

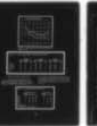
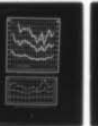
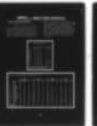
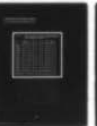
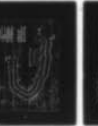
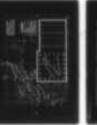
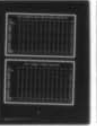
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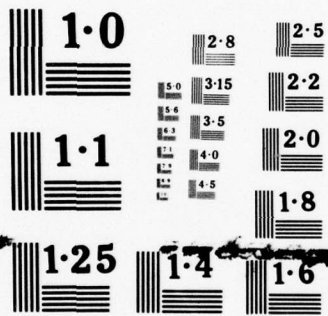
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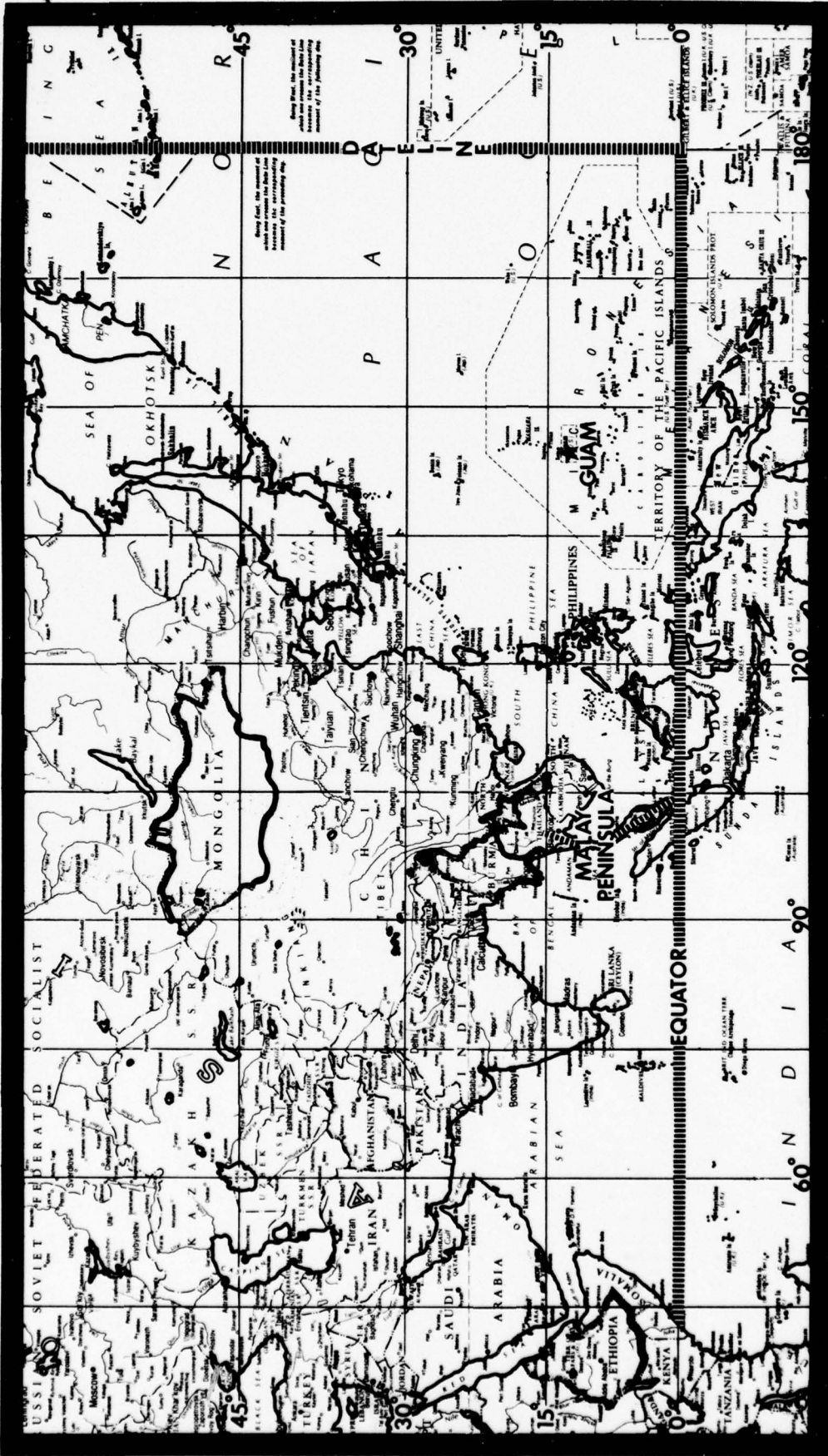


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MICROCOPY RESOLUTION TEST CHART

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Indian Ocean Area (Malay Peninsula to Africa) Pacific Area (Dateline to Malay Peninsula)

AREA OF RESPONSIBILITY - JOINT TYPHOON WARNING CENTER, GUAM

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12

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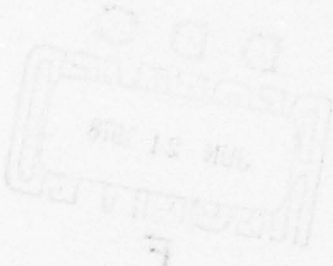
1977
ANNUAL TYPHOON REPORT

*Departed during 1977 season

78 06 19 005

FRONT COVER:

Infrared photograph of a two-storm situation with a third during its early stages of development, 19 September 1977. Typhoon Dinah (lower left) at 65 kt (33 m/sec) is meandering in the South China Sea. Details of Dinah can be found on page 30. Tropical Storm Emma (upper right) with 45 kt (23 m/sec) winds is undergoing recurvature southeast of Japan. A yet unnumbered tropical disturbance (which will eventually become Tropical Storm Freda) is slowly developing in the Philippine Sea (lower right). (Direct readout NOAA-5 VHRR IR imagery as received by Det 1, 1WW Nimitz Hill, Guam.)



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FOREWORD

Tropical cyclones have always been a menace to both military and civilian activities in tropical and subtropical oceanic regions. During recent times, much effort has been funneled toward more accurate tropical cyclone forecasts and toward more efficient operational responses to those forecasts. A large portion of this effort is based on studies which, if meaningful, must be based on accurately documented data. The Annual Typhoon Report represents such documentation. The body of this report is a summary of the tropical cyclones that occurred during 1977 in the western North Pacific, central North Pacific and North Indian Oceans.

The Annual Typhoon Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC). JTWC is a combined USAF/USN entity operating under the command of Fleet Weather Central, Guam. The senior Air Force officer assigned is designated as Director, JTWC and is responsible to the Commanding Officer, Fleet Weather Central, Guam for the operation of the JTWC. The senior Naval officer of the JTWC is designated as the Deputy Director/Operations Officer. JTWC was established by CINCPACFLT message 280208Z April 1959 when directed by CINCPAC message 230233Z April 1959. Its operation is guided by the CINCPAC INST 3140.1 (series).

The Fleet Weather Central/Joint Typhoon Warning Center, Guam has the responsibility to:

1. Provide continuous meteorological watch of all tropical activity north of the equator, west of the Date Line, and east of the African coast (JTWC area of responsibility) for potential tropical cyclone development;
2. Provide warnings for all tropical cyclones in the assigned area of responsibility;
3. Determine tropical cyclone reconnaissance requirements and assign priorities;

4. Conduct an annual post analysis of all tropical cyclones occurring within the area north of the equator from 140W west to the coast of Africa and prepare an Annual Typhoon Report for issuance to interested agencies; and

5. Conduct tropical cyclone forecasting and detection research as practicable.

In the event of incapacitation of the JTWC, the alternate (AJTWC) assumes the responsibility for the issuance of warnings. In early November, 1977, Fleet Weather Central, Pearl Harbor, Hawaii was designated as the AJTWC. Assistance in determining tropical cyclone reconnaissance requirements and in obtaining reconnaissance data is provided by Detachment 4, 1st Weather Wing, Hickam AFB, Hawaii. Previously, the AJTWC designate was Detachment 17, 30WS, Yokota AB, Japan, with assistance from the Naval Weather Service Facility, Yokosuka, Japan.

The Central Pacific Hurricane Center, (CPHC) Honolulu, Hawaii is manned by members of the U. S. National Weather Service who are responsible for the issuance of tropical cyclone warnings for the area north of the equator from the Date Line east to 140W. Warnings are issued in coordination with the Fleet Weather Central, Pearl Harbor and Detachment 4, 1WW, Hickam AFB, Hawaii. Post analysis information is forwarded to the JTWC for inclusion in the Annual Typhoon Report.

The meteorological services of the United States are planning to implement the metric system of measurement over the next few years. Some civilian and military agencies have started the education program by showing the metric equivalents to current units of measure. This Annual Typhoon Report includes metric equivalents to most measures.

Unless otherwise stated all satellite data used in this ATR is Air Force Weather Service DMSP Data as acquired by OL-C, 27CS personnel and analyzed by Det 1, 1WW personnel collocated with JTWC at Nimitz Hill, Guam.

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CHAPTER I - OPERATIONAL PROCEDURES

1. GENERAL

Routine services provided by the Joint Typhoon Warning Center (JTWC) include the following: (1) Significant Tropical Weather Advisories issued daily describing all tropical disturbances and their potential for further development; (2) Tropical Cyclone Formation Alerts issued whenever interpretation of satellite and synoptic data indicates likely formation of a significant tropical cyclone; (3) Tropical Cyclone Warnings issued four times daily whenever a significant tropical cyclone exists in the Pacific area; (4) Tropical Cyclone Warnings issued twice daily whenever a significant tropical cyclone exists in the Indian Ocean area; and (5) Prognostic Reasoning messages issued twice daily for tropical storms and typhoons in the Pacific area.

JTWC responds to changing requirements of activities serviced. Therefore, contents of routine services are subject to change from year to year usually as a result of the Annual Tropical Cyclone Conference deliberations.

2. DATA SOURCES

a. COMPUTER PRODUCTS:

FLEWEACEN Guam provides computerized meteorological/oceanographic products for JTWC. In addition, the standard array of synoptic-scale computer analyses and prognostic charts are available from the Fleet Numerical Weather Central (FNWC) at Monterey, California via FLEWEACEN Guam.

b. CONVENTIONAL DATA:

Conventional meteorological data are defined as surface and upper air observations from island, ship and land stations plus weather observations from commercial and military aircraft (AIREPS). Computer plotted charts of 0000Z and 1200Z conventional data are produced daily for the surface, 850 mb, 700 mb, and 500 mb levels. A chart of upper air data is produced which utilizes 200 mb rawinsonde data and AIREPS above 29,000 ft within 6 hours of the 0000Z and 1200Z synoptic times. The surface/gradient, 500 mb and 200 mb level charts are hand plotted over important tropical/subtropical regions during the tropical cyclone season to complement computer aids and insure all available data are used.

c. AIRCRAFT RECONNAISSANCE:

Aircraft weather reconnaissance data are invaluable in the positioning of centers of developing systems and essential for the accurate determination of the eye/center, maximum intensity, minimum sea-level pressure, and radius of significant winds exhibited by tropical cyclones. These data are plotted on large-scale sectional charts for each mission flown. A comprehensive discussion of aircraft weather reconnaissance is presented in Chapter II.

d. SATELLITE RECONNAISSANCE:

Meteorological satellite data from the Defense Meteorological Satellite Program (DMSP) and the National Oceanic and Atmospheric Administration played a major role in the early detection and tracking of tropical cyclones in 1977. A discussion of this role, as well as applications of satellite data to tropical cyclone analysis and forecasting, is presented in Chapter II.

e. RADAR RECONNAISSANCE:

During 1977, as in recent years, land radar coverage was utilized extensively when available. Once a storm moved within the range of a land radar site, reports were usually received hourly. Use of radar during 1977 is discussed in Chapter II.

3. ANALYSIS

A composite surface/gradient level (3000 ft) manual analysis 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 stressed for higher latitudes and vicinity of intense tropical systems.

Manual analysis of the 500 mb level is accomplished on the 0000Z and 1200Z data when significant tropical cyclones exist. Although the analysis of the 500 mb height field is stressed, analysis of the wind field to more clearly delineate steering currents is equally important.

A composite upper-tropospheric, manual analysis, utilizing rawinsonde data from 300 mb through 100 mb, wind directions extracted from satellite data by Det 1, 1WW and AIREPS (plus or minus 6 hours) at or above 29,000 feet is accomplished on 0000Z and 1200Z data daily. Wind and height data are used to arrive at a representative analysis of tropical cyclone outflow patterns, of steering currents, and of areas that may indicate tropical cyclone intensity change.

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

4. FORECAST AIDS

a. CLIMATOLOGY:

Climatological publications utilized during the 1977 typhoon season include previous JTWC Annual Typhoon Reports and climatic publications from Fleet Weather Central, Guam, Director Naval Oceanography and Meteorology, Naval Weather Research Facility, Naval Environmental Prediction Research Facility, Naval Postgraduate School, Air Weather Service, First Weather Wing and Chanute Technical

Training Center, plus publications from other Air Force and Navy activities, various universities and foreign countries.

b. OBJECTIVE TECHNIQUES:

The following objective techniques were employed in tropical cyclone forecasting during 1977. A description and an evaluation of these techniques is presented in Chapter V:

- (1) TYFN75
- (2) MOHATT 700/500
- (3) FCSTINT
- (4) 12-HR EXTRAPOLATION
- (5) HPAC
- (6) TROPICAL CYCLONE MODEL
- (7) INJAH74

5. FORECASTING PROCEDURES

a. INITIALIZATION:

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

b. TRACK FORECASTING:

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

- (1) The prospects for recurvature are evaluated for all westward and northward moving storms. This evaluation is based primarily on present and forecast position and amplitude of middle tropospheric mid-latitude troughs from the latest 500 mb analysis and numerical prognoses.
- (2) Determination of steering level is partly influenced by maturity and vertical extent of the system. For mature storms located south of the 500 mb subtropical ridge, forecast changes in speed of movement are closely correlated with forecast changes in the intensity of the ridge. When steering currents are very weak, the tendency for storms to move northward due to their internal forces is an important consideration.
- (3) Over the 12- to 72-hr forecast spectrum, speed of movement during the early time frame is biased toward persistence (12 hr extrapolation) while that near the end of the time frame is biased towards objective techniques and climatology.

(4) A final check is made against climatology to ascertain the likelihood of the forecast track. If the forecast deviates greatly from climatology, the forecast rationale is reappraised and the track adjusted as necessary.

c. INTENSITY FORECASTING:

In forecasting intensity, heavy reliance is placed on aircraft reconnaissance reports, the Dvorak satellite interpretation model, and the objective techniques. Additional considerations are the position and intensity of the tropical upper-tropospheric trough, extent and intensity of upper-level outflow, sea surface temperature, terrain influences, speed of movement, and proximity to an extratropical environment.

6. WARNINGS

Tropical cyclone warnings are numbered sequentially. If warnings are discontinued and the storm reintensifies, warnings are numbered consecutively from the last warning issued. Amended or corrected warnings are given the same number as the warnings they modify plus a sequential alphabetical designator. Each warning includes the initial warning time eye/center position, intensity, and the radial extent of 30, 50 and 100 kt surface winds (when applicable); the latest fix position used; the 12 hr forecast direction and speed of movement; and, forecast information. Warnings within the JTWC Pacific Area are issued within two hours of 0000Z, 0600Z, 1200Z and 1800Z with the constraint that two consecutive warnings may not be more than seven hours apart. This variable warning time allows for maximum use of all available reconnaissance platforms and spreads the workload in multiple storm situations. The forecast intervals for all tropical cyclones, regardless of intensity, are 12-, 24-, 48- and 72-hr.

Warnings in the JTWC Indian Ocean area are issued within two hours of 0800Z and 2000Z with the constraint that two consecutive warnings may not be more than fourteen hours apart. Warnings for this area are issued only after a tropical cyclone has attained an intensity of 34 kt or greater. Forecast intervals are 24 and 48 hours.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of the verification results for 1977 is presented in Chapter V.

7. PROGNOSTIC REASONING MESSAGE

In the Pacific Area, prognostic reasoning messages are transmitted based on the 0000Z and 1200Z warnings or whenever the previous reasoning is no longer valid. This plain language message is intended to provide field meteorologists with the reasoning behind the latest JTWC forecast. Prognostic reasoning messages are not prepared for tropical depressions nor for the Indian Ocean area.

This season JTWC began including confidence statements for the 24 hr forecasts. A summary of the verification results is presented in Chapter V.

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

8. SIGNIFICANT TROPICAL WEATHER ADVISORY

This plain language message, summarizing significant weather in the entire JTWC area of responsibility, is issued by 0600Z daily. It contains a detailed, non-technical description of all significant tropical disturbances and

the JTWC evaluation of potential for significant tropical cyclone development within the 24 hr forecast period.

9. TROPICAL CYCLONE FORMATION ALERT

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

CHAPTER II - RECONNAISSANCE & COMMUNICATIONS

1. GENERAL

The Joint Typhoon Warning Center depends on reconnaissance to provide necessary, accurate and timely meteorological information in support of each warning. The JTWC relies primarily on three sources of reconnaissance: aircraft, satellite and radar. Optimum utilization of all available reconnaissance assets is obtained through use of the Selective Reconnaissance Program (SRP) whereby various factors are considered in selecting a specific reconnaissance platform for each warning. Factors include: the cyclone's location and intensity, reconnaissance platform availability, current operations, limitation of reconnaissance assets, and the cyclone's threat to life/property. A listing of reconnaissance fixes used this season can be found in Chapter VI. Timely receipt of reconnaissance data is extremely important to the typhoon warning service. Similarly, a warning is useless unless it can be received by customers in a timely fashion. Therefore, efficient communications into and out of JTWC is invaluable.

2. RECONNAISSANCE

a. AIRCRAFT:

Aircraft weather reconnaissance is performed in the JTWC area of responsibility by the 54th Weather Reconnaissance Squadron (54 WRS). The squadron, presently equipped with six WC-130 aircraft, is located at Andersen Air Force Base, Guam. From July through October, augmentation by the 53rd Weather Reconnaissance Squadron at Keesler Air Force Base, Mississippi brings the total number of available aircraft to nine. The JTWC reconnaissance requirements are provided daily throughout the year to the Tropical Cyclone Aircraft Reconnaissance Coordinator (TCARC). These requirements include area(s) to be investigated, tropical cyclone(s) to be fixed, fix times, and forecast position of fix. In accordance with CINCPACINST 3140.1M, "Usage of reconnaissance assets in acquiring meteorological data from aircraft, satellites and land-based radar shall be at the discretion of FLEWEACEN/JTWC Guam based on the following priorities:

- (1) Alert flights and vortex or center fixes as required for issuance of tropical cyclone warnings in the Pacific area of responsibility;
- (2) Center or vortex fixes as required for issuance of tropical cyclone warnings in the Indian Ocean area of responsibility;
- (3) Supplementary fixes; and
- (4) Synoptic data acquisition".

As in previous years, aircraft reconnaissance provided direct measurements of height, temperature, flight level winds, sea level pressure, estimated surface winds (when observable) and numerous additional parameters.

The meteorological data is gathered by the Aerial Weather Reconnaissance Officers and dropsonde operators of Detachment 4, Hq AWS who crew with the 54th. These data provide the Typhoon Duty Officer indications of changing cyclone characteristics, radius of cyclone associated winds and position and intensity determinations. Another important aspect of this data is its availability for research in tropical cyclone analysis and forecasting. Aircraft reconnaissance will become even more important in years to come when high-resolution tropical cyclone dynamic steering programs will require a dense input of wind and temperature data.

b. SATELLITE

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

Detachment 1, 1st Weather Wing on Guam is the primary fix site for the western North Pacific. Both DMSP and NOAA data are received and processed. DMSP fix positions received at JTWC from the Air Force Global Weather Central (AFGWC), Offutt Air Force Base, Nebraska were the major source of satellite data for the Indian Ocean. NOAA satellite fixes were also received from Fleet Weather Facility (FLEWEAFAC), Suitland, Maryland for the western Pacific and Indian Ocean areas. GOES fixes were also provided by the National Environmental Satellite Service, Honolulu, Hawaii for the storms near the dateline.

c. RADAR

Land radar also provides very useful positioning data on well developed cyclones when in proximity (usually within 175 nm of the radar site) of the Republic of the Philippines, the Republic of China, Hong Kong, Japan (including the Ryukyu Islands), the Republic of Korea, and Guam.

3. AIRCRAFT RECONNAISSANCE EVALUATION CRITERIA

The following criteria are used to evaluate reconnaissance support to JTWC.

a. Six-hour fixes - To be counted as made on time, a fix must satisfy the following criteria:

- (1) Fix must be made not earlier than 1 hr before, nor later than 1/2 hr after scheduled fix time.
- (2) Aircraft in area requested by scheduled fix time, but unable to locate center due to:

(a) Cyclone dissipation; or

(b) Rapid acceleration of the cyclone away from the forecast position.

(3) If penetration not possible due to geographic or other flight restrictions, aircraft radar fixes are acceptable.

b. Levied 6-hr fixes made outside the above limits are evaluated as follows:

(1) Early-fix is made within the interval from 3 hr to 1 hr prior to scheduled fix times. However, no credit will be given for early fixes made within 3 hr of the previous fix.

(2) Late-fix is made within the interval from 1/2 hr to 3 hr after scheduled fix time.

c. When 3 hr fixes are levied, they must satisfy the same time criteria discussed above in order to be classified as made on time. Three-hour fixes made that do not meet the above criteria are classified as follows:

(1) Early-fix is made within the interval from 1 1/2 hr to 1 hr prior to schedule fix time.

(2) Late-fix is made within the interval from 1/2 hr to 1 1/2 hr after schedule fix time.

d. Fixes not meeting the above criteria are scored as missed.

e. Fixes levied as "resources permitting" are not evaluated.

f. Investigatives - to be counted as made on time, investigatives must satisfy the following criteria:

(1) The aircraft must be within 250 nm of the specified point by the scheduled time.

(2) The specified flight level and track must be flown.

(3) Reconnaissance observations are required every half-hour in accordance with AWSM 105-1. Turn and mid-point winds shall be reported on each full observation within 250 nm of the levied point.

(4) Observations are required in all quadrants unless a concentrated investigation in one or more quadrants has been specified.

(5) Aircraft must contact JTWC before leaving area of concern.

g. Investigatives not meeting the time criteria of paragraph f, will be classified as follows:

(1) Late-aircraft is within 250 nm of the specified point after the scheduled time, but prior to the scheduled time plus 2 hr.

(2) Missed-aircraft fails to be within 250 nm of the specified point by the scheduled time plus 2 hr.

4. AIRCRAFT RECONNAISSANCE SUMMARY

During the 1977 tropical cyclone season, 199 six-hourly vortex fixes and 4 supplementary vortex fixes were levied (Table 2-1). This was 114 less than during 1976. There were fewer tropical cyclones (4) and 169 fewer warnings issued. Increased reliance on satellite data as a fix platform and utilization of aircraft for synoptic data accounted for the lower percentage of aircraft fixes. For example in 1976, 310 aircraft fixes were levied for 661 warnings (46.9%) while in 1977 only 203 fixes were levied for 494 warnings (41.1%). In addition to vortex fixes, 42 investigative missions were levied during 1977 compared with 34 in 1976. Various factors accounted for the increase. In 1977 only 3 storms had no investigatives because of distances involved while 11 storms had 2 or more and 7 investigatives were levied on systems that did not develop. In 1976 7 storms had no investigatives with only 2 storms having 2 investigatives each.

Reconnaissance effectiveness is summarized in Table 2-1. The missed fix rate of 1.5% is the best in recent years.

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

EFFECTIVENESS	NUMBER OF FIXES	PERCENT
COMPLETED ON TIME	189	93.1
EARLY	0	0.0
LATE	11	5.4
MISSED	3	1.5
TOTAL	203	100.0

LEVIED VS. MISSED FIXES

	LEVIED	MISSED	PERCENT
AVERAGE 1965-1970	507	10	2.0
1971	802	61	7.6
1972	624	126	20.2
1973	227	13	5.7
1974	358	30	8.4
1975	217	7	3.2
1976	317	11	3.5
1977	203	3	1.5

5. SATELLITE RECONNAISSANCE SUMMARY

The Air Force provides satellite reconnaissance support to JTWC using meteorological data from polar orbiting meteorological satellites of the Defense Meteorological Satellite Program (DMSP).

A network of tactical DMSP sites at Nimitz Hill, Guam; Clark AB, Philippines; Kadena AB, Japan; Osan AB, Korea; and Hickam AFB, Hawaii provides direct readout coverage north of the equator from the dateline west

into the South China Sea. In February 1977, the Guam site was modified to acquire very high resolution data from the National Oceanic and Atmospheric Administration (NOAA) satellites. The Hawaii site was modified soon after.

The Air Force Global Weather Central (AFGWC) at Offutt AFB, Nebraska using stored data readout provides satellite reconnaissance over the Indian Ocean and backup for the tactical sites in WESTPAC. Det 1, 1WW at Guam, collocated with JTWC, operates the network, tasking appropriate sites for tropical cyclone position reports.

Prior to October 1977, both the technicians who maintain and operate the DMSP ground station equipment and the analysts who interpret the data were members of Air Weather Service (AWS). In October 1977, the technicians became members of the Air Force Communications Service (AFCS) as part of an overall AWS/AFCS maintenance consolidation.

Satellite positions are assigned Position Code Numbers (PCN's) depending on the availability of geography for precise gridding and the state of the tropical cyclone's circulation. These are shown in Table 2-2. Estimates of tropical cyclone intensity are obtained from visual data using the Dvorak technique (NOAA Technical Memorandum NESS 45 and later refinements).

TABLE 2-2. POSITION CODE NUMBERS

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

CC=Circulation Center

Increased satellite availability provided the opportunity to more effectively use satellite reconnaissance through the Selective Reconnaissance Program (SRP). For the first time more than half of JTWC's warnings in WESTPAC (51%) were based on satellite positions of tropical cyclones. In the Indian Ocean, where aircraft and radar were not available, 95.5% of JTWC's warnings were based on satellite fixes.

Use of a dual-site tasking concept which requires at least two DMSP sites to make each JTWC levied tropical cyclone fix has in the past resulted in a 99% reliability in meeting JTWC's satellite fix requirements. However in 1977, this reliability dropped to 94.9% due to an unreliable early afternoon and early morning DMSP satellite.

The loss of data from this satellite was random. Therefore, aircraft reconnaissance was levied to support the 0600Z and 1800Z warnings when appropriate. Radar and NOAA 5 satellite data was also used as primary or backup reconnaissance at these times limiting

the need to revert to extrapolation as a warning base.

A comparison of satellite derived positions and the JTWC Best Track positions is shown in Table 2-3. The relative accuracies of satellite positions can be obtained from this table. However, the values are also a function of the Best Track smoothing process.

Satellite derived fixes were also obtained from: USN ships equipped for DMSP direct readout; the National Environmental Satellite Service using NOAA and GOES data; Fleet Weather Facility (FLEWEAFAC), Suitland, Maryland using stored NOAA data; and, from the Naval Weather Service Environmental Detachment at Diego Garcia using NOAA APT data. This information was invaluable to the warning service. Since these were secondary sources, they were not put through the end of the year evaluation.

TABLE 2-3. Mean Deviations (nm) of DMSP Derived Tropical Cyclone Positions from JTWC Best Track Positions, 1974-1977 (all sites). Number of cases shown in parentheses.

PCN	1974	1975	1976	1977
	(ALL SITES)	(ALL SITES)	(ALL SITES)	(ALL SITES)
1	13.6 (226)	11.8 (214)	12.4 (131)	15.7 (134)
2	17.4 (37)	20.4 (35)	20.1 (124)	19.1 (47)
3	20.1 (422)	21.2 (271)	21.7 (161)	22.4 (141)
4	23.9 (70)	22.4 (50)	29.3 (122)	30.0 (75)
5	35.4 (342)	34.2 (323)	40.4 (247)	37.7 (357)
6	49.4 (108)	44.7 (71)	49.0 (153)	40.9 (247)
162	14.2 (261)	13.0 (249)	16.1 (255)	16.6 (181)
364	20.6 (492)	21.4 (321)	25.4 (313)	25.0 (216)
566	38.8 (450)	36.1 (394)	43.7 (400)	39.0 (604)

6. RADAR RECONNAISSANCE SUMMARY

The 1977 Typhoon season produced a total of 385 radar center fixes accounting for 16.3% of all tropical cyclone fixes in the western Pacific. One radar fix was taken by a WC-130 aircraft of the 54th Weather Reconnaissance Squadron during Tropical Storm Ruth. All other radar fixes were taken by land or ship. The number of storms that were within radar acquisition range this year was 11 compared to 12 last year, but the total number of radar fixes this year was only one half of last year's number. This apparent contradiction is explained by a smaller number of well organized storms especially of the Super Typhoon classification, one versus four last year.

The WMO radar code defines three categories of accuracy for the various national meteorological agencies' radar reports. These categories are: good [within 10 km (5.4 nm)], fair [within 10-30 km (5.4-16.2 nm)] and poor [within 30-50 km (16.2-27 nm)]. This year 287 radar fixes were coded in this manner of which 62% were good, 27% fair and 11% poor. Compared to the JTWC best track, the mean vector deviation for land radar sites was 18.3 nm (34 km) compared to 11.6 nm (21 km) last year and for the one aircraft fix the deviation was 32.4 nm (60 km) compared to 16.0 nm (30 km) last year. This decrease in accuracy is attributable to the smaller number of well organized storms.

Of the total 385 radar fixes this year,

the national meteorological agencies of various countries accounted for 75%; U. S. Air Force, Air Weather Service, Sites 19%; and 5% from aircraft control and warning (AC&W) sites. This year the land radar sites in Taiwan provided a much greater percentage of radar fixes (31%) as compared to previous years due to five storms (Ruth, Thelma, Vera, Amy and Dinah) passing through their area of acquisition. The extensive radar network of the Japan-Ryuku area provided 37% of the total with 13% from Guam and 3% from the Royal Observatory in Hong Kong. The Republic of the Philippines also noticeably increased their coverage, up to 12%, as five storms (Thelma, Sarah, Freda, Kim and Mary) moved through their area. As in previous years, there were no radar fixes taken within the Indian Ocean area.

