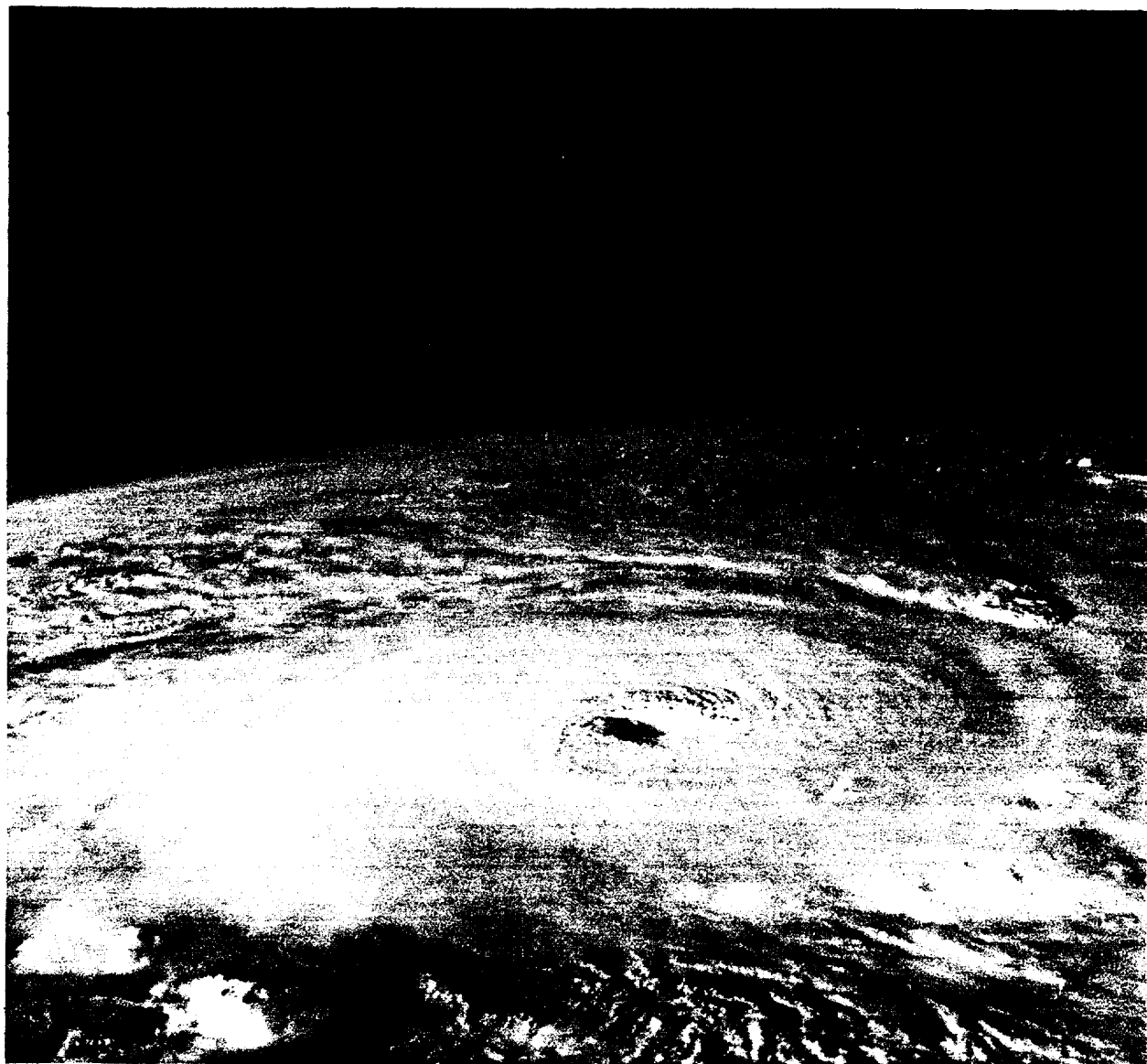


***1984
ANNUAL TROPICAL
CYCLONE REPORT***



***JOINT TYPHOON WARNING CENTER
GUAM, MARIANA ISLANDS***

FRONT COVER: A synoptic view of Tropical Cyclone 30S (Kamisy) taken on 8 April 1984 by Space Shuttle Mission 41C. Kamisy was located east-northeast of Madagascar with an estimated intensity of 100 kt (51 m/s). This photograph was taken with a 100mm lens from an altitude of 260 nm (482 km). Note the convergent banding well away from the eye. The cirrus outflow is extremely strong partially obscuring the near field image. (Photograph provided by LCDR W. T. Aldinger, NAVPOLAROCEANCEN Detachment, Johnson Space Center, Texas).

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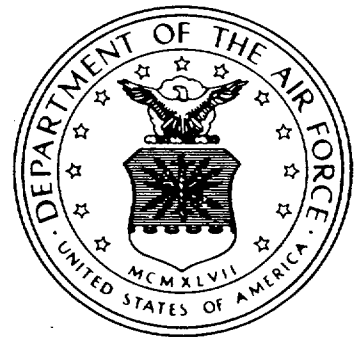
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FOREWARD

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

The mission of the Joint Typhoon Warning Center is multi-faceted and includes:

1. Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.
2. Issuing warnings on 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-storm analysis of all tropical cyclones occurring within the western North Pacific and North Indian Oceans for publication in this report.
5. Cooperation with the Naval Environmental Prediction Research Facility, Monterey, California, on the operational evaluation of tropical cyclone models and forecast aids, and the development of new techniques to support operational forecast scenarios.

Satellite imagery used throughout this report represents data obtained by the tropical cyclone satellite surveillance network. The personnel of Detachment 1,

1LWW, colocated with JTWC at Nimitz Hill, Guam, coordinate the satellite acquisitions and tropical cyclone surveillance with the following units:

Det 5, 1LWW, Clark AB, RP

Det 8, 1LWW, Kadena AB, Japan

Det 15, 30WS, Osan AB, Korea

Det 4, 1LWW, Hickam AFB, Hawaii

Air Force Global Weather Central,
Offutt AFB, Nebraska

In addition, the Naval Oceanography Command Detachment, Diego Garcia, and DMSF equipped U.S. Navy aircraft carriers have been instrumental in providing vital satellite position fixes of tropical cyclones in the Indian Ocean.

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

A special thanks is extended to the men and women of: 27th Information Systems Squadron, Operating Location C, for their continuing support by providing high quality real-time satellite imagery; the Pacific Fleet Audio-Visual Center, Guam, for their assistance in the reproduction of satellite and graphics data for this report; to the Navy Publications and Printing Service Branch Office, Guam, for their efforts to meet publication deadlines; and to Mrs. Patricia G. Lizama for her patience and perseverance in typing the many drafts and final manuscript of this report. A special thanks is also extended to SSGT Charles B. Siniff Jr. for gridding the numerous satellite pictures used in this report.

NOTE: Appendix V contains information on how to obtain past issues of the Annual Tropical Cyclone Report (titled Annual Typhoon Report prior to 1980).

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INDIVIDUAL TROPICAL CYCLONES
EDITOR: LT WIRFEL

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(01W)	TS VERNON	SHERMAN -----	16	(16W)	TS LYNN	COLUMBUS -----	70
(02W)	TS WYNNE	GARNER -----	18	(17W)	TS MAURY	GILFORD -----	72
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INDIVIDUAL TROPICAL CYCLONES

<u>TROPICAL CYCLONE</u>		<u>AUTHOR</u>	<u>PAGE</u>	<u>TROPICAL CYCLONE</u>		<u>AUTHOR</u>	<u>PAGE</u>
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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 during the advisory period;

b. Tropical Cyclone Formation Alerts: issued when synoptic, satellite and/or aircraft reconnaissance data indicates 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 tropical storms and typhoons in the western North Pacific; these messages discuss the rationale behind the most recent JTWC warnings.

The recipients of the services of JTWC essentially determine the content of JTWC's products according to their ever-changing requirements. Therefore, the spectrum of 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:

A 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 to JTWC via the Naval Environmental Data Network (NEDN).

b. CONVENTIONAL DATA:

This data set is comprised of land-based and shipboard surface and upper-air observations taken at or near synoptic times, cloud-motion winds derived twice daily from satellite data, and enroute meteorological observations from commercial and military aircraft (AIREPS) within six hours of synoptic times. Conventional data charts are prepared daily at 0000Z and 1200Z using hand- and computer-plotted data for the surface/gradient and 200 mb (upper-tropospheric) levels. In addition to these analyses, charts at the 850, 700, and 500 mb levels are computer-plotted from rawinsonde/pibal observations at the 12-hour synoptic times.

c. AIRCRAFT RECONNAISSANCE:

Aircraft weather reconnaissance data are invaluable for locating the position of the center of developing systems and essential for the accurate determination of numerous parameters, including;

- maximum surface and flight level wind
- minimum sea-level pressure
- horizontal surface and flight level wind distribution
- eye/center temperature and dewpoint

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

d. SATELLITE RECONNAISSANCE:

Meteorological satellite data obtained from the 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 1984. A discussion of the role of these programs is presented in Chapter II.

e. RADAR RECONNAISSANCE:

During 1984, as in previous years, land-based radar coverage was utilized extensively when available. Once a tropical cyclone moved within the range of land-based radar sites, their reports were essential for determination of small scale movement. Use of radar reports during 1984 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, alerts and other related bulletins to Department of Defense installations. These messages are relayed for further transmission over U.S. Navy Fleet Broadcasts, and 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, JTWC GUAM, or DET 1 IWW NIMITZ HILL GU.

(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 Telecommunications 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 to access the computers directly to execute numerical techniques.

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 circuits, and is capable of preparing messages for indirect AUTODIN transmission. The NEDS also provides a means for the Typhoon Duty Officer (TDO) to request forecast aids which are processed on the FLENUMOCEANCEN computers and transmitted to the TDO over the NEDN circuit.

4. ANALYSES

A composite surface/gradient level (3000 ft (915 m)) 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 Naval Oceanography Command Center (NOCC) Operations watch-team and is used by JTWC in conjunction with their analysis of the tropical wind fields.

A composite upper-tropospheric manual streamline analysis is accomplished daily utilizing rawinsonde data from 300 mb through 100 mb, winds derived from cloud motion analysis, and AIREPS (taken plus or minus 6 hours of chart valid time) at or above 29,000 feet (8,839 m). Wind and height data are used to generate a representative analysis of tropical cyclone outflow patterns, mid-latitude steering currents, and features that may influence tropical cyclone intensity. All charts are hand-plotted in the tropics to provide all available data as soon as possible to the TDO. These charts are augmented by computer-plotted charts for the final analysis.

Computer plotted charts for the 850, 700, and 500 mb levels are available for streamline and/or height-change analysis from the 0000Z and 1200Z data base. 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

The following objective techniques were employed in tropical cyclone forecasting during 1984 (a description of these techniques is presented in Chapter IV):

a. MOVEMENT

- (1) 12-HOUR EXTRAPOLATION
- (2) CLIMATOLOGY
- (3) TPAC (Extrapolation and Climatology Blend)
- (4) TYAN78 (Analog)
- (5) COSMOS (Model Output Statistics)
- (6) OTCM (Dynamical Model)
- (7) NTCM (Nested Grid Dynamical Model)
- (8) TAPT (Empirical)

b. INTENSITY

- (1) THETA E (Empirical)
- (2) DVORAK (Empirical)
- (3) CLIMATOLOGY
- (4) WIND RADIUS (Analytical)

6. FORECAST PROCEDURES

a. INITIAL POSITIONING

The warning position is the best estimate of the center of the surface circulation at synoptic time. It is estimated from an analysis of all fix information received up to one and one-half hours after synoptic time. This analysis is based on a semi-objective weighting of fix information based on the historical accuracy of the fix platform and the meteorological features used for the fix. The interpolated warning position reduces the weighting of any single fix and results in a more consistent movement and a warning position that is more representative of the larger-scale circulation. If the fix data is not available due to reconnaissance platform malfunctions or communication problems, synoptic data or extrapolation from previous fixes are used.

b. TRACK FORECASTING

A preliminary forecast track is developed based on an evaluation of the rationale behind the previous warning and the guidance given by the most recent set of objective techniques and numerical prognoses. This preliminary track is then subjectively modified based on the following considerations:

(1) The prospects for recurvature or erratic movement are evaluated. This evaluation is based primarily on the present and forecast positions and amplitudes of the middle-tropospheric, mid-latitude troughs and ridges as depicted on the latest upper-air analysis and numerical forecasts.

(2) Determination of the best steering level is partly influenced by the maturity and vertical extent of the tropical cyclone. For mature tropical cyclones located south of the subtropical ridge, forecast changes in speed of movement are closely correlated with anticipated changes in the intensity or relative position of the ridge. When steering currents are relatively weak, the tendency for tropical cyclones to move northward due to internal forces is an important consideration.

(3) Over the 12- to 72-hour forecast period, speed of movement during the early forecast period is usually biased towards persistence, while the subsequent forecast periods are biased toward objective techniques. When a tropical cyclone moves poleward, and toward the mid-latitude steering currents, speed of movement becomes increasingly more biased toward a selective group of objective techniques capable of estimating significant increases in speed of movement.

(4) The proximity of the tropical cyclone to other tropical cyclones is closely evaluated to determine if there is a possibility of interaction.

A final check is made against climatology to determine whether the forecast track is reasonable. If the forecast deviates greatly from one of the climatological tracks, the forecast rationale may be reappraised.

C. INTENSITY FORECASTING

In this parameter, heavy reliance is placed on intensity trends from aircraft reconnaissance reports, wind and pressure data from ships and land stations in the vicinity of the tropical cyclone, the Dvorak satellite empirical model and climatology. An evaluation of the entire synoptic situation is made, including the location of major troughs and ridges, the position and intensity of any nearby tropical upper-tropospheric troughs (TUTT's), the vertical and horizontal extent of the tropical cyclone's circulation and the extent of the associated upper-level outflow pattern. An essential element affecting each intensity forecast is the accompanying forecast track and the influence of environmental parameters along that track, such as terrain influences, vertical wind shear, and the existence of an extratropical environment.

Once the forecast intensities have been derived, the horizontal distribution of surface winds (winds greater than 30-, 50-,

and 100-knots) is determined. The most recent wind radii and associated asymmetries are deduced from all available surface wind observations and reconnaissance aircraft reports. Based on the current surface wind distribution, preliminary estimates of future wind radii are provided by an empirically derived objective technique. These estimates may be subjectively modified based upon the anticipated interaction of the tropical cyclone's circulation with forecast locations of large-scale wind regimes and significant landmasses. Other factors including the tropical cyclone's speed of movement and possible extratropical transition are considered.

7. WARNINGS

Tropical cyclone warnings are issued when a closed circulation is evident and maximum sustained winds are forecast to increase to 34 knots (18 meters per second) within 48 hours, or if the tropical cyclone is in such a position that life or property may be endangered within 72 hours. Warnings may also be issued in other situations if it is determined that there is a need to alert military or civil interests to conditions which may become hazardous in a short period of time.

Each tropical cyclone warning is numbered sequentially and includes the following information: the position of the surface center; estimate of the position accuracy and the supporting reconnaissance (fix) platforms; the direction and speed of movement during the past six hours; and the intensity and radial extent of surface winds over 30-, 50-, and 100-knots, when applicable. At forecast intervals of 12-, 24-, 48-, and 72-hours, information on the tropical cyclone's anticipated position, intensity and wind radii are also provided. Starting on 1 July 1984, vectors indicating the mean direction and mean speed between forecast positions were also included in all warnings.

Warnings in the western North Pacific and North Indian Ocean are issued every six hours valid at standard times (0000Z, 0600Z, 1200Z, and 1800Z). All warnings are released to the communications network no earlier than synoptic time and no later than synoptic time plus two and one-half hours so that recipients will have a reasonable expectation of having all warnings "in hand" by synoptic time plus three hours (0300Z, 0900Z, 1500Z, and 2100Z).

Warning forecast positions are later verified against the corresponding "best track" positions (obtained during detailed post-storm analysis to determine the actual path of the cyclone). A summary of the verification results from 1984 is presented in Chapter IV.

8. PROGNOSTIC REASONING MESSAGES

For tropical storms and typhoons in the western North Pacific Ocean, prognostic reasoning messages are transmitted following the 0000Z and 1200Z warnings, or whenever the forecast reasoning is no longer valid. This plain language message is intended to provide meteorologists with the reasoning behind the latest JTWC forecast.

In addition to this message, 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. TROPICAL CYCLONE FORMATION ALERT

Tropical Cyclone Formation Alerts (TCFAs) are issued whenever interpretation of satellite imagery and other meteorological data indicates that the formation of a significant tropical cyclone is likely. These formation alerts will specify a valid period not to exceed 24 hours and must

either be cancelled, reissued, or superseded by a tropical cyclone warning prior to the expiration of the valid time.

10. SIGNIFICANT TROPICAL WEATHER ADVISORY

This product contains a general, non-technical description of all tropical disturbances in the JTWC area of responsibility and an assessment of their potential for further (tropical cyclone) development. In addition, all tropical cyclones in warning status are briefly discussed. This message is issued at 0600Z daily and is valid for a 24 hour period. It is reissued whenever the situation warrants. For each suspect area, the words "poor", "fair", and "good" will be used to describe the potential for further development. "Poor" will be used to describe a tropical disturbance that is not expected to require a TCFA during the advisory period; "Fair" will be used to describe a tropical disturbance that is currently not covered by a TCFA, but for which it is likely that a TCFA will be issued during the advisory period; and "Good" will be used when the tropical disturbance is covered by a TCFA.

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 are also used to supplement the above. Optimum utilization of all available reconnaissance resources is obtained through the Selective Reconnaissance Program (SRP); various factors are considered in selecting a specific reconnaissance platform including capabilities and limitations, and the tropical cyclone's threat to life and property both afloat and ashore. A summary of reconnaissance fixes received during 1984 is included in Section 6 of this chapter.

2. RECONNAISSANCE AVAILABILITY

a. Aircraft

Aircraft weather reconnaissance for the JTWC is performed by the 54th Weather Reconnaissance Squadron (54th WRS) located at Andersen Air Force Base, Guam. The 54th WRS is presently equipped with six WC-130 aircraft and, from July through October, is augmented by three additional aircraft from the 53rd WRS, Keesler Air Force Base, Mississippi, bringing the total number of available aircraft to nine. The JTWC reconnaissance requirements are provided daily to the Tropical Cyclone Aircraft Reconnaissance Coordinator (TCARC), who marries the tasking from the JTWC with the available airframes from the 54th WRS.

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 Officer (ARWO) and dropsonde operators of Detachment 3, 1st Weather Wing who fly with the 54th WRS. These data provide the Typhoon Duty Officer (TDO) with indications of changing tropical cyclone characteristics, radii of associated winds and current tropical 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 tropical cyclone positions and estimates of current and forecast intensities through the Dvorak technique.

c. Radar

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

d. Synoptic

In 1984 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 or satellite were not available.

3. AIRCRAFT RECONNAISSANCE SUMMARY

During the 1984 tropical cyclone season, the JTWC levied 210 vortex fixes and 53 investigative missions of which 14 were flown into disturbances which did not develop. In addition to the levied fixes, 251 intermediate fixes were also obtained. The average vector error for all aircraft fixes received at the JTWC during 1984 was 12 nm (22 km).

Aircraft reconnaissance effectiveness is summarized in Table 2-1 using the criteria set forth in CINCPACINST 3140.1 (series).

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

EFFECTIVENESS	NUMBER OF LEVIED FIXES	PERCENT
COMPLETED ON TIME	202	96.1
EARLY	2	1.0
LATE	4	1.9
MISSED	2	1.0
TOTAL	210	100.0

LEVIED VS. MISSED FIXES			
AVERAGE 1965-1970	LEVIED	MISSED	PERCENT
1971	507	10	2.0
1972	802	61	7.6
1973	624	126	20.2
1974	227	13	5.7
1975	358	30	8.4
1976	217	7	3.2
1977	317	11	3.5
1978	203	3	1.5
1979	290	2	0.7
1980	289	14	4.8
1981	213	4	1.9
1982	201	3	1.5
1983	276	17	6.2
1984	157	3	1.9
	210	2	1.0

4. SATELLITE RECONNAISSANCE SUMMARY

The Air Force provides satellite reconnaissance support to JTWC using imagery from a variety of spacecraft. The tropical cyclone satellite surveillance network consists of both tactical and centralized facilities. Tactical DMSP sites are located at Nimitz Hill, Guam; Clark AB, Republic of the Philippines; Kadena AB, Japan; Osan AB, Korea; and Hickam AFB, Hawaii. These sites provide a combined coverage that includes most of the JTWC area of responsibility in the western North Pacific from near the dateline westward to the Malay Peninsula. JTWC relies on the Air Force Global Weather Central (AFGWC) to provide coverage over the remainder of its area of responsibility using stored satellite data. The Naval Oceanography Command Detachment, Diego Garcia, provides NOAA polar orbiting coverage in the central Indian Ocean as a supplement to this support. U. S. Navy ships equipped for direct readout also provided supplementary support.

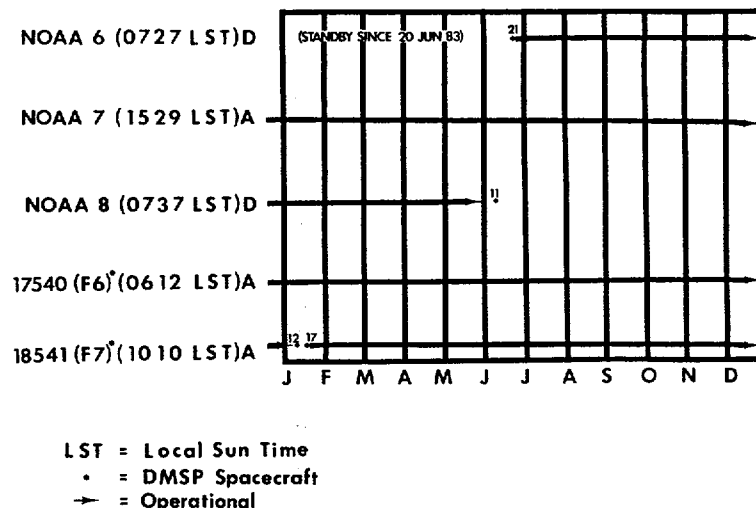
AFGWC, located at Offutt AFB, Nebraska, is the centralized member of the tropical cyclone satellite surveillance network. In support of JTWC, AFGWC processes stored imagery from DMSP and NOAA spacecraft. Imagery processed at AFGWC is recorded onboard the spacecraft as it passes over the earth. Later, these data are downlinked to AFGWC via a network of command/readout sites and communication satellites. This enables AFGWC to obtain the coverage necessary to fix all tropical systems of interest to JTWC. AFGWC has the primary responsibility to provide tropical cyclone surveillance over the entire Indian Ocean, southwest Pacific, and portions of the western North Pacific on both sides of the dateline. Additionally, AFGWC can be tasked to provide tropical cyclone positions in the entire western North Pacific as backup to coverage routinely available in that region.

The hub of the network is Det 1, 1WW, colocated with JTWC on 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 tropical cyclone fixes. Therefore, when a position from a polar-orbiting satellite is required as the basis for a warning, called a "levied fix", a dual-site tasking concept can be applied. Under this concept, two sites are tasked to fix the tropical cyclone from the same satellite pass. This provides the necessary redundancy to virtually guarantee JTWC a successful satellite fix on the tropical cyclone. Using this dual-site concept, the satellite reconnaissance network is capable of meeting all of JTWC's levied satellite fix requirements.

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 a formation alert or warning, the network is tasked to provide three products: tropical cyclone positions, intensity estimates, and 24-hour intensity forecasts. Satellite tropical cyclone positions are assigned position code numbers (PCN) depending on the availability of geography for precise gridding, and the degree of organization of the tropical cyclone's cloud system (Table 2-2). During 1984, the network provided JTWC with a total of 1971 satellite fixes on tropical systems in the western North Pacific. Another 184 fixes were made for tropical systems in the North Indian Ocean. A comparison of those fixes made on numbered tropical cyclones in the western North Pacific with their corresponding JTWC best track positions is shown in Table 2-3. Estimates of the tropical cyclone's current intensity and 24-hour intensity forecast are

Figure 2-1.

POLAR ORBITERS FOR 1984



made once each day by applying the Dvorak technique (NOAA Technical Memorandum NESDIS 45 as revised) to visual imagery. A similar technique using enhanced infrared imagery is under development.

Four polar orbiters were available throughout the season. Figure 2-1 shows the status of operational polar orbiters. NOAA 6 was reactivated a year after being placed in standby mode (20 June 1983) to compensate for the untimely loss of NOAA 8. Although not shown NOAA 9 was successfully launched on 12 December and should be of benefit in 1985.

5. RADAR RECONNAISSANCE SUMMARY

Fourteen of the 30 significant tropical cyclones in the western North Pacific during 1984 passed within range of land based radar with sufficient cloud pattern organization to be fixed. The land radar fixes that were obtained and transmitted to JTWC totaled 510. Two radar fixes were obtained by reconnaissance aircraft.

The WMO radar code defines three categories of accuracy: good (within 10 km (5nm)), fair (within 10 to 30 km (5 to 16 nm)), and poor (within 30 to 50 km (16 to 27nm)). This year 510 radar fixes were coded in this manner; 167 were good, 156 were fair, and 187 poor. Compared to the JTWC best track, the mean vector deviation for land radar sites was 20 nm (37 km). Excellent support through timely and accurate radar fix positioning allowed JTWC to track and forecast tropical cyclone movement through even the most difficult erratic tracks.

As in previous years, no radar reports were received on North Indian Ocean tropical cyclones.

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

6. TROPICAL CYCLONE FIX DATA

A total of 2918 fixes on 30 western North Pacific tropical cyclones and 193 fixes on four North 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 labeled 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

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

PCN	WESTERN NORTH PACIFIC OCEAN		NORTH INDIAN OCEAN	
	1972-1983 AVERAGE		1980-1983	
	(ALL SITES)	(ALL SITES)	(ALL SITES)	(ALL SITES)
1	13.7 (1843)	12.4 (119)	16.2 (27)	17.8 (13)
2	17.3 (802)	15.7 (97)	9.0 (4)	32.1 (3)
3	20.3 (2691)	23.6 (259)	21.8 (11)	19.0 (2)
4	23.1 (999)	25.1 (134)	21.8 (5)	136.0 (3)
5	36.8 (4395)	43.6 (317)	33.1 (87)	36.5 (84)
6	40.9 (2298)	42.4 (265)	35.1 (83)	62.7 (23)
1&2	14.4 (2645)	13.9 (216)	15.5 (31)	20.5 (16)
3&4	20.9 (3690)	24.1 (393)	26.3 (16)	89.2 (5)
5&6	38.0 (6693)	43.0 (582)	32.2 (170)	42.2 (107)
TOTAL NUMBER OF CASES	(13028)	(1191)	(217)	(128)

TABLE 2-4. FIX PLATFORM SUMMARY FOR 1984

FIX PLATFORM SUMMARY

<u>WESTERN NORTH PACIFIC</u>			<u>AIRCRAFT</u>	<u>SATELLITE</u>	<u>RADAR</u>	<u>SYNOPTIC</u>	<u>TOTAL</u>
TS	VERNON	(01W)	--	26	--	--	26
TS	WYNNE	(02W)	23	103	37	3	166
TY	ALEX	(03W)	5	40	34	3	82
TS	BETTY	(04W)	2	62	31	--	95
TY	CARY	(05W)	29	85	--	--	114
TY	DINAH	(06W)	28	85	--	--	113
TY	ED	(07W)	19	82	102	--	203
TS	FREDA	(08W)	5	39	12	--	56
TD	09W	(09W)	2	63	--	--	65
TS	GERALD	(10W)	9	68	52	3	132
TY	HOLLY	(11W)	21	81	117	1	220
TD	12W	(12W)	2	19	--	--	21
TY	IKE	(13W)	33	110	38	3	184
TS	JUNE	(14W)	7	46	14	--	67
TY	KELLY	(15W)	11	57	--	--	68
TS	LYNN	(16W)	--	41	--	2	43
TS	MAURY	(17W)	13	23	--	--	36
TS	NINA	(18W)	2	34	2	--	38
TY	OGDEN	(19W)	9	42	--	--	51
TY	PHYLLIS	(20W)	10	37	--	--	47
TS	ROY	(21W)	6	26	--	--	32
TS	SUSAN	(22W)	--	26	--	--	26
TD	23W	(23W)	1	11	--	--	12
TY	THAD	(24W)	14	60	--	--	74
STY	VANESSA	(25W)	27	114	13	--	154
TY	WARREN	(26W)	22	112	12	1	147
TY	AGNES	(27W)	19	108	4	--	131
STY	BILL	(28W)	46	163	44	--	253
TY	CLARA	(29W)	28	93	--	2	123
TY	DOYLE	(30W)	24	115	--	--	139
TOTAL			417	1971	512	18	2918
% OF TOTAL NR OF FIXES			14.3	67.6	17.5	.6	100.0
<u>INDIAN OCEAN</u>				<u>SATELLITE</u>		<u>SYNOPTIC</u>	<u>TOTAL</u>
TC	01A			18		--	18
TC	02B			40		2	42
TC	03B			37		3	40
TC	04B			89		4	93
TOTAL				184		9	193
% OF TOTAL NR OF FIXES				95.3		4.7	100.0

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

a. Satellite

(1) ACCRY - Position Code Number is used to indicate the accuracy of the fix position. A "1" or "2" indicates relatively high accuracy and a "5" or "6" relatively low accuracy.

(2) DVORAK CODE - Intensity evaluation and trend (Figure 2-2, Table 2-5). (For specifics, refer to NOAA TM; NESDIS - 45).

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

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

b. Aircraft

(1) FLT LVL - The constant pressure surface level, in millibars or altitude, in feet, maintained during the penetration. The normal level flow in developed tropical cyclones, due to turbulence factors, is 700 mb. Low-level missions are normally flown at 1500 ft (457 m).

(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 release 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 tropical 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. 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 many instances, the flight path is through the weak sector of the tropical 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 (perpendicular) to the aircraft heading.

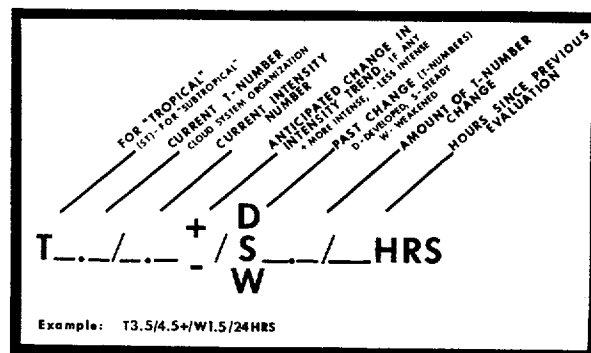


Figure 2-2. The current T-number is 3.5 but the current intensity estimate is 4.5 (equivalent to 77 kt). The cloud system has weakened by 1.5 T-numbers since the previous evaluation conducted 24 hours earlier. The plus (+) symbol indicates an expected reversal of the weakening trend or very little further weakening of the tropical cyclone during the next 24-hour period.

TABLE 2-5. MAXIMUM SUSTAINED WIND SPEED (KT) AS A FUNCTION OF DVORAK CI & FI (CURRENT & FORECAST INTENSITY) NUMBER AND MINIMUM SEA LEVEL PRESSURE (MSLP)

TROPICAL CYCLONE INTENSITY NUMBER	WIND SPEED	MSLP (NW PACIFIC)
0.0	<25	--
0.5	25	--
1.0	25	--
1.5	25	--
2.0	30	1003
2.5	35	999
3.0	45	994
3.5	55	988
4.0	65	981
4.5	77	973
5.0	90	964
5.5	102	954
6.0	115	942
6.5	127	929
7.0	140	915
7.5	155	900
8.0	170	884

(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 percent or more surrounded by wall cloud.

(8) EYE DIAM/ORIENTATION - Diameter of the eye in nautical miles. When an elliptical eye is present, the lengths of the major and minor axes and the orientation of the major axis are respectively listed. When concentric eye walls are present, each diameter is listed.

c. Radar

(1) RADAR - Specific type of

platform (land, aircraft, or ship) utilized for fix.

(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.

CHAPTER III - SUMMARY OF TROPICAL CYCLONES

1. WESTERN NORTH PACIFIC TROPICAL CYCLONES

During 1984, the western North Pacific experienced the sixth consecutive year of below average tropical cyclone activity. Thirty tropical cyclones occurred in 1984, one less than the annual average. Only three significant tropical cyclones failed to develop beyond the tropical depression (TD) stage and eleven tropical storms (TS) failed to reach typhoon intensity. Of the 16 tropical cyclones that developed to typhoon (TY) intensity, two reached the 130 kt (67 m/s) intensity necessary to be classified as super typhoons (STY). In the western North Pacific, tropical cyclones reaching tropical storm intensity or greater are assigned names in alphabetical order

from a list of alternating male/female names (refer to Appendix III). Table 3-1 provides a summary of key statistics for all western North Pacific tropical cyclones. Each tropical cyclone's maximum surface wind (in knots) and minimum sea level pressure (in millibars) were obtained from best estimates based on all available data. The distance traveled (in nautical miles) was calculated from the JTWC official best tracks (see Annex A).

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

TABLE 3-1.

WESTERN NORTH PACIFIC

1984 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS (KT)	ESTIMATED MSLP (MB)	BEST TRACK DISTANCE TRAVELED (NM)
01W TS VERNON	09 JUN - 11 JUN	3	9	40	993	556
02W TS WYNNE	19 JUN - 26 JUN	8	28	60	980	1609
03W TY ALEX	01 JUL - 05 JUL	5	18	75	970	1320
04W TS BETTY	06 JUL - 09 JUL	4	12	55	983	1157
05W TY CARY	07 JUL - 14 JUL	8	30	90	955	1355
06W TY DINAH	24 JUL - 01 AUG	9	35	125	915	2826
07W TY ED	25 JUL - 01 AUG	8	28	100	947	1700
08W TS FREDA	05 AUG - 08 AUG	4	12	55	982	1894
09W TD 09W	11 AUG - 15 AUG	5	10	30	996	1328
10W TS GERALD	16 AUG - 21 AUG	6	24	55	979	1009
11W TY HOLLY	16 AUG - 22 AUG	7	25	75	963	1712
12W TD 12W	24 AUG - 25 AUG	2	5	20	995	605
13W TY IKE	27 AUG - 06 SEP	11	42	125	947	2806
14W TS JUNE	28 AUG - 30 AUG	3	11	60	983	738
15W TY KELLY	13 SEP - 18 SEP	6	18	75	965	1297
16W TS LYNN	24 SEP - 27 SEP	4	14	40	996	553
17W TS MAURY	28 SEP - 01 OCT	4	13	60	992	863
18W TS NINA	28 SEP - 01 OCT	4	15	55	990	1201
19W TY OGDEN	07 OCT - 10 OCT	4	12	70	982	1236
20W TY PHYLLIS	11 OCT - 14 OCT	4	13	80	974	972
21W TS ROY	11 OCT - 13 OCT	3	9	35	996	735
22W TS SUSAN	11 OCT - 12 OCT	2	5	40	992	576
23W TD 23W	17 OCT - 18 OCT	2	4	25	998	287
24W TY THAD	19 OCT - 24 OCT	6	21	120	925	2362
25W STY VANESSA	22 OCT - 31 OCT	10	31	155	879	3125
26W TY WARREN	23 OCT - 31 OCT	9	31	65	976	1111
27W TY AGNES	01 NOV - 08 NOV	8	28	120	925	2666
28W STY BILL	08 NOV - 22 NOV	15	52	130	909	2892
29W TY CLARA	14 NOV - 21 NOV	8	30	110	938	2709
30W TY DOYLE	04 DEC - 11 DEC	8	26	125	935	1960

1984 TOTALS : 130* 611

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

TABLE 3-2.

1984 SIGNIFICANT TROPICAL CYCLONES

1959-1984 WESTERN NORTH PACIFIC TROPICAL CYCLONES															
NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	(1959-1984)	
														AVERAGE	CASES
TROPICAL DEPRESSIONS	0	0	0	0	0	0	0	2	0	1	0	0	3	3.8	98
TROPICAL STORMS	0	0	0	0	0	2	1	3	3	2	0	0	11	10.0	259
TYPHOONS	0	0	0	0	0	0	4	2	1	5	3	1	16	17.3	451
ALL TROPICAL CYCLONES	0	0	0	0	0	2	5	7	4	8	3	1	30	31.1	808
1959-1984 AVERAGE	.5	.3	.7	.8	1.3	2.0	4.9	6.3	5.7	4.6	2.7	1.4	31.1		
CASES	13	8	18	22	33	51	127	163	148	119	70	36	808		

FORMATION ALERTS: 30 of 37 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all significant tropical cyclones that developed in 1984.

WARNINGS: Number of warning days: 130

Number of warning days with two tropical cyclones in region: 46

Number of warning days with three or more tropical cyclones in region: 4

TABLE 3-3.

FREQUENCY OF TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.3	.4	.7	1.1	2.0	2.9	3.2	2.4	2.0	.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	5	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
1982	0	0	2	0	1	1	2	5	3	3	1	1	19
1983	0	0	0	0	0	0	3	2	1	4	2	0	12
1984	0	0	0	0	0	0	4	2	1	5	3	1	16
(1959-1984) AVERAGE	.2	.04	.2	.6	.8	.9	2.8	3.3	3.2	3.1	1.7	.6	17.3
CASES	6	1	6	15	20	23	73	85	82	81	43	16	451

TABLE 3-4.

FREQUENCY OF TROPICAL STORMS AND TYPHOONS BY MONTH AND YEAR

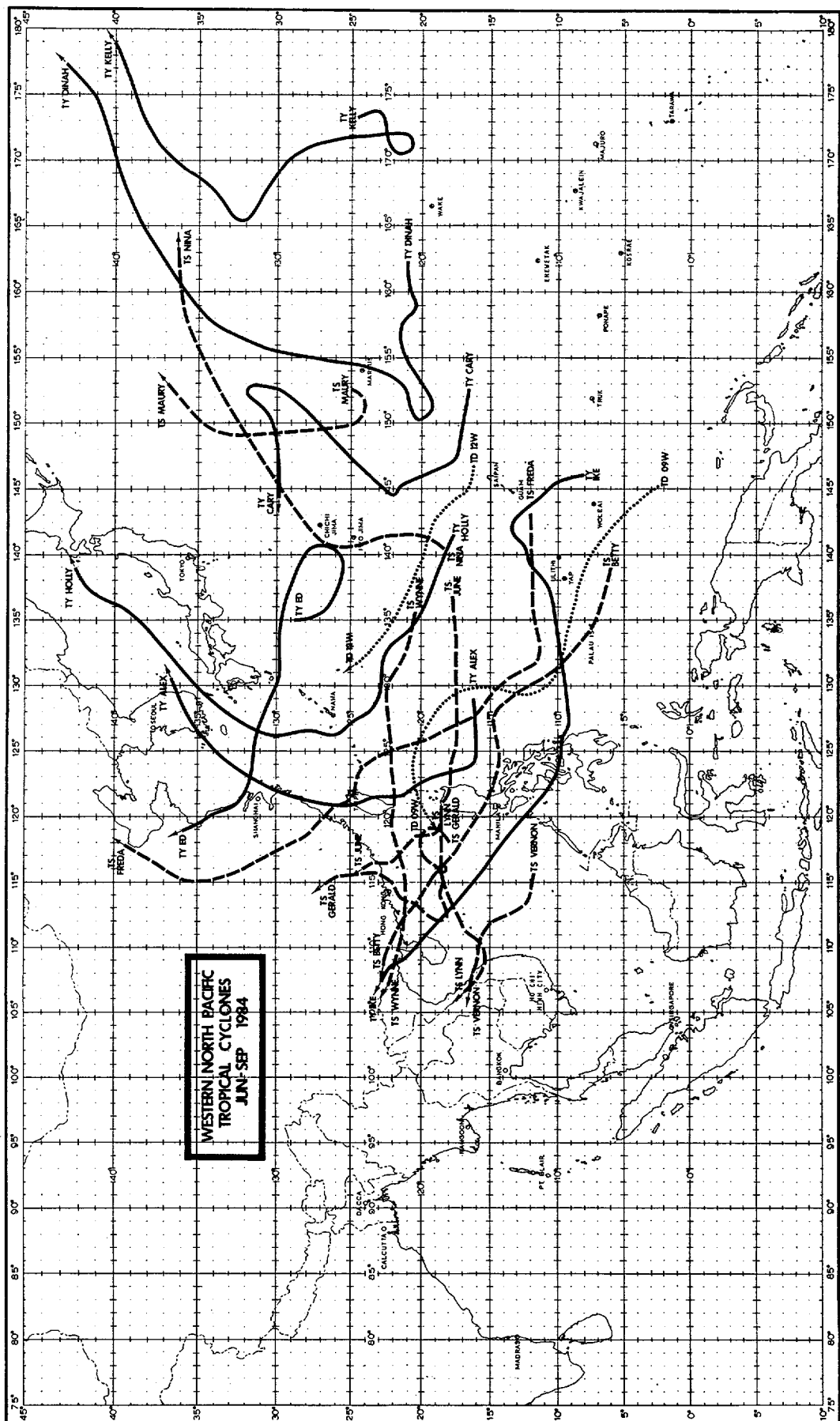
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.4	.5	.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	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	0	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
1982	0	0	3	0	1	3	4	5	5	3	1	1	26
1983	0	0	0	0	0	1	3	5	2	5	5	2	23
1984	0	0	0	0	0	2	5	5	4	7	3	1	27
(1959-1984) AVERAGE	.5	.3	.5	.8	1.1	1.6	4.5	5.4	4.8	4.1	2.5	1.2	27.3
CASES	12	7	14	21	29	42	116	140	126	107	65	31	710

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%
1982	36	26	28	72%
1983	31	25	25	81%
1984	37	30	30	81%
(1972-1984) AVERAGE	32.7	26.0	27.8	80%
CASES	425	338	362	



BEST TRACK TC-OIW
09 JUN - 11 JUN 1984
MAX SFC WIND 40 KTS
MINIMUM SLP 993 MBS

06 HOUR BEST TRACK POSITION	◆	SUPER TYPHOON START
A SPEED OF MOVEMENT	◇	SUPER TYPHOON END
B INTENSITY	◇◇◇	EXTRATROPICAL
C POSITION AT XX/0000Z	...	DISSIPATING STAGE
TROPICAL DEPRESSION	...	FIRST WARNING ISSUED
TROPICAL DISTURBANCE	---	LAST WARNING ISSUED
TROPICAL STORM	---	
TYPHOON		



TROPICAL STORM VERNON (01W)

The formation of Tropical Storm Vernon marked the start of the western Pacific tropical cyclone season. This is the second year in a row that the first tropical cyclone of the season did not develop until June, and the first time since JTWC was established that two consecutive seasons have started so late in the year.

Tropical Storm Vernon was very similar to its 1983 season opening counterpart, Tropical Storm Sarah, in that it formed in the South China Sea during June, developed into a weak Tropical Storm, and made landfall in central Vietnam.

The disturbance which was to develop into Tropical Storm Vernon was first detected early on 7 June as an area of poorly organized convection on the eastern end of the monsoon trough in the central South China Sea. The disturbance drifted slowly to the northwest and consolidated during the next 24 hours. At 0411Z on the 8th, a TCFA was issued based on improved organization of the convection and synoptic data which indicated the disturbance had a closed surface circulation with winds of 15 to 25 kt (8 to 13 m/s). Vernon continued moving to the northwest at 5 kt

(9 km/hr) and at 0000Z on the 9th the first warning was issued based on numerous 25 to 30 kt (13 to 15 m/s) ship reports. The MSLP at this time was near 999 mb.

Over the next 18 hours Vernon's forward speed doubled to 10 kt (19 km/hr) as the storm intensified, attaining tropical storm strength between 0000Z and 0600Z on the 9th and reaching a maximum intensity of 40 kt (21 m/s) approximately 6 to 9 hours later (Figure 3-01-1).

Vietnamese authorities reported that Vernon caused flooding of rice, sweet potato, and sesame crops in the Quang Nam-Danang province. No loss of life or other significant property damage was reported.

After reaching maximum intensity, Vernon moved in a more westerly direction at 12 kt (22 km/hr), and began to weaken as the storm entered a strong shearing environment. Vernon continued toward the coast of Vietnam, making landfall just north of Da Nang (WMO 48855) at approximately 101200Z. By this time most of Vernon's convection was sheared to the west of the low-level circulation. Vernon quickly dissipated over land.

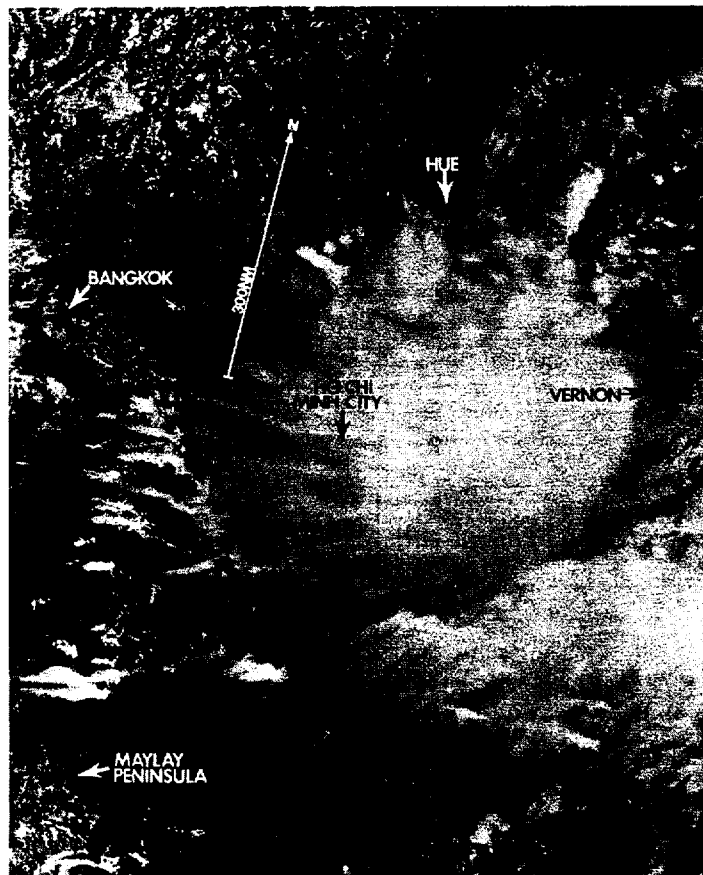
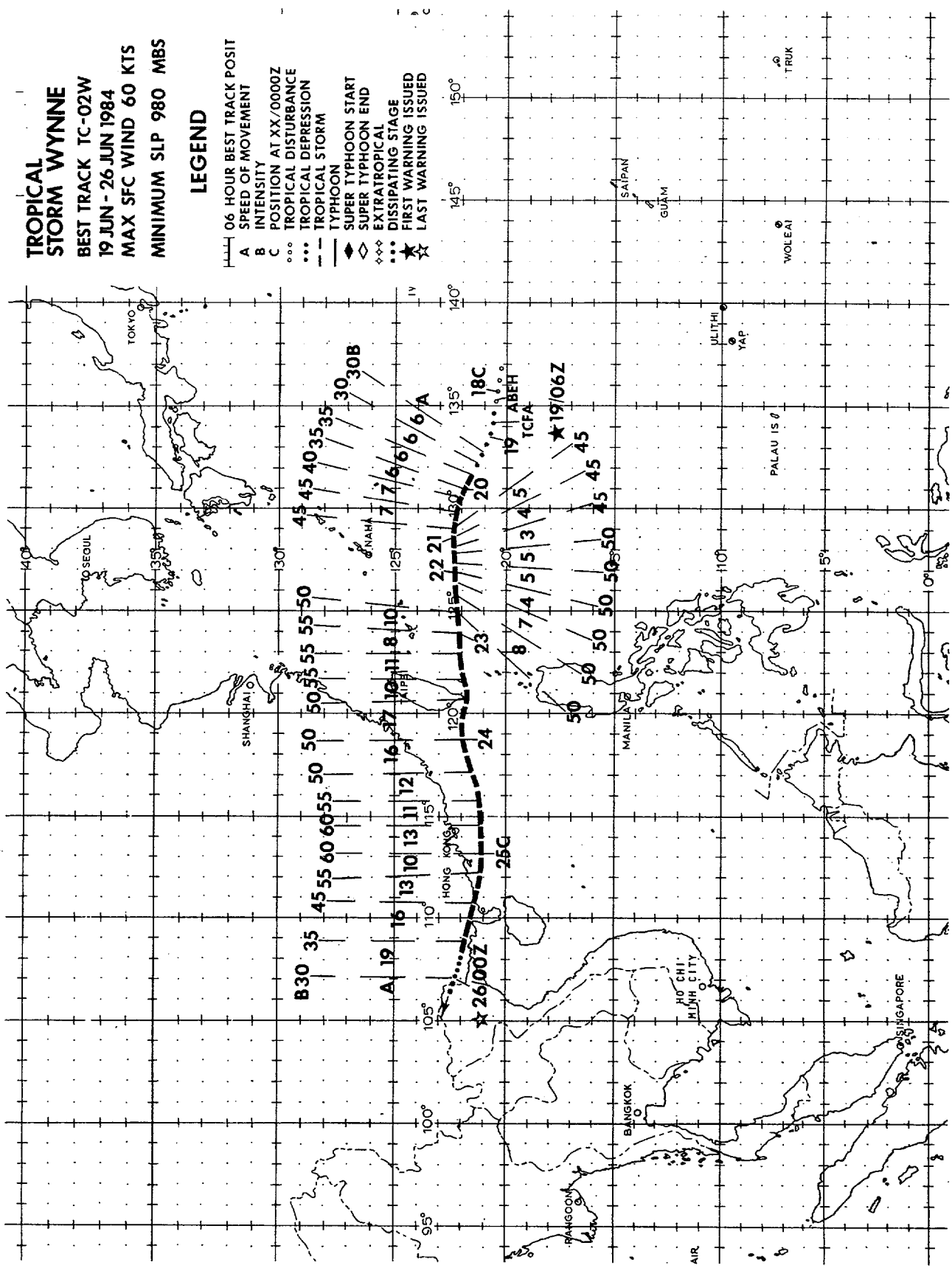


Figure 3-01-1. Tropical Storm Vernon with exposed low-level circulation as it attains tropical storm intensity (090316Z June DMSP visual imagery).

**TROPICAL
STORM WYNNE**
BEST TRACK TC-02W
19 JUN - 26 JUN 1984
MAX SFC WIND 60 KTS
MINIMUM SLP 980 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



TROPICAL STORM WYNNE (02W)

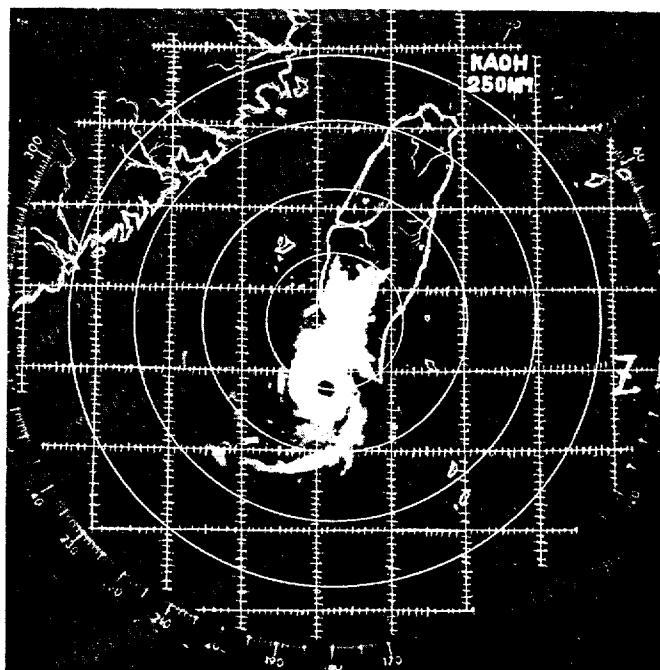
After Tropical Storm Vernon (01W) dissipated over Vietnam, the southwest monsoon was slow to re-establish itself. Surface ridging from an anticyclone over the northern Philippine Sea and later from a 1030 mb high east of Japan kept easterlies in the Philippine Sea and across Luzon until the 14th of June. By then the ridge east of Japan had moved far enough east to allow a weak southwest monsoon to become established from the South China Sea eastward into the Philippine Sea. This set the stage for the development of Tropical Storm Wynne.

The disturbance which developed into the second storm of the season was first detected late on 16 June in the northern Philippine Sea as an area of concentrated convection embedded in the southwest monsoon. By 17 June a broad, weak surface circulation had developed near 20N 137E with an MSLP of 1005 mb and 10 to 20 kt (5 to 10 m/s) surface winds. The organization of the convection continued to improve, prompting the issuance of a TCFA at 1600Z on the 18th. At that time, synoptic data indicated a weak upper-level anticyclone had developed aloft providing good outflow to the south and west. Late on the 18th, the first aircraft reconnaissance flight into the disturbance found a 6 nm (11 km) wide surface center with an MSLP of 998 mb and maximum surface winds of 20 kt (10 m/s). At 190933Z the first warning on Wynne, valid at 190600Z, was issued.

Wynne maintained a predominantly westward track throughout its life. The storm was steered by the westward flow along the southern side of the mid to low-level subtropical ridge. This ridge was apparently too narrow to be resolved by JTWC's primary forecast aid, the One-Way Interactive Tropical Cyclone Model (OTCM). As a result, OTCM repeatedly predicted a northward track for the storm. By the second warning, JTWC forecasters had noticed this apparent problem with OTCM and began forecasting a more westward track than OTCM indicated.

On 19 June a mid-latitude trough passed to the north of Wynne causing Wynne to turn briefly to the northwest. However, the trough did not weaken the subtropical ridge enough to allow for recurvature. After the trough passed on the 20th, Wynne once again resumed its westward heading which it maintained until landfall.

Despite the five days Wynne remained in the Philippine Sea east of Taiwan, it did not intensify beyond 55 kt (28 m/s). The weak upper-level anticyclone which developed over Wynne on the 18th remained very small, being overshadowed by a much larger upper-level anticyclone to the north over mainland China. Therefore, Wynne remained under a strong shearing environment from the north and northeast throughout its life, which hindered intensification.



NR: 187 WAYNE 1964.6.23. 1900Z
FFAA 23190 46744 43218 11202 10612 52612
OP: WANG

Figure 3-02-1. Tropical Storm Wynne as it passed south of Taiwan as seen by radar from Kaohsiung (WMO 46744) at 231900Z June (Photograph courtesy of Central Weather Bureau, Taipei, Taiwan).

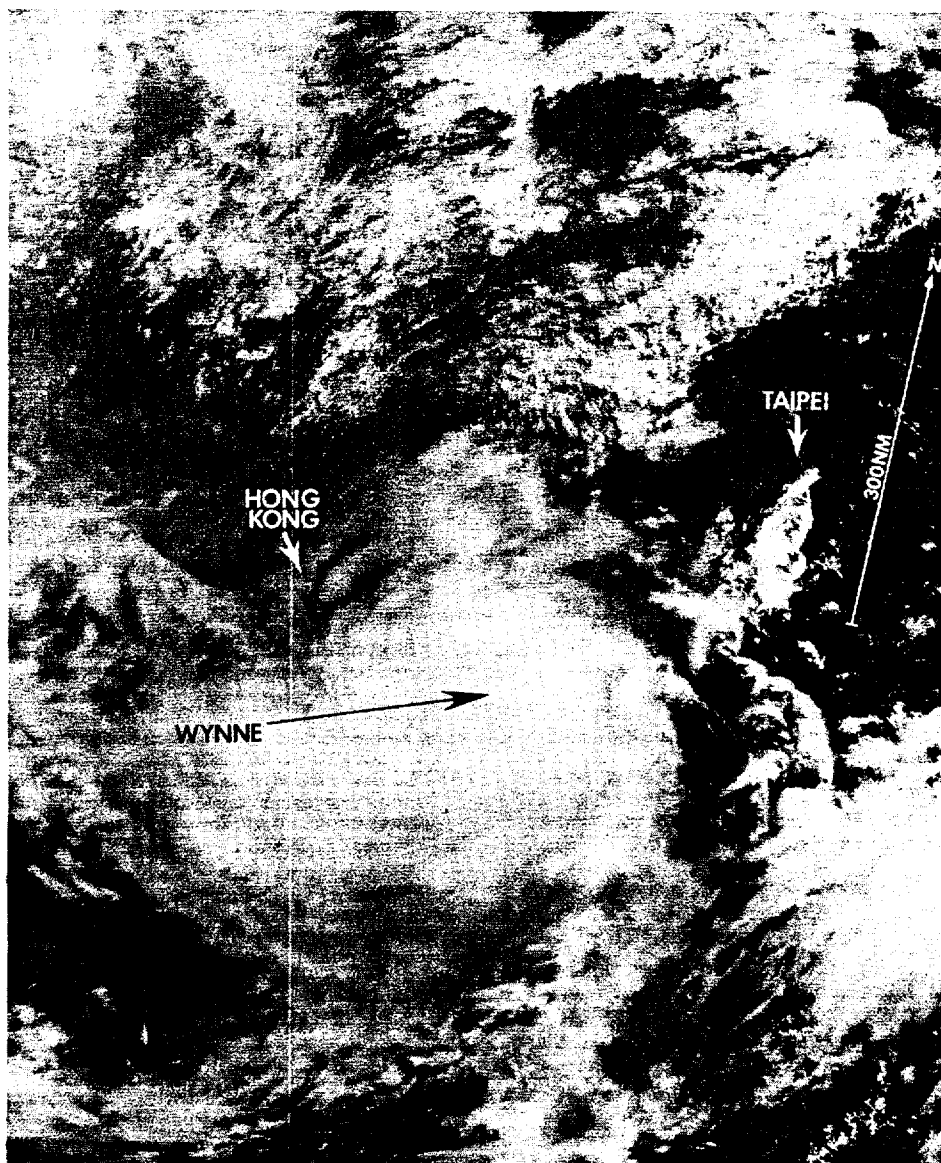


Figure 3-02-2. Wynne as a 50 kt (26 m/s) tropical storm entering the south China Sea (240136Z June DMSP visual imagery).

Wynne strengthened to 55 kt (28 m/s) just prior to passing the southern coast of Taiwan. The sea level pressure of Lanyu (WMO 46762), located just east of the southern tip of Taiwan, dropped 14 mb in the 12 hours preceeding the storm's arrival, reaching 984 mb with Wynne's passage. As Wynne passed the southern tip of Taiwan (Figure 3-02-1), its low-level circulation was disrupted causing Wynne to weaken slightly as it entered the South China Sea (Figure 3-02-2).

Wynne passed 70 nm (130 km) south of Hong Kong (WMO 45005) about 24 hours after passing the southern tip of Taiwan. By this time Wynne had intensified to its peak intensity of 60 kt (31 m/s). This was confirmed by the USS Mauna Kea (AE22) which inadvertently passed very close to Wynne's center and reported "maximum winds to 60 kt, gusts to 70 kt." Fortunately, no damage or

personnel injuries were reported aboard the Mauna Kea. Further north, Hong Kong reported gusts to 60 kt (31 m/s) with the passage of Wynne.

As Wynne traversed the Philippine Sea and the northern Luzon Straits, the southwest monsoon was enhanced producing 20 to 30 kt (10 to 15 m/s) winds, high seas and heavy rainfall. In Luzon, at least 20 families were reported left homeless and 10,000 hectares of riceland destroyed by floods. North of Luzon, three fishermen drowned when their boats capsized in heavy seas.

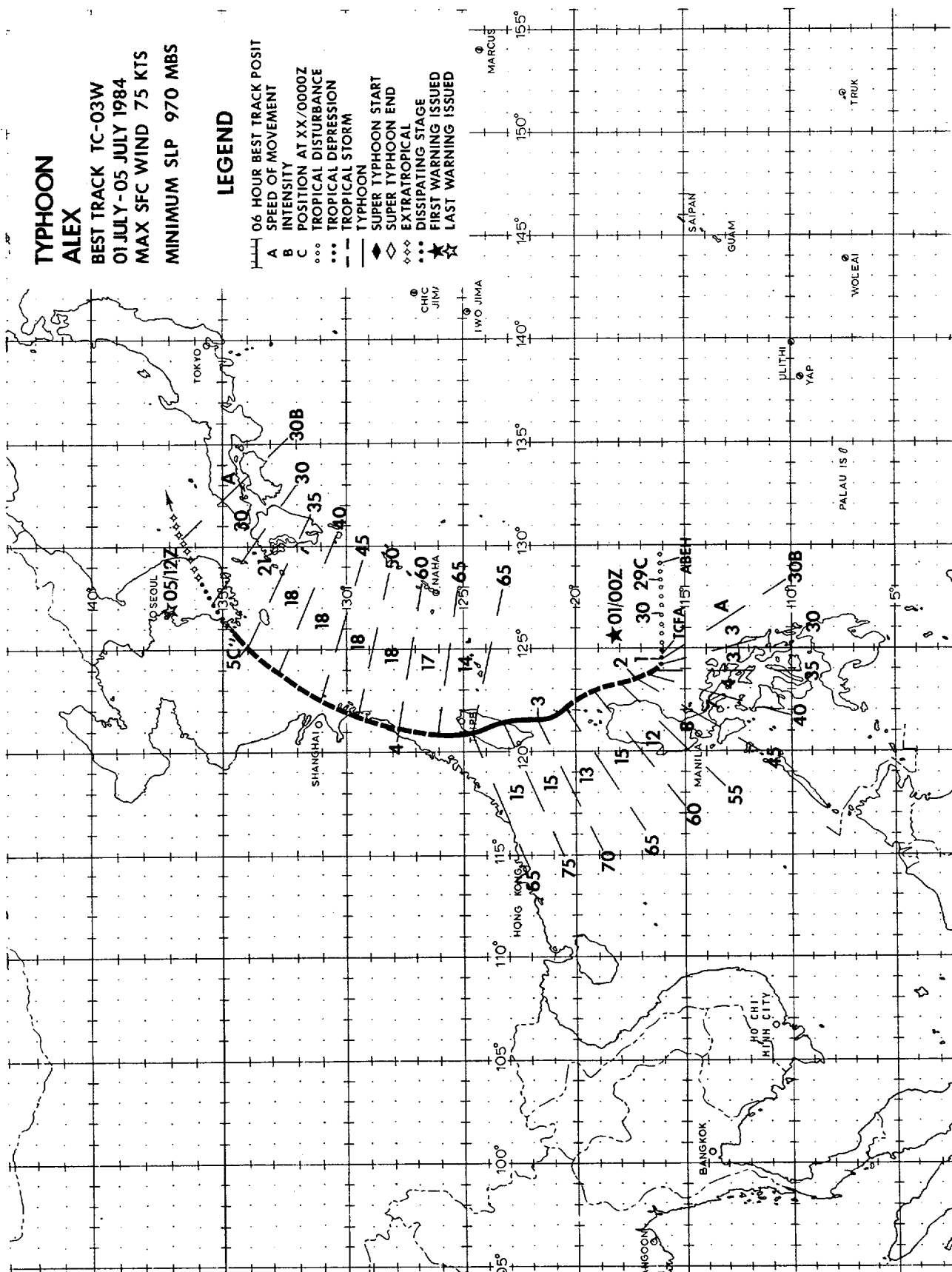
Tropical Storm Wynne made landfall at approximately 1200Z on the 25th on the coast of the People's Republic of China near the Luichow Peninsula, and weakened rapidly as it moved inland. The final warning on Wynne was issued at 0000Z on the 26th.

TYPHOON ALEX

BEST TRACK TC-03W
01 JULY-05 JULY 1984
MAX SFC WIND 75 KTS
MINIMUM SLP 970 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



Typhoon Alex was the first typhoon of the 1984 western Pacific season. It was also the season's first recurver. The satellite fixes during the formative stages of Alex were somewhat misleading and contributed to rather large forecast errors on the first day in warning status. After reaching typhoon intensity and crossing Taiwan, the last phase of Alex's life was characterized by a complex transition into an extratropical low.

The seedlings of Alex first caught the attention of the JTWC forecasters on the 28th of June. Based on several ship reports showing that a circulation center had developed in the Philippine Sea, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 281415Z stating that a 10 to 15 kt (5 to 8 m/s) surface circulation had developed near 16N 129E, within a disorganized area of convection in the monsoon trough (point A on Figures 3-03-1 and 3-03-2). This area was identified as one with a "poor" potential for development (meaning the disturbance was not expected to require a TCFA during the advisory period). For the next day-and-a-half the disturbance persisted with no signs of development. At 2301Z on the 29th, visual satellite pictures indicated that a partially exposed low-level circulation had developed on the northern edge of the disturbance (point B on Figures 3-03-1 and 3-03-2). Consequently an aircraft investigation of the area was requested for the following day.

Upon arrival at the invest point, the aircraft radioed back to the JTWC forecaster that a well-defined circulation center was present and that a vortex fix would be forthcoming. Now things happened quickly. The forecaster first notified his customers on Luzon that a tropical depression was developing just to the east of them and they could experience 30 kt (15 m/s) winds within 18 hours. At 2300Z on the 30th a TCFA was issued. Shortly thereafter, at 2338Z, the vortex fix was radioed to JTWC containing details on the closed surface circulation. The first warning on Alex, valid at 0000Z on 1 July quickly followed.

Unfortunately, the first four warnings forecast Alex to move to the west. Satellite fixes starting late on the 29th and continuing through 1800Z on the 1st indicated that the depression was moving west-southwest. Limited radar fixes indicated that the system was nearly stationary. However, when the daylight satellite pictures became available late on 1 July, it was obvious that the system had in reality moved north-northwest (along track CD in Figure 3-03-2) and was now a tropical storm. Thus it was not until warning number five that the westward track was abandoned and not until warning number seven that the recurvature scenario was fully developed.

The rationale behind the forecast track on warning number one now becomes instructive: When the system was first detected "on the doorstep" of Luzon, there

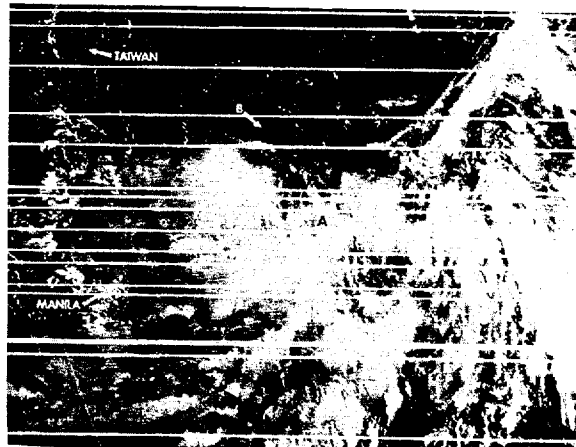


Figure 3-03-1. Initially the exposed low-level circulation center at point B was thought to be the origin of Typhoon Alex. However, post-analysis indicates the actual point of origin was probably near point A (292301Z June NOAA visual imagery).

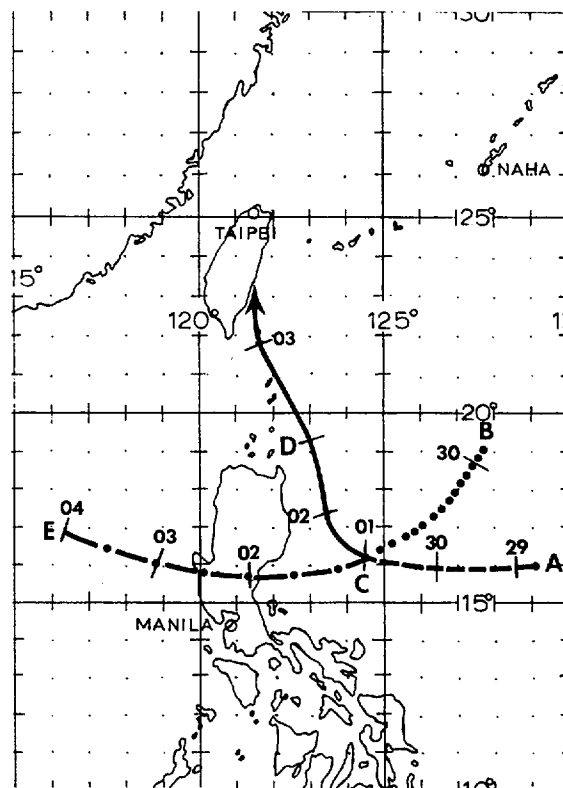


Figure 3-03-2. Point A is believed to be the actual point of origin of Typhoon Alex; Point B is the position of the partially exposed low-level circulation center, initially thought to be the origin of Alex; Point C is the location of the center found by the first aircraft invest; Point D is the best track through 021200Z, and Point E is the 72 hour forecast from warning number one.

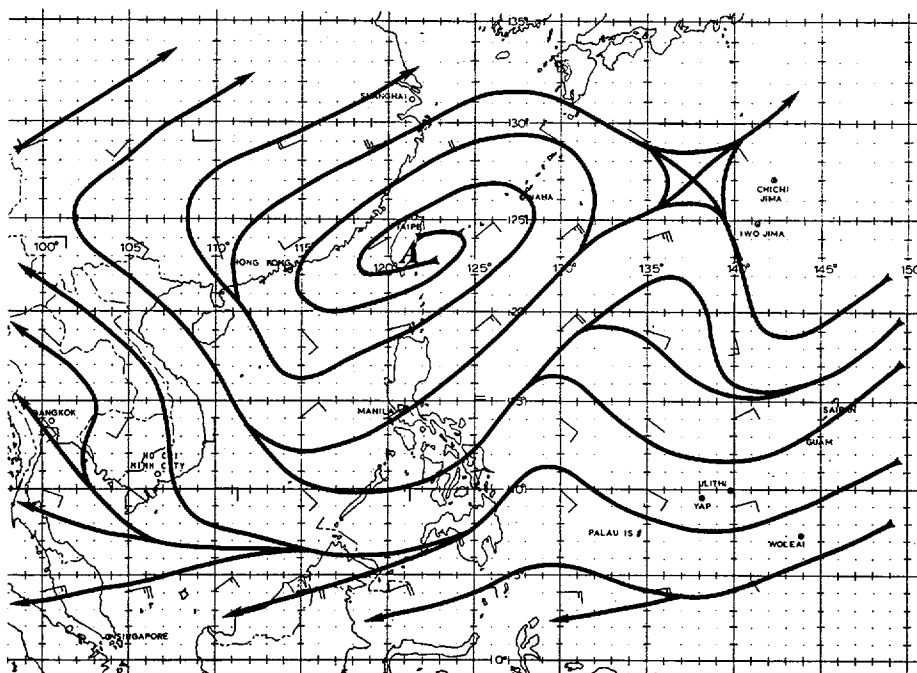


Figure 3-03-3. Mid-tropospheric flow prevailing during the formulation of the first warning forecast reasoning (Streamline analysis of the FNOC 400 mb NVA wind field valid at 301200Z June).

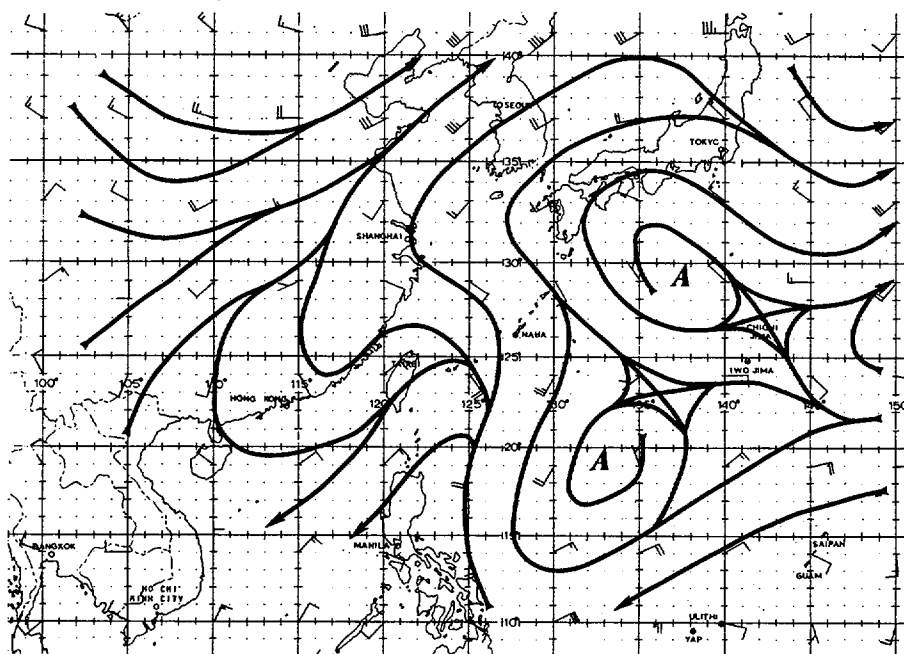


Figure 3-03-4. The mid-tropospheric synoptic situation prevailing during most of the life of Typhoon Alex. Note the anticyclone which has moved east to the south of Japan and the trough over central China which is also moving eastward (Streamline analysis of the FNOC NOGAPS 500 mb wind field valid at 021200Z July).

was an urgency to let the people there know that the potential existed for a tropical cyclone to affect them almost immediately. Therefore it was deemed necessary to devise the forecast track before all of the JTWC forecast aids could be obtained. Available to the forecaster were the past fixes which lead to best track BC on Figure 3-03-2 and a synoptic situation characterized by a mid-tropospheric ridge north of the storm as illustrated in Figure 3-03-3. Given the present and past position of the storm and the northeasterly flow across Luzon, a westward forecast with recurvature beyond the 72 hour point seemed logical. This scenario was briefed to all concerned. When the forecast aids did arrive, they generally agreed with this reasoning. One of the aids which did not agree was the One-Way Interactive Cyclone Model (OTCM), JTWC's primary forecast aid, which forecast Alex to move to the north-northwest to near point D in Figure 3-03-2 in twenty-four hours. The OTCM forecast was discounted for three reasons. First, it was perpendicular to the mid-tropospheric flow and headed toward the center of the ridge near Taiwan. Second, the track BCD seemed highly improbable. Finally, OTCM had consistently and erroneously forecast a westward moving storm (Tropical Storm Wynne (02W)) to go to the north only a week earlier in the same general area.

As it turned out, the OTCM forecast was excellent. Figure 3-03-4 reflects the new synoptic situation. The anticyclone that had been over Taiwan did not persist as originally anticipated but weakened and moved to the east. This movement allowed Alex to accelerate to the north-northwest towards Taiwan. The OTCM had correctly forecast this to occur. With the post-analysis knowledge that Alex did not transit the Philippines, but instead went north-northwest, Figure 3-03-2 should be examined for an explanation of the true origin of Alex. The track BCD seems highly improbable. There is currently no explanation for a path from B to C at a speed of nearly 10 kt (19 km/hr), a slow down to 3 kt (6 km/hr) at C



Figure 3-03-5. Typhoon Alex just prior to attaining maximum intensity (022329Z July NOAA visual imagery).

followed by a sudden 120 degree turn to the right and an acceleration to 12 kt (22 km/hr) by point D. A much more likely path would be genesis near point A, as was indicated by synoptic data back on 28 June, westward movement at about 5 kt (9 km/hr) to C and then a more gradual turn to the right with acceleration to D. Consequently it is now thought that the low-level circulation center found by satellite imagery at point B on the 29th of June was a "red-herring"; nothing more than an eddy in the monsoon trough.

Once the northward movement of Alex was well established, the forecasts were relatively accurate (although the speeds were somewhat slow). The only question was whether Alex would track up the east coast of Taiwan, cross the middle of the East China Sea and transit through the Korean Strait, or transfer across Taiwan, move along the coast of mainland China and cross South Korea. By warning number 11 this question was correctly resolved as the last eight warnings had excellent track forecasts. Alex continued to intensify reaching a maximum intensity of 75 kt (39 m/s) just prior to crossing Taiwan (Figures 3-03-5 and 3-03-6). During the middle and last phases of Alex's life, the southwesterlies in front of a trough that laid over central Korea provided the steering mechanism. This trough with its associated surface front was the same trough observed over northern China in Figure 3-03-4 several days earlier. Starting on 5 July Alex underwent a complex extratropical transition with this front. The final warning was issued at 051200Z as Alex became indistinguishable from the frontal system over the Sea of Japan.

In summary, Typhoon Alex can be identified as a typical, well-behaved recurver that transitioned into an extratropical system. The first four warnings were marred by erroneous rejection of OTCM, and by acceptance of early fixes from a feature that was probably not part of the genesis mechanism.

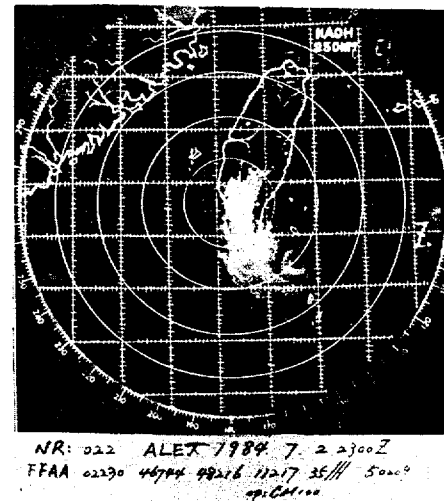


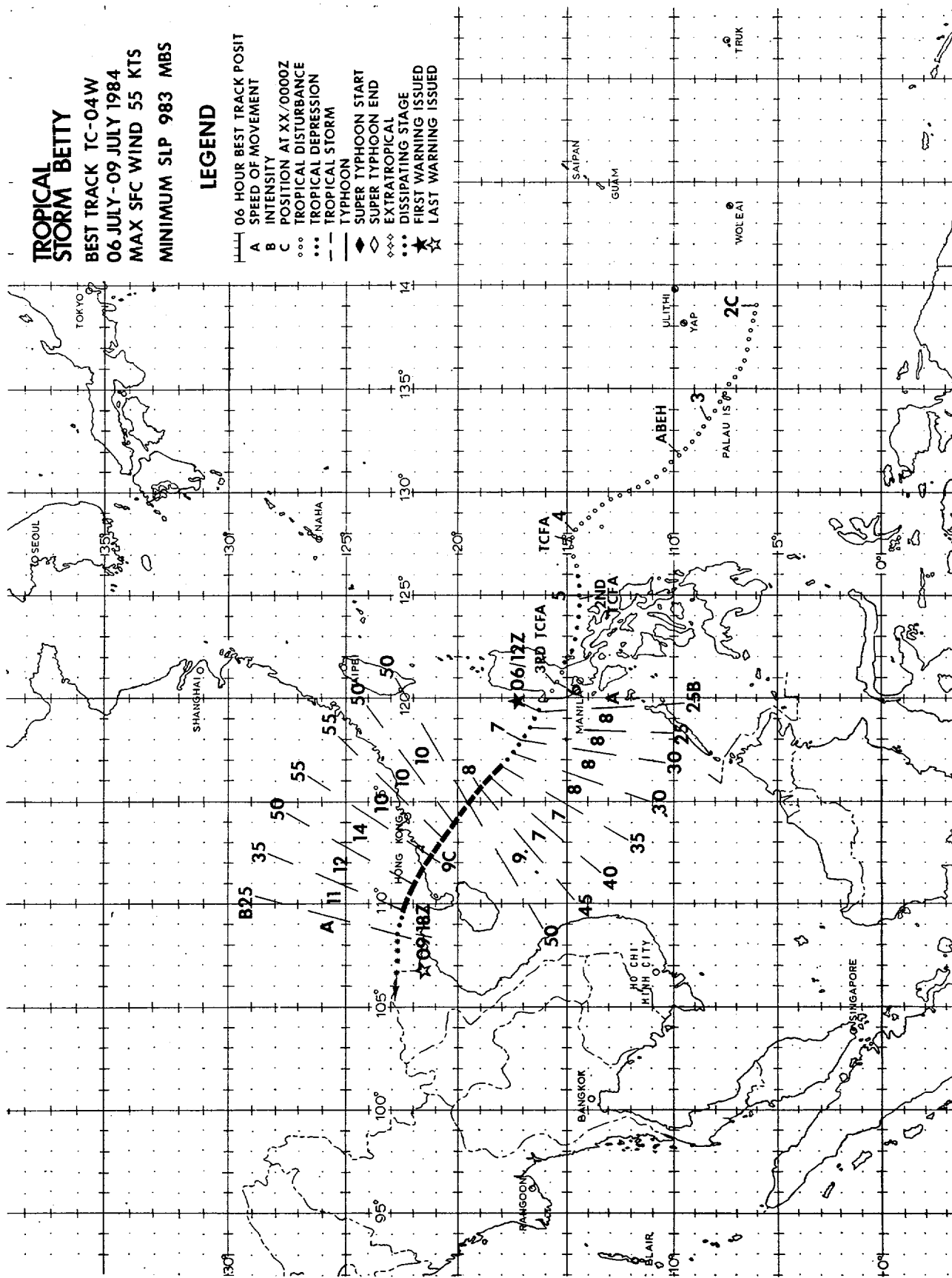
Figure 3-03-6. Typhoon Alex just prior to attaining maximum intensity as seen by radar from Kaohsiung (WMO 46744) at 022300Z July (Photograph courtesy of Central Weather Bureau, Taipei, Taiwan).

TROPICAL STORM BETTY

BEST TRACK TC-04W
06 JULY-09 JULY 1984
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



TROPICAL STORM BETTY (04W)

Tropical Storm Betty originated in the eastern extension of the monsoon trough early in July but took several days to develop into a significant tropical cyclone. Once developed, Betty moved steadily to the northwest through the South China Sea eventually making landfall and dissipating over southern China.

At 0000Z on the 2nd, a disturbance which later developed into Tropical Storm Betty was located approximately 550 nm (1019 km) southwest of Guam. Synoptic data showed the disturbance to be a broad, weak surface circulation with winds of 10 to 15 kt (5 to 8 m/s). Concurrent satellite imagery showed the disturbance as an area of poorly organized convection. Strong surface ridging was present between the disturbance and the developing Tropical Storm Alex (03W) to the north which was then located off the east coast of Luzon. Above this surface ridging a TUTT was providing good upper-level outflow to the north of the disturbance enhancing the convective activity.

When the disturbance was mentioned on the 030600Z Significant Tropical Weather Advisory (ABEH PGTW), it had moved northwest behind now Typhoon Alex (03W) which was located east of Taiwan and moving rapidly northward. With the TUTT providing good upper-level outflow over the disturbance, the convection exhibited a marked increase in organization and intensity over 24 hours earlier.

By 0200Z on the 4th, the disturbance had moved to near 15N 128E and was becoming more organized. At this time the first TCFA was issued on the system. Figure 3-04-1 shows the disturbance at the time the TCFA was issued. Note the banding in the convection and anticyclonic upper-level outflow. Synoptic data indicated that only a broad 10 to 15 kt (5 to 8 m/s) surface circulation was present. Strong ridging still persisted north of the disturbance. This ridging was instrumental in preventing Betty from following a path similar to that of Typhoon Alex (03W).

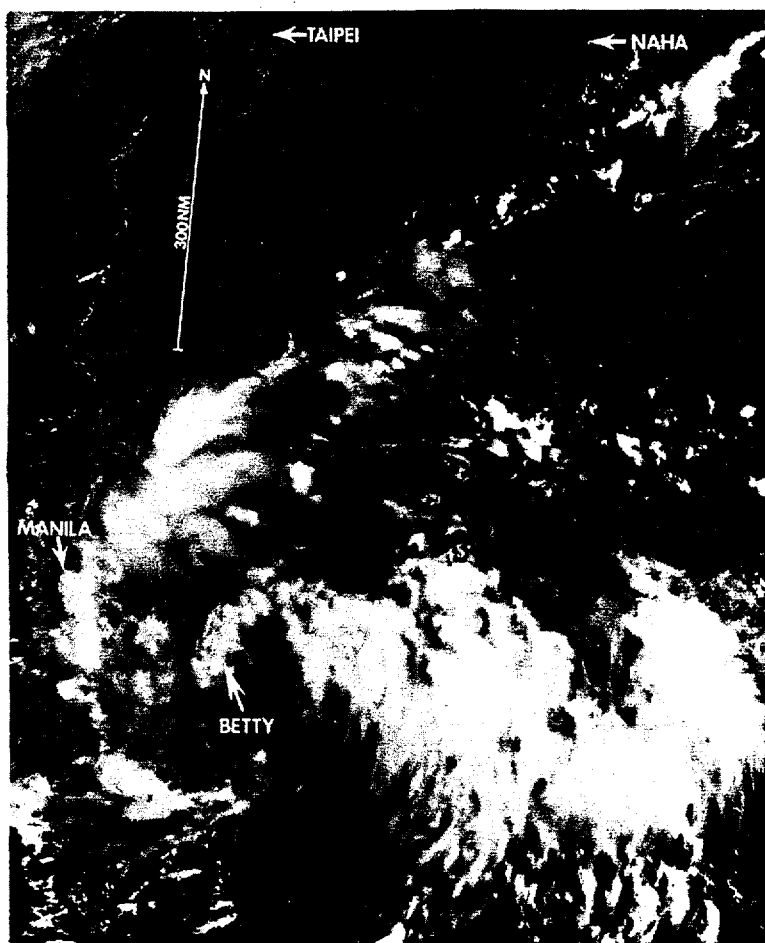


Figure 3-04-1 Tropical storm Betty at the time the first TCFA was issued [040116Z July DMSP visual imagery.

Aircraft reconnaissance flights on 3 and 4 July at the 1500 ft (457 m) level were unable to close-off a circulation center, finding instead a broad surface trough. The TCFA was reissued at 050200Z July since the possibility existed that the system would remain east of Luzon and develop. Aircraft reconnaissance during the afternoon of the 5th indicated that the system had intensified slightly into a weak tropical depression with an MSLP of 1002 mb and maximum surface winds of 25 kt (13 m/s). However, no further development occurred as the system moved west and approached the Philippines.

By the 6th, the depression had weakened as it transited Luzon. At this time the third and final TCFA was issued since it was considered likely that a significant tropical cyclone would finally develop once the disturbance moved out over the South China Sea.

At 1200Z on the 6th, synoptic data indicated that the disturbance had moved offshore west of Luzon and was developing. With surface reports of 20 to 25 kt (10 to 13 m/s) and further intensification very likely, the first warning was issued. Visual satellite imagery late on the 6th (Figure 3-04-2) showed Betty, then a depression, with a large, mostly clear area at its center. An exposed low-level circulation is evident as indicated by the spiraling low-level cumulus clouds. Convective activity is heaviest in the southern semicircle surrounding the mostly convection-free center. Aircraft reconnaissance at about the same time reported a large light and variable center 50 to 60 nm (93 to 111 km) in diameter associated with the depression. Surface winds of 25 to 30 kt (13 to 15 m/s) were observed southeast of the center where the depression's flow was enhanced by the southwest monsoon.

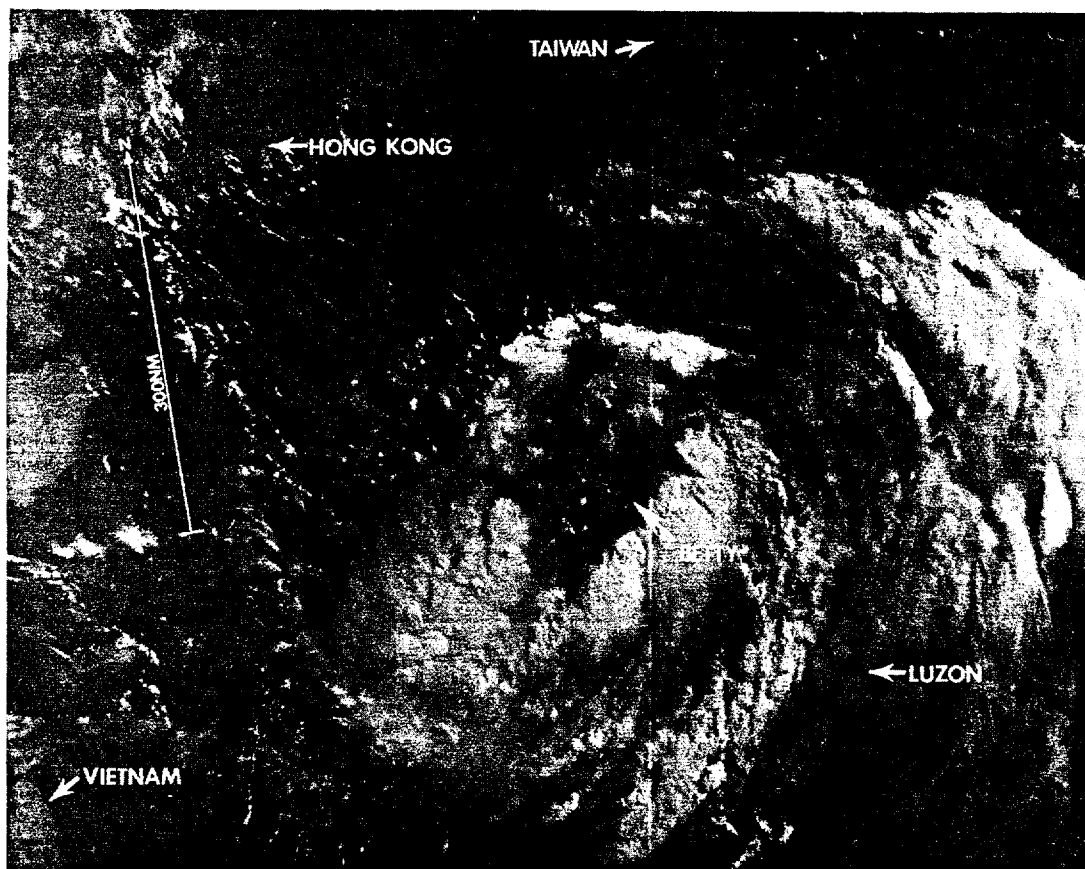


Figure 3-04-2. Tropical Storm Betty as a tropical depression after having crossed the Philippines. Note the exposed low-level circulation center as indicated by spiralling cumulus inside a large convection-free central area (062333Z July NOAA visual imagery).

Betty was upgraded to a tropical storm at 1200Z on the 7th based upon receipt of 35 kt ship reports and satellite imagery showing improved convective organization. Aircraft reconnaissance at 080034Z indicated that Tropical Storm Betty had intensified further with maximum surface winds of 50 kt (26 m/s) being reported in a small area in the east semicircle.

The Hong Kong Royal Observatory (WMO 45005) picked up Betty on weather radar at approximately 080300Z and transmitted position fixes until 090600Z. These hourly reports aided greatly in positioning the tropical storm during this period.

Between 0600Z on the 8th and 0600Z on the 9th, Betty maintained an intensity of 50 to 55 kt (26 to 28 m/s), making landfall at 090300Z approximately 135 nm (250 km) west-southwest of Hong Kong. Figure 3-04-3 shows Betty at maximum intensity just prior to landfall. Dissipation occurred after 091800Z over the southwestern portion of the Peoples Republic of China. No forecast problems were encountered with Tropical Storm Betty since it moved steadily to the northwest around the southwestern periphery of the subtropical ridge.

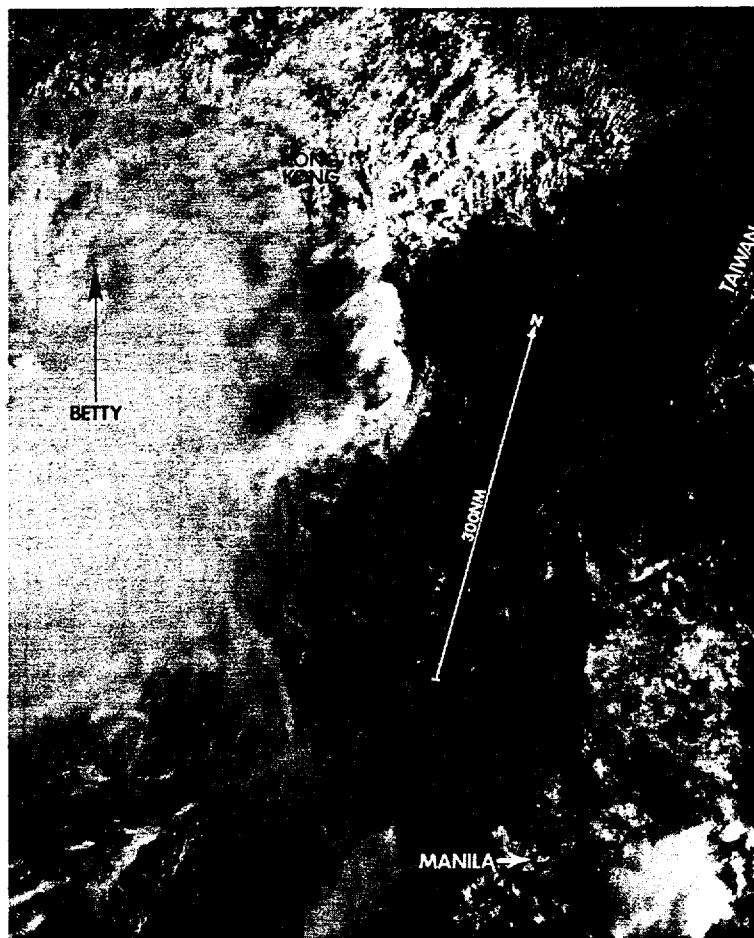


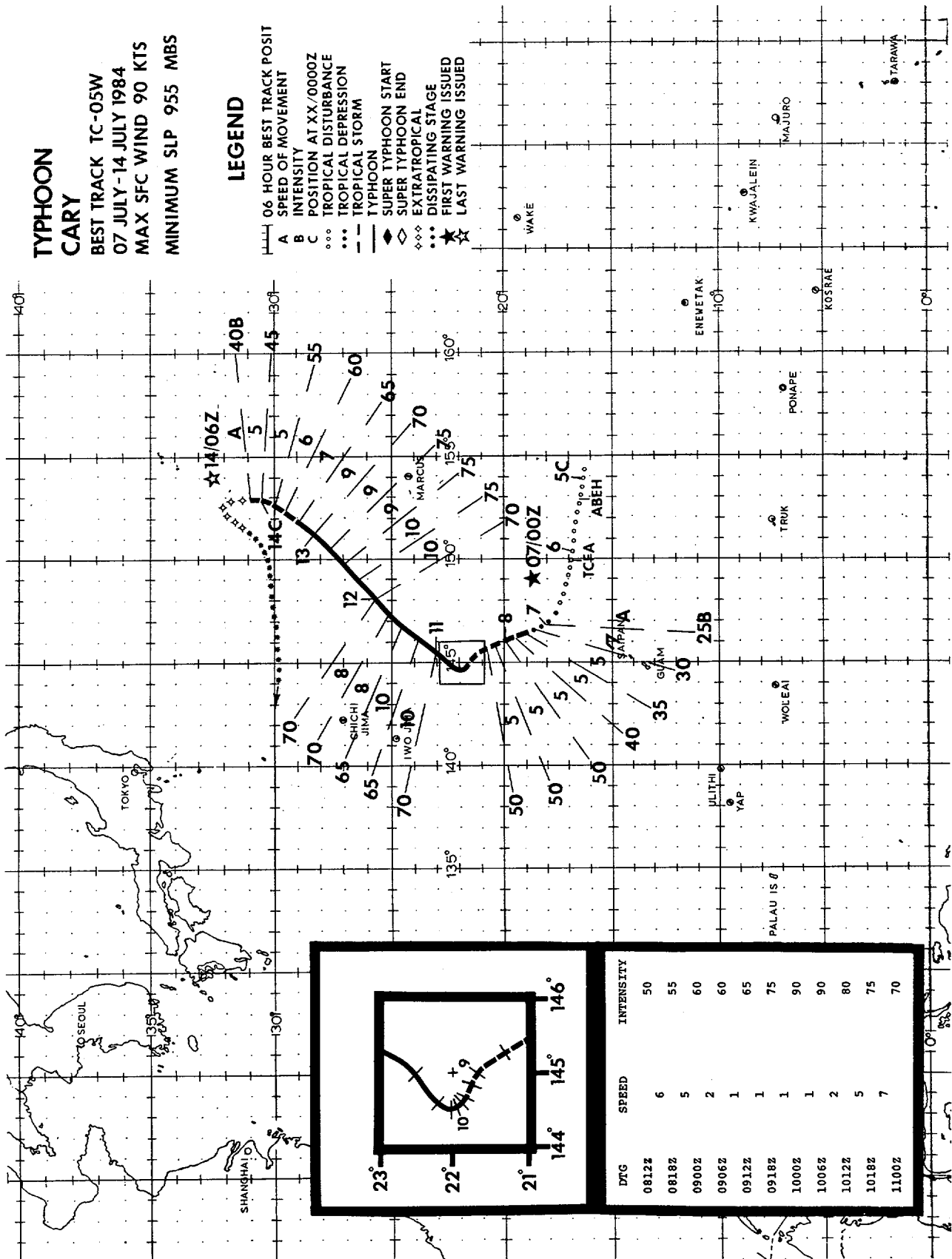
Figure 3-04-3. Tropical Storm Betty at maximum intensity of 55 kt (28 m/s) just prior to landfall (090137Z July DMSP visual imagery).

TYPHOON CARY

BEST TRACK TC-05W
07 JULY-14 JULY 1984
MAX SFC WIND 90 KTS
MINIMUM SLP 955 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



Typhoon Cary was the first storm of the season to be initiated by the Tropical Upper Tropospheric Trough (TUTT) in a manner similar to that described by Sadler (1976). While remaining over water its entire life, Cary distinguished itself by unusual intensity changes.

The disturbance which eventually developed into Typhoon Cary was first noticed on the 2nd of July as an area of very poorly organized convection near 18N 168E in the eastern, divergent side of a westward moving TUTT cell. During the next two days, the convection remained poorly organized as it moved to the west-southwest. Surface synoptic data indicated only easterly trades were present beneath the convection. Early on the 5th, the convection became more organized with satellite imagery indicating an anticyclone developing aloft over the system; however, due to sparse surface reports, the presence of a surface circulation could not be confirmed. Because of the improved organization, the area of convection was mentioned in the 050600Z Significant Tropical Weather Advisory (ABEH PGTW). Subsequent satellite imagery showed continued development of the convection and the ABEH was reissued at 051200Z indicating that the potential for significant tropical cyclone development was "fair" (meaning that it is likely that a TCFA will be issued during the advisory period). Early on the 6th, satellite imagery (Figure 3-05-1) showed that the convection had become comma shaped, with evidence that a surface circulation was forming. Consequently a TCFA was issued at 060317Z. During the following 21 hours the disturbance moved to the west-northwest, with no significant intensification.

Aircraft reconnaissance late on the 6th, had no trouble locating a surface circulation and reported that the disturbance had an MSLP of 1004 mb with estimated maximum surface winds of 25 kt (13 m/s). Based on this report, the first warning on Cary was issued at 0000Z on the 7th. During the next 12 hours, satellite imagery indicated the depression was slowly intensifying. This was confirmed by the next aircraft reconnaissance flight which found Cary had intensified to storm strength with a narrow band of 35 to 40 kt (18 to 21 m/s) surface winds north of its center and an MSLP of 999 mb.

Cary continued to intensify as it moved to the northwest toward an apparent break in the subtropical ridge. Due to uncertainty in the Fleet Numerical Oceanography Center (FNOC) analysis fields in the data sparse region southeast of Japan, 400 mb synoptic track missions were flown on 8 and 9 July to better define the mid-level flow north of Cary. These flights confirmed the presence of a weakness in the ridge, which indicated that forecasts for slow northwestward movement with eventual recurvature to the northeast were sound. Cary slowed as it approached the weakness in the subtropical ridge while continuing to intensify. At 091200Z, Cary was upgraded to typhoon status based on aircraft and satellite data which indicated that a 30 nm (56 km) wide eye had formed, 700 mb flight level winds were 64 kt (33 m/s), and an MSLP of 975 mb existed. During the subsequent 12 hours Cary intensified quite rapidly, reaching a maximum intensity of 90 kt (46 m/s) with an MSLP of 955 mb at 092332Z. Figure 3-05-2 shows Cary just prior to reaching maximum intensity.

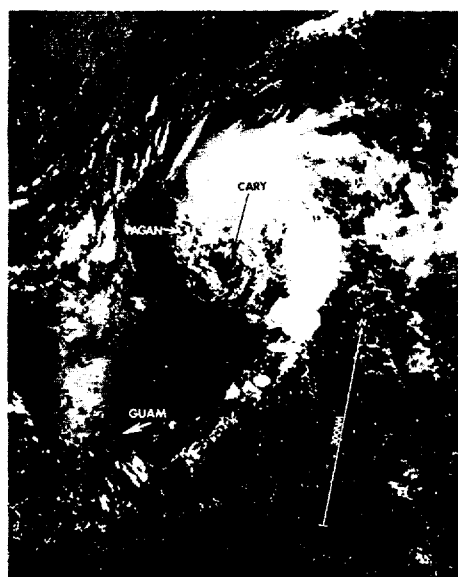


Figure 3-05-1. Satellite imagery which prompted issuance of the TCFA. Note the comma shaped convection and the exposed low-level circulation center to the southwest (060036Z July DMSP visual imagery).



Figure 3-05-2. Typhoon Cary just prior to reaching maximum intensity (092221Z July NOAA visual imagery).

Between 0000Z on the 9th and 1200Z on the 10th, Cary moved very slowly through the ridge axis. At the same time, a mid-latitude trough was forecast to deepen in the lee of Japan, suppress the subtropical ridge further south, and allow Cary to enter the westerlies and be steered to the northeast. Acceleration, although considered, was not forecast since the strong upper-level westerlies were forecast to remain well north of 30N through the forecast period.

Recurvature to the northeast was underway by 101200Z. This was accompanied by a significant shearing of the convection in the northwest semicircle of the storm (Figure 3-05-3) resulting in a reduction of intensity to near minimum typhoon strength. Approximately 18 hours later the trough approached a blocking ridge along 170E, turned to the north, and weakened. This allowed the shearing environment over Cary to decrease resulting in a gradual increase in convection and a halt to the weakening trend. At 111118Z the ARWO reported that Cary was once again developing an eye; this time 40 nm (74 km) across. This large eye persisted for 24 hours (Figure 3-05-4) as Cary reintensified. Figure 3-05-5 shows the intensity variations of Cary. Note the weakening when Cary was being sheared followed by reintensification as the upper-level environment improved.

