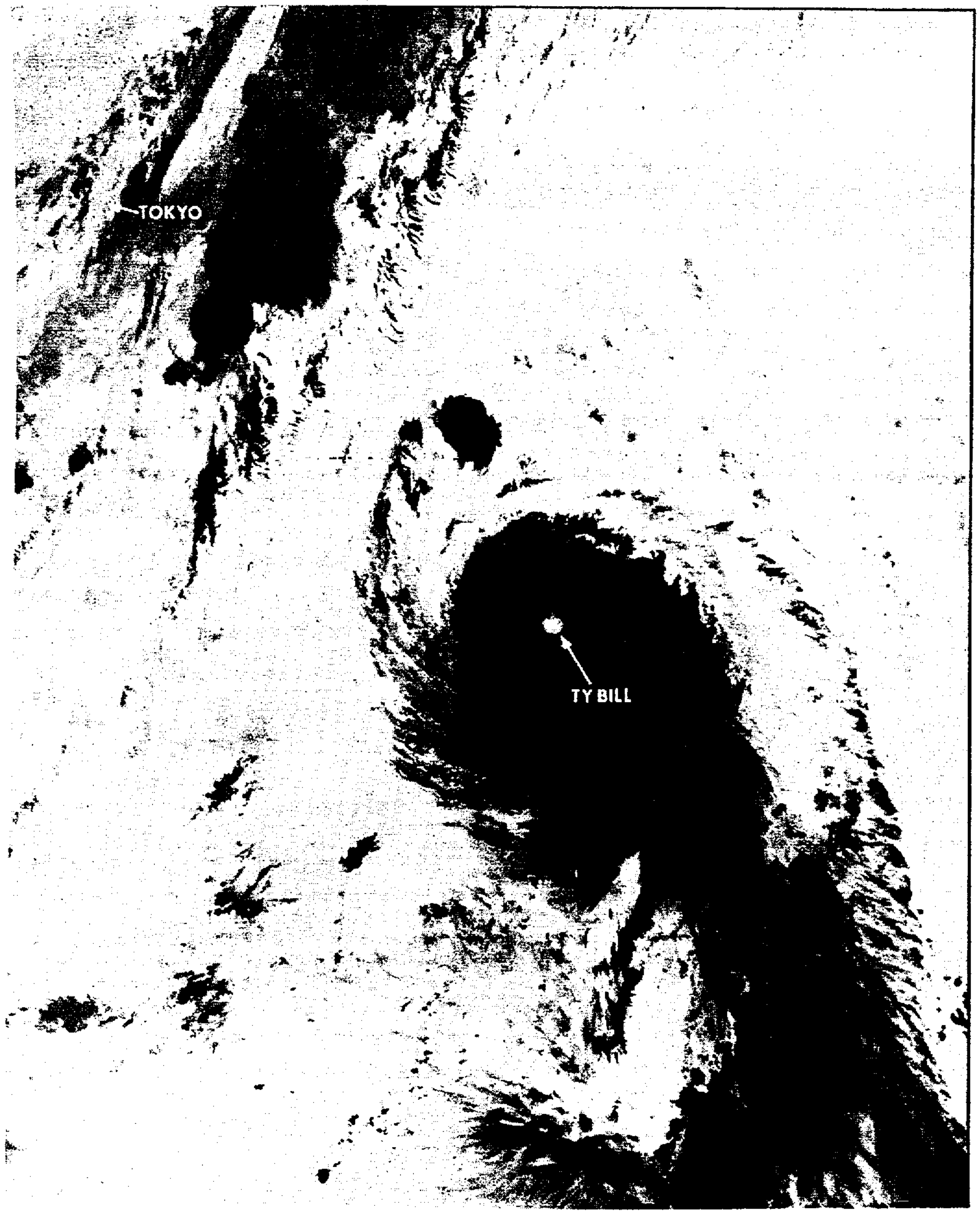


FIGURE 3-19-2. Typhoon Bill at 85 kt (44 m/sec) intensity, 5 September 1981, 1724Z. This imagery shows Bill at peak intensity has remained a compact system. (NOAA 7 infrared imagery)

FIGURE 3-19-3. *Typhoon Bill at 75 kt (39 m/sec) intensity, 6 September 1981, 0428Z. Here Bill is beginning to entrain cold air from the frontal system to the north. (NOAA 7 visual imagery)*

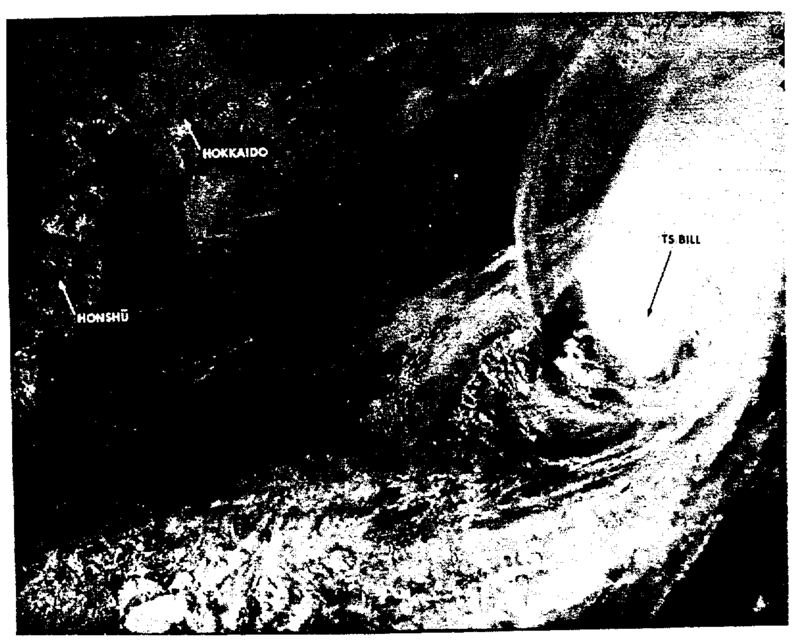
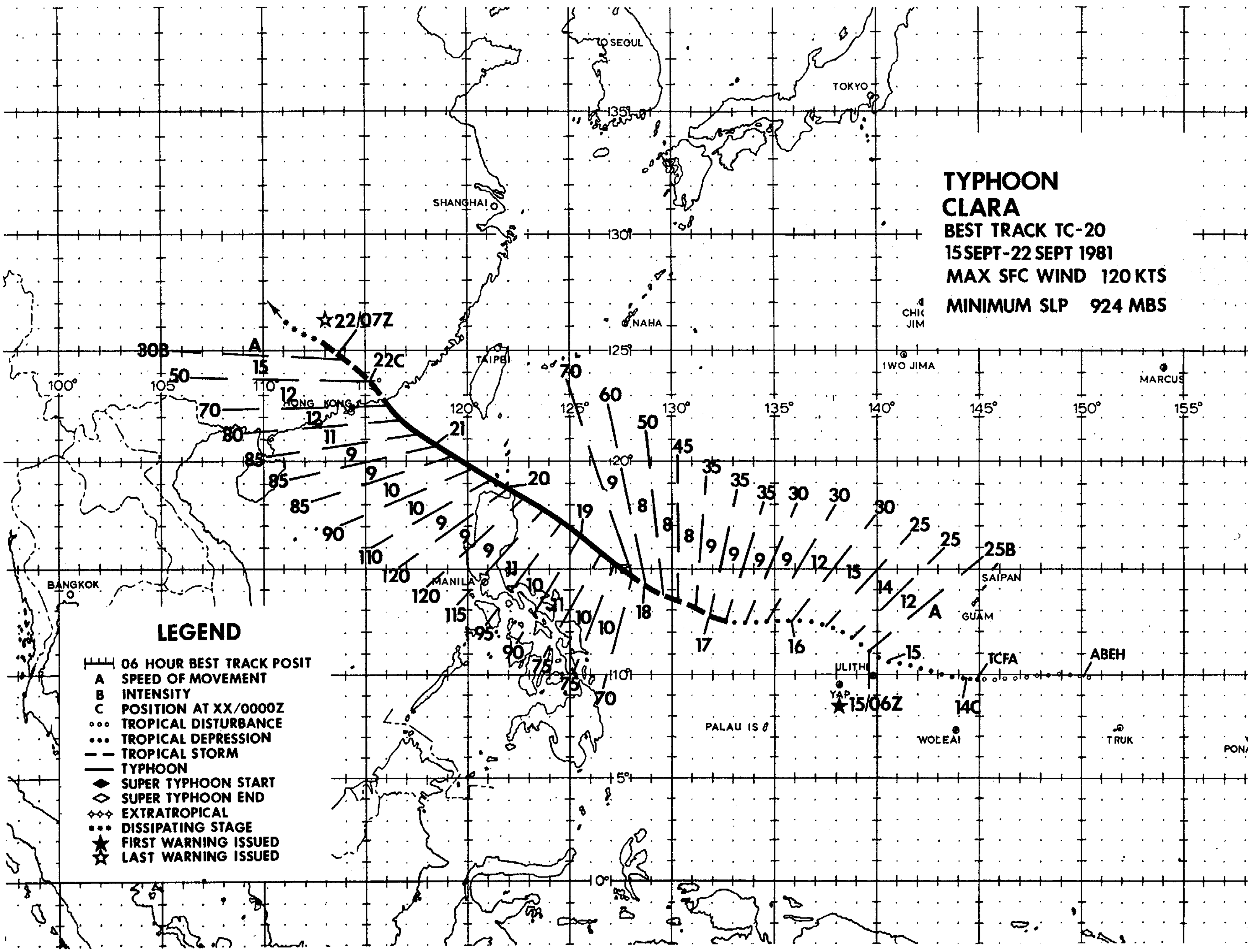


FIGURE 3-19-4. *Tropical Storm Bill at 40 kt (20 m/sec) intensity, 7 September 1981, 0416Z. This imagery shows Bill just prior to the issuance of the last warning and the extratropical transitioning is almost complete. (NOAA 7 visual imagery)*


TYPHOON
CLARA
BEST TRACK TC-20
15 SEPT-22 SEPT 1981
MAX SFC WIND 120 KTS
MINIMUM SLP 924 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
IWO JIMA
MARCUS
HONG KONG
BANGKOK
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
☆22/07Z
22C
30B
★15/06Z
TCFA
ABEH
14C
25B

Clara was first detected on satellite imagery at 1600Z, 11 September near Ponape as an area of concentrated convection embedded within the monsoon trough. No development was noted during the next two days as the disturbance tracked westward at 9 kt (16 km/hr).

A Tropical Upper Tropospheric Trough (TUTT) had been evident on the satellite imagery and was analyzed from synoptic data on the 200 mb streamline analysis northwest of Guam for several days. This feature had induced a large area of upper level divergence in the vicinity of the disturbance while some troughing and vertical wind shear were induced by a second TUTT cell analyzed to the northeast of the disturbance. The relative position of the disturbance to the upper level feature prevented significant development by restricting available outflow channels.

As Clara continued westward and moved past the trough axis it became apparent that the potential for significant development would increase as it moved into the upper level divergent area induced by the TUTT northwest of Guam. Satellite imagery at 131800Z showed increased convection and organization while synoptic reports indicated surface winds of 15 kt (8 m/sec) near the center of the convection. As a result a Tropical Cyclone Formation Alert (TCFA) was issued at 131935Z.

During the next 24 hours Clara remained under the upper level trough and further development was not evident based on satellite imagery during 13-14 September. However, near the end of the initial 24 hour period, convection flared up and the disturbance began moving west of the trough so the TCFA was re-issued at 141923Z.

After passing about 210 nm (389 km) south of Guam, slow but steady intensification took place as a 200 mb anticyclone became evident over the disturbance based on streamline analysis on 15 September. The first warning was issued at 150600Z with a straight westerly forecast track based on the 500 mb steering flow induced by a mid-tropospheric ridge north of Clara. Clara continued to track west-northwest and attained tropical storm intensity by 161800Z.

The warnings issued between 15 and 18 September continued to forecast Clara to take a westward track to eventually cross Luzon while, in fact, Clara was moving west-northwest. The forecast reasoning appeared sound based upon synoptic analyses that depicted a large sub-tropical ridge to the north of Taiwan, producing a strong easterly 500 mb steering flow over Clara. However, streamline analysis of the 500 mb chart on the 18th showed a weakness in the ridge west of Taiwan with a second anticyclone over southeast China. As a result of this new analysis, future forecast tracks steered Clara towards the break in the ridge with eventual recurvature west of Taiwan in response to the deepening trough moving into southeast China.

Figure 3-20-1. Typhoon Clara at 0521Z, 19 September 1981, at 115 kt (58 m/sec), 16 hours before crossing the northern tip of Luzon. (NOAA 7 visual imagery)

During this same period Clara had intensified rapidly as she attained her maximum surface winds of 120 kt (60 m/sec) six hours prior to crossing the northern tip of Luzon at 192200Z (Figures 3-20-1 and 3-20-2). Upon entering the South China Sea it became apparent that Clara was not going to recurve because the anticyclone over southeast China had moved northeast displacing the weakness west of Taiwan and preventing recurvature to the north. Clara responded to these changes and remained on a northwest track making landfall 140 nm (259 km) east-northeast of Hong Kong at 212000Z. After making landfall Clara dissipated rapidly as she accelerated inland into hilly terrain.

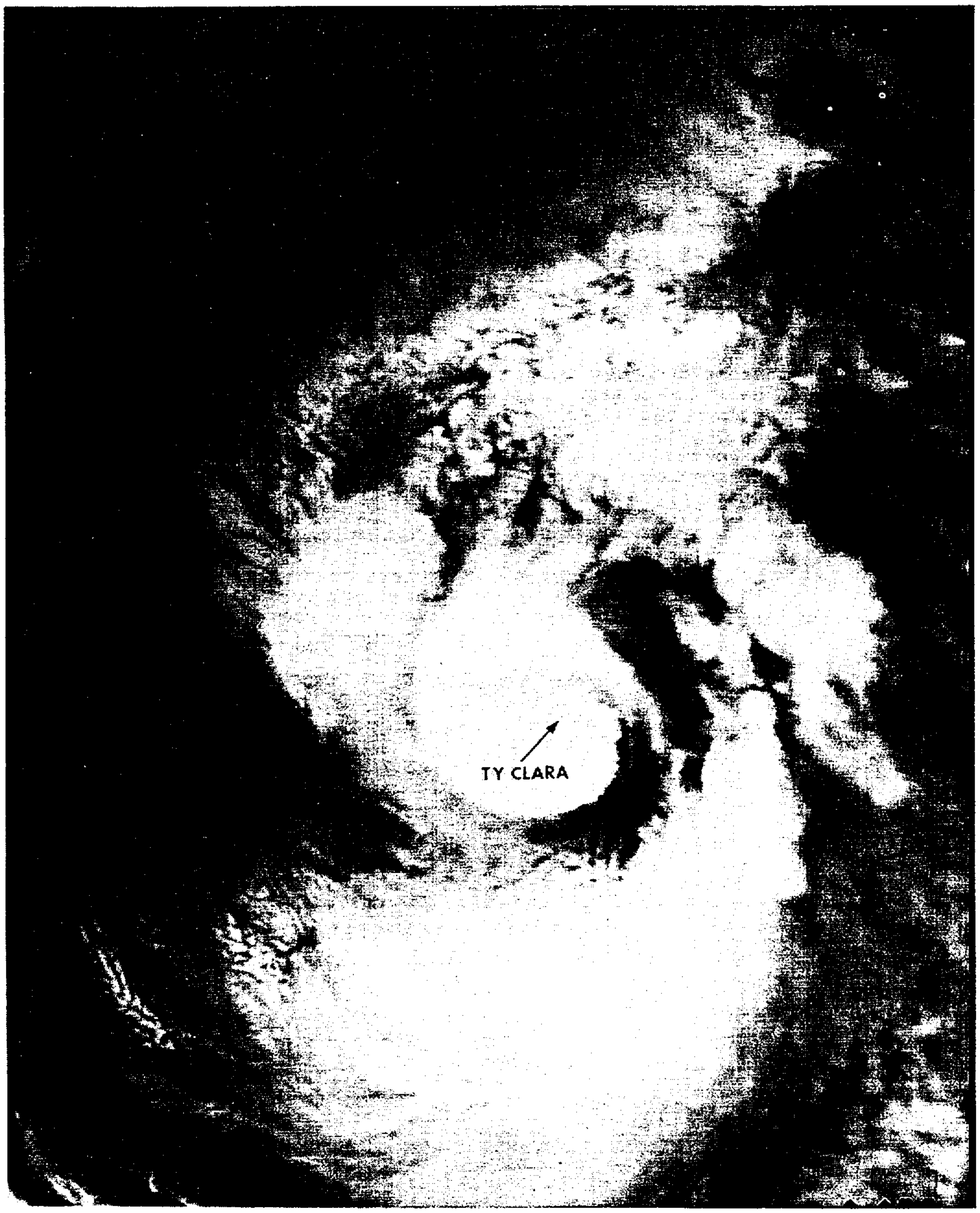


Figure 3-20-2. Typhoon Clara at 1937Z, 20 September 1981, at 85 kt (43 m/sec), about 24 hours after crossing the northern tip of Luzon and approximately 360 nm (667 km) northwest of Manila. (NOAA 7 infrared imagery)

Clara was a devastating storm as she crossed northern Luzon causing widespread damage and loss of life in eight northern Luzon provinces. Torrential rains caused floods which left thousands homeless and caused extensive damage to property and crops. A Philippine Navy destroyer and a cargo ship sank 330 nm (661 km) north of Manila leaving 68 persons missing (Fig. 3-20-3).

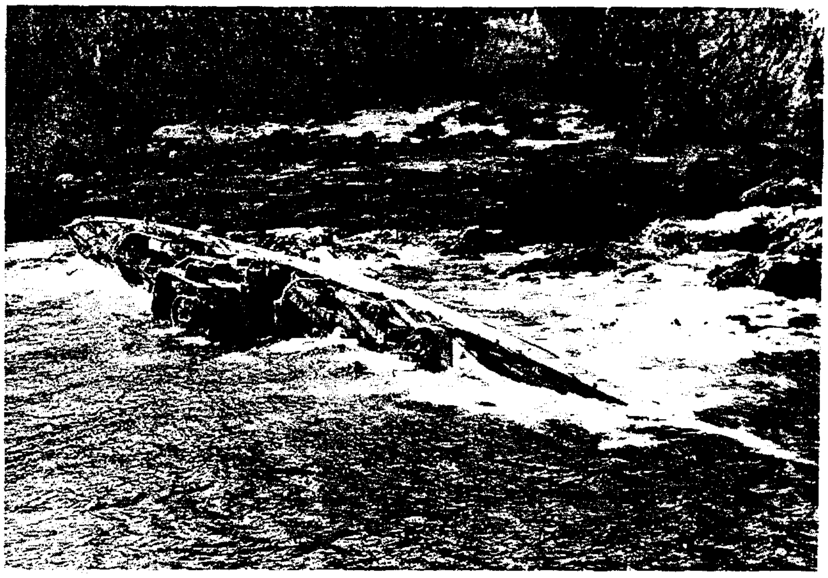
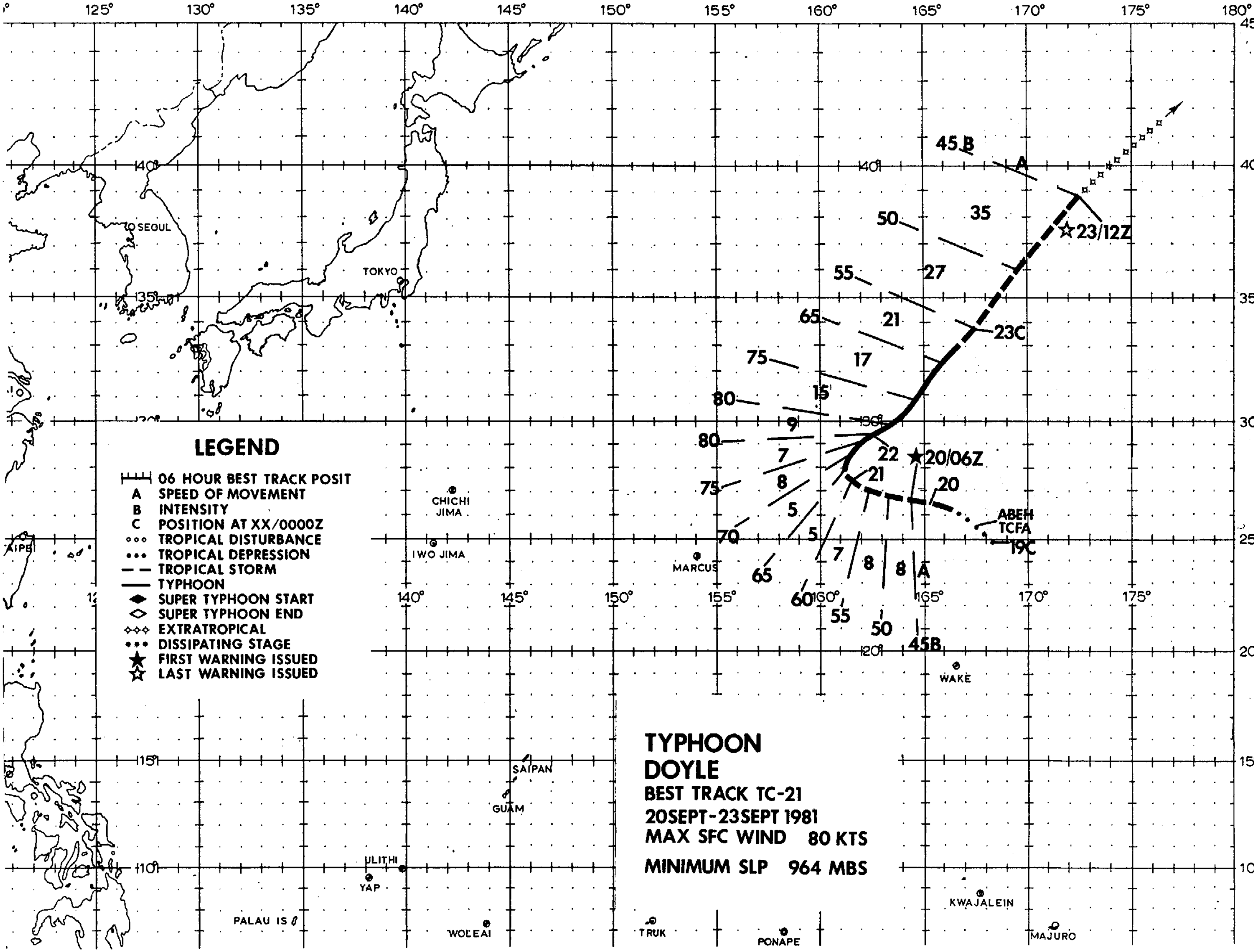


Figure 3-20-3. U. S. Navy personnel are seen on board the Philippine Navy Destroyer Datu Kalantigaw during recovery operations. The destroyer was forced aground on Calagan Island by Typhoon Clara. (U. S. Navy Photo by PH2 P. B. Soutar)


LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TYPHOON
DOYLE
BEST TRACK TC-21
20SEPT-23SEPT 1981
MAX SFC WIND 80 KTS
MINIMUM SLP 964 MBS
SEOUL
TOKYO
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KWAJALEIN
MAJURO
ABEH
TCFA
20/06Z
23/12Z
23C
19C

Typhoon Doyle was the second midget storm of the 1981 season and followed (Typhoon Bill (19), the first of the midget storms) by less than three weeks. Doyle and Bill were very similar in size, intensity and track. Doyle was also unusual in that all of the warnings were based on satellite imagery analysis.

Doyle was first detected as an apparent mid-to-upper-level disturbance early on 18 September near 25N 178E. The disturbance built down to the surface as it drifted westward at 8 kt (15 km/hr). A Tropical Cyclone Formation Alert was issued at 190600Z when low-level cumulus banding became apparent on satellite imagery. The first warning was issued at 200600Z based upon Dvorak analysis of visual satellite data which indicated that Tropical Storm Doyle had an estimated intensity of 35 kt (18 m/sec).

Doyle initially tracked west-northwest then recurved around a mid-tropospheric anticyclone. As Doyle recurved he became entrained in strong westerlies and accelerated rapidly northeastward. Doyle then started to weaken over the cooler waters north of 30N, finally losing tropical characteristics near 39N 172E when the system merged with an existing front. Typhoon Doyle was never larger than 180 nm (333 km) in diameter, even though the maximum intensity was 80 kt (41 m/sec) (Fig. 3-21-1).

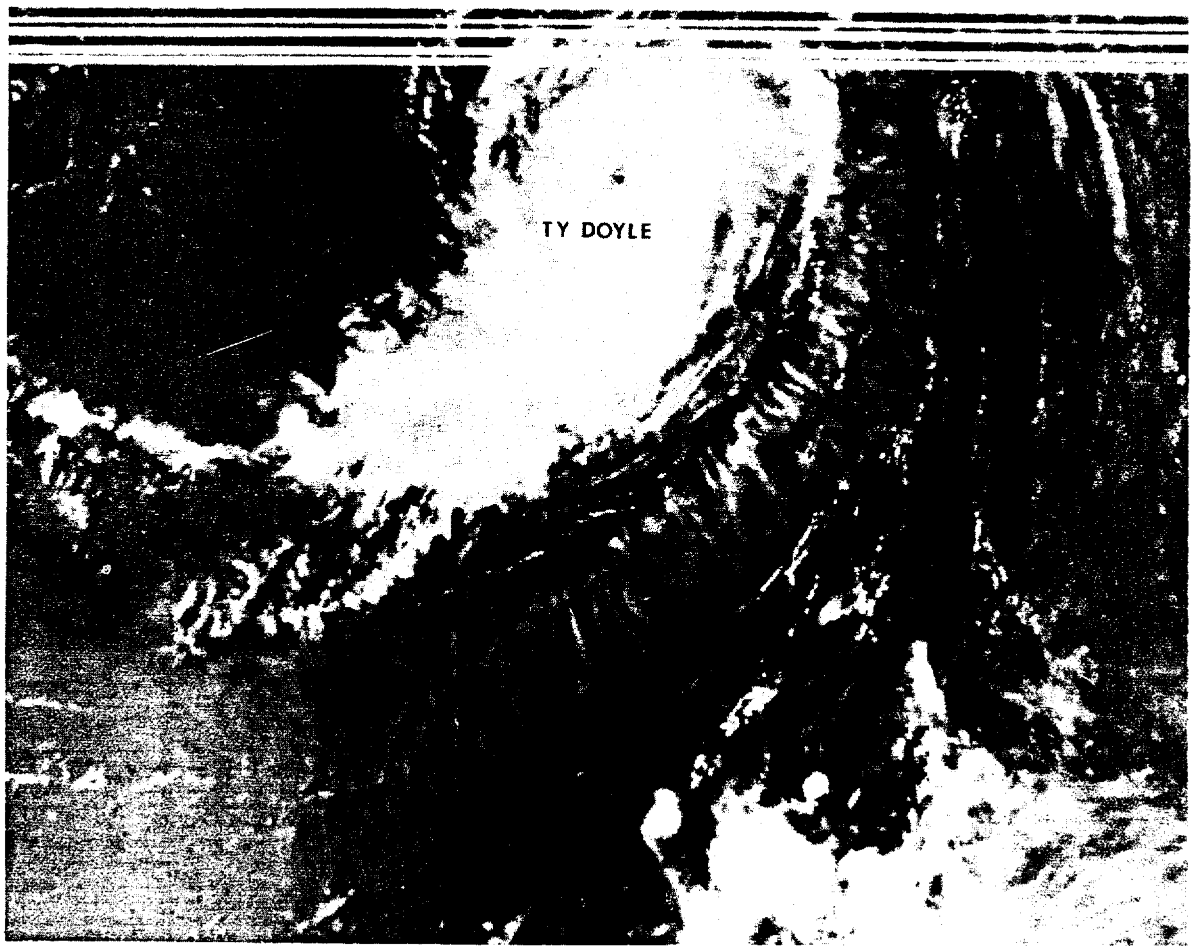
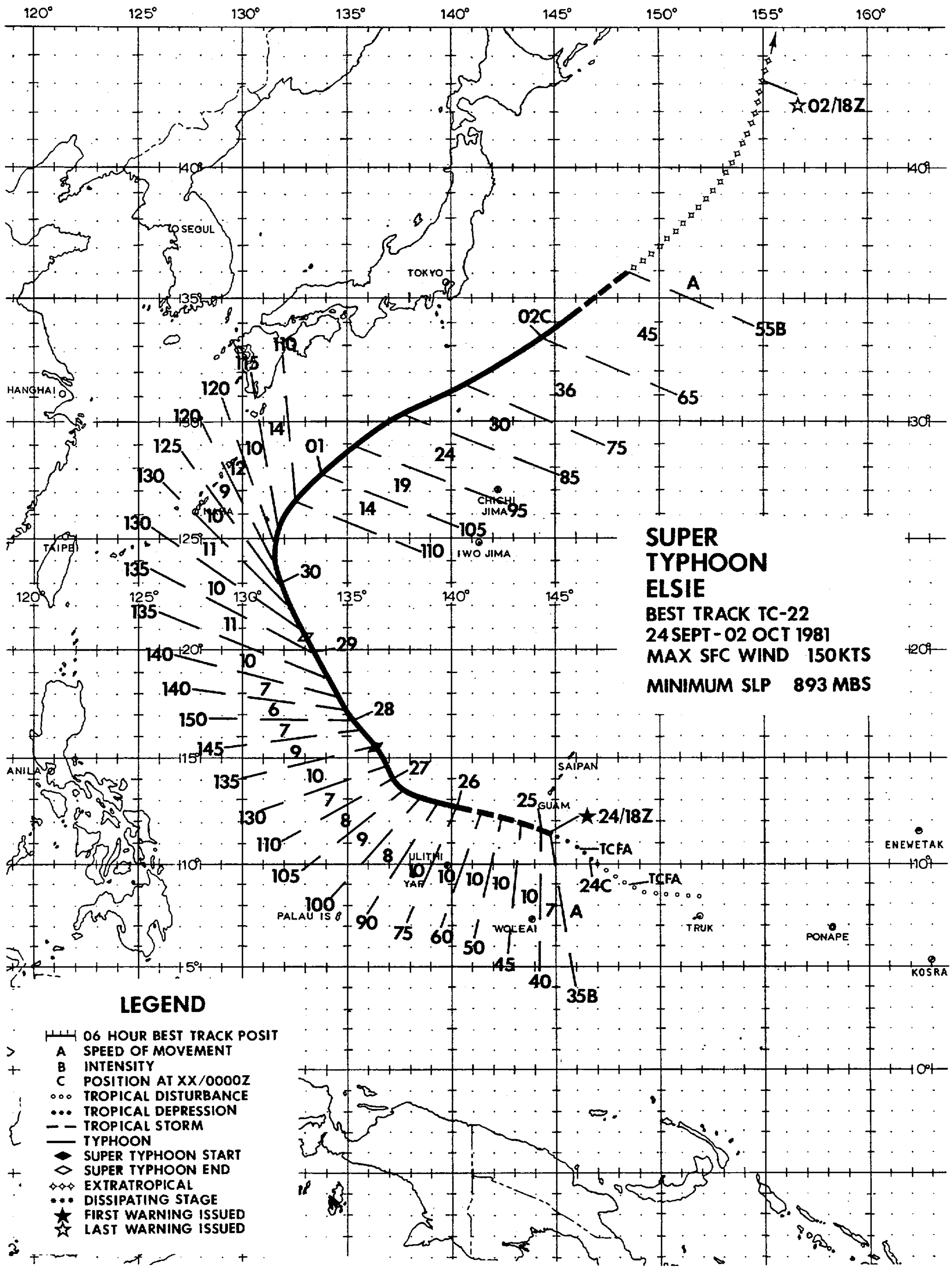


Figure 3-21-1. Doyle's compact size is graphically illustrated in this 210317Z satellite data. Note the well developed eye. At this time, Doyle was approximately 400 nm (741 km) northeast of Marcus Island. (NOAA 6 visual imagery)


SUPER
TYPHOON
ELSIE
BEST TRACK TC-22
24 SEPT - 02 OCT 1981
MAX SFC WIND 150KTS
MINIMUM SLP 893 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
HANGHAI
TAIPEI
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRA
TCFA
24/18Z
02/18Z

Following the northward progression of Typhoons Clara (20) and Doyle (21), the near equatorial trough became very weak and diffuse with very few areas of concentrated convection during 19 and 20 September 1981. By 210600Z two areas of significant convection, one near 10N 170E and the other near 5N 155E, signaled the re-establishment of substantial activity. The signal, however, appeared to be false, as convection along the trough dropped dramatically during the subsequent twenty-four hours. One small convective area, approximately one degree in diameter, remained near 8N 150E at 220600Z and surface/gradient level wind data at 220000Z identified a weak but well defined associated circulation. At 230700Z an initial Tropical Cyclone Formation Alert (TCFA) was issued for this convective area following further definition of the disturbance by satellite data which showed a fairly well organized upper-level anticyclone (ULAC) located above the low-level circulation. This action was taken despite the failure of aircraft reconnaissance to find anything significant. A second TCFA was issued at 240700Z, following a more successful aircraft reconnaissance mission which did locate the low-level circulation. Continued improvement of the satellite image, supported by the aircraft findings, culminated in the issuance of the first warning on TD-22 at 241800Z.

In retrospect, Elsie (Fig. 3-22-1) was a very well behaved cyclone. The major pro-

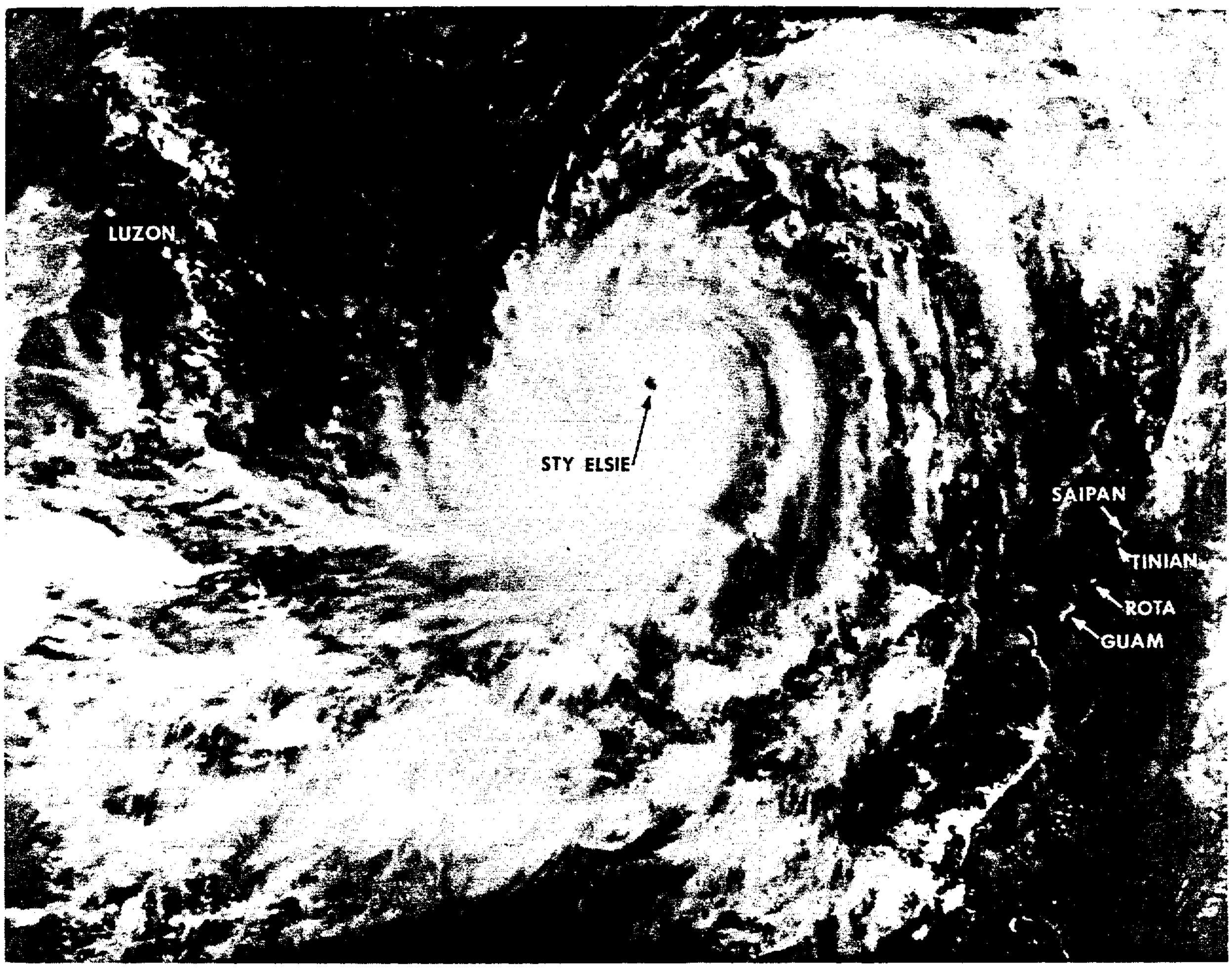


Figure 3-22-1. This 280520Z satellite photo shows Super Typhoon Elsie just after reaching a peak intensity of 150 kt (77 m/sec). At this time Elsie was located 615 nm (1139 km) west-northwest of Guam. (NOAA 7 visual imagery)

blem faced by JTWC was one of timing the significant segments (Fig. 3-22-2) of Elsie's track, each of which represents a different response to the surrounding environment. The approach of this discussion will be to evaluate each segment of the track, the apparent forecast reasoning at the time, and the performance of the one way interactive tropical cyclone model (OTCM) in predicting progression into the next segment.

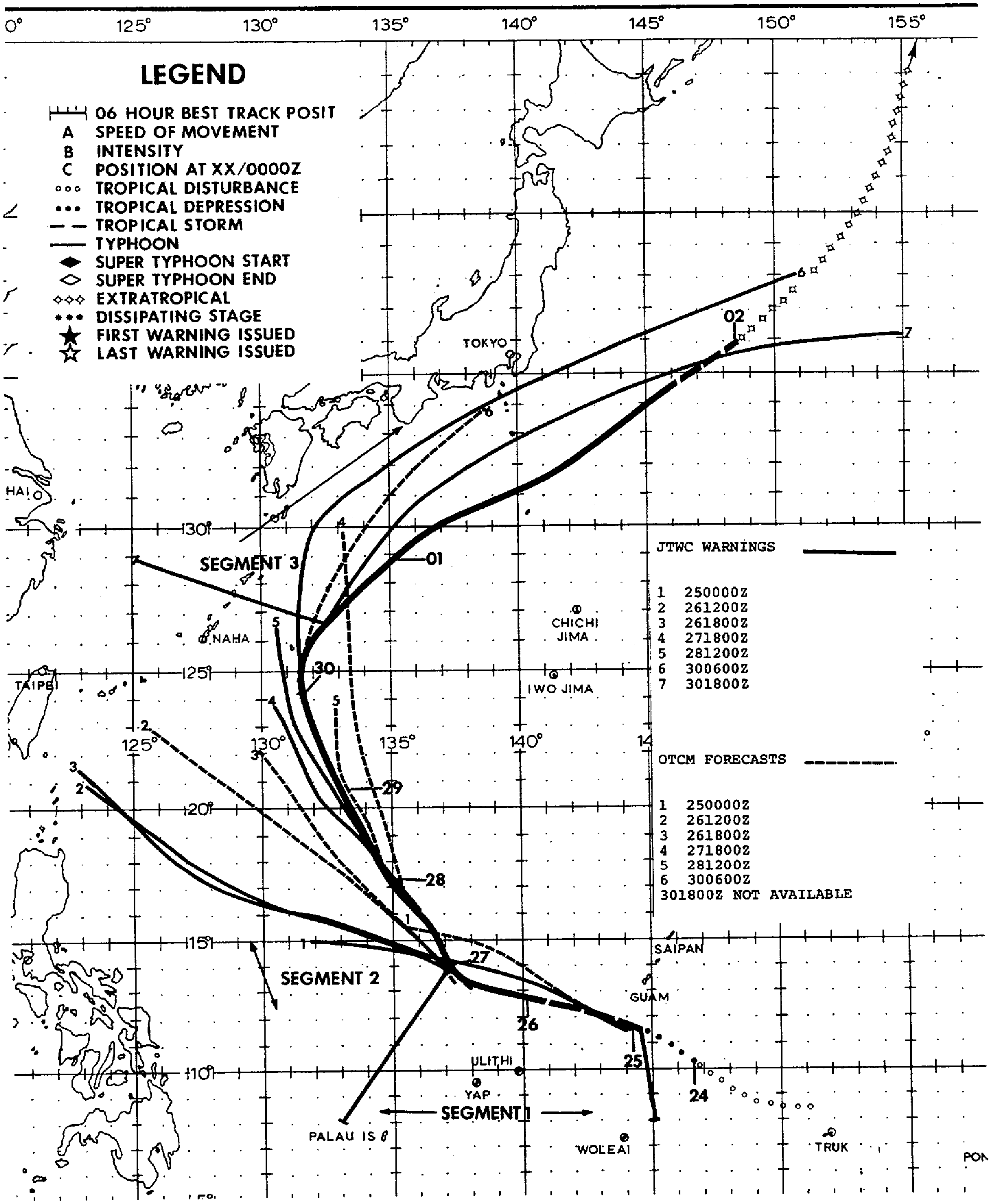


Figure 3-22-2. Elsie's best track overlayed with JTWC and OTCM forecasts. Forecasts illustrated here bracket significant changes in Elsie's direction of movement.

Segment #1 (241800Z - 261800Z Sep 81): During this period, which begins with the issuance of the first warning, the JTWC 500 mb analysis placed the subtropical ridge axis between 20N and 23N with no breaks along Elsie's predicted track. Analysis from Fleet Numerical Oceanography Center (FNOC) agreed on the placement of major 500 mb synoptic scale features. FNOC's 500 mb forecast built the ridge and the resultant OTCM predicted a west-northwest track. JTWC continued this forecast trend through warning No. 9, issued at 261800Z.

Prognostic reasoning bulletins were calling for an eventual shift toward a more northward track, however timing was the big factor. JTWC's analysis showed the building of the ridge; aircraft reconnaissance tracks north of Elsie continued to yield support to the JTWC forecast. FNOC's forecast did predict movement of a major 500 mb trough eastward over Japan. Height falls associated with this trough showed up on JTWC analysis at 260000Z, coincident with the appearance of a break in the ridge near 20N 135E, a position northwest of Elsie's 500 mb cyclone. The break was most likely induced by the trough to the north and the presence of Elsie to the south of the ridge.

Interestingly, the OTCM made its first change in track at 261200Z by suggesting a more northwestward track. By 261800Z the OTCM had definitely locked into a northwest track, however, it was not until warning No. 13, at 271800Z, that JTWC's warnings relinquished west-northwest movement for the more northwestward track shown by the OTCM.

Segment #2 (270000Z - 301200Z): FNOC and JTWC analysis of 500 mb data, and support from aircraft reconnaissance, continued to confirm the break in the ridge, which was fostered by the deep trough over Japan and Elsie's enlarging 500 mb circulation. Responding to this induced trough, Elsie began to track north-northwest for a period of 48 hours. JTWC forecasts through this segment of Elsie's life not only predicted the movement trend well but also predicted transition into the next segment of Elsie's track, the recurve.

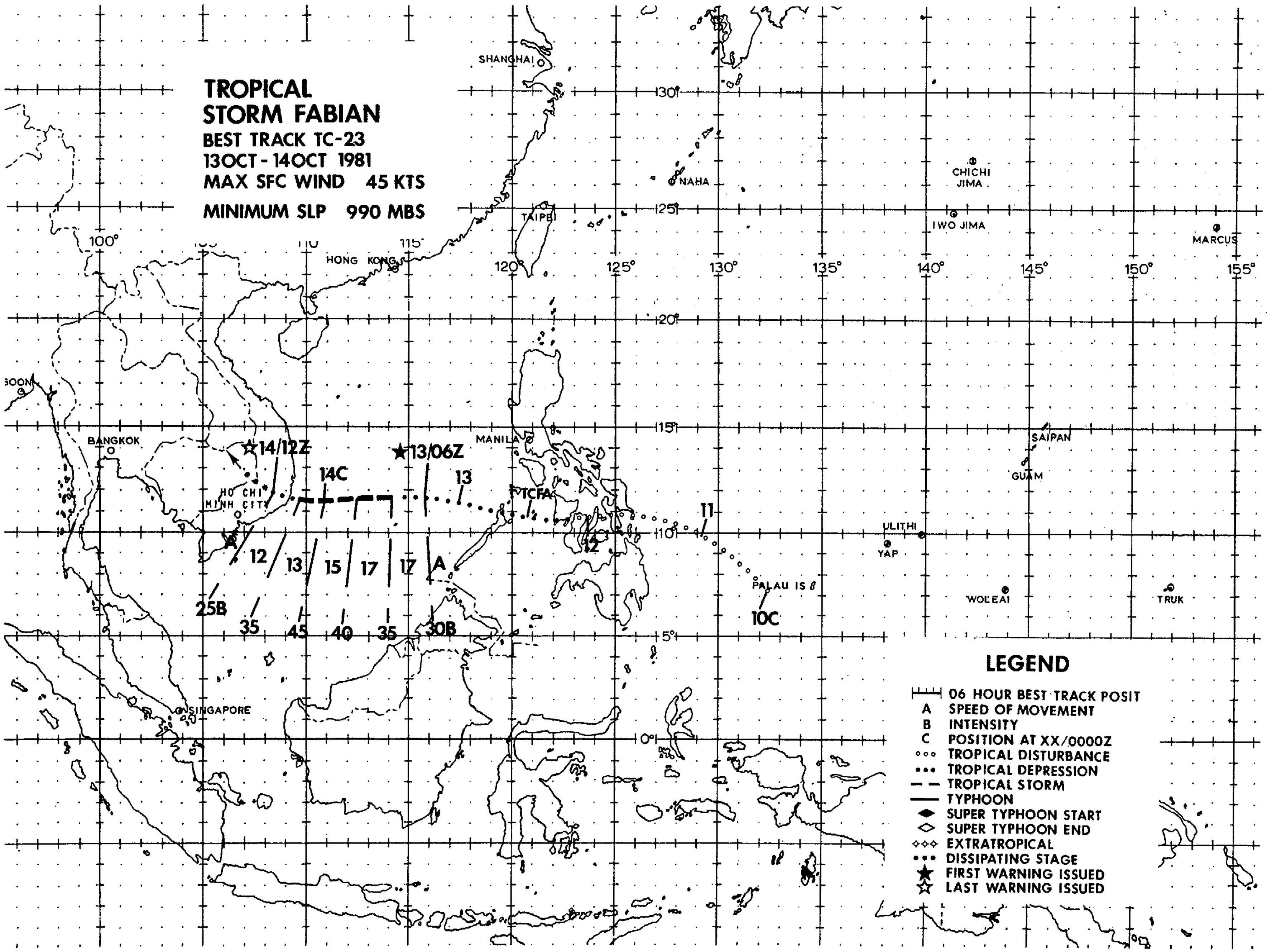
Warning No. 16, issued at 281200Z, represented the first warning that truly fits the segment 2 profile and predicted the change of track to segment 3. FNOC analysis and forecasts, as well as the JTWC analysis, defined the synoptic pattern extremely well, such that the JTWC forecasts were very consistent in their call for recurvature. Post-analysis has shown that in anticipating a recurve, JTWC's forecasts were conservative when compared with the OTCM and the actual storm best track. The conservatism of JTWC was based on the belief that the weak 500 mb winds (15-20 kt (8-10 m/sec)) south of Japan would allow Elsie to penetrate further north before encountering westerlies sufficiently strong enough to cause deflection northeastward. FNOC forecasts also showed no major trough movement at 500 mb that might lend support to any other forecast track. In fact, FNOC forecasts generally favored development of a zonal flow over Southern Japan. OTCM forecasts also drove Elsie northward toward Japan.

FNOC forecasts of a trough moving eastward off Asia did not indicate deepening, thus the most representative forecast was toward Japan. However, significant deepening did occur; the OTCM forecast for 300600Z Sep (Warning No. 23) was the initial indicator of this influence on the forecast track. JTWC's forecasts had predicted the recurve all along, but now began to converge on a tighter recurve pattern and finally stablized, by warning No. 25, at 301800Z Sep.

Segment #3 (301800Z - 020500Z Oct 81): This portion of the storm track began with Elsie accelerating rapidly northeastward and ended with extratropical transition. The FNOC forecasts, once they picked up the trough, deepened it significantly, as analyses at JTWC and FNOC eventually bore out. Elsie accelerated up the leading edge of the trough and by 020600Z had transitioned into an extratropical system. It is instructive to note that not until warning No. 30, issued at 020000Z, did JTWC make its final track change and forecast the disturbance to move north-northeast, up the back of the ridge. The OTCM had predicted this track some twelve hours earlier at 011200Z.

JTWC warnings up to warning No. 30 continued with the northeast track thus sending the system through the ridge. The JTWC warnings that continued to forecast eastward movement did have sound basis, since Elsie's movement as indicated from satellite and aircraft data continued to be northeast. This movement also placed Elsie within a steering regime that, based upon 500 mb analysis and forecast, should have kept Elsie moving northeast. The problem was the result of sound forecast logic based upon a faulty prognostic chart series. The 500 mb forecast series failed to adequately handle an advancing trough and the rapid building of the ridge ahead of Elsie. Once these forecasts began to reflect the changes, the JTWC forecaster was faced with making a decision based upon two significantly different 500 mb patterns. The first was the consistency of the longer established forecast trend, with its near zonal pattern, and the second was the rather abrupt change to this pattern which was first suggested in the 36 hour 500 mb forecasts valid at 021200Z. The apparent radical change in 500 mb steering caused by the sudden deepening of the trough and amplification of the ridge was not "bought" by the Typhoon Duty Officer, the OTCM did however "buy" the change by 011200Z. This final track predicted by the OTCM was followed by Elsie through her extratropical transition and subsequent merger with mid-latitude, migrating systems.

The OTCM handled the final segment of Elsie's life quite well just as it did with the earlier stages. In summary, this single case study indicates that for this particular cyclone, the OTCM appeared to "sense" the environmental changes to which Elsie responded from 12-24 hours prior to them being reflected in the JTWC forecast.


TROPICAL STORM FABIAN
BEST TRACK TC-23
13OCT - 14OCT 1981
MAX SFC WIND 45 KTS
MINIMUM SLP 990 MBS
SHANGHAI
NAHA
CHICHI JIMA
TAIPEI
IWO JIMA
MARCUS
HONG KONG
MANILA
SAIPAN
GUAM
BANGKOK
HO CHI MINH CITY
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
SINGAPORE
14/12Z
13/06Z
14C
13
TCFA
11
12
10C
25B
35
45
40
35
30B
15
17
17
A
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

On 6 October, satellite imagery indicated an area of active, but unorganized, convection northeast of the Palau Islands. During the 5 days that followed, the convective system moved westward and remained unorganized until just prior to making landfall on Samar Island. As it tracked over Samar, Cebu, Negros and Panay Islands, the disturbance lost much of what little convective organization it did have, however during this period, the affected central Philippine Islands reported torrential rainfall and flooding, although surface reports showed virtually no low-level wind circulation. When the disturbance entered the Sulu and South China Seas, it once again showed signs of reorganizing and at 121100Z, a Tropical Cyclone Formation Alert was issued.

As it traversed the South China Sea, the disturbance continued to develop although available surface observations showed small pressure falls near the system. Reconnaissance aircraft at 130600Z reported a 1002 mb center pressure and a closed circulation, prompting the first warning for Tropical Depression 23. Subsequent satellite imagery showed continued convective organization and at 131200Z, TD-23 was upgraded to Tropical Storm Fabian. The storm continued to intensify during the next 12 hours, reaching a maximum intensity of 45 kt (23 m/sec) at 140000Z. Figure 3-23-1 shows Fabian while at maximum intensity and 9 hours prior to making landfall just south of Cam Ranh Bay, Vietnam. As Fabian moved into Vietnam, surface winds weakened rapidly and by 15 October, the system could no longer be detected from synoptic reports or on satellite imagery.

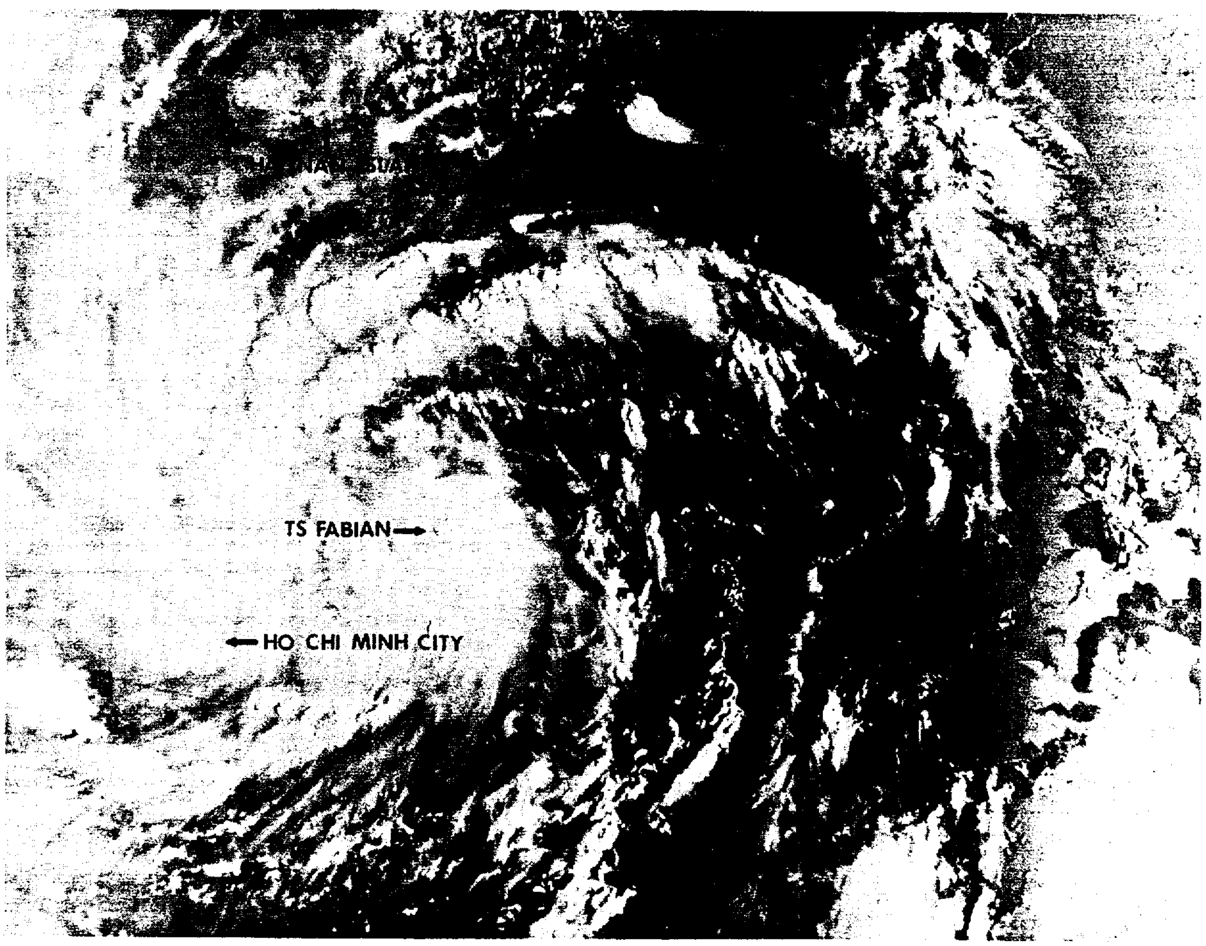
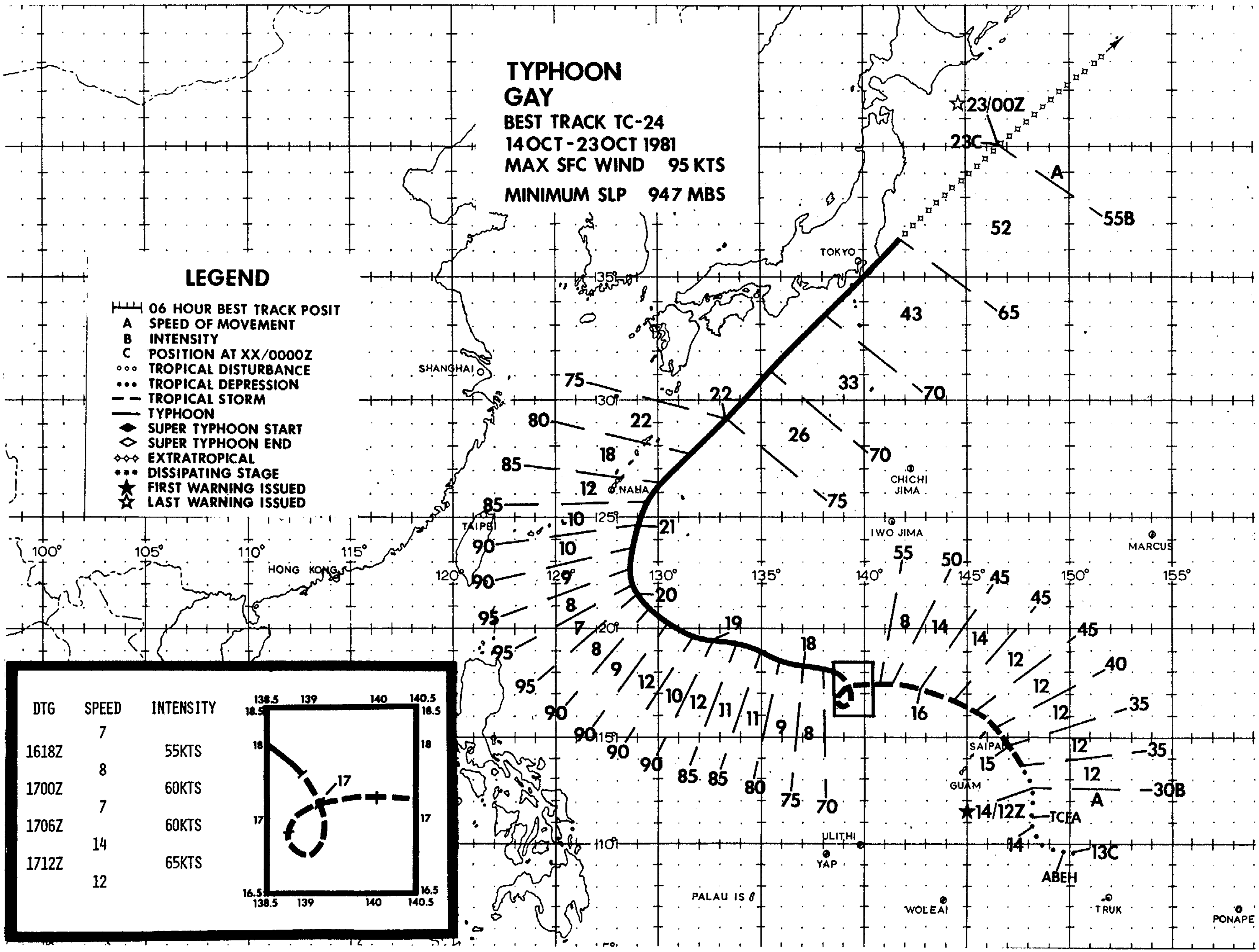


Figure 3-23-1. Four days after initial detection, Tropical Storm Fabian is located 100 nm (185 km) east of Cam Ranh Bay, Vietnam, at a peak intensity of 45 kt (23 m/sec) on this 140005Z December satellite image. (NOAA 6 visual imagery)


TYPHOON
GAY
BEST TRACK TC-24
14 OCT - 23 OCT 1981
MAX SFC WIND 95 KTS
MINIMUM SLP 947 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
23/00Z
14/12Z
TCFA
ABEH
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
DTG SPEED INTENSITY
1618Z 55KTS
1700Z 60KTS
1706Z 60KTS
1712Z 65KTS
7 8 7 14 12

Typhoon Gay was a harbinger of good tidings for the island of Okinawa, providing 5.89 inches (14.96 cm) of rain as she passed some 95 nm (176 km) to the southeast. Locked in a severe drought, Okinawa residents had been suffering under strict water rationing.

From its inception within an abnormally large convective area Gay was far from a straight forward system. Early satellite fixes were very unreliable, resulting in the vectoring of aircraft reconnaissance to the wrong portion of the convective area. Post-analysis has shown the actual "center" of the developing system was far to the west-southwest of where it was believed to be. Figure 3-24-1 shows the system shortly after initial warning.

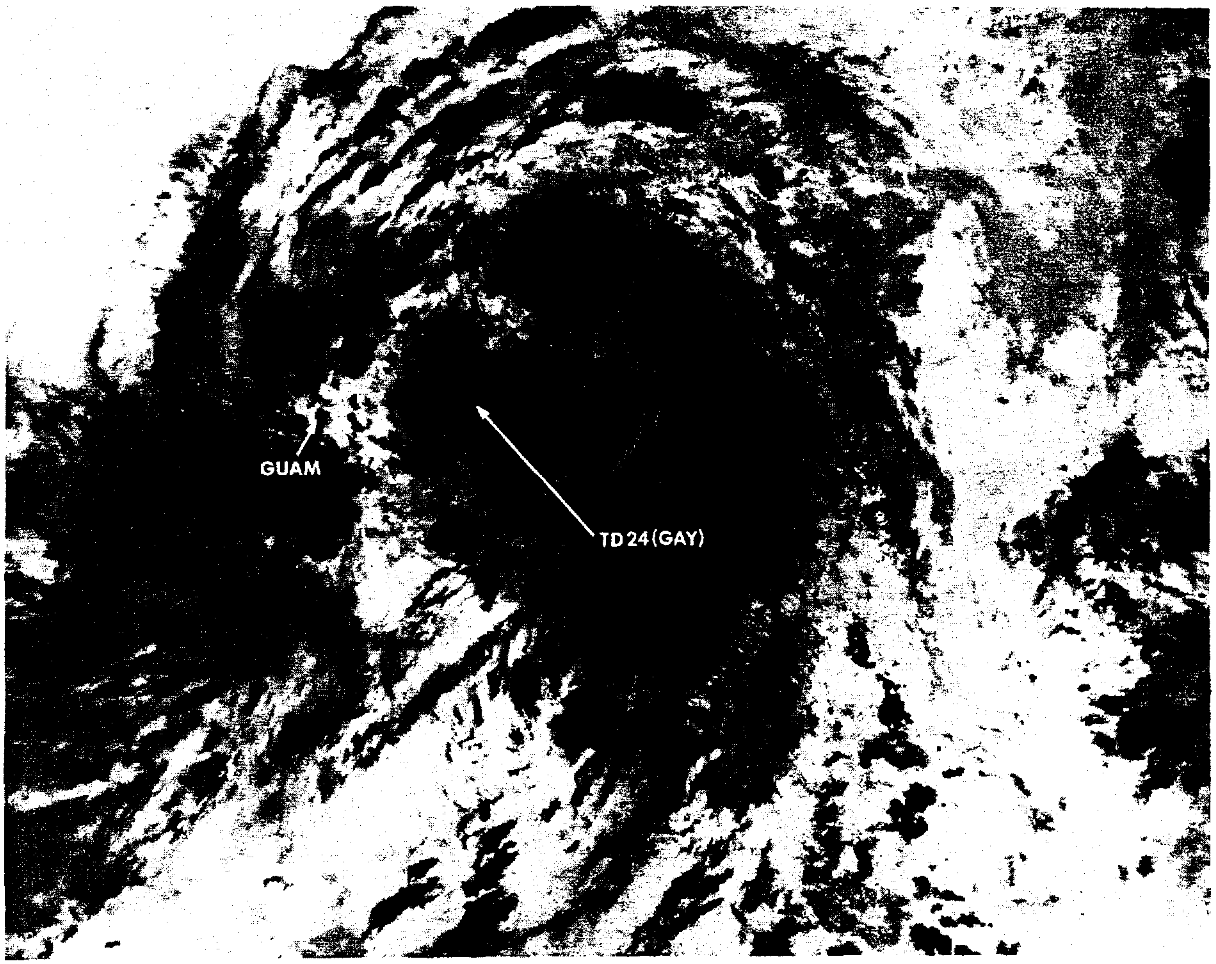


Figure 3-24-1. Tropical Depression 24 (Gay), 14 October 1981, 1614Z. At this time the initial warning with winds of 30 kt (15 m/sec) had been issued. The system was quickly upgraded to tropical storm status. The circulation center was approximately 100 nm (185 km) east of Guam. (NOAA 7 infrared imagery)

As Gay became better organized she became somewhat more predictable, with a forecast for a generally westward track and for an eventual recurvature around the west side of the prevailing mid-tropospheric anticyclone. Figure 3-24-2 shows Gay during a period when she took the slight southwest jog and loop shown on the best track in response to an eastward building anticyclone upstream from Gay's location.

Typhoon Gay remained a fickle system until reaching maximum intensity (Fig. 3-24-3) when a large eye finally developed. Until this time, the center of Gay was characterized by an unusually large area of light and variable winds, further contributing to the problems of accurate location.

Figure 3-24-2. Tropical Storm Gay, 17 October 1981, 0503Z when she began the slight southwestward movement and eventually looped. (NOAA 7 visual imagery)

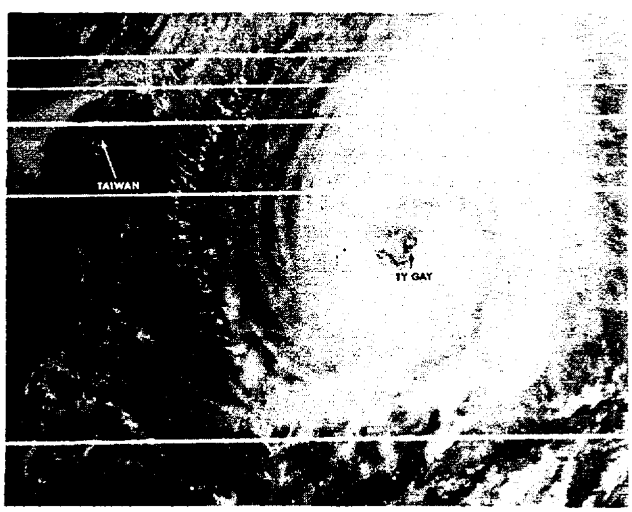


Figure 3-24-3. Typhoon Gay, 20 October 1981, 0610Z at maximum intensity of 95 kt (49 m/sec), located approximately 420 nm (778 km) east-southeast of Taiwan. (NOAA 7 visual imagery)

Following recurvature and passage to the east of Okinawa (Fig. 3-24-4), Gay continued around the western side of the mid-Pacific anticyclone and accelerated toward Japan. Eventually passing within 30 nm (56 km) of Tokyo, Gay brought extensive rainfall to the central regions of Japan. Yokosuka Naval Facility reported peak gusts of 60 kt (31 m/sec) and 9.38 inches (23.8 cm) of rain over the 24 hour period of Gay's passage.

A low pressure system north of Japan rapidly drew Gay northward and quickly initiated an extratropical transition with Gay merging completely with the existing low center.

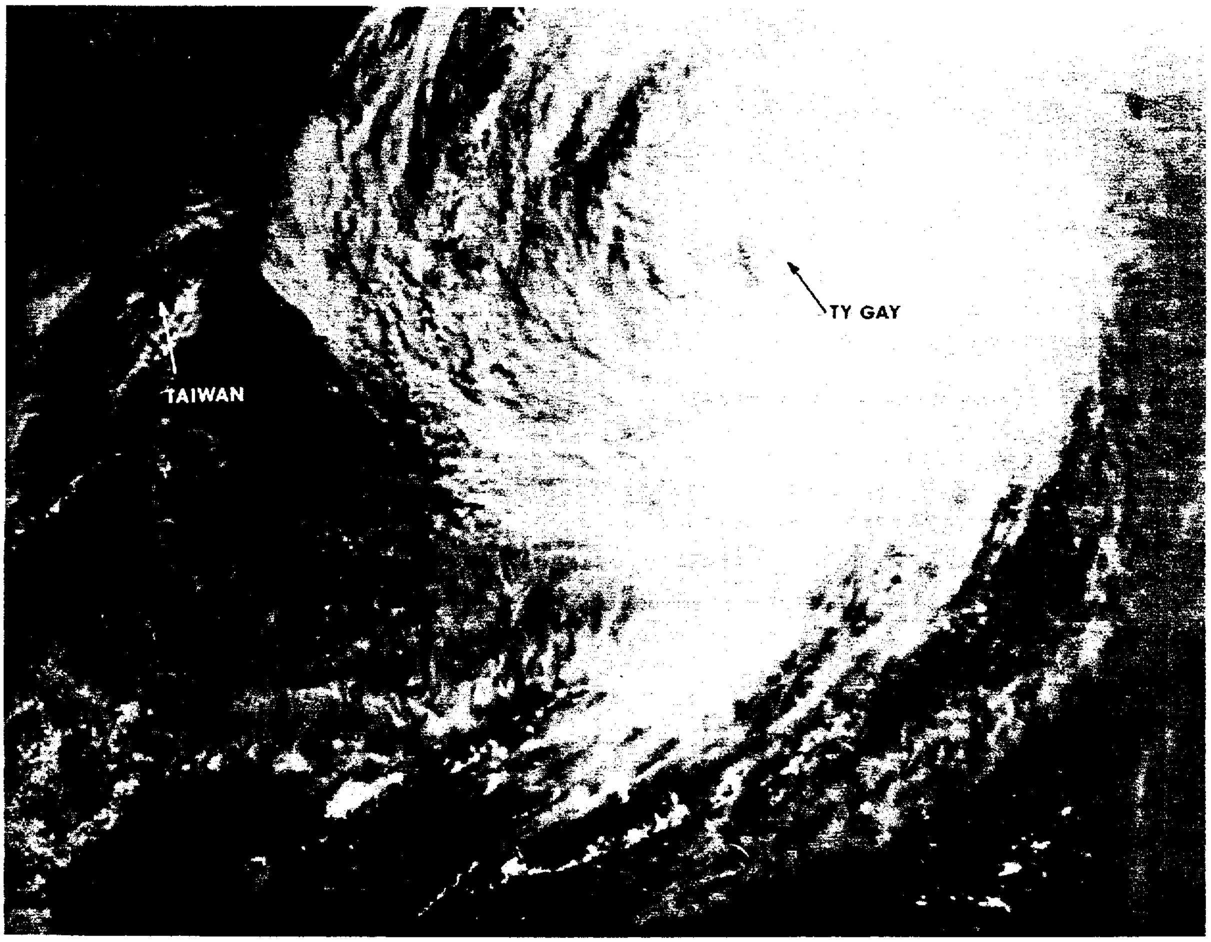
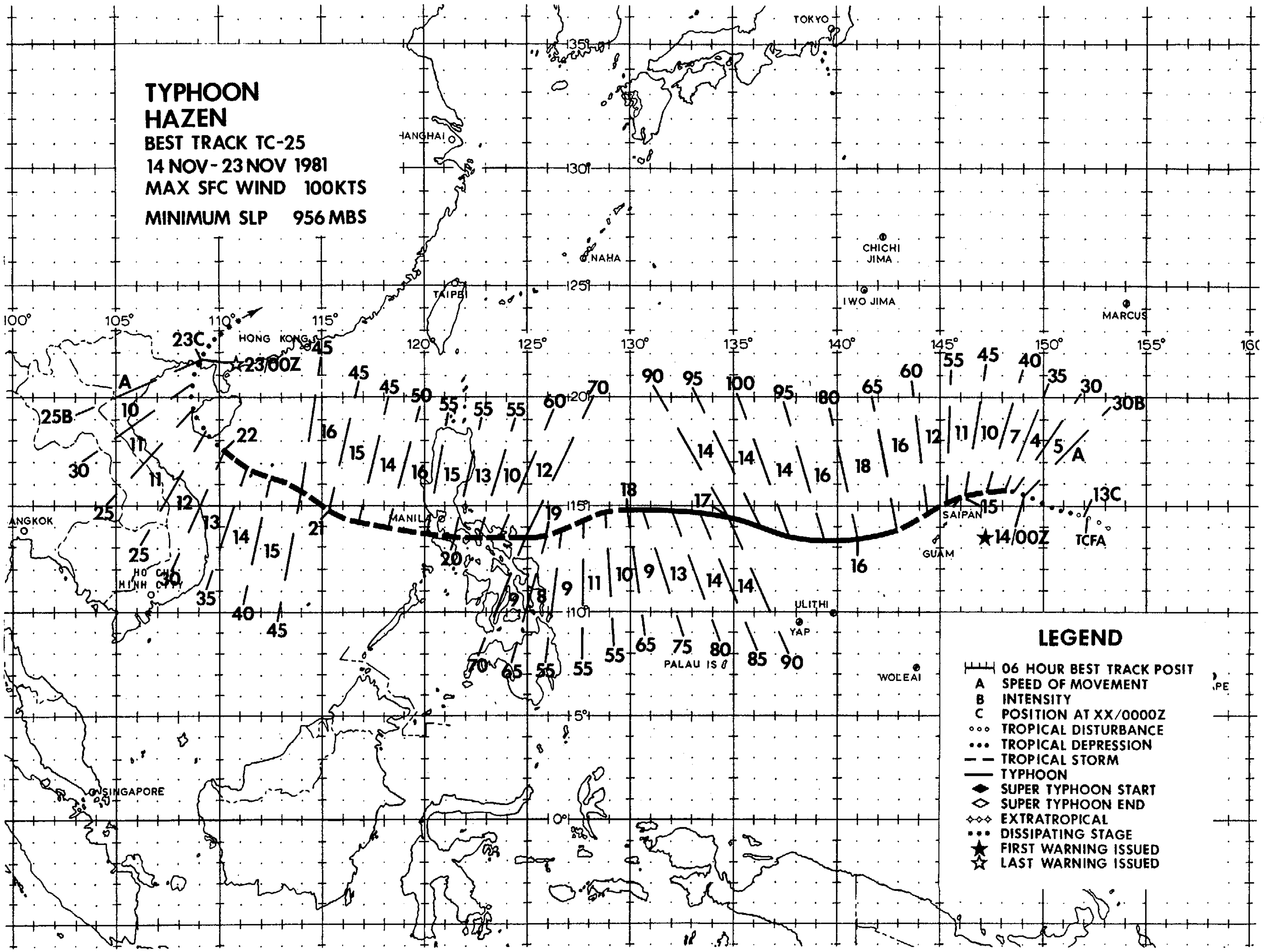


Figure 3-24-4. Typhoon Gay, 21 October 1981, 0559Z breaking the drought on Okinawa; center location is some 120 nm (185 km) east-southeast of the island. (NOAA 7 visual imagery)



TYPHOON
HAZEN
BEST TRACK TC-25
14 NOV - 23 NOV 1981
MAX SFC WIND 100KTS
MINIMUM SLP 956 MBS
TOKYO
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
SINGAPORE
23/00Z
14/00Z
TCFA
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

Following two weeks with no tropical cyclone activity in the northwest Pacific, a disturbance associated with enhanced convection began to develop in an elongated trough east of Guam. At 122347Z, November a Tropical Cyclone Formation Alert (TCFA) was issued as the system's circulation pattern improved and an increase in convection was evident from satellite imagery.