Of the eleven storms making up this year's number of radar fixes, three typhoons (Babe, Kim and Vera) accounted for 58% of the total. Typhoons Babe and Vera were tracked by the Japanese Meteorological Agency and Taiwan radar sites to account for 40% of the total. All three of these storms were fixed simultaneously by three radar sites on more than one occasion during their tracks.

7. COMMUNICATIONS

A new piece of communication equipment, the Naval Environmental Display Station (NEDS) was installed at FWC/JTWC in 1977. The NEDS is an addition to the existing variety of JTWC's communication systems which include the Automatic Voice Switching Network (AUTOVON), the Automatic Digital Network (AUTODIN), the Naval Environmental Data Network (NEDN), and the Air Force Automated Weather Network (AWN). The NEDS has been available, although not yet fully operational, since mid-1977 and promises to add significantly to the efficiency of data receipt and warning preparation. It will eventually replace the current FWC computer which is now providing the graphical display of much of the basic meteorological intelligence received via the NEDN.

The AUTOVON serves as a vital communication link and is a back-up for primary communication systems. AUTODIN is used for dissemination of warnings and other related bulletins which are concurrently transmitted via the AWN. These messages are also relayed for further transmission over US Navy Fleet Broadcasts and to all ships and island stations via US Coast Guard CW (Continuous Wave Morse Code) and voice communications. Inbound message traffic for JTWC is received via AUTODIN addressed to FLEWEACEN GUAM.

Actual message tape preparation and entering of messages into the AUTODIN and AWN circuits is performed by the Nimitz Hill Naval Telecommunications Center (NTCC) of the Naval Communications Area Master Station Western Pacific.

The main data source for JTWC analyses is a dedicated AWN circuit linking JTWC directly to the Automated Digital Weather Switch (ADWS) at Clark AB, RP. The ADWS selects and routes the large volume of meteorological reports necessary to satisfy JTWC requirements for the right data at the right time. At times of primary circuit outage, JTWC has other, though limited and less efficient, teletype data sources. One of these provides data to and from the U. S. Trust Territory, Guam, and the Northern Marianas.

High frequency single sideband (HF/SSB) and phone patch through the USAF aeronautical station at Andersen AFB (Andersen Airways) is the normal means of communication between weather reconnaissance aircraft and JTWC. Depending on storm location or propagation difficulties, the same direct voice contact can be established via AUTOVON through other USAF aeronautical stations, such as Clark, Yokota or Hickam Airways. USAF weather stations, collocated with the aeronautical stations, are designated weather reconnaissance monitors who are charged with acquiring, checking and transmitting reconnaissance reports into the AWN. As does JTWC, these monitor stations receive the data via HF/SSB and phone patch and often copy reports simultaneously with JTWC for efficiency and accuracy.

Reconnaissance aircraft provide vortex data in two stages. The preliminary data, requiring minimum onboard computations, contain enough information to permit JTWC forecasters to begin preparation of warnings. The average delay between the time the preliminary fix data messages were obtained and the time they were copied at JTWC was 19 minutes in 1977 as compared to 15 minutes in 1976, and 21 minutes in 1975. Similar delay times for the second stage, or complete eye/center fix data were 53 minutes in 1977, 30 minutes in 1976 and 49 minutes in 1975. The large difference between the 1976 and 1977 averages is in part due to cases when extremely poor propagation conditions caused exceptionally long delays. Further statistics relating to the efficiency of air/ground aircraft reconnaissance communications are given in Table 2-4.

TABLE 2-4. 1973-1977 AIR/GROUND DELAY STATISTICS FOR AIRCRAFT RECONNAISSANCE

	1973	1974	1975	1976	1977
%Complete fix messages delayed over one hour	20	19	20	21	
%Complete fix messages received after warning time	10.1	4.9	3.7	4.7	4.9

CHAPTER III - RESEARCH & DEVELOPMENT SUMMARY

1. GENERAL

One of the tasks of the Joint Typhoon Warning Center is to conduct applied tropical cyclone research, as time and resources permit. The objective of this research is to improve operational forecasts. This research primarily involves the development of forecasting and analysis techniques from published studies and preparing reports requested by outside agencies. Meteorologists from agencies such as the Naval Environmental Prediction Research Facility, the Naval Postgraduate School, Det 4, HQ Air Weather Service, Det 1, 1st Weather Wing and the 54th Weather Reconnaissance Squadron often collaborate on these projects. The following abstracts summarize the year's research and development projects completed or still in progress.

2. OPERATIONAL APPLICATION OF A TROPICAL CYCLONE RECURVATURE/NON-RECURVATURE STUDY BASED ON 200MB WIND FIELDS

(Guard, C. P., FLEWEACEN/JTWC TECH NOTE 77-1)

In his paper, Tropical Cyclone Motion and Surrounding Parameter Relationships, John E. George demonstrated the relationship between various 200 mb wind fields and recurvature/non-recurvature. Evaluation of the wind fields with data independent of George's study indicated that significant modification of his study was required to produce an operationally applicable recurvature/non-recurvature study. Synoptic analysis revealed two distinct environments affecting tropical cyclones, a Winter Regime and a Summer Regime. All tropical cyclones were stratified accordingly. By integrating the results of the evaluation with results from rigorous synoptic and statistical analyses, operationally applicable recurvature/non-recurvature techniques were developed for, both, Winter Regime and the Summer Regime tropical cyclones.

3. TROPICAL CYCLONE CENTER FIX DATA FOR THE 1976 STORM SEASON

(Staff, FLEWEACEN/JTWC TECH NOTE 77-2)

This publication is a listing of all center fix data for each tropical cyclone occurring in the western North Pacific, Bay of Bengal, and Arabian Sea during 1976. (Note: The 1977 center fix data is included in Chapter VI herein, and will not be published as a separate report.)

4. EVALUATION OF THE DVORAK IR TECHNIQUE FOR USE WITH DMSP DATA

(Corey, T. D., DET 1, 1ST WEATHER WING)

An evaluation was made of the Dvorak IR technique (1975) using nighttime DMSP IR data. The data included all tropical storms and typhoons occurring during the period 1 June through 31 December 1976. A comparison was made between the Dvorak IR intensity estimate

and the corresponding best track intensity. The results showed that the Dvorak IR technique is useful in describing intensity trends but not in making independent intensity estimates.

5. A CLIMATOLOGY OF TROPICAL CYCLONES FOR THE PERIOD 1971-1976

(Willms, G. R., FLEWEACEN/JTWC)

An analysis was made of all tropical cyclones occurring in the JTWC area of responsibility during 1971-1976. The analysis determined: the average speed of tropical cyclones, by month, traversing each 5° latitude/longitude square in the western North Pacific; and the average annual number of occurrences of tropical cyclones by 5° latitude/longitude square in the western North Pacific, Bay of Bengal and Arabian Sea. This study updated previous work.

6. RELATIONSHIPS BETWEEN THE TEMPORAL VARIATION OF EQUIVALENT POTENTIAL TEMPERATURE AND TROPICAL CYCLONE INTENSITY

(Hassebrock, A. W., FLEWEACEN/JTWC)

The use of equivalent potential temperature as a predictor of tropical cyclone intensity has been studied previously by Sikora (ATR, 1975) and Milner (ATR, 1976). These studies examined the equivalent potential temperature (magnitude) in relation to tropical cyclone intensity and found inconclusive results. In this study, aircraft center fix data for 1976-1977 tropical cyclones were analyzed to determine if temporal variations, versus magnitude, of equivalent potential temperature had any relationship with tropical cyclone intensification. Two types of variations were found which show potential as intensity forecasting aids. These two techniques will be evaluated during the 1978 storm season.

7. THE TRANSITIONING OF TROPICAL CYCLONES TO EXTRATROPICAL CYCLONES

(Guard, C. P., FLEWEACEN/JTWC and Brand, Samson, NEPRF)

An examination was made of the post-recurvature transition of tropical cyclones to extratropical cyclones. Particular emphasis is placed on the short-lived intensification that tropical cyclones sometimes undergo after recurvature, as cold air is initially advected into the region of the wall cloud.

8. FUTURE AIRCRAFT RECONNAISSANCE STORM TRACKS

(Staff, FLEWEACEN/JTWC, DET 4, HQ AWS AND 54 WRS)

An examination was made of storm tracks needed to satisfy future data requirements. New tracks were developed to provide increased peripheral data for the 1978 season. Additional tracks were discussed which may be

required to provide the necessary input data for the FNWC Tropical Cyclone Model.

9. TROPICAL CHART SERIES FOR SEPTEMBER 1975

(Sokol, D., Willms, G. R. and Guard, C. P., FLEWEACEN/JTWC)

A series of surface/gradient and 200 mb charts were prepared for the Naval Postgraduate School. These charts depicted a period of high storm activity during September 1975 and are now an integral part of the laboratory instruction at the school.

10. TROPICAL WEATHER STUDY GUIDE

(Fukada, E. M., FLEWEACEN/JTWC)

A study guide on tropical weather was prepared for the Navy Forecasters School. The study guide, which was in a programmed text format, discusses the climatology, synoptics and dynamics of tropical weather.

Note: Anyone desiring additional information on any of the above subjects should contact the Director, JTWC.

CHAPTER IV - SUMMARY OF TROPICAL CYCLONES

1. WESTERN NORTH PACIFIC TROPICAL CYCLONES

During 1977, the western North Pacific experienced the smallest number of typhoons since JTWC's formation in 1959. Of the 21 numbered tropical cyclones occurring during 1977 (Table 4-1), only eleven developed to mature typhoons, eight peaked out as tropical storms, and two did not develop beyond depression stages. Tables 4-2 and 4-3 show that both the number of tropical storms and typhoons were well below the quantity normally observed. During the season, only Babe reached the 130 kt (67 m/sec) intensity necessary to be classified as a "super" typhoon. The months, January through June, were completely void of typhoons and had only a total of two tropical storms, Patsy in March and Ruth in June. This early season lull in

activity was similar to that observed during 1973 and 1975. Tropical cyclone occurrences were near normal during July, but fell to a record low for August when no typhoons and only a single tropical storm was observed. During late July the southwest monsoon of India and Southeast Asia became very deep and intense, extended anomalously into the western North Pacific, and persisted for weeks. The monsoon trough was oriented in an east-northeast to west-southwest direction from Hainan Island to the Bonin Islands. Several cyclonic eddies formed within the trough as Monsoon Depressions, i.e., systems characterized by broad surface circulation centers, highly asymmetric wind fields, surface winds less than 34 kt (18 m/sec), greatest intensity at 5,000 to 10,000 ft (1470-2940 m), and strong vertical shear.

TABLE 4-1.
1977 TROPICAL CYCLONES

PACIFIC AREA										
CYCLONE	TYPE	NAME	PRD OF WRNG	CALENDAR	MAX	MIN	NO. OF WARNINGS		DISTANCE	
				DAYS OF WARNING	WIND	SFC OBS SLP	TOTAL	AS TY	TRAVELLED	
01	TS	PATSY	23 MAR-31 MAR	9	50	981	25	--		1199
02	TD	TD 02	26 MAY-27 MAY	2	30	1001	6	--		313
03	TS	RUTH	14 JUN-17 JUN	4	60	980	14	--		874
04	TD	TD 04	05 JUL-06 JUL	2	30	995	6	--		396
05	TY	SARAH	16 JUL-21 JUL	6	75	970	21	3		1548
06	TY	THELMA	21 JUL-26 JUL	6	85	957	21	11		1992
07	TY	VERA	28 JUL-01 AUG	5	110	926	18	13		814
08	TS	WANDA	31 JUL-04 AUG	5	45	986	17	--		936
09	TS	AMY	20 AUG-23 AUG	4	40	990	16	--		936
10	STY	BABE	02 SEP-10 SEP	9	130	906	36	20		2436
11	TS	CARLA	03 SEP-05 SEP	3	35	994	9	--		614
12	TY	DINAH	14 SEP-23 SEP	10	75	964	38	10		1998
13	TS	EMMA	15 SEP-20 SEP	6	60	966	21	--		1680
14	TS	FREDA	23 SEP-25 SEP	3	55	997	9	--		859
15	TY	GILDA	03 OCT-10 OCT	8	70	968	30	8		2332
16	TS	HARRIET	16 OCT-20 OCT	5	55	984	19	--		1544
17	TY	IVY	21 OCT-27 OCT	7	90	945	24	12		1877
18	TY	JEAN	*	6	65	972	20	3		1015
19	TY	KIM	06 NOV-17 NOV	12	125	916	44	25		1338
20	TY	LUCY	28 NOV-07 DEC	10	115	919	39	16		3922
21	TY	MARY	20 DEC-03 JAN	15	100	947	59	15		4002
1977 TOTALS				124**			492	136		
INDIAN OCEAN AREA										
TC	17-77		11 MAY-13 MAY	3	60	980	4	--		374
TC	18-77		10 JUN-13 JUN	4	60	985	6	--		510
TC	19-77		29 OCT-31 OCT	3	40	994	5	--		691
TC	21-77		*	11	70	979	19	4		1387
TC	22-77		15 NOV-19 NOV	5	115	930	10	8		875
1977 TOTALS				21**			44	12		

*JEAN 28 OCT-31 OCT AND 02 NOV-03 NOV
21-77 10 NOV-12 NOV AND 14 NOV-21 NOV

**OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM

TABLE 4-2 FREQUENCY OF TROPICAL STORMS AND TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.4	0.5	0.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	22.0
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
1974	1	0	1	1	1	4	4	5	5	4	4	2	32
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	2	1	19
AVERAGE (1959-77)	0.5	0.4	0.4	0.8	1.2	1.6	4.6	5.6	4.9	4.2	2.5	1.2	27.9

TABLE 4-3 FREQUENCY OF TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.3	0.4	0.7	1.1	2.0	2.9	3.2	2.4	2.0	0.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	2	1	20
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
1974	0	0	0	0	1	2	1	2	3	4	2	0	15
1975	1	0	0	0	0	0	1	3	4	3	2	0	14
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
AVERAGE (1959-77)	0.3	0.1	0.1	0.7	0.9	1.1	2.8	3.6	3.2	3.2	1.6	0.5	18.3

Upon relaxation of the deep, southwest monsoon flow, Tropical Storm Wilda developed, but did not exceed 45 kt (23 m/sec) intensity in the environment of strong vertical shear. As Wilda moved east of Japan, she caused the monsoonal flow over the western Pacific to move toward the north, rather than toward the climatologically favored regions where tropical cyclones normally develop. This northward flow toward low pressure continued as several extratropical systems developed near the sea of Japan, south of the normal regions for extratropical cyclogenesis in August. About the middle of August, the deep, southwest monsoon flow again intensified, and again several Monsoon Depressions formed. When the monsoon finally weakened, Tropical Storm Amy developed, but barely to 40 kt (21 m/sec). Amy again drew the western Pacific region of low pressure far north of its normal position, preventing establishment of a significant near-equatorial trough (NET). In fact, during much of August, pressures were much above normal in the tropics and easterly winds dominated the equatorial regions, helping to prevent cyclogenesis. By early September, pressures had fallen in the tropics, flow was back to normal, and Super Typhoon Babe developed in the NET, south of Guam. The remainder of the 1977 season for both tropical storms and typhoons was near normal.

During 1977, 26 Tropical Cyclone Formation Alerts were issued. Of these, 20 or 77%

TABLE 4-4.

PACIFIC AREA
TROPICAL CYCLONE FORMATION ALERT SUMMARY

YEAR	NUMBER OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE
	1972	41	29	52	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%

MONTHLY DISTRIBUTION

	J	F	M	A	M	J	J	A	S	O	N	D
FORMATION ALERTS	0	0	1	0	1	1	6	5	6	3	2	1

developed into significant tropical cyclones (Table 4-4). No formation alert was issued for Typhoon Jean. Instead, a warning was issued in order to provide more information to a U. S. Navy ship approaching the system. The average lead time between issuance of a Tropical Cyclone Formation Alert and the first warning was 21 hours, with a minimum of 4 hours with Tropical Storm Wanda and a maximum of 48 hours with Typhoon Kim.

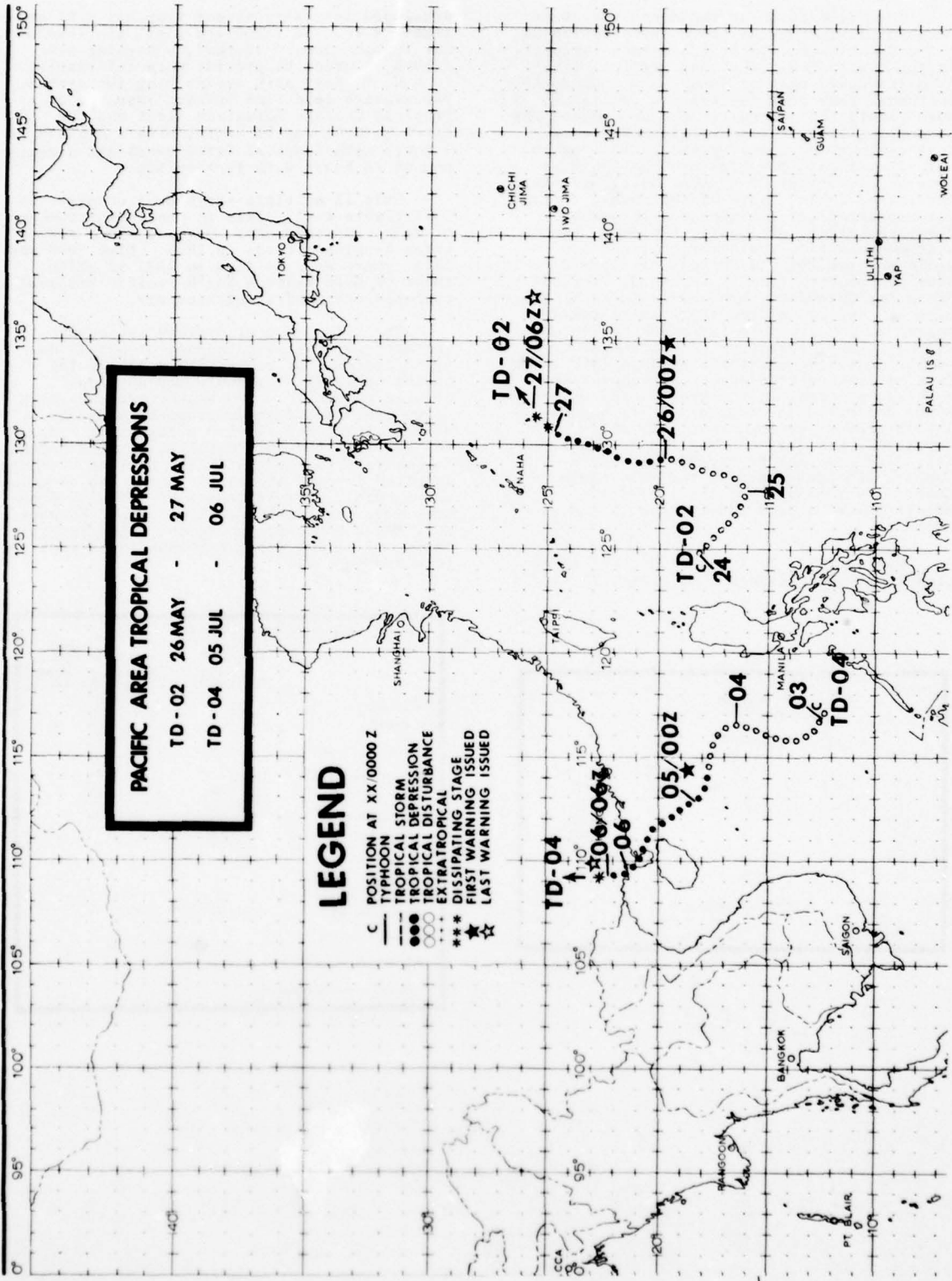
Only 12 multiple-storm days occurred in 1977 (Table 4-5). This is the lowest number of multiple-storm days observed since JTWC began keeping records in 1959. Like 1970 and 1975, there were no days in 1977 in which three or more western North Pacific tropical cyclones occurred simultaneously.

The 1977 tropical cyclone season was characterized by an abundance of poorly defined cyclones of relatively small radial extent of which many exhibited numerous erratic movements. The weaker cyclones were often inhibited from development by an unusually large and intense subtropical ridge and shear of the horizontal winds with height. In contrast, periods of weak steering currents resulted in five storms executing one or more loops each. Overall losses of life and property were thankfully small. Taiwan, however, survived a three-month drought, then experienced two of the worst typhoons in 80 years, Vera and Thelma.

TABLE 4-5. SUMMARY OF JTWC WARNINGS 1959-1977.

	WESTERN NORTH PACIFIC		NORTH INDIAN OCEAN		CENTRAL NORTH PACIFIC	
	1977	AVERAGE 1959-76	1977	AVERAGE 1971-76*	1977	AVERAGE 1971-76
TOTAL NUMBER OF WARNINGS	492	679	44	26	0	35
CALENDAR DAYS OF WARNINGS	124	142	21	16	0	10
NUMBER OF WARNING DAYS WITH TWO CYCLONES	12	46	5	1	0	1
NUMBER OF WARNING DAYS WITH THREE OR MORE CYCLONES	0	9	0	0	0	0
TROPICAL DEPRESSIONS	2	5	-	-	0	1
TROPICAL STORMS	8	11	-	-	0	1
TYPHOONS/HURRICANES	11	19	-	-	0	1
I.O. TROPICAL CYCLONES	-	-	5	4	-	-
TOTAL TROPICAL CYCLONES	21	34	5	4	0	3

* 1971-1974 DOES NOT INCLUDE ARABIAN SEA



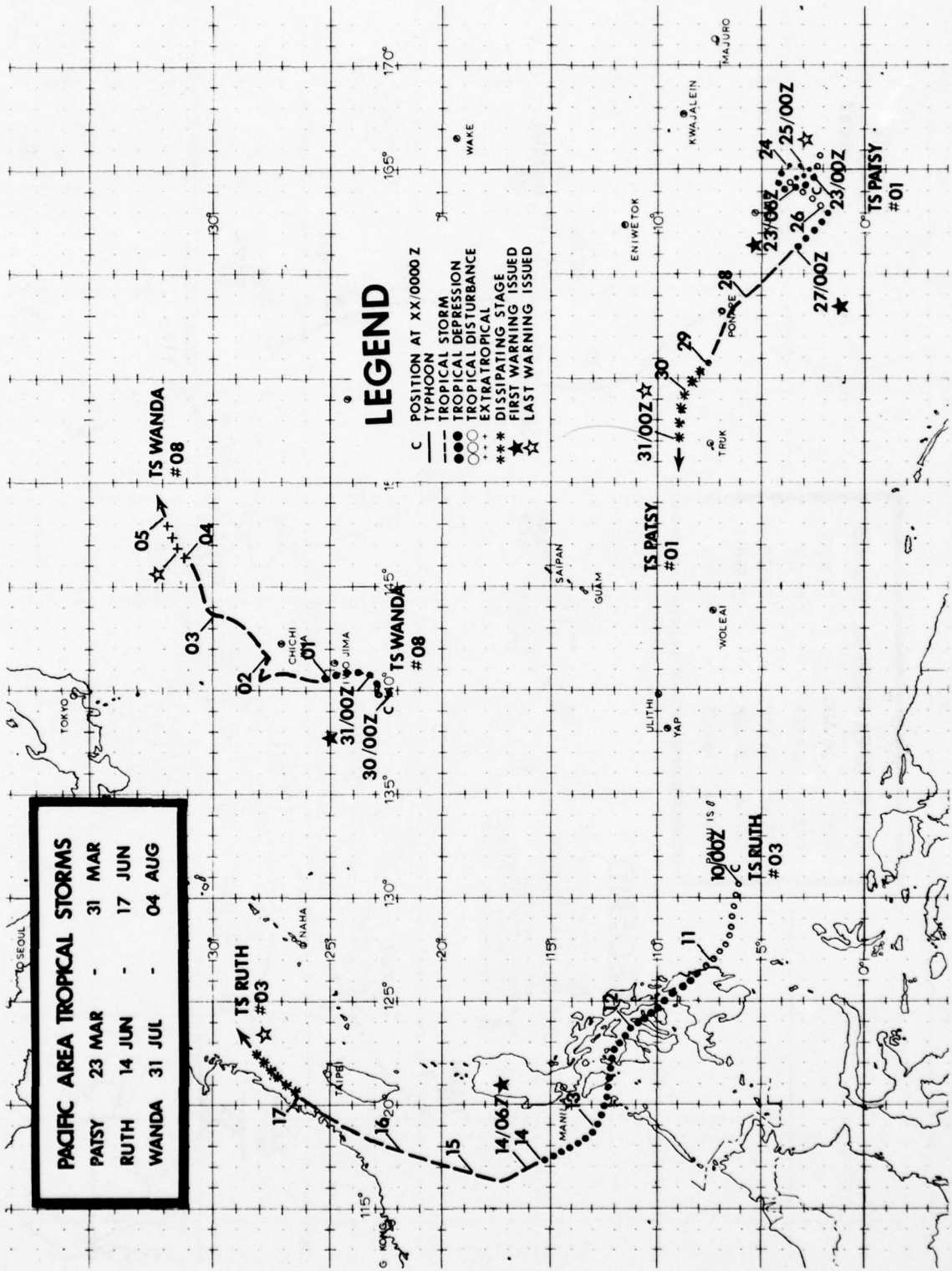
PACIFIC AREA TROPICAL DEPRESSIONS
 TD-02 26 MAY - 27 MAY
 TD-04 05 JUL - 06 JUL

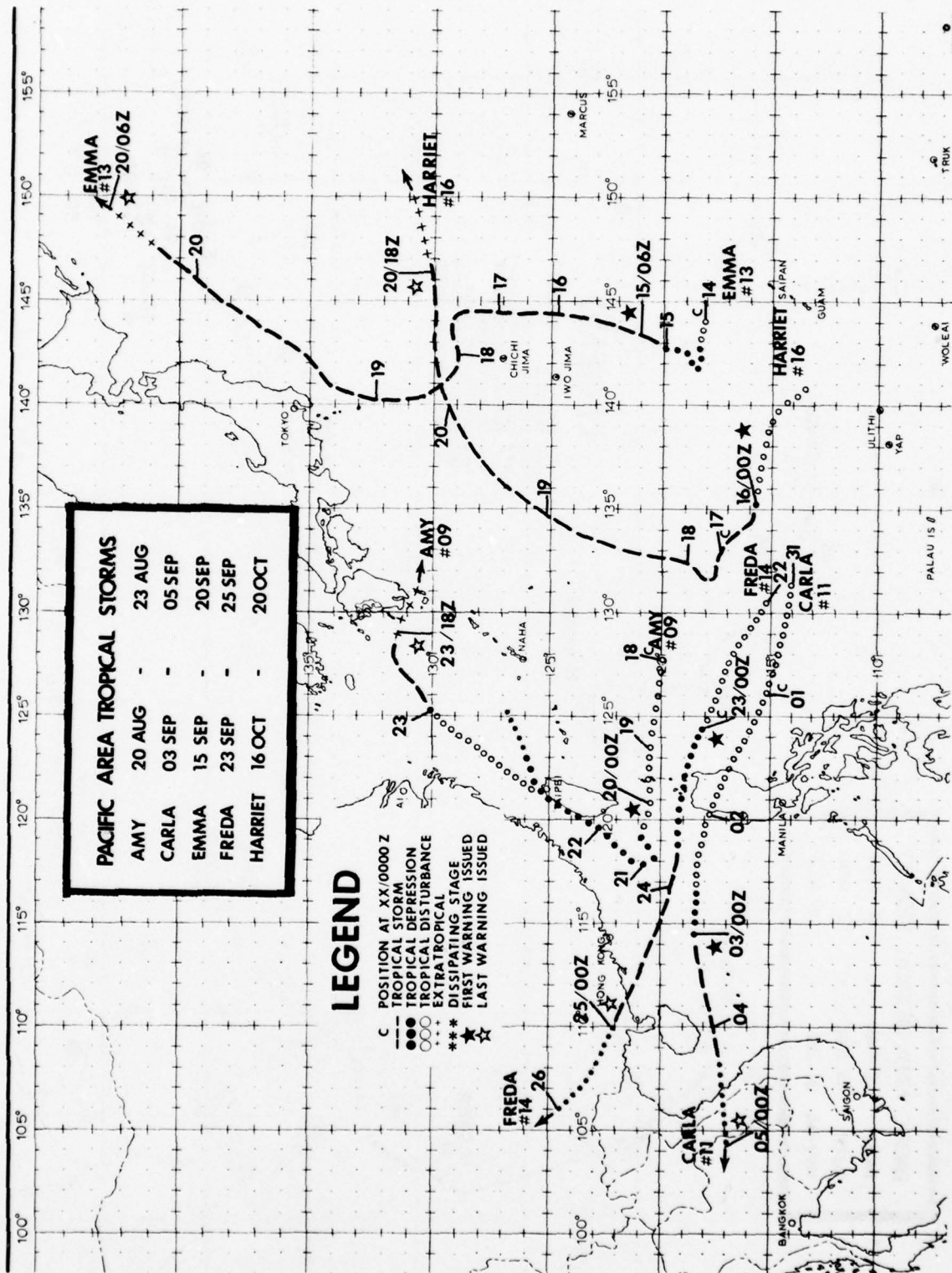
LEGEND

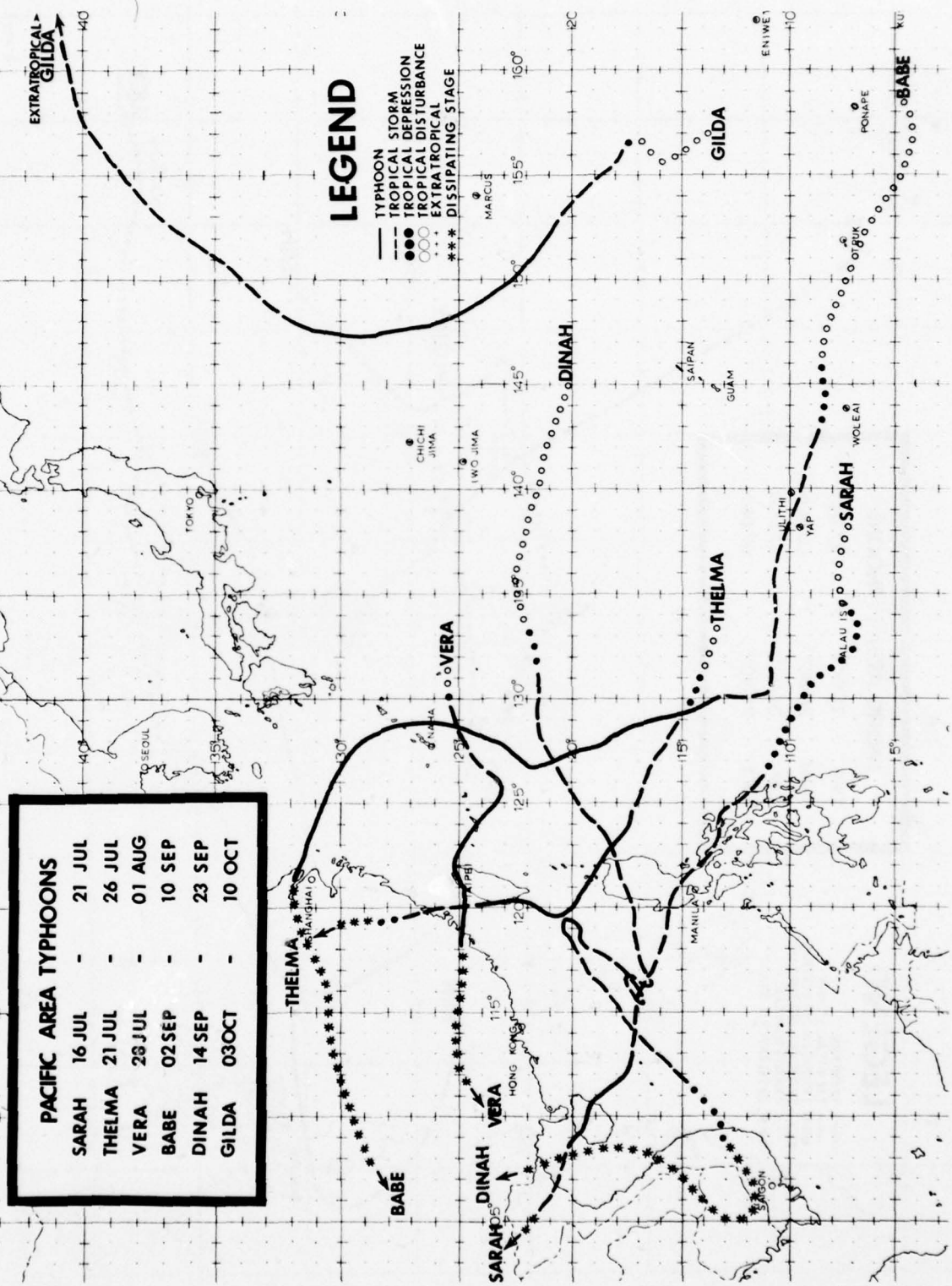
- C POSITION AT XX.0000 Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