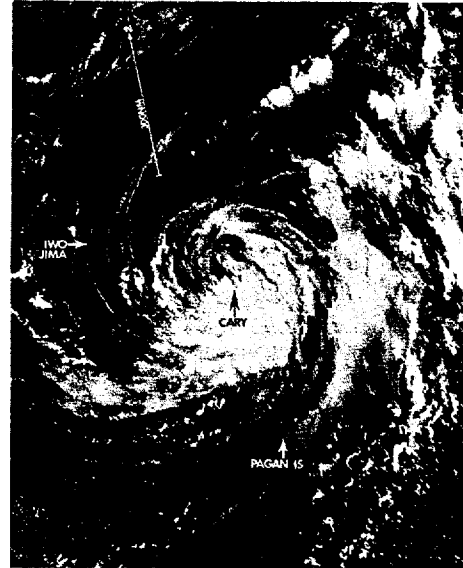


Figure 3-05-3. Typhoon Cary being sheared. Notice the complete absence of significant convection in the northwest semicircle (102156Z July NOAA visual imagery).

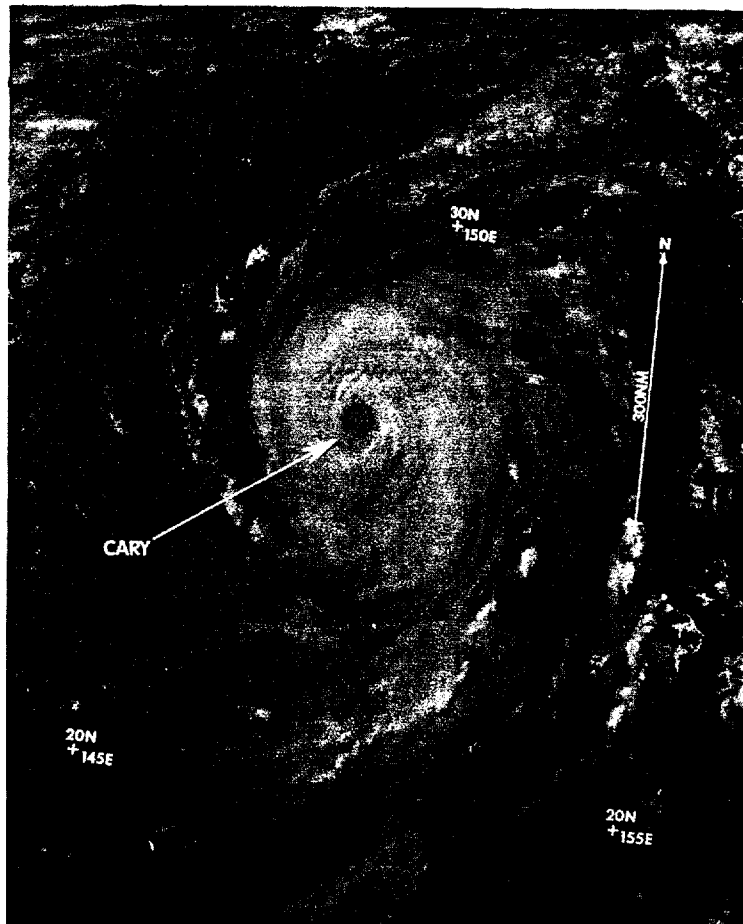


Figure 3-05-4. Typhoon Cary after reintensifying. Maximum sustained winds are 75 kt (39 m/s) (120529Z July NOAA visual imagery).

As Cary moved further north, increasing vertical shear and entrainment of cooler, drier air caused Cary to weaken and gradually become extratropical. By 140600Z Cary had completed its extratropical transition and the final warning was issued. Figure 3-05-6 shows Cary as it completed

transition to an extratropical low. The extratropical remains of Cary continued to weaken and moved west under the influence of a surface ridge northeast of Japan. Cary eventually dissipated to the south of Japan. There were no reports of injuries or damages from Cary.

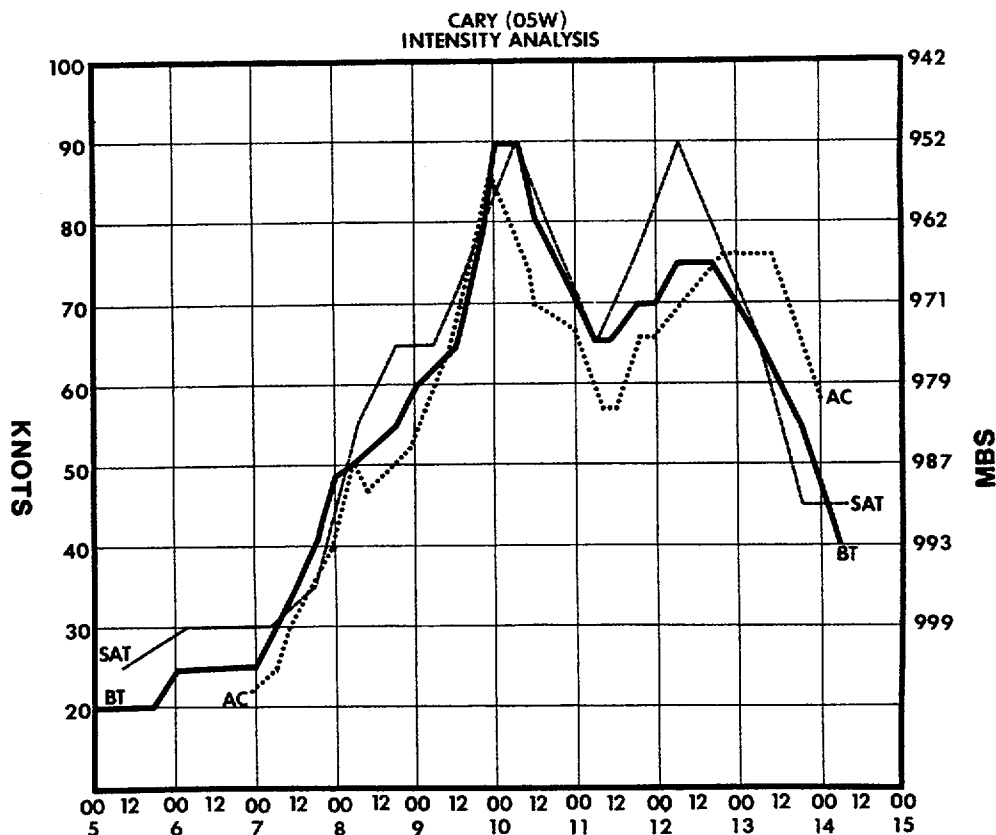


Figure 3-05-5. Satellite (Dvorak, 1973) and aircraft reconnaissance (Atkinson and Holliday, 1977) intensity estimates of Typhoon Cary. Best track intensities are shown as the solid line.

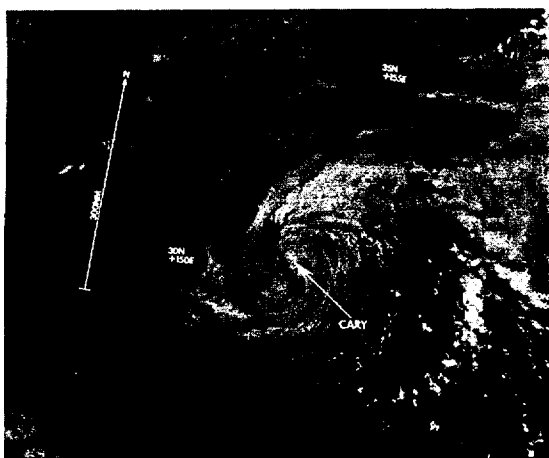
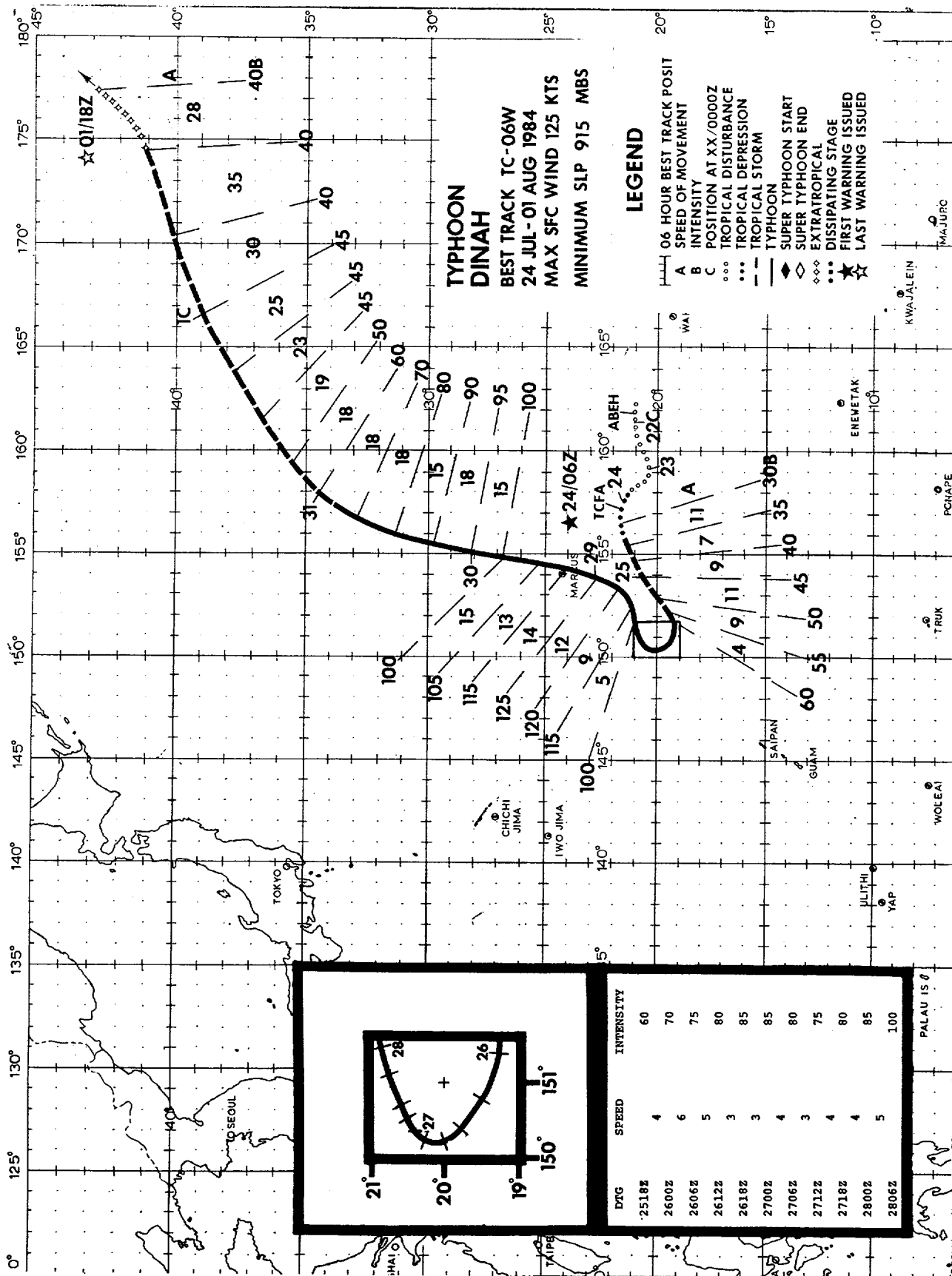


Figure 3-05-6. Cary completing extratropical transition. Note the absence of convection around the storm. Only stable stratocumulus clouds remain (140504Z July NOAA visual imagery).



TYPHOON DINAH (06W)

During much of July, the North Pacific was dominated by slow moving or stationary features. After Tropical Storm Betty dissipated over southern China, the southwest monsoon did not re-develop. Instead, surface ridging was established in the South China Sea. Gradually this ridging spread eastward, and by mid-July dominated the western North Pacific from Southeast Asia to the dateline. This anomalous ridging persisted for almost two weeks. Accompanying this ridging was an almost total absence of significant convection in the tropics. With high pressure dominating the climatologically favored area for tropical cyclone development, it was up to a cold front to provide the genesis mechanism for the next storm of the season. This front had persisted for nearly a week, extending across much of the central North Pacific southwestward to just north of Wake Island (WMO 91245). While the southern end of the associated trough had, at times, shown some convective activity, it was not until the front began to move eastward that the disturbance detached from the front and developed into Typhoon Dinah.

On the 20th and 21st, satellite imagery indicated that the trough and its associated surface front, which had been inactive for nearly a week, were finally moving east. As the trough moved eastward, an area of convection remained behind and began to show some organization. Synoptic data at 1200Z on the 21st indicated a surface circulation had formed beneath the convection, approximately

300 nm (556 km) to the northwest of Wake Island. During the next two days, the disturbance drifted slowly westward with no significant development. This lack of development and slow movement are attributed to the passage to the north of a developing mid-latitude frontal system which significantly elongated the convection.

Late on the 23rd, with the frontal system passing to the northeast and its influence lessening, the convection associated with the disturbance increased considerably. Based on the 240000Z imagery, a TCFA was issued. As the TCFA was being issued, the first aircraft reconnaissance of the disturbance was already underway. By 240250Z the aircraft had located a 1000 mb circulation center, and had observed surface winds of 30 kt (15 m/s). Since continued development was expected, the first warning on Dinah valid at 240600Z was issued.

During the next two days, Dinah tracked to the west-southwest and intensified. Late on the 25th, Dinah attained typhoon intensity with aircraft reporting that a 30 nm (56 km) wide circular eye had formed. Dinah's track to the west-southwest is attributed to the flow around a narrow mid-tropospheric ridge to its north (Figure 3-06-1). At this time, Tropical Storm Ed (soon to be Typhoon Ed) was moving southeast towards Dinah. This caused the ridge to the north to slide to the east allowing Dinah to turn to the northwest into the weakness.

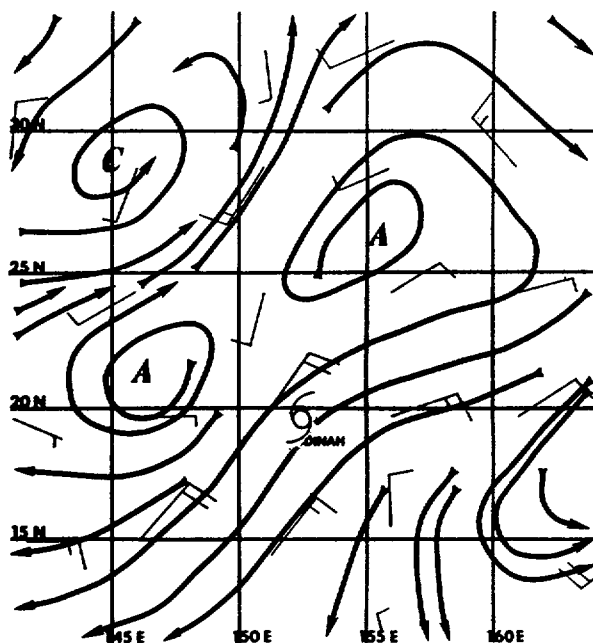


Figure 3-06-1. Mid-tropospheric wind flow which initially steered Typhoon Dinah. Note the ridge to the north with a weakness in the ridge to the northwest (FNOC 400 mb NVA analysis valid at 251200Z July).

Between 0000Z on the 26th and 0000Z on the 28th, Dinah and Ed were within 900 nm (1667 km) of each other, with the closest point of approach being at 262100Z when they were approximately 630 nm (1167 km) apart (Figure 3-06-2). While JTWC was warning on these systems it was thought that the major track changes to both were a result of their interaction. However, post-analysis indicates this interaction between Dinah and Ed was not nearly as great a factor as initially thought. It is now believed that the proximity of the storms did not have a major affect on their respective tracks and only a short-lived influence on Dinah's intensity.

Figure 3-06-3 shows the intensity variations of Dinah as measured by reconnaissance aircraft. After intensifying for three days, Dinah weakened for a 12 to 24 hour period on the 27th. This weakening happened after the closest point of approach between the two storms had occurred. The mechanism responsible for this temporary weakening was the well developed outflow of Ed which interacted with Dinah late on the 26th and early on the 27th. Figure 3-06-4 contains a series of three infrared satellite pictures showing the approach and interaction of Ed's outflow with Dinah. This interaction resulted in a significant shearing and suppression of the convection

in the northwest quadrant of Dinah, a temporary weakening of the eye and eyewall and an increase in the central pressure as observed in Figure 3-06-3. Figure 3-06-5 shows an enhanced infrared picture of Typhoon Dinah after interaction with Ed had taken place. Note that the eye is open to the northwest, and there is a lack of significant convection in the northwest quadrant. Although not verifiable, Dinah's brief turn to the east-northeast on the 27th may also be attributable to the pressure from Ed's outflow. By early on the 28th, with the distances between Ed and Dinah increasing, the shearing decreased and Dinah intensified rapidly, reaching its maximum intensity of 125 kt (64 m/s) at

0000Z on the 29th.

By now Dinah was moving to the north-northeast and increasing its forward speed as the storm tracked along the westward edge of the mid-Pacific high. At approximately 290600Z Dinah made its closest point of approach to Marcus Island (Minami Tori Shima (WMO 47991)) with an intensity of 115 kt (59 m/s). This was Dinah's only interaction with land and caused extensive damage to vegetation on the island. The Coast Guard Loran station sustained an estimated \$30,000 worth of damage to various buildings and equipment. Maximum observed winds on the island were 63 kt (32 m/s) with a peak gust to 89 kt (46 m/s).



Figure 3-06-2. View of Typhoon Dinah and the developing Tropical Storm Ed (soon to be Typhoon Ed) near the time of their closest point of approach (262213Z July NOAA visual imagery).

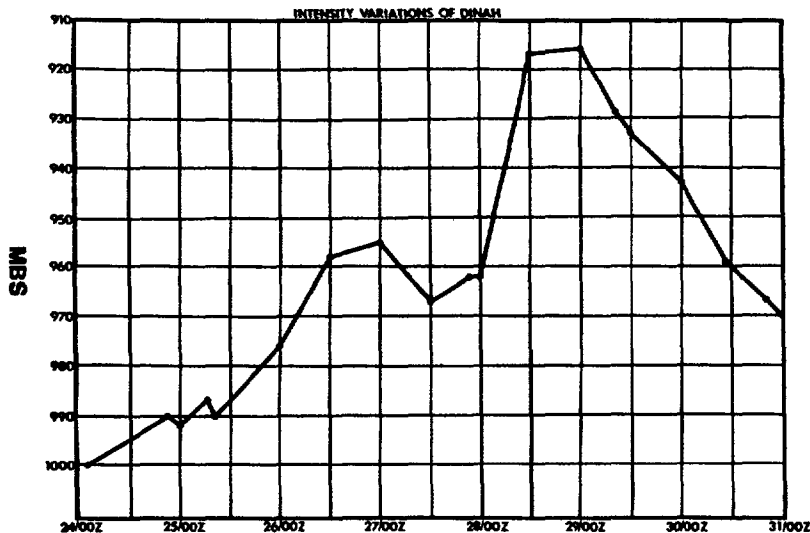


Figure 3-06-3. Intensity variations of Typhoon Dinah as derived from aircraft reconnaissance data.

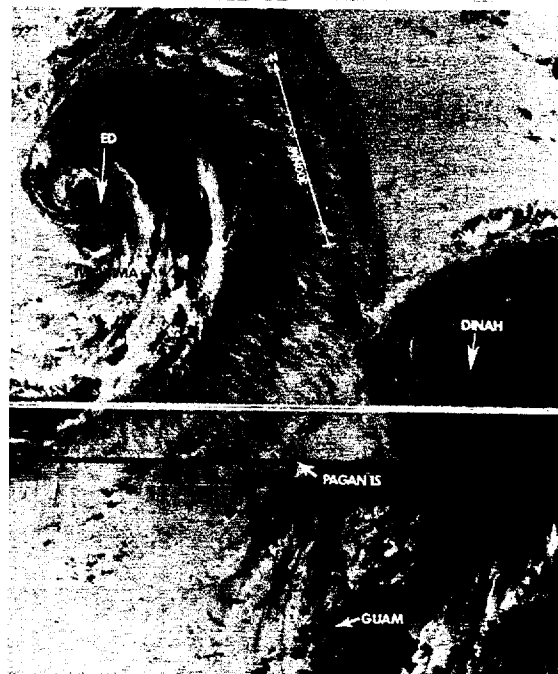
After passing clear of Marcus Island, Dinah continued to move to the north-northeast at 15 to 18 kt (28 to 33 km/hr) and weaken. Early on the 31st Dinah was downgraded to a tropical storm. A mid-latitude trough which had already been interacting with Dinah for approximately 12 hours, now started steering the storm towards the northeast. Transition to an

extratropical low, which began at about 1200Z on the 30th, was completed by 1200Z on the 1st of August.

The final warning was issued by the Joint Typhoon Warning Center at 1800Z on 1 August. The extratropical remains of Dinah continued to track eastward across the international dateline.

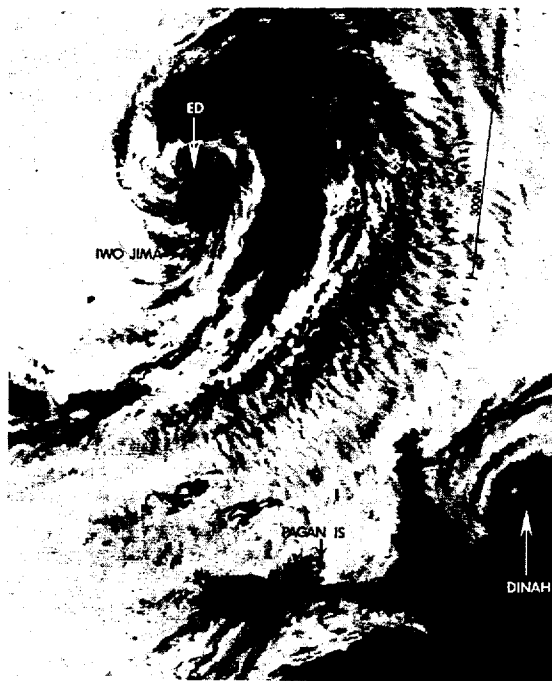


(a)



(b)

Figure 3-06-4. Three infrared pictures taken during a six hour period showing the approach of Ed's outflow and its interaction with Dinah (a. 261842Z July NOAA infrared imagery, b. 262214Z July NOAA infrared imagery, c. 270037Z July NOAA infrared imagery).



(c)

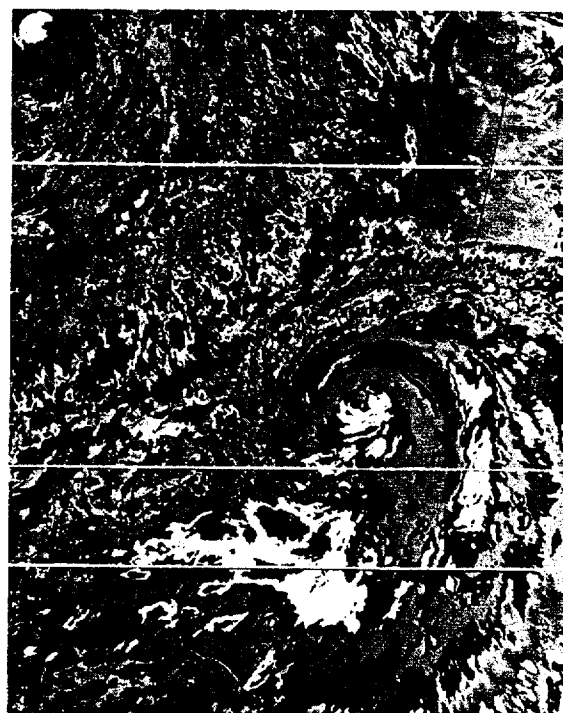


Figure 3-06-5. Enhanced infrared imagery of Typhoon Dinah after interaction with Ed (270545Z July NOAA infrared imagery).

TYPHOON

ED

BEST TRACK TC-07W

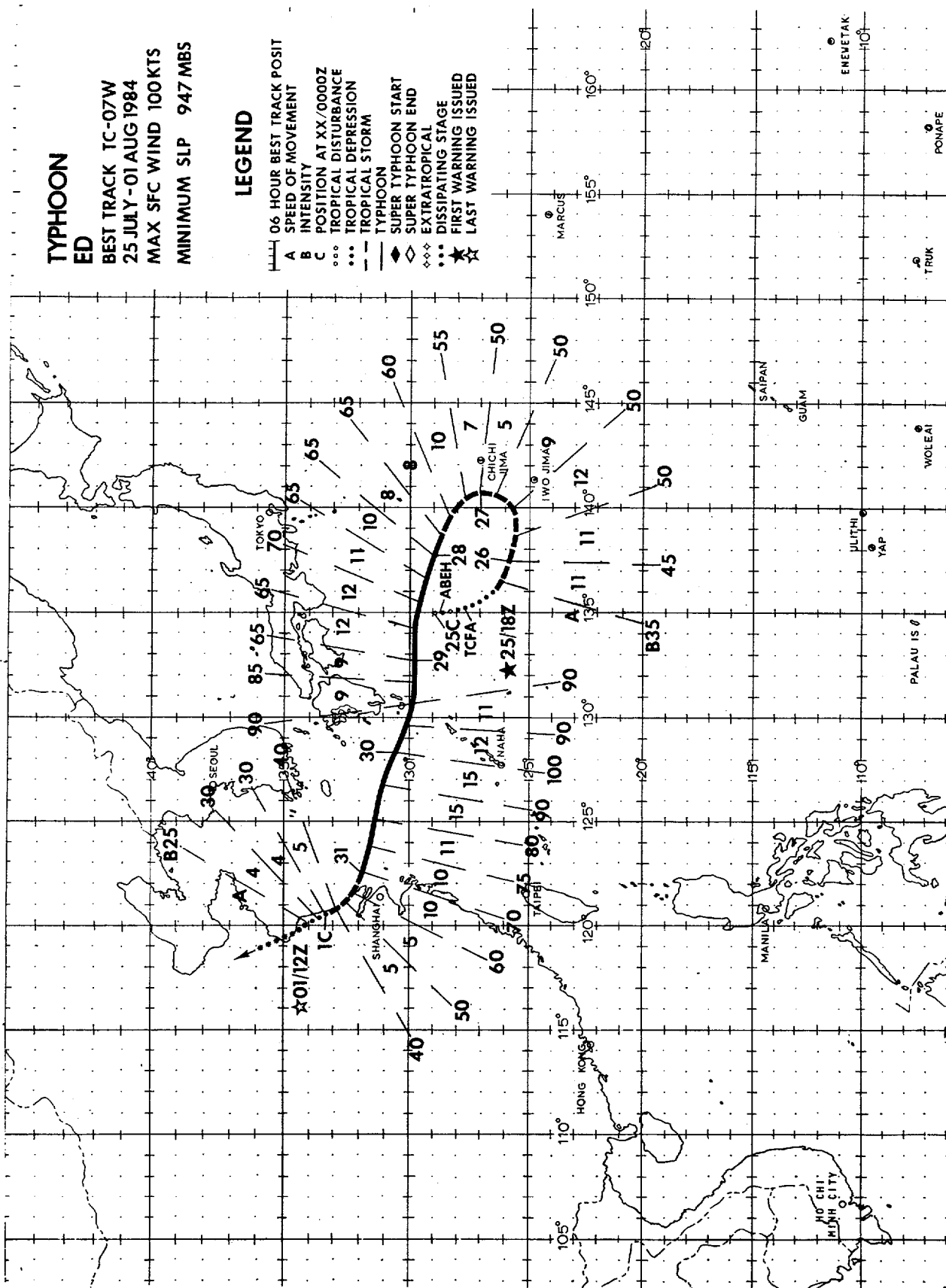
25 JULY-01 AUG 1984

MAX SFC WIND 100 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



Typhoon Ed, like its predecessor Typhoon Dinah, originated from a mid-latitude system. Forming just south of Japan, Ed initially moved to the southeast, a very unusual direction of movement for tropical cyclones in the northwest Pacific. After briefly interacting with Typhoon Dinah, Ed turned to the west-northwest, a course it maintained until it made landfall on the east coast of China.

The disturbance which eventually developed into Ed began as an area of convection at the southern end of a dissipating cold front transiting Japan. Although the convection was first noticed on 23 July, it was not until late on the 24th that the cloud mass became detached from the front and showed signs of becoming a tropical disturbance. At 0000Z on the 25th, synoptic data indicated a surface circulation had formed, with an MSLP near 1002 mb. Satellite imagery and synoptic data indicated an upper-level anticyclone had developed over the disturbance providing excellent outflow to the south. These developments prompted the Significant Tropical Weather Advisory (ABEH PGTW) to be reissued at 250135Z in order to include this system as a suspect area. The potential for significant tropical cyclone development was assessed as being "fair". Indeed this was an understatement. The area rapidly transitioned from an extratropical feature to a tropical depression as the convection increased and became more organized. At 250600Z, synoptic data showed surface pressures had decreased to 999 mb and Dvorak satellite intensity analysis estimated that surface winds of 30 kt (15 m/s) were present. Consequently a TCFA was issued at 250745Z. The disturbance continued to develop overnight and the first warning on Ed was issued at 1800Z on the 25th.

While Ed was developing, Typhoon Dinah located approximately 900 nm (1667 km) to the southeast, was moving to the west and intensifying. The first five warnings forecast Ed to move generally towards Dinah, remain weak and eventually be assimilated into Dinah's inflow. However, Ed did not remain weak but continued to intensify as it moved to the southeast. Aircraft reconnaissance at 252219Z found Ed had deepened to 985 mb and was supporting winds of 40 to 50 kt (21 to 26 m/s). Ed maintained a 50 kt (26 m/s) intensity during the next 24 hours as it moved closer to Dinah. Throughout this period, Ed's outflow remained very well organized and was elongating to the east towards Dinah. This outflow had a significant short term effect on Dinah's convection and intensity early on the 27th.

During the 26th, a short-wave trough moved eastward across the Sea of Japan. In response to the trough, Ed turned to the north while maintaining its intensity. By 270000Z, the trough had moved to the northeast and was weakening. Ed now came under the influence of a mid to low-level ridge east of Japan. This ridge kept building to the west and forced Ed to move to the west-northwest, a course it maintained until landfall.

While moving to the west Ed slowly intensified, reaching its peak intensity of 100 kt (51 m/s) shortly after passing south of the island of Kyushu (Figure 3-07-1). As Ed transited the East China Sea, entrainment of drier air and passage over cooler waters began to weaken the system. At 0900Z on the 31st, Ed made landfall approximately 60 nm (111 km) north of Shang-Hai (WMO 58367). Maximum sustained winds at landfall were 60 kt (31 m/s). After making landfall, Ed turned to the northwest, transited along coastal China and gradually dissipated. The final warning was issued at 1200Z on the 1st of August.

The only known damage caused by Typhoon Ed occurred to shipping. The Korean registered Ishlin Glory enroute from Pohang, South Korea to Nagoya, Japan sank in the Korea Strait on 29 July. One crew member is known dead, with eleven others reported missing.

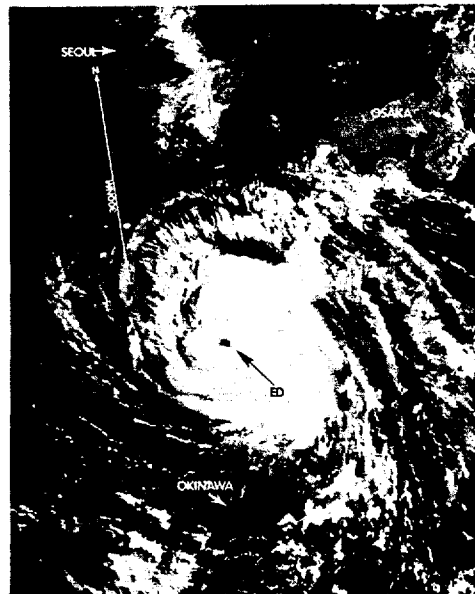
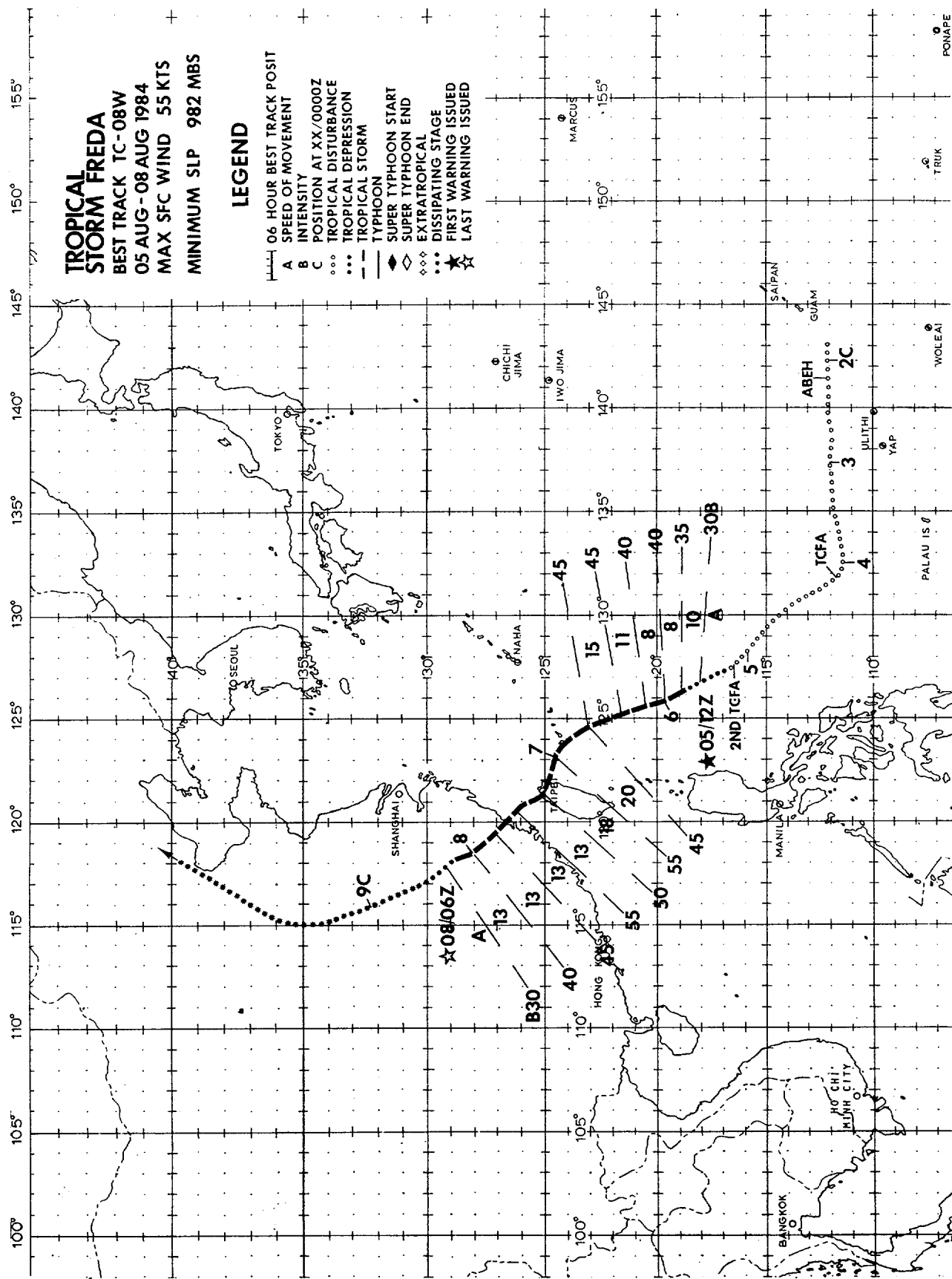


Figure 3-07-1. Typhoon Ed near maximum intensity (292242Z July NOAA visual imagery).



TROPICAL STORM FREDA (08W)

Tropical Storm Freda was the first of seven significant tropical cyclones to develop during August. Freda began just as Typhoon Ed was dissipating over eastern China and Typhoon Dinah was completing its extra-tropical transition well to the east of Japan. In the wake of these two typhoons, the atmosphere had not yet returned to its seasonally normal condition before Freda began to show signs of developing. This situation meant that Freda would be slow to develop and take several days to pull together into a tropical cyclone.

On the 1st of August, just prior to the development of Freda, the western Pacific was dominated at the surface by a deep trough extending southwest from Dinah into a disturbance north of Guam and then southwestward into the southern Philippine Sea (Figure 3-08-1). The southwest monsoon, which had re-established itself during the

last week of July, had not yet returned to its climatological position and would not do so for several more days. The low-level convergence at the base of this trough west of Guam, was the primary genesis mechanism for Freda. By 020600Z, enough convection had developed over the area to merit inclusion of the disturbance in the Significant Tropical Weather Advisory (ABEH PGTW). At 021200Z, a closed surface circulation was first analyzed in the Philippine Sea with an estimated MSLP of 1005 mb. The ABEH was reissued shortly thereafter upgrading the potential for significant tropical cyclone development to "fair". An aircraft investigation of the area was requested for the following afternoon. Although at this time it was assumed that the disturbance would progress into a typical tropical cyclone, it would turn out that the most difficult part of warning on this storm would be locating the surface center.

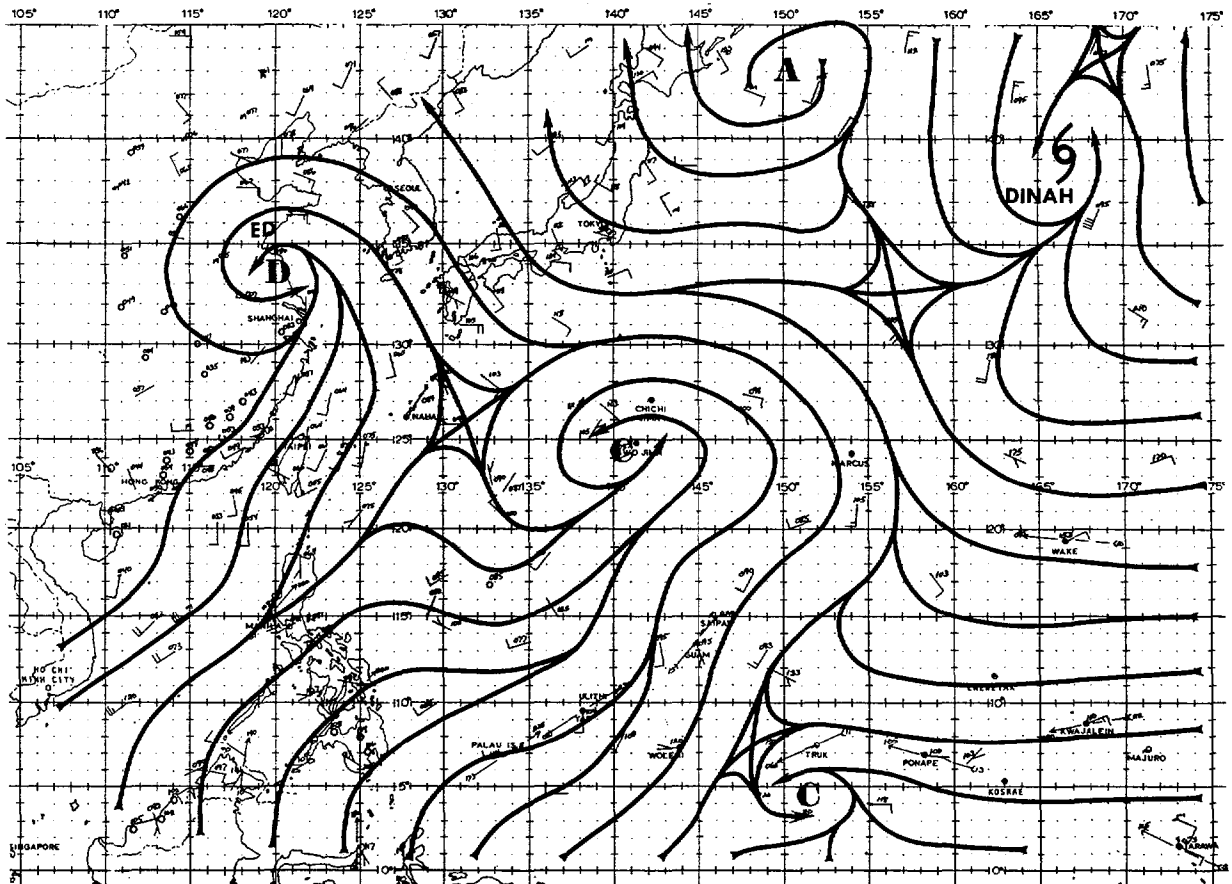


Figure 3-08-1. The 010000Z August 1984 surface/gradient level analysis. Low-level convergence at the base of the trough west of Guam was the primary genesis mechanism for Tropical Storm Freda.

Since the forecast scenario was not very difficult, and Freda followed a general track to the northwest, the remainder of the discussion will focus of Freda's development through aircraft reconnaissance and the subsequent results.

Mission number one was a resources-permitting invest on the afternoon of 3 August. It found a very broad, light and variable wind center but could not locate a definite closed circulation. The MSLP reported by the aircraft was 1003 mb. JTWC continued to watch the area and requested another invest for the following morning with a stand-by fix for later that afternoon. The second invest closed-off a 25 kt (13 m/s) circulation near 11.0N 132.7E. However, satellite imagery at that time revealed that the disturbance was developing very slowly. The MSLP observed on the second flight was 1005 mb or two millibars higher than on the previous day - not a promising sign. Since development was occurring so slowly, the afternoon stand-by fix was cancelled and the metwatch continued.

In anticipation of continued slow development during the next twenty-four hours, a TCFA was issued at 040415Z. Two fix missions were also requested for the following day. Mission number three, originally tasked as a fix mission for the morning of 5 August, could not find the system at the forecast location. Reverting to an invest pattern, the crew was still unable to locate a circulation center, although they did find a broad trough some 5 degrees further north than on the previous day. The lowest surface pressure reported was 999 mb. In rapid succession mission number four, the afternoon fix, was cancelled; the TCFA was reissued and positioned further to the northwest; and another aircraft invest was requested for the next morning with a follow-on afternoon fix. At 050716Z, Dvorak satellite intensity analysis of the imagery in Figure 3-08-2 indicated the disturbance was developing and estimated that surface winds of 30 kt (15 m/s) were now present. Based on the satellite intensity estimates, the lower pressures reported by aircraft and the forecast for continued slow intensification, JTWC issued the first warning on Freda as a tropical depression at 051200Z.

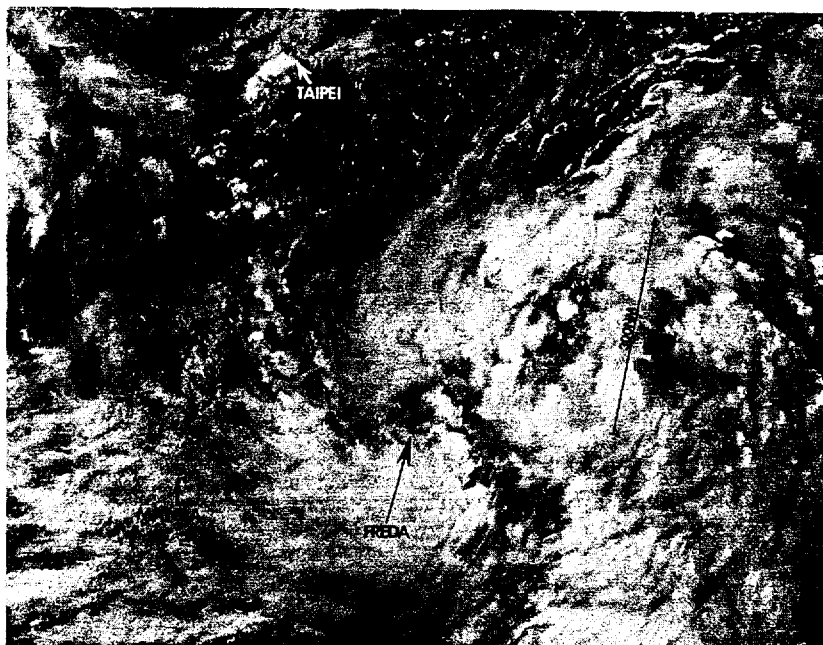


Figure 3-08-2. Dvorak intensity analysis of this imagery indicated 30 kt (15 m/s) winds were present prompting the first warning on Freda (050716Z August NOAA visual imagery).

Mission number five, an invest scheduled for NLT 060000Z, finally found a 993 mb circulation center with winds in excess of 35 kt (18 m/s) after several hours of searching. Mission number six, an afternoon fix mission, had little trouble fixing the circulation center of this now 40 kt (21 m/s) tropical storm. At last Freda was showing signs of cooperating; however, this was not to last long! The ARWO on mission number six commented, "This storm was rather weak and unorganized. It was very large and could very well have multiple centers." Indeed

this was the case. Satellite imagery indicated there were now two centers of activity - the second one developing to the north of the circulation fixed by the aircraft (Figure 3-08-3). Up until this time the fixes from both aircraft and satellite as well as the forecast emphasis had been on the southern center, but the northern area was about to assume dominance. The apparent storm movement from 060600Z to 070000Z was as much a reconsolidation around the northern center as it was a simple translation of the entire storm envelope to the northwest. This



Figure 3-08-3. Tropical Storm Freda when reconsolidation about the northern center was about to commence. Note the southern area of convection, where the aircraft and satellite had been fixing the center and a second area of convection located further to the north where the new center would develop (061010Z August DMSP visual imagery)

reconsolidation was complicated by the fact that it occurred at night when only infrared satellite imagery was available. When mission number seven went into Freda the next morning, it could not find a circulation where the southern center should have been. However, when the pattern was changed to that of an invest mission they found Freda located significantly to the northwest within the northern area of convection. The MSLP had now decreased to 988 mb with maximum surface wind of 45 kt (23 m/s) being reported. Mission number eight, the last one flown into Freda, was unable to penetrate the center since the storm had moved over Taiwan.

Freda quickly transited northern Taiwan and the Formosa Straits before making landfall on the Chinese mainland at approximately 071500Z. Like Typhoon Ed, a week earlier, Freda held together over land for two more days before finally dissipating.

In summary, Tropical Storm Freda was a slow developing system that exhibited two centers of action for a portion of its life. The southern center was more dominant until reconsolidation around the northern center occurred just prior to Freda crossing Taiwan. Freda tracked generally to the northwest and was identifiable over land for several days after it moved ashore.

TROPICAL DEPRESSION 09W

BEST TRACK TC-09W

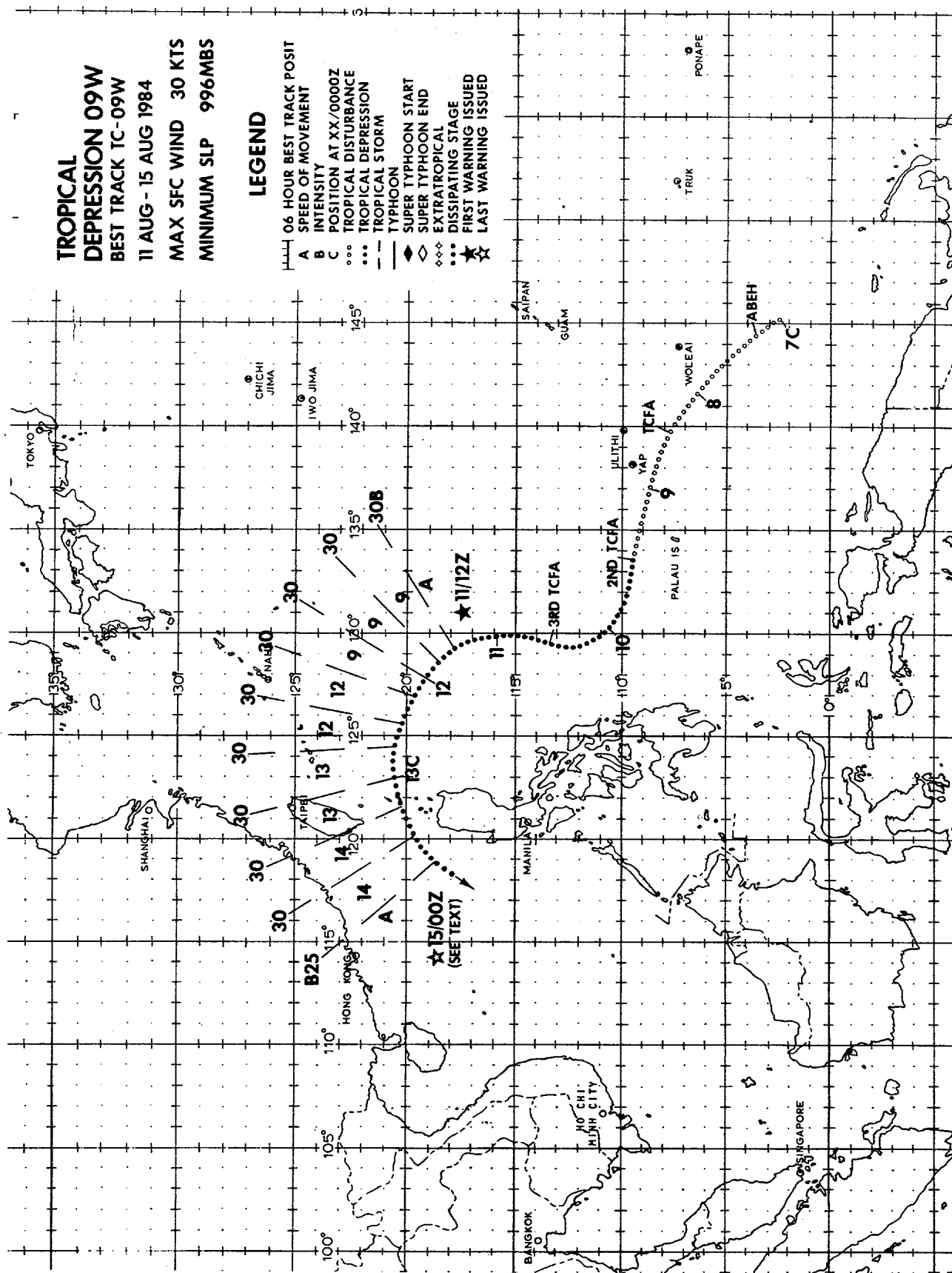
11 AUG - 15 AUG 1984

MAX SFC WIND 30 KTS

MINIMUM SLP 996MBS

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 DEPRESSION (09W)

Tropical Depression 09W, just like its predecessor Tropical Storm Freda, was a difficult storm to warn on. The depression's low-level circulation remained weak and poorly organized which made it very difficult to locate. Extensive post-analysis indicates that JTWC warned on the mid-level circulation, which was co-located with the organized convection, rather than the ill-defined low-level center which remained well to the south of the main convection.

Tropical Depression 09W first appeared early on the 7th of August as a broad 1006 mb low in the Near-Equatorial Trough approximately 660 nm (1222 km) south of Guam. The disturbance was mentioned on the 070600Z Significant Tropical Weather Advisory (ABEH PGTW). As it moved to the northwest, the disturbance showed signs of increased organization on satellite imagery, prompting the issuance of a TCFA at 081200Z.

Aircraft reconnaissance on the afternoon of 9 August, indicated that the surface circulation associated with the disturbance was broad and weak. Only 10 to 15 kt (5 to 8 m/s) surface winds were observed with an MSLP of 1004 mb. The TCFA was reissued daily from the 9th to the 11th as the system continued to show convective organization and the presence of a surface circulation in the synoptic data. During this period, the disturbance was very slow to develop a favorable upper-level circulation. The 200 mb flow persisted in being unidirectional (easterly) over the convection. This easterly flow sheared the convection preventing the accumulation of warm, moist air at the low-to-mid levels and the attendant surface pressure drop.

The aircraft reconnaissance investigative flight on the morning of 10 August could not find a surface circulation center. By this time, the system had moved out of the Near-Equatorial Trough and had become the south-eastern extension of the monsoon trough.

Between 100600Z and 110600Z, the disturbance moved almost due north. This brought the disturbance under the influence of a TUTT cell located to the northwest near Taiwan. The 200 mb flow over the system now came from the south and was diffluent north through east of the surface circulation. Satellite imagery confirms this by indicating the presence of the heaviest convection in that area. At 110729Z, aircraft reconnaissance closed-off a surface circulation center with 25 kt (13 m/s) surface winds and an MSLP of 1003 mb. Based on the improved upper-level wind flow and the closed circulation found by aircraft, the first warning on Tropical Depression 09W was issued at 111200Z.

The first six warnings on 09W forecast it to move to the northwest. These forecasts were based on objective forecast aids, including the One-Way Interactive Tropical Cyclone Model (OTCM). Upon post-analysis, these forecasts do not agree well with the synoptic situation present at the time. A low-to-middle level ridge was located to the

north of the depression. In retrospect, the more accurate and synoptically correct forecast, especially with such a weak system as Tropical Depression 09W, would have been a west-northwest to west track along the northern side of the monsoon trough.

Complicating the forecasting of Tropical Depression 09W was the difficulty in positioning the surface center. The surface circulation center was poorly organized because it was embedded in the monsoon trough. The displacement of the mid-to-upper level circulation to the north within the convection, made accurate positioning by satellite imagery of the actual low-level depression center very difficult. Figure 3-09-1 shows one of the few times that the weak, poorly defined, low-level circulation was visible on satellite imagery. Post-analysis of aircraft reconnaissance, synoptic, and satellite data, shows that the depression center, as reflected in the warning positions, was the middle-to-upper level center and not the weak and poorly defined surface circulation center which was located approximately 150 nm (278 km) to the south. JTWC warned on this mid-level feature until 150000Z when the convection finally dissipated over Taiwan and it was obvious that no significant low-level circulation persisted. It is now apparent that the surface center moved along the monsoon trough as a sheared, sometimes exposed low-level circulation from 111200Z to 131800Z and dissipated shortly thereafter as it merged with a cyclonic circulation in the northern South China Sea. This circulation would develop into Tropical Storm Gerald a few days later.

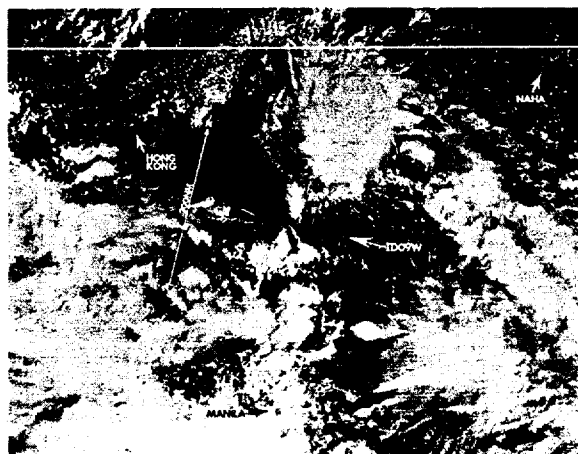
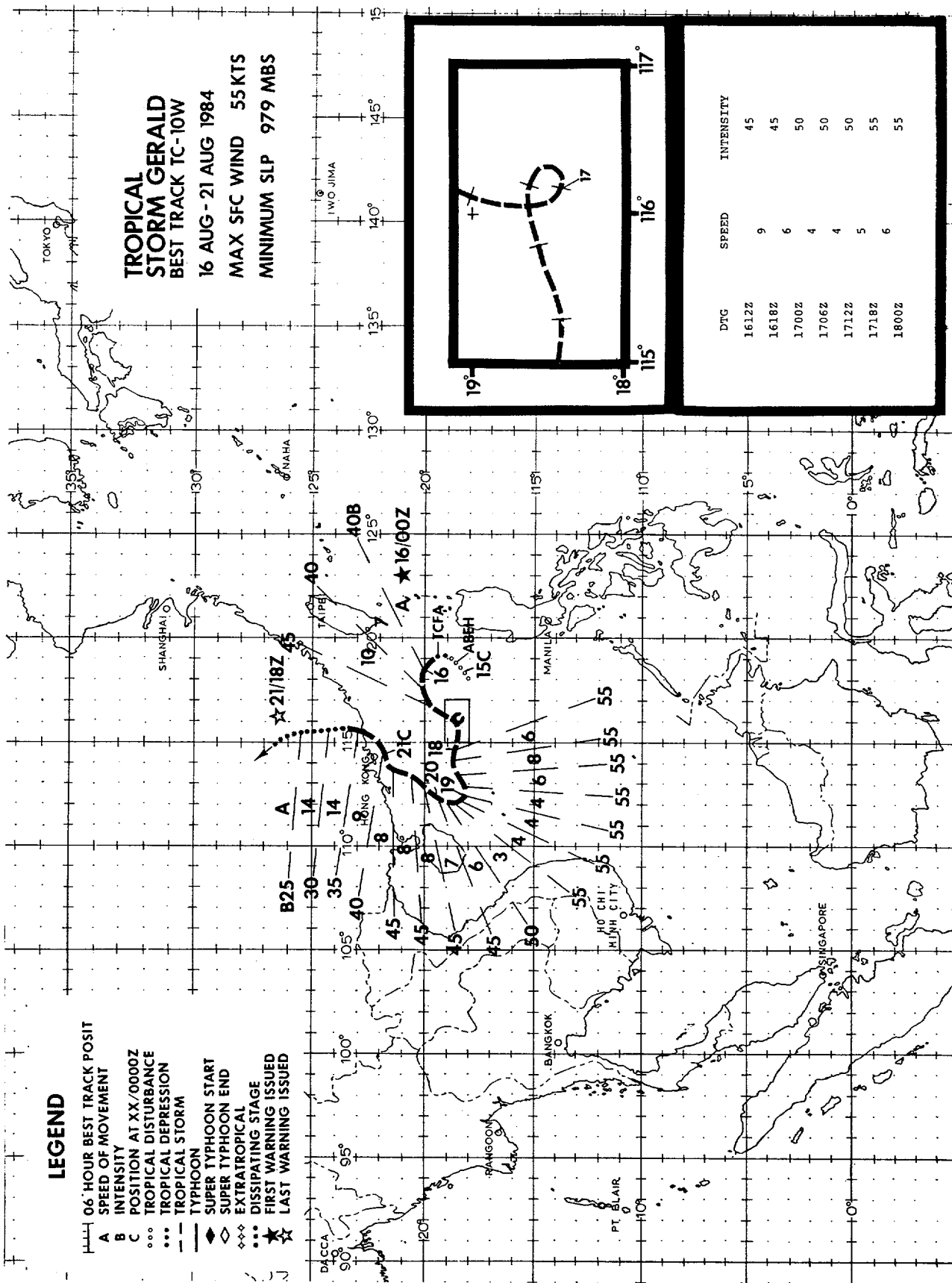


Figure 3-09-1. Tropical Depression 09W passing south of Taiwan. Note the poorly defined exposed low-level circulation located well to the south of the main convection. At the time, the depression's center was thought to be located underneath this convection. However, post-analysis now indicates the exposed low-level circulation was the actual location of the depression's center (130718Z August NOAA visual imagery).



TROPICAL STORM GERALD (10W)

Tropical Storm Gerald led a rather uneventful life. Developing in the northern South China Sea, Gerald remained embedded in the monsoon trough for five days. Its proximity to Typhoon Holly affected both its track and intensity. By the time it made landfall, it had weakened to a minimal tropical storm causing little, if any, damage.

By mid-August, the southwest monsoon had returned to its climatological position. The associated monsoon trough now extended from northern Vietnam across the northern South China Sea and then southeast to just south of Guam. As Tropical Depression 09W developed east of the Luzon Straits, the trough deepened. By the 12th of August, synoptic data indicated a closed surface circulation had formed in the northern South China Sea near 18N 117E with an MSLP near 1001 mb. The circulation continued to develop and at 131200Z the MSLP had decreased to 998 mb with winds near the center of 10 to 20 kt (5 to 10 m/s); 20 to 30 kt (10 to 15 m/s) winds were located south of the circulation center associated with the southwest monsoon.

By 141800Z the convection associated with remnants of Tropical Depression 09W near Taiwan, had nearly dissipated. Up to this point there was very little significant convection in the northern South China Sea. The convection that was present showed no real organization. Between 141800Z and 150000Z, the convection in the northern South China Sea increased considerably. Surface pressures had now decreased to 997 mb. However, winds near the center were light - only 5 to 15 kt (3 to 8 m/s), while

the 20 to 30 kt (10 to 15 m/s) winds still persisted further south - a classic monsoon depression.

The entire monsoon trough had been discussed on the Significant Tropical Weather Advisory (ABEH PGW) since 130600Z. However, with improved convective organization and lower pressures being observed in the northern South China Sea, this disturbance finally warranted inclusion on its own merits in the 150600Z ABEH.

Synoptic data at 151200Z indicated a broad circulation still persisted, but now 15 to 30 kt (8 to 15 m/s) winds were being reported much closer to the center. This prompted the issuance of a TCFA at 151327Z. Less than 12 hours later the first aircraft reconnaissance mission found the system had deepened to 991 mb and was supporting 40 kt (21 m/s) winds near the center. The first warning on Gerald, valid at 160000Z, followed shortly.

During the next three days, Gerald moved erratically on a generally westward course, remaining embedded in the monsoon trough. Gerald continued to intensify reaching its maximum intensity of 55 kt (28 m/s) at 171800Z. Gerald then maintained this intensity for the next two days. The inability of Gerald to intensify beyond 55 kt (28 m/s) was due to a strong shear over the storm primarily from the outflow of Typhoon Holly which had developed east of Taiwan on 16 August and persisted throughout most of Gerald's life. This shearing occasionally resulted in the low-level circulation being exposed east of the convection (Figure 3-10-1).

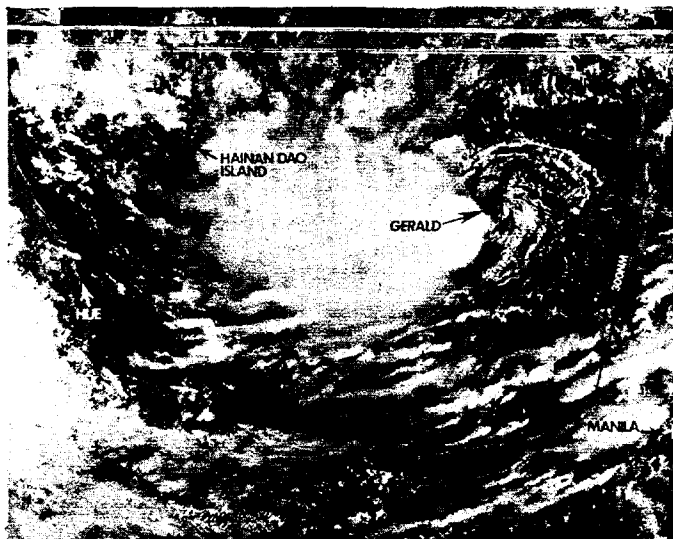


Figure 3-10-1. Example of the partially exposed low-level circulation of Tropical Storm Gerald which was observed periodically during the storm's lifetime. Note the strong easterly flow aloft shearing the convection to the west. This shear was caused by the outflow of Typhoon Holly located far to the northeast (170200Z August DMSP visual imagery).

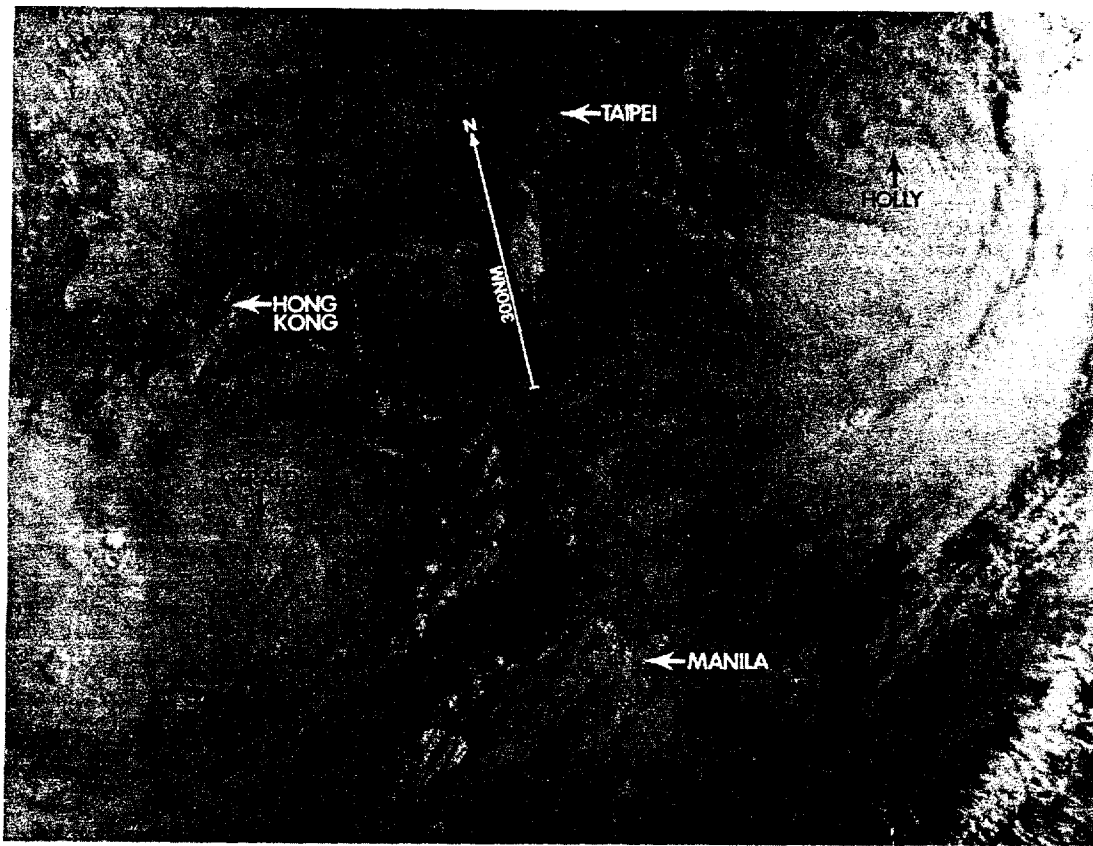


Figure 3-10-2. Tropical Storm Gerald and the developing Typhoon Holly near the time of their closest point of approach. At this time they were approximately 800 nm (1482 km) apart (172327Z August NOAA visual imagery).

Forecasting Gerald's movement proved to be difficult. Initially most forecast aids and JTWC's official forecast aid called for the storm to move northwest and make landfall over China. However, as Holly intensified and moved west Gerald slowed its westward movement, doing a small cyclonic loop early on the 17th. When Gerald slowed and moved to the south, the forecast scenario changed and called for Gerald to remain quasi-stationary for twelve to twenty-four hours, and then move slowly northeast under the influence of the inflow pattern of the developing Typhoon Holly. Figure 3-10-2 shows Tropical Storm Gerald and the developing Typhoon Holly near their closest point of approach. However, after completing its loop, Gerald once again resumed its westward course as Holly turned to the northwest.

Starting at 191800Z, Gerald turned to the northeast as the very large mid-level circulation of Typhoon Holly, now located

in the East China Sea, again affected Gerald. Accompanying this turn to the northeast was a decrease in the convection as the shearing increased. This began a weakening trend which continued until dissipation.

Gerald accelerated to the northeast and weakened making landfall at 210400Z approximately 50 nm (93 km) east-northeast of Hong Kong (WMO 45005). The closest point of approach to Hong Kong was at 210100Z when Gerald passed 30 nm (56 km) to the southeast.

After making landfall, Gerald turned to the north and weakened rapidly as Holly's influence decreased. Reports from the coastal stations along southern China indicated winds of 20 to 30 kt (10 to 15 m/s) accompanied Gerald as it made landfall. There were no reports of damages as Gerald moved inland over China and dissipated.

TYPHOON HOLLY

BEST TRACK TC-11W

16 AUG-22 AUG 1984

MAX SFC WIND 75 KTS

MINIMUM SLP 963 MBS

LEGEND

06 HOUR BEST TRACK POSIT

A SPEED OF MOVEMENT

B INTENSITY

C POSITION AT XX/0000Z

... TROPICAL DISTURBANCE

... TROPICAL DEPRESSION

--- TYPHOON

◇ SUPER TYPHOON START

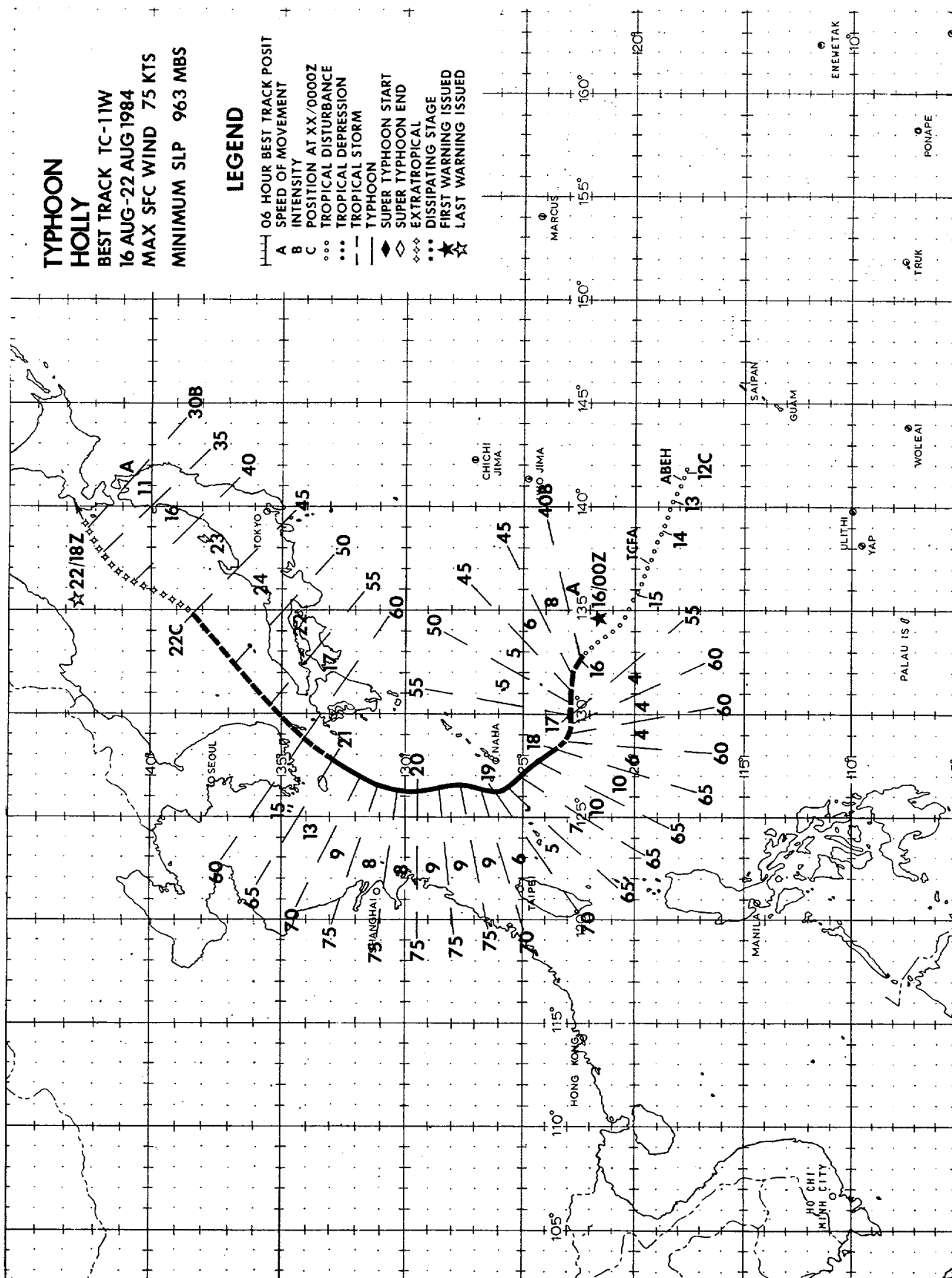
◇◇ SUPER TYPHOON END

◇◇◇ EXTRATROPICAL

... DISSIPATING STAGE

★ FIRST WARNING ISSUED

★ LAST WARNING ISSUED



TYPHOON HOLLY (11W)

Typhoon Holly formed in the eastern extension of the monsoon trough at the same time that Tropical Storm Gerald was forming in the South China Sea. It was the fourth significant tropical cyclone to develop in the trough in less than two weeks. Holly was unusual in that it never was, by definition, a tropical depression. Because it evolved from a very active monsoon trough, Holly was already at tropical storm strength when it finally attained a closed circulation. Despite only reaching a maximum intensity of 75 kt (39 m/s), Holly significantly affected much of the western North Pacific due to its large wind field.

Even as Tropical Depression 09W was transiting the Luzon Straits, synoptic data indicated that a very active trough with poorly organized convection persisted to the east. At 131200Z the monsoon trough extended from the weakening Tropical Depression 09W eastward to just northwest of Guam. By 141200Z the eastern end of the trough had moved northwest and become sharper. Synoptic data indicated the trough had deepened with an MSLP near 1000 mb. Numerous 20 to 35 kt (10 to 18 m/s) ship reports existed south of the trough axis in the active southwest monsoon. Organization of the convection over the trough also improved during this period, and suggested that a surface circulation was forming. These developments prompted the issuance of the first of two TCFAs at 141515Z.

The first aircraft reconnaissance mission into the disturbance at 0000Z on the

15th found only a sharp trough with 25 kt (13 m/s) surface winds and an MSLP of 998 mb. At 151200Z synoptic data indicated that the southwest monsoon along with a tight pressure gradient between the monsoon trough and the subtropical ridge to the northeast, were now generating gale force winds both north and south of the trough axis. This occurred before any closed circulation was analyzed. These areas of gale force winds were contained in a NAVOCEANCOMCEN Guam (WWPN PGTW) extratropical wind warning bulletin.

The second aircraft investigative mission into the disturbance closed-off a circulation center at 160225Z and found that the MSLP had decreased to 992 mb. Gale force winds were observed within two degrees of the center. The first warning, valid at 160000Z, was issued shortly thereafter with Holly at tropical storm strength.

Determination of the initial intensities of Holly and its associated 30 kt (15 m/s) wind radii were difficult since the gale force monsoon flow extended for hundreds of miles to the south and east of the storm. At first, the monsoon flow was included as a gale area in the NAVOCEANCOMCEN Guam extratropical wind warnings. However, as Holly developed, it took the monsoon flow into its circulation and subsequently became a very large storm. Figure 3-11-1, the 180600Z surface analysis, shows the very large area influenced by Holly. Aircraft and satellite data also indicated that Holly was abnormally large.

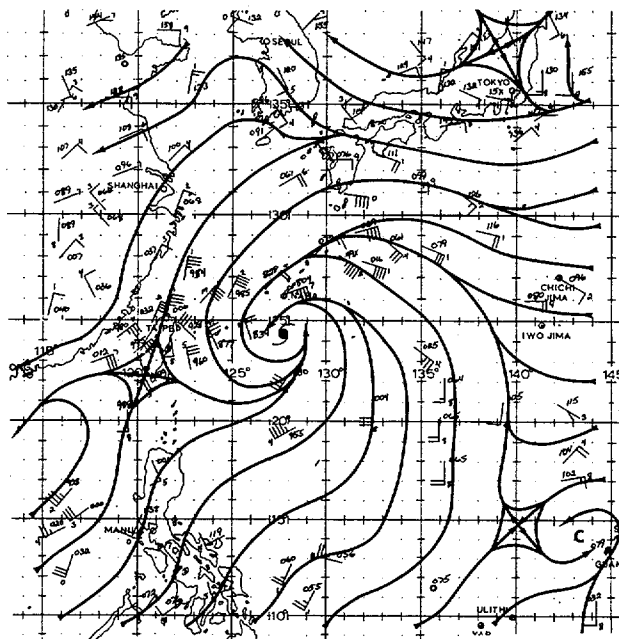


Figure 3-11-1. Surface analysis at 180600Z showing the large circulation of Typhoon Holly. Holly was still consolidating the monsoonal flow into its circulation at this time.

Figure 3-11-2 shows the wind field associated with Holly as reported by reconnaissance aircraft on 18 August. This flight was representative of the data obtained on many of the missions while Holly was a typhoon. The center was characterized by a large area of lighter winds. It was not until the aircraft was more than 60 nm (111 km) from the center that it encountered winds above 50 kt (26 m/s). Generally throughout the life of Holly, the highest winds were found in a band 60 to 150 nm (111 to 278 km) from the center. Within this band, the strongest winds were usually observed in the northern and eastern portions of the storm. The winds observed at Kadena AB, Okinawa confirmed the aircraft reports. The strongest winds observed at Kadena were

in two different periods: from 171300Z to 180900Z and from 190200Z to 191700Z when gusts above 50 kt (26 m/s) were reported. Lighter winds, corresponding to the passage of the huge center, were reported between these periods. The maximum sustained wind reported at Kadena was 50 kt (26 m/s) at 191355Z with a peak gust to 72 kt (37 m/s) at 190850Z. Fortunately, despite the strong winds and the 16.76 in (425 mm) of rain, there were no deaths or serious damage reported on Kadena AB. However, some 16,000 air and ferry travelers were stranded on the island during Holly's passage. Figure 3-11-3 shows Holly as it passed west of Okinawa. Notice the very large area covered by Holly's circulation.

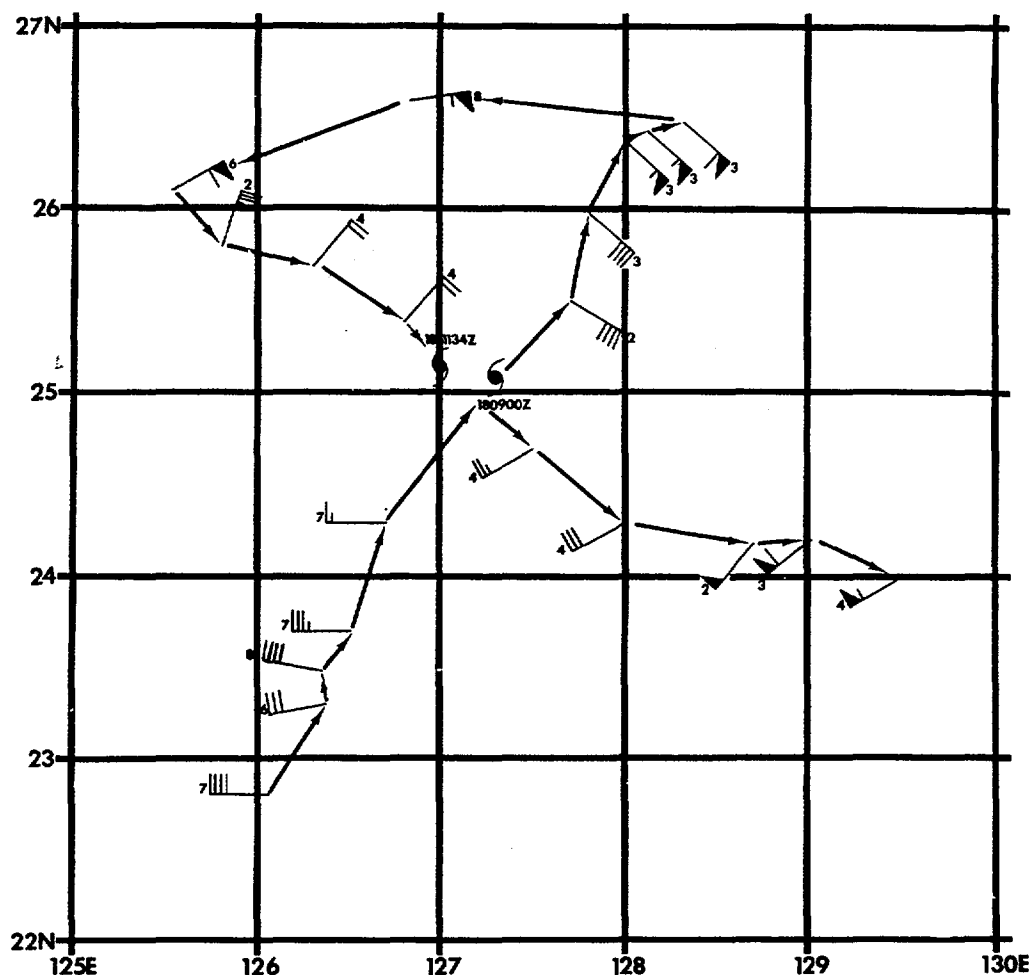


Figure 3-11-2. Plot of aircraft reconnaissance data from the seventh mission into Typhoon Holly. Holly's center was fixed at 180900Z and 181134Z August. Wind barbs are the measured 700 mb winds. The tens digit in the wind direction is plotted with the wind barb.

Holly initially moved to the west under the influence of the subtropical ridge, reaching typhoon intensity at 180000Z. At that time Holly had turned to the northwest, a course it maintained for almost 30 hours. After passing west of Okinawa, Holly turned to the north as it moved around the western periphery of the weakening subtropical ridge. Holly plodded to the north for the next twenty-four hours with no significant intensity changes. At this point the westerlies began to influence the storm. Holly was steered to the northeast and began to accelerate. Holly's forward speed peaked at 24 kt (49 km/hr) just prior to its transition to an extratropical low.

As Holly passed through the Korean Strait, it inflicted considerable damage on the Korean peninsula and the Japanese Island of Kyushu. News reports indicated at least one person killed, nine missing and eleven injured. Property damage was estimated initially at one million dollars. Heavy rainfall accompanied the storm. Miyazake (WMO 47830) on Kyushu recorded 15 inches (381 mm) of rain during a twenty-four hour

period. Extensive flooding and landslides were also reported.

Holly weakened as it transited the Korean Strait due to interaction with the rugged terrain. As Holly entered the Sea of Japan, it began transitioning to an extratropical system. Figure 3-11-4 shows Holly shortly after completing the extratropical transition. What little convection remains is associated with the front while the exposed low-level circulation is composed of stable stratocumulus clouds. The final warning was issued at 221800Z as Holly neared the island of Hokkaido.

Overall, the JTWC forecasts on Typhoon Holly provided good decision assistance to JTWC's customers. Kadena AB was provided the time needed to evacuate its planes, and South Korea and Japan had sufficient warning time to prepare and thus minimize damage. Even though Holly was not one of the strongest storms of the season, it definitely had a major impact on much of the northwest Pacific.



Figure 3-11-3. Typhoon Holly passing just west of Okinawa. Notice the large area covered by Holly's circulation (182303Z August NOAA visual imagery).



Figure 3-11-4. Holly after completing its extratropical transition. The low-level center is surrounded by stable stratocumulus clouds. What little convection remains is located southeast of the center and is due to the frontal system and orographic affects (220526Z August NOAA visual imagery).

TROPICAL DEPRESSION 12W

BEST TRACK TC-12W

24 AUG-25 AUG 1984

MAX SFC WIND 20 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

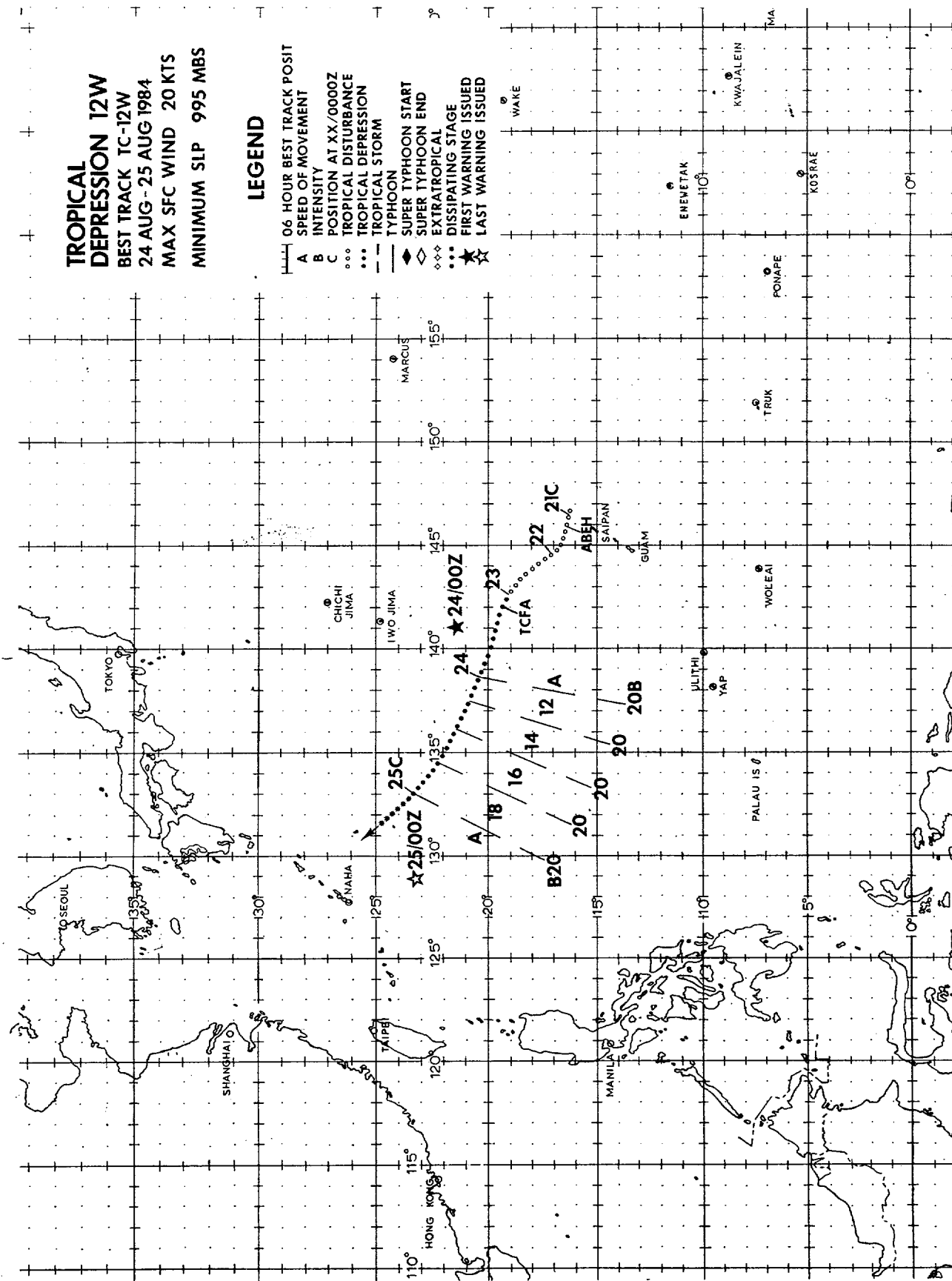
◇ SUPER TYPHOON END

◇◇◇ EXTRATROPICAL

... DISSIPATING STAGE

★ FIRST WARNING ISSUED

☆ LAST WARNING ISSUED



TROPICAL DEPRESSION (12W)

Tropical Depression 12W developed in the eastern periphery of the monsoon trough, a favorable position for development, but had a very brief existence. Although this system was located in an area of highly convergent low-level flow, the upper-level support, while initially favorable for development was unable to maintain itself and contributed to the depression's dissipation. The combination of a weak low-level circulation and ill-defined mid and upper-level features made satellite fixing difficult, resulting in a wide disparity between fixes. Aircraft reconnaissance also experienced difficulty in fixing this weak system.

The southwest monsoon was slow to re-develop in the wake of Typhoon Holly. Late on 20 August, with a broad trough extending across the northern Philippine Sea, an area of convection began to develop at the eastern end of the trough just to the north of Guam. Synoptic data at 210000Z indicated that a weak 1011 mb closed circulation had formed approximately 200 nm (370 km) north-northeast of Guam. These developments prompted a discussion of the disturbance in the 210600Z Significant Tropical Weather Advisory (ABEH PGTW). The disturbance tracked generally to the northwest during the next two days, and slowly consolidated.

Satellite imagery at 230000Z showed that the disturbance was separating from the trough. Dvorak satellite intensity analysis estimated that surface winds of 25 kt (13 m/s) were now associated with the system. The first aircraft reconnaissance mission was already underway, but could only find a broad weak circulation. No winds greater than 20 kt (10 m/s) were observed. During this time, a weak, upper-level anticyclone developed over the convection. Its development was aided by a TUTT cell located approximately 6 degrees to the west which provided good divergence aloft. These factors contributed to the issuance of a TCFA at 230500Z.

During the following 18 hours the disturbance showed little change. An aircraft reconnaissance mission the next morning fixed a broad wind and pressure center, with an MSLP of 999 mb. Once again no winds greater than 20 kt (10 m/s) were observed within 250 nm (463 km) of the center. Dvorak satellite intensity estimates now indicated that maximum sustained winds of 30 kt (15 m/s) were present and forecasted 35 kt (18 m/s) winds in 24 hours. Synoptic data revealed that 30 kt (15 m/s) winds were indeed present, but they were located approximately 250 nm (463 km) northeast of the disturbance's center, and were associated with the tight pressure gradient between the subtropical ridge located north of Marcus Island (Minami Tori-Shima (WMO 47991)) and the disturbance. However, upper-level support remained favorable for some intensification which meant that the disturbance would pose a threat within 36 hours to the military and civilian populations on the Ryukyu Islands. Accordingly, the first warning on Tropical Depression 12W was issued at 240000Z.

The favorable upper-level support proved to be short-lived. Visual satellite imagery at first light the next morning (Figure 3-12-1) revealed an exposed low-level circulation with the associated convective activity displaced several hundred miles to the north. Upper-level synoptic data indicated the TUTT cell had moved northwest to near Taiwan, and the convection had sheared to the north, remaining in the divergent region east of the TUTT cell. There was no longer any evidence of an upper-level anticyclone over the depression. The upper-level flow pattern over Tropical Depression 12W was now dominated by 30 to 50 kt (15 to 26 m/s) easterly winds from a large anticyclone which had been present near Japan for several days. This flow was sufficient to prevent the redevelopment of any significant convection near the low-level circulation center. With further development now

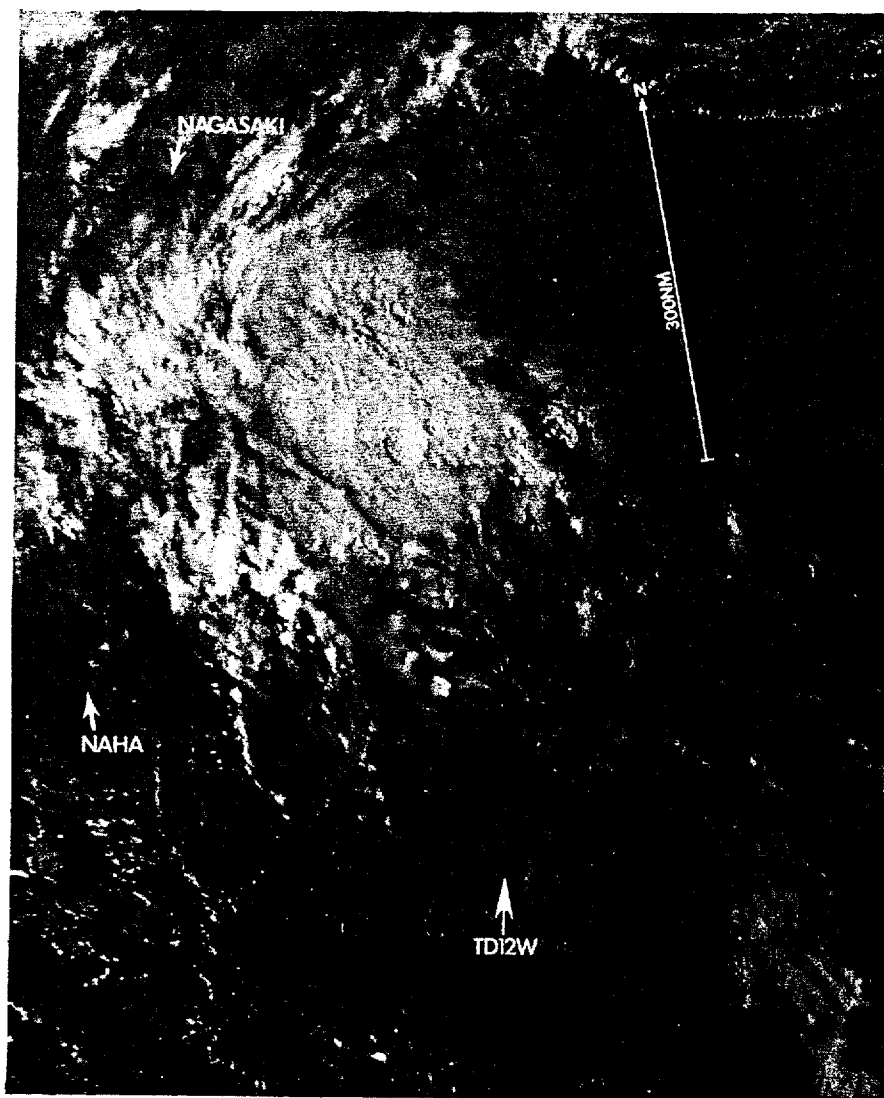


Figure 3-12-1. Exposed low-level circulation of Tropical Depression 12W. The convection which was colocated with the low-level circulation 24 hours earlier is now displaced to the north (242219Z August NOAA visual imagery).

unlikely, the final warning was issued at 0000Z on the 25th.

There were a total of four aircraft reconnaissance missions flown into this system, but only two could fix a center, and both of these had large meteorological and navigational errors. The maximum surface or 1500 ft (457 m) winds found within 200 nm (320 km) of the center were 20 kt (10 m/s). The minimum sea-level pressure found by aircraft was 995 mb at 240708Z which could support 35 kt (18 m/s) winds according to

Atkinson and Holliday (1977). However, no such winds were observed with Tropical Depression 12W.

The exposed low-level circulation, completely void of convection, was tracked northwest after the final warning was issued with 15 to 20 kt (8 to 10 m/s) winds and pressures near 1000 mb being reported. This circulation crossed the Ryukyu Islands near Okinawa before merging with a weak mid-latitude front in the northern East China Sea late on 26 August.

IKE

**BEST TRACK TC-13W
27 AUG-06 SEPT 1984
MAX SFC WIND 125 KTS
MINIMUM SLP 947 MBS**



06 HOUR BEST TRACK POSIT

A SPEED OF MOVEMENT

B INTENSITY

POSITION AT XX/0000Z
TROPICAL DISTURBANCE

●● TROPICAL DEPRESSION

--- — TROPICAL STORM

— TYPHOON
— SUPER TYPHOON START

 SUPER TYPHOON 31AR
 SUPER TYPHOON END

◆◆ EXTRATROPICAL

... DISSIPATING STAGE

★ ☆ FIRST WARNING ISSUE
★ ☆ LAST WARNING ISSUE

TYPHOON IKE (13W)

The deadliest typhoon to strike the Philippines this century began innocently enough as a weak disturbance on the eastern end of the monsoon trough. After passing Guam as a developing tropical storm, Ike turned to the west-southwest and gradually intensified. Four days later, Ike attained an intensity of 125 kt (64 m/s) and crossed the central Philippines causing extensive damage and over 2000 deaths. After wrecking havoc on the Philippines, a weakened Ike moved into the South China Sea where it reintensified to 115 kt (59 m/s) before making landfall and finally dissipating over mainland China.

As early as 21 August, a weak surface circulation was being analyzed southeast of Guam on the eastern extension of the monsoon trough. From the 21st through the 25th, various Trust Territory of the Pacific Islands reporting stations and ship observations indicated that a weak 1009 mb low persisted in this area. The lack of development of this circulation during this period was attributed to the strong winds aloft from the same anticyclone that sheared Tropical Depression 12W.

Late on the 25th the upper-level shearing began to decrease. This resulted in a rapid increase in the convection over the low-level circulation center. By 260000Z the disturbance, which was to develop into Ike, began to show continuity. Synoptic data at 261200Z indicated the disturbance was intensifying with 20 to 35 kt (10 to 18 m/s) winds being reported on the southern periphery of the circulation center. The MSLP of the disturbance was estimated to be near 1006 mb.

At 2100Z on the 26th, a TCFA was issued based on the earlier mentioned synoptic reports and satellite imagery which showed rapid development of a compact circulation (Figure 3-13-1). Due to the persistent improvement in organization and the proximity of the disturbance to Guam, the first warning on Ike was issued a few hours later at 270000Z.

The initial forecast track called for Ike to move to the northwest. This forecast was based on persistence and the One-Way Interactive Tropical Cyclone Model (OTCM), the best forecast aid currently available to the Joint Typhoon Warning Center. Based on the location of the system and the forecast track, Guam was placed in Condition of Readiness III at 270530Z. This was the first time since 1 December 1982 that Guam had been in other than Condition of Readiness IV. (At that time Typhoon Pamela was approaching from the east.)

The first aircraft reconnaissance flight into Ike fixed the center at 270510Z approximately 120 nm (222 km) south of Guam with an MSLP of 997 mb and estimated the maximum surface winds at 35 kt (18 m/s). Ike continued moving to the northwest at a speed of 7 to 9 kt (13 to 17 km/hr) during the next 24 hours and intensified. The storm remained compact as it passed 90 nm (167 km) southwest of Guam. At its closest point of approach to Guam, Ike supported winds of 50 to 60 kt (26 to 31 m/s) but due to the compact circulation, Guam suffered no ill effects from the storm. The Naval Oceanography Command Center (NAVOCEANCOMCEN) on Nimitz Hill recorded only 15 kt (8 m/s) sustained winds with a peak gust to 21 kt (11 m/s) during Ike's passage. Guam returned to Condition of Readiness IV at 272130Z based on the 271800Z warning position and forecast track.

After passing to the southwest of Guam, Ike continued tracking to the northwest for the next 12 hours. At approximately 0600Z on the 28th, Ike reached the northern most latitude it would attain in the Philippine Sea. At that time Ike was located 160 nm (296 km) due west of Guam. For the next four days Ike would track towards the Philippines on a west-southwest course.



Figure 3-13-1. Early morning picture of Ike at the time the TCFA was issued. A developing upper-level anticyclone is providing good outflow channels to the south and west [262131Z August NOAA visual imagery].

This change in track was due to the effects of the subtropical ridge south of Japan. From the 26th to the 28th, this ridge was orientated from east to west. However, as Tropical Storm June (which developed over the western Philippine Sea on 28 August) moved westward, the ridge built south in June's wake and took on a more north-south orientation. This forced Ike on a generally west-southwest course until it neared the central Philippines. Between 271800Z and 281800Z, Ike did not increase in intensity due to strong shearing of the convection from the north.

Late on the 28th, the shearing decreased slightly which allowed Ike to intensify to typhoon strength. During this intensification the Atkinson and Holliday (1977) pressure-wind relationship did not hold. For example, at 282341Z aircraft reconnaissance reported surface and flight level winds of 75 kt (39 m/s), yet the MSLP was only 991 mb. This would normally be expected to support winds of 45 kt (23 m/s), some 30 kt (15 m/s) less than what was being observed. After moving almost due west for 12 hours, Ike again turned to the southwest. During this time Ike weakened to below typhoon force due to the persistent strong shearing aloft. However, this weakening was to be temporary.

As Ike turned more to the west on the 30th, the upper-level anticyclone over Ike redeveloped and the weakening trend ceased. By 301200Z Ike had regained typhoon intensity. During this second intensification

period the pressure-wind relationships were in better agreement. At 302310Z aircraft reconnaissance found the MSLP had decreased to 971 mb and reported 700 mb flight level winds of 65 kt (33 m/s). This was in much better agreement with the 70 kt (36 m/s) winds expected by Atkinson and Holliday (1977). During this second intensification, Ike's circulation became larger - more typical of a WESTPAC typhoon.

For the next two days Ike tracked toward the central Philippines at an average speed of 12 kt (22 km/hr) and doubled in intensity. Figure 3-13-2 shows Ike as it neared the Philippines. On the 1st of September just prior to hitting the Philippines, the last aircraft reconnaissance flight was made. The lowest MSLP found was 947 mb at 010845Z and 700 mb flight level winds of 117 kt (60 m/s) were measured in the eyewall of a 25 nm (46 km) circular eye. The maximum surface winds were estimated at 120 to 130 kt (62 to 67 m/s).

For the next 30 hours Ike cut a path of death and destruction across the central Philippine Islands that is unequalled in recent history (Figure 3-13-3). In the wake of its path, Ike left a reported 1026 people dead, with 1147 people missing and presumed dead. Published figures for the number of people left homeless in the central Philippines range from 200,000 to 480,000. The worst hit region was the Surigao del Norte Province of Northern Mindanao where approximately 1000 people died (Figure 3-13-4).

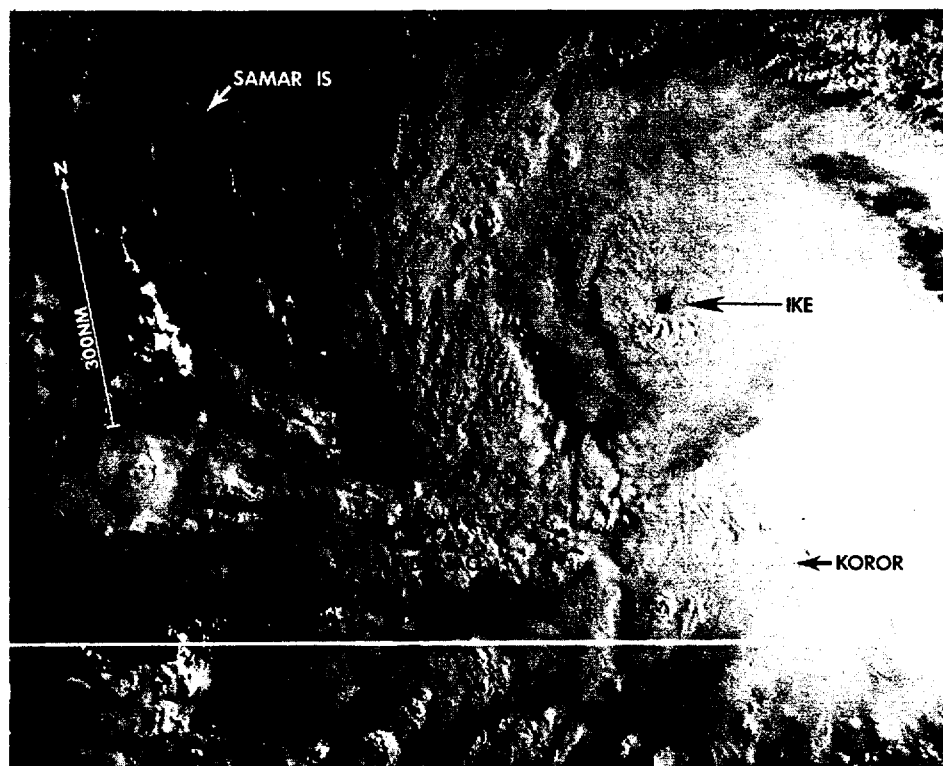


Figure 3-13-2. Typhoon Ike intensifying as it nears the Philippines. At this time Ike was supporting winds of about 105 kt (54 m/s) (312252Z August NOAA visual imagery).