Aircraft reconnaissance on 13 November was not able to close off a circulation, but the convective features and the satellite signature remained strong, so the TCFA was reissued. Aircraft reconnaissance data at 140000Z found a closed circulation with maximum surface winds of 35 kt (18 m/sec), thus the disturbance became Tropical Depression 25, with the first warning being issued at 140200Z. Aircraft reconnaissance later that evening reported the surface pressure had dropped to 990 mb, prompting upgrading to Tropical Storm Hazen with estimated maximum winds of 40 kt (20 m/sec). Satellite imagery at this time showed the development of an intense, 150 nm (278 km) diameter, convective mass.

Forecasts during the early stages of Hazen's rapid development predicted movement to the west-northwest at 7 kt (13 km/hr) in response to weak steering flow in the mid-troposphere. Hazen was expected to become entrained into a frontal boundary associated with a strong mid-latitude low pressure system east of Japan. However, this did not occur; the front weakened and moved to the east. A mid-tropospheric ridge began building behind the front, causing Hazen to take a westward jog and eventually forcing a southwest track as the ridge intensified north of the storm.

Tropical Storm Hazen's southwestward path took it over the northern tip of Saipan between 150300Z and 150600Z (Fig. 3-25-1). Maximum sustained winds of 35 kt (17 m/sec) with gusts to 62 kt (31 m/sec) were reported by the Saipan weather office. Minor structural damage and many downed trees and power lines were reported.

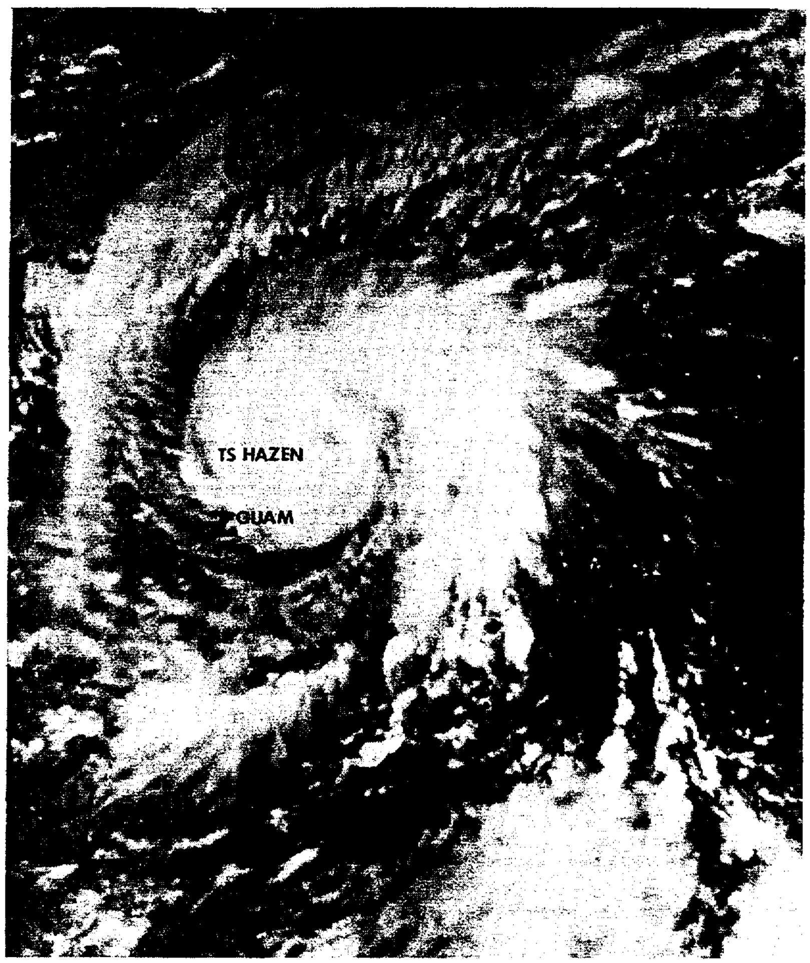


Figure 3-25-1. Tropical Storm Hazen at 55 kt (28 m/sec) intensity 110 nm (204 km) northeast of Guam shortly after crossing Saipan, 150430Z November. (NOAA 7 visual imagery)

Hazen then passed 60 nm (111 km) north of Guam at 151200Z and began a more westerly movement. Winds near the center were estimated to be 55 kt (28 m/sec) at this time but only the weaker southern quadrants passed over Guam, where winds of 15 kt (8 m/sec) were reported with some heavy showers. These synoptic reports provided verification that Hazen was a very compact storm with winds of over 30 kt (15 m/sec) extending no more than 30 nm (56 km) from the center.

Hazen was upgraded to typhoon strength at 151800Z, 3 hours before aircraft reconnaissance reported surface pressures of 957 mb and estimated surface winds of 90 kt (45 m/sec). After passing Guam, Hazen rapidly intensified to his maximum intensity of 100 kt (50 m/sec) as it followed the more westward track. Early on 17 November Hazen began to interact with a mid-latitude trough and was drawn northwestward into an area of increased vertical wind shear. Hazen weakened as the upper-level outflow channels to the north diminished. As the trough passed to the east, Hazen resumed westerly movement and reintensified (Fig. 3-25-2).

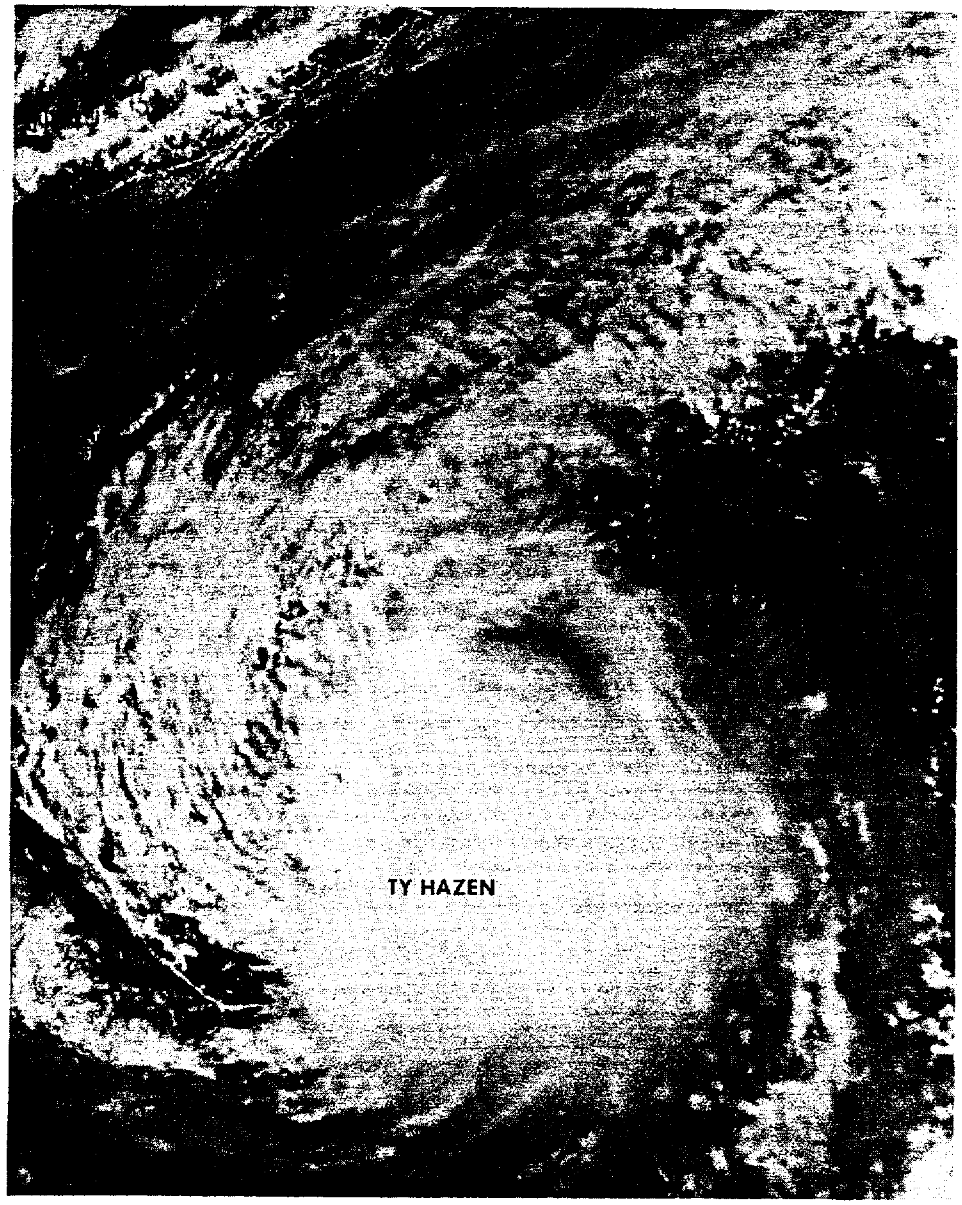


Figure 3-25-2. Typhoon Hazen at 85 kt (43/sec) intensity 640 nm (1185 km) west of Guam. Hazen is seen here interacting with the trough that eventually weakened Hazen to tropical storm strength, 170549Z November. (NOAA 7 visual imagery)

As Hazen approached the Philippines a slow weakening occurred as part of his circulation was interrupted by the mountainous terrain of the islands south of Luzon. Hazen passed just south of Catanduanes Island (WMO 98447) at 191200Z (Fig. 3-25-3) and entered the South China Sea 18 hours later. Highest recorded winds were 65 kt (33 m/sec) at Catanduanes Island. As Hazen entered the South China Sea no intensification occurred over the warm water due in part to the severe interactions between the low-level circulation and the mountainous terrain of southern Luzon; the loss of strength just could not be overcome. Hazen continued to weaken as he tracked toward Hanoi guided by a weakness in the 500 mb ridge that was evident upon the 211200Z streamline analysis. Hazen continued to move toward the weakness, eventually making landfall 150 nm (278 km) east-northeast of Hanoi and then dissipated over the hilly terrain of southeast China.

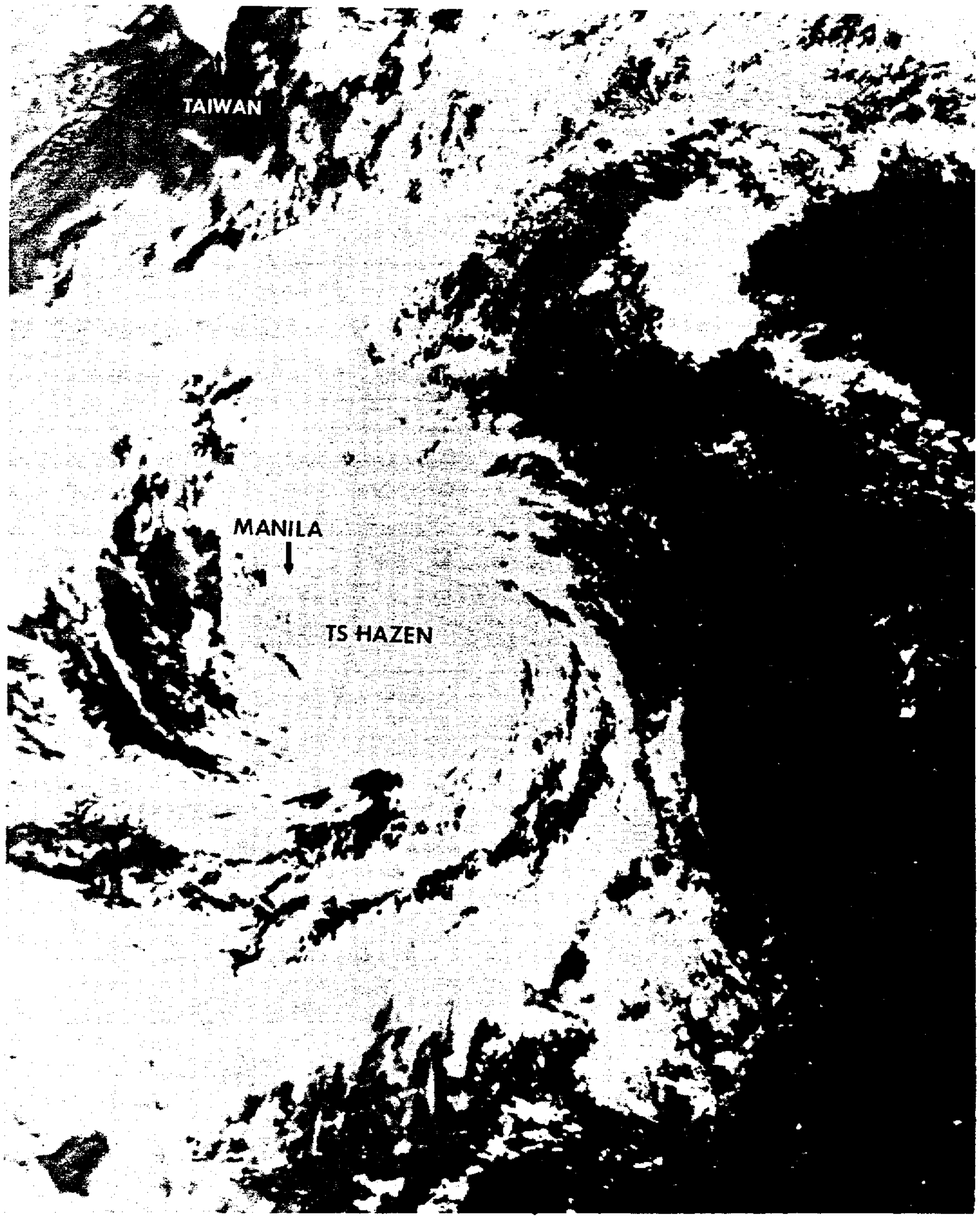
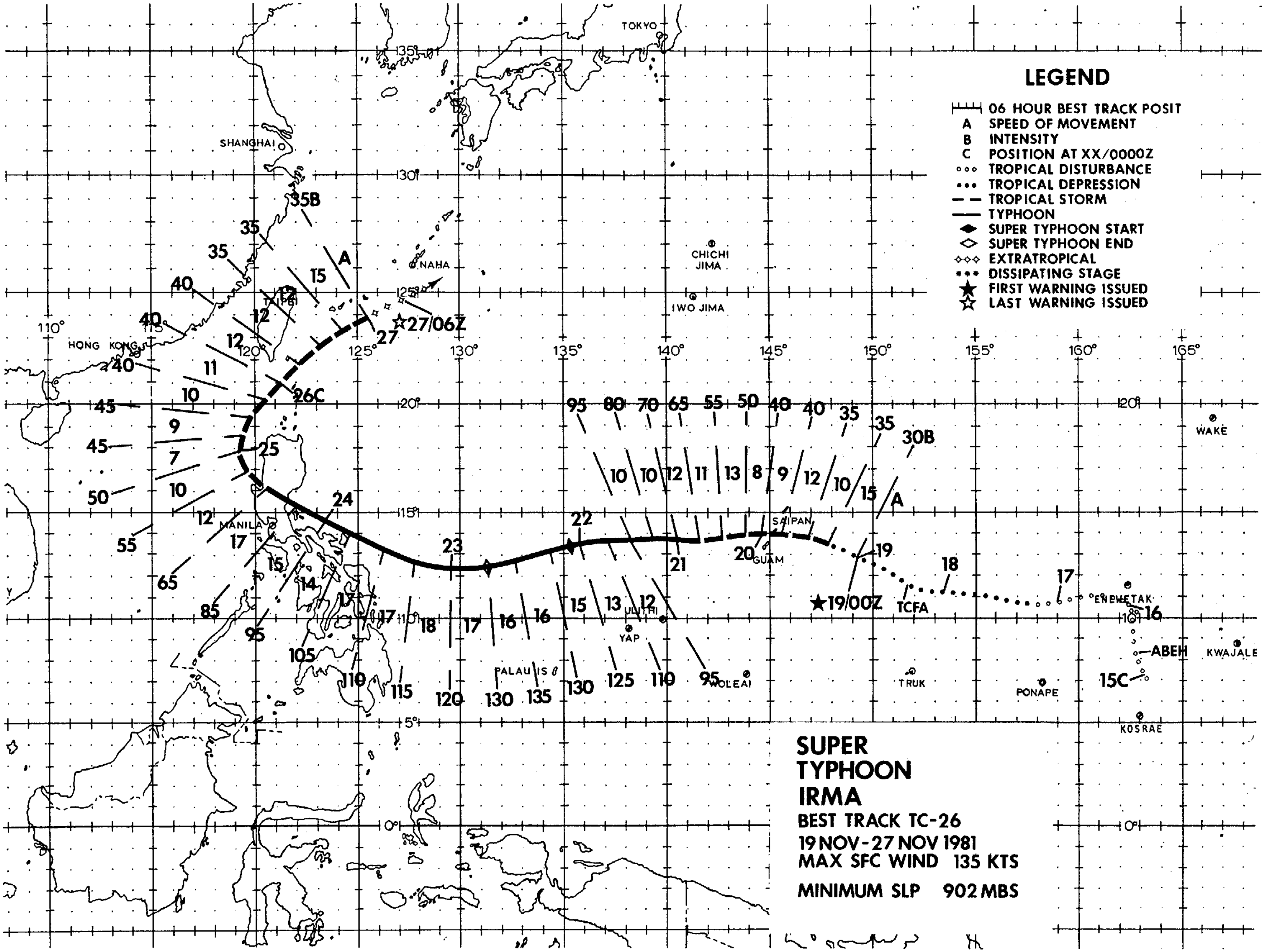


Figure 3-25-3. Tropical Storm Hazen at 55 kt (23 m/sec) 125 nm (232 km) southeast of Manila while moving south of Luzon, 191801Z November. (NOAA 7 infrared imagery)


LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SUPER
TYPHOON
IRMA
BEST TRACK TC-26
19 NOV - 27 NOV 1981
MAX SFC WIND 135 KTS
MINIMUM SLP 902 MBS
TOKYO
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
TAIPEI
HONG KONG
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
ABEH
KWAJALE
KOSRAE
WAKE
TCFA
★19/00Z
☆27/06Z
26C
15C
35B
30B

Super Typhoon Irma was the second of three tropical cyclones (Hazen(25), Irma (26), and Jeff(27)) to form in an active equatorial trough between 150E to 170E near 10N during the middle weeks of November. Reaching a maximum intensity of 135 kt (69 m/sec) and a minimum sea-level pressure of 902 mb, Irma was the strongest of the three storms, and fortunately, also the best "behaved" and the easiest to forecast.

When the area of enhanced convection that eventually became Typhoon Hazen formed near 10N 165E on 10 November, a zone of strong convective activity, located between 8N and 10N, stretched eastward from 165E to 150W. During the following week, westward propagating cloud clusters, as referenced in Ruprecht and Gray (1976) supported by convergence in the low-level easterly flow plus a strong upper-level divergent pattern, could be seen forming and dissipating along the entire zone. Throughout the period neither the data-sparse regions east of 170E, nor the satellite data, suggested the existence of a low-level circulation. Synoptic data along the western periphery of the zone, between 160E and 170E, did indicate the possibility of several minor troughs, or small circulations, propagating from the east. Similar synoptic situations existed for each of the three systems, i.e. Hazen, Irma, and Jeff; there was also a fourth circulation, detected on 12 November near 10N 161E. This latter system quickly dissipated because of the immediate proximity of the developing Hazen, a stronger cyclone.

The convective disturbance that spawned Super Typhoon Irma was first mentioned in the Significant Tropical Weather Advisory Bulletin (ABEH PGTW) on 15 November. Synoptic data indicated a circulation east of Ponape (WMO 91348) at 7N 163E and satellite imagery showed that a westward moving cloud cluster in the area beginning to develop an upper-level anticyclone. However, as the system moved north and then west during the ensuing three days, the convection fluctuated, then weakened greatly. A large clear subsidence region which extended 600 nm (1111 km) eastward from Typhoon Hazen seemed to hinder any further development (as it did for the 12 November circulation). However, by 181200Z Hazen had moved far enough to the west for the convection to once again increase in intensity as well as organization. A Tropical Cyclone Formation Alert (TCFA) was issued at 181641Z (Fig. 3-26-1). The following morning, an aircraft investigative mission found a central sea-level pressure of 1003 mb with 30 kt (15 m/sec) winds and the first warning was issued on Tropical Depression 26 at 190000Z.

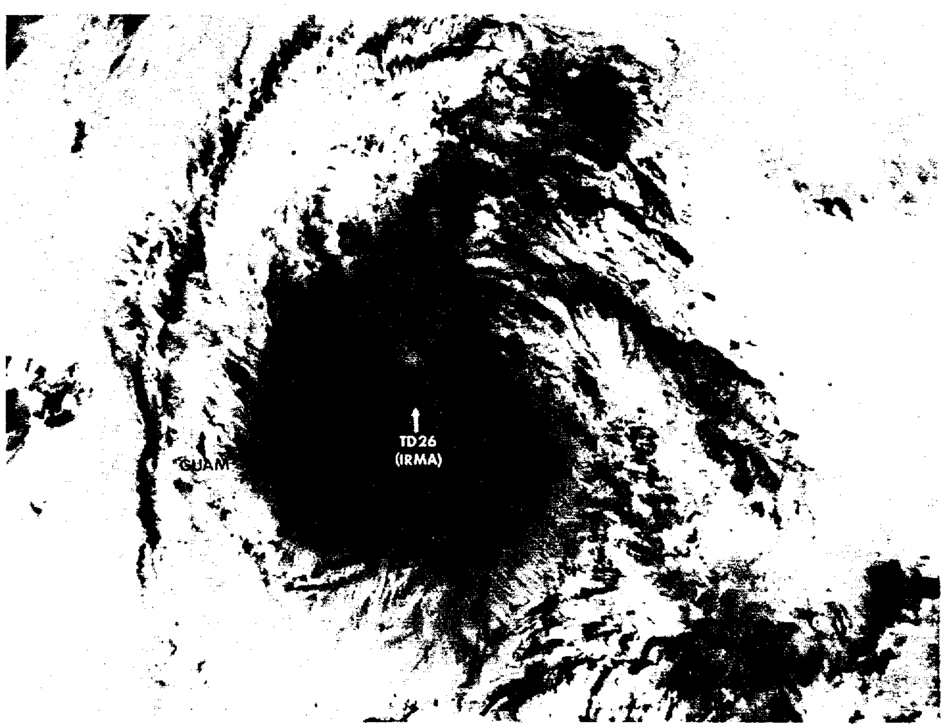


FIGURE 3-26-1. Tropical Depression 26 approximately 300 nm (556 km) east of Guam just prior to the first warning. Note the good outflow pattern developing with this system, 18 November, 2156Z. (NOAA 6 infrared imagery)

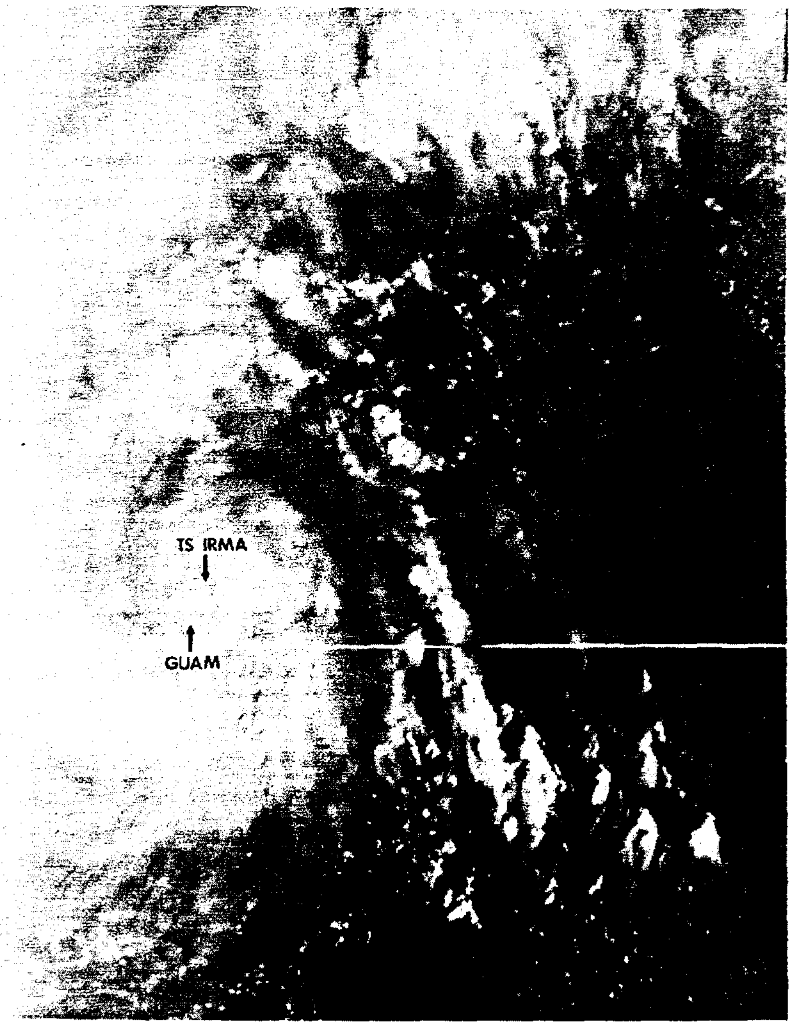


FIGURE 3-26-2. Tropical Storm Irma near its closest approach to Guam, 19 November, 2132Z. The extension of clouds just north of Irma are associated with a frontal system which was also near its closest approach to Guam. (NOAA 6 visual imagery)

Tropical Storm Irma passed just north of Guam at 182230Z (Fig. 3-26-2). Fortunately, at this time, the storm was intensifying very slowly and the strongest winds were away from Guam, in the northeast quadrant. In fact, Guam did not receive its strongest winds until nearly 8 hours later (29 kt (15 m/sec), with gusts to 43 kt (22 m/sec), at the Naval Air Station, Agana) when the storm began to deepen west of Guam.

Based upon the experience gained from Typhoon Hazen, JTWC's initial forecast tracks ignored the temptation to forecast an early recurvature into an advancing front just north of Guam. Although westerly winds north of 20N were in excess of 60 kt (31 m/sec) and 80 kt (41 m/sec) at 500 mb and 200 mb, respectively, it was deemed, that as in the case for Hazen, the strongest westerly winds associated with the front would pass too quickly to affect the storm. Furthermore, it was predicted that the strong northerly low-level flow beyond the front would force the storm back on a more westerly or southwesterly track. (JTWC's forecast errors for Super Typhoon Irma of 76, 118, and 141 nm (141, 219, and 261 km) for 24, 48, and 72 hours, respectively, were excellent - nearly half the long-term mean).

When the frontal system passed Irma and moved off to the east, the ridge at 500 mb built to the north and west of the storm. This ridge persisted along 18N throughout Irma's track towards the Philippines. Although the ridge was quite narrow and elongated, it appeared to shelter Irma from the effects of the strong westerly flow north of 20N. JTWC was able to monitor the strength of this ridge with the aid of several 500 mb synoptic tracks flown by the 54th Weather Reconnaissance Squadron (Fig. 3-26-3).

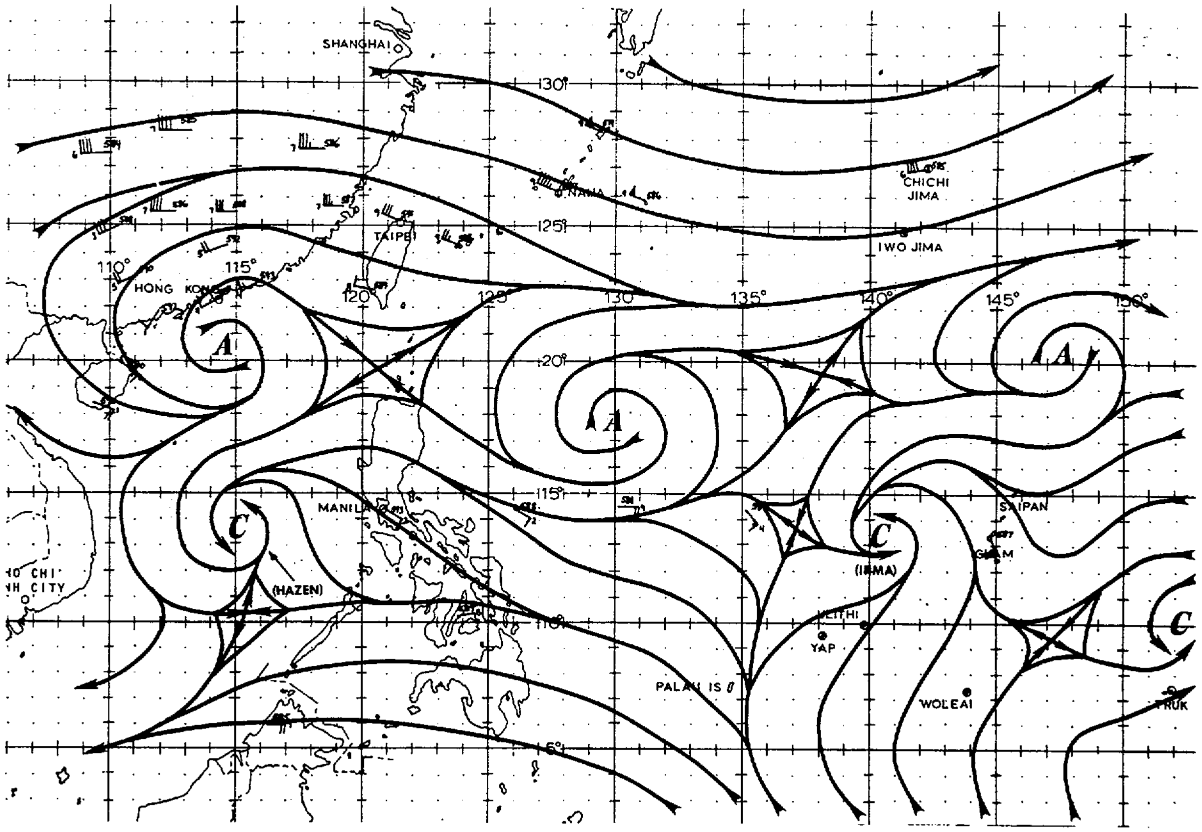


FIGURE 3-26-3. The 210000Z November 500 mb stream-line analysis. Wind speeds are in knots. Data taken along 14N are a JTWC requested 500 mb synoptic track.

The 202254Z weather reconnaissance mission found that Irma's pressure had dropped to 968 mb with 68 kt (25 m/sec) surface winds (85 kt (44 m/sec), 700 mb flight level winds) and that a 40 nm (74 km) diameter eye had developed. (In post-analysis, Irma was upgraded to typhoon status at 201800Z). By 210900Z, aircraft data was applied to JTWC's empirically derived relationship between sea-level pressure and 700 mb equivalent potential temperature (Dunnavan, 1981) and suggested the potential for rapid deepening below 925 mb within the next 12 to 36 hours. Twenty-four hours later, the aircraft reconnaissance mission verified this prediction with a 905 mb minimum sea-level pressure, low enough to qualify Irma as a Super Typhoon (Fig. 3-24-4). It is interesting to note that during the time of Irma's greatest deepening, another cold front had passed approximately 500 nm (926 km) to the north. The 200 mb data indicated a 120 kt (62 m/sec) jet maximum, associated with this fast moving front, had passed just north of Irma (at 30N). This jet, along with a 50 kt (26 m/sec) easterly flow to the south of Irma supplied her with two excellent outflow channels. Irma remained at super typhoon strength for near 16 hours before slowly weakening as the western half of the circulation field began to interact with the outher edges of the Philippine Islands.

Although Irma steadily weakened before making landfall at 240900Z with 85 kt (44 m/sec) winds about 60 nm (111 km) northeast of Manila, she still caused widespread destruction (Fig. 3-26-5). Reports from the Philippines indicated more than 200 deaths with hundreds injured and a damage estimate as high as $9 million. This included the almost total destruction of 4 coastal towns in the province of Camarines Sur, 170 nm (315 km) southeast of Manila, due to 50 foot (15 m) storm surge waves and the capsizing of a ship in Manila Bay.

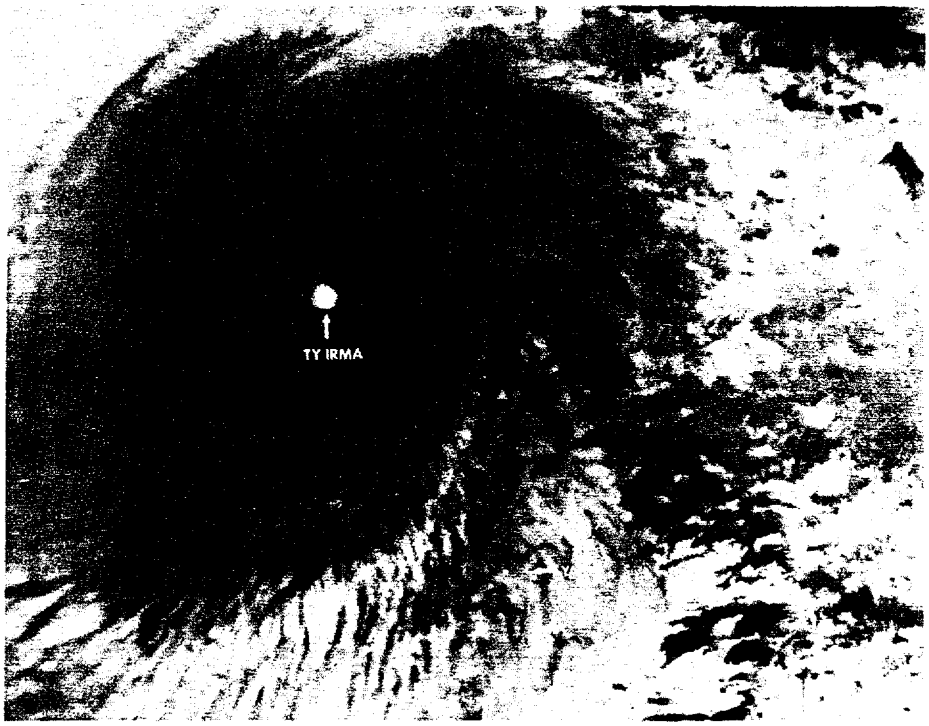


FIGURE 3-26-4. Super Typhoon Irma near maximum strength in the Philippine Sea, 22 November, 0450Z. Four hours later Irma's eye was described as an "... excellent stadium effect (with) layered clouds up to an overhead fishbowl...". (NOAA 7 infrared imagery)

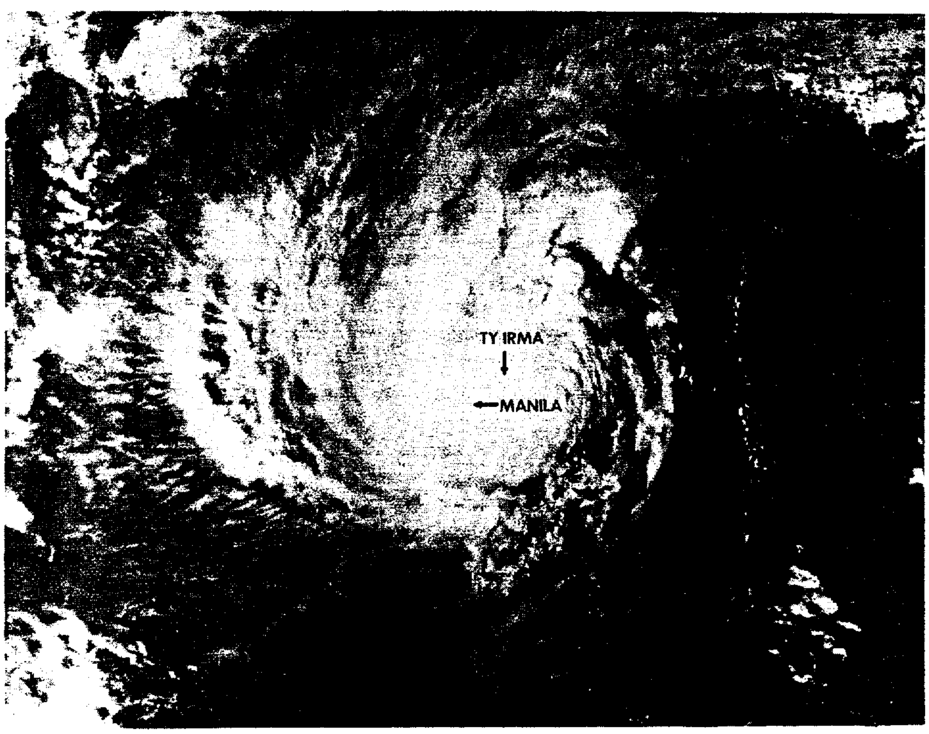
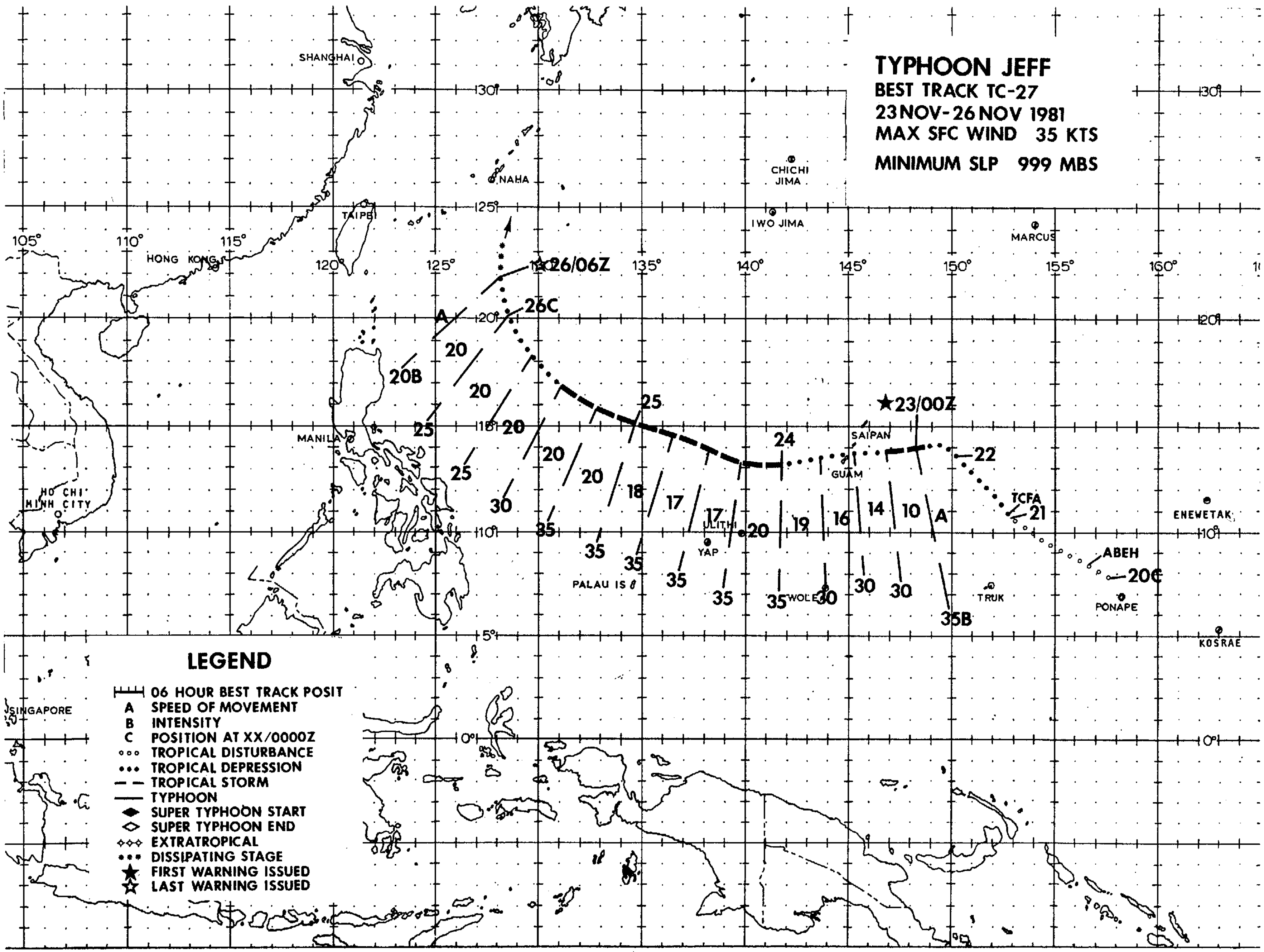


FIGURE 3-26-5. Typhoon Irma with 85 kt (44 m/sec) is only 65 nm (120 km) from Manila and three hours from reaching the coast of Luzon, 24 November, 0609Z. (NOAA 7 visual imagery)

As Irma approached the Philippines, JTWC correctly predicted that she would begin to move in a more northwesterly direction towards a break in the ridge just west of Luzon near 20N 118E. Synoptic data over Southeast Asia indicated the approach of a significant trough as evidenced by southwest winds of 70 kt (36 m/sec) at 500 mb and 80 kt (41 m/sec) at 200 mb occurring as far south as 20N. These indicators seemed to presage a situation that offered the best opportunity for Irma to recurve.

Irma lost her typhoon strength winds at 241200Z just before entering Lingayen Gulf and the South China Sea. Aircraft reconnaissance ten hours later found the storm moving north and poorly organized with strong convection and winds only on her north side. By 250900Z, Irma's upper-levels began to shear towards the northeast and Irma began to recurve into the Luzon Straits in advance of the trough moving off of Asia. Irma managed to linger on for another two days before finally becoming absorbed into a cold front at 270000Z just south of the Ryukyu Islands.


TYPHOON JEFF
BEST TRACK TC-27
23 NOV-26 NOV 1981
MAX SFC WIND 35 KTS
MINIMUM SLP 999 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
26/06Z
26C
23/00Z
TCFA
ABEH
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
TAIPEI
HONG KONG
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE
HO CHI MINH CITY
SINGAPORE
105°
110°
115°
120°
125°
130°
135°
140°
145°
150°
155°
160°
5°
10°
15°
20°
25°
30°
0°

Tropical Storm Jeff was first detected as a distinct surface circulation through synoptic data analysis on 18 November. Jeff developed from the second of two major disturbances that formed in the wake of Typhoon Hazen (25). The first disturbance, Super Typhoon Irma (26), was a determining factor in Jeff's development, intensity and track.

The first warning on Jeff was issued on 23 November. This was during the period that Irma dominated the wind fields of the western Pacific (21-25 Nov). Irma's strong low-level inflow was the major steering force in the early part of Jeff's life as he followed Irma across the Pacific (Fig. 3-27-1). Strong outflow from Irma created an upper-level east-west ridge that stretched across the western Pacific. Because of the expansiveness of the ridge and the small areal extent of Jeff's convection, he was prohibited from reaching favorable outflow channels.

Jeff, due mainly to a lack of upper-level support, never intensified beyond minimal tropical storm strength (Fig. 3-27-2). Jeff's initial movement, as a weak disturbance, was northwest towards Guam, following the low-level flow into Irma. Jeff reached tropical storm strength on 23 November, just after turning west towards Guam, eventually passing 15 nm (28 km) north of the island. Jeff's westward acceleration, just prior to reaching Guam resulted from a mid-tropospheric ridge that had built eastward from Taiwan. Maintaining an intensity between 30 and 35 kt (15 to 18 m/sec), Jeff continued westward until the forecast recurvature through a break in the ridge occurred near 130E. Jeff dissipated over water on 26 November due to increasing upper-level wind shear. The final warning was issued when aircraft reconnaissance could no longer discern a surface circulation.

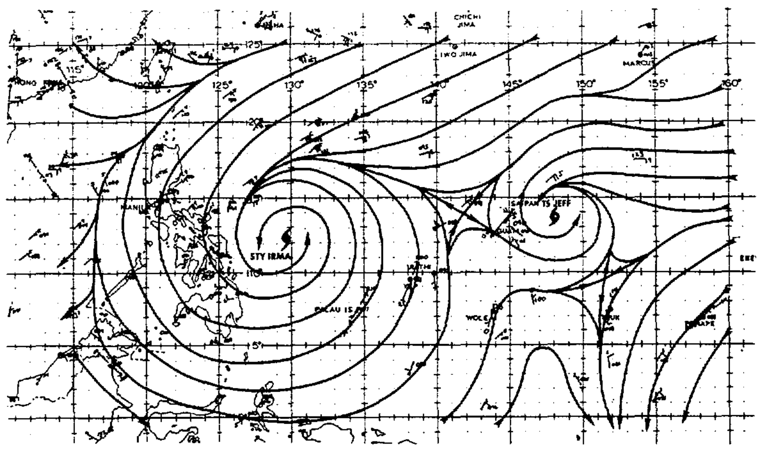


FIGURE 3-27-1. Surface (⟶) / gradient (⟵) level streamline analysis for 230000Z NOV showing the low-level flow into Super Typhoon Irma. This flow pattern acted as low-level steering for Jeff.

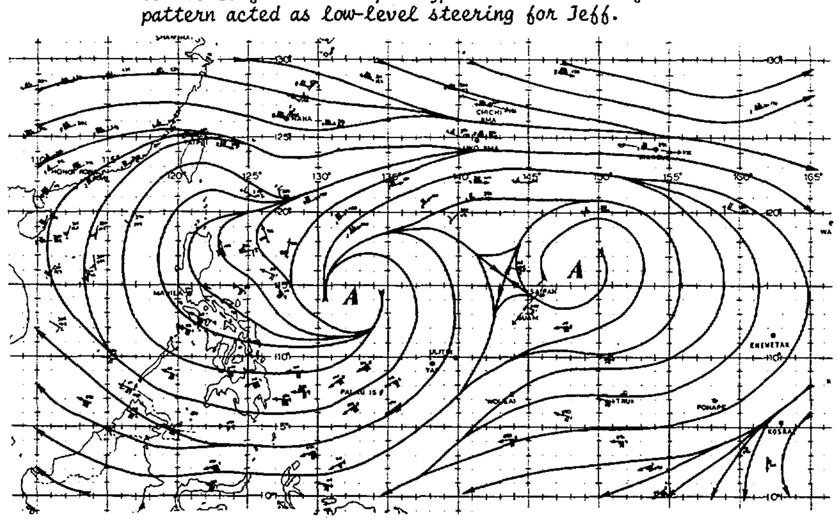
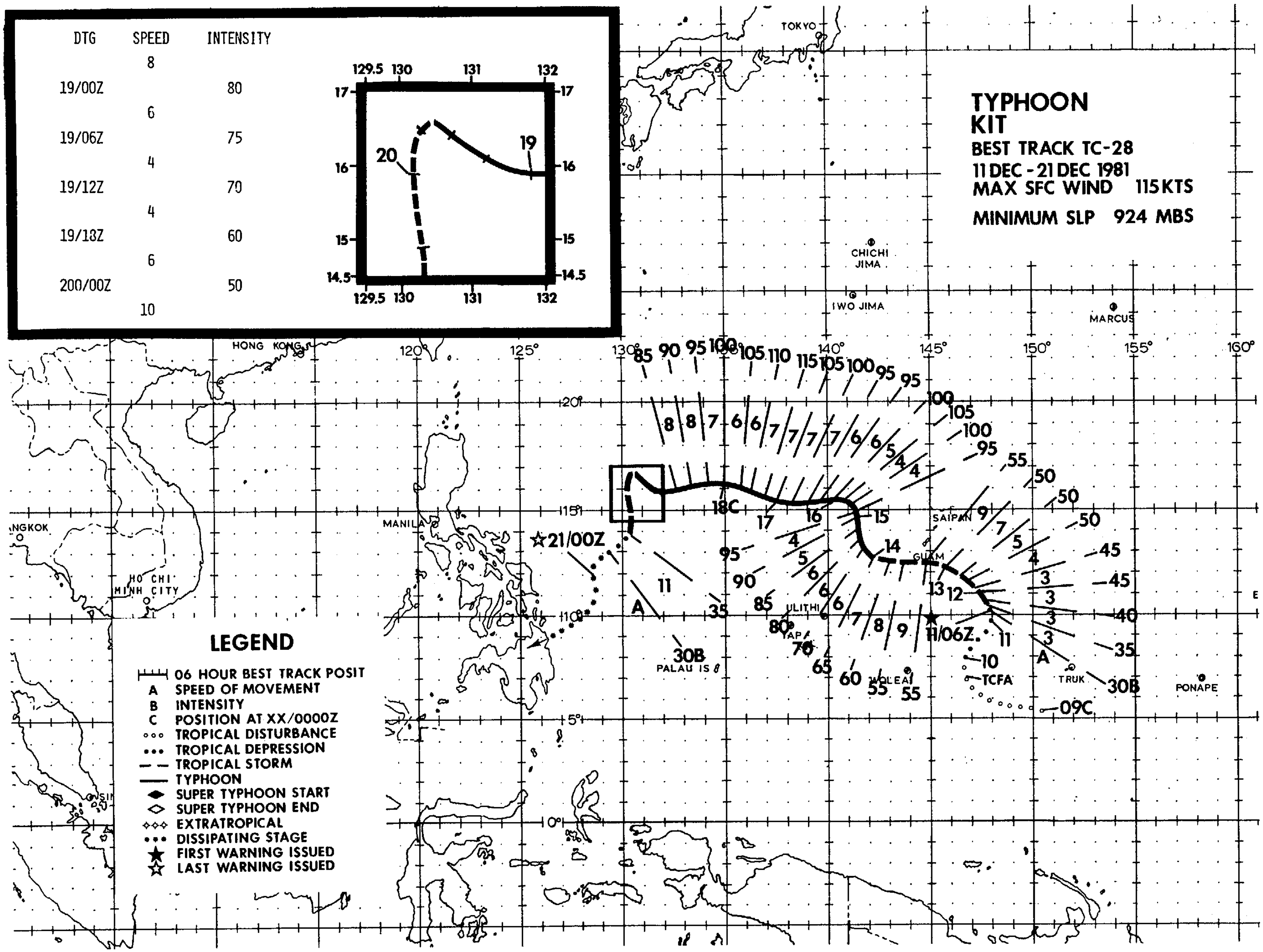


FIGURE 3-27-2. 200 mb streamline analysis at 221200Z November. Note the broad ridge across the western Pacific. Wind data are a combination rawinsonde, AIREPS, and satellite derived winds (⟵).


TYPHOON
KIT
BEST TRACK TC-28
11 DEC - 21 DEC 1981
MAX SFC WIND 115 KTS
MINIMUM SLP 924 MBS
DTG SPEED INTENSITY
8
19/00Z 80
6
19/06Z 75
4
19/12Z 70
4
19/18Z 60
6
200/00Z 50
10
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
CHICHI JIMA
IWO JIMA
MARCUS
HONG KONG
MANILA
HO CHI MINH CITY
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
21/00Z
11/06Z
TCFA
09C
18C
30B

Typhoon Kit was unlike most December tropical cyclones in that it had a prolonged lifetime (40 warnings) and attained a maximum intensity well over 100 kt (51 m/sec). Kit's origin was not uncommon for late season tropical cyclones; during early December, the winter near-equatorial trough had established itself south of 10N as the tradewind easterlies merged with northeasterlies from higher latitudes placing the westernmost extension of the trough in the Philippine Sea. Eastward, lighter winds were observed turning cyclonically within the trough and, as early as 4 December, surface analyses suggested a possible low-level center developing southwest of Ponape (WMO 91348). On 7 December, the Significant Tropical Weather Advisory (ABEH PGTW) discussed an area of disturbed weather southwest of Truk Atoll (WMO 91334), but the associated convective pattern and observational data were not conducive to further action for another two days. At 091930Z, based primarily upon the improved convective organization as revealed on satellite imagery, the first of three Tropical Cyclone Formation Alerts was issued.

On 10 December, a reconnaissance aircraft conducted an investigation in the western periphery of the trough and the opportunity to close off a circulation center was lost. Satellite data (Fig. 3-28-1) and subsequent aircraft reports suggest that the center existed just east of the area investigated. At 101845Z, a formation alert was reissued for the same general area. Later satellite data and aircraft observations indicated that the center had moved northward, thus at 102325Z the third formation alert was issued. Reconnaissance aircraft finally closed off a circulation center near 10N 148E (110348Z) and at 110443Z, the first warning on Tropical Depression 28 was issued (Fig. 3-28-2). The 111200Z warning upgraded TD-28 to Tropical Storm Kit based on aircarft data (110723Z) which indicated tropical storm strength winds in all four quadrants.

Figure 3-28-1. Active convection surrounds a developing low-level center. During this period, a reconnaissance aircraft investigated the westernmost area but did not reach the convective center as depicted on satellite imagery, 100443Z December. (NOAA 7 visual imagery)

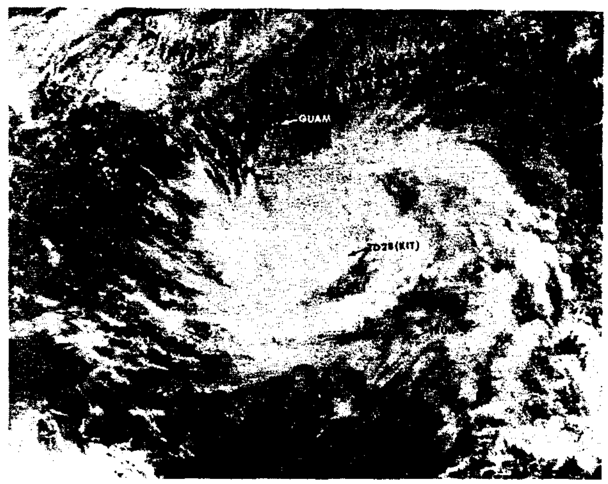


Figure 3-28-2. Tropical Depression 28 at the time of the first warning. Note the extended cirrus clouds on the western side. Strong upper-level easterlies would continue to exert considerable pressure on TD-28 (Kit) for another 2 1/2 days. Thus, most of the associated convection was displaced in the western two-thirds of the circulation, 110430Z December. (NOAA 7 visual imagery)

The initial warnings indicated that Kit would track slowly north-northwestward until approaching 12N then, as the system interacted with mid- and low-level easterlies, a more westward track was anticipated taking Kit just south of Guam. Although Kit maintained the forecast track, the speed of movement remained at or below 4 kt (7 km/hr) for the first 30 hours of warning status. Having not fully anticipated the exceptionally prolonged slow speed, all reconnaissance aircraft were evacuated to Clark AB after the 120849Z fix to avoid the expected destructive winds on Guam. As a result, warnings issued during the ensuing 25 hours were based entirely on satellite data. However, during this stage of development, Kit was not well-aligned in the vertical and the main convective mass was displaced to the west of the low-level center. Thus, nighttime infrared imagery had to be scrutinized for subtle details which could help locate the low-level center. Figure 3-28-3 is typical of the nighttime infrared imagery used to fix Kit during this period. Thanks to the efforts of satellite operations personnel from Detachment 1, 1WW, Nimitz Hill, Guam, the fixes received during this period were highly accurate (never more than 15 nm (28 km) from the final best track) and the warnings issued from this data followed Kit closely as she finally accelerated on a west-northwest track south of Guam.

Just after Kit passed south of Guam, reconnaissance aircraft indicated a central pressure of 992 mbs which revealed that no appreciable development had taken place during the 25 hour period between aircraft penetrations. However, during the two days that followed, Kit intensified and reached a peak of 105 kt (54 m/sec) before weakening slightly to 95 kt (49 m/sec) at 160600Z. Figure 3-28-4 shows Kit early in this intensification period. During this period of

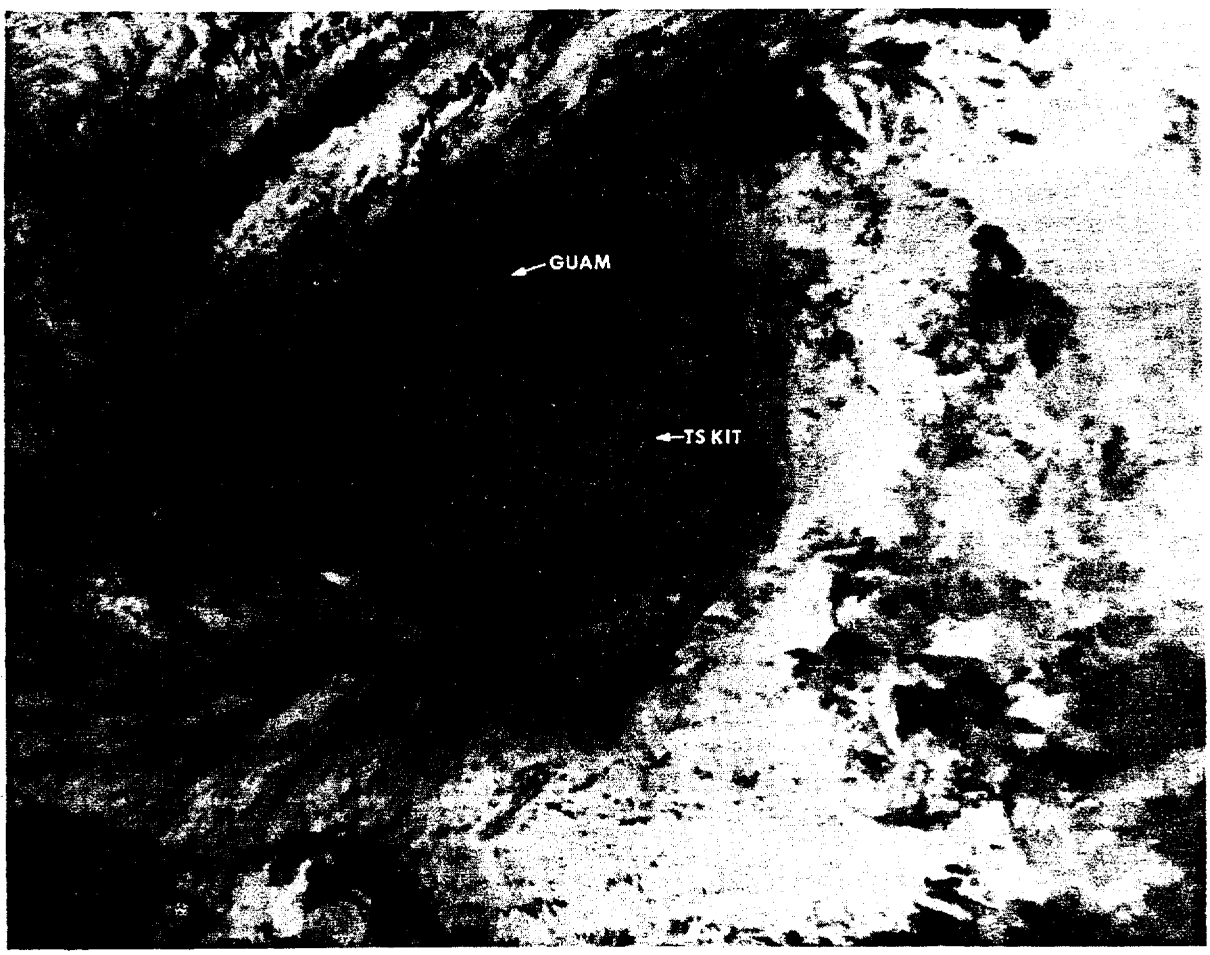


Figure 3-28-3. Infrared imagery which shows Tropical Storm Kit's large convective mass, however, the lighter grey shades on the eastern side show lower cloud features. Utilizing these data, Det 1, 1WW satellite analysts provided accurate fixes during a lengthy period without aircraft fixes, 121003Z December. (NOAA 6 infrared imagery)

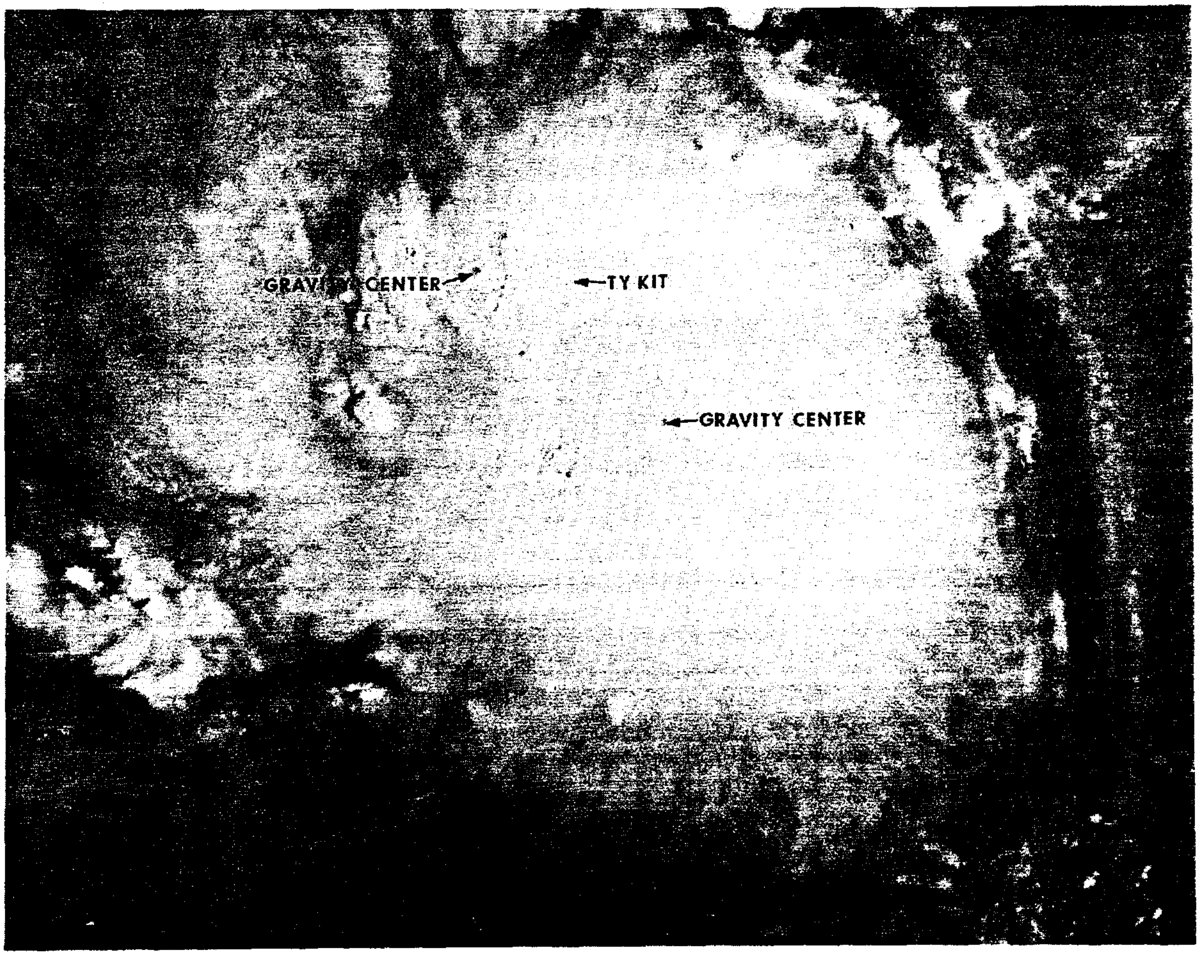


Figure 3-28-4. An intensifying Typhoon Kit, located 165 nm (306 km) west of Guam. Note the textured cloud pattern. Often referred to as gravity waves, these features are frequently seen in rapidly developing tropical cyclones prior to the development of an eye. About 14 hours later, Kit's eye was first detected, 132219Z December. (NOAA 6 visual imagery)

intensification, Kit turned sharply northward and once again slowed to a speed of movement of 4 kt (7 km/hr). Kit's northward movement presented JTWC forecasters with a major dilemma. From the very first warning, Kit was thought to be an eventual westward mover. The strength of the low-level northeast surge originating over Asia had previously dictated the tracks of Hazen (25), Irma (26) and Jeff (27). There had been no appreciable change in the mid-latitude wind regime since those tropical cyclones, thus, a similar scenario seemed very appropriate. But Kit's movement was seemingly in defiance to the synoptic situation. When the 142005Z reconnaissance aircraft data located Kit at 14.3N, the 141800Z warning was amended to show recurvature. However, at 150000Z, the synoptic data showed renewed strength in the northeast surge (Fig. 3-28-5) and accordingly, near 151200Z, Kit turned westward once again. At 161200Z the forecast that abandoned the concept of eventual recurvature was issued.

With hindsight it is fair to say that virtually all the ingredients were present to allow Kit to recurve, except one. The effect of the low-level flow could not be overcome, and despite the presence of a mid-latitude trough just north of Kit, there was a limit to her northward movement.

Following the resumption of a westerly track, Kit began to reintensify as she moved into a position that allowed strong upper-level westerlies to provide an excellent outflow channel to the northeast (Fig. 3-28-6). At 170830Z, a reconnaissance aircraft measured a 924 mb central pressure, or approximately 115 kt (59 m/sec) maximum winds based upon the Atkinson and Holliday (1977) pressure/intensity curve. During the next two days, as Kit began interacting with stronger mid-tropospheric westerlies, she steadily weakened and by 191800Z, had lost typhoon force winds. On 18 December, Kit

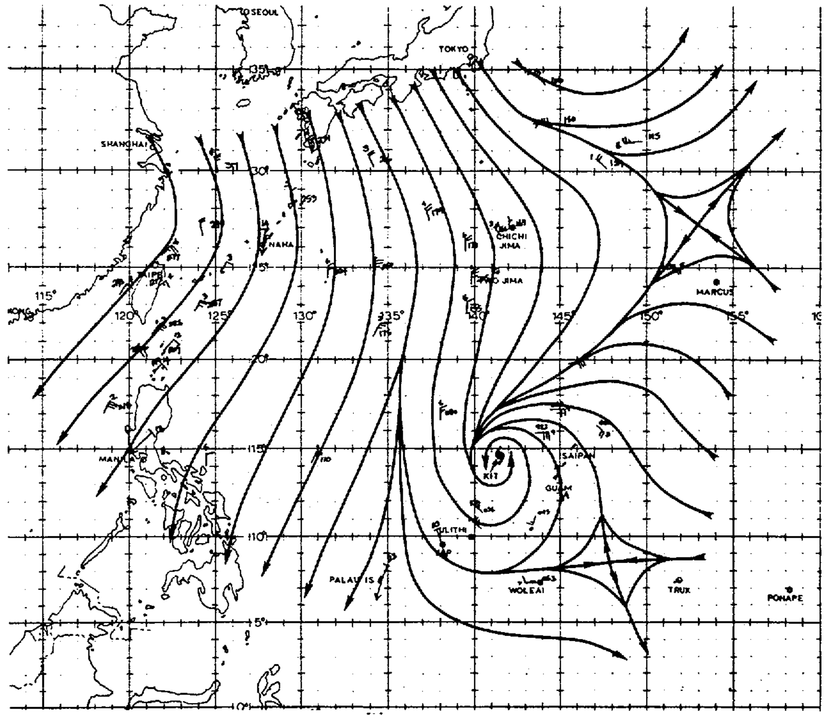


Figure 3-28-5. Surface and gradient level data at 150000Z December with streamline analysis showing a new surge of high pressure moving off of northeastern China. During the following 12 hour period, this surge effectively closed-off any potential for Kit to recurve and once again forced her on a westward track.

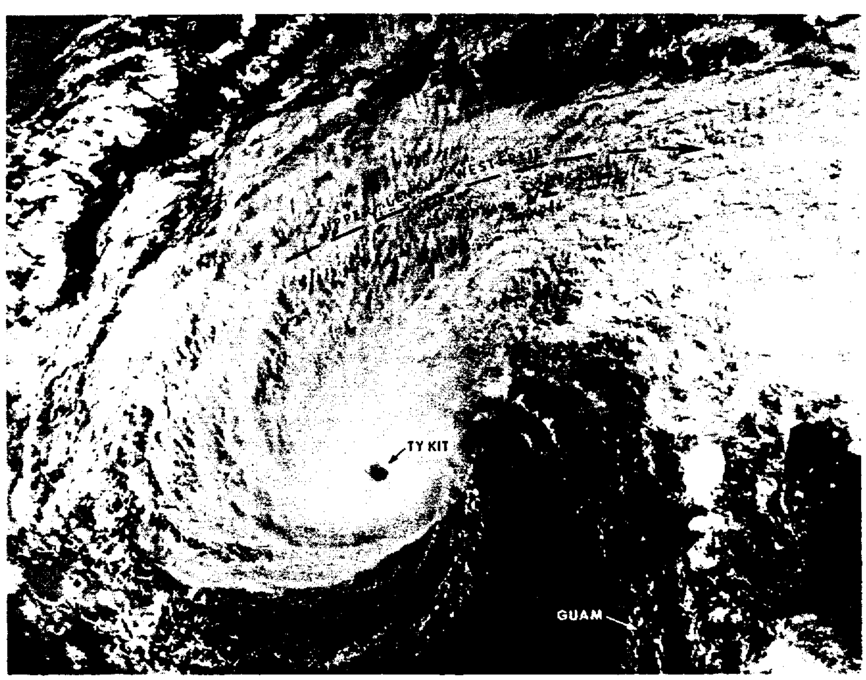


Figure 3-28-6. Typhoon Kit near peak intensity (115 kt (59 m/sec)). Virtually all of Kit's outflow is into the upper-level westerlies. This is the most common pattern for late season typhoons at higher latitudes, 170502Z December. (NOAA 7 visual imagery)

was once again in position where, because of the presence of a deepening trough over eastern China and a break in the northeast surge, she might again jog north and possibly recurve. Thus, from 180600Z to 191800Z, the forecasts showed an increasing tendency for a track toward recurvature near 125E. However, by 200000Z, it became obvious that Kit's low-level circulation had failed to link-up with the approaching shortwave trough and the track toward recurvature was once again abandoned. It was about this time, that aircraft and satellite data began showing Kit's low-level circulation center emerging on the southern edge of the main convective mass. Within hours, Kit's mid- and upper-level features weakened and began drifting northward into the shortwave trough. The low-level center, now fully exposed, turned southward under the influence of low-level northerlies which followed the shortwave trough off of China. At 200743Z, a reconnaissance aircraft located Kit's low-level center 110 nm (204 km) south of the 200000Z warning position. The 200743Z aircraft, as well as 200520Z satellite imagery (Fig. 3-28-7), showed Kit's entire circulation pattern enveloped in a heavy stratocumulus cloud deck. Later infrared imagery could not identify the circulation center, but at 202157Z, the final reconnaissance aircraft mission located a weak low-level center near 13N 129E. Downgraded to Tropical Depression 28 at 201800Z, the fortieth and final warning was issued at 210000Z. During the 36 hours which followed, a weak low-level center could be identified moving southwestward into Mindanao, Republic of the Philippines.