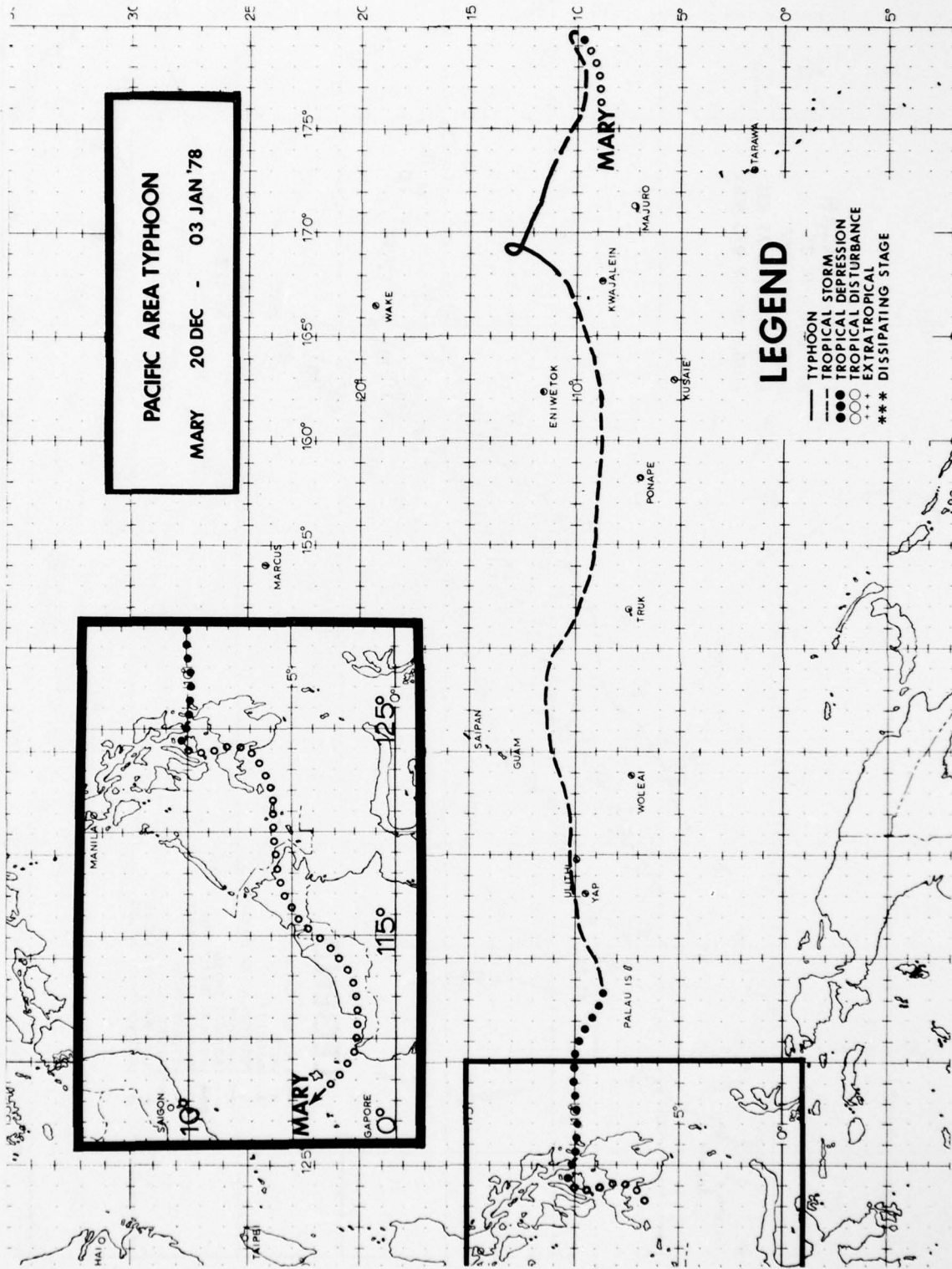
PACIFIC AREA TROPICAL STORMS

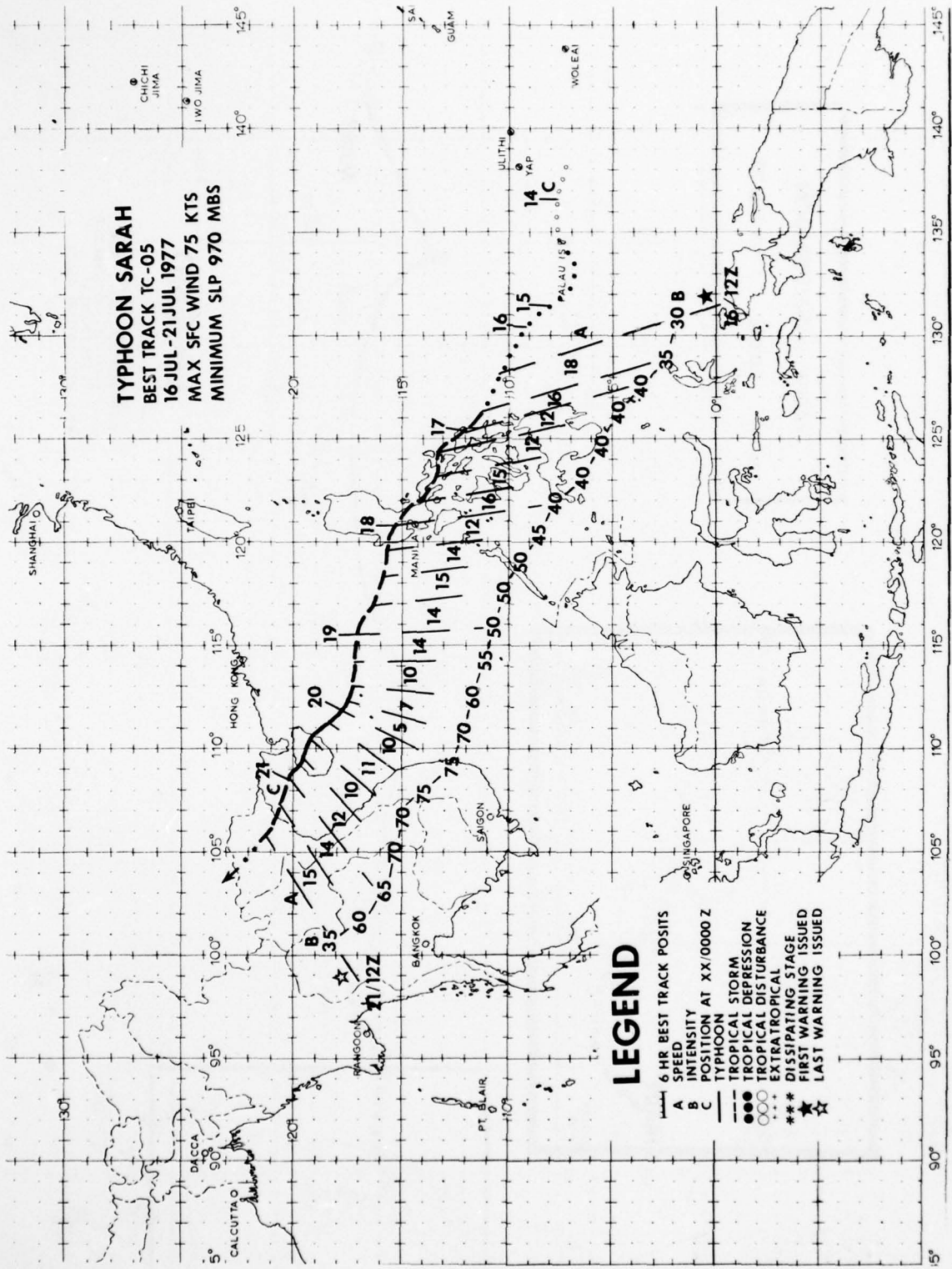
PATSY	23 MAR	31 MAR
RUTH	14 JUN	17 JUN
WANDA	31 JUL	04 AUG











TYPHOON SARAH
BEST TRACK TC-05
16 JUL-21 JUL 1977
MAX SFC WIND 75 KTS
MINIMUM SLP 970 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY AT XX/0000 Z
- C TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

SARAH

The first typhoon of the 1977 season did not occur until mid-July. Meteorological satellite data on the morning of July 13th showed an area of convection some 225 nm (417 km) east of Koror (WMO 91408) in the Palau Islands. This tropical disturbance meandered on a 10 kt (19 km/hr), westward track and crossed Koror at 1200Z on the 14th. On the morning of the 15th, the system exhibited increased organization and a Tropical Cyclone Formation Alert was issued at 0000Z. Simultaneously, the disturbance took a more climatological, west-northwestward track and showed evidence of possessing multiple circulation centers.

During the 16th, satellite data hinted that the western-most circulation center was becoming the dominant one. Reconnaissance aircraft refuted this however, and fixed the primary center approximately 200 nm (370 km) east of the satellite positions. At 0943Z aircraft observed 38 kt (20 m/sec) winds at 700 mb and estimated surface winds at 25 kt (13 m/sec). Satellite data an hour later showed that convection in the area had, in fact, consolidated around the aircraft-fixed circulation center, and the first warning on Tropical Depression (TD) number 05 was issued at 1200Z.

By the evening of the 16th, TD 05 had accelerated to 17 kt (31 km/hr), and satellite data illustrated increased organization. At 1800Z the depression was upgraded to Tropical Storm Sarah, while located 30 nm (56 km) east of the Philippine island of Samar. During the subsequent 24 hours, Sarah, possessing 40 kt (21 m/sec) intensity, moved toward Manila at 13 kt (24 km/hr) on a west-northwest to northwest heading (Fig. 4-1). At 2355Z on the 17th, Clark AB observed a minimum sea level pressure of 997.3 mb; winds were from the northwest at 12 kt (6 m/sec). Within two hours winds at the Air Base had become southerly. Synoptic reports were of great value during this period. The mountainous terrain prevented aircraft reconnaissance of the low level circulation center, while frictional effects weakened and disorganized Sarah making satellite positioning very difficult.

From the evening of the 16th until the morning of the 20th upper level patterns in Sarah's environment were favorable for enhancement of her upper level outflow, which would normally result in intensification. The Tropical Upper Tropospheric Trough (TUTT) was oriented east-west, north of her and was enhancing outflow in the north semicircle; strongly divergent winds south of the tropical storm increased outflow to the south. While over land, however, Sarah could not intensify since the latent and sensible heat required to maintain sufficient thermal and related pressure gradients were not available. The tropical storm entered the South China Sea on the afternoon of the 18th and immediately began to intensify.

On the evening of the 19th, a mid-tropospheric low over south central China deepened and weakened the subtropical ridge north of Sarah; she responded and turned to the northwest; toward Hainan Island, still intensi-

fying. Sarah was upgraded to a typhoon at 1800Z and six hours later reached its maximum intensity of 75 kt (39 m/sec). At 2100Z Hsi-Sha-Tao (WMO 59981) reported sustained winds (10 minute average) of 60 kt (31 m/sec) from the west-southwest and a sea level pressure of 977.5 mb.

Sarah went ashore on Hainan Island on the evening of the 20th. At 1200Z Ch'iu-Hai (19.3N-110.5E) reported 10 kt (5 m/sec) winds from the west and a sea level pressure of 978.5 mb. At this time Sarah's intensity was estimated to be 70 kt (36 m/sec). Meanwhile, the mid-level low over China had receded toward the north and the subtropical ridge began to build westward, north of Sarah. During the subsequent six hours, the typhoon slowed to 8 kt (15 km/hr) and took a westward course, passing north of the central mountain range of Hainan. At 1800Z Tan-Hsien (19.5N-109.6E) was near the center when it reported 15 kt (8 m/sec) winds from the east-northeast and a sea level pressure of 969.5 mb.

Typhoon Sarah entered the Gulf of Tonkin on the morning of the 21st with an estimated 65 kt (33 m/sec) intensity. The typhoon accelerated to 15 kt (28 km/hr) and went ashore near Haiphong. At 0600Z on the 21st, Kien-an Phulien (20.8N-106.6E), a Haiphong suburb, reported north-northwesterly winds of 30 kt (15 m/sec) and a sea level pressure of 986.9 mb. Six hours later these values had changed to 30 kt (15 m/sec) from the south and 988.5 mb with pressure rising rapidly.

The final warning on Sarah was issued at 1200Z on the 21st as she was dissipating over the Red River Valley, northwest of Hanoi. Very little damage occurred during Sarah's existence. Only Hanoi Radio reported cases of destruction with no casualties.

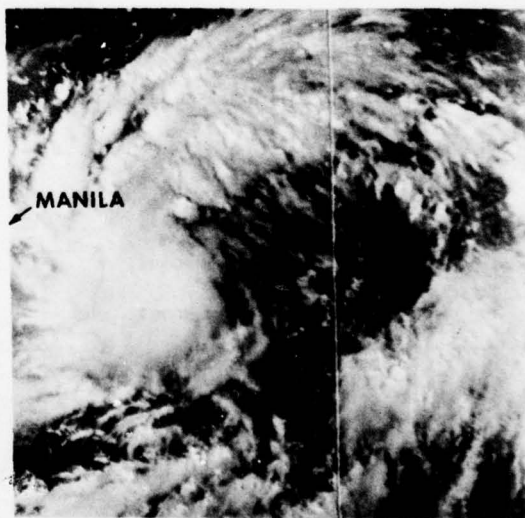
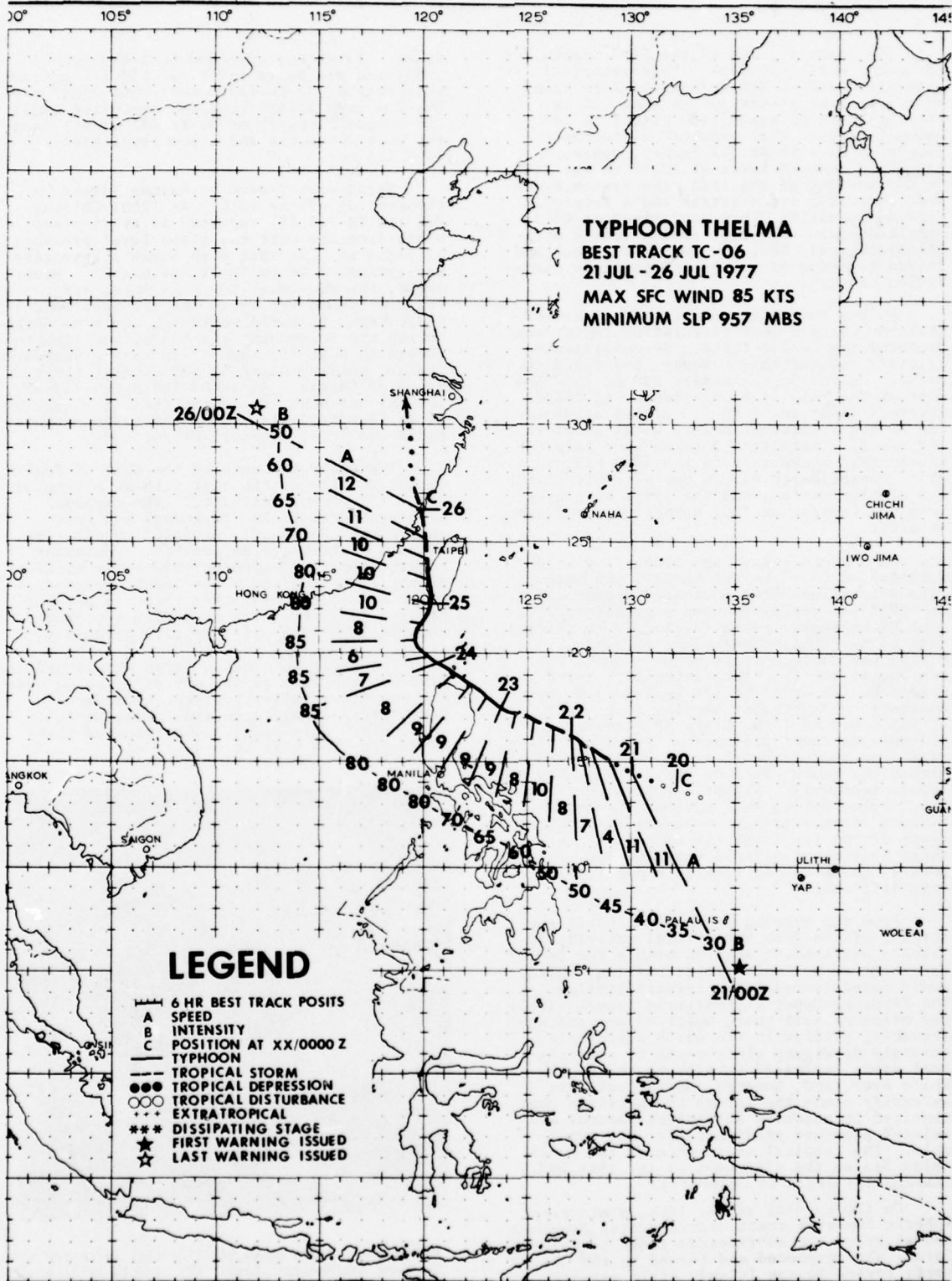


FIGURE 4-1. Sarah at 40 kt (21 m/sec) intensity crossing northeastern Samar, RP, 17 July 1977, 0057Z. (NOAA-5 imagery)



THELMA

Thelma, the second typhoon of the 1977 season, wrought more destruction on Taiwan than any event since World War II. While Typhoon Sarah was still crossing the South China Sea, Thelma was detected by satellite on the morning of July 20th as a tropical disturbance in the central Philippine Sea. The disturbance continued to organize during the subsequent 24 hours, and the first warning was issued on TD 06 at 0000Z on the 21st.

Reconnaissance aircraft at 0918Z on the 21st found flight level winds of 55 kt (28 m/sec), a central pressure of 993 mb, and surface winds estimated at 50 kt (26 m/sec). Based on the aircraft data and corroborating satellite data, TD 06 was upgraded to Tropical Storm Thelma at 1200Z. During the following 30 hours, Thelma continued to intensify at a rate of 5 kt (2.6 m/sec) per 6 hours. At 2050Z on the 22nd, aircraft fixed the tropical storm 255 nm (472 km) northeast of Manila, and observed 60 kt (31 m/sec) winds at its 700 mb flight level. The aircraft further indicated that the central pressure had fallen to 965 mb. As a result of those observations, the system was upgraded to Typhoon Thelma at 0000Z on the 23rd.

The trigger for Thelma's intensification was nearly identical to that of Sarah's a week earlier. Highly efficient outflow channels were provided Thelma by intense cyclonic cells in the TUTT, to the north, and by strongly divergent upper level northeasterlies over Indonesia and the South China Sea, to the south. This situation lasted from the 21st to the 24th when the TUTT receded northward, and Thelma ceased her intensification.

The typhoon continued to move northwestward at 9 kt (17 km/hr) toward the southern periphery of the mid-tropospheric subtropical ridge. On the evening of the 23rd, the storm entered the Bashi Channel, passing 10 nm (19 km) northeast of Escarpada Point on northeastern Luzon. At this time the Kakuho Maru reported 80 kt (41 m/sec) winds and 20 ft (6 m) seas just northwest of the center.

Since the time of Thelma's development, the mid-tropospheric subtropical ridge had been intense over the western Pacific and extended well into China. By 1200Z on the 23rd, geopotential heights at the 500 mb level began to fall over northern China as a low developed over eastern Mongolia and deepened rapidly. On the morning of the 24th, the subtropical ridge north of the tropical system showed signs of weakening.

During the evening of the 24th, reconnaissance aircraft positioned Thelma 145 nm (269 km) south-southwest of Kao-hsiung, which indicated that the storm was beginning to move northward. At this time the typhoon attained its maximum intensity of 85 kt (44 m/sec) with a minimum pressure of 957 mb, and slowed to 6 kt (11 km/hr). At 1800Z the passenger liner, President McKinley, reported 45 kt (23 m/sec) winds and 20 ft (6 m) seas while some 70 nm (130 km) northeast of the eye.

On the morning of the 25th, radar data

showed that Thelma had turned toward the north-northeast and had accelerated to 10 kt (19 km/hr). When satellite confirmed the radar movement, the 241800Z warning was amended to reflect the system's impending threat to southern Taiwan. During early afternoon of the 25th, Thelma crashed into Kao-hsiung harbor (Fig. 4-2). The Chinese Weather Central reported that Kao-hsiung (WMO 46744) observed 86 kt (44 m/sec) peak winds accompanied by a 991.5 mb pressure minimum at 250939 local. Satellite, aircraft, radar, and synoptic data all indicated that the typhoon was small, but very intense. Most damage was confined to the direct path of Typhoon Thelma as the central mountain range of Taiwan drastically weakened the peripheral winds east of the typhoon's track.

After moving across southwestern-Taiwan, Thelma began to weaken, and move on a track slightly west of north. On the evening of the 25th, Thelma entered the Taiwan Straits, and on the following morning went ashore on mainland China, 30 nm (56 km) north of Fuchou with 50 kt (26 m/sec) winds.

During her rampage over Taiwan, Thelma claimed more than 30 lives, injured thousands, and rendered an estimated 5,000 homeless. The typhoon ripped down 53 steel towers supporting high-tension power lines. The loss of power shut down more than one-half of the island's 45,000 factories. Taiwan's largest harbor at Kao-hsiung was virtually destroyed. All eight giant cranes used to load and unload cargo were badly damaged or destroyed. At least 17 ships capsized in the harbor. In her few short hours over southern Taiwan, Thelma left destruction amounting to several millions of dollars (U.S.). According to the Central Weather Bureau of Taiwan, Typhoon Thelma was the most destructive tropical cyclone to hit Taiwan in more than 80 years.

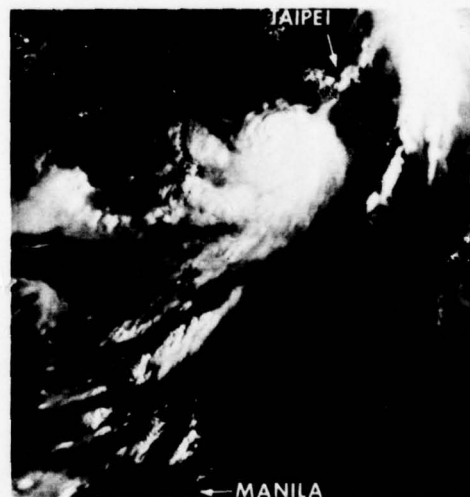
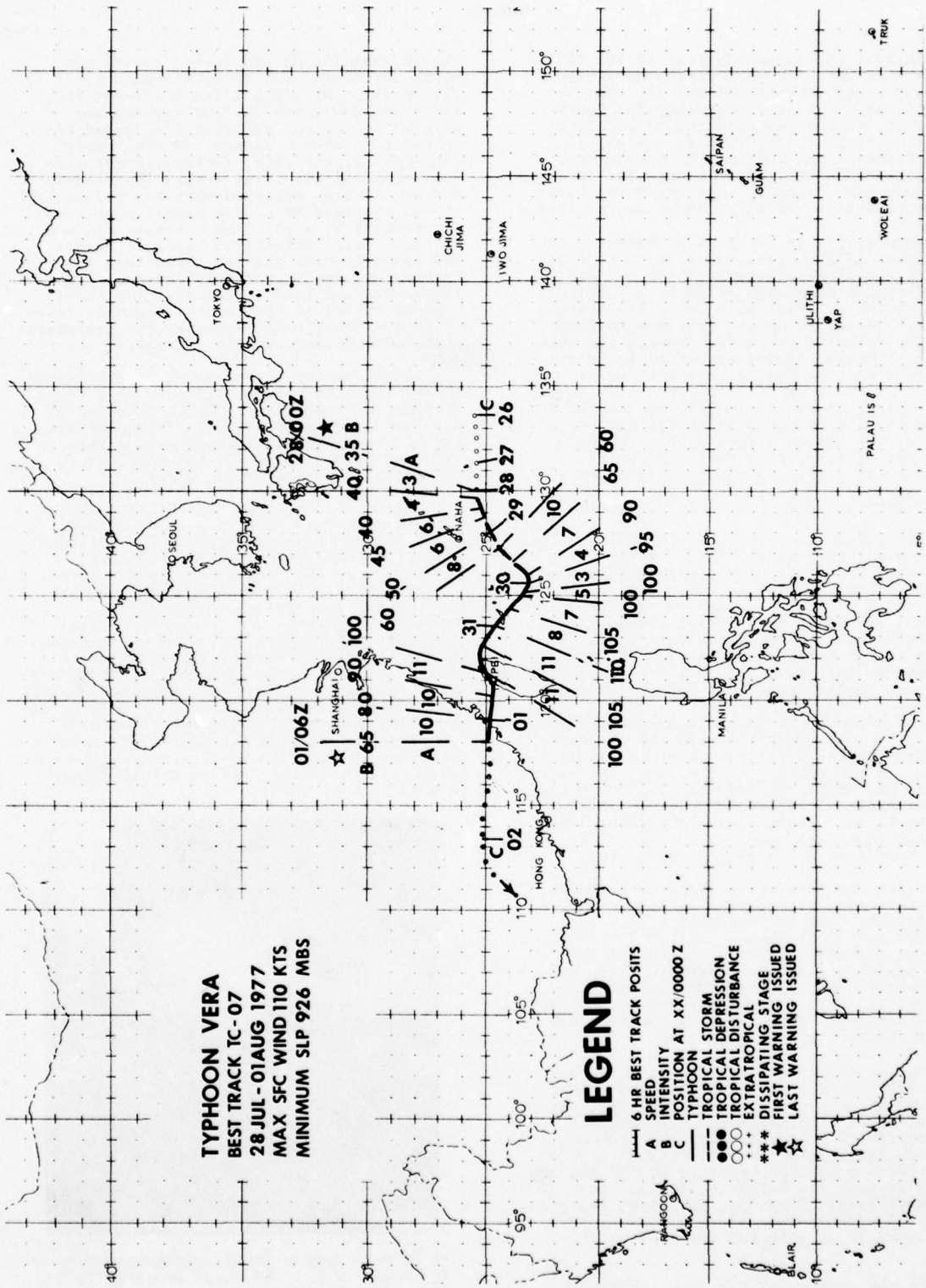


FIGURE 4-2. Typhoon Thelma entering southwestern Taiwan with an 80 kt (41 m/sec) intensity, 25 July 1977, 0243Z. (DMSP imagery)



TYPHOON VERA
BEST TRACK TC-07
28 JUL - 01AUG 1977
MAX SFC WIND 110 KTS
MINIMUM SLP 926 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY
- C POSITION AT XX/0000 Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- DISSIPATING STAGE
- FIRST WARNING ISSUED
- LAST WARNING ISSUED

VERA

A tropical disturbance, north of the climatologically favored area, was first evident on satellite imagery and JTWC's synoptic gradient level analysis at 260000Z July 77 with a cyclonic surface circulation center near 25.5N-133.6E. Exhibiting westward movement over the next 24 hour period, the disturbance gained organization and potential for significant development. At 270500Z, a formation alert was issued. By 271800Z the surface circulation reflected 30 kt (15 m/sec) of wind at the surface and JTWC's initial warning on the system as Tropical Depression 07 (TD 07) was issued at 280000Z. Subsequent post-storm analysis revealed that TD 07 had reached 35 kt (18 m/sec) intensity (minimum tropical storm intensity) by initial warning time.