Ike tracked to the west-northwest and then to the northwest at an average speed of 11 kt (20 km/hr) as it crossed the Philippines and weakened. At 0000Z on the 3rd of September Ike had weakened to 45 kt (23 m/s). Ike quickly reintensified as it moved into the South China Sea attaining typhoon intensity by 031200Z. Aircraft reconnaissance penetrating the 30 nm (56 km) wide eye at 030843Z found 65 kt (33 m/s) winds at the surface and 68 kt (35 m/s) winds at 700 mb. Ike continued to track steadily to the northwest at 12 to 13 kt (22 to 24 km/hr) reaching an intensity of 115 kt (59 m/s) at 041800Z. Ike gradually lost intensity from this point on, due to the proximity of land restricting the inflow, and shearing from a trough passing to the north.

Ike transited across Hainan Island on 5 September still packing winds of 70 to 80 kt (36 to 41 m/s). Shortly after 0000Z on the 6th, Ike crossed the coast of mainland China, as a tropical storm, approximately 60 nm (111 km) south-southeast of Nan-Ning (WMO 59431). News reports indicate Ike was responsible for at least 13 deaths in China. Extensive flooding and crop damage were also reported as Ike moved inland and dissipated.



Figure 3-13-3. Ike as it crossed the central Philippines. At this time Ike was supporting winds of about 90 kt (46 m/s) (020141Z September DMSP visual imagery).



Figure 3-13-4. Aerial reconnaissance photo of a town in Northern Mindanao showing some of the damage caused by Typhoon Ike. (Photo provided by CDR M. McCallister, Naval Oceanography Command Facility, Cubi Point).

BEST TRACK TC-14W
28 AUG-30 AUG 1984
MAX SFC WIND 60 KTS
MINIMUM SLP 983 MBS

06 HOUR BEST TRACK POSITION	
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 JUNE (14W)

Tropical Storm June, the last of seven significant tropical cyclones to develop during August, originated in the monsoon trough like most of the other storms before it. June would also be typical of several other storms during the month, in that the most difficult part of warning on the system would be in locating the actual surface center.

Even as the final warning was being issued on the exposed low-level circulation of Tropical Depression 12W, satellite imagery indicated a large area of convection persisted further south over the active monsoon trough (Figure 3-14-1). At 1200Z on the 25th of August, synoptic data indicated a closed 1000 mb circulation had formed in the trough. During the next two days this circulation drifted westward as the associated convection tried to consolidate. Strong upper-level shearing, from the same anticyclone which sheared Tropical Depression 12W, inhibited development on the 25th and 26th. But early on the 27th, an upper-level anticyclone began to form over the disturbance making conditions more favorable for development. Although synoptic data clearly indicated a surface circulation was present during this time, the low-level center was not consistently locatable on satellite imagery within the broad area of convection. This problem would plague JTWC throughout the life of Tropical Storm June.

The first aircraft reconnaissance mission into the disturbance at 270651Z found a closed 30 kt (15 m/s) circulation with a light and variable wind center 50 nm (93 km) in diameter. Based on this information and indications from satellite imagery that the convection was becoming more organized, a TCFA was issued at 270800Z. As typical with most monsoon disturbances, the strongest winds were observed south of the circulation center and associated with the southwest monsoon.

During the following 18 hours, synoptic data indicated the disturbance continued to intensify. However, the convection failed to show the expected increase in organization. During much of this time satellite imagery actually indicated multiple circulation centers were present! Although JTWC wanted to go to warning status on this disturbance as early as 271200Z, the inability to accurately position the surface center made this impossible. The area of gale force winds, however, were covered in the NAVOCEANCOMCEN Guam, extratropical wind warning bulletin (WWPN PGFW).

Between 280000Z and 280600Z the disturbance finally consolidated into a single circulation center (Figure 3-14-2). Aircraft and satellite fixes now began to consistently agree on the location of that center. This prompted the issuance of the first warning on June as a tropical storm at 280600Z.

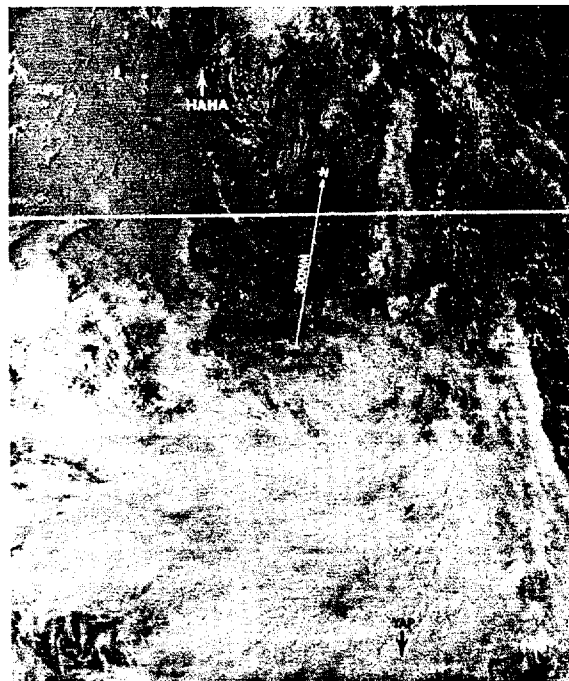


Figure 3-14-1. Active area of convection in the northern Philippine Sea associated with the southwest monsoon which would later develop into Tropical Storm June. Note the exposed low-level circulation further north which is the remnants of Tropical Depression 12W (250630Z August NOAA visual imagery).

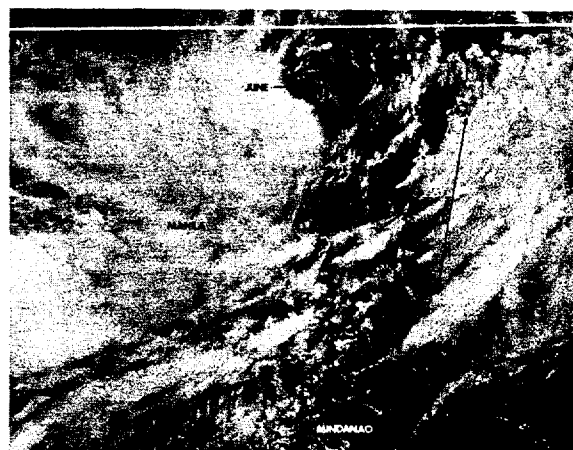


Figure 3-14-2. The developing Tropical Storm June east of the Philippines. At this time June was consolidating about a single circulation center (280734Z August NOAA visual imagery).

At the time of the first warning, Tropical Storm June was located 110 nm (204 km) east of Luzon. June was a broad circulation with the strongest winds in a band 60 to 150 nm (111 to 278 km) from the center. During the next 12 hours June headed west steered by the flow along the south side of a mid to low-level subtropical ridge. The storm made landfall on the east coast of northern Luzon at about 281500Z.

After landfall synoptic data indicated the surface circulation of June apparently

tracked to the west-northwest following the low-level terrain over northern Luzon and re-emerged on the northwest coast at approximately 290000Z. However, the mid-level circulation and nearly all of the convection continued to move almost due west. Since the passage over Luzon occurred at night when only infrared imagery was available, accurate positioning of the low-level center from satellite imagery was impossible.

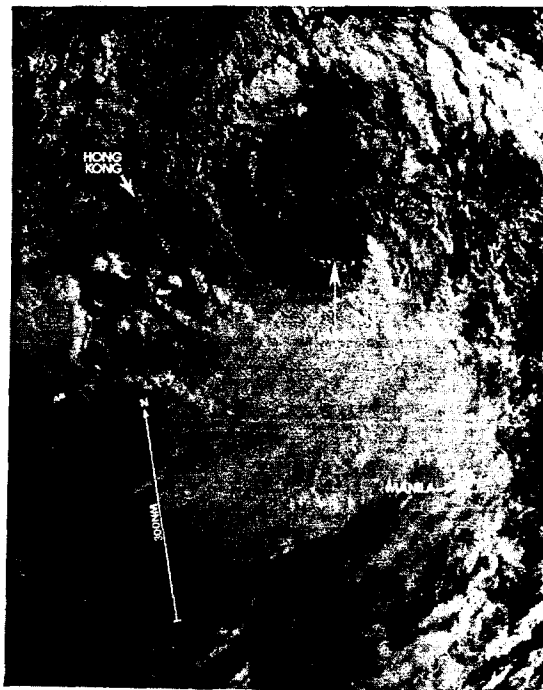
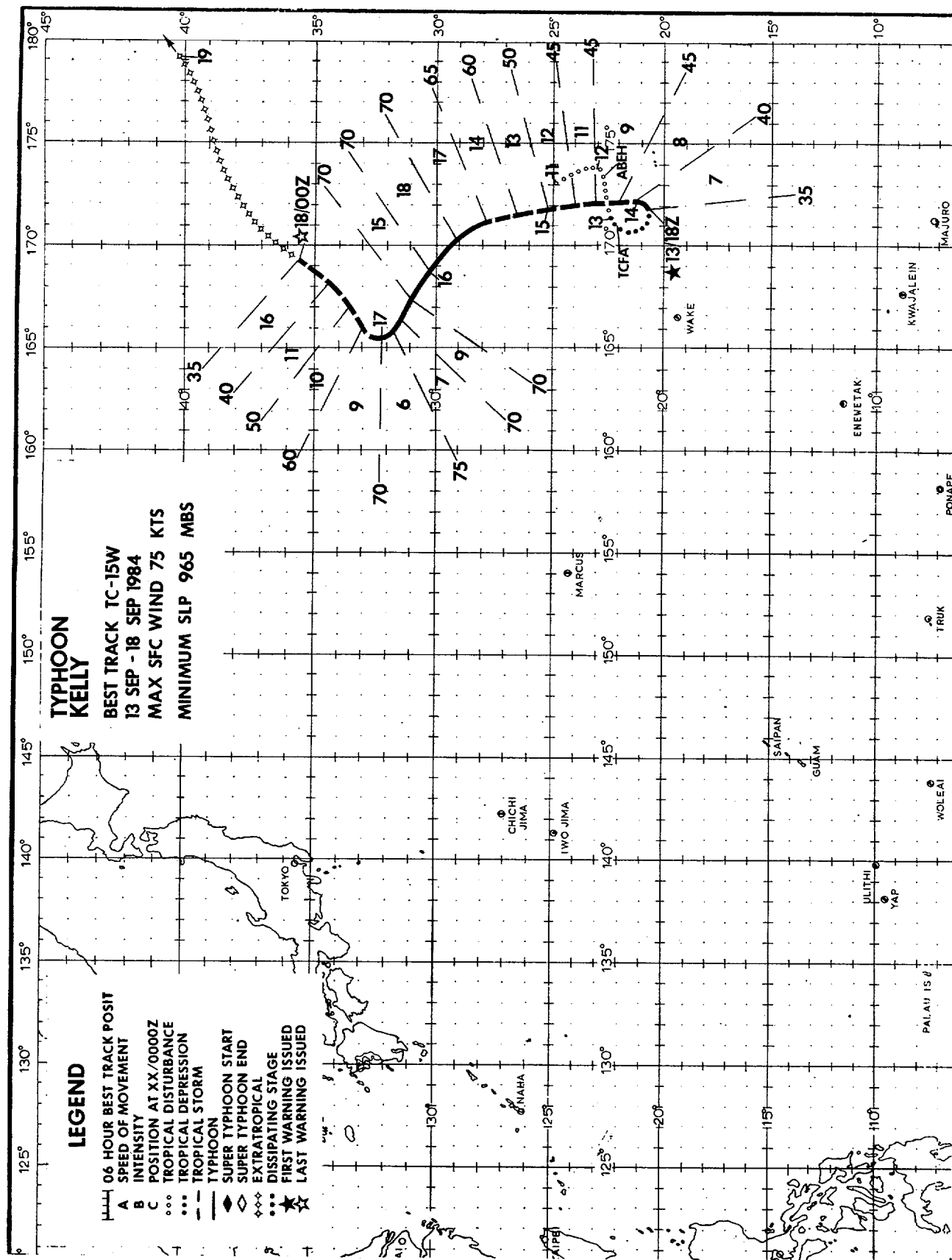


Figure 3-14-3. Tropical Storm June in the northern South China Sea. The broad surface circulation is located north of the convection. This is one of the few times that satellite imagery would be able to accurately fix the low-level circulation of June as it transited the South China Sea (292340Z NOAA visual imagery).

As June emerged in the northern South China Sea a mid-latitude trough moved across eastern China and weakened the subtropical ridge. This allowed June to turn to the northwest. June made landfall at approximately 301700Z on the coast of mainland China 130 nm (241 km) east of Hong Kong (WMO 45005). Although June did intensify to 60 kt (31 m/s) as it transitted the northern South China Sea, the storm remained poorly organized (Figure 3-14-3). During this time aircraft and radar were the only accurate and consistent means of locating the circulation center.

Tropical Storm June was the first named

tropical cyclone of the 1984 season to directly strike the Philippines. Heavy rains from the combination of June and the southwest monsoon caused extensive flooding throughout much of Luzon, particularly along the west coast and in river valleys. At least 67 deaths were attributed to the storm. The deaths resulted primarily from heavy rains, flooding and the accompanying landslides. In addition to extensive damage to crops and vegetation, over 25,000 families lost their homes. However, despite the considerable damage caused by June, it was relatively minor compared to the death and destruction Typhoon Ike brought to the central Philippines only four days later.



TYPHOON KELLY (15W)

Typhoon Kelly was quite representative of the first half of the 1984 season which was characterized by numerous high latitude, fast-moving systems. This typhoon developed at the southern end of a shear line and displayed some erratic movement during its formative stages before accelerating to the north-northwest towards a mid-level cut-off low. During the last phase of its life, Kelly recurved very sharply to the northeast and transitioned into an extratropical system.

During the first week of September, a strong frontal system moved across the North Pacific Ocean and left in its wake a quasi-stationary shear line extending between 20N 170E and 35N 180E. On 11 September the southern portion of the shear line became detached and began to take on tropical characteristics.

During the next two days the disturbance slowly developed as the associated convection increased in organization. At 0000Z on the 13th, an exposed low-level circulation was observed on satellite imagery west-northwest of the main convection. Dvorak intensity analysis of the 130000Z imagery estimated that 30 kt (15 m/s) surface winds were present near the center. Sparse synoptic data indicated a 20 to 25 kt (10 to 13 m/s) circulation was present. Based on this information, a TCFA was issued at 130435Z and an aircraft investigative mission was requested for the following morning. Throughout the evening the system continued to develop with the convection showing a

considerable increase in organization. This prompted the issuance of the first warning at 131800Z. While this was occurring in the south, a mid-level cold core low was developing further north on the northern remnants of the shear line. This cut-off low and the mid-latitude westerlies just north of it would be the principal steering mechanisms for Kelly.

As long as Kelly stayed below tropical storm strength it moved slowly. Satellite fixes on the 13th indicated Kelly moved in a cyclonic loop about its point of origin. However, after it became a named storm, Kelly accelerated to the north and eventually to the northwest as it was caught in the southerlies between the mid-Pacific high and the inflow pattern about the cut-off low. Because of its relatively high latitude, Kelly entrained cold air into its circulation almost from the start, and was slow to intensify. By 141800Z there was a noticeable "dry slot" forming and the storm took on a north-south orientation (Figure 3-15-1).

As Kelly approached the cold low (Figure 3-15-2) it slowed and reached maximum intensity. Then suddenly, under the influence of the mid-latitude westerlies just to the north, it abruptly turned and accelerated to the northeast. Although JTWC forecasts indicated recurvature to the northeast would occur, it was not forecast to begin until Kelly reached 35N. It now appears the westerlies were located further south than Figure 3-15-2 indicates. Kelly



Figure 3-15-1. Kelly as an intensifying tropical storm. Kelly was accelerating to the north-northwest at this time (142259Z September DMSP visual imagery).

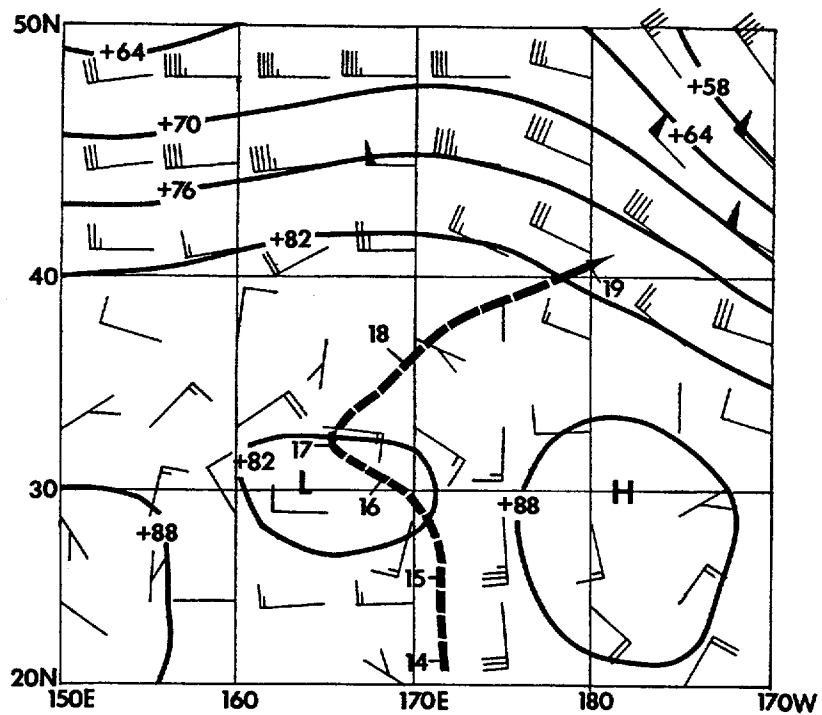


Figure 3-15-2. Mid-level tropospheric flow representative of the conditions present during the time Kelly was accelerating to the north and at the time of recurvature to the northeast. The simplified track of Typhoon Kelly is the dashed line (160000Z September 500 mb FNOC NOGAPS analysis).

weakened very rapidly after recurvature as the convection began to be sheared. By 171200Z the storm had started to lose its tropical characteristics.

In this phase, Kelly began to demonstrate intensity anomalies frequently observed in storms becoming extratropical. The low central pressures observed did not correspond well with the relatively weak winds found by aircraft reconnaissance. On

the other hand, since the central convection had nearly disappeared, the Dvorak intensity model estimated winds significantly lower than what was observed by aircraft. By 180000Z Kelly had completed its extratropical transition and the final warning was issued. The remnants of Kelly continued to the northeast and were locatable on satellite imagery until the 21st. By then the system was east of the International Dateline and moving into the Gulf of Alaska.

TROPICAL STORM LYNN (16W)

After Typhoon Ike moved inland over China early on 6 September, strong surface ridging from the subtropical ridge kept easterlies across much of the tropical Northwest Pacific. By mid-September, the ridging began to give way to the southwest monsoon. This helped set the stage for the development of Tropical Storm Lynn.

The disturbance that would eventually become Lynn was first noticed as an area of poorly organized convection near Guam on 19 September. During the following three days the area of convection moved west across the northern Philippine Sea with little development noted. The convection was apparently associated with a westward moving TUTT cell. As the TUTT cell weakened east of Luzon, divergence from an upper-level anticyclone north of Guam, which was ridging westward, maintained the convection. By the 22nd, a second upper-level anticyclone had developed just northeast of Luzon near the disturbance and the convection began to increase. During this entire time, surface synoptic data indicated only convergent easterly trades were present beneath the convection.

At 230000Z, the convection entered the South China Sea. At the same time, a lee side low-level cyclonic circulation formed in the monsoon trough just west of Luzon, apparently the result of persistent easterly flow across the mountainous terrain of northern Luzon. This provided the low-level circulation which would accelerate the development of Tropical Storm Lynn.

During the next several hours the disturbance rapidly consolidated. Ship reports indicated the surface circulation had 10 to 20 kt (5 to 10 m/s) winds with an MSLP estimated at 1003 mb. The associated convection showed a significant increase in development as it tried to organize near the low-level circulation. In addition, a cut-off low over southern China was enhancing the outflow from the anticyclone northeast of Luzon. Based on this collective information, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 231000Z to include this disturbance as a suspect area. The potential for significant tropical cyclone development was assessed as "fair".

During the next nine hours, the tropical disturbance continued to show signs of increased organization on satellite imagery. At 231800Z, imagery indicated that a central area of intense convection had formed. Synoptic data showed the disturbance now had winds of 20 to 30 kt (10 to 15 m/s). Based on these developments a TCFA was issued at 231900Z.

The first warning on Lynn as a tropical depression was issued at 240600Z when satellite imagery indicated that the convection was moving over the low-level circulation center and intensifying. The first few warnings forecast Lynn to slowly intensify and move to the west-northwest. This forecast track was based on guidance from the One-Way Interactive Tropical

Cyclone Model (OTCM). During the next 18 hours Lynn did intensify some, reaching tropical storm strength at 241800Z and peaking at 40 kt (21 m/s) at 250000Z. After that point in time, since Lynn had been moving slowly west-southwest away from the upper-level anticyclone northeast of Luzon, it lost its upper-level outflow and entered a shearing environment. This resulted in a displacement of the convection to the north of the low-level circulation center and the start of a weakening trend (Figure 3-16-1). In addition to the shearing, the enhancement of the anticyclonic outflow by the cut-off low over southern China had now ceased as the low dissipated at about 250000Z.

At 0600Z on the 25th, it was apparent that Lynn had become a sheared system and that no further intensification would likely occur. The closest convection was located more than 120 nm (222 km) to the northeast. Lynn was now expected to follow a west-southwest track along the northern periphery of the low-level monsoon trough until it dissipated over central Vietnam. Tropical Storm Lynn posed no further forecast problems after that except for the difficulty in positioning the exposed low-level circulation center at night.

During the twenty-four hours prior to landfall, Lynn did experience a flare-up of its convection. Synoptic data at 0000Z on the 27th showed that the upper-level anticyclone had reformed near Hainan Island and that the flow over Lynn had become weak but diffluent. Also possibly contributing to this convective flare-up prior to landfall was convergence of the low-level flow and orographic lifting; both caused by the mountainous terrain inland of the Vietnam coast. After making landfall 50 nm (93 km) southeast of Da Nang (WMO 48855) Lynn turned northwest dissipating along the Vietnam/Laos border after 271800Z. There were no reports of damage or injuries from Tropical Storm Lynn.

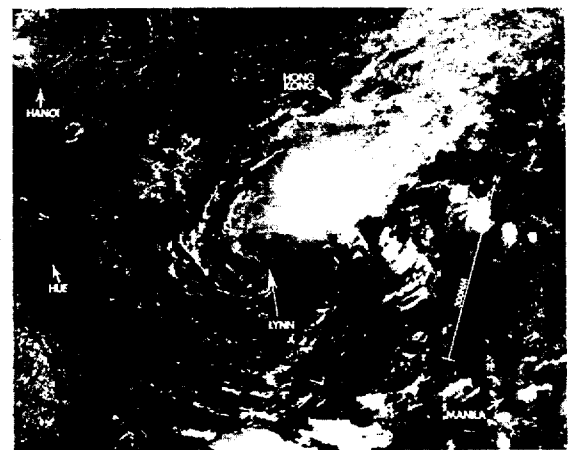


Figure 3-16-1. Tropical Storm Lynn being sheared. The exposed low-level circulation is southwest of the main convection (250223Z September DMSP visual imagery).

TROPICAL STORM MAURY

BEST TRACK TC-17W

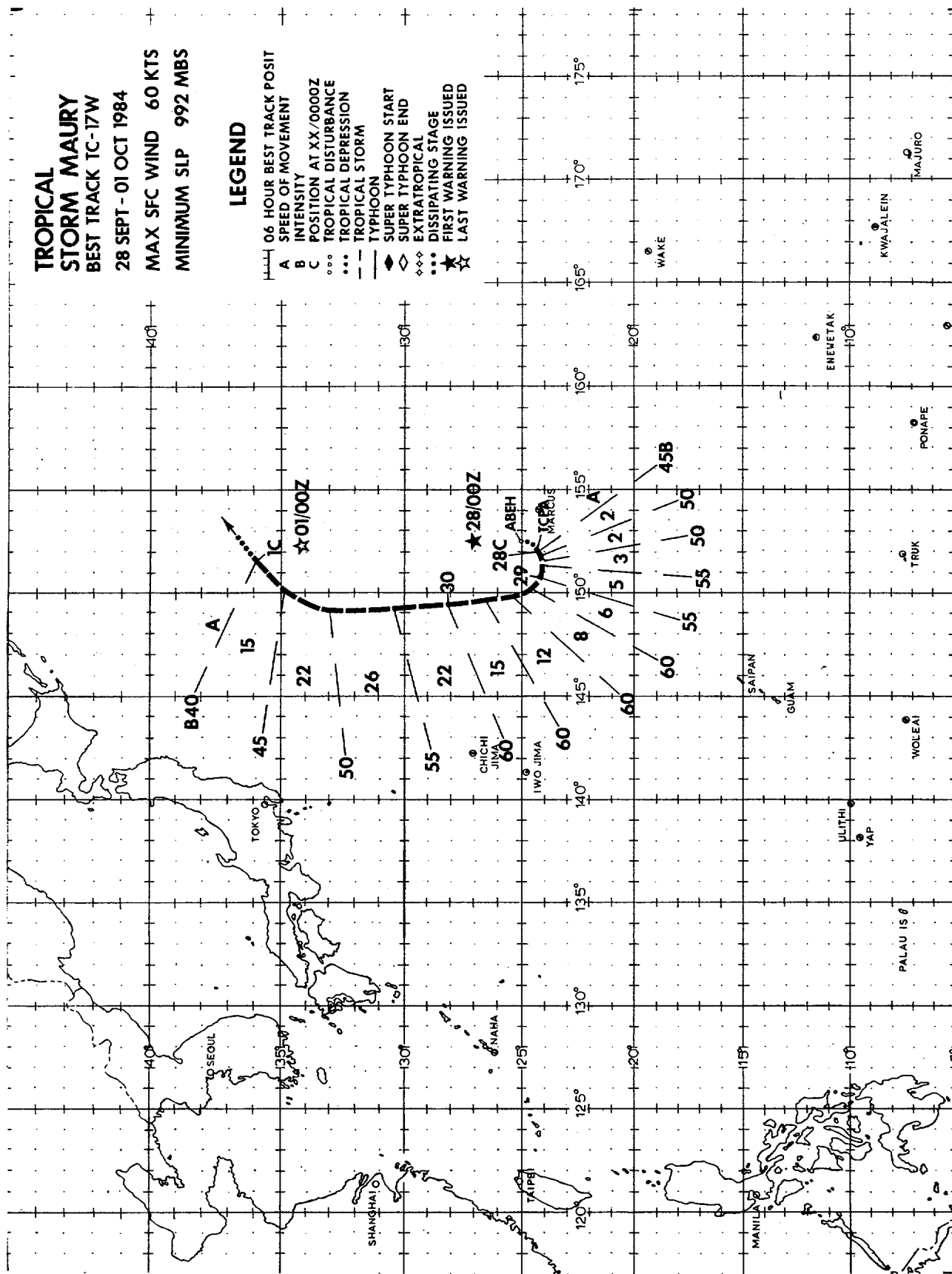
28 SEPT - 01 OCT 1984

MAX SFC WIND 60 KTS

MINIMUM SLP 992 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



TROPICAL STORM MAURY (17W)

During a four week period extending from the last week of September until the middle of October, a large amplitude long wave trough persisted in the western North Pacific. This trough weakened the subtropical ridge and displaced it to the east of its climatological position. As a result, tropical cyclones developing in the western North Pacific would accelerate to the north and recurve almost as soon as they developed. Tropical Storm Maury was the first of five storms to develop in the western North Pacific during this period. As would be the case with the four storms after it, Maury failed to show any significant westward movement prior to accelerating to the north and recurving.

Tropical Storm Maury formed near Marcus Island (Minami Tori-Shima (WMO 47991)) at approximately the same time that Tropical Storm Nina was developing some 700 nm (1296 km) to the west-southwest. Nina's proximity would ultimately have a significant influence on Maury's future.

Maury was originally detected early on 27 September as an area of developing convection on the northeast extension of the monsoon trough. Initially the trough was linked to the trailing end of a mid-latitude front and this may have supplied some low-level vorticity which aided in the

rapid development of the system.

The disturbance was first discussed on the 270600Z Significant Tropical Weather Advisory (ABEH PGTW) as one of several weak circulations embedded in the trough. During the next 10 hours it became evident that only two circulations would dominate. Consequently the ABEH was reissued at 271600Z to indicate this concern. These two circulations would soon develop into Maury and Nina respectively.

The disturbance continued to develop at a rapid pace; much faster than JTWC anticipated. Dvorak intensity analysis performed on the 271800Z imagery indicated that 25 kt (13 m/s) winds were present. The imagery over the area two hours later showed that a well-defined compact low-level circulation center had developed. Consequently, a TCFA was issued at 272300Z. At 272341Z, Dvorak analysis of Figure 3-17-1 indicated that 35 kt (18 m/s) winds were now present in this rapidly developing system. Based on the satellite intensity analysis, JTWC issued the first warning on Maury as a 35 kt (18 m/s) tropical storm at 280000Z. Synoptic data during this period was unable to shed any light on the true intensity of Maury.

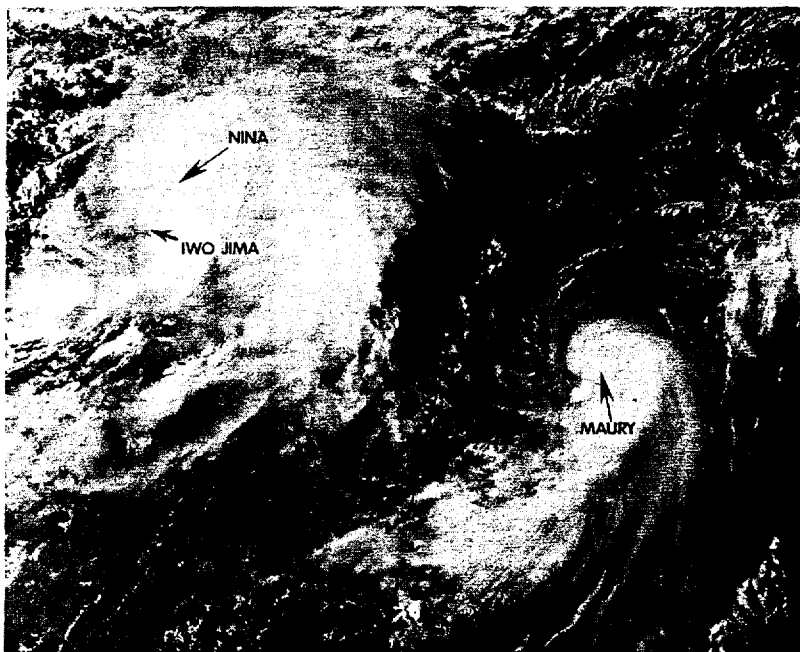


Figure 3-17-1. A compact Tropical Storm Maury just prior to issuance of the first warning. Dvorak intensity analysis of this imagery indicated that 35 kt (18 m/s) surface winds were present. This prompted JTWC to warn on this storm. The much larger Tropical Storm Nina is developing to the west (272341Z September DMSP visual imagery).

The first aircraft reconnaissance, conducted early on the 28th, quickly found the well-defined circulation center at 280303Z and reported that Maury was stronger than expected. Maximum surface winds of 50 kt (26 m/s) were found both southwest and northeast of the center. Consequently, the 280000Z warning was amended to reflect these higher wind speeds.

During the next 30 hours, Maury moved slowly west, then northwest and further intensified reaching its peak intensity of 60 kt (31 m/s) at 290600Z. From now on the movement and intensity of Maury would be governed primarily by the much larger Tropical Storm Nina.

The upper-level anticyclone which was located just east of Nina exerted considerable pressure on Maury's convection from the start. The large anticyclone brought strong northerly upper-level winds over Maury which displaced the convection to the south. As a result, Maury's low-level circulation center was consistently located near the northwest edge of the convection (Figure 3-17-1). This strong wind shear prevented Maury from ever attaining typhoon strength.

In addition to affecting Maury's intensity, these strong winds aloft may also have been responsible for preventing Maury from turning to the north on 27 and 28

September. It is likely that the outflow from the anticyclone descended and generated a weak mid-level induced ridge north of Maury which temporarily prevented any significant movement of the storm until Nina had moved further north.

On 29 September, Nina began to move northeast and approach Maury. This brought Maury under the influence of Nina's large low-level inflow. As a result, the weak ridge eroded and Maury began to accelerate to the north. As Maury accelerated to the north, the strong upper-level winds continued to displace Maury's convection away from the low-level center. This caused Maury's low-level circulation to become exposed (Figure 3-17-2) and marked the start of the weakening trend. The subtropical ridge located to the east of Maury was also a factor contributing to the acceleration. With these two factors combined, Maury reached a top speed of 26 kt (48 km/hr) between 300600Z and 301200Z.

The presence of the subtropical ridge dominated the JTWC forecast philosophy from the start. Maury was forecast to move around the ridge and recurve to the northeast. The actual movement was fairly close to the predicted track, although forecasting the speed of movement and the latitude of recurvature was difficult due to the influence of Nina.

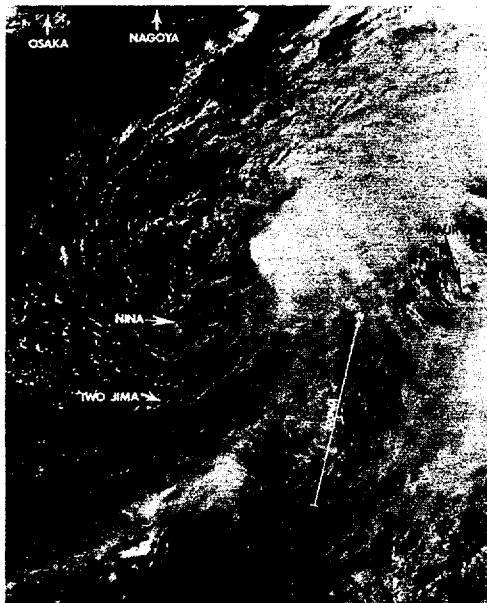


Figure 3-17-2. The exposed low-level circulation of Maury is now located just northwest of the main convection. Nina which by now had weakened to 30 kt (15 m/s), is located almost due west (300042Z September DMSP visual imagery).

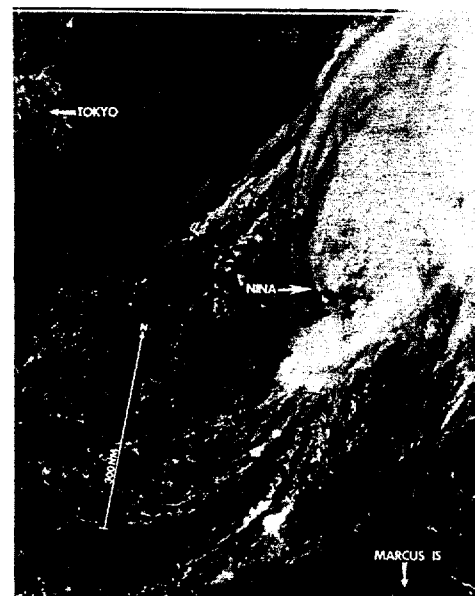


Figure 3-17-4. Imagery of Tropical Storm Nina just after the reconnaissance flight in Figure 3-17-3 was conducted. Maury is not locatable (010022Z October DMSP visual imagery).

At 301200Z, Maury was approximately 320 nm (593 km) northeast of Nina. Both storms were now moving to the northeast around the subtropical ridge. Instead of accelerating to the northeast like storms normally do, Maury slowed since it had entered Nina's larger circulation. With Nina moving to the northeast at 28 kt (52 km/hr) it took less than 12 hours to catch Maury and assimilate it into its circulation.

Maury was no longer identifiable on satellite imagery after 301831Z; however, aircraft reconnaissance several hours later was still able to locate both Maury and Nina (Figure 3-17-3). Satellite imagery at this time however, showed that only one storm, Nina, was present (Figure 3-17-4). At 010000Z, with Maury's continuation as a separate system highly unlikely, the final warning was issued.

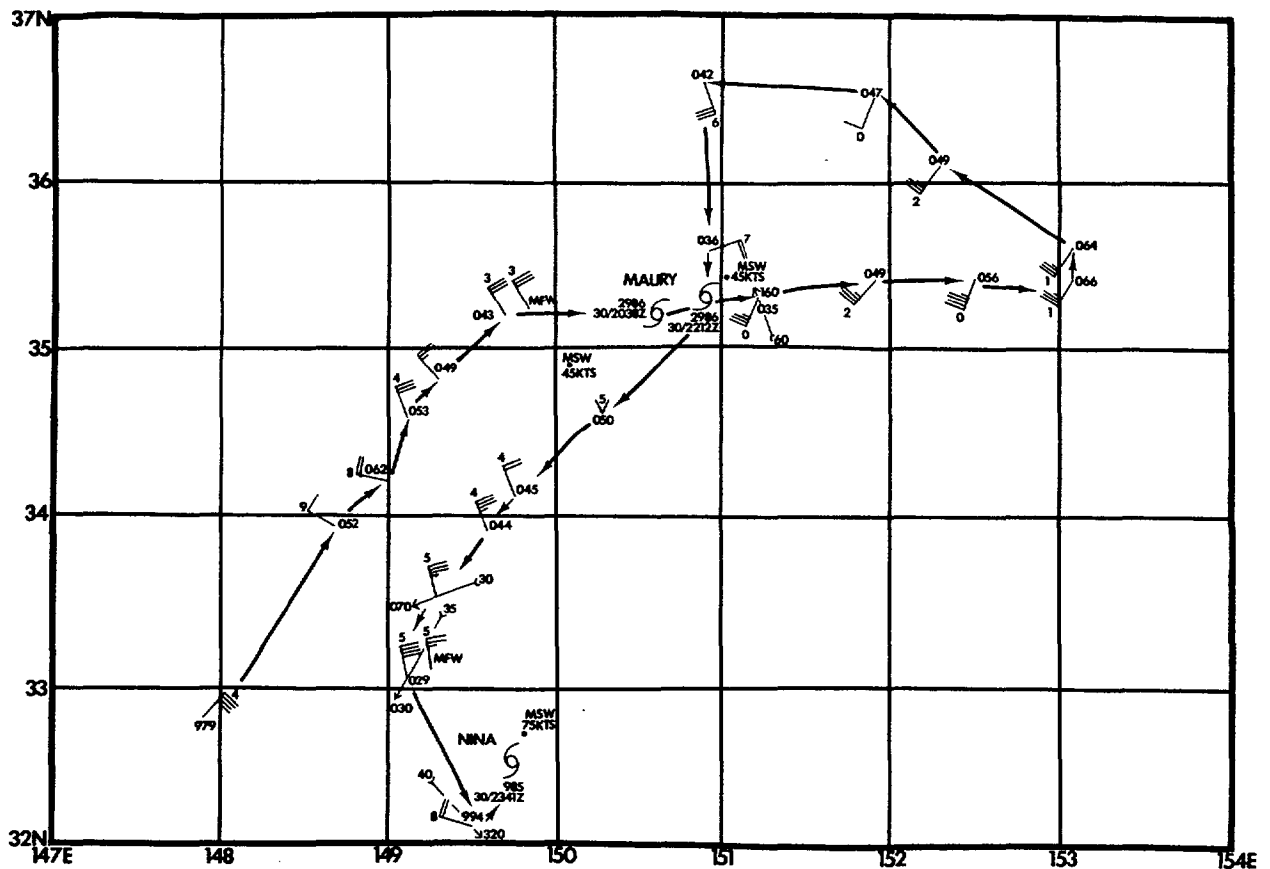
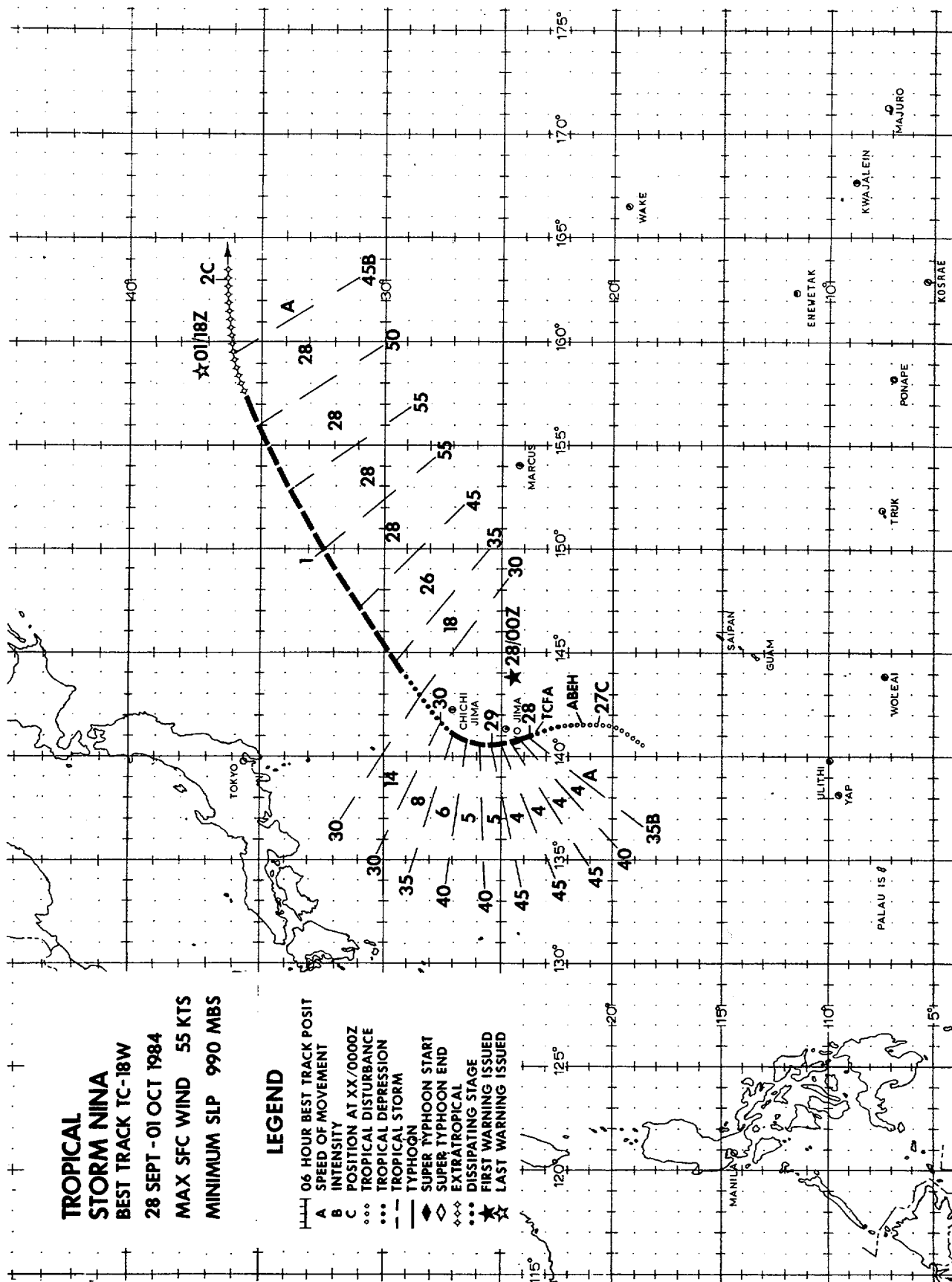


Figure 3-17-3. Although Tropical Storm Maury was no longer identifiable on satellite imagery, aircraft reconnaissance late on the 30th was still able to locate the storm's center. Wind and height data are from the 700 mb level. "MFW" represents the maximum observed flight level winds and "MSW" represents the maximum observed surface winds. The arrows with wind direction and speed represent the surface winds at that point. The number on the wind barb represents the tens digit of the 700 mb wind direction.

**TROPICAL
STORM NINA**
BEST TRACK TC-18W
28 SEPT - 01 OCT 1984
MAX SFC WIND 55 KTS
MINIMUM SLP 990 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



TROPICAL STORM NINA (18W)

Tropical Storm Nina was the third tropical storm to develop in the monsoon trough during the latter half of September. Despite originating in a region favorable for cyclogenesis, Nina never intensified beyond 55 kt (28 m/s). This was due to the inability of an upper-level anticyclone to persist over the storm. The last phase of Nina's life was noteworthy due to the storm's reintensification and assimilation of Tropical Storm Maury into its circulation.

On the 25th of September, a mid-latitude frontal system moved across the western North Pacific. As the front passed north of the monsoon trough, the trough was pulled to the northeast on the 26th. At 270000Z, the trough extended from the central Philippine Sea northeast to near Marcus Island (Minami Tori-Shima (WMO 47991)) where it became connected with the trailing edge of the cold front. Embedded in this trough were several weak circulations; most noticeable were the ones northeast and northwest of Guam. These would later develop into Tropical Storms Maury and Nina respectively.

Synoptic data at 270000Z indicated a closed 1004 mb circulation had formed 500 nm (926 km) north-northwest of Guam. The convection associated with the disturbance was poorly organized, but a large upper-level anticyclone north of Guam was providing good outflow channels to the south and east.

During the following twelve hours the circulation and the associated convection moved north and consolidated. At 271200Z numerous ship reports indicated the system had intensified and was detaching from the trough. Tropical cyclone development during the next 24 hours now became a distinct possibility. Consequently, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 271600Z upgrading the potential for development of this disturbance to "fair". This was followed by a TCFA at 272030Z based on satellite imagery which showed the disturbance was consolidating and becoming comma shaped.

The first aircraft reconnaissance flight into Nina took place late on the 27th and found only a sharp trough oriented northeast to southwest with an MSLP of 998 mb. However, a band of 30 to 40 kt (15 to 20 m/s) winds were observed south of the trough axis. This prompted the issuance of the first warning at 280000Z.

During the following 24 hours, Nina moved slowly north reaching an intensity of 45 kt (23 m/s) at 281200Z. Nina failed to develop a central dense overcast (CDO) as would be expected with normal tropical cyclone development. Instead, due to the displacement of the upper-level anticyclone to the east of the low-level circulation,



Figure 3-18-1. The broad exposed low-level circulation of Tropical Storm Nina (290102Z September NOAA visual imagery).

Nina more closely resembled a subtropical system. The convection was located poleward and eastward of the low-level center, and the radius of maximum winds was removed from the center. In addition, reconnaissance aircraft found only slight temperature increases at the center.

This displacement of the convection north and east of the low-level center introduced uncertainty in the storm's position on the night of 28 September when the low-level circulation was poorly defined. Analysis of satellite imagery indicated that the upper-level circulation center passed east of Iwo-Jima (WMO 47981), but the surface winds at Iwo-Jima remained from the southeast until about 281800Z. This clearly indicates the surface circulation passed west of the island. During this time, synoptic data was essential in fixing the surface center since

the low-level center was not locatable on satellite imagery.

Early on the 29th, Nina entered the westerlies and the convection was displaced even further to the east remaining under the strongest upper-level diffluence. This resulted in a weakening of the storm. The broad low-level circulation was now continuously exposed, generally 100 to 180 nm (185 to 333 km) west of the main convection (Figure 3-18-1).

By early on the 30th, Nina had weakened to depression strength with reconnaissance aircraft unable to locate the low-level circulation center and satellite imagery indicating several possible low-level circulation centers. Nina was now forecast to dissipate over water during the next 12 to 24 hours. However, this weakening was to be temporary.

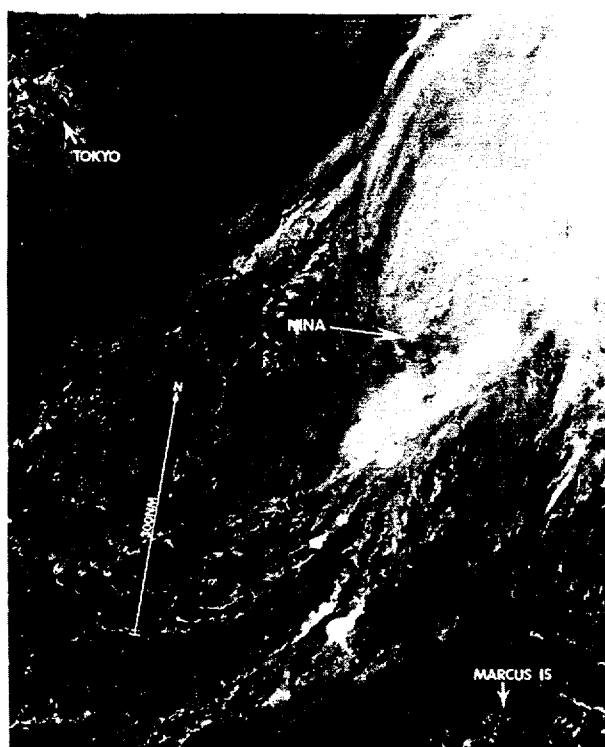
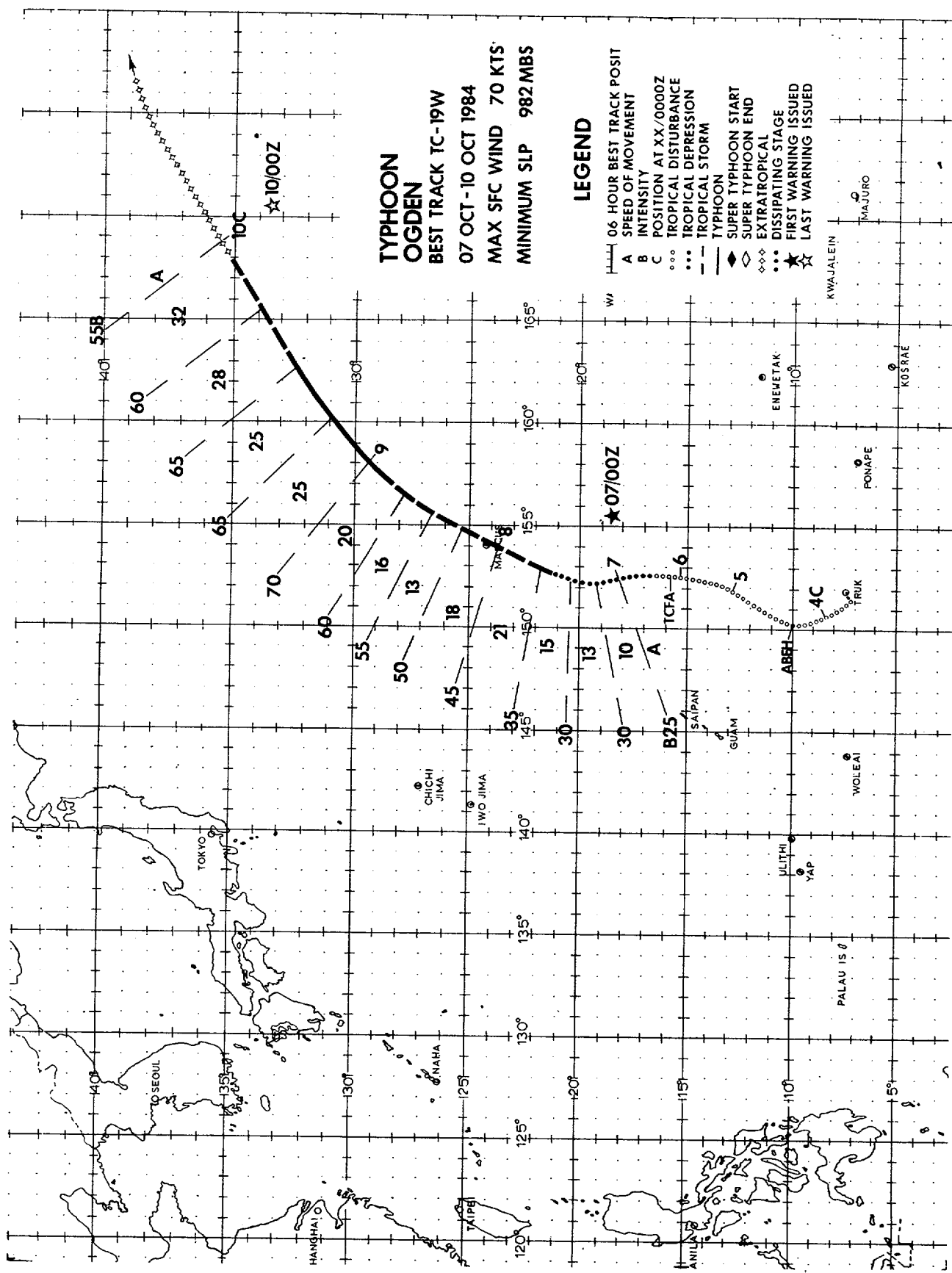


Figure 3-18-2. Tropical Storm Nina at maximum intensity. Maury is now assimilated into Nina's circulation (010022Z October DMSP visual imagery).

Between 300600Z and 301800Z, the low-level circulation moved rapidly northeast under the active convection resulting in a rapid reintensification of Nina. During this intensification, Tropical Storm Maury became incorporated into the larger circulation of Nina. However, there is no evidence to indicate that this intensification was due to the presence of Maury. At 0000Z on 1 October, Nina reached maximum

intensity of 55 kt (28 m/s) (Figure 3-18-2).

Early on the first of October, extratropical transition began. The convection rapidly decreased during the day as Nina continued to the northeast. Nina became extratropical between 011200Z and 011500Z, with the final warning being issued at 011800Z.



TYPHOON OGDEN (19W)

Typhoon Ogden was the first of a series of eight tropical cyclones during the month of October which established a new record for northwest Pacific tropical cyclone activity for that month. Ogden like the two storms before it, moved almost due north from the time it developed until it began to recurve. Ogden had great difficulty in becoming vertically aligned and would probably never have attained typhoon intensity if it had not accelerated after recurvature thereby adding the translation speed of movement to the storm's wind field.

The disturbance that developed into the eighth typhoon of the season was initially detected as a weak surface circulation west of Truk (WMO 91334) on the 3rd of October. No significant convection directly associated with the circulation was evident on satellite imagery at the time. The disturbance moved to the northwest over the next 18 hours and became part of the eastward extension of the resurging southwest monsoon trough. Synoptic data at 040000Z indicated a 10 to 20 kt (5 to 10 m/s) surface circulation was present, with an MSLP near 1008 mb. The persistence of the circulation prompted its inclusion in the 040600Z Significant Tropical Weather Advisory (ABEH PGTW).

The monsoon trough began to extend northwestward on the 4th as it had a week earlier when Tropical Storms Maury and Nina developed. As the circulation became embedded in the trough, the disturbance followed the trough orientation and tracked to the northeast. Some poorly organized convection associated with the surface circulation could now be detected on satellite imagery. Upper-level flow up to this time was weak but generally diffluent.

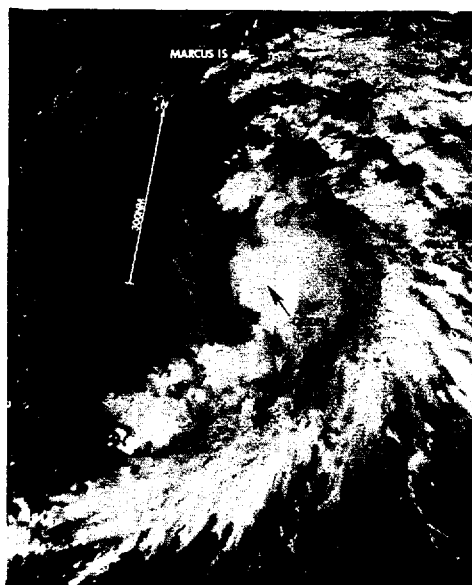
On 5 October, the convection indicated a further improvement in organization and was now consolidating in the northeast

periphery of the monsoon trough, several degrees northeast of the surface circulation. An upper-level anticyclone was also observed to be developing over the disturbance. Early on the 6th, the convection moved slightly southwest and continued to increase in size and organization. This brought the low-level circulation in closer proximity to the mid and upper-level features.

It was determined from sparse synoptic data at 060000Z that the circulation had turned more northward with an MSLP likely below 1004 mb. This led to the issuance of a TCFA at 060400Z. At 060600Z, a ship near the disturbance's center reported a 1002 mb pressure to confirm the earlier analysis.

The first of seven aircraft reconnaissance flights into Ogden occurred early on 6 October. A surface center was not located but a sharp low-level trough oriented northeast to southwest with an MSLP of 1000 mb was evident. Maximum sustained winds of 20 kt (10 m/s) were reported southeast of the trough axis. The second aircraft reconnaissance mission closed-off a circulation center at 062227Z with an MSLP of 999 mb and reported 15 kt (8 m/s) winds near the broad center. Winds of 35 kt (18 m/s) were found approximately 170 nm (315 km) east-northeast of the center associated with the tight pressure gradient between the developing Ogden and the subtropical ridge to the northeast. Intensity estimates from satellite analysis at this time indicated surface winds of 25 kt (13 m/s) were present. Although the disturbance was still located within the monsoon trough, satellite data indicated the system was moving north and separating from the trough. This in combination with the aircraft data prompted the issuance of the first warning on Ogden as a 25 kt (13 m/s) tropical depression at 070000Z (Figure 3-19-1).

Figure 3-19-1. Ogden at the time the first warning was issued. Dvorak intensity analysis indicated that 25 kt (13 m/s) surface winds were present (070002Z October DMSP visual imagery).



Over the next 24 hours, Ogden tracked around the southwest periphery of the mid-Pacific ridge. The ridge was retreating eastward in advance of a mid-latitude trough approaching from Japan. Although the first four JTWC warnings forecast eventual recurvature to the northeast, the actual recurvature was much sharper than anticipated, with significant acceleration occurring during the first twenty-four hours of the forecast period. This was due to the mid-latitude trough moving east faster than anticipated, resulting in a more rapid retreat of the mid-Pacific ridge. This quickly put Ogden under a southwesterly steering flow.

At approximately 071600Z, Ogden obtained tropical storm intensity. At this time, Ogden was already accelerating to the northeast. Part of the storm's intensification during the next 30 hours would be a result of the forward translational speed being added to the true wind speed. This would consistently put the stronger winds in the southeast semicircle.

The only land affected by Ogden was Marcus Island (Minami Tori-Shima (WMO

47991)). Ogden passed just to the east of the island at approximately 080200Z. The island was subjected to the weaker, northwest semicircle of the storm, and as a result, no damage was reported. The highest known wind occurred at 080000Z when northeast winds of 27 kt (14 m/s) were observed. At the same time the sea-level pressure was 990.3 mb. Only two hours earlier, aircraft reconnaissance reported an MSLP in Ogden of 993 mb. This suggests that the intensifying surface center passed very close to the island.

At 1200Z on 8 October, the mid-latitude westerlies began to accelerate Ogden to the northeast in earnest and Ogden began its transition to an extratropical low as it attained typhoon intensity (Figure 3-19-2). A combination of the extratropical transition and a 20 kt (37 km/hr) northeast movement contributed to an expanded asymmetric wind field and to the typhoon force winds in the southeast semicircle. Aircraft reconnaissance at 082132Z reported 70 kt (36 m/s) surface winds 30 nm (56 km) from the surface center in the southwest and southeast quadrants.

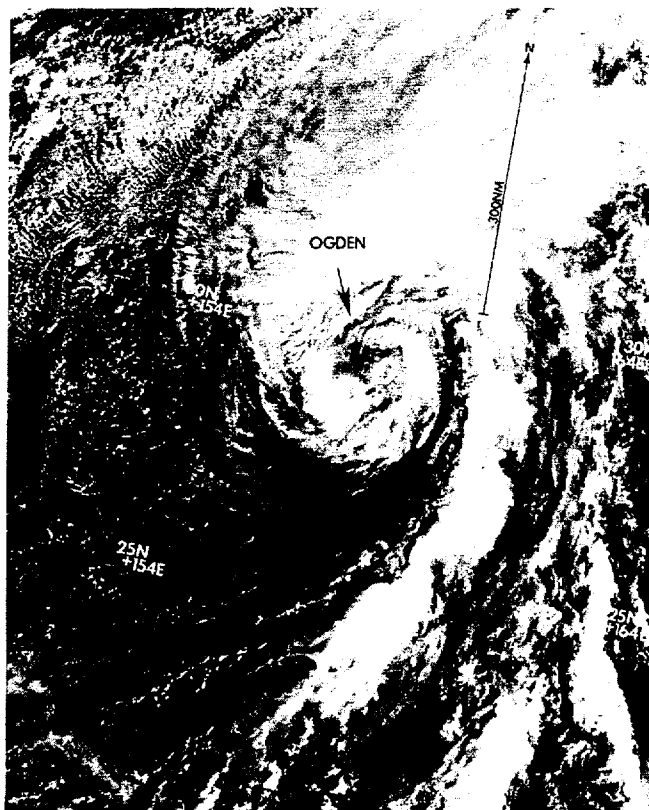


Figure 3-19-2. Typhoon Ogden near maximum intensity. Ogden was already beginning its extratropical transition at this time (082321Z October DMSP visual imagery).

The ARWO also verified that extratropical transition had commenced. Stratiform clouds were observed in the surface center and a 10 nm (19 km) northeast tilt was present from the surface to the 700 mb center. In addition, the measured MSLP was only 993 mb. This would normally support winds of 55 kt (28 m/s) according to Atkinson-Holliday (1977) pressure-wind curve. This discontinuity is often observed during extratropical transition.

The southwesterlies continued to shear Ogden as it accelerated to the northeast, further separating the 700 mb and upper-level centers from the surface center. Ogden weakened to tropical storm strength approximately twenty-four hours after it obtained typhoon strength, even though

maximum sustained winds of 77 kt (40 m/s) were indicated from satellite imagery. The satellite intensity estimates at this time were based on the Dvorak model of a subtropical system. Consequently, Ogden's 25 kt (46 km/hr) movement was directly added to the initial model intensity. It was apparent on satellite imagery at 0000Z on 10 October that Ogden had lost all convection and had completed its extratropical transition. It still supported 55 kt (28 m/s) winds and had a 32 kt (59 km/hr) northeast movement. At this time, the final warning was issued. The upper-level center was located more than one degree northeast of the surface center based on satellite imagery. The remains of Ogden continued northeast towards the International Dateline as an extratropical storm.

TYPHOON

PHYLLIS

BEST TRACK TC-20W

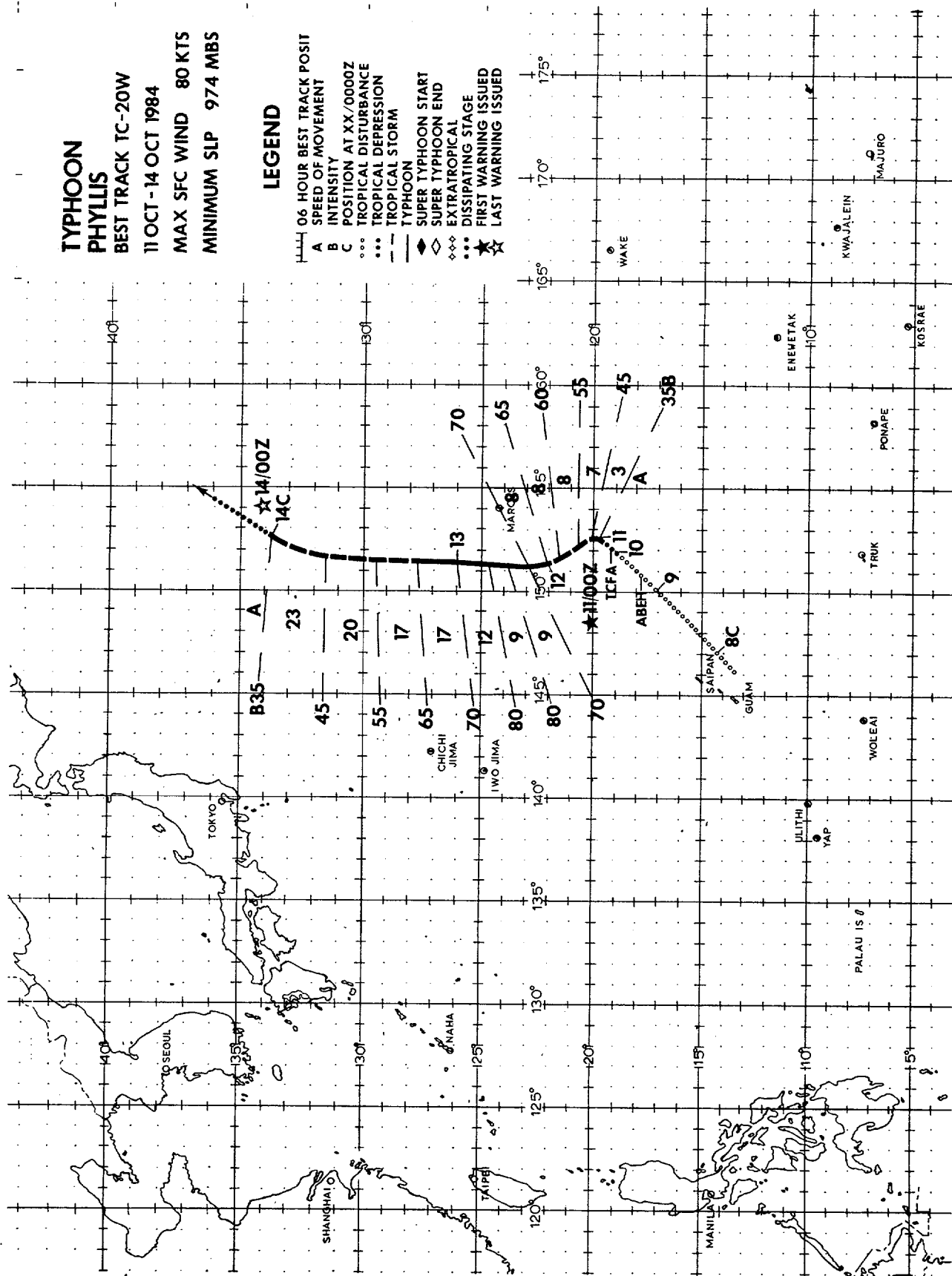
11 OCT - 14 OCT 1984

MAX SFC WIND 80 KTS

MINIMUM SLP 974 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



TYPHOON PHYLLIS (20W)

Typhoon Phyllis was the first of four significant tropical cyclones to develop in the monsoon trough during a two day period. Three of these would form in WESTPAC, with the fourth, Tropical Cyclone 02B developing in the Bay of Bengal. Of the four, Phyllis was by far the strongest, reaching a maximum intensity of 80 kt (41 m/s). However, despite its strength, Phyllis caused no reported damage as it remained over water throughout its life.

As an intensifying Typhoon Ogden began to accelerate to the northeast on 7 October, a broad area of troughing and low-level convergence persisted in its wake. By late on the 7th, the seedling of Phyllis was being analyzed as a weak surface circulation embedded in the trough east of Guam. During the next day-and-a-half, the disturbance

drifted to the northeast with no significant development noted. Figure 3-20-1 depicts the surface situation at 090000Z as Phyllis finally began to develop. A broad trough extends southwest from Typhoon Ogden across Guam and into the Philippine Sea. Embedded in this trough are two circulations; one to the northeast and one to the southwest of Guam. These would later develop into Typhoon Phyllis and Tropical Storm Roy respectively.

Although surface synoptic data was sparse near the circulation northeast of Guam, satellite imagery during the 9th and into the 10th indicated that a compact circulation was developing. This resulted in a TCFA being issued at 100630Z. At the time the TCFA was issued, Dvorak intensity analysis indicated that surface winds of 25 kts (13m/s) were present.

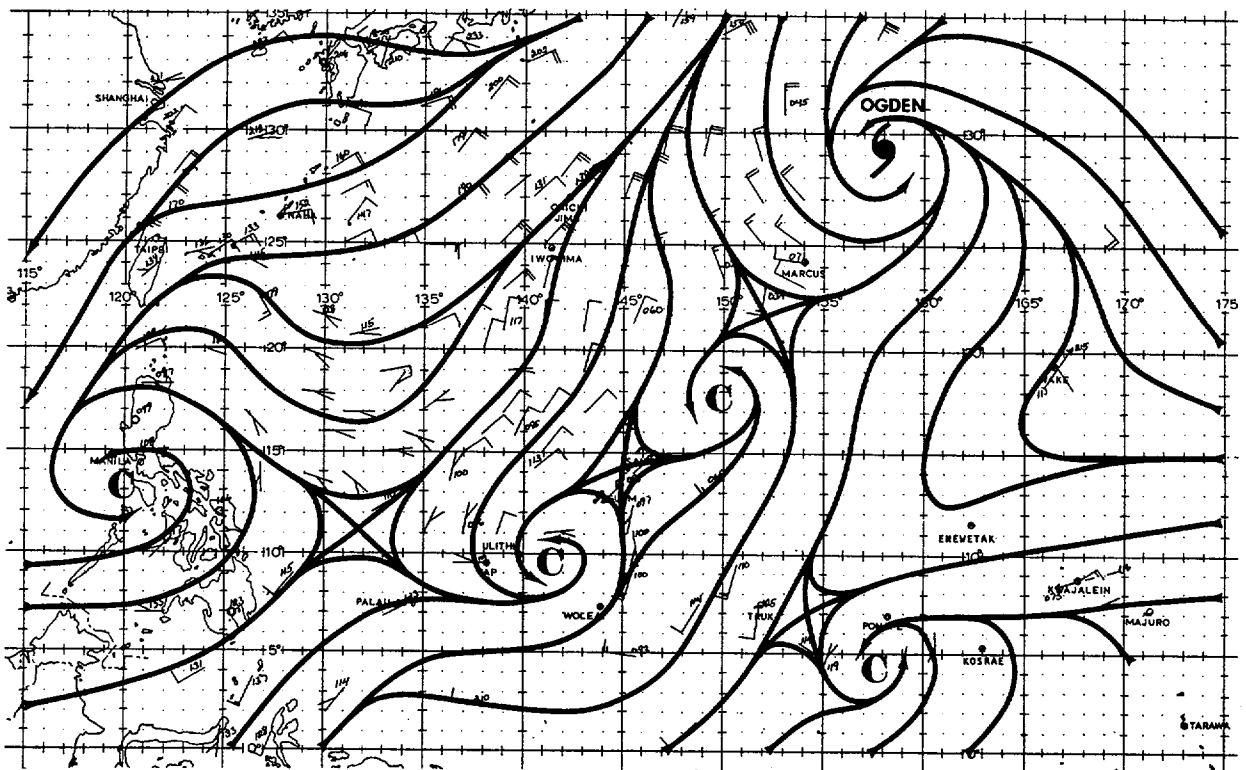


Figure 3-20-1. Surface analysis at the time Typhoon Phyllis and Tropical Storm Roy began to develop (090000Z October 1984).

The first warning on Phyllis was issued at 110000Z after satellite imagery indicated the disturbance had intensified further and now supported winds of 35 kt (18 m/s). By now Phyllis had nearly detached from the trough and would soon begin to accelerate to the north. During the next twenty-four hours Phyllis intensified rapidly reaching typhoon strength by 120000Z. The upgrade to typhoon status was based upon reports from reconnaissance aircraft and from Dvorak intensity analysis of Figure 3-20-2.

Phyllis continued to strengthen reaching a maximum intensity of 80 kt (41 m/s) twelve hours later at 121200Z. At the time Phyllis attained its peak intensity, it was located under a well-defined synoptic scale anticyclone (Figure 3-20-3). This anticyclone provided good outflow to all quadrants of the storm. As Phyllis moved north, however, the anticyclone would remain quasi-stationary

near Marcus Island (Minami Tori-Shima (WMO 47991)). As a result, less than twelve hours later Phyllis would enter the 50 to 70 kt (26 to 39 m/s) westerly flow and begin to shear and weaken.

Typhoon Phyllis maintained a predominantly northward track from the time it separated from the monsoon trough until it began to dissipate. The initial movement northward was a result of Typhoon Ogden weakening and displacing the subtropical ridge to the east. As Phyllis began to move north, a digging mid-latitude shortwave formed a vigorous cut-off low south of Honshu. This allowed the ridge east of Phyllis to rapidly build back northward, keeping Phyllis under a strong southerly steering flow. This southerly flow resulted in Phyllis accelerating to the north and prevented the typhoon from following a more typical recurvature track to the northeast.

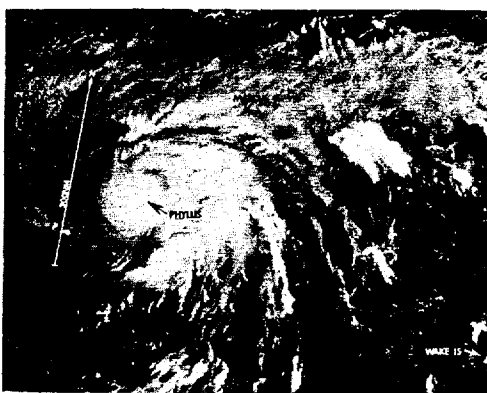


Figure 3-20-2. Phyllis at the time it was upgraded to typhoon intensity. Dvorak intensity analysis of this imagery indicated that surface winds of 65 kt (33 m/s) were present (120002Z October DMSP visual imagery).

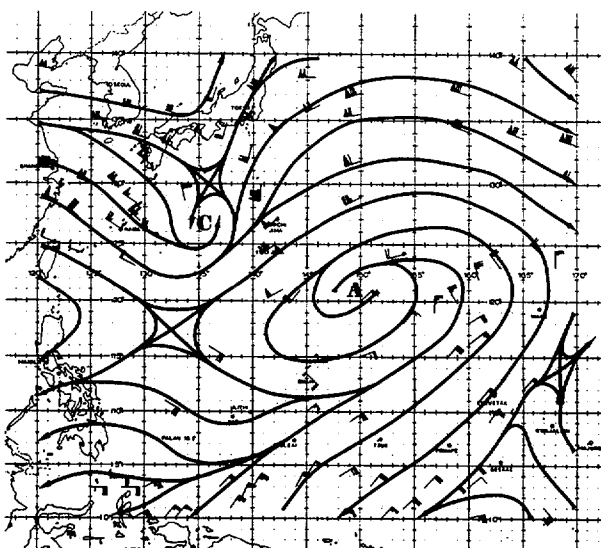


Figure 3-20-3. 200 mb analysis at the time Typhoon Phyllis attained maximum intensity. The synoptic scale anticyclone is located directly over Phyllis. The mid-level cut-off low south of Honshu extended through the 200 mb level (121200Z October 1984).

As Phyllis passed north of 25N, the cut-off low with its associated frontal system began to accelerate to the northeast. At the same time, Phyllis began to encounter the strong upper-level westerlies and the convection was displaced to the east of the low-level circulation (Figure 3-20-4). Phyllis responded by weakening at an even faster rate than it had earlier intensified.

The last aircraft reconnaissance mission was flown into Phyllis late on 13 October and found only a trough at the 700 mb level where less than twelve hours earlier, a well-developed circulation existed. At the surface, however, the

aircraft still found a 999 mb surface circulation. Satellite imagery at nearly the same time showed a broad low-level circulation center defining the remnants of Phyllis (Figure 3-20-5). All the convection had been displaced to the northeast. At 140000Z, the final warning was issued as Phyllis became indistinct from the cold front transiting through the region. There were no reports of damage from Phyllis although Marcus Island (Minami Tori-Shima (WMO 47991)) did report 20 to 30 kt (10 to 15 m/s) winds for almost two days as Phyllis passed some 150 nm (278 km) to the west.

Figure 3-20-4. Typhoon Phyllis as it began to weaken under strong upper-level wind shear. Note the extratropical low with its associated frontal system to the west (122342Z October DMSP visual imagery).

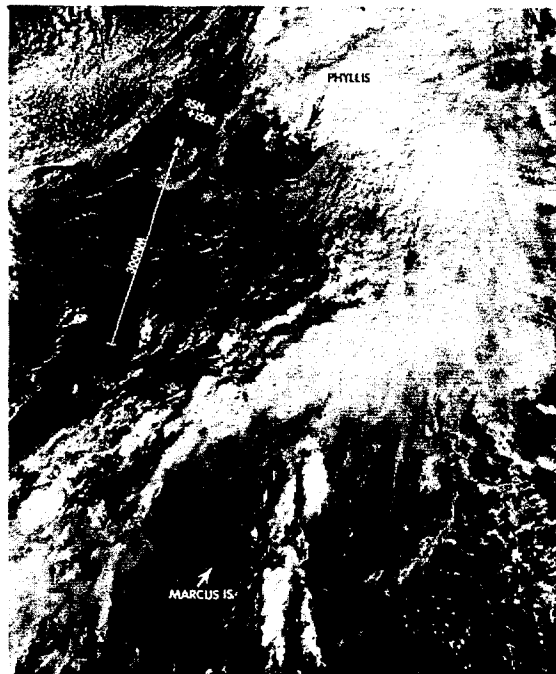
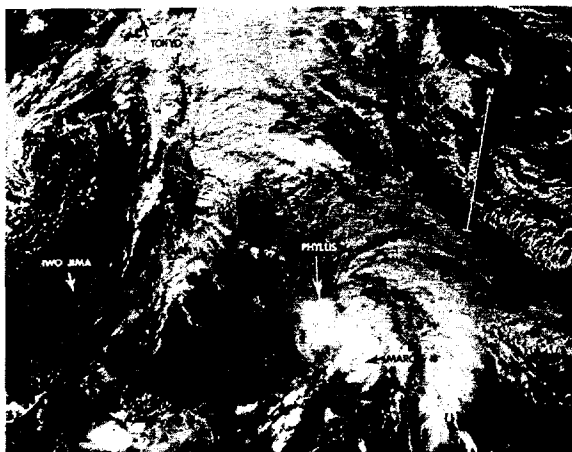
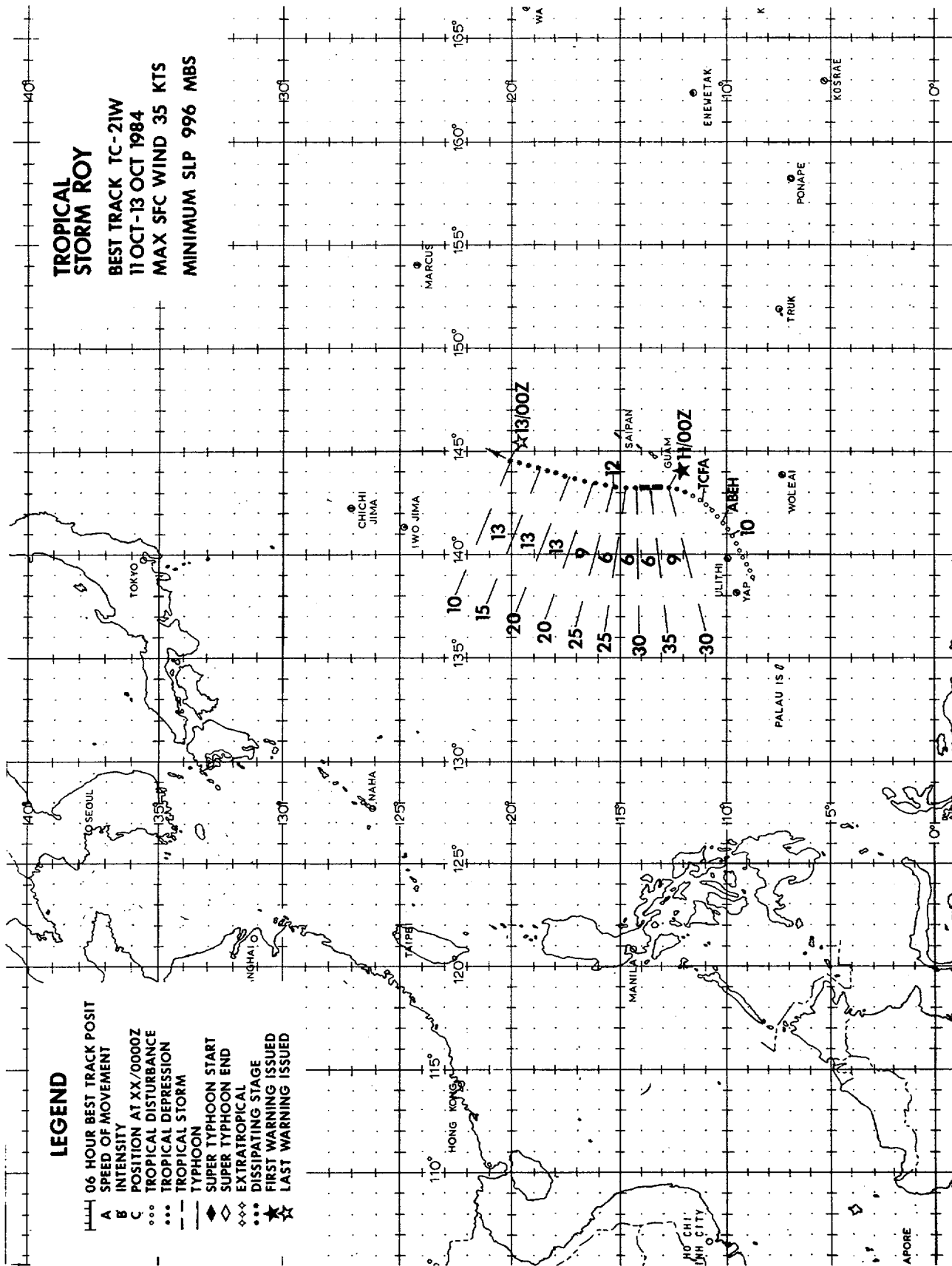


Figure 3-20-5. Phyllis as it merged with and became indistinct from a cold front. All that remained of Phyllis was a broad low-level circulation center (132321Z October DMSP visual imagery)



TROPICAL STORM ROY (21W)

Tropical Storm Roy developed in the monsoon trough southwest of Guam at the same time that Typhoon Phyllis was developing further to the northeast. Despite forming in an area climatologically favorable for tropical cyclone development, Roy was unable to persist. Strong upper-level wind shear resulted in a rapid weakening and eventual dissipation of the storm after only two days in warning status.

Early on 9 October, a weak circulation was first analyzed in the monsoon trough southwest of Guam. Development of the disturbance was slow during the next twenty-four hours due to strong wind shear from the upper-level outflow of Typhoon Ogden. By early on the 10th, Ogden's influence had lessened which resulted in the convection over the disturbance increasing and becoming more organized. At 100400Z, Dvorak intensity analysis of the convective banding indicated that 25 kt (13 m/s) surface winds were present. This prompted the issuance of a TCFA at 100700Z.

During the development stage no upper-level anticyclone was detected over the disturbance, although the flow did become diffluent. As it turned out, Roy never

developed an upper-level anticyclone. This inability to develop a good outflow pattern would ultimately be responsible for Roy's quick dissipation.

The first aircraft reconnaissance mission into the system found a small 1000 mb center at 110046Z located approximately 90 nm (167 km) west-southwest of Guam. Winds of 15 kt (8 m/s) were found around most of the center except for a small area of 30 kt (15 m/s) winds in the southeast quadrant. The aircraft position of the disturbance's center confirmed what satellite imagery indicated - that the system had turned to a more northerly heading from the steady northeast course of the previous two days. This meant Roy would pass safely to the west of Guam.

Based on the data obtained by reconnaissance aircraft and the expectation for further intensification, the first warning was issued at 110227Z, valid at 110000Z (Figure 3-21-1). Later that afternoon the second reconnaissance flight found Roy had indeed intensified. The MSLP had decreased to 998 mb and minimal tropical storm force winds existed 20 to 30 nm (37 to 56 km) from the center.

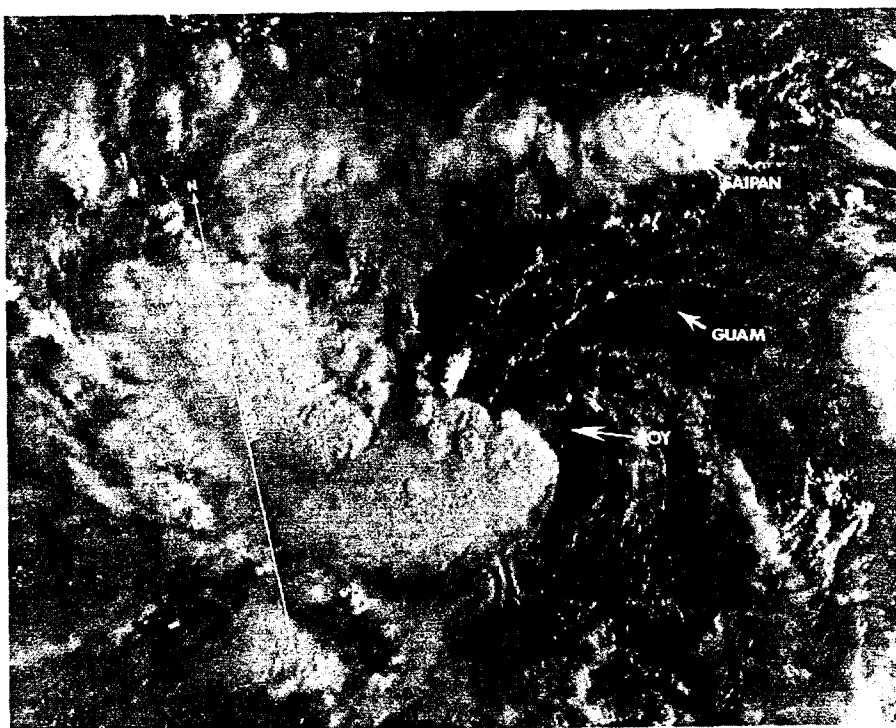


Figure 3-21-1. Roy just before the first warning was issued. The partially exposed low-level circulation center is visible on the eastern edge of the main convection. The island of Guam located 110 nm (204 km) to the northeast is completely cloud-free (102152Z October NOAA visual imagery).

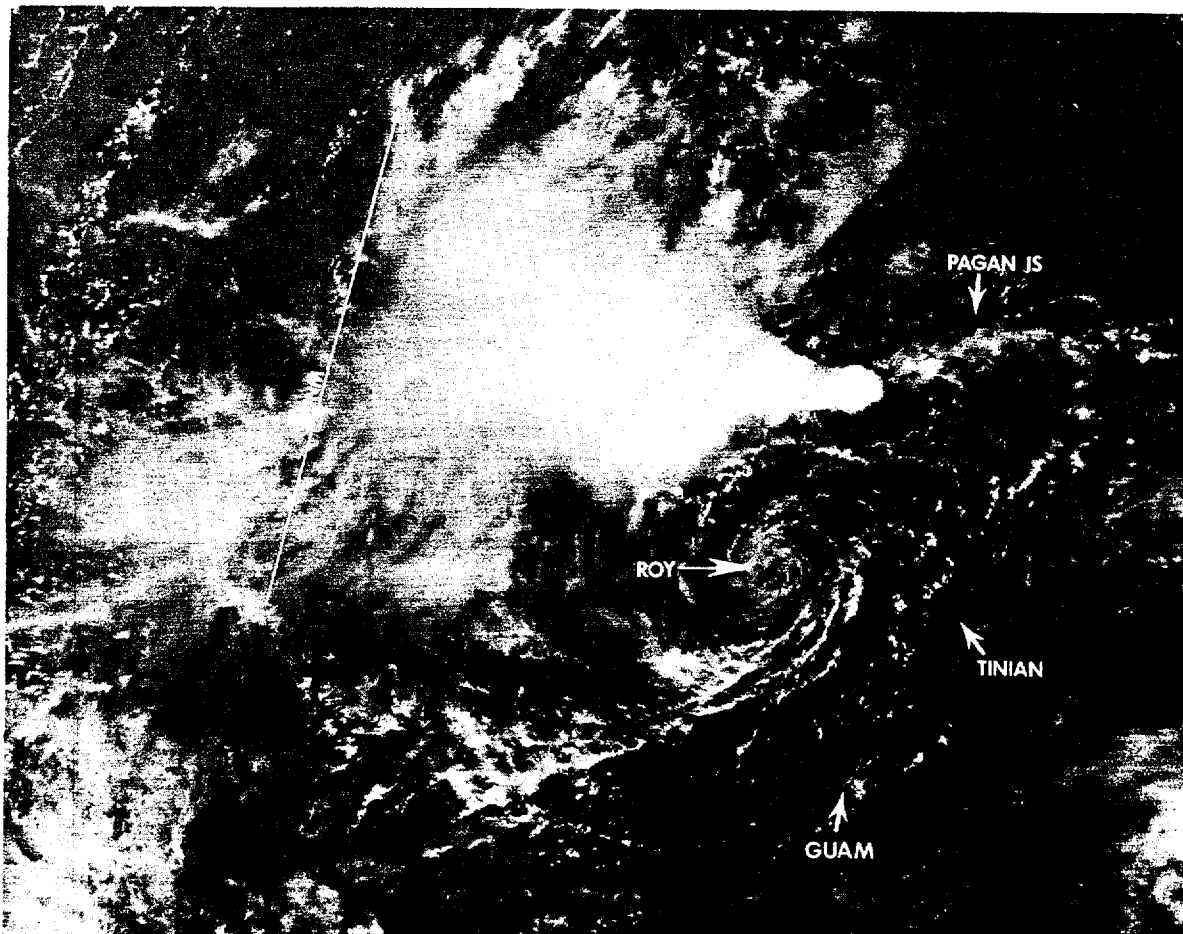


Figure 3-21-2. Tropical Storm Roy as an exposed low-level circulation center is located southeast of the convection (120002Z DMSP visual imagery).

As it turned out, these would be the strongest winds observed in Roy. Roy passed 80 nm (148 km) west of Guam as a minimal tropical storm, but caused no damage to the island. The Naval Oceanography Command Detachment (NOCD) at Brewer Field, NAS Agana, recorded maximum winds of only 14 kt (7 m/s) during Roy's passage.

As Roy moved to the north-northeast, strong easterlies from the synoptic scale anticyclone that was nearly co-located with the developing Typhoon Phyllis began to shear the storm. In addition, much of the monsoon flow which had earlier been directed into Roy was now feeding into the stronger Typhoon Phyllis. This began a weakening trend which continued until Roy's dissipation less than 36 hours later.

During the next twenty-four hours, Roy

did make several attempts to redevelop its convection about the low-level circulation center, but due to the strong shear, every attempt was doomed to fail. By the 12th, Roy had become an exposed system with the overall convection decreasing (Figure 3-21-2). However, it was at this time that the lowest MSLP was observed. At 120531Z, reconnaissance aircraft recorded an MSLP of 996 mb. Despite the lower pressures, no surface winds above 20 kt (10 m/s) were reported.

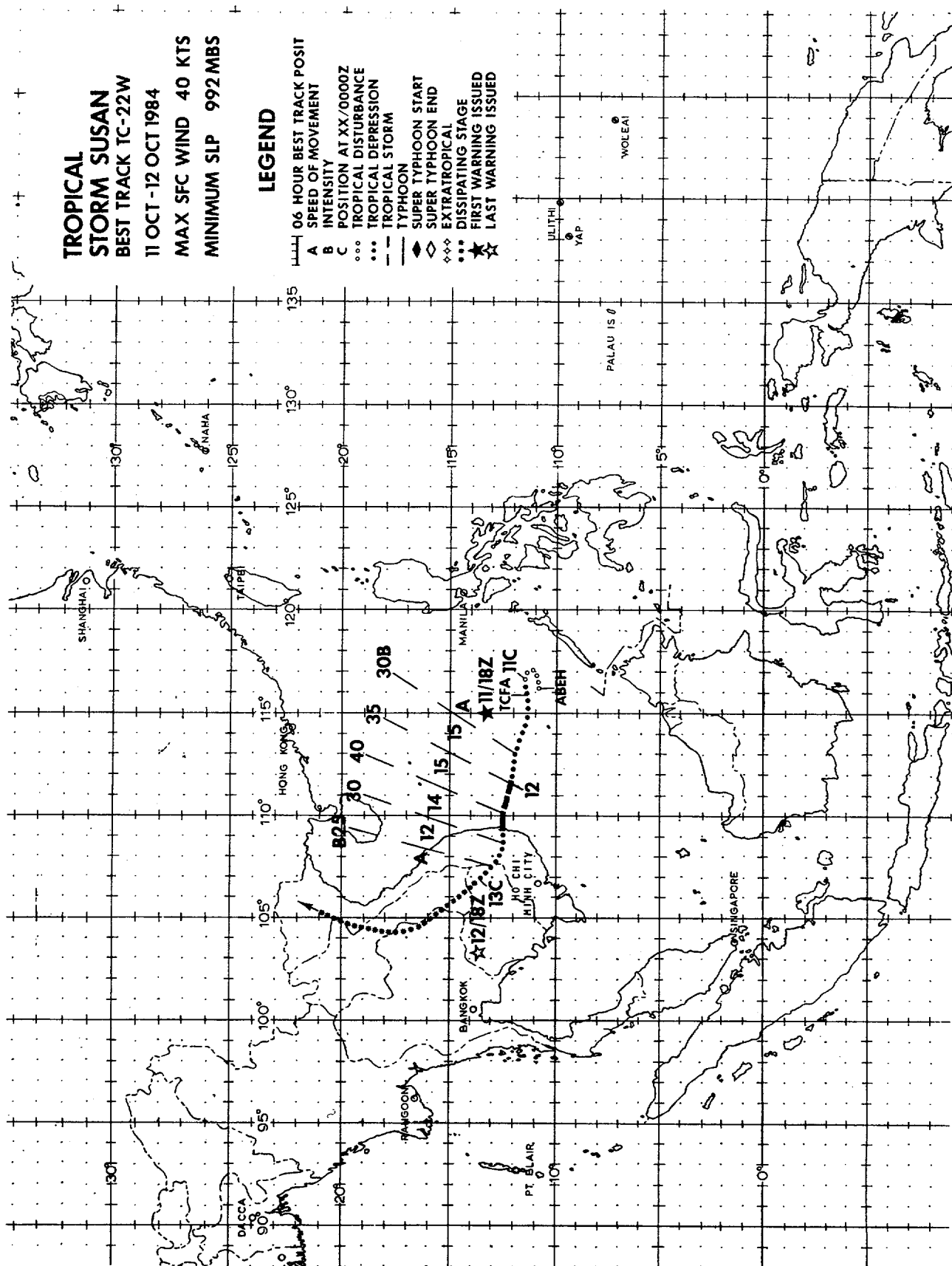
Late on the 12th, the last mission into the dissipating Roy was flown. It was unable to locate any circulation center and observed surface winds of 5 to 15 kt (3 to 8 m/s). This prompted the final warning to be issued at 130000Z as Roy dissipated over water.

TROPICAL STORM SUSAN BEST TRACK TC-22W

11 OCT -12 OCT 1984
MAX SFC WIND 40 KTS
MINIMUM SLP 992 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



TROPICAL STORM SUSAN (22W)

Tropical Storm Susan was the third of four significant tropical cyclones to develop in the monsoon trough in less than two days. During a brief existence Susan caused considerable damage to central Vietnam despite only intensifying to 40 kt (21 m/s).

Occasionally, when a typhoon is active in the Philippine Sea a "sympathetic" storm will form in the South China Sea. Recent examples of such storm pairs are Abby/Carmen and Orchid/Percy from the 1983 season. The mechanism at work in these cases is a combination of excess vorticity and convergence at low-levels, found around circulation centers embedded in the monsoon trough, and upper-level ventilation due to the divergence in the outflow downstream (west) of the dominant typhoon in the Philippine Sea. These "sympathetic" storms often exhibit erratic movement and are the victims of significant upper-level shearing. Intensification beyond minimal typhoon strength is unusual.

As a first impression, one might

assume that this scenario was valid in the case of Tropical Storm Susan. The surface situation present as Susan was forming is shown in Figure 3-22-1. The monsoon trough extends from the Marshall Islands across Micronesia, the Philippines, Southeast Asia and into the Bay of Bengal. Embedded within this trough is the precursor of Tropical Cyclone 02B in the Bay of Bengal, the depression that is soon to be Susan in the South China Sea and the short-lived Tropical Storm Roy just west of Guam. Tropical Storm Phyllis (soon to be typhoon Phyllis) had recently separated from the trough and was accelerating to the north. The first impression, however, is incorrect in this case. Susan was not a sympathetic storm induced by either of the storms to the east, but was instead a completely independent system. The inflow patterns about Roy and Phyllis disrupt each other whereas the flow around Susan dominates the entire South China Sea and controls much more mass than the other two. Given time and more open ocean, Susan would probably have become the most intense of the four systems.

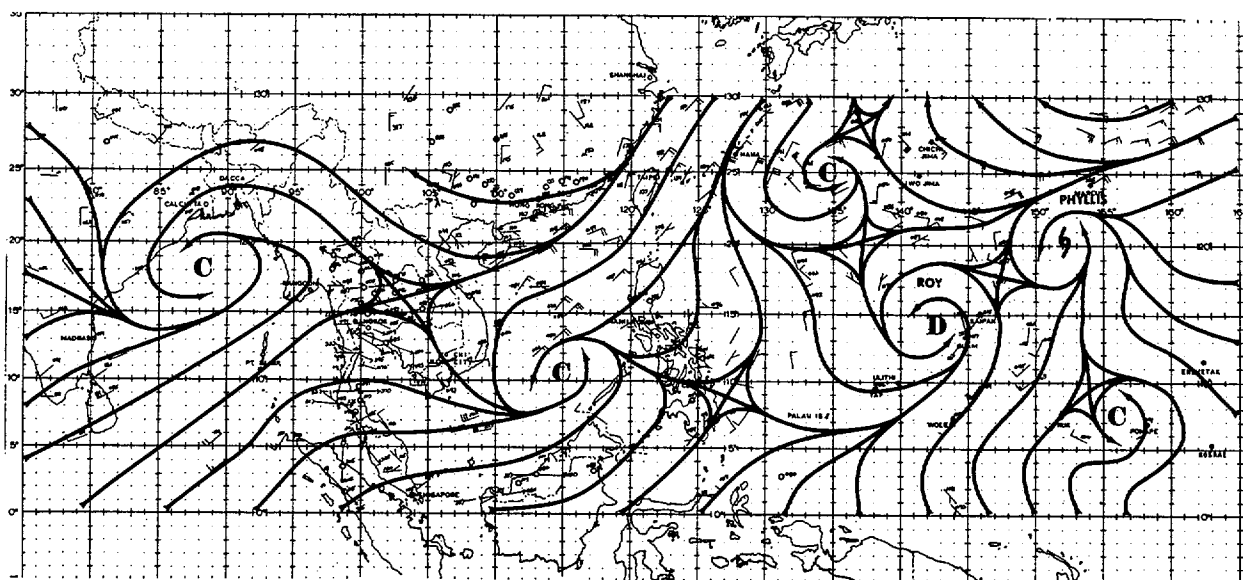


Figure 3-22-1. The 111200Z October surface/gradient level analysis during the formative stage of Tropical Storm Susan.

The upper-air pattern present during the development stage of Susan is shown in Figure 3-22-2. The anticyclone over the South China Sea is well-formed and distinct from one northeast of Guam. In fact, the upper-level anticyclone over the Pacific Ocean does not resemble the typical outflow pattern from a tropical storm. The system is much more representative of the climatological synoptic scale high. The overall pattern shows clearly that Susan developed on its own merits and not as a result of a "sympathetic" reaction.

The disturbance, which would later develop into Susan, was first noticed on 10 October as a loosely defined but very broad low-level circulation in the central South China Sea. Synoptic data showed that winds of 10 to 20 kt (5 to 10 m/s) were present

with the disturbance. The inflow pattern covered a very large area and was slow to consolidate. During this consolidation period the system remained nearly stationary.

By 110600Z the system had started to accelerate to the west along the axis of the monsoon trough. The convection and organization had both increased significantly, resulting in the issuance of a TCFA at 110730Z. By now winds near the center were 20 to 25 kt (10 to 13 m/s). The storm continued to develop as it moved quickly to the west-northwest, with the first warning issued at 111800Z. Susan made landfall as a 35 to 40 kt (18 to 21 m/s) tropical storm just north of Nha Trang, Vietnam (WMO 48877) some 16 hours later (Figure 3-22-3). After landfall, Susan turned northwest and

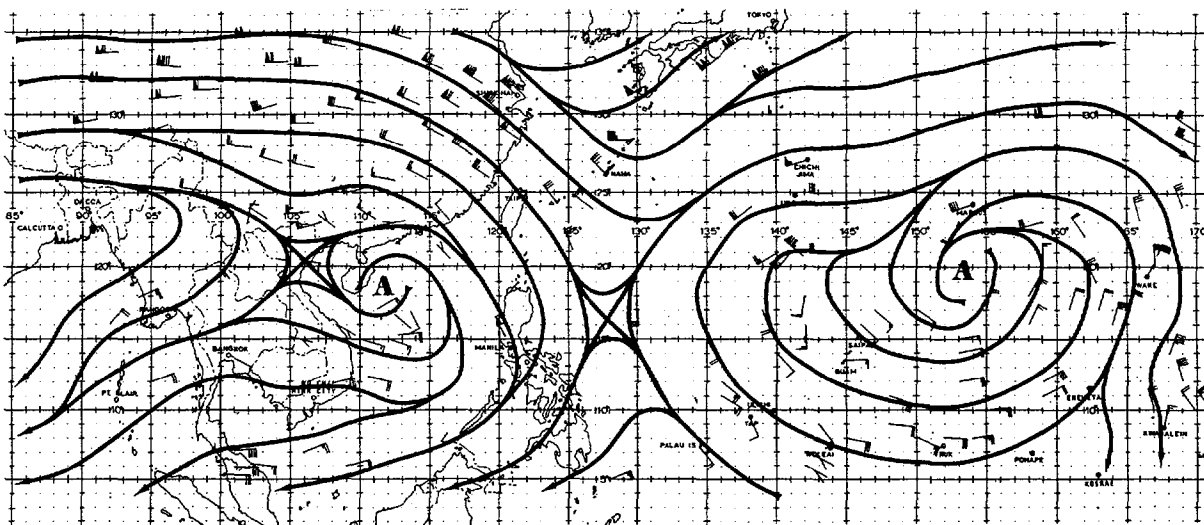


Figure 3-22-2. The 110000Z October 200 mb analysis. The upper-level anticyclone over the South China Sea is an independent system. It was not formed by the outflow pattern of the two tropical storms near Guam. (The 111200Z 200 mb analysis had insufficient data to conduct a meaningful analysis).

transited up the Mekong Valley. Even though Susan dissipated as a significant tropical cyclone at 130000Z, its remnants were still evident three days later as an area of convection just to the west of Hanoi (WMO 48820). Initial reports indicate 33 people were killed and some 68,000 families left homeless due to the heavy rains and floods which accompanied Susan. Thousands of hectares of ripening autumn rice were also reported destroyed.