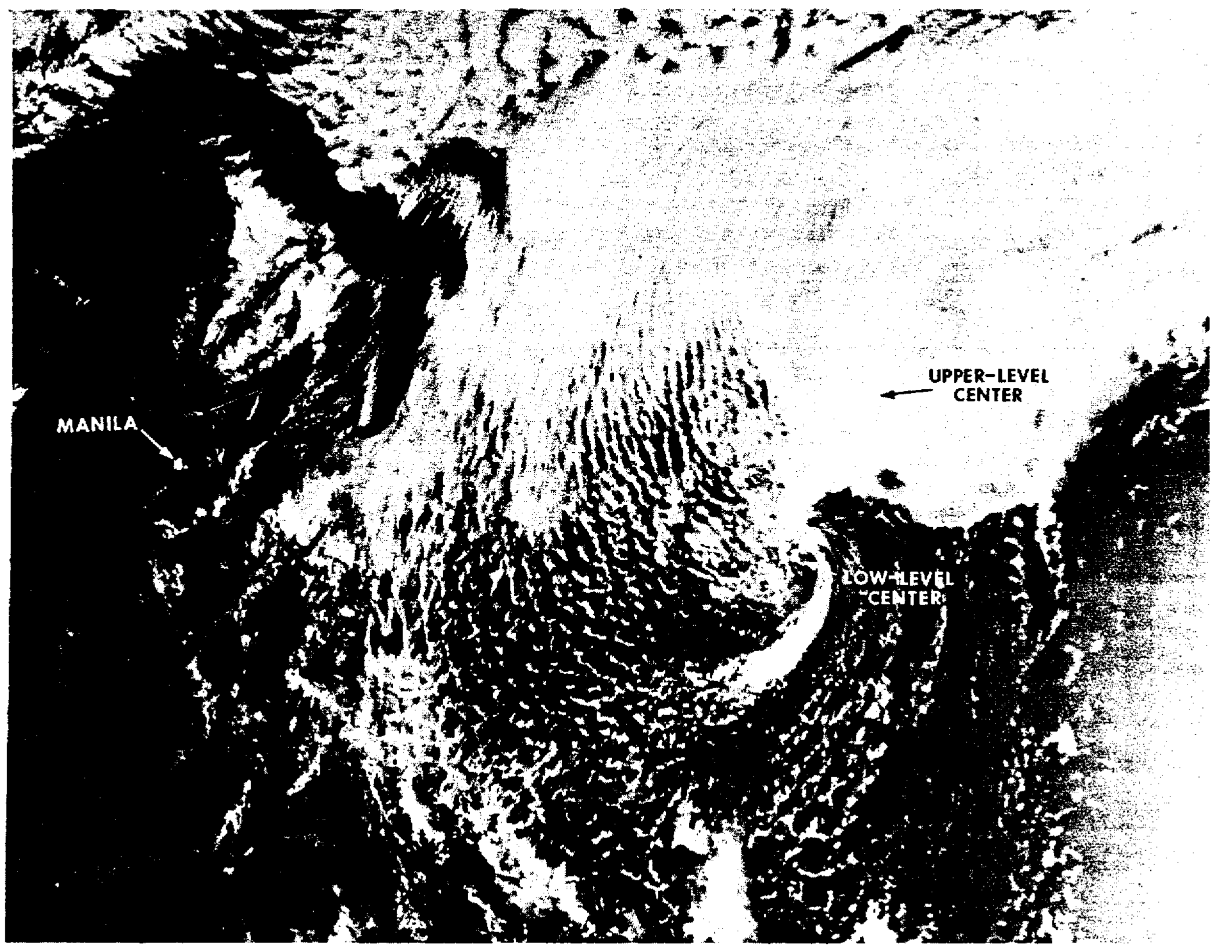
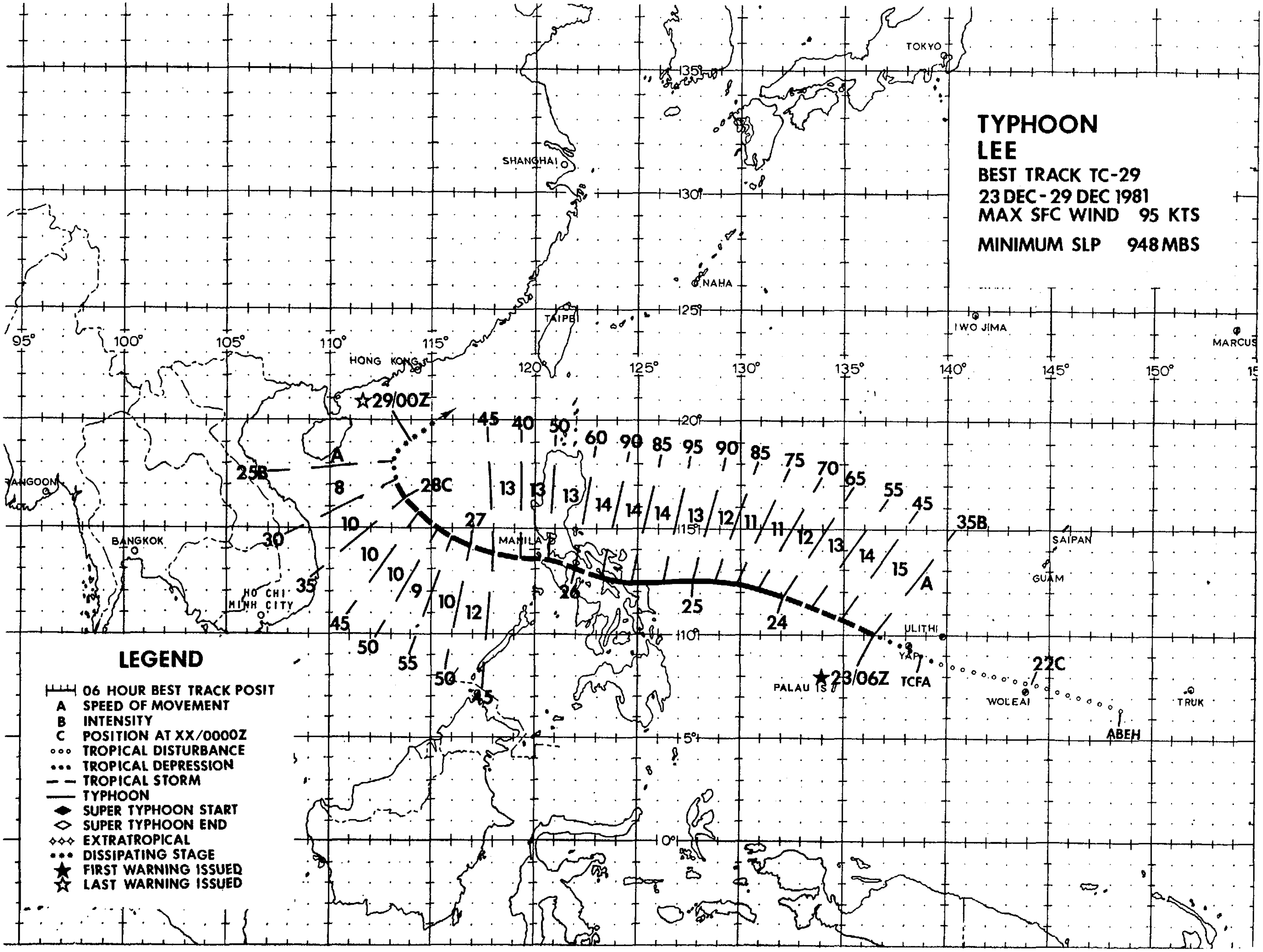


Figure 3-28-7. A weakening Tropical Storm Kit, with the low-level center moving southward while the remnants of her convection move northeastward into a shortwave trough. Note the hyper-extended circulation pattern. The low-level steering was literally stretching Kit southward with time, 200609Z December. (NOAA 7 visual imagery)



TYPHOON
LEE
BEST TRACK TC-29
23 DEC - 29 DEC 1981
MAX SFC WIND 95 KTS
MINIMUM SLP 948 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
RANGOON
HO CHI MINH CITY
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
ABEH
TCFA
☆29/00Z
★23/06Z
22C
28C
25B
35B

On 21 December, as Tropical Depression 28 (Kit) was dissipating in the western Philippine Sea, an area of convection began organizing west of Truk Atoll. Strong northerly winds, previously feeding into Kit, began moving toward the eastern Philippine Sea, thus closing the western end of the near-equatorial trough southwest of Guam. On 22 December, reconnaissance aircraft data indicated near-gale force tradewind easterlies had penetrated to 8N and to the south of the convective center. However, both the 220000Z 500 mb analysis and a portion of the 700 mb aircraft data indicated a mid-tropospheric trough was present southwest of Guam in a virtually convection-free region. A singular 700 mb height from the reconnaissance aircraft showed an extrapolated surface pressure of 1002 mb near 9N 143E. The aircraft reconnaissance mission was not able to thoroughly investigate this trough, thus it was not possible to determine whether or not a closed circulation had developed. By 221800Z, the convection had moved westward and was located close to the mid-tropospheric trough. At 222100Z, when Yap (WMO 91413) reported a 5 mb pressure fall in a 9 hour period, a Tropical Cyclone Formation Alert was issued for the developing system.

The first warning was issued for Tropical Depression 29 when reconnaissance aircraft data at 220503Z located a closed circulation; at 221200Z, because of increased convective organization and reports of stronger tradewinds north of the cyclone, TD-29 was upgraded to Tropical Storm Lee. During the first 24 hours in warning status, Lee moved west-northwestward in response to a mid-latitude shortwave trough moving off of Asia. Once this trough moved on, Lee turned toward the west into the Philippines. Lee intensified rapidly, reaching typhoon strength just 18 hours after initial warning and, subsequently, attaining a peak intensity of 95 kt (49 m/sec) within 48 hours. Figure 3-29-1 shows Lee during this intensification period. However, shortly after reaching maximum intensity, Lee began crossing the Philippines and a rapid weakening trend followed. Just 24 hours after

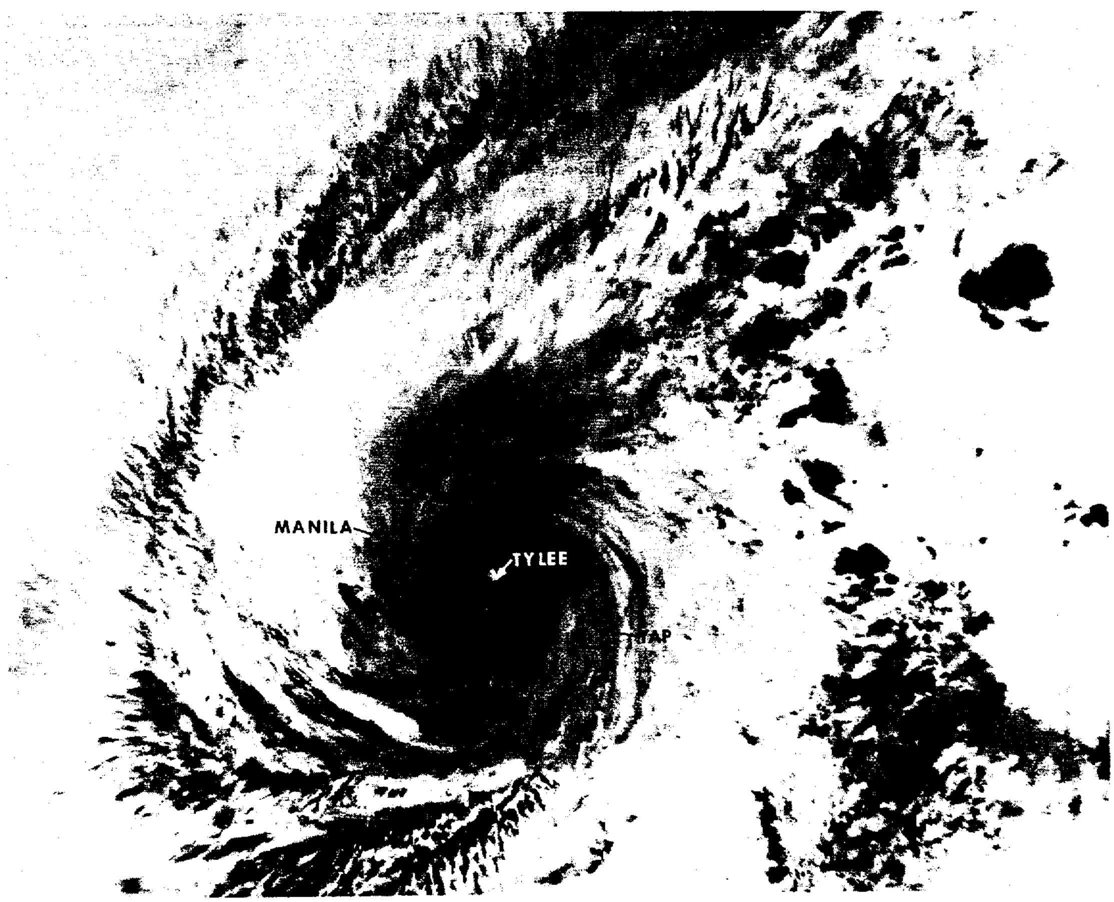


FIGURE 3-29-1. Typhoon Lee, now at 85 kt (44 m/sec), is intensifying rapidly while approaching the central Philippines. 12 hours later, aircraft data had Lee with a 948 mb surface pressure (95 kt (49 m/sec)), 241806Z December. (NOAA 7 infrared imagery)

reaching 95 kt (49 m/sec), Lee entered the South China Sea with an estimated intensity of 40 kt (21 m/sec).

The JTWC forecast tracks had accurately predicted a track between Mindoro and Luzon Islands, then into the South China Sea. Beyond this point, the track was much more difficult to forecast. The numerical prognostic fields were forecasting a deepening of a mid-latitude trough over central China and the subsequent development of a "Shanghai" low in the East China Sea. However, these same forecast fields were not weakening the prevailing northeasterly flow over the South China Sea in the lower-levels.. Because the forecast significant pressure changes over eastern China would certainly affect Lee's westward movement, the option for a more northward track in the South China Sea was indicated as early as the fourth warning (240000Z). However, as Lee tracked westward, the forecasted deepening of the mid-latitude trough was delayed on each 12-hour numerical forecast series. At 262048Z, when reconnaissance aircraft located Lee still tracking westward and the deepening of the trough had still not materialized, the 261800Z warning was amended to show a more westward track toward central Vietnam and south of a small high over Hai-nan Island. Within 12 hours of the amended warning, surface/gradient level wind reports in the region showed a lessening of low-level wind speeds as the previously strong northeast monsoonal flow off of Asia moved eastward and more directly affected the Philippine Sea. Although not yet forecasted, the effects of the approaching mid-latitude trough were finally changing the synoptic situation and accordingly, Lee gradually inched toward a more northwestward track.

The aircraft data received on 26 December indicated a 990 nm minimum sea-level pressure at Lee's center with a banding-type eye present. Although the banding feature remained for several days, Lee's surface pressure steadily climbed and reached 998 mb as reported by the 271406Z reconnaissance aircraft mission. On 27 December, satellite imagery began showing the effects of increased vertical wind shear on Lee; and by 280000Z, all of Lee's deep-layer convection and upper-level outflow had been advected well east of the low-level center. On the 28th, surface wind reports showed a weakening of Lee's circulation as surface pressures throughout the northern portion of the South China Sea continued to increase.

Despite Lee's more pronounced northward movement, it was not until the 280600Z warning that the JTWC abandoned the westward track forecast. Lacking throughout this period was an appreciation of how much the low-level wind regime had changed and that Lee was moving northward in the absence of any significant low-level steering. The westward track was continually supported by the usually reliable One-way Interactive Tropical Cyclone Model (OTCM/TCMO) which showed a slight northward jog before assuming a west-southwestward track. Finally, when fix-to-fix data from visual satellite imagery showed a northward movement in the six-hour period up to 280600Z, the JTWC forecast swung around to the north. Although the numerically forecast "Shanghai" low did not develop in the East China Sea, the effect of the mid-latitude trough on the low-level wind flow was a significant factor in Lee's northward movement, although somewhat delayed.

The final warning was issued at 290000Z when visual satellite imagery confirmed what synoptic data at 281200Z had indicated: Lee had essentially dissipated as a significant tropical cyclone. Figure 3-29-2 shows the remnants of Lee's circulation center located 150 nm (278 km) south of Hong Kong.

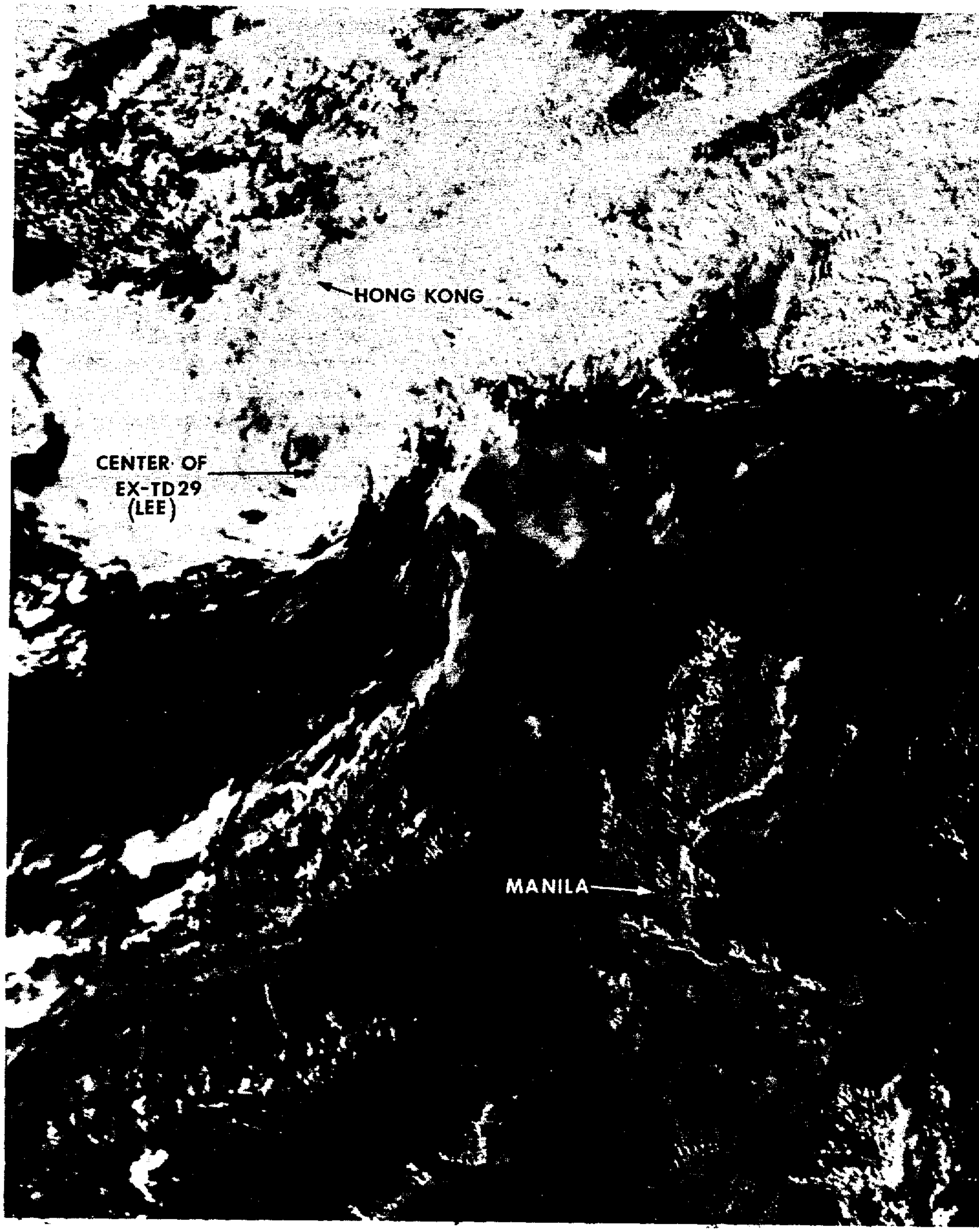


FIGURE 3-29-2. Once Typhoon Lee, now a weak small-scale circulation south of Hong Kong, 290604Z December. (NOAA 7 visual imagery)

2. NORTH INDIAN OCEAN TROPICAL CYCLONES

The 1981 North Indian Ocean tropical cyclone season was near normal. Three tropical cyclones developed during the monsoon transition season as the Northern Hemisphere storm season headed for its conclusion. One cyclone develped in the Arabian Sea and the remaining two cyclones developed in the Bay of Bengal. Tables 3-6 and 3-7 provide a summary of North Indian Ocean tropical cyclones, Tropical Cyclone Formation Alerts and warnings.

TABLE 3-6 NORTH INDIAN OCEAN

1981 SIGNIFICANT TROPICAL CYCLONES

CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	MAX SFC WIND(KT)	EST MIN SLP	NUMBER OF WARNINGS	DISTANCE TRAVELLED(NM)
TC 27-81	30 OCT-02 NOV	4	60	979	13	993
TC 29-81	17 NOV-20 NOV	4	75	964	12	595
TC 31-81	07 DEC-10 DEC	4	75	964	16	1088
	1981 TOTALS	12			41	

TABLE 3-7

1981 SIGNIFICANT TROPICAL CYCLONE STATISTICS

NORTH INDIAN OCEAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
ALL CYCLONES	0	0	0	0	0	0	0	0	0	1	1	1	3
(1971-1980) AVERAGE*	0.1	0	0	0.2	0.6	0.3	0	0	0.5	0.7	1.4	0.3	4.0

FORMATION ALERTS 3 of the 5 (60%) Formation Alert Events developed into numbered cyclones.

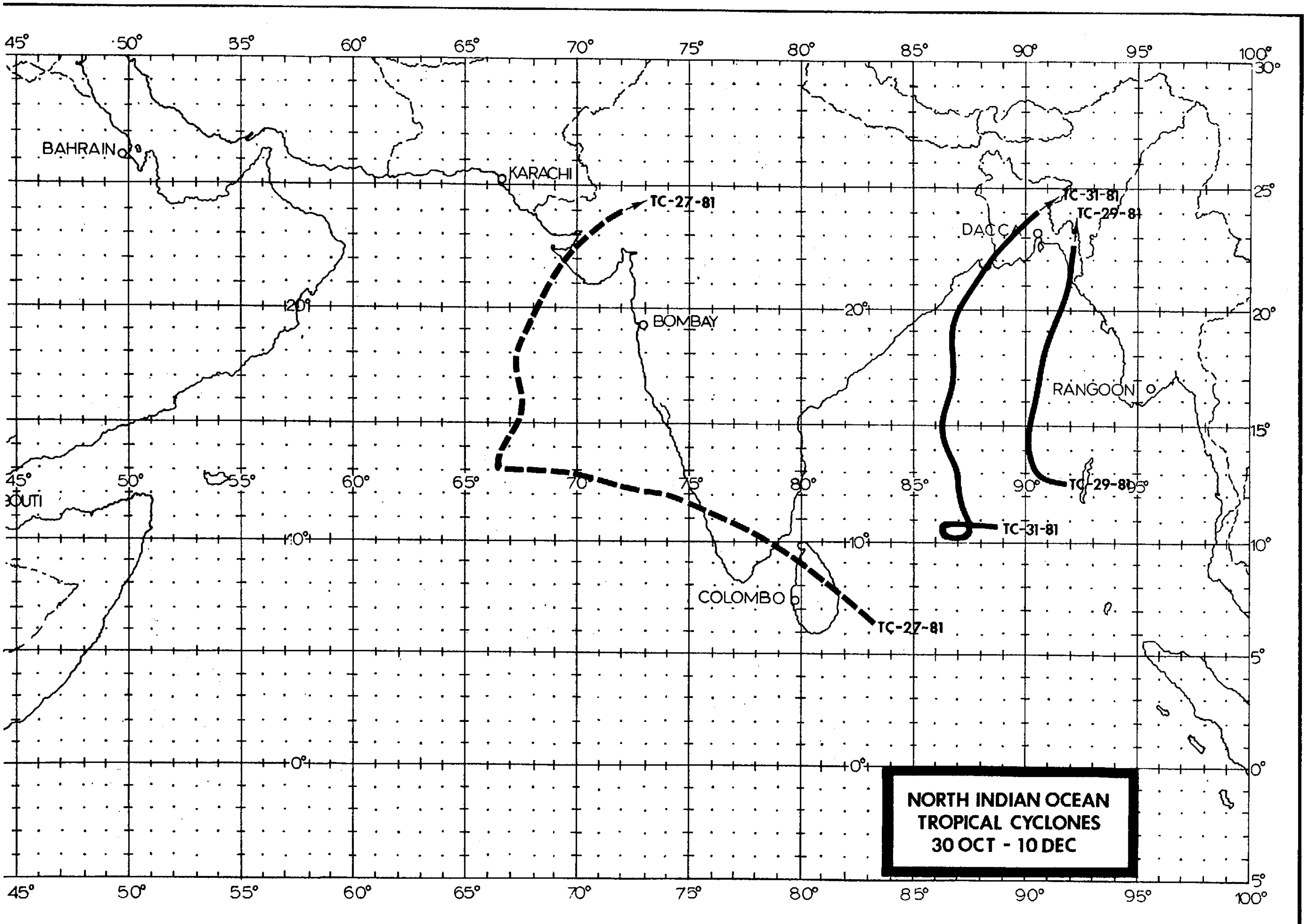
WARNINGS

Number of warning days: 12

Number of warning days with 2 cyclones: 0

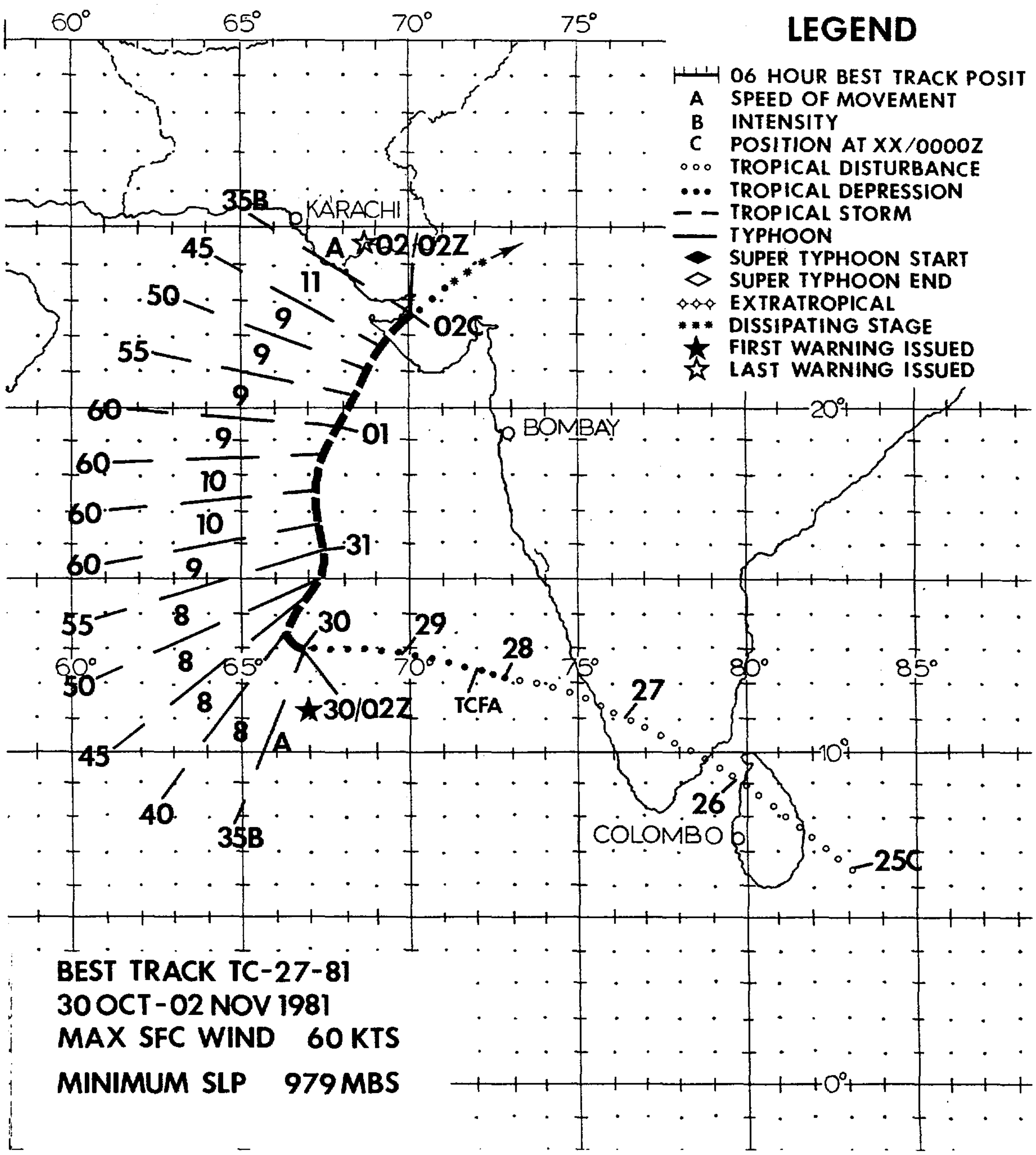
Number of warning days with 3 or more cyclones: 0

*From 1971 through 1979, only Bay on Bengal cyclones were considered; the JTWC area of responsibility was extended in 1975 to include Arabian Sea cyclones.

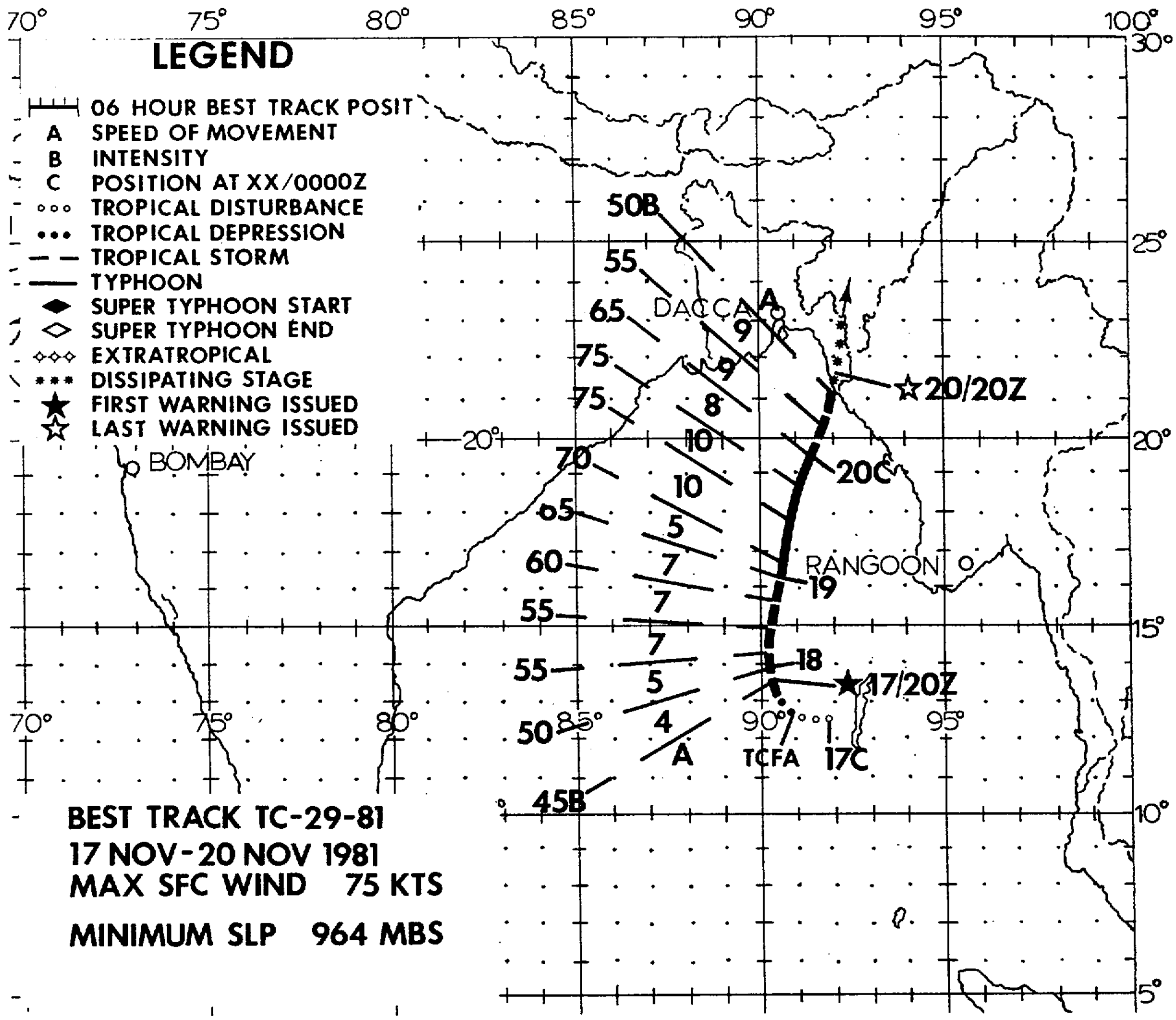

NORTH INDIAN OCEAN
TROPICAL CYCLONES
30 OCT - 10 DEC
BAHRAIN
KARACHI
BOMBAY
COLOMBO
DACCA
RANGOON
TC-27-81
TC-27-81
TC-31-81
TC-31-81
TC-29-81
TC-29-81

TC 27-81 developed from an area of enhanced convection that emerged from the monsoon trough off the southeast coast of India. The Fleet Numerical Oceanography Center 500 mb prognostic series forecasted a break in the subtropical ridge north of the cyclone. This forecast mid-tropospheric pattern formed the basis for the tropical cyclone forecasts issued by JTWC, which predicted a north-northeast movement with eventual dissipation over land.

The system's movement was slow and erratic while it was embedded within the weak steering currents to the south of the 500 mb break; however, by warning number six (310800Z Oct 81) TC 27-81 moved into a region of stronger steering and moved steadily toward the break. North of the break TC 27-81 encountered strong westerly flow near 20N, recurved northeastward and dissipated over land, south of the Gulf of Kutch, 3 days after cyclogenesis.



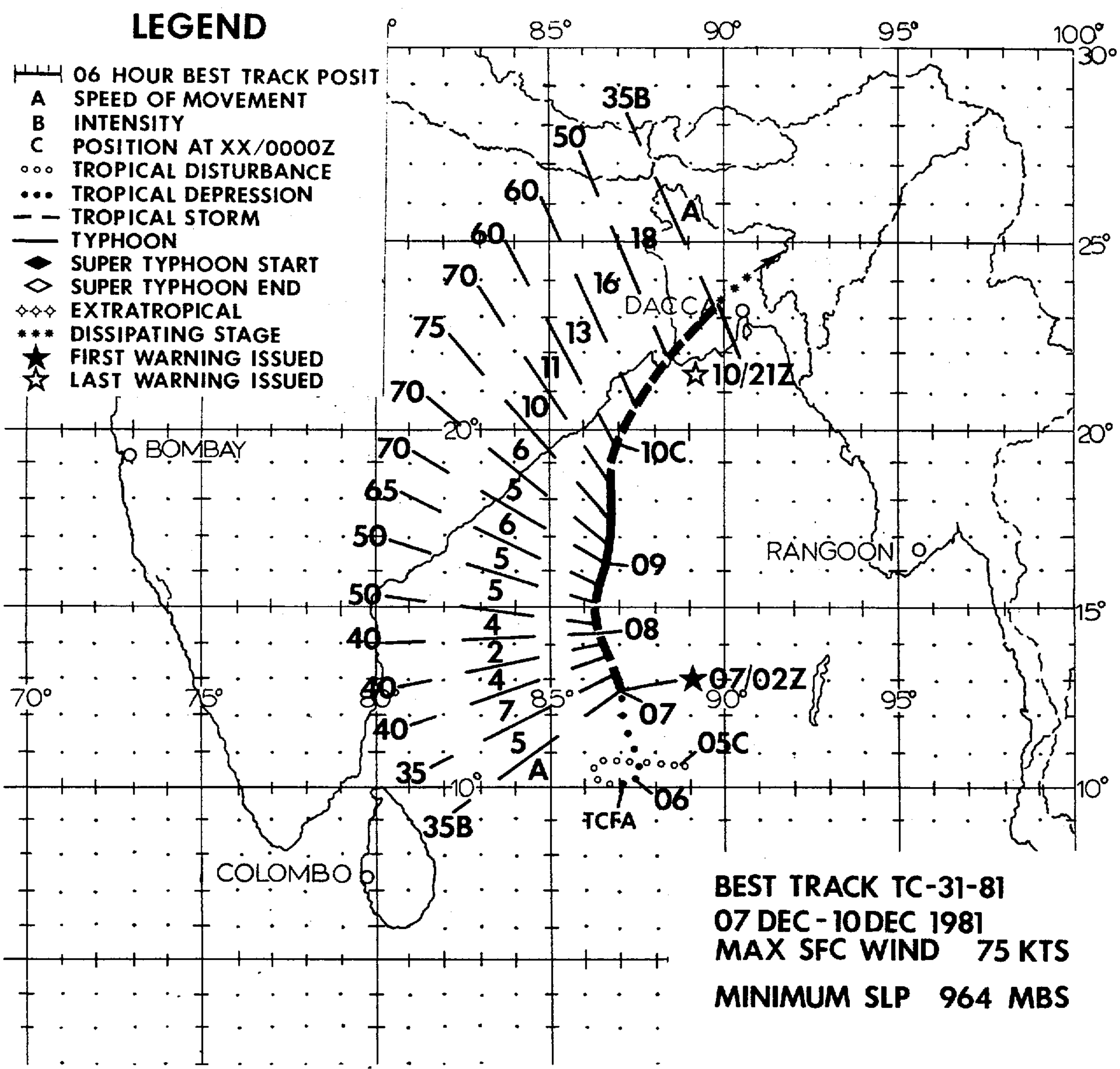
Tropical Cyclone 29-81 developed rapidly from an area of convection that first appeared on satellite data at 152100Z November. The disturbance which formed about 50 nm (111 km) west of the southern Andaman Islands initially moved northwest, but then went through a 24-hour quasi-stationary period between 170800Z and 180800Z. The first two warnings on TC 29-81 forecasted north-northwest movement, however, by the issuance of warning number three, mid-tropospheric wind data suggested movement toward the north-northeast was more likely. TC 29-81 finally headed north-northeast once it resumed significant movement and continued on this track through landfall (approximately 201800Z) and dissipation over southeastern Bangladesh. All cyclone positions and intensity estimates were based upon satellite data provided by Detachment 1, 1st Weather Wing and Air Force Global Weather Central. Synoptic data, sufficient to define the circulation of TC 29-81, was never available due to the sparcity of land stations and the lack of ships in the area coupled with the sporadic reporting of available land stations.



TC 31-81 was the second tropical cyclone to develop during the transition period of the monsoon season in the Bay of Bengal. As a tropical disturbance it was' first detected on satellite imagery at 031200Z December as it began moving westward from the Malay Peninsula. On 5 December the disturbance began to organize and surface pressures dropped to 1005 mb. A Tropical Cyclone Formation Alert (TCFA) was issued the following day as slow intensification continued. The first warning followed the TCFA by 24 hours and was issued at 070200Z.

TC 31-81 moved erratically under the influence of weak low- and mid-level steering until late on 6 December when the system headed north in response to an approaching mid-tropospheric trough. TC 31-81 maintained this northerly track while reaching it's maximum intensity of 75 kt (34 m/sec) at 091400Z. Movement remained slow until the 500 mb trough had passed far enough eastward to cause an increase in the gradient at the low- and mid-tropospheric steering levels. TC 31-81 accelerated in response to the ambient flow and tracked inland making landfall 20 nm (27 km) southeast of Calcutta.

TC 31-81 inflicted widespread destruction to fishing villages along the Bangladesh coast and contributed to at least 92 deaths.



CHAPTER IV - SUMMARY OF FORECAST VERIFICATION

1. ANNUAL FORECAST VERIFICATION

a. Western North Pacific

The positions given for warning times and those at the 24-, 48-, and 72-hour forecast times were verified against the post-analysis best track positions at the same valid times. The resultant vector and right angle errors (illustrated in Fig. 4-1) were then calculated for each tropical cyclone and are presented in Table 4-1 Table 4-2 provides the frequency distributions of vector errors for 24-, 48-, and 72-hour forecasts on all 1981 tropical cyclones in the western North Pacific. A summation of the mean errors, as calculated for all tropical cyclones in each year, is shown in Table 4-3 for comparative purposes. The data in this table is not to be confused with that presented in previous years where the sample was restricted to cyclones that reached typhoon intensity and then had the forecast errors calculated only for that portion of the life-cycle when winds were greater than 35 kt (last published as Table 5-1, 1977 Annual Typhoon Report). A comparison of the results using the truncated data set and these obtained for all tropical cyclones can be seen directly in Table 4-4. The annual mean vector errors are graphed in Fig. 4-2.

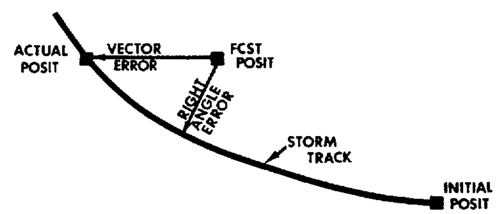


FIGURE 4-1. *Illustration of the method used to determine vector error and right angle error.*

TABLE 4-1. FORECAST ERROR SUMMARY FOR THE 1981 WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES (ERRORS IN NAUTICAL MILES)

		WARNING			24 HOUR			48 HOUR			72 HOUR		
		POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS
1.	FREDA	24	16	22	106	87	19	222	144	14	369	138	9
2.	GERALD	40	27	18	161	104	15	289	212	11	426	368	7
3.	HOLLY	22	12	30	86	36	29	187	38	29	284	46	29
4.	IKE	31	20	21	177	120	15	276	131	7	520	234	1
5.	JUNE	19	11	22	119	62	18	227	108	13	196	88	5
6.	KELLY	25	18	20	128	110	16	263	242	9	354	347	2
7.	LYNN	26	14	19	104	34	14	102	55	10	138	88	4
8.	MAURY	54	34	9	140	99	5	215	81	1			
9.	NINA	11	4	4									
10.	OGDEN	23	14	20	91	46	14	208	93	9	670	477	3
11.	TD-11	90	50	7	188	113	3						
12.	PHYLLIS	51	43	5	174	87	3						
13.	ROY	22	16	19	163	125	15	239	140	8	200	85	4
14.	SUSAN	25	17	19	188	147	14	303	254	5	131	106	2
15.	THAD	27	21	29	155	73	26	234	129	22	335	183	18
16.	VANESSA	31	20	8	184	143	5	354	49	1			
17.	WARREN	32	20	10	65	40	6	82	64	2			
18.	AGNES	20	11	25	104	76	21	167	132	17	244	208	12
19.	BILL	19	15	17	76	29	13	134	62	8	105	31	3
20.	CLARA	23	13	29	80	55	26	177	134	22	226	174	18
21.	DOYLE	17	11	14	149	102	10	269	194	6	494	253	2
22.	ELSIE	18	9	31	97	69	27	213	135	23	377	234	19
23.	FABIAN	13	11	6	48	43	2						
24.	GAY	31	24	35	163	86	32	275	115	27	410	140	24
25.	HAZEN	23	12	37	130	73	33	263	114	30	361	171	26
26.	IRMA	18	10	33	76	55	29	118	66	25	141	77	21
27.	JEFF	33	13	14	188	40	10	429	71	6	747	38	2
28.	KIT	17	9	39	134	82	35	291	168	31	603	326	27
29.	LEE	21	16	22	100	75	18	112	66	14	90	62	10
ALL FORECASTS		25	16	584	123	75	473	220	119	350	334	168	248

Table 4-2. Frequency distribution of 24-, 48-, and 72-hour forecast vector errors for all significant tropical cyclones in the western North Pacific in 1981. (Given in 10 nm increments)

LOWER LIMIT	24 HR	48 HR	72 HR
0	9	1	0
10	15	5	2
20	22	7	2
30	10	10	2
40	26	5	2
50	23	7	4
60	30	5	6
70	25	6	3
80	28	13	11
90	33	12	2
100	☆21	6	5
110	24	12	6
120	★28	16	7
130	29	14	2
140	16	13	6
150	13	8	4
160	12	14	8
170	11	12	11
180	13	☆11	7
190	9	14	1
200	7	9	5
210	13	9	2
220	11	★10	6
230	1	9	2
240	6	7	7
250	6	3	7
260	5	3	☆4
270	5	8	7
280	1	5	1
290	4	10	4
300	3	4	3
310	2	4	2
320	1	6	8
330	3	2	★2
340	0	9	1
350	1	2	0
360	0	8	4
370	2	2	0
380	0	5	6
390	0	3	5
400	2	2	6
410	0	2	7
420	0	3	1
430	0	2	2
440	1	3	2
450	0	4	1
460	0	4	1
470	0	1	2
480	0	2	2
490	0	0	1
500	0	1	4
510	0	3	2
520	1	1	5
530	0	3	5
540	0	1	0
550	0	0	3
560	0	0	1
570	0	1	1
580	0	1	1
590	0	1	4
600	0	0	0
610	0	6	0
620	0	1	3
630	0	1	0
640	0	0	2
650	1	0	1
660	0	0	1
670	0	0	0
680	0	0	1
690	0	1	2
700	0	0	0
710	0	2	0
720	0	0	1
730	0	0	0
740	0	1	1
750	0	0	3
760	0	0	1
770	0	0	1
780	0	0	1
790	0	0	2
800	0	0	0
810	0	0	0
820	0	0	0
830	0	0	0
840	0	0	0
850	0	0	3
860	0	0	0
870	0	0	0
880	0	0	0
890	0	0	0
900	0	0	0
910	0	0	0
920	0	0	1
930	0	0	0
940	0	0	0
950	0	0	0
960	0	0	1
970	0	0	1
980	0	0	0
990	0	0	0
1000	0	0	0
1010	0	0	0
1020	0	0	0
1030	0	0	0
1040	0	0	0
1050	0	0	0
1060	0	0	0
1070	0	0	0
1080	0	0	0
1090	0	0	0
1100	0	0	4

★ MEAN VECTOR ERROR (NM)

☆ MEDIAN VECTOR ERROR (NM)

TABLE 4-3. ANNUAL MEAN FORECAST ERRORS (NM) FOR THE WESTERN PACIFIC

	24-HR		48-HR		72-HR	
YEAR	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE
1971	111	64	212	118	317	117
1972	117	72	245	146	381	210
1973	108	74	197	134	253	162
1974	120	78	226	157	348	245
1975	138	84	288	181	450	290
1976	117	71	230	132	338	202
1977	148	83	283	157	407	228
1978	127	75	271	179	410	297
1979	124	77	226	151	316	223
1980	126	79	243	164	389	287
*1981	123	75	220	119	334	168

*The technique for calculating right angle error was revised in 1981, therefore, no attempt should be made to correlate 1981 data with previous years.

TABLE 4-4 ANNUAL MEAN FORECAST ERRORS (NM) FOR WESTERN NORTH PACIFIC

	24-HR		48-HR		72-HR	
YEAR	**ALL	*TYPHOON	ALL	*TYPHOON	ALL	*TYPHOON
1950-58		170				
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		272
1969		111		237		349
1970	104	98	190	181	279	272
1971	111	99	212	203	317	308
1972	117	116	245	245	381	382
1973	108	102	197	193	253	245
1974	120	114	226	218	348	351
1975	138	129	288	279	450	442
1976	117	117	230	232	338	336
1977	148	140	283	266	407	390
1978	127	120	271	241	410	459
1979	124	113	226	219	316	319
1980	126	116	243	221	389	362
1981	123	117	220	215	334	342

*FOR TYPHOONS ONLY WHILE WINDS OVER 35 KT
**FORECAST POSITIONS NORTH OF 35°N WERE NOT VERIFIED

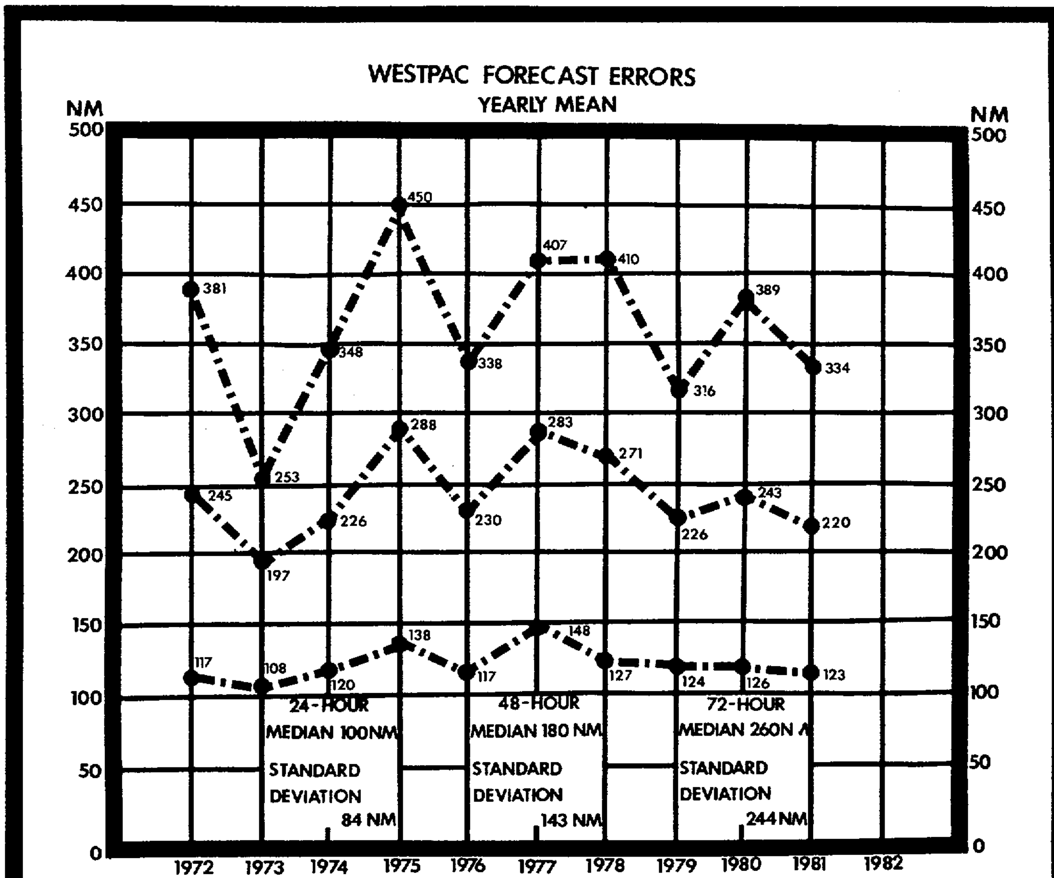


FIGURE 4-2. *Annual vector errors (nm) for all cyclones in the western North Pacific.*

b. North Indian Ocean Area

Forecast positions at warning, 24-, 48-, and 72-hour valid times were verified for TC 27-81, TC 29-81, and TC 31-81 by the same methods used for the western North Pacific. It should be noted that due to the low number of Indian Ocean tropical cyclones, the error statistics should not be taken as representative of any trend. Table 4-5 is the forecast error summary for the three cyclones and Table 4-6 contains the annual average of forecast errors back through 1971. Vector errors are plotted in Figure 4-3. Seventy-two-hour forecast errors were evaluated for the first time in 1979.

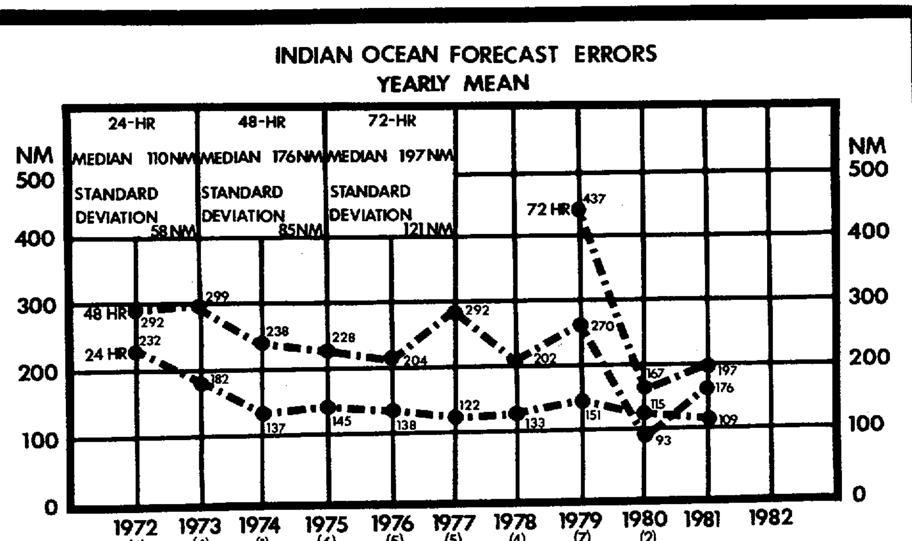
TABLE 4-5. FORECAST ERROR SUMMARY FOR THE 1981 NORTH INDIAN OCEAN SIGNIFICANT TROPICAL CYCLONES.

	WARNING			24 HOUR			48 HOUR			72 HOUR		
CYCLONE	POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS	POSIT ERROR	RT ANGLE ERROR	# WRNGS
TC 27-81	41	27	13	135	106	9	221	155	5	83	25	1
TC 29-81	28	12	12	69	35	8	172	110	4			
TC 31-81	17	14	16	115	55	12	151	67	8	225	85	4
ALL FORECASTS	28	17	41	109	65	29	176	103	17	197	73	5

TABLE 4-6. ANNUAL MEAN FORECAST ERRORS FOR THE NORTH INDIAN OCEAN (the Arabian Sea was not included prior to 1975).

	24-HR		48-HR		72-HR	
YEAR	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE
1971	232	-	410	-	-	-
1972	224	101	292	112	-	-
1973	182	99	299	160	-	-
1974	137	81	238	146	-	-
1975	145	99	228	144	-	-
1976	138	108	204	159	-	-
1977	122	94	292	214	-	-
1978	133	86	202	128	-	-
1979	151	99	270	202	437	371
1980	115	73	93	87	167	126
*1981	109	65	176	103	197	73

*The technique for calculating right angle error was revised in 1981, therefore, no attempt should be made to correlate 1981 data with previous years.



ARABIAN SEA NOT INCLUDED PRIOR TO 1975

FIGURE 4-3. *Annual mean vector errors (nm) for all cyclones in the north Indian Ocean.*

2. COMPARISON OF OBJECTIVE TECHNIQUES

a. General

Objective techniques used by JTWC are divided into four main categories:

(1) climatological and analog techniques;

(2) extrapolation;

(3) steering techniques;

(4) dynamic models

The analog techniques provide three movement forecasts, i.e. forecasts for straight moving cyclones, recurving cyclones, and a combination forecast based upon the tracks of straight, recurving, and all other cyclones that do not meet the specific criteria of those two categories. All objective tehcniques except one of the dynamic model modes, were executed using operational data available prior to warning time. The automatically run version of one of the dynamic models was initialized from analysis fields that are not available prior to warning times. These objective aids are usually received within 2 to 5 hours of a specific warning time.

b. Description of Objective Techniques

(1) CLIM -- A climatological aid providing 24-, 48-, and 72-hour tropical cyclone forecast positions, and intensity changes, based upon the initial position of the system. The output is based upon data records from 1945 to 1973.

(2) TYAN 78 -- An updated analog program which combines the earlier versions TYFN 75 and INJAH 74. The program scans history tapes for cyclones similar (within a specified acceptance envelope) to the current cyclone. For the NW Pacific region three types of position and intensity forecasts are provided at 24-, 48-, and 72-hour intervals (e.g. straight, recurve, and combined). For all other regions of the JTWC AOR, types of track are not specified.

(3) EXTRAPOLATION -- A track connecting the 12-hour old preliminary best track position and the current position which is then extrapolated to 24 and 48 hours.

(4) HPAC -- 24- and 48-hour forecast positions are derived by merely connecting the mid-points of straight lines which were drawn to connect these positions on the EXTRAPOLATION and CLIM tracks, respectively.

(5) BPAC -- A program used with a Texas Instrument's (TI-59) calculator system which generates 12 to 72 hr forecast positions. These forecasts are based on blending the past motion of the tropical cyclone with the CLIM forecast positions. The blending routine gives less weight to persistence at each succeeding forecast interval.

(6) CYCLOPS -- An updated version of the HATTRACK/MOHATT steering program which can provide steering forecasts at the 1000, 850, 700, 500, 400, 300, and 200 mb levels. The program can be run in the modified (includes a 12-hour persistence bias) or unmodified versions applied to either analysis or prognostic fields. The program advects a point vortex on a preselected analysis and/or smoothed prognostic field at designated levels in 6-hour time steps through 72 hours. In the modified version, the program uses the previous 12-hour history position to compute the 12-hour forecast error and applies a bias correction to the forecast positions. In 1981, only the modified version, in the prognostic mode for the 500 mb level was verified.

(7) TCM -- The dynamic Tropical Cyclone Model (TCM) is a course mesh (220 km) primitive equation model. The digitized cyclone warning position is bogused into the 850 mb wind and temperature fields of the FLENUMOCEANCEN Global Bands Analysis. Hemisphere forecast data are used on the boundaries. Two versions are currently run: The OTCM runs from forecasts fields and is available via ARQ mode; the TCMO version was mentioned in a. above.

(8) NTCM -- A "nested" primitive equation tropical cyclone model which is initialized on FLENUMOCEANCEN 12-hour forecast fields. The model covers a limited, but relocatable, tropical domain with three layers in the vertical. The finer scale or "nested" grid covers a 1200 x 1200 km^2 area with a 41 km grid spacing and moves to keep a 850 mb vortex in its center. This grid is integrated with a coarser channel model grid with a grid spacing of 205 km over a 6400 x 4700 km^2 domain. Once initialized, the model runs independent of the remaining FLENUMOCEANCEN forecast fields. The NTCM is available by ARQ for 0000Z and 1200Z forecast fields only.

c. Testing and Results

A comparison of selected techniques is included in Table 4-7 for all western North Pacific cyclones and in Table 4-8 for Indian Ocean Cyclones. In these Tables, "X-AXIS" refers to techniques listed horizontally across the top, while "Y-AXIS" refers to techniques listed vertically. The example in Table 4-7 compares CY50 to TCMO, i.e. in the 138 cases available for comparison, the average vector at 24-hours was 137 nm for CY50 and 117 nm for TCMO. The difference of -18 nm is shown in the lower right. (Differences are not always exact due to computational round off).

STATISTICS FOR YEAR 24 HR FCSTS

	JTWC		RECR		STRA		TOTL		CY50		NTCM		TCMO		BPAC		CLIM		XTRP		HPAC	
JTWC	473	123																				
	123	0																				
RECR	407	124	414	133																		
	132	8	133	0																		
STRA	369	120	370	129	375	138																
	139	18	138	9	138	0																
TOTL	414	123	414	133	375	138	422	132														
	132	9	131	0	127	-10	132	0														
CY50	410	123	384	133	348	140	392	133	420	132												
	133	9	131	-1	131	-8	131	-1	132	0												
NTCM	120	118	105	141	94	136	107	152	109	136	122	163										
	163	45	160	19	155	18	163	11	164	28	163	0										
TCMO	153	120	136	133	124	137	138	144	138	137	74	157	156	120								
	120	0	119	-13	116	-20	121	-22	117	-18	120	-36	120	0								
BPAC	437	122	396	132	356	137	402	131	397	131	117	163	148	119	447	124						
	124	2	123	-8	118	-18	124	-6	125	-5	121	-41	123	4	124	0						
CLIM	462	123	413	133	374	138	421	133	414	132	122	163	153	119	447	124	473	160				
	160	36	158	25	151	12	159	27	160	29	155	-7	158	39	159	35	160	0				
XTRP	448	123	402	133	362	139	409	133	409	133	119	163	152	118	437	124	454	161	460	132		
	132	9	132	0	128	-10	132	0	133	0	131	-31	127	9	132	7	133	-28	132	0		
HPAC	443	123	401	133	361	139	408	133	403	133	119	163	150	117	437	124	454	161	454	133	454	124
	124	1	123	-9	117	-22	124	-8	125	-7	117	-45	121	4	123	0	124	-36	124	-7	124	0

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X

STATISTICS FOR YEAR 48 HR FCSTS

	JTWC		RECR		STRA		TOTL		CY50		NTCM		TCMO		BPAC		CLIM		XTRP		HPAC	
JTWC	350	220																				
	220	0																				
RECR	306	221	329	261																		
	255	34	261	0																		
STRA	291	222	303	259	309	287																
	238	66	288	30	287	0																
TOTL	315	221	329	261	309	287	338	261														
	255	34	258	-2	253	-33	261	0														
CY50	298	217	296	259	278	283	305	258	323	323												
	325	108	327	69	333	50	325	67	323	0												
NTCM	92	200	86	236	81	307	88	260	86	308	100	275										
	279	79	267	32	262	-44	280	20	279	-28	275	0										
TCMO	111	223	108	271	101	291	111	274	106	340	61	279	123	218								
	214	-8	205	-65	197	-93	216	-57	220	-119	236	-42	218	0								
BPAC	325	219	313	258	293	285	321	258	307	325	98	273	119	218	355	253						
	246	28	253	-4	251	-33	255	-2	252	-73	238	-34	255	37	253	0						
CLIM	345	221	328	261	308	287	337	261	321	323	100	275	122	217	355	253	375	306				
	303	82	305	45	303	16	308	46	306	-16	295	19	300	83	302	49	306	0				
XTRP	331	223	314	262	293	292	322	263	307	326	98	276	118	216	340	255	354	311	356	289		
	235	61	287	25	288	-3	289	26	288	-37	286	10	292	76	288	33	290	-20	289	0		
HPAC	330	223	313	261	292	292	321	263	305	326	98	276	117	215	340	255	354	311	354	290	354	248
	244	21	245	-15	242	-49	248	-15	246	-79	239	-36	249	35	245	-9	248	-62	248	-41	248	0

JTWC - OFFICIAL JTWC FORECAST
STRA - STRAIGHT (TYAN 78)
RECR - RECURVE (TYAN 78)
COMB - COMBINED (TYAN 78)
CY50 - CYCLOPS 500-MB PROG
TCMO - TROPICAL CYCLONE MODEL (ONE-WAY)
CLIM - CLIMATOLOGY
XTRP - 12-HOUR EXTRAPOLATION
HPAC - MEAN OF XTRP AND CLIMATOLOGY

STATISTICS FOR YEAR 72 HR FCSTS

	JTWC		RECR		STRA		TOTL		CY50		NTCM		TCMO		BPAC		CLIM	
JTWC	248	334																
	334	0																
RECR	222	340	253	420														
	419	79	420	0														
STRA	208	346	232	425	236	412												
	418	71	415	-9	412	0												
TOTL	226	337	253	420	236	412	260	421										
	424	87	420	0	414	2	421	0										
CY50	202	332	219	428	206	401	226	418	239	570								
	613	280	586	158	598	197	579	161	570	0								
NTCM	60	309	65	408	62	486	67	439	63	553	76	441						
	428	119	424	16	419	-66	447	9	451	-101	441	0						
TCMO	68	322	69	428	66	412	72	452	65	624	35	449	80	309				
	293	-28	300	-127	279	-132	313	-137	310	-313	400	-48	309	0				
BPAC	229	350	240	420	222	415	246	421	227	575	74	441	76	309	271	393		
	392	62	395	-24	390	-23	396	-23	395	-179	384	-56	397	89	393	0		
CLIM	245	334	253	420	236	412	260	421	239	570	76	441	80	309	271	393	289	450
	457	123	456	36	451	39	457	35	450	-111	416	-23	456	147	447	54	450	0

TABLE 4-7
ERROR STATISTICS FOR THE WESTERN NORTH
PACIFIC FOR 1981

STATISTICS FOR YEAR 24 HR FCSTS

	JTWC	TOTL	NONE	NONE	CY70	CY50	TCMO	BPAC	CLIM	XTRP	HPAC
JTWC	29 109										
	109 0										
TOTL	28 112	28 117									
	117 5	117 0									
NONE	0 0	0 0	0 0								
	0 0	0 0	0 0								
NONE	0 0	0 0	0 0	0 0							
	0 0	0 0	0 0	0 0							
CY70	27 114	27 121	0 0	0 0	27 116						
	116 2	116 -3	0 0	0 0	116 0						
CY50	26 117	26 123	0 0	0 0	26 116	26 123					
	123 7	123 1	0 0	0 0	123 7	123 0					
TCMO	10 118	10 115	0 0	0 0	10 128	9 126	10 214				
	214 104	214 99	0 0	0 0	214 86	207 82	214 0				
BPAC	27 111	27 120	0 0	0 0	26 117	25 124	10 214	27 110			
	110 0	110 -9	0 0	0 0	112 -3	113 -10	114 -99	110 0			
CLIM	28 112	28 117	0 0	0 0	27 116	26 123	10 214	27 110	28 117		
	117 5	117 0	0 0	0 0	117 1	121 -2	128 -85	119 9	117 0		
XTRP	26 111	26 120	0 0	0 0	25 117	24 126	10 214	26 111	26 121	26 126	
	126 15	126 6	0 0	0 0	130 13	134 8	127 -86	126 15	126 5	126 0	
HPAC	26 111	26 120	0 0	0 0	25 117	24 126	10 214	26 111	26 121	26 126	26 114
	114 3	114 -5	0 0	0 0	116 0	121 -4	117 -96	114 3	114 -5	114 -11	114 0

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X

STATISTICS FOR YEAR 48 HR FCSTS

	JTWC	TOTL	NONE	NONE	CY70	CY50	TCMO	BPAC	CLIM	XTRP	HPAC
JTWC	17 176										
	176 0										
TOTL	16 167	16 246									
	246 79	246 0									
NONE	0 0	0 0	0 0								
	0 0	0 0	0 0								
NONE	0 0	0 0	0 0	0 0							
	0 0	0 0	0 0	0 0							
CY70	17 176	16 246	0 0	0 0	17 359						
	359 182	357 111	0 0	0 0	359 0						
CY50	16 178	15 250	0 0	0 0	16 367	16 414					
	414 236	417 166	0 0	0 0	414 46	414 0					
TCMO	6 166	5 225	0 0	0 0	6 375	5 387	6 473				
	473 307	447 222	0 0	0 0	473 98	460 73	473 0				
BPAC	16 176	15 252	0 0	0 0	16 351	15 417	6 473	16 232			
	232 55	228 -23	0 0	0 0	232 -118	232 -184	226 -246	232 0			
CLIM	17 176	16 246	0 0	0 0	17 359	16 414	6 473	16 232	17 226		
	226 49	212 -33	0 0	0 0	226 -132	232 -181	239 -233	228 -2	226 0		
XTRP	15 173	14 266	0 0	0 0	15 352	14 431	6 473	15 244	15 237	15 293	
	293 120	296 30	0 0	0 0	293 -58	300 -130	260 -212	293 49	293 56	293 0	
HPAC	15 173	14 266	0 0	0 0	15 352	14 431	6 473	15 244	15 237	15 293	15 253
	253 80	250 -15	0 0	0 0	253 -98	261 -169	233 -239	253 9	253 16	253 -39	253 0

JTWC - OFFICIAL JTWC FORECAST
TY78 - ANALOG (TYAN 78)
CY70 - CYCLOPS 700-MB PROG
CY50 - CYCLOPS 500-MB PROG
TCMO - TROPICAL CYCLONE MODEL (ONE-WAY)
XTRP - 12-HOUR EXTRAPOLATION
HPAC - MEAN OF XTRP AND CLIMATOLOGY

STATISTICS FOR YEAR 72 HR FCSTS

	JTWC	TOTL	NONE	NONE	CY70	CY50	TCMO	BPAC	CLIM
JTWC	5 197								
	197 0								
TOTL	5 197	5 307							
	307 110	307 0							
NONE	0 0	0 0	0 0						
	0 0	0 0	0 0						
NONE	0 0	0 0	0 0	0 0					
	0 0	0 0	0 0	0 0					
CY70	5 197	5 307	0 0	0 0	5 750				
	750 553	750 443	0 0	0 0	750 0				
CY50	4 138	4 354	0 0	0 0	4 737	4 909			
	909 771	909 555	0 0	0 0	909 172	909 0			
TCMO	1 149	1 235	0 0	0 0	1 876	1 962	1 761		
	761 612	761 526	0 0	0 0	761 -115	761 -200	761 0		
BPAC	5 197	5 307	0 0	0 0	5 750	4 909	1 761	5 299	
	299 103	299 -6	0 0	0 0	299 -449	352 -557	206 -554	299 0	
CLIM	5 197	5 307	0 0	0 0	5 750	4 909	1 761	5 299	5 348
	348 151	348 41	0 0	0 0	348 -400	395 -513	294 -466	348 49	348 0

TABLE 4-8.
ERROR STATISTICS FOR THE NORTH INDIAN OCEAN
FOR 1981

CHAPTER V - APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

1. JTWC RESEARCH

The JTWC mission includes the definition and conduct of applied technique development as time and resources permit. The goal of JTWC's effort is to improve the timeliness and accuracy of operational tropical cyclone warnings. During 1981, JTWC continued to pursue projects of operational and technical merit as summarized in the following abstracts of works in progress:

CLIMATOLOGY OF TROPICAL CYCLONES THAT DEVELOP IN THE TRUK AREA

(Allen, J. W., NAVOCEANCOMCEN/JTWC)

A comprehensive review of pertinent parameters conducive to tropical cyclone development in the Truk area is underway. The subsequent path of movement statistics will provide invaluable guidance on the forecasting of tropical cyclones that move out of this region, many of which affect military facilities on Guam.

EVALUATION OF THE BLENDED PERSISTENCE AND CLIMATOLOGY (BPAC) FORECAST AID

(Weir, R. C., NAVOCEANCOMCEN/JTWC)

From September 1980 to December 1981, JTWC utilized the BPAC forecast as one of the many objective forecast aids used to support the warning process. During the 1981 season, BPAC forecasts were verified against the official forecast and nine other objective aids. Although BPAC forecasts by comparison showed good skill in 1981, preliminary results from a detailed evaluation of these forecasts indicate that weighting factors between persistence and climatology, if modified, would have produced a better forecast in most of the investigated cases. Each of the persistence/climatology-type forecast aids is affected by sudden synoptic changes which influence the future cyclone track but have not occurred (persistence) and are not forecast (averaging of historical movements, climatology). However, most of these situations occur near higher latitudes where numerical forecast models can provide the forecaster substantual lead-time to alter the forecast. In the lower latitudes, especially south of 20N, the persistence/climatology-type forecast aids provide excellent guidance in nearly 75 percent of the forecast situations. It is within this region that BPAC offers the promise of providing the best non-synoptic forecast track. The results of this evaluation and details of the BPAC program will be published as a NAVOCEANCOMCEN/JTWC TECH NOTE.

GEOMAGNETIC CORRELATIONS WITH TROPICAL CYCLONE DEVELOPMENT

(Morss, D. A., Cianflone, R. E., Det 1, 1WW, NAVOCEANCOMCEN/JTWC)

A statistical study will be carried out to determine the degree of correlation between geomagnetic disturbances of the earth's atmosphere and the development period of tropical cyclones. No attempt will be made in this study to investigate a cause-effect relationship. The results could be applicable to tropical cyclone forecasters on a worldwide basis, provided they had access to the proper geomagnetic data such as that available through Air Force Global Weather Center, Offutt AFB, Nebraska.

ACCELERATION OF NORTHWARD MOVING TYPHOONS SOUTH OF JAPAN

(Weir, R. C., NAVOCEANCOMCEN/JTWC)

A study of typhoons approaching Japan from the south has resulted in a new forecast aid for use at JTWC. Of the systems that met the initial screening criteria, 90% were seen to have experienced significant accelerations. There was evidence that most of the typhoons nearly triple in speed over the initial 24 hour period. The results are presented for seasonal, and latitudinal, variations in tabular form.