Beginning as far back as 220000Z, a low cell imbedded in a tropical upper tropospheric trough (TUTT) had formed to the northeast of TD 07's initial warning position. Tracking west-southwest, this upper cell was centered near 30.5N-131.0E at 260000Z. The TUTT, now nearly east-west oriented, continued to dig toward the west and at the same time an upper level anticyclone over Korea/Japan north of this TUTT built eastward. The 200 mb winds at stations along the east coast of Japan reflected 60-75 kt (31-39 m/sec) out of the north-northeast. By 271200Z the TUTT cell was centered near 27.8N 133.5E with strong diffluence southeast of the cell located over the surface disturbance (Fig. 4-3). The vertical coupling had thus been effected and the necessary conditions for tropical cyclone development fulfilled.

By 280000Z, then, TD 07 was upgraded to a tropical storm and named Vera. A generally westward track (260°) at 3 kt (5.6 km/hr) was observed. Steering at this point seemed to be governed by the easterly flow on the southern periphery of the major anticyclone over Korea/Japan. The TUTT low also moved westward. By 291200Z the anticyclone over Korea/Japan began to build toward the southwest in advance of Vera. Therefore, steering influences were reflected in the observed west-southwest (becoming southwest) track that Vera assumed. As she proceeded southward, Vera continued to intensify attaining 65 kt (34 m/sec) by 291200Z. From 291200Z to 291800Z Vera intensified from 65 to 90 kt (34 to 46 m/sec) proceeding to the southwest at 9 kt (17 km/hr). Beyond 291800Z a marked decrease in forward speed was noted (from 9 to 4 kt [17 to 7.4 km/hr]) as the northeasterly steering at upper levels appeared to relax. Simultaneously, an increase in intensity occurred. By 300600Z Vera had attained winds of 100 kt (52 m/sec) and satellite imagery revealed a well-defined eye (Fig. 4-4) while reconnaissance aircraft reported 100 kt (52 m/sec) at the 700 mb flight level. By 301200Z satellite data showed improved outflow channels aloft to the west and north and fix positions from radar, satellite, and aircraft supported a more west-northwestward track.

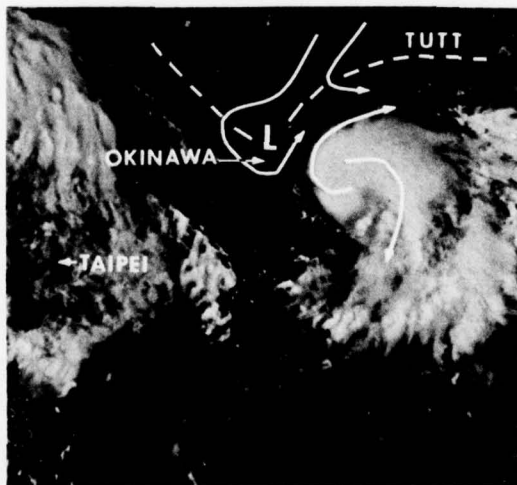


FIGURE 4-3. Vera at barely 40 kt (21 m/sec) intensity showing strong diffluence aloft to the southeast of a TUTT low, 28 July 1977, 0039Z. (NOAA-5 imagery)

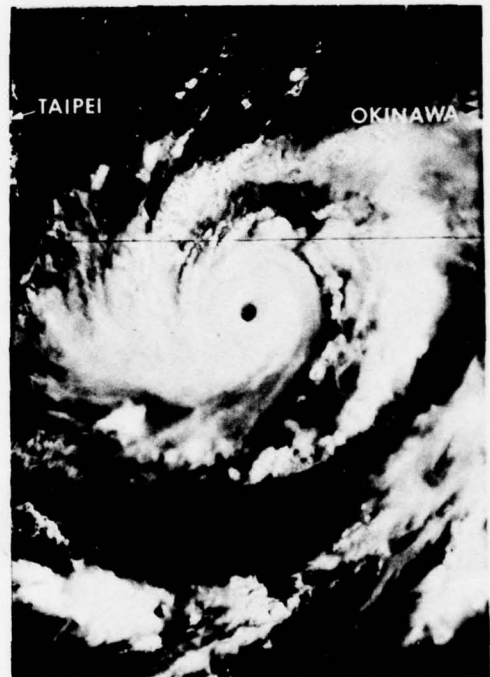


FIGURE 4-4. Typhoon Vera 200 nm (370 km) east of Taiwan and accelerating northwestward.

Upon making her turn to the west-north-west, it became evident that Vera would likely pass directly over Iriomote-Jima and just to the south of Ishigaki-Jima. Figure 4-5 shows the one-hourly surface reports from Ishigaki-Jima (WMO 47978) and indicates eye passage south of the island between 302100Z and 302200Z. Maximum winds reported were from the southeast at 103 kt (53 m/sec) at 302200Z (Fig. 4-6). Minimum pressure reported was 935.6 mb at 302100Z. As Vera

passed south of Ishigaki-Jima, her speed had increased to 10 kt (19 km/hr). Post-analysis revealed that Vera attained her maximum intensity of 110 kt (57 m/sec) by 310000Z (Fig. 4-7) and decreased in intensity slowly thereafter as she approached Taiwan at a speed of 11 kt (20 km/hr) (Fig. 4-8). Aircraft reconnaissance at 310850Z verified a slight intensity decrease as low level inflow channels were restricted by the island of Taiwan.

STATION	FWC/JTWC GUAM											
	DATE 30-31 JULY 1977											
47918 ROIG ISHIGAKIJIMA	30/17	30/18	30/19	30/20	30/21	30/22	30/23	31/00	31/01	31/02	31/03	31/04
	777	735	668	571	356	483	706	770	817	853	892	944
	○	○	○	○	○	○	○	○	○	○	○	○

FIGURE 4-5. Hourly surface synoptic observations from Ishigaki-Jima during passage of Typhoon Vera.

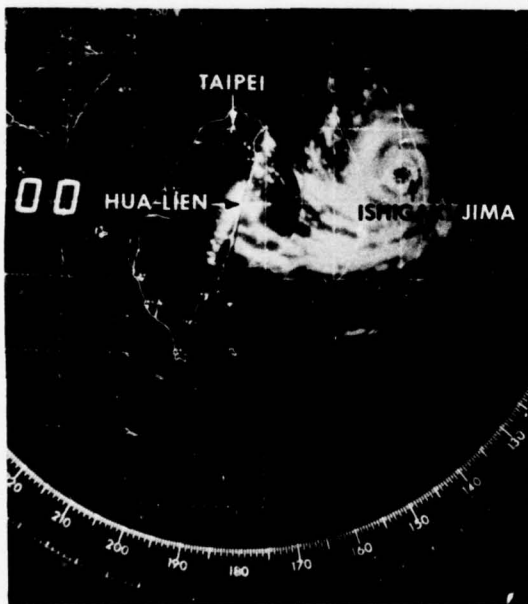


FIGURE 4-6. Hua-Lien radar presentation of Typhoon Vera when Ishigaki-Jima was receiving maximum sustained winds of 103 kt (53 m/sec), 30 July 1977, 2200Z. (Photograph courtesy of the Central Weather Bureau, Taipei, Taiwan, Republic of China.)

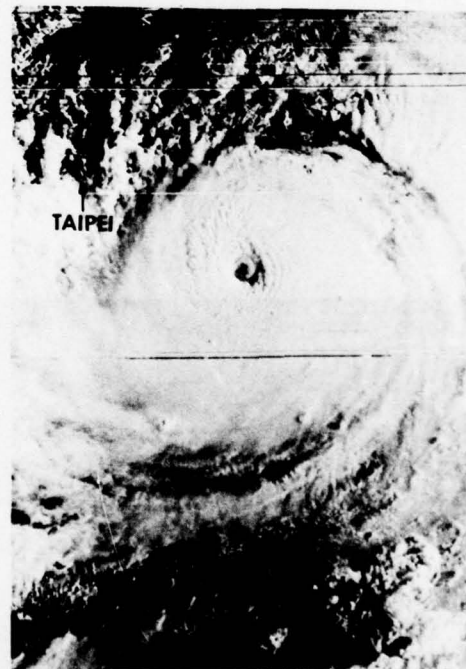


FIGURE 4-7. Typhoon Vera at maximum 110 kt (57 m/sec) intensity and just 19 minutes after the radar imagery in Figure 4-6, 30 July 1977, 2219Z. (DMSI imagery)

Landfall on the island of Taiwan occurred at Keelung (Chi-Lung) at the mouth of the Chi-Lung Ho River basin. Moving at 11 kt (20 km/hr) Vera followed the river basin to the west-southwest toward Taipei. Keelung recorded a minimum low pressure of 939.9 mb at 310930Z and a total rainfall of 7.95 in (202 mm). Maximum winds recorded at the Chinese Weather Bureau office in downtown Keelung were 66.6 kt (34 m/sec) with gusts to 113 kt (58 m/sec) at 311030Z. In Taipei, a minimum pressure of 951.5 mb was recorded at 311028Z with total rainfall recorded as 8.0 in (203 mm). Taipei International Airport reported maximum winds of 64 kt (33 m/sec) with gusts to 96 kt (49 m/sec). Both Keelung and Taipei established new records in observed maximum wind reports with Vera's passage. After passing over the northeastern part of Taipei

city, Vera continued on a nearly westward track and emerged in the Taiwan Straits just north of Hsin Chu at 311500Z. Vera continued on a westward track at 11 kt (20 km/hr) and made landfall on the China mainland near Ch'uan-Chou at 010100Z August with an intensity of 80 kt (41 m/sec).

Following so closely after Typhoon Thelma, which had wreaked havoc on the southern portion of Taiwan, Typhoon Vera left at least 25 dead in her wake and vast amounts of property and crop damage. Two ships sank, 10 went aground, 3 were washed away, and 22 were damaged. However, with timely warnings and the occurrence of Thelma two weeks prior, most ships diverted and rode out the storm in the safety of the open sea.

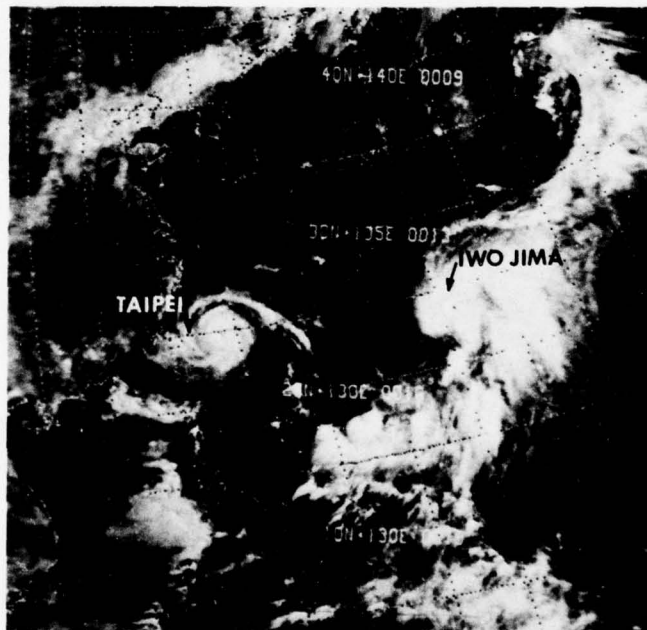
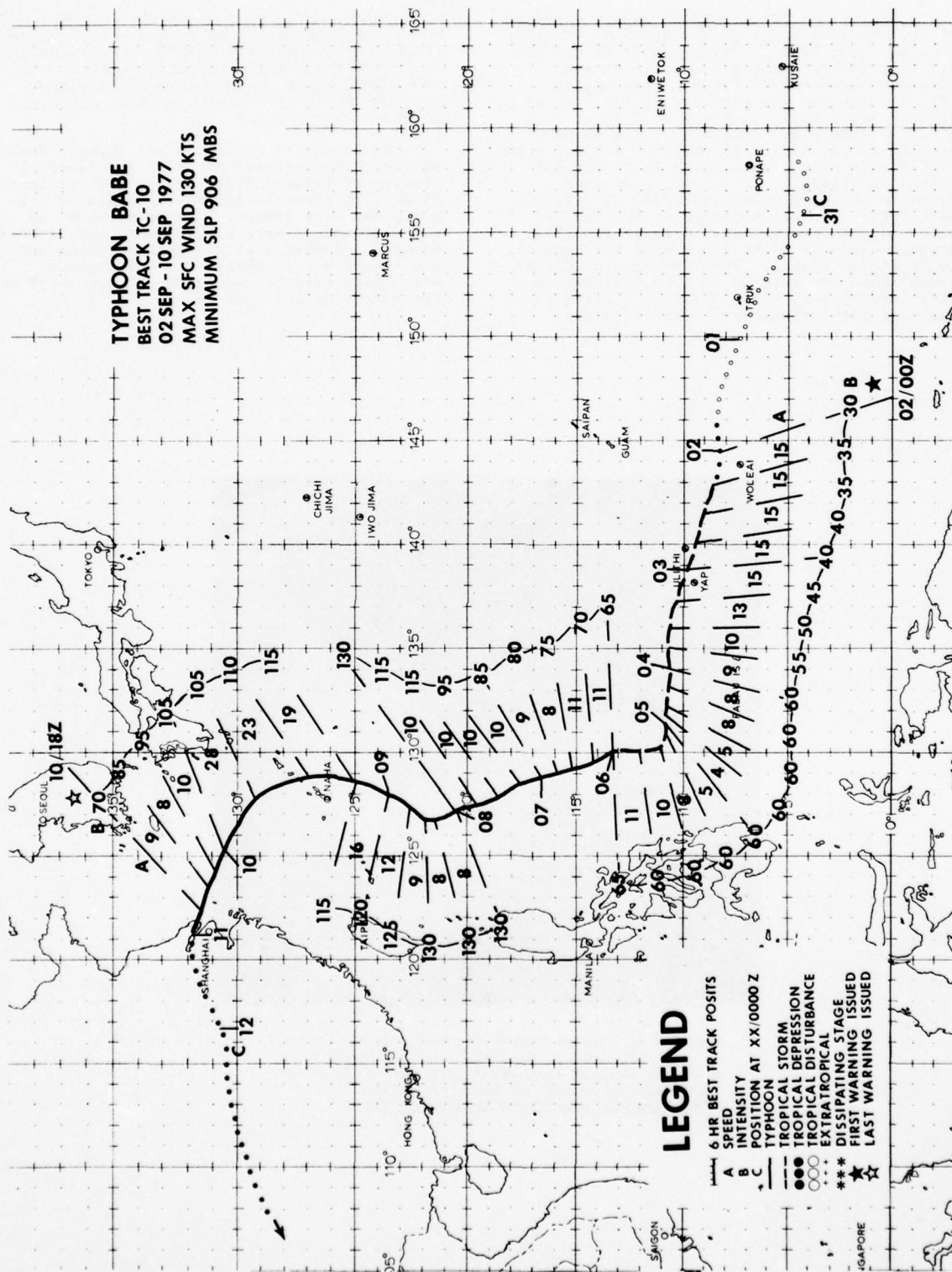


FIGURE 4-8. Typhoon Vera approaching northern Taiwan, 30 July 1977, 2352Z. The next cyclone, Tropical Storm Wanda, is shown at development stage with 30 kt (15 m/sec) winds 100 nm (185 km) south of Two-Jima. (NOAA-5 imagery from FLEWEAFAC Suitland, MD)

TYPHOON BABE
BEST TRACK TC-10
02 SEP - 10 SEP 1977
MAX SFC WIND 130 KTS
MINIMUM SLP 906 MBS



LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY AT XX/0000 Z
- C POSITION AT XX/0000 Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ★ LAST WARNING ISSUED

BABE

During August 1977, no typhoons were observed. The JTWC significant Tropical Weather Advisory of 31 August stated, "the probability is that the remainder of 1977 should see an increase in typhoon activity". The next day, 1 September, the seedling of the year's 10th tropical cyclone and the only super typhoon was first observed. Babe was a very challenging storm in that during her lifetime she threatened virtually every major DoD facility in the western North Pacific.

Satellite data on the 1st at 0143Z and 0000Z synoptic data indicated a weak surface circulation with associated convection near 7N-150E. Based on this data, a Tropical Cyclone Formation Alert was issued. At this time, there was a tropical upper tropospheric trough (TUTT) present at 200 mb to the North of the alert area. The TUTT maintained its position through the 3rd at 0000Z and the divergence on the southern side of the TUTT aided in the development of the seedling into Tropical Depression 10 (TD 10).

The first warning on TD 10 was issued on the 2nd at 0000Z. An aircraft fix on the 2nd at 0052Z estimated the maximum surface wind to be 40 kt (21 m/sec). On the following warning (0600Z), TD 10 was upgraded to Tropical Storm Babe. With the TUTT circulation providing fair outflow conditions aloft, Babe slowly intensified as she moved westward across the warm Philippine Sea. Babe was being steered at this time by a well developed mid-tropospheric subtropical ridge which extended from the dateline into central China. With this westward movement expected to continue, Babe was forecast to cross the Republic of the Philippines and pose a threat to Subic Bay and Clark AB. The westward movement continued until the 5th at 0000Z when signs of a change in direction of movement first appeared. Between the 2nd and the 4th, Babe had an average speed of 14 kt (25 km/hr). By the 4th at 1200Z, the speed had dropped to 8 kt (14 km/hr), further dropping to 5 kt (9 km/hr) in the following 12 hours.

On the 5th at 0000Z, an upper air trough in the mid-latitude westerlies appeared over northeastern Asia. A weakness in the subtropical ridge between the trough and Babe became evident and increased the probability of a more northerly storm track. A change in Babe's direction of movement was first noted by satellite data at 052155Z (Fig. 4-9) and confirmed by aircraft reconnaissance at 052243Z.

Taiwan, which was still recovering from the effects of earlier typhoons, Thelma and Vera, was now threatened again. Aircraft data between the 5th at 0832Z and the 7th at 2204Z showed Babe to have undergone rapid deepening with the central pressure dropping from 988 mb to 907 mb, a rate of 1.3 mb/hr. This rapid deepening was in response to the divergent southwesterly flow ahead of the strong upper air trough now stretching from east of Japan into central Taiwan, which provided a strong outflow channel aloft. Babe was upgraded to a typhoon on the 6th at 0000Z and a super typhoon on the 8th at 0000Z (Fig. 4-10).

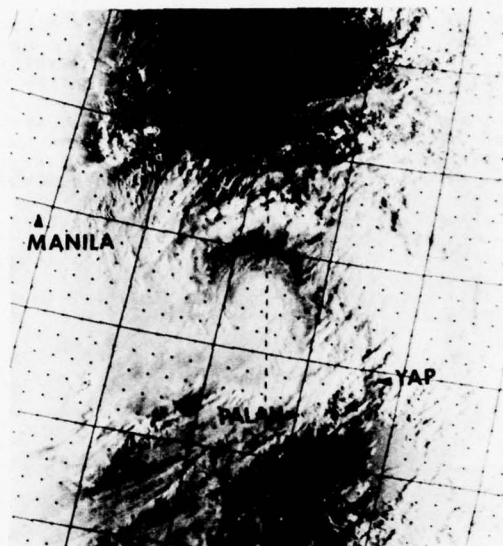


FIGURE 4-9. Babe at minimal typhoon strength and heading northward, 5 September 1977, 2155Z. (DMSP imagery)



FIGURE 4-10. Super Typhoon Babe at 130 kt (67 m/sec) intensity 250 nm (463 km) southeast of Ishigaki Jima, 8 September 1977, 0303Z. (DMSP imagery)

Up until the 080000Z warning, Babe was still forecast to cross Taiwan and then dissipate in mainland China prior to full recurvature. On the 7th at 1200Z, however, another upper air trough moved into northern China. This short wave additionally weakened the mid-tropospheric ridge over southeastern China. A low soon developed in this trough over Korea indicating the trough would move slowly and possibly deepen. This increased the probability that Babe would recurve much earlier than expected. This came to pass and as Taiwan was relieved, Okinawa and Japan now faced the fury of Babe. Aircraft and radar data showed Babe began recurvature to the northeast after the 8th at 0600Z and while weakening at a rate of 5 kt/6 hr (2.5 m/sec). Conditions of readiness were set for southern Japan and aircraft evacuated Kadena AB for appropriate "safe haven" locations (Fig. 4-11).

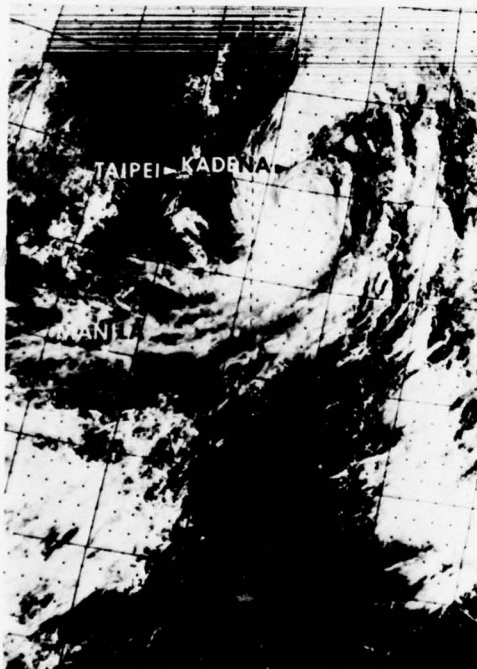


FIGURE 4-11. Typhoon Babe at 120 kt (62 m/sec) intensity, slowly weakening and accelerating northward, 9 September 1977, 0245Z. (DMSP imagery)

During Babe's north-northeastward transit, the upper air low which had formed over Korea moved south-southwestward, deepened and cut-off from the main upper air trough. This allowed ridging to the east and northeast of

Babe to build east-west to the north of Babe and the cut-off low steering Babe toward Korea, and eventually Shanghai. Evidence of a Fujiwhara type effect between Babe's circulation and the cut-off low also appeared. Babe finally steered around the northern periphery of the cut-off low and hit the People's Republic of China just north of Shanghai on the 11th at 0000Z with surface winds of 65 kt (33 m/sec) (Fig. 4-12).

The greatest damage from super typhoon Babe occurred after she recurved and headed for Japan. Newspaper reports described Babe as "the worst typhoon to threaten Japan in 18 years". Babe struck the Japanese island of Okino-Erabu with winds of 135 kts (69 m/sec) injuring 45 people and destroying 1600 homes. Kadena AB recorded maximum sustained winds of 36 kt (19 m/sec) on the 9th and a peak gust of 60 kt (31 m/sec) at 091328Z. Babe also disrupted maritime activities sinking a Panamanian freighter with 16 reported dead or missing and damaging approximately 100 Japanese fishing vessels which sought safety in the East China Sea.

The overall forecast accuracy for super typhoon Babe was below average. However, the DoD operational impact was decreased by the use of forecast confidence probabilities appended to JTWC prognostic discussion bulletins and the many telephone conversations between JTWC and WESTPAC staff meteorologists. This was confirmed by operations staff personnel at the 1978 Tropical Cyclone Conference.

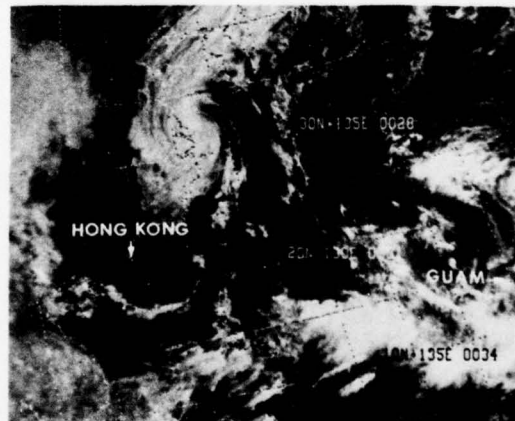
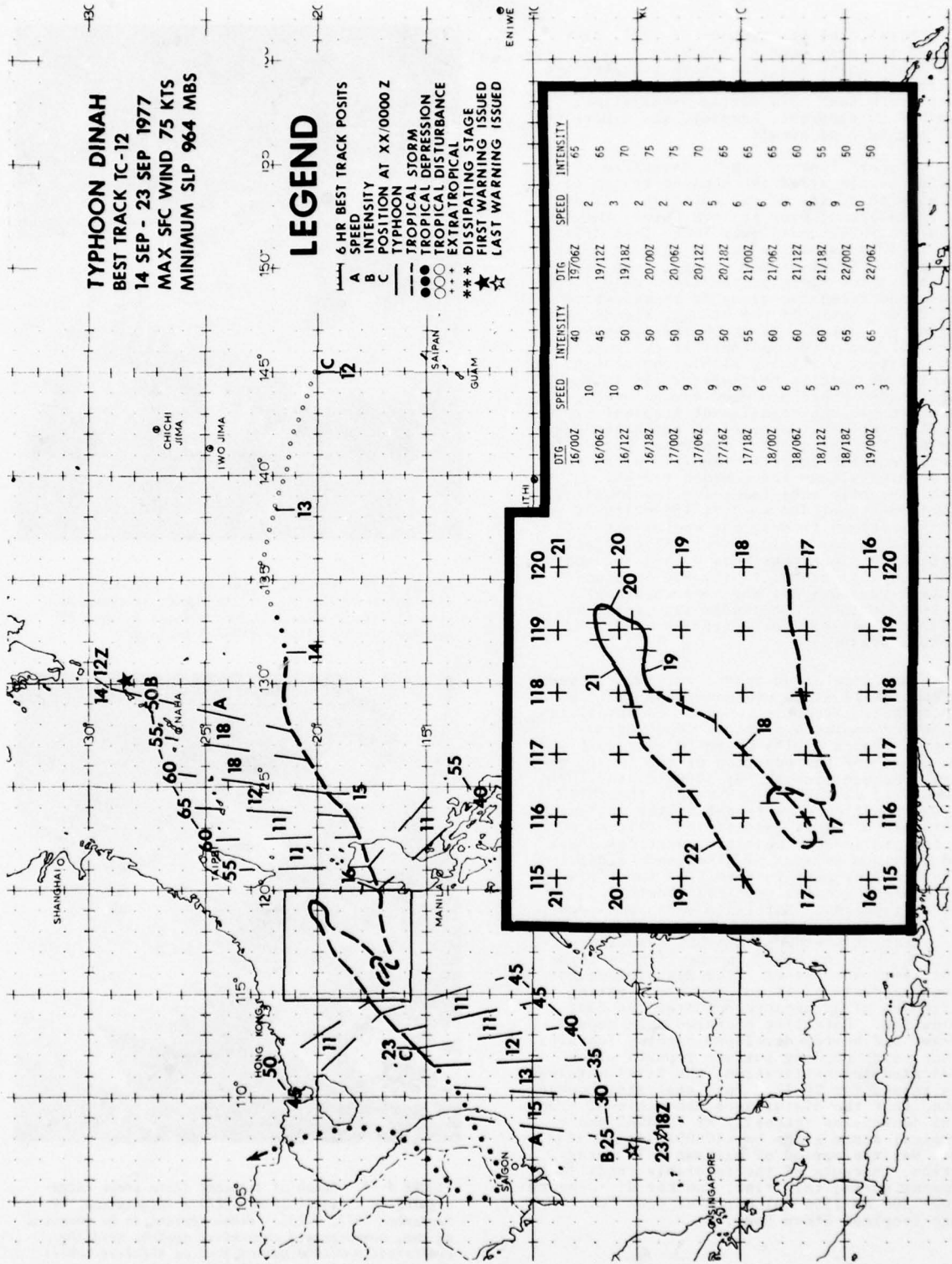


FIGURE 4-12. Typhoon Babe during landfall 60 nm (111 km) north of Shanghai, People's Republic of China, 11 September 1977, 0109Z. The monsoon trough extending from the Philippine to the Mariana Islands would soon spawn the next typhoon, Dinah. (NOAA-5 imagery from FLEWEAFAC Suitland, MD)

TYPHOON DINAH
BEST TRACK TC-12
14 SEP - 23 SEP 1977
MAX SFC WIND 75 KTS
MINIMUM SLP 964 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY
- C POSITION AT XX/0000 Z
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- *** EXTRATROPICAL
- ☆ FIRST WARNING ISSUED
- ★ LAST WARNING ISSUED



DTG	SPEED	INTENSITY	DTG	SPEED	INTENSITY
16/00Z	10	40	19/06Z	2	65
16/06Z	10	45	19/12Z	3	65
16/12Z	10	50	19/18Z	2	70
16/18Z	9	50	20/00Z	2	75
17/00Z	9	50	20/06Z	2	75
17/06Z	9	50	20/12Z	2	70
17/16Z	9	50	20/18Z	5	65
17/18Z	9	55	21/00Z	6	65
18/00Z	6	60	21/06Z	6	65
18/06Z	5	60	21/12Z	9	60
18/12Z	5	60	21/18Z	9	55
18/18Z	3	65	22/00Z	9	50
19/00Z	3	65	22/06Z	10	50

DINAH

Dinah, the 5th typhoon of 1977, displayed the most unusual behavior. While over the South China Sea, the storm executed two hairpin turns and one loop before meandering over South East Asia during dissipation. Dinah's development, however, was a more normal sequence of events.