In summary, although Susan was simultaneously active with three other tropical cyclones, analysis proves that it was not a sympathetic storm induced by the inflow/outflow patterns of its companions. Susan started as a very broad system embedded in the monsoon trough and stayed in the axis of the through as it moved inland over Vietnam. Once over land it recurved to the north but was identifiable for several more days.

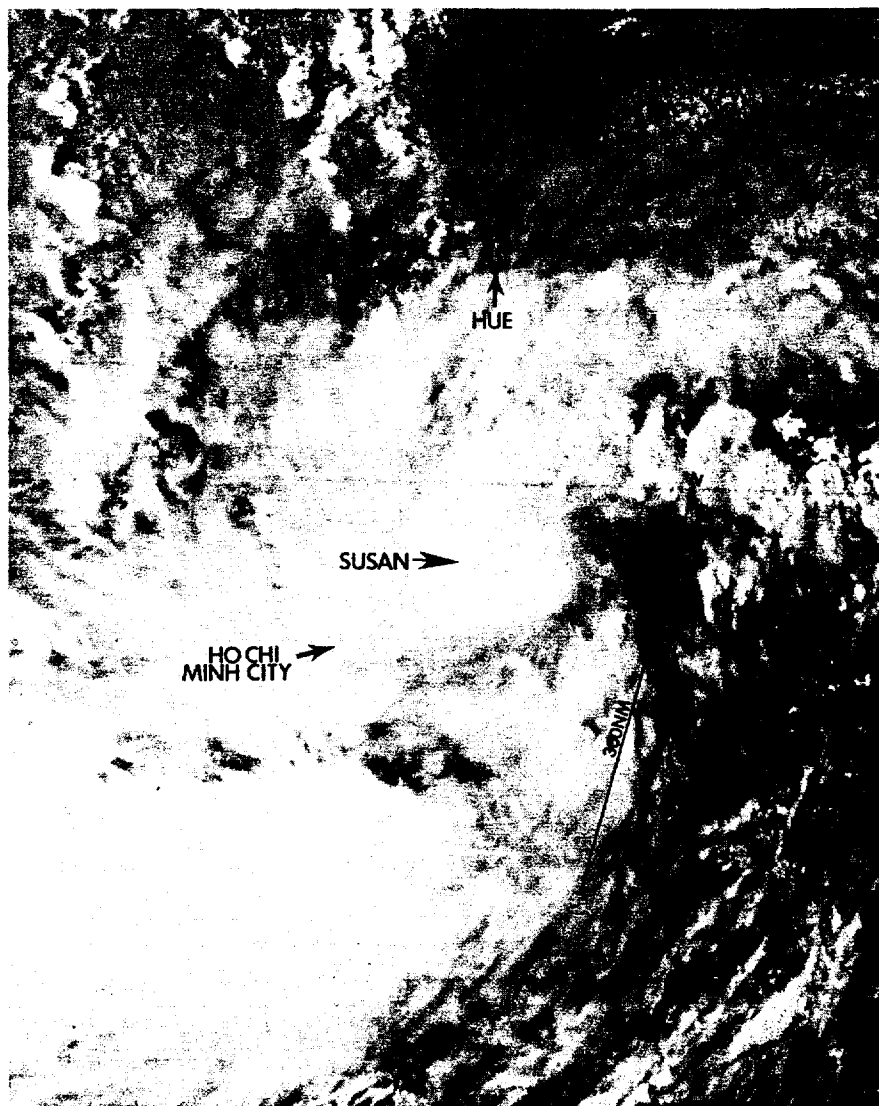
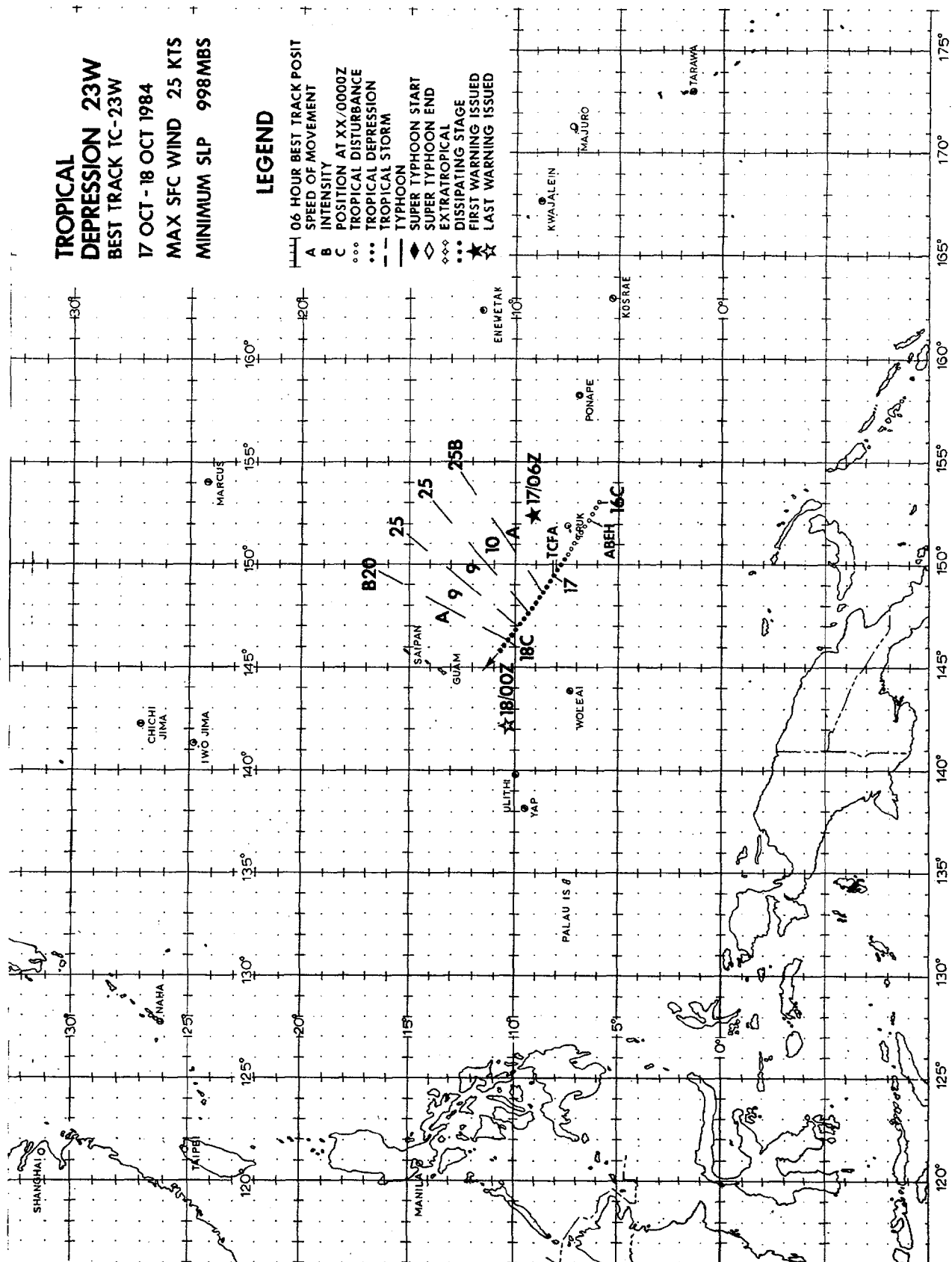


Figure 3-22-3. Tropical Storm Susan near maximum intensity. The storm made landfall over coastal Vietnam two hours later (120822Z October NOAA visual imagery).



TROPICAL DEPRESSION (23W)

Tropical Depression 23W was a short-lived system which developed in the monsoon trough. The lack of upper-level support resulted in dissipation only 18 hours after it became a significant tropical cyclone.

After the dissipation of Typhoon Phyllis on 14 October, the low-level monsoon trough still extended from Southeast Asia to the Marshall Islands. At 150000Z, the upper-level wind-flow was similar to the pattern present several days earlier, with a large anticyclone located near Marcus Island (Minami Tori-Shima (WMO 47991)). In addition, a westward moving TUTT cell was now located near 18N 172E. At this time the convection associated with the monsoon trough showed little organization. Upper-level flow over the area was generally easterly, with northeast flow inhibiting convective development along the northern side of the low-level trough.

Early on the 16th, the convection began to show signs of increased organization. This was especially evident near the island of Truk (WMO 91334), where the eastward extension of the monsoon trough and the strongest low-level cyclonic turning were located. Synoptic data at this time indicated a 1005 mb surface circulation was present. The Significant Tropical Weather Advisory (ABEH PGTW) at 160600Z mentioned this area as having a "fair" potential for significant tropical cyclone development.

Satellite imagery during the next 18 hours showed the convection had become more organized with the development of a central convective feature. Synoptic data revealed sea-level pressures of 1003 mb to 1006 mb around the periphery of the circulation with the central pressure estimated to be near 1000 mb. These developments prompted the issuance of a TCFA at 170000Z. Upper-level data indicated the flow was now slightly diffluent as the disturbance was located in

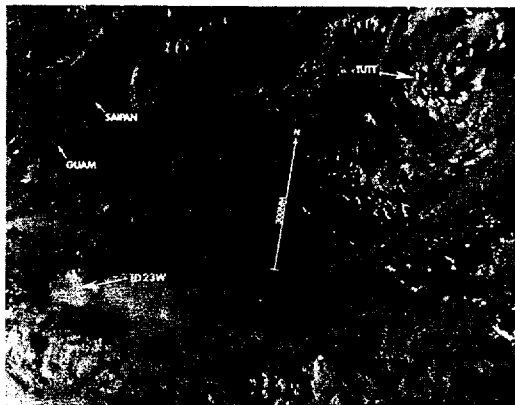
the TUTT axis.

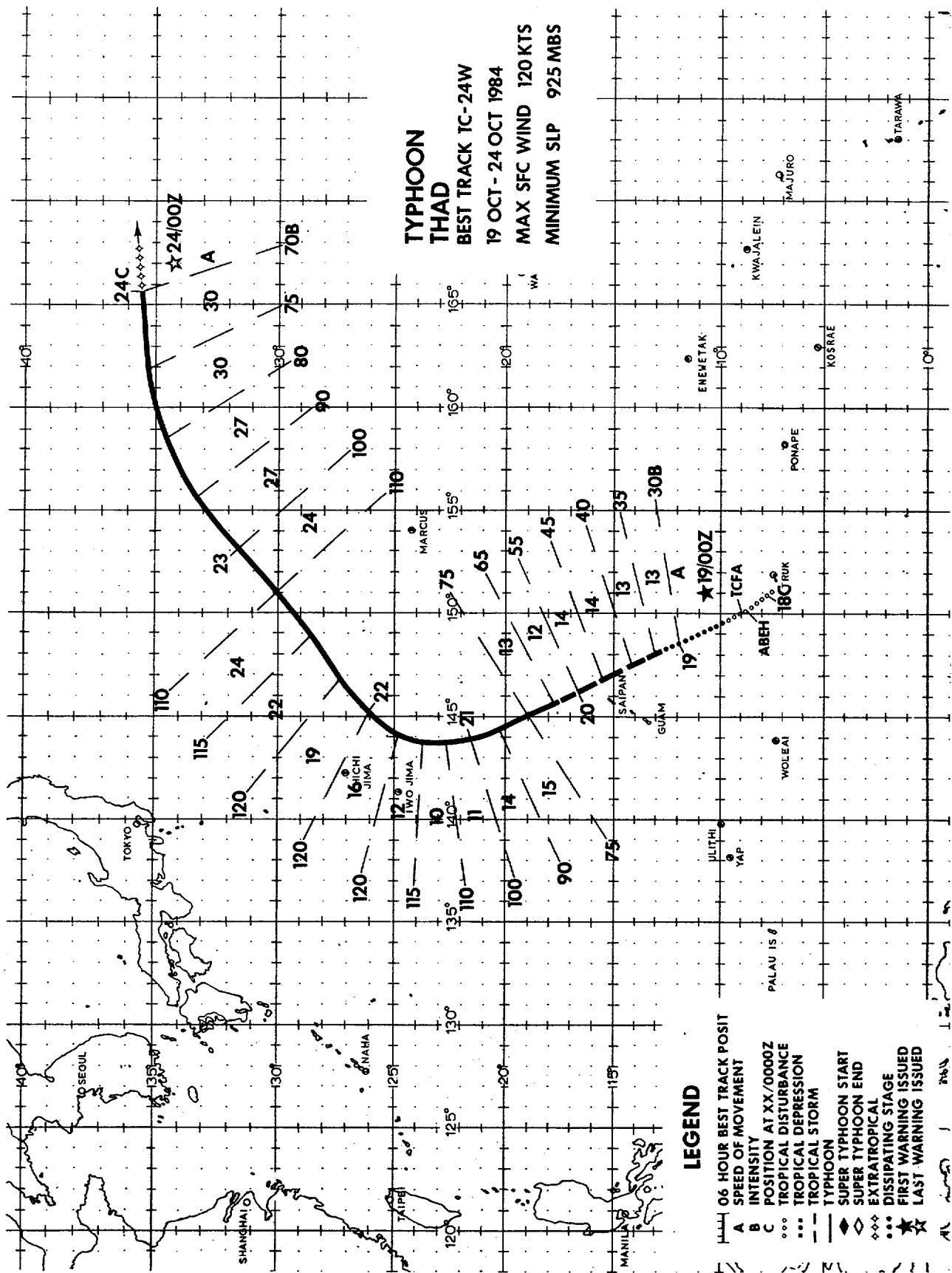
An investigative reconnaissance flight into the disturbance closed-off a surface circulation at 170600Z and reported maximum surface winds of 25 kt (13 m/s). The MSLP had decreased to 998 mb. Since further development was expected, the first warning on Tropical Depression 23W valid at 170600Z was issued a short time later (Figure 3-23-1).

During the next 18 hours, Tropical Depression 23W moved northwest and weakened rather than intensified. Aircraft reconnaissance at 172030Z could not locate a surface circulation, but instead observed winds which indicated that a much larger circulation was developing to the southeast. Consequently, the final warning on the dissipated Tropical Depression 23W was issued at 180000Z.

Post-analysis indicates that Tropical Depression 23W dissipated as a result of unfavorable upper-level support. As the poorly organized depression moved west-northwest along the northern periphery of the low-level monsoon trough, it moved into an area of 30 to 40 kt (15 to 21 m/s) northerly upper-level winds from the combined effects of the anticyclone (now located near Iwo Jima (WMO 47981)) and the TUTT cell to the northeast. The strong wind shear over the depression created an environment which was unfavorable for tropical cyclone development. In comparison, the area southeast of Tropical Depression 23W was located in a region of diffluent flow with the upper-level TUTT cell to the northeast enhancing the diffluence. Satellite imagery reflected this favorable upper-level outflow as much stronger convection was forming in this area. This area of convection would soon develop into Typhoon Thad.

Figure 3-23-1. Tropical Depression 23W at the time the first warning was issued. A TUTT cell is located northeast of the depression (170537Z October NOAA visual imagery).





Typhoon Thad developed southeast of Guam just as Tropical Depression 23W was dissipating several hundred miles to the northwest. Unlike its predecessor, Thad developed under favorable upper-level environment which permitted further intensification. As Thad developed, it tracked steadily to the north-northwest before recurving to the northeast. The typhoon's movement was well forecast except during the initial stages.

Late on 17 October, satellite imagery revealed that an area of strong convection was developing a few hundred miles southeast of the short-lived Tropical Depression 23W. The development of the convection was aided significantly by the presence of a weakening TUTT cell to the north-northeast which provided strong diffluence aloft over the convection.

Synoptic data at 180000Z confirmed what the last aircraft reconnaissance mission into Tropical Depression 23W had observed a few hours earlier; that a broad surface circulation was developing near Truk (WMO 91334). This circulation was underneath the developing convection and on the eastern end of the monsoon trough. Synoptic data south of the trough axis indicated the southwest monsoon was reintensifying with numerous 20 to 30 kt (10 to 15 m/s) west winds being reported.

Over the next several hours, the convection rapidly consolidated. In addition, satellite imagery and synoptic data showed an anticyclone was developing aloft providing good outflow to all quadrants. As a result, a TCFA was issued at 180630Z.

During the next 18 hours satellite imagery indicated the disturbance was moving northwest towards Guam. With Dvorak intensity analysis indicating 30 kt (15 m/s) surface winds present and 45 kt (23 m/s) surface winds forecast in 24 hours, the first warning on Thad was issued at 190000Z.

The initial warning forecast Thad to continue to move to the northwest, pass just south of Guam and gradually turn towards the west-northwest in the 48 to 72 hour period. This forecast was in good agreement with all JTWC forecast aids. Also the NOGAPS analysis and prog series indicated the subtropical ridge had returned closer to its climatological position north of Guam which further convinced JTWC that this track was reasonable.

As it turned out, this forecast would be wrong for two reasons. First, JTWC did not accurately know where the low-level center was located. Second, and more importantly, the subtropical ridge was not nearly as strong nor as far west as indicated in the analysis and prog series. Between 190000Z and 190600Z, as Thad supposedly neared Guam (WMO 91212), the winds on the island should have veered to the east or southeast. Instead, they

remained from the northeast. But analysis of satellite imagery indicated that Thad was heading directly towards Guam. Clearly something was amiss! JTWC's efforts to locate the surface center were further hampered by maintenance problems which prevented reconnaissance aircraft from penetrating the disturbances center.

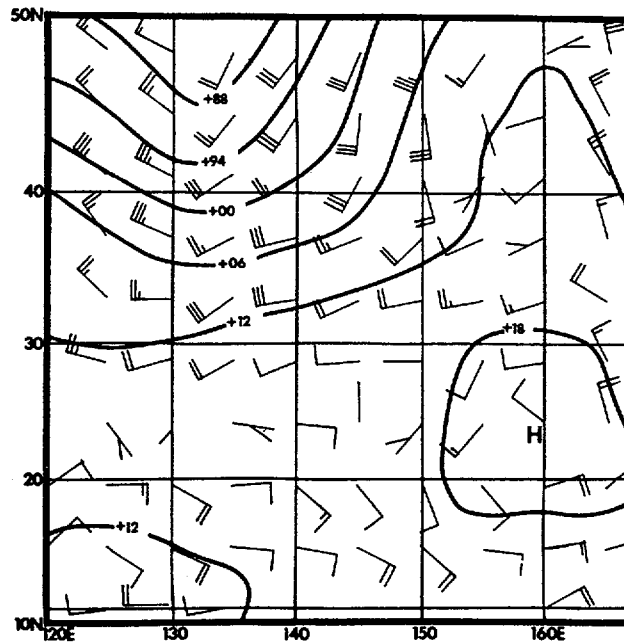
At 190728Z the first aircraft reconnaissance flight into the center of the disturbance was finally made and quickly settled the discrepancy. It located Thad almost 180 nm (333 km) east of Guam with an MSLP of 990 mb. As a result, the 190600Z warning position relocated Thad some 120 nm (222 km) to the northeast! This meant that the storm would now safely clear Guam.

At 200000Z, as a now well-developed Thad continued to move to the north-northwest at 13 to 14 kt (24 to 26 km/hr), it became obvious the storm was not going to turn towards the west. Clearly the subtropical ridge was not as well-established nor as far west as the NOGAPS progs had earlier indicated (Figure 3-24-1). JTWC now forecast continued north-northwest movement for the next 24 hours with recurvature to the northeast between 210000Z and 220000Z due to the approach of a mid-latitude trough. As it turned out, this forecast track was excellent, with the speeds of movement after recurvature being only slightly faster than anticipated.

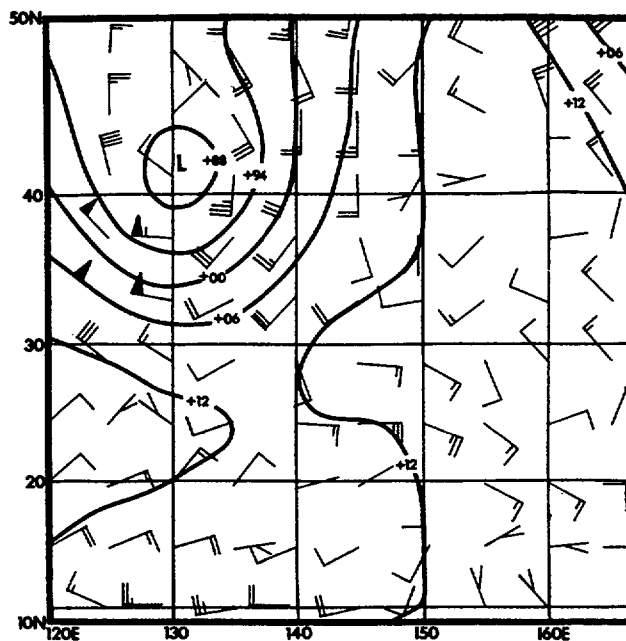
Thad intensified steadily from the time JTWC went into warning status at 190000Z, until it reached its peak intensity of 120 kt (62 m/s) at 211800Z (Figure 3-24-2). By this time Thad had begun to recurve and link-up with a mid-latitude trough. After maintaining the 120 kt (62 m/s) intensity for approximately 12 hours, Thad began a slow weakening trend which continued until the storm went extratropical. During this period, Thad accelerated from 16 to 30 kt (30 to 56 km/hr) as it became embedded in the westerlies. As would be expected with the storms that accelerate after recurvature, the strongest surface winds were consistently observed in the southeast semicircle.

As Thad accelerated to the northeast, strong upper-level westerlies began to displace the upper-level circulation and convection from the surface center. This was confirmed by the 222310Z aircraft reconnaissance fix which found the 700 mb center 28 nm (52 km) east-northeast of the surface center. All significant convection was now located north of the surface center.

On the 23rd, Thad lost most of its convection with an exposed low-level circulation center visible on satellite imagery. The final warning on this system was issued by JTWC at 240000Z. Future warnings on the extratropical low were contained in NAVOCEANCOMCEN GUAM extratropical wind warning bulletins (WWPN PGFW).

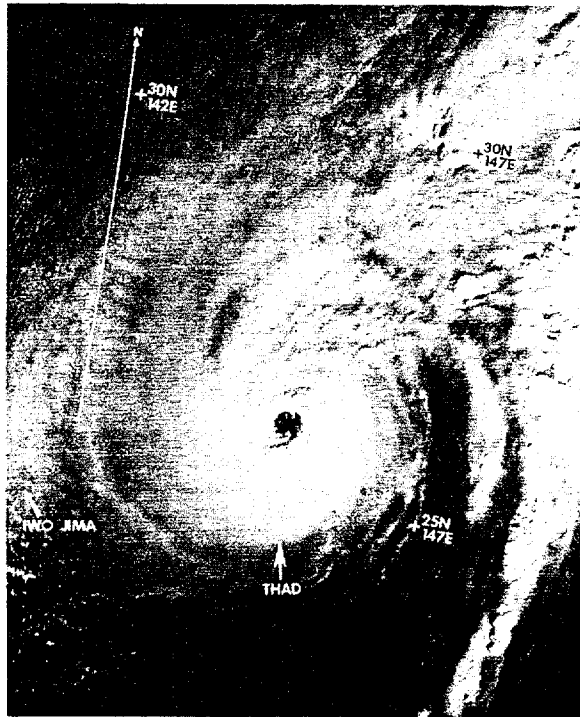


NOGAPS 700 mb 48-hour prog VT: 201200Z October

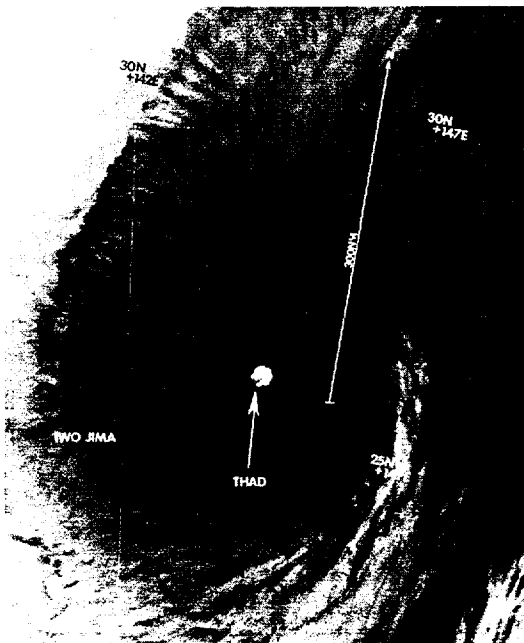


201200Z October 700 mb NOGAPS analysis

Figure 3-24-1. Comparison of the 48 hour 700 mb NOGAPS prog available to the TDO when the first warning was issued and the verifying analysis. The western extension of the subtropical ridge was forecast to extend west along 26N to near 130E. Instead, due to the effects of a digging mid-latitude trough moving into the Sea of Japan, the ridge slid east which allowed Thad to rapidly recurve to the northeast.



(a)

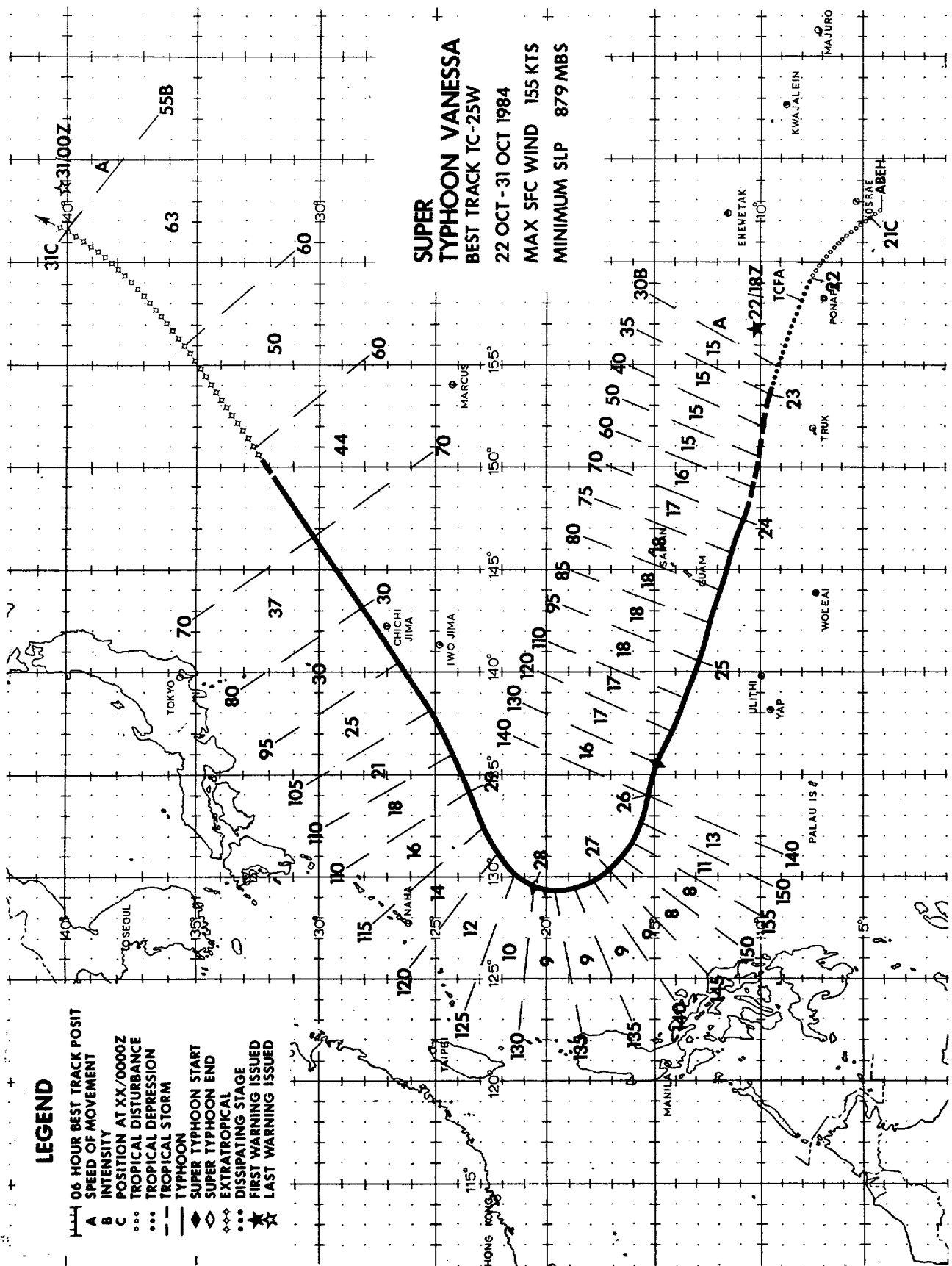


(b)



(c)

Figure 3-24-2. Three views of Typhoon Thad at maximum intensity: (a) Visual imagery (b) Infrared imagery and (c) Enhanced Infrared imagery - Dvorak Tropical Cyclone Curve. (220002Z October DMSP imagery).



SUPER TYPHOON VANESSA (25W)

Super Typhoon Vanessa, the first super typhoon of the 1984 season, also developed into the most intense storm of the year. At peak intensity Vanessa had an MSLP of 879 mb, only 9 mb above the record 870 mb observed in Super Typhoon Tip (1979). Except for a brief period when the storm brushed Guam, Vanessa remained clear of land and generally posed a threat only to shipping.

Super Typhoon Vanessa originated in the Near Equatorial Trough southeast of Ponape (WMO 91348) three days after Typhoon Thad formed some 700 nm (1296 km) further to the west. The disturbance was initially detected on 20 October as an area of convection near 4N 163E. Its rapid development resulted in the Significant Tropical Weather Advisory (ABEH PGTW) being reissued at 201900Z to include this area of convection as a suspect disturbance.

During the 21st and into the 22nd, the area of convection slowly increased in organization as the disturbance moved northwest to just north of Ponape. The persistent improvement in organization during this period resulted in the issuance of a TCFA at 220500Z. Sparse synoptic data at the time of the TCFA was only able to confirm the presence of a 10 to 15 kt (5 to 8 m/s) surface circulation. By now an upper-level anticyclone had developed, providing good outflow to all but the northwest quadrant which was still feeling some effects from the outflow of Typhoon Thad. The first warning on Vanessa was issued at 221800Z when analysis of satellite imagery resulted in an estimate that the disturbance now supported surface winds of 35 kt (18 m/s).

From beginning to end, Vanessa followed a very climatological track becoming one of the "great-recurver" storms of 1984. From the time it attained depression strength until it began to recurve, it moved almost due west-northwest. After recurving south of Okinawa, Vanessa underwent a complex transition into an extratropical low east of Japan.

Vanessa's intensity came very close to equalling the records established by Super Typhoon Tip in 1979. Figure 3-25-1 shows the MSLP versus time for Vanessa as obtained by reconnaissance aircraft. The pressure dropped 100 mb in a 48 hour period to reach a minimum of 879 mb at 261114Z. This is only 9 mb higher than the 870 mb recorded in Tip. (These pressures convert to 155 kt (80 m/s) and approximately 165 kt (85 m/s) for Vanessa and Tip, respectively, using the Atkinson and Holliday (1977) pressure-wind relationship).

The initial warning forecast Vanessa to move west-northwest and pass over Guam within 48 hours as a 65 kt (33 m/s) typhoon. The accuracy of the first forecasts gave the military and civilian communities on Guam sufficient time to properly prepare. Consequently there was little structural damage on the island and no personal injuries when Vanessa did approach as an 80 kt (41 m/s) typhoon. Vanessa's closest point of approach to Guam was 90 nm (167 km) to the south-southwest at 241100Z. Sustained winds above 30 kt (15 m/s) were recorded at numerous locations on the island with a peak gust of 59 kt (30 m/s) recorded at the Naval Oceanography Command Center (NAVOCEANCOMCEN) building on Nimitz Hill.

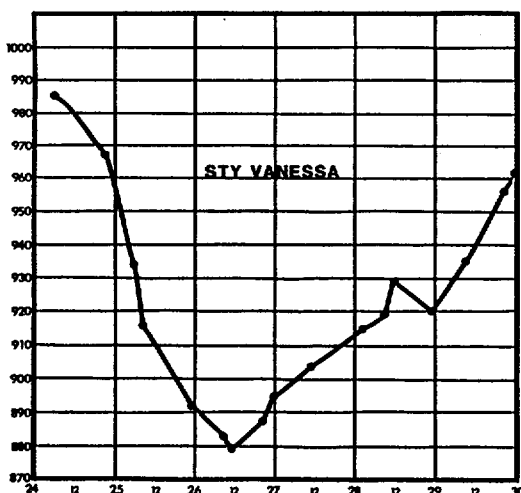


Figure 3-25-1. Time cross-section of Vanessa's minimum sea-level pressure as measured by reconnaissance aircraft. The pressure dropped 100 mb in a 48 hour period reaching a low of 879 mb at 261114Z. This is only 9 mb higher than the record 870 mb observed in Super Typhoon Tip in 1979.

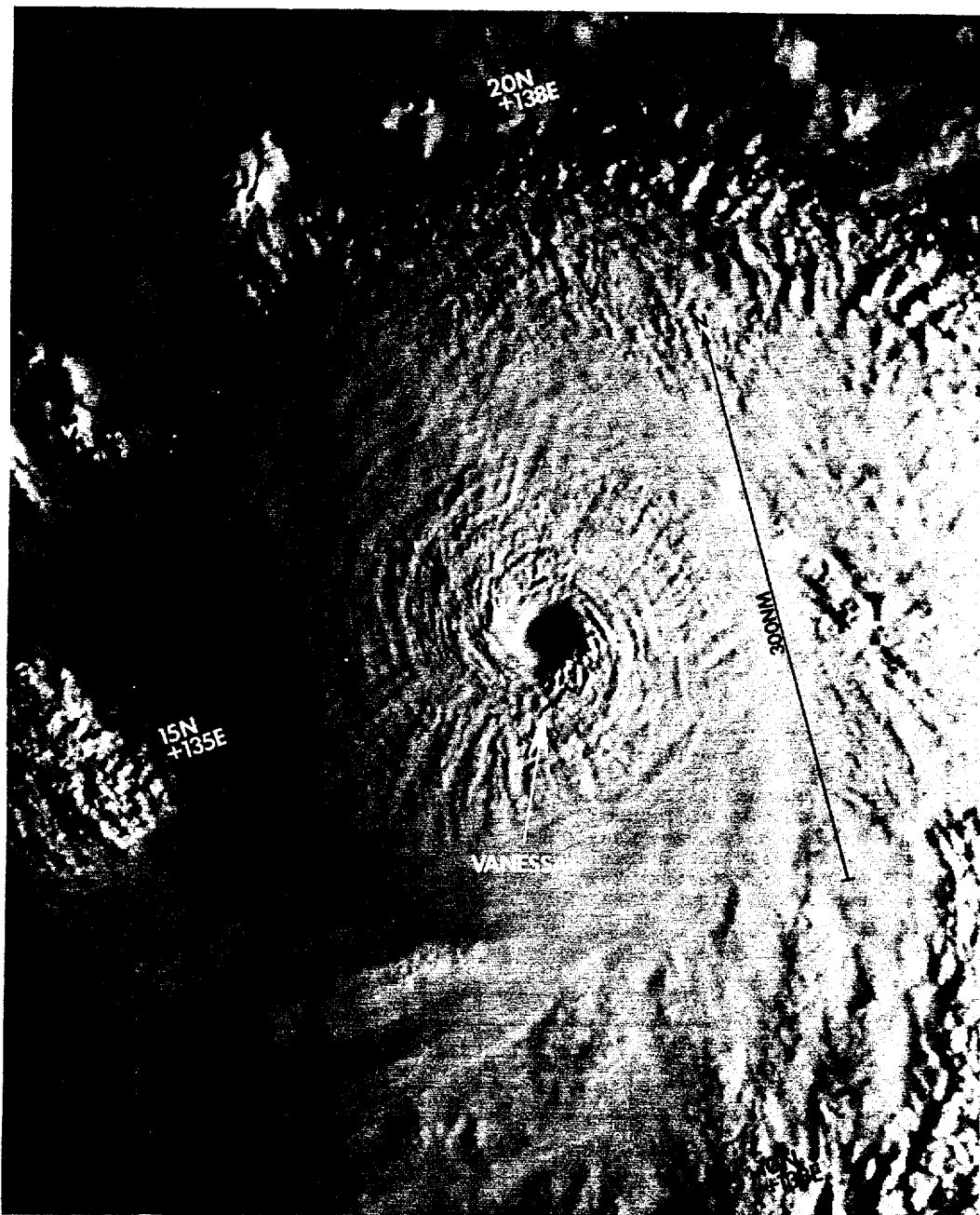


Figure 3-25-2. Super Typhoon Vanessa near maximum intensity (252233Z October NOAA visual imagery).

The only significant damage on Guam occurred to vegetation. An estimated 1.7 million dollars worth of crops were lost, principally bananas. Flooding was also reported in the southern coastal areas of the island.

Vanessa continued to intensify and move west-northwest after it passed south of Guam. The dominate synoptic feature was the subtropical ridge north of Vanessa which redeveloped in the wake of Typhoon Thad. Vanessa moved along the southern side of the ridge for nearly five days before recurving. It was just prior to recurvature, at 261200Z that a peak intensity of 155 kt (80 m/s) was attained (Figure 3-25-2). The ARWO flying the 261114Z fix mission that observed the 879 mb MSLP, described the 10 nm (19 km) circular eye as exhibiting a "fishbowl effect" with the convection in the eyewall spiralling vertically to the point of resembling corkscrews. During this flight, at a 700 mb height of 2022 m, the 700 mb temperature within the eye was an exceptionally high 30°C. Vanessa remained a super typhoon from 251800Z to 280000Z.

The recurvature which eventually took place on the 27th and 28th was initially

forecast on the 250000Z warning. A frontal system over eastern China was identified as the mechanism for recurvature. Vanessa was forecast to recurve at 21N to 22N, but actually turned to the northeast at 20N as the frontal system moved slightly faster than predicted. At no point during this period was Typhoon Warren in the South China Sea considered to be a factor in Vanessa's movement since Vanessa was the dominant storm both in size and strength.

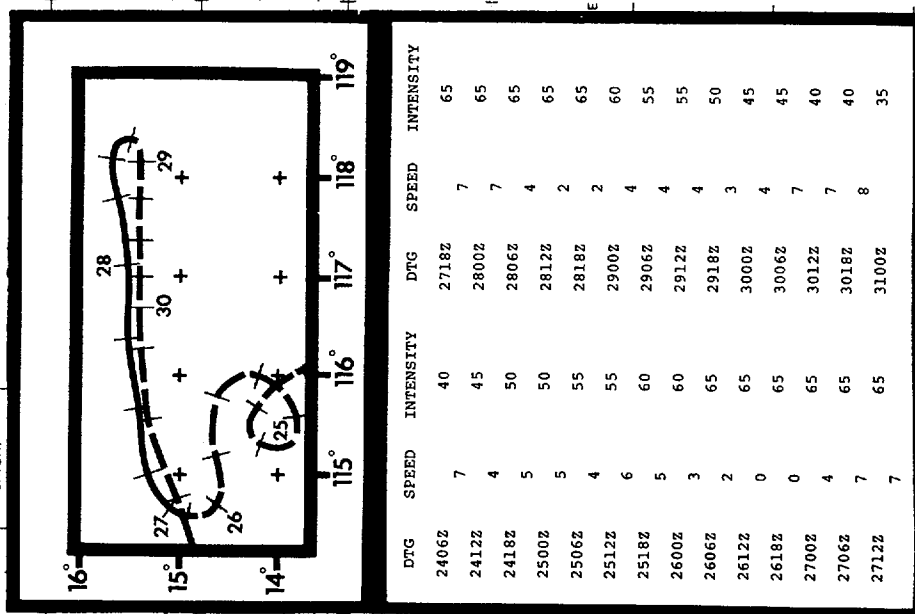
The final phase of Vanessa's life was a complex transition to an extratropical low. Interaction with the front began shortly after recurvature. The 282330Z aircraft reconnaissance mission indicated the transition was underway with strato-cumulus undercast present throughout much of the storm. Vanessa continued to weaken until the transition was complete.

Post-analysis indicates that extratropical transition was completed by 301200Z as satellite imagery showed no convection was present. Vanessa transitioned to a storm force low along the front and rapidly moved off to the northeast. The final warning was issued at 310000Z.

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
- ... DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

**TYPHOON
WARREN**
BEST TRACK TC-26W
23 OCT -31 OCT 1984
MAX SFC WIND 65 KTS
MINIMUM SLP 976 MBS



Typhoon Warren was the most erratic moving tropical cyclone of 1984. The system was the subject of two TCFA's. It made both a cyclonic and anticyclonic loop and varied in speed from quasi-stationary for 12 hours to 8 kt (15 m/s). Warren's erratic movements were due to interactions with eastward moving mid-latitude troughs and Super Typhoon Vanessa and due to its location in the monsoon trough.

The precursor of Warren appeared late on 17 October as an area of poorly organized convection at the trailing end of a shear line approximately 300 nm (556 km) northeast of Mindanao. Synoptic data at the time indicated that a broad 15 to 25 kt (8 to 13 m/s) circulation was collocated with the convection and embedded in the monsoon trough. Over the next 24 hours the convection persisted and appeared to be separating from the shear zone while increasing slightly in organization and intensity. This prompted the first TCFA to be issued at 181500Z. Aircraft reconnaissance investigated the alert area at 190159Z and found a broad weak surface circulation with an MSLP of 1006 mb. Satellite imagery now showed the convection to be decreasing which was confirmed by the ARWO who reported that no significant convection was directly associated with the disturbance. The TCFA was cancelled at 191130Z based on the lack of persistent significant convection near the low-level center, strong upper-level easterly winds over the region, and the proximity of the disturbance to land.

Over the next several days the surface circulation weakened and moved west-southwest along the trough axis across the Philippines and entered the South China Sea on 22

October. During this period synoptic data indicated that several weak circulations were embedded in the monsoon trough. Late on 22 October the tropospheric pattern became more favorable for development. Synoptic data showed that west of Palawan a strong northeast monsoon outbreak combined with a moderate southwest monsoon to the south had produced a well-defined surface circulation. Meanwhile, upper-level diffluence developed over the South China Sea on the western edge of an anticyclone located east of Luzon (Figure 3-26-1).

On 23 October the disturbance rapidly developed. Satellite imagery at 230300Z showed that an exposed low-level circulation center was present some 30 to 60 nm (56 to 111 km) southeast of the developing intense convection. Satellite data also indicated that the tightly wrapped surface circulation was moving north towards the convection. The 30 to 40 kt (15 to 21 m/s) east-southeast upper-level wind over the disturbance, while providing some diffluence, which contributed towards development, also hindered the surface circulation from aligning with the convection. At 230600Z the disturbance was again mentioned on the ABEH, followed several hours later by the second TCFA at 231100Z. With continued development evident, the first warning was issued at 1800Z. Infrared satellite imagery at the time of the first warning indicated the surface center was now located on the eastern edge of the Central Dense Overcast (CDO). Although Dvorak satellite intensity analysis on the 231800Z infrared imagery indicated that 35 kt (18 m/s) winds were present, JTWC did not upgrade Warren from

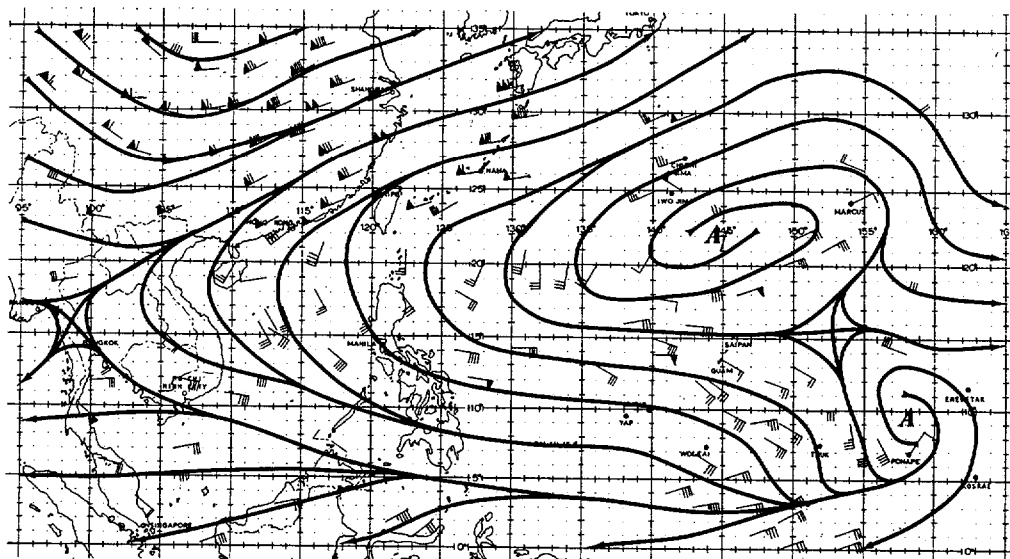


Figure 3-26-1. 200 mb analysis at 230000Z October. The diffluence over the South China Sea was sufficient to allow Warren to develop, although it would later hinder the low-level circulation from becoming collocated with the convection.

depression status until 12 hours later when visual imagery confirmed that the upgrade was warranted. Post analysis indicates this upgrade should have occurred at 231800Z. Warren and the monsoon trough moved north over the next 18 hours. Visual satellite imagery showed that a partially exposed low-level circulation center was now evident on the northeast edge of the convection.

Between 240600Z and 270000Z Warren moved erratically. It did a small cyclonic loop on the 24th and 25th, before resuming a slow westward course followed by a turn to the north and a 12-hour quasi-stationary period between 261200Z and 270000Z. This erratic movement was partially due to Warren's remaining embedded in the monsoon trough and the passage of a mid-latitude trough to the north.

During this period, despite the strong upper-level easterly winds which kept nearly all the convection west of the low-level center, Warren strengthened to typhoon intensity. Aircraft reconnaissance at 260330Z found a band of 60 to 70 kt (31 to 36 m/s) surface winds in the south semicircle of Warren. These winds were the result of the southwest monsoon enhancing Warren's circulation. Warren maintained this minimum 65 kt (33 m/s) typhoon intensity through 281800Z.

Warren became quasi-stationary at 261200Z. At this time Super Typhoon Vanessa (located some 960 nm (1778 km) to the east of Warren in the central Philippine Sea) was moving towards the northwest. Warren now came under the influence of Vanessa's large inflow and a mid-latitude trough passing to the north. (This trough would also be responsible for Vanessa's recurvature). Warren responded by turning to the east-northeast and accelerating to 7 kt (13 km/hr) (Figure 3-26-2). This placed the Philippine Islands north of 14N including Clark AB and the Subic Bay Naval Facilities in imminent danger of being hit by Warren. As a result, all Navy and Air Force Bases in the region were placed in Condition of Readiness I early on the 28th. Fortunately, Warren's interaction with Vanessa and the mid-latitude trough was short-lived sparing the Philippines a direct hit. On 28 October, with Vanessa recurving and the trough axis to the east, Warren slowed and commenced an anticyclonic turn back to the west. At its closest point of approach, Warren was 120 nm (222 km) west-northwest of Clark AB (WMO 98327). As the effects of the trough and Vanessa eased, Warren completed its turn to the west on 29 October. The highest wind reported at Clark AB was 22 kt (11 m/s) at 282055Z, with the total rainfall on 28 and 29 October reaching 8.74 inches (222 mm). No significant damage was reported at any of the military bases.

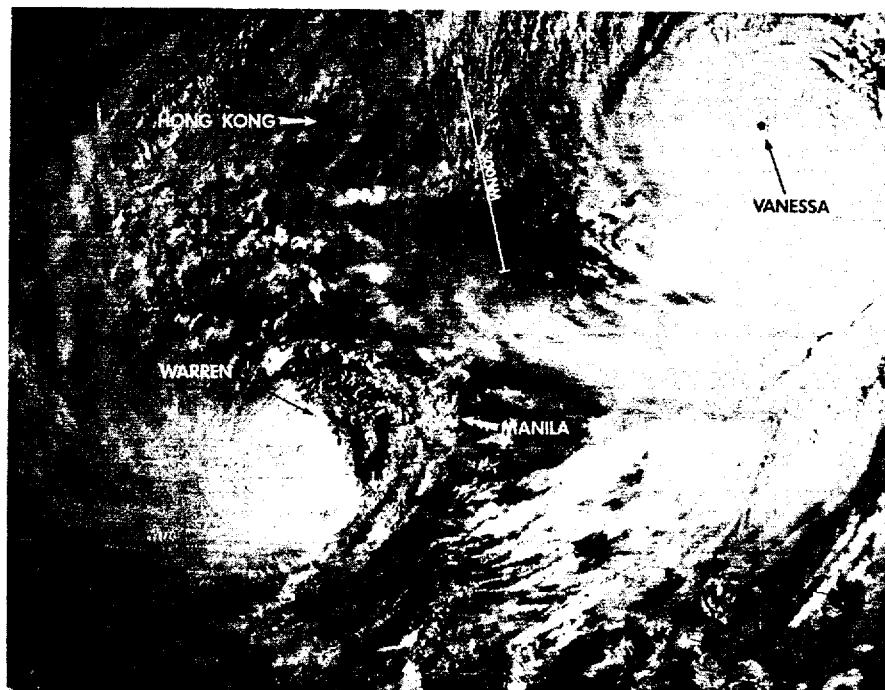


Figure 3-26-2. Typhoon Warren as it moved to the east-northeast under the influence of Super Typhoon Vanessa. Note the effects of the strong upper-level outflow from Vanessa displacing Warren's convection to the west (272326Z October NOAA visual imagery).

Other coastal areas and marine interests were not nearly as fortunate. Heavy rains caused landslides in several coastal towns killing at least 42 people. High seas capsized and sank the inter-island passenger ferry, MV VENUS (746 tons) on 28 October off Torrijos and Bondoc Peninsula. About 36 people were killed but at least 213 passengers were saved. In addition, a 930 ton ship, the Lorenzo Container VIII was sunk on 28 October near 14.0N 120.6E, with eight crew members listed as missing.

Ridging developed in the low to mid-levels in wake of the mid-latitude trough passage. The subtropical ridge now became anchored across the northern part of the South China Sea. Another surge of the northeast monsoon entered the South China Sea on 29 October and began to expand Warren's wind radii in the northern semicircle. Aircraft data indicated that Warren was beginning to weaken as it drew cooler, dryer air into its center. The ARWO reported that the center was surrounded by stratocumulus clouds. This was also evident on satellite imagery as the convection began to decrease in intensity. The deep-layered northeast monsoon flow pushed Warren's low-level circulation to the west-southwest on

30 October and created a significant tilt from the surface to the 700 mb center. On the 31st, the hard convection was associated with the 700 mb center, displaced approximately 60 nm (111 km) west-northwest of the weakening surface center (Figure 3-26-3). JTWC issued the final warning at 310600Z since the 30 kt (15 m/s) surface center was no longer expected to become aligned with the mid-level center and the convection. This prognosis held true, but because Warren's low-level circulation was still in a region of positive low-level vorticity, dissipation occurred much slower than was forecast. Satellite imagery still showed that a well-defined low-level circulation was present 24 hours after the last warning was issued. Warren's displaced convection crossed the central Vietnam coast on 1 November with moderate to heavy rain forecast. The combination of the northeast monsoon and dissipating surface circulation just offshore resulted in 30 to 35 kt (15 to 18 m/s) winds along the Vietnam coast. By 1800Z on 1 November the surface circulation was no longer discernable on satellite imagery and synoptic data on 2 November was inconclusive as to the location of the weakening surface center. Warren had finally dissipated.

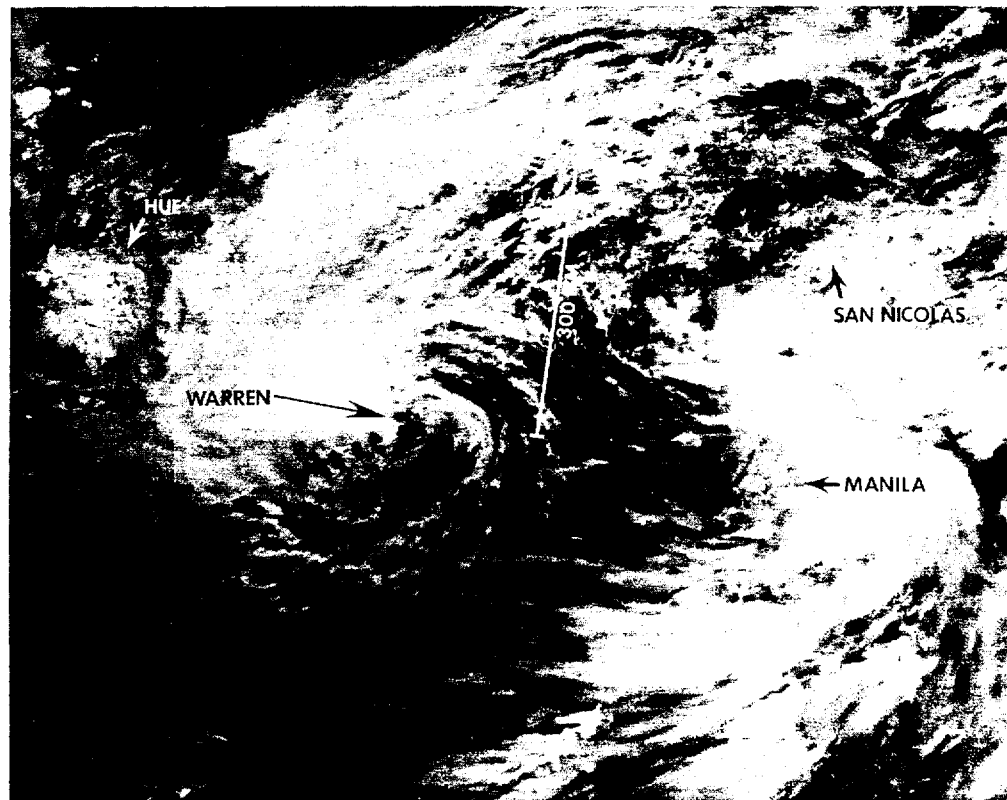
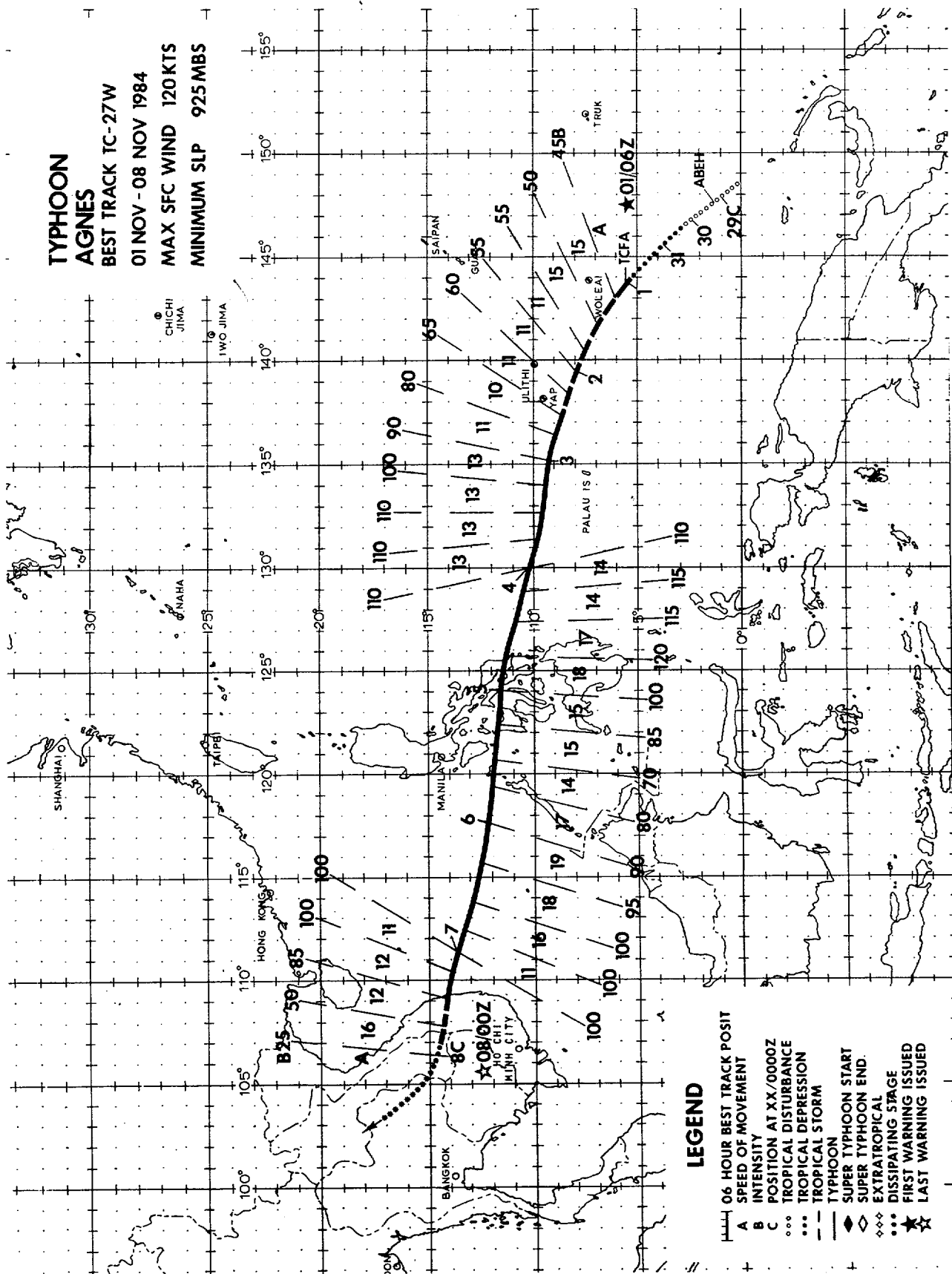


Figure 3-26-3. The partially exposed low-level circulation center displaced 60 to 70 nm (111 to 127 km) southeast of the 700 mb center. The northeast monsoon is pushing the low-level center to the southwest. This imagery was taken just four hours prior to the last warning (310204Z October DMSP visual imagery).

**TYPHOON
AGNES**
BEST TRACK TC-27W
01 NOV - 08 NOV 1984
MAX SFC WIND 120 KTS
MINIMUM SLP 925 MBS



TYPHOON AGNES (27W)

Typhoon Agnes was the first of three tropical cyclones to develop during the month of November. It was also the last storm of the season to directly hit the Philippines. From the time of the first warning until it made landfall over central Vietnam, Agnes moved rapidly on a nearly straight west-northwest course.

The system that eventually developed into Typhoon Agnes began as an isolated area of weak convection near the equator on 28 October. Synoptic data at the time hinted that a weak 5 kt (3 m/s) surface circulation might be present beneath the convection near 1N 149E. The southwest monsoon at this time was restricted to the South China and northern Philippine Seas and did not assist in the development of this system. Even in its incipient stage, however, a small upper-level anticyclone was analyzed over the disturbance providing good ventilation.

The system slowly developed during the next three days as the area of convection and associated weak circulation moved northwest to near 4N. Late on the 31st, satellite imagery revealed that a significant increase in convection and organization was taking place. This prompted the issuance of a TCFA at 0000Z on 1 November.

During the next six hours the disturbance rapidly pulled itself together into a potent, compact circulation. The first aircraft reconnaissance mission into the alert area at 010513Z found a closed circulation with maximum surface winds of 50 kt (26 m/s). Analysis of satellite imagery conducted just prior to the flight had indicated that only 35 kt (18 m/s) winds were to be expected. The first warning on Agnes as a tropical storm was issued a short time later at 010600Z.

From the time the disturbance was initially detected until the TCFA was issued, Agnes had moved slowly to the northwest. By early on the 1st, Agnes had moved far enough north to be influenced by the easterly flow along the south side of the broad mid- to low-level subtropical ridge which now extended from the dateline west to the coast of Vietnam. This ridge and its associated easterly steering flow persisted throughout the life of Typhoon Agnes and kept the storm on a west-northwest track from the 1st of November until it

dissipated over Vietnam six days later. This ridge was also responsible for making Agnes' wind field asymmetric. Due to the enhancement of the storm's circulation by the easterly trades, Agnes' wind field was consistently stronger and extended to a larger radii in the northern semicircle. This asymmetry would be present throughout much of the life of Agnes.

As Agnes transited the Philippine Sea it steadily intensified reaching a peak intensity of 120 kt (62 m/s) at 041800Z. This peak intensity occurred just prior to Agnes making landfall 10 nm (19 km) south of Borongan (WMO 98553) on the central Philippine Island of Samar. Figure 3-27-1 is satellite imagery of Agnes approximately twelve hours prior to reaching maximum intensity.

Agnes weakened as it crossed the central Philippines, but due to its rapid speed of movement was able to maintain typhoon intensity. After emerging in the South China Sea, Agnes once again intensified, this time to 100 kt (51 m/s). Agnes maintained this intensity until it made landfall 20 nm (37 km) north of Qui-Nhon, Vietnam (WMO 48870) at approximately 1100Z on 7 November (Figure 3-27-2). After landfall Agnes continued to track to the west-northwest and rapidly weakened. The final warning by JTWC was issued at 080000Z.

Typhoon Agnes caused substantial damage and loss of life when it crossed the Philippine Islands. Storm surge flooding of low-lying coastal areas on the islands of Samar and Leyte was particularly severe. In addition, heavy rainfall caused extensive flooding. The winds, floods and mudslides combined to leave over 350,000 homeless. At least 564 people are known dead as a result of the storm. When the number dead are combined with the number of people reported missing, the final death count is expected to be near 1000. News reports indicated that the damage exceeded 600 million pesos (30 million U.S. dollars).

When Typhoon Agnes made landfall on Vietnam three days later, there was additional destruction of property and loss of life. Heavy rains brought flooding which severely affected the rice harvest and winter crop cultivation.

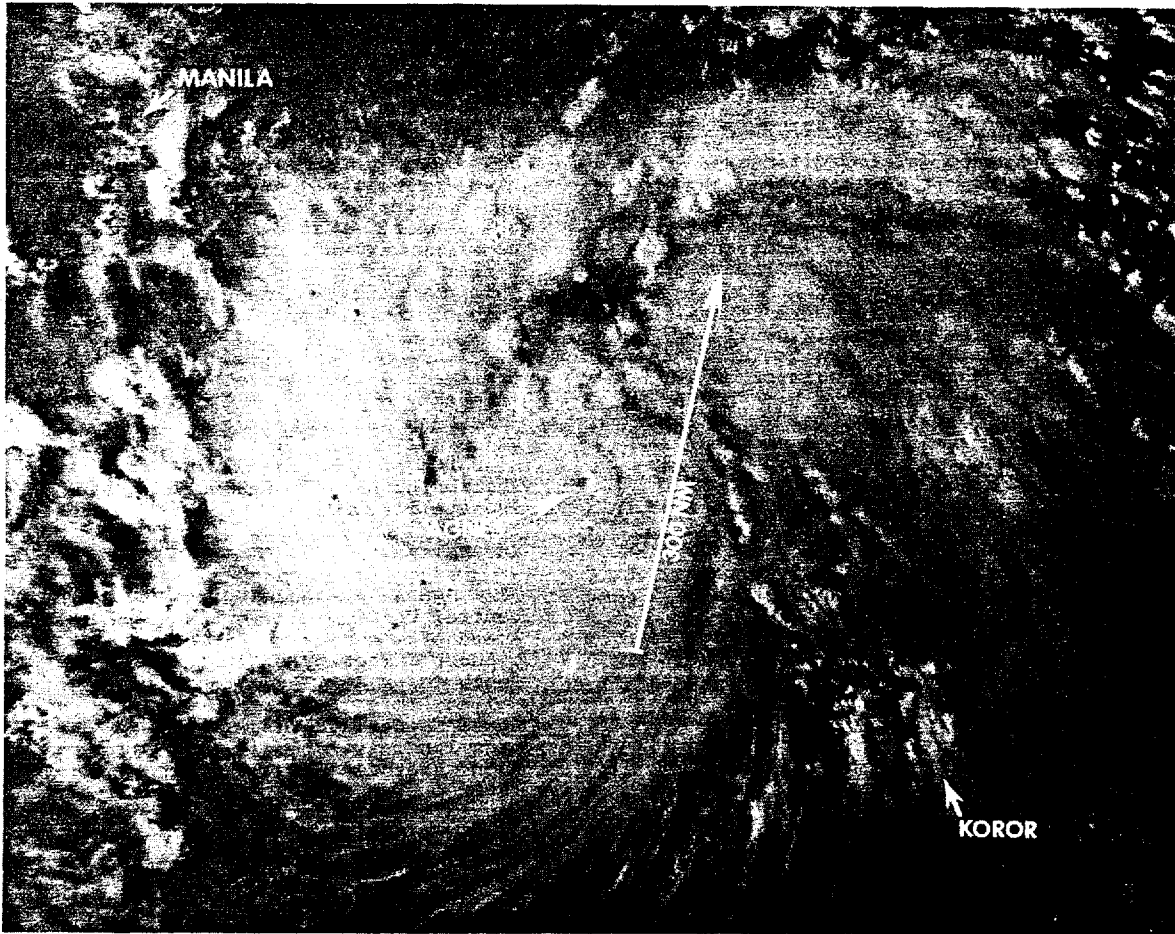


Figure 3-27-1. Agnes just prior to attaining peak intensity. At this time Agnes had a 5 nm (9 km) eye (040657Z November NOAA visual imagery).

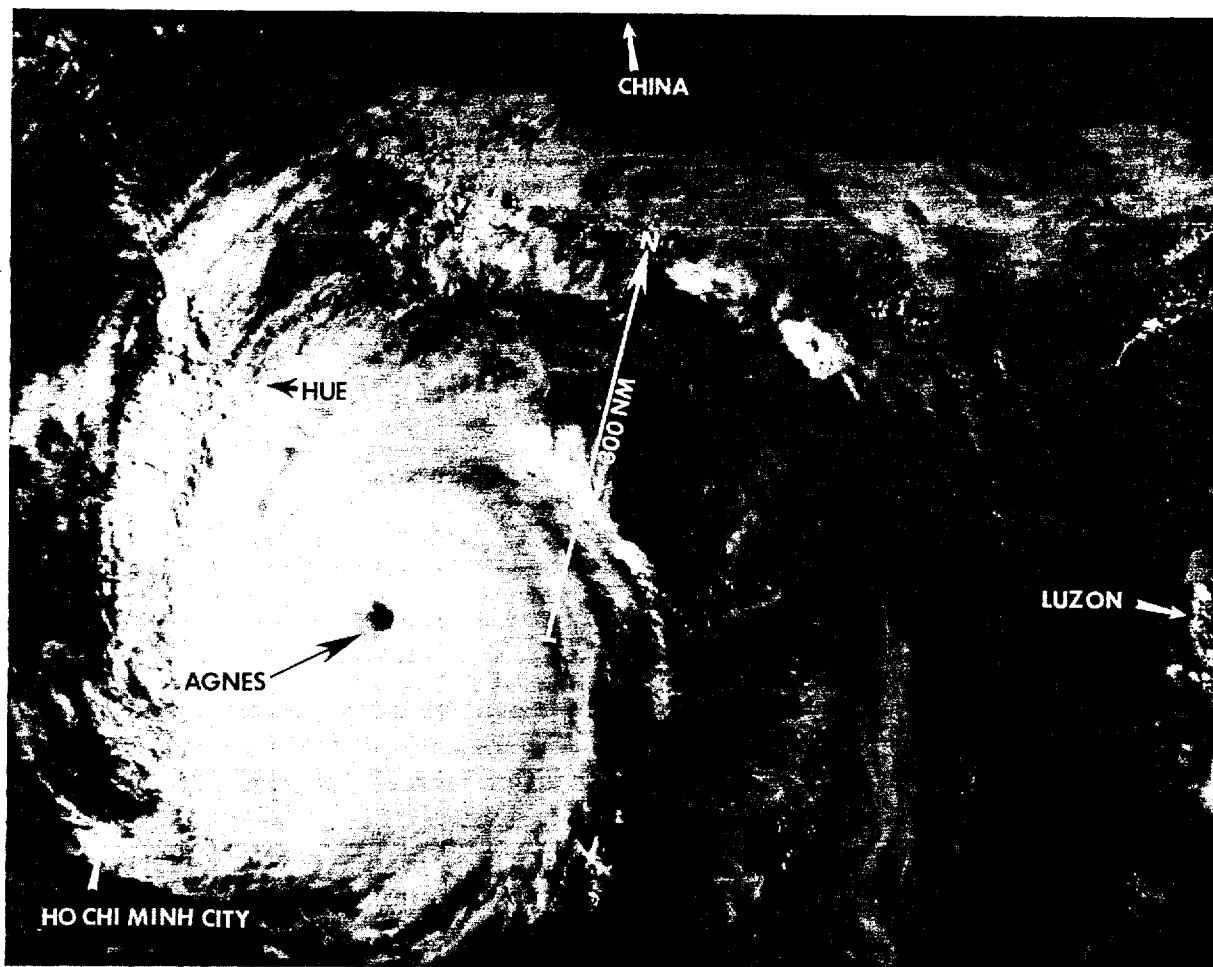
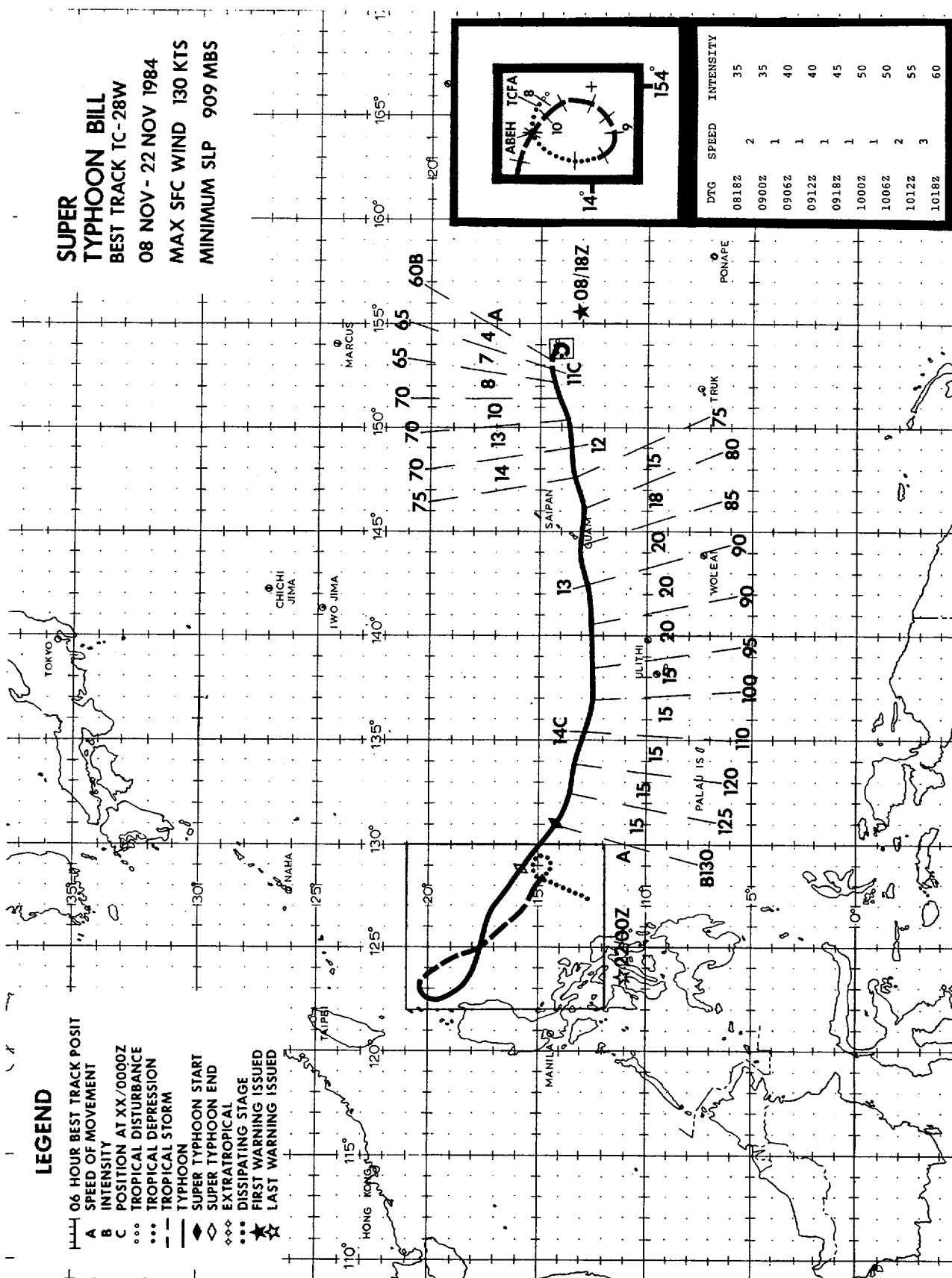
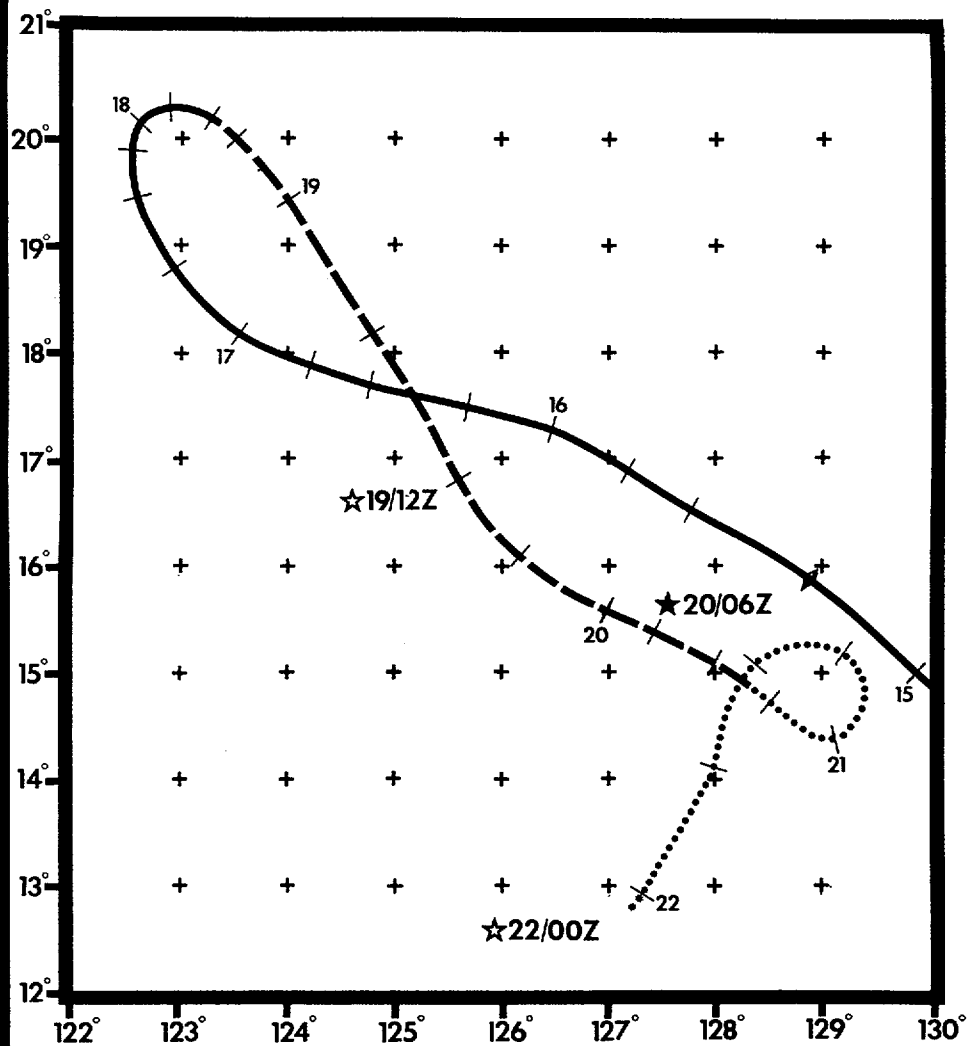


Figure 3-27-2. Typhoon Agnes at 100 kt (51 m/s) intensity just prior to making landfall over central Vietnam (070801Z November NOAA visual imagery).





DTG	SPEED	INTENSITY	DTG	SPEED	INTENSITY
1418Z		130	1812Z	3	65
1500Z	14	130	1818Z	7	60
1506Z	13	130	1900Z	14	55
1512Z	12	125	1906Z	16	50
1518Z	7	125	1912Z	8	50
1600Z	8	120	1918Z	8	45
1606Z	8	120	2000Z	5	45
1612Z	8	115	2006Z	5	40
1618Z	7	110	2012Z	7	40
1700Z	6	100	2018Z	6	30
1706Z	8	90	2100Z	7	30
1712Z	7	90	2106Z	7	30
1718Z	5	80	2112Z	11	25
1800Z	4	80	2118Z	13	25
1806Z	3	70	2200Z		25
	3				

SUPER TYPHOON BILL (28W)

The second and last super typhoon of the 1984 season led a rather unusual life. After forming east of Guam, it made a small cyclonic loop before heading to the west-southwest. Two days later, Bill passed just to the south of Guam by which time it had accelerated to almost 20 kt (37 km/hr). After causing some damage on the island of Guam, Bill entered the Philippine Sea and turned to the west-northwest. Although it was expected to recurve to the northeast and follow a track similar to that of Super Typhoon Vanessa, due to a complex steering environment including interaction with Typhoon Clara, Bill instead turned to the southeast before eventually dissipating east of the Philippines. Although this track is unusual, it is not uncommon for late season storms to move erratically for at least a portion of their life.

Super Typhoon Bill originated as an area of convection on 7 November near 14N 154E. The convection was at the trailing end of an eastward moving cold front and this may have supplied some low-level vorticity which contributed to the rapid development of the disturbance. The rapid development of the convection resulted in a TCFA at 080200Z. At the time of the TCFA, analysis of satellite imagery already indicated that 25 kt (13 m/s) surface winds were present.

The first of a total of 35 aircraft reconnaissance flights flown against Bill found the disturbance's circulation center at 080721Z but observed surface winds of only 20 kt (10 m/s). The system showed continued development during the next 12 hours, and as a result the first warning was issued at 081800Z.

From the 8th until the 10th, Bill slowly tracked in a 25 nm (46 km) wide cyclonic loop and continued to strengthen. At 0000Z on 10 November, reconnaissance aircraft reported that Bill had intensified to a 50 kt (26 m/s) tropical storm with an MSLP of 990 mb.

Bill attained typhoon strength on the 10th. The weak steering flow which had been present was replaced by easterly flow as the subtropical ridge strengthened to the north of the storm. At approximately 100600Z Bill completed its cyclonic loop and started to move to the west and then southwest on a course that would eventually bring the typhoon to the southern tip of Guam. On the 11th and 12th, Bill accelerated and gradually intensified (Figure 3-28-1). With Bill forecast to pass within 60 nm (111 km) of Guam, tropical cyclone Condition of Readiness III was set on the afternoon of 11 November. On the morning of the 12th, with Bill now

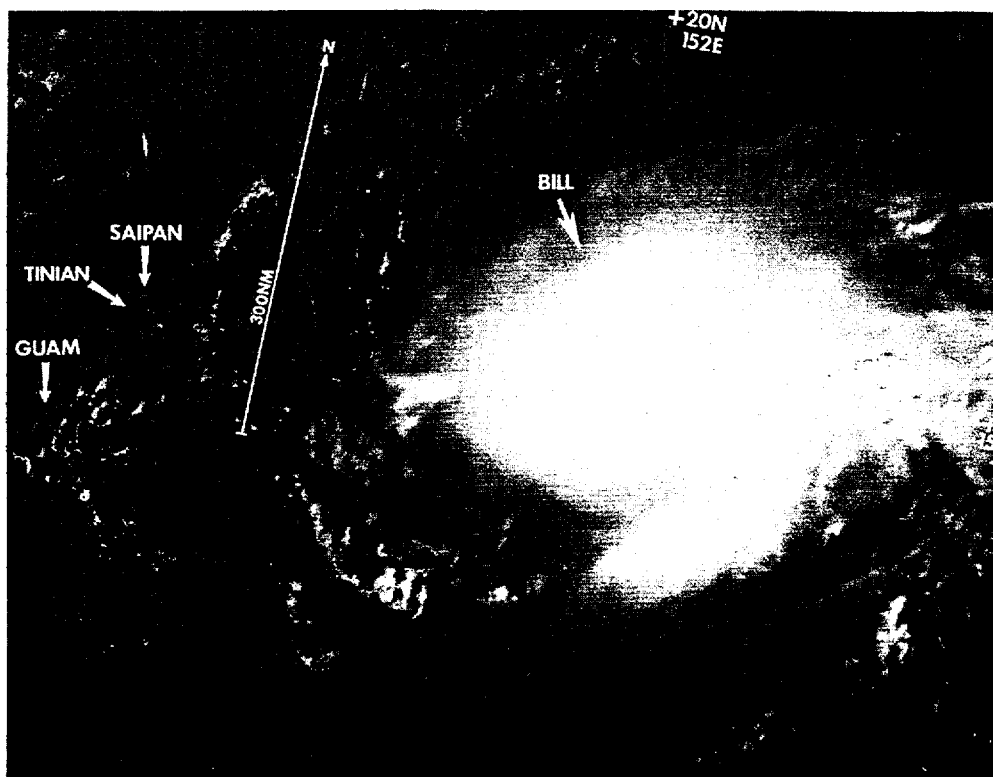


Figure 3-28-1. Bill consolidating east of Guam (110003Z November DMSP visual imagery).

forecast to pass less than 30 nm (56 km) south of the island, Condition of Readiness II was set at 112330Z.

Although Guam was forecast to be in the "dangerous" semicircle of the typhoon, the strength of the flow around the ridge did have a positive effect on Guam. Bill accelerated from 15 to 20 kt (28 to 37 km/hr) as it passed Guam thereby considerably shortening the time the typhoon affected the island. This rapid forward speed may also

have been a factor in the slow intensification of the system. Only a 15 kt (8 m/s) increase in intensity occurred during the 24 hour period between 111800Z and 121800Z as Bill approached Guam.

Condition of Readiness I was set on the evening of the 12th, as Bill neared Guam. Typhoon Bill passed the southern tip of the island at 121630Z at a distance of 12 nm (22 km). Figure 3-28-2 contains a plot of the data obtained by reconnaissance air-

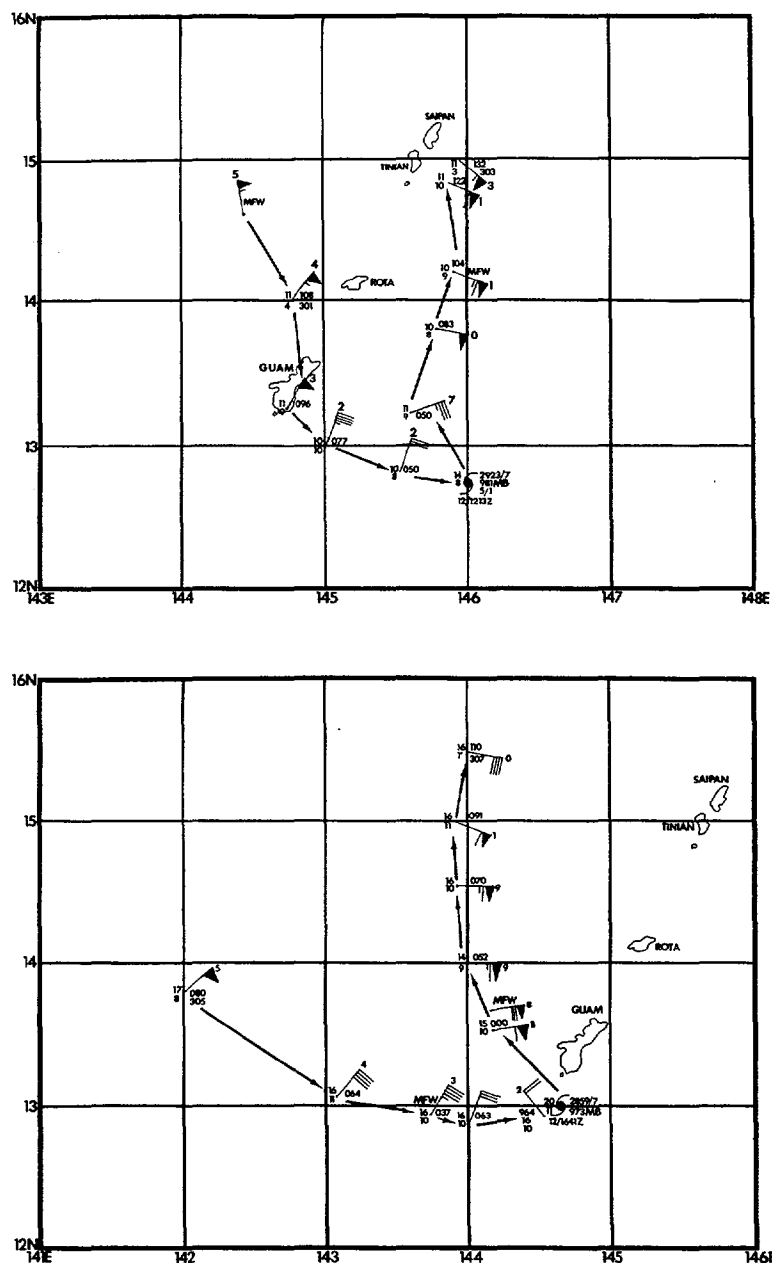


Figure 3-28-2. Plot of data obtained at the 700 mb level by aircraft reconnaissance on the two missions flown as Bill passed south of Guam.

craft during the two missions flown when Bill was at its closest point of approach to Guam. On the island itself, a maximum wind of 63 kt (32 m/s) was recorded at the National Weather Service Station (WMO 91217) at 121658Z, with a gust of 84 kt (43 m/s) recorded at Reserve Craft Beach in Apra Harbor. Typhoon Bill caused some damage on Guam, particularly to agricultural commodities. Banana trees that had been slightly damaged during the passage of Super Typhoon Vanessa were completely destroyed by Bill. Total crop damage was estimated at \$7,707,911. Some minor flooding also occurred but no personnel injuries were reported. Electrical power was out in certain sections of the island for several days.

Bill entered the Philippine Sea late on the 12th moving west at 20 kt (37 km/hr) and intensifying. In the 24 hour period between 131200Z and 141200Z, the MSLP dropped 54 mb to 912 mb and the wind speed increased from 95 kt (49 m/s) to 125 kt (64 m/s) (Figure 3-28-3). The pressure continued to drop for another 12 hours, with aircraft reconnaissance at 142234Z reporting an MSLP of 909 mb. This was the lowest pressure reported in Bill. Bill attained super typhoon strength at approximately 141800Z which it then maintained for 12 hours.

Bill turned to the west-northwest early on the 14th and by 141800Z had turned to the northwest. It now appeared that Bill was starting to move around the western end

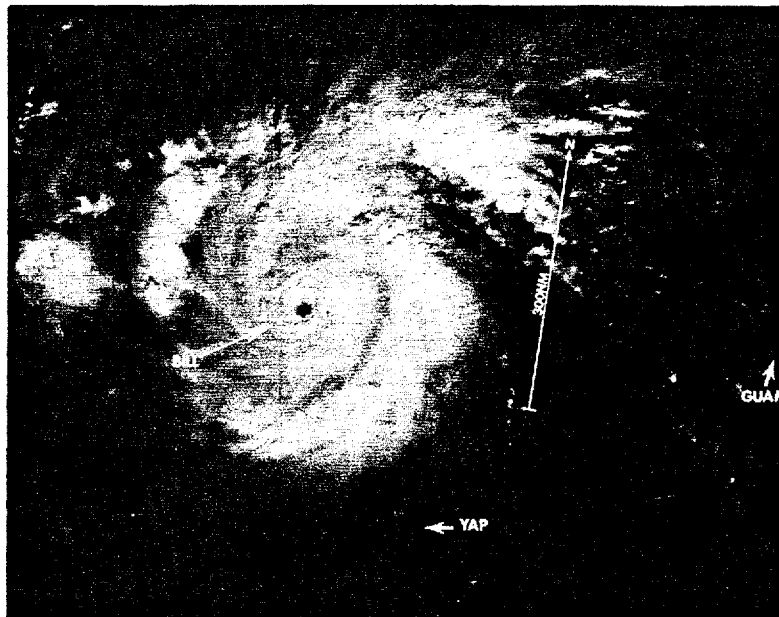


Figure 3-28-3. Typhoon Bill as it appeared on satellite imagery while undergoing rapid intensification (140044Z November DMSP visual imagery)

of the subtropical ridge. What was initially expected to be a simple recurvature scenario would soon become a complex interaction between Bill, the approaching Typhoon Clara (now developing near Truk (WMO 91334)), the mid-latitude westerlies, and the northeast monsoon. These factors would eventually cause Bill to weaken, double back on its present track and eventually dissipate.

Bill slowed down as it moved to the northwest and by 151800Z was moving at 7 kt (13 km/hr) down from the 15 kt (28 km/hr) movement of twenty-four hours earlier. This was due to the passage of a mid-latitude trough to the north which weakened the subtropical ridge. Bill now began to weaken as it encountered strong upper-level westerlies which disrupted its outflow and sheared the convection to the northeast (Figure 3-28-4). This marked the start of a weakening trend which would continue until dissipation.

At 1200Z on the 15th, the subtropical ridge reintensified temporarily forcing Bill back on a west-northwest course which

it maintained until late on the 16th. On the 17th, Bill started to track to the northwest as the ridge weakened once again. It now appeared that recurvature was finally going to occur. At 180000Z Bill turned again, this time to the northeast but unfortunately this was not to be the start of the long awaited recurvature.

At this time, three factors were involved in the steering of Bill: Typhoon Clara had become the dominant circulation in the Philippine Sea (Figure 3-28-5), the flow around the subtropical ridge was waning, and the northeast monsoon was gaining strength. The subtropical ridge was the first loser in this tug-of-war as Clara's large low-level circulation started to draw a weakening Bill to the southeast. Figure 3-28-6 shows the rapidly weakening Bill with little convection remaining as it moved towards Clara.

Bill continued to track to the southeast and weaken under the combined influence of Typhoon Clara and the westerlies. Aircraft reconnaissance at 191130Z confirmed this weakening trend. The MSLP had risen to 997 mb and the maximum observed 700 mb flight

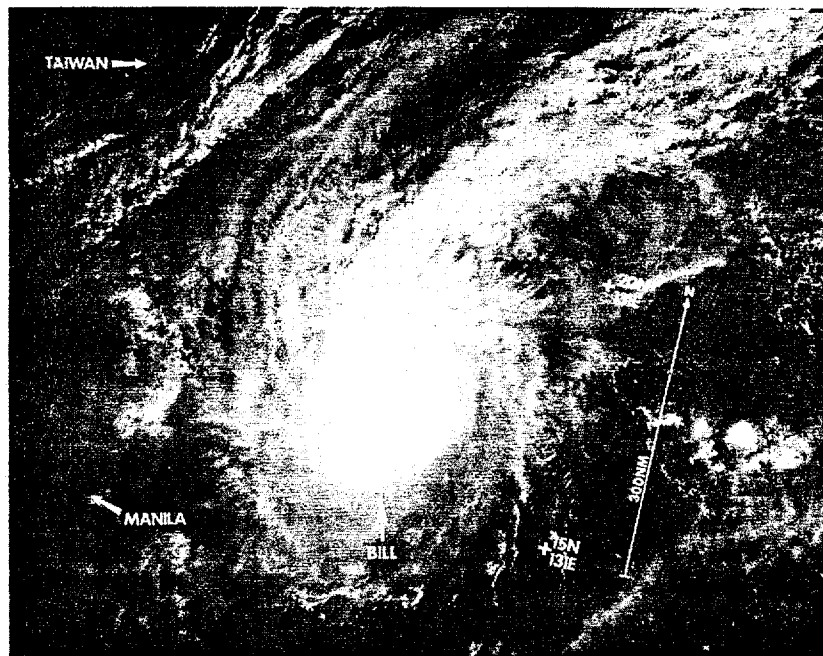


Figure 3-28-4. Bill east of Luzon as it encountered the upper-level westerlies and began to weaken. Note the cloud covered eye and the cirrus streaming to the northeast (160145Z November DMSP visual imagery).

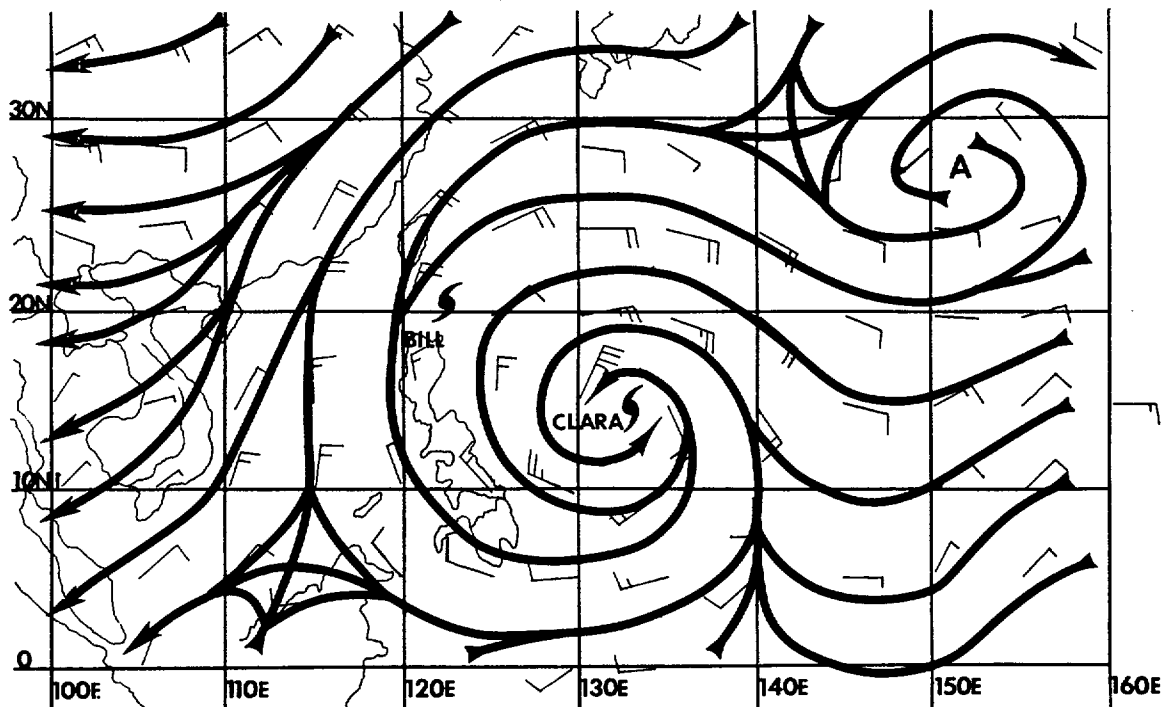


Figure 3-28-5. The 181200Z 925 mb NVA analysis showing the dominance of Typhoon Clara in the Philippine Sea. Bill which supported 65 kt (33 m/s) winds at this time was a small circulation compared to Clara and the northeast monsoon.

level wind was 28 kt (14 m/s). (Since the mission was flown at night, no surface wind data were available.) Based on the aircraft reconnaissance data and the lack of convection and organization on satellite imagery, Bill was downgraded to a tropical depression and finalized at 191200Z. As it turned out, this was premature. Early on the 20th, with Clara completing recurvature along 132E and accelerating to the northeast, its influence on Bill weakened and Bill began to regenerate some convection. Visible imagery indicated that a low-level circulation center was present. Aircraft reconnaissance a short time later, flying in the daylight at the 1500 ft (457 m) level at 200205Z reported that Bill was still moving to the southeast

and now had an MSLP of 999 mb. The aircraft also reported, that a well-defined low-level circulation with 40 to 55 kt (20 to 28 m/s) winds was present! The strongest winds were located in the western semicircle of the storm and were being enhanced by the northeast monsoon. As a result Bill was returned to warning status as a tropical storm at 200600Z (Figure 3-28-7).

Although the aircraft wind data suggests that Bill intensified between 191200Z and 200600Z, this is not considered likely. Due to the weak mid-level winds reported on the 191130Z fix mission, JTWC had the impression that Bill was rapidly dissipating. In fact Bill still possessed a well-defined surface

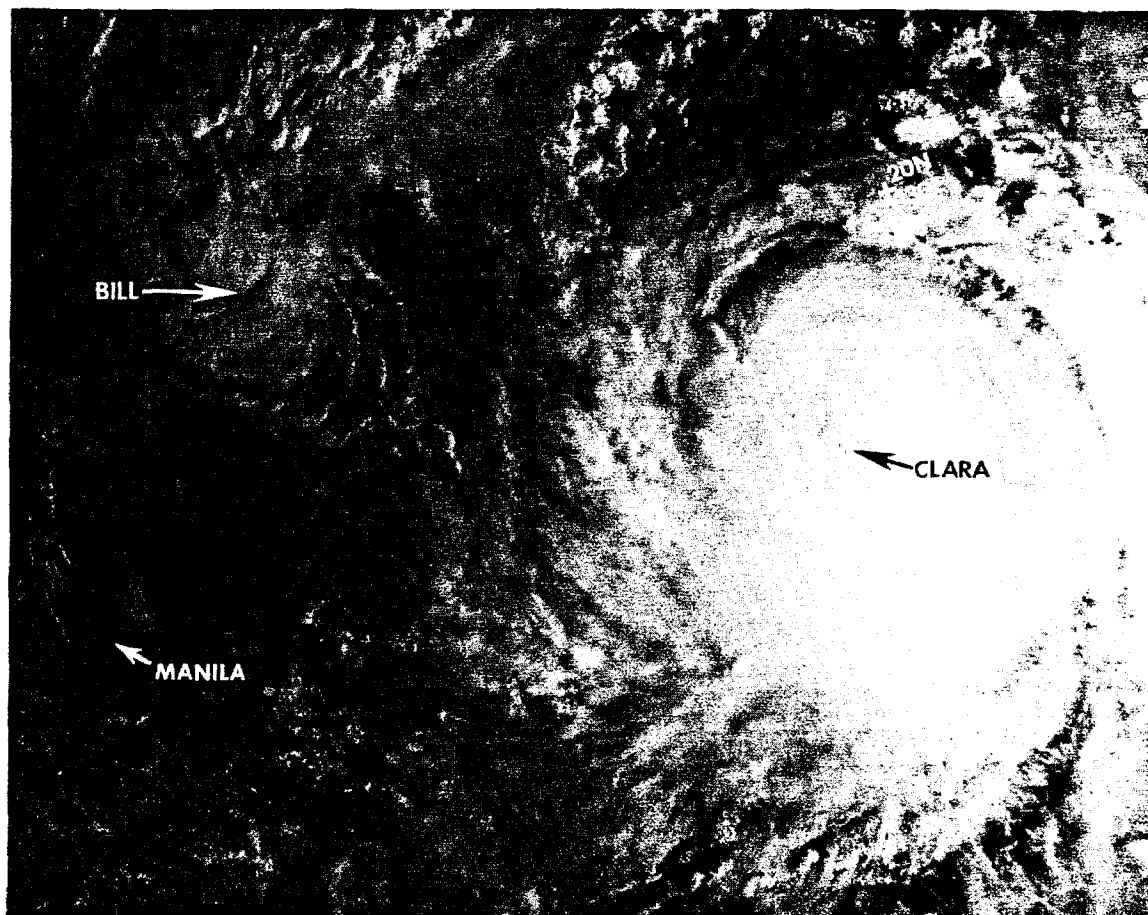


Figure 3-28-6. A weakened Bill as it heads southeast under the influence of Clara's inflow (182258Z November NOAA visual imagery).

circulation which was weakening at a much slower rate than the mid-level circulation. If the 191130Z fix mission had been able to observe surface winds it would probably have reported that 50 kt (26 m/s) surface winds were still associated with Bill.

As it turned out, the increase in convection was temporary. As Clara moved further away, its effect lessened and Bill slowed, doing a small cyclonic loop on the 21st. Bill was now under the influence of

the northeast monsoon which pushed the low-level circulation to the southwest. By the 22nd the low-level circulation became embedded in the northeast monsoon, and Bill was no longer identifiable as a significant tropical cyclone. The final warning was issued at 220000Z. Although the low-level circulation dissipated in the Philippine Sea, residual convection brought locally heavy rains to the central Philippines early on the 23rd of November.