EVALUATION OF THE NAVY NESTED TWO-WAY INTERACTIVE TCM (NTCM) AND THE ONE-WAY INTERACTIVE TCM (OTCM/TCMO)

(Weir, R. C., NAVOCEANCOMCEN/JTWC)

A continuing evaluation of both of these versions of the Navy's tropical cyclone models was conducted during the 1981 season. Initial data have shown the ARQ version of the NTCM (initialized on the 12-hour prognostic fields) is not performing up to expectations. The ARQ and automated versions of the OTCM have performed very well, especially at the 24 and 48 hour periods.

EVALUATION OF THE NAVY GENESIS POTENTIAL PROGRAM

(Allen, J. W., NAVOCEANCOMCEN/JTWC)

The Genesis potential program uses a set of algorithims applied to FNOC analysis fields to predict tropical cyclone formation at the 24, 48 and 72 hr periods. The products are output at 12-hour intervals by FNOC, and received in graphics form by JTWC, covering the entire Northern Hemisphere AOR. Based on the day-to-day evaluation of this product during 1981, its information did not have an impact on the JTWC decision making process for tropical cyclone genesis.

2. NEPRF RESEARCH

TROPICAL CYCLONE RESEARCH AT OR UNDER CONTRACT TO THE NAVAL ENVIRONMENTAL PREDICTION RESEARCH FACILITY (NEPRF), MONTEREY, CALIFORNIA

THE NAVY TWO-WAY INTERACTIVE NESTED TROPICAL CYCLONE MODEL (NTCM)

(Harrison, E. J., Jr., NEPRF)

Testing of the NTCM continued throughout the 1981 season. Comparison of results obtained when the model was initialized with prognosis vs. analysis data revealed that an unacceptable amount of skill was lost with the prognosis initialization. Unless the new global model prognosis fields are significantly better than the global band data currently used, the NTCM will necessarily be initialized with analysis data in the future.

A second test of the NTCM compared its performance to those of the Movable Fine Mesh Model (MFM) used by the National Hurricane Center in Miami. The favorable results of this comparison led to the NTCM code being requested for further testing and possible operations evaluation by the Hurricane Center.

TROPICAL CYCLONE PREDICTABILITY

(Fiorino, M., Harrison, E. J., Jr., NEPRF)

We have examined the predictability of the Nested Tropical Cyclone Model (NTCM) by comparing two series of 5-day model forecasts in which the initial state has been slightly modified. This initial difference led to random errors in the track forecasts that increase in time. We find that the predictability limits of the NTCM are approximately 105 nm at 24 hours, 152 nm at 48 hours and 200 nm at 72 hours.

THE ROLE OF THE LARGE-SCALE ENVIRONMENT IN DYNAMIC TROPICAL CYCLONE MODEL FORECASTS

(Fiorino, M., NEPRF)

The nested Tropical Cyclone Model (NTCM) has been tested for over 400 cases in the Western Pacific. The FNOC operational analyses used to initialize the NTCM have been archived and will form the data base for this study. The large-scale wind fields will be decomposed into spatial scales using the method of empirical orthogonal functions. The response of NTCM to the scales (principal components) contained in the initial data will be assessed by comparing track forecast "critical" scales of motion as well as model sensitivity to analysis errors.

TROPICAL CYCLONE OBJECTIVE FORECAST CONFIDENCE AND DISPLAY TECHNIQUE

(Tsui, T., NEPRF, Nuttall, K., Systems and Applied Sciences Corp.)

A Functional Description (FD) for the Combined Confidence Rating System has been prepared. Under this system, a scheme has been developed for operational use to evaluate all objective position forecasts of the western North Pacific tropical cyclones. Forecasters at JTWC can issue one combined ARQ request to generate all objective forecasts and their rated confidences/skills. According to the rated confidence of each technique, a combined forecast is constructed. In addition, a standard displaying format for all objective forecasts has been created; and is now being installed on the FNOC operational libraries.

TROPICAL CYCLONE INTENSITY FORECAST

(Tsui, T., Brody, L. R., NEPRF)

The first stage of the western North Pacific tropical cyclone intensity forecast program (MAXWND) is being implemented on the operational system at FNOC. This portion of the program deals with the intensity change due to the persistence change (past 12- and 24-hours) and the climatological influence (the position of the sun relative to the center of the storm). Intensity change information extracted from the satellite IR data and large-scale forecast fields, if warranted, will be added to the program in the future. Wind radius forecast algorithm will also be incorporated in the MAXWND. Along with the intensity forecasts for the western North Pacific tropical cyclones, the 100-, 50-, and 30-kt wind radius forecasts will also be the product of the MAXWND.

SATELLITE BASED TROPICAL CYCLONE INTENSITY FORECASTS

(Brody, L. R., Tsui, T., NEPRF, and Nicholson, F. H., Systems Control Technology)

Currently under development are methods to improve the MAXWND system by using satellite IR data. The NEPRF Satellite-data Processing and Display System is being used for this purpose. Two types of predictors to forecast intensity changes are being investigated. The first type are measures of the coldest equivalent black body temperatures of cloud tops for concentric rings centered on the tropical cyclone. The other type of predictors are derived from the characteristics of the spiral band structure of the tropical cyclone.

TROPICAL CYCLONE SPIRAL LINEARIZATION TECHNIQUE

(Lee, D. H., NEPRF)

A system for quantifying information inherent in the spiral band structure of tropical cyclones as depicted in satellite data has been implemented on the NEPRF Satellite-data Processing and Display System. The Spiral Linearization Technique involves the transformation of a satellite image to a selected spiral coordinate system; cloud structures which conform to the spiral shape are portrayed as linear formations after linearization. Statistical and quantitative analyses of the linearized image yield information on a cyclone's structure which can be correlated with the cyclone's characteristics and behavior. An investigation of these correlations is in progress to determine the technique's potential as an estimator of current and/or future cyclone parameters.

TROPICAL CYCLONE STRIKE AND WIND PROBABILITIES

(Brand, S., NEPRF; Jarrell, J. D., Science Applications, Inc.; Chin, D., Systems and Applied Sciences Corp.)

Tropical cyclone strike and wind probability is a method for determining up through 72-hr that a tropical cyclone will come within or affect geographical points of interest to the user. Applications presently being developed, tested and implemented for the western North Pacific, eastern North Pacific, North Indian Ocean, western North

Atlantic and Gulf of Mexico include: strike/wind probabilities and geographical depictions; optimum track ship routing (OTSR) aids; and HP9845/Tactical Environmental Support System (TESS) software for shipboard environmentalists and decision makers.

TROPICAL CYCLONE STORM SURGE

(Brand, S., NEPRF; Jarrell, J. D., Compton, J., Science Applications Inc.)

A tropical cyclone storm surge effort has been initiated to establish the following: (a) the needs of the Navy in forecasting tropical cyclone storm surge in the western Pacific; (b) the state of the art of storm surge forecasting techniques; and (c) the best approach to solving the Navy's problems associated with tropical cyclone storm surge.

TROPICAL CYCLONE FORMATION FORECAST

(Lowe, P., NEPRF)

The "Genesis" technique is a quasi-objective technique for producing probabalistic forecasts of tropical storm formation in the western North Pacific Ocean. "Genesis" performance has been closely monitored and evaluated. Currently, an effort is being made to modify the "Genesis" technique. The change includes the objectively derived fields of unconditional probabilities replacing the subjective values currently in use. The improved "Genesis" technique is expected to be available early in Calendar Year 1982.

3. PUBLICATIONS

Huntley, J. E., and Diercks, J. W., 1981: The Occurrence of Vertical Tilt in Tropical Cyclones, Monthly Weather Review, Vol. 109, No. 8, Aug 1981, pp. 1689-1700.

Developing tropical cyclone are often observed with significant displacements between their surface and upper-level circulation center. The slope is in the direction of the convective cloud mass which also is displaced from the surface center during the early stage of development. As the cyclone intensifies, the surface and upper-level centers become vertically aligned. Three representative tropical cyclones in the western North Pacific with extensive aircraft reconnaissance are discussed to illustrate this phenomenon.

Dunnavan, G. M., 1981: Forecasting Intense Tropical Cyclones Using 700 mb Equivalent Potential Temperature and Central Sea-Level Pressure, NAVOCEANCOMCEN/JTWC 81-1, TECH NOTE.

Sikora (1976), et al., suggests that the equivalent potential temperature at 700 mb in a developing tropical cyclone is an excellent parameter to measure the total thermodynamic energy such that abnormally high values of equivalent potential temperature ($\geq$ 370K) can herald a period of subsequent explosive deepening. This note expands on that idea to propose a technique for forecasting the development of intense tropical cyclones (minimum sea-level pressure $<$ 925 mb) based on the relationship of the total thermodynamic field, as measured by the tropical cyclone's central 700 mb equivalent potential temperature, and the kinematic field, as measured by the tropical cyclone's central sea-level pressure. One hundread seven tropical cyclones which occurred in the north Western Pacific and north Central Pacific Ocean were evaluated using 700 mb temperature, 500 mb dewpoint and sea-level pressure data which were available from past Annual Typhoon Reports (1975-1980). These data were used to develop a forecast technique whereby the tropical cyclone forecaster may anticipate significant development in a tropical cyclone by monitoring the central sea-level pressure and 700 mb equivalent potential temperature provided by aircraft reconnaissance.

Huntley, J. E., 1981: A Study of Recurving Tropical Cyclones $\geq$ 34 kt (18 m/sec) in the Northwest Pacific 1970-1979, NAVOCEANCOMCEN/JTWC 81-2, TECH NOTE.

Recurving tropical cyclones in the Northwest Pacific region were studied to observe their behavior relative to track and intensity. Tropical cyclones occurring from 1970 through 1979 were selected for this study and categorized into three groups based upon their maximum intensity. Parameters relating to the point of recurvature, direction and speed of movement, and intensity were analyzed. The skill of forecasting speed of movement by a solution to a first order differential equation was investigated.

ANNEX A TROPICAL CYCLONE DATA

1. WESTERN NORTH PACIFIC CYCLONE DATA

TYPHOON FREDA
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
031112Z	4.7 170.5	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031118Z	5.6 169.3	30	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031200Z	6.2 168.2	30	6.2 168.8	30.	36.	0.	8.2 166.2	45.	77.	5.	10.5 163.5	65.	118.	5.	12.7 161.8	75.	173.	-10.
031206Z	6.5 167.5	35	6.6 167.4	30.	8.	-5.	8.6 164.8	45.	53.	0.	11.3 161.8	65.	87.	0.	13.8 160.5	75.	228.	-20.
031212Z	6.9 166.8	35	7.0 165.8	35.	60.	0.	8.7 162.3	55.	86.	10.	10.3 159.6	70.	224.	5.	12.9 157.7	85.	485.	-10.
031218Z	7.4 165.9	40	7.3 164.4	40.	89.	0.	9.7 160.4	65.	127.	10.	12.5 157.9	75.	245.	0.	15.5 156.8	85.	519.	-15.
031300Z	8.1 164.9	40	8.0 165.3	45.	24.	5.	10.1 161.4	70.	100.	10.	13.0 158.8	75.	237.	-10.	16.2 158.4	85.	488.	-15.
031306Z	9.0 164.0	45	8.3 164.3	45.	45.	0.	10.4 161.0	55.	139.	-10.	13.5 158.4	65.	325.	-30.	16.7 158.5	70.	553.	-25.
031312Z	9.9 163.1	45	9.6 163.1	50.	18.	5.	12.7 159.5	60.	116.	-5.	16.1 158.6	70.	335.	-25.	20.3 160.6	55.	436.	-30.
031318Z	10.7 162.3	55	10.7 162.2	55.	6.	0.	15.0 159.8	65.	93.	-10.	18.4 160.9	55.	238.	-45.	21.3 165.2	45.	260.	-30.
031400Z	11.7 161.9	60	11.7 161.4	60.	29.	0.	15.8 159.8	60.	121.	-25.	19.4 162.0	50.	224.	-50.	22.7 168.0	40.	178.	-25.
031406Z	12.7 161.4	65	12.7 161.7	60.	17.	-5.	16.6 161.9	55.	55.	-40.	20.4 165.0	50.	124.	-45.	0.0 0.0	0.	-0.	0.
031412Z	13.7 161.2	65	13.7 161.2	60.	0.	-5.	17.6 161.5	55.	148.	-40.	20.8 165.0	50.	197.	-35.	0.0 0.0	0.	-0.	0.
031418Z	14.8 161.4	75	14.8 161.3	70.	6.	-5.	19.3 164.8	55.	11.	-45.	22.0 172.0	45.	181.	-30.	0.0 0.0	0.	-0.	0.
031500Z	15.6 161.9	85	15.7 162.0	70.	8.	-15.	19.6 166.7	70.	57.	-30.	22.0 174.2	40.	271.	-25.	0.0 0.0	0.	-0.	0.
031506Z	16.9 162.8	95	16.8 162.8	95.	6.	0.	20.2 167.9	90.	83.	-5.	22.2 175.7	45.	306.	-15.	0.0 0.0	0.	-0.	0.
031512Z	18.3 164.0	95	18.1 164.2	105.	16.	10.	21.2 171.0	80.	176.	-5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031518Z	19.3 165.0	100	19.2 165.2	100.	13.	0.	22.7 171.4	75.	132.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031600Z	20.2 165.9	100	19.9 166.0	100.	19:	0.	22.3 170.4	70.	149.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031606Z	21.3 167.0	95	21.2 167.1	100.	8.	5.	24.2 173.2	65.	125.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031612Z	22.4 168.1	85	22.5 168.7	95.	34.	10.	25.5 175.8	50.	164.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031618Z	23.6 169.2	75	24.0 169.6	85.	32.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031700Z	24.8 170.3	65	25.0 169.8	75.	30.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031706Z	25.7 171.6	60	25.6 171.8	60.	12.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031712Z	26.6 173.0	50	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
031718Z	27.4 174.3	45	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	24.	106.	222.	369.	23.	106.	222.	369.
AVG RIGHT ANGLE ERROR	16.	87.	144.	130.	15.	87.	144.	130.
AVG INTENSITY MAGNITUDE ERROR	4.	14.	23.	20.	4.	14.	23.	20.
AVG INTENSITY BIAS	1.	-9.	-21.	-20.	1.	-9.	-21.	-20.
NUMBER OF FORECASTS	22	19	14	9	21	19	14	9

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1912. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TYPHOON FREDA
FIX POSITIONS FOR CYCLONE NO. 1

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	112047	4.9N 168.4E	PCN 6	T2.0/2.0 /D1.0/24HRS	NOAA6		PGTW
2	112047	5.2N 168.7E	PCN 6	T1.5/1.5	NOAA6	INIT OBS	KGWC
3	120000	6.0N 167.2E	PCN 5		GMS		PGTW
4	120600	6.5N 166.6E	PCN 5		GMS		PGTW
* 5	120745	5.9N 165.7E	PCN 6		DMSP37		KGWC
6	120900	6.4N 166.2E	PCN 5		GMS		PGTW
7	121200	6.8N 165.8E	PCN 5		GMS		PGTW
* 8	121600	7.5N 164.4E	PCN 5		GMS	ULCC	PGTW
9	122024	7.5N 165.0E	PCN 5	T2.5/2.5 /D1.0/24HRS	NOAA6		KGWC
* 10	122100	7.4N 164.4E	PCN 5		GMS		PGTW
11	130000	7.6N 165.2E	PCN 5		GMS		PGTW
12	130600	8.9N 164.2E	PCN 5	T3.5/3.5 /D1.5/33HRS	GMS		PGTW
13	130903	8.9N 163.6E	PCN 6		NOAA6		KGWC
14	130904	9.4N 163.7E	PCN 6		NOAA6		PGTW
15	131200	10.3N 163.3E	PCN 5		GMS		PGTW
16	131600	10.3N 162.5E	PCN 5		GMS		PGTW
17	132100	11.1N 162.3E	PCN 5		GMS		PGTW
18	140000	11.9N 161.9E	PCN 5	T4.0/4.0 /D0.5/18HRS	GMS		PGTW
19	140300	12.7N 161.7E	PCN 5		GMS		PGTW
20	140900	13.6N 160.8E	PCN 5		GMS		PGTW
21	142120	15.3N 161.9E	PCN 3		NOAA6		PGTW
22	150000	15.6N 162.1E	PCN 1	T5.0/5.0 /D1.0/24HRS	GMS		PGTW
23	150900	17.6N 163.5E	PCN 1		GMS		PGTW
24	151200	18.3N 164.1E	PCN 1		GMS		PGTW
25	151600	19.2N 164.6E	PCN 1		GMS		PGTW
26	152057	19.3N 165.5E	PCN 2	T5.5/5.5-/D0.5/24HRS	NOAA6		KGWC
27	152100	19.6N 165.5E	PCN 1		GMS		PGTW
28	160300	20.9N 166.3E	PCN 3	T4.5/5.5 /W1.0/27HRS	GMS		PGTW

29	160900	22.2N 167.8E	PCN 5		GMS			PGTW
30	161200	22.9N 168.3E	PCN 5		GMS			PGTW
31	161600	23.8N 168.8E	PCN 5		GMS			PGTW
32	162034	23.6N 170.1E	PCN 6	T3.0/4.0-/W2.5/24HRS	NOAA6			KGWC
33	162100	24.6N 169.0E	PCN 5		GMS			PGTW
34	170000	25.3N 169.6E	PCN 5		GMS			PGTW
35	170600	25.6N 171.6E	PCN 5	T3.0/4.0 /W1.5/27HRS	GMS			PGTW
36	170732	25.8N 171.7E	PCN 6		NOAA6			KGWC
* 37	171200	26.2N 174.9E	PCN 5		GMS			PGTW
* 38	171600	26.8N 176.1E	PCN 5		GMS			PGTW
39	172011	27.6N 174.2E	PCN 6	T1.5/2.5 /W1.5/24HRS	NOAA6	LLCC		KGWC

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	122158	7.9N 165.4E	1500FT		993	40 320 80	030 45 320 120	5 3			+25 +25 26	1
2	131327	10.1N 163.0E	700MB	2990			060 40 330 90	5 3				2
3	131552	10.3N 162.7E	700MB	2957	987		120 57 060 90	8 3			+12 +11 +10	2
4	140132	11.8N 161.8E	700MB	2929		60 120 30	220 65 120 25	5 8			+11 +14 +12	3
5	140305	12.1N 161.8E	700MB	2914	979	20 060 5	170 51 060 15	5 5			+16 +14 +12	3
6	141317	14.0N 160.9E	700MB	2869			220 87 110 52	15 2	ELLIPTICAL	50 30 360		4
7	141600	14.5N 161.4E	700MB	2823	970		120 74 060 18	15 2	CIRCULAR	35	+13 +14 +11	4
8	150020	15.6N 162.0E	700MB	2738		50 280 70	310 77 220 8	10 5				5
9	150310	16.3N 162.4E	700MB	2647	947	90 150 20	230 100 150 25	10 5	CIRCULAR	20	+10 +16 +1`	5
10	151306	18.3N 164.0E	700MB	2635			190 99 080 50	5 3				6
11	151607	18.8N 164.6E	700MB	2615	944		310 69 250 30	5 3	ELLIPTICAL	40 30 060	+18 +18 +1	6

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	110000	2.5N 173.0E	10	30	
2	120000	6.5N 168.5E	20	45	

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM GERALD
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
041418Z	5.8 155.6	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041500Z	5.7 154.7	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041506Z	5.6 153.8	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041512Z	5.7 152.9	30	5.6 152.8	30.	8.	0.	6.3 149.7	45.	156.	-15.	8.0 146.0	55.	180.	5.	10.5 142.0	60.	296.	20.
041518Z	5.9 152.0	35	6.0 152.0	35.	6.	0.	7.1 149.0	50.	172.	-5.	8.9 145.3	65.	170.	20.	11.4 142.1	80.	297.	40.
041600Z	6.3 151.1	45	6.2 151.4	40.	19.	-5.	7.2 148.6	60.	188.	10.	9.1 145.1	80.	190.	35.	11.5 142.2	95.	340.	60.
041606Z	7.5 149.5	50	6.8 150.1	50.	55.	0.	9.2 145.9	70.	42.	20.	12.2 141.8	95.	242.	50.	15.8 138.1	100.	501.	70.
041612Z	8.1 147.8	60	8.5 147.9	55.	25.	-5.	12.5 142.5	80.	213.	30.	17.2 138.8	100.	478.	60.	22.5 140.0	95.	532.	65.
041618Z	8.4 146.4	55	8.8 146.8	55.	34.	0.	12.4 142.1	80.	220.	35.	16.3 139.2	100.	445.	60.	20.8 138.7	95.	540.	70.
041700Z	9.0 146.0	50	8.7 145.3	55.	45.	5.	10.8 140.8	75.	304.	30.	14.8 138.2	85.	514.	50.	18.5 138.5	85.	480.	60.
041706Z	9.9 145.9	50	9.8 145.8	50.	8.	0.	12.5 143.3	60.	153.	15.	15.3 142.1	65.	271.	35.	0.0 0.0	0.	-0.	0.
041712Z	11.0 145.8	50	11.1 145.8	45.	6.	-5.	15.3 146.6	45.	117.	5.	19.0 150.4	40.	344.	10.	0.0 0.0	0.	-0.	0.
041718Z	11.7 145.8	45	11.9 145.7	50.	13.	5.	14.0 145.3	60.	70.	20.	17.2 147.7	50.	188.	25.	0.0 0.0	0.	-0.	0.
041800Z	12.2 145.8	45	12.1 145.8	50.	6.	5.	14.4 145.3	60.	105.	25.	17.4 148.0	50.	162.	25.	0.0 0.0	0.	-0.	0.
041806Z	12.8 145.9	45	12.8 145.8	50.	6.	5.	15.1 146.1	60.	42.	30.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041812Z	13.4 146.1	40	13.6 145.9	50.	17.	10.	16.5 147.3	55.	113.	25.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041818Z	13.9 146.5	40	14.3 146.7	50.	27.	10.	17.2 149.1	45.	246.	20.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041900Z	14.6 147.1	35	14.9 147.3	50.	21.	15.	17.8 150.2	40.	273.	15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041906Z	15.3 146.8	30	15.3 147.3	50.	29.	20.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041912Z	15.4 145.7	30	16.2 148.2	45.	151.	15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
041918Z	14.7 145.7	25	17.2 149.2	25.	250.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
042000Z	15.3 146.2	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	40.	161.	289.	426.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	27.	104.	212.	368.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	6.	20.	34.	55.	0.	0.	0.	0.
AVG INTENSITY BIAS	4.	17.	34.	55.	0.	0.	0.	0.
NUMBER OF FORECASTS	18	15	11	7	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1183. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM GERALD
FIX POSITIONS FOR CYCLONE NO. 2

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	121200	4.7N 159.5E	PCN 5		GMS		PGTW
2	122100	5.8N 158.8E	PCN 5		GMS		PGTW
3	130000	5.8N 158.8E	PCN 5	T1.5/1.5	GMS	INIT OBS	PGTW
4	130300	6.1N 158.6E	PCN 5		GMS		PGTW
5	130906	6.2N 158.6E	PCN 6		NOAA6		PGTW
6	132146	6.6N 157.9E	PCN 5	T1.5/1.5 /S0.0/21HRS	GMS		PGTW
7	142123	6.2N 155.3E	PCN 5	T2.0/2.0 /D0.5/24HRS	NOAA6		PGTW
8	150000	6.3N 154.6E	PCN 5		GMS		PGTW
9	150300	6.3N 153.7E	PCN 5		GMS		PGTW
10	150900	6.5N 152.8E	PCN 5		GMS		PGTW
11	151002	6.1N 152.5E	PCN 5		NOAA6		PGTW
12	151200	6.8N 152.1E	PCN 5		GMS		PGTW
13	151600	6.8N 152.0E	PCN 5		GMS		PGTW
14	152100	6.0N 151.9E	PCN 5		GMS		PGTW
15	160000	6.4N 151.3E	PCN 5	T3.0/3.0 /D1.0/27HRS	GMS		PGTW
16	160300	6.6N 150.4E	PCN 5		GMS		PGTW
17	160900	7.8N 149.1E	PCN 5		GMS		PGTW
18	160939	7.8N 148.7E	PCN 5		GMS		PGTW
19	161200	8.8N 148.1E	PCN 5		GMS.		PGTW
20	161600	8.7N 147.0E	PCN 5		GMS		PGTW
21	162100	8.9N 145.2E	PCN 5		GMS		PGTW
22	162218	8.9N 145.1E	PCN 5		NOAA6		PGTW
23	162218	8.8N 146.0E	PCN 3	T3.5/3.5	NOAA6	INIT OBS	RODN
24	170000	8.7N 145.5E	PCN 5	T3.5/3.5 /D0.5/24HRS	GMS		PGTW
25	170300	9.6N 146.1E	PCN 5		GMS		PGTW
26	170600	9.9N 146.2E	PCN 5		GMS		PGTW
27	170916	10.7N 146.3E	PCN 6		NOAA6	ULCC 10.6N 144.6E	PGTW
28	171200	11.7N 146.0E	PCN 5		GMS		PGTW
29	171600	11.4N 145.7E	PCN 5		GMS		PGTW
30	172100	11.8N 145.7E	PCN 5		GMS		PGTW
31	172155	11.8N 145.6E	PCN 5		NOAA6		PGTW
32	180000	12.3N 145.8E	PCN 5	T3.5/3.5-/S0.0/24HRS	GMS		PGTW
33	180300	12.8N 145.7E	PCN 5		GMS		PGTW
34	180600	13.0N 146.3E	PCN 5		GMS		PGTW
35	180900	13.2N 146.0E	PCN 5		GMS		PGTW
36	181600	14.4N 147.1E	PCN 5		GMS		PGTW
37	182100	14.5N 147.5E	PCN 5		GMS		PGTW
38	182100	13.9N 146.7E	PCN 5		GMS		PGTW
39	190000	14.7N 147.7E	PCN 5	T4.0/4.0-/D0.5/24HRS	GMS		PGTW
40	190300	15.4N 147.4E	PCN 5		GMS		PGTW
41	190900	15.9N 147.6E	PCN 5		GMS		PGTW
42	191012	16.0N 147.8E	PCN 5		NOAA6		PGTW
43	191200	16.4N 148.1E	PCN 5		NOAA6		PGTW
44	191600	16.9N 149.1E	PCN 5		GMS		PGTW
45	192028	15.3N 146.5E	PCN 4		DMSP37	EXP LLCC	PGTW
46	192251	15.3N 146.1E	PCN 3		NOAA6		PGTW
47	200000	15.4N 146.4E	PCN 3	T2.0/2.0	GMS		PGTW
48	200300	15.6N 146.0E	PCN 3		GMS		PGTW
49	202228	17.2N 144.9E	PCN 3		NOAA6		PGTW
50	212205	20.8N 146.0E	PCN 5		NOAA6		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/	IN/	DP/	SST	MSN NO.
1	150804	5.5N 153.3E	1500FT		1000	30 290 10	270 26 180 10	3 5			+23	+25	+25	26	1
2	152248	6.2N 151.4E	700MB	3054		50 330 10	070 49 330 28	5 2							2
3	152352	6.3N 151.2E	700MB	3054	996	65 250 10	120 40 050 10	5 2				+13	+11		2
4	160312	6.6N 150.5E	700MB	3007		65 330 6	130 51 010 120	2 1	CIRCULAR	15		+15	+10		2
5	161305	8.0N 147.4E	700MB	3000			030 75 360 20	5 5							3
6	161558	8.1N 146.8E	700MB	2963	982		310 55 200 20	5 6			+ 9	+17	+ 9		3
7	170121	9.2N 146.0E	700MB	3028		45 090 15	080 46 340 20	4 3							4
8	170407	9.6N 146.0E	700MB	3008	989	50 160 50	260 44 180 20	7 5			+11	+18	+ 7		4
9	170937	10.7N 145.9E	700MB	3050	995		310 40 230 120	5 5	CIRCULAR	15	+11	+16	+16		5
10	171250	11.4N 145.8E	700MB	3052			230 57 140 180	5 5							5
11	171512	11.6N 145.6E	700MB	3012	990		180 69 090 10	2 3			+13	+14	+ 9		5
12	172202	12.0N 145.7E	700MB	3044	990	50 150 18	260 43 130 20	1 2			+10	+21	+ 6		7
13	180107	12.3N 145.9E	700MB	3054		40 220 30	200 41 160 20	1 2				+19	+ 7		7
14	180307	12.5N 145.8E	700MB	3047	991	50 240 30	290 26 240 30	1 2			+13	+18	+ 8		7
15	181830	14.0N 146.6E	700MB	3051	992		280 43 230 38	4 5			+14	+14	+12		8
16	190115	14.8N 147.1E	700MB	3040		40 100 60	180 44 100 40	5 4							9
17	190335	15.0N 147.0E	700MB	3035		35 040 15	150 40 050 40	5 2			+13	+17	+ 5		9

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	171410	11.4N 145.8E	LAND	POOR					13.6N 144.9E	91218
2	171435	11.6N 145.8E	LAND	POOR					13.6N 144.9E	91218
3	171635	11.7N 145.7E	LAND	POOR					13.6N 144.9E	91218
4	171710	11.7N 145.5E	LAND	FAIR					13.6N 144.9E	91218
5	171835	11.7N 145.5E	LAND	FAIR					13.6N 144.9E	91218
6	171935	12.0N 145.5E	LAND	FAIR					13.6N 144.9E	91218
7	172035	12.3N 145.3E	LAND	FAIR					13.6N 144.9E	91218
8	181035	13.1N 146.5E	LAND	GOOD					13.6N 144.9E	91218
9	181110	13.2N 146.5E	LAND	FAIR					13.6N 144.9E	91218
10	182135	14.0N 146.5E	LAND	FAIR		12		OPEN N	13.6N 144.9E	91218

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM HOLLY
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
042900Z	5.6	162.7	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
042906Z	6.1	162.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
042912Z	6.4	162.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
042918Z	6.7	161.7	30	6.8	161.5	30.	13.	0.	8.3	160.0	40.	111.	5.	9.9	157.6	50.	207.	5.	11.3	154.2	60.	187.	20.
043000Z	7.1	161.3	30	7.0	161.0	30.	19.	0.	8.8	159.4	40.	133.	0.	10.3	156.8	50.	209.	5.	11.6	153.4	60.	167.	20.
043006Z	7.8	160.5	30	7.5	160.7	30.	21.	0.	9.0	158.5	40.	131.	0.	10.2	156.1	50.	207.	5.	11.0	152.8	60.	125.	25.
043012Z	8.5	159.6	35	8.5	159.7	35.	6.	0.	10.2	157.0	50.	116.	5.	11.2	153.7	60.	136.	15.	11.8	150.2	70.	89.	35.
043018Z	9.1	158.3	35	9.2	158.7	35.	24.	0.	11.3	154.3	50.	108.	5.	12.2	149.6	65.	165.	25.	12.8	144.7	75.	369.	40.
050100Z	9.3	157.2	40	10.0	157.3	40.	42.	0.	11.8	152.4	55.	136.	10.	12.5	146.8	65.	285.	25.	13.4	141.2	75.	567.	40.
050106Z	9.3	156.3	40	9.5	155.9	40.	26.	0.	10.2	151.1	55.	91.	10.	11.4	146.3	65.	272.	30.	12.3	141.4	75.	526.	40.
050112Z	9.4	155.2	45	9.5	155.0	45.	13.	0.	10.3	150.3	60.	91.	15.	11.5	145.6	70.	306.	35.	12.4	140.9	75.	530.	40.
050118Z	9.5	154.1	45	10.0	153.8	45.	35.	0.	10.8	149.1	60.	138.	20.	11.8	144.2	70.	382.	35.	12.8	139.6	75.	597.	40.
050200Z	9.7	153.3	45	9.7	153.2	45.	6.	0.	10.2	149.6	65.	83.	25.	11.0	145.4	70.	300.	35.	11.7	140.8	75.	510.	40.
050206Z	9.8	152.6	45	9.8	152.3	45.	18.	0.	10.4	148.7	45.	124.	10.	11.1	144.8	50.	322.	15.	11.8	140.2	55.	527.	20.
050212Z	9.9	151.8	45	9.9	151.5	45.	18.	0.	10.6	147.8	45.	171.	10.	11.2	143.7	50.	363.	15.	11.9	139.1	55.	580.	20.
050218Z	10.0	151.3	40	10.1	150.8	40.	30.	0.	10.6	147.5	45.	182.	10.	11.4	143.5	55.	363.	20.	12.4	139.3	60.	551.	30.
050300Z	10.1	151.0	40	10.2	150.4	40.	36.	0.	10.6	147.8	50.	159.	15.	11.3	144.1	55.	316.	20.	12.1	140.4	65.	468.	35.
050306Z	10.3	150.8	35	10.2	150.6	35.	13.	0.	10.9	149.2	40.	65.	5.	11.4	146.7	45.	146.	10.	11.7	143.3	55.	269.	25.
050312Z	10.4	150.7	35	10.4	149.8	35.	53.	0.	10.9	147.6	45.	137.	10.	11.8	144.3	50.	276.	15.	13.2	140.4	60.	417.	30.
050318Z	10.6	150.6	35	10.8	150.4	35.	17.	0.	11.8	148.8	50.	61.	15.	12.4	145.3	55.	204.	25.	13.0	141.4	60.	323.	35.
050400Z	10.7	150.5	35	11.0	150.6	40.	19.	5.	12.0	149.2	50.	45.	15.	12.6	145.8	55.	161.	25.	12.9	142.0	60.	254.	35.
050406Z	11.0	150.3	35	11.1	150.5	40.	13.	5.	11.7	149.9	50.	45.	15.	12.0	148.4	55.	34.	25.	12.6	144.8	60.	51.	35.
050412Z	11.3	149.9	35	11.2	150.4	40.	30.	5.	11.8	149.2	50.	21.	15.	12.2	147.8	60.	33.	30.	12.7	143.9	65.	63.	45.
050418Z	11.3	149.7	35	11.4	150.0	40.	19.	5.	12.1	148.4	50.	35.	20.	12.5	145.7	60.	77.	35.	12.8	142.0	65.	118.	45.
050500Z	11.3	149.5	35	11.6	149.7	40.	21.	5.	12.2	147.8	45.	46.	15.	12.7	145.0	50.	88.	25.	12.9	142.4	55.	68.	35.
050506Z	11.4	149.2	35	11.3	149.8	40.	36.	5.	11.8	148.2	45.	19.	15.	12.3	146.2	50.	58.	25.	12.7	144.2	50.	136.	30.
050512Z	11.5	149.0	35	11.4	149.5	40.	30.	5.	11.9	147.0	45.	24.	15.	12.5	145.9	50.	84.	30.	12.8	143.7	50.	171.	30.
050518Z	11.6	148.7	30	11.6	149.1	40.	23.	10.	12.1	147.1	45.	25.	20.	12.6	145.0	50.	82.	30.	13.1	142.2	50.	140.	30.
050600Z	11.7	148.4	30	11.7	148.6	35.	12.	5.	12.0	147.3	35.	65.	10.	12.5	145.4	35.	138.	15.	13.0	142.8	35.	206.	15.
050606Z	11.7	147.9	30	11.7	147.8	30.	6.	0.	12.0	145.2	30.	8.	5.	12.6	142.5	30.	39.	10.	13.3	139.8	30.	86.	10.
050612Z	11.8	147.4	30	11.9	147.2	30.	13.	0.	12.5	144.2	30.	43.	10.	13.1	141.2	35.	48.	15.	13.7	138.3	45.	66.	25.
050618Z	11.8	146.8	25	12.0	147.1	30.	21.	5.	12.6	144.8	30.	72.	10.	13.2	141.7	35.	115.	15.	14.1	138.1	35.	89.	15.
050700Z	11.8	146.2	25	12.1	146.2	25.	18.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050706Z	11.9	145.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050712Z	11.9	144.6	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050718Z	11.9	143.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050800Z	12.0	143.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050806Z	12.3	141.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050812Z	12.4	140.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050818Z	12.4	139.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050900Z	12.5	139.3	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050906Z	12.6	138.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050912Z	12.7	137.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
050918Z	12.9	137.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
051000Z	13.2	136.4	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
051006Z	13.4	135.8	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	22.	86.	187.	284.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	12.	36.	38.	46.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	2.	12.	21.	31.	0.	0.	0.	0.
AVG INTENSITY BIAS	2.	12.	21.	31.	0.	0.	0.	0.
NUMBER OF FORECASTS	30	29	29	29	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1711. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 6. KNOTS

TROPICAL STORM HOLLY
FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	260000	4.5N 163.6E	PCN 5	T1.0/1.0	GMS	INIT OBS	PGTW
2	270300	4.3N 161.2E	PCN 5	T1.5/1.5 /D0.5/27HRS	GMS		PGTW
3	271200	4.5N 162.6E	PCN 5		GMS		PGTW
4	272129	4.9N 161.9E	PCN 5	T2.5/2.5 /D1.0/21HRS	NOAA6		PGTW
5	280300	4.9N 162.3E	PCN 5		GMS	ULCC 5.0N 161.2E	PGTW
6	280600	5.4N 161.0E	PCN 5		GMS		PGTW
7	280827	5.0N 160.0E	PCN 6		NOAA6		PGTW
8	281200	5.5N 160.4E	PCN 5		GMS		PGTW
9	282106	5.6N 162.5E	PCN 3	T1.5/2.5 /W1.0/24HRS	NOAA6		PGTW
10	290000	5.7N 162.3E	PCN 3		GMS		PGTW
11	290300	5.9N 162.6E	PCN 3		GMS		PGTW
12	291200	6.0N 162.0E	PCN 5		GMS		PGTW
13	292100	6.4N 163.1E	PCN 5		GMS	ULCC 8.2N 160.9E	PGTW
14	300000	7.8N 161.5E	PCN 5	T2.0/2.0 /D0.5/27HRS	GMS		PGTW
15	300300	7.7N 161.0E	PCN 5		GMS		PGTW
16	300600	8.0N 160.5E	PCN 5		GMS		PGTW
17	300923	8.5N 159.8E	PCN 5		NOAA6		PGTW
18	301200	8.4N 159.4E	PCN 5		NOAA6		PGTW
19	301600	9.2N 158.5E	PCN 5		GMS		PGTW
20	301947	9.3N 158.1E	PCN 6		DMSP37		PGTW
21	302202	9.5N 157.9E	PCN 5		NOAA6		PGTW
22	010000	9.3N 157.1E	PCN 5	T3.0/3.0 /D1.0/24HRS	GMS		PGTW
23	010300	9.3N 156.6E	PCN 5		GMS		PGTW
24	010900	9.5N 155.9E	PCN 5		NOAA6		PGTW
25	010900	9.5N 155.7E	PCN 5		GMS		PGTW
26	011200	10.0N 154.9E	PCN 5		GMS		PGTW
27	011600	9.8N 154.3E	PCN 5		GMS		PGTW
28	012100	10.0N 154.0E	PCN 5		GMS		PGTW

29	012139	10.0N 153.9E	PCN 5		NOAA6		PGTW
30	020000	9.8N 153.5E	PCN 5	T2.5/3.0 /W0.5/24HRS	GMS		PGTW
31	020300	9.9N 153.2E	PCN 5		GMS		PGTW
32	020900	10.4N 152.8E	PCN 5		GMS		PGTW
33	021200	10.3N 153.5E	PCN 5		GMS		PGTW
34	021600	10.3N 153.5E	PCN 5		GMS		PGTW
35	022115	10.2N 150.8E	PCN 3	T3.0/3.0 /D0.5/21HRS	NOAA6		PGTW
36	030000	10.3N 150.7E	PCN 3		GMS		PGTW
37	030300	10.3N 150.8E	PCN 3		GMS		PGTW
38	030900	10.4N 149.5E	PCN 5		GMS		PGTW
39	030955	10.3N 149.4E	PCN 5		NOAA6		PGTW
40	031200	10.8N 151.0E	PCN 5		GMS		PGTW
41	031600	11.2N 150.8E	PCN 5		GMS		PGTW
42	032022	10.9N 150.8E	PCN 5		DMSP37		PGTW
43	040000	11.2N 150.6E	PCN 5	T3.0/3.0 /S0.0/27HRS	GMS		PGTW
44	040300	11.6N 150.5E	PCN 5		GMS		PGTW
45	040900	12.3N 150.5E	PCN 5		GMS		PGTW
46	040932	11.3N 151.1E	PCN 5		NOAA6		PGTW
47	041200	11.9N 151.1E	PCN 5		GMS		PGTW
48	041600	12.0N 151.6E	PCN 5		GMS		PGTW
49	042211	11.5N 149.8E	PCN 5	T2.5/3.0+/W0.5/22HRS	NOAA6		PGTW
50	042211	11.3N 149.5E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	RODN
51	050000	11.6N 149.7E	PCN 5		GMS		PGTW
52	050600	11.2N 149.7E	PCN 5		GMS		PGTW
53	050909	11.3N 149.3E	PCN 5		NOAA6		PGTW
54	052148	11.7N 148.7E	PCN 3	T2.0/2.5 /W0.5/24HRS	NOAA6		PGTW
55	052149	11.7N 148.4E	PCN 3	T2.0/3.0 /W1.0/24HRS	NOAA6		RODN
56	060000	11.7N 148.3E	PCN 3		GMS		PGTW
57	060300	11.7N 148.1E	PCN 3		GMS		PGTW
58	060900	12.1N 147.6E	PCN 5		GMS		PGTW
59	061028	11.7N 147.5E	PCN 6		NOAA6		PGTW
60	061200	11.8N 147.4E	PCN 5		GMS		PGTW
61	061600	12.0N 147.2E	PCN 5		GMS		PGTW
62	062125	12.0N 146.4E	PCN 3	T1.0/1.5 /W1.0/24HRS	NOAA6		PGTW
63	070000	12.0N 146.1E	PCN 3		GMS		PGTW
64	070300	12.0N 145.9E	PCN 3		GMS		PGTW
65	070600	12.1N 145.5E	PCN 3		GMS		PGTW
66	071005	12.0N 144.8E	PCN 3		NOAA6		PGTW
67	072244	12.0N 143.4E	PCN 5	T0.0/0.5 /W1.0/24HRS	NOAA6		PGTW
68	080300	12.4N 142.6E	PCN 5		GMS		PGTW
69	090300	12.6N 138.9E	PCN 3		GMS		PGTW
70	100300	13.3N 136.1E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM	ORIEN-TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	290153	5.8N 162.7E	1500FT		1003	20 290 15	030 23 290 15	2 3				+25 +26 +25	1
2	300101	7.2N 161.3E	1500FT		1003	35 030 20	140 40 030 40	15 2				+25 +25 +25 26	2
3	010137	9.2N 156.9E	700MB	3087		40 010 45	070 46 010 45	10 5					3
4	010345	9.3N 156.5E	700MB	3070	1002	40 330 20	200 25 130 50	7 5				+11 +13 + 9	3
5	011805	9.4N 154.0E	700MB	3082			050 35 330 30	5 2				+11 +12 +12	4
6	012147	9.6N 153.5E	700MB	3059	997	55 130 15	180 45 090 10	2 3	CIRCULAR	12		+12 +14 + 8	5
7	020116	9.8N 153.1E	700MB	3074		55 030 5	120 54 030 10	4 3					5
8	020346	9.9N 152.9E	700MB	3055	997	55 050 10	020 27 300 25	8 3	CIRCULAR	15		+11 +15 + 7	5
9	021305	10.0N 151.8E	700MB	3118			330 25 270 20	3 3					6
10	021531	10.0N 151.4E	700MB	3107	1002		250 23 110 45	5 5	CIRCULAR	20		+10 +12 +11	6
11	030129	10.0N 150.9E	1500FT		999	15 220 40	300 25 220 50	2 2					7
12	030344	10.2N 150.9E	700MB	3073	997	30 040 30	270 31 060 7	2 2				+13 +17 + 7	7
13	031338	11.2N 150.5E	700MB	3106			020 30 090 15	15 6					8
14	031554	10.7N 151.0E	700MB	3097			150 35 060 16	5 5				+10 +11 +10	8
15	040116	11.1N 150.6E	700MB	3069		35 340 15	350 20 270 40	6 5					9
16	040403	11.1N 150.5E	700MB	3066	997	50 010 30	090 37 020 50	6 10				+11 +13 + 8	9
17	041604	11.4N 150.1E	700MB	3080	1001		060 20 350 90	10 3				+14 +12 + 8	10
18	050105	11.3N 149.7E	1500FT		1001	35 270 40	020 30 270 40	5 7					11
19	050356	11.1N 149.9E	700MB	3093	1000	45 030 65	140 27 030 90	5 7				+13 +14 + 6	11
20	051555	12.2N 149.3E	700MB	3101	1004		280 31 130 30	10 5				+11 +13 + 9	12
21	060412	11.5N 148.1E	700MB	3130	1004	30 360 30	270 21 070 30	5 5				+11 + 9 26	13
22	070042	11.8N 146.0E	1500FT		1005	15 040 15	030 20 320 35	5 3				+26 +27 +24 27	14

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON IKE
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
060718Z	16.7	118.7	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060800Z	17.4	117.3	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060806Z	17.8	115.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060812Z	17.9	114.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060818Z	17.8	112.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060900Z	17.6	111.6	30	17.7	111.3	30.	18.	0.	19.1	106.7	40.	293.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060906Z	17.6	111.2	30	17.7	110.2	30.	57.	0.	19.5	106.1	35.	334.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060912Z	17.4	111.1	30	17.7	110.0	35.	65.	5.	18.8	107.0	40.	275.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
060918Z	17.2	111.3	30	17.6	109.7	35.	94.	5.	18.6	106.6	35.	298.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061000Z	17.3	111.5	35	17.5	111.5	30.	12.	-5.	21.0	113.5	25.	198.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061006Z	17.5	111.6	35	17.9	111.6	40.	24.	5.	19.9	112.6	30.	103.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061012Z	17.7	111.7	40	17.9	111.6	40.	13.	0.	19.1	111.9	40.	62.	-10.	21.4	113.1	35.	247.	-30.	0.0	0.0	0.	-0.	0.
061018Z	17.9	111.8	40	18.0	111.6	40.	13.	0.	19.3	112.0	40.	97.	-15.	22.2	113.7	35.	287.	-30.	0.0	0.0	0.	-0.	0.
061100Z	18.0	112.0	40	18.1	111.6	40.	23.	0.	19.7	112.1	40.	167.	-15.	21.4	113.1	35.	380.	-25.	23.1	114.3	25.	520.	-15.
061106Z	18.2	112.3	45	18.5	111.5	40.	49.	-5.	19.8	111.9	40.	253.	-20.	21.7	113.1	35.	453.	-15.	0.0	0.0	0.	-0.	0.
061112Z	18.4	112.7	50	18.5	112.5	50.	13.	0.	20.1	114.1	65.	186.	0.	23.1	117.1	55.	270.	10.	0.0	0.0	0.	-0.	0.
061118Z	18.7	113.6	55	18.6	113.5	55.	8.	0.	20.5	116.8	60.	124.	-5.	24.3	121.0	25.	114.	-20.	0.0	0.0	0.	-0.	0.
061200Z	19.1	115.0	55	18.9	114.1	55.	52.	0.	20.8	117.1	60.	177.	0.	24.5	121.0	25.	181.	-15.	0.0	0.0	0.	-0.	0.
061206Z	19.7	116.4	60	19.7	116.5	60.	6.	0.	22.7	121.9	50.	61.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061212Z	20.4	117.4	65	20.7	117.8	55.	29.	-10.	25.0	122.0	25.	32.	-20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061218Z	21.4	118.8	65	21.3	118.5	55.	18.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061300Z	22.2	119.9	60	22.2	119.5	55.	22.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061306Z	23.4	121.1	50	23.2	120.7	45.	25.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061312Z	24.5	121.8	45	24.9	122.2	45.	32.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061318Z	25.8	122.3	45	26.5	123.3	40.	68.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061400Z	27.0	122.9	40	26.9	122.6	40.	17.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	31.	177.	276.	520.	25.	177.	276.	520.
AVG RIGHT ANGLE ERROR	20.	120.	131.	234.	13.	120.	131.	234.
AVG INTENSITY MAGNITUDE ERROR	3.	8.	21.	15.	3.	8.	21.	15.
AVG INTENSITY BIAS	-1.	-8.	-18.	-15.	-2.	-8.	-18.	-15.
NUMBER OF FORECASTS	21	15	7	1	17	15	7	1

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1387. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON IKE
FIX POSITIONS FOR CYCLONE NO. 4

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	072100	16.6N 117.5E	PCN 5		GMS		PGTW
2	080000	17.8N 116.3E	PCN 5		GMS		PGTW
3	080022	18.0N 116.7E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	RPMK
4	080300	17.9N 116.5E	PCN 5	T1.0/1.0	GMS	INIT OBS	PGTW
5	080600	18.0N 115.8E	PCN 5		GMS		PGTW
6	081120	17.9N 114.4E	PCN 5		NOAA6		RPMK
7	081200	18.1N 114.3E	PCN 5		GMS		PGTW
8	082100	18.1N 112.8E	PCN 5		GMS		RPMK
9	082359	17.5N 111.4E	PCN 5		NOAA6		PGTW
10	082359	17.6N 111.9E	PCN 5	T2.0/2.0-/D1.0/24HRS	NOAA6		RPMK
11	090000	17.7N 111.6E	PCN 5		GMS		PGTW
12	090300	17.6N 111.1E	PCN 5	T2.0/2.0 /D1.0/24HRS	GMS		PGTW
13	090600	17.6N 111.1E	PCN 5		GMS		PGTW
14	090900	17.7N 110.9E	PCN 5		GMS		PGTW
15	091200	17.4N 110.5E	PCN 5		GMS		PGTW
16	091238	17.4N 110.2E	PCN 5		NOAA6		RPMK
17	091600	17.4N 110.0E	PCN 5		GMS		PGTW
18	092100	17.5N 110.4E	PCN 5		GMS		PGTW
19	092336	17.3N 111.8E	PCN 5		NOAA6	EXP LLCC	PGTW
20	100000	17.5N 111.4E	PCN 5		GMS	EXP LLCC	PGTW
21	100117	17.2N 109.5E	PCN 5	T2.0/2.0-/S0.0/25HRS	NOAA6	ULCC 17.7N 110.1E	RPMK
22	100300	17.6N 111.5E	PCN 3	T1.0/2.0 /W1.0/24HRS	GMS		PGTW
23	100600	17.8N 111.6E	PCN 5		GMS		PGTW
24	100900	17.6N 111.6E	PCN 5		GMS		PGTW
25	101215	16.4N 111.0E	PCN 6		NOAA6		RPMK
26	101600	17.9N 111.6E	PCN 5		GMS		PGTW
27	102100	18.0N 111.6E	PCN 5		GMS		PGTW
28	110054	18.0N 111.9E	PCN 5	T2.0/2.0 /S0.0/24HRS	NOAA6		RPMK
29	110054	18.3N 111.6E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	RODN
30	110600	18.1N 112.3E	PCN 5	T3.0/3.0 /D2.0/27HRS	GMS		PGTW
31	110900	18.2N 112.5E	PCN 5		GMS		PGTW
32	111152	18.0N 112.6E	PCN 4		NOAA6		RODN
33	111200	18.3N 112.8E	PCN 5		GMS		PGTW
34	111600	18.4N 113.3E	PCN 5		GMS		PGTW
35	112100	19.1N 114.0E	PCN 5		GMS		PGTW
36	120000	19.5N 114.7E	PCN 5		GMS		PGTW
37	120031	19.1N 115.2E	PCN 5	T3.0/3.0 /D1.0/24HRS	NOAA6		RPMK
38	120300	19.3N 115.6E	PCN 3	T3.5/3.5 /D0.5/21HRS	GMS		PGTW
39	120600	19.8N 116.9E	PCN 5		GMS		PGTW
40	120900	20.3N 117.1E	PCN 5		GMS		PGTW
41	121129	20.4N 117.3E	PCN 3		NOAA6		RODN
42	121200	20.6N 117.4E	PCN 5		GMS		PGTW
43	121600	21.3N 118.3E	PCN 3		GMS		PGTW
44	122100	21.8N 119.3E	PCN 5		GMS		PGTW
45	130000	22.1N 119.8E	PCN 3		GMS		PGTW
46	130008	22.3N 120.0E	PCN 3	T4.0/4.0	DMSP37	INIT OBS	RODN
47	130300	22.8N 120.5E	PCN 3	T4.0/4.0 /D0.5/24HRS	GMS		PGTW
48	130600	23.8N 121.4E	PCN 5		GMS		PGTW

49	130900	25.2N 121.9E	PCN 5		GMS	PGTW
50	131200	25.9N 122.6E	PCN 5		GMS	PGTW
51	131600	26.6N 121.6E	PCN 5		GMS	PGTW
52	132245	26.6N 122.5E	PCN 5		NOAA6	PGTW
53	140000	27.0N 122.5E	PCN 5	T2.5/3.5-/W1.5/21HRS	GMS	PGTW
54	140900	28.1N 124.1E	PCN 5		GMS	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM	ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	121440	20.8N 117.8E	700MB	2834	967		190 61 100 45	3 2	CIRCULAR	20		+14 +17 +15	2

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	120600	20.1N 116.4E	LAND				65/// /////		22.3N 114.2E	45005
2	130000	21.9N 119.9E	LAND				55/62 50618		22.3N 114.2E	45005
3	130100	22.1N 120.1E	LAND				55/61 50614		22.6N 120.3E	46744

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON JUNE
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
061612Z	13.2	132.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061618Z	13.6	131.5	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061700Z	14.2	131.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061706Z	14.8	130.7	35	14.8	130.7	30.	0.	-5.	17.4	129.1	50.	133.	-5.	19.8	126.1	60.	142.	-15.	22.4	123.4	70.	111.	-5.
061712Z	15.5	130.2	35	15.4	130.3	35.	8.	0.	18.1	128.3	55.	141.	-10.	21.1	125.1	65.	112.	-10.	24.8	123.9	70.	115.	0.
061718Z	16.4	129.3	40	16.2	129.7	40.	26.	0.	19.0	127.9	60.	167.	-10.	22.0	125.4	65.	145.	-10.	26.0	125.0	70.	181.	5.
061800Z	17.4	128.2	45	17.0	129.0	45.	52.	0.	20.2	126.7	65.	135.	-5.	23.8	124.9	70.	137.	-5.	27.8	125.1	65.	182.	0.
061806Z	18.4	127.0	55	18.8	127.1	55.	25.	0.	24.6	124.1	65.	228.	-10.	29.8	125.8	45.	401.	-30.	0.0	0.0	0.	-0.	0.
061812Z	19.2	126.1	65	19.9	126.1	60.	42.	-5.	24.7	123.0	70.	209.	-5.	29.9	123.1	50.	324.	-20.	33.3	128.9	30.	393.	-20.
061818Z	19.9	125.1	70	20.0	125.0	65.	8.	-5.	23.8	121.3	65.	145.	-10.	28.8	120.5	30.	232.	-35.	0.0	0.0	0.	-0.	0.
061900Z	20.3	124.3	70	20.2	124.2	70.	8.	0.	22.6	120.5	60.	117.	-15.	25.7	117.3	25.	265.	-40.	0.0	0.0	0.	-0.	0.
061906Z	20.8	123.8	75	20.8	123.3	75.	28.	0.	23.2	119.9	50.	133.	-25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
061912Z	21.2	123.1	75	21.2	122.6	75.	28.	0.	22.8	120.2	40.	139.	-30.	25.2	117.8	30.	364.	-20.	0.0	0.0	0.	-0.	0.
061918Z	21.8	122.8	75	21.8	122.6	75.	11.	0.	24.2	121.6	50.	55.	-15.	27.3	121.2	35.	221.	-5.	0.0	0.0	0.	-0.	0.
062000Z	22.9	122.6	75	22.6	122.5	80.	19.	5.	26.3	121.9	50.	17.	-15.	30.2	123.0	30.	143.	-5.	0.0	0.0	0.	-0.	0.
062006Z	23.9	122.2	75	23.9	122.1	75.	5.	0.	27.8	121.8	50.	54.	-10.	31.4	123.3	30.	200.	-5.	0.0	0.0	0.	-0.	0.
062012Z	24.6	121.8	70	24.9	121.6	55.	21.	-15.	28.6	121.8	45.	84.	-5.	32.2	124.0	30.	263.	0.	0.0	0.0	0.	-0.	0.
062018Z	25.1	121.8	65	25.1	121.7	55.	5.	-10.	29.2	123.0	40.	76.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062100Z	26.2	122.2	65	26.0	121.9	50.	20.	-15.	29.8	123.9	40.	110.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062106Z	27.6	122.8	60	27.6	123.1	50.	16.	-10.	33.5	129.2	35.	143.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062112Z	28.7	123.4	50	28.8	123.3	45.	8.	-5.	33.1	128.2	30.	58.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062118Z	29.8	124.3	40	29.8	124.1	40.	10.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062200Z	30.8	125.7	35	30.2	125.0	35.	51.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062206Z	31.8	127.2	35	31.6	126.8	35.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062212Z	32.6	129.2	30	32.7	129.2	30.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	19.	119.	227.	196.	20.	123.	224.	196.
AVG RIGHT ANGLE ERROR	11.	62.	108.	88.	11.	62.	107.	88.
AVG INTENSITY MAGNITUDE ERROR	3.	10.	15.	6.	4.	10.	17.	6.
AVG INTENSITY BIAS	-3.	-9.	-15.	-4.	-3.	-10.	-17.	-4.
NUMBER OF FORECASTS	22	18	13	5	21	17	12	5

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1569. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 11. KNOTS

TYPHOON JUNE
FIX POSITIONS FOR CYCLONE NO. 5

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	142322	7.8N 131.8E	PCN 5	T0.5/0.5	NOAA6	INIT OBS	PGTW
	2	161200	12.7N 131.8E	PCN 5		GMS		PGTW
*	3	161600	12.7N 130.9E	PCN 5		GMS		PGTW
	4	162100	13.7N 130.7E	PCN 5		GMS		PGTW
*	5	162236	13.0N 130.3E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	PGTW
	6	170600	14.8N 130.6E	PCN 5		GMS		PGTW
	7	170900	15.1N 130.3E	PCN 5		GMS		PGTW
	8	171115	15.5N 129.6E	PCN 5		NOAA6		PGTW
	9	171200	15.5N 129.5E	PCN 5		GMS		PGTW
	10	171600	15.7N 129.7E	PCN 5		GMS		PGTW
	11	172100	16.8N 128.7E	PCN 5		GMS		PGTW
	12	172354	17.8N 128.4E	PCN 5	T3.0/3.0+/D2.0/25HRS	NOAA6		RODN
	13	172354	17.7N 128.0E	PCN 3	T4.0/4.0	NOAA6	INIT OBS	RPMK
	14	172354	17.8N 128.4E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	PGTW
	15	180600	18.5N 126.9E	PCN 5		GMS		PGTW
	16	180900	19.0N 126.3E	PCN 5		GMS		PGTW
	17	181052	18.8N 125.9E	PCN 5		NOAA6		PGTW
	18	181600	19.4N 125.4E	PCN 5		GMS		PGTW
	19	182100	20.1N 124.9E	PCN 5		GMS		RODN
	20	182331	20.5N 124.2E	PCN 3	T5.0/5.0 /D1.0/24HRS	NOAA6		PGTW
	21	182331	20.3N 124.4E	PCN 3	T4.5/4.5 /D1.5/24HRS	NOAA6		RPMK
	22	182331	20.3N 124.4E	PCN 3	T3.5/3.5 /D0.5/24HRS	NOAA6		PGTW
	23	190000	20.4N 124.2E	PCN 3		GMS		PGTW
	24	190600	21.0N 123.3E	PCN 3		GMS		PGTW
	25	190900	21.1N 123.1E	PCN 5		GMS		PGTW
	26	191029	21.2N 123.0E	PCN 5		NOAA6		PGTW
	27	191200	21.3N 123.1E	PCN 5		GMS		PGTW
	28	191600	21.6N 122.9E	PCN 5		GMS		PGTW
	29	192100	22.5N 122.8E	PCN 5		GMS		PGTW
	30	192308	22.8N 122.7E	PCN 5	T4.5/4.5 /S0.0/24HRS	NOAA6		PGTW
	31	200000	23.0N 122.8E	PCN 5		GMS		PGTW
	32	200300	23.6N 122.3E	PCN 1		GMS		PGTW
	33	200900	24.9N 122.0E	PCN 3		GMS		RKSO
	34	201147	25.4N 121.8E	PCN 4		NOAA6		PGTW
	35	201200	24.9N 121.8E	PCN 5		GMS		PGTW
	36	201600	25.0N 121.7E	PCN 5		GMS		PGTW
	37	202100	25.5N 121.8E	PCN 5		GMS		PGTW
	38	210000	26.1N 122.5E	PCN 5		GMS		RODN
	39	210026	26.4N 122.6E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	PGTW
	40	210300	27.2N 122.4E	PCN 3	T3.5/4.0 /W1.0/20HRS	GMS		PGTW
	41	210900	28.2N 122.6E	PCN 5		GMS		RKSO
	42	211124	28.4N 123.9E	PCN 4		NOAA6		PGTW
	43	211200	28.7N 123.4E	PCN 5		GMS		PGTW
	44	211600	29.1N 123.7E	PCN 5		GMS		PGTW
	45	212100	29.7N 124.7E	PCN 3		GMS		PGTW
	46	220000	30.5N 125.5E	PCN 5	T2.0/2.5 /W1.5/21HRS	GMS		RODN
	47	220004	31.0N 125.6E	PCN 5	T2.5/3.0 /W0.5/24HRS	NOAA6		RPMK
	48	220004	30.5N 125.6E	PCN 5	T2.0/2.0	NOAA6	INIT OBS	

49	220300	31.9N 126.5E	PCN 5	GMS	PGTW
50	220900	32.3N 128.4E	PCN 5	GMS	PGTW
* 51	221101	31.8N 132.1E	PCN 5	NOAA6	RODN
52	221200	32.6N 130.0E	PCN 5	GMS	PGTW
53	221600	33.2N 132.1E	PCN 5	GMS	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	170619	14.8N 130.8E	1500FT		995	35 120 30	220 40 170 70	4 5			+26 +26 +26 29	1
2	180047	17.6N 128.1E	700MB	3029		50 140 30	230 50 140 35	7 2				3
3	180243	18.0N 127.7E	700MB	2947	984	60 340 10	240 50 160 45	7 2			+13 +17 +10	3
4	181310	19.3N 126.1E	700MB	2846			130 65 070 32	8 4				4
5	181603	19.6N 125.2E	700MB	2842	971		090 70 010 26	8 4	CIRCULAR	20	+16 +15 +12	4
6	190016	20.5N 124.3E	700MB	2812		80 340 20	090 70 350 25	4 2				5
7	190252	20.7N 123.9E	700MB	2806	967	65 030 25	110 73 020 25	4 3	CIRCULAR	30	+15 +16 +12	5
8	191246	21.2N 123.0E	700MB	2775			340 80 260 10	5 5	CIRCULAR	20		6
9	191430	21.5N 122.8E	700MB	2782	963		110 70 060 16	7 5	CIRCULAR	15	+14 +15 +14	6
10	200152	23.3N 122.5E	700MB	2766		45 170 20	220 59 170 20	3 10				7
11	200348	23.5N 122.4E	700MB	2787	963	65 350 40	210 56 100 90	4 10			+15 +10 +14	7

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	191500	21.7N 123.0E	LAND				22913 53514		24.3N 124.2E	47918
2	191600	21.6N 123.0E	LAND				5/943 73506		24.3N 124.2E	47918
3	191700	21.7N 122.9E	LAND				20814 53208		24.3N 124.2E	47918
4	191800	21.8N 122.9E	LAND				20724 53506		24.3N 124.2E	47918
5	191900	22.1N 122.8E	LAND				22713 53416		24.3N 124.2E	47918
6	192000	22.2N 122.8E	LAND				10514 53408		24.3N 124.2E	47918
7	192100	22.3N 122.7E	LAND				11714 53607		24.3N 124.2E	47918
8	192200	22.5N 122.6E	LAND				21743 53411		24.3N 124.2E	47918
9	192300	22.7N 122.7E	LAND				22914 50214		24.3N 124.2E	47918
10	200000	22.9N 122.7E	LAND				21813 73611		24.3N 124.2E	47918
11	200100	23.1N 122.6E	LAND				21913 73611		24.3N 124.2E	47918
12	200200	23.4N 122.5E	LAND				21614 73414		24.3N 124.2E	47918
13	200300	23.5N 122.3E	LAND				10514 73315		24.3N 124.2E	47918
14	200400	23.6N 122.3E	LAND				10614 73312		24.3N 124.2E	47918
15	200500	23.8N 122.3E	LAND				10614 73309		24.3N 124.2E	47918
16	200515	23.8N 122.3E	LAND	GOOD		15			24.8N 125.3E	47927
17	200600	24.1N 122.2E	LAND				22714 73512		24.3N 124.2E	47918
18	200630	24.2N 122.2E	LAND	POOR		15			24.8N 125.3E	47927
19	200700	24.4N 122.2E	LAND				52614 73515		24.3N 124.2E	47918
20	200800	24.6N 122.0E	LAND				52514 73510		24.3N 124.2E	47918
21	200830	24.5N 121.9E	LAND	POOR		15			24.8N 125.3E	47927
22	200900	24.5N 121.9E	LAND				24545 73209		24.3N 124.2E	47918
23	201000	24.7N 121.5E	LAND				6///5 73014		24.3N 124.2E	47918

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON KELLY
BEST TRACK DATA

	BEST TRACK			WARNING						24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST.				
							ERRORS					ERRORS					ERRORS							
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
062818Z	13.7	135.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062900Z	12.9	132.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062906Z	13.1	130.6	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062912Z	13.5	129.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
062918Z	13.8	127.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
063000Z	13.9	126.6	30	13.8	126.3	30.	18.	0.	14.2	121.9	35.	79.	5.	16.0	117.2	35.	120.	-15.	21.5	115.3	35.	320.	-40.
063006Z	13.8	125.1	35	13.9	125.7	30.	35.	-5.	14.2	121.8	30.	128.	-5.	16.7	116.8	35.	162.	-20.	22.5	115.5	35.	388.	-40.
063012Z	13.7	123.7	35	14.2	123.6	35.	30.	0.	15.3	118.2	35.	98.	-5.	20.6	115.3	35.	349.	-25.	0.0	0.0	0.	-0.	0.
063018Z	13.5	122.3	30	14.0	122.2	35.	30.	5.	16.2	117.2	35.	138.	-10.	21.4	115.2	35.	350.	-30.	0.0	0.0	0.	-0.	0.
070100Z	13.2	121.0	30	13.6	121.1	30.	25.	0.	15.8	116.4	40.	102.	-10.	21.5	114.5	40.	302.	-35.	0.0	0.0	0.	-0.	0.
070106Z	13.3	119.8	35	13.6	120.1	30.	25.	-5.	15.8	115.8	40.	91.	-15.	21.6	114.0	40.	298.	-35.	0.0	0.0	0.	-0.	0.
070112Z	13.7	118.6	40	13.8	119.1	30.	30.	-10.	16.8	115.2	40.	124.	-20.	23.2	114.2	25.	399.	-45.	0.0	0.0	0.	-0.	0.
070118Z	13.9	117.4	45	14.1	117.3	45.	13.	0.	18.8	113.6	50.	186.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070200Z	14.1	116.5	50	14.7	115.9	50.	50.	0.	19.0	112.1	45.	143.	-30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070206Z	14.3	115.5	55	14.5	115.3	60.	17.	5.	16.4	112.2	55.	62.	-20.	19.5	110.0	35.	140.	-15.	0.0	0.0	0.	-0.	0.
070212Z	14.8	114.6	60	14.9	114.2	60.	24.	0.	18.2	110.7	55.	42.	-15.	22.8	109.0	25.	248.	-20.	0.0	0.0	0.	-0.	0.
070218Z	15.7	113.8	65	15.7	113.8	60.	0.	-5.	19.2	110.5	50.	94.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070300Z	16.7	112.8	75	16.9	113.0	65.	17.	-10.	21.4	111.0	40.	222.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070306Z	17.2	111.5	75	18.0	112.2	65.	62.	-10.	22.7	110.8	25.	289.	-25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070312Z	17.6	110.3	70	17.8	110.4	70.	13.	0.	20.7	107.0	40.	90.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070318Z	18.1	109.3	65	18.2	109.5	65.	13.	0.	21.8	106.9	25.	161.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070400Z	18.6	108.4	55	19.1	108.3	50.	30.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070406Z	18.9	107.6	50	19.6	107.2	40.	48.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070412Z	19.2	106.8	45	19.2	107.0	40.	11.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070418Z	19.3	105.8	35	19.4	106.0	50.	13.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070500Z	19.2	104.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	25.	128.	263.	354.	25.	131.	263.	354.
AVG RIGHT ANGLE ERROR	18.	110.	242.	347.	18.	114.	242.	347.
AVG INTENSITY MAGNITUDE ERROR	5.	14.	27.	40.	5.	14.	27.	40.
AVG INTENSITY BIAS	-2.	-13.	-27.	-40.	-3.	-14.	-27.	-40.
NUMBER OF FORECASTS	20	16	9	2	17	15	9	2

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1870. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

TYPHOON KELLY
FIX POSITIONS FOR CYCLONE NO. 6

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	250447	8.7N 148.0E	PCN 5	T0.5/0.5	NOAA7	INIT OBS	PGTW
* 2	260436	12.6N 144.2E	PCN 5	T1.5/1.5 /D1.0/24HRS	NOAA7		PGTW
* 3	270424	13.1N 140.6E	PCN 5	T2.5/2.5 /D1.0/24HRS	NOAA7		PGTW
* 4	271048	13.9N 137.6E	PCN 6		NOAA6	ULCC	PGTW
* 5	281200	14.0N 134.6E	PCN 5		GMS		PGTW
6	282304	12.9N 133.5E	PCN 3	T1.0/1.0	NOAA6	INIT OBS	PGTW
7	282304	12.8N 133.7E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	RPMK
8	290542	12.8N 130.2E	PCN 5		NOAA7		PGTW
9	290900	13.5N 129.3E	PCN 5		GMS		PGTW
10	291200	13.9N 128.6E	PCN 5		GMS		PGTW
11	291600	13.7N 128.0E	PCN 5		GMS		PGTW
12	292100	13.7N 126.8E	PCN 5		GMS		PGTW
13	292240	14.5N 127.1E	PCN 5	T2.5/2.5 /D1.5/24HRS	NOAA6		RPMK
14	292241	13.7N 126.6E	PCN 5	T2.5/2.5 /D1.5/24HRS	NOAA6		PGTW
15	300531	13.7N 124.7E	PCN 5		NOAA6		PGTW
16	300900	13.7N 123.8E	PCN 5		GMS		PGTW
17	301120	13.4N 123.6E	PCN 6		NOAA6		PGTW
18	301200	13.6N 123.1E	PCN 5		GMS		PGTW
19	301600	13.7N 122.4E	PCN 5		GMS		PGTW
20	302100	13.3N 121.7E	PCN 3		GMS		PGTW
21	302359	12.8N 121.3E	PCN 3	T3.0/3.0+/D0.5/24HRS	NOAA6		PGTW
22	302359	12.8N 121.5E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	RODN
23	302359	13.1N 121.1E	PCN 5	T2.5/2.5+/S0.0/25HRS	NOAA6		RPMK
24	010703	13.6N 120.0E	PCN 3		NOAA6		RPMK
25	010900	13.5N 119.6E	PCN 5		GMS		PGTW
26	011057	13.4N 119.3E	PCN 5		NOAA6		PGTW
27	011057	13.5N 118.9E	PCN 6		NOAA6		RPMK
28	011200	13.7N 118.9E	PCN 5		GMS		PGTW
29	011600	13.6N 117.6E	PCN 5		GMS		PGTW
30	012100	14.1N 116.6E	PCN 5		GMS		PGTW
31	012336	14.0N 116.5E	PCN 5	T3.0/3.0 /S0.0/24HRS	NOAA6		RODN
32	012336	14.0N 116.4E	PCN 5	T3.5/3.5 /D0.5/24HRS	NOAA6		PGTW
33	020649	14.2N 116.5E	PCN 5	T4.0/4.0+/D1.5/31HRS	NOAA7		RPMK
34	020900	14.7N 114.7E	PCN 5		GMS		PGTW
35	021200	14.7N 114.3E	PCN 5		GMS		PGTW
36	021600	15.4N 113.8E	PCN 5		GMS		PGTW
37	022100	16.5N 113.4E	PCN 5		GMS		PGTW
38	030000	16.9N 112.7E	PCN 3		GMS		PGTW
* 39	030054	17.5N 113.0E	PCN 3	T4.0/4.0 /D1.0/24HRS	NOAA6		RODN
40	030054	16.8N 112.6E	PCN 1	T4.5/4.5 /D0.5/18HRS	NOAA6		RPMK
41	030300	17.1N 112.1E	PCN 5	T4.0/4.0-/D0.5/27HRS	GMS		PGTW
42	030600	17.3N 111.5E	PCN 3		GMS		PGTW
43	030900	17.4N 111.0E	PCN 1		GMS		PGTW
44	031200	17.6N 110.5E	PCN 1		GMS		PGTW
45	031600	17.9N 109.7E	PCN 3		GMS		PGTW
46	032100	18.4N 108.8E	PCN 5		GMS		PGTW
47	040000	18.6N 108.0E	PCN 5		GMS		PGTW
48	040031	18.3N 108.1E	PCN 3	T3.5/4.0-/W0.5/24HRS	NOAA6		RODN