"Super" Typhoon Babe's extensive circulation system aided the monsoon trough to move north of its normal location. After Babe dissipated over eastern China, the monsoon trough extended from South East Asia to the Mariana Islands along 20 degrees north latitude. South of the trough, deep southwesterly flow produced localized gale force winds and extensive areas of thundershower activity. North of the trough, steady easterlies prevailed. Although the opposing currents produced considerable cyclonic shear and relative vorticity within the trough, the counter productive northeasterlies in the upper troposphere produced enough vertical shear to prevent significant tropical cyclone development. Meteorological satellite data during this 2nd week of September period showed several loosely organized areas of convection within the monsoon trough. On the 12th, synoptic data located a low level circulation center 400 nm (741 km) north of Guam. Maximum intensity near the center was estimated to be 20 kt (10 m/sec) while localized gale force winds continued within the southwest monsoon current to the southern and eastern periphery of the monsoon trough. (Islanders in the southwest flow could not believe there was not a tropical storm or typhoon nearby.)

The circulation center initially moved northwestward at an average speed of 16 kt (30 km/hr). Synoptic reports and satellite imagery revealed a tropical upper-tropospheric trough (TUTT) oriented east-west and just north of the position of the low to mid-level monsoon trough. By 1200Z on the 12th, a westward moving cyclone within the TUTT became positioned northeast of the surface disturbance. This orientation relieved much of the previously inhibiting vertical shear and provided an area of divergence aloft. This new flow pattern permitted the surface disturbance greater vertical growth and intensification. Satellite data soon identified a distinct vortex which separated from the areas of southwest monsoon cloudiness (Fig. 4-13). At 0100Z on the 14th, a formation alert was issued. The disturbance now moved westward as it entered the steering influence of an anticyclone over the East China Sea. Satellite pictures soon showed larger and better developed banding features. Since corresponding surface reports also indicated intensification, the first warning was issued for TD 12. Post analysis, however, found that the disturbance had achieved tropical depression intensity by 131800Z and tropical storm stage by 140000Z (Fig. 4-14). This was the period of maximum TUTT interaction. Because of the favorable conditions present during this time, another disturbance about 300 nm (556 km) north of Guam developed into Tropical Storm Emma.

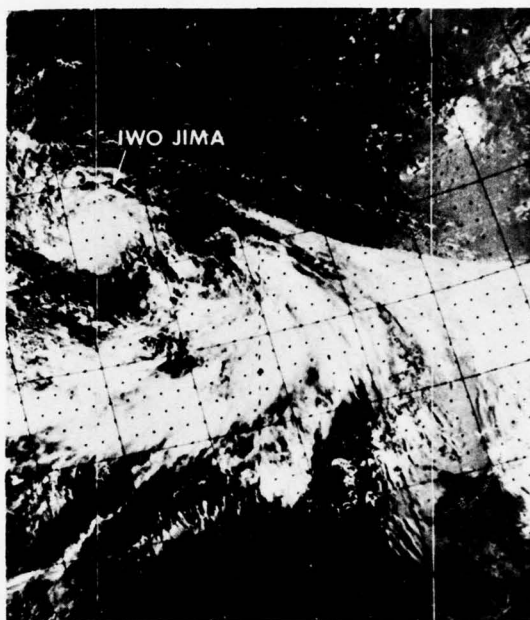


FIGURE 4-13. Tropical Depression 12 (Dinah) 225 nm (417 km) southwest of Iwo Jima while breaking away from its place of origin, the monsoon trough, 12 September 1977, 2310Z. (NOAA-5 imagery)

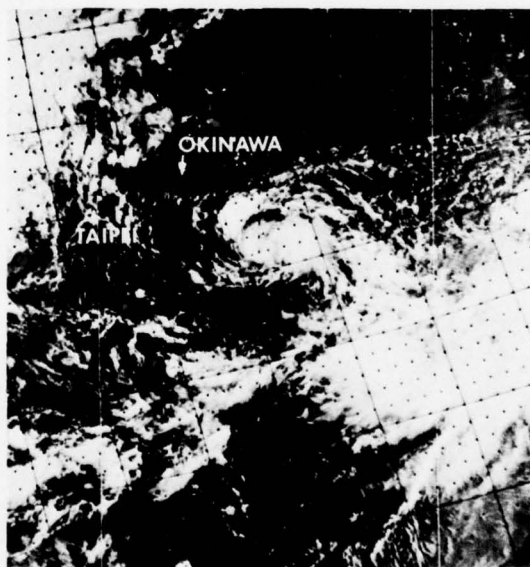


FIGURE 4-14. Dinah at tropical storm stage intensifying in an interesting split configuration, 14 September 1977, 0023Z. Dinah appears to be composed of two, comma-shaped convective systems rotating cyclonically with a narrow zone of relative subsidence between them. (NOAA-5 imagery)

As TD 12 grew and became Tropical Storm Dinah, the pressure gradient between the storm and the subtropical ridge increased. The associated easterly steering currents correspondingly increased and accelerated Dinah to a maximum speed of 19 kt (35 km/hr). An intensifying, mid-tropospheric high over eastern China was now the primary source of these easterlies. As this high pressure cell continued to build, Dinah was steered in a southwesterly direction towards the Republic of the Philippines. Forward speed decreased as the gradient slackened. Steady intensification continued as upper level outflow was well established in all quadrants. This trend persisted until Dinah reached minimum typhoon strength at 150600Z just 100 nm (185 km) off northern Luzon. With a maximum intensity of 55 kt (28 m/sec), the storm entered Luzon 35 nm (65 km) south of Escarpada Point at 151500Z. That evening Dinah passed near Tuguegarao, a station in northeastern Luzon which experienced 96 kt (49 m/sec) peak winds and a mean sea-level pressure of 977.0 mb.

Upon entering the South China Sea after 7 hours over land, Dinah weakened to 40 kt (21 m/sec), but quickly reintensified to 50 kt (26 m/sec) winds within 14 hours. Headed west-southwestward, Dinah entered an area of weaker steering currents. The dominating anticyclone over China was beginning to weaken and mid-latitude westerlies began extending southward. By the 17th, the continued weakening of steering currents caused the storm to slow to 9 kt (17 km/hr) movement.

For the next 4 days, Dinah exhibited unusual behavior. The weakening subtropical ridge over China broke down into a series of smaller high cells while the southwest monsoon deepened. Caught between these oscillating and opposing steering sources, Dinah abruptly turned northeast and then executed a loop during the 17th. As the southwest monsoon strengthened and became the dominant steering flow, the storm was directed northeastward toward Taiwan.

Intensification resumed as a result of the enhanced monsoon. The weakening subtropical ridge and increasing outflow aloft also contributed to Dinah's growth. By 181800Z, typhoon strength was again achieved. After being displaced north nearly 150 nm (218 km), movement slowed to 5 kt (9 km/hr) as Dinah's steering flow became less effective. By the 19th an advancing mid-latitude trough over China aided in steering Dinah eastward. Sustained winds of 65 kt (33 m/sec) persisted as satellite imagery at 191201Z revealed an eye. At 200000Z, Dinah reached a short-lived maximum intensity of 75 kt (39 m/sec) (Fig. 4-15). Ever since Dinah's origin, the southwest monsoon was the major feeding current. By 200600Z, this flow was being diverted into the beginnings of Tropical Storm Freda in the Philippine Sea and Dinah began to weaken.

As the mid-latitude trough advanced over China, it did not dig south as forecast and a large high pressure area built in behind it. In response, Dinah did not continue eastward in advance of the trough; it slowed to 2 kt (3.7 km/hr), turned westward, then southwest-

ward being influenced by the intensifying high over China. Dinah was the first storm to be directly affected by an early autumn surge in the northeast monsoon.

The northeasterlies from the strong high over China controlled Dinah's movement for the next 2 days. Diminishing moist southwesterlies and increasing dry northeasterlies steadily weakened the storm. Dinah accelerated southwestward and reached south Vietnam as a weak tropical depression at 231700Z. JTWC's last warning was issued one hour later.

After landfall, Dinah, in its dissipating stage, persisted for 4 days. Tropical Storm Freda and the weakening of the northeast monsoon were the controlling agents in the last days of Dinah's unusual track. After crossing the South China Sea, Freda entered southern China drawing the southwest monsoon northward. Once again embedded in a southwest steering current, TD 12 (Dinah) journeyed northward through Cambodia, northeastward over the Gulf of Tonkin then northward into southern China and finally dissipated.

Dinah's sweep across northern Luzon caused loss of lives and property. Floods and landslides alone caused 15 deaths and 11 missing. Although Dinah remained a safe distance from mainland China while jogging unpredictably over the South China Sea, Hong Kong displayed the Stand By Signal No. 1 for a record 124 hours and 40 minutes.

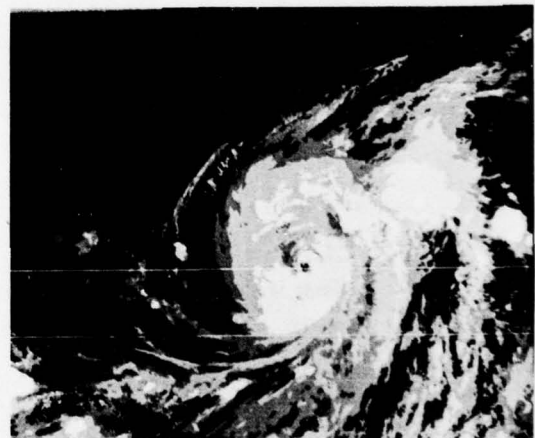
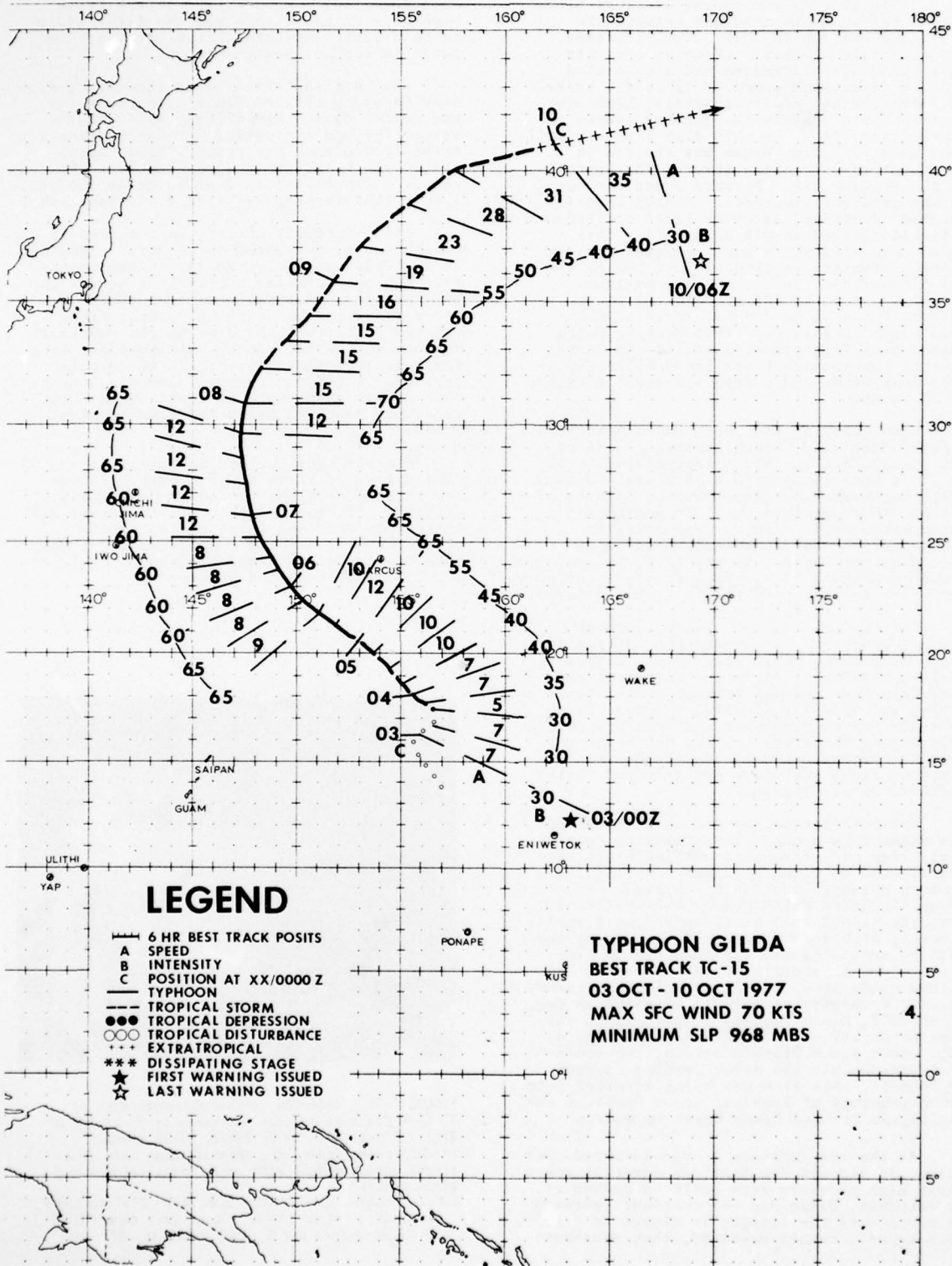


FIGURE 4-15. Infrared, threshold photograph of Typhoon Dinah at maximum intensity of 75 kt (39 m/sec), 19 September 1977, 2310Z. This special product consolidates the thermal range into four slices (gray shades) with white being coldest and black warmest. Black: greater than 253°K; dark gray: 253° to 233°K; light gray: 233° to 213°K; white: less than 213°K. (DMSP imagery from Det 5, 1WW, Clark AB, RP)



GILDA

On the 1st of October, a large area of heavy convection, 300 nm (556 km) in diameter, was detected by satellite approximately 325 nm (600 km) north of Ponape. Synoptic data indicated a weak surface circulation in the vicinity. The system, which would later become Typhoon Gilda, was observed to be moving northward toward a weakness in the mid-tropospheric subtropical ridge.

On the 2nd of October, a Tropical Cyclone Formation Alert was issued as satellite data indicated increased organization and upper level outflow. Further intensification was expected due to the existence of an upper level trough to the northwest.

Aircraft reconnaissance on the morning of the 3rd reported 38 kt (20 m/sec) winds at the 1500 foot (441 m) flight level. Based on this data and the assessed good potential for further intensification, the first warning was issued on TD 15 at 0000Z on the 3rd.

For the next 18 hours the tropical depression moved erratically toward the north at a speed of 5 kt (9.3 km/hr). During the 3rd, the mid-tropospheric subtropical ridge northeast of TD 15 began to build toward the west. Late on the 3rd, TD 15 responded and began to move toward the northwest. Simultaneously, the tropical depression began to interact with a cyclonic cell in the Tropical Upper Tropospheric Trough (TUTT) located to the depression's northwest. Divergent southwesterlies aloft, on the southeast periphery of the upper level cyclonic cell, enhanced the outflow of TD 15 and by 1800Z on the 3rd the system had intensified to tropical storm intensity.

During the 4th, Tropical Storm Gilda continued to intensify as it accelerated to 12 kt (22 km/hr) on its northwestward track. Reconnaissance aircraft on the afternoon of the 5th indicated 80 kt (41 m/sec) winds at its 700 mb flight level, and observed that the central pressure of Gilda had fallen to 974 mb, a 15 mb drop in 11.5 hours. Using this information, Gilda was upgraded to typhoon at 0600Z.

During the past 36 hours, a mid-tropospheric, short wave trough moved eastward from eastern China toward Japan, and began to deepen. By the 5th this trough had moved east of northern Japan, and had dug sufficiently equatorward to sever the subtropical ridge north of Gilda. By the afternoon of the 6th, the typhoon had acquired a north-northwestward track toward the weakness in the ridge. At 0622Z, aircraft reconnaissance showed that the central pressure had risen to 986 mb. Consequently, the 0600Z warning was amended and Gilda was downgraded to a Tropical Storm. The weakening, however, was short lived; 24 hours later she had again attained typhoon intensity. At 1500Z on the 7th Gilda passed through the weakness in the subtropical ridge and shortly thereafter began recurving toward the north-northeast. As frequently observed with October tropical cyclones, Typhoon Gilda continued to intensify after recurvature. She attained her peak intensity of 70 kt (36 m/sec) on the 8th when aircraft at 0325Z reported the typhoon's minimum sea level pressure of 968 mb (Fig. 4-16).

By the night of the 8th, Gilda had again weakened to tropical storm strength, and had taken a northeast heading around the northwestern periphery of the mid-tropospheric high cell. During the subsequent 36 hours, the tropical storm accelerated rapidly toward the east-northeast and weakened at a rate of 5 kt (2.6 m/sec) per 6 hours. On the morning of the 10th, Gilda became extratropical, moving toward the east-northeast at more than 30 kt (55 km/hr).

During her eight day span, the closest point of approach to land was 220 nm (407 km) when she passed southwest of Marcus Island on the evening of October 5th. On the ocean, ships stayed well away from Gilda's strong winds. As a result, Gilda claimed no loss of life or damage to property.

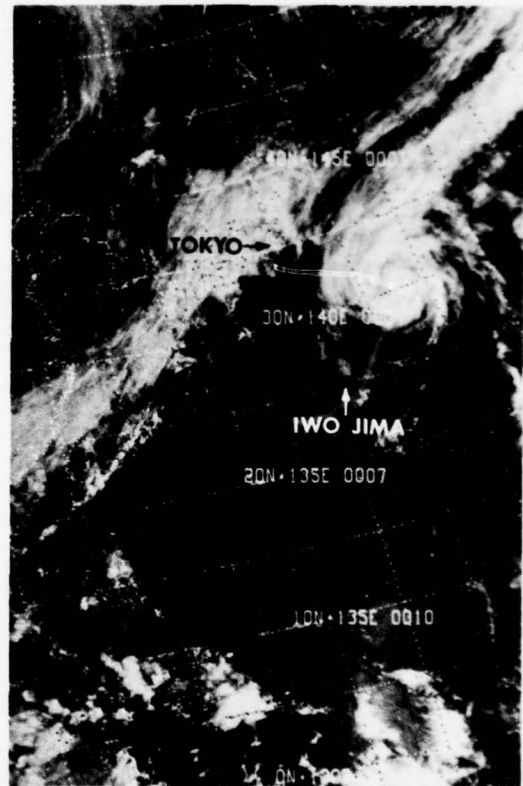
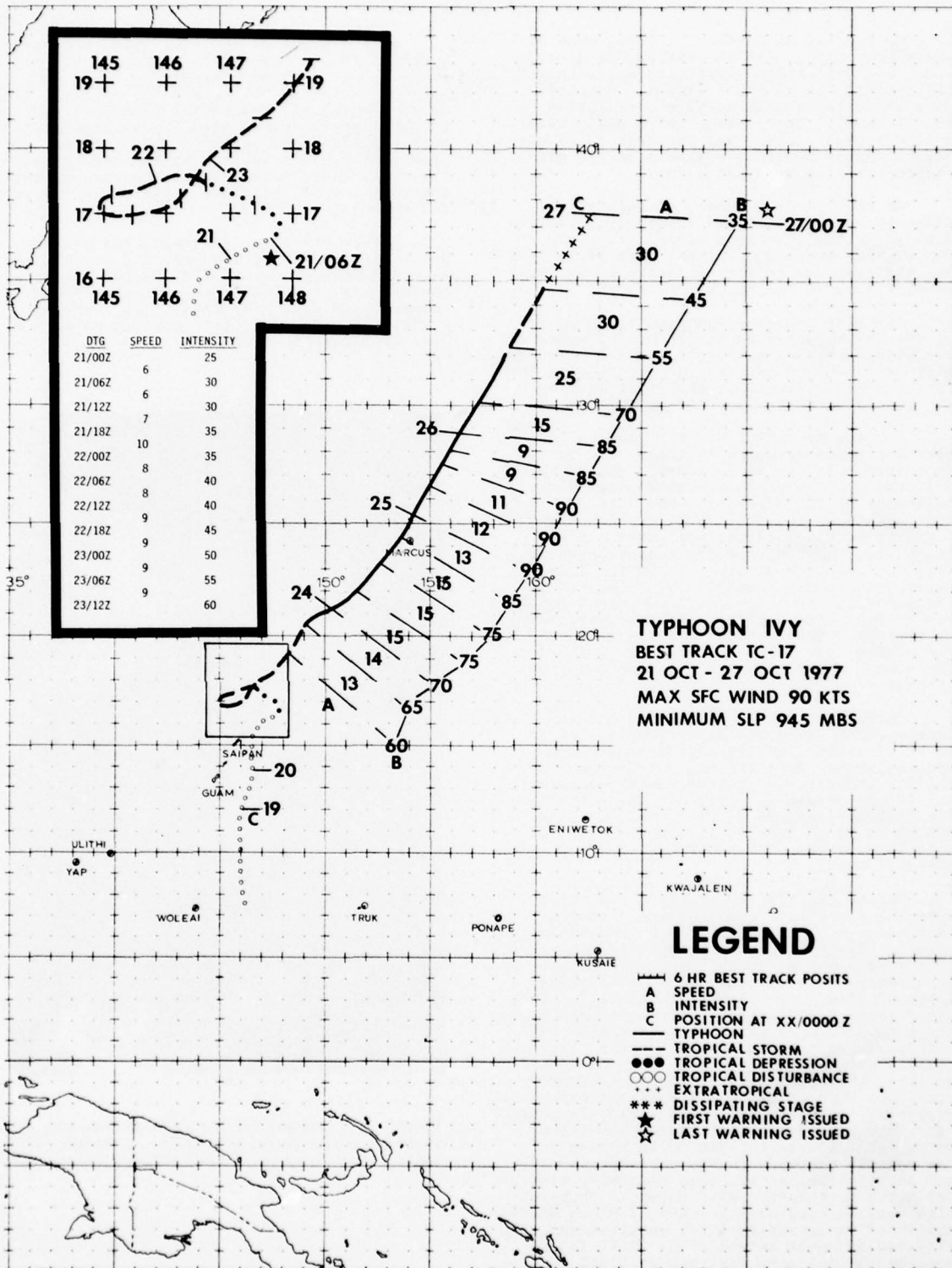


FIGURE 4-16. Typhoon Gilda at maximum intensity of 70 kt (36 m/sec) during recurvature, 7 October 1977, 2343Z. (NOAA-5 imagery from FLEWEAFAC Suitland, MD)



145	146	147	19+
18+	22+		+18
17+			+17
16+			21
			21/06Z
145	146	147	148

DTG	SPEED	INTENSITY
21/00Z		25
21/06Z	6	30
21/12Z	6	30
21/18Z	7	35
22/00Z	10	35
22/06Z	8	40
22/12Z	8	40
22/18Z	9	45
23/00Z	9	50
23/06Z	9	55
23/12Z	9	60

TYPHOON IVY
 BEST TRACK TC-17
 21 OCT - 27 OCT 1977
 MAX SFC WIND 90 KTS
 MINIMUM SLP 945 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY
- C POSITION AT XX/0000 Z
- TYPHOON
- - - TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- *** EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

IVY

Ivy, the 7th typhoon of 1977, originated from an easterly wave. It was first detected by synoptic data moving westward over the Marshall Islands on the 14th of October. Within 24 hours it entered an area of increased low level convergence associated with the near equatorial trough (NET), intensified, and developed a surface circulation. For the next 8 days it remained within the NET before breaking loose.

The development of Ivy was also aided by the movement of Tropical Storm Harriet, which was also embedded in the NET. TS Harriet moved northward through the Philippine Sea displacing the NET northward. This northward shift allowed for an increase in favorable conditions for intensification. By the 19th the developing cyclone (Ivy) was receiving most of the low level, southwesterly flow that was previously supplied to the now weakening Harriet (Fig. 4-17). The next day satellite data indicated that the disturbance's convective activity and organization had increased while surface reports indicated that the central pressures were steadily falling. JTWC, therefore, issued a formation alert at 200126Z.

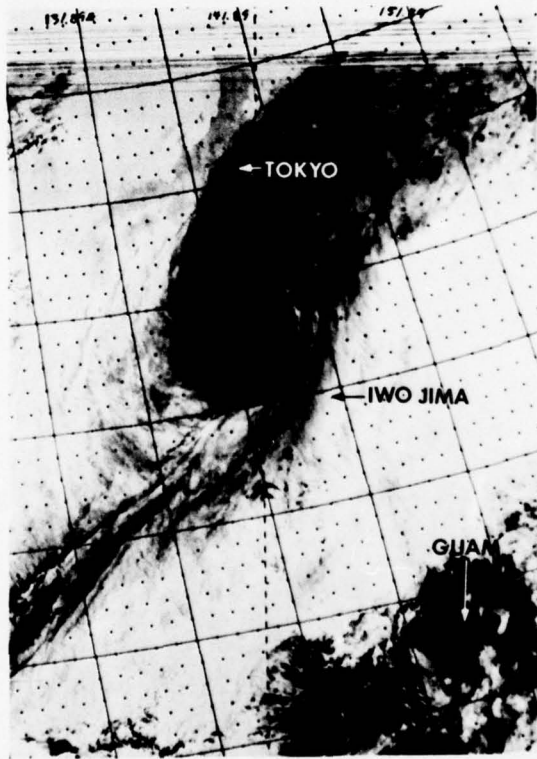


FIGURE 4-17. Infrared photograph of Ivy in the formative stage near Guam with Tropical Storm Harriet at maximum intensity of 55 kt (28 m/sec), 19 October 1977, 1014Z. (DMSP imagery)

Upper tropospheric, synoptic data from the morning of the 21st indicated that the outflow pattern above the alert area was continuing to strengthen. An aerial reconnaissance investigation on the afternoon of the 21st detected an organized surface cyclonic circulation with a 996 mb central pressure. Reconnaissance data further indicated that the disturbance was moving northward just east of the Mariana Islands. Along with supportive satellite data, the first warning on TD 17 was issued at 210600Z.

On the morning of the 20th, TD 17 began moving through a break in the subtropical ridge previously opened by Harriet. This was also an area of weak and variable steering currents. From the morning of the 21st to the evening of the 22nd, there was a lack of any definitive, middle tropospheric steering flow which resulted in the erratic movement of the storm. For 36 hours TD 17 meandered and then looped before heading northeastward (Fig. 4-18).

During the formative stages of TD 17, upper tropospheric, synoptic and satellite data indicated the presence of a weak tropical upper tropospheric trough (TUTT) to the northeast. As the disturbance reached tropical depression intensity, data indicated that a low in the TUTT had developed. The establishment of the TUTT low in this region allowed for an increase in the advection of mass away from the storm. This allowed for further intensification and the depression to reach tropical storm intensity during the course of its loop. Aircraft reconnaissance

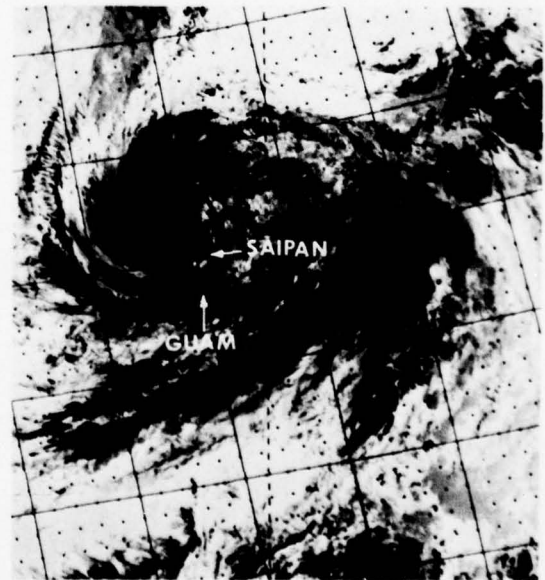


FIGURE 4-18. Infrared photograph of Ivy with 40 kt (21 m/sec) winds executing a cyclonic loop, 22 October 1977, 0923Z. (DMSP imagery)

on the 21st at 1545Z observed a maximum flight level, 700 mb, wind of 38 kt (20 m/sec) associated with the storm. Based on this data TD 17 was upgraded to Tropical Storm Ivy at 211800Z.

From the evening of the 22nd, the storm began to accelerate and move northeastward in response to an eastward moving short-wave trough in the mid-latitude westerlies. During this period the TUTT began to intensify. This created an upper air regime which was favorable for further intensification. On the morning of the 24th Ivy reached typhoon intensity. Reconnaissance aircraft at 0341Z recorded a central pressure of 967 mb and observed sustained, 700 mb winds of 75 kt (39 m/sec) about an eye 30 nm (56 km) in diameter.

After reaching typhoon intensity, Ivy continued to the northeast. This movement caused the storm to pass 20 nm northwest of Marcus Island (WMO 47991) at 241930Z. Marcus reported a sustained 70 kt (36 m/sec) at 1800Z and 111 kt (57 m/sec) gusts at 2100Z. As Ivy continued northeastward, further intensification took place. After establishment of other TUTT lows to the north and south of the storm, a maximum strength of 90 kt (46 m/sec) was reached on the 25th (Fig. 4-19). New aircraft data reported a well defined eye with a 945 mb central pressure.

Typhoon Ivy maintained maximum intensity for 12 hours. The continued northward displacement was due to the increasing influence of a quasi-stationary upper-level trough east of Japan. This also caused the storm to enter a cooler environment which began to degrade Ivy into an extratropical system. As a result, the last warning was issued at 261800Z. Ivy quickly weakened and became extratropical along a cold front.