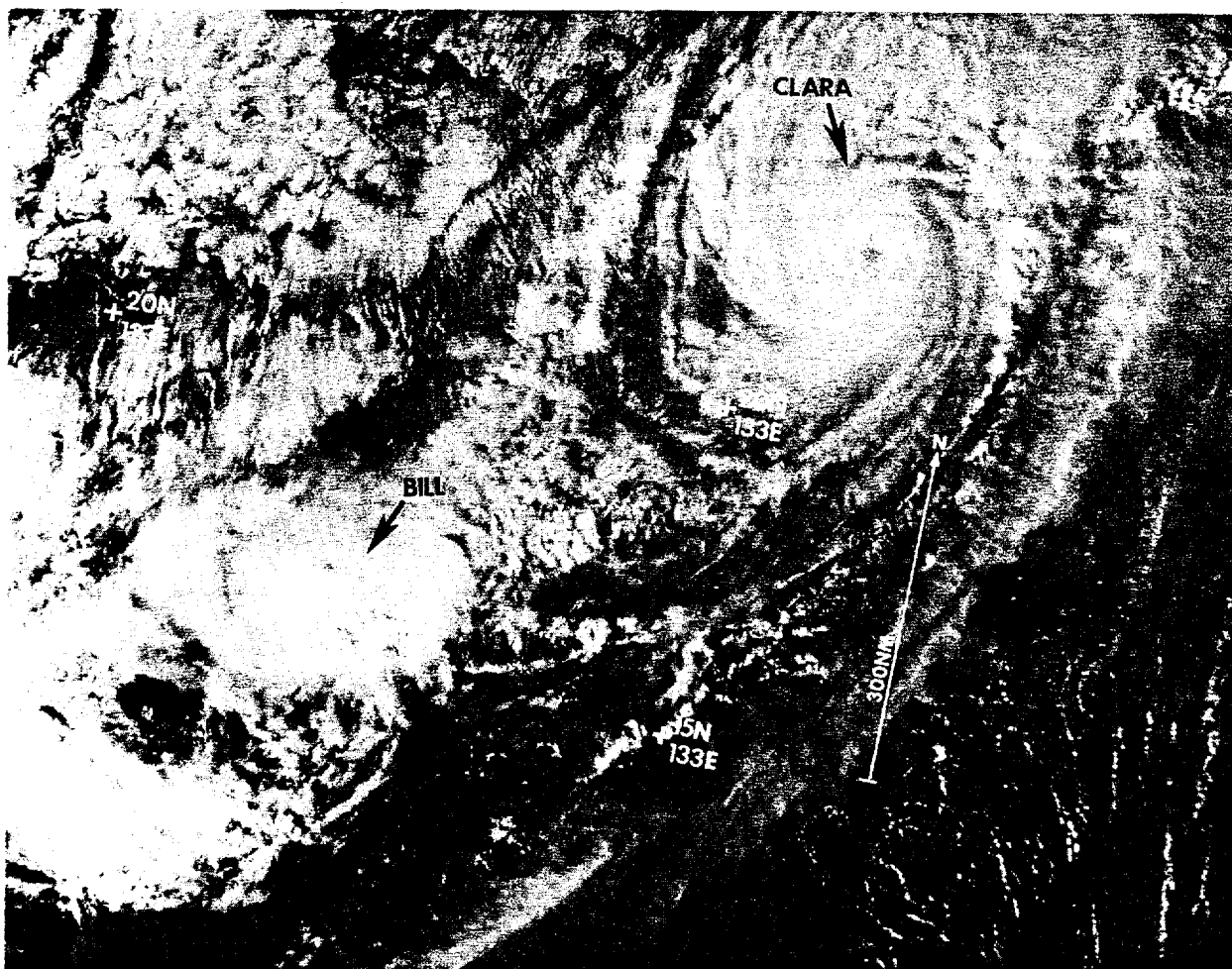
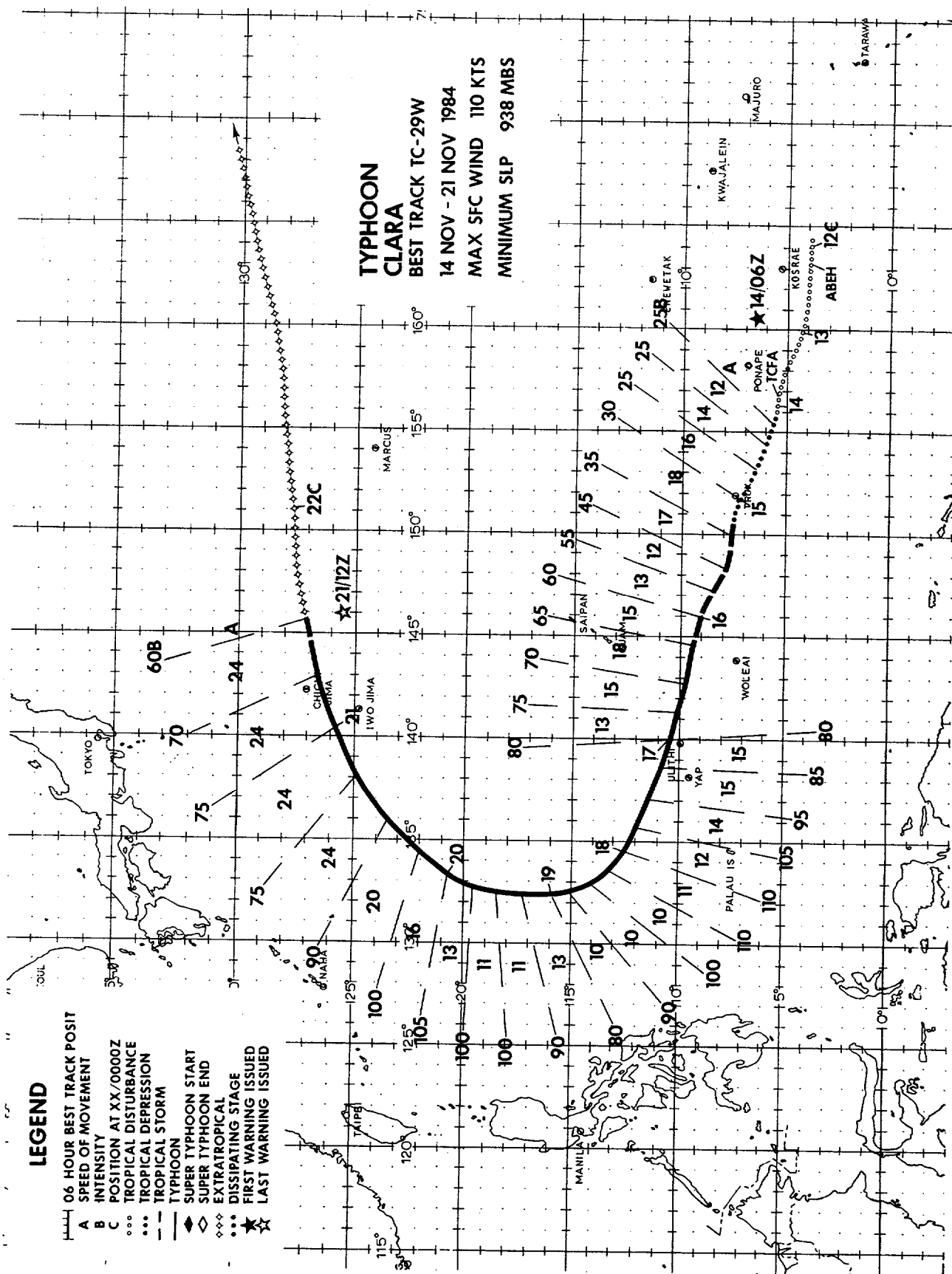


Figure 3-28-7. Typhoon Clara accelerating to the northeast and beginning extratropical transition. Bill now has more convection than 24 hours earlier, but this convective flare-up was temporary (200700Z November NOAA visual imagery).



TYPHOON CLARA (29W)

Typhoon Clara was the last significant tropical cyclone to develop during the month of November. It developed into a textbook, late-season recurver and was noteworthy due to its effect on Super Typhoon Bill.

Clara began as a large, low-latitude disturbance in the eastern Caroline Islands. It was located by surface synoptic data before it was identified in satellite imagery. This disturbance first appeared late on 11 November as a weak circulation near 4N 164E and received first mention as a suspect area in the 120600Z Significant Tropical Weather Advisory (ABEH PGTW). By 130000Z, a very broad area of convection was associated with the circulation. The circulation's development was aided by the presence of a disturbance in the Southern Hemisphere near the Solomons which strengthened the westerly flow south of the circulation. These westerlies combined with the northeast trades to the north to supply the excess low-level vorticity needed for continued development. The upper-level

pattern was also favorable with anticyclones over Super Typhoon Bill and over the Solomons providing divergence aloft over the developing system. This cross-equatorial interaction at both the surface and 200 mb level was instrumental in the development of Typhoon Clara.

The area continued to consolidate throughout the day and at 131600Z the ABEH was reissued upgrading the system's potential for development to "fair". Analysis of satellite imagery at this time yielded an intensity estimate of 25 kt (13 m/s) with a forecast to intensify. An aircraft investigation was requested for later in the day and with continued development evident, a TCFA was issued at 132030Z. AT 140454Z aircraft reconnaissance found a surface center with 15 to 25 kt (8 to 13 m/s) winds; consequently warning number one was issued at 140600Z. Figure 3-29-1 shows Clara fifteen hours later as a 30 kt (15 m/s) tropical depression.

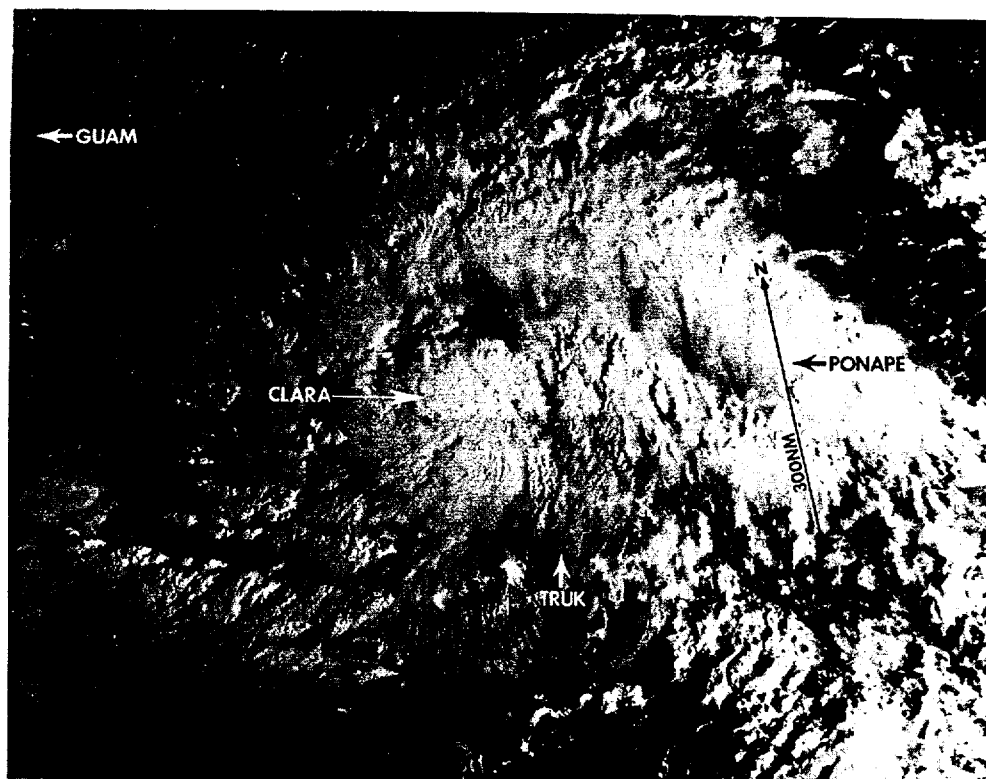


Figure 3-29-1. Clara at Tropical Depression intensity during its consolidation stage. Maximum surface winds at this time were near 30 kt (15 m/s). This system was upgraded to Tropical Storm Clara less than nine hours later (142113Z November NOAA visual imagery).

From this point on, Clara was a well-behaved and well forecast system. As Clara intensified it developed into a large circulation. As early as 151200Z, Clara controlled as much inflow as Bill, and by late on the 16th was clearly the dominant of the two storms. Progress along its track was typical of a well-behaved fast moving typhoon, and anticipated well in advance by JTWC. Typhoon Clara recurved just east of 132E. As Clara recurved, it passed within 500 nm (926 km) of the weakening Super Typhoon Bill. This proximity to Bill disrupted Clara's outflow and resulted in a slight weakening late on the 18th and into the 19th. However, Bill's effect on Clara was considerably less than the major course and intensity changes that Clara inflicted on Bill. Late on the 19th, as Clara recurved to the northeast and opened on Bill, it

reintensified to 105 kt (54 m/s). This was just 5 kt (3m/s) less than the peak intensity of 110 kt (57 m/s) recorded prior to recurvature.

Figure 3-29-2 shows Clara after it had completed recurvature and was about to begin extratropical transition with a frontal system to the northeast. This transition was of the complex variety in which the typhoon merges with an existing front and becomes a wave on the front. This wave then propagates along the front and usually accelerates to the northeast. In this process the typhoon loses all of its convection and tropical characteristics but still retains a strong low-level wind field. In Clara's case, the transition was rapid and complete by 211200Z. The extratropical low was still discernable on satellite imagery as a frontal wave 30 hours later.

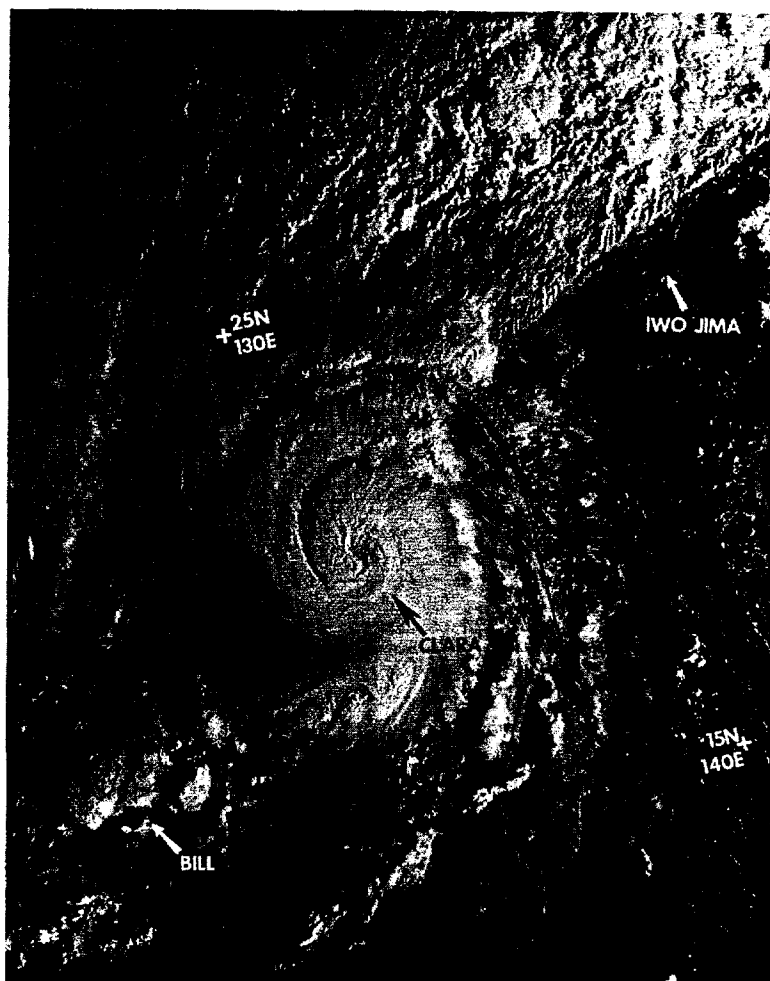


Figure 3-29-2. Typhoon Clara just after completing recurvature and about to begin extratropical transition with the frontal system to the northeast. Even this close to the weakening Super Typhoon Bill, Clara showed little indication of interaction (192234Z November NOAA visual imagery).

As Clara accelerated to the east-northeast, it passed to the north of Iwo-Jima (WMO 47981) which put the island in the dangerous semicircle of the typhoon. Sustained winds of 40 kt (21 m/s) with gusts to 63 kt (32 m/s) were reported during Clara's passage. However, no known damage was sustained on the island.

In summary, Clara was one of the classic typhoons of 1984. Forming at low-latitudes as a very broad disturbance,

Clara slowly consolidated and deepened into a 110 kt (55 m/s) system. Moving rapidly across the western Pacific, Clara recurved and, in textbook fashion, transitioned into an extratropical low while accelerating to the east-northeast. During Clara's entire lifetime, Super Typhoon Bill was active in the same portion of the ocean. Even though they were at times close to each other, Bill had no noticable effect on Clara's track and only minor influence on Clara's intensity.

TYPHOON DOYLE

BEST TRACK TC-30W

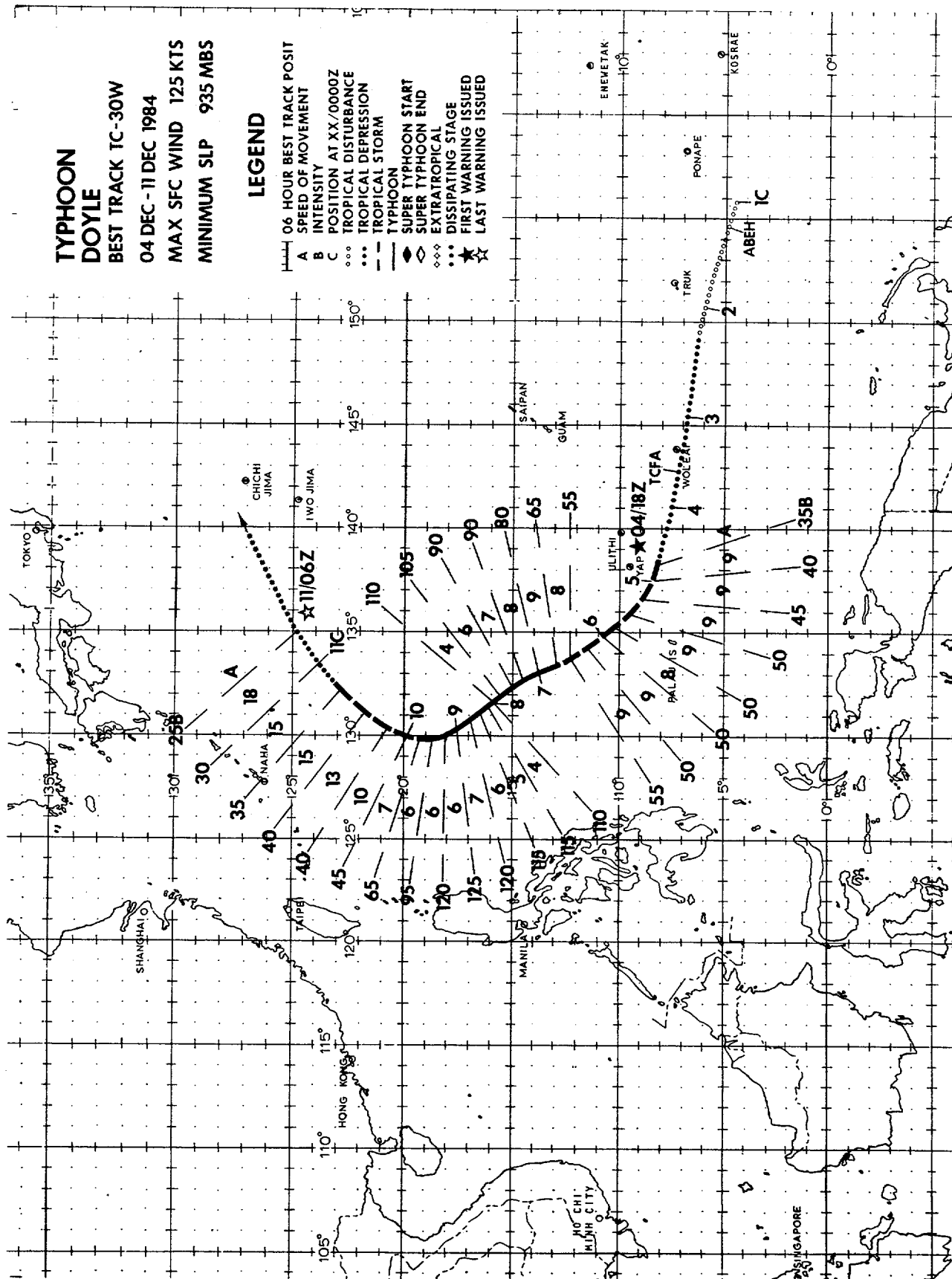
04 DEC - 11 DEC 1984

MAX SFC WIND 125 KTS

MINIMUM SLP 935 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
- ... DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED



TYPHOON DOYLE (30W)

Typhoon Doyle was the final tropical cyclone of the 1984 season and the only one to develop during the month of December. Doyle followed a typical recurvature track and remained over open water throughout its lifetime.

The tropical disturbance that was to become Doyle first appeared as an area of convective activity near 5N 156E at 0000Z on the 1st of December. It was mentioned as a new suspect area on the 010600Z Significant Tropical Weather Advisory (ABEH PGW) and was given a "poor" potential for significant tropical cyclone development.

During the next 36 hours the disturbance moved west-northwest and gradually increased in intensity and organization. During this time satellite imagery showed the disturbance was developing good upper-level support in the form of anticyclonic outflow. With the potential for significant tropical cyclone development now considered to be "fair", the ABEH was reissued at 021800Z.

Aircraft reconnaissance early on the 3rd was unable to locate a surface circulation, but did find a trough with an MSLP of 1004 mb. The system continued to show signs of increased organization prompting the issuance of a TCFA at 031100Z. On the afternoon of the 4th, aircraft reconnaissance indicated that the MSLP had dropped to 1001 mb and that 25 kt (13 m/s) surface winds were now associated with the disturbance. Again no low-level circulation center could be found. Since continued slow development was evident on satellite imagery, the TCFA was reissued at 041100Z. At this time imagery showed several spiralling convective bands were present indicating that the formation of a significant tropical cyclone was imminent. Also present at this time was a Southern Hemisphere low-level circulation in the Coral Sea east of Cape York. This vortex contributed to the development of Doyle by increasing the westerly low-level flow to its south.

Satellite imagery at 041600Z indicated that the system now had some intense

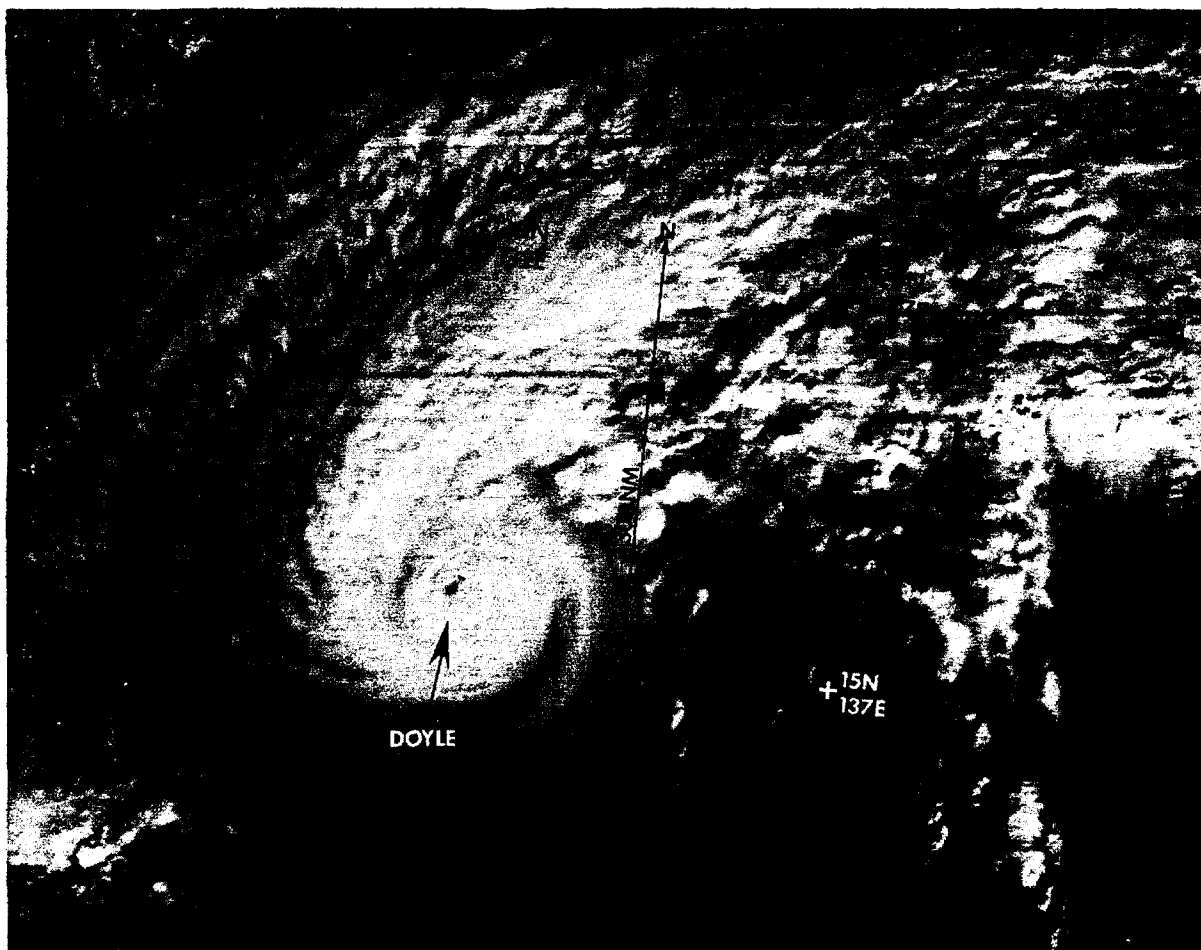


Figure 3-30-1. Typhoon Doyle one day before attaining maximum intensity (080106Z December DMSP visual imagery).

convection near the center of the developing circulation and that two intensifying convective bands were present. With Dvorak intensity analysis of this imagery indicating that 35 kt (18 m/s) surface winds were present, the initial warning on Doyle was issued at 041800Z.

An investigative flight into Doyle several hours later was finally able to locate the storm's center at 050129Z observing 40 kt (21 m/s) surface winds and measuring a central pressure of 994 mb. The surface center was very small - measuring a mere 5 nm (9 km) in diameter, with the maximum winds located 5 nm (9 km) from the center and decreasing rapidly outward. The small size of the surface center may have been a factor in the inability of previous reconnaissance flights to locate it.

During the next 48 hours, Doyle slowly intensified. Aircraft reconnaissance confirmed this slow development until the mission late on 6 December, when the central pressure was measured at 973 mb, a drop of 18 mb in just 12 hours. Maximum sustained surface winds of 90 kt (46 m/s) were observed on the north side of the storm where the easterly trades were enhancing Doyle's circulation. Doyle was upgraded to typhoon strength at 070000Z based on this information. Accompanying this intensification was a change in movement to a more northwesterly track.

The plotted values of equivalent potential temperatures versus the MSLP for the 30 hours prior to 070000Z December indicated the strong possibility of rapid deepening during the next 36 hours (Dunnavan, 1981). This indication was incorporated in the 070000Z December warning with some modification. The warnings prior to 070000Z had indicated no significant increase in intensity was likely due to the presence of the northwest monsoon flow to the north of the storm. Since that situation was still present, intensification to more than 120 kt (62 m/s) was not forecast. At this time the area north of Doyle was marked by the presence of stratocumulus clouds indicating the stability of the atmosphere in that region.

At 072047Z the MSLP had decreased to 935 mb, a fall of 43 mb in 24 hours (Figure 3-30-1). Maximum sustained winds reported by the ARWO at this time were 110 kt (57 m/s). After 072047Z, Doyle's central sea-level pressure began to rise - reaching 993 mb at 092037Z December (a rise of 58 mb in 48 hours). An unusual feature of Typhoon Doyle was the way the maximum surface winds lagged the occurrence of its MSLP. According to the best track intensities, which are based on all available data, Typhoon Doyle reached a maximum intensity of 125 kt (64 m/s) at 090000Z some 27 hours after the lowest minimum sea-level pressure was recorded!

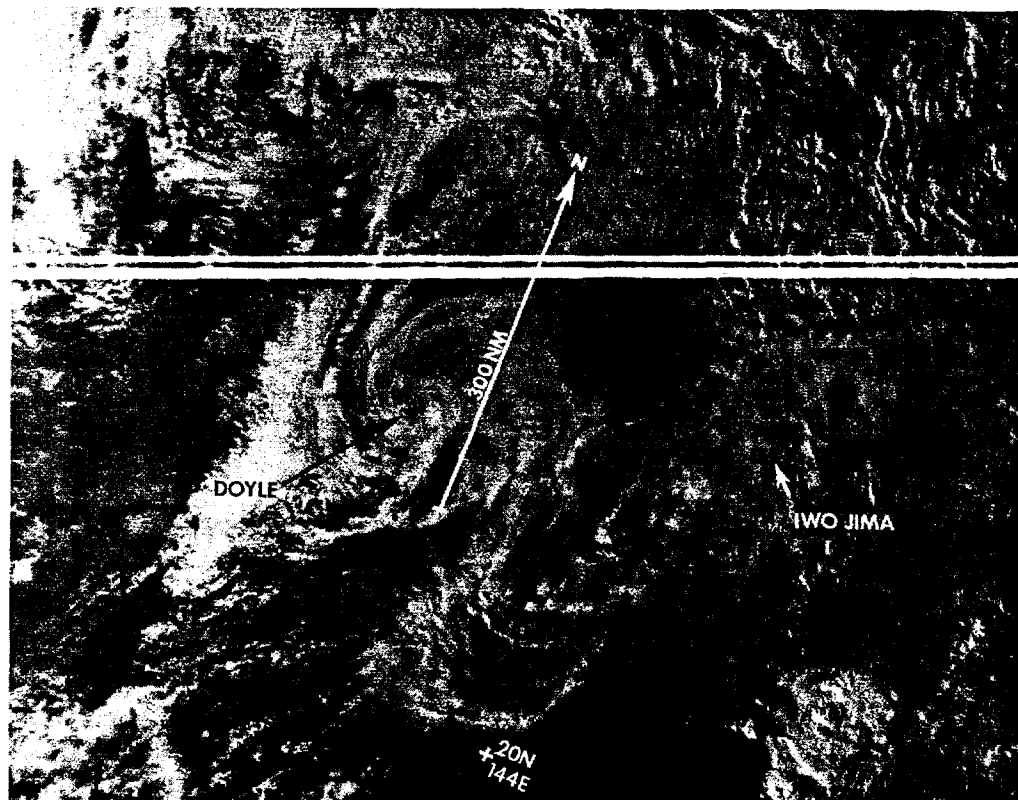


Figure 3-30-2. The exposed low-level circulation of Doyle at the time of the final warning (110601Z December NOAA visual imagery).

Between 091200Z and 100000Z, Doyle turned to the north and rapidly weakened from 95 kt (49 m/s) to 45 kt (23 m/s). Satellite imagery during this time showed a dramatic decrease in the intensity and extent of Doyle's convection. After 100000Z Doyle weakened more gradually while accelerating to the northeast. The final

warning was issued at 110600Z as the nearly convection-free low-level circulation center dissipated as a significant tropical cyclone (Figure 3-30-2).

There were no reports of damages from Typhoon Doyle as it remained over open water throughout its lifetime.

2. NORTH INDIAN OCEAN TROPICAL CYCLONES

Tropical cyclone activity in the North Indian Ocean was nearly normal during 1984. Four storms originated in this area as compared to the annual average of 4.4.

Tables 3-6 through 3-8 provide a summary of North Indian Ocean tropical cyclone activity for 1984 as compared to earlier years.

TABLE 3-6.

1984 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WIND (KT)	ESTIMATED MSLP (MB)	BEST TRACK DISTANCE TRAVELED (NM)
1. TC 01A	26 MAY - 28 MAY	3	9	45	990	819
2. TC 02B	12 OCT - 14 OCT	3	8	45	980	380
3. TC 03B	11 NOV - 15 NOV	5	16	85	975	719
4. TC 04B	28 NOV - 08 DEC	11	34	75	973	2662
1984 TOTALS:		22	67			

TABLE 3-7.

1984 SIGNIFICANT TROPICAL CYCLONES

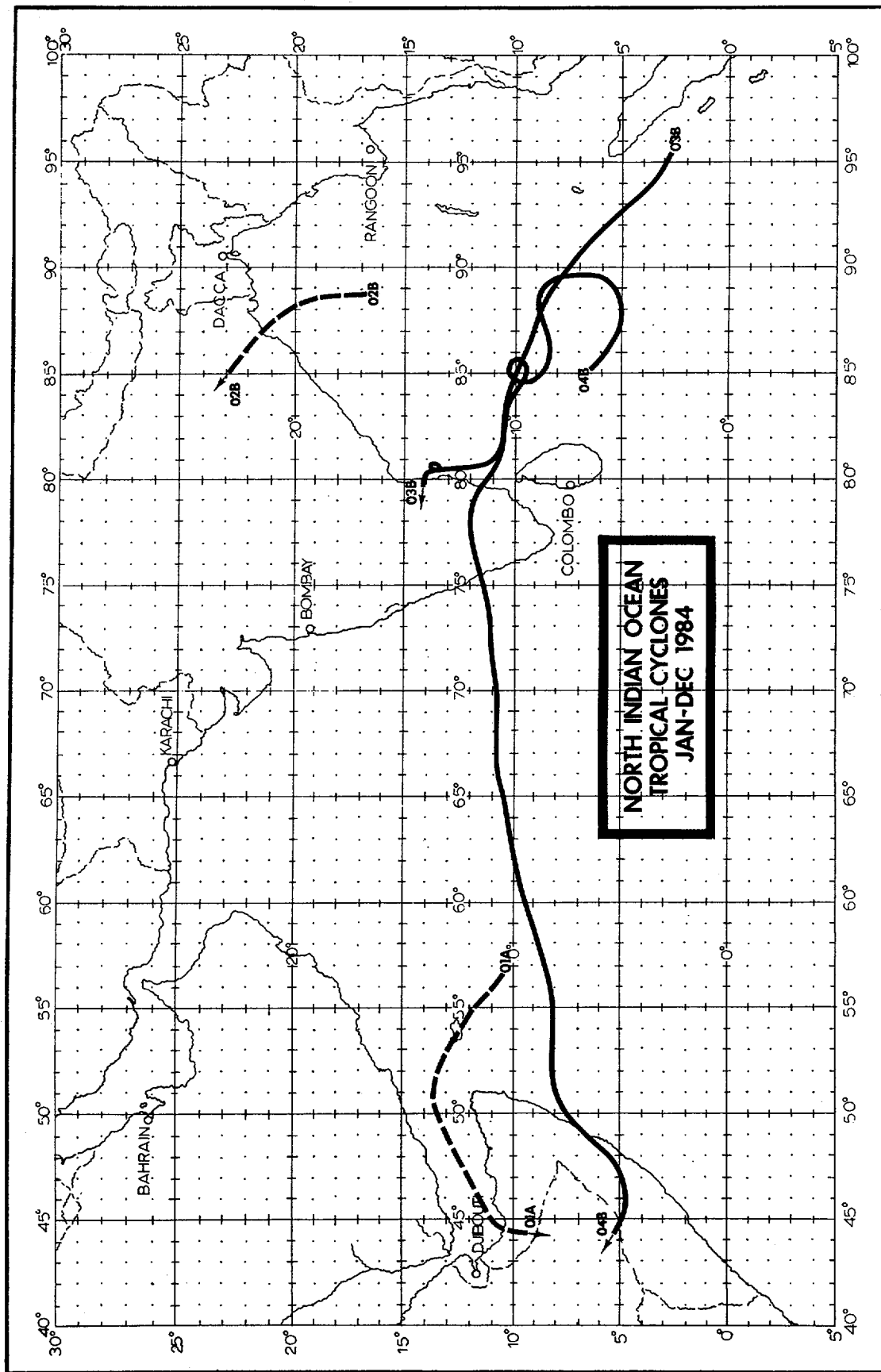
NORTH INDIAN OCEAN

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1984 TROPICAL CYCLONES	0	0	0	0	1	0	0	0	0	1	2	0	4
1975-1984 AVERAGE	.1	-	-	.1	.7	.4	-	.1	.3	1.0	1.4	.3	4.4
CASES	1	-	-	1	7	4	-	1	3	10	14	3	44

FORMATION ALERTS: 4 out of 10 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all significant tropical cyclones that developed during 1984.

WARNINGS:

Number of warning days:	22
Number of warning days with two tropical cyclones in region:	0
Number of warning days with three or more tropical cyclones in region:	0



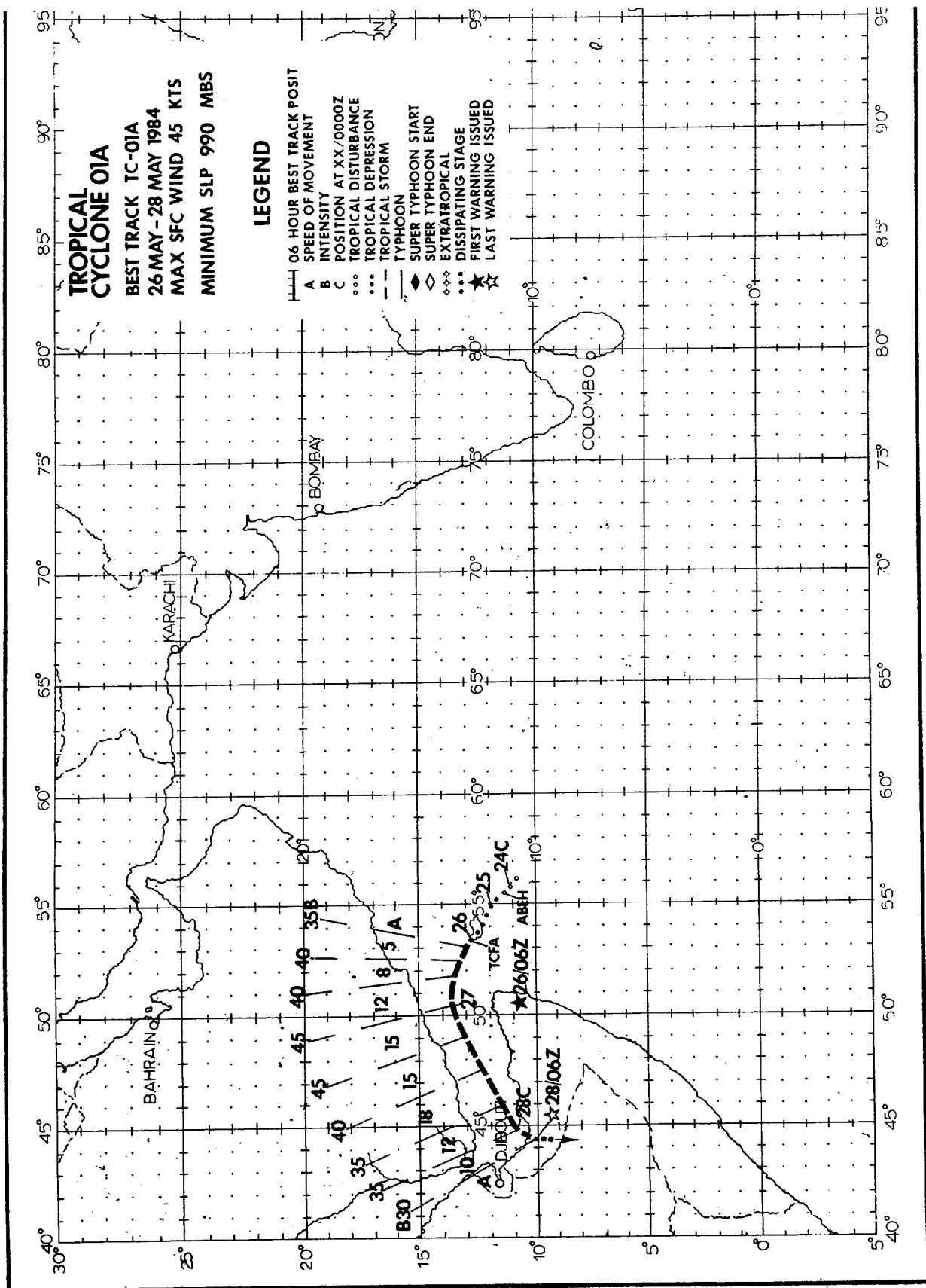
FNC/JTWC GUAM 3142/62 (NEW 2-76)

TABLE 3-8.

FREQUENCY OF TROPICAL CYCLONES BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971*	-	-	-	-	-	0	0	0	0	1	1	0	2
1972*	0	0	0	1	0	0	0	0	2	0	1	0	4
1973*	0	0	0	0	0	0	0	0	0	1	2	1	4
1974*	0	0	0	0	0	0	0	0	0	0	1	0	1
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
1977	0	0	0	0	1	1	0	0	0	1	2	0	5
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
1981	0	0	0	0	0	0	0	0	0	1	1	1	3
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
1975-1984 AVERAGE	.1	-	-	.1	.7	.4	-	.1	.3	1.0	1.4	.3	4.4
CASES	1	0	0	1	7	4	0	1	3	10	14	3	44

* JTWC warning responsibility began on 4 June 1971 for the Bay of Bengal, east of 90E. As directed by USCINCPAC, JTWC issued warnings only for those tropical cyclones that developed or tracked through that portion of the Bay of Bengal. Commencing with the 1975 tropical cyclone season, JTWC's area of responsibility was extended westward to include the western portion of the Bay of Bengal and the entire Arabian Sea.



TROPICAL CYCLONE 01A

Tropical Cyclone 01A, the only tropical cyclone to develop in the North Indian Ocean during the Spring transition season, distinguished itself by its non-climatological track. After developing in the western Arabian Sea, Tropical Cyclone 01A turned to the west-southwest and transited through the Gulf of Aden rather than moving to the north or northwest along the climatologically favored track and making landfall along the east coast of the Arabian peninsula. This is the only tropical cyclone of record to transit through the Gulf of Aden.

The disturbance which eventually developed into Tropical Cyclone 01A was first detected on 23 May as an area of strong convection centered approximately 180 nm (333 km) southeast of Socotra (WMO 61599). The convection persisted and the disturbance was mentioned as a suspect area in the Significant Tropical Weather Advisory (ABEH PGTW) at 0600Z on the 24th. The disturbance moved slowly northwestward during the next 36 hours with a gradual increase in organization. At 260051Z, a TCFA was issued prompted by the persistent slow improvement in the convective organization and by indications from satellite imagery that a small but well organized low-level circulation was developing. Throughout this period, synoptic data was unable to confirm the

presence of a surface circulation. At 261055Z, the first warning on Tropical Cyclone 01A, valid at 260600Z was issued. This was based on a Dvorak intensity analysis of Figure 3-31-1 which estimated that surface winds of 35 kt (18 m/s) were present.

Tropical Cyclone 01A remained a compact system throughout its life. Even at its maximum intensity of 45 kt (23 m/s) between 0000Z and 0600Z on 27 May, the radius of greater than 30 kt (15 m/s) winds was estimated to be only 60 nm (111 km). The small size of Tropical Cyclone 01A coupled with the sparsity of synoptic data in the area precluded any verification of surface intensity estimates. Intensity estimates on this system were based entirely on Dvorak satellite analysis.

Tropical Cyclone 01A moved northwestward until late on the 26th, when it turned to the west-southwest and entered the Gulf of Aden in response to a strong subtropical ridge over Saudi Arabia. Tropical Cyclone 01A transited up the Gulf of Aden until it made landfall at 0300Z on 28 May, approximately 35 nm (65 km) west of Berbera, Somalia (WMO 63160). After making landfall, Tropical Cyclone 01A moved inland over Somalia and dissipated. There were no reports of damages or injuries from this system.

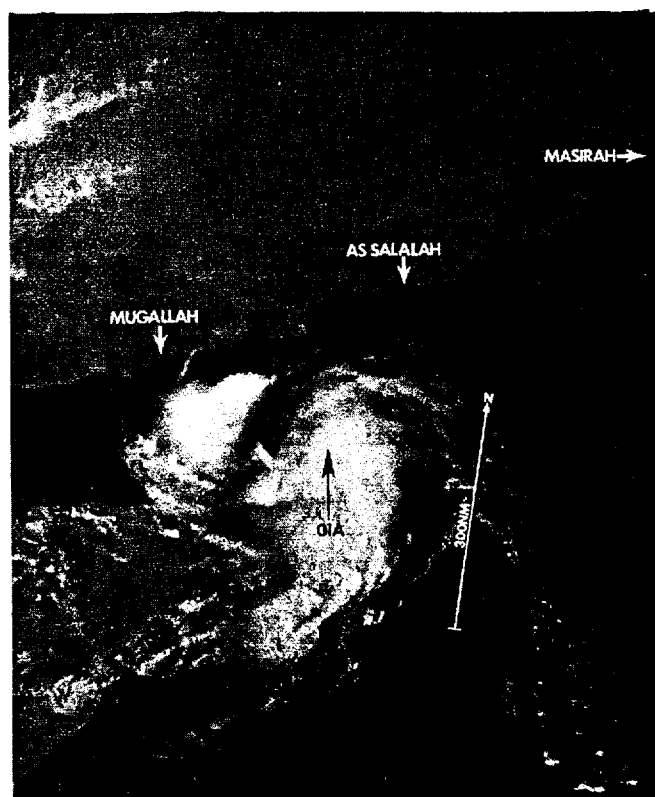
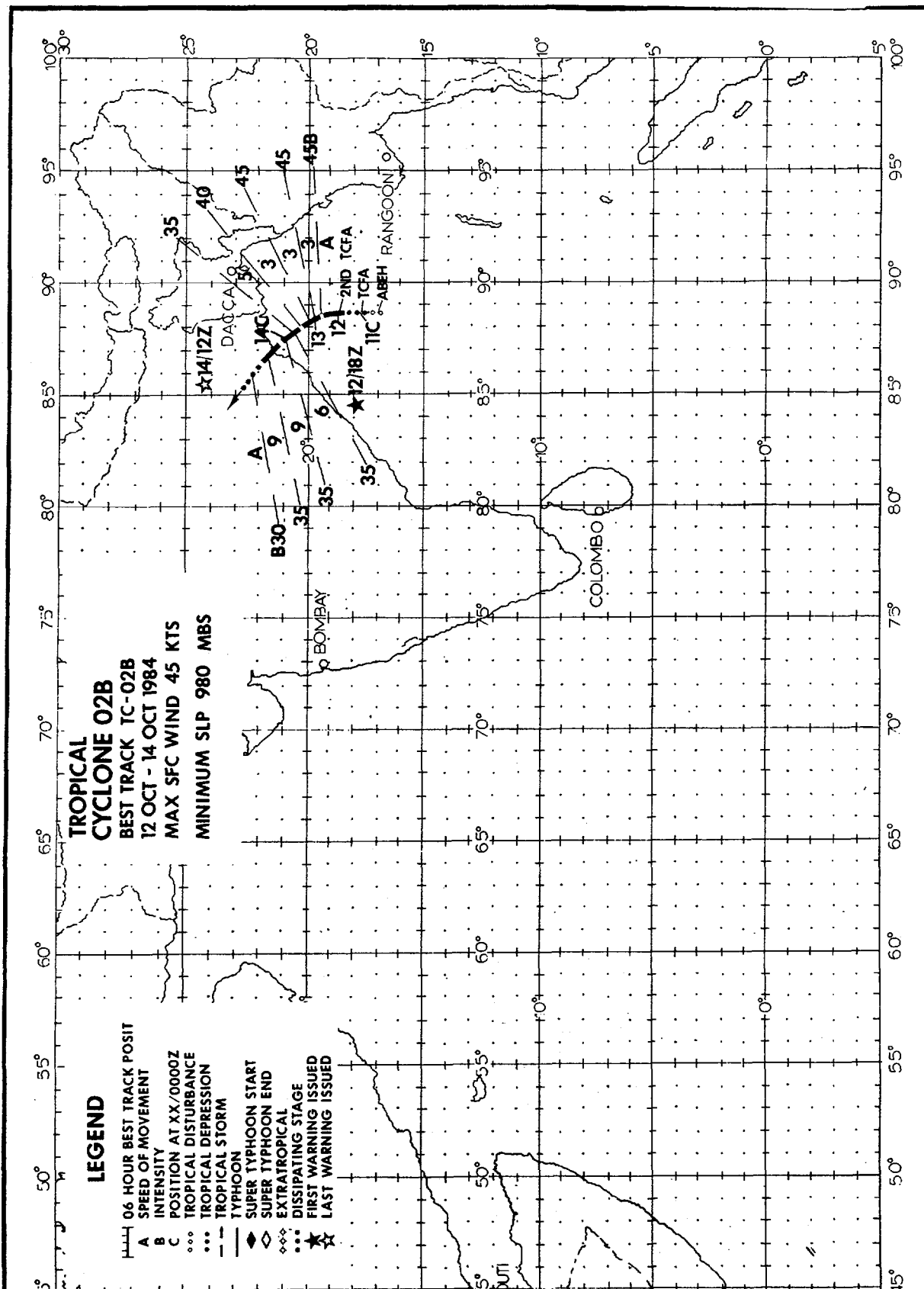


Figure 3-31-1 Tropical Cyclone 01A at the entrance to the Gulf of Aden (260617Z May DMSP visual imagery).



TROPICAL CYCLONE 02B

Tropical Cyclone 02B, the first tropical cyclone to develop in the North Indian Ocean during the Fall transition season, led a rather uneventful life. Tropical Cyclone 02B was first detected early on the 10th of October as a broad area of convection in the north-central Bay of Bengal. During the day the convection showed improved organization with cirrus plumes indicating an upper-level anticyclone existed over the disturbance. No surface synoptic data was available in the area; however, curvature of the low-level clouds indicated a developing low-level circulation was present. Dvorak intensity analysis of the 101800Z imagery estimated that surface winds of 30 kt (15 m/s) were present in the system. This prompted the issuance of the first of two TCFAs at 102300Z.

During the next two days the disturbance developed a broad circulation covering the head of the Bay of Bengal and intensified slowly. Upper-level support remained favorable for further intensification and the only inhibiting factor for development was the proximity of the disturbance to land which restricted the low-level inflow. Although Tropical Cyclone 02B formed in the monsoon trough, most of the flow from the southwest monsoon was being drawn into Tropical Storm Susan (22W) which was developing in the South China Sea. If Susan

had not been present, Tropical Cyclone 02B may have developed into a more potent system.

The developing cyclone tracked slowly north until 0600Z on the 12th when a turn to the northwest began. At 121800Z the first warning was issued. The initial warning on Tropical Cyclone 02B was prompted by satellite imagery which indicated that the system had intensified significantly over the past 24 hours and was now supporting winds of 45 kt (23 m/s). Once again due to lack of synoptic data, the intensity estimate was based solely on Dvorak analysis of satellite imagery. Tropical Cyclone 02B maintained this intensity for the next 12 hours until strong upper-level easterlies began to shear the convection to the west on 13 October (Figure 3-32-1). This started a weakening trend which continued until dissipation.

As it weakened, Tropical Cyclone 02B continued moving to the northwest and increased its forward speed. At about 140300Z Tropical Cyclone 02B made landfall on the coast of India approximately 10nm (19 km) south of Balasore (WMO 42895). The system weakened rapidly over land with the final warning being issued at 141200Z. Although some heavy rains accompanied this storm as it made landfall there have been no reports of damage.

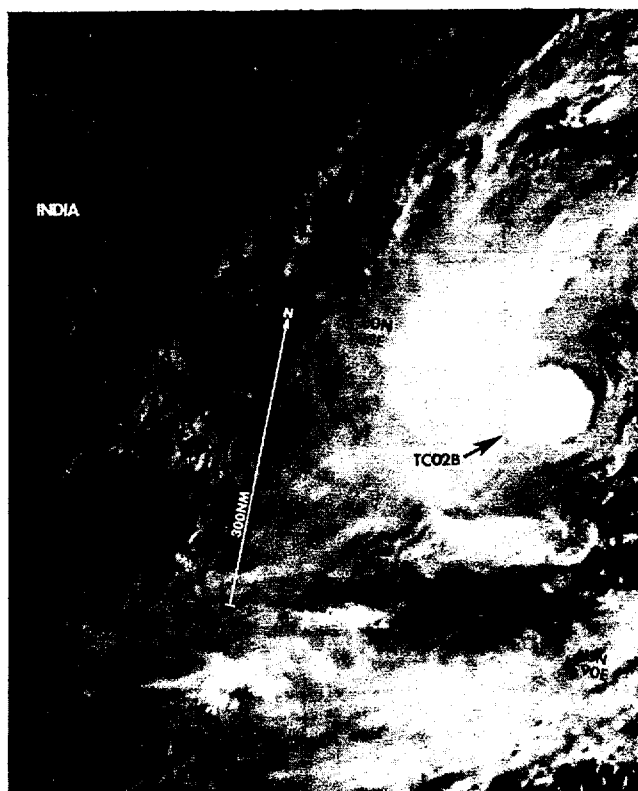
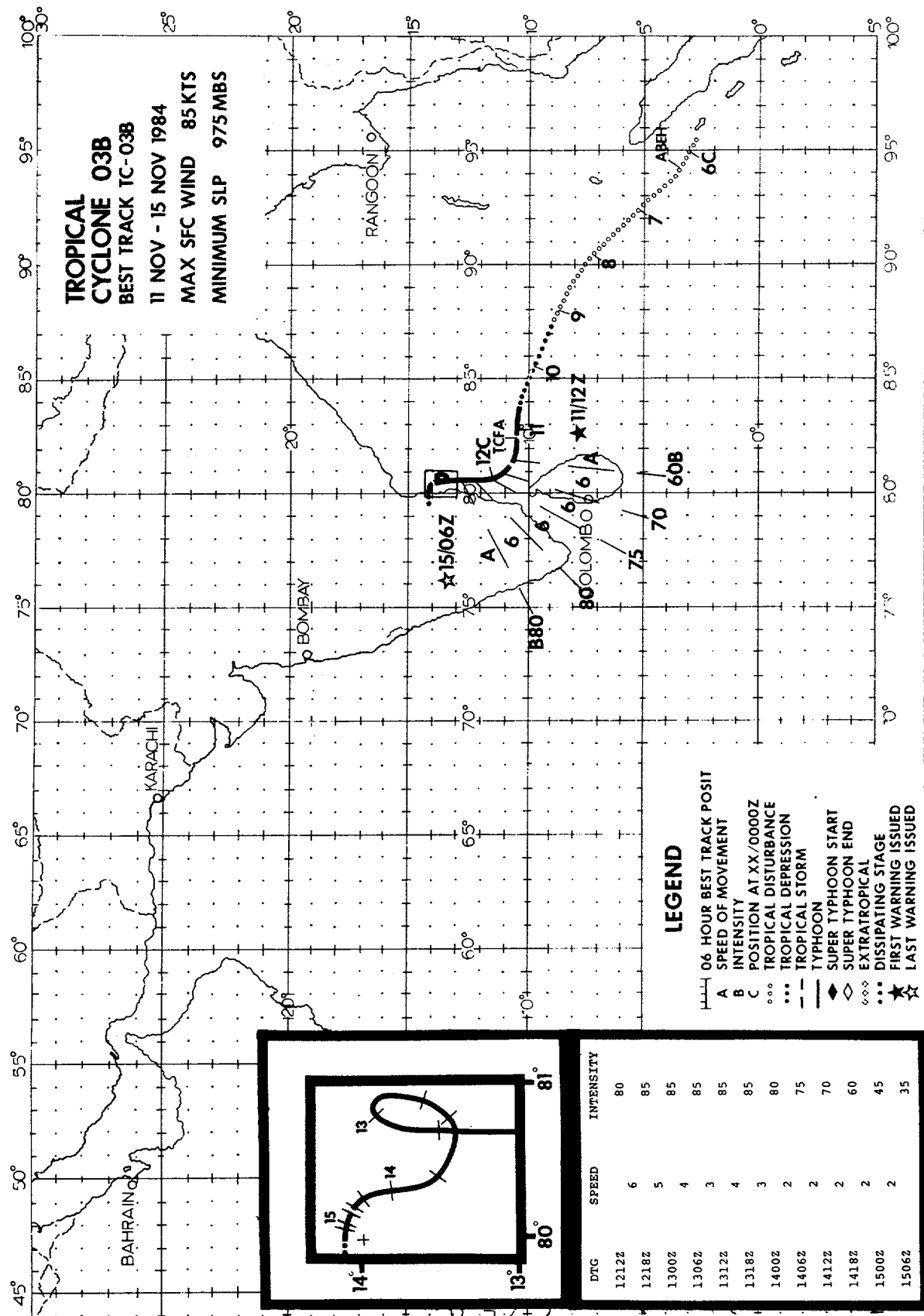


Figure 3-32-1. Tropical Cyclone 02B near maximum intensity (130446Z October DMSP visual imagery).



'62 (NEW 2-76)

TROPICAL CYCLONE 03B

Tropical Cyclone 03B, the second cyclone to form in the North Indian Ocean during the Autumn transition season, developed into the most intense of all 1984 North Indian Ocean Storms. The storm was responsible for at least 430 deaths and has been called the worst tropical cyclone to affect the central east coast of India in 15 years.

The disturbance that would eventually develop into Tropical Cyclone 03B, was first noticed late on 5 November as a broad area of poorly organized convection west of Sumatra. Over the next few days the disturbance moved northwest. Although the system showed periodic convective flare-ups, there was no permanent significant increase in organization until 9 November. By then a well-defined low-level circulation center was visible on satellite imagery. During the 9th and into the 10th, the disturbance moved to the west-northwest with only slow development noted. At that time it was thought the disturbance might make landfall over the southeast coast of India before

developing into a significant tropical cyclone. However, that was not to be the case.

Late on the 10th, analysis of satellite imagery indicated that the overall convection and organization of the disturbance was increasing. Since Dvorak intensity analysis already indicated that 30 kt (15 m/s) winds were present, a TCFA was issued at 110330Z.

Less than four hours later, JTWC received a Dvorak intensity analysis from the Air Force Global Weather Central (AFGWC) which indicated the disturbance had intensified rapidly and now supported winds of 55 kt (28 m/s)! The first warning on Tropical Cyclone 03B was issued at 111200Z.

Figure 3-33-1 is a streamline analysis of the mid-level flow that was present throughout much of the warning phase of the storm's lifetime. The dominant features are the ridging across the Bay of Bengal and the associated neutral point over the east coast of India.

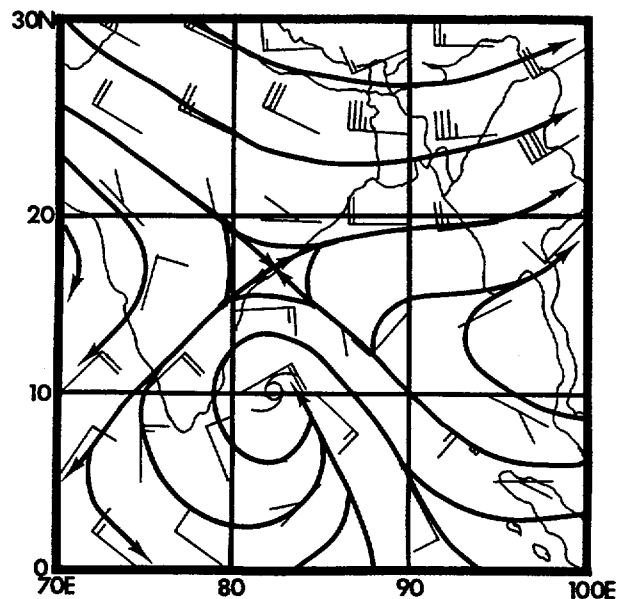


Figure 3-33-1. The mid-level flow present during much of Tropical Cyclone 03B's lifetime. Streamline analysis performed on the 111200Z November 500 mb NOGAPS wind field.

Since Tropical Cyclone 03B was firmly embedded in the southeasterly flow south of the ridge axis, the initial forecasts called for continued west-northwest movement, with dissipation over India within 36 hours. However, Tropical Cyclone 03B was to take a different course. Responding to the flow around the periphery of the ridge, the storm curved to the north and moved into the neutral point, lost all steering, and began an erratic movement. It took at least one clockwise loop (and perhaps a second) before

finally drifting slowly to the northwest towards India.

As the storm moved north on the 12th, it deepened rapidly attaining a peak intensity of 85 kt (44 m/s) at 121800Z. During this development stage, the system was vertically aligned with the upper-level anticyclone. From early on the 12th until the 14th, a 6 to 15 nm (11 to 28 km) wide eye was observed on satellite imagery (Figure 3-33-2).

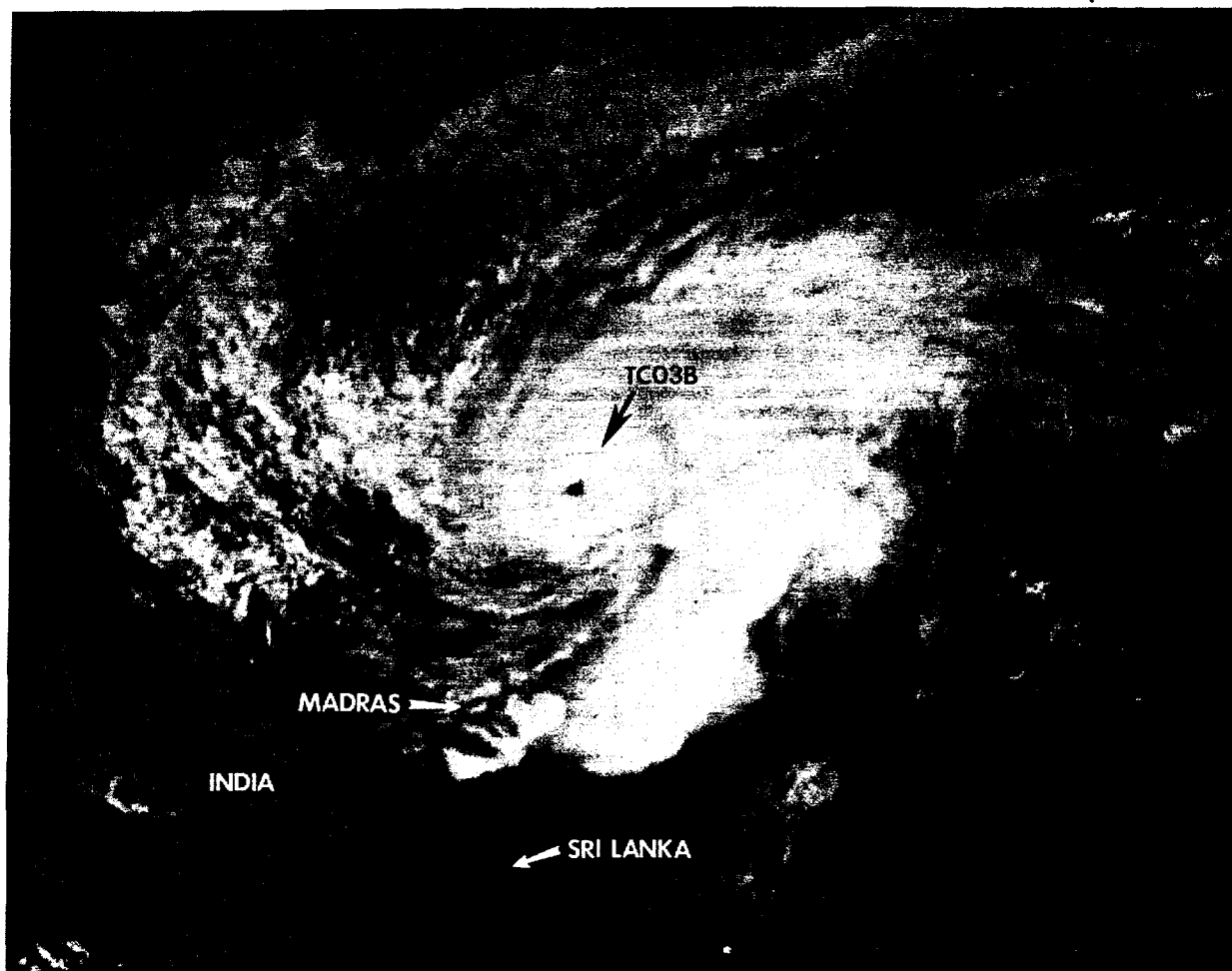


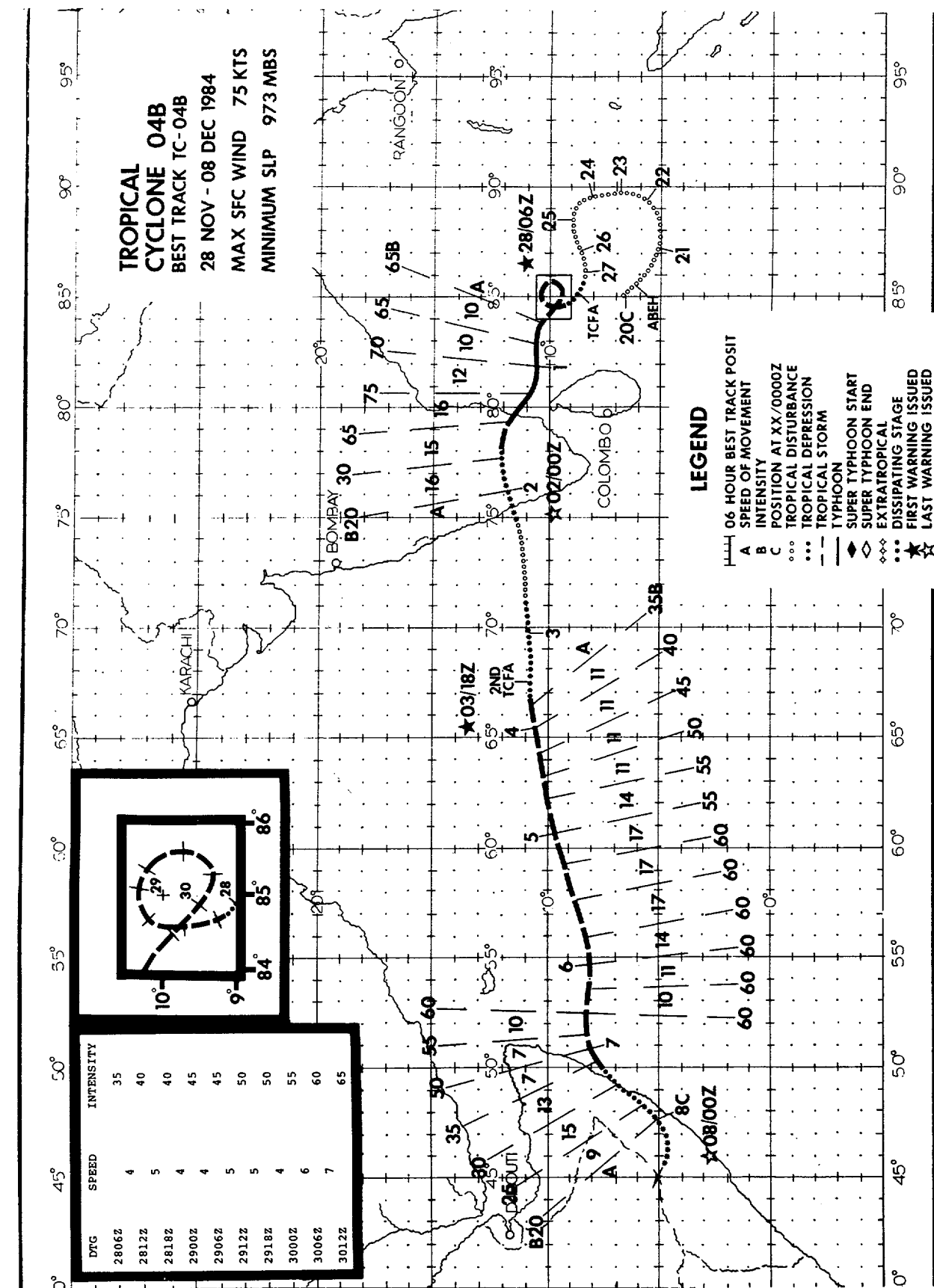
Figure 3-33-2. Tropical Cyclone 03B near maximum intensity (130427Z November DMSP visual imagery).

On 14 November, strong upper-level southwesterlies began to exert pressure on the storm. As a result, the convection began to be displaced to the northeast. Gradual weakening followed under this shearing environment until the storm made landfall where final dissipation occurred.

Unfortunately, the erratic movement and intensification of Tropical Cyclone 03B occurred very close to the east coast of

India and brought a prolonged period of heavy rain and flooding to much of the region. At least 430 are known dead as a result of the storm. Over 20,000 people were stranded in coastal villages due to flooding.

At 150600Z the last warning was issued as the nearly convection-free low-level center dissipated over land just south of Nellore (WMO 43245).



TROPICAL CYCLONE 04B

Tropical Cyclone 04B was the last tropical cyclone of 1984 to develop in the North Indian Ocean. Like two of the three storms before it, Tropical Cyclone 04B distinguished itself by its unusual track.

Early on 20 November a large area of convection extended from the southern Bay of Bengal across the equator into the South Indian Ocean. There were two weak low-level circulations associated with this convection - one on either side of the equator. Although the convection showed no organization at this time, it was extensive in size; extending from 12N to 12S and from 70E to 100E. The most intense convection was near the equator where northwest low-level flow from the northern hemisphere converged with southwest flow from the southern hemisphere.

The tropical disturbance that was to become Tropical Cyclone 04B first appeared as an organized area of convection within the broad area near 6N 85.5E. The area was mentioned on the 200600Z Significant Tropical Weather Advisory (ABEH PGTW) and was given a "poor" potential for development into a significant tropical cyclone during the next 24 hours.

The broad disturbance persisted during the next five days and by 0600Z on the 25th, the two surface circulations on either side of the equator had moved further apart and were becoming more organized. Upper-level outflow over the area appeared weak but diffluent.

By 270600Z, the disturbance in the Bay of Bengal had reached tropical depression strength and had become more organized. This was indicated on satellite imagery by convective banding and the presence of anticyclonic upper-level outflow. This system was now judged to have "fair" potential for significant tropical cyclone development during the next 24 hours. During the next 12 hours the intensity and organization of the convection continued to increase prompting the issuance of a TCFA valid at 271900Z.

At 280600Z, the system had further intensified with Dvorak intensity analysis indicating that surface winds of 35 kt (18 m/s) were present. The disturbance now had a central core of intense convection. This prompted the first warning on Tropical Cyclone 04B to be issued at 280600Z.

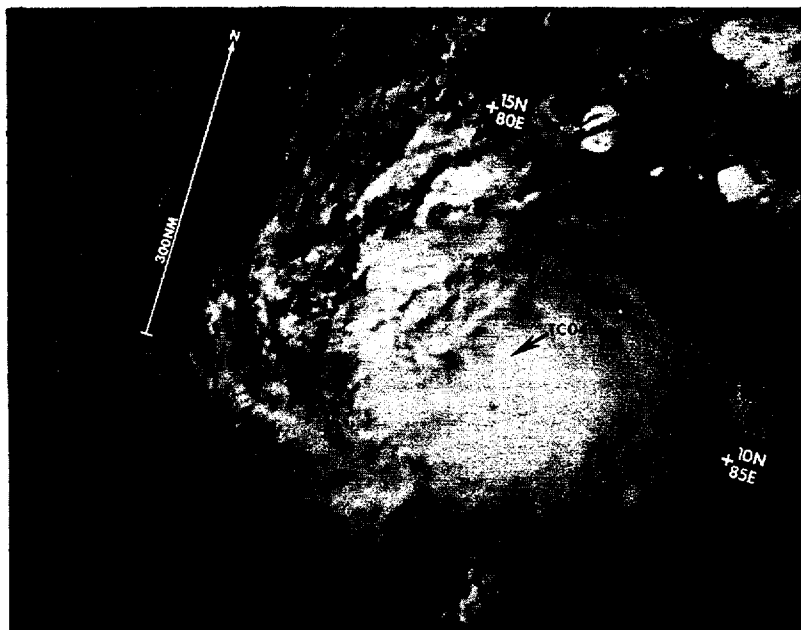


Figure 3-34-1. Tropical Cyclone 04B near maximum intensity (010509Z December DMSP visual imagery).

During the next 48 hours, Tropical Cyclone 04B moved in a slow anticyclonic loop while steadily intensifying. At 301200Z November, it had completed its loop and was estimated to have sustained surface winds of 65 kt (33 m/s). Once again this was based solely on the Dvorak intensity analysis of satellite imagery.

Tropical Cyclone 04B moved west during the next 18 hours, accelerated slightly and intensified to a peak intensity of 75 kt (39 m/s) (Figure 3-34-1). It then made a slight turn to the west-northwest and accelerated further to 16 kt (30 km/hr) as it made landfall on the east coast of India 40 nm (74 km) north of Nagappattinam (WMO 43340) at 011000Z December. After making landfall, the low-level circulation moved west across the southern tip of India and rapidly weakened. The mid-to-upper

level circulation, however, took a more northwestward track and became displaced from the low-level center by approximately 120 nm (222 km). Warning status was terminated on Tropical Cyclone 04B at 020000Z since the system had no convection associated with it and the low-level circulation was weak and poorly defined.

This weak but persistent low-level circulation now turned to the west-southwest, entered the Arabian Sea and slowly redeveloped (Figure 3-34-2). By the 3rd of December, the convection was redeveloping near the low-level center and reintensification appeared likely. This prompted the issuance of a second TCFA at 031200Z. The system continued to intensify and warning status was resumed at 031800Z December.

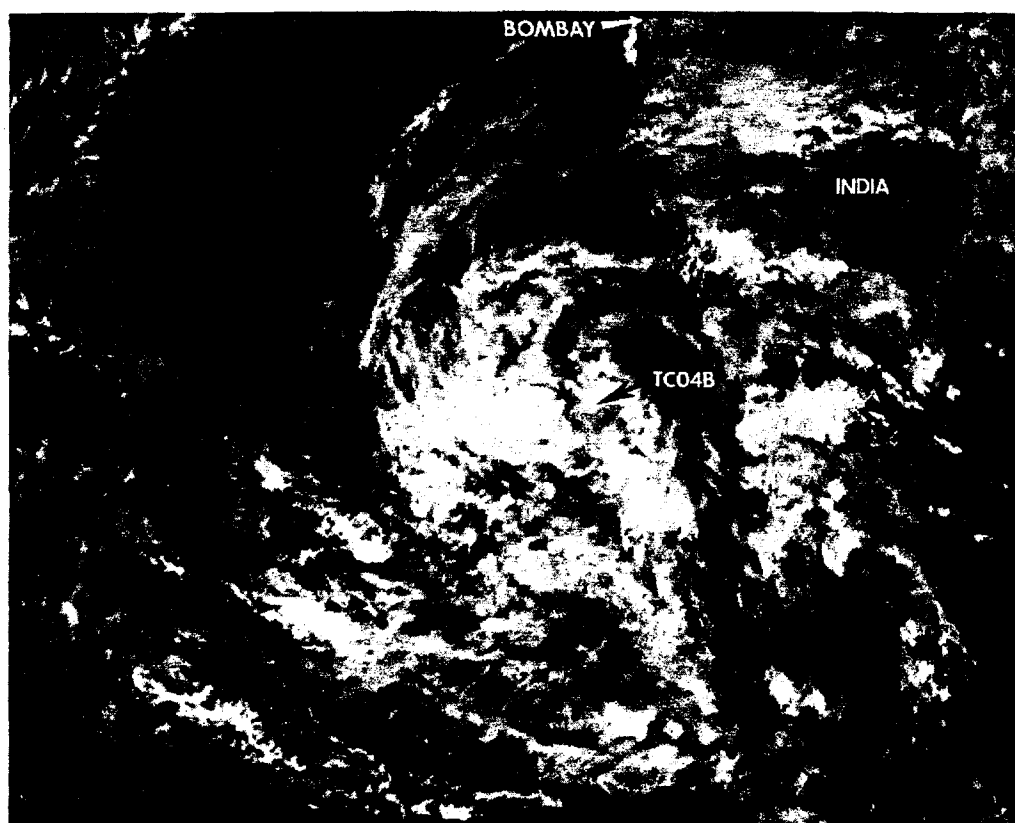


Figure 3-34-2. The poorly organized remnants of Tropical Cyclone 04B as it entered the Arabian Sea and began to reintensify (020448Z December DMSP visual imagery).

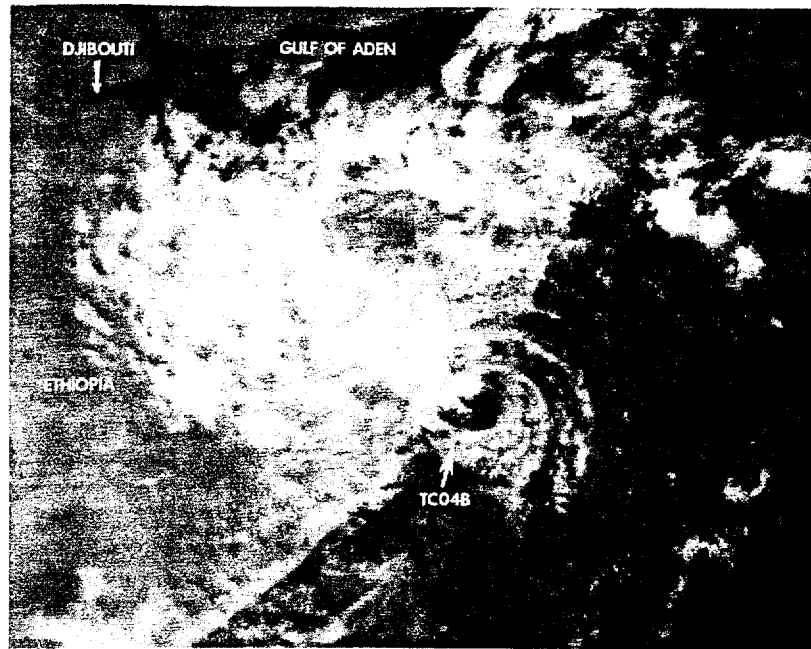


Figure 3-34-3. The exposed low-level circulation of Tropical Cyclone 04B located just off the east coast of Somalia (070630Z December DMSP visual imagery).

Tropical Cyclone 04B continued to move west-southwest, reaching an intensity of 60 kt (31 m/s) at 050600Z. For the next 42 hours it moved in a general westerly direction across the Arabian Sea around the southern periphery of a low to mid-level anticyclone located near the Persian Gulf. There was no significant change in intensity during this period.

At 070600Z, Tropical Cyclone 04B was within 25 nm (46 km) of the Somalia coast and had weakened to 35 kt (18 m/s) (Figure 3-34-3). At this point, the low-level circulation, became exposed, moved inland, and then moved southwestward along the coast for 24 hours before dissipating over land. The mid-to-upper level circulation and associated convection moved off to the northwest. The final warning was issued at 080000Z.

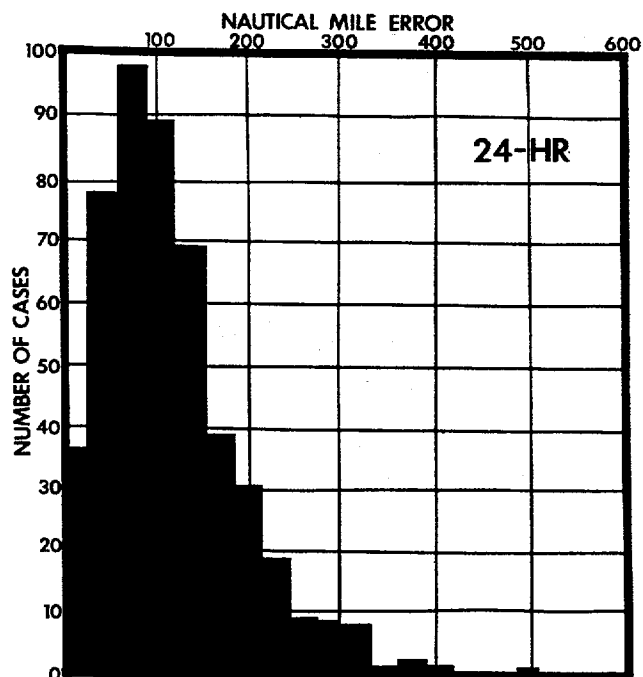
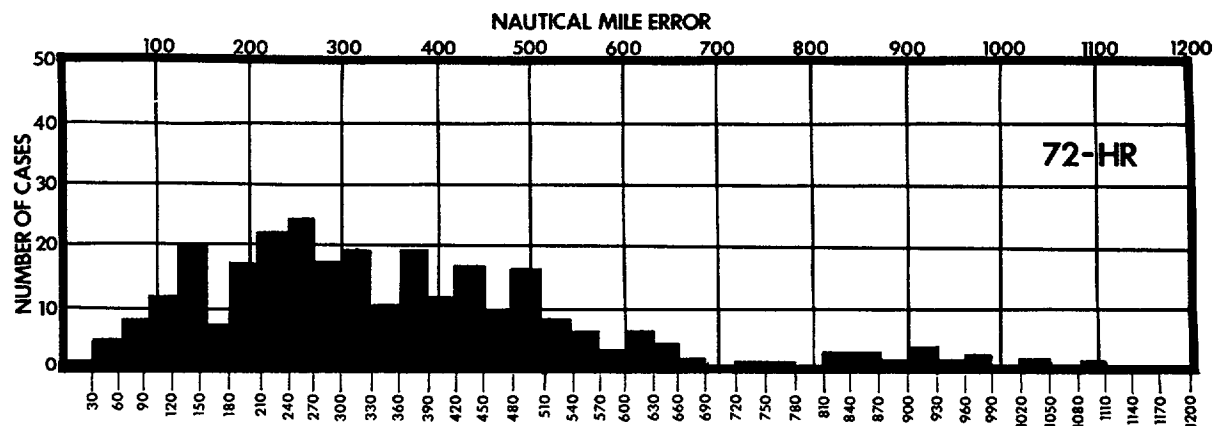
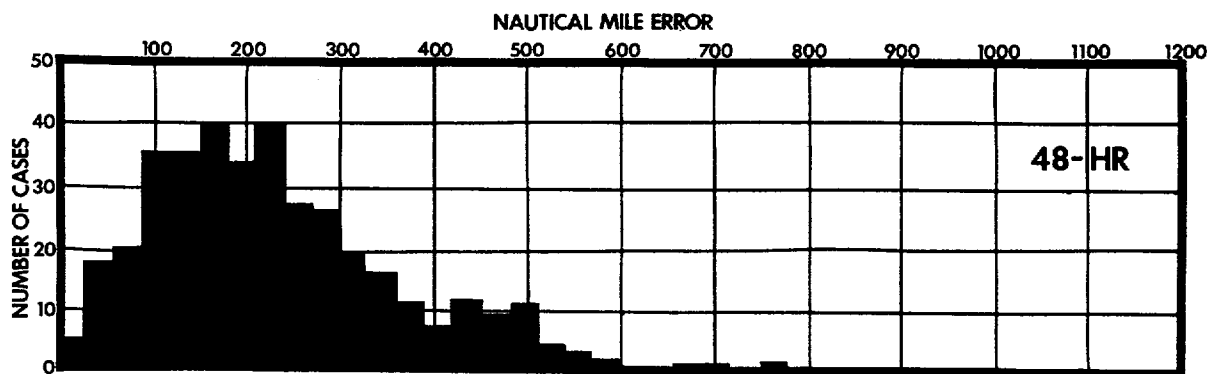


Figure 4-2

Frequency distribution of the 24-, 48-, and 72-hour forecast errors in 30 nm increments for all significant tropical cyclones in the western North Pacific during the 1984 season.

FORECAST ERRORS (nm)

	<u>24-HR</u>	<u>48-HR</u>	<u>72-HR</u>
MEAN:	117	233	363
MEDIAN:	101	211	316
STANDARD DEVIATION:	77	135	221
CASES:	492	378	286



CHAPTER IV - SUMMARY OF FORECAST VERIFICATION

1. ANNUAL FORECAST VERIFICATION

a. Western North Pacific Ocean

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 (track) errors (illustrated in Figure 4-1) were then calculated for each tropical cyclone and are presented in Table 4-1. Figure 4-2 provides the frequency

distributions of vector errors in 30 nm increments for 24-, 48-, and 72-hour forecasts of all 1984 tropical cyclones in the western North Pacific. A summation of the mean vector and right angle errors, as calculated for all tropical cyclones in each year, is shown in Table 4-2. A comparison of the annual mean vector errors for all tropical cyclones as compared to those tropical cyclones that reached typhoon intensity can be seen directly in Table 4-3. The annual mean vector errors for 1984 as compared to the ten previous years are graphed in Figure 4-3.

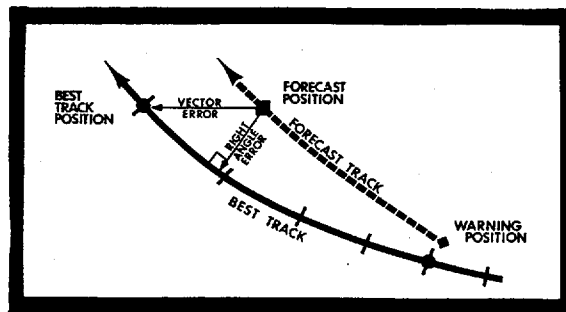


Figure 4-1. Illustration of the method to determine vector error and right angle error.

TABLE 4-1.

FORECAST ERROR SUMMARY FOR THE WESTERN NORTH PACIFIC
SIGNIFICANT TROPICAL CYCLONES OF 1984. (ERRORS IN NM)

		WARNING			24-HOUR			48-HOUR			72-HOUR		
		VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS
01W.	TS VERNON	31	28	9	116	86	5	147	55	1			
02W.	TS WYNNE	14	10	28	93	44	24	224	114	18	389	224	16
03W.	TY ALEX	27	23	18	155	93	14	351	197	10	803	328	6
04W.	TS BETTY	13	9	12	72	42	10	105	46	5	83	80	2
05W.	TY CARY	13	7	30	92	56	26	190	149	22	282	246	18
06W.	TY DINAH	20	11	35	142	73	29	336	178	25	564	284	23
07W.	TY ED	12	9	28	140	82	23	232	117	14	246	125	10
08W.	TS FREDIA	30	20	12	163	81	9	328	218	8	448	283	6
09W.	TD 09W	122	105	10	297	248	6	420	296	2			
10W.	TS GERALD	25	9	24	136	57	20	311	123	16	331	170	7
11W.	TY HOLLY	16	11	25	111	73	21	230	149	17	423	316	13
12W.	TD 12W	46	8	5	204	16	1						
13W.	TY IKE	13	10	42	80	63	39	179	149	35	279	242	31
14W.	TS JUNE	70	28	11	121	104	8	125	85	4			
15W.	TY KELLY	27	14	18	225	121	14	302	159	10	244	201	6
16W.	TS LYNN	26	21	14	112	63	10	231	178	6	402	362	3
17W.	TS MAURY	28	18	13	215	87	9	421	221	5	447	0	1
18W.	TS NINA	30	12	15	156	37	9	279	85	5	482	146	3
19W.	TY OGDEN	30	15	12	227	100	8	620	219	4			
20W.	TY PHYLLIS	15	12	13	113	23	9	233	120	5	498	113	1
21W.	TS ROY	21	19	9	173	87	5	207	179	1			
22W.	TS SUSAN	13	9	5	47	25	1						
23W.	TD 23W	13	16	4									
24W.	TY THAD	19	18	21	114	86	17	286	178	12	635	319	8
25W.	STY VANESSA	14	11	31	102	68	27	179	106	23	245	165	19
26W.	TY WARREN	21	9	31	95	53	29	205	128	27	353	219	23
27W.	TY AGNES	11	7	28	72	23	25	139	54	21	197	69	18
28W.	STY BILL	20	9	52	98	50	46	226	141	41	406	297	39
29W.	TY CLARA	20	13	30	94	61	26	185	93	22	265	131	18
30W.	TY DOYLE	13	10	26	69	58	22	193	161	19	397	310	15
ALL FORECASTS:		22	14	611	117	66	492	233	137	378	363	231	286

TABLE 4-2.

ANNUAL MEAN FORECAST ERRORS (NM) FOR THE WESTERN NORTH PACIFIC

YEAR	24-HOUR		48-HOUR		72-HOUR	
	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
1982*	113	67	237	139	341	206
1983*	117	72	259	152	405	237
1984*	117	66	233	137	363	231

* The technique for calculating right angle error was revised in 1981; therefore, a direct correlation in right angle statistics cannot be made for the errors computed before 1981 and the errors computed since 1981.

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

YEAR	24-HOUR		48-HOUR		72-HOUR	
	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		337
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
1982	113	114	237	229	341	337
1983	117	110	259	247	405	384
1984	117	110	233	228	363	361

* for Typhoons only while winds were over 35 kt (18 m/sec).

** forecast positions north of 35°N were not verified.

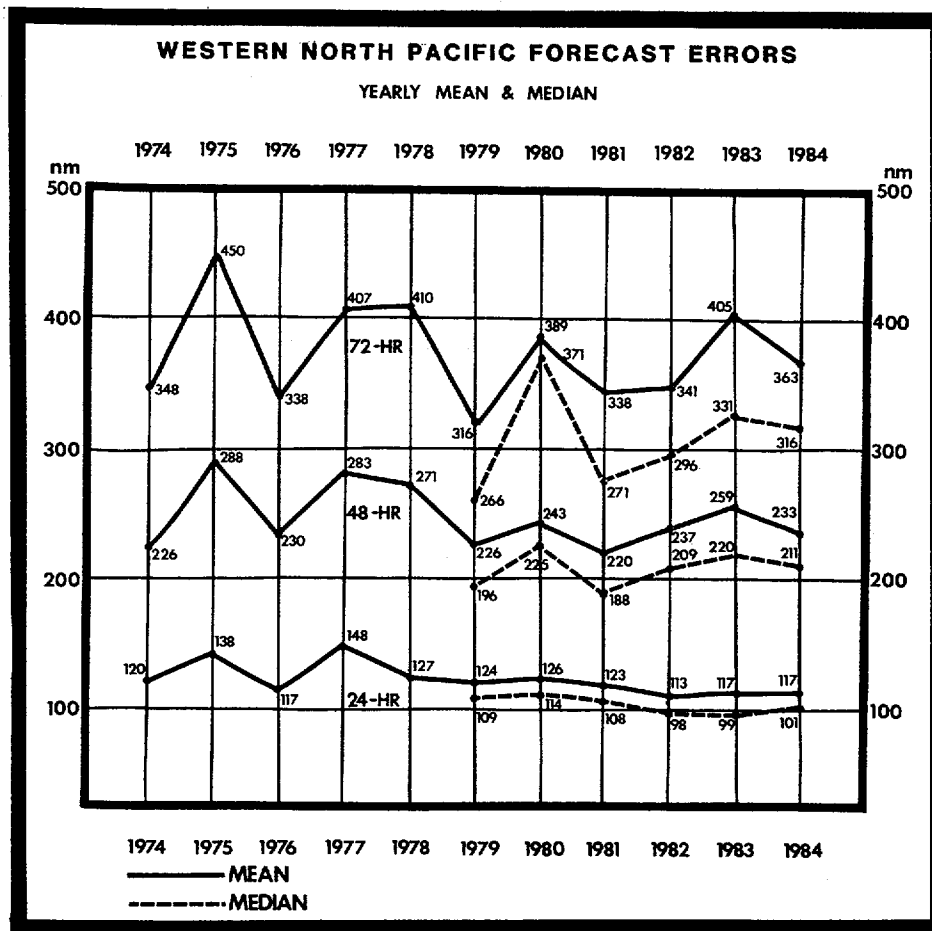


Figure 4-3. Annual mean and median vector errors (nm) for all tropical cyclones in the western North Pacific.

b. North Indian Ocean

The positions given for warning times and those at the 24-, 48-, and 72-hour valid times were verified for tropical cyclones in the North Indian Ocean by the same methods used for the western North Pacific. It should be noted that due to the low number of North Indian Ocean tropical cyclones, these error statistics should not be taken as representative of any trend.

Table 4-4 is the forecast error summary for the North Indian Ocean and Table 4-5 contains the annual average of forecast errors for each year through 1974. Vector errors are plotted in Figure 4-4. (Seventy-two hour forecast errors were evaluated for the first time in 1979). There were no verifying 72-hour forecasts in 1983.

TABLE 4-4.

FORECAST ERROR SUMMARY FOR THE NORTH INDIAN OCEAN
SIGNIFICANT TROPICAL CYCLONES FOR 1984. (ERRORS IN NM)

			WARNING			24-HOUR			48-HOUR			72-HOUR		
			POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS
01.	TC	01A	31	19	9	225	79	5	347	195	1			
02.	TC	02B	29	13	8	71	40	4						
03.	TC	03B	26	16	16	132	107	9						
04.	TC	04B	38	17	34	160	60	24	271	123	19	388	159	16
ALL FORECAST:			33	16	67	154	71	42	274	127	20	388	159	16

TABLE 4-5.

ANNUAL MEAN FORECAST ERRORS FOR THE NORTH INDIAN OCEAN

YEAR	24-HOUR		48-HOUR		72-HOUR	
	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
1982**	138	66	368	175	762	404
1983**	117	46	153	67	-	-
1984**	154	71	274	127	388	159

* The western Bay of Bengal and the Arabian Sea were not included in the JTWC area of responsibility until the 1975 tropical cyclone season.

** The technique for calculating right angle error was revised in 1981; therefore, a direct correlation in right angle statistics cannot be made for the errors computed before 1981 and the errors computed since 1981.

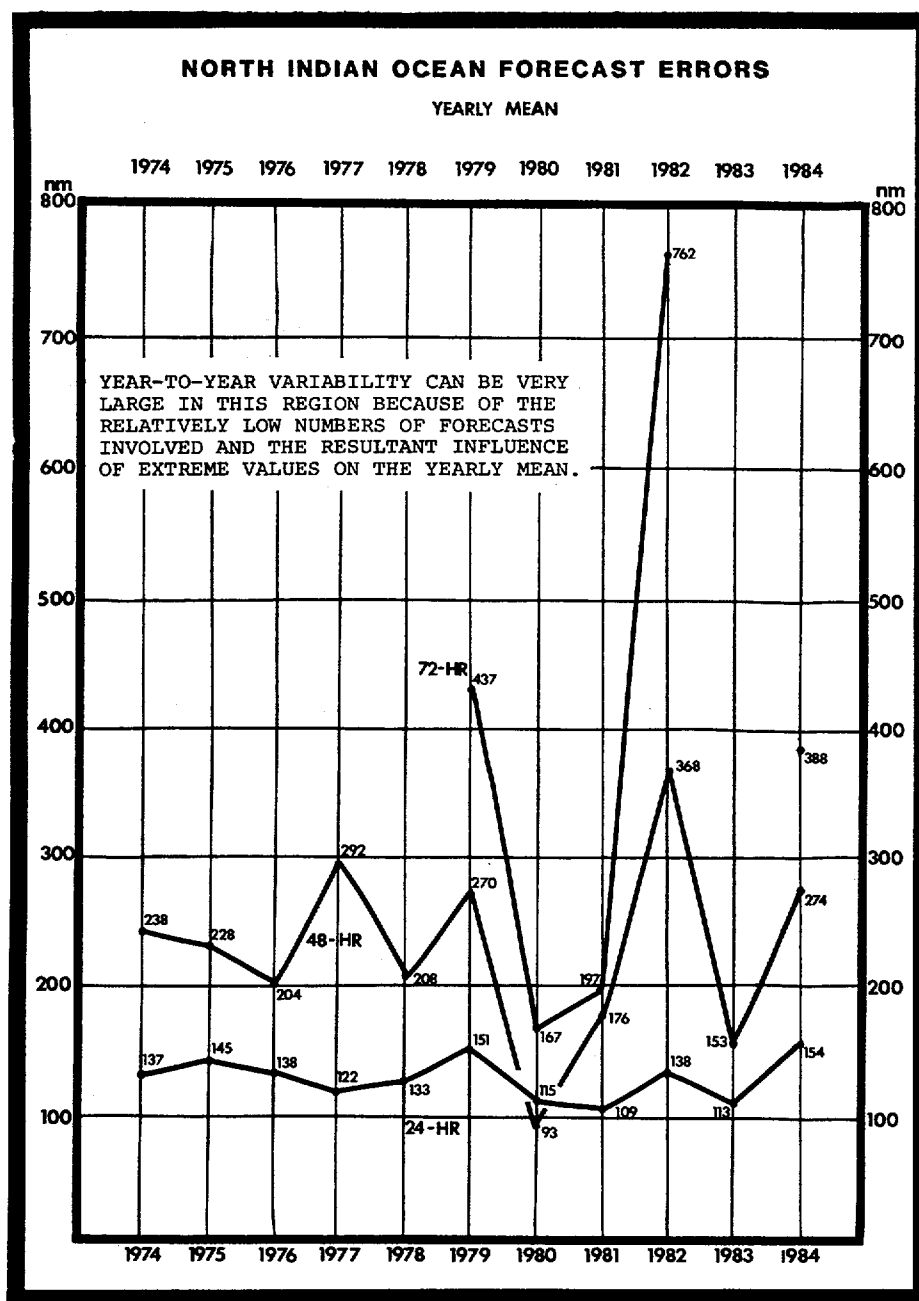


Figure 4-4. Annual mean vector errors (nm) for all tropical cyclones in the North Indian Ocean.

2. COMPARISON OF OBJECTIVE TECHNIQUES

a. General

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

- (1) extrapolation;
- (2) climatological and analog techniques
- (3) model output statistics;
- (4) dynamical models; and
- (5) empirical and analytical techniques

In September 1981, JTWC began to initialize its array of objective forecast techniques (described below) on the six-hour-old preliminary best track position (an interpolative process) rather than the forecast (partially extrapolated) warning position, e.g. the 0600Z warning is now supported by objective techniques developed from the 0000Z preliminary best track position. This operational change has yielded several advantages;

- *techniques can now be requested much earlier in the warning development time line, i.e. as soon as the track can be approximated by one or more fix positions after the valid time of the previous warning;
- *receipt of these techniques is virtually assured prior to development of the next warning; and
- *improved (mean) forecast accuracy.

This latter aspect arises because JTWC now has a more reliable approximation of the short-term tropical cyclone movement. Further, since most of the objective techniques are biased for persistence, this new procedure optimizes their performance and provides more consistent guidance on short-term movement, indirectly yielding a more accurate initial position estimate as well as lowering 24-hour forecast errors.

b. Description of Objective Techniques

(1) XTRP -- Forecast positions for 24- and 48-hours are derived from the extension of a straight line which connects the most-recent and 12-hour-old preliminary best track positions.

(2) CLIM -- A climatological aid providing 24-, 48-, and 72-hour tropical cyclone forecast positions (and intensity changes in the western North Pacific) based upon the position of the tropical cyclone. The output is based upon data records from 1945 to 1981 for the western North Pacific Ocean and 1900 to 1981 for the North Indian Ocean.

(3) TPAC -- Forecast positions are generated from a blend of climatology and persistence. The 24- and 48-hour positions are equally weighted between climatology and persistence and the 72-hour position is one quarter persistence and three quarters climatology. Persistence is a straight line extension of a line connecting the current and 12-hour-old positions. Climatology is based on data from 1945 to 1981 for the western North

Pacific Ocean and 1900 to 1981 for the North Indian Ocean.

(4) TYAN78 -- An updated analog program which combines the earlier versions TYFN 75 and INJAN 74. The program scans a 30-year climatology with a similar history (within a specified acceptance envelope) to the current tropical cyclone. For the western North Pacific Ocean, three forecasts of position and intensity are provided for 24-, 48-, and 72-hours: RECR - a weighted mean of all accepted tropical cyclones which were categorized as "recurving" during their best track period; STRA - a weighted mean of all accepted tropical cyclones which were categorized as moving "straight" (westward) during their best track period; and TOTL - a weighted mean of all accepted tropical cyclones, including those used in the RECR and STRA forecasts. For the North Indian Ocean, a single (total) forecast track is provided for 12-hour intervals to 72 hours.

(5) COSMOS -- A model output statistics (MOS) routine based on the geostrophic steering at the 850-, 700-, and 500-mb levels. The steering is derived from the HATTRACK point advection model run on Global prognostic fields from the FLENUMOCEANCEN NOGAPS prediction system. The MOS forecast is then blended with the 6-hour past movement to generate the forecast track.

(6) OTCM -- (One-way Interactive Tropical Cyclone Model) A coarse-mesh, three-layer in the vertical, primitive equation model with a 205 km grid spacing over a 6400 X 4700 km domain. The model's fields are computed around a bogus, digitized cyclone vortex using FLENUMOCEANCEN Numerical Variational Analysis (NVA) or NOGAPS prognostic fields for the specified valid time. The past motion of the tropical cyclone is compared to initial steering fields and a bias correction is computed and applied to the model. FLENUMOCEANCEN NOGAPS global prognostic fields are used at 12-hour intervals to update the model's boundaries. The resultant forecast positions are derived by locating the 850 mb vortex at six hour intervals to 72-hours.

(7) NTCM -- (Nested Tropical Cyclone Model) A primitive equation model with similar properties as the OTCM. The NTCM differs by containing a finer scale "nested" grid, initializing on NVA analysis fields only, not containing a (persistence) bias correction, and being a channel model which runs independent of FLENUMOCEANCEN prognostic fields (not requiring updating of its boundaries). The "nested grid" covers a 1200 X 1200 km area with a 41 km grid spacing which moves within the coarse-mesh domain to keep an 850 mb vortex at its center.

(8) TAPT -- An empirical technique which utilizes upper-tropospheric wind fields to estimate acceleration associated with the tropical cyclones interaction with the mid-latitude westerlies. It includes guidelines for duration of acceleration, upper-limits, and probable path of the cyclone.

(9) CLIP -- A statistical regression technique based on climatology, current intensity and position and past movement. This technique is used as a crude measure of real forecast skill when verifying forecast accuracy.

(10) THETA E -- An empirically derived relationship between a tropical cyclone's minimum sea-level pressure (MSLP) and 700 mb equivalent potential temperature (θ_e) was developed by Sikora (1976) and Dunnavan (1981). By monitoring MSLP and θ_e trends, the forecaster can evaluate the potential for sudden, rapid deepening of a tropical cyclone.

(11) WIND RADIUS -- Following an analytic model of the radial profiles of sea-level pressures and winds in mature tropical cyclones (Holland, 1980), a set of radii for 30-, 50-, and 100-knot winds based on the tropical cyclone's maximum winds have been produced to aid the forecaster in determining forecast wind radii.

(12) Dvorak -- An estimation of a tropical cyclone's current and 24-hour forecast intensity is made from interpolation of satellite imagery (Dvorak, 1973, 1982) and provided to the forecaster. These intensity estimates are used in conjunction with other intensity-related data and trends to forecast

tropical cyclone intensity.

JTWC currently uses TPAC, TAPT, TYAN78, COSMOS, and OTCM operationally with NTCM in an evaluation mode to develop track forecasts.

c. Testing and Results

A comparison of mean and median forecast errors (for a non-homogeneous data set) is provided for selected techniques in Table 4-6 for all western North Pacific tropical cyclones and in Table 4-8 for all North Indian Ocean tropical cyclones.

A comparison of selected techniques is included in Table 4-7 for all western North Pacific tropical cyclones and in Table 4-9 for all North Indian Ocean tropical cyclones. In these tables, "X-AXIS" refers to techniques listed vertically. The example in Table 4-7 compares COSM to OTCM, i.e. in the 461 cases available for a (homogeneous) comparison, the average vector error at 24 hours was 125 nm for COSMOS and 129 nm for OTCM. The difference of 4 nm is shown in the lower right. (Differences are not always exact, due to computational round-off which occurs for each of the cases available for comparison).