49	040300	18.7N 107.7E	PCN 5	T3.5/4.0-/W0.5/24HRS	GMS	PGTW
50	040600	18.9N 107.5E	PCN 1		GMS	PGTW
51	040625	19.0N 107.6E	PCN 5	T3.5/3.5 /S0.0/06HRS	NOAA7	RODN
52	040900	19.0N 107.2E	PCN 3		GMS	PGTW
53	041200	19.2N 106.9E	PCN 5		GMS	PGTW
54	041600	19.3N 106.2E	PCN 3		GMS	PGTW
55	042100	19.4N 105.0E	PCN 3		GMS	PGTW
56	050000	19.1N 104.6E	PCN 5	T1.0/1.5-/W2.5/21HRS	GMS	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG			MAX-FLT-LVL-WND DIR/VEL/BRG/RNG				ACCRY NAV/MET		EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST				MSN NO.
1	300300	13.9N 126.3E	1500FT		1002	30	110	55	160	33	090	100	3	5				+25	+25	28	2
2	011311	13.8N 118.6E	700MB	3021					090	59	340	55	4	7							5
3	011603	13.9N 117.7E	700MB	3026	991				230	36	170	20	8	5			+11	+12	+11		5
4	020143	14.2N 115.9E	700MB	2954		65	340	30	100	70	030	10	10	2							6
5	020418	14.2N 115.8E	700MB	2924	981	45	270	15	020	35	330	30	5	3	CIRCULAR	20	+11	+11	+11		6
6	021323	14.9N 114.7E	700MB	2892					190	80	100	44	10	1							7
7	021600	15.4N 114.2E	700MB	2883	975				150	82	070	37	8	2	CIRCULAR	17	+13	+14	+13		7

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	010500	14.4N 119.3E	LAND				1080/ /////	EYE 60 PCT CI OPEN E	16.3N 120.6E	98321
2	010900	13.7N 119.4E	LAND				3034/ /////		14.8N 120.2E	98426
3	011300	14.1N 118.8E	LAND				60341 /////		14.8N 120.2E	98426
4	011400	13.7N 118.2E	LAND				1163/ 42915	EYE 50 PCT EL OPEN NW	16.3N 120.6E	98321
5	011500	14.1N 118.6E	LAND				60371 /////		14.8N 120.2E	98426
6	011500	13.7N 118.1E	LAND				1064/ 42710	EYE 50 PCT CI OPEN W	16.3N 120.6E	98321
7	011800	13.7N 117.5E	LAND				1091/ 52610	EYE 50 PCT CI OPEN W	16.3N 120.6E	98321

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM LYNN
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
070100Z	8.6	139.7	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070106Z	9.0	138.0	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070112Z	9.2	136.4	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070118Z	9.4	134.8	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070200Z	9.6	133.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070206Z	10.0	131.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070212Z	11.5	129.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070218Z	12.1	128.5	30	13.2	127.0	25.	109.	-5.	15.3	122.4	25.	64.	-20.	16.9	118.6	30.	91.	-5.	18.5	114.8	35.	87.	-15.
070300Z	12.4	127.1	40	12.2	126.7	35.	26.	-5.	13.6	122.0	40.	67.	-5.	15.2	117.2	50.	162.	10.	18.5	112.5	65.	172.	15.
070306Z	13.2	125.6	45	13.4	125.6	45.	12.	0.	15.7	119.9	35.	108.	-10.	17.8	115.6	55.	127.	10.	20.2	112.0	70.	129.	20.
070312Z	14.2	124.4	50	13.8	124.2	55.	27.	5.	16.5	118.8	35.	144.	-5.	19.4	115.0	65.	122.	15.	23.0	112.2	30.	164.	-25.
070318Z	14.4	123.0	45	14.5	123.1	55.	8.	10.	17.8	118.0	40.	146.	5.	20.9	114.7	65.	99.	15.	0.0	0.0	0.	-0.	0.
070400Z	14.7	122.2	45	14.9	121.8	55.	26.	10.	17.3	117.2	50.	109.	10.	20.8	113.0	65.	127.	15.	0.0	0.0	0.	-0.	0.
070406Z	15.2	121.7	45	14.7	121.2	35.	42.	-10.	16.8	117.0	50.	95.	5.	19.7	112.6	65.	100.	15.	0.0	0.0	0.	-0.	0.
070412Z	15.8	121.2	40	15.5	121.3	40.	19.	0.	17.0	118.2	35.	130.	-15.	20.2	114.0	65.	32.	10.	0.0	0.0	0.	-0.	0.
070418Z	16.4	120.1	35	16.3	120.5	35.	24.	0.	18.8	117.2	50.	92.	0.	21.4	112.5	65.	28.	10.	0.0	0.0	0.	-0.	0.
070500Z	17.2	119.1	40	16.9	119.3	45.	21.	5.	20.0	115.0	65.	6.	15.	22.9	110.2	25.	135.	-20.	0.0	0.0	0.	-0.	0.
070506Z	18.2	117.8	45	18.1	117.4	45.	23.	0.	21.6	112.4	60.	135.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070512Z	18.9	117.1	50	19.2	116.6	50.	33.	0.	22.4	111.8	35.	151.	-20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070518Z	19.6	115.8	50	19.8	115.6	45.	16.	-5.	22.6	111.3	25.	122.	-30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070600Z	20.0	115.1	50	20.5	114.8	45.	34.	-5.	23.2	111.7	25.	87.	-20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070606Z	20.2	114.3	50	20.6	113.9	40.	33.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070612Z	20.7	113.8	55	21.0	113.5	45.	25.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070618Z	21.3	113.0	55	21.3	112.9	45.	6.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070700Z	21.9	112.4	45	21.9	112.4	35.	0.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070706Z	22.8	111.4	30	22.8	111.6	30.	11.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070712Z	23.5	110.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	26.	104.	102.	138.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	14.	34.	55.	88.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	5.	12.	13.	19.	0.	0.	0.	0.
AVG INTENSITY BIAS	-2.	-6.	8.	-1.	0.	0.	0.	0.
NUMBER OF FORECASTS	19	14	10	4	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1992. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL STORM LYNN
FIX POSITIONS FOR CYCLONE NO. 7

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	300531	7.4N	143.1E	PCN 5		NOAA7		PGTW
*	2	012336	9.0N	134.6E	PCN 6	T0.5/0.5	NOAA6	INIT OBS	PGTW
	3	020510	10.0N	131.3E	PCN 5		NOAA7		PGTW
	4	020510	10.0N	132.6E	PCN 5	T1.0/1.0	NOAA7	INIT OBS	RPMK
	5	020900	10.3N	130.5E	PCN 5		GMS		PGTW
	6	021034	11.8N	129.9E	PCN 5		NOAA6		PGTW
	7	021200	12.2N	129.3E	PCN 5		GMS		PGTW
*	8	021600	13.0N	127.9E	PCN 5		GMS		PGTW
	9	022100	12.4N	127.2E	PCN 5		GMS		PGTW
	10	022313	12.0N	126.8E	PCN 5	T2.5/2.5 /D2.0/24HRS	NOAA6		PGTW
	11	030300	12.2N	126.2E	PCN 5		GMS		PGTW
	12	030600	13.2N	125.4E	PCN 5		GMS		PGTW
	13	030900	12.9N	124.9E	PCN 5		GMS		PGTW
	14	031200	13.6N	124.3E	PCN 5		GMS		PGTW
	15	031600	14.2N	123.8E	PCN 5		GMS		PGTW
	16	032100	14.5N	122.5E	PCN 5		GMS		PGTW
	17	040000	14.5N	121.9E	PCN 5	T3.0/3.0-/D0.5/25HRS	GMS		PGTW
	18	040031	14.5N	122.2E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RPMK
	19	040300	14.5N	121.7E	PCN 5		GMS		PGTW
	20	040600	14.8N	121.7E	PCN 5		GMS		PGTW
	21	040625	15.1N	121.0E	PCN 5	T2.0/2.0	NOAA7	INIT OBS	RODN
	22	040900	15.3N	121.6E	PCN 5		GMS		PGTW
	23	041129	15.7N	121.2E	PCN 6		NOAA6		PGTW
	24	041129	15.9N	121.2E	PCN 5		NOAA6		RPMK
	25	041600	16.1N	120.8E	PCN 5		GMS		PGTW
	26	042100	16.7N	119.5E	PCN 5		GMS		PGTW
	27	050000	16.7N	119.3E	PCN 5	T3.0/3.0+/S0.0/24HRS	GMS		PGTW
	28	050008	17.8N	119.4E	PCN 5	T3.0/3.0+/S0.0/24HRS	NOAA6		RPMK
	29	050300	17.6N	118.1E	PCN 5		GMS		PGTW
	30	050617	18.5N	117.8E	PCN 5		NOAA7		PGTW
	31	050900	18.7N	117.6E	PCN 5		GMS		PGTW
	32	051106	18.9N	117.2E	PCN 5		NOAA6		PGTW
	33	051200	18.9N	117.1E	PCN 5		GMS		PGTW
	34	052100	20.3N	115.4E	PCN 5		GMS		PGTW
	35	052345	20.0N	115.4E	PCN 5	T3.0/3.0 /S0.0/24HRS	NOAA6		PGTW
	36	060000	19.9N	115.1E	PCN 5		GMS		PGTW
	37	060300	20.2N	113.9E	PCN 5		GMS		PGTW
	38	060608	20.3N	114.3E	PCN 5		NOAA7		PGTW
	39	060900	20.6N	114.0E	PCN 5		GMS		PGTW
	40	061200	20.6N	113.7E	PCN 5		GMS		PGTW
	41	061224	20.8N	113.8E	PCN 4		NOAA6		RPMK
	42	061600	20.9N	112.9E	PCN 5		GMS		PGTW
	43	062100	21.3N	112.2E	PCN 5		GMS		PGTW
	44	070000	22.0N	111.8E	PCN 5		GMS		PGTW
	45	070103	21.3N	111.7E	PCN 3	T3.0/3.0-	NOAA6	INIT OBS	RODN
	46	070103	21.8N	111.7E	PCN 5	T3.5/3.5	NOAA6	INIT OBS	RPMK

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	030059	12.5N 126.9E	1500FT		999	40 060 15	230 44 210 60	3 5			+25 +24 +24	2
2	030419	13.1N 126.1E	700MB	3033	993	60 110 30	120 57 360 25	5 4			+10 +12 +12	2
3	050342	17.8N 118.1E	700MB	3012	998	40 340 25	240 44 150 105	9 10			+13 +14 +14	4
4	051510	19.4N 115.9E	700MB	3039			180 48 080 90	5 10			+10 +11 + 8	5

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	030900	13.8N 125.5E	LAND				22402 424//		14.0N 124.3E	98447
2	031000	13.8N 125.0E	LAND				20583 529//		14.0N 124.3E	98447
3	031200	14.2N 124.6E	LAND				20663 53019		14.0N 124.3E	98447
4	031300	14.1N 124.0E	LAND				20613 53035		14.0N 124.3E	98447
5	031400	14.7N 123.5E	LAND				20643 /////		14.0N 124.3E	98447
6	031400	14.6N 123.4E	LAND				///// /////		16.3N 120.6E	98321
7	031500	14.9N 123.2E	LAND				2///3 52927		14.0N 124.3E	98447
8	031600	14.8N 123.1E	LAND				1050/ 53016		16.3N 120.6E	98321
9	032000	14.9N 123.5E	LAND				116// 53015	EYE 80 PCT EL OPEN NW	16.3N 120.6E	98321
10	032100	15.1N 123.1E	LAND				4//// 43010		16.3N 120.6E	98321
11	032300	14.8N 122.7E	LAND				4//// 72625		16.3N 120.6E	98321
12	040000	14.8N 122.8E	LAND				4//// 43305		16.3N 120.6E	98321
13	040100	14.5N 122.8E	LAND				11983 42305		16.3N 120.6E	98321
14	040200	14.9N 122.2E	LAND				10724 43007		16.3N 120.6E	98321
15	040230	14.9N 122.2E	LAND				10714 40000		16.3N 120.6E	98321
16	040300	14.9N 122.1E	LAND				10934 42805		16.3N 120.6E	98321
17	040400	15.0N 122.1E	LAND				11844 43303		16.3N 120.6E	98321
18	040500	15.0N 122.1E	LAND				1042/ 50000		16.3N 120.6E	98321
19	040530	15.1N 122.1E	LAND				1069/ 43606		16.3N 120.6E	98321
20	040600	15.2N 122.0E	LAND				1042/ 43208	EYE 100 PCT CI	16.3N 120.6E	98321
21	040630	15.3N 122.0E	LAND				1183/ 43604		16.3N 120.6E	98321
22	040730	15.4N 122.0E	LAND				1093/ 53606		16.3N 120.6E	98321
23	040800	15.5N 121.9E	LAND				1191/ 43205		16.3N 120.6E	98321
24	040830	15.6N 121.9E	LAND				1078/ 43405		16.3N 120.6E	98321
25	040900	15.6N 121.9E	LAND				1071/ 43601		16.3N 120.6E	98321
26	041000	15.7N 121.8E	LAND				1025/ 53405		16.3N 120.6E	98321
27	041200	15.9N 121.5E	LAND				1021/ 43305		16.3N 120.6E	98321
28	041300	16.1N 121.3E	LAND				1023/ 45011		16.3N 120.6E	98321
29	041400	16.3N 121.7E	LAND				1017/ 43406		16.3N 120.6E	98321
30	041530	16.3N 120.9E	LAND				25/// 43510		16.3N 120.6E	98321
31	041600	16.6N 121.0E	LAND				1086/ 43308		16.3N 120.6E	98321
32	041700	16.9N 120.9E	LAND				25/// 53506		16.3N 120.6E	98321
33	042000	16.9N 119.9E	LAND				1020/ /////		16.3N 120.6E	98321
34.	042030	17.1N 119.9E	LAND				1149/ 43610		16.3N 120.6E	98321
35	042100	17.1N 119.7E	LAND				1141/ 53428		16.3N 120.6E	98321
36	042200	18.0N 118.8E	LAND				10341 42916		16.3N 120.6E	98321
37	050000	18.1N 118.4E	LAND				204// 52020		16.3N 120.6E	98321
38	050100	18.3N 118.2E	LAND				1059/ 53112		16.3N 120.6E	98321
39	050130	18.3N 118.0E	LAND				1073/ 42915		16.3N 120.6E	98321
40	050200	18.1N 117.7E	LAND				1074/ 42610		16.3N 120.6E	98321
41	050300	18.1N 117.5E	LAND				1168/ 52409		16.3N 120.6E	98321
42	050330	18.1N 117.5E	LAND				1179/ 40000		16.3N 120.6E	98321
43	050400	18.1N 117.5E	LAND				1188/ 4////		16.3N 120.6E	98321
44	050430	18.1N 117.5E	LAND				1181/ 40000	EYE 60 PCT EL OPEN NW	16.3N 120.6E	98321
45	050500	18.2N 117.5E	LAND				1081/ 40000	EYE 50 PCT CI OPEN SW	16.3N 120.6E	98321
46	050700	18.4N 117.4E	LAND				4//// /////		16.3N 120.6E	98321
47	050800	18.9N 117.3E	LAND				4//// 53430		16.3N 120.6E	98321
48	051800	19.9N 115.8E	LAND				65/// /////		22.3N 114.2E	45005
49	052000	20.0N 115.3E	LAND				55/// 62815		22.3N 114.2E	45005
50	052100	20.3N 115.0E	LAND				55/// 72916		22.3N 114.2E	45005
51	052200	20.3N 114.8E	LAND				55/// 52815		22.3N 114.2E	45005
52	060000	20.4N 114.8E	LAND				65/// /////		22.3N 114.2E	45005
53	060200	20.1N 114.8E	LAND				20901 /////		22.3N 114.2E	45005
54	060300	20.1N 114.6E	LAND				20/// /////		22.3N 114.2E	45005
55	060400	20.1N 114.6E	LAND				65/// /////		22.3N 114.2E	45005
56	060500	20.1N 114.3E	LAND				65/// /////		22.3N 114.2E	45005
57	060600	20.1N 114.3E	LAND				65/// /////		22.3N 114.2E	45005
58	060700	20.2N 114.2E	LAND				65/// /////		22.3N 114.2E	45005
59	060800	20.4N 114.2E	LAND				65/// /////		22.3N 114.2E	45005
60	060900	20.3N 114.2E	LAND				65/// /////		22.3N 114.2E	45005
61	061000	20.5N 114.0E	LAND				65/// /////		22.3N 114.2E	45005
62	061100	20.6N 114.0E	LAND				65/// /////		22.3N 114.2E	45005
63	061200	20.7N 113.9E	LAND				65/// /////		22.3N 114.2E	45005
64	061300	20.8N 113.8E	LAND				65/// /////		22.3N 114.2E	45005
65	061400	20.9N 113.6E	LAND				65/// /////		22.3N 114.2E	45005
66	061500	21.0N 113.4E	LAND				65/// /////		22.3N 114.2E	45005
67	061600	21.2N 113.2E	LAND				65/// /////		22.3N 114.2E	45005
68	061700	21.3N 113.2E	LAND				65/// /////		22.3N 114.2E	45005
69	061800	21.4N 113.1E	LAND				55/// /////		22.3N 114.2E	45005
70	061900	21.5N 113.1E	LAND				55/// /////		22.3N 114.2E	45005
71	062000	21.6N 113.0E	LAND				55/// /////		22.3N 114.2E	45005
72	062100	21.7N 112.9E	LAND				55/// /////		22.3N 114.2E	45005
73	062200	21.8N 112.8E	LAND				65/// 83207		22.3N 114.2E	45005
74	062300	21.8N 112.8E	LAND				55/// 83107		22.3N 114.2E	45005
75	070000	21.8N 112.6E	LAND				55/// 72907		22.3N 114.2E	45005
76	070100	22.0N 112.4E	LAND				55/// 73108		22.3N 114.2E	45005
77	070200	22.2N 112.1E	LAND				55/// 73015		22.3N 114.2E	45005
78	070300	22.5N 112.0E	LAND				55/// 83112		22.3N 114.2E	45005

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM MAURY
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST.				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
071700Z	18.9	130.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071706Z	19.3	129.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071712Z	19.4	129.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071718Z	19.7	128.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071800Z	20.2	127.7	35	20.5	129.5	35.	102.	0.	21.8	126.0	55.	218.	0.	23.7	122.2	70.	215.	40.	0.0	0.0	0.	-0.	0.
071806Z	21.3	126.6	45	20.8	126.6	40.	30.	-5.	22.8	122.8	60.	132.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071812Z	22.8	126.1	50	21.1	125.4	45.	109.	-5.	23.2	120.5	45.	131.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071818Z	24.3	125.9	55	21.5	124.2	50.	192.	-5.	23.6	119.6	50.	112.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071900Z	25.1	124.3	55	25.0	124.3	60.	6.	5.	27.3	119.7	35.	105.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071906Z	25.0	123.0	55	25.0	123.0	65.	0.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071912Z	25.2	121.5	40	25.3	121.0	35.	28.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
071918Z	25.4	120.2	35	25.6	120.0	35.	16.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072000Z	25.7	118.9	30	25.6	118.9	30.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	54.	140.	215.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	34.	99.	81.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	6.	40.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-1.	6.	40.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 869. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

TROPICAL STORM MAURY
FIX POSITIONS FOR CYCLONE NO. 8

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	162255	19.3N	131.4E	PCN 3	T1.0/1.0	NOAA6	INIT OBS	PGTW
	2	162255	19.0N	131.3E	PCN 5	T0.5/0.5	NOAA6	INIT OBS	RPMK
	3	170542	19.8N	129.8E	PCN 5		NOAA7		PGTW
*	4	172231	21.1N	130.4E	PCN 5	T1.5/1.5 /D0.5/24HRS	NOAA6		PGTW
	5	180531	20.9N	127.6E	PCN 5		NOAA7		PGTW
	6	180900	21.6N	125.9E	PCN 5		GMS		PGTW
*	7	181600	22.2N	128.5E	PCN 5		GMS	BROKE CONTINUITY	PGTW
	8	182100	25.3N	125.5E	PCN 5		GMS		PGTW
	9	182350	25.5N	124.0E	PCN 5	T4.0/4.0-/D2.5/25HRS	NOAA6		PGTW
	10	190519	25.5N	123.0E	PCN 5		NOAA7		PGTW
	11	190900	25.4N	121.8E	PCN 5		GMS		PGTW
	12	191047	25.2N	121.2E	PCN 5		NOAA6		PGTW
	13	191200	25.2N	120.5E	PCN 5		GMS		PGTW
	14	191600	25.3N	121.0E	PCN 5		GMS		PGTW
	15	192100	25.5N	119.6E	PCN 5		GMS		PGTW
	16	192327	25.4N	119.4E	PCN 5	T1.5/1.5-/W2.5/24HRS	NOAA6		PGTW
	17	200600	25.7N	117.6E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION		FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG			MAX-FLT-LVL-WND DIR/VEL/BRG/RNG				ACCRY NAV/MET		EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST				MSN NO.
1	180312	20.5N	127.3E	1500FT		995	45	100	150	240	46	120	140	5	4			+25	+26	+23	27	1
2	180405	21.2N	127.8E	700MB	3018		45	160	140	330	21	260	30	5	15			+13	+12			1
3	190543	24.7N	123.2E	700MB	2998	985	30	100	170	180	35	070	110	4	4			+13	+18	+ 7		2

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM NINA
BEST TRACK DATA

	BEST TRACK		WARNING					24 HOUR FORECAST						48 HOUR FORECAST						72 HOUR FORECAST					
						ERRORS					ERRORS						ERRORS								
MO/DA/HR	POSIT	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
072200Z	25.3 122.9	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072206Z	26.1 121.8	35	26.0	122.0	30.	12.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072212Z	26.7 121.0	35	26.8	120.8	30.	12.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072218Z	27.2 120.4	30	27.4	120.2	30.	16.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072300Z	27.6 120.0	25	27.6	119.9	25.	5.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	11.	0.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	4.	0.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	3.	0.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-3.	0.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	4	0	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 200. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM NINA
FIX POSITIONS FOR CYCLONE NO. 9

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	212100	25.8N 123.9E	PCN 5		GMS		PGTW
2	220000	25.6N 123.0E	PCN 5	T1.0/1.0	GMS	INIT OBS	PGTW
* 3	220022	25.1N 121.5E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	RODN
4	220022	25.1N 123.0E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	RPMK
5	220300	26.0N 122.4E	PCN 3		GMS		PGTW
6	220627	26.0N 121.5E	PCN 3	T1.5/1.5	NOAA7	INIT OBS	RODN
7	220900	26.2N 121.1E	PCN 5		GMS		PGTW
8	221200	26.4N 120.6E	PCN 5		GMS		PGTW
9	221600	26.9N 120.5E	PCN 5		GMS		PGTW
10	221912	27.0N 119.4E	PCN 3		NOAA7		RPMK
11	222100	26.8N 120.3E	PCN 5		GMS		PGTW
12	222359	27.6N 120.9E	PCN 5	T1.5/1.5-/D0.5/24HRS	NOAA6		RPMK

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	300400	30.9N 135.4E	LAND				248// /////		33.3N 134.2E	47899
2	300400	31.0N 135.8E	LAND	POOR				MOVG 3135	33.6N 135.8E	
3	300500	30.9N 135.2E	LAND				35/6/ 52711		33.3N 134.2E	47899
4	300600	31.0N 134.7E	LAND	POOR		20			31.3N 131.9E	
5	300600	31.0N 134.9E	LAND				35/1/ 53016		33.3N 134.2E	47899
6	300600	31.1N 134.8E	LAND	POOR				MOVG 3135	33.6N 135.8E	
7	300700	31.1N 134.4E	LAND				55/1/ 52827		33.3N 134.2E	47899
8	300700	31.0N 134.3E	LAND	POOR		35			31.3N 131.9E	
9	300700	31.2N 134.3E	LAND	POOR				MOVG 2835	33.6N 135.8E	
10	300800	31.2N 134.0E	LAND	POOR		40			31.3N 131.9E	
11	300800	31.1N 134.1E	LAND				55/41 52716		33.3N 134.2E	47899
12	300900	31.2N 133.7E	LAND	POOR		40			31.3N 131.9E	
13	300900	31.4N 133.5E	LAND				21/71 53032		33.3N 134.2E	47899
14	301000	31.2N 133.4E	LAND	POOR		40			31.3N 131.9E	
15	301000	31.3N 133.3E	LAND				52911 52816		33.3N 134.2E	47899
16	301100	31.2N 132.8E	LAND				6///1 5////		30.6N 131.0E	47869
17	301100	31.2N 133.1E	LAND				65/41 52616		33.3N 134.2E	47899
18	301100	31.2N 133.1E	LAND	POOR		40			31.3N 131.9E	
19	301200	31.2N 132.8E	LAND				65/41 52616		33.3N 134.2E	47899
20	301200	31.2N 132.7E	LAND				6///1 52408		30.6N 131.0E	47869
21	301200	31.2N 132.8E	LAND	POOR		40			31.3N 131.9E	
22	301255	31.3N 132.7E	LAND	POOR					32.1N 131.5E	47854
23	301300	31.2N 132.5E	LAND				65/4/ 52716		33.3N 134.2E	47899
24	301300	31.2N 132.6E	LAND				6///1 53005		30.6N 131.0E	47869
25	301300	31.2N 132.7E	LAND	POOR		40			31.3N 131.9E	
26	301355	31.3N 132.3E	LAND	POOR				MOVG W	32.1N 131.5E	47854
27	301400	31.3N 132.2E	LAND				65/4/ 52816		33.3N 134.2E	47899
28	301400	31.2N 132.2E	LAND				5///1 52722		30.6N 131.0E	47869
29	301400	31.3N 132.4E	LAND	FAIR		40			31.3N 131.9E	
30	301455	31.5N 132.0E	LAND	FAIR				MOVG WNW	32.1N 131.5E	47854
31	301500	31.4N 131.9E	LAND				65/4/ 53022		33.3N 134.2E	47899
32	301500	31.4N 131.8E	LAND				52911 /////		33.4N 130.3E	47806
33	301500	31.4N 131.9E	LAND				5///1 53022		30.6N 131.0E	47869
34	301500	31.5N 132.1E	LAND	FAIR		40			34.2N 130.8E	47762
35	301555	31.5N 131.8E	LAND	FAIR				MOVG WNW	32.1N 131.5E	47854
36	301600	31.5N 131.7E	LAND				5///1 53011		30.6N 131.0E	47869
37	301600	31.5N 131.6E	LAND				21912 52911		33.4N 130.3E	47806
38	301600	31.5N 131.7E	LAND	FAIR		40			33.4N 130.3E	
39	301655	31.7N 131.5E	LAND	FAIR				MOVG WNW	32.1N 131.5E	47854
40	301700	31.7N 131.5E	LAND	FAIR		40		MOVG 2830	33.4N 130.3E	
41	301700	31.6N 131.3E	LAND				21912 53016		33.4N 130.3E	47806
42	301700	31.6N 131.3E	LAND				5///1 53019		30.6N 131.0E	47865
43	301755	31.8N 131.1E	LAND	FAIR				MOVG WNW	32.1N 131.5E	47854
44	301800	31.7N 131.2E	LAND	FAIR		40		MOVG 3140	33.4N 130.3E	
45	301800	31.7N 131.0E	LAND				5///1 52922		30.6N 131.0E	47869
46	301800	31.7N 131.1E	LAND				21812 53111		33.4N 130.3E	47806
47	301855	31.8N 131.1E	LAND	FAIR				MOVG WNW	32.1N 131.5E	47854
48	301900	31.8N 131.0E	LAND	FAIR		40		MOVG 3130	33.4N 130.3E	
49	301900	31.8N 130.9E	LAND				21712 53111		33.4N 130.3E	47806
50	301900	31.9N 130.8E	LAND				6///1 53119		30.6N 131.0E	47869
51	301900	32.1N 131.1E	LAND				65112 52811		34.3N 132.6E	47792
52	302000	31.9N 130.5E	LAND				6///1 52716		30.6N 131.0E	47869
53	302000	32.1N 130.7E	LAND	POOR		40			32.7N 128.8E	47844
54	302000	32.2N 130.8E	LAND				65//2 52916		34.3N 132.6E	47792
55	302100	32.3N 130.2E	LAND	FAIR		40		MOVG 3030	32.7N 128.8E	47844
56	302100	32.2N 130.4E	LAND				31352 53213		33.4N 130.3E	47806
57	302200	32.4N 130.1E	LAND				35/11 43119		33.4N 130.3E	47806
58	302300	32.6N 129.9E	LAND	FAIR		35			32.7N 128.8E	47844
59	302300	32.6N 129.8E	LAND				10283 52922		33.4N 130.3E	47806
60	310000	32.8N 129.5E	LAND	FAIR				MOVG NW	32.7N 128.8E	47844
61	310000	32.8N 129.5E	LAND				11563 53122		33.4N 130.3E	47806
62	310100	32.8N 129.2E	LAND	FAIR		30			32.7N 128.8E	47844
63	310100	32.9N 129.0E	LAND				21733 53022		33.4N 130.3E	47806
64	310200	32.9N 129.0E	LAND	POOR		30			32.7N 128.8E	47844
65	310200	33.0N 128.9E	LAND				21742 53005		33.4N 130.3E	47806
66	310300	33.0N 128.7E	LAND	FAIR		45			33.4N 130.3E	
67	310300	33.0N 128.8E	LAND				21862 52705		33.4N 130.3E	47806
68	310400	33.2N 128.2E	LAND	FAIR		55		MOVG WNW	33.4N 130.3E	
69	310400	32.9N 128.3E	LAND				31812 52624		33.4N 130.3E	47806
70	310500	33.2N 128.2E	LAND	POOR		30		STNRY	33.4N 130.3E	
71	310500	33.0N 128.2E	LAND				33962 53111		33.4N 130.3E	47806
72	310600	33.2N 128.1E	LAND	POOR		22			33.4N 130.3E	
73	310600	33.2N 128.1E	LAND				33942 53413		33.4N 130.3E	47806

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON OGDEN
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
072700Z	22.5	150.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072706Z	23.1	149.0	25	22.8	148.6	30.	28.	5.	25.0	146.4	45.	35.	10.
072712Z	23.7	148.2	30	23.4	148.7	30.	33.	0.	25.4	146.8	45.	117.	0.
072718Z	24.1	147.4	30	24.5	147.5	30.	25.	0.	27.4	144.8	45.	93.	-5.
072800Z	24.6	146.6	35	24.5	146.3	30.	17.	-5.	26.0	142.3	30.	81.	-20.
072806Z	25.2	145.8	35	25.2	146.0	35.	11.	0.	27.8	142.9	35.	112.	-15.
072812Z	25.9	144.7	45	25.9	145.3	35.	32.	-10.	28.0	141.9	35.	135.	-20.
072818Z	26.6	143.3	50	26.9	143.4	40.	19.	-10.	29.8	137.3	50.	55.	-5.
072900Z	27.3	141.9	50	27.8	142.2	45.	34.	-5.	30.2	137.9	40.	58.	-15.
072906Z	28.1	140.8	50	28.2	140.7	55.	8.	5.	30.6	135.7	45.	38.	-10.
072912Z	28.8	139.5	55	29.1	139.5	55.	18.	0.	31.9	134.7	45.	110.	-20.
072918Z	29.3	138.2	55	29.4	138.1	50.	8.	-5.	31.9	133.0	45.	92.	-10.
073000Z	30.0	136.8	55	30.1	136.6	50.	12.	-5.	32.4	131.6	35.	108.	-5.
073006Z	30.8	135.0	55	30.7	134.8	50.	12.	-5.	33.0	130.2	25.	116.	-15.
073012Z	31.2	132.7	65	31.8	132.9	55.	37.	-10.	0.0	0.0	0.	-0.	0.
073018Z	31.8	131.2	55	31.8	131.1	45.	5.	-10.	0.0	0.0	0.	-0.	0.
073100Z	32.8	129.5	40	32.6	129.6	35.	13.	-5.	36.2	123.1	30.	131.	5.
073106Z	33.2	127.9	40	33.1	128.2	35.	16.	-5.	0.0	0.0	0.	-0.	0.
073112Z	33.8	126.8	35	33.7	126.8	30.	6.	-5.	0.0	0.0	0.	-0.	0.
073118Z	34.8	126.2	30	33.2	127.8	30.	124.	0.	0.0	0.0	0.	-0.	0.
080100Z	36.0	125.8	25	36.0	125.8	25.	0.	0.	0.0	0.0	0.	-0.	0.

	48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
072700Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072706Z	28.8	144.8	50.	214.	0.	32.5	145.0	45.	518.	-10.
072712Z	29.8	145.1	45.	298.	-10.	35.4	147.8	40.	793.	-25.
072718Z	31.2	141.7	45.	213.	-10.	36.8	144.8	35.	698.	-20.
072800Z	28.3	139.2	25.	161.	-30.	0.0	0.0	0.	-0.	0.
072806Z	30.0	139.2	25.	222.	-30.	0.0	0.0	0.	-0.	0.
072812Z	29.7	137.3	25.	253.	-40.	0.0	0.0	0.	-0.	0.
072818Z	31.2	133.0	45.	98.	-10.	0.0	0.0	0.	-0.	0.
072900Z	32.3	133.6	35.	209.	-5.	0.0	0.0	0.	-0.	0.
072906Z	33.3	131.9	30.	200.	-10.	0.0	0.0	0.	-0.	0.
072912Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
072918Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073000Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073006Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073012Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073018Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073100Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073106Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073112Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073118Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080100Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	23.	91.	208.	670.	17.	88.	208.	670.
AVG RIGHT ANGLE ERROR	14.	46.	93.	477.	15.	39.	93.	477.
AVG INTENSITY MAGNITUDE ERROR	5.	11.	16.	18.	6.	12.	16.	18.
AVG INTENSITY BIAS	-4.	-9.	-16.	-18.	-5.	-10.	-16.	-18.
NUMBER OF FORECASTS	20	14	9	3	15	13	9	3

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1542. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TYPHOON OGDEN
FIX POSITIONS FOR CYCLONE NO. 10

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	262227	23.5N 149.3E	PCN 5	T1.5/1.5	NOAA6	INIT OBS	PGTW
2	270300	22.8N 149.2E	PCN 5		GMS		PGTW
3	270900	23.8N 149.4E	PCN 5		GMS		PGTW
* 4	270925	26.3N 148.4E	PCN 6		NOAA6		RODN
* 5	271200	24.4N 149.2E	PCN 5		GMS		PGTW
* 6	271600	25.0N 148.7E	PCN 5		GMS		PGTW
7	272204	24.4N 146.8E	PCN 3	T2.0/2.0 /D0.5/24HRS	NOAA6	EXP LLCC	PGTW
8	280336	25.0N 145.9E	PCN 3		NOAA7		PGTW
9	280902	25.7N 145.5E	PCN 5		NOAA6		PGTW
* 10	280902	27.9N 144.3E	PCN 4		NOAA6		RODN
11	281200	26.6N 145.0E	PCN 5		GMS		PGTW
12	281600	26.9N 144.0E	PCN 5		GMS		PGTW
13	282100	27.3N 142.9E	PCN 5		GMS		PGTW
14	282322	27.5N 142.5E	PCN 5	T3.0/3.0 /D1.0/25HRS	NOAA6		PGTW
15	290300	28.0N 141.4E	PCN 3		GMS		PGTW
16	290900	28.8N 140.2E	PCN 3		GMS		PGTW
17	291020	28.7N 139.6E	PCN 3		NOAA6		PGTW
18	291200	28.9N 139.4E	PCN 3		GMS		PGTW
19	291600	29.2N 138.6E	PCN 3		GMS		PGTW
20	291800	29.4N 138.0E	PCN 5		GMS		PGTW
21	292100	29.5N 137.5E	PCN 3		GMS		PGTW
22	292259	30.0N 137.1E	PCN 3	T2.5/3.0 /W0.5/24HRS	NOAA6		PGTW
23	300300	30.6N 135.9E	PCN 3		GMS		PGTW
24	300900	31.4N 133.9E	PCN 3		GMS		PGTW
25	300957	31.4N 133.4E	PCN 3		NOAA6		PGTW
26	301200	31.5N 132.8E	PCN 3		GMS		PGTW
27	301600	31.7N 131.8E	PCN 3		GMS		PGTW
28	302100	32.4N 130.5E	PCN 5		GMS		PGTW
29	302236	32.6N 129.9E	PCN 5	T2.5/2.5+/S0.0/24HRS	NOAA6		PGTW
30	310300	32.9N 128.5E	PCN 3		GMS		PGTW
31	310900	33.4N 127.6E	PCN 5		GMS		PGTW
32	311200	33.9N 127.0E	PCN 5		GMS		PGTW
33	311600	34.6N 126.3E	PCN 5		GMS		PGTW
34	312100	35.5N 125.8E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	271326	23.9N 147.9E	700MB	3070			110 40 050 60	2 3			+13 +10	2
2	271601	24.2N 147.6E	700MB	3069	998		240 30 140 95	2 3			+12 +15 + 8	2
3	280300	24.9N 146.4E	700MB	3019	993	35 170 15	160 30 030 20	3 5			26	3
4	281313	26.2N 144.2E	700MB	2996			180 33 080 15	4 5			+14 +13 +13	4
5	281554	26.8N 143.7E	700MB	2974	987		110 49 350 120	6 5			+16 +13 +11	4
6	290320	27.8N 141.2E	700MB	2946	985	35 040 15	230 53 160 60	2 10			+13 +12 +12	5
7	291332	28.8N 138.8E	700MB	2922			120 50 040 60	3 2				6
8	291607	29.2N 138.4E	700MB	2920	981		070 40 320 20	3 4			+13 +14 +12	6
9	300007	29.9N 136.6E	700MB	2970		50 320 40	060 60 320 63	4 5				7
10	300245	30.1N 135.8E	700MB	2949	984	60 030 70	160 70 030 70	4 5			+12 +14 +11	7
11	301310	31.2N 132.2E	700MB	2886	976		180 70 140 22	2 8			+13 +15 +11	8

TROPICAL DEPRESSION 11
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
						ERRORS					ERRORS					ERRORS							
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
073112Z	18.0	141.5	20	17.8	144.8	30.	188.	10.	18.8	142.2	40.	69.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
073118Z	18.2	142.2	20	17.9	144.2	30.	115.	10.	18.7	141.7	40.	119.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080100Z	18.3	142.7	20	17.6	141.1	30.	100.	10.	18.4	137.5	40.	375.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080106Z	18.4	143.1	20	18.3	143.1	30.	6.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080112Z	18.6	143.4	20	17.4	144.0	30.	79.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080118Z	18.8	143.8	20	17.2	143.9	30.	96.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080200Z	19.0	144.1	20	18.5	143.5	30.	45.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	90.	188.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	50.	113.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	10.	20.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	10.	20.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	7	3	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 161. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 4. KNOTS

TROPICAL DEPRESSION TD-11
FIX POSITIONS FOR CYCLONE NO. 11

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	302236	17.9N	143.1E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	PGTW
2	310000	17.7N	143.3E	PCN 5		GMS		PGTW
3	310934	17.7N	145.1E	PCN 6		NOAA6		PGTW
4	311200	17.8N	144.9E	PCN 5		GMS		PGTW
5	311600	17.5N	144.5E	PCN 5		GMS		PGTW
6	312100	17.3N	141.9E	PCN 5		GMS		PGTW
7	010000	16.6N	141.5E	PCN 5	T1.5/1.5 /D0.5/25HRS	GMS		PGTW
8	010300	17.1N	146.5E	PCN 5		GMS		PGTW
9	010432	17.4N	146.2E	PCN 5		NOAA7		PGTW
10	010600	17.5N	145.5E	PCN 5		GMS		PGTW
11	011200	17.4N	144.0E	PCN 5		GMS		PGTW
12	011600	17.1N	143.9E	PCN 6		GMS		PGTW
13	011718	17.2N	144.0E	PCN 5		NOAA7		PGTW
14	012150	17.3N	143.6E	PCN 5	T1.5/1.5 /S0.0/22HRS	NOAA6		PGTW
15	021200	19.6N	139.0E	PCN 5		GMS		PGTW

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION		INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	010000	18.2N	142.8E	20	30	
2	020000	19.0N	144.0E	25	70	

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM PHYLLIS
BEST TRACK DATA

	BEST TRACK			WARNING				
							ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND
080300Z	25.8	146.5	30	0.0	0.0	0.	-0.	0.
080306Z	27.7	146.7	35	27.7	147.6	35.	48.	0.
080312Z	28.9	146.6	40	28.0	147.9	40.	87.	0.
080318Z	29.9	146.2	40	29.7	145.7	40.	29.	0.
080400Z	31.0	146.1	45	31.0	145.5	40.	31.	-5.
080406Z	32.1	146.1	45	32.0	145.2	35.	62.	-10.
080412Z	33.4	146.0	40	0.0	0.0	0.	-0.	0.
080418Z	35.0	145.3	35	0.0	0.0	0.	-0.	0.

	24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
				ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
080300Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080306Z	29.5	145.2	45.	162.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080312Z	30.6	146.8	50.	172.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080318Z	32.7	142.7	50.	188.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080400Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080406Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080412Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080418Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	51.	174.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	43.	87.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	3.	8.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-3.	8.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	5	3	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 560. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL STORM PHYLLIS
FIX POSITIONS FOR CYCLONE NO. 12

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	021200	24.8N 147.7E	PCN 5		GMS		PGTW
* 2	021600	25.5N 148.1E	PCN 5		GMS		PGTW
* 3	022100	26.7N 148.3E	PCN 5		GMS		PGTW
4	030000	25.4N 146.2E	PCN 3	T1.0/1.0	GMS	INIT OBS	PGTW
5	030300	27.3N 146.2E	PCN 5		GMS		PGTW
6	030410	27.1N 146.5E	PCN 3		NOAA7		PGTW
7	030600	27.5N 147.3E	PCN 5		GMS		PGTW
* 8	030900	27.6N 147.7E	PCN 5		GMS		PGTW
9	031600	29.6N 146.2E	PCN 5		GMS		PGTW
10	031655	29.3N 146.4E	PCN 3		NOAA7		PGTW
11	032100	30.5N 146.1E	PCN 5		GMS		PGTW
12	032245	31.0N 146.6E	PCN 5		NOAA6		PGTW
13	040000	31.1N 146.7E	PCN 5	T1.0/1.0 /S0.0/24HRS	GMS		PGTW
14	040300	32.1N 146.8E	PCN 5		GMS		PGTW
15	040900	32.3N 146.9E	PCN 5		GMS		PGTW
16	040943	32.8N 146.8E	PCN 3		NOAA6		PGTW
17	041200	32.9N 146.1E	PCN 5		GMS		PGTW
18	041600	33.8N 146.6E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	030510	27.6N 146.6E	1500FT		983	50 030 80	070 52 030 80	3 5			+26 +25 26	1
* 2	040100	31.9N 145.3E	700MB	2916		35 270 60	330 28 240 70	5 5				2
* 3	040300	32.2N 145.3E	700MB	2900		35 280 120	350 35 270 90	5 5			+15 +15 + 7	2

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM ROY
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
080400Z	15.8	115.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080406Z	15.7	114.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080412Z	15.1	115.2	30	15.3	115.2	30.	12.	0.	16.5	115.9	45.	89.	0.	17.4	114.2	50.	282.	0.	19.2	112.0	50.	282.	15.
080418Z	15.3	116.0	35	15.2	115.1	30.	52.	-5.	16.2	115.8	45.	129.	0.	17.4	114.3	50.	276.	5.	19.3	111.9	50.	245.	20.
080500Z	15.8	116.8	35	15.8	116.9	35.	6.	0.	18.8	117.2	45.	67.	-5.	19.4	115.6	50.	135.	10.	20.3	113.4	50.	120.	20.
080506Z	16.3	117.2	40	16.3	117.1	35.	6.	-5.	18.4	116.8	45.	91.	-5.	19.9	114.8	50.	145.	15.	20.8	112.6	50.	154.	20.
080512Z	16.9	117.4	45	16.9	117.3	40.	6.	-5.	19.9	117.3	35.	94.	-15.	23.3	114.7	25.	199.	-10.	0.0	0.0	0.	-0.	0.
080518Z	17.5	117.6	45	17.6	117.6	40.	6.	-5.	20.8	117.2	35.	86.	-10.	23.5	114.3	25.	210.	-5.	0.0	0.0	0.	-0.	0.
080600Z	17.9	117.9	50	18.5	117.4	45.	46.	-5.	21.6	116.2	45.	118.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080606Z	18.5	118.4	50	18.6	118.2	50.	13.	0.	21.4	118.4	50.	82.	15.	24.0	115.6	25.	277.	-5.	0.0	0.0	0.	-0.	0.
080612Z	19.2	118.8	50	19.4	118.9	55.	13.	5.	22.8	119.3	55.	191.	20.	25.2	116.2	30.	388.	5.	0.0	0.0	0.	-0.	0.
080618Z	19.9	118.4	45	20.2	118.7	45.	25.	0.	23.6	117.0	35.	198.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080700Z	20.3	117.8	40	20.8	118.0	35.	32.	-5.	24.1	115.6	30.	251.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080706Z	20.5	117.3	35	21.1	117.1	30.	38.	-5.	23.9	114.4	25.	270.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080712Z	20.6	116.8	35	21.2	116.8	30.	36.	-5.	23.5	114.4	20.	269.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080718Z	20.4	116.1	30	20.8	116.6	30.	37.	0.	23.0	113.8	20.	264.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080800Z	19.9	115.5	30	20.4	115.4	30.	30.	0.	22.6	112.6	25.	251.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080806Z	19.4	114.9	30	19.6	115.4	30.	31.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080812Z	19.0	114.1	25	19.1	114.1	30.	6.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080818Z	18.6	113.3	25	18.9	113.2	30.	19.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080900Z	18.4	112.5	20	18.5	112.5	30.	6.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	22.	163.	239.	280.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	16.	125.	140.	85.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	3.	7.	7.	19.	0.	0.	0.	0.
AVG INTENSITY BIAS	-1.	0.	2.	19.	0.	0.	0.	0.
NUMBER OF FORECASTS	19	15	8	4	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 830. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TROPICAL STORM ROY
FIX POSITIONS FOR CYCLONE NO. 13

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	030000	14.4N 114.7E	PCN 5		GMS		PGTW
2	030300	14.5N 114.7E	PCN 3		GMS		PGTW
3	040000	15.6N 115.4E	PCN 5		GMS		PGTW
4	040300	16.2N 115.3E	PCN 5	T1.5/1.5	GMS	INIT OBS	PGTW
5	041124	15.2N 115.1E	PCN 5		NOAA6		PGTW
6	041600	14.9N 114.9E	PCN 5		GMS		PGTW
7	042100	15.8N 115.8E	PCN 5		GMS		PGTW
8	050003	15.6N 117.1E	PCN 5	T1.5/1.5	NOAA6	INIT OBS	RODN
9	050300	16.4N 117.2E	PCN 5		GMS		PGTW
10	050600	17.1N 117.2E	PCN 5	T1.5/1.5 /S0.0/27HRS	GMS		PGTW
* 11	050900	17.4N 117.2E	PCN 5		GMS		PGTW
12	051101	17.4N 117.2E	PCN 5		NOAA6		PGTW
13	051200	17.5N 117.2E	PCN 5		GMS		PGTW
14	051600	17.6N 117.5E	PCN 5		GMS		PGTW
15	052100	18.0N 117.5E	PCN 5		GMS		PGTW
16	052340	18,1N 117.8E	PCN 5		NOAA6		PGTW
17	060300	18.2N 117.7E	PCN 5		GMS		PGTW
18	060600	18.7N 118.5E	PCN 3	T3.0/3.0-/D1.5/24HRS	GMS		PGTW
19	060900	18.9N 118.7E	PCN 5		GMS		PGTW
20	061038	19.3N 118.7E	PCN 5		NOAA6		PGTW
21	061200	19.4N 118.6E	PCN 3		GMS		PGTW
22	061600	19.7N 118.2E	PCN 3		GMS		PGTW
23	061945	20.2N 118.5E	PCN 3		NOAA7		RPMK
* 24	061945	21.4N 118.7E	PCN 6		NOAA7		RODN
25	062100	20.3N 117.8E	PCN 3		GMS		PGTW
26	062317	20.4N 117.8E	PCN 3	T2.0/3.0 /W1.0/17HRS	NOAA6		PGTW
27	062317	20.4N 118.0E	PCN 3	T2.5/2.5	NOAA6	INIT OBS	RPMK
28	070058	20.4N 117.9E	PCN 3		NOAA6		RPMK
29	070300	20.4N 117.2E	PCN 5		GMS		PGTW
30	070648	20.4N 117.7E	PCN 3	T1.5/1.5	NOAA7	INIT OBS	RODN
31	070900	20.6N 117.2E	PCN 5		GMS		PGTW
* 32	071156	21.6N 115.5E	PCN 5		NOAA6		RPMK
33	071600	20.2N 116.6E	PCN 5		GMS		PGTW
34	072100	20.2N 115.8E	PCN 5		GMS		PGTW
35	080000	19.9N 115.8E	PCN 3	T1.0/1.5 /W1.0/24HRS	GMS		PGTW
36	080035	20.1N 115.8E	PCN 3	T1.5/1.5 /S0.0/17HRS	NOAA6		RODN
37	080300	19.7N 115.5E	PCN 3		GMS		PGTW
38	080600	19.5N 114.9E	PCN 3		GMS		PGTW
39	080636	19.3N 114.8E	PCN 3	T1.0/2.0 /W1.5/31HRS	NOAA7		RPMK
40	080900	19.3N 114.7E	PCN 5		GMS		PGTW
41	081133	19.6N 114.4E	PCN 6		NOAA6		RODN
42	081200	19.0N 114.2E	PCN 5		GMS		PGTW
43	081600	18.6N 113.7E	PCN 5		GMS		PGTW
44	082100	18.5N 112.9E	PCN 5		GMS		PGTW
45	090000	18.8N 112.1E	PCN 5	T1.0/1.0 /S0.0/24HRS	GMS		PGTW
46	090012	18.5N 112.4E	PCN 5	T1.0/1.0 /S0.0/18HRS	NOAA6		RPMK
47	090300	18.4N 112.0E	PCN 5		GMS		PGTW
* 48	090625	19.5N 111.9E	PCN 5		NOAA7		RODN

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	051301	17.0N 117.4E	700MB	3085			140 39 040 40	10 3				2
2	051514	17.3N 117.5E	700MB	3008	989		280 47 090 115	5 3			+12 +15 +10	2
3	060305	18.1N 118.1E	700MB	2984		50 100 30	200 46 110 60	5 5			+18 +19 + 7	4
4	061230	19.5N 118.5E	700MB	3070			230 33 140 30	5 5				5
5	061523	19.8N 118.0E	700MB	3086	998		120 27 060 90	7 10			+14 +17 +10	5

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	051400	17.0N 117.5E	LAND				4//// 50525		16.3N 120.6E	98321
2	051900	17.3N 117.2E	LAND				1051/ 52930	EYE 50 PCT CI OPEN N	16.3N 120.6E	98321
3	052000	17.4N 117.2E	LAND				1051/ 53406	EYE 50 PCT CI OPEN N	16.3N 120.6E	98321
4	060200	18.0N 117.1E	LAND				5//// 53512	10 DEG SPIRAL OVERLAY	16.3N 120.6E	98321

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM SUSAN
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
080618Z	20.3	166.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080700Z	20.4	166.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080706Z	20.6	165.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080712Z	21.0	165.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080718Z	21.6	165.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080800Z	22.5	165.5	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080806Z	23.5	165.3	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080812Z	24.9	165.0	40	24.4	164.8	45.	32.	5.	27.0	162.9	60.	197.	10.	29.0	160.1	55.	205.	0.	31.2	157.6	45.	176.	0.
080818Z	26.4	164.9	40	25.2	164.8	45.	72.	5.	28.0	163.0	55.	168.	0.	30.4	160.8	50.	143.	-5.	33.1	158.6	40.	86.	0.
080900Z	27.9	164.7	45	28.0	164.5	45.	12.	0.	33.8	162.8	55.	165.	-5.	38.4	163.4	40.	360.	-10.	0.0	0.0	0.	-0.	0.
080906Z	29.2	164.4	45	29.4	164.2	50.	16.	5.	35.2	162.4	55.	210.	-5.	39.5	164.4	40.	434.	-10.	0.0	0.0	0.	-0.	0.
080912Z	30.2	163.8	50	30.8	164.2	50.	41.	0.	36.2	163.4	50.	257.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
080918Z	30.8	162.8	55	31.6	163.6	55.	63.	0.	36.7	163.1	45.	259.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081000Z	31.2	161.7	60	31.6	161.8	60.	24.	0.	35.5	158.7	50.	165.	0.	41.0	157.7	40.	371.	0.	0.0	0.0	0.	-0.	0.
081006Z	31.8	161.3	60	31.8	161.2	60.	5.	0.	36.9	158.6	50.	222.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081012Z	32.3	161.2	55	32.3	161.5	60.	15.	5.	36.3	159.4	50.	145.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081018Z	32.8	160.8	55	33.0	161.2	55.	23.	0.	37.8	159.2	45.	203.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081100Z	33.0	160.1	50	33.8	160.5	50.	52.	0.	38.3	158.3	40.	217.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081106Z	33.3	159.7	50	33.2	159.6	50.	8.	0.	35.1	157.8	40.	88.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081112Z	33.9	159.0	45	33.8	159.0	45.	6.	0.	37.0	157.4	35.	135.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081118Z	34.5	158.2	40	34.5	158.4	40.	10.	0.	38.4	157.9	30.	201.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081200Z	34.8	157.1	40	35.2	157.2	40.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081206Z	35.1	156.0	35	35.3	156.0	35.	12.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081212Z	35.6	155.2	35	35.6	155.3	35.	5.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081218Z	36.2	154.7	30	36.9	154.3	30.	46.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081300Z	36.9	154.2	30	36.9	154.2	30.	0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	25.	188.	303.	131.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	17.	147.	254.	106.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	1.	4.	5.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	1.	0.	-5.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	19	14	5	2	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1291. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM SUSAN
FIX POSITIONS FOR CYCLONE NO. 14

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	062136	20.5N 166.2E	PCN 3	T0.5/0.5	NOAA6	INIT OBS EXP LLCC	PGTW
2	070000	20.7N 165.9E	PCN 3		GMS	EXP LLCC	PGTW
3	070323	20.3N 165.4E	PCN 4	T1.5/1.5	NOAA7	INIT OBS EXP LLCC	KGWC
4	070900	20.7N 164.9E	PCN 5		GMS		PGTW
5	071600	21.4N 165.8E	PCN 5		GMS		PGTW
6	071608	20.1N 165.2E	PCN 6		NOAA7	ULAC 19.4N 166.9E	KGWC
7	072112	20.5N 166.3E	PCN 6	T2.5/2.5+/D1.0/18HRS	NOAA6	ULAC 20.5N 166.5E	KGWC
8	080300	23.4N 165.3E	PCN 5	T1.5/1.5	GMS	INIT OBS EXP LLCC	PGTW
9	080312	21.0N 166.2E	PCN 6		NOAA7	SECNDRY LLCC 23.5N 165.2E	KGWC
10	080810	23.1N 165.5E	PCN 6		NOAA6	ULAC 23.3N 167.1E	KGWC
11	080811	23.8N 165.0E	PCN 6		NOAA6		PGTW
12	081200	24.3N 164.9E	PCN 5		GMS	ULAC 24.9N 168.1E	PGTW
13	081557	24.0N 166.0E	PCN 6		NOAA7		KGWC
14	081600	24.9N 164.9E	PCN 5		GMS		PGTW
15	082049	27.5N 165.1E	PCN 4	T3.5/3.5 /D1.0/23HRS	NOAA6	ULAC 28.7N 166.5E	KGWC
16	082100	25.7N 164.8E	PCN 5		GMS		PGTW
17	090000	28.0N 164.3E	PCN 3	T3.0/3.0 /D1.5/21HRS	GMS	EXP LLCC	PGTW
18	090300	28.3N 164.1E	PCN 5		GMS		PGTW
19	090900	29.5N 164.4E	PCN 5		GMS		PGTW
20	091200	30.2N 163.9E	PCN 5		GMS		PGTW
21	091600	31.0N 163.3E	PCN 5		GMS		PGTW
22	092100	31.2N 162.3E	PCN 5		GMS		PGTW
23	092208	31.1N 161.9E	PCN 3	T4.0/4.0 /D1.0/22HRS	NOAA6		PGTW
24	100000	31.1N 161.5E	PCN 3		GMS		PGTW
25	100300	31.5N 161.6E	PCN 3		GMS		PGTW
26	100600	31.8N 161.7E	PCN 5		GMS		PGTW
27	100906	31.9N 161.3E	PCN 5		NOAA6		PGTW
28	101200	32.3N 161.3E	PCN 5		GMS		PGTW
29	101600	32.8N 161.2E	PCN 5		GMS		PGTW
30	102100	33.1N 159.9E	PCN 5		GMS		PGTW
31	102145	32.9N 159.9E	PCN 5	T3.5/4.0 /W0.5/24HRS	NOAA6		PGTW
32	110000	32.7N 159.7E	PCN 5		GMS		PGTW
33	110300	32.8N 159.7E	PCN 5		GMS		PGTW
34	110600	33.2N 159.6E	PCN 5		GMS		PGTW
35	110843	33.8N 159.3E	PCN 4		NOAA6		PGTW
36	110900	33.8N 159.4E	PCN 5		GMS		PGTW
37	111600	34.5N 158.7E	PCN 5		GMS		PGTW
38	111705	34.1N 158.2E	PCN 5		NOAA7		PGTW
39	112100	34.8N 157.4E	PCN 5		GMS		PGTW
40	120000	34.6N 156.9E	PCN 5	T2.5/3.0 /W1.0/22HRS	GMS		PGTW
41	120300	34.7N 156.6E	PCN 5		GMS		PGTW
42	120408	34.8N 156.1E	PCN 5		NOAA7		PGTW
43	120600	35.1N 156.1E	PCN 3		GMS		PGTW
44	120900	35.2N 155.8E	PCN 5		GMS		PGTW
45	121200	36.0N 155.3E	PCN 5		GMS		PGTW
46	121600	36.9N 155.4E	PCN 5		GMS		PGTW
47	122240	36.5N 154.5E	PCN 5	T1.5/2.0 /W1.0/22HRS	NOAA6		PGTW
48	130000	36.9N 154.4E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	080015	22.6N 165.4E	1500FT		992	20 250 10	290 24 250 10	3 3				1
2	110620	33.1N 159.7E	700MB	2885	978	30 230 30	030 30 290 60	5 3			+12 +14 + 9	2

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON THAD
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		WIND	WARNING POSIT		WIND	ERRORS DST	ERRORS WIND	24 HOUR FORECAST POSIT		WIND	ERRORS DST	ERRORS WIND	48 HOUR FORECAST POSIT		WIND	ERRORS DST	ERRORS WIND	72 HOUR FORECAST POSIT		WIND	DST	WIND
081612Z	19.6	131.8	35	19.8	131.0	30.	58.	-5.	19.8	128.2	40.	277.	-10.	20.3	125.2	45.	488.	-30.	20.9	122.8	50.	690.	-35.
081618Z	20.0	131.9	40	19.2	130.4	30.	97.	-10.	19.8	127.8	40.	309.	-15.	20.4	124.9	45.	533.	-35.	21.0	122.2	50.	743.	-35.
081700Z	20.3	132.2	40	19.2	130.0	35.	140.	-5.	19.9	127.8	45.	316.	-20.	20.8	124.8	50.	547.	-30.	21.5	121.9	55.	771.	-25.
081706Z	20.2	132.8	45	20.6	132.7	45.	25.	0.	21.4	132.5	55.	74.	-15.	23.0	131.2	65.	197.	-20.	24.2	127.1	70.	480.	-10.
081712Z	20.4	133.1	50	20.1	133.7	50.	38.	0.	20.8	134.2	60.	137.	-15.	22.8	133.7	65.	144.	-20.	24.6	131.9	70.	248.	-10.
081718Z	20.9	133.2	55	21.1	133.6	55.	25.	0.	23.0	135.4	45.	100.	-35.	25.1	136.4	40.	91.	-45.	27.5	136.2	40.	19.	-40.
081800Z	21.5	133.2	65	21.8	133.0	60.	21.	-5.	24.2	134.0	70.	0.	-10.	26.2	135.9	70.	45.	-10.	27.4	138.5	65.	93.	-15.
081806Z	22.4	133.3	70	22.2	133.4	70.	13.	0.	25.1	133.7	75.	40.	-10.	27.5	135.0	70.	86.	-10.	29.2	137.5	65.	39.	-15.
081812Z	23.0	133.5	75	23.1	133.5	70.	6.	-5.	26.2	133.9	60.	73.	-25.	29.1	135.1	50.	162.	-30.	31.6	137.6	40.	150.	-35.
081818Z	23.8	133.8	80	23.6	133.8	75.	12.	-5.	26.5	134.2	65.	63.	-20.	29.8	134.8	55.	174.	-25.	32.1	137.0	45.	152.	-30.
081900Z	24.2	134.0	80	24.6	134.0	75.	24.	-5.	27.9	135.2	65.	125.	-15.	30.8	137.2	60.	180.	-20.	32.7	140.8	55.	225.	-20.
081906Z	24.7	134.3	85	24.8	134.3	80.	6.	-5.	26.9	135.2	70.	50.	-10.	28.8	136.7	60.	76.	-20.	32.1	140.1	53.	130.	-22.
081912Z	25.1	134.5	85	25.5	134.6	80.	24.	-5.	28.0	135.2	85.	99.	5.	30.4	135.3	65.	134.	-10.	34.4	136.0	55.	166.	-15.
081918Z	25.6	134.8	85	25.8	134.8	85.	12.	0.	28.4	135.4	80.	86.	0.	31.2	135.2	65.	152.	-10.	35.3	136.7	50.	146.	-20.
082000Z	25.8	135.2	80	26.0	135.2	85.	12.	5.	28.7	135.5	80.	87.	0.	31.5	135.4	65.	133.	-10.	35.7	137.0	50.	195.	-10.
082006Z	26.2	135.7	80	26.2	135.6	80.	5.	0.	28.8	136.7	70.	29.	-10.	31.7	137.2	60.	55.	-15.	34.9	140.7	55.	418.	5.
082012Z	26.5	136.0	80	26.7	136.0	80.	12.	0.	29.0	137.3	65.	8.	-10.	32.5	138.6	55.	16.	-15.	36.4	142.9	45.	624.	0.
082018Z	27.2	136.3	80	27.1	136.3	75.	6.	-5.	29.7	137.5	65.	6.	-10.	33.3	139.4	55.	84.	-15.	37.0	144.2	45.	750.	5.
082100Z	27.8	136.8	80	27.5	136.8	75.	18.	-5.	30.0	138.2	65.	38.	-10.	33.8	139.4	55.	231.	-5.	0.0	0.0	0.	-0.	0.
082106Z	28.6	137.2	80	28.6	137.3	75.	5.	-5.	33.0	139.0	65.	132.	-10.	36.4	142.8	55.	341.	5.	0.0	0.0	0.	-0.	0.
082112Z	29.1	137.4	75	29.2	137.7	75.	17.	0.	33.2	139.6	65.	81.	-5.	37.3	144.2	50.	580.	5.	0.0	0.0	0.	-0.	0.
082118Z	29.6	137.5	75	30.0	137.8	70.	29.	-5.	34.4	140.1	60.	30.	-10.	38.3	146.2	45.	698.	5.	0.0	0.0	0.	-0.	0.
082200Z	30.2	137.5	75	30.3	137.4	70.	8.	-5.	33.6	139.0	60.	247.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082206Z	31.0	137.9	75	31.0	137.6	70.	15.	-5.	34.5	140.1	60.	443.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082212Z	32.4	138.3	70	32.2	138.1	70.	16.	0.	35.8	141.8	60.	657.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082218Z	34.7	139.6	70	34.8	139.8	55.	11.	-15.	41.3	146.0	40.	527.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082300Z	37.6	140.3	60	38.0	140.4	60.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082306Z	41.9	140.8	50	42.3	141.2	60.	38.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082312Z	46.8	141.5	45	45.4	142.0	50.	86.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082318Z	49.3	140.7	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	27.	155.	234.	335.	27.	155.	234.	335.
AVG RIGHT ANGLE ERROR	21.	73.	129.	183.	21.	73.	129.	183.
AVG INTENSITY MAGNITUDE ERROR	4.	11.	18.	19.	4.	11.	18.	19.
AVG INTENSITY BIAS	-3.	-9.	-16.	-18.	-3.	-9.	-16.	-18.
NUMBER OF FORECASTS	29	26	22	18	29	26	22	18

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1928. NM

TYPHOON THAD
FIX POSITIONS FOR CYCLONE NO. 15

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	152312	18.8N 130.2E	PCN 5	T0.5/0.5	NOAA6	INIT OBS	PGTW
2	160300	19.1N 130.8E	PCN 5		GMS		PGTW
3	160900	17.7N 130.5E	PCN 5		GMS	ULCC	PGTW
4	161200	19.1N 131.9E	PCN 5		GMS		PGTW
5	161600	19.1N 131.5E	PCN 5		GMS		PGTW
6	162100	19.2N 131.2E	PCN 5		GMS	ULCC	PGTW
7	162249	19.2N 131.5E	PCN 5	T2.0/2.0 /D1.5/24HRS	NOAA6		PGTW
8	170453	19.8N 132.8E	PCN 5		NOAA7		PGTW
9	170900	20.2N 133.4E	PCN 5		GMS		PGTW
10	170947	20.3N 133.1E	PCN 5		NOAA6		PGTW
11	171200	20.5N 133.2E	PCN 5		GMS		PGTW
12	171600	21.1N 132.7E	PCN 5		GMS		PGTW
13	172100	22.4N 133.4E	PCN 5		GMS		PGTW
14	172130	22.1N 133.0E	PCN 6		DMSP37		PGTW
15	172226	21.6N 132.8E	PCN 5	T3.5/3.5 /D1.5/24HRS	NOAA6		PGTW
16	172226	21.5N 132.9E	PCN 3	T3.0/3.0	NOAA6	INIT OBS	RODN
17	180000	21.4N 133.1E	PCN 5		GMS		PGTW
18	180000	21.6N 133.1E	PCN 4		GMS		RODN
19	180300	22.0N 133.6E	PCN 5		GMS		PGTW
20	180300	22.0N 133.3E	PCN 4		GMS		RODN
21	180600	22.7N 133.6E	PCN 3		GMS		PGTW
22	180600	22.6N 133.4E	PCN 3		GMS		RODN
23	180900	23.0N 133.5E	PCN 5		GMS		PGTW
24	181105	23.1N 133.5E	PCN 5		NOAA6		PGTW
25	181600	23.5N 133.7E	PCN 5		GMS		PGTW
26	182100	24.3N 133.9E	PCN 5		GMS		PGTW
27	182107	24.2N 133.8E	PCN 6		DMSP37		PGTW
28	182344	24.3N 134.3E	PCN 5	T4.5/4.5 /D1.0/25HRS	NOAA6		PGTW
29	190000	24.4N 134.4E	PCN 3		GMS		PGTW
30	190300	24.8N 134.3E	PCN 5		GMS		PGTW
31	190900	25.3N 134.4E	PCN 5		GMS		PGTW
32	191200	25.6N 134.5E	PCN 3		GMS		PGTW
33	191600	25.4N 134.6E	PCN 3		GMS		PGTW
34	192100	25.8N 135.2E	PCN 5		GMS		PGTW
35	192321	25.6N 135.4E	PCN 3	T4.5/4.5 /S0.0/24HRS	NOAA6		PGTW
36	192321	25.6N 135.4E	PCN 3	T4.0/4.0	NOAA6	INIT OBS	RPMK
37	200300	26.0N 135.7E	PCN 3		GMS		PGTW
38	200419	25.8N 135.8E	PCN 3		NOAA7		PGTW
39	200900	26.4N 136.1E	PCN 3		GMS		PGTW
40	201019	26.5N 136.3E	PCN 3		NOAA6		PGTW
41	201200	26.8N 136.4E	PCN 5		GMS		PGTW
42	202100	27.2N 137.0E	PCN 3		GMS		PGTW
43	202258	27.5N 137.1E	PCN 3	T4.0/4.5 /W0.5/24HRS	NOAA6		PGTW
44	210000	27.8N 137.2E	PCN 3		GMS		PGTW
45	210300	28.2N 137.2E	PCN 3		GMS		PGTW

46	210900	28.8N 137.5E	PCN 3		GMS	PGTW
47	211200	29.2N 137.8E	PCN 3		GMS	PGTW
48	211600	29.3N 138.0E	PCN 5		GMS	PGTW
49	212100	30.1N 137.8E	PCN 5		GMS	PGTW
50	212235	30.3N 137.7E	PCN 5	T3.5/4.0 /W0.5/24HRS	NOAA6	PGTW
51	220000	30.4N 138.0E	PCN 3		GMS	PGTW
52	220300	30.6N 137.9E	PCN 3		GMS	PGTW
53	220900	31.4N 138.2E	PCN 3		GMS	PGTW
54	220933	31.7N 138.2E	PCN 5		NOAA6	PGTW
55	221200	32.2N 138.4E	PCN 3		GMS	PGTW
56	222100	36.5N 140.2E	PCN 5		GMS	PGTW
57	222212	37.1N 140.3E	PCN 5	T3.0/3.5-/W0.5/24HRS	NOAA6	PGTW
58	230000	37.6N 140.7E	PCN 5		GMS	PGTW
59	230300	40.2N 141.7E	PCN 5		GMS	PGTW
60	230900	45.9N 143.9E	PCN 5		GMS	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM	ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	160415	18.9N 131.8E	1500FT		992	40 130 45	200 39 130 45	5 10				+24 +24 +23 32	1
2	170105	20.3N 132.5E	700MB	2972		25 280 150	030 34 290 200	5 10					2
3	170309	20.2N 132.8E	700MB	2956	985	50 150 80	240 52 160 100	5 10				+13 +13	2
4	171413	20.6N 132.9E	700MB	2947			200 65 130 140	5 8					4
5	171706	20.9N 133.6E	700MB	2923	980		020 50 290 110	5 5				+13 +15 +15	4
6	180000	21.6N 133.2E	700MB	2853		70 130 90	230 75 130 95	4 15					5
7	180215	21.8N 133.3E	700MB	2859	972	35 040 70	150 63 050 75	4 10				+14 +14	5
8	181512	23.2N 133.8E	700MB	2814	965		040 61 310 85	5 5	CIRCULAR	90		+15 +18 +14	6
9	190030	24.4N 134.1E	700MB	2788		50 210 75	300 80 200 55	4 15					8
10	190235	24.2N 134.1E	700MB	2766	960	60 310 120	140 74 050 113	4 10				+16 +19 +13	8
11	191305	24.9N 134.6E	700MB	2714			210 82 120 60	10 5					9
12	191549	25.4N 134.7E	700MB	2716	956		360 74 230 65	10 6	CIRCULAR	60		+13 +17 +11	9
13	200102	25.8N 135.4E	700MB	2741		45 250 125	220 75 120 108	4 15					10
14	200355	26.1N 135.6E	700MB	2741	959	50 020 120	120 68 020 95	4 15	ELLIPTICAL	80 60	050	+15 +16 +13	10
15	201245	26.8N 136.1E	700MB	2756			020 61 290 125	5 7					11
16	201425	26.8N 136.2E	700MB	2756	961		360 66 270 150	5 5				+13 +14 +14	11
17	210017	27.6N 136.7E	700MB	2800			330 84 260 70	10 10					12
18	210302	28.2N 137.0E	700MB	2787	964	80 060 100	140 89 060 70	7 5	CIRCULAR	99		+14 +15 +15	12
19	211307	29.2N 137.4E	700MB	2800			230 66 130 120	8 15					13
20	212158	30.1N 137.4E	700MB	2821	968	40 260 100	350 85 260 140	5 3				+15 +16 +15	14
21	220040	30.2N 137.3E	700MB	2831		50 010 60	020 70 300 85	5 3					14
22	220243	30.5N 137.4E	700MB	2830	969	65 240 85	330 73 240 55	5 4				+15 +15 +15	14
23	220723	31.1N 138.2E	700MB	2820			170 70 060 86	3 5				+14 +13	15
24	221000	32.0N 138.4E	700MB	2822	967		320 44 250 65	5 10				+14 +13	15
25	221224	32.8N 138.6E	700MB	2823			220 71 120 90	10 10					16
26	221526	33.2N 138.3E	700MB	2826	970		110 35 040 70	5 25				+14 +13 +13	16