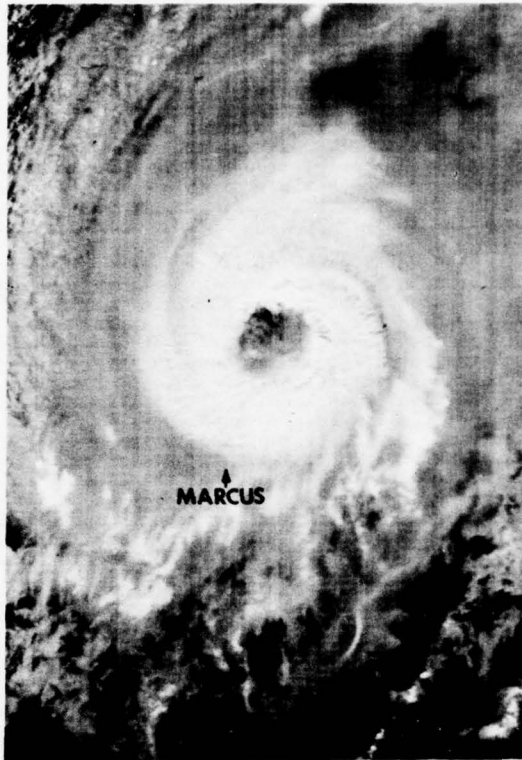
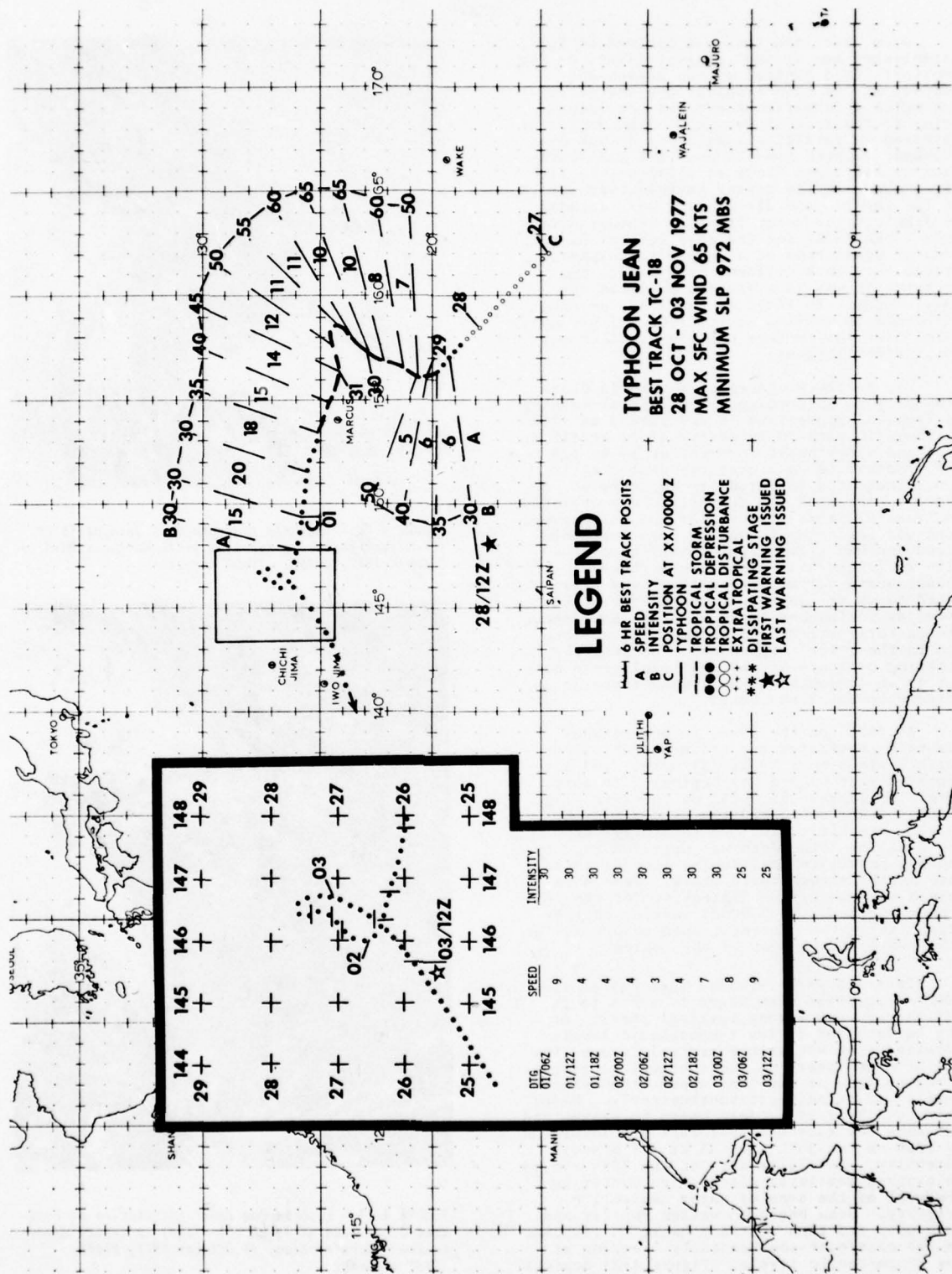


FIGURE 4-19. Typhoon Ivy displaying a well defined eye at its maximum intensity of 90 kt (46 m/sec), 25 October 1977, 0106Z. (DMSP imagery)



TYPHOON JEAN
BEST TRACK TC-18
28 OCT - 03 NOV 1977
MAX SFC WIND 65 KTS
MINIMUM SLP 972 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY AT XX/0000 Z
- C TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- DISSIPATING STAGE
- *** FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

DTG	SPEED	INTENSITY
01/06Z	9	30
01/12Z	4	30
01/18Z	4	30
02/00Z	4	30
02/06Z	3	30
02/12Z	4	30
02/18Z	7	30
03/00Z	8	30
03/06Z	9	25
03/12Z	9	25

JEAN

Jean, the 18th tropical cyclone of 1977, established two season records; first, as the shortest-lived typhoon of the season and second, as the only tropical cyclone of 1977 for which a formation alert was not issued prior to the initial warning. Jean was first observed on satellite imagery as a weak disturbance located some 200 nm (371 km) southeast of Kwajalein Atoll at 2128Z on the 24th of October. While moving northwestward at 14 kt (26 km/hr), the disturbance was included on JTWC's Significant Tropical Weather Advisory (ABEH PGTW) for the next several days. Located downstream of an upper tropospheric trough axis in a diffluent area aloft, the disturbance was in a favored position for development. By 1200Z on the 27th, an upper tropospheric outflow center (200 mb) was analyzed over the surface position further supporting development.

Due to the presence of a ship in close proximity to the cyclone, the initial warning on Tropical Depression 18 was issued at 1200Z on the 28th with an intensity of 30 kt (15 m/sec) and a northwest movement at 14 kt (26 km/hr). Satellite data over the next 6 to 12 hours indicated an intensity increase and at 1800Z on the 28th the depression was upgraded to tropical storm status. At this same time, Jean was beginning to show a more northward trend and had slowed appreciably to a speed of 6 kt (11 km/hr). The more northward thence north-northeastward track was attributed to upper- and mid-tropospheric level steering influences which were dominant above the easterly steering flow near the surface and in the lower troposphere. Because the steering currents at various levels were not acting in conjunction, a slowing trend in forward movement was noted.

At 0513Z on the 29th, reconnaissance aircraft penetrated the storm and observed surface winds near 60 kt (31 m/sec) and also reported that an eye was beginning to form. Satellite imagery at 0905Z on the 29th (Fig. 4-20) further supported the aircraft's observed intensification; consequently, at 1800Z on the 29th, Jean was upgraded to a typhoon. Satellite positioning also dictated a more north-northeastward track. Jean maintained minimum typhoon intensity for the next 6 hours through the 300000Z warning thereby establishing the aforementioned record as the shortest-lived typhoon of the season.

Post analysis revealed that beyond the 300000Z position Jean began to react to the effects of very strong vertical shear. At the surface and at low-tropospheric levels, steering flow was strong easterly around the southern periphery of the subtropical ridge. Steering flow at mid- and upper-tropospheric levels was strong west-southwesterly. Under this hostile regime, Jean began to weaken and had made her furthest northeastward incursion by 1200 on the 30th with 55 kt (28 m/sec) intensity. Satellite data on the 30th showed an exposed low-level circulation center to the west of the area of major convective activity. Jean began to weaken rapidly and move west and then west-northwest in response to the east/east-southeasterly steering at low tropospheric levels. Figure 4-21 depicts

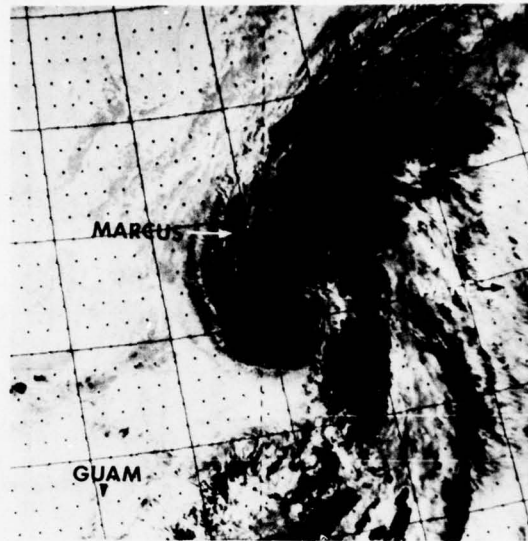


FIGURE 4-20. Infrared photograph of Jean at 55 kt (28 m/sec) intensity tracking north-northeastward, 29 October 1977, 0905Z. (DMSP imagery)

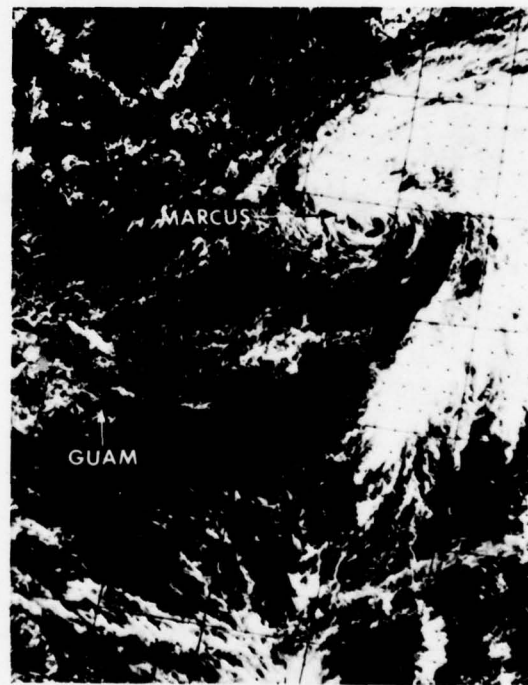


FIGURE 4-21. Exposed low level circulation of Tropical Storm Jean at 40 kt (21 m/sec) intensity during westward acceleration, 31 October 1977, 0102Z. (DMSP imagery)

the low level circulation center with the major convection sheared off to the east. Figure 4-22 is a graphic depiction of Jean's passage north of Marcus Island through three-hourly synoptic reports.

JTWC issued its expected final warning on TD 18 (formerly Tropical Storm Jean) at 1200Z on the 31st with a forecast dissipation within 12 hours. The low level circulation was closely monitored via satellite for signs of reintensification for the next 24-36 hours. By 2323Z on the 1st of November, the disturbance began to show an improved satellite signature with an increase in convective activity. TD 18 was reactivated and a warning was issued at 0000Z on the 2nd of November. At this time, TD 18 began meandering northward at 3 to 4 kt (5.5 to 7.5 km/hr)

and showed an intensity of 30 kt (15 m/sec). For the next 12 to 24 hours, the system executed a looping movement and by 1450Z on the 2nd satellite data again showed the effects of strong vertical shear with an exposed low level circulation again visible to the west of the main convection. Once sheared off, the low level circulation responded to low tropospheric, northeasterly flow around the southeastern periphery of a large anticyclone centered over the Sea of Japan. The final warning was issued at 031200Z with dissipation forecast by 031800Z. The low level circulation center continued tracking to the southwest and then west-southwest remaining weak and visible on satellite imagery until 0019Z on the 6th of November.

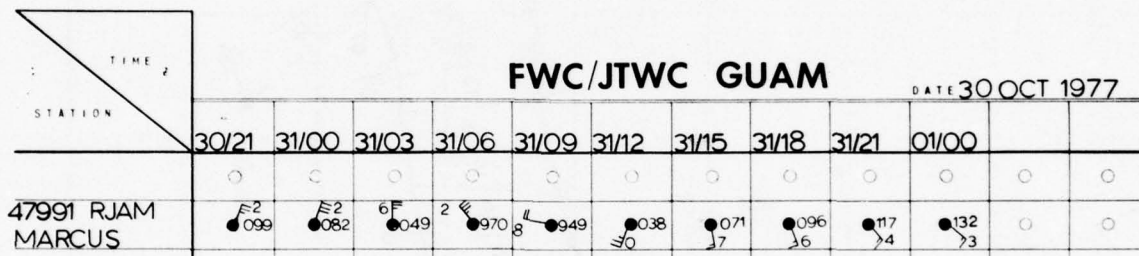
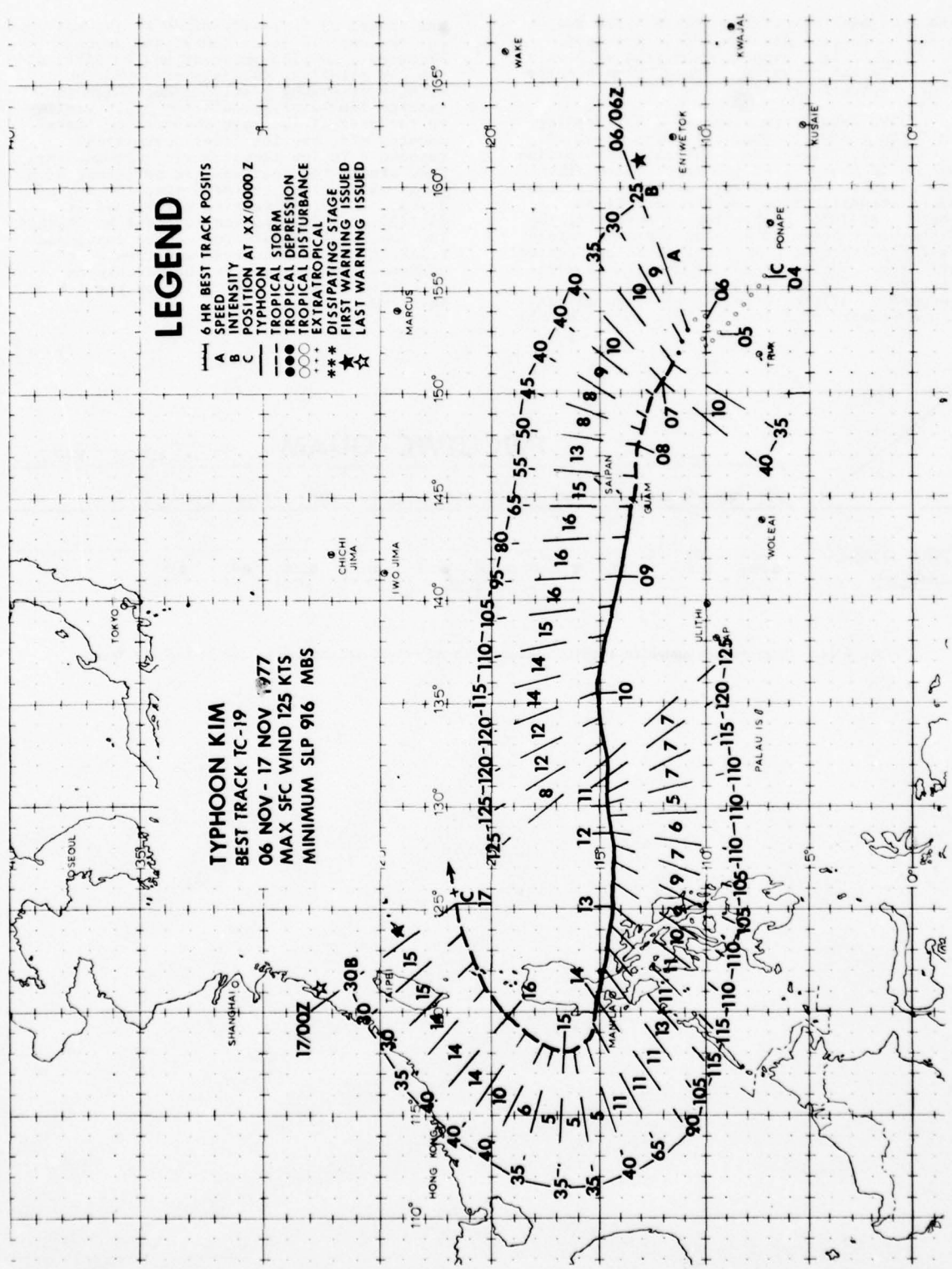


FIGURE 4-22. Three-hourly synoptic surface observations at Marcus Island during the passage of Jean.



LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY AT XX/0000 Z
- C TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- *** EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

TYPHOON KIM
BEST TRACK TC-19
06 NOV - 17 NOV 1977
MAX SFC WIND 125 KTS
MINIMUM SLP 916 MBS

KIM

Kim, the 9th typhoon of the season, originated in an active near-equatorial trough (NET), which extended through the western Marshall Islands. Weak surface circulations existed within this trough near Ponape and Kwajalein. During the 2nd of November, this activity had consolidated into a single surface circulation 100 nm (185 km) southwest of Ponape with a central pressure of 1007 mb. The disturbance began moving northwestward within the NET at approximately 6 kt (11 km/hr).

At 2155Z on the 3rd, satellite first fixed the disturbance and estimated the winds to be 20 kt (10 m/sec). A circulation center was located 150 nm (270 km) northwest of Ponape. With the weekend approaching, a formation alert was issued on the 4th as satellite and synoptic data indicated a strengthening surface circulation. Aircraft reconnaissance the next day found a central pressure of 1007 mb and estimated a maximum surface wind of 20 kt (10 m/sec). As the disturbance continued northwestward toward a broad, relative weakness in the strong mid-tropospheric subtropical ridge, synoptic and satellite data still indicated no significant development. Potential for development remained fair to good and the formation alert was therefore extended for 24 hours. A second aircraft investigation on the 6th fixed the system with a 1004 mb central pressure and maximum surface winds of about 25 kt (13 m/sec). Kim's first warning as TD 19 was issued at 0600Z on the 6th. The system was upgraded to Tropical Storm Kim just 12 hours later.

Kim next turned toward Guam at a speed of approximately 10 kt (19 km/hr). Slow intensification occurred during the next 48 hours due to the dominating presence of the strong subtropical ridge to the north. A short wave trough in the upper tropospheric westerlies also hampered rapid development by restricting outflow to the north of Kim. However, after the trough passed by, outflow aloft steadily strengthened. A deepening long wave trough over eastern Asia was now beginning to weaken the subtropical ridge which was previously suppressing Kim's low level development. Satellite data at 080204Z indicated increased organization (Fig. 4-23). Kim began intensifying at the rate of 30 kt (15 m/sec) in 24 hours and the central pressure dropped 22 mb in a 24 hour period.

Kim passed directly over Guam on 8 November between 1020Z and 1235Z approaching Guam from the east-southeast, moving westward over the island, and exiting toward the west-northwest. The eye entered with a circular configuration and exited with an elliptical configuration. Figure 4-24 depicts eye passage as seen by radar while Figure 4-25 displays the barograph trace recorded at Andersen AFB, Guam. The duration of the eye passage over the island lasted up to 1 hour and 10 minutes near the center of the storm track. The peak gust recorded was 77 kt (40 m/sec) on Nimitz Hill. The greatest damage was in the southern end of the island where 22 homes were damaged or destroyed (Figs. 4-26 and 4-27). Fortunately, no lives were lost on Guam.

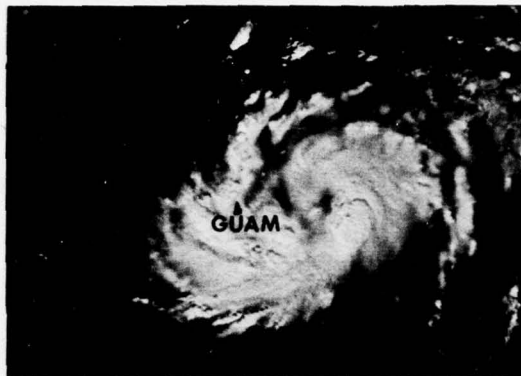


FIGURE 4-23. Kim at 50 kt (26 m/sec) intensity, rapidly intensifying, and heading for Guam, 8 November 1977, 0204Z. (DMSP imagery)

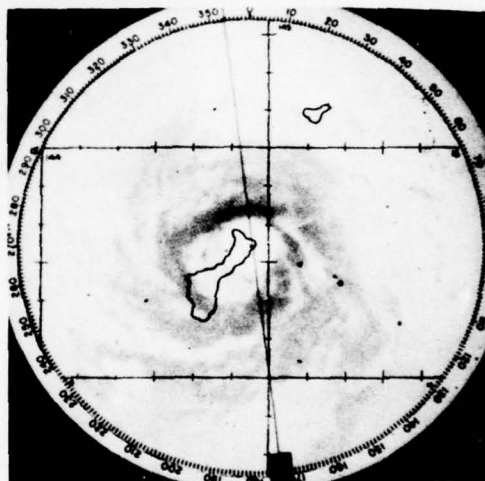


FIGURE 4-24. Air Weather Service radar presentation of Kim at 60 kt (31 m/sec) intensity with the eye over Guam, 8 November 1977, approximately 1130Z. (Photograph courtesy of Det 2, 1WWG, Andersen AFB, Guam.)

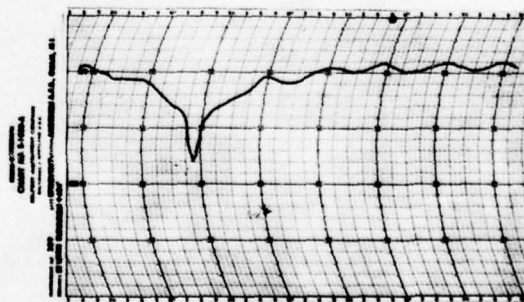


FIGURE 4-25. Reproduction of the barograph trace from Andersen AFB, Guam during eye passage of Kim. The center passed approximately 8 nm (15 km) south of Andersen AFB.



FIGURE 4-26. Kim's nearly typhoon strength winds battered the exposed, coastal village of Umatac. (Photograph courtesy of P. J. Ryan of the Pacific Daily News.)



FIGURE 4-27. Although damage was slight on most of the island, Umatac Village on the southwest coast did not fare so well. (Photograph courtesy of P. J. Ryan of the Pacific Daily News.)

Kim was upgraded to typhoon strength at 2200 local on the 8th just after exiting Guam. For the next 48 hours the storm continued to intensify. The subtropical ridge continued to slowly weaken throughout this period, but it maintained sufficient strength to steer Kim in a west-northwestward direction. Moving at approximately 15 kt (28 km/hr), Kim advanced toward another weakness in the ridge located between two subtropical high pressure cells. As the tropospheric steering flow weakened, forward speed decreased and intensification increased. When Kim was nearest this weakness within the ridge, she attained a speed minimum, 5 kt (9 km/hr), and an intensity maximum of 125 kt (64 m/sec) (Fig. 4-28).

Kim now took on a more westward track as she came under the influence of the next subtropical high cell. Kim was also gradually approaching a deep, quasi-stationary, upper tropospheric trough over Asia. This trough produced strong southwesterly flow which began to restrict outflow ahead of Kim resulting in decreasing intensity. At the same time, a deepening low cell in the Tropical Upper Tropospheric Trough (TUTT) was slowly approaching Kim from the east. This low cell eventually came in position to enhance upper level outflow. A secondary maximum intensity, 120 kt (62 m/sec), was achieved from this interaction.

Kim was soon headed straight for central Luzon (Fig. 4-29). Landfall occurred on the 13th causing extensive damage on the coastline with winds of 115 kt (59 m/sec). The storm passed about 35 nm (65 km) north of Manila and 5 nm (9 km) south of Clark AB.

The typhoon exited into the South China Sea 7 hours after landfall with an intensity of 65 kt (33 m/sec). This amount of weakening is in good agreement with the latest climatological studies of intense typhoons crossing Luzon. Even though the South China Sea still had warm sea surface temperatures, Kim never reintensified due to strong, cool northeast monsoon flow entraining into the storm environment. By this time the mid-latitude westerlies had sufficiently weakened the subtropical ridge which separated Kim from the westerlies. Rapidly decelerating, Kim turned northward in response to the steady southwesterly steering flow being produced by an approaching upper tropospheric trough. Increased upper level shearing began the storm's extratropical transformation. Turning northward, Kim entered deeper westerly flow and was accelerated northeastward through the Bashi Channel. Kim became an extratropical system by 0000Z on the 17th and merged with a weak frontal system east of Taiwan.

Kim was a long-lived storm with 44 warnings issued during a 12 day period. Guam sustained moderate property damage when Kim crossed the island as a strong tropical storm. Luzon, however, reported 55 drownings due to widespread flooding. In Manila, a fire in a hotel, caused by a lighted candle, during the height of the storm resulted in 47 deaths. Minor damage occurred at Clark AB with a roof blown from a school building and falling trees causing other damage. One ship was reported sunk while another went aground as Kim exited into the South China Sea.

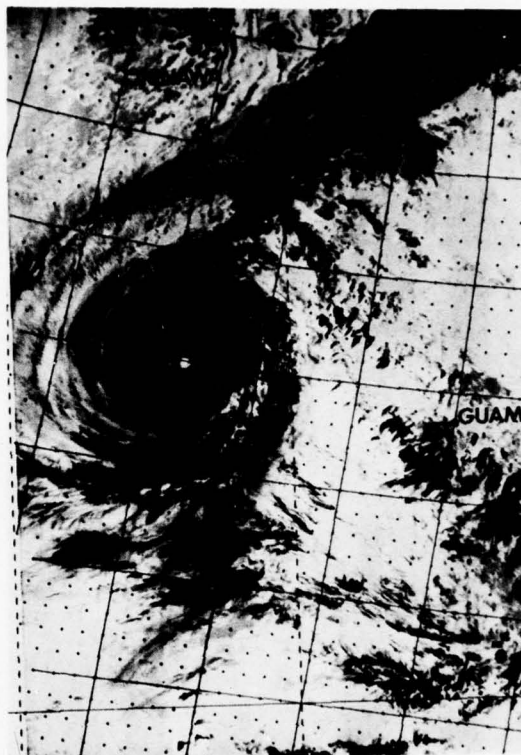


FIGURE 4-28. Infrared photograph of Typhoon Kim at peak intensity of 125 kt (64 m/sec), 10 November 1977, 2145Z. (DMSP imagery)

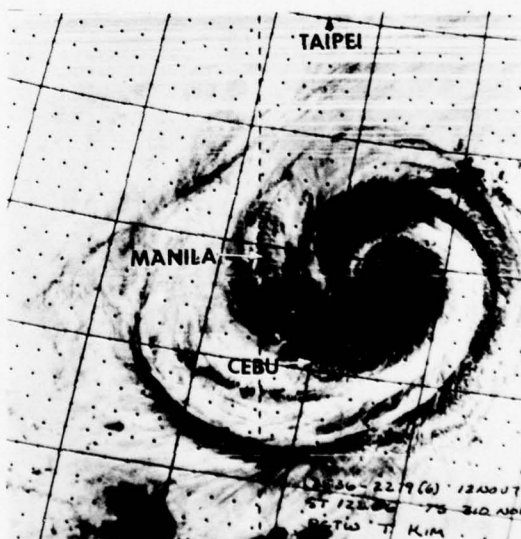


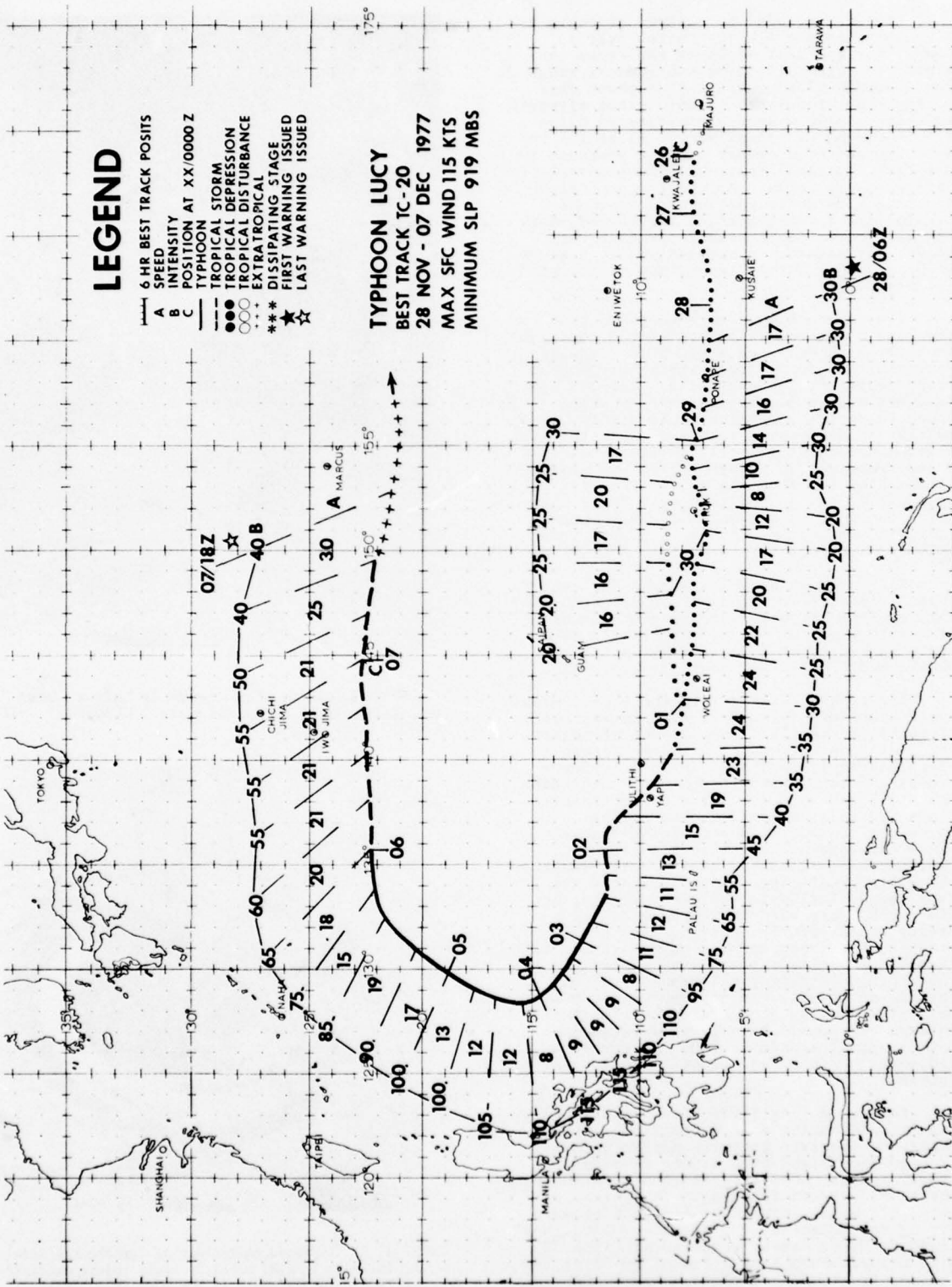
FIGURE 4-29. Infrared photograph of Typhoon Kim with 110 kt (57 m/sec) winds about 20 hours before landfall on the Philippine Islands, 12 November 1977, 2255Z. (DMSP imagery)

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY
- C POSITION AT XX/0000 Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

TYPHOON LUCY

BEST TRACK TC-20
 28 NOV - 07 DEC 1977
 MAX SFC WIND 115 KTS
 MINIMUM SLP 919 MBS



LUCY

Lucy, the 10th typhoon, was in most respects a typical winter season storm. Development was difficult and near the equator while recurvature occurred at a low latitude. An unusual event happened during the development stage when the system divided into two disturbances and then recombined 2 days later.