TABLE 4-7. 1984 ERROR STATISTICS FOR SELECTED OBJECTIVE TECHNIQUES IN THE WESTERN NORTH PACIFIC OCEAN

24-HOUR FORECAST ERRORS (NM)

	JTWC	RECR	CLIP	TOTL	COSM	NTCM	OTCM	TPAC	CLIM	XTRP	HPAC
JTWC	492 117 117 0										
RECR	459 115 472 130 128 13 130 0										
CLIP	409 117 392 130 422 120 119 117 -12 120 0										
TOTL	475 115 471 130 409 117 489 130 129 14 129 0 130 13 130 0										
COSM	473 117 456 129 408 119 473 130 486 125 122 6 123 -6 127 7 122 -6 125 0										
NTCM	421 117 404 130 421 120 421 130 420 126 435 121 120 3 119 -10 122 1 118 -11 120 -5 121 0										
OTCM	461 116 442 128 401 120 459 129 461 125 413 121 474 130 128 12 129 0 132 12 128 0 129 4 131 10 130 0										
TPAC	484 116 466 129 416 120 482 129 479 124 428 120 465 130 499 133 132 15 131 2 133 13 131 2 133 9 132 11 132 3 133 0										
CLIM	488 116 470 129 420 120 416 129 483 125 432 120 469 130 499 133 503 125 180 64 181 52 183 63 181 52 183 58 182 62 181 52 183 50 183 0										
XTRP	487 117 468 129 419 120 485 130 482 124 431 121 469 130 498 133 500 183 503 125 124 7 123 -6 126 6 123 -5 126 1 126 5 125 -4 125 -7 125 -57 125 0										
HPAC	485 116 467 129 417 120 483 129 480 124 429 120 466 130 498 133 500 183 500 125 500 133 132 15 131 2 133 13 131 2 133 9 132 12 132 3 133 0 133 -49 133 8 133 0										

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

48-HOUR FORECAST ERRORS (NM)

	JTWC	RECR	CLIP	TOTL	COSM	NTCM	OTCM	TPAC	CLIM	XTRP	HPAC
JTWC	378 233 233 0										
RECR	358 231 376 285 277 46 285 0										
CLIP	322 232 323 280 344 262 255 23 258 -21 262 0										
TOTL	366 230 374 285 325 257 389 288 283 53 284 0 282 26 288 0										
COSM	364 231 363 283 333 261 376 288 387 246 237 6 246 -36 248 -12 242 -45 246 0										
NTCM	331 231 332 280 343 262 344 283 342 246 353 257 252 21 255 -24 258 -2 251 -30 255 9 257 0										
OTCM	344 231 342 277 314 259 353 284 355 243 321 256 364 242 241 9 239 -37 245 -13 238 -44 239 -2 246 -9 242 0										
TPAC	372 230 371 283 340 260 383 285 381 246 349 257 358 243 395 284 277 47 281 -1 282 21 280 -4 284 38 281 24 281 38 284 0										
CLIM	375 231 374 284 343 261 386 286 384 246 352 257 361 242 395 284 398 363 353 122 358 74 360 99 360 74 363 117 359 102 360 118 362 78 363 0										
XTRP	374 232 372 284 341 261 385 288 383 246 350 257 360 242 394 284 395 363 397 290 281 49 286 2 293 32 286 0 292 46 291 34 286 43 289 5 290 -72 290 0										
HPAC	372 230 371 284 340 261 383 286 381 246 349 257 358 243 394 284 395 363 395 290 395 285 278 47 282 -1 283 22 281 -4 285 39 281 25 281 39 284 0 285 -77 285 -4 285 0										

JTWC - OFFICIAL JTWC FORECAST
 RECR - RECURVER (TYAN 78)
 CLIP - CLIPPER
 TOTL - TOTAL (TYAN 78)
 COSM - COSMOS (MOS)
 NTCM - NESTED TROPICAL CYCLONE MODEL
 OTCM - ONE-WAY TROPICAL CYCLONE MODEL
 TPAC - CLIM AND PERSISTENCE BLEND
 CLIM - CLIMATOLOGY
 XTRP - 12-HOUR EXTRAPOLATION
 HPAC - MEAN OF XTRP AND CLIM

72-HOUR FORECAST ERRORS (NM)

	JTWC	RECR	CLIP	TOTL	COSM	NTCM	OTCM	TPAC	CLIM
JTWC	286 363 363 0								
RECR	272 371 289 477 474 103 477 0								
CLIP	251 365 254 473 267 413 404 39 418 -54 413 0								
TOTL	278 366 288 477 261 414 296 470 464 98 474 -3 464 50 470 0								
COSM	277 358 280 473 259 411 287 467 295 389 386 28 397 -74 387 -22 393 -72 389 0								
NTCM	259 365 262 471 266 414 269 465 267 383 275 430 432 67 435 -35 432 18 433 -32 422 39 430 0								
OTCM	235 366 244 492 219 426 246 472 244 399 225 451 251 363 364 -1 364 -127 359 -66 364 -106 358 -39 361 -89 363 0								
TPAC	282 360 284 476 264 413 291 468 290 390 272 430 246 365 299 455 450 90 457 -17 499 37 453 -14 451 62 449 19 458 93 455 0								
CLIM	285 361 287 476 267 413 294 470 293 389 275 430 249 364 299 455 302 514 513 152 515 39 508 95 512 42 511 122 506 76 519 156 513 58 514 0								

TABLE 4-9.

1984 ERROR STATISTICS FOR SELECTED OBJECTIVE TECHNIQUES IN
THE NORTH INDIAN OCEAN

24-HOUR FORECAST ERRORS (NM)																
JTWC			TOTL		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	42	154														
	154	0														
TOTL	31	147	35	130												
	124	-21	130	0												
NTCM	36	162	29	144	43	161										
	160	-1	155	11	161	0										
OTCM	38	154	32	130	39	163	47	160								
	161	7	154	24	168	5	160	0								
TPAC	39	148	34	133	39	152	41	148	45	137						
	139	-8	143	10	146	-4	134	-13	137	0						
CLIM	39	148	34	133	39	152	41	148	45	137	45	183				
	189	41	191	58	181	30	181	33	183	46	183	0				
XTRP	42	154	35	130	43	161	46	160	45	137	45	183	50	138		
	133	-20	120	-10	147	-13	138	-21	134	-3	134	-48	138	0		
HPAC	39	148	34	133	39	152	41	148	45	137	45	183	45	134	45	142
	145	-2	149	16	146	-5	140	-8	142	5	142	-40	142	8	142	0

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

48-HOUR FORECAST ERRORS (NM)															
JTWC		TOTL		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	20	274													
	274	0													
TOTL	14	292	26	299											
	303	11	299	0											
NTCM	19	271	24	303	33	322									
	283	13	345	42	322	0									
OTCM	18	263	24	293	31	317	33	318							
	289	27	364	71	312	-4	318	0							
TPAC	19	285	26	299	32	325	32	325	34	308					
	359	73	307	8	310	-15	301	-23	308	0					
CLIM	19	285	26	299	32	325	32	325	34	308	34	387			
	466	181	379	80	384	59	372	47	387	79	387	0			
XTRP	20	274	26	299	33	322	33	318	34	308	34	387	35	282	
	272	-1	259	-39	287	-33	285	-31	285	-22	285	-101	282	0	
HPAC	19	285	26	299	32	325	32	325	34	308	34	387	34	285	34
	358	73	307	8	309	-15	301	-23	308	0	308	-78	308	23	308

JTWC - OFFICIAL JTWC FORECAST
TOTL - ANALOG (TYAN 78)
NTCM - NESTED TROPICAL CYCLONE MODEL
OTCM - ONE-WAY TROPICAL CYCLONE MODEL
TPAC - CLIM AND PERSISTENCE BLEND
CLIM - CLIMATOLOGY
XTRP - 12-HOUR EXTRAPOLATION
HPAC - MEAN OF XTRP AND CLIM

JTWC - OFFICIAL JTWC FORECAST
 TOTL - ANALOG (TYAN 78)
 NTCM - NESTED TROPICAL CYCLONE MODEL
 OTCM - ONE-WAY TROPICAL CYCLONE MODEL
 TPAC - CLIM AND PERSISTENCE BLEND
 CLIM - CLIMATOLOGY
 XTRP - 12-HOUR EXTRAPOLATION
 HPAC - MEAN OF XTRP AND CLIM

72-HOUR FORECAST ERRORS (NM)											
	JTWC		TOTL		NTCM		OTCM		TPAC		CLIM
JTWC	16	388									
	388	0									
TOTL	12	368	22	476							
	475	107	476	0							
NTCM	15	383	21	475	25	547					
	417	34	567	92	547	0					
OTCM	6	489	11	542	11	669	12	290			
	290	-198	304	-237	286	-382	290	0			
TPAC	16	388	22	476	25	547	12	290	26	566	
	616	229	545	69	553	5	669	379	566	0	
CLIM	16	388	22	476	25	547	12	290	26	566	26
	691	303	616	140	609	61	788	498	629	64	629

CHAPTER V - APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

The following articles delineate the extent of the research program at Naval Environmental Prediction Research Facility (NAVENVPREDRSCHFAC) dedicated to supporting the operations at JTWC. There are three major research departments at NAVENVPREDRSCHFAC, each contributing to the overall program; research on current and future tropical cyclone models is performed in the Numerical Modeling Department, the Tactical Applications Department conducts statistical applications studies, and the Satellite Processing and Display Department develops computer interactive techniques.

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

(Fiorino, M., NAVENVPREDRSCHFAC)

Two techniques for incorporating persistence into the NTCM forecast were tested on 157 independent cases from the 1982 and 1983 WESTPAC seasons. The first method uses the bias-corrector strategy in which the winds around the storm are modified to force the storm to initially move with the observed current motion. The bias-corrector is a pre-processing technique because the forecast track is affected before the model integration. The second method uses the post-processing technique of COSMOS. In this method, the 72-hour forecast position is retained and a combination of persistence and a straight line between the initial position and 72-hour point is used to fill in for the 24- and 48-hour positions. Superior results were obtained with the post-processing method. The median forecast errors at 24, 48, and 72 hours were 90, 201, and 296 nm compared to 102, 225, and 312 nm for the pre-processing method. Although the bias-corrector degraded the median 72-hour forecast error of the NTCM, it was effective in reducing the speed bias.

One-Way influence boundary conditions have been built into the NTCM. The initialization of the large-scale flow and the vortex were also modified to accommodate the change to the lateral boundary conditions. Experiments are underway to determine how the time variation of the flow at the boundaries affects the forecast track. The new version of the NTCM with one-way boundaries will be ready for the 1985 WESTPAC season.

TROPICAL CYCLONE SYNOPTIC ANALYSIS DISPLAY SYSTEM

(Tsui, T., NAVENVPREDRSCHFAC)

A new SPADS software is under development for the purpose of demonstrating that the existing computer softwares can be adapted for SPADS and be streamlined

together to provide tropical cyclone forecasters a means to investigate immediate synoptic situation changes. This new SPADS system will be able to process satellite IR, VIS, and microwave data as they become available and translate these digital data into meteorological information which is to be merged with the FNOC wind/height field analysis. To maximize the utility of the system, the modified wind/height field should be updated every three hours so the forecasters could detect the most recent changes in the synoptic-scale flow influencing the tropical cyclone movement.

TROPICAL CYCLONE OBJECTIVE DECISION-TREE FORECASTING AID

(Elsberry, R. L. and J. Chan, NAVPGSCOL)

In view of the short tour length and limited forecast experience of many JTWC TDO's, an objective approach to the tropical cyclone track forecasting decision making process is desired. Forecasters need assistance in determining when, where, and how to use the objective aids. A research effort is now underway to study the performance of different tropical cyclone forecast aids for various cyclone characteristics under different environmental conditions. Each of the factors, including center fix errors, affecting the accuracy of objective forecast aids will be incorporated into a decision tree to assist the forecaster in following a logical and reasonable path in selecting appropriate aids in any given situation. In FY85, NTCM will be used as a test case to prove the concept.

JTWC CLIMATOLOGICAL DATA SET

(Tsui, T., NAVENVPREDRSCHFAC)

The JTWC tropical cyclone data base has been updated and expanded. The data base resides on FNOC computer disks on a storm-by-storm basis containing fix data, best track information, and official and objective aid forecasts. All three data sets have a separate but consistent data format. The data period begins at 1966 for the fix data, 1945 for the best track information, and 1967 for the official and objective aid forecasts. Currently, the last year included in this data set is 1983.

A STATISTICAL METHOD FOR 1 to 3 DAY TROPICAL CYCLONE TRACK PREDICTION

(Matsumoto, C. R. and W. M. Gray, Colorado State University)

Growing out of the Colorado State University's own research effort, a new

method of incorporating climatology, persistence and synoptic data to forecast the 1 to 3 day tropical cyclone motion has been developed in an attempt to improve the accuracy of track prediction. Cyclones are stratified based on their position relative to the 500 mb subtropical ridge to better define the environmental influences on the cyclones. The 72-hr track forecast is segmented into three 24-hr time steps to permit the application of updated persistence and synoptic data relative to the new cyclone position as the 24-hr displacements are stepped forward to the desired forecast projection. Since the initial results warrant further investigations, NAVENVPREDRSCHFAC will evaluate the program under a simulated operational environment in FY85.

TROPICAL CYCLONE HAVEN STUDIES

(Brand, S. NAVENVPREDRSCHFAC)

With the completion of seven new hurricane haven studies, the Hurricane Havens Handbook for the North Atlantic Ocean provides 22 port and harbor evaluations. In addition, the haven study for Pearl Harbor has been completed and published. Requests for copies for official use may be directed to Commanding Officer, Attn: Technical Library, Naval Environmental Prediction Research Facility, Monterey, CA 93943-5106. Registered qualified users may request copies from Director, Defense Technical Information Center, Cameron Station, Alexandria, VA 22314. Others may purchase copies from National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22151.

NAVY TACTICAL APPLICATIONS GUIDE (MTAG), Vol. 6

(Fett, R., NAVENVPREDRSCHFAC)

An effort is now underway to develop a series of examples demonstrating the use of high quality satellite data for analysis and forecasting in the tropics. Both polar orbital and geostationary satellite data are used to study the evolution of certain weather effects or of a particular weather phenomenon at a given time. These examples are intended for publishing in the NTAG Volume 6, Part I, Tropical Weather Analysis and Forecast Applications, and Volume 6, Part II, Tropical Cyclone Weather Analysis and Forecast Applications. This NTAG Volume 6 is scheduled to be published in 1988.

STATISTICAL TROPICAL CYCLONE FORECASTING AIDS FOR THE SOUTHERN HEMISPHERE

(Keenan, T., Bureau of Meteorology, Australia)

Statistical models for forecasting Southern Hemisphere tropical cyclones have been adapted and developed. From a limited

sample test, it is apparent that the Australian aids provide a level of assistance similar to the JTWC aids. The forecast errors of the Australian statistical aids range from 111 to 148 nm for 24-hr forecast and from 215 to 252 nm for 48-hr forecast. The classical regression technique turns out to be the best aid. This regression technique is derived from prescreened data sets which consist of 1000, 850, 700, 500, and 300 mb height fields, climatology predictors and persistence predictors. All the Australian aid programs reside on JTWC disk files in the FNOC computer system. Forecasters can activate these aids by providing date-time-group, previous and current storm locations and intensities.

SATELLITE BASED TROPICAL CYCLONE INTENSITY FORECASTS

(Cook, J. and T. Tsui, NAVENVPREDRSCHFAC)

An objective spiral analysis technique for tropical cyclone intensity forecasting has been installed on the Satellite Data Processing And Display System (SPADS). Through the satellite IR image displayed by SPADS, the technique first accepts a user described outline of a major cloud band of the tropical cyclone. The technique then objectively finds the best fitting spherical logarithmic spiral to the cloud band, and performs multiple Fourier analyses of the radiance field along orthogonal spirals to the band. By using these Fourier coefficients along with climatology and persistence predictors, tropical cyclone intensity forecasts can be deduced from regression equations. Independent tests show that the spiral technique possesses remarkably better skill in estimating the current intensity (6 kts RMS errors) than the Dvorak technique (15 kts RMS errors). Also, the spiral technique has a reliable 12-hr intensity forecasting skill (14 kts RMS errors).

CHARACTERISTICS OF NORTH INDIAN OCEAN TROPICAL CYCLONE ACTIVITY

(Lee, C. S. and W. M. Gray, Colorado State University)

A detailed individual case analysis is made of each of the North Indian Ocean (NIO) tropical cyclones which occurred during the 1979 First GARP GlobalExperiment (FGGE) period. Each NIO tropical cyclone's characteristics from genesis to decay are discussed. These tropical cyclones are found to form almost exclusively within the monsoon trough. Low-level equatorial westerly winds and Southern Hemisphere influences appear more important for the NIO tropical cyclones than for monsoon trough tropical cyclone formations in other regions. However, their basic structure, intensity change, and movement characteristics are very similar to tropical cyclones occurring in the other regions. A NAVENVPREDRSCHFAC technical report of this study will be published in early 1985.

TROPICAL CYCLONE READINESS CONDITION
SETTING PROGRAM

(Brand, S. NAVENVPREDRSCHFAC and Jarrel, J.,
Science Applications, Inc.)

A procedure for setting tropical cyclone readiness conditions with a high degree of reliability has been developed. The methodology utilizes a large number of computer-simulated forecasts for actual tropical cyclones since 1899 that passed near Key West, FL and Guantanamo Bay, Cuba. Wind probabilities were computed from these

forecasts assuming present-day official forecast error characteristics, and then compared to hindsight estimates of actual winds. These data were used to establish tropical cyclone condition thresholds at desired levels of confidence as related to wind probability. Sample nomographs with 95% threshold confidence values have been developed for hurricane readiness conditions at Key West and Guantanamo Bay. In the coming year, the readiness condition setting program will be adapted for five Pacific sites (Subic Bay, Buckner Bay, Yokosuka, Guam, and Pearl Harbor). In addition, this program will be developed for the afloat units in the Pacific area.

ANNEX A TROPICAL CYCLONE TRACK AND FIX DATA

1. WESTERN NORTH PACIFIC CYCLONE DATA

TROPICAL STORM VERNON BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			ERRORS			24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND	WIND	POSIT	WIND	WIND	DST	WIND	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
060718Z	11.9 114.8	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	0.0	0.0	0.0	0.0	0.0
060800Z	12.1 114.2	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	0.0	0.0	0.0	0.0	0.0
060805Z	12.3 113.7	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	0.0	0.0	0.0	0.0	0.0
060812Z	12.6 113.3	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	0.0	0.0	0.0	0.0	0.0
060818Z	13.0 113.0	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	0.0	0.0	0.0	0.0	0.0
060900Z	13.4 112.7	30	13.3	112.6	30	12	0.0	15.0	111.1	40	38	5	16.9	109.6	50	147	25	0.0	0.0	0.0	0.0
060905Z	14.2 112.5	35	14.0	112.2	35	12	0.0	16.4	110.6	45	105	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
060912Z	14.0 111.9	40	14.9	111.7	40	12	0.0	17.4	109.1	45	89	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
060918Z	15.5 111.1	40	15.5	111.2	40	16	0.0	18.1	109.0	45	135	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
061000Z	15.9 109.9	35	16.2	110.4	40	34	5	19.0	108.1	35	166	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
061005Z	16.1 108.8	35	16.5	109.1	35	30	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
061012Z	16.2 108.2	30	17.1	108.4	35	55	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
061018Z	16.3 107.6	30	17.8	107.7	30	90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
061100Z	16.4 107.1	25	17.0	107.0	25	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AVG FORECAST POSIT ERROR	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG RIGHT ANGLE ERROR	31	116	147	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	28	86	55	0	0	0	0	0
AVG INTENSITY	1	11	25	0	0	0	0	0
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 556. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TROPICAL STORM VERNON FIX POSITIONS FOR CYCLONE NO. 1

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	070215	12.1N 114.7E	PCN 5	T1.5/1.5	ULAC 9.6N 113.8E	RPMK
2	080155	11.8N 114.1E	PCN 5	T2.0/2.0 /D0.5/24HRS		RPMK
3	080729	11.4N 114.4E	PCN 5	T1.0/1.0	INIT OBS	PGTU
4	080729	12.6N 113.6E	PCN 5			RPMK
5	081435	12.9N 113.6E	PCN 5			RPMK
6	082014	12.0N 113.7E	PCN 5			RODN
7	082100	13.4N 112.8E	PCN 6			PGTU
8	082356	13.3N 111.5E	PCN 6	T2.0/2.0	INIT OBS	RODN
9	090000	13.4N 112.5E	PCN 5	T2.0/2.0	INIT OBS	PGTU
10	090135	13.4N 112.9E	PCN 5	T2.0/2.0 /S0.0/24HRS	EXP LLCC	PGTU
11	090300	14.1N 112.5E	PCN 4		EXP LLCC	RPMK
12	090315	14.3N 112.5E	PCN 3	T2.5/2.5 /D0.5/23HRS	EXP LLCC	PGTU
13	090716	14.4N 112.1E	PCN 3			PGTU
14	091025	14.7N 111.8E	PCN 5			RPMK
15	091235	15.6N 113.0E	PCN 5			PGTU
16	091500	14.9N 111.7E	PCN 6			RODN
17	091800	15.4N 111.2E	PCN 6			PGTU
18	092001	14.8N 109.2E	PCN 5			RPMK
19	092100	16.0N 111.0E	PCN 6			PGTU
20	092306	15.8N 109.6E	PCN 6	T2.0/2.5 /W0.5/20HRS		RPMK
21	100000	15.8N 110.0E	PCN 6	T2.5/2.5 /D0.5/24HRS		PGTU
22	100256	15.9N 109.3E	PCN 5	T2.0/2.5 /W0.5/24HRS	EXP LLCC	PGTU
23	100300	16.1N 109.2E	PCN 4			RPMK
24	101214	16.7N 107.2E	PCN 5			RPMK
25	102243	16.7N 107.1E	PCN 6			PGTU
26	110000	16.2N 107.2E	PCN 6			PGTU

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

**TROPICAL STORM WYNNE
BEST TRACK DATA**

[illegible]

	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	14.	93.	224.	389.	0.	0.	0.	0.
AVG FORECAST NGT ERROR	10.	44.	114.	224.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	0.	1.	1.	12.	0.	0.	0.	0.
AVG INTENSITY BIAS	0.	1.	1.	12.	0.	0.	0.	0.
NUMBER OF FORECASTS	28	24	18	16	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1609. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM WYNNE
FIX POSITIONS FOR CYCLONE NO. 2

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	180000	20.0N 135.5E	PCN 6			
2	180705	20.3N 135.3E	PCN 6	T0.0/0.0	INIT OBS	
3	181200	20.6N 134.8E	PCN 6			
4	181500	20.6N 134.1E	PCN 6			
5	182136	20.6N 132.9E	PCN 6			
6	190000	21.0N 132.8E	PCN 6			
7	190136	20.9N 132.4E	PCN 6			
8	190136	20.9N 133.1E	PCN 6	T0.5/0.5 /D0.5/26HRS		
9	190300	20.8N 132.1E	PCN 6	T0.5/0.5	INIT OBS	
10	190653	20.9N 132.3E	PCN 6			
11	191016	20.7N 131.8E	PCN 6			
12	191200	20.8N 131.5E	PCN 6			
13	191415	20.8N 131.1E	PCN 6			
14	191500	20.8N 131.1E	PCN 6	T2.5/2.5 /D1.5/24HRS		
15	191800	21.0N 130.8E	PCN 6			
16	191938	22.1N 130.6E	PCN 6			
17	192144	22.1N 129.2E	PCN 6			
18	200115	21.5N 130.2E	PCN 6	T2.0/2.0 /D1.5/24HRS		
19	200116	22.1N 130.8E	PCN 6	T2.5/2.5 /D2.0/24HRS		
20	200300	22.4N 130.7E	PCN 6			
21	200641	21.3N 130.2E	PCN 6			
22	200641	22.1N 130.3E	PCN 6			
23	200900	22.2N 129.8E	PCN 6			
24	201200	22.4N 129.8E	PCN 6			
25	201356	22.2N 129.2E	PCN 6			
26	201800	22.3N 128.9E	PCN 4	T3.0/3.0 /D0.5/27HRS	ULCC FIX	
27	201925	22.5N 129.3E	PCN 5			
28	202053	22.3N 128.7E	PCN 6	T2.5/2.5	INIT OBS	
29	202100	22.5N 128.6E	PCN 6			
30	210000	22.1N 128.2E	PCN 6			
31	210055	22.5N 128.1E	PCN 3	T3.0/3.0 /D1.0/24HRS	ULCC FIX	
32	210300	22.6N 128.2E	PCN 4	T3.0/3.0 /D0.5/23HRS		
33	210600	22.6N 127.8E	PCN 4			
34	210628	22.4N 127.9E	PCN 3			
35	210628	22.3N 128.1E	PCN 3			
36	210900	22.6N 127.9E	PCN 6			
37	210933	22.3N 127.7E	PCN 4			
38	211200	22.4N 127.6E	PCN 6			
39	211335	22.4N 127.6E	PCN 6			
40	211500	22.4N 127.5E	PCN 6	T3.0/3.0 /S0.0/21HRS	ULCC FIX	
41	211800	22.4N 127.2E	PCN 6			
42	212100	22.2N 126.9E	PCN 6			
43	212213	22.3N 127.2E	PCN 6	T3.0/3.0 /S0.0/22HRS	ULCC FIX	
44	212221	22.3N 127.4E	PCN 3	T2.5/2.5 /S0.0/24HRS		
45	220000	22.5N 126.8E	PCN 6			
46	220035	22.4N 126.5E	PCN 3	T3.0/3.0 /S0.0/22HRS		
47	220035	22.4N 126.8E	PCN 5			
48	220217	22.3N 126.7E	PCN 7	T3.5/3.5	INIT OBS	
49	220300	22.6N 126.6E	PCN 6			
50	220600	22.2N 126.2E	PCN 6			
51	220615	22.3N 126.2E	PCN 3			
52	220616	22.2N 126.2E	PCN 6			
53	220900	22.2N 126.0E	PCN 6			
54	221053	22.4N 126.1E	PCN 5			
55	221200	22.0N 125.7E	PCN 6			
56	221457	22.0N 125.2E	PCN 6			
57	221600	22.0N 125.0E	PCN 6	T3.5/3.5 /D0.5/24HRS		
58	221800	22.0N 124.6E	PCN 6			
59	221900	22.1N 124.3E	PCN 6			
60	221512	22.1N 124.0E	PCN 6	T3.0/3.0 /S0.0/24HRS		
61	230000	22.0N 124.0E	PCN 6			
62	230156	21.8N 124.0E	PCN 5			
63	230300	22.2N 123.7E	PCN 6	T3.0/3.0	INIT OBS	
64	230600	22.2N 131.1E	PCN 6	T3.5/3.5 /D0.5/27HRS		
65	230900	21.7N 122.8E	PCN 6			
66	231032	22.0N 122.8E	PCN 5	T3.5/3.5-	ULCC FIX	
67	231200	22.1N 121.7E	PCN 6		INIT OBS	
68	231437	22.1N 121.4E	PCN 6			
69	231800	22.8N 120.7E	PCN 6	T3.5/3.5 /S0.0/26HRS		
70	232100	22.0N 119.6E	PCN 6			
71	232330	22.3N 119.8E	PCN 6			
72	240000	22.0N 118.8E	PCN 6			
73	240136	21.9N 118.3E	PCN 6			
74	240136	21.0N 117.5E	PCN 5	T3.0/3.0 /S0.0/27HRS		
75	240300	21.6N 117.8E	PCN 6	T3.0/3.5 /U0.5/24HRS		

AIRCRAFT FIXES

RADAR FIXES

SYNOPTIC FIXES

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

TYPHOON ALEX
BEST TRACK DATA

MO/DA/HR	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
070108Z	16.1 124.5	30	16.1 124.6	25	35	0	15.9 121.3	30	15.7	15	16.2 118.8	35	16.2 118.8	35	16.2 118.8	35	16.2 118.8	35	16.2 118.8	35
070112Z	16.3 124.0	35	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070118Z	16.8 123.8	40	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070200Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070206Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070212Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070218Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070300Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070306Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070312Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070318Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070400Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070406Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070412Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070418Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070500Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40
070506Z	17.3 123.6	45	16.0 120.8	30	30	0	16.0 120.5	30	16.0	15	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40	16.2 118.1	40

	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	27	155	351	803	29	183	372	859
AVG RIGHT ANGLE ERROR	23	33	187	328	23	99	285	376
AVG INTENSITY MAGNITUDE ERROR	3	18	27	8	3	18	26	8
AVG INTENSITY BIAS	1	-3	-3	5	1	-4	-6	4
NUMBER OF FORECASTS	18	14	10	6	15	13	9	5

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1320. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TYPHOON ALEX
FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	292105	18.7N 127.7E	PCN 3	T1.0/1.0	INIT OBS	PQTU
2	292301	19.0N 127.6E	PCN 3		EXP LLCC	PQTU
3	300500	16.1N 126.8E	PCN 6		ULCC FIX	PQTU
4	010056	16.1N 124.2E	PCN 3	T2.0/2.0-	INIT OBS	PQTU
5	010556	16.1N 124.2E	PCN 3	T2.5/2.5-	INIT OBS	PQTU
6	010600	16.2N 123.5E	PCN 6			RPMK
7	011100	15.7N 123.2E	PCN 6			PQTU
8	011115	14.8N 123.3E	PCN 6			PQTU
9	011337	15.4N 123.2E	PCN 6		ULCC FIX	PQTU
10	011700	15.7N 123.3E	PCN 6	T3.0/3.0-	INIT OBS	PQTU
11	012504	16.8N 123.1E	PCN 6		EXP LLCC	PQTU
12	012300	17.2N 123.1E	PCN 6	T3.0/3.0-/D1.0/24HRS		PQTU
13	012354	17.0N 123.0E	PCN 5	T3.0/3.0 /D0.5/23HRS		PQTU
14	012354	17.1N 123.1E	PCN 5	T3.0/3.0	INIT OBS	RPMK
15	020217	18.0N 123.1E	PCN 6			RODN
16	020217	18.0N 123.1E	PCN 6			RPMK
17	020600	17.9N 123.3E	PCN 4			PQTU
18	021044	18.9N 123.5E	PCN 4			RODN
19	021050	18.9N 123.3E	PCN 6			PQTU
20	021200	18.5N 123.1E	PCN 6		ULCC FIX	PQTU
21	021800	20.0N 122.0E	PCN 6		ULCC FIX	PQTU
22	022142	21.4N 121.4E	PCN 2	T3.5/3.5-/D0.5/25HRS		PQTU
23	022320	21.5N 121.4E	PCN 1			PQTU
24	022320	21.7N 121.8E	PCN 1	T4.0/4.0 /D1.0/24HRS		RPMK
25	030157	22.4N 121.7E	PCN 1	T4.0/4.0 /D1.0/24HRS		PQTU
26	030157	22.3N 121.6E	PCN 3	T4.5/4.5 /D1.5/26HRS	12NM EVE	RPMK
27	030722	22.3N 121.6E	PCN 3			PQTU
28	031026	24.4N 120.9E	PCN 5		ULCC FIX	PQTU
29	031438	25.1N 120.7E	PCN 5		ULCC FIX	RPMK
30	032007	25.7N 120.5E	PCN 6			RODN
31	032121	26.6N 120.5E	PCN 6			PQTU
32	032305	27.6N 121.6E	PCN 5	T2.0/3.0-/W2.0/24HRS		PQTU
33	032305	26.8N 120.6E	PCN 5			RPMK
34	040137	28.8N 121.7E	PCN 3	T3.0/4.0 /W1.5/24HRS		RPMK
35	040137	29.7N 122.7E	PCN 3	T2.0/2.0	INIT OBS	RODN
36	040709	29.8N 122.2E	PCN 3			RPMK
37	041001	30.1N 122.4E	PCN 5			PQTU
38	041954	32.9N 124.8E	PCN 3			RPMK
39	050117	34.3N 125.1E	PCN 3	T2.0/3.0 /W1.0/24HRS		RPMK
40	051200	36.8N 131.7E	PCN 6			PQTU

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM-TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	302327	16.1N 124.6E	1500FT		1000	30 100 60	110 35 090 30	10 5			+26 +24 +23	1
2	020351	17.7N 123.5E	700MB	2964		65 040 15	140 60 030 25	15 15			+9 +11 +11	2
3	020549	18.0N 123.3E	700MB	2962	984	65 180 10	060 30 340 38	15 15	ELLIPTICAL	30 20 030	+16 +13 +9	3
4	022045	21.2N 121.5E	700MB	2772		55 090 30	120 92 100 16	12 30	CIRCULAR	15		
5	022337	21.6N 121.6E	700MB	2779	962	80 050 10	180 69 030 20	13 1	CIRCULAR	12	+10 +16 +16	3

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADAR-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WHO NO.
1	011900	16.6N 123.9E	LAND				11320 63515	EYE 100 PCT ELIP	15.7N 121.6E	98333
2	020330	17.6N 123.5E	LAND				10301		18.4N 121.6E	98231
3	020600	18.1N 123.4E	LAND				10991 60406		18.4N 121.6E	98231
4	020900	18.6N 123.3E	LAND				10971 63430		18.4N 121.6E	98231
5	020900	18.7N 123.2E	LAND				11922 43506		18.4N 121.6E	98231
6	021600	20.5N 122.4E	LAND				10612 43510	EYE 80 PCT CIR OPN N	18.4N 121.6E	98231
7	021600	20.3N 122.3E	LAND				35350 53230		20.4N 121.8E	98136
8	021700	20.4N 122.3E	LAND				39550 53230	EYE ILL DEFINED	20.4N 121.8E	98136
9	021730	20.7N 122.3E	LAND				10550 43320	EYE 60 PCT CIR OPN N	18.4N 121.6E	98231
10	021800	20.8N 122.2E	LAND				10512 43418	EYE 60 PCT CIR OPN N	18.4N 121.6E	98231
11	021800	20.6N 122.2E	LAND				35550 53231	EYE ILL DEFINED	20.4N 121.8E	98136
12	022000	21.8N 121.6E	LAND				11714 53616		22.6N 120.7E	46744
13	022100	21.3N 121.6E	LAND				65550 53018		22.6N 120.7E	46752
14	022100	21.3N 121.7E	LAND				65550 53610		22.6N 120.7E	46752
15	022200	21.5N 121.6E	LAND				45550 53610		22.5N 120.5E	59553
16	030100	22.1N 121.6E	LAND				65550 53616		24.3N 124.2E	47918
17	030100	22.0N 121.6E	LAND				25550 53616		22.6N 120.7E	46744
18	030100	21.8N 121.7E	LAND				65550 53608		22.6N 120.7E	46752
19	030100	22.0N 121.8E	LAND				10332 50119		23.8N 121.6E	46699
20	030200	22.4N 121.6E	LAND				11714 53616		24.3N 124.2E	47918
21	030300	22.5N 121.5E	LAND				11713 53511		24.3N 124.2E	47918
22	030300	22.5N 121.5E	LAND				25550 53411		22.6N 120.3E	46744
23	030300	22.5N 121.6E	LAND				10222 53518		23.8N 121.6E	46699
24	030300	22.6N 121.6E	LAND				65550 53614		22.6N 120.7E	46752

025	030400	22.7N	121.6E	LAND	12212	53612	23.8N	121.6E	46699
026	030400	22.9N	121.6E	LAND	22413	73615	24.3N	124.2E	47918
027	030400	22.8N	121.6E	LAND	6///	53614	22.0N	120.7E	46752
028	030500	23.2N	121.6E	LAND	4/533	53615	23.8N	121.6E	46699
029	030500	23.0N	121.4E	LAND	645//	53514	22.6N	120.3E	46744
030	030500	23.2N	121.5E	LAND	6///	53614	22.0N	120.7E	46752
031	030500	23.1N	121.5E	LAND	25/13	73615	24.3N	124.2E	47918
032	030600	23.3N	121.4E	LAND	65/13	73516	24.3N	124.2E	47918
033	030700	23.5N	121.5E	LAND	35/13	73612	24.3N	124.2E	47918
034	030800	23.8N	121.5E	LAND	65/13	73615	24.3N	124.2E	47918

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	040600	29.4N 121.6E	045	035	58556 58562 58569
2	040900	29.8N 122.0E	045	030	58562 58474 58569
3	041200	31.3N 122.9E	045	030	58472 58477 58367

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

TROPICAL STORM BETTY BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND
070418Z	14.7 126.3	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	0.0	0.0	0.0
070500Z	14.5 125.0	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	0.0	0.0	0.0
070506Z	14.6 123.8	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	0.0	0.0	0.0
070512Z	14.8 122.8	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	0.0	0.0	0.0
070518Z	15.1 121.8	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	0.0	0.0	0.0
070600Z	15.5 120.0	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	0.0	0.0	0.0
070606Z	15.9 120.2	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	0.0	0.0	0.0
070612Z	16.3 119.4	25	16.4	119.0	25	24	0.0	18.3 115.6	40	58	5	20.6 112.1	50	111	0	23.1 109.8	30	42	-5
070618Z	16.8 118.6	25	17.2	118.3	30	30	5	19.3 115.1	45	75	5	21.8 111.8	60	98	5	24.4 109.8	30	125	5
070700Z	17.2 117.0	30	17.4	117.8	30	13	0	19.4 115.3	50	73	5	21.9 112.4	60	98	5	24.4 109.8	30	125	5
070706Z	17.6 117.3	30	17.5	117.2	30	8	0	19.1 115.0	45	30	-5	21.6 112.9	55	109	5	24.4 109.8	30	125	5
070712Z	18.1 116.6	35	18.0	116.5	30	8	-5	20.0 114.5	45	29	-5	23.2 112.7	30	173	-5	24.4 109.8	30	125	5
070718Z	18.6 116.2	40	18.5	115.9	30	18	-10	20.8 113.9	45	45	-10	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070800Z	19.0 115.7	45	19.0	115.5	45	11	0	21.3 113.5	55	73	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070806Z	19.6 115.0	50	19.8	115.0	50	12	0	22.5 112.8	50	104	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070812Z	20.1 114.0	50	20.2	114.1	50	8	0	23.2 111.9	40	131	5	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070818Z	20.7 113.1	55	20.8	113.0	55	8	0	23.6 110.9	25	143	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070900Z	21.3 112.3	55	21.3	112.0	55	6	0	24.0 110.0	0	0	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070906Z	22.0 111.0	50	22.1	111.0	50	6	0	24.0 110.0	0	0	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070912Z	22.4 109.7	35	22.0	109.0	0	0	0	24.0 110.0	0	0	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5
070918Z	22.7 108.5	25	22.0	108.0	0	0	0	24.0 110.0	0	0	0	20.0 0.0	0	0	0	24.4 109.8	30	125	5

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	WRNG	24-HR	48-HR	72-HR
AVG RIGHT ANGLE ERROR	13	72	105	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	9	42	46	0	0	0	0
AVG INTENSITY	2	4	5	0	0	0	0
NUMBER OF FORECASTS	12	10	5	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1157. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TROPICAL STORM BETTY FIX POSITIONS FOR CYCLONE NO. 4

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	012023	18.8N 146.4E	PCN 5	T0.0/0.0	INIT OBS	PQTU
2	020500	16.1N 140.0E	PCN 6		ULCC FIX	PQTU
3	021800	11.8N 136.4E	PCN 5		INIT OBS	PQTU
4	031027	9.8N 131.0E	PCN 5	T1.0/1.0	INIT OBS	PQTU
5	032121	9.6N 130.0E	PCN 6		INIT OBS	PQTU
6	032300	14.6N 128.0E	PCN 6	T1.5/1.5	INIT OBS	PQTU
7	040137	15.0N 128.0E	PCN 5	T1.5/1.5	INIT OBS	RPNK
8	040709	14.6N 127.1E	PCN 5		INIT OBS	PQTU
9	040709	16.1N 128.0E	PCN 5		INIT OBS	RPNK
10	041001	15.5N 127.4E	PCN 5		INIT OBS	PQTU
11	041200	15.2N 127.7E	PCN 6		INIT OBS	PQTU
12	041417	14.8N 127.4E	PCN 6		INIT OBS	PQTU
13	041800	15.1N 127.1E	PCN 6	T0.5/0.5	INIT OBS	PQTU
14	042241	15.1N 126.4E	PCN 5		INIT OBS	PQTU
15	050117	14.0N 123.8E	PCN 3	T1.0/1.0-	INIT OBS	PQTU
16	050117	14.7N 125.0E	PCN 5	T1.5/1.5 /S0.0/24HRS	INIT OBS	RPNK
17	050657	14.4N 123.8E	PCN 5		INIT OBS	PQTU
18	051119	14.7N 123.4E	PCN 6		INIT OBS	RPNK
19	051200	14.0N 123.2E	PCN 6		INIT OBS	PQTU
20	051357	15.2N 122.0E	PCN 6		INIT OBS	PQTU
21	051800	15.2N 122.0E	PCN 6	T1.0/1.0+/D0.5/24HRS	INIT OBS	PQTU
22	051942	15.3N 121.4E	PCN 6		INIT OBS	PQTU
23	052220	15.4N 121.4E	PCN 5	T2.0/2.0	INIT OBS	RODN
24	052358	15.3N 120.6E	PCN 5	T1.5/1.5+/S0.0/23HRS	INIT OBS	RPNK
25	060000	15.6N 120.8E	PCN 6		INIT OBS	PQTU
26	060644	15.8N 119.7E	PCN 5		INIT OBS	PQTU
27	061055	16.5N 119.4E	PCN 6		INIT OBS	PQTU
28	061200	17.1N 119.6E	PCN 6		INIT OBS	PQTU
29	061800	17.6N 118.5E	PCN 6		INIT OBS	PQTU
30	061900	17.0N 117.7E	PCN 6	T2.5/2.5 /D1.5/24HRS	INIT OBS	PQTU
31	062333	17.5N 118.2E	PCN 5		INIT OBS	PQTU
32	062335	17.3N 118.1E	PCN 3	T2.0/2.0 /S0.0/25HRS	EXP LLCC	RODN
33	070218	17.7N 118.2E	PCN 5	T1.5/1.5+/S0.0/26HRS	INIT OBS ULCC FIX	RPNK
34	070600	17.4N 118.0E	PCN 6	T2.0/2.0	INIT OBS	PQTU
35	070814	17.9N 116.3E	PCN 5	T2.0/2.0+/D0.5/32HRS	INIT OBS	RPNK
36	071030	17.7N 116.5E	PCN 6		INIT OBS	PQTU
37	071200	18.0N 116.5E	PCN 6		INIT OBS	PQTU
38	071458	18.4N 115.3E	PCN 5		INIT OBS	RODN
39	071800	18.3N 115.7E	PCN 6	T2.0/2.5+/W0.5/23HRS	INIT OBS	PQTU
40	072059	18.3N 115.0E	PCN 6	T2.0/2.0 /D0.5/26HRS	INIT OBS	RPNK
41	072138	18.5N 115.3E	PCN 6		INIT OBS	PQTU
42	072249	19.1N 115.0E	PCN 6	T3.0/3.0 /D1.0/24HRS	INIT OBS	RODN
43	072309	18.5N 115.2E	PCN 6		INIT OBS	PQTU
44	080000	18.6N 115.3E	PCN 6		INIT OBS	PQTU
45	080157	19.6N 115.3E	PCN 5	T3.0/3.0 /D1.0/20HRS	INIT OBS	PQTU
46	080600	20.0N 114.7E	PCN 6		INIT OBS	PQTU
47	080801	20.0N 114.7E	PCN 4	T3.0	INIT OBS	RPNK
48	081017	20.4N 114.2E	PCN 6		INIT OBS	PQTU
49	081147	20.3N 114.0E	PCN 4		INIT OBS	RODN
50	081148	20.1N 114.1E	PCN 6		INIT OBS	RPNK
51	081200	20.1N 113.9E	PCN 6		INIT OBS	PQTU
52	081438	20.6N 113.1E	PCN 6		INIT OBS	RPNK
53	081500	20.5N 112.7E	PCN 6	T3.0/3.0-/D1.0/24HRS	INIT OBS	PQTU
54	082046	21.3N 112.5E	PCN 3		INIT OBS	RODN
55	090000	21.5N 112.3E	PCN 6		INIT OBS	PQTU
56	090055	21.4N 112.4E	PCN 6		INIT OBS	PQTU
57	090137	21.8N 111.9E	PCN 3	T3.0/3.0	INIT OBS	RPNK
58	090600	22.0N 111.4E	PCN 6		INIT OBS	PQTU
59	090749	22.0N 109.7E	PCN 5		INIT OBS	RODN
60	091127	22.1N 109.9E	PCN 6		INIT OBS	RPNK
61	091138	22.0N 107.2E	PCN 6		INIT OBS	RODN
62	091138	22.6N 109.9E	PCN 6		INIT OBS	RPNK

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	080034	19.2N 115.6E	1500FT	997	60	050 30	170 61 080 95	20 5			+23 +23 31	6
2	080251	19.7N 115.5E	700MB	3038	997	55 050 60	150 51 060 49	20 5			+10 +11 + 9	6

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RAD08-CODE ASUAR TDDFF	COMMENTS	RADAR POSITION	SITE WHO NO.
* 1	061500	15.8N 123.6E	LAND				21000 5////	EYE 90 PCT ELIP	15.8N 121.6E	98333
* 2	070218	17.7N 118.2E	LAND				4333/ 43406		16.3N 120.6E	98321
* 3	070900	19.0N 120.6E	LAND				1020/ ////		16.3N 120.6E	98321

TYPHOON CARY
BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS		
070506Z	16 5 152.8	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070512Z	16 5 152.8	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070518Z	16 5 151.1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070600Z	16 3 150.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070606Z	17 1 149.5	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070612Z	17 3 148.6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070618Z	17 6 147.7	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070700Z	18 0 146.9	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
070706Z	18 6 146.6	30	18.6	146.2	30	23.0	20.2	144.7	40	55.6	-15	18.3	137.4	40	474.4	-20	19.3		
070712Z	19 0 146.4	35	19.5	146.1	30	34.0	5.5	144.7	40	55.6	-10	22.1	143.0	45	114.4	-15	21.2		
070718Z	19 6 146.2	40	19.4	145.9	30	45.0	1.0	144.4	40	59.0	-15	22.1	142.9	50	95.5	-20	23.3		
070800Z	19 0 146.0	50	20.0	145.8	45	55.0	0.0	144.7	60	17.0	0	23.7	143.1	70	133.0	-20	25.9		
070806Z	20 4 145.8	50	20.3	145.8	50	6.0	0.0	144.9	60	6.0	0	24.0	143.4	70	135.0	-20	26.3		
070812Z	20 8 145.6	50	20.7	145.5	50	8.0	0.0	144.6	65	5.0	0	25.0	144.7	70	168.0	-10	27.4		
070818Z	21 3 145.3	55	21.1	145.0	50	12.0	0.0	144.2	70	108.0	-5	25.7	144.3	75	196.0	0	28.3		
070900Z	21 7 145.0	60	21.0	144.7	50	13.0	0.0	144.2	70	131.0	-20	27.0	144.9	75	236.0	5	31.1		
070906Z	21 8 144.9	60	21.0	144.9	50	12.0	0.0	144.5	75	138.0	-15	27.7	145.2	80	239.0	15	31.7		
070912Z	21 8 144.7	65	21.4	144.4	50	13.0	0.0	144.5	80	155.0	-10	28.6	145.6	85	264.0	20	31.0		
070918Z	21 9 144.5	70	21.3	144.4	50	15.0	0.0	144.5	85	175.0	-5	29.0	145.6	85	306.0	20	31.5		
071000Z	22 0 144.5	90	22.0	144.4	50	16.0	0.0	144.4	90	188.0	-5	29.4	144.1	105	225.0	35	28.3		
071006Z	22 0 144.5	80	22.0	144.4	50	16.0	0.0	144.4	95	188.0	-5	29.4	144.1	115	278.0	40	28.7		
071012Z	22 2 144.6	80	22.2	144.4	50	16.0	0.0	144.4	95	188.0	-5	29.4	144.1	115	278.0	40	28.7		
071018Z	22 5 144.0	80	22.2	144.4	50	16.0	0.0	144.4	95	188.0	-5	29.4	144.1	115	278.0	40	28.7		
071100Z	22 5 144.0	80	22.2	144.4	50	16.0	0.0	144.4	95	188.0	-5	29.4	144.1	115	278.0	40	28.7		
071106Z	23 3 146.1	65	23.3	146.1	70	0.0	0.0	148.3	65	44.0	-10	31.2	150.7	55	144.0	-10	36.4		
071112Z	23 6 146.3	65	23.4	146.3	70	0.0	0.0	148.3	65	44.0	-10	31.2	150.7	55	144.0	-10	36.4		
071118Z	23 7 146.1	70	23.7	146.1	70	0.0	0.0	148.3	65	44.0	-10	31.2	150.7	55	144.0	-10	36.4		
071200Z	23 7 146.1	70	23.7	146.1	70	0.0	0.0	148.3	65	44.0	-10	31.2	150.7	55	144.0	-10	36.4		
071206Z	23 6 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071212Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071218Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071300Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071306Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071312Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071318Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071400Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	0	0.0		
071406Z	23 7 146.4	75	23.6	146.4	75	13.0	0.0	148.3	65	51.0	-15	32.6	152.0	45	144.0	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	13	92	190	282	12	92	190	282	
AVG RIGHT ANGLE ERROR	7	56	149	246	6	56	149	246	
AVG INTENSITY MAGNITUDE ERROR	1	12	17	22	2	12	17	22	
AVG INTENSITY BIAS	30	26	22	18	28	26	22	18	
NUMBER OF FORECASTS	30	26	22	18	28	26	22	18	

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1355. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 6. KNOTS

TYPHOON CARY
FIX POSITIONS FOR CYCLONE NO. 5

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	050759	16.7N 152.7E	PCN 6	T1.0/1.0	INIT OBS	PGTU
2	052030	16.3N 150.9E	PCN 5			PGTU
3	060000	16.4N 150.3E	PCN 6			PGTU
4	060502	17.7N 150.5E	PCN 5	T2.0/2.0 /D1.0/21HRS	ULCC FIX	PGTU
5	060919	17.7N 149.7E	PCN 6			PGTU
6	061116	18.3N 149.1E	PCN 6			PGTU
7	061747	19.0N 148.7E	PCN 5	T2.0/2.0	INIT OBS	PGTU
8	062018	17.9N 147.0E	PCN 5			PGTU
9	062212	17.9N 147.1E	PCN 4		EXP LLCC	PGTU
10	070000	17.9N 147.1E	PCN 4		EXP LLCC	PGTU
11	070036	17.8N 147.2E	PCN 4		EXP LLCC	PGTU
12	070449	18.2N 146.7E	PCN 6	T2.0/2.0 /S0.2/23HRS	ULCC 18.9N 147.1E	PGTU
13	070900	18.7N 146.9E	PCN 5		ULCC FIX	PGTU
14	070857	19.2N 146.4E	PCN 5		ULCC FIX	PGTU
15	071200	19.7N 146.2E	PCN 6			PGTU
16	071317	18.6N 146.5E	PCN 5			PGTU
17	071735	18.9N 146.0E	PCN 6	T2.5/2.5 /D0.5/24HRS		PGTU
18	071957	19.4N 146.1E	PCN 5			PGTU
19	072128	19.7N 145.9E	PCN 5			PGTU
20	080016	20.0N 145.6E	PCN 5			PGTU
21	080016	20.0N 145.6E	PCN 5	T3.0/3.0	INIT OBS	RODN
22	080619	20.2N 145.6E	PCN 5	T3.5/3.5-/D1.5/26HRS		PGTU
23	080836	20.5N 145.1E	PCN 5		ULCC FIX	PGTU
24	081200	20.5N 145.3E	PCN 5		ULCC FIX	PGTU
25	081257	20.7N 145.2E	PCN 6			PGTU
26	081800	21.5N 145.2E	PCN 6	T4.0/4.0 /D1.5/24HRS	EYEWALL OPN TO NE AND WSU	PGTU
27	082104	21.6N 145.0E	PCN 6			PGTU
28	082355	21.8N 145.0E	PCN 3			PGTU
29	090607	21.3N 144.9E	PCN 3	T4.0/4.0 /D0.5/24HRS		PGTU
30	090815	22.0N 144.8E	PCN 4			PGTU
31	090943	21.7N 144.7E	PCN 3		EVE DIA 24NM	PGTU
32	091200	22.0N 144.5E	PCN 2			PGTU
33	091236	21.8N 144.3E	PCN 2			PGTU
34	091800	21.7N 144.5E	PCN 2	T4.5/4.5 /D0.5/24HRS		PGTU
35	091852	22.2N 144.4E	PCN 2			PGTU
36	092055	22.1N 144.7E	PCN 1			PGTU
37	092231	22.0N 144.5E	PCN 1			PGTU
38	092336	21.9N 144.5E	PCN 1			PGTU
39	092336	21.9N 144.4E	PCN 3	T5.0/5.0	INIT OBS	RODN
40	100512	22.0N 144.4E	PCN 1	T5.0/5.0 /D1.0/24HRS		PGTU
41	100554	22.0N 144.4E	PCN 1	T5.5/5.5	INIT OBS	RPKH
42	100918	22.0N 144.6E	PCN 1			PGTU
43	101200	22.1N 144.5E	PCN 3			PGTU
44	101216	22.1N 144.6E	PCN 3			PGTU
45	101800	22.2N 144.8E	PCN 6	1.0/4.5 /W0.5/24HRS		PGTU
46	101839	22.4N 144.9E	PCN 3			PGTU
47	102034	22.8N 145.0E	PCN 3			PGTU
48	102157	23.0N 145.2E	PCN 3			PGTU
49	102315	21.3N 145.3E	PCN 3			PGTU
50	110056	23.2N 145.6E	PCN 3			PGTU
51	110057	23.3N 145.6E	PCN 3	T4.0/4.0	INIT OBS	RSKO
52	110542	23.8N 146.1E	PCN 3	T4.0/5.0-/D1.0/24HRS		PGTU
53	110542	23.7N 146.4E	PCN 2	T5.0/5.5 /W0.5/24HRS		PGTU
54	110914	24.2N 146.3E	PCN 1		EVE DIA 30NM	PGTU
55	111156	24.6N 146.9E	PCN 4		EVE DIS 30NM	PGTU
56	111200	24.5N 146.9E	PCN 4			PGTU
57	111811	25.6N 147.6E	PCN 2			RSKO
58	111826	25.1N 147.4E	PCN 2	T4.5/4.5-/D0.5/24HRS		PGTU
59	112013	25.3N 147.6E	PCN 2			PGTU
60	112132	25.4N 147.9E	PCN 1			PGTU
61	120037	25.8N 148.4E	PCN 1			PGTU
62	120529	26.2N 149.2E	PCN 1	T5.0/5.0-/D1.0/24HRS		PGTU
63	120529	26.3N 149.9E	PCN 3		INIT OBS	RODN
64	121200	27.0N 150.0E	PCN 2	T4.0/4.0		PGTU
65	121317	27.0N 150.0E	PCN 1		40NM EVE	PGTU

66 121200 27.7N 150.7E PCH 2 T4.5/4.5-50.0/24HRS
 67 121814 27.9N 150.7E PCH 2
 68 121952 27.7N 150.3E PCH 2
 69 122108 28.0N 151.1E PCH 1
 70 130016 28.2N 151.3E PCH 1
 71 130600 29.2N 151.5E PCH 2
 72 130832 29.2N 152.2E PCH 4
 73 131200 29.6N 153.2E PCH 4
 74 131257 29.7N 152.9E PCH 3
 75 131802 30.0N 152.2E PCH 3
 76 131931 29.8N 152.6E PCH 4
 77 132356 30.1N 152.9E PCH 3
 78 140504 30.3N 153.1E PCH 3
 79 140811 31.5N 152.8E PCH 4
 80 141200 30.6N 153.1E PCH 3
 81 141237 31.7N 152.8E PCH 3
 82 150931 31.9N 152.9E PCH 3
 83 152029 31.4N 151.6E PCH 3
 84 160909 30.7N 151.0E PCH 2
 85 171947 29.9N 145.2E PCH 4

50NM EYE

EXP LLCC

EXP LLCC

EXP LLCC

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AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/5ST	MSN NO.
1	062257	17.6N 146.9E	1500FT		1004	25 050	10 140 20 050 10	3 1			+23 +23 +22 30	1
2	070652	18.9N 146.7E	1500FT		1002	40 040	60 090 35 010 5				+21 +24 +24	2
3	070845	18.9N 146.3E	1500FT	3035	999	40 020 5	040 40 330 15	5 1			+23 +25 +25	3
4	072128	19.9N 146.0E	700MB			50 240 25	330 58 280 30	5 10			+22 +26 +24	4
5	080004	20.0N 146.0E	1500FT		991	50 010 20	020 35 300 60	5 5			+12 +14 +12	5
6	080530	20.3N 146.0E	1500FT		987	55 220 25	100 53 360 40	5 2			+22 +26 +24	6
7	080807	20.6N 145.9E	1500FT		989	45 090 30	170 50 090 30	5 2			+11 +24 +24	7
8	082353	21.8N 145.1E	700MB	2964		45 180 35	250 44 180 60	5 10			+10 +14 +11	8
9	090245	21.8N 144.9E	700MB	2942	981	45 130 70	030 44 330 60	5 10			+10 +13 +9	9
10	090836	21.8N 144.7E	700MB	2894	977	45 180 10	140 51 010 55	5 10	CIRCULAR	30	+13 +18 +10	10
11	091125	21.8N 144.5E	700MB	2887	975	65 360 60	080 88 360 35	7 10	CIRCULAR	25	+11 +14 +12	11
12	092100	21.8N 144.5E	700MB	2721		90 270 45	360 82 270 40	6 10	CIRCULAR	10	+10 +12 +11	12
13	092332	21.9N 144.5E	700MB	2723		50 180 60	330 78 240 18	10 3	CIRCULAR	10	+10 +11 +11	13
14	100855	22.1N 144.5E	700MB	2791	967	50 290 15	270 70 180 10	10 4			+10 +12 +11	14
15	101130	22.1N 144.6E	700MB	2820	971	60 040 47	160 65 050 80	7 12			+10 +11 +11	15
16	101953	22.7N 145.2E	700MB	2855		50 290 15	270 70 180 10	10 4	CIRCULAR	40	+10 +13 +10	16
17	102323	23.0N 145.5E	700MB	2875	974	60 040 47	160 65 050 80	7 12			+10 +11 +11	17
18	110837	24.4N 146.0E	700MB	2912	982	60 100 60	190 63 100 60	8 5			+10 +13 +10	18
19	111118	24.5N 146.7E	700MB	2915	982	50 050 70	310 74 230 44	10 4	ELLIPTICAL	30 10 090	+10 +11 +11	19
20	112032	25.4N 147.5E	700MB	2859		50 290 75	350 71 350 55	12 5			+10 +13 +10	20
21	112314	25.2N 148.2E	700MB	2855	974	50 360 5	240 78 140 30	5 10	CIRCULAR	40	+10 +13 +10	21
22	120847	26.7N 149.4E	700MB	2831		60 290 75	350 71 350 55	12 5	CIRCULAR	40	+10 +13 +10	22
23	121141	26.9N 149.8E	700MB	2820		55 230 25	220 82 110 33	10 4	CIRCULAR	35	+11 +14 +12	23
24	122053	27.9N 151.0E	700MB	2776		60 300 60	090 70 360 23	15 3	CIRCULAR	35	+12 +16 +13	24
25	122329	28.2N 151.2E	700MB	2777		55 120 30	210 90 120 65	15 7			+12 +16 +11	25
26	130532	29.1N 151.6E	700MB	2755		60 300 75	040 65 300 65	10 16			+12 +16 +11	26
27	130805	29.3N 152.1E	700MB	2802	965	45 320 40	060 39 340 40	5 15			+10 +11 +10	27
28	132056	30.1N 152.6E	700MB	2876		40 050 85	180 46 050 120	5 10				28
29	132328	30.3N 152.7E	700MB	2889	980							29

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

59	290600	24.2N	154.3E	PCN 2				PCTU
60	291232	25.2N	154.7E	PCN 6				RODN
61	291800	26.7N	155.1E	PCN 6	TS.0/5.0	INIT OBS		PCTU
62	291805	26.7N	154.8E	PCN 4				RODN
63	292337	27.0N	154.9E	PCN 3	TS.0/6.0 /U1.0/24HRS			RODN
64	300000	28.3N	155.2E	PCN 4	T4.5/5.5 /U1.0/24HRS	EVERALL OPN N-E-S		PCTU
65	300503	29.4N	155.7E	PCN 3				RODN
66	300600	29.8N	155.8E	PCN 4				PCTU
67	300915	30.5N	155.4E	PCN 3				RSKO
68	300915	30.1N	156.1E	PCN 4				PCTU
69	301217	31.1N	156.1E	PCN 3				PCTU
70	301218	31.3N	156.2E	PCN 4				RODN
71	301753	32.4N	156.4E	PCN 6	T3.5/4.5 /U1.5/24HRS	ULCC FIX		PCTU
72	301753	32.7N	156.8E	PCN 5				RODN
73	302015	33.4N	157.1E	PCN 3				PCTU
74	302316	34.3N	157.7E	PCN 4				PCTU
75	310455	35.6N	159.6E	PCN 4	T3.0/4.5 /U1.5/29HRS			PCTU
76	310355	35.1N	161.2E	PCN 6	T3.0/3.0	INIT OBS ULAC 36.2N 160.8E		KGWC
77	311157	36.2N	161.1E	PCN 6		ULAC 36.5N 161.0E		KGWC
78	311140	37.8N	163.8E	PCN 6		ULAC 38.4N 163.6E		KGWC
79	311112	37.7N	163.9E	PCN 6		ULAC 38.0N 163.6E		KGWC
80	312256	38.8N	166.2E	PCN 6	T3.0/3.0	INIT OBS		KGWC
81	010000	39.1N	166.3E	PCN 6	T3.0/3.0	INIT OBS ULCC FIX		PCTU
82	010600	39.9N	169.9E	PCN 6		ULCC FIX		PCTU
83	010652	39.9N	170.3E	PCN 6				KGWC
84	011137	40.7N	174.6E	PCN 6	T2.5/3.0 /U0.5/14HRS			KGWC
85	011727	42.9N	176.3E	PCN 6				KGWC

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	240250	21.7N 156.9E	1500FT		1000	30 070 40	160 38 070 40	5 0			+25 +25 +24 30	2
2	240537	21.8N 156.7E	1500FT		999	25 260 60	360 32 230 30	10 0			+25 +25	2
3	240537	20.8N 154.5E	700MB	3007	990	60 050 7	030 45 350 15	3 55	CIRCULAR	20	+14 +13 + 8	3
4	242352	20.8N 153.9E	700MB	3021	992	45 310 3	070 64 020 15	3 55	CIRCULAR	20	+12 +13 +13	4
5	250624	20.1N 152.8E	700MB	3009	987	65 110 30	040 39 350 30	5 55			+12 +15 + 8	4
6	250826	19.9N 152.6E	700MB	3002	990	65 040 10	110 72 040 10	7 55	CIRCULAR	25	+10 +17 + 9	4
7	252046	19.8N 151.7E	700MB	2923		50 130 15	230 68 130 20	5 55			+10 +16 + 9	7
8	252323	19.5N 151.5E	700MB	2966	976	75 310 20	110 86 020 15	5 10	CIRCULAR	30		7
9	260923	19.9N 150.7E	700MB	2731			300 73 220 15	3 55				7
10	261157	19.9N 150.5E	700MB	2719	958	30 290 60	130 97 050 13	3 55	CIRCULAR	13	+10 +16	7
11	262037	20.1N 150.3E	700MB	2689		80 230 45	290 67 230 30	10 55	CIRCULAR	12	+12 +16 +11	8
12	262319	20.2N 150.2E	700MB	2697	956	110 030 10	240 80 310 10	10 10	CIRCULAR	13	+11 +13 +13	9
13	270831	20.7N 150.7E	700MB	2770		50 230 60	310 71 220 31	8 33	CIRCULAR	15	+11 +14 +12	9
14	271104	20.2N 150.7E	700MB	2790	967	10 030 62	300 30 8 33	3 55	CIRCULAR	10		10
15	272139	20.9N 151.3E	700MB	2764	962	65 150 10	330 78 250 15	3 55	CIRCULAR	15	+11 +14 +12	10
16	272350	21.0N 151.4E	700MB	2761	962	75 300 30	030 67 300 30	3 55	CIRCULAR	15	+12 +21 + 8	11
17	280832	21.1N 152.0E	700MB	2470		120 240 10	310 105 240 10	4 33	CIRCULAR	15	+14 +25 +10	11
18	281123	20.9N 152.6E	700MB	2382	917		350 116 300 10	6 33	CIRCULAR	12	+14 +22 +14	12
19	282042	22.3N 153.4E	700MB	2351		110 360 2	290 116 220 19	8 33	CIRCULAR	10	+13 +22 +14	12
20	282328	22.7N 153.6E	700MB	2349	916	100 040 7	130 97 020 10	8 33	CIRCULAR	10	+12 +17 +15	13
21	290845	24.4N 154.3E	700MB	2464	929	70 240 20	220 85 110 30	15 55	ELLIPTICAL	15 5 050	+12 +16 +16	13
22	291139	25.1N 154.4E	700MB	2521	935		150 82 080 22	15 55	ELLIPTICAL	20 10 050	+12 +16 +16	13
23	292116	27.6N 155.0E	700MB	2603			300 80 210 35	10 55			+15 +14	15
24	292326	28.0N 155.0E	700MB	2510	943	50 210 30	150 85 070 21	10 55	CIRCULAR	7	+11 +15 +15	15
25	300834	30.4N 155.9E	700MB	2686		50 210 30	250 68 180 8	10 55	CIRCULAR	8	+13 +14 +14	16
26	301032	31.0N 155.9E	700MB	2722	959		210 83 130 24	10 55	CIRCULAR	5	+14 +15 +15	16
27	302114	33.7N 157.4E	1500FT		967	45 280 90	360 41 270 120	10 10			+22 +24	17
28	302345	34.3N 157.9E	700MB	2826	970	45 050 120	140 60 050 120	10 10			+14 +16	17

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

TYPHOON ED
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT
072506Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072512Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072518Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072524Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072530Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072536Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072542Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072548Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072554Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072600Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072606Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072612Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072618Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072624Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072630Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072636Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072642Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072648Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072654Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072700Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072706Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072712Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072718Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072724Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072730Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072736Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072742Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072748Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072754Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072800Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072806Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072812Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072818Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072824Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072830Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072836Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072842Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072848Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072854Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072900Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072906Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072912Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072918Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072924Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072930Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072936Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072942Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072948Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
072954Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073000Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073006Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073012Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073018Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073024Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073030Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073036Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073042Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073048Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073054Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073100Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073106Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073112Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073118Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073124Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073130Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073136Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073142Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073148Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073154Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073200Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1
073206Z	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1	25	135.1

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	24-HR	48-HR	72-HR		24-HR	48-HR	72-HR	
AVG FORECAST POSIT ERROR	12.	140.	232.	246.	13.	139.	245.	345.
AVG RIGHT ANGLE ERROR	9.	82.	117.	125.	9.	81.	126.	137.
AVG INTENSITY MAGNITUDE ERROR	3.	17.	31.	17.	3.	19.	33.	15.
AVG INTENSITY BIAS	-11.	-15.	2.		-11.	-12.	-22.	-15.
NUMBER OF FORECASTS	28	23	14	10	25	21	12	5

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1700. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON ED
FIX POSITIONS FOR CYCLONE NO. 7

SATELLITE FIXES

FIX NO.	TIME (Z)	POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	200000	26.6N 141.9E	PCN 6	T1.0/1.0	INIT OBS	PGTW
2	200500	26.7N 142.4E	PCN 6			PGTW
3	201000	26.4N 142.4E	PCN 6			PGTW
4	202025	26.7N 143.8E	PCN 3			PGTW
5	221042	28.5N 146.4E	PCN 3	T1.0/1.0	INIT OBS	PGTW
6	242041	28.7N 135.2E	PCN 3	T1.5/1.5	INIT OBS EXP LLCC	PGTW
7	250610	28.2N 135.2E	PCN 5	T2.0/2.0	INIT OBS	PGTW
8	250921	28.0N 134.9E	PCN 6			PGTW
9	251200	26.3N 136.0E	PCN 6			PGTW
10	251350	26.0N 136.8E	PCN 6			PGTW
11	251800	26.2N 136.3E	PCN 6	T2.5/2.5	INIT OBS	PGTW
12	251855	26.2N 135.8E	PCN 6		ULCC FIX	PGTW
13	252020	26.2N 136.1E	PCN 3			PGTW
14	252238	26.5N 136.8E	PCN 3			PGTW
15	260026	28.1N 137.8E	PCN 6			PGTW
16	260558	25.5N 138.7E	PCN 5	T3.5/3.5-D1.5/24HRS		PGTW
17	260558	25.8N 138.7E	PCN 3	T3.0/3.0	INIT OBS	RSKO
18	260558	25.6N 138.7E	PCN 3	T3.5/3.5	INIT OBS	RODN
19	260900	25.5N 139.2E	PCN 6			PGTW
20	261200	25.4N 140.1E	PCN 6			PGTW
21	261338	25.6N 140.3E	PCN 6			PGTW
22	261600	26.3N 140.6E	PCN 6	T3.5/3.5-D1.0/24HRS		PGTW
23	261843	26.3N 140.5E	PCN 6		ULCC FIX	PGTW
24	261959	26.2N 140.4E	PCN 6		ULCC FIX	PGTW
25	262214	26.2N 140.5E	PCN 6	T2.5/3.0+U0.5/16HRS		RSKO
26	262314	26.3N 140.6E	PCN 6		ULCC FIX	PGTW
27	270038	26.0N 140.7E	PCN 3			PGTW
28	270545	27.6N 140.6E	PCN 3	T3.5/3.5-D1.0/24HRS		PGTW
29	270545	27.5N 140.4E	PCN 6	T3.0/3.5 U0.5/24HRS		RODN
30	270911	27.7N 140.5E	PCN 6			PGTW
31	271200	28.0N 140.2E	PCN 6			PGTW
32	271318	28.1N 139.6E	PCN 4			PGTW
33	271830	28.4N 138.4E	PCN 4	T4.0/4.0-D0.5/24HRS		PGTW
34	272144	28.3N 137.3E	PCN 4			PGTW
35	280000	29.0N 137.6E	PCN 4			PGTW
36	280532	29.4N 136.2E	PCN 3	T4.0/4.0 D1.0/24HRS		RODN
37	280533	29.3N 136.4E	PCN 3	T4.0/4.0-D0.5/24HRS		PGTW
38	280959	29.4N 136.0E	PCN 1			PGTW
39	281258	29.5N 135.4E	PCN 2			PGTW
40	281800	29.6N 134.1E	PCN 2	T4.0/4.0-S0.0/24HRS		RSKO
41	282357	29.6N 133.7E	PCN 2	T4.0/4.0	INIT OBS	PGTW
42	290000	29.8N 133.0E	PCN 2			PGTW
43	290139	29.7N 132.8E	PCN 1	T4.5/4.5 D0.5/20HRS		RODN
44	290600	29.8N 131.7E	PCN 2	T4.0/4.0-S0.0/24HRS		PGTW
45	290702	29.7N 131.8E	PCN 2			RSKO
46	290938	29.9N 131.2E	PCN 3	T5.0/5.0	INIT OBS EVE DIA 30NM	RPMK
47	291004	29.6N 131.1E	PCN 1			RSKO
48	291200	29.6N 130.8E	PCN 2	T5.0/5.0 D1.0/18HRS		PGTW
49	291419	30.0N 129.6E	PCN 3		CIRCULAR EYE	RPMK
50	291847	30.3N 129.0E	PCN 1			RPMK
51	292036	30.0N 128.8E	PCN 1			RSKO
52	292842	30.2N 128.6E	PCN 2	T5.0/5.0 D1.0/24HRS	12NM EYE	PGTW
53	300000	30.2N 128.4E	PCN 2			PGTW
54	300118	30.7N 128.2E	PCN 1	T4.5/5.0 U0.5/16HRS		RPMK
55	300600	31.3N 126.4E	PCN 2	T5.0/5.0-D1.0/24HRS		PGTW
56	300650	31.0N 126.7E	PCN 1			RSKO
57	300900	31.1N 126.7E	PCN 4			PGTW
58	300940	31.6N 125.7E	PCN 6			RPMK
59	301058	31.3N 125.5E	PCN 3			PGTW
60	301200	31.1N 125.3E	PCN 4			PGTW
61	301359	31.5N 124.4E	PCN 3			PGTW
62	301359	31.3N 124.8E	PCN 5			RPMK
63	301935	31.5N 123.2E	PCN 5	T3.5/4.5-U1.5/30HRS		PGTW
64	302359	31.8N 122.9E	PCN 5	T4.0/4.5-U0.5/23HRS		RPMK
65	310000	31.8N 122.6E	PCN 3			PGTW
66	310637	32.2N 121.7E	PCN 4		ULCC FIX	PGTW
67	311036	32.5N 122.0E	PCN 3	T4.0/5.0-U1.0/09HRS	ULCC FIX	RSKO
68	311520	32.2N 121.0E	PCN 6			RPMK
69	312335	33.0N 120.9E	PCN 3	T2.5/3.5-U1.5/23HRS		RSKO
70	312335	33.1N 120.5E	PCN 3	T4.0/4.0	INIT OBS	RODN
71	010000	33.0N 120.7E	PCN 4			PGTW
72	010038	33.1N 120.7E	PCN 4			PGTW

73	010214	33.3N 120.8E	PCN 3	T4.0/4.0	INIT OBS	RODN
74	010600	33.7N 120.5E	PCN 4			PGTU
75	010628	33.7N 120.7E	PCN 3			RSKO
76	011015	33.8N 120.1E	PCN 4			PGTU
77	011032	33.9N 119.9E	PCN 3		ULCC FIX	RSKO
78	011459	33.9N 120.6E	PCN 4			RPKH
79	020159	34.8N 119.6E	PCN 3	T2.5/2.5	INIT OBS	RODN
80	020159	34.7N 119.8E	PCN 3			PGTU
81	020600	35.0N 119.6E	PCN 4		EXP LLCC	RSKO
82	020616	35.1N 120.2E	PCN 3			

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/5ST	MSN NO.
1	252219	26.2N 137.2E	1500FT		985	70 220 15	320 53 220 15	15 18	CIRCULAR	20	+26 +27 +23 30	1
2	250618	25.7N 139.0E	700MB	2984		50 140 25	250 53 140 39	17 30	ELLIPTICAL	18 10 090	+11 +14 +10	2
3	250844	25.7N 139.0E	700MB	2983	986	25 270 10	010 30 330 54	18 30				3
4	252218	26.9N 140.6E	700MB	2937		40 200 40	250 45 200 40	40 10	CIRCULAR	30	+12 +14 +11	4
5	252341	26.9N 140.8E	700MB	2930	982	40 090 60	190 56 090 30	10 10				5
6	250830	26.9N 140.1E	1500FT		976	40 210 34	210 68 110 20	3 3			+13 +17 +10	6
7	251116	28.8N 138.5E	700MB	2888	974	50 100 20	050 57 100 74	18 30			+12 +16	7
8	252038	28.8N 138.5E	700MB	2858		50 050 50	300 71 180 35	18 30	CIRCULAR	20	+13 +15 +12	8
9	252324	28.9N 137.9E	700MB	2867	976	70 130 34	100 70 320 108	5 10	ELLIPTICAL	25 20 170	+12 +15	9
10	250837	28.9N 137.9E	700MB	2842	967	50 050 50	300 71 180 35	18 30			+12 +15	10
11	251112	28.9N 137.9E	700MB	2840		65 310 12	140 92 050 24	4 4			+13 +17 +13	11
12	252029	29.9N 133.3E	700MB	2806		65 120 40	200 67 140 19	10 10	ELLIPTICAL	30 25 050	+14 +19 +12	12
13	252320	29.8N 133.0E	700MB	2818	968	100 050 15	051 52 051 15	34 10	CIRCULAR	20	+12 +17 +13	13
14	250835	29.8N 133.0E	700MB	2822	945	90 240 60	330 80 250 20	5 5	CIRCULAR	20	+12 +17 +13	14
15	251114	29.8N 133.0E	700MB	2825	949	110 150 10	140 87 010 30	4 1	CIRCULAR	20	+12 +17 +13	15
16	252030	30.1N 129.3E	700MB	2658	947	55 030 42	150 87 070 33	10 10	CIRCULAR	20	+13 +16	16
17	252321	30.4N 128.4E	700MB	2693	953							17
18	250930	31.3N 125.2E	700MB	2734	958							18
19	301136	31.3N 125.2E	700MB	2771	965							19

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADOB-CODE ASUAR TDDFF	COMMENTS	RADAR POSITION	SITE UMO NO.
1	250000	29.7N 132.7E	LAND				10712 52411		28.4N 129.5E	47909
2	250100	29.7N 132.5E	LAND				10712 52711		28.4N 129.5E	47909
3	250100	29.7N 132.5E	LAND				10771 52611		30.6N 131.0E	47869
4	250200	29.8N 132.4E	LAND				10713 52911		28.4N 129.5E	47909
5	250200	29.7N 132.3E	LAND				10711 52911		30.6N 131.0E	47869
6	250300	29.8N 132.2E	LAND				10712 52711		28.4N 129.5E	47909
7	250300	29.7N 132.3E	LAND				10711 52711		30.6N 131.0E	47869
8	250300	29.8N 132.4E	LAND	POOR		37	10612 52611	VMNT 3120	31.4N 131.3E	69952
9	250400	29.8N 132.0E	LAND	POOR		35	10712 52611	VMNT 3120	30.6N 131.0E	47869
10	250400	29.8N 132.0E	LAND				10712 52711		28.4N 129.5E	47909
11	250400	29.7N 132.1E	LAND				10712 52711		30.6N 131.0E	47869
12	250500	29.7N 131.9E	LAND				10612 52708	VMNT 2720	31.4N 131.3E	69952
13	250500	29.7N 132.0E	LAND	POOR		35	10612 52708	VMNT 2720	30.6N 131.0E	47869
14	250600	29.7N 131.7E	LAND				10612 52708		28.4N 129.5E	47909
15	250600	29.7N 131.8E	LAND				10612 52708		30.6N 131.0E	47869
16	250700	29.7N 131.6E	LAND				10712 52708	VMNT 2715	28.4N 129.5E	47909
17	250700	29.7N 131.7E	LAND	GOOD		30	10612 52708	VMNT 2715	31.4N 131.3E	69952
18	250700	29.7N 131.6E	LAND				10612 52708		28.4N 129.5E	47909
19	250800	29.7N 131.5E	LAND	GOOD		30	10522 52705	VMNT 2710	30.6N 131.0E	47869
20	250800	29.7N 131.5E	LAND				10712 52711		28.4N 129.5E	47909
21	250900	29.7N 131.4E	LAND				10712 52711		30.6N 131.0E	47869
22	250900	29.7N 131.3E	LAND	GOOD		30	10512 52711	VMNT 2910	31.4N 131.3E	69952
23	250900	29.7N 131.4E	LAND				10512 52711		28.4N 129.5E	47909
24	250900	29.7N 131.4E	LAND				10512 52711		30.6N 131.0E	47869
25	251000	29.8N 131.2E	LAND				10512 52711		28.4N 129.5E	47909
26	251000	29.8N 131.2E	LAND	GOOD		30	10512 52711	VMNT 2810	31.4N 131.3E	69952
27	251000	29.8N 131.2E	LAND				10512 52711		28.4N 129.5E	47909
28	251100	29.8N 131.0E	LAND	GOOD		30	10512 52711	VMNT 2810	30.6N 131.0E	47869
29	251100	29.8N 131.0E	LAND				10512 52711		28.4N 129.5E	47909
30	251200	29.8N 130.8E	LAND	GOOD		25	10712 52813	VMNT 2712	31.4N 131.3E	69952
31	251200	29.8N 130.8E	LAND				10612 52716	VMNT 2825	30.6N 131.0E	47869
32	251200	29.8N 130.8E	LAND	GOOD		35	10513 52811	VMNT 2825	28.4N 129.5E	47909
33	251300	29.8N 130.5E	LAND				10712 52711	VMNT 2722	31.4N 131.3E	69952
34	251300	29.8N 130.4E	LAND	GOOD		35	10712 52811	VMNT 2722	28.4N 129.5E	47909
35	251300	29.8N 130.4E	LAND				10513 52811	VMNT 2818	30.6N 131.0E	47869
36	251400	29.8N 130.3E	LAND	GOOD		35	10513 52811	VMNT 2818	28.4N 129.5E	47909
37	251400	29.8N 130.3E	LAND				10712 52911	VMNT 2918	31.4N 131.3E	69952
38	251400	29.8N 130.3E	LAND	GOOD		35	10613 53011	VMNT 3225	28.4N 129.5E	47909
39	251500	29.9N 130.1E	LAND				10613 53016	VMNT 3130	30.6N 131.0E	47869
40	251500	29.9N 130.1E	LAND	GOOD		30	10612 53011	VMNT 3015	28.4N 129.5E	47909
41	251500	29.9N 130.1E	LAND				10612 52814	VMNT 2720	31.4N 131.3E	69952
42	251500	29.9N 130.1E	LAND	GOOD		30	10612 52711	VMNT 2720	30.6N 131.0E	47869
43	251600	30.0N 129.9E	LAND				10512 52705		28.4N 129.5E	47909
44	251600	30.0N 129.9E	LAND	GOOD		35	10612 52811	VMNT 2720	31.4N 131.3E	69952
45	251600	30.0N 129.9E	LAND				10612 52811		28.4N 129.5E	47909
46	251700	30.0N 129.9E	LAND	GOOD		35	10512 53213	VMNT 2720	30.6N 131.0E	47869
47	251700	30.1N 129.7E	LAND				10612 53011		28.4N 129.5E	47909
48	251700	30.1N 129.8E	LAND	GOOD		30	10612 53011	VMNT 3225	31.4N 131.3E	69952
49	251800	30.2N 129.5E	LAND				10612 53016	VMNT 3130	28.4N 129.5E	47909
50	251800	30.2N 129.5E	LAND	GOOD		30	10612 53011	VMNT 3130	30.6N 131.0E	47869
51	251800	30.2N 129.5E	LAND				10612 53011		28.4N 129.5E	47909
52	251900	30.2N 129.5E	LAND	GOOD		30	10612 53011	VMNT 3015	31.4N 131.3E	69952
53	251900	30.2N 129.5E	LAND				10612 52814	VMNT 2720	30.6N 131.0E	47869
54	251900	30.2N 129.5E	LAND	GOOD		30	10612 52711	VMNT 2720	28.4N 129.5E	47909
55	252000	30.3N 129.0E	LAND				10512 52705		31.4N 131.3E	69952
56	252000	30.3N 129.0E	LAND	GOOD		30	10612 52811	VMNT 2720	30.6N 131.0E	47869
57	252000	30.3N 129.0E	LAND				10612 52811		28.4N 129.5E	47909
58	252100	30.2N 128.9E	LAND				10512 53011	VMNT 2720	31.4N 131.3E	69952
59	252100	30.3N 128.9E	LAND	GOOD		30	10612 53011	VMNT 2720	30.6N 131.0E	47869
60	252200	30.4N 128.7E	LAND				10612 53011		28.4N 129.5E	47909
61	252200	30.4N 128.7E	LAND	GOOD		35	10612 53011	VMNT 2720	31.4N 131.3E	69952
62	252300	30.4N 128.5E	LAND				10612 53011		28.4N 129.5E	47909
63	252300	30.5N 128.5E	LAND	GOOD		35	10612 53011	VMNT 2720	30.6N 131.0E	47869
64	300000	30.6N 128.2E	LAND				10342 53116		28.4N 129.5E	47909
65	300000	30.6N 128.3E	LAND				55//2 52911		30.6N 131.0E	47869
66	300100	30.6N 128.1E	LAND				65//2 52911		28.4N 129.5E	47909
67	300100	30.7N 128.0E	LAND	GOOD		30	20513 53014	VMNT 3120	31.4N 131.3E	69952
68	300100	30.7N 128.1E								

100 311700 32.8N 120.7E LAND
101 311900 32.8N 120.9E LAND
*102 312000 33.0N 120.7E LAND

30541 52805
20521 50000
31452 53213

33.8N 120.3E 58151
33.8N 120.3E 58151
33.8N 120.3E 58151

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

TROPICAL STORM FREDA BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND
080400Z	11.3 132.4	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
080405Z	12.2 131.5	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
080410Z	13.7 130.6	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
080415Z	14.9 129.3	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
080500Z	15.8 128.3	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
080505Z	16.3 127.2	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
080510Z	18.0 126.8	30	17.8	126.3	30	31.1	19.2 125.6	45	141.1	21.3 122.5	65	310.1	10.0 120.6	75	408.5
080515Z	18.9 126.2	30	18.8	126.2	30	6.5	20.6 124.5	50	144.5	22.7 122.5	70	308.3	25.1 120.9	75	432.5
080600Z	19.7 125.8	40	20.0	125.8	40	25.5	20.4 125.3	55	117.0	25.9 124.6	70	323.3	30.1 125.6	85	514.5
080605Z	20.4 125.5	40	20.4	125.3	45	11.1	20.4 124.4	60	180.0	27.6 123.8	75	322.9	45.3 124.5	90	481.7
080610Z	21.5 125.1	45	23.0	125.5	45	92.3	22.6 124.6	65	226.1	29.6 124.4	80	386.5	55.3 125.4	80	520.4
080615Z	23.0 119.4	45	25.6	124.8	50	38.5	26.3 123.8	70	208.5	29.9 122.3	80	313.6	60.3 122.0	70	332.5
080700Z	24.4 123.2	55	24.3	123.3	50	8.8	28.2 121.8	65	155.5	32.2 121.8	45	300.0	25.0 0.0	0.0	0.0
080705Z	25.0 121.3	50	25.0	121.9	50	33.3	28.3 121.0	50	175.5	32.2 122.2	40	351.1	20.0 0.0	0.0	0.0
080710Z	26.1 120.4	55	25.8	121.1	50	42.5	28.9 118.8	25	115.5	0.0 0.0	0.0	0.0	0.0	0.0	0.0
080715Z	27.0 119.4	45	26.6	119.7	45	29.9	0.0 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
080800Z	28.0 118.5	40	25.0	119.0	40	29.9	0.0 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
080805Z	29.1 117.8	30	29.0	118.2	30	22.2	0.0 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
080810Z	30.0 117.0	25	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
080815Z	31.1 116.4	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
080900Z	32.2 115.9	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
080905Z	33.5 115.4	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
080910Z	35.1 115.1	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
080915Z	36.9 116.0	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

ALL FORECASTS					TYPHOONS WHILE OVER 35 KTS				
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR	
30.163.328.448.					0.0.0.0.0.				
AVG RIGHT ANGLE ERROR	20.81.218.283.				0.0.0.0.0.				
AVG INTENSITY MAGNITUDE ERROR	11.34.58.				0.0.0.0.0.				
AVG INTENSITY BIAS	12.9.8.				0.0.0.0.0.				
NUMBER OF FORECASTS					0.0.0.0.0.				
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1894. NM									
AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS									

TROPICAL STORM FREDA FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENT	SITE
* 1	040000	12.7N 133.7E	PCN 6	T1.0/1.0	INIT OBS	PGTU
* 2	040729	11.4N 132.0E	PCN 5			PGTU
* 3	040912	11.4N 130.6E	PCN 6			PGTU
* 4	041101	11.4N 131.7E	PCN 6			PGTU
* 5	041359	13.0N 121.5E	PCN 5	T1.5/1.5	INIT OBS	PGTU
* 6	042152	15.8N 129.5E	PCN 6		ULCC FIX	PGTU
* 7	050058	15.4N 127.4E	PCN 5			PGTU
* 8	050717	16.8N 126.2E	PCN 5	T2.0/2.0 /D1.0/31HRS		PGTU
* 9	051036	17.8N 126.4E	PCN 6			PGTU
* 10	051200	17.8N 126.4E	PCN 6			PGTU
* 11	051339	18.6N 126.8E	PCN 5			PGTU
* 12	051800	19.1N 126.5E	PCN 6	T2.5/2.5 /D1.0/28HRS		PGTU
* 13	052001	19.2N 126.7E	PCN 6			PGTU
* 14	052001	19.7N 126.2E	PCN 6			RODN
* 15	052131	19.4N 125.9E	PCN 5			PGTU
* 16	060038	21.3N 128.7E	PCN 5	T3.0/3.0	INIT OBS	PGTU
* 17	060250	20.2N 125.6E	PCN 6	T2.5/2.5 /D0.5/24HRS		RPBK
* 18	060704	20.4N 125.1E	PCN 6			PGTU
* 19	060704	20.1N 125.5E	PCN 5			RPBK
* 20	061010	23.3N 125.8E	PCN 6			PGTU
* 21	061200	23.1N 125.5E	PCN 6			PGTU
* 22	061500	23.7N 124.2E	PCN 4			RODN
* 23	061800	23.3N 124.5E	PCN 6	T3.0/3.0 /D0.5/27HRS		PGTU
* 24	062100	24.3N 123.1E	PCN 6			PGTU
* 25	062251	24.3N 123.1E	PCN 5			PGTU
* 26	070000	24.4N 122.8E	PCN 6			PGTU
* 27	070159	25.3N 122.4E	PCN 5	T3.5/3.5 /D0.5/24HRS		RPBK
* 28	070952	25.5N 121.1E	PCN 6	T3.0/3.0 /D0.5/24HRS		PGTU
* 29	070945	25.5N 121.1E	PCN 6			PGTU
* 30	071129	25.4N 121.2E	PCN 4			RODN
* 31	071129	26.0N 121.2E	PCN 3			RPBK
* 32	071440	26.4N 121.2E	PCN 3			RPBK
* 33	071800	26.9N 119.3E	PCN 6			PGTU
* 34	071936	27.5N 118.8E	PCN 5			PGTU
* 35	072229	28.7N 118.5E	PCN 5		ULCC FIX	RODN
* 36	080000	28.3N 118.5E	PCN 6		ULCC FIX	RODN
* 37	080000	28.2N 118.8E	PCN 6		ULCC FIX	PGTU
* 38	080008	27.4N 118.4E	PCN 6		ULCC FIX	RPBK
* 39	080600	29.0N 117.9E	PCN 6		ULCC FIX	PGTU

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIENTATION	EYE TEMP (C) IN/DP/SST	MSN NO.
1	032240	11.0N 132.7E	1500FT		1095	25 260 35	060 30 330 110	4 10			+25 +25	32 2
2	060207	19.7N 125.4E	1500FT		993	50 160 125	270 47 160 150	3 1	CIRCULAR	20	+27 +25	33 5
3	060541	20.2N 125.5E	1500FT		991	40 130 120	220 36 130 30	13 10			+26 +26	6 6
4	060813	20.1N 125.4E	1500FT		989	35 040 120	010 28 310 30	10 10			+26 +26	6 6
5	070919	24.3N 123.0E	1500FT		988	45 100 55	170 45 100 55	1 5			+26 +25	7 7

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADAR-CODE ASUAR TDDFF	COMMENTS	RADAR POSITION	SITE WHO NO.
* 1	061700	21.6N 124.8E	LAND				3//13 53619		24.3N 124.8E	47918
* 2	061900	23.0N 124.7E	LAND				6//13 53534		24.3N 124.8E	47918
* 3	061900	23.0N 124.7E	LAND				6//13 53534		24.3N 124.8E	47918
* 4	062000	23.5N 124.4E	LAND				6//13 53432		24.3N 124.8E	47918
* 5	062200	23.4N 123.9E	LAND				6//12 53227		24.3N 124.8E	47918
* 6	062300	24.2N 124.1E	LAND				6//12 53118		24.8N 125.3E	47927
* 7	070000	24.7N 122.9E	LAND				6//12 52938		24.3N 124.8E	47918
* 8	070000	24.6N 122.8E	LAND				35//4 52938		24.8N 125.3E	47927
* 9	070100	24.8N 122.6E	LAND				6//12 72934		24.3N 124.8E	47918
* 10	070200	24.9N 122.3E	LAND				6//12 72934		24.3N 124.8E	47918
* 11	070200	24.7N 122.3E	LAND				35//3 52915		24.8N 125.3E	47927
* 12	070500	25.0N 120.8E					34574 53012		27.6N 121.1E	58760

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

**TROPICAL DEPRESSION 09
BEST TRACK DATA**

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS	
080918Z	9.9	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
080918Z	13.1	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081000Z	13.7	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081006Z	14.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081012Z	14.5	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081018Z	14.4	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081100Z	15.5	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081106Z	17.1	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081112Z	17.9	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081118Z	18.5	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	0.0	
081200Z	19.2	18.3	129.3	25.0	-5.2	127.1	45.0	111.0	15.0	24.8	123.3	60.0	354.0	30.0	0.0	0.0	-0.0	0.0	
081206Z	19.7	19.3	129.0	30.0	-5.0	126.4	50.0	169.0	20.0	26.1	122.7	60.0	486.0	35.0	0.0	0.0	-0.0	0.0	
081212Z	20.2	20.2	127.8	25.0	-5.0	124.5	35.0	193.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081218Z	20.5	21.8	126.5	25.0	-5.0	123.0	45.0	368.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081300Z	20.5	22.2	126.3	30.0	-5.0	123.2	45.0	442.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081306Z	20.2	22.6	125.5	30.0	-5.0	122.3	44.4	501.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081312Z	20.5	23.0	123.0	30.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081318Z	19.7	22.8	121.0	30.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081318Z	18.8	22.4	120.0	30.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	
081318Z	18.8	22.3	120.5	30.0	-5.0	0.0	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			
AVG FORECAST POSIT ERROR	URNG	24-HR	48-HR	72-HR	URNG	24-HR	48-HR
122.0	297.0	420.0	0.0	0.0	0.0	0.0	0.0
AVG RIGHT ANGLE ERROR	105.0	296.0	0.0	0.0	0.0	0.0	0.0
AVG INTENSITY MAGNITUDE ERROR	2.0	15.0	33.0	0.0	0.0	0.0	0.0
AVG INTENSITY BIAS	-1.0	15.0	33.0	0.0	0.0	0.0	0.0
NUMBER OF FORECASTS	10	6	2	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1328. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

**TROPICAL DEPRESSION TD09W
FIX POSITIONS FOR CYCLONE NO. 9**

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	050000	7.8N 147.2E	PCN 6	T0.5/0.5	INIT OBS	PGTU
2	072048	6.4N 137.4E	PCN 6	T1.0/1.0	INIT OBS	PGTU
3	080139	8.8N 138.2E	PCN 5			PGTU
4	080639	8.6N 139.4E	PCN 6		ULCC FIX	PGTU
5	081238	8.3N 134.4E	PCN 5			PGTU
6	082202	7.7N 130.8E	PCN 6	T1.0/1.0+/50.0/25HRS		PGTU
7	090626	9.4N 135.6E	PCN 6			PGTU
8	091200	8.9N 133.7E	PCN 6			PGTU
9	091400	9.2N 133.4E	PCN 6			PGTU
10	091911	10.1N 130.7E	PCN 6	T1.0/1.0+/50.0/24HRS	EXP LLCC	PGTU
11	092147	10.7N 129.6E	PCN 6			PGTU
12	100058	11.0N 129.4E	PCN 5		ULCC FIX	PGTU
13	100514	12.0N 128.4E	PCN 6	T0.0/0.0	INIT OBS ULCC FIX	PGTU
14	101339	13.7N 130.4E	PCN 6			PGTU
15	101859	15.5N 129.1E	PCN 6	T1.0/1.0+/50.0/24HRS		PGTU
16	102255	15.6N 130.4E	PCN 5			PGTU
17	102555	15.5N 130.9E	PCN 6	T1.0/1.0	INIT OBS	PGTU
18	110030	15.1N 130.2E	PCN 6			RPMK
19	110600	17.6N 129.9E	PCN 6	T1.5/1.5 /D1.5/24HRS		PGTU
20	110743	17.5N 129.1E	PCN 6	T1.0/1.0	INIT OBS	RODN
21	111006	18.0N 129.5E	PCN 6		ULCC FIX	PGTU
22	111200	18.4N 130.0E	PCN 6		ULCC FIX	PGTU
23	111319	18.5N 130.2E	PCN 6	T2.5/2.5-/D1.5/23HRS	EXP LLCC	PGTU
24	111800	19.4N 129.4E	PCN 6			PGTU
25	111846	19.5N 129.2E	PCN 6			PGTU
26	112104	19.6N 129.2E	PCN 6			PGTU
27	112230	20.2N 128.8E	PCN 5			PGTU
28	120000	20.5N 127.2E	PCN 6			PGTU
29	120000	20.5N 127.2E	PCN 6			PGTU
30	120500	22.1N 126.6E	PCN 5			PGTU
31	120731	21.2N 128.4E	PCN 6	T2.0/2.0 /D1.0/33HRS		RPMK
32	120731	22.1N 126.3E	PCN 6	T1.5/1.5+/50.0/25HRS		PGTU
33	120944	22.1N 126.6E	PCN 5		ULCC FIX	PGTU
34	121109	21.8N 126.6E	PCN 5			RPMK
35	121109	21.1N 126.6E	PCN 6			RSKO
36	121200	22.1N 126.2E	PCN 6			PGTU
37	121440	22.0N 126.2E	PCN 6			RPMK
38	121800	22.6N 124.9E	PCN 6	T1.0/1.5 /U0.5/11HRS		PGTU
39	122016	22.5N 123.7E	PCN 6			RODN
40	122225	23.1N 123.8E	PCN 5			RODN
41	122348	23.4N 123.8E	PCN 5	T1.0/1.0	INIT OBS	RSKO
42	122348	23.0N 123.8E	PCN 5	T1.5/1.5	INIT OBS	PGTU
43	130140	22.9N 122.4E	PCN 5	T1.5/1.5-/50.0/24HRS		PGTU
44	130718	23.0N 121.5E	PCN 5	T2.0/2.0 /50.0/24HRS		PMTU
45	130718	23.0N 121.5E	PCN 5		ULCC FIX	RPMK
46	131045	23.0N 121.4E	PCN 5			PMTU
47	131104	23.5N 120.6E	PCN 6			RODN
48	131105	23.5N 120.6E	PCN 6			PMTU
49	131200	23.1N 121.6E	PCN 6			PMTU
50	131420	23.2N 121.2E	PCN 5	T1.0/1.0-/50.0/24HRS		PMTU
51	131800	22.7N 121.0E	PCN 6			PMTU
52	132003	22.0N 120.6E	PCN 6			PMTU
53	132203	21.5N 120.5E	PCN 5		INIT OBS	PMTU
54	132203	21.7N 120.6E	PCN 5	T2.5/2.5		RODN
55	132323	21.9N 120.2E	PCN 5	T2.0/2.0-/D0.5/24HRS		RSKO
56	140119	21.0N 120.4E	PCN 6			PMTU
57	140706	22.8N 119.6E	PCN 6	T1.5/1.5-/50.0/24HRS		PMTU
58	141043	23.3N 121.6E	PCN 5		ULCC 23.5N 121.4E	RPMK
59	141200	23.2N 119.8E	PCN 6		ULCC FIX	PMTU
60	141400	23.3N 120.3E	PCN 6			RODN
61	141800	23.3N 119.2E	PCN 6	T0.0/0.0 /U1.0/24HRS		PMTU
62	142259	19.8N 118.5E	PCN 5			RODN
63	142259	24.3N 118.2E	PCN 5	T1.0/1.0	ULCC FIX	RPMK

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WIND VEL/BRG/RNG	MAX-FLT-LVL-WIND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM-TATION	EYE TEMP (C) OUT/ IN/ DP/ SST	MSM NO.
1	110729	17.3N 129.5E	1500FT	1003	25 310 37	150 25 310 37	8 20				+26 +23 +22 29	3
2	120027	17.9N 126.6E	1500FT	1003	18 030 130	160 21 030 135	3 00				+25 +25 31	4

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

**TROPICAL STORM GERALD
BEST TRACK DATA**

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND		POSIT	WIND			POSIT	WIND			POSIT	WIND			POSIT	WIND		
081512Z	19.2 119.1	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	0.0	0.0	0.0
081518Z	19.7 118.8	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	0.0	0.0	0.0
081600Z	20.0 117.6	40	20.0	118.4	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
081606Z	20.1 117.6	40	20.0	118.2	40	36.0	0.0	21.8 117.1	60	199	10	23.4 115.2	45	289	-10	0.0	0.0	0.0	0.0
081612Z	19.7 116.7	45	20.0	117.9	45	74.0	0.0	21.1 116.8	55	166	5	22.8 114.9	55	273	0	0.0	0.0	0.0	0.0
081618Z	19.0 116.1	45	20.0	116.8	45	87.0	0.0	20.8 114.7	55	148	5	21.6 112.6	55	264	0	22.3 110.6	30	215	0
081700Z	18.4 116.2	50	18.5	116.2	50	6.0	0.0	18.5 116.2	50	85	5	18.6 117.4	55	302	0	15.3 119.0	45	374	0
081706Z	18.6 116.2	50	18.5	116.2	50	6.0	0.0	18.5 116.2	50	120	5	18.6 117.4	55	302	0	15.3 119.0	45	374	0
081712Z	18.5 115.8	55	18.5	116.3	55	28.0	0.0	18.5 116.3	55	171	5	19.1 118.1	55	347	0	20.2 119.3	60	337	15
081718Z	18.4 115.9	55	18.5	116.0	55	42.0	0.0	18.3 116.0	55	217	5	19.4 118.4	55	358	0	21.1 119.6	65	336	15
081800Z	18.5 114.7	55	18.4	114.9	55	13.0	0.0	18.3 116.0	55	69	5	18.3 112.3	60	72	15	15.4 111.0	65	289	20
081806Z	18.7 114.1	55	18.5	114.2	55	13.0	0.0	18.6 112.1	60	12	5	18.7 110.9	60	133	15	18.8 109.6	60	403	25
081812Z	18.5 113.3	55	18.9	113.1	55	27.0	0.0	20.5 111.2	50	117	5	22.4 109.6	35	230	-10	0.0	0.0	0.0	0.0
081818Z	18.2 112.8	55	19.0	112.6	55	61.0	0.0	20.8 110.7	50	134	0	22.6 109.1	35	250	-10	0.0	0.0	0.0	0.0
081900Z	18.1 112.4	55	18.2	112.2	55	13.0	0.0	18.3 109.6	50	174	5	18.5 106.6	50	482	10	0.0	0.0	0.0	0.0
081906Z	18.4 112.1	55	18.5	112.3	55	13.0	0.0	19.1 110.2	45	157	0	19.6 107.8	45	464	10	0.0	0.0	0.0	0.0
081912Z	18.7 112.0	55	18.5	111.8	55	17.0	0.0	18.8 110.1	50	214	5	19.3 108.1	45	506	15	0.0	0.0	0.0	0.0
081918Z	19.0 112.0	55	18.7	111.8	55	35.0	0.0	18.5 110.9	45	231	0	19.0 109.3	40	512	15	0.0	0.0	0.0	0.0
082000Z	19.5 112.4	45	19.0	112.0	45	38.0	0.0	19.0 112.0	45	215	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082006Z	20.0 112.8	45	20.0	112.8	40	0.0	-5	22.7 115.4	35	13	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082012Z	20.7 113.3	45	20.0	113.4	45	13.0	0.0	24.3 116.1	30	33	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082018Z	21.4 114.0	45	20.0	113.4	40	6.0	-5	25.0 114.8	20	40	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082100Z	21.8 114.4	40	21.7	114.0	40	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082106Z	22.9 115.3	35	23.0	115.4	35	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082112Z	24.2 115.5	30	24.0	115.7	30	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082118Z	25.4 115.4	25	25.8	115.7	25	29.0	0.0	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	135	311	331	0	0	0	0	
AVG RIGHT ANGLE ERROR	9	57	123	170	0	0	0	0	
AVG INTENSITY MAGNITUDE ERROR	1	3	8	15	0	0	0	0	
AVG INTENSITY BIAS	-1	1	3	9	0	0	0	0	
NUMBER OF FORECASTS	24	20	16	7	0	0	0	0	