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	220100	30.8N 138.0E	LAND				53903 /////		35.3N 138.7E	47639
2	220200	31.0N 138.0E	LAND				55/4/ 536//		35.3N 138.7E	47639
3	220400	30.7N 138.4E	LAND				63913 /////		35.3N 138.7E	47639
4	220500	31.0N 138.1E	LAND				53974 53424		35.3N 138.7E	47639
5	220500	31.3N 138.6E	LAND	POOR				MOVG 0220	33.6N 135.8E	
6	220600	31.2N 138.1E	LAND				53913 53611		35.3N 138.7E	47639
7	220600	31.8N 138.4E	LAND	POOR					33.6N 135.8E	
8	220700	31.4N 138.2E	LAND				53913 73516		35.3N 138.7E	47639
9	220700	32.0N 138.4E	LAND	POOR					33.6N 135.8E	

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM VANESSA
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
081606Z	23.8	154.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081612Z	25.2	155.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081618Z	26.5	156.7	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081700Z	27.4	158.2	50	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081706Z	28.3	159.5	55	28.7	159.2	40.	29.	-15.	32.8	159.7	55.	204.	10.	36.8	159.7	45.	354.	5.	0.0	0.0	0.	-0.	0.
081712Z	29.3	160.3	50	29.7	160.1	50.	26.	0.	34.6	159.5	50.	294.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081718Z	30.2	161.3	45	30.9	161.2	50.	42.	5.	36.0	165.2	40.	143.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081800Z	31.1	162.2	45	32.2	163.2	45.	83.	0.	36.8	168.8	35.	176.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081806Z	31.9	163.6	45	32.2	163.5	45.	19.	0.	35.8	169.0	30.	103.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081812Z	32.8	165.0	45	32.8	164.9	40.	5.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081818Z	33.7	166.0	45	33.8	166.0	40.	6.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081900Z	34.6	166.4	45	35.0	167.0	35.	38.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081906Z	35.6	166.9	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	31.	184.	354.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	20.	143.	349.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	5.	8.	5.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-4.	-2.	5.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	8	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 971. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL STORM VANESSA
FIX POSITIONS FOR CYCLONE NO. 16

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	160300	24.3N 154.7E	PCN 3	T1.0/1.0	GMS	INIT OBS EXP LLCC	PGTW
2	160300	24.3N 154.7E	PCN 3		GMS		RPMK
3	160828	25.3N 154.8E	PCN 5		NOAA6		PGTW
4	161200	26.1N 155.0E	PCN 5		GMS		PGTW
5	161600	26.5N 155.2E	PCN 5		GMS		PGTW
* 6	162100	27.4N 156.0E	PCN 5		GMS		PGTW
7	170300	27.8N 159.0E	PCN 5	T2.5/2.5 /D1.5/24HRS	GMS		PGTW
8	170311	28.1N 159.1E	PCN 6		NOAA7		PGTW
9	170900	29.1N 159.8E	PCN 5		GMS		PGTW
10	171200	29.7N 160.3E	PCN 5		GMS		PGTW
11	171600	30.4N 161.1E	PCN 5		GMS		PGTW
12	172100	31.2N 163.5E	PCN 5		GMS		PGTW
13	180000	31.2N 162.2E	PCN 5	T3.0/3.0-/D0.5/21HRS	GMS		PGTW
14	180300	31.5N 163.1E	PCN 3		GMS		PGTW
15	180600	31.8N 163.7E	PCN 3		GMS	EXP LLCC	PGTW
16	180900	32.4N 164.5E	PCN 5		GMS		PGTW
17	181200	32.8N 165.0E	PCN 3		GMS	EXP LLCC	PGTW
18	181600	33.5N 165.6E	PCN 3		GMS		PGTW
19	182100	34.2N 166.2E	PCN 5		GMS		PGTW
20	190000	34.5N 166.1E	PCN 3	T2.0/3.0 /W1.0/24HRS	GMS	EXP LLCC	PGTW
21	190600	35.8N 166.6E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	160736	24.2N 154.8E	700MB	3031	992	25 130 60	240 25 130 60	5 2			+11 +15 + 9 28	3
2	170144	27.6N 158.7E	1500FT		983	55 240 50	010 61 240 50	10 5			+27 +22 29	4

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM WARREN
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
081700Z	17.9	112.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081706Z	17.9	112.2	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081712Z	18.1	111.7	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081718Z	18.2	111.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081800Z	18.2	111.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081806Z	18.3	110.8	35	17.9	109.6	30.	72.	-5.	17.9	106.8	45.	142.	5.	19.5	104.3	25.	123.	-5.	0.0	0.0	0.	-0.	0.
081812Z	18.4	110.4	35	18.6	109.8	35.	36.	0.	19.2	107.9	35.	33.	-5.	21.0	105.6	25.	41.	5.	0.0	0.0	0.	-0.	0.
081818Z	18.5	110.2	35	18.6	109.8	35.	23.	0.	19.5	107.9	35.	29.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081900Z	18.9	109.6	35	18.8	108.8	30.	46.	-5.	20.4	107.2	35.	21.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081906Z	19.2	108.9	40	18.9	108.5	30.	29.	-10.	20.4	106.6	30.	41.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081912Z	19.6	108.3	40	19.7	108.2	40.	8.	0.	20.8	107.2	40.	124.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081918Z	19.9	107.6	45	20.0	107.7	45.	8.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082000Z	20.2	106.9	45	19.7	107.2	40.	34.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082006Z	20.8	106.0	30	20.2	106.0	35.	36.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082012Z	21.5	105.1	20	21.1	105.0	25.	25.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	32.	65.	82.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	20.	40.	64.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	8.	5.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-2.	0.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	10	6	2	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 494. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 6. KNOTS

TROPICAL STORM WARREN
FIX POSITIONS FOR CYCLONE NO. 17

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	171200	17.8N 111.2E	PCN 5		GMS		PGTW
	2	171600	18.0N 110.9E	PCN 5		GMS		PGTW
	3	180000	17.9N 110.1E	PCN 5		GMS		PGTW
*	4	180007	17.8N 112.2E	PCN 5	T0.5/0.5	NOAA6	INIT OBS	RODN
*	5	180600	17.6N 109.6E	PCN 5	T2.0/2.0	GMS	INIT OBS	PGTW
*	6	180900	17.5N 109.5E	PCN 5		GMS		PGTW
*	7	181200	17.3N 109.0E	PCN 5		GMS		PGTW
*	8	181600	18.1N 109.0E	PCN 5		GMS		PGTW
	9	182100	18.6N 109.1E	PCN 5		GMS		PGTW
	10	190000	18.7N 108.9E	PCN 5		GMS		PGTW
	11	190125	18.6N 108.6E	PCN 6	T2.0/2.0	NOAA6	INIT OBS	RPMK
	12	190300	18.7N 109.0E	PCN 5		GMS		PGTW
	13	190600	18.9N 108.6E	PCN 5	T2.0/2.0 /S0.0/24HRS	GMS		PGTW
	14	190900	19.0N 108.3E	PCN 5		GMS		PGTW
	15	191200	19.1N 108.0E	PCN 5		GMS		PGTW
	16	191223	19.2N 108.0E	PCN 6		NOAA6		RODN
	17	191600	19.2N 107.8E	PCN 5		GMS		PGTW
	18	192100	19.1N 107.3E	PCN 5		GMS		PGTW
	19	200000	19.7N 106.7E	PCN 5		GMS		PGTW
	20	200102	20.3N 106.1E	PCN 5	T1.5/2.0 /W0.5/24HRS	NOAA6		RPMK
	21	200300	20.0N 106.1E	PCN 5	T2.5/2.5-/D0.5/21HRS	GMS		PGTW
	22	200900	21.1N 105.6E	PCN 5		GMS		PGTW
	23	201200	21.6N 105.0E	PCN 5		GMS		PGTW
	24	201200	22.6N 105.6E	PCN 6		NOAA6		RODN

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON AGNES
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR WIND	72 HOUR DST	72 HOUR WIND
082512Z	15.2	145.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082518Z	15.8	145.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082600Z	16.2	144.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082606Z	16.6	143.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082612Z	16.9	142.0	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082618Z	17.2	140.8	30	16.9	141.2	25.	29.	-5.	18.0	137.6	35.	87.	-5.	19.0	133.7	40.	158.	-15.	20.2	129.9	45.	234.	-30.
082700Z	17.3	139.7	35	16.8	139.7	30.	30.	-5.	17.8	135.6	45.	88.	0.	18.5	131.4	55.	198.	-5.	19.3	127.5	60.	299.	-20.
082706Z	17.5	138.4	35	17.2	138.7	40.	25.	5.	18.3	134.7	50.	98.	0.	19.3	130.6	55.	187.	-10.	20.6	126.6	60.	257.	-25.
082712Z	17.9	137.2	40	18.0	137.5	45.	18.	5.	19.6	133.9	60.	74.	5.	22.6	130.0	65.	63.	-5.	27.0	128.0	65.	137.	-25.
082718Z	18.6	136.2	40	18.6	135.8	45.	23.	5.	20.7	131.8	60.	26.	5.	23.4	128.2	65.	21.	-10.	26.0	128.2	65.	158.	-25.
082800Z	19.2	135.1	45	18.8	135.2	50.	25.	5.	20.8	131.1	60.	60.	0.	23.8	128.3	65.	67.	-15.	26.9	127.1	70.	125.	-25.
082806Z	19.8	134.0	50	20.0	134.0	50.	12.	0.	22.8	130.4	60.	29.	-5.	26.0	128.3	65.	122.	-20.	29.2	127.5	70.	173.	-25.
082812Z	20.5	133.0	55	20.9	132.7	55.	29.	0.	24.0	129.5	65.	60.	-5.	26.6	128.0	70.	125.	-20.	30.3	127.5	65.	202.	-30.
082818Z	21.1	132.0	55	21.2	131.7	60.	18.	5.	24.2	128.6	75.	44.	0.	27.1	127.0	80.	97.	-10.	30.8	126.1	70.	154.	-20.
082900Z	21.8	131.1	60	22.0	130.8	65.	20.	5.	25.2	127.9	80.	66.	0.	28.8	126.5	70.	127.	-25.	32.8	127.0	60.	244.	-25.
082906Z	22.4	130.1	65	22.5	130.0	65.	8.	0.	25.9	127.6	75.	88.	-10.	29.8	126.2	70.	134.	-25.	34.4	130.0	50.	413.	-30.
082912Z	23.1	129.0	70	23.2	129.2	70.	13.	0.	26.2	126.5	85.	44.	-5.	30.3	124.8	75.	91.	-20.	36.8	131.5	45.	529.	-25.
082918Z	23.7	128.0	75	23.7	128.0	70.	0.	-5.	26.5	124.4	85.	48.	-5.	31.6	123.8	70.	115.	-20.	0.0	0.0	0.	-0.	0.
083000Z	24.3	127.2	80	24.4	127.3	80.	8.	0.	28.2	124.7	75.	54.	-20.	33.5	125.2	65.	216.	-20.	0.0	0.0	0.	-0.	0.
083006Z	24.9	126.4	85	25.2	126.4	90.	18.	5.	29.4	124.3	85.	72.	-10.	34.8	126.5	60.	297.	-20.	0.0	0.0	0.	-0.	0.
083012Z	25.7	125.9	90	25.8	125.8	90.	8.	0.	30.4	124.1	85.	84.	-10.	35.8	128.0	50.	362.	-20.	0.0	0.0	0.	-0.	0.
083018Z	26.5	125.3	90	26.7	125.1	90.	16.	0.	31.4	123.2	80.	102.	-10.	38.0	129.0	40.	467.	-20.	0.0	0.0	0.	-0.	0.
083100Z	27.3	124.8	95	27.4	124.6	90.	12.	-5.	32.4	123.1	70.	126.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
083106Z	28.2	124.4	95	28.1	124.2	90.	12.	-5.	34.4	124.6	65.	230.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
083112Z	29.0	123.9	95	29.3	124.0	90.	19.	-5.	35.9	125.9	60.	305.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
083118Z	29.7	123.4	90	30.4	123.2	90.	43.	0.	37.4	128.0	45.	409.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
090100Z	30.3	123.2	85	30.7	122.9	85.	28.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
090106Z	30.8	123.0	80	31.2	123.0	80.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
090112Z	31.4	123.0	70	31.8	122.7	80.	28.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
090118Z	31.8	123.2	60	32.2	123.5	70.	28.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	20.	104.	167.	244.	19.	104.	167.	244.
AVG RIGHT ANGLE ERROR	11.	76.	132.	208.	11.	76.	132.	208.
AVG INTENSITY MAGNITUDE ERROR	3.	7.	16.	25.	3.	7.	16.	25.
AVG INTENSITY BIAS	1.	-6.	-16.	-25.	1.	-6.	-16.	-25.
NUMBER OF FORECASTS	25	21	17	12	24	21	17	12

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1717. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TYPHOON AGNES
FIX POSITIONS FOR CYCLONE NO. 18

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	251200	15.5N	145.5E	PCN 5		GMS		PGTW
*	2	260300	17.2N	142.7E	PCN 5	T1.5/1.5	GMS	INIT OBS	PGTW
	3	260900	16.8N	142.5E	PCN 5		GMS		PGTW
	4	261200	16.4N	141.6E	PCN 5		GMS	ULCC	PGTW
	5	261600	16.3N	141.4E	PCN 5		GMS		PGTW
	6	261800	16.4N	140.8E	PCN 5		GMS		PGTW
	7	262100	16.5N	140.2E	PCN 5		GMS		PGTW
	8	262221	16.3N	140.0E	PCN 5	T2.0/2.0 /D0.5/20HRS	NOAA6		PGTW
	9	270000	16.9N	139.7E	PCN 5		GMS		PGTW
	10	270300	16.8N	139.1E	PCN 5		GMS		PGTW
	11	270600	17.7N	138.2E	PCN 5		GMS		PGTW
	12	270900	17.8N	138.2E	PCN 5		GMS		PGTW
	13	271100	17.5N	137.6E	PCN 6		NOAA6		PGTW
	14	271200	17.6N	137.5E	PCN 5		GMS		PGTW
	15	271600	18.0N	136.7E	PCN 5		GMS		PGTW
	16	272100	18.6N	136.1E	PCN 5		GMS		PGTW
	17	272109	18.7N	136.1E	PCN 6		DMSP37		PGTW
	18	272339	19.1N	135.1E	PCN 5	T3.5/3.5 /D1.5/25HRS	NOAA6		PGTW
*	19	272339	19.5N	133.9E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RODN
	20	280300	20.0N	134.2E	PCN 5		GMS		PGTW
	21	280900	20.6N	133.1E	PCN 5		GMS		PGTW
	22	281037	20.7N	132.9E	PCN 5		NOAA6		PGTW
	23	281200	20.8N	132.8E	PCN 5		GMS		PGTW
	24	281630	21.0N	132.1E	PCN 5		GMS		PGTW
	25	282100	21.6N	131.5E	PCN 5		GMS		PGTW
	26	282316	22.2N	131.0E	PCN 5	T4.0/4.0 /D0.5/24HRS	NOAA6		PGTW
	27	290000	22.0N	131.3E	PCN 5		GMS		PGTW
	28	290300	22.3N	130.7E	PCN 3		GMS		PGTW
	29	290900	22.8N	129.7E	PCN 3		GMS		PGTW
	30	291014	22.8N	129.5E	PCN 3		NOAA6		PGTW
	31	291200	23.2N	128.9E	PCN 3		GMS		PGTW
	32	291600	23.7N	128.3E	PCN 3		GMS		PGTW
	33	292100	24.3N	127.7E	PCN 5		GMS		PGTW
	34	300000	24.7N	127.1E	PCN 1	T5.0/5.0 /D1.0/25HRS	GMS		PGTW
	35	300300	25.1N	126.7E	PCN 1		GMS		PGTW
	36	300548	25.1N	126.4E	PCN 1		NOAA7		PGTW
	37	300900	25.5N	126.2E	PCN 1		GMS		PGTW
	38	301132	25.7N	126.1E	PCN 3		NOAA6		RKSO
	39	301200	25.9N	125.9E	PCN 1		GMS		PGTW
	40	302100	27.0N	124.9E	PCN 1		GMS		PGTW
	41	310000	27.4N	124.7E	PCN 1	T6.0/6.0-/D1.0/24HRS	GMS		PGTW
	42	310011	27.2N	124.9E	PCN 3	T5.0/5.0	NOAA6	INIT OBS	RKSO
	43	310300	27.8N	124.5E	PCN 3		GMS		PGTW
	44	310600	28.3N	124.4E	PCN 3		GMS		PGTW
	45	310900	28.8N	124.2E	PCN 3		GMS		PGTW

46	311109	29.1N 123.9E	PCN 3		NOAA6		RKSO
47	311200	29.3N 123.7E	PCN 3		GMS		PGTW
48	311600	29.7N 123.4E	PCN 1		GMS		PGTW
49	312100	30.1N 123.0E	PCN 3		GMS		PGTW
50	312348	30.2N 122.9E	PCN 3		NOAA6		PGTW
51	010300	30.4N 123.0E	PCN 3	T5.0/6.0-/W1.0/27HRS	GMS		PGTW
52	010525	30.7N 123.1E	PCN 3		NOAA7		PGTW
53	010900	30.9N 122.8E	PCN 5		GMS		PGTW
54	011200	30.8N 123.7E	PCN 5		GMS		PGTW
55	011600	31.0N 124.0E	PCN 5		GMS		PGTW
56	011810	32.2N 123.5E	PCN 5		NOAA7	EXP LLCC	PGTW
57	012100	32.9N 123.6E	PCN 5		GMS	EXP LLCC	PGTW
58	020000	32.2N 123.4E	PCN 5		GMS	EXP LLCC MLCC	PGTW
59	020300	32.5N 123.5E	PCN 3	T3.5/5.0 /W1.5/24HRS	GMS		PGTW
60	020900	32.7N 124.1E	PCN 5		GMS		PGTW
61	021200	32.9N 124.2E	PCN 5		GMS		PGTW
62	021759	32.6N 125.8E	PCN 5		NOAA7		PGTW
63	021941	34.0N 124.5E	PCN 5		NOAA7		RKSO
64	022100	33.2N 125.2E	PCN 5		GMS		PGTW
65	030000	33.5N 125.8E	PCN 3		GMS	EXP LLCC MLCC	PGTW
66	030300	33.7N 126.2E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

	FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
	1	260807	16.7N 142.8E	1500FT		1006	30 140 30	230 30 140 30	3 10			+24 +24 +24 28	1
	2	270225	17.5N 139.1E	1500FT		994	60 110 100	170 46 110 97	4 20				2
*	3	271624	18.8N 136.0E	700MB	3001	990		260 35 140 60	7 10			+ 9 +12 +10	3
	4	280040	19.3N 135.0E	700MB	2978	985	50 030 80	140 47 030 60	5 10			+15 +14 +11	4
	5	280251	19.8N 134.6E	700MB	2974	985	35 230 60	060 38 310 90	10 4			+13 +15 + 9	4
	6	281325	20.4N 132.8E	700MB	2939			140 63 040 102	5 5				5
	7	281547	20.8N 132.0E	700MB	2923	977		330 65 250 103	5 5	CIRCULAR	25	+12 +14 + 9	5
	8	290248	21.9N 130.8E	700MB	2888	976	45 140 90	330 50 250 75	7 10			+13 +14 +14	6
	9	291301	23.1N 128.8E	700MB	2842			130 68 040 130	8 14				7
	10	291602	23.3N 128.2E	700MB	2819	970		250 61 150 100	5 3	CIRCULAR	50	+14 +14 +14	7
	11	292222	24.0N 127.6E	700MB	2770	962	65 060 120	150 77 030 35	5 5	CIRCULAR	60	+15 +18 +11	8
	12	300141	24.5N 127.1E	700MB	2764		40 310 150	030 62 310 40	5 10			+18 +14	8
	13	300248	24.6N 127.0E	700MB	2755	958	50 250 120	010 65 300 30	5 5	CIRCULAR	40	+14 +18 +13	8
	14	301310	25.8N 125.9E	700MB	2699			140 91 050 105	3 5				9
	15	301530	26.2N 125.5E	700MB	2689	952		080 60 330 60	3 5	CIRCULAR	50	+16 +18 +15	9
	16	310024	27.2N 124.8E	700MB	2671		40 110 10	100 82 080 85	5 5				10
	17	310205	27.5N 124.6E	700MB	2665	949	65 350 30	080 64 350 30	6 8	ELLIPTICAL	40 30 150	+15 +16 +16	10

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	291245	23.7N 129.2E	LAND	POOR				MOVG 3230	26.1N 127.7E	47937
2	291600	23.5N 128.5E	LAND	POOR				MOVG 3230	26.1N 127.7E	47937
3	291700	23.7N 128.3E	LAND	POOR				MOVG 3225	26.1N 127.7E	47937
4	291710	24.3N 127.9E	LAND	FAIR	CIRCULAR	15			26.4N 127.8E	47931
5	291810	23.9N 128.2E	LAND	POOR	CIRCULAR	10			26.4N 127.8E	47931
6	291900	23.8N 127.9E	LAND				65//3 52705		26.2N 127.8E	47937
7	291900	23.8N 128.2E	LAND	POOR				MOVG 3220	26.1N 127.7E	47937
8	292000	24.0N 128.0E	LAND	POOR				MOVG 3420	26.1N 127.7E	47937
9	292000	24.0N 128.0E	LAND				65//4 5////		24.8N 125.3E	47927
10	292000	23.9N 127.9E	LAND				55912 53511		26.2N 127.8E	47937
11	292100	24.1N 127.8E	LAND	POOR				MOVG 3420	26.1N 127.7E	47937
12	292100	24.1N 127.8E	LAND				55912 53414		26.2N 127.8E	47937
13	292100	24.1N 127.6E	LAND				6///4 52922		24.8N 125.3E	47927
14	292200	24.3N 127.5E	LAND	POOR				MOVG 3420	26.1N 127.7E	47937
15	292200	24.3N 127.6E	LAND				22994 53611		24.8N 125.3E	47927
16	292200	24.3N 127.7E	LAND				22972 53312		26.2N 127.8E	47937
17	292300	24.4N 127.4E	LAND				21944 52916		24.8N 125.3E	47927
18	292300	24.4N 127.5E	LAND				20912 53016		26.2N 127.8E	47937
19	292300	24.3N 127.5E	LAND	POOR				MOVG 3220	26.3N 126.8E	47929
20	292300	24.3N 127.5E	LAND				50914 53311		24.3N 124.2E	47918
21	300000	24.4N 127.2E	LAND				50914 52816		24.3N 124.2E	47918
22	300000	24.5N 127.3E	LAND	GOOD		75		MOVG 3220	26.1N 127.7E	47937
23	300000	24.5N 127.3E	LAND				10912 53108		26.2N 127.8E	47937
24	300000	24.5N 127.2E	LANI				11914 53014		24.8N 125.3E	47927
25	300010	24.4N 127.2E	LAND	GOOD	CIRCULAR	25			26.4N 127.8E	47931
26	300035	24.7N 127.3E	LAND	GOOD	CIRCULAR	25			26.4N 127.8E	47931
27	300100	24.6N 127.1E	LAND				51914 73112		24.3N 124.2E	47918
28	300100	24.6N 127.1E	LAND				22944 53111		24.8N 125.3E	47927
29	300100	24.7N 127.0E	LAND				11962 53122		26.2N 127.8E	47937
30	300100	24.6N 127.2E	LAND	GOOD		75		MOVG 3220	26.1N 127.7E	47937
31	300135	24.8N 127.1E	LAND	GOOD	CIRCULAR	35			26.4N 127.8E	47931
32	300200	24.6N 126.9E	LAND				10982 52716		26.2N 127.8E	47937
33	300200	24.7N 126.9E	LAND				20924 53011		24.8N 125.3E	47927
34	300200	24.7N 126.9E	LAND	GOOD		75		MOVG 3020	26.1N 127.7E	47937
35	300200	24.6N 126.8E	LAND				41915 72912		24.3N 124.2E	47918
36	300235	24.9N 126.9E	LAND	GOOD	CIRCULAR	50			26.4N 127.8E	47931
37	300300	24.8N 126.8E	LAND				12914 53008		24.8N 125.3E	47927
38	300300	24.8N 126.8E	LAND	GOOD		80		MOVG 3020	26.1N 127.7E	47937
39	300300	24.7N 126.8E	LAND				21933 53306		26.2N 127.8E	47937
40	300300	24.6N 126.7E	LAND				11975 72909		24.3N 124.2E	47918
41	300310	24.7N 126.8E	LAND	GOOD	CIRCULAR	50			26.4N 127.8E	47931
42	300400	24.8N 126.7E	LAND	GOOD		80		MOVG 3015	26.1N 127.7E	47937
43	300400	24.8N 126.7E	LAND				11914 52908		24.8N 125.3E	47927
44	300400	24.7N 126.7E	LAND				11975 42705		24.3N 124.2E	47918
45	300400	24.8N 126.7E	LAND				21913 53208		26.2N 127.8E	47937
46	300410	24.8N 126.6E	LAND	GOOD	CIRCULAR	45			26.4N 127.8E	47931
47	300435	24.8N 126.4E	LAND	GOOD	CIRCULAR	40			26.4N 127.8E	47931
48	300500	24.8N 126.6E	LAND				21913 52905		26.2N 127.8E	47937
49	300500	24.7N 126.5E	LAND				55/43 52711		24.3N 124.2E	47918
50	300500	24.8N 126.5E	LAND	GOOD		75		MOVG 3315	26.3N 126.8E	47929
51	300510	24.9N 126.4E	LAND	GOOD	CIRCULAR	40			26.4N 127.8E	47931
52	300535	24.9N 126.4E	LAND	GOOD	CIRCULAR	40			26.4N 127.8E	47931
53	300600	24.9N 126.5E	LAND	GOOD		70		MOVG 3020	26.3N 126.8E	47929
54	300600	24.9N 126.5E	LAND				41973 53414		24.3N 124.2E	47918
55	300600	24.9N 126.5E	LAND				21913 53207		26.2N 127.8E	47937

56	300610	24.9N	126.4E	LAND	GOOD	CIRCULAR	40			26.4N	127.8E	47931
57	300635	24.9N	126.4E	LAND	GOOD	CIRCULAR	40			26.4N	127.8E	47931
58	300700	25.1N	126.4E	LAND				21913 53408		24.8N	125.3E	47927
59	300700	24.9N	126.5E	LAND				21913 50000		26.2N	127.8E	47937
60	300700	25.0N	126.3E	LAND	GOOD		70		MDVG 3215	26.1N	127.7E	47937
61	300700	25.0N	126.4E	LAND				40883 73100		24.3N	124.2E	47918
62	300710	25.1N	126.3E	LAND	GOOD	CIRCULAR	40			26.4N	127.8E	47931
63	300800	25.1N	126.3E	LAND	GOOD		70		MDVG 3215	26.1N	127.7E	47937
64	300800	25.1N	126.4E	LAND				11913 50000		24.8N	125.3E	47927
65	300800	25.0N	126.3E	LAND				41914 73300		24.3N	124.2E	47918
66	300800	25.0N	126.5E	LAND				11913 53408		26.2N	127.8E	47937
* 67	300800	34.0N	128.4E	LAND				55//1 50727		33.4N	130.3E	47806
68	300810	25.2N	126.3E	LAND	GOOD	CIRCULAR	40			26.4N	127.8E	47931
69	300835	25.2N	126.2E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
70	300900	25.1N	126.3E	LAND				41914 73205		24.3N	124.2E	47918
71	300900	25.2N	126.4E	LAND				10913 53411		24.8N	125.3E	47927
72	300900	25.2N	126.4E	LAND				11913 53511		26.2N	127.8E	47937
73	300900	25.2N	126.3E	LAND	GOOD		80		MDVG 3420	26.1N	127.7E	47937
74	300910	25.2N	126.2E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
75	300935	25.2N	126.2E	LAND	GOOD	CIRCULAR	40			26.4N	127.8E	47931
76	301000	25.4N	126.4E	LAND				12913 53411		24.8N	125.3E	47927
77	301000	25.2N	126.3E	LAND	GOOD		40		MDVG 3405	26.1N	127.7E	47937
78	301000	25.2N	126.3E	LAND				51914 73404		24.3N	124.2E	47918
79	301000	25.3N	126.3E	LAND				10973 53311		26.2N	127.8E	47937
80	301010	25.3N	126.2E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
81	301035	25.4N	126.2E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
82	301100	25.5N	126.2E	LAND				21943 53311		26.2N	127.8E	47937
83	301100	25.4N	126.3E	LAND				55/44 73607		24.3N	124.2E	47918
84	301100	25.5N	126.3E	LAND				12913 53411		24.8N	125.3E	47927
85	301100	25.5N	126.3E	LAND	GOOD		55		MDVG 3520	26.1N	127.7E	47937
86	301110	25.5N	126.2E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
87	301135	25.6N	126.1E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
88	301200	25.5N	126.2E	LAND				55/44 73507		24.3N	124.2E	47918
89	301200	25.7N	126.1E	LAND	FAIR				MDVG 3320	26.1N	127.7E	47937
90	301200	25.5N	126.2E	LAND				21/43 73207		26.2N	127.8E	47937
91	301210	25.7N	126.0E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
92	301235	25.8N	125.9E	LAND	FAIR	CIRCULAR	45			26.4N	127.8E	47931
93	301300	25.9N	125.9E	LAND				11914 53314		24.8N	125.3E	47927
94	301300	25.8N	126.0E	LAND				31914 53319		26.2N	127.8E	47937
95	301300	25.7N	126.0E	LAND				41974 73307		24.3N	124.2E	47918
96	301300	25.7N	126.0E	LAND	GOOD		65		MDVG 3410	26.1N	127.7E	47937
97	301310	25.9N	125.9E	LAND	FAIR	CIRCULAR	50			26.4N	127.8E	47931
98	301335	25.9N	125.8E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
99	301400	25.8N	125.8E	LAND				55/44 73111		24.3N	124.2E	47918
100	301400	26.0N	125.8E	LAND	GOOD				MDVG 3410	26.1N	127.7E	47937
101	301400	25.9N	125.8E	LAND				31/14 53011		26.2N	127.8E	47937
102	301400	26.0N	125.8E	LAND				21913 53114		24.8N	125.3E	47927
103	301410	26.0N	125.7E	LAND	GOOD	CIRCULAR	45			26.4N	127.8E	47931
104	301435	26.1N	125.7E	LAND	FAIR	CIRCULAR	50			26.4N	127.8E	47931
105	301500	25.9N	125.9E	LAND				55/14 73209		24.3N	124.2E	47918
106	301500	26.2N	125.6E	LAND				21913 53216		24.8N	125.3E	47927
107	301500	26.1N	125.6E	LAND				32/44 53216		26.2N	127.8E	47937
108	301500	26.2N	125.8E	LAND	GOOD		75		MDVG 3420	26.1N	127.7E	47937
109	301600	26.1N	125.6E	LAND				55/14 73111		24.3N	124.2E	47918
110	301600	26.2N	125.3E	LAND				35//4 53016		26.2N	127.8E	47937
111	301600	26.3N	125.4E	LAND				21913 53111		24.8N	125.3E	47927
112	301600	26.3N	125.3E	LAND	GOOD		75		MDVG 3220	26.1N	127.7E	47937
113	301700	26.4N	125.2E	LAND				65//3 53312		26.2N	127.8E	47937
114	301700	26.3N	125.4E	LAND				55/14 73211		24.3N	124.2E	47918
115	301700	26.4N	125.2E	LAND				21914 53011		24.8N	125.3E	47927
116	301700	26.4N	125.2E	LAND	FAIR		75		MDVG 3210	26.1N	127.7E	47937
117	301800	26.5N	125.2E	LAND				21914 53005		24.8N	125.3E	47927
118	301800	26.4N	125.5E	LAND				55/14 73211		24.3N	124.2E	47918
119	301800	26.5N	124.9E	LAND				65//3 53016		26.2N	127.8E	47937
120	301800	26.5N	125.2E	LAND	FAIR		75		MDVG 3210	26.1N	127.7E	47937
121	301900	26.6N	125.2E	LAND				21913 50210		24.8N	125.3E	47927
122	301900	26.7N	125.0E	LAND				65//4 50311		26.2N	127.8E	47937
123	301900	26.4N	125.4E	LAND				55/14 73208		24.3N	124.2E	47918
124	301900	26.7N	125.2E	LAND	FAIR		75		MDVG 3615	26.1N	127.7E	47937
125	302000	26.9N	125.0E	LAND				65945 53511		26.2N	127.8E	47937
126	302000	26.8N	125.1E	LAND				21944 53411		24.8N	125.3E	47927
127	302000	26.5N	125.2E	LAND				65/14 73305		24.3N	124.2E	47918
128	302000	26.7N	125.2E	LAND	FAIR		75		MDVG 3220	26.1N	127.7E	47937
129	302100	26.9N	125.0E	LAND				65945 50000		26.2N	127.8E	47937
130	302100	26.8N	125.0E	LAND	FAIR		75		MDVG 3210	26.1N	127.7E	47937
131	302100	26.9N	125.0E	LAND				35/44 53216		24.8N	125.3E	47927
132	302200	27.0N	124.9E	LAND				55915 53411		26.2N	127.8E	47937
133	302200	27.0N	125.0E	LAND	POOR				MDVG 3210	26.3N	126.8E	47929
134	302200	27.1N	124.9E	LAND				35/14 53211		24.8N	125.3E	47927
135	302300	27.2N	124.7E	LAND				3///4 53214		24.8N	125.3E	47927
136	302300	27.1N	124.8E	LAND				65945 53008		26.2N	127.8E	47937
137	310000	27.3N	124.6E	LAND	FAIR		40		MDVG 3225	26.3N	126.8E	47929
138	310200	27.6N	124.6E	LAND	GOOD		65		MDVG 3620	26.3N	126.8E	47929
139	310300	27.8N	124.5E	LAND	GOOD		55		MDVG 3210	26.3N	126.8E	47929
140	310500	28.1N	124.5E	LAND	POOR				MDVG 3410	26.3N	126.8E	47929

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON BILL
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR DST	72 HOUR WIND
090306Z	22.4 153.4	45	22.6 153.2	45.	16.	0.	24.2 150.0	55.	42.	-5.	26.4 146.4	60.	52.	-25.	30.2 144.8	65.	171.	-10.
090312Z	22.6 152.4	50	22.8 152.3	50.	13.	0.	25.2 148.2	60.	30.	-5.	28.5 145.0	65.	34.	-20.	33.2 145.8	65.	120.	-5.
090318Z	22.8 151.5	50	23.5 151.2	50.	45.	0.	26.6 146.7	50.	86.	-25.	31.9 145.4	45.	149.	-40.	36.7 150.0	35.	25.	-25.
090400Z	23.2 150.4	55	23.7 150.3	50.	30.	-5.	26.9 146.3	50.	52.	-35.	32.3 146.2	45.	87.	-35.	0.0 0.0	0.	-0.	0.
090406Z	23.9 149.3	60	24.0 149.3	55.	6.	-5.	28.1 145.6	50.	58.	-35.	33.9 146.5	45.	67.	-30.	0.0 0.0	0.	-0.	0.
090412Z	24.7 148.3	65	24.8 148.2	65.	8.	0.	29.5 145.2	60.	75.	-25.	35.2 147.8	45.	36.	-25.	0.0 0.0	0.	-0.	0.
090418Z	25.3 147.4	75	25.7 147.2	65.	26.	-10.	31.1 145.2	50.	102.	-35.	37.5 150.3	35.	66.	-25.	0.0 0.0	0.	-0.	0.
090500Z	26.1 146.7	85	26.2 146.4	70.	17.	-15.	31.8 144.8	50.	71.	-30.	37.8 140.5	35.	584.	-15.	0.0 0.0	0.	-0.	0.
090506Z	27.2 146.0	85	27.0 145.8	75.	16.	-10.	33.9 145.2	50.	82.	-25.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090512Z	28.3 145.6	85	28.0 145.8	85.	21.	0.	33.1 146.6	60.	103.	-10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090518Z	29.4 145.4	85	29.4 145.5	80.	5.	-5.	35.5 149.2	55.	67.	-5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090600Z	30.9 145.7	80	30.9 145.7	85.	0.	5.	37.2 151.5	50.	107.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090606Z	32.8 146.2	75	32.6 146.1	80.	13.	5.	39.3 155.8	40.	109.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090612Z	34.7 147.4	70	34.8 147.2	70.	11.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090618Z	36.6 149.5	60	37.0 149.5	60.	24.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090700Z	38.6 152.9	50	38.4 153.7	50.	39.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
090706Z	40.5 157.6	40	40.0 157.5	40.	30.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	19.	76.	134.	105.	19.	76.	134.	105.
AVG RIGHT ANGLE ERROR	15.	29.	62.	31.	15.	29.	62.	31.
AVG INTENSITY MAGNITUDE ERROR	4.	18.	27.	13.	4.	18.	27.	13.
AVG INTENSITY BIAS	-2.	-18.	-27.	-13.	-2.	-18.	-27.	-13.
NUMBER OF FORECASTS	17	13	8	3	17	13	8	3

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1583. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 16. KNOTS

TYPHOON BILL
FIX POSITIONS FOR CYCLONE NO. 19

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	030000	22.4N 154.0E	PCN 5	T1.0/1.0	GMS	INIT OBS	PGTW
2	030900	22.7N 152.8E	PCN 5		GMS		PGTW
3	031200	22.8N 152.3E	PCN 3		GMS		PGTW
* 4	031605	23.9N 151.4E	PCN 5		NOAA7		PGTW
5	032100	23.5N 150.9E	PCN 5		GMS		PGTW
6	040000	23.5N 150.4E	PCN 3	T3.5/3.5 /D2.5/24HRS	GMS		PGTW
7	040300	23.8N 149.8E	PCN 1		GMS		PGTW
8	040451	23.9N 149.4E	PCN 3		NOAA7		PGTW
9	040600	24.1N 149.3E	PCN 3		GMS		PGTW
10	040900	24.7N 148.8E	PCN 5		GMS		PGTW
11	041200	25.2N 148.2E	PCN 5		GMS		PGTW
12	041600	25.6N 147.7E	PCN 5		GMS		PGTW
13	041736	25.5N 147.6E	PCN 5		NOAA7		PGTW
14	041800	25.5N 147.6E	PCN 5		GMS		PGTW
15	042100	26.0N 147.2E	PCN 1		GMS		PGTW
16	050000	26.1N 146.6E	PCN 1		GMS		PGTW
17	050300	26.6N 146.3E	PCN 1	T4.5/4.5 /D1.0/27HRS	GMS		PGTW
18	050439	27.0N 146.1E	PCN 1		NOAA7		PGTW
19	050600	27.3N 146.0E	PCN 1		GMS		PGTW
20	051200	28.6N 145.6E	PCN 1		GMS		PGTW
* 21	051600	29.8N 145.6E	PCN 1		GMS		PGTW
22	051724	29.4N 145.4E	PCN 1		NOAA7		PGTW
23	060000	31.0N 145.4E	PCN 3		GMS		PGTW
24	060300	31.7N 145.6E	PCN 1	T3.5/4.0 /W1.0/24HRS	GMS		PGTW
25	060428	32.1N 146.1E	PCN 3		NOAA7		PGTW
26	060600	32.6N 146.4E	PCN 3		GMS		PGTW
27	061200	34.5N 147.7E	PCN 5		GMS		PGTW
28	061600	36.4N 148.7E	PCN 5		GMS		PGTW
29	061713	36.3N 148.9E	PCN 5		NOAA7		PGTW
30	062100	37.2N 151.1E	PCN 5		GMS		PGTW
31	070000	38.5N 152.8E	PCN 5		GMS		PGTW
32	070416	39.7N 156.0E	PCN 5		NOAA7		PGTW
33	070416	39.8N 155.1E	PCN 5	T3.0/3.0-	NOAA7	INIT OBS	RODN
34	070900	42.4N 160.1E	PCN 5		GMS		PGTW
35	071200	43.4N 162.9E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	030807	22.6N 152.8E	700MB	3031		70 050 32	130 86 050 32	5 5			+11 + 9	1
2	032232	23.1N 150.6E	700MB	2978		40 300 25	110 65 350 30	5 5				2
3	040020	23.2N 150.2E	700MB	2976	986	35 320 60	030 56 300 40	5 3			+ 8 +12	2
4	040848	24.4N 148.8E	700MB	2917	978	75 020 18	120 77 010 15	4 5	CIRCULAR	40	+10 +15 + 8	3
5	042052	25.6N 147.1E	700MB	2793	965	90 360 38	100 91 340 30	7 5	ELLIPTICAL	20 16 020	+10 +16 +10	4
6	042352	26.0N 146.7E	700MB	2729		50 180 40	290 82 180 15	5 5	ELLIPTICAL	20 18 010	+ 9 +15 +12	4
7	050703	27.4N 145.9E	700MB	2749		80 070 60	160 84 060 15	5 3				5
8	050859	27.6N 145.8E	700MB	2752	961	100 020 30	120 91 020 20	3 5	CIRCULAR	20	+15 +16	5
9	051801	29.4N 145.5E	700MB	2744			160 78 050 60	2 2	CIRCULAR			6
10	052042	30.1N 145.5E	700MB	2741	959	70 340 10	350 65 290 30	5 5	CIRCULAR	14	+13 +16 +14	6
11	060619	32.9N 146.2E	700MB	2800		75 150 10	270 81 170 27	5 5				7
12	060830	33.4N 146.5E	700MB	2800		55 120 15	250 76 140 30	5 5	CIRCULAR	40	+13 +23 +10	7

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON CLARA
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HR DST	72 HR WIND
091318Z	9.9	144.9	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091400Z	9.9	144.2	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091406Z	10.0	143.4	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091412Z	10.1	142.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091418Z	10.3	141.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091500Z	10.5	140.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091506Z	11.1	139.5	25	10.2	140.2	25.	68.	0.	11.0	137.0	35.	162.	5.	11.8	132.7	45.	134.	10.	11.7	127.8	55.	180.	-15.
091512Z	11.8	138.7	25	11.0	138.5	30.	49.	5.	13.2	134.0	45.	45.	15.	15.2	129.6	55.	107.	10.	17.1	126.0	65.	130.	-10.
091518Z	12.3	137.3	25	11.8	136.9	35.	30.	10.	14.1	132.4	50.	85.	15.	16.2	128.4	60.	157.	10.	18.0	124.2	70.	182.	-5.
091600Z	12.4	135.8	30	12.6	135.2	35.	37.	5.	14.7	131.3	40.	117.	5.	16.6	127.3	50.	167.	-10.	18.5	123.3	60.	173.	-30.
091606Z	12.5	134.7	30	12.8	133.8	35.	55.	5.	14.8	129.1	45.	142.	10.	16.5	125.1	50.	198.	-20.	18.8	121.3	60.	208.	-35.
091612Z	12.5	133.7	30	12.7	133.6	35.	13.	5.	14.4	129.9	45.	56.	0.	16.0	126.1	50.	75.	-25.	18.0	122.6	60.	64.	-55.
091618Z	12.7	132.7	35	12.6	132.8	40.	8.	5.	13.4	129.3	50.	27.	0.	14.1	125.7	60.	102.	-15.	14.7	122.0	70.	221.	-50.
091700Z	12.8	131.8	35	12.5	132.3	35.	34.	0.	13.1	129.2	45.	70.	-15.	14.0	125.8	55.	145.	-35.	14.7	122.0	65.	245.	-55.
091706Z	13.3	131.0	35	12.6	131.8	40.	63.	5.	13.2	128.4	50.	93.	-20.	14.2	124.9	60.	175.	-35.	14.9	121.1	60.	257.	-50.
091712Z	13.5	130.2	45	13.2	130.8	45.	39.	0.	14.2	127.9	55.	76.	-20.	15.0	124.4	60.	172.	-55.	15.6	120.7	50.	246.	-40.
091718Z	13.8	129.5	50	13.8	130.2	50.	41.	0.	14.6	127.2	60.	84.	-15.	15.1	123.8	65.	198.	-55.	15.7	119.9	50.	265.	-35.
091800Z	14.2	128.8	60	13.9	128.8	60.	18.	0.	14.5	124.7	70.	120.	-20.	15.0	120.6	50.	243.	-70.	14.9	116.5	60.	365.	-25.
091806Z	14.7	128.0	70	14.5	128.2	70.	17.	0.	15.5	124.4	80.	96.	-15.	16.0	120.2	50.	199.	-60.	16.2	116.1	60.	308.	-25.
091812Z	15.2	127.1	75	15.1	127.2	75.	8.	0.	15.8	122.7	75.	132.	-40.	16.2	118.7	50.	228.	-40.	16.8	114.8	65.	321.	-15.
091818Z	15.7	126.3	75	15.8	126.2	75.	8.	0.	18.0	122.2	70.	44.	-50.	20.6	119.0	65.	34.	-20.	23.9	116.4	30.	81.	-40.
091900Z	16.4	125.4	90	16.5	125.4	90.	6.	0.	18.7	122.1	80.	6.	-40.	21.4	118.4	65.	42.	-20.	25.0	115.5	25.	85.	-25.
091906Z	17.1	124.5	95	17.2	124.3	95.	13.	0.	19.9	120.7	80.	50.	-30.	23.0	117.3	65.	117.	-20.	26.4	114.2	25.	109.	-5.
091912Z	17.8	123.7	115	18.0	123.7	115.	12.	0.	21.0	120.2	125.	78.	35.	24.8	118.2	80.	193.	0.	30.4	123.0	45.	623.	25.
091918Z	18.3	122.9	120	18.7	122.7	120.	26.	0.	21.7	119.4	110.	96.	25.	26.1	118.6	70.	252.	0.	0.0	0.0	0.	-0.	0.
092000Z	18.8	122.1	120	19.2	122.1	120.	24.	0.	22.4	119.2	100.	109.	15.	27.5	119.8	65.	340.	15.	0.0	0.0	0.	-0.	0.
092006Z	19.2	121.2	110	19.2	121.2	115.	0.	5.	22.5	118.0	95.	84.	10.	28.4	119.9	60.	393.	30.	0.0	0.0	0.	-0.	0.
092012Z	19.7	120.3	90	19.6	120.4	90.	8.	0.	22.1	117.2	75.	24.	-5.	26.5	116.8	30.	232.	10.	0.0	0.0	0.	-0.	0.
092018Z	20.1	119.3	85	20.2	119.4	85.	8.	0.	23.7	116.4	65.	69.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092100Z	20.7	118.5	85	20.8	118.4	85.	8.	0.	23.9	115.0	50.	21.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092106Z	21.1	117.8	85	21.2	117.6	85.	13.	0.	23.8	114.2	45.	51.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092112Z	21.8	116.9	80	21.7	116.9	80.	6.	0.	23.4	114.4	50.	146.	30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092118Z	22.6	116.0	70	22.6	116.2	70.	11.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092200Z	23.6	115.2	50	23.2	115.2	50.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092206Z	24.6	113.9	30	24.5	114.1	30.	12.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092212Z	25.3	112.7	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	23.	80.	177.	226.	18.	76.	164.	208.
AVG RIGHT ANGLE ERROR	13.	55.	134.	174.	10.	56.	119.	153.
AVG INTENSITY MAGNITUDE ERROR	2.	10.	26.	30.	1.	10.	26.	32.
AVG INTENSITY BIAS	2.	-4.	-10.	-27.	1.	-7.	-22.	-32.
NUMBER OF FORECASTS	29	26	22	18	22	22	20	16

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2129. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TYPHOON CLARA
FIX POSITIONS FOR CYCLONE NO. 20

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	120300	9.6N 150.8E	PCN 5	T1.0/1.0	GMS	INIT OBS	PGTW
2	130449	9.6N 147.4E	PCN 5	T1.5/1.5 /D0.5/26HRS	NOAA7		PGTW
3	131600	9.3N 144.8E	PCN 5		GMS		PGTW
4	140000	10.1N 144.8E	PCN 5		GMS		PGTW
5	140437	10.2N 144.3E	PCN 5	T2.0/2.0 /D0.5/24HRS	NOAA7		PGTW
6	141200	9.2N 142.4E	PCN 5		GMS		PGTW
7	141722	10.2N 141.5E	PCN 5		NOAA7		PGTW
8	150000	10.1N 140.8E	PCN 5		GMS		PGTW
9	150426	10.6N 140.4E	PCN 5	T2.0/2.0 /S0.0/24HRS	NOAA7		PGTW
10	150600	10.8N 139.7E	PCN 5		GMS		PGTW
11	151026	11.3N 138.6E	PCN 5		NOAA6		PGTW
12	151200	11.6N 137.9E	PCN 5		GMS		PGTW
13	151711	11.8N 137.0E	PCN 6		NOAA7		PGTW
* 14	151711	11.6N 136.4E	PCN 5		NOAA7		RODN
15	152100	11.9N 135.6E	PCN 5		GMS		PGTW
16	160000	12.0N 135.0E	RCN 5		GMS		PGTW
17	160300	12.0N 134.5E	PCN 5		GMS		PGTW
18	160556	11.8N 134.4E	PCN 5	T2.5/2.5+/D0.5/25HRS	NOAA7		PGTW
19	161003	11.8N 134.0E	PCN 5		NOAA7		RPMK
20	161200	12.5N 133.6E	PCN 5		GMS		PGTW
21	161600	12.2N 132.9E	PCN 5		GMS		PGTW
22	161700	12.2N 132.8E	PCN 5		NOAA7		PGTW
23	161700	12.0N 132.9E	PCN 6		NOAA7		RPMK
24	162100	12.0N 132.3E	PCN 5		GMS		PGTW
25	170545	13.2N 131.8E	PCN 5	T4.0/4.0 /D1.5/24HRS	NOAA7		PGTW
26	171830	13.9N 129.5E	PCN 5		GMS		PGTW
27	172100	13.9N 129.4E	PCN 5		GMS		PGTW
28	180000	14.0N 129.0E	PCN 5		GMS		PGTW
29	180533	14.7N 128.7E	PCN 1	T5.0/5.0 /D1.0/24HRS	NOAA7		PGTW
30	180600	14.8N 128.5E	PCN 1		GMS		PGTW
31	180900	15.4N 127.9E	PCN 1		GMS		PGTW
32	181200	15.6N 127.2E	PCN 3		GMS		PGTW
33	181600	16.0N 126.6E	PCN 3		GMS		PGTW
34	181818	16.1N 126.1E	PCN 3		NOAA7		PGTW
35	190000	16.7N 125.3E	PCN 3		GMS		PGTW
36	190522	17.2N 124.5E	PCN 1	T5.5/5.5-/D0.5/24HRS	NOAA7		PGTW
37	191200	18.0N 123.6E	PCN 1		GMS		PGTW
38	191600	18.6N 122.8E	PCN 1		GMS		PGTW
39	191800	18.6N 122.7E	PCN 1		GMS		PGTW
40	200000	18.8N 122.1E	PCN 1	T5.5/5.5 /S0.0/19HRS	GMS		PGTW

41	200300	18.8N 121.7E	PCN 1		GMS		PGTW
42	200600	18.8N 121.1E	PCN 3		GMS		PGTW
43	200900	19.1N 120.9E	PCN 3		GMS		PGTW
44	201200	19.6N 120.4E	PCN 3		GMS		PGTW
45	201600	20.4N 119.7E	PCN 3		GMS		PGTW
46	201800	20.5N 119.4E	PCN 3		GMS		PGTW
47	201937	20.1N 119.2E	PCN 3		NOAA7		RPMK
48	202100	20.2N 118.7E	PCN 3		GMS		PGTW
49	210000	20.6N 118.8E	PCN 3	T4.5/5.5 /W1.0/24HRS	GMS		PGTW
50	210032	20.6N 119.0E	PCN 3	T5.0/5.0	NOAA6	INIT OBS	RODN
51	210300	20.9N 118.1E	PCN 3		GMS		PGTW
52	210600	21.1N 117.7E	PCN 1		GMS		PGTW
53	210900	21.5N 117.3E	PCN 1		GMS		PGTW
54	211200	21.8N 116.8E	PCN 1		GMS		PGTW
55	211600	22.7N 116.4E	PCN 5		GMS		PGTW
56	211800	23.0N 116.0E	PCN 5		GMS		PGTW
57	211926	22.8N 116.7E	PCN 3		NOAA7		RODN
58	212100	23.1N 115.6E	PCN 5		GMS		PGTW
59	220300	24.3N 114.5E	PCN 3	T3.0/3.5-/W1.5/27HRS	GMS		PGTW
60	220600	25.0N 114.1E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	152336	11.9N 134.3E	1500FT		1005	20 080 130	280 30 240 42	10 10			+24 +25 27	5
2	160601	12.4N 134.5E	1500FT		1001	30 360 62	100 37 360 62	5 5				7
3	160901	12.4N 134.3E	1500FT		1001	25 320 110	060 45 320 110	5 6			+26 +26 +26 28	7
4	162129	12.5N 132.8E	1500FT		1000	40 280 60	170 32 100 132	14 5			+24 +23 27	8
5	170850	13.2N 131.2E	700MB	3009	992	45 110 90	160 57 100 135	3 3			+11 +12 +10	9
6	172142	13.8N 129.2E	700MB	2939	979		170 55 090 150	5 5			+13 +15 +11	10
7	180737	14.7N 127.9E	700MB	2852		65 050 50		4 10				11
8	181010	15.0N 127.6E	700MB	2848	969	80 140 45	190 79 100 35	4 15			+14 +17 +10	11
9	182002	16.2N 126.0E	700MB	2740			220 81 140 35	5 5	CIRCULAR	35	+14 +17	12
10	182211	16.3N 125.7E	700MB	2706	956	70 020 32	130 95 020 32	8 5	CIRCULAR	40	+12 +17	12
11	190944	17.6N 124.0E	700MB	2447	924	75 120 10	180 117 110 25	5 3	CIRCULAR	30	+13 +21 + 7	13
12	191217	17.9N 123.6E	700MB	2426			030 109 290 20	5 5				13
13	191913	18.6N 122.8E	700MB	2468	931		050 124 330 15	10 5				14
14	192214	18.5N 122.3E	700MB	2565		115 270 10	140 73 030 90	10 10	CIRCULAR	40	+15 +21 +13	14
15	200736	19.3N 120.8E	700MB	2686		55 010 90	080 79 030 35	6 10				15
16	201000	19.4N 120.8E	700MB	2733	957	45 250 60	310 69 270 20	4 3	CIRCULAR	20	+16 +16 +16	15
17	201631	20.0N 119.7E	700MB	2747			120 76 030 30	5 3	ELLIPTICAL	15 12 360	+14 +15 +15	16
18	201857	20.1N 119.0E	700MB	2718	956		190 65 130 90	3 3	ELLIPTICAL	20 15 010	+14 +17 +16	16
19	202051	20.2N 118.8E	700MB	2722		50 330 31	240 68 130 15	6 4	ELLIPTICAL	20 15 010	+16 +17 +16	16

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	190800	17.8N 124.0E	LAND				108// 4////	EYE 50 PCT CI OPEN N	16.3N 120.6E	98321
2	191000	18.0N 123.9E	LAND				5///1 /999/		16.3N 120.6E	98321
3	191200	18.1N 123.6E	LAND				21831 52910		16.3N 120.6E	98321
4	191400	18.3N 123.3E	LAND				10991 53208		16.3N 120.6E	98321
5	191500	18.4N 123.2E	LAND				10991 53209		16.3N 120.6E	98321
6	191600	18.4N 123.0E	LAND				11991 52915		16.3N 120.6E	98321
7	191700	18.5N 122.9E	LAND				11991 52909		16.3N 120.6E	98321
8	191800	18.5N 122.7E	LAND				11911 13508		16.3N 120.6E	98321
9	192000	18.4N 122.5E	LAND				11911 52605		16.3N 120.6E	98321
10	192100	18.5N 122.4E	LAND				10931 53006		16.3N 120.6E	98321
11	192200	18.6N 122.3E	LAND				10911 53009		16.3N 120.6E	98321
12	192300	18.6N 122.2E	LAND				10911 52907		16.3N 120.6E	98321
13	200000	18.7N 122.0E	LAND				10911 52910		16.3N 120.6E	98321
14	200100	18.7N 121.9E	LAND				10911 52909		16.3N 120.6E	98321
15	200200	18.8N 121.7E	LAND				11821 52907		16.3N 120.6E	98321
16	200300	18.8N 121.6E	LAND				11811 53012		16.3N 120.6E	98321
17	200500	19.0N 121.3E	LAND				10811 53005		16.3N 120.6E	98321
18	200900	19.4N 120.7E	LAND				5//// 53516		16.3N 120.6E	98321
19	201100	19.3N 120.5E	LAND				45/// 4////		22.6N 120.3E	46744
20	201200	19.3N 120.4E	LAND				45//2 52906		22.6N 120.3E	46744
21	201300	19.4N 120.3E	LAND				45/43 53007		22.6N 120.3E	46744
22	201300	19.6N 120.2E	LAND				105// 5////		16.3N 120.6E	98321
23	201400	19.5N 120.2E	LAND				45/43 53004		22.6N 120.3E	46744
24	201400	19.8N 119.9E	LAND				105// 43308		16.3N 120.6E	98321
25	201430	19.9N 119.8E	LAND				105// 43305		16.3N 120.6E	98321
26	201500	20.1N 119.0E	LAND				15513 52614		22.6N 120.3E	46744
27	201530	20.0N 119.7E	LAND				105// 43025		16.3N 120.6E	98321
28	201600	20.0N 119.7E	LAND				105// 43125		16.3N 120.6E	98321
29	201700	20.1N 119.4E	LAND				105// 52810		16.3N 120.6E	98321
30	202000	20.2N 118.9E	LAND				45573 52807		22.6N 120.3E	46744
31	202200	20.2N 118.8E	LAND				45/43 52804		22.6N 120.3E	46744
32	202300	20.4N 118.8E	LAND				45/13 53516		22.6N 120.3E	46744
33	210000	20.6N 118.5E	LAND				107// 53110		16.3N 120.6E	98321
34	210200	20.7N 118.2E	LAND				10374 51316		22.6N 120.3E	46744
35	210300	20.8N 117.8E	LAND				4/6/3 52911		22.6N 120.3E	46744
36	210300	20.8N 117.7E	LAND				65/// /////		22.3N 114.2E	45005
37	210530	20.9N 117.6E	LAND				4///3 52807		22.6N 120.3E	46744
38	210600	20.8N 117.6E	LAND				55/// /////		22.3N 114.2E	45005
39	210800	21.3N 117.4E	LAND				4//// 53309		22.6N 120.3E	46744
40	210900	21.3N 117.2E	LAND				55/// /////		22.3N 114.2E	45005
41	211200	21.6N 116.9E	LAND				11412 73110		22.3N 114.2E	45005
42	211400	21.9N 116.8E	LAND				4//// 53209		22.6N 120.3E	46744
43	211500	21.9N 116.6E	LAND				11412 73110		22.3N 114.2E	45005
44	211800	22.4N 116.2E	LAND				31412 73111		22.3N 114.2E	45005
45	212100	23.0N 115.7E	LAND				10442 73313		22.3N 114.2E	45005

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON DOYLE
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
091900Z	24.9	168.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091906Z	25.4	167.5	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091912Z	25.8	166.9	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
091918Z	26.2	166.2	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092000Z	26.5	165.2	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092006Z	26.6	164.2	45	26.8	164.2	35.	12.	-10.	28.0	161.0	45.	12.	-20.	30.2	158.8	55.	239.	-25.	33.2	157.8	65.	599.	15.
092012Z	26.9	163.2	50	26.9	163.4	35.	11.	-15.	28.6	160.2	45.	58.	-25.	32.0	158.9	45.	299.	-30.	36.2	165.0	35.	390.	-10.
092018Z	27.1	162.3	55	27.2	162.2	40.	8.	-15.	30.6	158.8	45.	183.	-30.	35.2	163.0	40.	230.	-25.	0.0	0.0	0.	-0.	0.
092100Z	27.4	161.5	60	27.6	161.3	50.	16.	-10.	30.6	158.8	60.	202.	-20.	35.2	162.9	40.	241.	-15.	0.0	0.0	0.	-0.	0.
092106Z	27.9	161.2	65	27.9	160.8	65.	21.	0.	31.9	158.8	70.	267.	-10.	36.2	165.6	40.	189.	-10.	0.0	0.0	0.	-0.	0.
092112Z	28.5	161.3	70	28.2	160.8	70.	32.	0.	30.8	160.2	75.	226.	0.	35.4	165.0	45.	414.	0.	0.0	0.0	0.	-0.	0.
092118Z	29.0	161.8	75	29.2	161.8	75.	12.	0.	33.4	166.2	60.	73.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092200Z	29.5	162.5	80	29.7	162.7	75.	16.	-5.	33.6	168.0	55.	28.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092206Z	29.8	163.4	80	29.8	163.0	75.	21.	-5.	32.6	167.8	50.	220.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092212Z	30.8	164.6	75	30.4	164.5	80.	24.	5.	35.3	171.7	50.	218.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092218Z	32.2	165.9	65	32.5	166.2	75.	23.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092300Z	33.8	167.5	55	33.8	167.5	65.	0.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092306Z	36.0	169.5	50	35.8	169.2	55.	19.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092312Z	38.9	172.5	45	38.7	172.2	45.	18.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092318Z	41.4	176.2	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	17.	149.	269.	494.	17.	149.	269.	494.
AVG RIGHT ANGLE ERROR	11.	102.	194.	253.	11.	102.	194.	253.
AVG INTENSITY MAGNITUDE ERROR	6.	12.	18.	13.	6.	12.	18.	13.
AVG INTENSITY BIAS	-2.	-11.	-18.	3.	-2.	-11.	-18.	3.
NUMBER OF FORECASTS	14	10	6	2	14	10	6	2

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1533. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TYPHOON DOYLE
FIX POSITIONS FOR CYCLONE NO. 21

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
	1	172037	24.1N	174.2E	PCN 6	T1.5/1.5	NOAA6	INIT OBS	KGWC
	2	181454	24.7N	170.7E	PCN 6		NOAA6		KGWC
	3	182014	24.6N	169.0E	PCN 6	T2.0/2.0 /D0.5/24HRS	NOAA6		KGWC
	4	190340	25.0N	167.5E	PCN 6	T2.0/2.0	NOAA7	INIT OBS	PGTW
*	5	190853	25.3N	168.4E	PCN 6		NOAA6		KGWC
	6	191600	26.5N	166.7E	PCN 5		GMS		PGTW
	7	192132	26.2N	165.7E	PCN 4	T3.0/3.0 /D1.0/25HRS	NOAA6		KGWC
	8	200328	26.4N	164.5E	PCN 6	T3.0/3.0 /D1.0/24HRS	NOAA7		PGTW
	9	200600	26.4N	164.3E	PCN 5		GMS		PGTW
	10	200900	26.6N	163.7E	PCN 5		GMS		PGTW
	11	201200	26.8N	163.1E	PCN 5		GMS		PGTW
	12	201600	27.2N	162.6E	PCN 5		GMS		PGTW
	13	201800	27.2N	162.3E	PCN 5		GMS		PGTW
	14	202109	27.2N	161.9E	PCN 5		NOAA7		PGTW
	15	210000	27.3N	161.5E	PCN 1		GMS		PGTW
	16	210317	27.8N	161.1E	PCN 2	T4.0/..0 /D1.0/24HRS	NOAA7		PGTW
	17	210600	27.9N	161.2E	PCN 1		GMS		PGTW
	18	210900	28.1N	161.2E	PCN 1		GMS		PGTW
	19	211200	28.3N	161.4E	PCN 1		GMS		PGTW
	20	211600	29.0N	161.8E	PCN 1		GMS		PGTW
	21	211800	29.1N	161.8E	PCN 1		GMS		PGTW
	22	212100	29.1N	162.0E	PCN 1		GMS		PGTW
	23	220000	29.3N	162.5E	PCN 1		GMS		PGTW
	24	220300	29.5N	162.8E	PCN 1	T4.5/4.5-/D0.5/24HRS	GMS		PGTW
	25	220600	29.8N	163.3E	PCN 1		GMS		PGTW
	26	220900	30.2N	163.9E	PCN 1		GMS		PGTW
	27	221200	30.8N	164.5E	PCN 1		GMS		PGTW
	28	221600	32.1N	165.6E	PCN 1		GMS		PGTW
	29	221800	32.4N	166.0E	PCN 1		GMS		PGTW
	30	222100	32.9N	166.6E	PCN 3		GMS		PGTW
	31	230000	33.8N	167.5E	PCN 3		GMS		PGTW
	32	230253	34.7N	168.5E	PCN 2	T3.5/4.5 /W1.0/24HRS	NOAA7		KGWC
	33	230300	35.0N	168.3E	PCN 5	T3.0/3.5-/W1.5/24HRS	GMS		PGTW
	34	230600	36.0N	169.4E	PCN 5		GMS		PGTW
	35	230900	37.2N	170.8E	PCN 5		GMS		PGTW
	36	231200	38.8N	172.8E	PCN 5		GMS		PGTW

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

SUPER TYPHOON ELSIE
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HR DST	72 HR WIND
092400Z	10.2	146.6	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092406Z	10.7	146.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092412Z	11.1	145.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092418Z	11.3	144.7	35	11.1	145.0	30.	21.	-5.	12.8	141.2	40.	24.	-20.	14.2	137.4	50.	51.	-55.	15.5	133.5	60.	144.	-85.
092500Z	11.5	144.1	40	11.6	144.0	30.	8.	-10.	13.0	141.2	45.	67.	-30.	14.2	137.0	60.	13.	-50.	15.0	131.9	80.	223.	-70.
092506Z	11.9	143.2	45	11.8	143.3	40.	8.	-5.	12.8	140.4	60.	64.	-30.	13.7	136.7	75.	55.	-55.	14.2	131.4	90.	270.	-55.
092512Z	12.2	142.2	50	12.3	142.7	50.	30.	0.	13.7	139.5	70.	65.	-30.	14.6	135.0	80.	102.	-55.	16.9	129.8	90.	278.	-50.
092518Z	12.4	141.2	60	12.7	141.7	50.	34.	-10.	13.8	138.0	70.	30.	-35.	14.9	133.6	80.	153.	-65.	18.0	128.8	90.	308.	-45.
092600Z	12.7	140.1	75	12.6	140.6	70.	30.	-5.	13.2	136.5	95.	59.	-15.	15.4	131.9	110.	213.	-40.	17.5	127.0	120.	400.	-15.
092606Z	12.9	139.3	90	12.8	139.7	75.	24.	-15.	13.8	135.3	100.	104.	-30.	16.0	130.8	115.	249.	-30.	18.8	125.7	120.	448.	-10.
092612Z	13.2	138.5	100	13.4	138.1	85.	26.	-15.	15.7	132.6	105.	225.	-30.	17.8	127.2	120.	421.	-20.	20.8	123.2	110.	531.	-20.
092618Z	13.4	137.7	105	13.8	137.1	105.	42.	0.	16.0	131.7	130.	241.	-15.	18.2	126.3	120.	448.	-15.	21.4	122.8	105.	524.	-20.
092700Z	14.0	137.1	110	13.8	136.8	115.	21.	5.	16.0	134.2	135.	78.	-15.	17.8	131.0	120.	187.	-15.	19.8	127.7	110.	309.	-10.
092706Z	14.6	136.9	130	14.5	136.6	125.	18.	-5.	16.8	134.2	135.	49.	-10.	18.5	130.5	115.	193.	-15.	21.3	128.0	100.	275.	-20.
092712Z	15.5	136.5	135	15.2	136.7	135.	21.	0.	17.4	135.0	150.	29.	10.	19.1	132.6	135.	137.	5.	21.7	129.9	100.	244.	-15.
092718Z	16.2	135.9	145	16.2	136.2	140.	17.	-5.	18.5	134.3	140.	8.	5.	20.4	132.2	115.	113.	-10.	23.7	130.4	90.	207.	-20.
092800Z	16.6	135.4	150	16.8	135.2	145.	17.	-5.	19.4	132.6	140.	63.	5.	22.1	130.1	115.	119.	-5.	25.5	129.0	95.	276.	-10.
092806Z	17.1	135.0	145	17.2	134.8	150.	13.	5.	19.3	132.2	140.	91.	10.	22.0	129.8	115.	177.	-5.	25.4	129.0	90.	387.	-5.
092812Z	17.7	134.6	140	17.8	134.5	140.	8.	0.	20.6	132.9	110.	49.	-20.	23.1	131.2	90.	141.	-25.	26.5	130.5	80.	434.	-5.
092818Z	18.6	134.2	135	18.5	134.2	135.	6.	0.	21.4	133.0	105.	70.	-20.	24.2	131.8	85.	148.	-25.	27.8	131.8	75.	505.	0.
092900Z	19.6	133.7	135	19.2	134.1	135.	33.	0.	22.3	133.0	105.	81.	-15.	25.0	132.1	90.	175.	-15.	28.6	132.6	80.	652.	15.
092906Z	20.5	133.2	130	20.4	133.1	130.	8.	0.	24.3	131.3	100.	23.	-20.	28.0	130.9	85.	231.	-10.	31.3	134.4	65.	754.	10.
092912Z	21.4	132.7	130	21.5	132.7	130.	6.	0.	25.0	130.8	105.	59.	-10.	29.7	131.7	90.	307.	5.	0.0	0.0	0.	-0.	0.
092918Z	22.3	132.2	125	22.2	132.2	125.	6.	0.	26.1	130.5	100.	111.	-10.	30.8	133.2	85.	380.	10.	0.0	0.0	0.	-0.	0.
093000Z	23.2	131.9	120	23.2	131.8	120.	5.	0.	27.5	130.7	95.	154.	-10.	32.0	135.0	75.	464.	10.	0.0	0.0	0.	-0.	0.
093006Z	24.4	131.7	120	24.2	131.5	115.	16.	-5.	29.6	131.9	85.	179.	-10.	34.4	139.9	60.	430.	5.	0.0	0.0	0.	-0.	0.
093012Z	25.4	131.8	115	25.3	131.6	110.	12.	-5.	30.8	133.5	85.	214.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093018Z	26.6	132.5	110	26.3	132.2	105.	24.	-5.	30.9	136.2	75.	227.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100100Z	27.6	133.6	105	27.8	133.5	90.	13.	-15.	33.3	141.5	60.	130.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100106Z	28.8	135.2	95	29.1	135.8	90.	36.	-5.	34.2	149.9	50.	127.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100112Z	30.2	137.6	85	30.1	137.5	80.	8.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100118Z	31.4	140.6	75	31.5	140.4	70.	12.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100200Z	33.3	144.1	65	33.3	144.2	65.	5.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100206Z	36.0	148.5	55	36.2	148.7	55.	15.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	TYPHOONS WHILE OVER 35 KTS 24-HR	TYPHOONS WHILE OVER 35 KTS 48-HR	TYPHOONS WHILE OVER 35 KTS 72-HR
AVG FORECAST POSIT ERROR	18.	97.	213.	377.	18.	97.	213.	377.
AVG RIGHT ANGLE ERROR	9.	69.	135.	234.	9.	69.	135.	234.
AVG INTENSITY MAGNITUDE ERROR	4.	15.	24.	25.	4.	15.	24.	25.
AVG INTENSITY BIAS	-4.	-13.	-21.	-23.	-4.	-13.	-21.	-23.
NUMBER OF FORECASTS	31	27	23	19	31	27	23	19

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2447. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