As with the previous typhoon (Kim), Lucy's birth was a "double vortice" development pattern discussed by many authors. The earliest accounts of tropical storms occurring simultaneously on both sides of the equator are described in a book "The Law of Storms" by Reid (1849). In this particular case the tropical cyclone in the Southern Hemisphere near equatorial trough (NET) developed first and was well on its way to maturity before Lucy formed in the Northern Hemisphere NET. The expanding circulation about the Southern Hemisphere TC 24-77 (Steve) strengthened the westerly flow along the equator increasing the horizontal shear along the Northern Hemisphere NET aiding the development of Lucy (Fig. 4-30). On the 26th, 33 kt (17 m/sec) gradient level winds were observed at Tarawa (WMO 91610), an island about 75 nm (139 km) north of the equator. Westerlies extended above 500 mb and created an extensive horizontal wind shear trough north of the equator. Enough cyclonic spin was imparted over the Marshall Island area that the nearby preexisting disturbance began to develop. All factors for further development were present therefore, at 270600Z a Tropical Cyclone Formation Alert was issued.

A large mid-tropospheric anticyclone dominated the subtropical western Pacific and concentrated strong trade winds north of the depression. The system soon began accelerating westward as it neared the anticyclone's southern domain. Synoptic data indicated an increase in circulation size and satellite imagery showed better organization. Weather

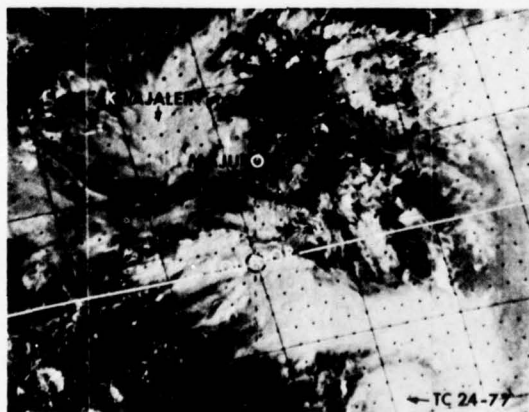


FIGURE 4-30. "Double Vortices". Lucy is seen in her formative stage in the Northern Hemisphere NET between Kwajalein and Majuro while TC 24-77 (Steve) is near maturity in the Southern Hemisphere NET, 25 November 1977, 2118Z. (NOAA-5 imagery)

reconnaissance aircraft were sent in to investigate further. Early on the 28th aircraft found a 997 mb surface pressure center with 30 kt (15 m/sec) surface winds and 45 kt (23 m/sec) flight level winds at 1500 ft (457 m). JTWC thus issued their first warning on TD 20 at 280600Z. Six hours later the depression crossed the southern coast of Ponape (WMO 91348) with only 10 kt (5 m/sec) sustained and 25 kt (13 m/sec) gusts reported. These unexpectedly weak surface winds supported prior aircraft reports which observed maximum winds at flight level, not surface.

On the 29th TD 20 split into two disturbances. One went northwestward and the other west-southwest around the Truk Islands (Fig. 4-31). This split occurred when increasing amplitudes in the mid-latitude long wave patterns strengthened the subtropical, mid-tropospheric anticyclone which was positioned north of TD 20. The pressure gradient between TD 20 and the high pressure cell generated 45 kt (23 m/sec) easterly flow at 500 mb. The resulting intense, horizontal shear produced enough vorticity to induce a secondary circulation system just north of TD 20. As they separated, both systems weakened as their energy sources also became divided.

Because the northern system was generated in the mid-troposphere, it was reflected on the surface only as a weak depression. Infrared satellite imagery identified the northern split as having more activity at higher levels. Aircraft and synoptic data indicated better organization in the southern split. The northern system reached a maximum forward speed of 20 kt (37 km/hr) as the pressure gradient peaked. This rapid movement

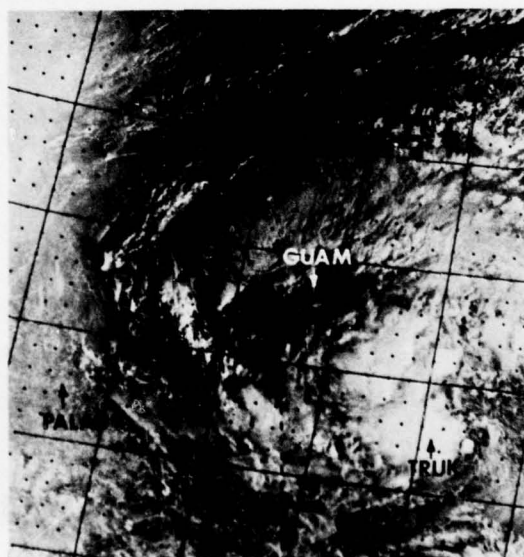


FIGURE 4-31. Lucy during an unusual split configuration while over the Caroline Islands, 29 November 1977, 2125Z. (DMSP imagery)

placed the secondary disturbance well ahead of TD 20's primary circulation. As the dual system moved westward away from the dominating influence of the subtropical high, horizontal shear and induced vorticity diminished. This resulted in the northern system's deceleration and dissipation. The southern, primary, system soon caught up to and absorbed the remnants of the northern system 100 nm (185 km) northwest of Woleai Atoll. By 0000Z on the 1st of December, TD 20 was again a single system with the same intensity as it was before the split.

TD 20 now began heading northwestward around the southwestern periphery of the steering anticyclone toward a break in the subtropical ridge. Deceleration and intensification progressed for the next 2 days. TD 20 became Tropical Storm Lucy at 010600Z. Aircraft data, however, still indicated that the storm was best developed in the middle layers. This was again evidenced when Lucy passed 25 nm (46 km) northwest of Yap (WMO 91413) which only experienced 15 kt (8 m/sec) sustained surface winds and a sea-level pressure minimum of 1001 mb.

Continuing northwestward, Lucy appeared to be heading for a recurvature path. An intense, short-wave trough was passing north of Lucy, with an apparent weakening in the subtropical ridge. But the trough quickly passed, trailing a migratory anticyclone behind and Lucy again took a more westward track. Now headed for the Republic of the Philippines, Lucy attained typhoon intensity at 020600Z and continued to deepen. Synoptic and satellite data showed excellent upper

level divergence in all quadrants. Aircraft reconnaissance began reporting maximum winds nearer the surface, indicating better vertical development. By this time Lucy attained a maximum intensification rate of 20 kt (10 m/sec) per 6 hours and satellite data revealed a large, well defined eye (Fig. 4-32).

By the 3rd of December, Lucy was again heading northwestward as a strong westerly trough began creating another weakness in the subtropical ridge. In 24 hours the ridge west of Lucy had completely dissipated. Lucy's easterly steering currents rapidly weakened under increasing pressure from the advancing trough. At 1800Z on the 3rd, a 115 kt (59 m/sec) maximum intensity was reached with a minimum forward speed of 8 kt (15 km/hr). Within the next 12 hours, Lucy recurved ahead of the approaching trough.

The storm soon became completely embedded in mid-latitude westerly flow and accelerated northeastward. Lucy was downgraded to tropical storm stage 48 hours after recurvature. Upper level vertical shear and low level cool, dry entrainment became the significant factors for weakening. Lucy was eventually steered into a frontal zone and became an extratropical wave within the boundary.

The last warning was issued at 071800Z. Lucy's extratropical transformation extended over several days since both polar and tropical air flows converged into the system. Lucy traveled eastward as a weak cyclone along the front and was eventually absorbed into a large, winter storm system over the central Pacific.

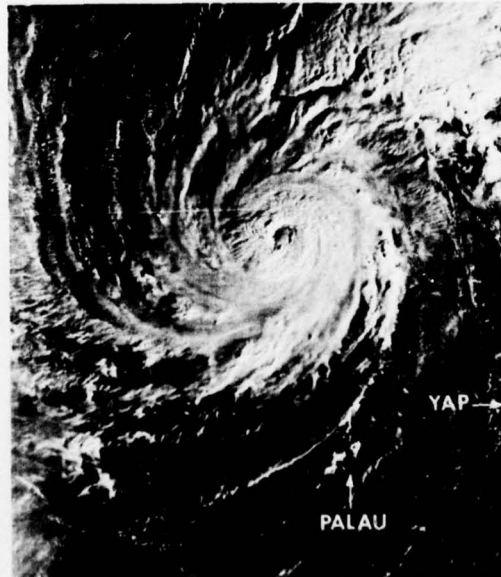
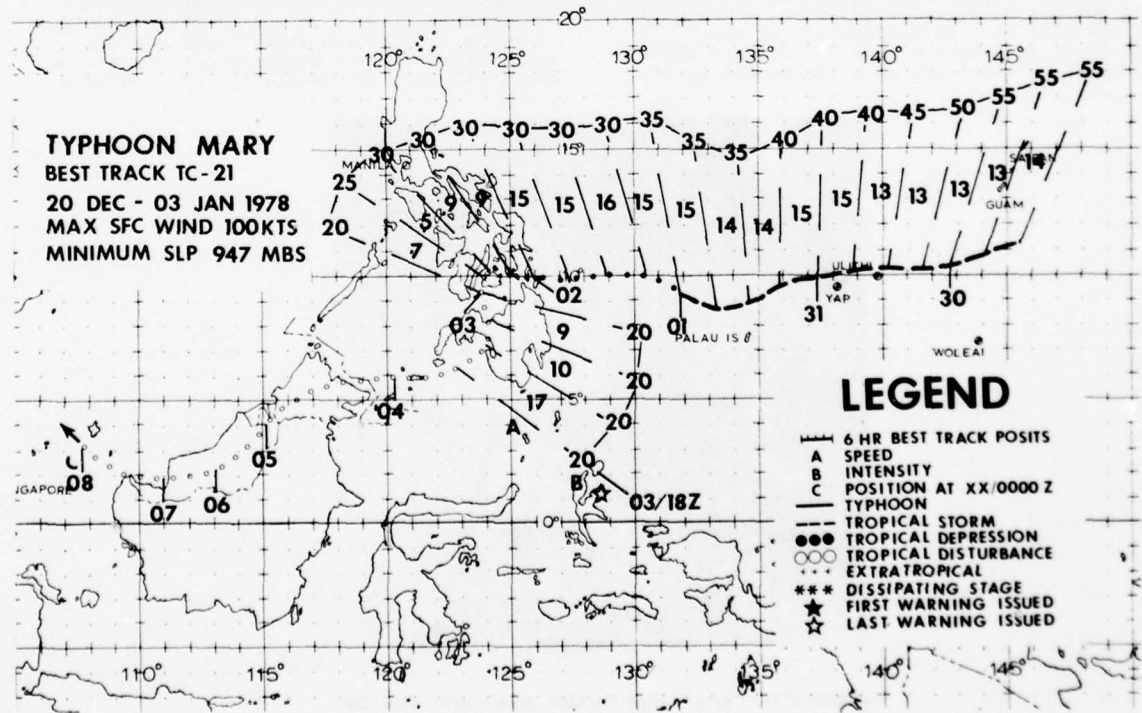
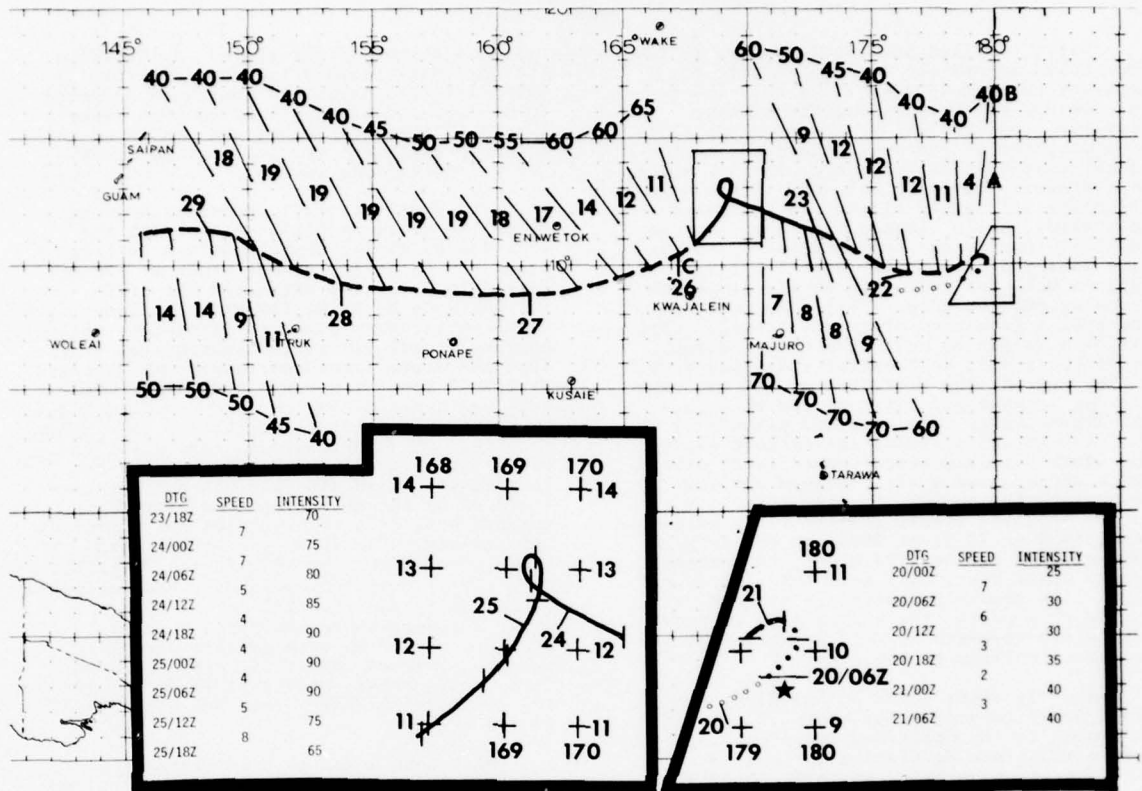


FIGURE 4-32. Typhoon Lucy with 85 kt (44 m/sec) winds and undergoing rapid deepening, 2 December 1977, 2215Z. (DNMSP imagery)



MARY

Mary, the 11th and final typhoon of the year moved across the western Pacific for 15 days and covered 4002 nm (7445 km), the second longest storm on record for distance traveled. On the 19th of December satellite data detected a tropical disturbance moving slowly east-northeastward near 9N-177E where weak steering currents existed. Steering was primarily influenced by the winter season westerlies, which extended far into the subtropics. During the next few hours, satellite data indicated slow intensification while a well defined comma shaped cloud was becoming evident (Fig. 4-33). At 0000Z on the 20th a formation alert was issued. Upper air data at 500 mb indicated that a strong mid-tropospheric subtropical ridge had formed to the west of the disturbance. At the same time an intense mid-latitude 500 mb trough was approaching. The combined effects of this trough and a strong anticyclone above the storm produced steady upper level divergence and created a well defined outflow channel to the north. Further intensification appeared likely and the first warning was issued on TD 21 at 0600Z on the 20th. However, for the next 24 hours, the system became quasi-stationary near 10N-179E as the westerlies gradually receded northward. During this period the system grew to tropical storm strength as GOES imagery indicated increased outflow to the north.

Shortly after 1200Z on the 21st, the storm began to accelerate westward. The 500 mb trough to the north had moved eastward with a ridge now developing north of Mary. This formation imparted westerly steering flow south of the ridge axis. Mary responded and quickly accelerated to 12 kt (22 km/hr). On the 22nd Mary turned toward the west-northwest in response to a shallow mid-latitude trough which weakened the subtropical

ridge northwest of the storm. By 0000Z on the 23rd Mary reached typhoon intensity as satellite data indicated continued increase in outflow and formation of an eye. Mary slowed to 8 kt (15 km/hr) and continued moving west-northwest for the next 30 hours while intensifying further.

The first aircraft reconnaissance entered the storm at 0115Z on the 24th and reported 90 kt (46 m/sec) maximum surface winds and 75 kt (39 m/sec) winds at 700 mb. Satellite data also estimated the storm intensity to be 75 kt (39 m/sec). About five hours later, Mary began to decelerate while nearing a weakness in the subtropical ridge. Then the storm turned northward and appeared as though recurvature was beginning. However, analysis of 500 mb synoptic data indicated the mid-latitude westerlies were again receding. The subtropical ridge again re-established itself and Mary responded by looping clockwise and was subsequently influenced by the northerly flow around the eastern edge of a strong, eastward migrating anticyclone. The storm now moved south-southwestward at 5 kt (9 km/hr). Satellite data (Fig. 4-34) indicated Mary had continued to intensify and at 0314Z on the 25th aircraft reconnaissance indicated a central pressure of 947 mb with maximum sustained surface winds of 100 kt (51 m/sec). Just three hours later, Utirik Atoll 55 nm (102 km) southeast of Mary, recorded winds of 40 kt (21 m/sec).

Mary soon began to accelerate to 12 kt (22 km/hr) towards the west-southwest along the southeastern periphery of the strengthening subtropical high cell. The resulting steering flow at mid-levels plus rapid movement of the typhoon were expected to weaken Mary. By the 26th satellite data indicated

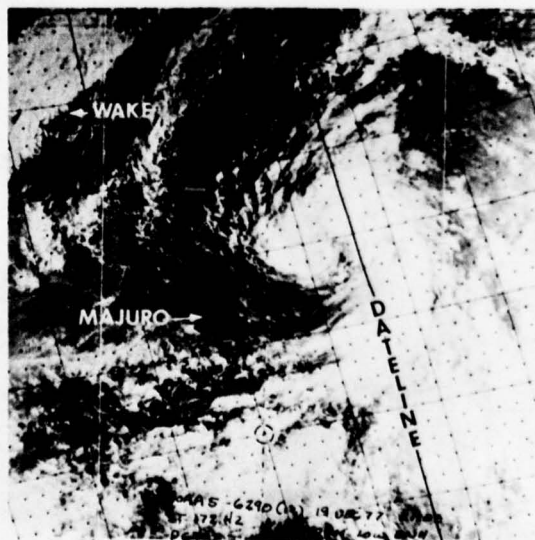


FIGURE 4-33. Mary during initial development near the dateline, 19 December 1977, 2110Z. (NOAA-5 imagery)

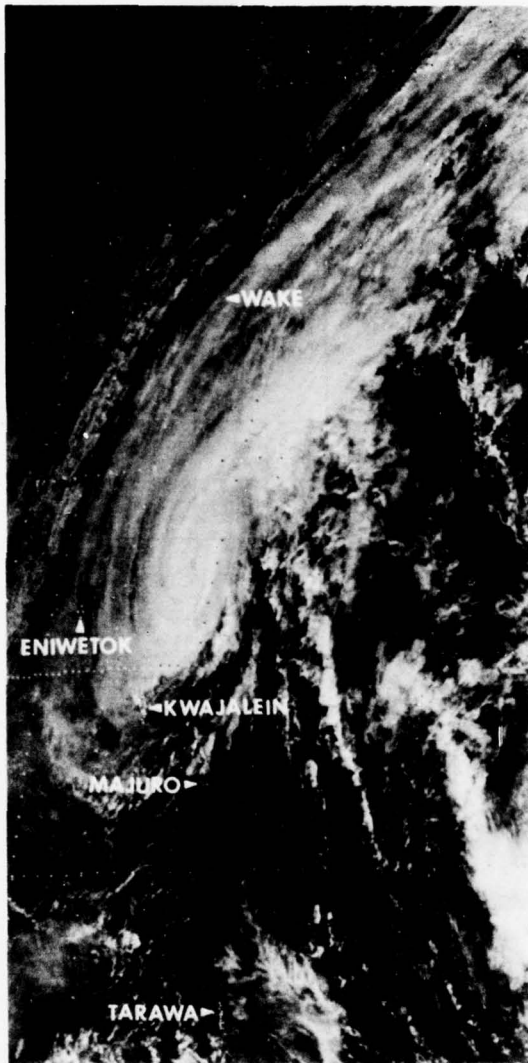


FIGURE 4-34. Typhoon Mary during execution of a loop 6 hours before attaining a maximum 100 kt (51 m/sec) intensity, 24 December 1977, 2049Z. (GOES imagery from SFSS, Honolulu, HI)

Mary had indeed weakened and Mary was downgraded to a tropical storm. Aircraft reconnaissance at 0357Z on the 26th confirmed corresponding satellite data when 60 kt (31 m/sec) surface winds were observed.

As Mary turned westward along the southern boundary of the subtropical high cell, the storm accelerated to 19 kt (35 km/hr). By the 28th Mary began moving west-northwestward in response to another trough induced weakness in the subtropical ridge. Mary again slowed due to the weaker steering currents. Satellite data once again indicated intensification (Fig. 4-35). As the trough moved rapidly eastward, the subtropical ridge again strengthened north of the storm and Mary turned west-southwestward and began to weaken for the second time. Accelerating steadily Mary attained a 15 kt (28 km/hr) forward movement and continued to weaken as development became restricted by the expanding ridge.

Mary continued her westward movement for the next several days. Weakening slowly, the storm was downgraded to a tropical depression at 0000Z on the 1st of January. The system maintained 30 kt (15 m/sec) winds until moving over the central Philippines near Leyte Gulf. Satellite data indicated rapid dissipation over land with the final warning issued at 1800Z on the 3rd. Mary turned sharply southward over the Philippines when the strong northeast monsoon was encountered, which aided rapid dissipation.

Although Mary was not the longest lived storm on record, the 4002 nm (7445 km) distance traveled was the second longest. What is also noteworthy is that no injuries or major damage resulted during its long journey across the western Pacific. Mary was indeed a fitting end to a most unusual tropical cyclone year.

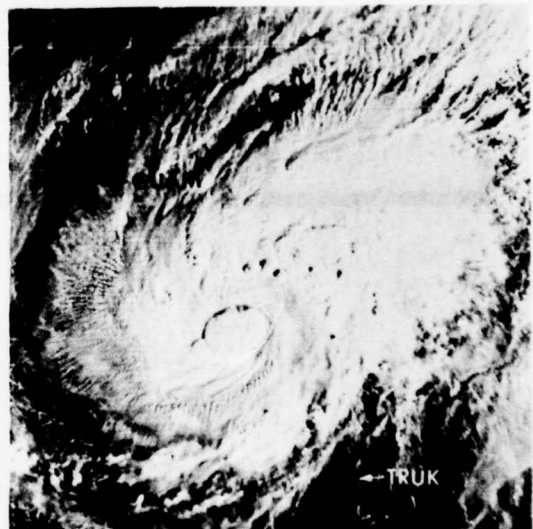


FIGURE 4-35. Mary at 50 kt (26 m/sec) intensity and slowly deepening between Guam and Truk, 28 December 1977, 2136Z. (DMSP imagery)

2. NORTH INDIAN OCEAN TROPICAL CYCLONES

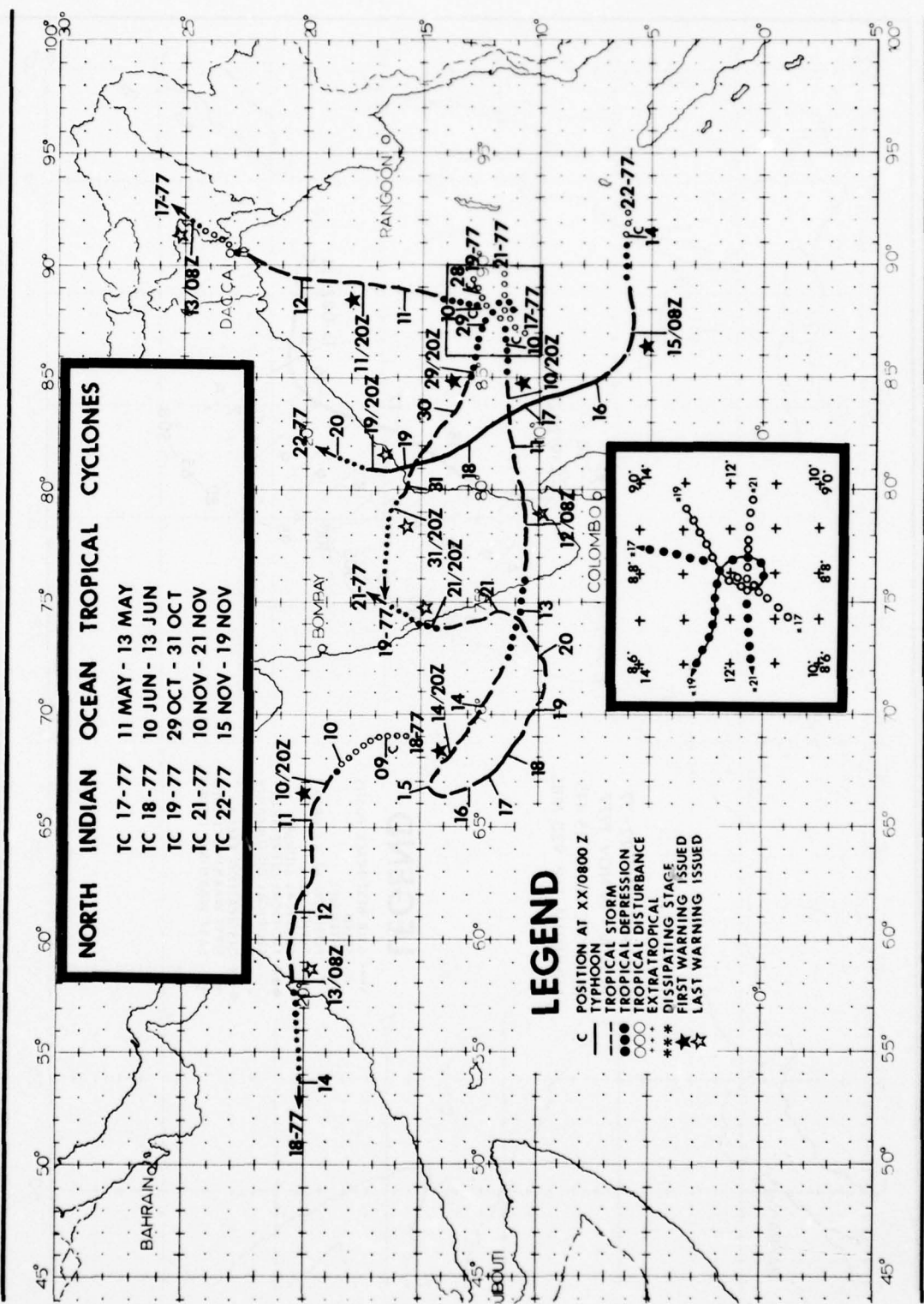
During 1977, there were five tropical cyclones in the North Indian Ocean (Table 4-6). These occurrences were climatologically consistent; two in the spring and three in the autumn. However, these cyclones persisted much longer and were more intense than normal. TC 21-77, for example, developed in the Bay

of Bengal, traversed southern India, regenerated in the Arabian Sea, looped while reaching typhoon strength, then finally dissipated over southwestern India after traveling a total of 1387 nm (2570 km). TC 22-77 was the next and largest cyclone this season. It became the third and most destructive storm to hit India. Because of its strength and devastating impact, TC 22-77 is further discussed in the following individual summary.

TABLE 4-6. FREQUENCY OF NORTH INDIAN OCEAN CYCLONES BY MONTH AND YEAR.