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1009. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TROPICAL STORM GERALD
FIX POSITIONS FOR CYCLONE NO. 10

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
* 1	150241	20.0N 117.7E	PCN 5	T1.5/1.5	INIT OBS	RPMK
2	151022	19.0N 119.0E	PCN 6	T1.5/1.5	INIT OBS	PCTU
3	151800	19.6N 118.9E	PCN 6			PCTU
4	151938	20.0N 118.7E	PCN 6	T2.0/2.0	INIT OBS	PCTU
5	160016	19.8N 118.4E	PCN 6			RPMK
6	160220	19.9N 118.6E	PCN 3	T2.5/2.5 /D1.0/24HRS		RPMK
7	160600	20.3N 117.8E	PCN 3			PCTU
8	160823	20.0N 118.0E	PCN 3			RPMK
9	161113	20.1N 117.6E	PCN 5			RPMK
10	161113	20.4N 116.7E	PCN 5			RODN
11	161501	19.5N 116.3E	PCN 6			RODN
12	161800	19.6N 115.5E	PCN 6			PCTU
13	162241	18.4N 115.1E	PCN 5			RODN
14	162352	18.7N 115.9E	PCN 3			RPMK
15	170000	19.0N 116.1E	PCN 6			PCTU
16	170200	18.6N 116.0E	PCN 6	T3.0/3.0-/D0.5/24HRS	EXP LLCC	RPMK
17	170200	18.4N 116.3E	PCN 4	T3.0/3.0	INIT OBS	PCTU
18	170600	18.5N 116.3E	PCN 4		EXP LLCC	PCTU
19	171045	18.4N 116.3E	PCN 4			PCTU
20	171121	18.6N 116.5E	PCN 4			RPMK
21	171441	17.9N 116.1E	PCN 6			RSKO
22	171800	19.0N 115.1E	PCN 6	T3.5/3.5 /D1.5/22HRS		PCTU
23	172055	18.0N 114.2E	PCN 5		ULCC FIX	RPMK
24	172220	18.3N 115.0E	PCN 3			RODN
25	172328	18.2N 114.4E	PCN 3			PCTU
26	172328	18.0N 114.8E	PCN 5	T3.0/3.0	INIT OBS ULCC FIX	RSKO
27	180140	18.2N 114.2E	PCN 5			PCTU
28	180600	18.1N 114.0E	PCN 6	T3.5/3.5-/S0.0/12HRS		PCTU
29	180758	18.5N 113.8E	PCN 5	T3.5/3.5 /D0.5/30HRS		RPMK
30	181100	18.4N 113.2E	PCN 6			RPMK
31	181206	18.3N 113.1E	PCN 6			RPMK
32	182042	18.0N 112.9E	PCN 3			RODN
33	182159	18.2N 112.5E	PCN 4			PCTU
34	183000	18.1N 112.5E	PCN 6			PCTU
35	190045	18.2N 112.0E	PCN 6	T3.5/3.5-/S0.0/19HRS		RPMK
36	190301	18.6N 112.6E	PCN 3			RPMK
37	190600	18.6N 112.4E	PCN 4	T3.0/3.0	INIT OBS	PCTU
38	190745	18.5N 111.9E	PCN 5	T3.5/3.5 /D0.5/30HRS		RSKO
39	191039	18.4N 112.0E	PCN 4			PCTU
40	191141	18.3N 112.0E	PCN 3			RPMK
41	191800	18.5N 111.8E	PCN 6	T3.0/3.0-/S0.0/24HRS		PCTU
42	192010	19.2N 111.7E	PCN 6			RODN
43	192310	19.4N 111.8E	PCN 5	T3.0/3.5 /W0.5/23HRS		RPMK
44	200000	19.4N 112.5E	PCN 6			PCTU
45	200020	19.9N 112.0E	PCN 5	T2.0/2.0	INIT OBS	RODN
46	200600	20.1N 112.9E	PCN 6	T3.0/3.0 /S0.0/24HRS		PCTU
47	200733	20.3N 113.4E	PCN 3			RPMK
48	200733	20.2N 112.5E	PCN 5	T3.5/3.5-/S0.0/24HRS		RSKO
49	201017	20.8N 113.1E	PCN 6			PCTU
50	201117	21.0N 113.2E	PCN 9		EXP LLCC	RPMK
51	201117	20.5N 112.9E	PCN 6			RODN
52	201200	20.9N 113.4E	PCN 6			PCTU
53	201521	21.7N 112.8E	PCN 6	T3.0/3.0-/S0.0/24HRS		RPMK
54	201800	21.4N 113.5E	PCN 6	T2.5/3.0 /W0.5/24HRS		PCTU
55	202356	21.4N 114.8E	PCN 3			RPMK
56	202356	21.7N 112.7E	PCN 5			RODN
57	210000	21.8N 113.7E	PCN 6			PCTU
58	210221	22.5N 115.4E	PCN 3		EXP LLCC	RPMK
59	210720	23.6N 114.9E	PCN 5			PCTU
60	211137	24.1N 115.6E	PCN 6			RPMK
61	211137	24.2N 113.8E	PCN 6			RODN
62	211200	25.8N 114.5E	PCN 6			PCTU
63	211501	24.7N 115.6E	PCN 6			RPMK
64	212236	26.4N 114.9E	PCN 6			RODN
65	212335	26.8N 114.3E	PCN 6			RPMK
66	212335	26.3N 115.1E	PCN 6			PCTU
67	220200	26.7N 114.6E	PCN 5			RPMK
68	230000	22.8N 121.4E	PCN 6			PCTU

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	152335	20.0N 118.4E	1500FT		991	40 300 15	030 42 300 20	7 3	CIRCULAR	10	+24 +26 +26	1
2	162042	18.3N 116.1E	700MB	2929	979		310 47 190 32	20 5			+15 +16 +13	
3	162313	18.5N 116.3E	700MB	2931	980	50 100 15	240 44 120 05	15			+12 +16 +14	
4	170831	18.5N 116.3E	700MB	2941	980	55 030 20	360 50 280 30	10	CIRCULAR	20	+12 +26 +23	29
5	171032	18.5N 116.2E	1500FT		981	50 210 60	340 46 210 30	10			+13 +14	4
6	172042	18.4N 114.9E	700MB	2930	979		170 52 090 118	10 15			+13 +18	4
7	172316	18.5N 114.8E	700MB	2932	980	50 170 20	150 30 040 21	15				
8	180614	18.7N 114.2E	700MB	2952		55 120 45	190 45 120 15	10				
9	180844	18.8N 113.6E	1500FT		984	45 120 40	200 46 120 120	7			+25 +27 +26	26

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WHO NO.
1	180800	18.3N 113.8E	LAND				5775 72706		16.8N 112.3E	59981
2	181700	18.0N 112.6E	LAND				10203 72606		16.8N 112.3E	59981
3	182100	18.1N 112.5E	LAND				12834 72706		16.8N 112.3E	59981
4	182200	18.1N 112.4E	LAND				12717 72706		16.8N 112.3E	59981
5	182300	18.1N 112.4E	LAND				11713 52706		16.8N 112.3E	59981
6	190000	18.1N 112.3E	LAND				11814 52704		16.8N 112.3E	59981
7	190100	18.1N 112.3E	LAND				11614 52702		16.8N 112.3E	59981
8	190200	18.2N 112.3E	LAND				11634 53006		16.8N 112.3E	59981
9	190500	18.5N 112.1E	LAND				11614 53208		16.8N 112.3E	59981
10	190600	18.5N 111.9E	LAND				11934 52808		16.8N 112.3E	59981
11	190700	18.5N 111.9E	LAND				21933 52808		16.8N 112.3E	59981
12	190900	18.6N 111.9E	LAND				11713 53104		16.8N 112.3E	59981
13	191100	18.7N 112.0E	LAND				11563 53402		16.8N 112.3E	59981
14	191200	18.7N 112.1E	LAND				11814 53602		16.8N 112.3E	59981
15	191300	18.7N 112.2E	LAND				11814 53602		16.8N 112.3E	59981
16	191400	18.8N 112.2E	LAND				21814 53602		16.8N 112.3E	59981
17	191500	18.8N 112.2E	LAND				21814 53602		16.8N 112.3E	59981
18	191600	18.8N 112.1E	LAND				21744 53402		16.8N 112.3E	59981
19	191600	18.3N 111.8E	LAND				5773 52803		16.8N 112.3E	59981
20	191700	18.8N 112.1E	LAND				4774 53402		16.8N 112.3E	59981
21	191800	18.8N 112.1E	LAND				4774 53602		16.8N 112.3E	59981
22	192100	19.2N 112.3E	LAND				5774 50208		16.8N 112.3E	59981
23	192300	19.5N 112.4E	LAND				5774 50208		16.8N 112.3E	59981
24	192400	19.5N 112.4E	LAND				5774 50202		16.8N 112.3E	59981
25	192500	19.5N 112.5E	LAND				5774 50604		16.8N 112.3E	59981
26	192600	19.6N 112.9E	LAND				11523 53605		16.8N 112.3E	59981
27	192700	19.3N 112.7E	LAND				4773 50406		16.8N 112.3E	59981
28	192800	19.9N 112.8E	LAND				4771 50406		16.8N 112.3E	59981
29	192900	20.0N 112.8E	LAND				4771 50306		16.8N 112.3E	59981
30	192800	20.2N 113.1E	LAND				65907 /		16.8N 112.3E	59981
31	192800	20.3N 113.1E	LAND				5771 50406		16.8N 112.3E	59981
32	192900	20.2N 113.2E	LAND				22977 /		16.8N 112.3E	59981
33	192900	20.4N 113.2E	LAND				5771 50306		16.8N 112.3E	59981
34	192900	20.4N 113.4E	LAND				35667 /		16.8N 112.3E	59981
35	192900	20.6N 113.4E	LAND				35997 /		16.8N 112.3E	59981
36	192900	20.5N 112.8E	LAND				6771 83310		16.8N 112.3E	59981
37	192900	20.7N 113.4E	LAND				20977 70310		16.8N 112.3E	59981
38	192900	20.7N 113.3E	LAND				10977 70310		16.8N 112.3E	59981
39	192900	21.0N 113.5E	LAND				20917 70309		16.8N 112.3E	59981
40	192900	21.1N 113.6E	LAND				31917 70309		16.8N 112.3E	59981
41	192900	21.2N 113.6E	LAND				25947 70309		16.8N 112.3E	59981
42	192900	21.5N 113.6E	LAND				20917 70310		16.8N 112.3E	59981
43	192900	21.5N 113.6E	LAND				35947 70309		16.8N 112.3E	59981
44	192900	21.7N 113.5E	LAND				25947 73609		16.8N 112.3E	59981
45	192900	21.7N 113.6E	LAND				35947 73604		16.8N 112.3E	59981
46	192900	21.5N 113.8E	LAND				35947 73604		16.8N 112.3E	59981
47	192900	21.5N 113.9E	LAND				35947 70904		16.8N 112.3E	59981
48	192900	21.6N 114.1E	LAND				25827 60510		16.8N 112.3E	59981
49	192900	21.5N 114.6E	LAND				35917 80910		16.8N 112.3E	59981
50	192900	21.7N 114.4E	LAND				65947 70510		16.8N 112.3E	59981
51	192900	22.0N 114.6E	LAND				65947 70510		16.8N 112.3E	59981
52	192900	22.3N 114.7E	LAND				65947 80312		16.8N 112.3E	59981

RDR ECHO OPN TO E

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	210000	22.1N 114.5E	040	024	
2	210300	21.5N 115.1E	035	024	
3	210900	23.5N 115.9E	030	025	59317 59316 59303

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

TYPHOON HOLLY
BEST TRACK DATA

MO/DA/HR	POSIT	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
		WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND
081412Z	19.3	137.6	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
081418Z	19.6	138.8	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
081500Z	20.0	139.8	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
081506Z	20.3	134.8	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
081512Z	21.1	134.1	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
081518Z	21.9	133.4	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
081600Z	22.6	132.6	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
081606Z	22.9	131.1	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
081612Z	22.8	131.1	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
081618Z	22.8	130.5	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
081700Z	23.0	129.0	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
081706Z	23.0	129.0	60	0.0	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	23.0	129.1	60	0.0	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	23.2	128.7	60	0.0	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	23.1	128.6	65	0.0	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	24.4	127.6	65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081812Z	25.2	127.0	65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081818Z	25.7	126.3	65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081900Z	26.2	125.7	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081906Z	26.8	125.3	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081912Z	27.7	126.5	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
081918Z	28.6	126.3	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082000Z	29.0	126.3	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082006Z	30.3	126.2	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082012Z	31.1	126.5	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082018Z	31.8	126.9	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082100Z	32.4	127.1	65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082106Z	34.2	128.9	60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082112Z	35.4	130.4	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
082118Z	36.8	132.4	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
082200Z	38.4	134.8	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

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	16.	111.	230.	423.	16.	111.	230.	423.	
AVG RIGHT ANGLE ERROR	11.	73.	149.	316.	11.	73.	149.	316.	
AVG INTENSITY MAGNITUDE ERROR	1.	7.	14.	13.	1.	7.	14.	13.	
AVG INTENSITY BIAS	-1.	3.	8.	-11.	-1.	3.	8.	-11.	
NUMBER OF FORECASTS	25	21	17	13	25	21	17	13	
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1718. NM									
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS									

TYPHOON HOLLY
FIX POSITIONS FOR CYCLONE NO. 11

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	121800	17.9N 140.8E	PCN 6	T0.0/0.0	INIT OBS	PQTU
2	122043	17.5N 138.6E	PCN 6		ULCC FIX	PQTU
3	130523	17.3N 139.0E	PCN 6	T0.5/0.5	INIT OBS	PQTU
4	140902	19.0N 138.0E	PCN 6	T1.0/1.0 /D0.5/24HRS		PQTU
5	141200	19.7N 137.1E	PCN 6			PQTU
6	141400	19.8N 136.9E	PCN 5			PQTU
7	141500	19.6N 136.8E	PCN 6	T2.0/2.0 /D1.0/09HRS		PQTU
8	142142	20.0N 136.4E	PCN 6			PQTU
9	142259	19.5N 138.0E	PCN 3	T1.5/1.5	INIT OBS	RODN
10	150000	19.3N 136.0E	PCN 6		ULCC FIX	PQTU
11	150555	19.3N 133.8E	PCN 6			RODN
12	150556	19.3N 133.8E	PCN 6			RSKO
13	151022	20.0N 134.1E	PCN 6		ULCC FIX	PQTU
14	151340	21.5N 133.9E	PCN 5			PQTU
15	151340	21.5N 133.9E	PCN 5			PQTU
16	151038	22.0N 133.5E	PCN 5	T2.5/2.5 /D0.5/26HRS		PQTU
17	152235	23.0N 132.1E	PCN 3		EXP LLCC	PQTU
18	160038	23.3N 132.1E	PCN 4		EXP LLCC	PQTU
19	160541	21.8N 132.7E	PCN 5	T3.0/3.0	INIT OBS	RODN
20	160541	21.8N 132.7E	PCN 5	T3.0/3.0	ULCC FIX	PQTU
21	161001	22.0N 132.6E	PCN 6			PQTU
22	161319	22.6N 131.0E	PCN 5		ULCC FIX	PQTU
23	161930	22.5N 130.5E	PCN 5	T3.5/3.5 /D1.0/24HRS		PQTU
24	162100	22.8N 130.3E	PCN 5			PQTU
25	162211	22.9N 130.0E	PCN 5			PQTU
26	170000	22.8N 129.5E	PCN 6		ULCC FIX	PQTU
27	170200	22.7N 129.5E	PCN 6			PQTU
28	170628	23.1N 128.7E	PCN 5	T3.5/3.5 /D0.5/24HRS		PQTU
29	170940	23.2N 128.3E	PCN 6		ULCC FIX	PQTU
30	171049	23.2N 128.3E	PCN 6			PQTU
31	171441	23.2N 128.3E	PCN 6			RSKO
32	171913	23.4N 127.7E	PCN 6	T3.5/3.5+/50.0/24HRS		PQTU
33	172038	23.9N 128.1E	PCN 4			PQTU
34	172328	23.3N 127.7E	PCN 3			RSKO
35	172328	23.3N 127.7E	PCN 5	T4.0/4.0	INIT OBS	PQTU
36	180140	23.6N 127.9E	PCN 3			PQTU
37	180615	24.3N 127.6E	PCN 3	T2.5/3.5+/U1.0/24HRS		PQTU
38	180918	24.8N 127.3E	PCN 5		ULCC FIX	PQTU
39	181025	24.8N 127.3E	PCN 5		ULCC FIX	PQTU
40	181100	24.5N 122.9E	PCN 5		ULCC FIX	RPHK
41	181500	26.0N 125.5E	PCN 6	T3.5/3.5 /50.0/24HRS		PQTU
42	183042	26.0N 125.1E	PCN 5			RODN
43	182150	25.8N 125.7E	PCN 4		EYEWALL OPN NE	PQTU
44	182303	26.4N 125.4E	PCN 3	T4.0/4.0 /50.0/24HRS		RSKO
45	182303	26.0N 126.0E	PCN 4			PQTU
46	190120	26.1N 126.0E	PCN 3			PQTU
47	190600	26.7N 126.3E	PCN 4	T3.5/3.5 /D1.0/24HRS		PQTU
48	190745	26.8N 125.8E	PCN 5			RSKO
49	191039	26.3N 126.4E	PCN 4			PQTU
50	191200	27.5N 126.7E	PCN 4			PQTU
51	191400	28.2N 126.3E	PCN 5		ULCC FIX	PQTU
52	191800	28.4N 126.1E	PCN 6	T4.0/4.0-/D0.5/23HRS		PQTU
53	192010	28.8N 125.6E	PCN 4		ULCC FIX	RODN
54	192137	28.7N 125.8E	PCN 3			PQTU
55	192230	28.8N 125.9E	PCN 3		PARTIAL EYEWALL S-SE	PQTU
56	200059	29.6N 126.3E	PCN 3			PQTU
57	200500	30.0N 126.1E	PCN 4	T4.0/4.0-/D0.5/24HRS		PQTU
58	200733	30.1N 125.5E	PCN 4	T4.0/4.0-/50.0/31HRS		RSKO
59	200733	30.0N 126.2E	PCN 3		INIT OBS	RPHK
60	200900	30.4N 126.2E	PCN 6		ULCC FIX	PQTU
61	201111	31.2N 126.2E	PCN 4			RODN
62	201200	31.1N 126.4E	PCN 4			PQTU
63	201340	31.1N 126.5E	PCN 4			PQTU
64	201800	31.7N 126.9E	PCN 4	T3.0/4.0-/U1.0/24HRS		PQTU
65	202017	32.0N 127.1E	PCN 4			RODN
66	202116	32.1N 127.5E	PCN 6			PQTU
67	202356	32.6N 128.4E	PCN 3			RODN
68	202356	32.7N 128.2E	PCN 3	T3.5/4.0-/U0.5/25HRS		RPHK
69	210039	33.3N 128.1E	PCN 5		ULCC FIX	PQTU
70	210720	34.6N 129.3E	PCN 5	T2.5/3.5-/U1.5/24HRS		RSKO
71	210956	35.0N 129.7E	PCN 5	T2.5/3.5-/U1.5/27HRS		PQTU
72	211053	35.0N 130.1E	PCN 6			RSKO
73	211200	35.2N 130.4E	PCN 6		ULCC FIX	PQTU

74 211320 35.3N 131.2E PCN 6
 75 212005 37.3N 132.4E PCN 6
 76 212332 38.3N 133.4E PCN 6
 77 220000 38.6N 134.7E PCN 6
 78 220526 40.7N 135.7E PCN 3
 79 220526 38.5N 136.2E PCN 5
 80 220935 41.4N 136.2E PCN 5
 81 230000 42.3N 139.7E PCN 4

ULCC FIX
 EXP LLCC

PQTU
 RSKO
 RSKO
 PQTU
 RSKO
 PQTU
 RSKO
 PQTU

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSCLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE OUT/ IN/ DP/SST	MSN NO.
1	160225	23.0N 132.3E	1500FT		992	55 210 130	270 52 210 130	3 3			+25 +25 +24 29	2
2	160620	22.5N 132.0E	1500FT		990	25 080 32	080 52 090 55	10 10			+25 +25	3
3	160856	22.6N 131.3E	1500FT		987	50 160 20	280 42 220 70	10 20			+25 +26	4
4	162055	22.8N 130.3E	700MB	2951		57 040 90	060 53 340 70	20 30			+16 +13 +11	4
5	162330	22.5N 129.7E	700MB	2942		70 350 60	190 65 350 15	10 20			+14 +14 +12	5
6	170653	23.0N 129.6E	700MB	2892		70 350 80	090 65 350 15	10 18			+13 +13	6
7	170833	23.0N 129.2E	700MB	2892	977	70 350 145	070 70 350 107	5 5			+13 +13	7
8	172036	23.3N 128.3E	700MB	2856	970	65 080 70	200 74 090 110	10 30	CIRCULAR	60	+13 +15 +10	8
9	172344	23.5N 126.4E	700MB	2863	973	60 350 90	250 52 170 120	10 15			+15 +10 +13	9
10	180900	25.1N 127.3E	700MB	2855		40 210 120	130 67 030 100	10 10			+15 +10 +13	10
11	181134	25.2N 127.0E	700MB	2845			220 61 120 115	10 15			+15 +10 +12	11
12	182344	26.6N 126.3E	700MB	2811	964	50 220 30	230 39 290 93	10 15	CIRCULAR	5	+13 +16 +12	12
13	190227	25.1N 127.1E	700MB	2799	963	45 310 90	040 57 150 120	10 10			+15 +10 +12	13
14	190832	26.9N 126.6E	700MB	2818		75 050 90	260 75 170 58	10 10	CIRCULAR	15	+14 +16 +15	14
15	191127	27.7N 126.8E	700MB	2814	966	40 290 130	280 40 220 120	10 10	CIRCULAR	15	+15 +16 +15	15
16	192142	29.2N 126.2E	700MB	2804		75 130 120	220 72 120 87	10 10			+14 +16 +12	16
17	192158	26.5N 126.4E	700MB	2812	965	60 050 45	160 61 050 55	10 10			+15 +10 +16	17
18	200850	30.7N 126.3E	700MB	2797	965	70 130 60	220 73 140 140	10 10			+15 +10 +16	18
19	201125	31.2N 126.7E	700MB	2806			280 78 210 135	10 10			+14 +16	19
20	202045	32.5N 127.3E	700MB	2853	973		270 70 180 60	10 10			+14 +16	20
21	202330	33.1N 127.7E	700MB	2862	975		230 56 140 125	5 5	CIRCULAR	25	+14 +13 +13	21

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADAR-CODE ASUAR TDFF	COMMENTS	RADAR POSITION	SITE WMO NO
* 1	170500	23.6N 128.7E	LAND				54512 5777		26.2N 127.8E	47937
2	180000	25.0N 127.5E	LAND				6777 5777		24.8N 125.3E	47937
3	180900	25.0N 127.5E	LAND				6777 50000		24.8N 125.3E	47937
4	181000	25.3N 127.4E	LAND				6777 53519		24.8N 125.3E	47937
5	181100	25.4N 127.1E	LAND				6777 52919		24.8N 125.3E	47937
6	181200	25.0N 127.3E	LAND				5777 5777		26.2N 127.8E	47937
7	181200	25.5N 127.0E	LAND				6777 53008		24.8N 125.3E	47937
8	181300	25.1N 127.1E	LAND				6777 53111		26.2N 127.8E	47937
9	181400	25.1N 127.0E	LAND				5777 52704		26.2N 127.8E	47937
10	181400	25.1N 127.1E	LAND				5777 5777		24.8N 125.3E	47937
11	181500	25.2N 127.1E	LAND				54113 50308		26.2N 127.8E	47937
12	181500	25.3N 127.1E	LAND				5777 53615		24.8N 125.3E	47937
13	181600	25.3N 127.1E	LAND				5777 53608		26.2N 127.8E	47937
14	181600	25.3N 127.1E	LAND				5777 53611		24.8N 125.3E	47937
15	181600	25.4N 126.3E	LAND				6777 53012		27.6N 121.1E	58760
16	181700	25.8N 127.0E	LAND				5777 73614		26.2N 127.8E	47937
17	181700	25.5N 126.2E	LAND				6777 53012		27.6N 121.1E	58760
18	181700	25.7N 127.0E	LAND						26.2N 127.8E	47937
19	181800	26.1N 126.8E	LAND	POOR		60	5777 53019	MOV 3620	27.6N 121.1E	58760
20	181800	26.7N 126.1E	LAND				6777 53212		27.6N 121.1E	58760
21	181800	26.8N 126.5E	LAND				5438 73416	MOV 3250	26.2N 127.8E	47937
22	181800	26.0N 126.7E	LAND	POOR		60	5777 5777		26.2N 127.8E	47937
23	181900	25.9N 125.9E	LAND				6777 5777		27.6N 121.1E	58760
24	181900	26.6N 126.5E	LAND				6777 53222		24.8N 125.3E	47937
25	181900	26.6N 126.5E	LAND				5412 73219	MOV 3140	26.2N 127.8E	47937
26	181900	26.0N 126.3E	LAND	POOR		60	5777 5777		26.2N 127.8E	47937
27	182000	26.2N 125.8E	LAND				5412 72923		26.2N 127.8E	47937
28	182100	16.3N 125.6E	LAND				6777 53215		27.6N 121.1E	58760
29	182100	16.1N 125.6E	LAND				5412 72718		26.2N 127.8E	47937
30	182200	26.5N 126.1E	LAND				10288 72011		26.2N 127.8E	47937
31	182200	25.8N 126.1E	LAND				6777 5777		26.2N 127.8E	47937
32	182300	25.9N 126.2E	LAND				20442 71410		26.2N 127.8E	47937
33	182300	25.9N 126.1E	LAND				5777 5777		24.8N 125.3E	47937
34	190000	26.0N 126.2E	LAND				5455 50105		26.2N 127.8E	47937
35	190000	26.2N 126.1E	LAND				3777 53614		26.2N 127.8E	47937
36	190100	26.2N 126.1E	LAND				5412 73610		26.2N 127.8E	47937
37	190200	27.0N 125.4E	LAND				5777 73610		27.6N 121.1E	58760
38	190200	26.3N 126.1E	LAND				6572 73609		26.2N 127.8E	47937
39	190300	26.6N 126.2E	LAND				6777 73608		24.8N 125.3E	47937
40	190300	26.5N 126.1E	LAND				6572 73510		26.2N 127.8E	47937
41	190400	26.7N 126.1E	LAND				6777 73608		26.2N 127.8E	47937
42	190400	26.5N 126.1E	LAND				6777 51905		24.8N 125.3E	47937
43	190400	27.0N 125.8E	LAND				5777 53405		27.6N 121.1E	58760
44	190500	26.3N 126.1E	LAND				5777 51812		24.8N 125.3E	47937
45	190500	26.5N 126.1E	LAND				73608		27.6N 121.1E	58760
46	190500	26.7N 125.8E	LAND				5777 53405		26.2N 127.8E	47937
47	190600	26.6N 126.0E	LAND				6777 53422		24.8N 125.3E	47937
48	190600	26.6N 126.2E	LAND				6777 70302		26.2N 127.8E	47937
49	190700	26.7N 126.2E	LAND				6777 70304		26.2N 127.8E	47937
50	190700	26.7N 125.9E	LAND				6777 52805		24.8N 125.3E	47937
51	190700	27.0N 125.8E	LAND				5777 53405		27.6N 121.1E	58760
52	190800	27.0N 125.8E	LAND				5777 50000		26.2N 127.8E	47937
53	190900	26.8N 126.2E	LAND				6777 70306		26.2N 127.8E	47937
54	190900	27.1N 126.4E	LAND				5777 70210		27.6N 121.1E	58760
55	191000	27.0N 125.8E	LAND				5777 50000		26.2N 127.8E	47937
56	191100	27.2N 126.7E	LAND				5777 70215		27.6N 121.1E	58760
57	191100	27.3N 126.6E	LAND				6777 70215		26.2N 127.8E	47937
58	191200	27.7N 126.5E	LAND				54773 70112		26.2N 127.8E	47937
59	191300	27.5N 125.5E	LAND				5777 53408		27.6N 121.1E	58760
60	191300	27.9N 126.5E	LAND				5777 73611		26.2N 127.8E	47937
61	191400	28.3N 126.5E	LAND				3504 5777		28.4N 129.5E	47909
62	191400	28.4N 126.6E	LAND				6573 73617		26.2N 127.8E	47937
63	191400	27.7N 125.5E	LAND				5777 53408		27.6N 121.1E	58760
64	191500	28.8N 126.6E	LAND				7573 73621		26.2N 127.8E	47937
65	191500	28.6N 126.5E	LAND				3574 53616		28.4N 129.5E	47909
66	191500	27.8N 125.5E	LAND				5777 53408		27.6N 121.1E	58760
67	191600	28.0N 125.5E	LAND				5777 53409		27.6N 121.1E	58760
68	191600	28.9N 126.5E	LAND				5777 53616		28.4N 129.5E	47909
69	191700	28.1N 125.5E	LAND				5777 53409		27.6N 121.1E	58760
70	191800	28.2N 125.5E	LAND				5777 53409		27.6N 121.1E	58760
71	191900	28.3N 125.4E	LAND				6777 53409		27.6N 121.1E	58760
72	192000	28.5N 126.3E	LAND				6504 5777		28.4N 129.5E	479

99 211300 35.6N 131.2E LAND
 100 211300 35.6N 131.1E LAND
 101 211300 35.6N 131.2E LAND
 102 211400 35.8N 131.4E LAND
 103 211400 35.9N 131.4E LAND
 104 211400 35.9N 131.3E LAND
 105 211500 36.1N 131.8E LAND
 106 211500 36.2N 131.6E LAND
 107 211500 36.2N 131.5E LAND
 108 211600 36.5N 131.8E LAND
 109 211700 36.7N 133.2E LAND
 110 211800 36.8N 132.7E LAND
 111 211900 37.0N 133.2E LAND
 112 212000 37.2N 133.6E LAND
 113 212100 37.5N 134.0E LAND
 114 212200 37.6N 134.5E LAND
 115 212300 37.9N 134.9E LAND
 *116 220100 38.7N 137.7E LAND
 *117 220200 39.2N 137.0E LAND

65/51 50422
 304/1 50327
 65/// 50527
 55/// 50522
 65/51 50422
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 65/1 50622
 5/// 50322
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34.3N 132.6E 47792
 33.4N 130.4E 47806
 35.5N 133.1E 47791
 33.4N 130.4E 47806
 34.3N 132.6E 47792
 35.5N 133.1E 47791
 34.3N 132.6E 47792
 33.4N 130.4E 47806
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 35.5N 133.1E 47791
 37.7N 138.8E 47572
 37.7N 138.8E 47572

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	181800	25.8N 126.3E	060	040	47929 47936 47927

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

**TROPICAL DEPRESSION 12
BEST TRACK DATA**

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND		POSIT	WIND			POSIT	WIND			POSIT	WIND			POSIT	WIND		
082300Z	19.1 142.7	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	0.0	0.0	0.0
082306Z	19.5 141.8	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	0.0	0.0	0.0
082312Z	19.7 140.8	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	0.0	0.0	0.0
082318Z	20.0 139.8	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	0.0	0.0	0.0
082400Z	20.3 138.7	20	20.4	139.0	25.0	18.0	5.0	21.2	135.9	45.0	20.4	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082406Z	20.8 137.4	20	20.7	137.5	30.0	8.0	10.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082412Z	21.4 135.1	20	21.0	135.8	25.0	46.0	5.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082418Z	22.2 134.5	20	21.8	135.8	25.0	147.0	5.0	0.0	0.0	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
082500Z	23.3 133.0	20	23.5	133.1	25.0	13.0	5.0	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
46	204	0	0	0	0	0	0
8	16	0	0	0	0	0	0
6	25	0	0	0	0	0	0
5	25	0	0	0	0	0	0
5	1	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 605. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL DEPRESSION TD12U
FIX POSITIONS FOR CYCLONE NO. 12

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
* 1	212151	17.0N 142.0E	PCN 6	T1.0/1.0	INIT OBS	PGTU
* 2	220000	16.7N 143.2E	PCN 6		ULCC FIX	PGTU
* 3	220526	17.0N 138.2E	PCN 6		ULCC FIX	PGTU
* 4	222034	19.1N 143.5E	PCN 6			PGTU
* 5	222359	19.8N 142.4E	PCN 5	T1.5/1.5 /D0.5/26HRS		PGTU
* 6	230600	20.3N 140.8E	PCN 6			PGTU
* 7	230914	19.0N 141.4E	PCN 6		ULCC FIX	PGTU
* 8	231005	19.7N 142.4E	PCN 6		ULCC FIX	PGTU
* 9	231239	20.4N 141.1E	PCN 6		ULCC FIX SCNDRY 18.6N 142.3E	PGTU
* 10	231758	19.2N 141.4E	PCN 6	T2.0/2.0	INIT OBS	PGTU
* 11	232012	19.5N 140.6E	PCN 6		ULCC FIX	PGTU
* 12	240000	20.5N 139.4E	PCN 6		ULCC FIX	PGTU
* 13	240120	20.5N 139.2E	PCN 6	T2.0/2.0 /D0.5/25HRS		PGTU
* 14	240642	21.5N 137.6E	PCN 6		ULCC 24.4N 136.9E	PGTU
* 15	240852	21.6N 137.5E	PCN 6		ULCC FIX	PGTU
* 16	240941	19.5N 139.1E	PCN 6		ULCC FIX SCNDRY 25.3N 136.1E	PGTU
* 17	241927	17.0N 138.3E	PCN 5			PGTU
* 18	242133	17.5N 137.9E	PCN 5			PGTU
* 19	242219	17.8N 137.7E	PCN 5			PGTU

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	240010	20.3N 138.4E	1500FT		999	20 100 90	160 20 100 90	15 40			+26 +25	2
2	240708	20.3N 137.2E	1500FT		995	20 140 150	160 20 030 90	10 60			+25 +25 +23	3

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			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	
082600Z	8.2 146.0	20	8.2 146.0	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	
082605Z	8.3 145.9	20	8.3 145.9	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	
082610Z	8.4 145.8	20	8.4 145.8	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	
082615Z	8.5 145.7	20	8.5 145.7	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	
082700Z	10.8 144.9	35	10.8 145.1	30	12.0	-5.0	13.5 143.7	45	67.0	-15.0	15.0 141.5	60	227.0	-10.0	17.8 138.8	75	411.0	15.0	
082705Z	11.4 144.4	40	11.4 144.6	40	12.0	-5.0	14.0 143.0	60	74.0	-10.0	16.3 140.1	70	248.0	-10.0	17.7 136.2	80	429.0	20.0	
082710Z	11.9 143.9	50	11.9 143.8	45	6.0	-5.0	14.1 141.7	65	61.0	-5.0	16.5 138.3	85	273.0	-20.0	18.3 134.1	90	491.0	25.0	
082715Z	12.5 143.3	60	12.5 143.3	50	6.0	-5.0	14.9 140.6	70	139.0	-10.0	17.0 137.2	85	333.0	-25.0	19.1 133.0	95	546.0	30.0	
082800Z	13.2 142.6	60	13.1 142.5	60	8.0	-5.0	15.4 139.6	70	190.0	-10.0	18.0 135.2	80	430.0	-20.0	20.2 132.3	90	618.0	20.0	
082805Z	13.6 141.8	60	13.7 141.8	60	6.0	-5.0	16.1 138.8	70	239.0	-10.0	18.7 135.0	80	501.0	-20.0	20.6 130.3	90	659.0	10.0	
082810Z	13.8 141.6	60	13.8 141.6	60	6.0	-5.0	16.5 137.8	75	272.0	-10.0	18.9 134.0	80	527.0	-15.0	20.7 129.3	90	668.0	5.0	
082815Z	13.9 141.5	60	13.9 141.5	60	6.0	-5.0	16.8 136.8	80	299.0	-10.0	19.1 133.0	80	549.0	-15.0	20.8 128.3	90	676.0	5.0	
082900Z	12.3 140.3	70	12.2 140.3	70	6.0	-5.0	12.3 138.4	90	83.0	-30.0	13.7 136.5	100	249.0	-30.0	16.1 134.7	110	494.0	5.0	
082905Z	12.2 139.6	70	12.2 139.6	70	18.0	-5.0	12.7 137.3	90	127.0	-30.0	14.4 134.6	100	275.0	-20.0	17.0 131.6	110	500.0	-5.0	
082910Z	12.0 139.0	65	12.1 139.0	70	16.0	-5.0	12.9 136.1	90	150.0	-25.0	14.7 132.9	105	292.0	-20.0	17.4 129.3	115	502.0	-10.0	
082915Z	11.6 138.5	60	11.6 138.5	65	30.0	-5.0	12.4 135.6	80	144.0	-15.0	13.9 133.8	90	316.0	-15.0	16.2 130.3	105	472.0	-10.0	
083000Z	11.0 137.9	60	11.0 137.9	60	0.0	-5.0	10.6 134.5	70	32.0	-10.0	12.0 129.9	85	146.0	-20.0	13.7 125.3	100	239.0	-5.0	
083005Z	10.6 137.1	60	10.6 137.0	60	6.0	-5.0	10.6 133.0	70	40.0	-10.0	11.7 129.3	85	155.0	-30.0	12.9 124.6	100	182.0	25.0	
083010Z	10.4 136.3	60	10.4 136.3	65	6.0	-5.0	10.7 132.0	75	67.0	-10.0	11.7 129.0	85	159.0	-40.0	13.1 124.7	100	210.0	35.0	
083015Z	10.3 135.4	60	10.3 135.4	70	6.0	-5.0	10.5 131.9	80	89.0	-15.0	11.3 128.0	95	168.0	-20.0	12.7 123.3	110	149.0	55.0	
083100Z	10.1 134.4	70	10.2 134.4	70	6.0	-5.0	10.4 130.5	95	81.0	-10.0	12.0 126.0	115	169.0	-20.0	14.2 120.5	130	90.0	45.0	
083105Z	10.0 133.3	80	10.3 133.5	80	22.0	-5.0	10.7 129.4	105	109.0	-10.0	12.7 124.0	105	156.0	-30.0	15.3 118.8	85	148.0	30.0	
083110Z	10.8 132.8	85	10.8 132.8	85	12.0	-5.0	11.0 128.5	110	99.0	-15.0	13.2 121.9	90	144.0	-25.0	15.5 117.5	75	115.0	10.0	
083115Z	9.6 132.7	95	9.7 132.7	90	12.0	-5.0	10.9 127.6	115	51.0	-10.0	12.5 119.8	90	109.0	-35.0	15.1 115.4	95	126.0	20.0	
090100Z	9.6 129.5	105	9.7 129.5	100	8.0	-5.0	10.7 124.1	110	48.0	-15.0	13.0 119.0	85	90.0	-40.0	16.1 115.1	85	93.0	0.0	
090105Z	9.4 128.1	115	9.5 128.1	115	6.0	-5.0	10.4 122.2	90	40.0	-15.0	13.4 117.3	85	126.0	-30.0	17.3 114.4	85	102.0	-5.0	
090110Z	9.4 126.8	115	9.4 126.8	125	0.0	-5.0	11.6 121.3	100	63.0	-15.0	15.2 117.4	95	155.0	-30.0	21.0 113.4	85	863.0	-15.0	
090115Z	9.4 125.6	115	9.6 125.6	115	13.0	-5.0	11.4 120.4	105	115.0	-18.0	14.4 116.8	90	35.0	-15.0	18.7 112.1	85	95.0	-30.0	
090200Z	9.9 124.1	95	10.0 124.1	100	6.0	-5.0	11.8 119.6	75	48.0	-30.0	14.8 116.2	90	32.0	-5.0	18.4 112.0	100	45.0	0.0	
090205Z	10.3 123.0	75	10.4 122.7	85	12.0	-5.0	12.5 118.1	80	80.0	-25.0	15.4 115.2	90	32.0	-10.0	18.6 112.7	100	92.0	20.0	
090210Z	10.8 121.8	85	10.8 121.8	30	12.0	-5.0	12.8 117.8	85	69.0	-20.0	15.5 114.4	90	72.0	-10.0	18.8 110.9	100	83.0	30.0	
090215Z	11.3 121.2	55	11.0 121.3	50	13.0	-5.0	13.3 117.5	85	72.0	-15.0	16.5 113.0	90	74.0	-25.0	19.6 109.7	100	74.0	40.0	
090300Z	12.0 120.3	45	12.0 120.4	50	13.0	-5.0	14.5 116.9	75	51.0	-10.0	17.5 112.0	85	62.0	-15.0	20.3 108.8	85	78.0	35.0	
090305Z	12.9 119.4	55	12.6 119.4	55	18.0	-5.0	15.2 115.9	80	51.0	-10.0	18.1 111.9	90	77.0	-10.0	21.4 107.5	75	72.0	35.0	
090310Z	12.7 118.4	55	12.7 118.5	55	18.0	-5.0	15.2 115.9	80	51.0	-10.0	18.1 111.9	90	77.0	-10.0	21.4 107.5	75	72.0	35.0	
090315Z	14.5 117.4	55	14.4 117.4	55	6.0	-5.0	17.8 113.3	100	19.0	-15.0	21.0 107.2	65	31.0	-5.0	23.8 106.6	35	63.0	5.0	
090400Z	15.2 116.4	85	15.1 116.5	85	8.0	-5.0	18.3 112.4	75	11.0	-25.0	21.8 108.1	50	46.0	-5.0	23.8 106.6	35	63.0	5.0	
090405Z	15.9 115.4	90	16.0 115.5	85	8.0	-5.0	19.3 111.1	70	18.0	-10.0	22.9 107.2	35	50.0	-5.0	23.8 106.6	35	63.0	5.0	
090410Z	17.7 114.3	90	17.6 114.3	90	6.0	-5.0	19.9 110.3	70	18.0	-10.0	23.9 107.4	30	61.0	-5.0	23.8 106.6	35	63.0	5.0	
090415Z	17.5 113.2	115	17.5 113.2	115	0.0	-5.0	21.0 109.2	75	16.0	-15.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090500Z	18.3 112.2	100	18.4 112.2	110	6.0	-5.0	21.9 108.6	70	25.0	-20.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090505Z	19.2 111.2	90	19.3 111.1	80	15.0	-5.0	23.0 108.2	30	32.0	-10.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090510Z	20.0 110.4	70	20.2 110.2	70	13.0	-5.0	23.9 107.8	30	32.0	-10.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090515Z	20.8 109.4	60	21.0 109.2	65	16.0	-5.0	24.0 107.0	0	0.0	-5.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090600Z	21.6 108.9	50	21.8 108.8	50	13.0	-5.0	24.0 107.0	0	0.0	-5.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090605Z	22.5 108.0	40	22.3 108.0	40	12.0	-5.0	24.0 107.0	0	0.0	-5.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	
090612Z	22.9 107.2	30	22.9 107.2	0	-5.0	-5.0	24.0 107.0	0	0.0	-5.0	24.0 107.0	0	0.0	-5.0	23.8 106.6	35	63.0	5.0	

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	13.	80.	179.	13.	80.	182.	287.
AVG RIGHT ANGLE ERROR	10.	63.	149.	10.	63.	149.	242.
AVG INTENSITY MAGNITUDE ERROR	3.	14.	17.	3.	14.	18.	20.
AVG INTENSITY BIAS	1.	5.	7.	1.	5.	7.	15.
NUMBER OF FORECASTS	42	39	35	42	38	34	30
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2806. NM							
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS							

TYPHOON IKE
FIX POSITIONS FOR CYCLONE NO. 13

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	260000	8.2N 146.0E	PCN 6	T0.0/0.0	INIT OBS	PGTU
2	260617	8.8N 145.7E	PCN 5			PGTU
3	261800	9.6N 145.2E	PCN 6	T1.0/1.0	INIT OBS	PGTU
4	262050	10.5N 145.3E	PCN 3			PGTU
5	262131	10.4N 145.4E	PCN 3			PGTU
6	270019	10.9N 145.0E	PCN 5	T2.0/2.0 /D2.0/24HRS		PGTU
7	270605	11.4N 144.4E	PCN 5			PGTU
8	270930	11.0N 144.5E	PCN 6			PGTU
9	271200	12.0N 143.9E	PCN 6	T3.0/3.0	INIT OBS ULCC 11.0N 143.7E	PGTU
10	271300	11.9N 143.8E	PCN 6			PGTU
11	271800	12.5N 143.2E	PCN 6			PGTU
12	271850	12.4N 142.9E	PCN 6		ULCC FIX	PGTU
13	272025	12.8N 142.5E	PCN 6		ULCC FIX	PGTU
14	272359	13.0N 142.3E	PCN 3	T3.5/3.5 /D1.5/24HRS		PGTU
15	280909	13.6N 141.2E	PCN 5			PGTU
16	281200	13.4N 140.8E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTU
17	281240	13.1N 140.7E	PCN 7		ULCC FIX	PGTU
18	281337	13.2N 140.3E	PCN 6		ULCC FIX	PGTU
19	282008	12.0N 140.0E	PCN 6		ULCC FIX	PGTU
20	290120	12.2N 140.4E	PCN 3	T3.5/3.5+/S0.0/25HRS		PGTU
21	290540	12.2N 139.9E	PCN 3			PGTU
22	290840	11.2N 139.4E	PCN 5		RODN	PGTU
23	290921	11.9N 139.6E	PCN 5			PGTU
24	291219	12.3N 139.2E	PCN 5	T3.5/3.5-/S0.0/24HRS		PGTU
25	291825	11.8N 138.8E	PCN 6		ULCC FIX	PGTU
26	291825	12.2N 138.3E	PCN 5			RODN
27	292128	11.8N 138.2E	PCN 6			PGTU
28	292159	11.6N 137.9E	PCN 6			PGTU
29	300107	11.4N 137.5E	PCN 6	T3.5/3.5+/S0.0/24HRS		PGTU
30	300709	10.6N 136.9E	PCN 4		FRMG EYEWALL	PGTU
31	301008	10.5N 136.7E	PCN 4		FRMG EYEWALL	PGTU
32	301038	10.5N 136.4E	PCN 4			PGTU
33	301306	10.6N 136.0E	PCN 6	T4.5/4.5 /D1.0/24HRS		PGTU
34	301812	10.3N 135.3E	PCN 4		FRMG EYEWALL	PGTU
35	302107	10.3N 134.9E	PCN 3		FRMG EYEWALL W-S-E	PGTU
36	310040	10.2N 134.2E	PCN 4			PGTU
37	310657	10.4N 133.3E	PCN 2	T5.0/5.0 /D1.5/30HRS	EYE FIX	PGTU
38	310947	9.9N 132.4E	PCN 2			PGTU
39	311013	10.0N 132.3E	PCN 3			PGTU
40	311320	9.9N 131.6E	PCN 1		EYE DIA 12NM	PGTU
41	311800	9.6N 130.7E	PCN 4			PGTU
42	311941	9.6N 130.3E	PCN 1	T6.0/6.0 /D1.5/32HRS		PGTU
43	312045	9.6N 130.0E	PCN 1			PGTU
44	312252	9.7N 129.7E	PCN 1		EYE DIA 9NM	PGTU
45	010201	9.7N 129.1E	PCN 1			PGTU
46	010201	9.7N 129.1E	PCN 1	T6.0/6.0-	INIT OBS	RPMK
47	010600	9.5N 128.0E	PCN 2			PGTU
48	010644	9.5N 128.0E	PCN 2	T5.5/5.5-/D0.5/24HRS		PGTU
49	010925	9.3N 127.4E	PCN 4			PGTU
50	011200	9.4N 126.8E	PCN 2		EYE DIA 12NM	PGTU
51	011442	9.7N 126.5E	PCN 3			RPMK
52	011800	9.5N 125.5E	PCN 4			PGTU
53	011925	9.9N 124.1E	PCN 3	T5.0/6.0+/W1.0/24HRS		PGTU
54	012205	9.9N 124.4E	PCN 3	T5.0/6.0-/W1.0/24HRS		REMY

PGTU
PGTW
PGTW
PGTW
RPMK
RODN
PGTW
PGTW
RODN
RPMK
RPMK
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RPMK
RODN
PGTW
PGTW
PGTW
PGTW
RPMK
RPMK
PGTW
RSKO
RODN
RPMK
PGTW
RODN
PGTW
PGTW
PGTW
RSKO
RPMK
PGTW

FIX NO.	TIME (Z)	FIX POSITION	FLV LVL	780MB HGT	OBS MSLP	MAX-SFC-WND VEL/CRG/RNG	MAX-FLT-LVL-WND DIR/CRG/RNG	ACCRV HAV/MET	EYE SHAPE	EYE DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	270510	11.3N 144.5E	1500FT		997	35 330 17	060 42 330 17	9 2				1
2	270713	11.4N 144.2E	1500FT		999	50 120 40	220 51 120 40	8 1			+26 +25	1
3	272120	12.8N 142.6E	1500FT		997	50 040 20	010 54 320 23	6 2			+23 +24 +24 28	1
4	280807	13.2N 142.4E	700MB			65 140 20	310 61 240 16	10 1				2
5	280531	13.05S 11.7E	700MB			65 110 10	055 110 10	16 10				3
6	280844	13.7N 141.6E	700MB			25 290 60	040 54 280 50	8 1			+10 +14 + 8	3
7	282111	12.4N 140.7E	1500FT		990	65 210 30	250 65 210 30	7 2			+10 +11 + 6	4
8	282340	12.3N 140.4E	1500FT		991	75 140 10	170 75 090 10	5 5			+26 +25 +23 30	4
9	290245	12.1N 139.5E	700MB	2971		45 090 35	015 151 090 35	10 3	CIRCULAR	20		4
10	291118	12.1N 139.0E	700MB	3006			220 48 140 55	8 3	CIRCULAR	20		4
11	292035	11.3N 138.3E	700MB	2969	985		140 66 070 15	10 1	CIRCULAR	25		4
12	292322	11.6N 138.0E	700MB	2978		50 140 15	190 48 120 25	10 1	ELLIPTICAL	30 25 030	+ 8 +15 +10	7
13	292917	10.9N 137.8E	700MB	2989			030 71 240 30	12 2	ELLIPTICAL	45 35 050	+11 +16 +10	9
14	301120	10.6N 136.4E	700MB	2915			340 71 240 30	12 2	ELLIPTICAL	45 35 050	+ 9 +16 +10	9
15	302040	10.1N 135.0E	700MB	2872			040 87 310 30	7 5				10
16	302310	10.2N 134.6E	700MB	2855		75 120 30	180 177 120 19	3 3				10
17	302837	10.3N 134.2E	700MB	2775	961	85 080 10	210 119 320 15	7 6				10
18	311111	9.9N 132.2E	700MB	2757	960		280 68 190 15	15 3	ELLIPTICAL	25 20 170	+12 +18 + 7	12
19	312356	9.7N 129.6E	700MB	2670	953	100 300 30	030 102 290 22	10 5	CIRCULAR	18	+ 5 +18 + 8	12
20	312846	9.5N 128.4E	700MB	2654		125 150 15	055 124 140 15	7 6	CIRCULAR	15	+10 +20 +18	13
21	010845	9.4N 127.7E	700MB	2530	947	130 040 15	080 117 040 12	7 6	CIRCULAR	30	+ 9 +19 +11	13
22	011118	9.3N 126.9E	700MB	2551	949		250 103 030 17	7 5	CIRCULAR	30	+ 5 +21 +12	14
23	011222	9.4N 126.7E	700MB	2659	951		070 110 350 10	8 5	CIRCULAR	25	+10 +16 +13	14
24	021144	10.9N 120.0E	700MB	2663			060 69 30 4	7 7			+ 8 +16 +10	15
25	021417	10.9N 121.8E	700MB	3042			930 44 020 30	7 7			+ 8 +16 +10	15
26	022055	12.0N 120.4E	700MB	2986	990		020 41 250 36	4 5	CIRCULAR	35	+10 +15 + 6	16
27	022339	12.0N 120.8E	700MB	3022	992	45 150 30	210 47 150 38	4 5	CIRCULAR	40	+11 +15 + 7	16
28	030843	13.0N 119.1E	700MB	2962		65 040 30	030 65 040 30	7 7	CIRCULAR	30	+11 +15 + 7	16
29	031132	13.8N 118.4E	700MB	2978	989		080 65 100 21	7 6			+15 8	17
30	032033	14.7N 116.4E	700MB	2937	984		040 66 340 16	10 6	CIRCULAR	20	+10 +12	17
31	032238	15.1N 116.5E	700MB	2913	981	70 030 15	130 90 330 32	12 6	C			

PIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADOB-CODE ASUAR	TDDFF	COMMENTS	RADAR POSITION	SITE UMO NO
1	270735	11.4N 144.5E	LAND	POOR						13.6N 144.9E	91218
2	270935	11.4N 144.5E	LAND	POOR						13.6N 144.9E	91218
3	271043	11.4N 144.5E	LAND	POOR					MOV 1805	13.6N 144.9E	91218
4	271235	11.6N 143.7E	LAND	POOR					MOV 0608	13.6N 144.9E	91218
5	271735	11.6N 143.7E	LAND	FAIR					MOV 0810	13.6N 144.9E	91218
6	271435	13.0N 142.7E	LAND	POOR					EYE OPH ERN QUADS	13.6N 144.9E	91218
7	271835	13.0N 142.7E	LAND	POOR						13.6N 144.9E	91218
8	272155	11.7N 142.8E	LAND	POOR						13.6N 144.9E	91218
9	274400	9.3N 126.5E	LAND				10801	42710		10.3N 124.0E	98646
10	011500	9.8N 126.5E	LAND				10811	42815		10.3N 124.0E	98646
11	011600	9.9N 126.1E	LAND				11891	42815		10.3N 124.0E	98646
12	011700	9.8N 125.7E	LAND				10482	42615		10.3N 124.0E	98646
13	011800	9.8N 125.5E	LAND				14382	42612		10.3N 124.0E	98646
14	030700	13.5N 118.6E	LAND				51111	53014		14.8N 120.3E	98426
15	030800	13.2N 119.0E	LAND				51111	53111		14.8N 120.3E	98426
16	030900	13.5N 118.8E	LAND				51670	53308		14.8N 120.3E	98426
17	031000	13.7N 118.7E	LAND				62584	43208		14.8N 120.3E	98426
18	031100	13.9N 118.6E	LAND				65547	43308		14.8N 120.3E	98426
19	031200	14.0N 118.6E	LAND				71111	43309		14.8N 120.3E	98426
20	031200	13.3N 118.7E	LAND				10502	42910		16.8N 112.3E	59981
21	031300	13.5N 118.4E	LAND				10612	42910		16.8N 112.3E	59981
22	031500	13.6N 118.0E	LAND				10763	42718		16.8N 112.3E	59981
23	041000	16.6N 114.7E	LAND				10426	53112		16.8N 112.3E	59981
24	041300	17.0N 114.0E	LAND				10315	53014		16.8N 112.3E	59981
25	041500	17.3N 113.6E	LAND				10316	53114		16.8N 112.3E	59981
26	041600	17.4N 113.4E	LAND				10315	53114		16.8N 112.3E	59981
27	041700	17.5N 113.2E	LAND				10315	53014		16.8N 112.3E	59981
28	041800	17.6N 113.0E	LAND				10315	53014		16.8N 112.3E	59981
29	041900	17.7N 112.3E	LAND				10312	53014		16.8N 112.3E	59981
30	042000	17.9N 112.6E	LAND				10314	53114		16.8N 112.3E	59981
31	050000	18.4N 112.0E	LAND				21434	53011		16.8N 112.3E	59981
32	050200	18.6N 111.6E	LAND				21414	53011		16.8N 112.3E	59981
33	050300	18.7N 111.5E	LAND				21414	53111		16.8N 112.3E	59981
34	050400	18.8N 111.3E	LAND				21464	53012		16.8N 112.3E	59981
35	050500	19.1N 111.1E	LAND				31111	53214		16.8N 112.3E	59981
36	050600	19.2N 110.9E	LAND				31111	53114		16.8N 112.3E	59981
37	050700	19.4N 109.8E	LAND				31111	53214		16.8N 112.3E	59981

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	051200	20.2N 110.2E	070	017	59758 59658 59355 59845
2	051800	21.0N 109.2E	065	010	59647 59644 59658 59632
3	060600	22.3N 108.0E	040	025	59431 59417

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

TROPICAL STORM JUNE
BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT
082800Z	17.7 125.3	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
082806Z	17.9 124.2	45	17.9	124.5	45	17.9	124.5	45	17.9	124.5	45	17.9	124.5	45	17.9	124.5	45	17.9	124.5
082812Z	17.9 122.9	55	18.0	122.0	50	63	121.6	60	149	10	20.9	118.3	70	112	10	0	0	0	0
082818Z	18.2 121.9	45	17.9	121.4	50	69	119.3	60	128	5	22.3	115.6	70	65	25	0	0	0	0
082900Z	18.6 120.6	45	18.2	119.4	50	32	115.3	70	157	10	21.3	112.0	80	278	55	0	0	0	0
082906Z	18.7 119.6	50	18.2	119.4	50	32	115.3	70	145	15	0	0	0	0	0	0	0	0	0
082912Z	18.9 119.0	50	18.5	118.7	50	29	114.8	70	131	10	0	0	0	0	0	0	0	0	0
082918Z	19.6 118.7	55	18.9	117.7	50	71	113.6	75	189	30	0	0	0	0	0	0	0	0	0
083000Z	20.4 118.4	60	20.9	118.8	60	37	116.8	40	15	15	0	0	0	0	0	0	0	0	0
083006Z	21.1 117.4	60	21.9	117.4	60	48	0	0	0	0	0	0	0	0	0	0	0	0	0
083012Z	21.9 116.6	60	24.1	115.2	40	153	0	0	0	0	0	0	0	0	0	0	0	0	0
083018Z	23.1 116.4	45	25.3	114.9	25	175	0	0	0	0	0	0	0	0	0	0	0	0	0
083100Z	24.1 116.0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR
70	121	125	0	0	0	0	0
AVG RIGHT ANGLE ERROR	25	104	25	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	5	13	25	0	0	0	0
AVG INTENSITY BIAS	-4	13	25	0	0	0	0
NUMBER OF FORECASTS	11	8	4	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 738. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TROPICAL STORM JUNE
FIX POSITIONS FOR CYCLONE NO. 14

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCR	DVORAK CODE	COMMENTS	SITE
1	250630	18.1N 136.3E	PCN 6	T0.5/0.5	INIT OBS	PGTU
2	250915	18.1N 133.0E	PCN 5	T0.0/0.5	ULCC FIX	PGTU
3	260617	19.7N 133.0E	PCN 5	T0.0/0.5	ULCC FIX	PGTU
4	270201	19.6N 126.3E	PCN 5	T1.0/1.0	/D1.0/24HRS	PGTU
5	270605	18.1N 128.8E	PCN 6	T1.0/1.0	INIT OBS	PGTU
6	271200	18.4N 129.4E	PCN 6	T1.0/1.0	ULCC FIX	PGTU
7	271800	19.0N 128.9E	PCN 6	T1.0/1.0	ULCC FIX	PGTU
8	271850	19.2N 128.8E	PCN 6	T1.0/1.0	ULCC FIX	PGTU
9	272247	19.4N 126.1E	PCN 6	T1.0/1.0	ULCC FIX	PGTU
10	280141	17.4N 124.5E	PCN 5	T2.5/2.5	INIT OBS	PGTU
11	280141	18.0N 123.8E	PCN 5	T2.5/2.5	INIT OBS	PGTU
12	280734	18.3N 124.6E	PCN 5	T2.5/2.5	/D1.5/25HRS	PGTU
13	280734	17.5N 124.4E	PCN 5	T2.5/2.5	INIT OBS	PGTU
14	280734	18.0N 125.1E	PCN 5	T2.5/2.5	INIT OBS	PGTU
15	281126	17.8N 123.5E	PCN 5	T2.5/2.5	INIT OBS	PGTU
16	281126	17.8N 123.0E	PCN 6	T2.5/2.5	INIT OBS	PGTU
17	282019	18.1N 124.1E	PCN 6	T2.5/2.5	INIT OBS	PGTU
18	281421	17.7N 122.9E	PCN 6	T2.5/2.5	INIT OBS	PGTU
19	281800	17.5N 122.4E	PCN 6	T2.5/2.5	INIT OBS	PGTU
20	282019	17.5N 122.4E	PCN 6	T2.5/2.5	INIT OBS	PGTU
21	282149	17.7N 121.6E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
22	282149	17.2N 121.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
23	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
24	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
25	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
26	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
27	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
28	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
29	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
30	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
31	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
32	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
33	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
34	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
35	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
36	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
37	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
38	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
39	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
40	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
41	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
42	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
43	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
44	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
45	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU
46	282149	18.2N 119.7E	PCN 6	T3.0/3.0	/D0.5/20HRS	PGTU

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	ACCR NAV/MET	EYE SHAPE	EYE ORIENT- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	270651	17.5N 129.7E	1500FT		993	30 220 90	260 35 270 149	7 15			+26 +24 27	1
700443	272341	17.5N 124.0E	1500FT		990	45 150 65	250 50 150 85	13 11			+25 +25	
	280540	18.0N 124.6E	1500FT		986	45 080 100	170 35 080 100	10 20				
	280820	17.9N 124.2E	1500FT		986	55 230 65	040 44 310 100	10 10			+26 +26	
	290627	18.2N 119.3E	700MB	2972	986	50 180 30	250 42 180 30	10 10				
	290838	18.7N 119.6E	1500FT		986	40 300 70	250 60 160 30	10 10			+26 +25	
	292305	20.7N 118.9E	700MB	2939	983	65 080 60	210 45 130 90	6 7			+12	

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCR	EYE SHAPE	EYE DIAM	RADAR-CODE ASUAR	TDDFF	COMMENTS	RADAR POSITION	SITE
1	281200	17.1N 122.6E	LAND				20351	73418		18.4N 121.6E	98231
2	301000	21.4N 116.9E	LAND				77774	73007		23.4N 116.7E	59316
3	301100	21.4N 116.8E	LAND				77774	43008		23.4N 116.7E	59316
4	301200	21.5N 116.8E	LAND				67773	53008		23.4N 116.7E	59316
5	301200	21.1N 116.5E	LAND				55777	73318		22.3N 114.2E	45005
6	301300	21.6N 116.6E	LAND				55777	73318		22.3N 114.2E	45005
7	301400	21.6N 116.6E	LAND				55777	73318		22.3N 114.2E	45005
8	301500	22.4N 116.2E	LAND				55777	73318		22.3N 114.2E	45005
9	301600	22.3N 116.1E	LAND				55777	73318		22.3N 114.2E	45005
10	301700	22.5N 116.1E	LAND				55777	73318		22.3N 114.2E	45005
11	301800	22.5N 116.0E	LAND				55777	83310		22.3N 114.2E	45005
12	302000	22.8N 115.9E	LAND				25777	73310		22.3N 114.2E	45005
13	302100	22.8N 115.9E	LAND				35777	73310		22.3N 114.2E	45005
14	302200	23.3N 115.1E	LAND				35777	73310		22.3N 114.2E	45005

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

TROPICAL STORM LYNN
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	
092400Z	18.6	115.7	25	0	0	0	0	0	0	0	0	0	0	0	
092406Z	18.5	115	2	7	0	11	0	19.5	111.7	50	130	15	21.1	109.3	
092412Z	18.4	114.7	30	114.4	30	19	0	19.4	112.7	50	136	20	20.6	110.4	
092418Z	18.2	114.1	35	114.3	30	19	0	19.4	112.2	40	149	10	20.2	109.8	
092500Z	18.0	113.5	40	113.5	35	18	0	18.7	111.2	40	138	15	20.1	108.8	
092506Z	17.6	112.8	35	112.8	35	6	0	16.9	110.8	30	66	5	16.5	107.9	
092512Z	17.2	112.1	30	112.3	30	11	0	16.2	109.4	25	68	0	15.8	106.4	
092518Z	17.0	111.5	30	111.7	30	13	0	16.0	108.3	25	99	0	0	0	
092600Z	16.4	111.0	25	111.0	25	13	0	15.9	107.4	20	119	-5	0	0	
092606Z	15.8	110.7	25	110.6	25	15	0	15.3	107.0	20	93	-5	0	0	
092612Z	15.6	110.4	25	110.4	25	13	0	16.0	110.0	20	117	0	0	0	
092618Z	15.4	109.9	25	110.0	25	36	0	0	0	0	0	0	0	0	
092700Z	15.4	109.4	25	109.4	25	42	0	0	0	0	0	0	0	0	
092706Z	15.6	108.6	25	109.0	25	38	0	0	0	0	0	0	0	0	
092712Z	15.7	108.0	20	108.4	20	43	0	0	0	0	0	0	0	0	
092718Z	16.1	107.4	15	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	112	231	402	0	0	0	0
AVG RIGHT ANGLE ERROR	21	63	178	362	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	1	8	12	8	0	0	0	0
AVG INTENSITY BIAS	-1	6	12	8	0	0	0	0
NUMBER OF FORECASTS	14	10	6	3	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 553. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 6. KNOTS

TROPICAL STORM LYNN
FIX POSITIONS FOR CYCLONE NO. 16

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	161131	15.1N 111.8E	PCN 5			RPMK
2	230600	13.8N 119.5E	PCN 6	T1.5/1.5	INIT OBS	PGTU
3	231005	19.2N 118.9E	PCN 6			PGTU
4	231800	19.4N 117.3E	PCN 6	T1.5/1.5	INIT OBS ULCC FIX	PGTU
5	232845	20.0N 117.3E	PCN 5	T1.5/1.5	INIT OBS	RPMK
6	232941	20.1N 117.0E	PCN 5			RPMK
7	240000	18.1N 115.4E	PCN 4			PGTU
8	240243	18.9N 115.7E	PCN 5	T2.0/2.0	INIT OBS	RODN
9	240600	18.6N 115.0E	PCN 6	T2.5/2.5 /D1.0/24HRS		PGTU
10	241039	18.1N 114.6E	PCN 6			PGTU
* 11	241125	19.7N 116.1E	PCN 5			RODN
12	241200	18.8N 114.8E	PCN 6			PGTU
13	241523	19.3N 115.3E	PCN 5		ULCC FIX	RPMK
14	242317	18.0N 113.6E	PCN 3	T2.0/2.0 /D0.5/25HRS		RPMK
15	242317	18.1N 113.7E	PCN 5	T2.5/2.5 /S0.0/18HRS		PGTU
* 16	242317	19.2N 114.3E	PCN 5	T3.0/3.0	INIT OBS	RSKO
17	250223	17.8N 113.5E	PCN 3			RPMK
18	250800	17.4N 112.9E	PCN 4			PGTU
19	250831	17.4N 112.6E	PCN 5	T0.5/1.5 /U1.5/24HRS		RODN
20	251103	17.3N 111.9E	PCN 3			RPMK
21	252116	16.8N 111.5E	PCN 5			RPMK
22	252203	16.8N 110.3E	PCN 5	T1.5/2.5 /U1.0/23HRS		PGTU
23	252203	17.0N 111.1E	PCN 5	T2.5/3.0 /U0.5/23HRS		RSKO
24	260034	17.2N 111.4E	PCN 5			RODN
25	260203	16.7N 111.0E	PCN 3	T1.0/1.5 /U1.0/24HRS		RPMK
26	260203	16.8N 110.2E	PCN 5			PGTU
27	260600	15.8N 110.2E	PCN 6			RODN
* 28	260818	15.8N 111.0E	PCN 5	T0.5/0.5 /S0.0/24HRS		PGTU
29	261131	15.7N 110.6E	PCN 6			RODN
* 30	261200	15.7N 111.5E	PCN 6	T2.5/2.5 /D1.0/14HRS		PGTU
* 31	261443	15.7N 111.2E	PCN 5			RODN
* 32	261200	16.0N 110.9E	PCN 6		ULCC FIX	PGTU
* 33	262103	15.5N 109.9E	PCN 5			RPMK
* 34	270009	14.5N 109.3E	PCN 5			RODN
35	270010	14.8N 109.7E	PCN 5	T1.0/1.5 /S0.0/22HRS		RPMK
* 36	270324	15.5N 110.6E	PCN 3			PGTU
37	270600	15.8N 108.8E	PCN 6		INIT OBS	PGTU
38	271200	15.8N 108.3E	PCN 6	T1.0/1.0-		RPMK
39	271203	15.6N 108.8E	PCN 6			PGTU
40	271500	16.2N 107.6E	PCN 6			RPMK
41	271500	16.3N 107.2E	PCN 6			PGTU

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
* 1	251200	16.4N 113.0E	020	040	BASED ON 59985 AND 59981 AND SHIP
2	251800	16.7N 111.9E	020	020	BASED ON 59985 AND 59981

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			
MO/DA/HR	POSIT	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS		
092712Z	24.6 152.3	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	0.0		
092718Z	24.4 152.2	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	0.0		
092800Z	24.4 152.0	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	0.0		
092806Z	24.3 152.0	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	0.0		
092812Z	24.2 151.9	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	0.0		
092818Z	24.1 151.1	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	0.0		
092900Z	24.7 150.8	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	0.0		
092906Z	24.3 150.8	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	0.0		
092912Z	24.7 150.8	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	0.0		
092918Z	25.4 149.9	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	0.0		
093000Z	26.6 149.7	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	0.0		
093006Z	28.2 149.4	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	0.0		
093012Z	30.4 149.2	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	0.0		
093018Z	34.9 150.2	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	0.0		
100100Z	36.0 151.6	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	0.0		

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	24-HR	48-HR	72-HR	24-HR	48-HR	72-HR	72-HR
28.2	215	421	447	0	0	0	0
AVG RIGHT ANGLE ERROR	18	87	221	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	4	4	10	0	0	0	0
AVG INTENSITY BIAS	-3	-2	10	0	0	0	0
NUMBER OF FORECASTS	13	9	5	0	0	0	0
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 863. NM							
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS							

TROPICAL STORM MAURY FIX POSITIONS FOR CYCLONE NO. 17

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
* 1	271800	22.7N 151.5E	PCN 6	T1.5/1.5	INIT OBS	PGTU
2	271939	24.1N 151.9E	PCN 4			PGTU
3	272204	24.3N 152.2E	PCN 4			PGTU
4	272341	24.2N 152.0E	PCN 4	T2.5/2.5	INIT OBS	PGTU
5	280000	24.5N 152.1E	PCN 6			PGTU
6	280430	24.0N 152.0E	PCN 6			PGTU
7	280600	23.8N 152.5E	PCN 6		ULCC FIX	PGTU
* 8	280819	22.7N 152.8E	PCN 6			PGTU
9	281221	23.8N 151.9E	PCN 6			PGTU
10	281800	24.0N 151.5E	PCN 6	T2.5/2.5 /D1.0/26HRS		PGTU
11	282140	23.9N 151.2E	PCN 5			PGTU
12	282321	24.0N 150.9E	PCN 5			PGTU
13	280300	24.8N 150.4E	PCN 4	T1.5/2.5 /U1.0/28HRS	EXP LLCC	PGTU
14	290600	24.9N 150.5E	PCN 6			PGTU
15	291201	25.3N 149.8E	PCN 2			PGTU
16	291600	26.3N 149.6E	PCN 6			PGTU
17	291844	26.7N 149.9E	PCN 6			PGTU
18	292116	27.3N 150.0E	PCN 6	T3.0/3.0~/D0.5/25HRS		PGTU
19	292301	27.3N 149.4E	PCN 3		EXP LLCC	PGTU
20	300042	28.3N 149.5E	PCN 3		EXP LLCC	PGTU
21	300300	29.0N 149.7E	PCN 6			PGTU
22	301322	32.9N 150.0E	PCN 6			PGTU
23	301831	34.9N 151.2E	PCN 6			PGTU

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WIND VEL/BRG/RNG	MAX-FLT-LVL-WIND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAN/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	280303	24.0N 151.8E	700MB	3027	992	50 060 30	130 55 060 30	10 5			+14 +11	1
2	282049	24.0N 151.1E	1500FT		994	55 020 40	130 64 020 40	6 5				0
3	282330	24.2N 150.7E	1500FT		995	55 140 55	230 44 130 35	3 5			+24 +25 +25 25	0
4	290540	24.8N 150.6E	1500FT		995	60 040 35	120 64 040 35	8 5				0
5	290823	24.8N 150.3E	700MB	3058		45 050 35	120 64 050 35	8 5			+13 +13 + 8	0
6	292105	27.3N 149.7E	1500FT		997	70 020 37	130 77 020 37	4 5			+26 +28 +25	4
7	292337	28.0N 149.6E	1500FT		998	45 230 15	260 53 230 13	4 5			+26 +28 +24 31	4
8	301011	32.3N 149.0E	700MB	3065	996	230 45 120 45	120 45 120 45	12 5			+14 +17 +10	0
9	301143	33.1N 149.1E	700MB	3055		210 59 130 70	120 59 130 70	12 5				0
10	302028	35.2N 150.6E	700MB	2986		60 080 25	200 45 080 25	10 5			+ 9 +13	6
11	302212	35.3N 150.9E	700MB	2986		45 050 10	200 45 050 10	5 6			+24 +26 +22 30	6
12	010537	33.9N 152.7E	1500FT		994	70 130 60	220 77 130 46	5 7			+12 +14 + 9	7
13	010819	34.3N 153.9E	700MB	3012	996	360 42 300 90	13 360 90	13 7				7

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			
MO/DA/HR	POSIT	WIND		POSIT	WIND		POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND			
092712Z	141.3	3	25	0	0	0	0	0	0	0	0	0	0	0	0	0			
092718Z	141.1	3	25	0	0	0	0	0	0	0	0	0	0	0	0	0			
092800Z	140.9	35	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092806Z	140.8	40	25	14	0	0	0	0	0	0	0	0	0	0	0	0			
092812Z	140.7	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092818Z	140.6	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092900Z	140.5	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092906Z	140.4	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092912Z	140.3	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
092918Z	140.2	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
093000Z	140.1	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
093006Z	140.0	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
093012Z	139.9	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
093018Z	139.8	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
100100Z	139.7	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
100106Z	139.6	45	24	14	0	0	0	0	0	0	0	0	0	0	0	0			
100112Z	139.5	45	24	14	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
30	156	279	482	0	0	0	0
12	37	85	146	0	0	0	0
5	15	34	13	0	0	0	0
0	3	22	13	0	0	0	0
15	9	5	3	0	0	0	0

AVG FORECAST POSIT ERROR
 AVG RIGHT ANGLE ERROR
 AVG INTENSITY MAGNITUDE ERROR
 AVG INTENSITY BIAS
 NUMBER OF FORECASTS

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1201. NM
 AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL STORM NINA
FIX POSITIONS FOR CYCLONE NO. 18

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	270840	22.6N 142.1E	PCN 6	T1.0/1.0	INIT OBS	PGTU
2	271200	22.5N 141.6E	PCN 6			PGTU
3	271600	22.3N 141.7E	PCN 6	T1.5/1.5	INIT OBS	PGTU
4	271800	22.4N 141.5E	PCN 6			PGTU
5	271939	23.8N 141.6E	PCN 6		EXP LLCC TO NU	PGTU
6	272204	24.1N 141.6E	PCN 6			PGTU
7	280000	24.8N 141.9E	PCN 6		ULCC FIX	PGTU
8	280300	25.4N 141.9E	PCN 6		ULCC FIX	PGTU
9	280612	25.4N 141.9E	PCN 6	T2.0/2.0 /D1.0/22HRS		PGTU
10	282059	25.3N 140.9E	PCN 4		EXP LLCC	PGTU
11	282140	25.5N 140.8E	PCN 3		EXP LLCC	PGTU
12	290102	25.8N 140.5E	PCN 3	T1.5/2.0 /W0.5/24HRS		PGTU
13	290559	26.1N 140.7E	PCN 3		EXP LLCC	PGTU
14	290559	26.0N 140.8E	PCN 5	T1.5/1.5	INIT OBS	RPNK
15	290939	25.9N 140.8E	PCN 5			PGTU
16	291200	26.1N 140.3E	PCN 6			PGTU
17	291343	26.8N 140.4E	PCN 3		EXP LLCC	PGTU
18	291844	27.1N 141.0E	PCN 5	T2.0/2.0	INIT OBS	PGTU
19	292038	27.4N 140.7E	PCN 3		EXP LLCC	PGTU
20	300042	26.9N 141.5E	PCN 5		EXP LLCC	PGTU
21	300300	27.5N 142.0E	PCN 4		EXP LLCC	PGTU
22	300600	28.5N 142.9E	PCN 6	T1.0/1.5 /W0.5/24HRS		PGTU
23	301322	29.8N 145.0E	PCN 6			PGTU
24	301800	30.4N 146.6E	PCN 6	T2.0/2.0 /S0.0/24HRS		PGTU
25	302233	31.9N 148.6E	PCN 6			PGTU
26	010022	32.4N 149.7E	PCN 5			PGTU
27	010534	33.7N 152.4E	PCN 5	T2.5/2.5 /D1.5/24HRS		PGTU
28	010856	34.2N 154.4E	PCN 6			PGTU
29	011200	34.7N 155.4E	PCN 6			PGTU
30	011600	35.6N 158.2E	PCN 5	T3.5/3.5 /D1.5/24HRS		PGTU
31	011800	36.3N 159.3E	PCN 5			PGTU
32	012100	36.5N 161.2E	PCN 5			PGTU
33	020000	35.8N 163.4E	PCN 4			PGTU
34	020300	36.0N 164.9E	PCN 6			PGTU

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSH NO.
1	292249	27.5N 141.5E	1500FT		994	25 330 40	930 38 330 40	5 15			+26 +26 +24 29	4
2	302341	32.6N 149.8E	700MB	2982		75 230 20	350 25 320 50	8 7	CIRCULAR	10	+7 +11	6

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADOB-CODE ASUAR TDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	281200	24.6N 141.0E	0				50022 RJAU WMO 47981			
2	301926	32.1N 147.2E	ACFT							

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

TYPHOON OGDEN
BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	
100700Z	18.1 152.3	25	18.5 152.4	25	25	0	21.8 151.2	35	183	-10	26.6 150.9	50	417	-20	0	0	0	0	
100706Z	19.1 152.1	30	19.0 152.0	30	25	0	22.1 151.1	40	276	-10	26.5 150.9	50	560	-15	0	0	0	0	
100712Z	20.4 152.2	30	19.6 151.6	30	59	0	22.8 150.6	40	347	-15	27.2 150.7	50	702	-15	0	0	0	0	
100718Z	21.9 152.7	35	20.4 151.6	35	109	0	23.6 151.0	45	394	-15	28.0 151.5	55	802	-5	0	0	0	0	
100800Z	23.8 153.7	45	24.0 153.3	40	35	-5	32.5 160.9	45	235	-25	0	0	0	0	0	0	0	0	
100806Z	25.4 154.6	50	25.8 155.0	50	32	0	35.4 162.8	50	298	-15	0	0	0	0	0	0	0	0	
100812Z	26.5 154.6	55	26.6 155.6	50	8	-5	31.8 153.9	50	291	-15	0	0	0	0	0	0	0	0	
100818Z	27.8 156.6	60	27.6 156.4	50	16	-10	32.5 160.2	50	279	-10	0	0	0	0	0	0	0	0	
100900Z	29.4 158.1	70	29.1 157.7	70	28	0	0	0	0	-0	0	0	0	0	0	0	0	0	
100906Z	30.9 160.3	65	30.7 159.8	65	28	0	0	0	0	-0	0	0	0	0	0	0	0	0	
100912Z	32.4 162.8	60	32.2 162.8	60	15	0	0	0	0	-0	0	0	0	0	0	0	0	0	
100918Z	33.9 165.5	60	33.9 165.8	60	15	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
30	277	620	0	30	277	620	0
15	100	219	0	15	100	219	0
2	14	14	0	2	14	14	0
-2	-14	-14	0	-2	-14	-14	0
12	8	4	0	9	8	4	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1236. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 19. KNOTS

TYPHOON OGDEN
FIX POSITIONS FOR CYCLONE NO. 19

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCY	DVORAK CODE	COMMENTS	SITE
* 1	051800	12.4N 151.2E	PCN 6	T0.0/0.0	INIT OBS	PGTU
* 2	060000	13.5N 152.5E	PCN 6			PGTU
* 3	060300	17.9N 154.4E	PCN 6	T1.0/1.0	INIT OBS	PGTU
* 4	060500	18.1N 155.1E	PCN 6		ULCC FIX	PGTU
* 5	060900	19.5N 155.0E	PCN 6		ULCC FIX	PGTU
* 6	061200	18.7N 155.1E	PCN 6			PGTU
* 7	061600	18.5N 155.0E	PCN 6	T1.5/1.5 /D1.5/22HRS		PGTU
* 8	061800	18.6N 154.8E	PCN 6			PGTU
* 9	061900	19.6N 155.0E	PCN 6			PGTU
* 10	062100	18.4N 154.8E	PCN 6			PGTU
11	070002	18.4N 152.9E	PCN 5			PGTU
12	070300	19.0N 151.6E	PCN 4	T1.0/1.0 /S0.0/24HRS	EXP LLCC	PGTU
13	070501	18.3N 152.3E	PCN 3			PGTU
14	070830	19.0N 151.6E	PCN 6			PGTU
* 15	071242	19.9N 153.5E	PCN 6	T2.0/2.0 /D0.5/24HRS		PGTU
* 16	071600	20.2N 153.6E	PCN 6			PGTU
* 17	071800	20.8N 154.1E	PCN 6			PGTU
* 18	072124	21.9N 152.8E	PCN 6		ULCC 23.0N 155.5E	PGTU
19	072342	20.4N 153.3E	PCN 4	T2.5/2.5 /D1.5/21HRS		PGTU
20	072442	24.2N 159.8E	PCN 3		INIT OBS	PGTU
* 21	080300	25.6N 154.6E	PCN 4	T3.5/3.5 /D2.5/24HRS		PGTU
22	080542	25.7N 154.8E	PCN 3			PGTU
23	080542	25.3N 154.8E	PCN 3			RODN
24	080821	26.0N 155.1E	PCN 4			PGTU
25	081222	26.6N 155.6E	PCN 3			PGTU
* 26	081222	26.9N 154.5E	PCN 4	T3.0/3.0 /D1.0/24HRS		RODN
27	081600	27.2N 156.1E	PCN 6			PGTU
28	081833	27.6N 156.5E	PCN 5			PGTU
29	082100	28.4N 157.3E	PCN 6			PGTU
30	082321	29.2N 158.1E	PCN 3			PGTU
31	090300	29.8N 159.2E	PCN 4	T4.0/4.0 /D0.5/24HRS		PGTU
32	090536	30.5N 160.7E	PCN 4			PGTU
33	090900	31.4N 161.6E	PCN 6			PGTU
34	091200	32.2N 162.7E	PCN 6		ULCC FIX	PGTU
35	091600	33.5N 164.8E	PCN 6	T4.5/4.5 /D1.5/24HRS		PGTU
36	091638	33.1N 165.1E	PCN 6			PGTU
37	091800	34.0N 165.7E	PCN 6		ULCC FIX	KGUC
38	091820	34.3N 166.0E	PCN 5			PGTU
39	091846	34.3N 166.0E	PCN 6		ULAC 34.7N 167.1E	RODN
40	092301	35.5N 169.5E	PCN 6			KGUC
41	100000	35.8N 169.3E	PCN 6			PGTU
42	100400	37.7N 172.8E	PCN 6	T4.0/4.0 /S0.0/25HRS		PGTU

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	ACCY NAV/MET	EYE SHAPE	EYE ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	062227	18.4N 152.2E	1500FT		999	15 340 70	160 16 030 70	10 3			+26 +26 +25	26
2	070533	18.8N 152.2E	1500FT		997	45 130 140	210 38 130 125	10 25			+29 +29 +25	26
* 3	070821	19.9N 152.6E	700MB	3080	1000		180 29 080 54	13 7			+16 +16 +9	26
4	072046	22.1N 152.2E	1500FT		998	25 040 105	340 30 220 82	45 15			+29 +29 +20	27
5	072359	23.8N 154.0E	1500FT		993	45 100 25	240 24 180 45	15 5			+29 +30 +23	28
6	080540	25.5N 154.7E	700MB	2976		50 150 15	220 58 130 60	12 15			+12 +13 +13	
7	080817	25.8N 155.0E	700MB	2961	986	40 040 60	130 51 040 90	10 10			+13 +13 +11	
8	082132	29.0N 157.6E	700MB	2945	983	70 250 30	170 76 250 28	5 1			+12 +15 +14	
9	082312	29.2N 156.0E	700MB	2942	982	40 280 90	170 68 060 70	5 5	CIRCULAR	40	+13 +14 +14	

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

**TYPHOON PHYLLIS
BEST TRACK DATA**

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	
100912Z	18.4	151.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
100918Z	18.7	151.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
101000Z	19.1	151.9	0.0	0.0	0.0	0.0	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	19.4	152.2	0.0	0.0	0.0	0.0	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	19.4	152.2	0.0	0.0	0.0	0.0	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	19.6	152.3	0.0	0.0	0.0	0.0	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	19.7	152.4	0.0	0.0	0.0	0.0	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	20.1	152.4	0.0	0.0	0.0	0.0	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	20.7	152.1	0.0	0.0	0.0	0.0	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	21.4	151.7	0.0	0.0	0.0	0.0	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	22.1	151.3	0.0	0.0	0.0	0.0	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	22.7	151.4	0.0	0.0	0.0	0.0	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	23.3	151.2	0.0	0.0	0.0	0.0	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	24.8	151.3	0.0	0.0	0.0	0.0	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	26.0	151.4	0.0	0.0	0.0	0.0	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	27.7	151.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
101312Z	29.5	151.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
101318Z	31.6	151.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
101400Z	33.8	152.6	0.0	0.0	0.0	0.0	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			
AVG FORECAST POSIT ERROR	24-HR	48-HR	72-HR	24-HR	48-HR	72-HR	
15. 113. 233. 498.	15. 113. 233. 498.	15. 113. 233. 498.	15. 113. 233. 498.	15. 113. 233. 498.	15. 113. 233. 498.	15. 113. 233. 498.	
AVG RIGHT ANGLE ERROR	12. 23. 120. 113.	12. 23. 120. 113.	12. 23. 120. 113.	12. 23. 120. 113.	12. 23. 120. 113.	12. 23. 120. 113.	
AVG INTENSITY MAGNITUDE ERROR	5. 19. 20. 40.	5. 19. 20. 40.	5. 19. 20. 40.	5. 19. 20. 40.	5. 19. 20. 40.	5. 19. 20. 40.	
AVG INTENSITY ERROR	14. 28. 40. 40.	14. 28. 40. 40.	14. 28. 40. 40.	14. 28. 40. 40.	14. 28. 40. 40.	14. 28. 40. 40.	
NUMBER OF FORECASTS	13. 9. 5. 1.	13. 9. 5. 1.	13. 9. 5. 1.	13. 9. 5. 1.	13. 9. 5. 1.	13. 9. 5. 1.	