SUPER TYPHOON ELSIE
FIX POSITIONS FOR CYCLONE NO. 22

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	230435	8.8N 149.0E	PCN 5	T1.0/1.0	NOAA7	INIT OBS	PGTW
2	231721	9.0N 147.9E	PCN 6		NOAA6		PGTW
3	240424	10.4N 146.8E	PCN 5	T1.0/1.0 /S0.0/24HRS	NOAA7		PGTW
4	241200	10.9N 145.9E	PCN 5		GMS		PGTW
5	241600	10.9N 145.3E	PCN 5		GMS		PGTW
6	241709	11.2N 145.1E	PCN 5		NOAA7		PGTW
7	242100	11.5N 144.7E	PCN 5		GMS		PGTW
8	250000	11.8N 143.7E	PCN 5		GMS		PGTW
9	250412	12.1N 143.3E	PCN 5	T2.5/2.5 /D1.5/24HRS	NOAA7		PGTW
10	250600	12.3N 143.5E	PCN 5		GMS		PGTW
11	250900	12.7N 143.0E	PCN 5		GMS		PGTW
12	251200	12.4N 142.5E	PCN 5		GMS		PGTW
13	251600	12.6N 141.6E	PCN 5		GMS		PGTW
14	251658	12.7N 141.5E	PCN 3		NOAA7		PGTW
15	260000	12.6N 140.6E	PCN 3		GMS		PGTW
16	260300	12.9N 140.0E	PCN 5		GMS		PGTW
17	260543	13.2N 139.3E	PCN 1	T4.0/4.0 /D1.5/25HRS	NOAA7		PGTW
18	260900	13.7N 138.9E	PCN 5		GMS		PGTW
19	261200	13.4N 138.3E	PCN 5		GMS		PGTW
20	261646	13.5N 137.8E	PCN 3		NOAA7		PGTW
21	261800	13.8N 137.7E	PCN 5		GMS		PGTW
22	270000	14.0N 137.3E	PCN 1		GMS		PGTW
23	270300	14.4N 137.0E	PCN 1		GMS		PGTW
24	270531	14.5N 137.0E	PCN 1	T6.0/6.0 /D2.0/24HRS	NOAA7		PGTW
25	270600	14.8N 136.9E	PCN 1		GMS		PGTW
26	270900	15.1N 136.8E	PCN 1		GMS		PGTW
27	271200	15.4N 136.5E	PCN 1		GMS		PGTW
28	271600	16.2N 136.1E	PCN 1		GMS		PGTW
29	271800	16.4N 135.8E	PCN 1		GMS		PGTW
30	271816	16.2N 135.8E	PCN 1		NOAA7		PGTW
31	272121	16.8N 135.4E	PCN 2		DMSP37		PGTW
32	272331	16.8N 135.6E	PCN 1	T6.5/6.5	NOAA6	INIT OBS	RODN
33	280000	16.6N 135.2E	PCN 1		GMS		PGTW
34	280300	16.8N 135.0E	PCN 1		GMS		PGTW
35	280520	17.0N 134.9E	PCN 1	T7.5/7.5 /D1.5/24HRS	NOAA7		PGTW
36	281200	17.7N 134.6E	PCN 1		GMS		PGTW
37	281600	18.3N 134.3E	PCN 1		GMS		PGTW
38	281805	18.6N 134.3E	PCN 1		NOAA7		PGTW
39	282100	19.0N 134.0E	PCN 1		GMS		PGTW
40	290000	19.5N 133.7E	PCN 1		GMS		PGTW
41	290300	20.0N 133.4E	PCN 1		GMS		PGTW

42	290500	20.5N 133.1E	PCN 1	T6.0/7.5 /W1.5/24HRS	NOAA7	PGTW
43	291200	21.4N 132.6E	PCN 1		GMS	PGTW
44	291600	21.8N 132.3E	PCN 1		GMS	PGTW
45	291753	22.0N 132.2E	PCN 1		NOAA7	PGTW
46	292100	22.7N 132.0E	PCN 1		GMS	PGTW
47	300000	23.2N 131.8E	PCN 1		GMS	PGTW
48	300300	23.9N 131.7E	PCN 1		GMS	PGTW
49	300457	24.3N 131.6E	PCN 1	T6.0/6.0 /S0.0/24HRS	NOAA7	PGTW
50	300900	24.9N 131.7E	PCN 1		GMS	PGTW
51	301600	26.0N 132.3E	PCN 1		GMS	PGTW
52	301742	26.3N 132.5E	PCN 1		NOAA7	PGTW
53	302100	27.0N 133.0E	PCN 1		GMS	PGTW
54	010000	27.4N 133.8E	PCN 1		GMS	PGTW
55	010300	28.2N 134.2E	PCN 1		GMS	PGTW
56	010445	28.6N 135.1E	PCN 3	T4.5/5.0-/W1.5/24HRS	NOAA7	PGTW
57	010600	28.9N 135.3E	PCN 3		GMS	PGTW
58	011200	30.3N 138.0E	PCN 5		GMS	PGTW
59	011600	31.0N 139.5E	PCN 5		GMS	PGTW
60	011730	31.2N 140.3E	PCN 5		NOAA7	PGTW
61	012100	32.5N 142.4E	PCN 5		GMS	PGTW
62	020000	33.1N 144.1E	PCN 3		GMS	PGTW
63	020433	35.6N 147.4E	PCN 5	T3.0/3.5 /W1.5/24HRS	NOAA7	PGTW
64	020600	36.1N 148.3E	PCN 5		GMS	PGTW
65	021200	39.1N 153.0E	PCN 5		GMS	PGTW
66	021600	42.0N 155.1E	PCN 5		GMS	PGTW
67	021800	43.1N 155.7E	PCN 5		GMS	PGTW
68	030000	46.5N 156.9E	PCN 5		GMS	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM	ORIEN- TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	240139	10.3N 146.4E	1500FT		1006	20 240 80	280 21 240 40	4 20				+25 +24 +24 27	2
2	242208	11.5N 144.3E	1500FT		997	35 030 70	090 40 050 55	5 2				+27 +28 +25 32	3
3	250250	11.6N 143.8E	1500FT		994	50 130 25	190 49 130 25	7 2				+25 +26 +24 32	3
4	251143	12.2N 142.2E	700MB	3003	989		060 50 300 60	3 5				+13 +11	4
5	251822	12.3N 141.2E	700MB	2898			130 67 050 30	4 5					5
6	252103	12.3N 141.0E	700MB	2886	973	80 090 20	140 82 050 25	5 5	CIRCULAR	30		+13 +19 +10	5
7	260644	13.1N 139.2E	700MB	2778		100 080 15	050 99 310 30	5 3					6
8	260855	13.2N 138.8E	700MB	2763	961	50 160 40	230 67 140 15	10 5				+12 +16 + 8	6
9	261857	13.4N 137.6E	700MB	2546			080 112 360 15	5 5					7
10	262125	13.7N 137.2E	700MB	2494	929	70 280 10	170 103 080 20	5 5	CIRCULAR	18		+11 +19 + 8	7
11	270615	14.7N 136.9E	700MB	2261		120 240 30	090 100 360 15	3 2	CIRCULAR	20			8
12	270904	15.0N 136.8E	700MB	2251	902	100 150 20	090 105 340 15	5 3	CIRCULAR	15		+12 +30 +14	9
13	272120	16.5N 135.5E	700MB	2139	893	110 010 25	110 120 010 20	5 3	CIRCULAR	15		+14 +23 +14	9
14	280616	17.1N 135.0E	700MB	2182		60 130 90	210 105 140 10	6 5					10
15	280847	17.4N 134.8E	700MB	2205	898	80 050 75	110 120 040 15	6 6	CIRCULAR	15		+15 +18 +18	10
16	282014	18.9N 134.2E	700MB	2161	895	60 350 110	210 105 110 8	15 2	CONCENTRIC	15 50		+17 +21 +16	11
17	282315	19.5N 133.8E	700MB	2191		100 250 25	220 104 110 40	15 2	CIRCULAR	15			11
18	290657	20.7N 133.1E	700MB	2237		120 330 20	300 103 220 20	3 3	CIRCULAR	20			12
19	290902	20.9N 132.8E	700MB	2250		120 270 20	360 114 250 20	5 5	CIRCULAR	20		+13 +20 +19	12
20	291811	22.3N 132.1E	700MB	2312			190 104 130 25	3 3					13
21	292047	22.6N 132.1E	700MB	2311	911	80 200 30	010 97 270 35	4 5	CIRCULAR	40		+12 +17 +17	13
22	300607	24.4N 131.8E	700MB	2392		100 230 35	310 112 220 25	5 5					14
23	300909	24.9N 131.7E	700MB	2434	924		090 77 010 60	10 10	ELLIPTICAL	30 25	020	+14 +17 +17	14
24	301905	26.9N 132.8E	700MB	2512			180 97 080 90	10 5					15
25	302135	27.0N 133.2E	700MB	2528	937	80 220 80	300 79 190 30	5 6				+14 +15 +10	15
26	010108	27.8N 134.0E	700MB	2579		70 250 90	340 90 250 70	5 5				*	16
27	010257	28.2N 134.6E	700MB	2596	942	65 290 60	350 75 270 60	2 5				+16 +17 +17	16
28	010618	28.8N 135.3E	700MB	2565			240 97 170 65	3 8					17
29	010917	29.3N 136.5E	700MB	2595	942		320 80 270 50	6 6				+17 +18 +15	17

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	301300	25.4N 131.6E	LAND				6///2 53311		28.4N 129.5E	47909
2	301400	25.6N 131.6E	LAND				6///2 53612		28.4N 129.5E	47909
3	301500	25.8N 131.7E	LAND				6///2 50211		28.4N 129.5E	47909
4	301600	25.9N 131.9E	LAND				6///2 50612		28.4N 129.5E	47909
5	301700	26.1N 132.0E	LAND				6///2 50313		28.4N 129.5E	47909
6	301800	26.4N 132.1E	LAND				6///2 50219		28.4N 129.5E	47909
7	301900	26.6N 132.3E	LAND				6///2 50316		28.4N 129.5E	47909
8	302000	26.8N 132.6E	LAND				6///2 50513		28.4N 129.5E	47909
9	302100	27.1N 132.7E	LAND				6///2 50318		28.4N 129.5E	47909

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM FABIAN
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
101000Z	7.3	132.4	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101006Z	8.0	131.7	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101012Z	8.6	130.8	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101018Z	9.2	129.9	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101100Z	9.8	129.1	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101106Z	10.3	128.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101112Z	10.7	126.6	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101118Z	10.9	125.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101200Z	10.8	123.6	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101206Z	10.6	122.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101212Z	10.8	120.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101218Z	11.0	119.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101300Z	11.3	117.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101306Z	11.6	115.8	30	11.6	115.8	30.	0.	0.	11.9	109.4	35.	25.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101312Z	11.7	114.1	35	11.8	114.0	35.	8.	0.	12.6	107.4	20.	72.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101318Z	11.6	112.3	40	12.0	112.8	40.	38.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101400Z	11.5	110.9	45	11.4	110.9	40.	6.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101406Z	11.6	109.7	35	11.5	109.8	45.	8.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101412Z	11.9	108.4	25	11.6	108.4	35.	18.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13.	48.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	11.	43.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	3.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	3.	-3.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	6	2	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1479. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS

TROPICAL STORM FABIAN
FIX POSITIONS FOR CYCLONE NO. 23

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	081751	7.6N 130.4E	PCN 5		NOAA7		PGTW
2	110613	10.3N 128.4E	PCN 5	T1.0/1.0	NOAA7	INIT OBS	PGTW
3	120601	10.6N 121.8E	PCN 5	T2.0/2.0 /D1.0/24HRS	NOAA7		PGTW
* 4	121847	10.9N 120.0E	PCN 5		NOAA7		RPMK
5	130000	11.9N 117.9E	PCN 5		GMS		PGTW
6	130300	12.2N 116.4E	PCN 5		GMS		PGTW
7	130600	11.7N 114.4E	PCN 5	T2.5/2.5 /D0.5/24HRS	GMS		PGTW
8	130900	11.8N 114.5E	PCN 5		GMS		PGTW
9	131200	12.0N 114.0E	PCN 5		GMS		PGTW
10	131600	12.1N 112.8E	PCN 5		GMS		PGTW
11	131835	11.5N 112.1E	PCN 5		NOAA7		PGTW
12	132100	11.1N 111.7E	PCN 5		GMS		PGTW
13	140000	11.2N 111.2E	PCN 5	T3.0/3.0-/D0.5/18HRS	GMS		PGTW
14	140005	11.3N 111.4E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RPMK
15	140300	11.7N 110.8E	PCN 5		GMS		PGTW
16	140600	11.8N 109.8E	PCN 5		GMS		PGTW
17	140720	11.6N 109.8E	PCN 5		NOAA7		RPMK
18	140900	11.7N 109.2E	PCN 5		GMS		PGTW
19	141200	12.0N 108.4E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	130600	11.6N 115.8E	1500FT		1002	40 030 65	060 50 080 40	8 10			+25	1

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON GAY
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
101400Z	10.8	148.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101406Z	11.6	148.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101412Z	12.6	148.2	30	12.0	148.0	25.	30.	-5.	15.0	145.7	40.	75.	-5.	16.8	141.1	65.	30.	10.	20.0	137.5	75.	167.	10.
101418Z	13.8	147.8	35	13.0	147.8	25.	48.	-10.	15.5	144.5	50.	80.	5.	17.2	140.0	70.	6.	15.	21.0	137.2	80.	172.	10.
101500Z	14.7	147.1	35	14.7	147.2	25.	6.	-10.	16.8	143.4	40.	42.	-5.	18.7	139.3	70.	90.	10.	22.4	136.7	80.	251.	5.
101506Z	15.4	146.3	40	16.9	147.4	30.	110.	-10.	20.5	145.2	45.	292.	-5.	22.1	141.2	60.	344.	0.	24.9	138.0	70.	405.	-10.
101512Z	16.2	145.3	45	18.7	147.4	40.	191.	-5.	22.8	143.9	50.	374.	-5.	26.2	141.7	60.	535.	-5.	31.2	145.7	55.	929.	-30.
101518Z	16.8	144.2	45	18.3	146.0	40.	136.	-5.	22.0	143.0	55.	328.	0.	25.3	140.8	60.	454.	-10.	30.4	143.9	55.	851.	-30.
101600Z	17.2	142.8	45	17.3	142.4	45.	24.	0.	18.8	135.6	60.	226.	0.	22.0	131.8	70.	370.	-5.	26.8	131.2	70.	444.	-20.
101606Z	17.3	141.3	50	17.4	141.1	45.	13.	-5.	18.8	135.7	60.	213.	0.	21.9	131.8	70.	311.	-10.	26.4	131.1	70.	390.	-20.
101612Z	17.3	140.7	55	17.5	140.4	55.	21.	0.	18.8	135.8	65.	195.	0.	21.8	132.8	70.	208.	-15.	25.5	132.0	70.	323.	-20.
101618Z	17.3	140.0	55	17.5	139.8	55.	17.	0.	18.6	136.3	65.	94.	-5.	21.0	133.4	70.	100.	-15.	24.6	132.0	70.	258.	-20.
101700Z	17.2	139.2	60	17.3	139.2	60.	6.	0.	17.6	136.2	70.	58.	-5.	19.5	132.9	75.	11.	-15.	23.2	131.2	70.	166.	-25.
101706Z	16.8	138.8	60	17.3	138.5	60.	34.	0.	17.6	135.7	70.	49.	-10.	19.6	132.6	70.	54.	-20.	23.6	130.7	65.	150.	-30.
101712Z	17.6	139.0	65	17.0	139.3	65.	40.	0.	18.4	136.8	80.	108.	-5.	20.6	133.5	75.	174.	-15.	25.0	131.6	65.	210.	-30.
101718Z	18.2	137.9	70	18.3	137.6	65.	18.	-5.	21.5	132.7	80.	142.	-5.	26.2	131.5	75.	333.	-15.	30.2	135.8	65.	538.	-25.
101800Z	18.2	137.0	75	18.2	136.7	75.	17.	0.	20.2	133.5	85.	61.	-5.	24.5	131.6	85.	237.	-10.	29.1	133.6	75.	364.	-15.
101806Z	18.4	135.9	80	18.6	135.3	75.	36.	-5.	22.0	132.2	90.	128.	0.	26.7	132.2	85.	344.	-10.	31.3	136.5	75.	501.	-10.
101812Z	19.0	135.0	85	19.0	135.0	85.	0.	0.	22.5	132.0	95.	159.	5.	26.8	131.8	85.	295.	-10.	31.2	135.7	75.	406.	-10.
101818Z	19.4	133.9	85	19.9	133.6	85.	34.	0.	24.1	131.6	95.	221.	5.	28.6	132.4	85.	351.	-5.	32.2	137.7	75.	411.	-5.
101900Z	19.5	132.7	90	19.9	132.8	90.	25.	0.	23.2	130.8	95.	150.	0.	27.2	130.4	95.	173.	5.	31.8	132.5	85.	162.	10.
101906Z	19.9	131.7	90	19.9	131.6	90.	6.	0.	22.9	128.2	100.	66.	5.	27.1	127.5	95.	140.	10.	31.7	129.2	85.	323.	15.
101912Z	20.3	130.4	90	20.3	130.6	90.	11.	0.	23.9	127.8	100.	79.	5.	28.3	127.7	90.	175.	5.	32.8	130.4	75.	392.	5.
101918Z	20.9	129.6	90	20.8	129.5	90.	8.	0.	24.8	126.8	100.	127.	10.	28.9	127.7	90.	215.	10.	33.0	130.7	75.	588.	10.
102000Z	21.4	128.9	95	21.5	129.0	90.	8.	-5.	24.3	127.2	90.	99.	0.	28.2	128.3	80.	274.	5.	33.3	136.1	55.	650.	0.
102006Z	21.9	128.7	95	22.2	128.3	95.	28.	0.	25.2	127.1	85.	132.	0.	29.5	129.5	75.	324.	5.	34.2	139.5	50.	784.	-5.
102012Z	22.8	128.6	95	22.8	128.4	95.	11.	0.	26.2	127.6	80.	140.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102018Z	23.7	128.8	90	23.6	128.6	90.	12.	0.	27.2	129.5	80.	117.	0.	31.2	134.0	70.	503.	5.	0.0	0.0	0.	-0.	0.
102100Z	24.6	129.0	90	24.6	129.1	85.	5.	-5.	28.4	131.8	75.	96.	0.	32.5	137.7	60.	626.	5.	0.0	0.0	0.	-0.	0.
102106Z	25.6	129.5	85	25.7	129.2	85.	17.	0.	30.2	133.2	75.	130.	5.	34.2	140.8	55.	742.	0.	0.0	0.0	0.	-0.	0.
102112Z	26.4	130.2	85	26.8	130.1	85.	24.	0.	31.2	134.9	75.	216.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102118Z	27.8	131.6	80	27.5	131.1	80.	32.	0.	31.6	136.1	70.	410.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102200Z	29.2	133.4	75	28.5	133.3	75.	42.	0.	34.4	144.4	55.	353.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102206Z	31.1	135.5	70	30.9	136.1	75.	33.	5.	39.6	148.8	55.	254.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102212Z	33.5	138.2	70	32.9	137.8	70.	41.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102218Z	36.5	141.9	65	36.6	142.0	65.	8.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102300Z	40.0	146.8	55	40.0	146.8	55.	0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102306Z	43.2	151.8	55	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	31.	163.	275.	410.	31.	163.	275.	410.
AVG RIGHT ANGLE ERROR	24.	86.	115.	140.	24.	86.	115.	140.
AVG INTENSITY MAGNITUDE ERROR	2.	3.	9.	15.	2.	3.	9.	15.
AVG INTENSITY BIAS	-2.	-0.	-3.	-10.	-2.	-0.	-3.	-10.
NUMBER OF FORECASTS	35	32	27	24	34	32	27	24

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 3233. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 15. KNOTS

TYPHOON GAY
FIX POSITIONS FOR CYCLONE NO. 24

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	130000	9.7N 150.2E	PCN 5		GMS		PGTW
2	130408	9.6N 149.8E	PCN 5	T1.0/1.0	NOAA7	INIT OBS	PGTW
3	130900	9.9N 148.9E	PCN 5		GMS		PGTW
4	140356	11.0N 147.9E	PCN 5	T2.0/2.0 /D1.0/24HRS	NOAA7		PGTW
5	140600	11.4N 147.9E	PCN 5		GMS		PGTW
6	140900	12.0N 147.9E	PCN 5		GMS		PGTW
7	141641	12.8N 148.3E	PCN 5		NOAA7		PGTW
8	141800	13.4N 148.1E	PCN 5		GMS		PGTW
9	142100	14.1N 148.2E	PCN 5		GMS		PGTW
* 10	150345	16.4N 147.7E	PCN 5	T3.0/3.0 /D1.0/24HRS	NOAA7		PGTW
* 11	150600	16.9N 147.7E	PCN 5		GMS		PGTW
* 12	150900	17.7N 147.4E	PCN 5		GMS		PGTW
* 13	151600	17.7N 146.4E	PCN 5		GMS		PGTW
* 14	151800	17.3N 145.8E	PCN 5		GMS		PGTW
* 15	152100	17.4N 145.4E	PCN 5		GMS		PGTW
16	152137	17.5N 144.1E	PCN 5		NOAA6		PGTW
17	160000	17.5N 142.7E	PCN 5		GMS		PGTW
18	160515	17.5N 142.2E	PCN 5	T3.0/3.0 /S0.0/26HRS	NOAA7	SECNDRY LLCC 12.2N 139.6E	PGTW
19	160515	17.7N 141.8E	PCN 5	T2.5/2.5	NOAA6	INIT OBS	RPMK
20	160900	17.4N 141.1E	PCN 5		GMS		PGTW
21	161200	17.7N 140.8E	PCN 5		GMS		PGTW
22	161600	17.4N 140.0E	PCN 5		GMS		PGTW
23	161800	17.2N 139.5E	PCN 5		NOAA7		PGTW
24	162100	17.2N 139.1E	PCN 5		GMS		PGTW
25	170000	17.3N 139.1E	PCN 3		GMS		PGTW
26	170300	17.3N 138.8E	PCN 5		GMS		PGTW
27	170503	17.3N 138.5E	PCN 5	T3.5/3.5 /D0.5/24HRS	NOAA7		PGTW
28	170900	16.6N 139.1E	PCN 5		GMS	BREAKS CONTINUITY	PGTW
29	171200	17.0N 139.1E	PCN 5		GMS		PGTW
* 30	171600	17.9N 139.4E	PCN 5		GMS		PGTW
31	171749	18.4N 138.1E	PCN 5		NOAA7		PGTW
32	172100	18.2N 137.1E	PCN 5		GMS		PGTW
33	180000	18.1N 136.9E	PCN 5		GMS		PGTW
34	180300	18.4N 136.2E	PCN 5		GMS		PGTW
35	180452	18.7N 135.6E	PCN 5	T4.5/4.5 /D1.0/24HRS	NOAA7		PGTW
36	180900	18.4N 135.3E	PCN 5		GMS		PGTW
37	181200	19.4N 134.6E	PCN 5		GMS		PGTW
38	181737	20.0N 133.9E	PCN 5		NOAA7		PGTW
39	182100	20.2N 133.1E	PCN 5		GMS		PGTW

40	190000	19.7N 132.7E	PCN 5		GMS		PGTW
41	190440	20.0N 131.1E	PCN 5	T5.0/5.0 /D0.5/24HRS	NOAA7		PGTW
42	190440	20.1N 131.2E	PCN 5	T5.0/5.0	NOAA7	INIT OBS	RODN
43	190600	20.0N 131.5E	PCN 5		GMS		PGTW
44	191200	20.3N 130.4E	PCN 3		GMS		PGTW
45	191600	20.7N 129.7E	PCN 3		GMS		PGTW
46	191725	20.9N 129.5E	PCN 3		NOAA7		PGTW
47	192327	21.2N 129.2E	PCN 3	T5.5/5.5	NOAA6	INIT OBS	RPMK
48	192327	21.4N 128.9E	PCN 1	T6.0/6.0-/D1.0/18HRS	NOAA6		PGTW
49	192327	21.4N 128.9E	PCN 3	T6.0/6.0 /D1.0/19HRS	NOAA6		RODN
50	200610	22.0N 128.7E	PCN 3		NOAA7		PGTW
51	200610	22.0N 128.8E	PCN 3		NOAA7		RPMK
52	200610	22.0N 128.6E	PCN 3		NOAA7		RODN
53	200900	22.4N 128.6E	PCN 3		GMS		PGTW
54	201200	22.7N 128.6E	PCN 3		GMS		PGTW
55	201600	23.3N 128.6E	PCN 1		GMS		PGTW
56	201800	23.5N 128.7E	PCN 1		GMS		PGTW
57	202100	24.0N 129.0E	PCN 1		GMS		PGTW
58	210000	24.3N 129.1E	PCN 1		GMS		PGTW
59	210300	25.1N 129.6E	PCN 1		GMS		PGTW
* 60	210559	25.8N 130.1E	PCN 1	T4.5/5.0 /W1.5/30HRS	NOAA7		PGTW
61	211200	26.2N 130.5E	PCN 3		GMS		PGTW
62	211600	27.2N 131.7E	PCN 3		GMS		PGTW
63	211844	27.7N 132.5E	PCN 3		NOAA7		PGTW
* 64	212100	28.3N 133.8E	PCN 3		GMS		PGTW
65	220000	29.4N 133.9E	PCN 5		GMS		PGTW
* 66	220405	30.3N 136.3E	PCN 5	T3.5/4.0 /W1.0/22HRS	NOAA7		PGTW
* 67	221600	34.3N 142.8E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	141420	13.2N 148.5E	700MB	3063	998		230 26 150 30	10 8			+10 +11 +11	3
2	160135	17.3N 142.0E	1500FT		990	35 010 20	130 37 010 20	10 8			+25 +24 +24 28	6
3	160803	17.2N 141.1E	700MB	2926	980	25 120 90	030 35 310 30	3 3			+16 +13	7
4	161804	17.5N 140.1E	700MB	2909			140 41 040 60	5 5				8
5	162049	17.3N 139.8E	700MB	2902	977	50 320 20	360 38 240 30	5 5	CIRCULAR	15	+12 +14 +14	8
6	170830	16.6N 139.2E	700MB	2831	968	65 100 90	190 60 100 90	3 3	CIRCULAR	7	+17 +19 +13	9
7	171921	18.2N 137.4E	700MB	2788			180 83 120 120	15 2				10
8	172204	18.1N 137.0E	700MB	2783	962	50 230 60	170 61 060 90	5 2	CIRCULAR	4	+13 +17 + 9	10
9	180811	18.3N 135.7E	700MB	2660	947	65 130 80	200 65 100 125	3 5			+17 +19	11
10	181910	19.3N 133.0E	700MB	2734			160 59 100 90	10 10				12
11	182210	19.4N 133.2E	700MB	2771	961	90 120 25	240 72 190 45	10 10			+13 +17 +14	12
12	190645	19.8N 131.4E	700MB	2741		80 080 70	140 101 080 70	5 10				13
13	190851	20.1N 131.2E	1500FT		957			3 3			+23 +25 +22 30	13
14	191900	21.2N 129.4E	700MB	2645			050 87 310 60	5 3	ELLIPTICAL	90 70 330		15
15	192156	21.2N 129.2E	700MB	2659	947	75 010 110	110 88 010 110	5 3	CIRCULAR	80	+13 +17	15
16	200056	21.4N 128.8E	700MB	2649		60 300 100	170 86 090 100	5 5				16
17	200315	21.8N 128.7E	700MB	2648	948	55 240 120	110 81 020 120	5 5			+14 +17 +13	16
18	200600	22.0N 128.6E	700MB	2621		85 100 110	200 97 100 110	5 5	CIRCULAR	75		17
19	200831	22.2N 128.5E	700MB	2630	947		060 99 320 100	10 5	CIRCULAR	80	+15 +18 +12	17
20	202248	24.4N 129.1E	700MB	2687	953		080 56 330 60	6 5			+14 +14	19
21	210122	24.8N 129.2E	700MB	2696			190 124 120 90	4 5			+15 +14	19
22	210247	25.2N 129.0E	700MB	2698	953	65 260 120	350 68 260 60	5 5			+14 +14	19
23	210950	26.1N 130.0E	700MB	2728	959		340 69 270 60	5 9			+14 +14	20
24	211257	26.8N 130.8E	700MB	2741			210 94 130 100	10 8				20
25	211523	27.1N 131.1E	700MB	2763			170 106 140 120	10 3			+15 +15	20
26	212228	28.2N 132.7E	3000FT			30 030 60		15 15			+13 +21	21
27	220045	29.6N 133.8E	700MB	2775	964	30 270 85	030 56 290 120	5 5			+13 +14	21
28	220314	30.2N 134.4E	700MB	2740	961	60 230 120	150 85 030 120	10 8			+10 +17 +13	22
29	220641	31.2N 135.7E	700MB	2771		90 360 90	220 88 130 130	15 8				22
30	220804	31.5N 136.0E	700MB	2780	965	90 330 60	330 42 310 30	10 5			+15 +20 +10	22

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	200800	22.7N 128.3E	LAND				65//5 /////		26.2N 127.8E	47937
2	200900	22.8N 128.2E	LAND				55//5 53010		26.2N 127.8E	47937
3	201000	22.9N 128.2E	LAND				65//5 53608		26.2N 127.8E	47937
4	201300	23.1N 128.4E	LAND				65//5 70103		26.2N 127.8E	47937
5	201400	23.1N 128.3E	LAND				65//5 73203		26.2N 127.8E	47937
6	201500	23.1N 128.3E	LAND				65//5 73003		26.2N 127.8E	47937
7	201600	23.1N 128.3E	LAND				65//5 73203		26.2N 127.8E	47937
8	201700	23.2N 128.5E	LAND				65//5 70514		26.2N 127.8E	47937
9	201800	23.6N 128.5E	LAND				65//5 70211		26.2N 127.8E	47937
10	201900	23.6N 128.5E	LAND				65//5 70510		26.2N 127.8E	47937
11	201900	23.7N 123.7E	LAND	GOOD		100		MOVG 3415	26.1N 127.7E	47937
12	202000	23.8N 128.8E	LAND				65//5 70212		26.2N 127.8E	47937
13	202000	23.8N 128.8E	LAND	GOOD		110			26.1N 127.7E	47937
14	202100	24.0N 128.9E	LAND				65//5 70411		26.2N 127.8E	47937
15	202100	23.9N 128.8E	LAND	GOOD		110		MOVG 0420	26.1N 127.7E	47937
16	202200	24.1N 128.9E	LAND				65//4 70313		26.2N 127.8E	47937
17	202200	24.2N 129.0E	LAND	GOOD		120		MOVG 0330	26.1N 127.7E	47937
18	210000	24.5N 129.0E	LAND	GOOD		135		MOVG 3610	26.1N 127.7E	47937
19	210100	24.6N 129.3E	LAND				65//4 70312		26.2N 127.8E	47937
20	210100	24.7N 129.0E	LAND	GOOD		145		MOVG 3620	26.1N 127.7E	47937
21	210200	24.4N 129.4E	LAND				65//4 70608		26.2N 127.8E	47937
22	210200	24.8N 129.1E	LAND	POOR				MOVG 0225	26.1N 127.7E	47937
23	210300	25.1N 129.2E	LAND	FAIR		140		MOVG 0225	26.1N 127.7E	47937
24	210400	25.0N 129.5E	LAND				65//4 70211		26.2N 127.8E	47937
25	210400	24.9N 129.2E	LAND				6///2 5////		28.4N 129.5E	47909
26	210400	25.3N 129.3E	LAND	FAIR		130		MOVG 0220	26.1N 127.7E	47937
27	210500	25.2N 129.6E	LAND				6///2 50627		28.4N 129.5E	47909
28	210500	25.4N 129.4E	LAND				65//4 73514		26.2N 127.8E	47937
29	210500	25.5N 129.3E	LAND	POOR				MOVG 0325	26.1N 127.7E	47937
30	210600	25.4N 129.7E	LAND				6///2 50116		28.4N 129.5E	47909
31	210600	25.7N 129.5E	LAND	POOR					26.1N 127.7E	47937
32	210700	25.8N 129.9E	LAND				6///2 50227		28.4N 129.5E	47909
33	210700	25.8N 129.5E	LAND				65//4 73515		26.2N 127.8E	47937
34	210800	26.0N 129.8E	LAND				65//4 70315		26.2N 127.8E	47937
35	210900	26.3N 129.8E	LAND				6///2 5////		28.4N 129.5E	47909

36	210900	26.1N	129.9E	LAND		65//3 70412		26.2N	127.8E	47937
37	210900	26.2N	130.0E	LAND	POOR		MOVG 0420	27.4N	128.7E	47942
38	211000	26.2N	130.0E	LAND		65//3 70416		26.2N	127.8E	47937
39	211000	26.5N	130.4E	LAND		6///2 50635		28.4N	129.5E	47909
40	211100	26.4N	130.2E	LAND		65//2 70411		26.2N	127.8E	47937
41	211100	26.4N	130.1E	LAND		6///2 5////		28.4N	129.5E	47909
42	211200	26.5N	130.2E	LAND		65//2 70411		26.2N	127.8E	47937
43	211200	26.6N	130.2E	LAND		6///3 50216		28.4N	129.5E	47909
44	211300	26.8N	130.3E	LAND		6///3 50116		28.4N	129.5E	47909
45	211400	27.2N	130.3E	LAND		6///3 50119		28.4N	129.5E	47909
46	211500	27.3N	130.4E	LAND		6///3 50211		28.4N	129.5E	47909
47	211600	27.6N	130.6E	LAND		6///3 50419		28.4N	129.5E	47909
48	211700	27.9N	131.0E	LAND		6///2 50430		28.4N	129.5E	47909
49	211800	28.1N	131.2E	LAND		6///2 50516		28.4N	129.5E	47909

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON HAZEN
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST.				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
111212Z	13.8	153.3	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111218Z	14.2	152.7	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111300Z	14.4	151.9	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111306Z	14.7	151.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111312Z	14.8	150.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111318Z	15.2	149.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111400Z	15.4	149.0	30	15.7	148.6	30.	29.	0.	17.9	145.4	45.	156.	0.	20.6	144.2	55.	467.	-25.	24.5	145.4	45.	852.	-45.
111406Z	15.6	148.4	30	15.8	147.8	30.	37.	0.	17.9	145.3	50.	161.	-5.	20.7	144.4	50.	524.	-45.	25.2	146.2	40.	961.	-45.
111412Z	15.7	149.2	35	16.0	147.6	30.	39.	-5.	17.8	145.4	40.	207.	-20.	19.8	145.5	40.	592.	-60.	21.8	147.4	30.	973.	-50.
111418Z	15.7	147.3	35	15.7	147.2	35.	6.	0.	16.2	144.8	50.	179.	-15.	17.2	143.1	50.	446.	-45.	19.9	142.8	30.	759.	-45.
111500Z	15.4	146.2	45	15.6	146.6	45.	26.	0.	16.3	144.1	55.	249.	-25.	17.6	141.9	60.	453.	-30.	19.1	139.2	65.	592.	0.
111506Z	15.2	145.3	55	15.2	145.6	55.	17.	0.	14.1	141.4	65.	129.	-30.	13.2	137.2	70.	234.	-15.	12.9	133.0	75.	272.	20.
111512Z	14.5	144.3	60	14.0	143.9	65.	38.	5.	13.1	139.3	75.	100.	-25.	13.0	135.3	80.	214.	0.	13.0	131.3	85.	226.	30.
111518Z	13.9	142.8	65	13.8	142.3	65.	30.	0.	13.7	137.5	75.	76.	-20.	13.7	133.6	80.	186.	5.	13.7	129.7	85.	174.	30.
111600Z	13.4	141.0	80	13.5	140.9	80.	8.	0.	13.4	136.0	100.	88.	10.	13.4	132.0	105.	156.	40.	13.3	127.8	110.	113.	45.
111606Z	13.4	139.3	95	13.2	138.8	90.	31.	-5.	13.1	132.1	110.	113.	25.	12.8	126.4	120.	175.	65.	12.1	121.5	120.	215.	50.
111612Z	13.4	137.6	100	13.3	136.9	95.	41.	-5.	13.2	130.2	120.	134.	40.	13.2	124.9	110.	168.	55.	14.0	120.5	90.	188.	30.
111618Z	13.8	136.2	95	13.5	136.0	100.	21.	5.	14.0	131.3	125.	63.	50.	13.5	126.7	110.	24.	55.	13.8	122.0	90.	47.	35.
111700Z	14.3	134.8	90	14.4	134.7	90.	8.	0.	14.2	129.4	95.	48.	30.	13.3	124.6	90.	79.	25.	14.1	120.0	75.	86.	20.
111706Z	14.5	133.4	85	14.5	133.2	90.	12.	5.	13.8	127.9	90.	71.	35.	13.5	123.0	85.	110.	15.	14.4	118.6	75.	84.	20.
111712Z	14.6	132.0	80	14.6	131.9	85.	6.	5.	13.6	126.8	70.	59.	15.	13.5	121.6	60.	122.	0.	15.3	117.0	45.	108.	-5.
111718Z	14.8	130.6	75	15.2	130.8	75.	27.	0.	15.2	125.4	60.	108.	5.	15.7	121.2	45.	162.	-10.	18.2	117.2	40.	234.	-5.
111800Z	14.9	129.8	65	15.1	129.3	65.	31.	0.	15.5	124.5	50.	135.	-15.	16.2	120.1	40.	181.	-15.	19.0	116.5	45.	259.	0.
111806Z	14.7	128.7	55	15.1	128.2	55.	37.	0.	15.0	123.4	45.	125.	-25.	16.8	119.4	30.	193.	-25.	19.8	115.8	45.	271.	0.
111812Z	14.2	127.6	55	14.8	127.6	55.	36.	0.	14.8	123.4	50.	80.	-10.	15.9	120.2	30.	158.	-20.	18.2	117.2	40.	291.	0.
111818Z	13.9	126.7	55	14.0	126.6	55.	8.	0.	13.7	122.8	40.	19.	-15.	14.6	119.3	30.	140.	-15.	17.1	116.8	40.	320.	5.
111900Z	13.7	125.9	65	13.8	126.1	65.	13.	0.	12.8	123.4	55.	127.	0.	13.1	120.1	40.	291.	-5.	13.5	115.7	50.	405.	20.
111906Z	13.5	124.9	70	13.5	125.2	70.	17.	0.	13.0	122.2	55.	144.	0.	13.2	118.8	45.	312.	0.	13.8	114.2	50.	397.	25.
111912Z	13.5	123.7	60	13.5	124.1	65.	23.	5.	13.8	120.7	45.	140.	-5.	14.2	117.5	50.	314.	10.	14.2	113.5	55.	420.	30.
111918Z	13.4	122.7	55	13.4	123.2	60.	29.	5.	13.6	119.8	40.	173.	-5.	14.2	116.2	55.	330.	20.	16.8	112.8	55.	325.	25.
112000Z	13.4	121.3	55	13.3	122.0	55.	41.	0.	13.5	118.0	50.	169.	5.	13.6	113.2	55.	298.	25.	15.0	109.0	40.	400.	15.
112006Z	13.6	119.8	55	13.7	120.5	55.	41.	0.	13.4	116.2	65.	183.	20.	14.0	111.2	65.	290.	40.	16.1	107.3	25.	413.	5.
112012Z	14.0	118.3	50	13.9	118.4	50.	8.	0.	14.0	113.8	60.	156.	20.	14.7	109.3	55.	294.	30.	0.0	0.0	0.	-0.	0.
112018Z	14.3	116.9	45	14.2	117.2	45.	18.	0.	14.1	112.6	60.	186.	25.	15.0	108.2	40.	342.	10.	0.0	0.0	0.	-0.	0.
112100Z	14.8	115.4	45	14.4	116.1	50.	47.	5.	14.8	111.8	60.	194.	30.	16.0	107.9	40.	346.	15.	0.0	0.0	0.	-0.	0.
112106Z	15.6	114.0	45	15.6	114.2	45.	12.	0.	18.4	108.6	35.	40.	10.	22.3	104.7	20.	282.	0.	0.0	0.0	0.	-0.	0.
112112Z	16.3	112.5	40	16.5	112.1	40.	26.	0.	19.8	106.6	35.	124.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112118Z	16.9	111.2	35	16.9	111.2	35.	0.	0.	19.2	106.2	35.	171.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112200Z	17.6	110.1	30	17.5	109.6	30.	29.	0.	21.8	105.6	20.	189.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112206Z	18.5	109.3	25	18.2	108.7	25.	38.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112212Z	19.6	108.8	25	19.5	108.9	25.	8.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112218Z	20.7	108.8	30	20.5	108.7	30.	13.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112300Z	21.7	109.0	25	21.6	109.1	25.	8.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112306Z	22.6	109.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	23.	130.	263.	361.	23.	128.	251.	351.
AVG RIGHT ANGLE ERROR	12.	73.	114.	171.	11.	65.	99.	192.
AVG INTENSITY MAGNITUDE ERROR	1.	17.	24.	23.	2.	18.	25.	24.
AVG INTENSITY BIAS	1.	3.	3.	8.	1.	2.	-1.	5.
NUMBER OF FORECASTS	37	33	30	26	30	28	24	20

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2968. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

TYPHOON HAZEN
FIX POSITIONS FOR CYCLONE NO. 25

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	121609	14.2N 153.0E	PCN 5		NOAA7		PGTW
2	130000	15.0N 151.7E	PCN 5		GMS	ULAC 16.0N 152.0E	PGTW
3	130454	14.4N 151.2E	PCN 5	T1.5/1.5	NOAA7	INIT OBS	PGTW
4	130900	14.8N 150.7E	PCN 5		GMS		PGTW
5	131557	15.0N 150.3E	PCN 5		NOAA7		PGTW
6	140300	15.6N 148.1E	PCN 5	T2.5/2.5-/D1.0/22HRS	GMS		PGTW
7	140600	15.6N 148.0E	PCN 5		GMS		PGTW
8	140900	15.7N 147.8E	PCN 5		GMS		PGTW
9	141200	15.7N 147.6E	PCN 5		GMS		PGTW
10	141600	15.8N 146.8E	PCN 5		GMS		PGTW
* 11	141728	16.3N 146.7E	PCN 5		NOAA7		PGTW
12	142100	15.9N 147.0E	PCN 5		GMS		PGTW
13	150000	15.4N 146.7E	PCN 3		GMS		PGTW
14	150300	15.2N 145.8E	PCN 3	T3.5/3.5 /D1.0/24HRS	GMS		PGTW
15	150431	15.1N 145.2E	PCN 3		NOAA7		PGTW
16	150600	15.0N 145.2E	PCN 3		GMS		PGTW
17	150900	14.7N 144.5E	PCN 3		GMS		PGTW
18	151600	14.0N 142.8E	PCN 1		GMS		PGTW
19	151716	13.9N 142.3E	PCN 1		NOAA7		PGTW
20	152100	14.2N 143.8E	PCN 1		GMS		PGTW
21	152100	13.8N 141.3E	PCN 1		GMS		PGTW
22	160000	13.7N 140.7E	PCN 1		GMS		PGTW
23	160419	13.4N 139.0E	PCN 1	T5.0/5.0 /D1.5/25HRS	NOAA7		PGTW
24	160419	13.2N 139.1E	PCN 1	T3.5/3.5	NOAA7	INIT OBS	RODN
25	160600	13.3N 138.5E	PCN 3		GMS		PGTW
26	160900	13.5N 138.2E	PCN 3		GMS		PGTW
27	161200	13.6N 137.7E	PCN 1		GMS		PGTW
28	161600	13.6N 136.6E	PCN 3		GMS		PGTW
29	161705	13.7N 136.2E	PCN 3		NOAA7		PGTW
30	162242	14.0N 135.0E	PCN 3	T5.0/5.0	NOAA6	INIT OBS	RPMK
31	170000	14.5N 134.6E	PCN 5		GMS		PGTW
32	170300	14.5N 134.0E	PCN 5		GMS		PGTW

33	170550	14.5N 133.2E	PCN 5	T4.5/5.0+/W0.5/26HRS	NOAA7		PGTW
34	171200	15.0N 132.0E	PCN 5		GMS		PGTW
35	171600	15.5N 130.9E	PCN 5		GMS		PGTW
36	171834	15.9N 130.3E	PCN 5		NOAA7		PGTW
37	180000	15.0N 129.9E	PCN 5		GMS		PGTW
38	180300	15.0N 128.7E	PCN 5	T4.0/4.5 /W0.5/21HRS	GMS		PGTW
39	180900	15.0N 127.4E	PCN 5		GMS		PGTW
40	181200	14.2N 127.3E	PCN 5		GMS		PGTW
41	181823	14.2N 126.6E	PCN 5		NOAA7		PGTW
42	182337	14.0N 126.0E	PCN 3	T4.0/4.0	NOAA6	INIT OBS	RPMK
43	190000	14.0N 125.9E	PCN 5		GMS		PGTW
44	190300	13.8N 125.3E	PCN 1	T5.0/5.0 /D1.0/24HRS	GMS		PGTW
45	190600	13.7N 124.9E	PCN 5		GMS		PGTW
46	190900	13.9N 124.3E	PCN 5		GMS		PGTW
47	191200	14.2N 123.7E	PCN 5		GMS		PGTW
48	191600	13.4N 123.1E	PCN 5		GMS		PGTW
49	191811	13.5N 122.6E	PCN 5		NOAA7		PGTW
50	192100	13.4N 121.6E	PCN 5		GMS		PGTW
51	200000	13.6N 121.1E	PCN 5		GMS		PGTW
52	200300	13.7N 120.4E	PCN 5		GMS		PGTW
53	200600	13.8N 119.7E	PCN 5	T3.5/4.0 /W1.5/27HRS	GMS		PGTW
54	200900	13.9N 119.0E	PCN 5		GMS		PGTW
55	201200	13.9N 118.4E	PCN 5		GMS		PGTW
56	201600	14.2N 117.7E	PCN 5		GMS		PGTW
57	202100	14.6N 116.9E	PCN 5		GMS		PGTW
58	210000	15.2N 115.6E	PCN 5		GMS		PGTW
* 59	210031	14.8N 116.0E	PCN 5	T4.0/4.0	NOAA6	INIT OBS	RPMK
60	210600	16.1N 113.3E	PCN 5	T2.5/3.5 /W1.0/24HRS	GMS		PGTW
61	210644	15.9N 113.2E	PCN 5		NOAA7		RPMK
62	210900	16.2N 112.8E	PCN 5		GMS		PGTW
63	211200	16.2N 112.5E	PCN 5		GMS		PGTW
64	211600	16.9N 111.7E	PCN 5		GMS		PGTW
65	212100	17.1N 110.2E	PCN 5		GMS		PGTW
66	220300	17.9N 109.3E	PCN 5	T1.5/2.5 /W1.0/21HRS	GMS		PGTW
67	220900	18.9N 109.0E	PCN 5		GMS		PGTW
68	221600	19.9N 109.3E	PCN 5		GMS		PGTW
69	221800	20.5N 109.4E	PCN 5		GMS		PGTW
70	222100	21.2N 110.2E	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIEN-TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	132345	15.6N 148.6E	1500FT		1006	35 010 30	110 36 010 30	5 30			+23 +23 +23 32	2
2	141544	15.7N 147.8E	700MB	3029	992		060 39 020 30	10 5	ELLIPTICAL	25 15 090	+10 +15 + 9	3
3	142135	15.4N 146.8E	700MB	3002		50 090 10	140 36 080 70	10 2	CIRCULAR	30	+ 9 +16 + 9	3
4	150710	14.7N 145.0E	700MB	2927		45 310 20	170 67 080 10	5 3	CIRCULAR	25	+10 +17 + 8	4
5	150908	14.4N 144.5E	700MB	2916	979		340 74 230 25	5 3	CIRCULAR	20	+12 +15 +11	4
6	152117	13.5N 141.3E	700MB	2738	957	100 120 10	030 97 290 20	5 3	CIRCULAR	20	+12 +21 + 9	5
7	160839	13.3N 138.3E	700MB	2738	956	80 050 20	080 92 350 30	10 3	CIRCULAR	20	+13 +21 + 8	6
8	161930	14.2N 135.8E	700MB	2838			030 141 300 10	5 2	CIRCULAR	20		7
9	162158	14.3N 135.0E	700MB	2937	979	100 130 15	140 87 130 15	5 3	ELLIPTICAL	30 15 090	+ 8 +23 + 4	7
10	170631	14.6N 133.1E	700MB	2952	986	50 360 7	130 79 020 27	3 3	CIRCULAR	30	+10 +17 + 6	8
11	170845	14.7N 132.5E	700MB	2982	986	30 220 30	200 52 130 15	10 6	ELLIPTICAL	40 30 050	+11 +17 + 7	8
12	171904	15.2N 130.2E	700MB	2960	985		060 55 310 30	10 2				9
13	172201	15.0N 130.0E	700MB	2967	984	30 030 80	150 56 010 60	5 2			+14 +18 +10	9
14	180925	14.6N 128.0E	700MB	2986	986		120 56 030 35	6 3	ELLIPTICAL	30 15 010	+15 + 9	10
15	181206	14.6N 127.5E	700MB	2989			080 57 040 30	10 4	ELLIPTICAL	40 20 090	+13 +15 +10	10
16	181401	14.3N 127.5E	700MB	2982	987		100 52 130 45	17 5	ELLIPTICAL	40 20 100	+ 9 +14 +10	10
17	182150	13.8N 126.4E	700MB	2914	976	70 010 15	100 82 010 15	5 2	CIRCULAR	20	+13 +18 +10	11
18	190830	13.6N 124.7E	700MB	2886	974	75 010 15	060 70 330 20	2 3	CIRCULAR	20	+15 +10	12
* 19	210249	15.3N 114.8E	700MB	3136	1012	30 330 20	150 27 090 60	5 3			+12 +12 +11	14

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	150135	15.1N 145.8E	LAND	GOOD	CIRCULAR	35		OPEN N	13.6N 144.9E	91218
2	150210	15.0N 145.8E	LAND	GOOD	ELLIPTICAL	35		OPEN W	13.6N 144.9E	91218
3	150235	15.0N 144.8E	LAND	GOOD	ELLIPTICAL	32		OPEN S	13.6N 144.9E	91218
4	150310	15.0N 144.8E	LAND	GOOD	ELLIPTICAL	32		OPEN S	13.6N 144.9E	91218
5	150335	14.9N 144.7E	LAND	GOOD	CIRCULAR	30		OPEN SE	13.6N 144.9E	91218
6	150410	14.9N 145.5E	LAND	GOOD	CIRCULAR	30		OPEN ENE	13.6N 144.9E	91218
7	150435	14.8N 145.3E	LAND	GOOD	ELLIPTICAL	30			13.6N 144.9E	91218
8	150510	14.8N 145.2E	LAND	GOOD	CIRCULAR	28		OPEN N	13.6N 144.9E	91218
9	150535	14.8N 145.2E	LAND	GOOD	ELLIPTICAL	28		OPEN W	13.6N 144.9E	91218
10	150610	14.7N 145.0E	LAND	GOOD	ELLIPTICAL	28		OPEN S	13.6N 144.9E	91218
11	150635	14.6N 144.9E	LAND	GOOD	CIRCULAR	28		OPEN E AND N	13.6N 144.9E	91218
12	150735	14.5N 144.8E	LAND	GOOD	ELLIPTICAL	22		OPEN NW	13.6N 144.9E	91218
13	150810	14.4N 144.8E	LAND	GOOD	ELLIPTICAL	20			13.6N 144.9E	91218
14	150835	14.3N 144.6E	LAND	GOOD	ELLIPTICAL	18			13.6N 144.9E	91218
15	150910	14.2N 144.5E	LAND	GOOD	CIRCULAR	18			13.6N 144.9E	91218
16	150935	14.2N 144.4E	LAND	GOOD	ELLIPTICAL	19			13.6N 144.9E	91218
17	151010	14.2N 144.2E	LAND	GOOD	ELLIPTICAL	19			13.6N 144.9E	91218
18	151035	14.1N 144.2E	LAND	GOOD	ELLIPTICAL	17			13.6N 144.9E	91218
19	151110	14.1N 144.2E	LAND	GOOD	ELLIPTICAL	17			13.6N 144.9E	91218
20	151135	14.1N 144.0E	LAND	GOOD	ELLIPTICAL	17			13.6N 144.9E	91218
21	151210	14.0N 143.9E	LAND	GOOD	CIRCULAR				13.6N 144.9E	91218
22	151235	14.1N 144.0E	LAND	GOOD	ELLIPTICAL	16			13.6N 144.9E	91218
23	151310	14.1N 143.8E	LAND	GOOD	CIRCULAR	17			13.6N 144.9E	91218
24	151335	15.0N 143.6E	LAND	GOOD	CIRCULAR	15			13.6N 144.9E	91218
25	151410	14.0N 143.4E	LAND	GOOD	CIRCULAR	12			13.6N 144.9E	91218
26	151435	14.0N 143.2E	LAND	GOOD	CIRCULAR	15			13.6N 144.9E	91218
27	151510	14.0N 143.1E	LAND	GOOD	CIRCULAR	16			13.6N 144.9E	91218
28	151535	14.0N 143.0E	LAND	GOOD	ELLIPTICAL	16			13.6N 144.9E	91218
29	151610	13.9N 142.8E	LAND	GOOD	CIRCULAR	15			13.6N 144.9E	91218
30	151635	13.9N 142.7E	LAND	GOOD	CIRCULAR	14			13.6N 144.9E	91218
31	151710	13.8N 142.5E	LAND	GOOD	CIRCULAR	16			13.6N 144.9E	91218
32	151735	13.8N 142.2E	LAND	GOOD	ELLIPTICAL	22			13.6N 144.9E	91218
33	151835	13.8N 142.0E	LAND	GOOD	ELLIPTICAL	19			13.6N 144.9E	91218
34	151935	13.8N 141.6E	LAND	FAIR				APRNT CI EYE	13.6N 144.9E	91218
35	190300	13.7N 125.3E	LAND				20621 52414		14.0N 124.3E	98447

36	190430	13.6N	125.1E	LAND	20620	42607		14.0N	124.3E	98447
37	190500	13.6N	125.0E	LAND	10520	42606		14.0N	124.3E	98447
38	190600	13.6N	124.8E	LAND	11630	42611	EYE EL	14.0N	124.3E	98447
39	190630	13.6N	124.7E	LAND	11630	42610		14.0N	124.3E	98447
40	190700	13.6N	124.7E	LAND	11630	42702		14.0N	124.3E	98447
41	190730	13.6N	124.6E	LAND	11630	42702		14.0N	124.3E	98447
42	190800	13.7N	124.6E	LAND	60630	42906	EYE SEMI CI	14.0N	124.3E	98447
43	190830	13.7N	124.5E	LAND	10640	42706	EYE CI OPEN NE	14.0N	124.3E	98447
44	191000	13.7N	124.4E	LAND	10530	42708	EYE CI OPEN NE	14.0N	124.3E	98447
45	191130	13.7N	124.0E	LAND	20221	42720	EYE CI OPEN W	14.0N	124.3E	98447
46	191200	13.6N	123.9E	LAND	20221	42715	EYE SEMI CI OPEN N	14.0N	124.3E	98447
47	191400	13.4N	123.5E	LAND	35/60	42508		14.0N	124.3E	98447
48	200700	13.8N	120.0E	LAND	55/1/	/////		14.8N	120.2E	98426
49	201400	14.1N	118.1E	LAND	1025/	52710		16.3N	120.6E	98321
50	201500	14.1N	118.0E	LAND	1027/	52708		16.3N	120.6E	98321

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

SUPER TYPHOON IRMA
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
111718Z	11.1	154.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111800Z	11.2	153.4	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111806Z	11.3	152.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111812Z	11.6	151.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111818Z	12.2	150.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111900Z	12.9	149.2	30	13.1	149.3	30.	13.	0.	14.0	145.6	55.	53.	15.	14.2	141.9	70.	96.	0.	13.4	136.2	80.	24.	-45.
111906Z	13.4	147.8	35	13.2	148.1	35.	21.	0.	13.8	143.8	60.	8.	10.	12.2	139.3	75.	96.	-5.	11.2	133.9	85.	122.	-45.
111912Z	13.7	146.8	35	13.7	146.9	45.	6.	10.	14.2	142.5	65.	19.	10.	13.4	137.8	75.	29.	-20.	12.7	131.7	85.	64.	-50.
111918Z	13.8	145.6	40	13.9	145.7	50.	8.	10.	14.2	141.3	70.	27.	5.	14.2	136.4	80.	47.	-30.	14.2	130.6	85.	96.	-45.
112000Z	13.9	144.7	40	13.9	144.7	45.	0.	5.	13.3	140.3	70.	30.	0.	12.9	134.4	85.	89.	-40.	13.0	128.3	95.	72.	-25.
112006Z	13.9	143.9	50	13.8	144.0	50.	8.	0.	13.3	140.0	75.	55.	-5.	13.0	134.0	85.	21.	-45.	12.9	128.0	95.	13.	-20.
112012Z	13.9	142.6	55	13.9	142.8	55.	12.	0.	13.6	137.4	80.	47.	-15.	13.1	131.3	85.	89.	-50.	13.0	125.3	50.	48.	-60.
112018Z	13.8	141.5	65	13.9	141.8	60.	18.	-5.	13.5	137.2	80.	19.	-30.	13.0	131.1	75.	19.	-55.	13.0	124.9	55.	62.	-50.
112100Z	13.8	140.3	70	13.8	140.5	65.	12.	-5.	13.5	136.0	80.	12.	-45.	12.9	129.8	70.	21.	-50.	12.9	123.8	55.	104.	-40.
112106Z	13.8	139.2	80	13.8	139.2	75.	0.	-5.	13.0	134.8	85.	31.	-45.	11.8	129.6	75.	121.	-40.	12.1	123.7	55.	215.	-30.
112112Z	13.7	138.2	95	13.8	138.0	85.	13.	-10.	13.0	133.2	105.	26.	-30.	12.1	128.1	105.	134.	-5.	12.1	122.9	75.	276.	10.
112118Z	13.8	137.1	110	13.8	137.0	100.	6.	-10.	13.2	132.3	125.	71.	-5.	12.8	127.2	115.	167.	10.	13.2	122.0	85.	258.	30.
112200Z	13.5	135.8	125	13.5	135.8	115.	0.	-10.	13.2	130.8	135.	81.	15.	14.0	126.0	120.	155.	25.	15.6	120.8	90.	160.	40.
112206Z	13.2	134.3	130	13.4	134.4	125.	13.	-5.	13.3	129.4	140.	98.	25.	14.4	124.8	125.	170.	40.	16.1	120.8	75.	167.	30.
112212Z	12.8	132.8	135	12.8	132.8	130.	0.	-5.	13.0	126.4	130.	21.	20.	14.4	122.2	100.	141.	35.	17.5	119.3	70.	118.	25.
112218Z	12.7	131.2	130	12.6	131.2	135.	6.	5.	13.1	125.0	125.	59.	20.	15.2	121.1	85.	129.	30.	19.0	119.6	65.	88.	25.
112300Z	12.7	129.5	120	12.6	129.8	135.	18.	15.	13.4	123.8	120.	75.	25.	16.6	120.1	80.	88.	30.	20.8	119.8	65.	79.	25.
112306Z	12.8	127.8	115	12.8	128.0	125.	12.	10.	14.6	122.3	80.	45.	-5.	18.0	119.2	65.	30.	20.	22.2	118.8	65.	184.	25.
112312Z	13.2	126.1	110	13.0	126.3	125.	17.	15.	15.0	121.6	45.	91.	-20.	18.4	119.1	65.	75.	20.	22.7	119.0	45.	226.	10.
112318Z	14.0	124.6	105	13.9	124.6	115.	6.	10.	16.7	119.8	70.	13.	15.	20.7	118.8	60.	100.	20.	24.8	120.0	40.	248.	5.
112400Z	14.6	123.4	95	14.8	122.9	105.	31.	10.	17.7	118.8	70.	24.	20.	21.5	117.8	60.	192.	20.	25.0	119.6	40.	327.	5.
112406Z	15.3	122.0	85	15.3	122.0	95.	0.	10.	17.7	118.4	65.	70.	20.	21.4	116.9	55.	290.	15.	0.0	0.0	0.	-0.	0.
112412Z	16.1	120.5	65	16.0	120.7	75.	13.	10.	20.2	117.8	55.	127.	10.	25.1	120.3	45.	210.	10.	0.0	0.0	0.	-0.	0.
112418Z	16.9	119.7	55	17.0	119.5	65.	13.	10.	21.3	117.8	55.	164.	15.	26.2	122.0	35.	215.	0.	0.0	0.0	0.	-0.	0.
112500Z	17.8	119.2	50	17.9	118.8	55.	24.	5.	22.2	118.1	50.	186.	10.	27.5	124.0	30.	230.	-5.	0.0	0.0	0.	-0.	0.
112506Z	18.5	119.3	45	19.5	118.7	50.	69.	5.	24.9	120.1	40.	215.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112512Z	19.4	119.9	45	19.7	119.9	45.	18.	0.	23.4	124.2	35.	74.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112518Z	20.2	120.5	40	20.2	120.4	45.	6.	5.	24.8	126.5	35.	158.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112600Z	21.0	121.2	40	21.2	121.5	45.	21.	5.	26.8	130.3	30.	312.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112606Z	21.8	122.1	40	22.7	123.1	40.	77.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112612Z	22.7	123.1	35	23.2	123.8	35.	49.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112618Z	23.2	124.2	35	23.7	124.8	30.	44.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112700Z	23.9	125.5	35	24.0	126.2	30.	39.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	18.	76.	118.	141.	18.	76.	118.	141.
AVG RIGHT ANGLE ERROR	10.	55.	66.	77.	9.	55.	66.	77.
AVG INTENSITY MAGNITUDE ERROR	6.	15.	25.	30.	6.	15.	25.	30.
AVG INTENSITY BIAS	2.	1.	-3.	-9.	2.	1.	-3.	-9.
NUMBER OF FORECASTS	33	29	25	21	32	29	25	21

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2732. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

SUPER TYPHOON IRMA
FIX POSITIONS FOR CYCLONE NO. 26

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	171834	11.6N 153.9E	PCN 5		NOAA7		PGTW
* 2	180600	14.1N 151.7E	PCN 5	T1.5/1.5	GMS	INIT OBS	PGTW
* 3	180900	14.2N 151.0E	PCN 5		GMS		PGTW
* 4	181200	13.7N 150.1E	PCN 5		GMS		PGTW
* 5	181641	13.7N 149.9E	PCN 5		NOAA7		PGTW
* 6	182156	13.8N 149.1E	PCN 5		NOAA6		PGTW
7	190000	13.0N 148.4E	PCN 5	T3.0/3.0 /D1.5/18HRS	GMS		PGTW
8	190300	13.5N 148.4E	PCN 5		GMS		PGTW
9	190600	13.5N 147.7E	PCN 5		GMS		PGTW
10	190900	13.7N 147.2E	PCN 5		GMS		PGTW
11	191200	14.0N 146.8E	PCN 5		GMS		PGTW
12	191600	13.8N 145.9E	PCN 5		GMS		PGTW
13	191629	13.7N 145.5E	PCN 5		NOAA7		PGTW
14	192100	13.7N 144.9E	PCN 5		GMS		PGTW
15	192132	13.7N 144.9E	PCN 5		NOAA6		PGTW
16	200000	14.0N 144.4E	PCN 5		GMS		PGTW
17	200300	13.9N 144.1E	PCN 5	T3.5/3.5 /D0.5/27HRS	GMS		PGTW
18	200900	14.0N 143.2E	PCN 5		GMS		PGTW
19	201200	13.8N 142.6E	PCN 5		GMS		PGTW
20	201600	14.0N 142.1E	PCN 5		GMS		PGTW
21	201759	14.0N 141.4E	PCN 3		NOAA7		PGTW
22	202100	14.2N 140.8E	PCN 5		GMS		PGTW
23	210000	13.7N 140.2E	PCN 5		GMS		PGTW
24	210502	13.8N 139.3E	PCN 1	T4.5/4.5 /D1.0/26HRS	NOAA7		PGTW
25	211200	13.7N 138.2E	PCN 1		GMS		PGTW
26	211600	13.8N 137.4E	PCN 1		GMS		PGTW
27	211747	13.8N 137.2E	PCN 1		NOAA7		PGTW
28	212100	13.5N 136.6E	PCN 1		GMS		PGTW
29	220000	13.5N 135.9E	PCN 1		GMS		PGTW
30	220300	13.4N 135.0E	PCN 1		GMS		PGTW
31	220450	13.3N 134.3E	PCN 1	T6.5/6.5 /D2.0/24HRS	NOAA7		PGTW
32	220900	13.1N 133.6E	PCN 1		GMS		PGTW
33	221200	12.8N 132.8E	PCN 1		GMS		PGTW
34	221600	12.7N 131.7E	PCN 1		GMS		PGTW
35	221800	12.7N 131.3E	PCN 1		GMS		PGTW
36	222100	12.8N 130.5E	PCN 1		GMS		PGTW

37	230000	12.0N 129.5E	PCN 1		GMS		PGTW
38	230300	12.9N 128.6E	PCN 1		GMS		PGTW
39	230621	12.9N 127.7E	PCN 1	T6.5/6.5-/S0.0/26HRS	NOAA7		PGTW
40	230900	13.1N 127.0E	PCN 1		GMS		PGTW
41	231200	13.3N 126.1E	PCN 1		GMS		PGTW
42	231600	13.9N 125.0E	PCN 1		GMS		PGTW
43	231800	14.0N 124.5E	PCN 1		GMS		PGTW
44	232100	14.3N 123.7E	PCN 1		GMS		PGTW
45	232321	14.4N 123.4E	PCN 1		NOAA6		RPMK
46	240000	14.5N 123.2E	PCN 1		GMS		PGTW
47	240300	14.7N 122.6E	PCN 1		GMS		PGTW
48	240609	15.2N 121.9E	PCN 3	T5.0/5.5 /W1.5/24HRS	NOAA7		PGTW
49	240900	15.7N 121.3I	PCN 5		GMS		PGTW
50	241200	16.2N 120.8E	PCN 5		GMS		PGTW
51	241600	16.9N 120.0E	PCN 3		GMS		PGTW
52	241800	17.1N 119.6E	PCN 3		GMS		PGTW
53	241854	17.4N 119.2E	PCN 3		NOAA7		PGTW
54	242100	17.6N 119.2E	PCN 5		GMS		PGTW
55	250000	18.4N 119.1E	PCN 5		GMS		PGTW
56	250300	19.0N 119.4E	PCN 5		GMS		PGTW
57	250557	19.3N 119.6E	PCN 5	T3.5/4.0 /W1.5/24HRS	NOAA7		PGTW
58	251137	19.8N 119.8E	PCN 4		NOAA6		RPMK
* 59	251200	20.0N 120.6E	PCN 5		GMS		PGTW
60	251842	20.8N 120.9E	PCN 5		NOAA7		PGTW
61	252100	21.3N 120.8E	PCN 5		GMS		PGTW
62	260000	21.6N 121.7E	PCN 5		GMS		PGTW
* 63	260016	22.1N 121.8E	PCN 5	T2.5/2.5	NOAA6	INIT OBS	RPMK
64	260300	22.1N 122.3E	PCN 5		GMS		PGTW
65	260545	22.4N 122.7E	PCN 5	T3.0/3.5 /W0.5/24HRS	NOAA7		PGTW
66	261600	23.2N 124.3E	PCN 5		GMS		PGTW
67	261831	23.3N 124.8E	PCN 5		NOAA7		PGTW
68	262100	23.6N 125.7E	PCN 5		GMS		PGTW
69	262352	23.7N 126.3E	PCN 5	T2.0/2.5-/W0.5/24HRS	NOAA6		RPMK
70	270000	23.9N 125.7'	PCN 5		GMS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	190057	13.0N 149.1E	1500FT		1003	40 120 60	220 40 130 60	5 8			+25 +25 29	1
2	190303	13.0N 148.7E	700MB	3087	1003	15 160 30	220 19 160 30	5 5			+11 + 9	1
3	190656	13.5N 147.7E	700MB	3047		35 020 100	010 40 280 60	2 5				2
* 4	190855	13.5N 147.6E	700MB	3062	1000		040 40 320 90	3 6			+10 +10	2
5	191212	13.9N 146.8E	700MB	3060			190 45 140 130	5 10				2
6	191906	13.8N 145.6E	700MB	3080			170 44 090 30	5 2	CIRCULAR	25	+11 +12 +12	3
7	192129	13.8N 145.2E	700MB	3018	993	35 340 20	360 42 270 20	3 3	CIRCULAR	20	+11 +13 + 9	3
8	202254	13.8N 140.6E	700MB	2831	968	65 260 7	170 84 090 10	10 15	CIRCULAR	40	+11 +17 +11	5
9	210900	13.8N 138.8E	700MB	2670	951		170 96 100 15	5 2	CIRCULAR	20	+16 +15 +13	6
10	212242	13.4N 136.2E	700MB			130 040 10	170 126 040 10	5 2	CIRCULAR	20	+14 +20 + 9	9
11	220842	12.9N 133.7E	700MB	2242	905	100 090 25	040 112 290 30	10 3	CIRCULAR	20	+12 +18 +14	10
12	222126	12.6N 130.5E	700MB	2330		100 350 20	120 111 350 40	5 2	CIRCULAR	20	+13 +20 +16	11
* 13	230655	12.7N 128.3E	700MB	2488	922	100 010 15	070 122 090 15	10 3	CIRCULAR	20	+14 +16 +15	12
14	242112	17.5N 119.4E	700MB	2971	988		000 31 340 60	4 5			+12 +10	14
15	250915	18.9N 119.8E	700MB	2998	989	35 270 40	110 43 010 140	5 5			+13 +15 +10	15
16	251319	19.8N 120.0E	700MB	3002			190 46 060 26	5 5			+12 +13 +11	15
17	252130	20.8N 121.1E	700MB	3012	992	40 100 35	210 43 090 90	3 10			+12 +12	16
18	260910	22.4N 122.5E	700MB	3009	995		150 44 070 60	4 7			+11 +11	17

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
* 1	191010	14.0N 146.9E	LAND	FAIR					13.6N 144.9E	91218
2	191035	14.0N 146.9E	LAND	FAIR					13.6N 144.9E	91218
3	191110	14.0N 146.9E	LAND	FAIR	CIRCULAR	25		OPEN N AND SE	13.6N 144.9E	91218
4	191135	14.0N 146.9E	LAND	POOR	CIRCULAR	24		OPEN S-SW AND NW-N	13.6N 144.9E	91218
* 5	191210	14.2N 146.8E	LAND	POOR	CIRCULAR	24		OPENINGS ALQDS	13.6N 144.9E	91218
6	191435	14.0N 146.2E	LAND	FAIR	CIRCULAR	22			13.6N 144.9E	91218
7	191510	14.0N 146.0E	LAND	FAIR	CIRCULAR	22			13.6N 144.9E	91218
8	191535	14.0N 145.8E	LAND	FAIR	ELLIPTICAL	30			13.6N 144.9E	91218
9	191610	14.0N 145.8E	LAND	FAIR	ELLIPTICAL	30			13.6N 144.9E	91218
10	191635	13.9N 145.7E	LAND	FAIR	CIRCULAR	20			13.6N 144.9E	91218
11	191735	13.9N 145.7E	LAND	FAIR	CIRCULAR	22			13.6N 144.9E	91218
12	191810	13.9N 145.5E	LAND	FAIR	CIRCULAR	24			13.6N 144.9E	91218
13	191835	13.9N 145.5E	LAND	FAIR	CIRCULAR	18			13.6N 144.9E	91218
14	191935	13.9N 145.4E	LAND	FAIR	CIRCULAR	22			13.6N 144.9E	91218
15	192010	13.9N 145.4E	LAND	FAIR	CIRCULAR	22			13.6N 144.9E	91218
16	192035	14.0N 145.4E	LAND	GOOD	CIRCULAR	18			13.6N 144.9E	91218
17	192110	13.8N 145.1E	LAND	FAIR	ELLIPTICAL	20			13.6N 144.9E	91218
18	192135	13.8N 145.2E	LAND	GOOD	CIRCULAR	7		SECNDRY CNTR 13.9N 145.2E	13.6N 144.9E	91218
19	192210	13.9N 145.1E	LAND	GOOD	CIRCULAR	12			13.6N 144.9E	91218
20	192235	13.9N 145.1E	LAND	GOOD	CIRCULAR	10			13.6N 144.9E	91218
21	192335	14.0N 144.8E	LAND	GOOD	CIRCULAR	17			13.6N 144.9E	91218
22	200010	13.9N 144.6E	LAND	GOOD	CIRCULAR	16		OPEN NW	13.6N 144.9E	91218
23	200035	13.9N 144.5E	LAND	GOOD	CIRCULAR	13		OPEN N TOPS IN WALL CLD 500	13.6N 144.9E	91218
24	200110	13.8N 144.3E	LAND	GOOD					13.6N 144.9E	91218
25	200135	13.8N 144.3E	LAND	GOOD					13.6N 144.9E	91218
26	200210	13.7N 144.3E	LAND	GOOD	CIRCULAR	14		OPEN SW-NW-N	13.6N 144.9E	91218
27	200235	13.8N 144.2E	LAND	FAIR					13.6N 144.9E	91218
28	200335	13.7N 144.2E	LAND	POOR					13.6N 144.9E	91218
29	200510	13.8N 144.1E	LAND	GOOD	CIRCULAR	18			13.6N 144.9E	91218
30	200535	13.8N 144.1E	LAND	GOOD	CIRCULAR	20			13.6N 144.9E	91218
31	200610	13.9N 143.9E	LAND	FAIR	ELLIPTICAL	28		OPEN N	13.6N 144.9E	91218
32	200710	14.1N 143.6E	LAND	POOR					13.6N 144.9E	91218
33	200935	14.0N 143.2E	LAND	FAIR	ELLIPTICAL	25		OPEN NW SECNDRY CNTR 14N 143.3E	13.6N 144.9E	91218
34	201035	13.9N 143.0E	LAND	POOR					13.6N 144.9E	91218
35	201110	13.9N 142.8E	LAND	POOR					13.6N 144.9E	91218
36	201135	13.9N 142.7E	LAND	POOR				EASTERN SEMICIRCLE VSBL ONLY	13.6N 144.9E	91218
37	231700	13.7N 125.2E	LAND				21200 42608		14.0N 124.3E	98447
38	231730	13.8N 124.9E	LAND				11330 43018		14.0N 124.3E	98447
39	231800	14.0N 124.7E	LAND				11340 43018		14.0N 124.3E	98447
40	231830	14.0N 124.4E	LAND				11340 42718		14.0N 124.3E	98447