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 972. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

**TYPHOON PHYLLIS
FIX POSITIONS FOR CYCLONE NO. 20**

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	072124	13.7N 146.9E	PCN 6	T0.0/0.0	INIT OBS	PGTW
2	091202	18.8N 150.7E	PCN 6	T0.5/0.5	INIT OBS	PGTW
3	092028	20.2N 152.5E	PCN 6		ULCC FIX	PGTW
4	092301	19.4N 152.1E	PCN 6	T1.5/1.5	INIT OBS	PGTW
5	100400	19.7N 152.3E	PCN 6		ULCC 20.7N 152.3E	PGTW
6	100600	20.5N 152.6E	PCN 6			PGTW
7	100900	20.3N 152.8E	PCN 6			PGTW
8	101141	20.1N 152.7E	PCN 6			PGTW
9	101600	19.8N 152.4E	PCN 6	T2.0/2.0	INIT OBS	PGTW
10	101800	20.0N 152.3E	PCN 6		ULCC FIX	PGTW
11	102007	19.6N 152.4E	PCN 4			PGTW
12	102152	19.4N 152.4E	PCN 4			PGTW
13	110022	19.5N 152.5E	PCN 5	T2.5/2.5 /D1.0/25HRS		PGTW
14	110511	19.8N 152.3E	PCN 3			PGTW
15	110847	20.3N 152.9E	PCN 4			PGTW
16	111200	20.3N 152.9E	PCN 6			PGTW
17	111303	20.7N 152.1E	PCN 3			PGTW
18	111600	21.2N 151.7E	PCN 4			PGTW
19	111755	21.8N 151.3E	PCN 4	T3.5/3.5 /D1.5/26HRS		PGTW
20	112125	21.8N 151.8E	PCN 3			PGTW
21	120000	22.0N 151.4E	PCN 3	T4.0/4.0 /D1.5/24HRS		PGTW
22	120458	22.6N 151.1E	PCN 3			PGTW
23	120600	22.8N 150.9E	PCN 4			PGTW
24	120825	23.1N 151.1E	PCN 4			PGTW
25	121243	23.9N 151.3E	PCN 4			PGTW
26	121600	24.5N 151.0E	PCN 4			PGTW
27	121743	24.7N 150.9E	PCN 2	T5.0/5.0 /D1.5/24HRS		PGTW
28	121924	25.0N 150.7E	PCN 4			PGTW
29	122104	25.3N 151.2E	PCN 3			PGTW
30	122342	26.1N 151.8E	PCN 4	T3.5/4.0 -/U0.5/24HRS		PGTW
31	130400	26.7N 151.4E	PCN 6			PGTW
32	130445	27.2N 151.5E	PCN 6			PGTW
33	130600	27.8N 151.9E	PCN 6		ULCC FIX	PGTW
34	131222	29.7N 151.1E	PCN 4		EXP ULCC	PGTW
35	131222	29.8N 151.0E	PCN 6		ULCC FIX	PGTW
36	132321	35.5N 154.0E	PCN 5	T2.0/2.0	INIT OBS	RODH
37	132322	34.9N 153.5E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	110401	20.0N 152.4E	1500FT	2986	989	50 240 10	330 50 240 10	8 4	CIRCULAR	10	+30 +30 28	1
2	112042	21.7N 151.6E	700MB	2986	985	65 270 5	160 60 030 20	12 1	CIRCULAR	10	+11 +17 +10	3000
3	112322	22.1N 151.3E	700MB	2953	983	95 180 10	240 57 150 20	12 1	CIRCULAR	15	+17 +13 +12	3000
4	120855	23.3N 151.2E	700MB	2920	975		250 91 220 20	10 5	CIRCULAR	15	+16 +24 +10	3000
5	121128	23.8N 151.1E	700MB	2927	974		380 74 230 12	8 2	CIRCULAR	10	+14 +27 +10	3000
6	122032	25.1N 151.3E	700MB	2950		70 110 8	260 65 110 10	10 5	CIRCULAR	30	+15 +24 +12	4
7	122304	25.8N 151.2E	700MB	2973	988	65 050 50	140 55 050 50	10 5	CIRCULAR	30	+16 +24 +10	5
8	130645	28.0N 151.5E	700MB	3056		65 200 40	150 65 040 15	15 10			+17 +23 +10	5
9	130831	28.5N 151.4E	700MB	3055	997		260 50 130 60	15 15			+18 +22 +7	5
10	132327	33.7N 152.4E	1500FT		999	35 150 30	260 43 180 77	8 4			+26 +26 +18 25	6

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

TROPICAL STORM ROY
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND
100918Z	9.3 140.1	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
101000Z	9.8 141.0	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
101005Z	10.4 141.8	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
101012Z	11.0 142.4	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
101018Z	11.8 143.0	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
101100Z	12.7 143.0	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
101105Z	13.6 143.0	35	13.8	143.1	35	13	0.0	16.3	143.0	50	68	25	19.4	141.0	60
101112Z	14.2 143.2	30	14.7	142.8	40	38	10	18.9	141.0	55	129	35	0.0	0.0	0.0
101118Z	14.8 143.2	25	16.2	142.0	40	189	15	23.9	142.1	45	325	30	0.0	0.0	0.0
101200Z	15.4 143.3	25	15.2	143.0	30	6	5	17.8	143.2	35	154	25	0.0	0.0	0.0
101205Z	16.2 143.6	20	16.2	143.5	30	0	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101212Z	17.3 143.8	20	17.4	143.7	30	8	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101218Z	18.8 144.1	15	18.7	143.9	20	13	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101300Z	20.0 144.6	10	20.0	144.0	20	6	10	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	173	207	0	0	0	0	0
AVG RIGHT ANGLE ERROR	18	87	179	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	8	31	50	0	0	0	0	0
AVG INTENSITY BIAS	8	31	50	0	0	0	0	0
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 735. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM ROY
FIX POSITIONS FOR CYCLONE NO. 21

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	091820	9.7N 140.1E	PCN 6		ULCC FIX	PGTU
2	092028	10.0N 140.7E	PCN 6		ULCC FIX	PGTU
3	100400	10.0N 142.2E	PCN 6	T1.5/1.5	INIT OBS	PGTU
4	100600	10.4N 142.0E	PCN 6			PGTU
5	100908	10.8N 141.3E	PCN 6		ULCC FIX	PGTU
6	101200	11.5N 141.8E	PCN 6		INIT OBS	PGTU
7	101322	11.0N 142.8E	PCN 6		ULCC FIX	PGTU
8	101600	11.3N 143.1E	PCN 6	T1.5/1.5		PGTU
9	101800	11.5N 143.1E	PCN 6			PGTU
10	102007	12.0N 143.4E	PCN 6			PGTU
11	102152	12.1N 143.2E	PCN 3			PGTU
12	110022	12.7N 143.2E	PCN 3			PGTU
13	110400	13.3N 143.2E	PCN 4			PGTU
14	110552	13.8N 143.9E	PCN 5	T2.5/2.5 /D1.0/27HRS		PGTU
15	110847	14.3N 142.9E	PCN 6			PGTU
16	111200	14.6N 142.7E	PCN 6			PGTU
17	111303	14.6N 142.6E	PCN 5	T1.0/1.5 /W0.5/26HRS		PGTU
18	111500	15.3N 141.9E	PCN 6			PGTU
19	112128	14.8N 143.0E	PCN 5		EXP LLCC	PGTU
20	120000	15.2N 143.4E	PCN 3			PGTU
21	120400	16.0N 143.6E	PCN 4	T2.0/2.5 /W0.5/24HRS		PGTU
22	120540	16.1N 143.9E	PCN 3		EXP LLCC	PGTU
23	120825	16.7N 143.7E	PCN 4			PGTU
24	121007	17.1N 143.8E	PCN 5			PGTU
25	121243	17.5N 143.6E	PCN 6			PGTU
26	122342	20.0N 144.6E	PCN 4			PGTU

AIRCRAFT FIXES

* FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HCT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIENTATION	EYE TEMP (C) OUT/IN/DP/SST	MSN NO.
1	110046	12.8N 143.3E	1500FT		1000	30 140 20	230 29 140 20	5 10			+30 +31 +21 28	1
2	110526	13.6N 143.1E	1500FT		999	40 110 23	080 44 020 37	9 2			+26 +27 +26	2
3	110829	14.1N 143.1E	1500FT		998	25 240 30	360 22 240 41	8 3			+31 +31 +28	3
4	112327	15.2N 143.3E	1500FT		1000	30 140 20	260 40 140 20	4 10			+25 +27 +25	4
5	120531	16.2N 143.5E	1500FT		996	20 160 40	240 28 160 25	7 20			+27 +27 +27	5
6	120824	16.8N 143.6E	1500FT		998	10 200 30	230 23 220 53	8 20				6

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			
MO/DA/HR	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS	POSIT	WIND	ERRORS	ERRORS
101106Z	11.5 116.2	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	0.0	0.0	0.0
101112Z	11.4 114.6	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	0.0	0.0	0.0
101118Z	11.9 113.0	30	12.0	112.5	30	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
101200Z	12.1 111.6	35	12.0	111.5	35	8	0.0	13.0	108.3	30	47	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101206Z	12.5 108.6	30	12.0	108.5	30	13	0.0	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	12.5 107.5	25	12.0	107.3	25	13	0.0	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	13.0 106.9	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	0.0	0.0	0.0

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	WRNG	24-HR	48-HR	72-HR
AVG RIGHT ANGLE ERROR	9	25	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	0	5	0	0	0	0	0
AVG INTENSITY BIAS	0	5	0	0	0	0	0
NUMBER OF FORECASTS	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 576. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS

**TROPICAL STORM SUSAN
FIX POSITIONS FOR CYCLONE NO. 22**

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	100600	11.2N 116.1E	PCN 4	T1.5/1.5	INIT OBS	PGTU
* 2	101200	12.8N 112.7E	PCN 6			PGTU
* 3	101600	13.7N 112.5E	PCN 6			PGTU
* 4	101800	13.6N 112.6E	PCN 6	T1.0/1.0	INTI OBS ULCC FIX	PGTU
5	110400	11.4N 116.8E	PCN 6	T1.5/1.5+/-50.0/22HRS		PGTU
6	110600	11.4N 116.5E	PCN 6			PGTU
7	110834	11.5N 116.6E	PCN 5			PGTU
8	111028	11.0N 115.4E	PCN 5	T1.5/1.5	INIT OBS	RPMK
9	111200	11.0N 115.0E	PCN 6			PGTU
10	111444	11.6N 113.7E	PCN 5			PGTU
* 11	111600	12.2N 112.6E	PCN 6	T2.5/2.5 /D1.5/22HRS		RPMK
* 12	111800	11.8N 111.2E	PCN 6			PGTU
13	112100	11.8N 112.2E	PCN 6			PGTU
14	112309	12.3N 112.1E	PCN 5			PGTU
15	112309	12.3N 111.7E	PCN 5			PGTU
16	120000	12.2N 111.4E	PCN 6			RPMK
17	120400	12.5N 110.7E	PCN 6	T3.0/3.0-/D1.5/24HRS		PGTU
18	120600	12.8N 110.1E	PCN 6			PGTU
19	120822	12.3N 109.2E	PCN 6	T2.0/2.0-/D0.5/24HRS		PGTU
20	120900	12.5N 109.2E	PCN 6			RPMK
21	121147	12.6N 108.3E	PCN 6			PGTU
22	121200	12.4N 108.6E	PCN 6			PGTU
23	121600	13.0N 107.8E	PCN 6			RPMK
24	122107	10.8N 107.6E	PCN 5			PGTU
25	122247	13.1N 107.2E	PCN 5			RPMK
26	130026	13.6N 107.1E	PCN 5			RPMK

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

**TROPICAL DEPRESSION 23
BEST TRACK DATA**

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND		POSIT	WIND		POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS
101618Z	7.5	150.2	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	0.0
101700Z	8.2	149.4	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	0.0
101706Z	8.7	148.6	25	8.7	148.5	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
101712Z	9.3	147.7	25	9.1	147.5	25	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101718Z	9.8	146.9	25	9.6	146.6	25	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101800Z	10.3	146.2	20	10.3	146.3	20	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	13	0	0	0	0	0	0	0
AVG RIGHT ANGLE ERROR	16	0	0	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	0	0	0	0	0	0	0	0
AVG INTENSITY BIAS	0	0	0	0	0	0	0	0
NUMBER OF FORECASTS	4	0	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 287. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

**TROPICAL DEPRESSION TD23W
FIX POSITIONS FOR CYCLONE NO. 23**

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	141800	12.6N 155.8E	PCN 6	T1.5/1.5	INIT OBS	PJTU
2	142023	12.3N 154.1E	PCN 5			PJTU
3	152002	11.6N 153.2E	PCN 5	T0.5/0.5	INIT OBS EXP LLCC	PJTU
4	160300	11.5N 152.2E	PCN 6	T1.5/1.5	INIT OBS	PJTU
5	161600	7.1N 150.4E	PCN 6	T1.0/1.0	INIT OBS	PJTU
6	161800	7.4N 150.2E	PCN 6			PJTU
* 7	162100	7.4N 151.4E	PCN 6			PJTU
8	170821	9.1N 148.1E	PCN 6			PJTU
* 9	171200	6.8N 147.6E	PCN 6		ULCC FIX	PJTU
* 10	171243	6.8N 147.7E	PCN 6		ULCC FIX	PJTU
11	171822	9.6N 146.3E	PCN 6	T1.0/1.0~/S0.0/26HRS	ULCC FIX	PJTU

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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSH NO.
1	170600	8.7N 148.5E	1500FT		998	25 170 30	230 28 170 30	1 5			+27 +27 +20 25	1

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

TYPHOON THAD
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND	POSIT	WIND	WIND
101805Z	8.7	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
101815Z	9.7	149.6	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
101825Z	10.8	149.1	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
101900Z	11.9	148.5	30	11.2	147.2	25	87	-5	14.0	142.7	50	255	-5	15.8	137.9
101905Z	13.1	147.9	35	13.0	147.9	35	6	0	15.8	143.6	50	165	-15	16.8	138.6
101915Z	14.3	147.4	40	14.1	147.1	42	21	5	16.9	142.7	60	182	-15	18.7	138.0
101925Z	15.5	146.7	45	15.4	146.1	42	35	0	18.9	141.5	60	179	-30	21.3	137.0
102000Z	16.7	145.6	55	16.7	145.9	55	11	0	21.0	143.3	70	49	-30	25.6	143.2
102005Z	17.8	145.6	65	17.8	145.7	65	26	0	22.0	144.2	75	50	-35	26.0	144.5
102015Z	19.0	145.0	75	19.0	145.4	70	23	0	24.3	143.4	85	49	-35	29.3	147.0
102025Z	20.3	144.3	90	20.3	144.5	80	11	-10	24.3	143.4	85	49	-35	29.3	147.0
102100Z	21.6	143.9	100	21.8	144.0	100	13	0	29.0	146.7	80	191	-40	35.2	153.8
102105Z	22.7	143.7	110	22.9	143.6	95	13	-15	28.2	144.8	75	124	-45	33.0	151.7
102115Z	23.7	143.7	115	23.3	143.7	95	6	0	29.0	145.8	80	123	-35	33.6	153.6
102125Z	24.9	144.1	120	24.8	144.0	120	6	-20	31.9	152.9	85	19	-15	34.9	157.7
102200Z	26.1	145.2	120	26.0	145.1	115	8	-5	31.9	152.9	85	19	-15	34.9	157.7
102205Z	27.1	146.9	120	27.2	146.7	110	12	-10	33.0	155.6	80	25	-10	33.6	153.6
102215Z	28.6	149.0	115	28.3	149.0	100	8	-15	34.7	160.1	75	85	-15	34.9	157.7
102225Z	30.1	151.1	110	30.2	151.2	95	8	-15	34.7	160.1	75	85	-15	34.9	157.7
102300Z	31.7	153.2	100	31.5	153.0	110	16	10	37.1	164.5	70	110	-10	37.1	164.5
102305Z	33.4	155.7	90	33.3	155.6	100	28	10	0.0	0.0	0.0	0.0	-10	0.0	0.0
102315Z	34.4	158.5	80	34.2	157.9	90	32	10	0.0	0.0	0.0	0.0	-10	0.0	0.0
102325Z	35.3	162.0	75	35.9	161.1	75	57	0	0.0	0.0	0.0	0.0	-10	0.0	0.0
102400Z	35.5	165.6	70	35.5	165.5	75	5	5	0.0	0.0	0.0	0.0	-10	0.0	0.0

ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	WRNG	24-HR	48-HR	72-HR
AVG RIGHT ANGLE ERROR	18	86	178	14	86	178	635
AVG INTENSITY MAGNITUDE ERROR	7	22	33	7	22	33	21
AVG INTENSITY BIAS	-3	-22	-33	-3	-22	-33	-21
NUMBER OF FORECASTS	21	17	12	20	17	12	8

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2362. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 17. KNOTS

TYPHOON THAD
FIX POSITIONS FOR CYCLONE NO. 24

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	172342	8.0N 150.4E	PCN 5	T1.0/1.0	INIT OBS ULCC FIX	PGTW
2	180525	9.2N 146.7E	PCN 6		ULCC FIX	PGTW
3	180759	8.7N 150.2E	PCN 6		ULCC FIX	PGTW
4	181200	9.2N 149.7E	PCN 6		ULCC FIX	PGTW
5	181223	9.6N 149.5E	PCN 6		ULCC FIX	PGTW
6	181800	10.5N 148.8E	PCN 6		ULCC FIX	PGTW
7	182039	10.5N 147.5E	PCN 6	T2.0/2.0 /D1.0/24HRS	ULCC FIX	PGTW
8	182201	10.5N 147.2E	PCN 6		ULCC FIX	PGTW
9	182321	11.5N 146.5E	PCN 6		ULCC FIX	PGTW
10	190103	11.5N 146.5E	PCN 6	T2.0/2.0 /D1.0/25HRS	ULCC FIX	PGTW
11	190600	13.3N 146.6E	PCN 6		ULCC FIX	PGTW
12	190919	13.8N 147.0E	PCN 6		ULCC FIX	PGTW
13	191130	13.8N 146.8E	PCN 4		ULCC FIX	PGTW
14	191600	15.1N 146.4E	PCN 4		ULCC FIX	PGTW
15	191757	16.2N 146.4E	PCN 4	T3.0/3.0 /D1.0/24HRS		PGTW
16	192018	16.4N 146.2E	PCN 4			PGTW
17	192137	16.4N 146.2E	PCN 4			PGTW
18	200043	16.8N 146.8E	PCN 3	T3.5/3.5 /D1.5/24HRS		PGTW
19	200300	17.2N 145.9E	PCN 4			PGTW
20	200641	17.8N 145.9E	PCN 3			PGTW
21	200858	18.5N 145.5E	PCN 4			PGTW
22	201200	18.9N 145.4E	PCN 4			PGTW
23	201304	19.1N 145.1E	PCN 4			PGTW
24	201600	20.1N 144.5E	PCN 4			PGTW
25	201800	20.3N 144.7E	PCN 4	T5.0/5.0 /D2.0/24HRS		PGTW
26	201957	20.9N 144.0E	PCN 2			PGTW
27	202112	21.1N 144.0E	PCN 2			PGTW
28	202200	21.6N 143.9E	PCN 1			PGTW
29	210022	21.1N 143.7E	PCN 1	T5.5/5.5 /D2.0/24HRS		PGTW
30	210300	22.2N 143.7E	PCN 2			PGTW
31	210600	22.8N 143.6E	PCN 2			PGTW
32	210659	22.8N 143.7E	PCN 1			PGTW
33	210833	23.1N 143.4E	PCN 2			PGTW
34	210950	23.4N 143.8E	PCN 4			PGTW
35	211200	23.6N 143.8E	PCN 2			PGTW
36	211303	23.7N 143.7E	PCN 1			PGTW
37	211600	24.3N 144.6E	PCN 2			PGTW
38	211800	24.9N 144.2E	PCN 2	T6.5/6.5 /D1.5/24HRS		PGTW
39	211914	25.1N 144.4E	PCN 1			PGTW
40	212100	25.6N 144.2E	PCN 2			PGTW
41	212229	25.6N 145.0E	PCN 2			PGTW
42	220003	26.0N 145.3E	PCN 2	T6.0/6.0 /D0.5/24HRS	EYE FIX	PGTW
43	220300	26.6N 145.7E	PCN 2			PGTW
44	220500	27.1N 146.7E	PCN 2			PGTW
45	220616	27.3N 147.0E	PCN 2			PGTW
46	220815	27.4N 147.2E	PCN 2			PGTW
47	220900	27.8N 147.8E	PCN 2			PGTW
48	220926	28.1N 148.1E	PCN 2			PGTW
49	221200	28.6N 149.2E	PCN 4			PGTW
50	221243	28.8N 149.1E	PCN 1			PGTW
51	221600	29.4N 150.5E	PCN 6			PGTW
52	221800	30.3N 151.3E	PCN 6	T4.5/5.5 /W1.5/24HRS	EYE FIX	PGTW
53	222204	32.0N 153.6E	PCN 6		ULCC FIX	PGTW
54	222342	31.9N 153.0E	PCN 5	T4.5/6.0 /W1.5/24HRS	ULCC FIX	PGTW
55	222342	32.6N 153.1E	PCN 3	T3.5/3.5	INIT OBS	RODN
56	230300	33.4N 164.0E	PCN 6		EXP LLCC	PGTW
57	231600	34.9N 160.9E	PCN 6		EXP LLCC	PGTW
58	231800	35.2N 161.8E	PCN 6		EXP LLCC	PGTW
59	232141	35.5N 164.3E	PCN 4			PGTW
60	232322	35.5N 165.3E	PCN 5	T3.5/4.5 /W1.0/24HRS		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	ACCRV NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	190728	13.6N 147.9E	1500FT		990	45 120 72	310 30 210 70	10 2			+24 +25 +24	2
2	192305	16.4N 146.2E	1500FT		981	60 320 10	180 59 090 10	10 1	CIRCULAR	15	+24 +25 +25	3
3	200154	17.0N 145.3E	700MB	2917	978	75 310 10	180 57 070 17	10 2	CIRCULAR	20	+11 +18 +9	4
4	200543	17.7N 145.8E	700MB	2879		70 020 10	170 49 070 27	5 4	CIRCULAR	20	+6 +15 +11	4
5	200800	18.2N 145.5E	700MB	2866		90 020 15	190 46 010 37	3 5			+16 +16 +12	6
6	200935	20.8N 144.2E	700MB	2718	957	100 110 15	190 79 070 64	15 1	CIRCULAR	10	+17 +19 +15	6
7	202310	21.6N 144.0E	700MB	2662	948	100 220 10	210 75 360 10	10 1			+16 +18	6
8	210743	22.9N 143.9E	700MB	2535	936	90 160 20	210 90 110 10	20 10	CONCENTRIC	10 25	+16 +21	7
9	211025	23.3N 143.6E	700MB	2536		080 76 350 12	10 10		CONCENTRIC	10 30	+13 +20 +14	8
10	212055	25.0N 145.5E	700MB	2544		120 180 10	190 95 130 36	15 8	ELLIPTICAL	20 15	+19 +22 +14	8
11	212338	26.0N 145.1E	700MB	2552	935	110 110 10	320 99 240 10	5 8			+19 +22	9
12	220536	27.2N 146.6E	700MB	2526	925	110 180 15	200 107 080 17	9 1	CIRCULAR	25	+17 +20	9
13	220806	27.8N 147.5E	700MB	2581	941	100 220 10	210 85 160 36	10 1	CIRCULAR	20	+19 +21 +8	10
14	222310	31.4N 152.8E	700MB	2895	979	120 160 36	280 85 160 36	10 1				

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

SUPER TYPHOON VANESSA
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	
10220002	7.5 159.2	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	
10220002	8.1 157.8	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	
10220002	8.1 157.8	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	
10220002	8.6 156.9	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	
10220002	9.1 154.9	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	
10220002	9.4 153.4	35	9.4	153.9	30.0	30.0	11.5	143.9	50.0	98.0	20.0	13.9	144.5	70.0	
10220002	9.8 152.0	40	9.7	152.1	35.0	35.0	11.9	146.6	55.0	59.0	20.0	14.4	142.2	70.0	
10220002	10.1 150.5	40	10.0	150.5	40.0	40.0	12.0	145.3	60.0	82.0	15.0	14.4	140.7	75.0	
10220002	10.4 149.0	50	10.7	149.0	55.0	55.0	12.3	143.7	75.0	106.0	10.0	14.6	139.4	90.0	
10220002	10.8 147.4	70	10.6	147.6	70.0	70.0	12.4	142.7	90.0	137.0	5.0	14.7	138.5	105.0	
10220002	11.3 145.8	75	11.2	146.1	75.0	75.0	12.8	140.2	95.0	95.0	15.0	15.3	135.5	110.0	
10220002	11.8 144.0	80	12.0	144.1	75.0	75.0	14.1	137.7	95.0	35.0	25.0	16.1	133.0	110.0	
10220002	12.3 142.2	85	12.4	142.1	85.0	85.0	14.8	135.7	105.0	13.0	25.0	16.9	131.1	115.0	
10220002	12.8 140.4	95	12.8	140.4	90.0	90.0	15.4	134.7	100.0	50.0	40.0	16.7	130.5	115.0	
10220002	13.4 138.7	110	13.4	138.8	110.0	110.0	15.3	133.1	120.0	30.0	30.0	17.7	129.7	130.0	
10220002	14.1 137.1	120	14.0	137.3	125.0	13.0	15.8	130.4	140.0	57.0	15.0	18.4	128.7	130.0	
10220002	14.8 135.6	130	15.0	135.6	130.0	13.0	15.8	128.8	140.0	133.0	5.0	23.3	128.4	125.0	
10220002	15.3 134.0	140	15.5	134.0	140.0	12.0	15.7	127.8	140.0	145.0	0.0	24.1	129.1	125.0	
10220002	15.7 132.7	150	16.0	132.6	140.0	31.0	15.7	127.8	145.0	91.0	10.0	23.3	128.9	130.0	
10220002	16.0 131.7	155	16.3	131.6	155.0	19.0	15.9	127.6	145.0	101.0	10.0	23.7	128.8	130.0	
10220002	16.5 130.9	150	16.7	130.8	155.0	13.0	15.9	127.6	145.0	92.0	0.0	24.6	130.0	115.0	
10220002	17.2 130.3	145	17.1	130.3	145.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	17.9 129.8	140	17.9	129.8	140.0	0.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	18.8 129.3	135	18.6	129.3	135.0	13.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	19.7 129.3	135	19.6	129.1	135.0	13.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	20.6 129.5	130	20.6	129.3	135.0	11.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	21.4 130.1	125	21.3	130.0	125.0	8.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	22.3 130.7	120	22.2	130.6	120.0	8.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	23.2 131.4	115	23.2	131.4	115.0	18.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	24.1 132.1	110	24.1	132.1	115.0	11.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	25.0 132.8	105	25.0	132.8	110.0	11.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	25.9 133.5	100	25.9	133.5	105.0	11.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	26.8 134.2	95	26.8	134.2	100.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	27.7 134.9	90	27.7	134.9	95.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	28.6 135.6	85	28.6	135.6	90.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	29.5 136.3	80	29.5	136.3	85.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	30.4 137.0	75	30.4	137.0	80.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	31.3 137.7	70	31.3	137.7	75.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	32.2 138.4	65	32.2	138.4	70.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	33.1 139.1	60	33.1	139.1	65.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	34.0 139.8	55	34.0	139.8	60.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	34.9 140.5	50	34.9	140.5	55.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	35.8 141.2	45	35.8	141.2	50.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	36.7 141.9	40	36.7	141.9	45.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	37.6 142.6	35	37.6	142.6	40.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	38.5 143.3	30	38.5	143.3	35.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	39.4 144.0	25	39.4	144.0	30.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	40.3 144.7	20	40.3	144.7	25.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	41.2 145.4	15	41.2	145.4	20.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	42.1 146.1	10	42.1	146.1	15.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	43.0 146.8	5	43.0	146.8	10.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	43.9 147.5	0	43.9	147.5	5.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	44.8 148.2	0	44.8	148.2	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	45.7 148.9	0	45.7	148.9	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	46.6 149.6	0	46.6	149.6	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	47.5 150.3	0	47.5	150.3	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	48.4 151.0	0	48.4	151.0	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	49.3 151.7	0	49.3	151.7	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	50.2 152.4	0	50.2	152.4	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	51.1 153.1	0	51.1	153.1	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	52.0 153.8	0	52.0	153.8	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	52.9 154.5	0	52.9	154.5	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	53.8 155.2	0	53.8	155.2	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	54.7 155.9	0	54.7	155.9	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	55.6 156.6	0	55.6	156.6	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	56.5 157.3	0	56.5	157.3	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	57.4 158.0	0	57.4	158.0	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	58.3 158.7	0	58.3	158.7	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	59.2 159.4	0	59.2	159.4	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	60.1 160.1	0	60.1	160.1	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	61.0 160.8	0	61.0	160.8	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	61.9 161.5	0	61.9	161.5	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	62.8 162.2	0	62.8	162.2	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	63.7 162.9	0	63.7	162.9	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	64.6 163.6	0	64.6	163.6	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	65.5 164.3	0	65.5	164.3	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	66.4 165.0	0	66.4	165.0	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	67.3 165.7	0	67.3	165.7	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
10220002	68.2 166.4	0	68.2	166.4	0.0	6.0	15.7	127.9	130.0	124.0	5.0	25.5	131.2	115.0	
1															

TYPHOON WARREN BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND
102306Z	11.1 116.0	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	0.0	0.0	0.0
102306Z	11.6 116.2	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	0.0	0.0	0.0
102312Z	12.0 116.3	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	0.0	0.0	0.0
102318Z	12.4 116.3	35	10.0	115.9	30	26.0	12.9	114.8	50	83.0	13.3	113.2	55	140.0	13.9	111.1	60	216.0	15.0
102400Z	12.9 116.3	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	0.0	0.0	0.0
102406Z	13.6 116.1	40	13.4	116.2	45	13.0	14.1	115.7	60	18.0	14.8	114.8	70	13.0	15.5	113.2	80	105.0	15.0
102412Z	14.2 115.7	45	13.5	116.1	50	48.0	14.6	115.6	60	12.0	15.9	114.5	70	48.0	16.8	112.7	80	192.0	15.0
102418Z	14.2 115.3	50	14.3	115.2	55	16.0	15.4	113.5	70	110.0	16.6	111.3	80	211.0	18.0	109.3	80	435.0	15.0
102500Z	13.8 115.3	50	14.0	115.5	60	13.0	15.0	114.5	70	27.0	16.9	114.2	80	91.0	16.9	111.4	80	339.0	15.0
102506Z	14.2 116.0	55	14.5	115.8	60	21.0	15.4	114.8	70	32.0	16.4	113.5	75	109.0	17.4	111.6	80	373.0	15.0
102512Z	14.6 115.8	55	14.9	115.2	60	39.0	16.5	114.0	70	91.0	18.1	112.1	75	263.0	19.5	110.0	75	521.0	10.0
102518Z	14.6 115.2	60	15.0	115.0	65	27.0	16.0	113.8	45	71.0	16.9	112.3	45	251.0	17.5	111.2	45	431.0	-20.0
102600Z	14.6 114.7	60	15.3	115.3	55	55.0	16.4	114.8	45	79.0	17.4	114.1	45	207.0	18.2	113.2	45	333.0	-15.0
102606Z	14.9 114.6	65	14.6	114.4	65	21.0	15.1	113.3	70	99.0	15.7	112.3	75	318.0	16.3	111.2	80	385.0	25.0
102612Z	15.1 114.6	65	15.0	114.3	65	18.0	15.0	114.3	65	85.0	16.2	112.9	75	307.0	16.8	112.3	75	306.0	20.0
102618Z	15.1 114.6	65	15.5	114.0	65	30.0	16.1	114.1	70	138.0	17.0	113.8	70	284.0	18.0	113.4	75	259.0	25.0
102700Z	15.1 114.6	65	15.0	114.9	65	18.0	15.4	114.6	70	149.0	16.9	114.2	70	247.0	17.5	113.6	75	218.0	30.0
102706Z	15.3 115.0	65	15.5	115.0	65	12.0	15.9	115.0	70	163.0	16.9	114.4	76	216.0	17.6	113.4	75	213.0	30.0
102712Z	15.4 115.7	65	15.5	115.3	65	24.0	16.5	116.1	70	130.0	17.6	116.5	75	142.0	18.7	116.6	75	212.0	35.0
102718Z	15.5 116.4	65	15.6	115.9	65	32.0	16.5	116.1	70	148.0	17.8	116.5	75	147.0	18.7	116.6	75	245.0	35.0
102800Z	15.5 117.1	65	15.2	117.7	65	39.0	16.3	121.0	45	220.0	15.0	125.3	55	564.0	23.4	129.0	65	989.0	30.0
102806Z	15.6 117.8	65	15.5	117.9	55	5.0	15.9	121.2	40	199.0	15.7	124.9	45	506.0	19.9	129.4	55	974.0	25.0
102812Z	15.7 118.2	65	15.7	118.1	55	8.0	16.7	119.3	45	134.0	16.0	118.6	50	237.0	18.9	116.7	55	373.0	25.0
102818Z	15.5 118.4	65	15.6	118.0	60	24.0	16.5	118.2	65	96.0	15.7	116.7	65	181.0	17.6	114.7	70	286.0	45.0
102900Z	15.4 118.4	65	15.4	118.0	60	17.0	16.0	118.0	65	83.0	15.7	116.3	70	183.0	17.6	114.4	75	311.0	50.0
102906Z	15.4 117.8	55	15.5	117.8	60	6.0	16.0	117.4	65	73.0	16.2	115.4	70	158.0	16.5	113.4	75	259.0	50.0
102912Z	15.4 117.4	55	15.5	117.3	55	5.0	15.7	115.5	50	25.0	16.0	113.5	45	118.0	15.0	113.0	40	0.0	0.0
102918Z	15.4 117.0	50	15.4	116.5	50	29.0	15.6	114.7	50	265.0	16.0	112.7	45	127.0	15.0	112.0	40	0.0	0.0
103000Z	15.4 116.7	45	15.4	116.5	40	3.0	15.5	115.0	40	33.0	15.0	113.0	40	102.0	14.0	111.0	40	0.0	0.0
103006Z	15.4 116.3	45	15.4	116.2	50	6.0	15.5	114.5	45	92.0	15.5	113.0	45	221.0	14.0	111.0	40	0.0	0.0
103012Z	15.3 115.6	40	15.4	115.8	45	13.0	15.5	114.1	45	121.0	15.0	113.0	40	0.0	0.0	0.0	0.0	0.0	0.0
103018Z	15.0 114.8	40	15.4	115.3	38	3.0	15.0	113.0	40	137.0	15.0	113.0	40	0.0	0.0	0.0	0.0	0.0	0.0
103100Z	14.4 113.4	30	14.4	113.4	25.0	0.0	15.0	113.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
103106Z	14.4 113.4	30	14.4	113.4	25.0	0.0	15.0	113.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
103112Z	14.0 112.7	30	14.0	112.7	0.0	0.0	15.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
103118Z	13.6 112.0	25	13.6	112.0	0.0	0.0	15.0	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110100Z	13.1 111.4	25	13.1	111.4	0.0	0.0	15.0	111.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110106Z	13.0 110.8	25	13.0	110.8	0.0	0.0	15.0	110.0	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
21	95	205	353	22	93	215	328
9	53	128	219	9	54	139	207
4	10	15	24	4	9	13	20
0	4	11	20	1	3	9	15
31	29	27	23	30	26	22	18

AVG FORECAST POSIT ERROR
 AVG RIGHT ANGLE ERROR
 AVG INTENSITY MAGNITUDE ERROR
 AVG INTENSITY BIAS
 NUMBER OF FORECASTS

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1111. NM
 AVERAGE SPEED OF TROPICAL CYCLONE IS 5. KNOTS

TYPHOON WARREN FIX POSITIONS FOR CYCLONE NO. 26

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCUR	DVORAK CODE	COMMENTS	SITE
1	230300	11.5N 115.7E	PCN 4	T1.0/1.0	INIT OBS EXP LLCC	PGT
2	230600	11.5N 116.1E	PCN 4		EXP LLCC	PGT
3	230743	11.7N 116.4E	PCN 3	T1.5/1.5	INIT OBS EXP LLCC	RPM
4	231200	12.0N 116.5E	PCN 6			PGT
5	231600	12.2N 116.2E	PCN 6			PGT
6	231800	12.4N 116.6E	PCN 6	T2.5/2.5	INIT OBS	PGT
7	232030	12.5N 116.0E	PCN 5		ULCC FIX	PGT
8	232100	12.6N 115.8E	PCN 6		ULCC FIX	PGT
9	232216	12.7N 116.0E	PCN 6	T3.0/3.0	INIT OBS	ROD
10	232321	12.7N 115.3E	PCN 5			ROD
11	232322	12.6N 116.2E	PCN 6			RPM
12	240245	13.0N 116.0E	PCN 5	T2.5/2.5 /D1.0/19HRS		RPM
13	240300	13.2N 116.4E	PCN 4	T3.5/3.5 /D2.5/24HRS		PGT
14	240722	13.1N 115.9E	PCN 3	T3.0/3.0 /D1.5/24HRS		RPM
15	240733	13.4N 115.7E	PCN 6			PGT
16	240900	13.7N 115.9E	PCN 6			PGT
17	241056	13.8N 115.9E	PCN 5			ROD
18	241200	13.3N 115.2E	PCN 5			RPM
19	241200	14.1N 115.8E	PCN 6			PGT
20	241526	13.2N 115.1E	PCN 6			RPM
21	241600	14.3N 115.3E	PCN 6			PGT
22	241800	14.4N 115.0E	PCN 6	T4.0/4.0 /D1.5/24HRS		RPM
23	242018	14.0N 115.1E	PCN 5			PGT
24	242558	13.8N 115.4E	PCN 6			RPM
25	250224	14.7N 116.5E	PCN 3	T4.0/4.0 /D1.0/28HRS		ROD
26	250721	14.8N 115.8E	PCN 4			PGT
27	250721	14.8N 115.8E	PCN 3	T3.0/3.0+/S0.0/24HRS	EXP LLCC	RPM
28	251034	14.6N 115.6E	PCN 6			RPM
29	251136	14.9N 114.9E	PCN 3		EXP LLCC	RPM
30	251136	14.0N 113.7E	PCN 4			ROD
31	251200	14.8N 115.3E	PCN 6			PGT
32	251505	14.7N 114.5E	PCN 3			ROD
33	251600	15.0N 115.0E	PCN 6	T3.0/4.0+/W1.0/22HRS		PGT
34	252005	15.0N 115.0E	PCN 5		ULCC FIX	RPM
35	252315	15.3N 115.6E	PCN 3			RPM
36	260000	14.6N 115.0E	PCN 6			PGT
37	260205	14.5N 114.9E	PCN 3	T3.0/3.0 /S0.0/19HRS	EXP LLCC	PGT
38	260300	14.8N 114.8E	PCN 6	T3.0/3.5 /S0.0/20HRS	EXP LLCC	RPM
39	260600	15.0N 114.7E	PCN 4			PGT
40	260900	15.6N 113.8E	PCN 6			PGT
41	261112	15.0N 114.9E	PCN 3			RPM
42	261112	13.9N 113.3E	PCN 6		ULCC FIX	ROD
43	261445	15.2N 115.2E	PCN 5			RPM
44	261600	15.4N 115.6E	PCN 6	T2.5/3.0 /W0.5/24HRS		PGT
45	261800	15.6N 115.0E	PCN 6			PGT
46	262253	15.4N 115.4E	PCN 4	T3.5/4.0 /W0.5/21HRS	EXP LLCC	ROD
47	262350	15.0N 115.1E	PCN 3		EXP LLCC	RPM
48	270144	15.2N 115.0E	PCN 3		EXP LLCC	PGT
49	270144	15.2N 114.9E	PCN 4		EXP LLCC	ROD
50	270300	15.3N 115.2E	PCN 4	T3.0/3.0+/S0.0/24HRS	EXP LLCC	PGT
51	270600	15.5N 115.0E	PCN 4		EXP LLCC	PGT
52	270835	15.0N 115.1E	PCN 3		EXP LLCC	RPM
53	270900	15.6N 115.4E	PCN 6		EXP LLCC	PGT
54	271048	15.4N 115.7E	PCN 6			PGT
55	271134	15.0N 115.0E	PCN 5	T3.0/3.0 /S0.0/31HRS		RPM
56	272326	15.2N 117.9E	PCN 3	T3.5/3.5 /D0.5/15HRS		RPM
57	272326	15.3N 117.0E	PCN 6			PGT
58	272326	15.2N 117.6E	PCN 6			ROD
59	280124	15.3N 118.2E	PCN 5			PGT
60	280124	15.3N 118.1E	PCN 3			RPM
61	280300	15.4N 117.9E	PCN 6	T4.0/4.0-/D1.0/24HRS		PGT
62	280600	15.8N 118.2E	PCN 6			PGT
63	280825	15.4N 118.0E	PCN 5	T3.5/3.5-/D0.5/24HRS		RPM

RPMK
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PGTW

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/MET	EYE SHAPE	EYE ORIENT- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	250216	14.0N 115.8E	1500FT		985	50 360 40	230 47 180 24	12 4 5			+29 +29	1
2	260316	14.7N 115.5E	1500FT		989	65 360 40	220 60 050 37	4 4 5			+29 +26	2
3	260551	14.5N 114.4E	700MB	2951	982	75 130 40	220 55 120 60	4 4 5			+17 +20 + 8	3
4	270032	14.9N 114.7E	700MB	2977		70 080 30	220 77 120 56	4 4 4			+21 +21	3
5	270305	15.3N 114.8E	700MB	2951	979	40 010 90	320 57 040 83	5 5 5				3
6	270951	15.3N 115.5E	1500FT		983	55 050 60	270 68 190 65	5 5 5				3
7	271227	15.2N 115.5E	700MB	2892	976		240 59 130 86	5 5 5			+22 +25 +19	4
8	280257	15.5N 117.4E	700MB	2905		50 290 30	010 53 300 20	15 3 3			+ 9 +18 +12	4
9	280658	15.7N 117.8E	700MB	2982		65 090 20	300 58 100 60	10 5 5			+ 7 +24 +25	5
10	290957	15.7N 118.3E	700MB	2918		50 070 50	210 51 180 95	10 5 5			+12 +12 +13	5
11	281135	15.7N 118.1E	700MB	2929	976		300 60 240 15	8 5 5	CIRCULAR	35	+12 +17 +11	6
12	290941	15.5N 117.5E	1500FT		990	45 070 30	070 55 130 50	5 5 5			+22 +25 +23	7
13	290941	15.5N 117.5E	700MB	3003	984		030 52 220 75	5 5 5			+ 9 +15 +15	7
14	290645	15.3N 116.7E	700MB	3004		310	040 050 90	7 8 5			+24 +25 +23	8
15	292333	15.3N 116.7E	1500FT		994	50 030 130	120 51 030 48	8 5 5			+23 +26 +23	8
16	300333	15.5N 116.0E	700MB	3071	995	50 030 105	070 44 330 55	5 5 5			+24 +25 +22	8
17	300855	15.4N 115.9E	1500FT		992	40 070 60	140 42 050 100	10 8 5			+24 +26 +22	8
18	301129	15.3N 115.3E	700MB	3056			130 42 060 100	10 8 5			+12 +15 + 8	9
19	301410	15.2N 115.1E	700MB	3057			200 42 110 45	10 10 10			+12 +15 + 8	9
20	302232	14.9N 114.4E	1500FT			25 180 30	240 39 180 15	15 7 7			+23 +23 +22	10
21	310129	14.9N 113.9E	1500FT			150 060 60	340 030 60	6 10 10			+23 +23 +22	10
22	310545	14.4N 113.5E	1500FT		999	38 060 65	340 020 60	6 10 10			+29 +29 +29	28

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRV	EYE SHAPE	EYE DIAM	RADAR-CODE ASUAR	TDDFF	COMMENTS	RADAR POSITION	SITE WHO NO
1	280500	15.2N 117.5E	LAND				1041	////		16.3N 120.6E	98321
2	280600	15.3N 117.8E	LAND				1042	57020		16.3N 120.6E	98321
3	280900	15.5N 118.0E	LAND				10412	49005	EYE 60 PCT OPN	16.3N 120.6E	98321
4	281200	15.1N 118.2E	LAND				1041	49005		16.6N 120.3E	98321
5	281500	15.6N 117.8E	LAND				10212	45305	EYE 60 PCT CIR OPN NNW	16.3N 120.6E	98321
6	281800	15.6N 117.8E	LAND				1041	49005		16.3N 120.6E	98321
7	281800	15.8N 118.4E	LAND				1041	49005		16.6N 120.3E	98321
8	281900	15.9N 118.4E	LAND				10412	49005		16.3N 120.6E	98321
9	290100	15.4N 116.9E	LAND				4	52705		16.3N 120.6E	98321
10	290300	15.4N 117.3E	LAND				4	42704		16.3N 120.6E	98321
11	290400	15.4N 117.2E	LAND				10312	42705	EYE 60 PCT CIR OPN E	16.3N 120.6E	98321
12	290800	4N 116.9E	LAND				4	52705		16.3N 120.6E	98321

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	251800	15.0N 115.0E	055	005	SHIP

198

PGTU
RPMK
PGTU
RPMK
PGTU
PGTU
RODN
RPMK
PGTU
RPMK
PGTU
RODN
RPMK
PGTU
RPMK
PGTU
RODN
RPMK
PGTU
RPMK
PGTU
PGTU
PGTU
PGTU
PGTU
PGTU

FIX NO.	TIME (Z)	POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRV NAV/RET	EYE SHAPE	EYE ORIENT- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	010513	5.8N 143.0E	700MB	3815								
2	012032	7.5N 140.3E	700MB	3825	996	50 030 5	170 48 090 10	9 1	CIRCULAR	15	+10 +13 +10	1
3	012325	7.7N 139.5E	700MB	3825	993	55 340 15	050 60 060 20	4 5	ELLIPTICAL	30 20 240	+10 +14 +7	3
4	020535	8.2N 138.5E	700MB	2994	988	60 360 10	060 65 360 11	10 10	ELLIPTICAL	15 10 250	+10 +14 +7	1
5	020931	8.3N 138.0E	1500FT	987	987	60 260 10	080 28 260 33	10 10				3
6	022117	9.0N 137.7E	700MB	2913	980	50 360 10	050 30 360 10	10 10	CIRCULAR	20	+26 +28 +27	1
7	022332	9.1N 135.3E	700MB	2889	978	100 330 10		10 10	CIRCULAR	15	+15 +17 +10	6
8	023532	9.4N 134.0E	700MB	2692	956	100 330 5	150 92 070 27	5 1	CIRCULAR	10	+16 +19 +10	7
9	024109	9.3N 134.5E	700MB	2695	951	110 330 5	240 37 160 25	10 10	CIRCULAR	15	+12 +18 +10	8
10	032005	9.9N 131.0E	700MB	2665	956	110 330 5	050 05 090 12	10 10	CIRCULAR	8	+11 +19 +10	7
11	032303	10.0N 130.3E	700MB	2445	926	100 200 6	050 93 300 10	10 10	CIRCULAR	10	+8 +21 +12	8
12	040850	10.7N 128.1E	700MB	2513	925	100 090 10	100 106 070 14	5 1	CONCENTRIC	10 30	+8 +15 +14	9
13	041127	10.8N 127.5E	700MB	2423			060 106 330 22	4 1	CONCENTRIC	08 25	+8 +19 +12	9
14	050900	11.5N 121.8E	700MB	2913	973	35 300 90	050 73 300 54	10 10	CIRCULAR	15	+3 +6 +2	10
15	052145	11.7N 120.9E	700MB	2909	973		060 72 360 40	10 10	CIRCULAR	15	+8 +15 +6	10
16	052828	12.1N 118.4E	700MB	2853	977	90 020 20	140 95 020 30	10 10	CIRCULAR	20	+9 +15 +7	11
17	060004	12.1N 118.9E	700MB	2864			050 060 16	10 10	CIRCULAR	20	+11 +18 +8	11
18	060843	12.7N 115.3E	700MB	2790		100 060 20	070 89 350 04	6 5	CIRCULAR	45	+11 +18 +8	11
19	061136	12.9N 114.1E	700MB	2801	966							11

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR	TDDFF	COMMENTS	RADAR POSITION	SITE UMO NO.
1	050200	11.5N 123.4E	LAND				20963	52730		14.0N 124.3E	98447
2	050300	11.4N 123.8E	LAND				10802	47777		14.0N 124.3E	98447
3	050400	11.5N 122.9E	LAND				10782	52730		14.0N 124.3E	98447
4	050600	11.8N 122.5E	LAND				2552	53037	EYE BECOMING LESS DISTINCT	14.0N 124.3E	98447

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

TYPHOON BILL
BEST TRACK DATA

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	29.	98.	226.	405.	15.	93.	220.	389.	
AVG RIGHT ANGLE ERROR	14.	14.	18.	22.	15.	136.	28.	28.	
AVG INTENSITY MAGNITUDE ERROR	8.	14.	18.	22.	8.	12.	18.	21.	
AVG INTENSITY BIAS	-0.	3.	4.	7.	-1.	1.	3.	4.	
NUMBER OF FORECASTS	52	46	41	39	46	42	40	36	
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2892. NM									
AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS									

**TYPHOON BILL
FIX POSITIONS. FOR CYCLONE NO. 28**

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	072323	13.5N 154.5E	PCN 5			
2	080300	14.0N 154.2E	PCN 6	T1.5/1.5	INIT OBS	PGTW
3	080607	13.9N 154.7E	PCN 5			PGTW
4	080900	14.1N 154.6E	PCN 5			PGTW
5	081204	14.7N 154.3E	PCN 6		ULCC 14.1N 155.8E	PGTW
6	081600	14.1N 155.3E	PCN 6		ULCC FIX	PGTW
7	081800	14.6N 153.6E	PCN 6	T1.5/1.5	INIT OBS ULCC 14.0N 155.3E	PGTW
8	081959	14.2N 153.9E	PCN 6		ULCC 14.2N 155.1E	PGTW
9	082300	14.0N 154.1E	PCN 6	T3.0/3.0 /D1.5/24HRS		PGTW
10	090300	14.1N 153.6E	PCN 6			PGTW
11	090554	14.2N 153.7E	PCN 5			PGTW
12	090839	14.0N 153.9E	PCN 5			PGTW
13	091143	14.3N 154.7E	PCN 6	T3.0/3.0 /D1.5/24HRS	ULCC 14.9N 154.9E	PGTW
14	091600	14.3N 154.3E	PCN 6			PGTW
15	091839	14.2N 154.3E	PCN 5			PGTW
16	091937	14.3N 154.5E	PCN 6			PGTW
17	092133	14.4N 153.7E	PCN 5			PGTW
18	100024	14.0N 154.2E	PCN 3	T3.0/3.0+/S0.0/25HRS		PGTW
19	100300	14.1N 153.7E	PCN 6			PGTW
20	100542	14.2N 153.8E	PCN 6			PGTW
21	100817	14.3N 153.7E	PCN 6			PGTW
22	101200	15.5N 153.2E	PCN 6		ULCC FIX	PGTW
23	101600	14.7N 153.3E	PCN 6	T3.0/3.0+/S0.0/24HRS		PGTW
24	101800	14.2N 153.1E	PCN 6		ULCC FIX	PGTW
25	101916	14.2N 152.8E	PCN 6		ULCC FIX	PGTW
26	102109	14.3N 152.4E	PCN 5			PGTW
27	110004	14.2N 152.5E	PCN 3	T4.0/4.0 /D1.0/24HRS		PGTW
28	110000	14.6N 152.7E	PCN 6			PGTW
29	110529	14.7N 152.3E	PCN 6			PGTW
30	110756	14.2N 151.7E	PCN 4			PGTW
31	111244	14.3N 150.9E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTW
32	111600	14.0N 150.0E	PCN 6			PGTW
33	111814	13.8N 150.3E	PCN 6			PGTW
34	112036	13.8N 149.9E	PCN 6		ULCC 14.8N 150.5E	PGTW
35	112100	13.8N 150.1E	PCN 6			PGTW
36	112444	13.7N 149.9E	PCN 3	T3.5/4.0+/W0.5/24HRS		PGTW
37	120300	13.6N 148.5E	PCN 4			PGTW
38	120517	13.4N 147.7E	PCN 5			PGTW
39	120916	13.2N 146.7E	PCN 3			PGTW
40	121224	13.8N 145.6E	PCN 4	T4.5/4.5 /D1.0/24HRS		PGTW
41	121600	13.1N 144.8E	PCN 4			PGTW
42	121801	13.1N 144.0E	PCN 4			PGTW
43	122015	13.1N 143.5E	PCN 4			PGTW
44	130105	12.8N 141.8E	PCN 3	T4.5/4.5 /D1.0/25HRS		PGTW
45	130300	12.8N 141.2E	PCN 3			PGTW
46	130646	12.7N 140.3E	PCN 2			PGTW

[illegible]

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	080735	14.4N 153.6E	850MB			20 240 90	280 30 220 60	8 10					
2	082142	14.2N 153.7E	1500FT		1000	40 320 40	050 40 320 49	12 10 10				+21 +20 +16	1
3	082348	13.8N 153.7E	1500FT		999	45 350 40	060 48 350 45	12 10 10				+24 +25 +23	2
4	090555	14.2N 153.9E	700MB	3070		40 260 45	220 31 140 103	8 10				+24 +25 +23	4
5	090826	14.2N 153.8E	700MB	3071	998		150 37 040 65	12 10 10				+13 +15 + 9	5
6	092102	14.3N 153.9E	700MB	3037	990	50 260 30	340 56 260 33	8 4				+21 +21	5
7	092328	14.3N 153.8E	700MB	3037	990	50 360 30	120 50 360 14	8 1				+26 +27 +26	5
8	100601	14.3N 153.7E	700MB	3004		65 240 20	300 55 230 17	10 10				+19 +22 +10	7
9	100835	14.3N 153.7E	700MB	3038			180 48 060 30	10 10				+13 +17 + 7	7
10	102042	14.3N 153.1E	700MB	3046		50 270 20	260 39 180 20	15 10				+17 +19 + 7	8
11	102323	14.6N 152.9E	700MB	2364	986	100 350 40	080 57 350 10	10 10				+15 +15 +16	10
12	110832	14.3N 151.8E	700MB	3019	983		190 33 130 140	4 10				+12 +13 +13	11
13	111036	14.2N 151.6E	700MB	3021	991		080 64 320 58	10 10				+13 +17 + 9	11
14	112050	13.4N 149.9E	700MB	3019		70 270 40	080 64 320 58	10 10				+13 +17 + 9	11
15	122331	13.4N 149.1E	700MB	3009	991	70 030 30	140 47 030 120	6 10				+16 +20 + 2	13
16	121213	12.7N 146.0E	700MB	2323	981		350 65 320 150	5 10				+12 +18 +13	13
17	121641	13.0N 144.6E	700MB	2353	983		090 78 330 45	17 10				+14 +11 +11	15
18	122300	12.8N 142.5E	700MB	2341	969	100 310 10	090 70 360 20	6 10				+12 +18 +13	15
19	130741	12.7N 139.7E	700MB	2317	967	80 280 10	030 69 280 30	6 10				+11 +15 +12	15
20	131019	12.5N 138.9E	700MB	2792	966		090 90 360 20	6 10				+11 +15 +12	15

RADAR FIXES

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

TYPHOON CLARA
BEST TRACK DATA

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND	DST WIND	POSIT	WIND
111400Z	5.4 155.4	20	5.4 155.4	20	0.0 0.0	5.4 155.4	20	0.0 0.0	5.4 155.4	20	0.0 0.0	5.4 155.4	20	0.0 0.0	5.4 155.4	20	0.0 0.0	5.4 155.4	20
111406Z	5.7 155.4	25	5.7 155.4	25	0.0 0.0	5.7 155.4	25	0.0 0.0	5.7 155.4	25	0.0 0.0	5.7 155.4	25	0.0 0.0	5.7 155.4	25	0.0 0.0	5.7 155.4	25
111412Z	6.1 154.4	25	6.1 154.4	25	0.0 0.0	6.1 154.4	25	0.0 0.0	6.1 154.4	25	0.0 0.0	6.1 154.4	25	0.0 0.0	6.1 154.4	25	0.0 0.0	6.1 154.4	25
111418Z	6.7 153.1	25	6.7 153.1	25	0.0 0.0	6.7 153.1	25	0.0 0.0	6.7 153.1	25	0.0 0.0	6.7 153.1	25	0.0 0.0	6.7 153.1	25	0.0 0.0	6.7 153.1	25
111500Z	7.2 151.7	30	7.2 151.7	30	0.0 0.0	7.2 151.7	30	0.0 0.0	7.2 151.7	30	0.0 0.0	7.2 151.7	30	0.0 0.0	7.2 151.7	30	0.0 0.0	7.2 151.7	30
111506Z	7.7 149.9	35	7.7 149.9	35	0.0 0.0	7.7 149.9	35	0.0 0.0	7.7 149.9	35	0.0 0.0	7.7 149.9	35	0.0 0.0	7.7 149.9	35	0.0 0.0	7.7 149.9	35
111512Z	8.9 148.2	45	8.9 148.2	45	0.0 0.0	8.9 148.2	45	0.0 0.0	8.9 148.2	45	0.0 0.0	8.9 148.2	45	0.0 0.0	8.9 148.2	45	0.0 0.0	8.9 148.2	45
111518Z	8.4 147.2	55	8.4 147.2	55	0.0 0.0	8.4 147.2	55	0.0 0.0	8.4 147.2	55	0.0 0.0	8.4 147.2	55	0.0 0.0	8.4 147.2	55	0.0 0.0	8.4 147.2	55
111600Z	9.1 146.0	60	9.1 146.0	60	0.0 0.0	9.1 146.0	60	0.0 0.0	9.1 146.0	60	0.0 0.0	9.1 146.0	60	0.0 0.0	9.1 146.0	60	0.0 0.0	9.1 146.0	60
111606Z	9.4 144.6	65	9.4 144.6	65	0.0 0.0	9.4 144.6	65	0.0 0.0	9.4 144.6	65	0.0 0.0	9.4 144.6	65	0.0 0.0	9.4 144.6	65	0.0 0.0	9.4 144.6	65
111612Z	9.3 142.8	70	9.3 142.8	70	0.0 0.0	9.3 142.8	70	0.0 0.0	9.3 142.8	70	0.0 0.0	9.3 142.8	70	0.0 0.0	9.3 142.8	70	0.0 0.0	9.3 142.8	70
111618Z	10.2 141.3	75	10.2 141.3	75	0.0 0.0	10.2 141.3	75	0.0 0.0	10.2 141.3	75	0.0 0.0	10.2 141.3	75	0.0 0.0	10.2 141.3	75	0.0 0.0	10.2 141.3	75
111700Z	10.5 139.9	80	10.5 139.9	80	0.0 0.0	10.5 139.9	80	0.0 0.0	10.5 139.9	80	0.0 0.0	10.5 139.9	80	0.0 0.0	10.5 139.9	80	0.0 0.0	10.5 139.9	80
111706Z	10.9 138.5	85	10.9 138.5	85	0.0 0.0	10.9 138.5	85	0.0 0.0	10.9 138.5	85	0.0 0.0	10.9 138.5	85	0.0 0.0	10.9 138.5	85	0.0 0.0	10.9 138.5	85
111712Z	11.5 137.1	95	11.5 137.1	95	0.0 0.0	11.5 137.1	95	0.0 0.0	11.5 137.1	95	0.0 0.0	11.5 137.1	95	0.0 0.0	11.5 137.1	95	0.0 0.0	11.5 137.1	95
111718Z	12.0 135.8	105	12.0 135.8	105	0.0 0.0	12.0 135.8	105	0.0 0.0	12.0 135.8	105	0.0 0.0	12.0 135.8	105	0.0 0.0	12.0 135.8	105	0.0 0.0	12.0 135.8	105
111800Z	12.5 134.7	110	12.5 134.7	110	0.0 0.0	12.5 134.7	110	0.0 0.0	12.5 134.7	110	0.0 0.0	12.5 134.7	110	0.0 0.0	12.5 134.7	110	0.0 0.0	12.5 134.7	110
111806Z	13.2 133.8	110	13.2 133.8	110	0.0 0.0	13.2 133.8	110	0.0 0.0	13.2 133.8	110	0.0 0.0	13.2 133.8	110	0.0 0.0	13.2 133.8	110	0.0 0.0	13.2 133.8	110
111812Z	14.0 133.1	100	14.0 133.1	100	0.0 0.0	14.0 133.1	100	0.0 0.0	14.0 133.1	100	0.0 0.0	14.0 133.1	100	0.0 0.0	14.0 133.1	100	0.0 0.0	14.0 133.1	100
111818Z	15.0 132.7	90	15.0 132.7	90	0.0 0.0	15.0 132.7	90	0.0 0.0	15.0 132.7	90	0.0 0.0	15.0 132.7	90	0.0 0.0	15.0 132.7	90	0.0 0.0	15.0 132.7	90
111900Z	16.0 132.4	80	16.0 132.4	80	0.0 0.0	16.0 132.4	80	0.0 0.0	16.0 132.4	80	0.0 0.0	16.0 132.4	80	0.0 0.0	16.0 132.4	80	0.0 0.0	16.0 132.4	80
111906Z	17.3 132.4	70	17.3 132.4	70	0.0 0.0	17.3 132.4	70	0.0 0.0	17.3 132.4	70	0.0 0.0	17.3 132.4	70	0.0 0.0	17.3 132.4	70	0.0 0.0	17.3 132.4	70
111912Z	18.6 132.5	100	18.6 132.5	100	0.0 0.0	18.6 132.5	100	0.0 0.0	18.6 132.5	100	0.0 0.0	18.6 132.5	100	0.0 0.0	18.6 132.5	100	0.0 0.0	18.6 132.5	100
111918Z	19.7 132.7	110	19.7 132.7	110	0.0 0.0	19.7 132.7	110	0.0 0.0	19.7 132.7	110	0.0 0.0	19.7 132.7	110	0.0 0.0	19.7 132.7	110	0.0 0.0	19.7 132.7	110
112000Z	20.8 132.4	105	20.8 132.4	105	0.0 0.0	20.8 132.4	105	0.0 0.0	20.8 132.4	105	0.0 0.0	20.8 132.4	105	0.0 0.0	20.8 132.4	105	0.0 0.0	20.8 132.4	105
112006Z	22.0 134.4	100	22.0 134.4	100	0.0 0.0	22.0 134.4	100	0.0 0.0	22.0 134.4	100	0.0 0.0	22.0 134.4	100	0.0 0.0	22.0 134.4	100	0.0 0.0	22.0 134.4	100
112012Z	23.4 136.0	90	23.4 136.0	90	0.0 0.0	23.4 136.0	90	0.0 0.0	23.4 136.0	90	0.0 0.0	23.4 136.0	90	0.0 0.0	23.4 136.0	90	0.0 0.0	23.4 136.0	90
112018Z	24.7 138.2	75	24.7 138.2	75	0.0 0.0	24.7 138.2	75	0.0 0.0	24.7 138.2	75	0.0 0.0	24.7 138.2	75	0.0 0.0	24.7 138.2	75	0.0 0.0	24.7 138.2	75
112024Z	26.6 143.0	70	26.6 143.0	70	0.0 0.0	26.6 143.0	70	0.0 0.0	26.6 143.0	70	0.0 0.0	26.6 143.0	70	0.0 0.0	26.6 143.0	70	0.0 0.0	26.6 143.0	70
112100Z	27.1 145.7	60	27.1 145.7	60	0.0 0.0	27.1 145.7	60	0.0 0.0	27.1 145.7	60	0.0 0.0	27.1 145.7	60	0.0 0.0	27.1 145.7	60	0.0 0.0	27.1 145.7	60

	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	29	185	265	265		29	94	185	265
AVG RIGHT ANGLE ERROR	13	61	93	131		14	61	93	131
AVG INTENSITY MAGNITUDE ERROR	8	16	17	22		8	16	17	22
AVG INTENSITY BIAS	-1	2	2	8		-2	2	4	8
NUMBER OF FORECASTS	30	26	22	18		26	26	22	18

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2709. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 15. KNOTS

TYPHOON CLARA
FIX POSITIONS FOR CYCLONE NO. 29

SATELLITE FIXES

FIX NO.	TIME (Z)	POSITION	ACCUR	DVORAK CODE	COMMENTS	SITE	
*****	1	130600	4.7N 157.1E	PCN 6	T0.0/0.0	INIT OBS	PGTU
	2	131200	6.0N 156.9E	PCN 6			PGTU
	3	131600	5.8N 156.2E	PCN 6	T1.5/1.5	INIT OBS	PGTU
	4	131800	6.0N 155.7E	PCN 6			PGTU
	5	131954	5.7N 155.3E	PCN 6			PGTU
	6	132303	5.4N 155.0E	PCN 6			PGTU
	7	140452	5.5N 155.7E	PCN 6			PGTU
	8	140600	5.4N 155.7E	PCN 6	T2.0/2.0 /D0.5/10HRS		PGTU
	9	140834	6.0N 155.0E	PCN 6		ULCC FIX	PGTU
	10	141144	7.2N 153.3E	PCN 6			PGTU
*****	11	141600	8.5N 150.1E	PCN 6	T3.5/3.5	INIT OBS	PGTU
	12	141736	7.7N 152.3E	PCN 6			PGTU
	13	141933	8.4N 151.1E	PCN 6			PGTU
	14	142113	7.9N 151.4E	PCN 5			PGTU
	15	150000	8.2N 150.9E	PCN 6		ULCC FIX	PGTU
	16	150024	7.6N 150.5E	PCN 6		ULCC FIX	PGTU
	17	150300	7.9N 150.1E	PCN 6	T3.0/3.0 /D1.0/21HRS		PGTU
	18	150600	7.8N 149.7E	PCN 6		ULCC FIX	PGTU
	19	150621	7.3N 149.6E	PCN 6		ULCC FIX	PGTU
	20	150812	7.8N 149.1E	PCN 6		ULCC FIX	PGTU
	21	150951	8.0N 149.1E	PCN 6		ULCC FIX	PGTU
	22	151200	8.3N 147.7E	PCN 6			PGTU
	23	151305	7.7N 147.6E	PCN 5			PGTU
	24	151600	8.5N 147.4E	PCN 6			PGTU
	25	151800	8.9N 147.0E	PCN 6	T3.0/3.5 /W0.5/26HRS		PGTU
	26	151906	9.1N 146.9E	PCN 6			PGTU
	27	152053	8.9N 146.1E	PCN 6			PGTU
	28	160004	9.1N 145.3E	PCN 5			PGTU
	29	160300	9.3N 145.4E	PCN 4	T3.5/3.5 /D0.5/24HRS		PGTU
	30	160600	9.6N 144.7E	PCN 3			PGTU
*****	31	160933	9.6N 143.5E	PCN 6			PGTU
	32	161244	9.8N 142.5E	PCN 6			PGTU
	33	161853	10.4N 140.9E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTU
	34	162031	10.6N 140.3E	PCN 6			PGTU
	35	162205	10.1N 140.5E	PCN 5			PGTU
	36	170125	10.5N 140.0E	PCN 6			PGTU
	37	170300	10.6N 139.6E	PCN 6			PGTU
	38	170556	11.1N 138.3E	PCN 5	T4.5/4.5 /D1.0/27HRS		PGTU
	39	170556	11.0N 138.6E	PCN 6	T4.0/4.0	INIT OBS	RODN
	40	170911	11.2N 137.9E	PCN 6			PGTU
	41	171200	11.8N 137.0E	PCN 6			PGTU
	42	171800	12.6N 135.8E	PCN 6	T5.0/5.0 /D1.5/24HRS		PGTU
	43	172100	12.5N 135.1E	PCN 6			PGTU
	44	180000	12.3N 134.4E	PCN 4			PGTU
	45	180105	12.6N 134.6E	PCN 6			PGTU
	46	180300	12.8N 134.1E	PCN 6	T5.0/5.0 /D1.0/20HRS	INIT OBS	RPMK
	47	180600	13.4N 133.7E	PCN 4			PGTU
	48	180725	13.0N 133.6E	PCN 3			RPMK
	49	181000	14.1N 133.1E	PCN 5			RPMK
	50	181020	13.5N 133.2E	PCN 5			RODN
*****	51	181200	14.2N 133.1E	PCN 6			PGTU
	52	181346	14.5N 132.9E	PCN 5			RPMK
	53	181600	14.6N 133.1E	PCN 6	T5.5/5.5 /D0.5/22HRS		PGTU
	54	181800	15.3N 132.9E	PCN 6			RPMK
	55	182010	15.0N 132.3E	PCN 4			RPMK
	56	182100	15.8N 132.8E	PCN 6			PGTU
	57	182130	15.1N 132.7E	PCN 4		ULCC FIX	PGTU
	58	182130	15.2N 132.3E	PCN 4		RPMK	PGTU
	59	182258	15.8N 132.3E	PCN 4			PGTU
	60	182258	15.3N 132.6E	PCN 4			RPMK
	61	190000	16.3N 132.1E	PCN 1			PGTU
	62	190045	15.7N 132.2E	PCN 2	T6.0/6.0	INIT OBS	RSKO
	63	190300	16.8N 132.2E	PCN 2	T5.0/5.0 /W0.5/24HRS		PGTU
	64	190713	17.4N 132.6E	PCN 2			PGTU
	65	190900	18.1N 132.1E	PCN 2			PGTU
	66	191010	17.8N 132.2E	PCN 2			PGTU
	67	191200	18.7N 132.3E	PCN 2			PGTU
	68	191325	19.2N 132.5E	PCN 1			PGTU
	69	191600	19.5N 132.6E	PCN 2	T6.0/6.0-/D0.5/24HRS		PGTU

AIRCRAFT FIXES

SYNOPTIC FIXES

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			
MO/DA/HR	POSIT	WIND		POSIT	WIND	ERRORS	DST WIND	POSIT	WIND	ERRORS	DST WIND	POSIT	WIND	ERRORS	DST WIND	POSIT	WIND	ERRORS	DST WIND
120206Z	6.3	149.2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120212Z	6.4	148.2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120218Z	6.6	146.8	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120300Z	6.9	145.4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120306Z	7.0	144.1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120312Z	7.2	142.9	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120318Z	7.4	141.9	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120400Z	7.5	141.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120406Z	7.7	140.2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120412Z	8.0	139.2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120418Z	8.3	138.3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120500Z	8.6	137.5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120506Z	9.1	136.7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120512Z	9.6	136.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120518Z	10.2	135.3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120600Z	10.8	134.8	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120606Z	11.1	134.3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120612Z	11.5	133.8	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120618Z	12.0	133.4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120700Z	13.6	133.1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120706Z	14.4	132.7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120712Z	15.0	132.3	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120718Z	15.5	131.9	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120800Z	15.8	131.4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120806Z	16.1	131.4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120812Z	16.5	131.1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120818Z	17.0	130.7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120900Z	17.1	130.4	0	0.0	0.0	0.0	0.0	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	18.1	130.1	0	0.0	0.0	0.0	0.0	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	18.7	130.0	0	0.0	0.0	0.0	0.0	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	19.0	129.9	0	0.0	0.0	0.0	0.0	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	20.0	130.4	0	0.0	0.0	0.0	0.0	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	20.8	130.4	0	0.0	0.0	0.0	0.0	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	21.9	131.2	0	0.0	0.0	0.0	0.0	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	22.0	132.3	0	0.0	0.0	0.0	0.0	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	24.0	135.0	0	0.0	0.0	0.0	0.0	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	24.8	135.0	0	0.0	0.0	0.0	0.0	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				
AVG FORECAST POSIT ERROR	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR	
AVG RIGHT ANGLE ERROR	13	69	193	397	13	69	192	381	
AVG INTENSITY MAGNITUDE ERROR	6	18	34	53	6	59	156	329	
AVG INTENSITY BIAS	-3	-1	-1	-6	-4	-0	-5	-17	
NUMBER OF FORECASTS	26	22	19	15	24	21	17	13	

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1950. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON DOYLE
FIX POSITIONS FOR CYCLONE NO. 30

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRV	DVORAK CODE	COMMENTS	SITE
1	020957	6.6N 148.4E	PCN 5	T1.0/1.0	INIT OBS	PGTU
2	021200	6.8N 148.2E	PCN 6			PGTU
3	021600	7.0N 147.7E	PCN 6	T1.0/1.0	INIT OBS	PGTU
4	021800	7.2N 147.5E	PCN 6			PGTU
5	021955	7.3N 147.4E	PCN 6			PGTU
6	030000	7.1N 144.7E	PCN 6			PGTU
7	030300	7.2N 145.6E	PCN 6	T1.5/1.5 /D0.5/24HRS	ULCC 7.2N 144.7E	PGTU
8	030600	7.5N 143.9E	PCN 6		ULCC FIX	PGTU
9	030835	7.6N 143.6E	PCN 6		ULCC FIX	PGTU
10	031200	7.9N 142.9E	PCN 6		ULCC FIX	PGTU
11	031600	7.6N 142.3E	PCN 6	T1.0/1.0+/S0.0/24HRS	ULCC FIX	PGTU
12	031800	7.4N 141.8E	PCN 6		ULCC FIX	PGTU
13	031844	7.3N 141.8E	PCN 6		ULCC FIX	PGTU
14	032115	8.3N 140.8E	PCN 6		ULCC FIX	PGTU
15	040000	8.3N 142.4E	PCN 6		ULCC FIX	PGTU
16	040045	8.3N 141.9E	PCN 6			PGTU
17	040300	8.7N 141.5E	PCN 6	T2.0/2.0 /D0.5/24HRS		PGTU
18	040546	8.6N 141.7E	PCN 6			PGTU
19	040855	8.2N 140.0E	PCN 5			PGTU
20	040900	8.7N 141.5E	PCN 6			PGTU
21	041200	8.0N 139.8E	PCN 6			PGTU
22	041326	8.1N 139.3E	PCN 5		ULCC FIX	PGTU
23	041600	8.5N 138.7E	PCN 6	T2.5/2.5 /D1.5/24HRS	ULCC FIX	PGTU
24	041800	8.5N 138.3E	PCN 4		ULCC FIX	PGTU
25	042054	8.9N 137.6E	PCN 6		ULCC FIX	PGTU
26	050000	8.7N 137.5E	PCN 6			PGTU
27	050300	9.0N 136.7E	PCN 6	T3.0/3.0 /D1.0/24HRS		PGTU
28	050600	9.2N 136.6E	PCN 6			PGTU
29	050716	9.6N 136.5E	PCN 6			PGTU
30	050900	9.4N 136.2E	PCN 6			PGTU
31	050934	9.9N 135.2E	PCN 4			RODN
32	051012	9.9N 135.7E	PCN 4			RODN
33	051200	9.7N 135.6E	PCN 6			PGTU
34	051305	10.0N 135.5E	PCN 3			RODN
35	051600	10.4N 135.4E	PCN 6	T3.5/3.5-/D1.0/24HRS		PGTU
36	051800	10.8N 135.6E	PCN 6			PGTU
37	051819	10.1N 134.8E	PCN 4			RODN
38	052033	10.7N 134.1E	PCN 4			RODN
39	052100	10.6N 134.7E	PCN 6			PGTU
40	052250	10.2N 135.0E	PCN 6	T3.0/3.0	INIT OBS	PGTU
41	060000	11.1N 135.1E	PCN 4			PGTU
42	060145	11.7N 134.1E	PCN 3			RODN
43	060300	11.5N 135.0E	PCN 4	T3.5/3.5	INIT OBS	PGTU
44	060600	11.3N 134.2E	PCN 4	T3.5/3.5 /D0.5/24HRS		PGTU
45	060900	11.7N 133.9E	PCN 4			PGTU
46	060913	11.7N 133.9E	PCN 4			RODN
47	060947	11.9N 133.5E	PCN 4			RODN
48	061200	12.2N 133.6E	PCN 4			PGTU
49	061600	12.4N 133.0E	PCN 4	T4.0/4.0 /D0.5/24HRS		PGTU
50	061800	13.1N 133.4E	PCN 4			PGTU
51	062100	13.4N 133.5E	PCN 6			PGTU
52	062226	13.2N 133.4E	PCN 6	T4.0/4.0 /D1.0/24HRS		PGTU
53	070000	13.5N 133.1E	PCN 4			PGTU
54	070126	13.9N 133.2E	PCN 1	T5.0/5.0+/D1.5/24HRS	40 PCT EYE WALL E-SW	RODN
55	070300	14.1N 132.1E	PCN 3	T5.0/5.0 /D1.5/24HRS	EYE DIA SHM	PGTU
56	070600	14.6N 132.9E	PCN 6		EYE FIX	PGTU
57	070900	14.8N 132.6E	PCN 6		EYE FIX	P

56	072132	15.5N 132.2E	PCN 1	T5.0/5.0 /D1.0/24HRS	EYE FIX	RPMK
57	072202	15.7N 131.7E	PCN 2		EYE FIX 50 PCT EYEWALL	RODN
58	080000	15.7N 131.8E	PCN 2			PGTU
59	080106	15.7N 131.8E	PCN 1			RPMK
70	080300	16.0N 131.6E	PCN 2	T5.5/5.5-/D0.5/24HRS		PGTU
71	080600	16.1N 131.4E	PCN 2			PGTU
72	080900	16.2N 131.3E	PCN 2			PGTU
73	081011	16.3N 131.0E	PCN 2		EYE FIX	RODN
74	081040	16.5N 131.7E	PCN 1		EYE FIX	RPMK
75	081200	16.5N 131.2E	PCN 2			PGTU
76	081347	16.5N 131.2E	PCN 1		EYE FIX	RPMK
77	081600	16.8N 130.9E	PCN 4	T5.0/5.5 /U0.5/24HRS		PGTU
78	081800	17.0N 130.7E	PCN 4			PGTU
79	082111	16.5N 130.5E	PCN 4			RODN
80	082319	17.1N 130.8E	PCN 4			RPMK
81	082319	17.1N 131.1E	PCN 3	T5.0/5.0-/S0.0/26HRS		PGTU
82	090000	17.5N 130.6E	PCN 4			RPMK
83	090046	17.3N 130.5E	PCN 3			PGTU
84	090300	17.9N 130.3E	PCN 4	T4.5/5.5 /U1.0/24HRS		PGTU
85	090600	18.4N 130.1E	PCN 4		ULCC FIX	PGTU
86	090626	17.8N 130.1E	PCN 5			RPMK
87	090900	18.7N 129.9E	PCN 6			PGTU
88	090951	18.8N 129.9E	PCN 6			RODN
89	091016	18.8N 129.9E	PCN 6			RODN
90	091200	19.1N 130.1E	PCN 6			PGTU
91	091326	20.0N 131.2E	PCN 5			RPMK
92	091600	19.5N 130.8E	PCN 6	T3.0/4.0+/U2.0/24HRS		PGTU
93	091800	20.0N 131.3E	PCN 6		ULCC FIX	PGTU
94	091910	20.1N 131.5E	PCN 6			RPMK
95	092049	20.0N 130.7E	PCN 6			RODN
96	092100	20.1N 132.0E	PCN 6		ULCC FIX	PGTU
97	092254	20.3N 131.3E	PCN 6		ULCC FIX	RODN
98	100000	20.4N 130.5E	PCN 6		ULCC FIX	PGTU
99	100026	20.2N 130.5E	PCN 6	T3.5/4.5 /U1.5/25HRS		RPMK
100	100300	20.5N 130.3E	PCN 6	T3.0/4.0 /U1.5/24HRS		PGTU
101	100600	21.4N 130.7E	PCN 6		ULCC FIX	PGTU
102	100626	21.4N 130.7E	PCN 3			RPMK
103	100900	21.4N 130.8E	PCN 6		ULCC FIX	PGTU
104	101200	21.2N 131.1E	PCN 6		ULCC 21.4N 132.8E	PGTU
105	101600	23.2N 133.5E	PCN 6		ULCC FIX	PGTU
106	101800	23.1N 134.1E	PCN 6			PGTU
107	101857	23.0N 133.2E	PCN 6			RODN
108	102100	23.2N 134.7E	PCN 6			PGTU
109	102230	22.8N 135.0E	PCN 6		ULCC FIX	RODN
110	110000	23.3N 133.6E	PCN 4	T1.5/2.5 /U1.5/21HRS	EXP LLCC	PGTU
111	110005	23.2N 133.0E	PCN 6	T1.5/1.5	INIT OBS	RODN
112	110005	23.2N 133.3E	PCN 6	T1.5/1.5	INIT OBS	RSKO
113	110600	24.6N 135.0E	PCN 4			PGTU
114	110601	24.4N 135.4E	PCN 3	T1.5/2.5 /U2.0/30HRS	EXP LLCC	RPMK
115	120300	29.9N 144.9E	PCN 6			PGTU

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-UND VEL/BRG/RNG	MAX-FLT-LVL-UND DIR/VEL/BRG/RNG	ACCRV NAV/NET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	050129	8.7N 137.3E	1500FT		994	40 180 5	280 35 180 5	5 2			+23 +27 +23	4
2	050533	9.1N 137.0E	1500FT		993	45 200 15	110 41 010 86	6 0			+27 +29 +26	5
3	052030	10.6N 135.3E	700MB	2955		40 350 40	160 47 110 35	10 10	CIRCULAR	70	+14 +15 +8	6
4	052336	11.1N 135.1E	1500FT		991	50 140 30	250 48 150 5	10 10	CIRCULAR	60	+25 +27 +25	30
5	060852	11.8N 134.0E	700MB	2997	989	50 070 50	140 45 060 60	10 05	CIRCULAR	20	+15 +17 +11	7
6	061124	12.0N 133.8E	700MB	2998	991		290 35 230 60	8			+14 +17 +12	7
7	062034	13.1N 133.5E	700MB	2910	978		090 62 010 14	12 55	ELLIPTICAL	15 10 080	+16 +19 +12	8
8	062336	13.5N 133.2E	700MB	2876	973	90 360 10	280 74 190 08	10 5	CIRCULAR	20	+15 +19 +12	8
9	070932	14.8N 132.6E	700MB	2676	953		150 89 060 20	8	CIRCULAR	18	+14 +19 +13	9
10	071137	15.1N 132.4E	700MB	2685	953		260 89 170 14	10 05	CIRCULAR	12	+15 +18 +14	9
11	072047	15.6N 131.8E	700MB	2526	935	45 310 120	080 99 020 10	5 02	ELLIPTICAL	15 10 210	+14 +19 +14	10
12	072329	15.8N 131.8E	700MB	2570	940	110 240 10	190 95 120 30	55 33	ELLIPTICAL	15 10 280	+14 +20 +13	10
13	080835	16.2N 131.2E	700MB	2585	944	120 090 15	140 113 030 10	5 3	CIRCULAR	20	+11 +16 +15	11
14	081106	16.4N 131.2E	700MB	2562			260 101 180 10	5 55	CIRCULAR	20	+9 +17 +15	11
15	082044	17.2N 130.5E	700MB	2642			130 110 120 23	8 55	CIRCULAR	20	+13 +21 +12	12
16	082339	17.4N 130.5E	700MB	2675	951	130 090 5	190 125 160 20	8 55	CIRCULAR	20	+13 +21 +11	12
17	090843	18.4N 130.1E	700MB	2991	972	120 100 24	100 74 360 69	10 1	CIRCULAR	40	+18 +21 +4	13
18	091123	18.8N 129.8E	700MB	3011	987		230 40 190 35	8 55			+22 +24 +3	13
19	092037	19.4N 130.3E	700MB	3041	993		150 50 010 60	55 55			+22 +21 +7	14
20	092337	20.1N 130.0E	1500FT		993	50 130 50	300 43 200 72	55 55			+28 +27 +25	14
21	100559	20.9N 130.6E	1500FT		993	50 020 30	230 38 150 67	10 55			+24 +24 +24	15
22	100835	21.2N 130.9E	1500FT		996	25 280 35	350 35 280 35	15 55			+24 +24 +24	15
23	102212	23.5N 133.0E	1500FT		1002	40 140 50	220 49 140 78	8 55			+27 +29 +24	16
24	110059	24.2N 133.5E	1500FT		1004	15 340 10	350 31 260 25	8 55			+26 +27 +24	16

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

2. NORTH INDIAN OCEAN CYCLONE DATA

TROPICAL CYCLONE 01-84
BEST TRACK DATA

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS
052312Z	10.7	56.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052318Z	10.9	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052400Z	11.1	55.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052406Z	11.3	55.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052412Z	11.5	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052418Z	11.7	55.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052500Z	11.9	54.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052506Z	12.1	54.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052512Z	12.3	54.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052518Z	12.5	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052600Z	12.7	54.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052606Z	13.0	53.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052612Z	13.2	53.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052618Z	13.4	53.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052700Z	13.6	53.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052706Z	13.8	53.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052712Z	14.0	52.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052718Z	14.2	52.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052800Z	14.4	52.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
052806Z	14.6	52.3	0.0	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
 AVG FORECAST POSIT ERROR 31 225 347 0
 AVG RIGHT ANGLE ERROR 19 75 195 0
 AVG INTENSITY MAGNITUDE ERROR 2 6 10 0
 AVG INTENSITY BIAS 2 4 -10 0
 NUMBER OF FORECASTS 9 5 1 0
 TYPHOONS W/ILE OVER 35 KTS
 WRNG 24-HR 48-HR 72-HR
 0 0 0 0
 DISTANCE TRAVELED BY TROPICAL CYCLONE IS 819. NM
 AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TC01A
FIX POSITIONS FOR CYCLONE NO. 1

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCUR	DVORAK CODE	COMMENTS	SITE
1	231444	10.3N 56.2E	PCN 5	T1.0/1.0	INIT OBS	KGUC
2	232333	10.3N 54.0E	PCN 5			FJDG
3	240658	11.2N 55.3E	PCN 5	T1.5/1.5 /D0.5/16HRS	ULAC 10.2N 54.4E	KGUC
4	250638	12.5N 55.4E	PCN 5	T1.5/1.5 /S0.0/24HRS	ULAC 11.4N 55.8E	KGUC
5	251918	12.2N 53.7E	PCN 5			KGUC
6	260050	12.3N 53.1E	PCN 5			KGUC
7	260241	13.0N 53.4E	PCN 5			KGUC
8	260617	13.3N 53.1E	PCN 5	T2.5/2.5 /D1.0/24HRS	ULAC 12.3N 53.4E	KGUC
9	261153	13.2N 52.6E	PCN 5			KGUC
10	261521	13.1N 52.1E	PCN 5			KGUC
11	261858	13.6N 51.6E	PCN 5			KGUC
12	270037	13.4N 50.4E	PCN 5			KGUC
13	270220	13.5N 49.9E	PCN 5	T2.5/2.5 /S0.0/22HRS	ULAC 13.1N 51.7E	KGUC
14	271140	12.1N 47.7E	PCN 5			KGUC
15	271500	11.7N 46.7E	PCN 5			KGUC
16	271838	11.6N 45.3E	PCN 5			KGUC
17	280025	11.2N 44.7E	PCN 5			KGUC
18	280340	9.5N 44.9E	PCN 5			KGUC

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

**TROPICAL CYCLONE 02-84
BEST TRACK DATA**

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
MO/DA/HR	POSIT	WIND	POSIT	WIND	POSIT	WIND	ERRORS	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
101012Z	16.0	88.6	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	0.0	0.0
101018Z	17.5	88.6	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	0.0	0.0
101100Z	17.7	88.6	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	0.0	0.0
101106Z	18.0	88.6	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	0.0	0.0
101112Z	18.2	88.6	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	0.0	0.0
101118Z	18.4	88.6	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	0.0	0.0
101200Z	18.7	88.6	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	0.0	0.0
101206Z	19.0	88.6	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	0.0	0.0
101212Z	19.2	88.6	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	0.0	0.0
101218Z	19.5	88.4	45	19.5	88.8	45	23.0	0.22.3	88.3	50	113	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101300Z	19.7	88.3	45	19.8	88.3	45	6.0	0.21.5	87.7	60	37	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101306Z	19.9	88.1	45	19.2	87.8	55	45	10	20.9	86.8	60	43	25	0.0	0.0	0.0	0.0	0.0	0.0
101312Z	20.2	87.9	40	19.0	88.3	45	29	5	21.2	87.1	35	90	5	0.0	0.0	0.0	0.0	0.0	0.0
101318Z	20.5	87.7	35	20.3	87.9	45	16	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101400Z	21.0	87.3	35	20.6	87.8	40	37	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101406Z	21.6	86.6	35	21.0	87.0	40	42	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
101412Z	22.2	85.9	30	21.7	86.3	30	37	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	29	71	0	0	0	0	0
AVG RIGHT ANGLE ERROR	13	0	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	4	18	0	0	0	0	0
AVG INTENSITY BIAS	4	18	0	0	0	0	0
NUMBER OF FORECASTS	8	4	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 380. NM
AVERAGE SPEED OF TROPICAL CYCLONE IS 4. KNOTS

TC02B
FIX POSITIONS FOR CYCLONE NO. 2

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCR	DVORAK CODE	COMMENTS	SITE
1	101200	16.9N 89.5E	PCN 6		ULCC FIX	PGTW
2	101600	18.0N 90.0E	PCN 5		ULCC FIX	PGTW
3	101645	17.0N 89.8E	PCN 5	T1.5/1.5	INIT OBS ULAC 18.0N 90.3E	KGUC
4	101800	18.1N 89.0E	PCN 6	T2.0/2.0		PGTW
5	102100	18.5N 88.8E	PCN 6		ULCC FIX	PGTW
6	110345	17.5N 88.5E	PCN 5	T1.5/1.5 /D0.5/11HRS	ULAC 18.9N 89.8E	KGUC
7	111016	18.4N 89.7E	PCN 6		ULAC 19.0N 89.7E	KGUC
8	111200	19.0N 87.6E	PCN 6			PGTW
9	111209	19.4N 88.1E	PCN 5		ULAC 19.1N 89.1E	KGUC
10	111600	18.6N 87.9E	PCN 6			PGTW
11	111625	19.1N 88.7E	PCN 5		ULAC 19.1N 89.6E	KGUC
12	111800	18.4N 88.5E	PCN 6	T2.0/2.0 /S0.0/24HRS		PGTW
13	112100	18.8N 88.7E	PCN 6			PGTW
14	112300	20.2N 89.4E	PCN 6			KGUC
15	120049	19.6N 90.1E	PCN 5			KGUC
16	120324	18.7N 89.8E	PCN 5	T2.0/2.0 /D0.5/24HRS	ULAC 18.8N 88.0E	KGUC
17	121003	18.7N 89.8E	PCN 4		ULAC 18.0N 88.0E	KGUC
18	121329	19.1N 88.9E	PCN 6		ULAC 20.1N 88.0E	KGUC
19	121600	19.0N 88.5E	PCN 6			PGTW
20	121605	19.1N 88.8E	PCN 6		ULAC 21.0N 87.6E	KGUC
21	121800	19.4N 88.3E	PCN 6	T3.0/3.0 /D1.0/24HRS		PGTW
22	122248	20.0N 88.0E	PCN 5			KGUC
23	130000	19.7N 87.9E	PCN 6			PGTW
24	130028	19.9N 88.4E	PCN 5		ULAC 18.9N 88.2E	KGUC
25	130400	19.0N 87.0E	PCN 6		ULCC FIX	PGTW
26	130446	19.3N 89.2E	PCN 5	T3.0/3.0 /D1.0/25HRS	ULAC 18.8N 89.1E	KGUC
27	130600	19.2N 87.9E	PCN 6		ULCC FIX	PGTW
28	130900	19.8N 87.5E	PCN 6		ULCC FIX	PGTW
29	130951	19.8N 88.7E	PCN 2		EXP LLCC ULAC 19.9N 88.5E	KGUC
30	131200	19.6N 87.0E	PCN 6		ULCC FIX	PGTW
31	131308	20.4N 88.5E	PCN 6			KGUC
32	131545	20.2N 88.2E	PCN 6			KGUC
33	131600	20.3N 87.5E	PCN 6	T2.5/3.0-/U0.7/22HRS	ULCC FIX	PGTW
34	132100	19.9N 86.9E	PCN 6			PGTW
35	132235	20.9N 88.7E	PCN 6			KGUC
36	140000	20.0N 86.8E	PCN 6		ULCC FIX	PGTW
37	140007	21.7N 87.7E	PCN 6		ULAC 20.4N 86.9E	KGUC
38	140400	21.0N 86.6E	PCN 6		ULCC FIX	PGTW
39	140425	20.9N 86.2E	PCN 5			KGUC
40	140600	21.2N 86.7E	PCN 6		ULCC FIX	PGTW

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	140300	21.0N 87.2E	040	045	42895 42973 42977
2	141200	21.7N 86.3E	030	030	42895 42971 42798

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

**TROPICAL CYCLONE 03-84
BEST TRACK DATA**

MO/DA/HR	BEST TRACK			WARNING			24 HOUR FORECAST			48 HOUR FORECAST			72 HOUR FORECAST		
	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS	POSIT	WIND	ERRORS
110900Z	8.8	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110906Z	9.0	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
110912Z	9.3	86.8	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
110918Z	9.5	85.6	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
111000Z	9.0	85.6	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
111006Z	10.0	85.0	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
111012Z	10.0	84.2	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
111018Z	10.3	83.6	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
111100Z	10.4	82.8	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
111106Z	10.5	82.1	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
111112Z	10.8	81.4	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
111118Z	11.1	81.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111200Z	11.6	80.7	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111206Z	12.2	80.7	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111212Z	12.8	80.6	80.0	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	13.5	80.7	85.0	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	13.0	80.8	85.0	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	13.6	80.9	85.0	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	13.4	80.7	85.0	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	13.5	80.4	85.0	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	13.8	80.3	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111406Z	14.0	80.3	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111412Z	14.0	80.2	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111418Z	14.1	80.2	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111500Z	14.1	80.1	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
111506Z	14.1	80.1	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

ALL FORECASTS
 AVG FORECAST POSIT ERROR 26
 AVG RIGHT ANGLE ERROR 16
 AVG INTENSITY MAGNITUDE ERROR 11
 AVG INTENSITY BIAS -7
 NUMBER OF FORECASTS 16

TYPHOONS WHILE OVER 35 KTS
 WRNG 24-HR 48-HR 72-HR
 0 0 0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 719. NM
 AVERAGE SPEED OF TROPICAL CYCLONE IS 5. KNOTS

TC03B
 FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCUR	DVORAK CODE	COMMENTS	SITE
1	090300	9.4N 87.3E	PCN 6	T1.0/1.0	INIT OBS	PGTU
2	090407	8.6N 87.5E	PCN 6	T1.5/1.5	INIT OBS	KGUC
3	090600	9.0N 87.0E	PCN 6			PGTU
4	090900	9.3N 86.5E	PCN 6			PGTU
5	091600	9.7N 87.2E	PCN 6	T1.0/1.0	INIT OBS	KGUC
6	091647	9.3N 87.8E	PCN 5		ULAC 10.1N 087.5E	KGUC
7	100346	10.4N 85.6E	PCN 5	T2.0/2.0 /D0.5/24HRS	ULAC 09.5N 085.9E	KGUC
8	110020	10.3N 82.3E	PCN 6		ULAC 09.8N 082.6E	KGUC
9	110508	10.8N 82.6E	PCN 5	T3.5/3.5 /D1.5/25HRS		KGUC
10	111035	10.8N 81.1E	PCN 5		ULAC 11.3N 081.7E	KGUC
11	111300	11.0N 87.5E	PCN 5			KGUC
12	111607	11.2N 81.1E	PCN 5			KGUC
13	112359	11.7N 80.5E	PCN 5			KGUC
14	120148	13.0N 81.0E	PCN 6	T2.5/2.5	INIT OBS	KGUC
15	120447	12.4N 80.8E	PCN 1	T5.0/5.0 /D1.5/24HRS	EYE DIA 6NM	FJDG
16	121022	12.8N 80.9E	PCN 1		EYE FIX	KGUC
17	121238	12.8N 80.4E	PCN 1		EYE FIX	KGUC
18	121728	13.4N 80.7E	PCN 1		EYE FIX	KGUC
19	122307	13.7N 80.7E	PCN 1		EYE DIA 15NM	FJDG
20	122308	13.5N 81.0E	PCN 5	T4.5/4.5 /D2.0/24HRS		KGUC
21	130119	14.0N 81.0E	PCN 2	T5.5/5.5 /D0.5/24HRS		KGUC
22	130427	14.8N 80.7E	PCN 1		EYE FIX	KGUC
23	131010	13.4N 80.7E	PCN 1		EYE FIX	KGUC
24	131359	13.3N 80.9E	PCN 1		EYE FIX	KGUC
25	131708	13.4N 80.3E	PCN 1		EYE FIX	KGUC
26	132254	14.0N 80.2E	PCN 1		EYE FIX	KGUC
27	140057	13.9N 80.4E	PCN 1		EYE FIX	KGUC
28	140407	13.7N 79.9E	PCN 1			KGUC
29	140957	14.2N 80.2E	PCN 1			KGUC
30	141337	13.8N 80.8E	PCN 5		ULAC 13.3N 080.4E	KGUC
31	141647	14.0N 80.9E	PCN 5		ULAC 13.8N 080.6E	KGUC
32	142242	13.7N 80.0E	PCN 5			KGUC
33	150036	14.0N 80.4E	PCN 5			KGUC
34	150528	13.4N 80.1E	PCN 5			KGUC
35	150944	13.8N 80.3E	PCN 5			KGUC
36	151627	13.6N 80.4E	PCN 5			KGUC
37	160508	14.1N 80.0E	PCN 5			KGUC

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	130300	13.8N 80.5E	070	050	STATIONS 43245 AND 43279
2	130600	13.7N 80.2E	070	045	STATIONS 43245 AND 43279
3	142100	13.7N 80.0E	030	030	STATIONS 43245 AND 43279

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

TROPICAL CYCLONE 04-84
BEST TRACK DATA

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	38.	160.	271.	388.	0.	0.	0.	0.	
AVG RIGHT ANGLE ERROR	17.	60.	153.	0.	0.	0.	0.	0.	
AVG INTENSITY MAGNITUDE ERROR	1.	9.	19.	23.	0.	0.	0.	0.	
AVG INTENSITY BIAS	0.	4.	19.	15.	0.	0.	0.	0.	
NUMBER OF FORECASTS	34	24	19	16	0	0	0	0	
DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2662. NM									
AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS									

TC04B
FIX POSITIONS FOR CYCLONE NO. 4

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCR	DVORAK CODE	COMMENTS	SITE
1	270448	8.3N 85.9E	PCN 5	T1.0/1.0	INIT OBS ULAC 08.4N 084.4E	KGUW
2	271729	9.3N 84.9E	PCN 6			KGUW
3	271800	8.9N 83.9E	PCN 6	T1.5/1.5		PGTL
4	272140	9.5N 88.3E	PCN 4			KGUW
5	280000	2.6N 85.2E	PCN 6		ULAC 09.1N 086.3E	PGTL
6	280104	9.4N 88.1E	PCN 6			KGUW
7	280300	8.8N 84.8E	PCN 6	T2.0/2.0	INIT OBS ULAC 09.8N 084.8E	PGTL
8	280428	2.6N 85.6E	PCN 5	T2.5/2.5 /D1.5/24HRS	ULAC 10.2N 084.6E	KGUW
9	280500	9.4N 84.7E	PCN 6			PGTL
10	280900	9.8N 84.8E	PCN 6		ULCC FIX	PGTL
11	281025	9.8N 84.6E	PCN 5			KGUW
12	281200	10.2N 84.7E	PCN 6			PGTL
13	281203	10.4N 84.3E	PCN 6			PGTL
14	281600	10.3N 84.4E	PCN 6			KGUW
15	281708	10.6N 84.3E	PCN 5			PGTL
16	281800	10.4N 84.9E	PCN 6	T2.5/2.5 /D1.0/24HRS		KGUW
17	282100	10.4N 85.1E	PCN 6			PGTL
18	282310	10.0N 84.4E	PCN 5			PGTL
19	290000	10.6N 84.8E	PCN 6			KGUW
20	290304	10.1N 85.6E	PCN 6		ULAC 09.7N 084.9E	PGTL
21	290309	10.1N 84.6E	PCN 6	T3.0/3.0 /D1.0/24HRS	ULCC FIX	KGUW
22	290408	9.4N 85.5E	PCN 5	T3.0/3.0 /D0.5/24HRS		PGTL
23	290600	10.2N 84.5E	PCN 6		ULCC FIX	PGTL
24	290900	10.1N 84.3E	PCN 6		ULCC FIX	PGTL
25	291015	9.5N 85.2E	PCN 5		ULAC 09.7N 085.4E	PGTL
26	291200	9.6N 84.6E	PCN 6			KGUW
27	291323	9.2N 86.4E	PCN 5			PGTL
28	291600	9.6N 85.1E	PCN 6			KGUW
29	291648	9.7N 85.7E	PCN 6			PGTL
30	291800	9.9N 85.1E	PCN 6	T3.5/3.5 /D1.0/24HRS		KGUW
31	292100	10.0N 84.8E	PCN 6			PGTL
32	292258	9.7N 84.9E	PCN 5	T3.5/3.5 /D1.0/24HRS		PGTL
33	300000	9.5N 85.5E	PCN 5		ULCC FIX	FJDO
34	300021	9.7N 85.2E	PCN 5			PGTL
35	300300	9.6N 84.8E	PCN 6	T4.0/4.0 /D1.0/24HRS		PGTL
36	300347	9.5N 84.9E	PCN 5	T3.5/3.5 /D0.5/24HRS		KGUW
37	300500	9.6N 84.8E	PCN 6			PGTL
38	300900	2.6N 84.1E	PCN 6			KGUW
39	301000	10.0N 84.4E	PCN 6			PGTL
40	301200	10.2N 83.6E	PCN 6			KGUW
41	301301	10.4N 85.7E	PCN 5			PGTL
42	301622	10.7N 82.8E	PCN 6			KGUW
43	010000	10.0N 81.7E	PCN 2			PGTL
44	010000	10.7N 82.1E	PCN 6			KGUW
45	010300	10.3N 81.4E	PCN 6	T4.5/4.5 /D0.5/24HRS		PGTL
46	010506	10.6N 81.2E	PCN 5			KGUW
47	010600	10.3N 81.1E	PCN 6			PGTL
48	010900	10.5N 80.3E	PCN 6		ULCC FIX	PGTL
49	010943	11.3N 77.1E	PCN 6		ULCC FIX	PGTL
50	011200	10.8N 80.1E	PCN 6		ULCC FIX	PGTL
51	011240	11.6N 78.4E	PCN 6			KGUW
52	011749	12.9N 77.3E	PCN 5			KGUW
53	012235	14.2N 75.7E	PCN 5			KGUW
54	020120	13.2N 74.9E	PCN 6			KGUW
55	020442	11.3N 74.2E	PCN 5	T0.0/1.5 /U3.5/24HRS		KGUW
56	021400	11.2N 72.6E	PCN 5			KGUW
57	021723	11.4N 71.1E	PCN 5			KGUW
58	030002	10.2N 69.7E	PCN 5			KGUW
59	030057	11.0N 69.5E	PCN 5		ULAC 10.9N 070.2E	KGUW

60	030609	11.0N	69.4E	PCN 5	T2.5/2.5 /D2.5/25HRS	ULAC 10.4N 069.4E	KGWC
61	031104	11.1N	68.0E	PCN 5			KGWC
62	031105	11.2N	67.9E	PCN 5	T2.0/2.0+/50.5/11HRS		FJDG
63	031339	11.2N	67.4E	PCN 5		ULAC 11.0N 067.8E	KGWC
64	031709	11.1N	66.1E	PCN 5			KGWC
65	032349	10.8N	65.6E	PCN 5			KGWC
66	040219	10.2N	65.7E	PCN 5	T3.0/3.0 /D0.5/24HRS	ULAC 10.0N 064.1E	KGWC
67	040549	9.7N	64.0E	PCN 5			KGWC
68	041052	9.9N	63.3E	PCN 5			KGWC
69	041052	10.6N	62.5E	PCN 5			KGWC
70	041457	9.9N	62.7E	PCN 5			FJDG
71	041830	9.9N	62.2E	PCN 5	T3.5/3.5	INIT OBS ULAC 09.1N 061.8E	KGWC
72	042337	10.0N	61.2E	PCN 5		ULAC 09.6N 061.3E	KGWC
73	042338	11.0N	59.0E	PCN 4	T3.0/3.0		FJDG
74	050153	9.3N	60.0E	PCN 5	T4.0/4.0 /D1.0/24HRS		KGWC
75	050529	9.0N	59.3E	PCN 5			KGWC
76	051224	8.2N	57.3E	PCN 5			KGWC
77	051438	8.1N	56.6E	PCN 5			FJDG
78	051515	9.7N	56.6E	PCN 5			KGWC
79	051810	8.5N	55.1E	PCN 5			KGWC
80	060313	7.5N	54.4E	PCN 5	T3.5/4.0 /U0.5/24HRS	ULAC 08.0N 053.7E	KGWC
81	060650	8.8N	53.4E	PCN 5			KGWC
82	061417	8.1N	51.5E	PCN 5	T3.0/4.0 /U1.0/25HRS		KGWC
83	061931	8.2N	51.2E	PCN 5		ULAC 08.1N 049.6E	KGWC
84	070257	8.2N	49.7E	PCN 5	T1.5/2.5 /U1.5/24HRS	EXP LLCC ULAC 08.1N 048.3E	KGWC
85	070630	7.6N	50.4E	PCN 5		EXP LLCC ULAC 08.2N 047.1E	KGWC
86	071537	6.2N	48.9E	PCN 5		EXP LLCC ULAC 10.0N 047.0E	KGWC
87	071911	5.5N	47.9E	PCN 5			KGWC
88	080235	5.1N	46.8E	PCN 5			KGWC
89	080751	5.1N	46.7E	PCN 5			KGWC

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	011200	11.5N 79.2E	065	060	43344 43295 43279
2	011500	12.1N 78.8E	060	090	43295 43279 42845
3	011800	11.5N 77.8E	050	060	43321 43344 43279 43295
4	020000	12.2N 77.0E	020	040	43295 43284 43279 43201

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

APPENDIX I

CONTRACTIONS

ACCRY	Accuracy	FI	Forecast Intensity (Dvorak)
ACFT	Aircraft	FLT	Flight
ADP	Automated Data Processing	FNOC	Fleet Numerical Oceanography Center
AFGWC	Air Force Global Weather Central	FT	Feet
AIREP	Aircraft Weather Report(s) (Commercial and Military)	GMT	Greenwich Mean Time
ANT	Antenna	GOES	Geostationary Operational Environmental Satellite
AOR	Area of Responsibility	HATTRACK	Hurricane and Typhoon Tracking (Steering) Program
APRNT	Apparent	HGT	Height
APT	Automatic Picture Transmission	HPAC	Mean of XTRP and CLIM Techniques (Half Persistence and Climatology)
ARWO	Aerial Reconnaissance Weather Officer	HR(s)	Hour(s)
ATT	Attenuation	HVY	Heavy
AVG	Average	ICAO	International Civil Aviation Organization
AWN	Automated Weather Network	INIT	Initial
BPAC	Blended Persistence and Climatology	INJAH	North Indian Ocean Component of TYAN
BRG	Bearing	INST	Instruction
CDO	Central Dense Overcast	IR	Infrared
CI	Cirriiform Cloud or Cirrus also Current Intensity (Dvorak)	KM	Kilometer(s)
USCINCPAC	Commander-in-Chief Pacific AF - Air Force, FLT - Fleet (Navy)	KT	Knot(s)
CLD	Cloud	LLCC	Low-level Circulation Center
CLIM	Climatology	LVL	Level
CLSD	Closed	M	Meter(s)
CM	Centimeter	M/S	Meter(s) per Second
CNTR	Center	MAX	Maximum
CPA	Closest Point of Approach	MB	Millibar(s)
CSC	Cloud System Center	MET	Meteorological
CYCLOPS	Tropical Cyclone Steering Program (HATTRACK and MOHATT)	MIN	Minimum
DEG	Degree(s)	MOHATT	Modified HATTRACK
DIAM	Diameter	MOVG	Moving
DIR	Direction	MSLP	Minimum Sea Level Pressure
DMSF	Defense Meteorological Satellite Program	MSN	Mission
DST	Distance	NAV	Navigational
EL	Elongated	NEDN	Naval Environmental Data Network
ELEV	Elevation	NEDS	Naval Environmental Display Station
EXP	Exposed		

NEPRF	Naval Environmental Prediction Research Facility	SST	Sea Surface Temperature
NESS	National Environmental Satellite Service	ST	Subtropical
NESDIS	National Environmental Satellite, Data, and Information Service	STR	Subtropical Ridge
NET	Near Equatorial Trough	STY	Super Typhoon
NM	Nautical Mile(s)	TAPT	Typhoon Acceleration Prediction Technique
N/O	Not Observed	TC	Tropical Cyclone
NOAA	National Oceanic and Atmospheric Administration	TCARC	Tropical Cyclone Aircraft Reconnaissance Coordinator
NOCC	Naval Oceanography Command Center	TCFA	Tropical Cyclone Formation Alert
NOGAPS	Navy Operational Global Atmospheric Prediction System	TCM	Tropical Cyclone Model
NWOC	Naval Western Oceanography Center	TD	Tropical Depression
NR	Number	TDO	Typhoon Duty Officer
NRL	Naval Research Laboratory	TIROS	Television Infrared Observation Satellite
NTCM	Nested Tropical Cyclone Model	TPAC	Extrapolation and Climatology blend
OBS	Observations	TS	Tropical Storm
OTCM	One-Way (Interactive) Tropical Cyclone Model	TY	Typhoon
PACOM	Pacific Command	TYAN	Typhoon Analog Program
PCN	Position Code Number	TYFN	Western North Pacific Component (Revised) of TYAN
PSBL	Possible	TUTT	Tropical Upper-Tropospheric Trough
PTLY	Partly	ULAC	Upper-level Anticyclone
QUAD	Quadrant	ULCC	Upper-level Circulation Center
RADOB	Radar Observations	VEL	Velocity
RECON	Reconnaissance	VIS	Visual
RNG	Range	VMNT	Vector Movement (ddff)
RT	Right	WESTPAC	Western (North) Pacific
SAT	Satellite	WMO	World Meteorological Organization
SFC	Surface	WND	Wind
SLP	Sea Level Pressure	WRNG(s)	Warning(s)
SPOL	Spiral Overlay	WRS	Weather Reconnaissance Squadron
SRP	Selective Reconnaissance Program	XTRP	Extrapolation
STNRY	Stationary	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 for gridding satellite imagery. Since ephemeris gridding is based solely on the predicted 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 six 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 - A term used to describe the central area of a tropical cyclone when it is more than half surrounded by wall cloud.

FUJIWARA EFFECT - An interaction in which tropical cyclones within about 700 nm (1296 km) of each other begin to rotate 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 - Highest surface wind speed averaged over a one-minute period of time. Peak gusts over water average 20 to 25 percent higher than sustained winds.

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 a path toward the northeast.

RIGHT ANGLE ERROR - The distance described by a perpendicular line from the best track to a forecast position. (See figure 4-1).

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 (one-minute mean) is 130 kt (67 m/s) 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 USCINCPACAF 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 USCINCPACAF, aircraft weather reconnaissance units, and the appropriate typhoon/hurricane warning center.

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

TROPICAL DISTURBANCE - A discrete system of apparently organized convection---generally 100 to 300 nm (185 to 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 of intensification, may be classified as a tropical depression, tropical storm or typhoon (hurricane).

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds (one-minute mean) in the range of 34 to 63 kt (17 to 32 m/s) 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, J.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 (one-minute mean) is 64 kt (33 m/s) 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 distance described by a straight line from the forecast position to the position at verification time as found on the best track. (See Figure 4-1).

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

APPENDIX III

NAMES FOR TROPICAL CYCLONES

<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>	<u>Column 4</u>
ANDY	ABBY	ALEX	AGNES
BRENDA	BEN	BETTY	BILL
CECIL	CARMEN	CARY	CLARA
DOT	DOM	DINAH	DOYLE
ELLIS	ELLEN	ED	ELSIE
FAYE	FORREST	FREDA	FABIAN
GORDON	GEORGIA	GERALD	GAY
HOPE	HERBERT	HOLLY	HAL
IRVING	IDA	IKE	IRMA
JUDY	JOE	JUNE	JEFF
KEN	KIM	KELLY	KIT
LOLA	LEX	LYNN	LEE
MAC	MARGE	MAURY	MAMIE
NANCY	NORRIS	NINA	NELSON
OWEN	ORCHID	OGDEN	ODESSA
PEGGY	PERCY	PHYLLIS	PAT
ROGER	RUTH	ROY	RUBY
SARAH	SPERRY	SUSAN	SKIP
TIP	THELMA	THAD	TESS
VERA	VERNON	VANESSA	VAL
WAYNE	WYNNE	WARREN	WINONA

NOTE:

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APPENDIX IV

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APPENDIX V

PAST ANNUAL TROPICAL CYCLONE REPORTS

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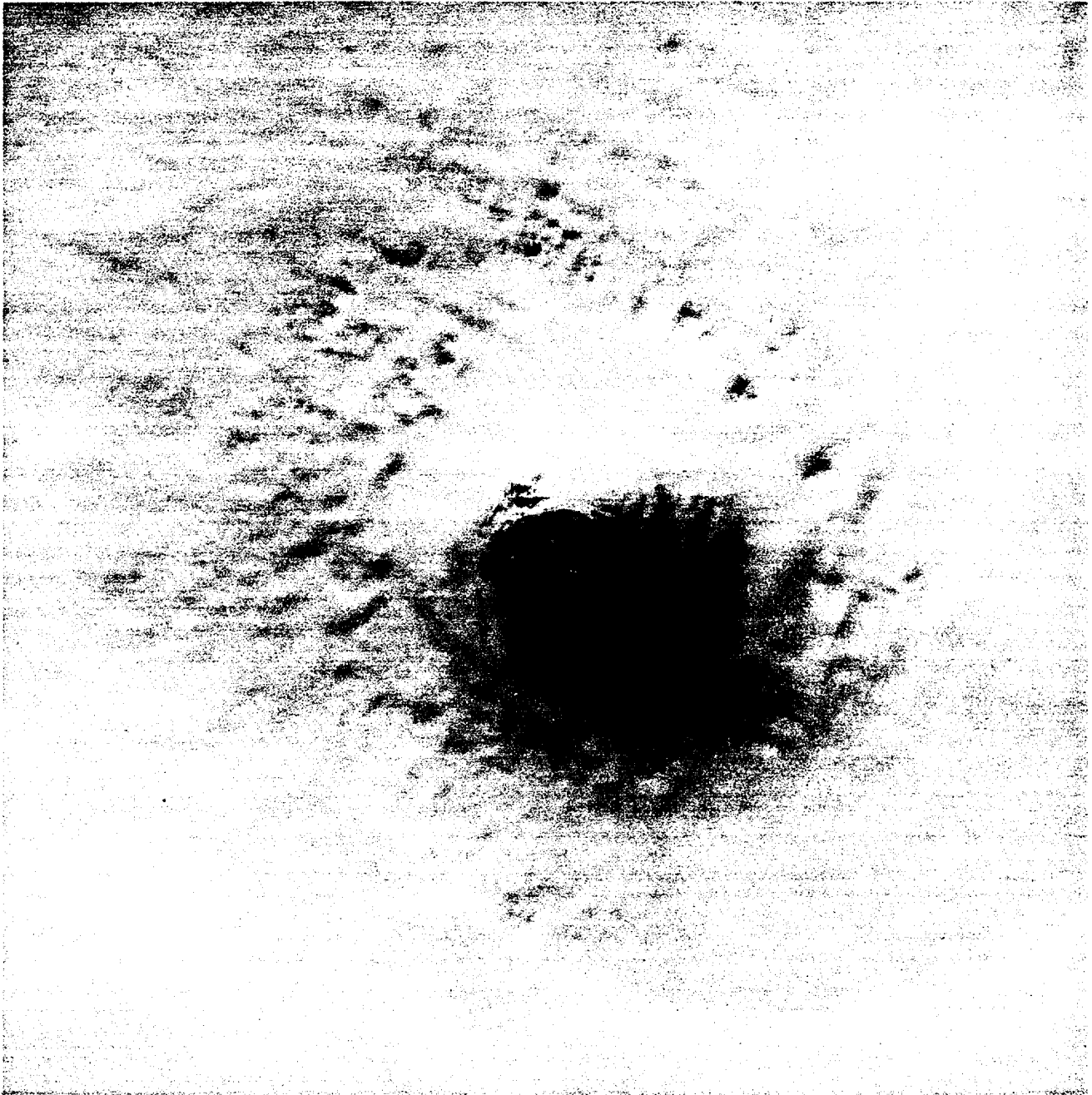
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Annual publication summarizing the tropical cyclone season in the western North Pacific, Bay of Bengal and Arabian Sea. A brief narrative is given on each significant tropical cyclone including its best track. All reconnaissance data used to construct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

Block 19, (Continued)

Dynamic tropical cyclone models
Typhoon analog model
Tropical cyclone steering model
Climatology/persistence techniques



Tropical Cyclone 30S (Kamisy) on 9 April 1984, one day after the front cover photograph. Mission 41C orbit was directly over the storm. This nadir view was taken with a 250 mm lens. To give a sense of size, the picture is approximately 55 by 55 nm (102 by 102 km). The eye diameter is 10 nm (19 km). Note the overshooting tops through the tropopause in the eyewall convection. The resolution with this lens is 40 to 50 meters. (Photograph provided by LCDR W. T. Aldinger, NAVPOLAROCEANCEN Detachment, Johnson Space Center, Texas).