-41	240000	14.5N	123.5E	LAND	4////	3////		16.3N	120.6E	98321
42	240030	14.6N	123.5E	LAND	1080/	4////	EYE 50 PCT CI OPEN SE	16.3N	120.6E	98321
43	240100	14.6N	123.4E	LAND	1081/	4////	EYE 90 PCT CI OPEN SE	16.3N	120.6E	98321
44	240130	14.7N	123.3E	LAND	1078/	43008	EYE 100 PCT CI	16.3N	120.6E	98321
45	240200	14.8N	123.2E	LAND	1071/	43005	EYE 100 PCT CI	16.3N	120.6E	98321
46	240230	14.8N	123.1E	LAND	1078/	43008	EYE 100 PCT CI	16.3N	120.6E	98321
47	240400	15.1N	122.7E	LAND	1078/	43006	EYE 100 PCT CI	16.3N	120.6E	98321
48	240600	15.2N	122.3E	LAND	1081/	42904	EYE CI OPEN N EYEWALL 16NM	16.3N	120.6E	98321
49	240730	15.5N	121.8E	LAND	1062/	43211	EYE 100 PCT CI	16.3N	120.6E	98321
50	240800	15.6N	121.7E	LAND	1062/	43211	EYE CI	16.3N	120.6E	98321
51	240830	15.7N	121.6E	LAND	1061/	42909	EYE CI	16.3N	120.6E	98321
52	241000	15.9N	121.1E	LAND	1061/	53120	EYE CI OPEN E DIA 9NM	16.3N	120.6E	98321
53	241200	16.2N	120.4E	LAND	20211	42818		14.8N	120.2E	98426
54	241330	16.4N	120.2E	LAND	1080/	42906		16.3N	120.6E	98321
55	241330	16.3N	119.9E	LAND	20211	42818		14.8N	120.2E	98426
56	241430	16.7N	120.0E	LAND	4////	5////		16.3N	120.6E	98321
57	241830	17.0N	119.3E	LAND	4////	43625		16.3N	120.6E	98321
58	242000	17.3N	119.4E	LAND	4////	40000		16.3N	120.6E	98321
59	242100	17.5N	119.4E	LAND	4////	53614		16.3N	120.6E	98321
60	242130	17.6N	119.3E	LAND	4////	43104		16.3N	120.6E	98321
61	242200	17.6N	119.2E	LAND	108//	43204		16.3N	120.6E	98321
* 62	242230	17.6N	119.2E	LAND	108//	4////		16.3N	120.6E	98321
63	242300	17.7N	119.3E	LAND	118//	43604	EYE EL MAJ AXIS NE/SW	16.3N	120.6E	98321
64	250000	17.8N	119.2E	LAND	118//	43307	EYE EL MAJ AXIS NE/SW	16.3N	120.6E	98321
65	250030	18.0N	119.2E	LAND	118//	43608		16.3N	120.6E	98321
66	250200	18.4N	119.2E	LAND	118//	43608		16.3N	120.6E	98321
67	252100	20.7N	121.1E	LAND	6////	5////		22.6N	120.3E	46744
68	252200	20.8N	121.0E	LAND	6////	5////		22.6N	120.3E	46744
69	262100	23.5N	125.0E	LAND	55//2	/////		24.3N	124.2E	47918
70	262200	23.5N	125.4E	LAND	55/12	50927		24.3N	124.2E	47918

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM JEFF
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
112100Z	10.7	152.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112106Z	11.6	152.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112112Z	12.3	151.4	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112118Z	12.8	150.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112200Z	13.5	150.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112206Z	13.9	149.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112212Z	14.1	149.3	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112218Z	14.0	148.6	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112300Z	13.9	148.1	35	14.0	148.1	35.	6.	0.	13.7	145.2	55.	206.	20.	13.7	142.5	65.	459.	30.	13.4	139.1	70.	728.	45.
112306Z	13.8	146.8	30	13.8	147.4	40.	35.	10.	13.3	144.4	55.	267.	20.	13.1	141.2	65.	514.	30.	13.0	137.8	70.	766.	50.
112312Z	13.6	145.2	30	13.6	145.9	40.	41.	10.	13.1	142.0	45.	233.	10.	13.0	138.0	60.	461.	30.	0.0	0.0	0.	-0.	0.
112318Z	13.4	143.5	30	13.8	144.3	35.	52.	5.	13.8	139.6	55.	193.	20.	14.1	134.9	65.	394.	40.	0.0	0.0	0.	-0.	0.
112400Z	13.2	141.7	35	13.2	142.2	40.	29.	5.	13.3	135.6	50.	119.	15.	14.8	130.2	60.	327.	35.	0.0	0.0	0.	-0.	0.
112406Z	13.3	139.8	35	13.2	140.5	40.	41.	5.	13.2	134.2	50.	180.	15.	15.0	129.4	60.	419.	40.	0.0	0.0	0.	-0.	0.
112412Z	14.0	138.1	35	13.7	137.9	45.	21.	10.	15.7	133.0	35.	130.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112418Z	14.7	136.4	35	14.5	137.4	35.	59.	0.	16.5	132.5	40.	197.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112500Z	15.1	134.7	35	15.0	136.0	35.	75.	0.	17.2	131.5	45.	242.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112506Z	15.9	132.8	35	16.3	132.7	35.	25.	0.	20.4	129.4	40.	115.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112512Z	16.9	131.1	30	17.5	131.0	30.	36.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112518Z	18.3	129.6	25	18.0	129.8	25.	21.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112600Z	20.0	128.4	25	19.9	128.7	25.	18.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112606Z	21.9	128.1	20	21.8	128.2	25.	8.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	33.	188.	429.	747.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	13.	40.	71.	38.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	16.	34.	48.	0.	0.	0.	0.
AVG INTENSITY BIAS	4.	16.	34.	48.	0.	0.	0.	0.
NUMBER OF FORECASTS	14	10	6	2	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1754. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS

TROPICAL STORM JEFF
FIX POSITIONS FOR CYCLONE NO. 27

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	200300	7.9N 157.5E	PCN 5	T1.0/1.0	GMS	INIT. OBS	PGTW
2	202100	10.3N 153.1E	PCN 5		GMS		PGTW
3	210000	10.5N 152.8E	PCN 5		GMS		PGTW
4	210600	11.6N 152.2E	PCN 5	T1.5/1.5 /D0.5/27HRS	GMS		PGTW
5	211200	13.3N 151.5E	PCN 5		GMS		PGTW
6	211600	12.4N 150.1E	PCN 5		GMS		PGTW
7	212100	13.5N 150.0E	PCN 5		GMS		PGTW
8	220300	13.6N 150.2E	PCN 5	T1.0/1.5 /W0.5/21HRS	GMS		PGTW
9	221200	14.4N 149.5E	PCN 5		GMS		PGTW
10	221800	15.1N 148.2E	PCN 5		GMS		PGTW
11	222100	14.4N 147.7E	PCN 5		GMS		PGTW
12	230000	13.9N 147.8E	PCN 5		GMS		PGTW
13	230300	13.9N 147.7E	PCN 5		GMS		PGTW
14	230439	13.8N 147.0E	PCN 5	T2.0/2.0 /D1.0/26HRS	NOAA7		PGTW
15	230600	13.8N 146.7E	PCN 5		GMS		PGTW
16	230900	13.6N 146.1E	PCN 5		GMS		PGTW
17	231200	13.7N 145.6E	PCN 5		GMS		PGTW
18	231600	13.9N 144.5E	PCN 5		GMS		PGTW
19	231800	14.1N 143.6E	PCN 5		GMS		PGTW
20	232100	14.0N 142.8E	PCN 5		GMS		PGTW
21	240000	13.2N 141.8E	PCN 5		GMS		PGTW
22	240300	12.9N 140.7E	PCN 5		GMS		PGTW
23	240427	13.2N 139.9E	PCN 5	T3.0/3.0 /D1.0/24HRS	NOAA7		PGTW
24	240600	13.7N 139.5E	PCN 5		GMS		PGTW
25	240900	14.0N 138.6E	PCN 5		GMS		PGTW
26	241200	14.2N 137.2E	PCN 5		GMS		PGTW
27	241600	14.5N 136.2E	PCN 5		GMS		PGTW
28	241712	14.4N 137.7E	PCN 4		NOAA7	ULCC 14.8N 135.6E EXP LLCC	PGTW
29	242100	14.8N 136.3E	PCN 5		GMS		PGTW
30	250000	15.4N 134.7E	PCN 5		GMS	EXP LLCC	PGTW
31	250300	15.7N 133.4E	PCN 5		GMS		PGTW
32	250557	16.3N 132.3E	PCN 5	T2.5/2.5 /W0.5/24HRS	NOAA7		PGTW
33	250900	16.7N 131.8E	PCN 5		GMS		PGTW
34	251200	16.9N 130.7E	PCN 5		GMS		PGTW
35	251842	17.8N 129.9E	PCN 5		NOAA7		PGTW
36	251843	18.6N 129.7E	PCN 6		NOAA7		RODN
37	252100	19.2N 129.0E	PCN 5		GMS		PGTW
38	260000	19.9N 128.4E	PCN 5		GMS		PGTW
39	260300	20.9N 127.9E	PCN 5		GMS		PGTW
40	260545	21.8N 128.1E	PCN 5	T1.5/2.0 /W1.0/24HRS	NOAA7		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT	IN	DP	SST	MSN NO.
1	210848	12.0N 152.0E	700MB	3109	999	25 140 60	120 33 130 30	10 10				+9	+9		1
2	212305	13.3N 150.2E	700MB	3113	1002	15 090 5	220 20 090 15	5 2			+9	+11	+9		2
3	222242	13.9N 148.3E	1500FT		1000	35 250 20	320 33 250 20	4 5				+26	+25	28	3
4	230021	13.8N 148.0E	1500FT		999	40 320 20	040 45 320 10	5 3				+26	+25	28	3
5	230651	13.8N 146.8E	1500FT		999	30 110 15	200 37 110 15	3 2							4
6	230811	13.2N 146.4E	700MB	3113	1004	20 030 40	150 23 030 40	10 30			+13	+12	+8		4
7	232133	13.6N 142.9E	700MB	3107		30 030 60	120 36 070 60	10 10			+10	+12			5
8	232353	13.2N 141.0E	700MB	3090		25 090 10	050 39 340 60	10 10							5
9	250008	15.1N 134.7E	700MB	3119		35 340 35	080 50 340 35	5 15							7

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	231635	13.7N 143.7E	LAND	FAIR					13.6N 144.9E	91218

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON KIT
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HR DST	72 HR WIND
120900Z	5.2	150.4	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120906Z	5.6	149.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120912Z	6.0	147.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120918Z	6.8	146.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121000Z	7.9	146.7	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121006Z	8.5	147.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121012Z	8.9	147.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121018Z	9.3	147.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121100Z	9.8	147.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121106Z	10.2	147.8	30	10.2	147.6	30.	12.	0.	12.3	145.9	45.	96.	0.	12.9	141.8	55.	183.	0.	12.0	136.2	60.	333.	-10.
121112Z	10.4	147.7	35	11.0	147.6	45.	36.	10.	13.2	144.8	55.	155.	5.	13.1	139.9	60.	230.	5.	14.5	134.3	65.	422.	-15.
121118Z	10.7	147.5	40	11.2	147.3	50.	32.	10.	13.1	144.8	65.	121.	15.	13.2	140.4	70.	156.	10.	14.4	134.5	75.	406.	-10.
121200Z	11.0	147.3	45	11.2	147.2	50.	13.	5.	13.1	144.3	70.	103.	20.	13.4	139.9	80.	139.	15.	13.5	133.8	85.	451.	-5.
121206Z	11.2	147.1	45	11.6	147.0	50.	25.	5.	13.2	143.8	60.	80.	5.	13.5	138.9	75.	170.	5.	13.5	132.9	80.	499.	-15.
121212Z	11.5	146.8	50	11.5	146.8	50.	0.	0.	13.0	144.8	60.	65.	5.	13.3	140.6	70.	54.	-10.	13.0	134.9	80.	395.	-20.
121218Z	11.8	146.4	50	11.8	146.6	50.	12.	0.	13.2	144.3	60.	84.	0.	13.3	140.0	65.	99.	-20.	13.0	134.3	70.	410.	-35.
121300Z	12.2	145.8	50	12.2	146.2	50.	23.	0.	13.2	143.8	60.	96.	-5.	13.2	139.8	65.	129.	-25.	13.0	134.1	70.	387.	-30.
121306Z	12.4	144.9	55	12.2	145.3	50.	26.	-5.	12.7	142.5	60.	47.	-10.	12.6	138.8	65.	204.	-30.	12.5	133.4	70.	407.	-25.
121312Z	12.5	143.8	55	12.5	144.2	55.	23.	0.	12.4	140.2	65.	100.	-15.	12.0	135.3	70.	400.	-30.	12.2	129.2	70.	596.	-25.
121318Z	12.6	143.0	60	12.6	143.2	55.	12.	-5.	12.3	138.8	65.	190.	-20.	12.0	134.5	70.	426.	-35.	12.5	127.7	65.	630.	-35.
121400Z	12.8	142.2	65	12.8	142.2	65.	0.	0.	12.6	137.8	75.	246.	-15.	12.2	132.6	80.	486.	-20.	12.2	126.5	70.	664.	-35.
121406Z	13.1	141.8	70	12.8	140.9	70.	55.	0.	12.5	136.2	80.	334.	-15.	12.2	131.2	75.	532.	-20.	12.7	125.4	65.	682.	-50.
121412Z	13.5	141.5	80	13.5	141.4	70.	6.	-10.	14.2	137.8	80.	213.	-20.	13.6	133.0	75.	360.	-20.	13.1	127.0	70.	558.	-40.
121418Z	14.1	141.5	85	14.2	141.5	80.	6.	-5.	17.8	142.1	75.	154.	-30.	22.3	146.5	60.	632.	-40.	24.1	156.1	40.	1238.	-65.
121500Z	14.6	141.5	90	14.9	141.5	80.	18.	-10.	18.3	142.5	70.	214.	-30.	22.5	147.6	55.	714.	-50.	24.2	157.1	35.	1326.	-65.
121506Z	14.9	141.4	95	15.1	141.4	95.	12.	0.	18.2	142.2	90.	221.	-5.	22.4	147.2	60.	714.	-55.	24.2	156.6	35.	1341.	-60.
121512Z	15.3	141.3	100	15.2	141.2	100.	8.	0.	17.1	141.5	95.	183.	0.	20.0	144.2	75.	516.	-35.	22.7	153.8	40.	1214.	-50.
121518Z	15.5	140.9	105	15.3	140.9	105.	12.	0.	15.1	141.2	110.	173.	10.	17.3	142.2	95.	379.	-10.	20.5	147.0	60.	859.	-25.
121600Z	15.4	140.3	100	15.4	140.6	100.	17.	0.	16.0	139.8	90.	139.	-15.	11.9	139.9	80.	383.	-20.	20.1	142.2	65.	642.	-15.
121606Z	15.3	139.8	95	15.3	140.0	100.	12.	5.	17.1	139.1	90.	159.	-25.	19.8	140.7	80.	427.	-15.	21.6	144.1	65.	799.	-10.
121612Z	15.2	139.0	95	15.2	139.1	95.	6.	0.	13.9	136.4	80.	120.	-30.	12.3	132.8	75.	230.	-15.	12.1	126.8	75.	350.	5.
121618Z	15.2	138.2	100	15.2	138.7	90.	29.	-10.	13.9	135.5	75.	132.	-30.	13.0	131.4	70.	192.	-15.	13.8	125.4	65.	325.	5.
121700Z	15.3	137.5	105	15.1	137.3	100.	17.	-5.	14.4	134.5	85.	111.	-15.	14.1	131.5	70.	109.	-10.	14.3	125.8	65.	271.	15.
121706Z	15.6	136.8	115	15.2	136.7	115.	25.	0.	14.9	133.7	105.	83.	10.	14.6	129.7	85.	124.	10.	15.0	124.8	75.	317.	35.
121712Z	15.9	136.2	110	15.7	136.5	115.	21.	5.	16.3	133.2	110.	17.	20.	16.2	129.4	85.	87.	15.	16.6	124.6	75.	363.	40.
121718Z	16.1	135.7	105	16.1	135.6	120.	6.	15.	16.3	132.6	110.	18.	25.	16.2	129.0	85.	77.	25.	17.0	124.2	75.	383.	45.
121800Z	16.2	135.0	100	16.2	135.1	115.	6.	15.	16.2	131.9	90.	19.	10.	16.1	128.2	80.	115.	30.	0.0	0.0	0.	-0.	0.
121806Z	16.2	134.2	95	16.3	134.5	100.	10.	5.	16.7	132.2	85.	60.	10.	16.8	129.2	75.	130.	35.	0.0	0.0	0.	-0.	0.
121812Z	16.1	133.4	90	16.3	133.6	90.	17.	0.	16.7	130.9	75.	10.	5.	17.7	127.9	65.	260.	30.	0.0	0.0	0.	-0.	0.
121818Z	16.0	132.6	85	16.3	132.8	85.	21.	0.	16.7	129.7	70.	36.	10.	18.7	127.2	60.	363.	30.	0.0	0.0	0.	-0.	0.
121900Z	15.9	131.8	80	15.9	131.8	80.	0.	0.	15.8	128.6	60.	92.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121906Z	16.1	131.2	75	15.9	131.2	75.	12.	0.	17.5	128.5	60.	186.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121912Z	16.4	130.9	70	16.2	130.4	65.	31.	-5.	17.9	128.2	55.	271.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121918Z	16.5	130.3	60	16.6	129.8	65.	29.	5.	18.2	127.3	50.	333.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
122000Z	15.9	130.2	50	16.3	130.2	50.	24.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
122006Z	14.9	130.3	40	14.9	130.2	40.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
122012Z	13.8	130.2	35	13.8	130.2	35.	0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
122018Z	13.0	129.4	30	13.2	129.8	30.	26.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	TYPHOONS WHILE OVER 35 KTS 24-HR	TYPHOONS WHILE OVER 35 KTS 48-HR	TYPHOONS WHILE OVER 35 KTS 72-HR
AVG FORECAST POSIT ERROR	17.	134.	291.	603.	17.	128.	289.	611.
AVG RIGHT ANGLE ERROR	9.	82.	160.	326.	9.	78.	167.	325.
AVG INTENSITY MAGNITUDE ERROR	3.	14.	22.	29.	4.	14.	22.	28.
AVG INTENSITY BIAS	1.	-2.	-9.	-10.	1.	-2.	-10.	-21.
NUMBER OF FORECASTS	39	35	31	27	37	34	30	26

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1901. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TYPHOON KIT
FIX POSITIONS FOR CYCLONE NO. 28

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	090454	5.5N 149.5E	PCN 5	T0.5/0.5	NOAA7	INIT OBS	PGTW
2	091200	5.9N 147.7E	PCN 5		GMS		PGTW
3	091800	6.8N 146.8E	PCN 5		GMS		PGTW
4	100443	8.4N 146.7E	PCN 5	T0.5/0.5 /S0.0/24HRS	NOAA7	ULCC 8.0N 143.0E	PGTW
5	101200	8.6N 146.7E	PCN 5		GMS		PGTW
6	102100	11.1N 146.0E	PCN 5		GMS	ULCC	PGTW
7	110431	10.2N 147.4E	PCN 5	T2.0/2.0 /D1.5/24HRS	NOAA7		PGTW
8	110600	10.5N 147.5E	PCN 5		GMS		PGTW
9	110900	11.0N 146.9E	PCN 5		GMS		PGTW
* 10	111200	11.2N 146.6E	PCN 5		GMS		PGTW
11	111600	11.2N 147.2E	PCN 5		GMS		PGTW
12	120000	11.1N 147.6E	PCN 3		GMS	LLCC	PGTW
13	120300	11.3N 147.4E	PCN 5		GMS		PGTW
14	120419	11.5N 147.3E	PCN 5	T3.0/3.0 /D1.0/24HRS	NOAA7		PGTW
15	120600	11.6N 146.9E	PCN 5		GMS		PGTW
16	121003	11.3N 146.9E	PCN 5		NOAA6		PGTW
17	121600	11.4N 146.6E	PCN 5		GMS		PGTW
18	121704	11.5N 146.4E	PCN 5		NOAA7		PGTW
19	122100	11.7N 146.1E	PCN 5		GMS		PGTW
20	122242	12.0N 146.0E	PCN 5		NOAA6		PGTW
21	122242	12.0N 145.9E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RODN
22	122242	11.7N 145.2E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RPMK
23	130000	12.1N 145.7E	PCN 5		GMS		PGTW
24	130300	12.2N 145.5E	PCN 5		GMS		PGTW
25	130407	12.4N 145.4E	PCN 5	T3.0/3.0 /S0.0/24HRS	NOAA7		PGTW
26	130940	12.8N 144.6E	PCN 5		NOAA6	SECNDRY CNTR 12.8N 143.5E	RODN

27	130940	12.4N 144.6E	PCN 6		NOAA6		PGTW
28	131600	12.6N 143.6E	PCN 5		GMS		PGTW
29	132218	12.5N 142.1E	PCN 5	T4.0/4.0 /D1.0/24HRS	NOAA6		RPMK
30	132219	12.5N 142.2E	PCN 5		NOAA6		PGTW
31	140300	13.0N 141.6E	PCN 5		GMS		PGTW
32	140357	12.6N 141.3E	PCN 5	T4.0/4.0-/D1.0/24HRS	NOAA7		PGTW
33	141200	13.6N 141.6E	PCN 5		GMS		PGTW
34	141600	13.7N 141.2E	PCN 5		GMS		PGTW
35	141641	14.0N 140.9E	PCN 5		NOAA7		PGTW
36	142155	14.5N 141.5E	PCN 3		NOAA6		PGTW
37	142156	14.7N 141.5E	PCN 3	T4.5/4.5	NOAA6	INIT OBS	RODN
38	150300	15.4N 141.3E	PCN 2		GMS		PGTW
39	150526	14.9N 141.4E	PCN 1	T5.0/5.0 /D1.0/24HRS	NOAA6		PGTW
40	150526	15.0N 141.3E	PCN 1	T4.0/4.0 /S0.0/31HRS	NOAA7		RPMK
41	150900	15.5N 141.3E	PCN 1		GMS		PGTW
42	151200	15.3N 141.1E	PCN 1		GMS		PGTW
43	151600	15.4N 141.0E	PCN 1		GMS		PGTW
44	151811	15.5N 141.0E	PCN 1		NOAA7		PGTW
45	152100	15.6N 140.8E	PCN 1		GMS		PGTW
46	160000	15.5N 140.5E	PCN 1		GMS		PGTW
47	160300	15.4N 140.3E	PCN 1		GMS		PGTW
48	160514	15.3N 140.0E	PCN 1	T4.5/5.0 /W0.5/24HRS	NOAA7		PGTW
49	161200	15.2N 139.3E	PCN 1		GMS		PGTW
50	161600	15.4N 138.6E	PCN 1		GMS		PGTW
51	161759	15.3N 138.2E	PCN 1		NOAA7		PGTW
52	162100	15.3N 137.8E	PCN 1		GMS		PGTW
53	162250	15.2N 137.6E	PCN 1		NOAA6		PGTW
54	170502	15.6N 136.7E	PCN 1	T5.5/5.5 /D1.0/24HRS	NOAA7		PGTW
55	171600	16.0N 135.8E	PCN 1		GMS		PGTW
56	171747	16.2N 135.7E	PCN 1		NOAA7		PGTW
57	172100	16.1N 135.4E	PCN 1		GMS		PGTW
58	180000	16.1N 135.3E	PCN 1		GMS		PGTW
59	180300	16.3N 134.9E	PCN 1		GMS		PGTW
60	180450	16.2N 134.4E	PCN 2	T4.5/5.5 /W1.0/24HRS	NOAA7		PGTW
61	181200	16.2N 133.6E	PCN 1		GMS		PGTW
62	181600	16.1N 132.8E	PCN 5		GMS		PGTW
63	182100	16.3N 132.0E	PCN 5		GMS		PGTW
64	190000	16.1N 131.6E	PCN 3		GMS		PGTW
65	190300	16.1N 131.4E	PCN 3	T3.5/4.5 /W1.0/22HRS	GMS		PGTW
66	190620	16.2N 131.0E	PCN 4		NOAA7		PGTW
67	191200	17.0N 130.0E	PCN 5		GMS		PGTW
68	191600	17.0N 130.0E	PCN 5		GMS		PGTW
69	192100	16.4N 129.6E	PCN 5		GMS		PGTW
* 70	200300	15.5N 130.5E	PCN 3	T3.0/3.5 /W0.5/24HRS	GMS	EXP LLCC	PGTW
71	200609	14.8N 130.3E	PCN 3		NOAA7	EXP LLCC	PGTW
72	201600	13.6N 130.0E	PCN 5		GMS		PGTW
73	210557	10.8N 128.8E	PCN 3	T1.5/2.5 /W1.0/27HRS	NOAA7		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	110348	9.9N 147.7E	1500FT		996	35 180 25	030 33 350 65	5 5			+24 +24 +24 28	3
2	110723	10.2N 147.8E	1500FT		994	45 150 55	230 50 150 55	5 5			+25 +24 +24 26	3
3	112005	10.8N 147.5E	700MB	3005		35 130 60	080 40 330 90	2 5			+16 + 8	4
4	112157	11.0N 147.4E	700MB	3020	991	40 290 30	140 35 040 80	3 5			+15 + 8	4
5	120609	11.3N 147.1E	700MB	3014		50 140 60	220 45 140 60	5 8				5
6	120849	11.3N 147.1E	700MB	3021	990		290 42 200 30	10 5			+18 + 9	5
7	130942	12.2N 144.0E	700MB	2996	992		030 38 290 60	4 10			+17 +11 +11	7
8	132125	12.7N 142.6E	700MB	2934		80 360 20	130 66 050 20	5 5			+12 +17 + 9	8
9	140803	13.3N 141.9E	700MB	2854		80 330 15	040 50 330 35	10 3	ELLIPTICAL	40 30 050	+11 +17 +12	9
10	142005	14.4N 141.5E	700MB	2763		65 050 70	150 82 050 20	3 3				10
11	142212	14.5N 141.5E	700MB	2743		90 090 15	170 91 090 14	4 2	CIRCULAR	25	+11 +17 +12	10
12	150554	14.9N 141.4E	700MB	2620		100 080 25	100 100 360 30	3 2	CIRCULAR	35	+15 +21 +10	11
13	150835	15.1N 141.3E	700MB	2597		60 270 15	330 92 270 18	5 2	ELLIPTICAL	30 20 130	+12 +20 +11	11
14	151200	15.2N 141.2E	700MB	2574			120 99 030 17	5 2	ELLIPTICAL	25 20 030	+11 +20 +11	11
15	151516	15.2N 141.0E	700MB	2558			220 100 130 19	5 1	CIRCULAR	25	+11 +19 +12	11
16	151840	15.4N 140.8E	700MB	2588			140 98 040 26	4 2				13
17	152201	15.4N 140.7E	700MB	2629		80 040 20	040 81 310 27	4 5	CIRCULAR	25	+10 +16 +11	13
18	160302	15.3N 140.2E	700MB	2628		80 050 25	120 93 050 25	10 10	CIRCULAR	20	+10 +15 +14	14
19	160550	15.2N 140.0E	700MB	2635	948	65 310 40	030 75 310 40	10 10	CIRCULAR	15	+13 +14 +14	14
20	160838	15.2N 139.6E	700MB	2645		80 110 27	170 104 110 27	10 3	CIRCULAR	15	+ 9 +16 +13	14
21	162208	15.2N 137.8E	700MB	2574	943	110 360 15	210 113 110 20	5 2	CIRCULAR	25	+11 +17 +12	15
22	170015	15.2N 137.4E	700MB	2532		130 180 15	170 101 090 20	5 2	CIRCULAR			15
23	170253	15.4N 137.1E	700MB	2483		75 130 12	110 108 350 15	3 2	CIRCULAR	25	+ 9 +22 + 9	16
24	170830	15.6N 136.5E	700MB	2433	924	100 260 30	160 122 070 14	2 5	CIRCULAR	20	+14 +25	16
25	171921	16.0N 135.5E	700MB	2534			040 110 010 15	5 3	CIRCULAR	15	+25 +10	17
26	172211	16.1N 135.6E	700MB	2588	940	100 340 20	360 96 310 15	5 3	CIRCULAR	15	+13 +24 +11	17
27	180831	16.2N 134.1E	700MB	2713		100 270 10	220 82 320 32	3 10	CIRCULAR	15	+17 +16 +13	18
28	182218	15.9N 132.1E	700MB	2872		100 090 5	160 81 070 15	5 3	CIRCULAR	15	+10 +16 +12	19
29	190837	16.1N 131.0E	700MB	2907	978	80 090 30	120 81 020 20	8 5			+12 +22 + 8	20
30	191920	16.2N 130.8E	700MB	3016			250 40 220 20	10 10			+17 +18 + 4	21
31	192208	16.3N 130.3E	700MB	3057		50 360 40	150 57 360 40	10 3			+12 +15 + 6	21
32	200743	14.7N 130.4E	700MB	3107	1000	40 320 60	100 33 330 130	5 5			+16 +17 +13	22
33	202157	12.7N 128.8E	700MB	3132			020 20 280 100	10 10			+ 9 +12 + 8	23

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	131535	12.5N 143.4E	LAND	GOOD					13.6N 144.9E	91218
2	131635	12.5N 143.2E	LAND	GOOD					13.6N 144.9E	91218

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON LEE
BEST TRACK DATA

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST.			
					ERRORS				ERRORS				ERRORS					
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
122218Z	8.8 139.3	30	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122300Z	9.3 137.4	30	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122306Z	10.0 136.9	35	9.4 135.6	30.	85.	-5.	10.6 129.6	50.	118.	-20.	11.2 124.8	55.	117.	-40.	12.1 120.8	45.	90.	-5.
122312Z	10.8 134.7	45	10.3 134.1	40.	46.	-5.	11.4 128.1	60.	121.	-15.	12.2 123.2	55.	96.	-30.	13.2 119.2	45.	36.	5.
122318Z	11.4 133.3	55	11.2 133.8	45.	32.	-10.	12.6 129.0	65.	12.	-20.	13.2 123.3	50.	24.	-20.	14.6 118.7	55.	58.	10.
122400Z	11.8 132.0	65	11.8 132.1	55.	6.	-10.	12.9 126.5	70.	65.	-20.	13.6 121.8	50.	30.	-10.	15.9 117.3	55.	104.	5.
122406Z	12.1 130.9	70	12.2 130.8	65.	8.	-5.	13.8 125.3	80.	89.	-15.	13.8 120.8	60.	13.	10.	16.2 116.9	70.	103.	15.
122412Z	12.4 129.9	75	12.5 129.7	70.	13.	-5.	13.2 125.7	80.	63.	-5.	13.8 120.7	60.	81.	20.	15.2 116.1	50.	52.	0.
122418Z	12.6 128.8	85	12.5 128.8	75.	6.	-10.	13.3 124.8	75.	92.	5.	13.8 119.9	60.	110.	15.	15.4 115.2	50.	55.	5.
122500Z	12.7 127.6	90	12.8 127.8	85.	13.	-5.	13.6 123.8	75.	114.	15.	14.0 119.0	60.	122.	10.	15.7 114.8	50.	76.	15.
122506Z	12.6 126.2	95	12.8 126.5	85.	21.	-10.	13.6 122.6	75.	110.	25.	14.1 118.7	60.	160.	5.	15.5 114.9	50.	145.	20.
122512Z	12.6 124.8	85	12.7 124.8	90.	6.	5.	13.8 119.2	60.	6.	20.	16.1 115.1	50.	60.	0.	20.8 114.7	30.	182.	5.
122518Z	12.8 123.3	70	12.8 123.2	80.	6.	10.	14.2 118.0	55.	18.	10.	17.4 114.5	40.	102.	-5.	0.0 0.0	0.	-0.	0.
122600Z	13.1 121.9	60	13.1 121.8	70.	6.	10.	14.8 117.5	50.	50.	0.	18.8 115.3	45.	170.	10.	0.0 0.0	0.	-0.	0.
122606Z	13.6 120.7	50	13.6 120.3	55.	23.	5.	16.3 115.9	50.	96.	-5.	20.2 115.8	40.	227.	10.	0.0 0.0	0.	-0.	0.
122612Z	13.8 119.3	40	14.2 119.0	55.	30.	15.	17.2 114.9	40.	127.	-10.	21.8 115.5	30.	256.	5.	0.0 0.0	0.	-0.	0.
122618Z	13.9 118.0	45	14.0 117.9	50.	8.	5.	14.8 112.9	40.	97.	-5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122700Z	14.2 116.9	50	14.2 116.8	50.	6.	0.	14.7 111.8	40.	149.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122706Z	14.7 116.0	55	14.5 115.8	50.	17.	-5.	14.6 110.7	40.	216.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122712Z	15.1 115.2	50	14.9 115.0	50.	17.	0.	14.8 110.2	35.	261.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122718Z	15.7 114.3	45	15.5 113.9	45.	26.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122800Z	16.4 113.7	35	16.0 112.8	45.	57.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122806Z	17.3 113.2	30	17.2 113.3	40.	8.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
122812Z	18.1 113.2	25	18.4 113.1	30.	19.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	21.	100.	112.	90.	22.	83.	91.	72.
AVG RIGHT ANGLE ERROR	16.	75.	66.	62.	17.	58.	39.	54.
AVG INTENSITY MAGNITUDE ERROR	7.	12.	14.	9.	7.	12.	15.	8.
AVG INTENSITY BIAS	0.	-1.	-1.	0.	-1.	-2.	-3.	6.
NUMBER OF FORECASTS	22	18	14	10	20	16	12	8

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1710. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

TYPHOON LEE
FIX POSITIONS FOR CYCLONE NO. 29

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	211200	9.4N 146.7E	PCN 5		GMS	ULCC	PGTW
* 2	212100	10.2N 146.2E	PCN 5		GMS	ULCC	PGTW
3	221800	9.6N 139.9E	PCN 5		GMS	ULCC	PGTW
4	222100	9.4N 138.9E	PCN 5		GMS	ULCC	PGTW
5	230000	10.0N 137.5E	PCN 5	T2.5/2.5	GMS	INIT OBS	PGTW
6	230900	10.7N 135.3E	PCN 5		GMS		PGTW
7	231200	10.6N 134.7E	PCN 5		GMS		PGTW
8	231600	11.0N 134.2E	PCN 5		GMS	ULCC	RPMK
9	231818	11.3N 133.6E	PCN 5		NOAA7		PGTW
10	232100	11.6N 133.0E	PCN 5		GMS		PGTW
11	240000	12.2N 131.9E	PCN 5	T3.5/3.5 /D1.0/24HRS	GMS		PGTW
12	240300	12.6N 131.4E	PCN 5		GMS		PGTW
13	240900	12.4N 130.6E	PCN 3		GMS		PGTW
14	241200	12.4N 129.8E	PCN 2		GMS		PGTW
15	241600	12.4N 129.2E	PCN 1		GMS		PGTW
16	241806	12.4N 128.8E	PCN 1		NOAA7		PGTW
17	250300	12.5N 126.9E	PCN 1	T4.5/4.5 /D1.0/27HRS	GMS		PGTW
18	250600	12.6N 126.2E	PCN 1		GMS		PGTW
19	250900	12.7N 125.4E	PCN 1		GMS		PGTW
20	251200	12.6N 124.8E	PCN 1		GMS		PGTW
21	251600	12.7N 123.7E	PCN 3		GMS		PGTW
22	251755	12.7N 122.9E	PCN 3		NOAA7		PGTW
23	252100	12.8N 122.3E	PCN 3		GMS		PGTW
24	260000	13.0N 121.8E	PCN 3		GMS		PGTW
25	260300	13.5N 121.0E	PCN 5	T3.5/4.5 /W1.0/24HRS	GMS		PGTW
26	260600	13.7N 120.5E	PCN 5		GMS		PGTW
* 27	260639	13.8N 119.9E	PCN 1	T4.5/4.5	NOAA7	INIT OBS	RODN
28	260900	14.4N 119.8E	PCN 5		GMS		PGTW
29	261600	14.8N 118.7E	PCN 5		GMS		PGTW
30	261800	14.8N 118.5E	PCN 5		GMS		PGTW
31	261925	14.8N 117.7E	PCN 5		NOAA7		RODN
32	270300	14.7N 116.4E	PCN 3	T3.5/3.5 /S0.0/24HRS	GMS		PGTW
33	270628	14.6N 116.1E	PCN 3		NOAA7		PGTW
34	271200	14.8N 114.7E	PCN 5		GMS		PGTW
35	271600	15.2N 114.2E	PCN 5		GMS	EXP LLCC	PGTW
36	271800	15.5N 113.7E	PCN 5		GMS	ULCC 15.0N 117.9E EXP LLCC	PGTW
37	272100	15.9N 113.2E	PCN 5		GMS	EXP LLCC	PGTW
38	272336	16.4N 113.7E	PCN 5	T3.0/3.0	NOAA6	INIT OBS	RPMK
39	280000	16.4N 113.4E	PCN 5		GMS		PGTW
40	280300	17.0N 113.0E	PCN 5	T2.0/3.0 /W1.5/24HRS	GMS		PGTW
41	280616	17.2N 113.4E	PCN 5		NOAA7		PGTW
42	280616	17.3N 113.4E	PCN 3		NOAA7		RPMK
43	280900	17.9N 113.1E	PCN 5		GMS		PGTW
44	281200	18.6N 113.3E	PCN 5		GMS		PGTW
45	281600	18.9N 113.6E	PCN 5		GMS		PGTW
46	282100	19.4N 113.6E	PCN 5		GMS		PGTW
47	290300	19.3N 113.8E	PCN 3	T1.0/2.0 /W1.0/24HRS	GMS		PGTW
48	290604	19.6N 114.4E	PCN 3		NOAA7		PGTW
49	290604	19.6N 114.4E	PCN 3	T2.0/3.0-/W1.0/30HRS	NOAA7		RPMK

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	230504	10.0N 136.2E	1500FT		997	35 320 40	030 31 320 40	10 5			+23 +23	2
2	232207	11.7N 132.5E	700MB	2955	992	80 040 5	180 68 040 5	5 5	ELLIPTICAL	40 30 120	+ 7 +15 +11	3
3	240611	12.0N 130.8E	700MB	2858		80 100 15	070 73 330 28	7 5			+15 +13	4
4	240854	12.2N 130.2E	700MB	2845	972	25 200 90	130 75 040 20	7 5	ELLIPTICAL	25 15 150	+10 +15 +13	4
5	242103	12.8N 128.2E	700MB	2705	956	55 040 60	030 91 320 30	10 2	ELLIPTICAL	25 18 010	+12 +18 +12	5
6	250626	12.6N 126.1E	700MB	2640		100 050 15	130 113 050 15	8 5	CIRCULAR	25	+10 +16 +11	6
7	250905	12.5N 125.5E	700MB	2629	948	30 100 70	100 111 320 12	5 3	ELLIPTICAL	24 18 270	+ 9 +18 +12	6
8	262048	14.2N 117.3E	700MB	2996			050 54 350 24	5 5			+12 +16 + 9	8
9	262319	14.2N 117.1E	700MB	2997	990	45 020 45	150 51 020 45	5 5	ELLIPTICAL	35 25 020	+11 +15 +10	8
10	270850	14.9N 115.8E	700MB	2996	990	50 150 15	220 66 150 15	12 10	CIRCULAR	40	+ 8 +14 + 9	9
11	271201	15.4N 115.2E	700MB	3043			200 60 060 20	10 10				9
12	271406	15.8N 114.8E	700MB	3068	990		130 62 030 70	10 10			+ 8 +16 + 7	9

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	260930	13.5N 119.8E	LAND				1080/ 4////	EYE 60 PCT CI	16.3N 120.6E	98321
2	261000	13.6N 119.5E	LAND				1081/ 42915	EYE 60 PCT CI OPEN SE	16.3N 120.6E	98321
3	261100	13.6N 119.4E	LAND				1081/ 42915		16.3N 120.6E	98321
4	261200	13.6N 119.2E	LAND				1081/ 52715		16.3N 120.6E	98321
5	261230	13.6N 119.1E	LAND				1081/ 42715	EYE 70 PCT CI OPEN SE	16.3N 120.6E	98321
6	261330	13.6N 118.9E	LAND				10817 52730	EYE 100 PCT CI	16.3N 120.6E	98321
7	261400	13.6N 118.7E	LAND				10817 52715		16.3N 120.6E	98321
8	261500	13.6N 118.5E	LAND				10817 42715		16.3N 120.6E	98321
9	261600	13.7N 118.3E	LAND				10817 42815		16.3N 120.6E	98321
10	261800	13.8N 118.0E	LAND				1081/ 629//	EYE 80 PCT CI OPEN SE	16.3N 120.6E	98321
11	270200	14.2N 116.4E	LAND				1081/ 62855	EYE 80 PCT CI OPEN SW	16.3N 120.6E	98321

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

2. NORTH INDIAN OCEAN TROPICAL CYCLONES

TROPICAL CYCLONE 27-81
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS						
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
102802Z	12.2	72.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102808Z	12.4	72.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102814Z	12.5	71.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102820Z	12.7	70.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102902Z	12.8	69.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102908Z	12.9	69.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102914Z	13.0	68.5	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102920Z	12.9	67.9	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103002Z	13.0	66.9	35	13.2	67.1	30.	17.	-5.	15.5	65.3	40.	122.	-15.	18.9	65.8	55.	122.	-5.	21.9	68.8	60.	83.	25.
103008Z	13.8	66.5	40	13.6	65.8	35.	42.	-5.	16.4	64.4	55.	167.	-5.	20.1	65.8	65.	146.	10.	0.0	0.0	0.	-0.	0.
103014Z	14.4	66.9	45	13.6	66.0	45.	71.	0.	15.8	64.3	60.	198.	0.	19.3	65.2	65.	229.	15.	0.0	0.0	0.	-0.	0.
103020Z	15.0	67.4	50	13.8	65.7	50.	122.	0.	15.8	64.4	60.	239.	0.	19.0	65.0	65.	285.	20.	0.0	0.0	0.	-0.	0.
103102Z	15.8	67.4	55	15.2	67.8	55.	43.	0.	16.6	70.0	65.	205.	5.	17.9	72.9	60.	322.	25.	0.0	0.0	0.	-0.	0.
103108Z	16.7	67.3	60	16.8	68.1	60.	46.	0.	20.2	70.9	55.	140.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103114Z	17.6	67.2	60	18.2	67.8	60.	49.	0.	22.2	69.4	50.	74.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103120Z	18.6	67.4	60	18.8	67.4	60.	12.	0.	22.5	69.5	55.	51.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110102Z	19.4	67.9	60	19.2	67.4	60.	31.	0.	22.8	69.9	45.	16.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110108Z	20.3	68.4	55	20.4	68.3	55.	8.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110114Z	21.1	68.8	50	20.6	69.6	50.	54.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110120Z	21.7	69.2	45	21.7	69.5	45.	17.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110202Z	22.6	70.1	35	22.3	70.2	35.	19.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	41.	135.	221.	83.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	27.	106.	155.	25.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	1.	5.	15.	25.	0.	0.	0.	0.
AVG INTENSITY BIAS	-1.	1.	13.	25.	0.	0.	0.	0.
NUMBER OF FORECASTS	13	9	5	1	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 993. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 8. KNOTS

TC27-81
FIX POSITIONS FOR CYCLONE NO. 27

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
* 1	250234	6.6N	83.3E	PCN 5	T1.0/1.0	NOAA6	INIT OBS	KGWC
* 2	251332	6.7N	82.9E	PCN 6		NOAA6		KGWC
* 3	260210	8.9N	79.6E	PCN 6	T1.0/1.0 /S0.0/24HRS	NOAA6		KGWC
* 4	261449	10.3N	78.0E	PCN 6		NOAA6		KGWC
* 5	270954	12.1N	79.9E	PCN 6		NOAA7	ULAC 15.2N 79.8E	KGWC
6	280305	12.3N	71.7E	PCN 5	T1.5/1.5	NOAA6	INIT OBS	KGWC
7	280943	12.3N	71.4E	PCN 5		NOAA7		KGWC
8	281403	12.3N	70.7E	PCN 6		NOAA6		KGWC
9	282228	12.7N	70.0E	PCN 6		NOAA7		KGWC
10	290242	13.4N	68.5E	PCN 6	T2.5/2.5 /D1.0/24HRS	NOAA6	ULAC 13.6N 67.9E	KGWC
* 11	290931	13.5N	68.3E	PCN 5		NOAA7	ULAC 13.3N 67.4E	KGWC
12	291521	13.1N	68.7E	PCN 6		NOAA6	PSBL DUAL LLCC	KGWC
13	292216	13.1N	67.6E	PCN 6		NOAA7		KGWC
14	300400	13.2N	66.4E	PCN 5	T3.5/3.5 /D1.0/25HRS	NOAA6		KGWC
15	300919	13.3N	66.6E	PCN 5		NOAA7		KGWC
* 16	301458	13.3N	66.3E	PCN 6		NOAA6		KGWC
17	302205	14.9N	67.7E	PCN 6		NOAA7		KGWC
18	310455	16.3N	67.7E	PCN 1	T4.5/4.5 /D1.0/25HRS	NOAA6		KGWC
19	310908	17.2N	67.1E	PCN 6		NOAA7		KGWC
20	311434	17.9N	67.2E	PCN 6		NOAA6		KGWC
21	312153	18.4N	67.3E	PCN 6		NOAA7		KGWC
22	010313	19.4N	68.3E	PCN 5	T3.0/4.0-/W1.5/24HRS	NOAA6		KGWC
23	010856	20.1N	69.1E	PCN 5		NOAA7		KGWC
24	011411	21.3N	68.1E	PCN 6		NOAA6		KGWC
25	012141	22.0N	69.0E	PCN 6		NOAA7		KGWC
26	020250	21.9N	69.6E	PCN 3	T2.5/3.0 /W0.5/24HRS	NOAA6		KGWC
27	020844	23.4N	71.0E	PCN 5		NOAA7		KGWC

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL CYCLONE 29-81
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		WIND	WARNING POSIT		WIND	ERRORS DST	ERRORS WIND	24 HOUR FORECAST POSIT		WIND	ERRORS DST	ERRORS WIND	48 HOUR FORECAST POSIT		WIND	ERRORS DST	ERRORS WIND	72 HOUR FORECAST POSIT		WIND	DST	WIND
111702Z	12.5	91.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111708Z	12.8	90.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111714Z	13.2	90.4	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111720Z	13.5	90.2	45	14.2	90.4	30.	43.	-15.	17.1	88.8	40.	120.	-20.	19.9	87.2	55.	226.	-20.	0.0	0.0	0.	-0.	0.
111802Z	13.8	90.1	50	15.0	90.3	40.	73.	-10.	17.9	89.2	50.	122.	-15.	21.0	88.5	60.	181.	-5.	0.0	0.0	0.	-0.	0.
111808Z	14.3	90.0	55	14.0	90.2	45.	21.	-10.	14.9	90.0	60.	111.	-10.	17.1	90.0	70.	209.	15.	0.0	0.0	0.	-0.	0.
111814Z	14.9	90.1	55	14.6	90.3	55.	21.	0.	16.9	90.8	70.	54.	-5.	20.0	91.6	55.	74.	5.	0.0	0.0	0.	-0.	0.
111820Z	15.6	90.2	60	15.2	90.2	60.	24.	0.	17.8	90.5	80.	61.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111902Z	16.2	90.4	65	16.5	90.5	65.	19.	0.	19.8	91.2	70.	19.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111908Z	16.7	90.5	70	17.4	90.8	70.	45.	0.	21.0	91.5	60.	49.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111914Z	17.8	90.8	75	18.0	91.0	75.	16.	0.	21.5	92.0	50.	19.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111920Z	18.7	91.0	75	18.7	91.6	75.	34.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112002Z	19.5	91.3	65	19.6	91.2	70.	8.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112008Z	20.2	91.7	55	20.2	91.8	60.	6.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112014Z	21.2	91.9	50	20.8	92.1	40.	26.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	28.	69.	172.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	12.	35.	110.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	5.	8.	11.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-3.	-4.	-1.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	12	8	4	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 595. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TC29-81
FIX POSITIONS FOR CYCLONE NO. 29

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	160228	12.1N	91.7E	PCN 6	T1.0/1.0	NOAA6	INIT OBS	KGWC
2	161325	12.1N	91.5E	PCN 6		NOAA6		KGWC
3	162028	12.0N	91.4E	PCN 6		NOAA7		KGWC
4	170204	12.5N	91.9E	PCN 5	T2.5/2.5 /D1.5/24HRS	NOAA6	ULAC 11.9N 91.1E	KGWC
5	170600	12.6N	90.7E	PCN 5		GMS		PGTW
6	170913	13.2N	90.6E	PCN 6		NOAA7		KGWC
7	171302	13.7N	90.5E	PCN 6		NOAA6		KGWC
8	171600	13.2N	90.6E	PCN 5		GMS		PGTW
9	171800	13.9N	90.4E	PCN 5		GMS		PGTW
10	172016	13.2N	90.4E	PCN 6		NOAA7		KGWC
11	180000	15.0N	90.0E	PCN 5		GMS		PGTW
12	180141	13.5N	90.1E	PCN 5	T3.5/3.5 /D1.0/24HRS	NOAA6		KGWC
13	180600	14.0N	90.0E	PCN 5	T3.5/3.5	GMS	INIT OBS	PGTW
14	180901	13.9N	90.3E	PCN 5		NOAA7		KGWC
15	181200	14.5N	90.3E	PCN 5		GMS		PGTW
16	181239	14.6N	90.0E	PCN 2		NOAA6		KGWC
17	182004	15.6N	90.4E	PCN 2		NOAA7		KGWC
18	190000	14.8N	90.4E	PCN 5		GMS		PGTW
19	190118	16.1N	90.3E	PCN 1	T4.5/4.5 /D1.0/24HRS	NOAA6		KGWC
20	190300	16.5N	90.5E	PCN 1		GMS		PGTW
21	190600	16.8N	90.5E	PCN 3	T4.0/4.0 /D0.5/24HRS	GMS		PGTW
22	190849	17.0N	90.8E	PCN 1		NOAA7		KGWC
23	190900	17.3N	90.8E	PCN 5		GMS		PGTW
24	191200	17.8N	91.1E	PCN 5		GMS		PGTW
25	191356	17.8N	91.2E	PCN 5		NOAA6		KGWC
26	191600	18.3N	91.2E	PCN 5		GMS		PGTW
27	191800	18.6N	90.9E	PCN 5		GMS		PGTW
* 28	192134	18.5N	91.5E	PCN 6		NOAA7		KGWC
29	200000	19.5N	90.9E	PCN 5		GMS		PGTW
30	200235	20.7N	92.4E	PCN 6	T4.5/4.5-/S0.0/24HRS	NOAA6		KGWC
31	200600	21.0N	92.0E	PCN 5	T2.0/3.0 /W2.0/24HRS	GMS		PGTW
32	200837	20.2N	91.7E	PCN 3		NOAA7	ULAC 22.1N 94.7E	KGWC
33	201333	20.2N	91.6E	PCN 3		NOAA6	EXP LLCC	KGWC
34	201600	21.4N	91.7E	PCN 5		GMS		PGTW
35	210212	20.1N	92.1E	PCN 5		NOA6	EXP LLCC	KGWC

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL CYCLONE 31-81
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST				
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
120502Z	10.6	88.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120508Z	10.8	87.8	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120514Z	10.8	86.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120520Z	10.2	86.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120602Z	10.2	87.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120608Z	11.1	87.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120614Z	11.6	87.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120620Z	12.2	87.0	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120702Z	12.7	87.0	35	12.7	86.8	30.	12.	-5.	16.6	87.6	45.	162.	0.	20.5	89.5	50.	305.	-20.	24.5	92.3	25.	431.	-35.
120708Z	13.1	86.9	35	13.1	86.6	35.	17.	0.	16.0	86.3	40.	98.	-10.	19.4	87.6	45.	175.	-25.	22.8	89.6	35.	179.	-25.
120714Z	13.7	86.7	40	13.5	87.0	40.	21.	0.	16.0	87.6	45.	97.	-15.	18.8	89.2	35.	171.	-40.	21.3	90.8	25.	149.	-25.
120720Z	14.0	86.5	40	13.9	86.3	45.	13.	5.	16.6	84.9	50.	100.	-15.	19.2	85.8	30.	74.	-40.	21.2	88.3	20.	142.	-15.
120802Z	14.2	86.3	45	14.5	85.8	50.	34.	5.	17.3	84.9	45.	117.	-25.	20.0	86.4	30.	42.	-30.	0.0	0.0	0.	-0.	0.
120808Z	14.5	86.3	50	14.9	85.6	55.	47.	5.	17.8	84.9	45.	125.	-25.	20.3	86.8	30.	38.	-30.	0.0	0.0	0.	-0.	0.
120814Z	15.1	86.2	60	15.1	86.0	65.	12.	5.	17.1	85.8	75.	52.	0.	19.4	87.2	55.	159.	5.	0.0	0.0	0.	-0.	0.
120820Z	15.6	86.3	65	15.5	86.4	70.	8.	5.	17.5	87.2	70.	56.	0.	19.2	88.9	50.	243.	15.	0.0	0.0	0.	-0.	0.
120902Z	16.2	86.6	70	15.9	86.6	70.	18.	0.	17.6	87.1	60.	109.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120908Z	16.6	86.7	70	16.4	86.6	75.	13.	5.	18.0	87.2	65.	156.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120914Z	17.2	86.7	75	17.1	86.8	75.	8.	0.	18.9	87.5	65.	183.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120920Z	18.3	86.7	70	18.4	86.5	70.	13.	0.	22.6	87.3	40.	137.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121002Z	19.4	86.8	60	19.5	86.6	65.	13.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121008Z	20.6	87.4	60	20.7	87.2	55.	13.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121014Z	21.9	88.2	50	22.1	87.9	50.	20.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
121020Z	23.2	89.7	35	23.2	89.6	35.	5.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	17.	115.	151.	225.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	14.	55.	67.	85.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	3.	10.	26.	25.	0.	0.	0.	0.
AVG INTENSITY BIAS	2.	-5.	-21.	-25.	0.	0.	0.	0.
NUMBER OF FORECASTS	16	12	8	4	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1088. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 8. KNOTS

TC31-81
FIX POSITIONS FOR CYCLONE NO. 31

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	SATELLITE	COMMENTS	SITE
1	040212	10.7N	90.1E	PCN 5	T1.0/1.0	NOAA6	ULAC 9.6N 92.5E INIT OBS	KGWC
2	041310	10.8N	89.1E	PCN 6		NOAA6	ULAC 9.7N 91.6E	KGWC
3	050149	10.8N	88.7E	PCN 5	T2.0/2.0 /D1.0/24HRS	NOAA6	ULAC 9.8N 91.0E	KGWC
* 4	050600	10.6N	88.1E	PCN 5	T2.0/2.0	GMS	INIT OBS	PGTW
5	051428	10.8N	86.3E	PCN 6		NOAA6	ULAC 11.5N 86.6E	KGWC
* 6	052100	10.3N	84.3E	PCN 5		GMS		PGTW
* 7	060000	10.3N	84.3E	PCN 5		GMS		PGTW
8	060125	10.3N	86.7E	PCN 3	T1.5/2.0 /W0.5/24HRS	NOAA6	EXP LLCC	KGWC
* 9	060300	9.0N	87.1E	PCN 3		GMS	EXP LLCC	PGTW
* 10	060600	9.0N	87.0E	PCN 3	T2.0/2.0 /S0.0/24HRS	GMS		PGTW
11	060853	10.5N	87.3E	PCN 3		NOAA7	ULAC 10.8 85.0E EXP LLCC	KGWC
12	061404	11.2N	87.2E	PCN 6		NOAA6		KGWC
13	061600	12.1N	86.8E	PCN 5		GMS		PGTW
14	070000	12.3N	86.8E	PCN 5		GMS		PGTW
15	070243	12.3N	87.1E	PCN 1	T3.5/3.5 /D2.0/25HRS	NOAA6		KGWC
* 16	070600	13.4N	84.8E	PCN 5	T3.0/3.0 /D1.0/24HRS	GMS		PGTW
17	070842	12.9N	87.0E	PCN 5		NOAA7		KGWC
18	071200	13.7N	86.5E	PCN 5		GMS		PGTW
19	071341	13.7N	87.1E	PCN 6		NOAA6		KGWC
20	071800	14.0N	85.9E	PCN 5		GMS		PGTW
21	072127	13.8N	86.0E	PCN 5		NOAA7	BREAKS CONTINUITY	KGWC
22	080000	14.3N	85.3E	PCN 5		GMS		PGTW
23	080220	14.2N	86.3E	PCN 1	T4.5/4.5+/D1.0/24HRS	NOAA6		KGWC
24	080600	14.2N	85.7E	PCN 5	T4.0/4.0 /D1.0/24HRS	GMS		PGTW
25	080830	14.2N	86.6E	PCN 3		NOAA7		KGWC
26	081200	14.7N	86.2E	PCN 5		GMS		PGTW
27	081318	14.8N	86.7E	PCN 3		NOAA6		KGWC
28	081800	15.1N	86.3E	PCN 5		GMS		PGTW
29	082100	15.5N	86.3E	PCN 5		GMS		PGTW
30	082115	15.2N	86.8E	PCN 5		NOAA7		KGWC
31	090156	15.6N	86.7E	PCN 1	T5.5/5.5 /D1.0/24HRS	NOAA6		KGWC
32	090300	16.1N	86.4E	PCN 1		GMS		PGTW
33	090600	16.3N	86.2E	PCN 1	T4.5/4.5 /D0.5/24HRS	GMS		PGTW
34	090818	16.8N	86.7E	PCN 1		NOAA7		KGWC
35	090900	16.5N	86.2E	PCN 5		GMS		PGTW
36	091200	16.7N	86.2E	PCN 5		GMS		PGTW
37	091254	17.1N	86.8E	PCN 5		NOAA6		KGWC
38	091800	17.0N	86.2E	PCN 5		GMS		PGTW
39	092100	18.6N	86.3E	PCN 1		GMS		PGTW
40	092103	18.5N	86.7E	PCN 1		NOAA7	EYE 15NM DIAMETER	KGWC
41	100000	18.9N	86.5E	PCN 3		GMS	EYEWALL OPEN E	PGTW
42	100133	19.2N	87.0E	PCN 1	T5.5/5.5 /S0.0/24HRS	NOAA6		PGTW
43	100600	20.1N	87.2E	PCN 3	T3.5/4.0-/W1.0/24HRS	GMS		PGTW
44	100806	20.9N	87.8E	PCN 1		NOAA7		KGWC
45	100900	20.5N	87.5E	PCN 5		GMS		PGTW
46	101200	22.1N	88.1E	PCN 5		GMS		PGTW
47	101412	21.7N	88.0E	PCN 6		NOAA6		KGWC
48	101800	22.8N	88.5E	PCN 5		GMS		PGTW
* 49	102051	22.7N	88.0E	PCN 5		NOAA7	OVER LAND	KGWC

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

APPENDIX I

CONTRACTIONS

ACCRY	Accuracy
ACFT	Aircraft
ADP	Automatic Data Processing
AFGWC	Air Force Global Weather Central
AIREP	Aircraft Weather Report(s) (Commercial and Military)
ANT	Antenna
APT	Automatic Picture Transmission
ARWO	Aerial Reconnaissance Weather Officer
ATT	Attenuation
AVG	Average
AWN	Automated Weather Network
BPAC	Blended Persistance and Climatology
BRG	Bearing
CDO	Central Dense Overcast
CI	Current Intensity
CLD	Cloud
CLSD	Closed
CNTR	Center
CPA	Closest Point of Approach
DEG	Degree(s)
DIAM	Diameter
DIR	Direction
DMSP	Defense Meteorological Satellite Program
ELEV	Elevation
FLT	Flight
FNOC	Fleet Numerical Oceanography Center
GOES	Geostationary Operational Environmental Satellite
HGT	Height
HPAC	Mean of XTRP and Climatology
HR	Hour(s)
HVY	Heavy
ICAO	International Civil Aviation Organization
IR	Infrared
KM	Kilometer(s)
KM/HR	Kilometer(s) per hour
LLCC	Low-Level Circulation Center
LVL	Level
M	Meter(s)
M/SEC	Meters per Second
MAX	Maximum
MB	Millibar(s)
MET	Meteorological
MIN	Minimum
MSN	Mission
NAV	Navigational
NAVPGSCOL	Naval Postgraduate School
NEDN	Naval Environmental Data Network
NEDS	Naval Environmental Display Station
NEPRF	Naval Environmental Prediction Research Facility
NESS	National Environmental Satellite Service
NET	Near Equatorial Trough
NM	Nautical Mile(s)
N/O	Not Observed
NOAA	National Oceanic and Atmospheric Administration
NRL	Naval Research Laboratory
NTCC	Naval Telecommunications Center
NTCM	Nested Tropical Cyclone Model
OBS	Observation(s)
OTCM	One-Way Interactive Tropical Cyclone Model
PCN	Position Code Number
PSBL	Possible
PTLY	Partly
QUAD	Quadrant
RADOB	Radar Observation
RECON	Reconnaissance
RNG	Range
SAT	Satellite
SFC	Surface
SLP(MSLP)	Sea-Level Pressure (Minimum Sea-Level Pressure)
SPOL	Spiral Overlay

SRP	Selective Reconnaissance Program
STNRY	Stationary
SST	Sea Surface Temperature
ST	Super Typhoon
TC	Tropical Cyclone
TCARC	Tropical Cyclone Aircraft Reconnaissance Coordinator
TCFA	Tropical Cyclone Formation Alert
TCM	Tropical Cyclone Model
TD	Tropical Depression
TDO	Typhoon Duty Officer
TIROS	Television Infrared Observation Satellite
TS	Tropical Storm
TY	Typhoon
TUTT	Tropical Upper Tropospheric Trough (Sadler, 1976)
ULAC	Upper-Level Anticyclone
VEL	Velocity
VIS	Visual
VSBL	Visible
WESTPAC	Western Pacific
WMO	World Meteorological Organization
WND	Wind
WRS	Weather Reconnaissance Squadron
XTRP	Extrapolation
Z	Zulu Time (Greenwich mean time)

APPENDIX II

DEFINITIONS

BEST TRACK - A subjectively smoothed path, versus a precise and very erratic fix-to-fix path, used to represent tropical cyclone movement.

CENTER - The vertical axis or core of a tropical cyclone. Usually determined by wind, temperature, and/or pressure distribution.

CYCLONE - A closed atmospheric circulation rotating about an area of low pressure (counterclockwise in the northern hemisphere).

EPHEMERIS - Position of a body (satellite) on space as a function of time; used when no geographic reference is available for gridding satellite imagery. Since ephemeris gridding is based soley on the theoretical position of the satellite, it is susceptible to errors from vehicle pitch, orbital eccentricity, and the oblateness of the earth.

EXPLOSIVE DEEPENING - A decrease in the minimum sea-level pressure of a tropical cyclone of 2.5 mb/hr for 12 hrs or 5.0 mb/hr for 6 hrs (ATR 1971).

EXTRATROPICAL - A term used in warnings and tropical summaries to indicate that a cyclone has lost its "tropical" characteristics. The term implies both poleward displacement from the tropics and the conversion of the cyclone's primary energy sources from release of latent heat of condensation, to baroclinic processes. The term carries no implications as to strength or size.

EYE - "EYE" is used to describe the central area of a tropical cyclone when it is more than half surrounded by wall cloud.

FUJIWHARA EFFECT - An interaction in which tropical cyclones within about 700 nm (1296 km) of each other begin to rotate cyclonically about one another. When intense tropical cyclones are within about 400 nm (741 km) of each other, they may also begin to move closer to each other.

MAXIMUM SUSTAINED WIND - Maximum surface wind speed averaged over a 1-minute period of time. Peak gusts over water average 20 to 25 percent higher than sustained wind.

RAPID DEEPENING - A decrease in the minimum sea-level pressure of a tropical cyclone of 1.25 mb/hr for 24 hrs (ATR 1971).

RECURVATURE - The turning of a tropical cyclone from an initial path toward the west or northwest to the north then northeast.

RIGHT ANGLE ERROR - The distance described by a perpendicular line from the best track to a forecast position.

SIGNIFICANT TROPICAL CYCLONE - A tropical cyclone becomes "significant" with the issuance of the first numbered warning by the responsible warning agency.

SUPER TYPHOON/HURRICANE - A typhoon/hurricane in which the maximum sustained surface wind (1-minute mean) is 130 kt (67 m/sec) or greater.

TROPICAL CYCLONE - A non-frontal low pressure system of synoptic scale developing over tropical or subtropical waters and having a definite organized circulation.

TROPICAL CYCLONE AIRCRAFT RECONNAISSANCE COORDINATOR - A CINCPACAF representative designated to levy tropical cyclone aircraft weather reconnaissance requirements on reconnaissance units within a designated area of the PACOM and to function as coordinator between CINCPACAF, aircraft weather reconnaissance units, and the appropriate typhoon/hurricane warning center.

TROPICAL DEPRESSION - A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 33 kt (17 m/sec) or less.

TROPICAL DISTURBANCE - A discrete system of apparently organized convection--generally 100 to 300 nm (185-556 km) in diameter--originating in the tropics or subtropics, having a non-frontal migratory character, and having maintained its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field. As such, it is the basic generic designation which, in successive stages or intensification, may be classified as a tropical depression, tropical storm or typhoon (hurricane).

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds (1-minute mean) in the range of 34 to 63 kt (17-32 m/sec) inclusive.

TROPICAL UPPER TROPOSPHERIC TROUGH (TUTT) - "A dominant climatological system, and a daily synoptic feature, of the summer season over the tropical North Atlantic, North Pacific and South Pacific Oceans," from Sadler, James C., Feb. 1976: Tropical Cyclone Initiation by the Tropical Upper Tropospheric Trough (NAVENVPREDRSCHFAC Technical Paper No. 2-76).

TYPHOON/HURRICANE - A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 64 kt (33 m/sec) or greater. West of 180 degrees longitude they are called typhoons and east of 180 degrees they are called hurricanes. Foreign governments use these or other terms for tropical cyclones and may apply different intensity criteria.

VECTOR ERROR - The vector drawn between a forecast position and the location of the storm at the verifying time of the forecast.

WALL CLOUD - An organized band of cumuliform clouds immediately surrounding the central area of a tropical cyclone. The wall cloud may entirely enclose the eye or only partially surround the center.

APPENDIX III

REFERENCES

Arnold, C. P., 1974: Tropical Cyclone Position and Intensity Analysis using Satellite Data. First Weather Wing Pamphlet, 1WWP 105-10, Department of the Air Force, Hq 1st Weather Wing (MAC), 88 pp.

Atkinson, G. D., and Holliday C. R., 1977: Tropical Cyclone Minimum Sea-Level Pressure - Maximum Sustained Wind Relationship for Western North Pacific. Monthly Weather Review, Vol. 105, No. 4, pp. 421-427.

Burroughs, L. D. and Brand, S., 1973: Speed of Tropical Storms and Typhoons After Recurvature in the Western North Pacific Ocean. Journal of Applied Meteorology, Vol. 12, No. 3, pp. 452-458.

Dunnavan, G. M., 1981: Forecasting Intense Tropical Cyclones Using 700-MB Equivalent Potential Temperature and Central Sea-Level Pressure, NAVOCEANCOMCEN/JTWC TECH NOTE 81-1, 12 pp.

Dvorak, V. F., 1973: A Technique for the Analysis and Forecasting of Tropical Cyclone Intensities from Satellite Pictures, NOAA TM NESS 45, 19 pp.

Ruprecht, E., and Gray, W. M., 1976: Analysis of Satellite-Observed Tropical Cloud Clusters, Part I: Wind and Dynamic Fields. Tellus, 28, 391-413.

Sadler, J. C., 1976: Tropical Cyclone Initiation by the Tropical Upper Tropospheric Trough, NAVENVPREDRSCHFAC Technical Paper No. 2-76, 103 pp.

Sikora, C. R., 1976: A Reevaluation of the Changes in Speed and Intensity of Tropical Cyclones Crossing the Philippines, FLEWEACEN TECH NOTE: JTWC 76-2, 11 pp.

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Annual publication summarizing the tropical cyclone season in the western North Pacific, Bay of Bengal and Arabian Sea. A brief narrative is given on each significant tropical cyclone including the best track. All reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics for the JTWC are summarized. Research efforts at the JTWC and NEPRF are briefly discussed.

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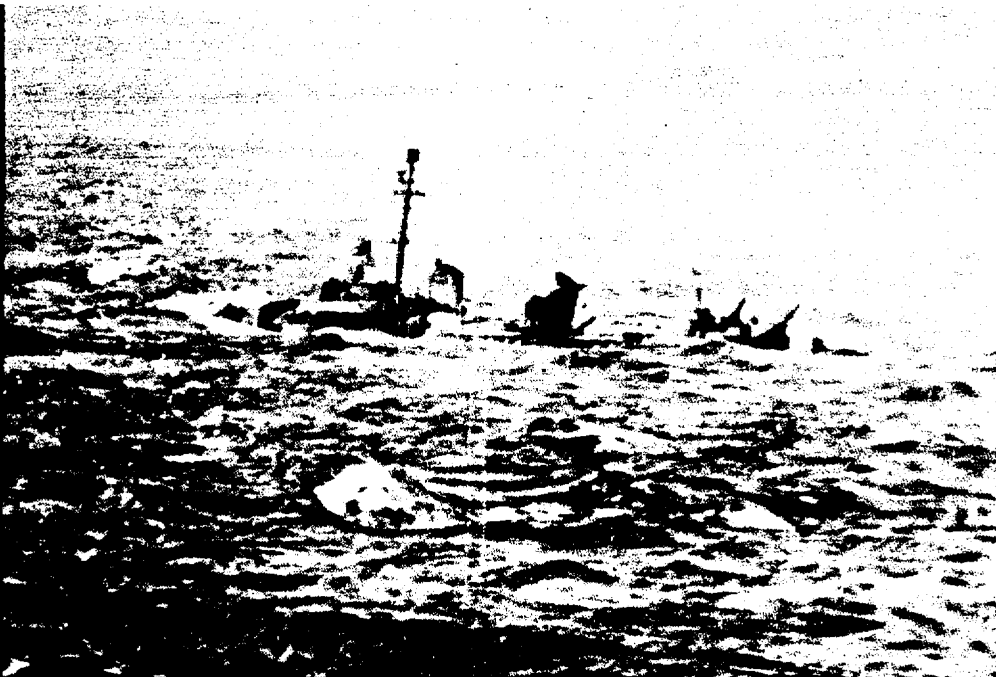

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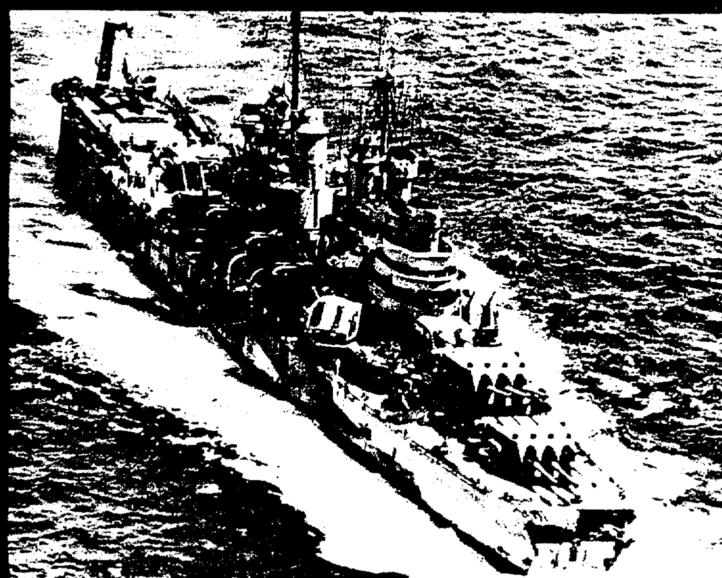

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