YEAR*	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
1971	0	0	0	0	0	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
AVG	0.1	0	0	0.3	0.4	0.3	0	0	0.4	0.7	1.3	0.3	3.9

*1971-1974 REPRESENT BAY OF BENGAL CYCLONES ONLY

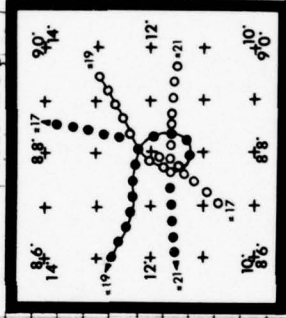


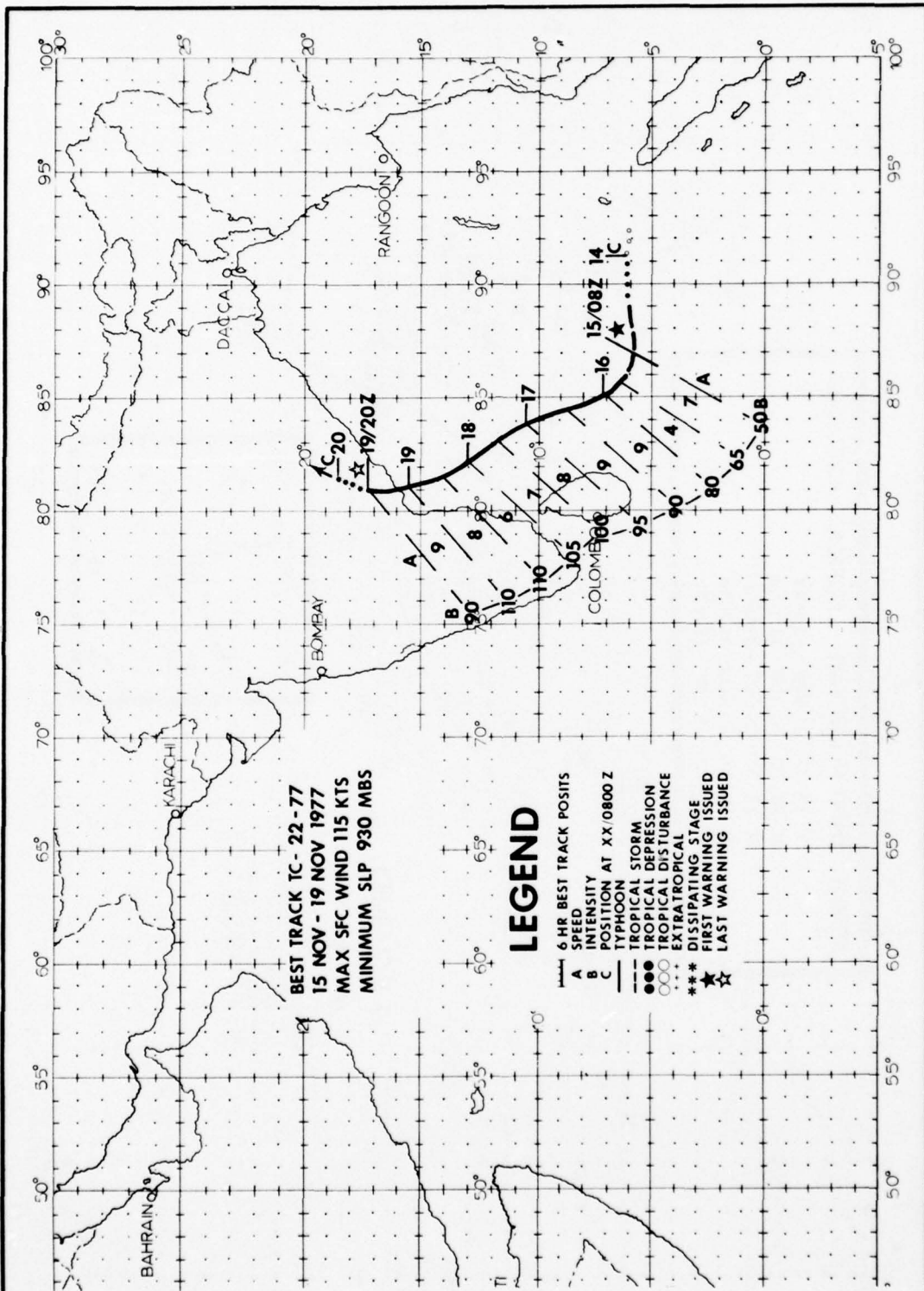
NORTH INDIAN OCEAN TROPICAL CYCLONES

TC 17-77	11 MAY - 13 MAY
TC 18-77	10 JUN - 13 JUN
TC 19-77	29 OCT - 31 OCT
TC 21-77	10 NOV - 21 NOV
TC 22-77	15 NOV - 19 NOV

LEGEND

- C POSITION AT XX/0800 Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRA-TROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED





BEST TRACK TC- 22-77
15 NOV - 19 NOV 1977
MAX SFC WIND 115 KTS
MINIMUM SLP 930 MBS

LEGEND

- 6 HR BEST TRACK POSITS
- A SPEED
- B INTENSITY
- C POSITION AT XX 0800Z
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED

TC 22-77

TC 22-77 was the most devastating storm in the Indian Ocean since 1971. It developed 115 kt (59 m/sec) winds and inundated South-eastern India with heavy rains and high seas. TC 22-77 occurred during the autumn monsoon transition period, when cyclone development is most favorable, and became the only storm to attain typhoon strength this season in the Bay of Bengal.

Meteorological satellite first located TC 22-77 during the morning of the 14th of November as a weak disturbance, approximately 150 nm (278 km) southwest of the Nicobar Islands. Five hours later new satellite data revealed better defined banding which indicated increased organization. This prompted the issuance of a formation alert the same day at 1310Z. Heading due west along the southern periphery of the mid-tropospheric subtropical ridge, the disturbance quickly accelerated to 13 kt (24 km/hr), while steadily intensifying. Later satellite and synoptic data supported a well developed cyclone of about 40 kt (21 m/sec). At 0800Z on the 15th the first warning was issued. A post analysis showed that TC 22-77 was rapidly developing during this period.

Ever since TC 22-77 was first detected, an upper tropospheric trough was forming over northern India. By the 15th this trough was firmly established and extended over central India, creating a break in the subtropical ridge. As the cyclone neared India, it began moving northwestward toward the trough induced break. This break also weakened the mid-tropospheric anticyclone and consequently reduced the storm's steering flow, and as a result, TC 22-77 steadily slowed to a 4 kt

(7 km/hr) movement. It was now intensifying at the rate of 30 kt (15 m/sec) per 24 hours, primarily in response to the divergent southwesterly flow produced by the upper level trough above the approaching cyclone. TC 22-77 attained typhoon strength by the afternoon of the 15th, and by 0629Z on the 16th satellite data revealed an eye.

For the next 2 days, TC 22-77 tracked north-northwestward at an average speed of 9 kt (17 km/hr) while continuing to strengthen. By the 18th, it began to decelerate and was intensifying 10 kt (5 m/sec) each day. Successive satellite pictures showed tighter banding features while the eye became more distinct (Fig. 4-36). Approximately 75 nm (140 km) from the Indian coast, TC 22-77 reached a maximum intensity of 115 kt (59 m/sec). Just prior to landfall, TC 22-77 accelerated to 9 kt (17 km/hr) toward the north-northwest. At 1100Z on the 19th, the storm struck with sustained winds of 105 kt (54 m/sec) and an 18 ft (5.5 m) tidal wave along the coast of Andhra Pradesh about 40 nm (75 km) south of Vijayawada (WMO 43181). TC 22-77 then turned northward over flat farm lands while weakening slowly, and the final warning was issued at 2000Z on the 19th.

The combined winds, seas and rains generated by TC 22-77 killed nearly 10,000 people, left hundreds of thousands homeless and devastated lands that produce roughly 40 per cent of India's food grains. The tidal wave was probably the single most destructive force accompanying the storm. It penetrated 10 nm (19 km) inland and washed away more than 21 villages.

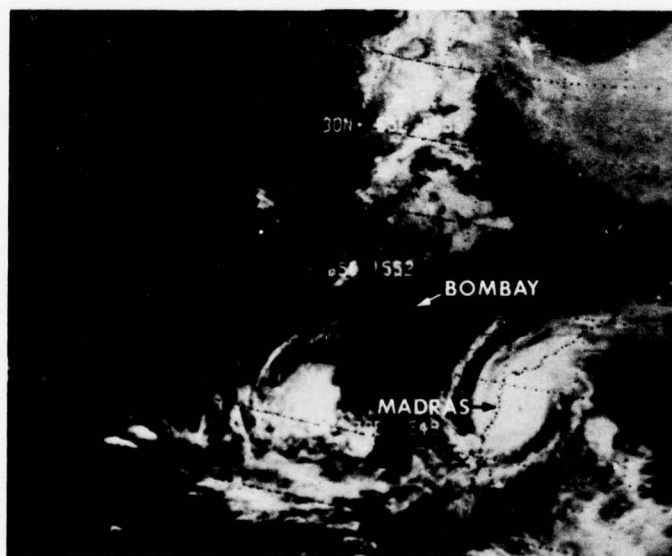


FIGURE 4-36. Infrared photograph of TC 22-77 at maximum intensity of 115 kt (59 m/sec), 18 November 1977, 1618Z. In the Arabian Sea TC 21-77 with 65 kt (33 m/sec) winds completing a loop before striking southwestern India. (NOAA-5 imagery from FLEWEAFAC Suitland, MD)

3. CENTRAL NORTH PACIFIC TROPICAL CYCLONES

No tropical cyclones developed over the central North Pacific during 1977 (Table 4-7).

TABLE 4-7. FREQUENCY OF CENTRAL PACIFIC STORMS BY MONTH AND YEAR. (NUMBER IN PARENTHESIS INDICATE STORMS REACHING HURRICANE INTENSITY)

	JAN- JUN	JUL	AUG	SEP	OCT	NOV- DEC
1967	0	0	0	0	1	0
1968	0	0	2	0	0	0
1969	0	0	0	0	0	0
1970	0	0	1	0	0	0
1971	0	1 (1)	1	0	0	0
1972	0	0	3 (1)	1	0	0
1973	0	1 (1)	0	0	0	0
1974	0	0	2 (1)	0	0	0
1975	0	0	0	0	0	0
1976	0	0	0	1 (1)	0	0
1977	0	0	0	0	0	0
AVERAGE	0	.2(.2)	.8(.2)	.2(.1)	.1	0

CHAPTER V - SUMMARY OF FORECAST VERIFICATION DATA

1. ANNUAL FORECAST VERIFICATION

a. POSITION FORECAST VERIFICATION

Forecast positions at initial warning times and those at 24-, 48-, and 72-hour times are verified against the best track. Positions for dissipated or extrapolated storms are not verified. In addition to the overall verifications depicted in Table 5-1, a separate verification for only Pacific Area typhoons is computed. This information is listed in Table 5-2, for comparison with

previous years. This same information is depicted graphically in Figure 5-1. A computation of closest distance to the best track (right angle error) is also calculated. Right angle error, graphically depicted in Figure 5-2, is a measure of ability to forecast the path of motion without regard to speed. In the Indian Ocean Area, no 72-hour forecasts are available for verification, and no attempt is made to segregate storms by intensity. Error statistics for this area are summarized in Tables 5-2 and 5-3 and Figure 5-3.

TABLE 5-1. JTWC ANNUAL AVERAGE POSITION FORECAST ERROR FOR TROPICAL CYCLONES

	WESTERN NORTH PACIFIC**			INDIAN OCEAN***	
	24-HR	48-HR	72-HR	24-HR	48-HR
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	98	181	272	---	---
1971	99	203	308	220	410
1972	116	245	382	193	233
1973	102	193	245	203	305
1974	114	218	351	137	238
1975	129	279	442	145	228
1976	117	232	336	138	204
1977	140	266	390	122	292

*FORECAST POSITIONS NORTH OF 35°N WERE NOT VERIFIED.
 **FOR TYPHOONS ONLY WHILE WINDS OVER 35 KNOTS
 ***1971-1974 DOES NOT INCLUDE ARABIAN SEA

TABLE 5-2. 1977 JTWC ERROR SUMMARY FOR THE WESTERN NORTH PACIFIC

CYCLONE	WARNING			24 HOUR			48 HOUR			72 HOUR		
	POSIT ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# WRNGS
1. TS PATSY	55	36	25	108	77	17	84	54	9	163	127	9
2. TD 02	20	10	6	167	13	2						
3. TS RUTH	19	16	14	92	72	10	298	177	6	884	447	2
4. TD 04	46	31	6	211	70	2						
5. TY SARAH	22	12	21	119	70	17	121	83	13	129	94	8
6. TY THELMA	16	9	21	97	58	17	200	134	13	255	157	9
7. TY VERA	14	8	18	121	72	14	174	123	10	180	162	6
8. TS WANDA	27	17	17	129	84	13	278	163	9	446	235	5
9. TS AMY	38	19	16	201	51	12	446	145	8	755	285	3
10. STY BABE	17	11	36	144	95	32	279	192	28	458	324	23
11. TS CARLA	53	26	9	112	46	5	274	33	1			
12. TY DINAH	19	13	38	159	106	34	396	254	30	613	398	25
13. TS EMMA	32	16	21	200	105	17	365	146	13	431	185	8
14. TS FREDA	26	14	9	220	82	5	454	146	1			
15. TY GILDA	39	22	30	130	58	26	198	86	22	295	139	18
16. TS HARRIET	26	13	19	198	121	15	376	197	11	757	375	7
17. TY IVY	40	22	24	186	77	20	330	167	16	408	241	12
18. TY JEAN	27	14	20	239	144	14	489	288	8	1007	775	1
19. TY KIM	16	10	44	111	57	40	239	129	36	327	186	32
20. TY LUCY	33	18	39	178	97	34	330	172	30	543	255	27
21. TY MARY	34	23	59	135	86	55	256	140	47	299	132	33
ALL FORECASTS	29	17	492	148	83	401	283	157	311	407	228	228
TYPHOONS ONLY*	22	14	301	140	80	273	266	156	232	390	232	180

*WHILE WINDS OVER 35 KNOTS

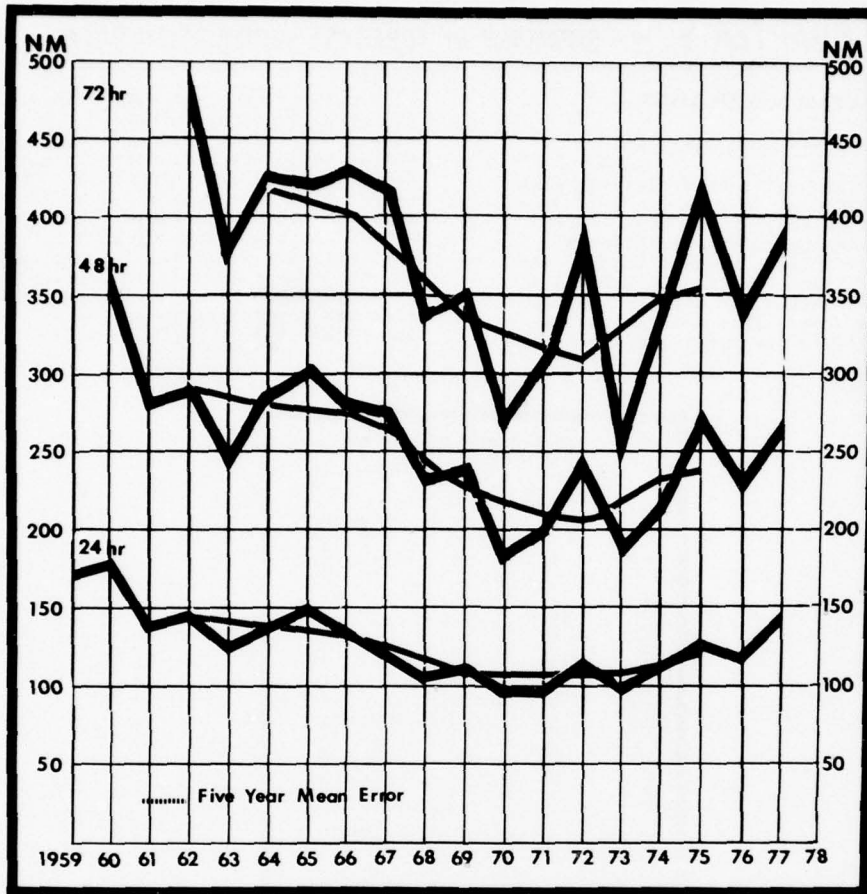


FIGURE 5-1. Mean vector error for the Pacific Area.

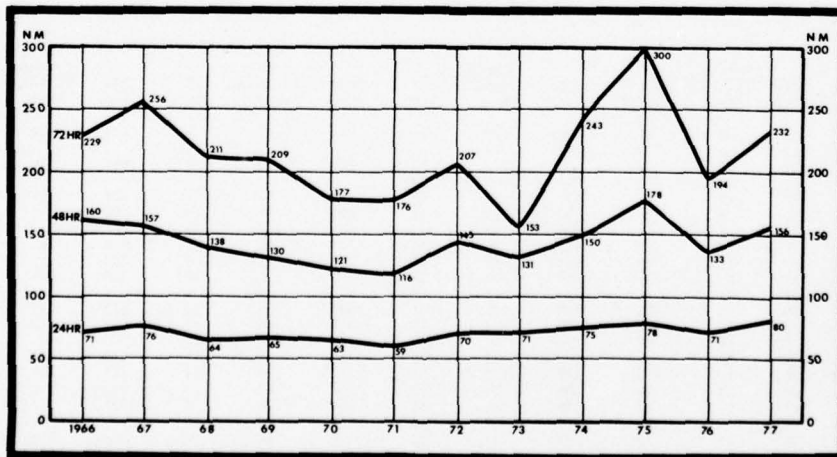


FIGURE 5-2. Mean right angle error for the Pacific Area.

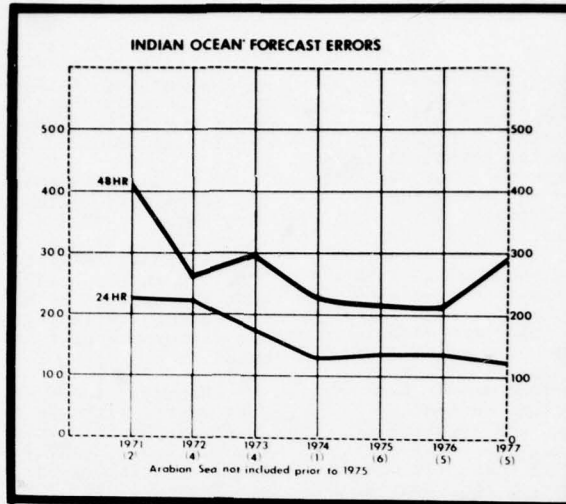


FIGURE 5-3. Mean vector error for the Indian Ocean Area; number of storms ().

TABLE 5-3. 1977 JTWC ERROR SUMMARY FOR THE NORTH INDIAN OCEAN

	WARNINGS			24 HOUR			48 HOUR		
	POSIT ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# WRNGS
TC 17-77	31	31	4	127	122	2	---	---	---
TC 18-77	21	21	6	92	85	4	270	250	2
TC 19-77	45	44	5	77	73	3	122	68	1
TC 21-77	41	29	19	153	108	15	371	250	11
TC 22-77	30	29	10	96	74	8	182	161	6
ALL	35	30	44	122	94	32	292	214	20

b. INTENSITY FORECAST VERIFICATION

Intensity verification statistics for tropical cyclones attaining typhoon intensity are depicted in Table 5-4. Adherence to a standardized pressure-height versus wind speed relationship and improved satellite

analysis techniques have resulted in a low initial position intensity error (4.8 kt) over the past four seasons. This in turn has contributed to smaller 24-, 48-, and 72-hour intensity forecast deviations from the JTWC best track.

TABLE 5-4. JTWC ANNUAL AVERAGE INTENSITY FORECAST ERROR

	WESTERN NORTH PACIFIC*				INDIAN OCEAN**		
	WARNING POSITION	24-HR	48-HR	72-HR	WARNING POSITION	24-HR	48-HR
1971	7	16	21	24	--	--	--
1972	9	14	20	24	13	15	12
1973	7	16	20	28	8	15	20
1974	4	11	15	20	0	8	18
1975	4	13	18	20	7	14	18
1976	5	12	19	22	5	10	15
1977	6	13	20	23	5	8	23
AVERAGE	6	14	19	23	6	12	18

*FOR TYPHOONS ONLY

**1971-1974 DOES NOT INCLUDE ARABIAN SEA

2. COMPARISON OF OBJECTIVE TECHNIQUES

a. GENERAL

Objective techniques have been verified annually since 1967, however, year-to-year modifications and improvements prevent any long term comparisons of the various techniques. The analog technique provides three movement forecasts, one for straight moving storms, one for recurving storms and one combining the tracks of straight, recurving and other storms that do not meet the criteria as straight or recurving analogs. However, only the combined is listed for verification. The analog technique also provides an intensity forecast for each warning position. The dynamic objective technique employs the steering concept of a point vortex in a smoothed large-scale flow field. A new technique, the tropical cyclone model executes basic equations of motion, computes streamfunctions and displays the location of minimum streamfunction center every six hours to 72 hours. An intensity forecast scheme is based on statistical regression equations of analog storms.

b. DESCRIPTION OF OBJECTIVE TECHNIQUES

(1) TYFN75-Analog program which scans history tapes for storms similar (within a specified acceptance envelope) to the instant storm. Three 24-, 48-, and 72-hour forecasts are provided. In addition, 24-, 48-, and 72-hour intensity forecasts are provided.

(2) MOHATT 700/500-Steering program which advects a point vortex on a preselected analysis or smoothed prognostic fields at the designated upper-levels in 6-hour time steps through 72 hours. Utilizing the previous 12-hour history position, MOHATT computes the 12-hour forecast error and applies a bias correction to the forecast position.

(3) TCM-Tropical Cyclone Forecast Model is coarse mesh (220 km), with the digitized storm warning position bogused at 850 mb level of FNWC Global Band Analysis utilizing wind and temperature fields. Boundary conditions permit no mass transfer across north or south walls, and east/west boundaries are cyclical.

(4) FCSTINT-Intensity forecast program which utilizes statistical regression equations to provide 24-, 48-, and 72-hour forecast intensities.

(5) 12-HR EXTRAPOLATION-A track through current warning position and 12-hour old preliminary best track position is linearly extrapolated to 24 and 48 hours.

(6) HPAC-Mean 24 and 48 hour forecast positions are derived by averaging the 24 and 48 hour positions from the 12-HR EXTRAPOLATION track and a track based on climatology.

(7) INJAH74-Analog program for North Indian Ocean. Similar to TYFN75, except tracks are not segregated.

c. TESTING AND RESULTS

It is of interest to compare the performance of the objective techniques to each other and to the official forecast as well. This information is listed in Table 5-5 for Pacific typhoons only and in Table 5-6 for all Pacific forecasts.

In these tables "X-AXIS" refers to the techniques listed horizontally across the top, while "Y-AXIS" refers to those listed vertically. As a matter of explanation, the example shown in Table 5-5 compares TYFC to TCM. In the 75 cases available for comparison, the average 24 hour vector error for TYFC was 136 nm, while that for TCM was 128 nm. The difference of 8 nm is shown in the lower right.

Figure 5-4 compares JTWC intensity forecast errors with the objective technique forecast errors. Only TYFC (TYFN75 combined analog) and FCSTINT intensity forecasts were verified this season. All forecasts were verified against JTWC best track intensities. The number of cases verified were:

FORECAST	24HR	48HR	72HR
JTWC	401	311	228
FCSTINT	312	246	182
TYFC	293	234	172

Statistics are only available for the Pacific area.

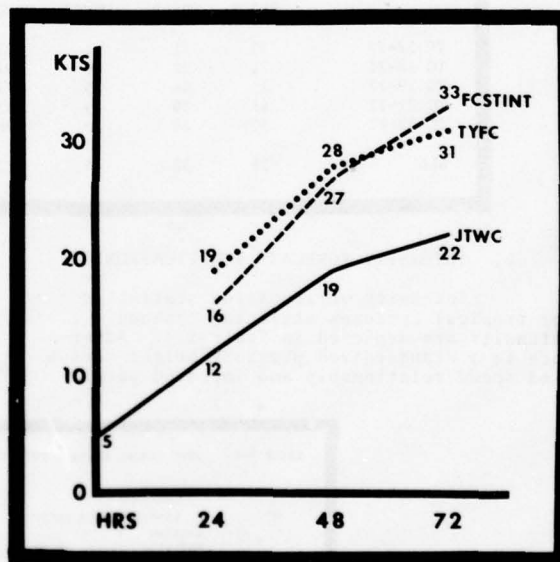


FIGURE 5-4. Comparison of intensity forecast errors for the Pacific area.

TABLE 5-5. 1977 OBJECTIVE TECHNIQUES FOR WESTERN NORTH PACIFIC TYPHOONS (ALL FORECASTS)

24-HOUR									
	JTWC	XTRP	HPAC	TCM	TYFC	MH70	MH50		
JTWC	303 144 144 0								
XTRP	289 143 149 6 149 0							NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
HPAC	278 142 141 -0	278 147 141 -6	278 141 141 0						
TCM	88 138 132 -6	86 137 132 -5	83 132 129 -3	38 132 132 0				Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X
TYFC	246 145 147 2	244 152 147 -5	240 143 147 4	75 128 136 8	246 147 147 0				
MH70	222 141 162 21	220 144 161 17	214 136 160 25	72 127 146 19	197 141 160 19	222 162 162 0			
MH50	189 142 154 12	187 146 154 8	182 136 154 18	67 127 144 17	168 142 158 16	189 159 154 -5	189 154 154 0		

48-HOUR									
	JTWC	XTRP	HPAC	TCM	TYFC	MH70	MH50		
JTWC	253 275 275 0								
XTRP	242 274 306 33	242 306 306 0							JTWC-OFFICIAL JTWC SUBJECTIVE FORECAST XTRP-12-HOUR EXTRAPOLATION HPAC-MEAN OF XTRP AND CLIMATOLOGY TYFC-TYPN75 (WEIGHTED CLIMO) COMBINED MH70-MOHATT 700-MB PROG MH50-MOHATT 500-MB PROG TCM-TROPICAL CYCLONE MODEL
HPAC	234 270 265 -6	234 302 265 -38	234 265 265 0						
TCM	64 304 255 -49	63 317 257 -60	62 280 256 -25	64 255 255 0					
TYFC	207 277 261 -16	206 316 261 -55	204 264 258 -6	56 245 278 33	207 261 261 0				
MH70	188 274 337 63	187 297 337 40	182 253 335 82	52 236 321 86	168 246 329 82	188 337 337 0			
MH50	158 276 322 46	157 300 322 22	152 253 321 68	49 235 335 100	142 245 324 79	158 333 322 -11	158 322 322 0		

72-HOUR						
	JTWC	TCM	TYFC	MH70	MH50	
JTWC	194 393 393 0					
TCM	38 509 454 -56	38 454 454 0				
TYFC	161 395 363 32	36 462 445 -16	162 362 362 0			
MH70	137 402 561 160	31 429 557 128	128 364 561 197	142 564 564 0		
MH50	121 407 525 119	29 443 594 151	111 364 527 163	124 543 520 -24	126 520 520 0	

TABLE 5-6. 1977 OBJECTIVE TECHNIQUES FOR ALL WESTERN NORTH PACIFIC FORECASTS

24-HOUR

	<u>JTWC</u>	<u>XTRP</u>	<u>HPAC</u>	<u>TCM</u>	<u>TYFC</u>	<u>MH70</u>	<u>MH50</u>
JTWC	401 148 148 0						
XTRP	381 148 155 8	381 155 155 0					
HPAC	366 146 149 3	366 154 149 5	366 149 149 0				
TCM	99 135 138 3	97 136 139 3	93 134 137 3	99 138 138 0			
TYFC	317 152 157 5	315 160 157 2	310 151 157 6	32 134 138 4	317 157 157 0		
MH70	287 145 167 22	283 152 166 15	277 146 166 20	78 138 148 11	252 152 168 16	287 167 167 0	
MH50	245 146 163 17	241 154 162 8	236 146 163 17	73 134 144 10	217 152 157 15	243 167 164 -3	245 163 163 0

48-HOUR

	<u>JTWC</u>	<u>XTRP</u>	<u>HPAC</u>	<u>TCM</u>	<u>TYFC</u>	<u>MH70</u>	<u>MH50</u>
JTWC	311 283 283 0						
XTRP	297 282 318 36	297 318 318 0					
HPAC	288 278 276 -2	288 314 276 -38	288 276 276 0				
TCM	70 290 262 -27	69 307 264 -43	68 275 263 -12	70 262 262 0			
TYFC	251 286 280 -6	250 326 280 -46	248 277 278 1	60 251 274 23	251 280 280 0		
MH70	231 288 352 64	229 318 352 34	224 276 351 76	55 249 327 77	204 275 348 73	231 352 352 0	
MH50	196 290 341 51	194 323 340 17	189 277 340 63	58 247 336 89	176 276 342 66	194 353 343 -10	196 341 341 0

JTWC-OFFICIAL JTWC SUBJECTIVE FORECAST
 XTRP-12-HOUR EXTRAPOLATION
 HPAC-MEAN OF XTRP AND CLIMATOLOGY
 TYFC-TYFN-TYFN75 (WEIGHTED CLIMO) COMBINED
 MH70-MOHATT 700-MB PROG
 MH50-MOHATT 500-MB PROG
 TCM-TROPICAL CYCLONE MODEL

72-HOUR

	<u>JTWC</u>	<u>TCM</u>	<u>TYFC</u>	<u>MH70</u>	<u>MH50</u>
JTWC	228 407 407 0				
TCM	39 505 450 -56	39 450 450 0			
TYFC	184 412 392 -20	37 457 448 -9	185 391 391 0		
MH70	156 421 580 159	32 425 548 123	146 394 576 181	162 583 583 0	
MH50	138 424 555 131	30 439 590 151	127 397 553 156	142 569 551 -18	144 551 551 0

3. EVALUATION OF THE TROPICAL CYCLONE MODEL (TCM)

a. BACKGROUND

A primitive equation tropical cyclone forecast model based on original work by Harrison and Elsberry and developed by the Naval Environmental Prediction Research Facility and Fleet Numerical Weather Central (FNWC) was introduced for testing during the 1976 tropical cyclone season. The model is a four level, coarse mesh (horizontal grid increment nominally 200 km), limited area (28 grid points east-west, 20 grid points north-south), five parameter model with cyclical boundary conditions on the longitudinal boundaries and no-flux conditions on the latitudinal boundaries. Initial conditions are provided by the FNWC Global Band NVA model. No interaction with large scale models occurs during the forecast period. In August 1977, a "bias input vector" based on JTWC's 12 hour direction and speed of movement forecast was incorporated in an effort to improve initial movement accuracy.

During 1977, the TCM was operable using the 0000Z or 1200Z data bases when tropical cyclone intensity was 50 kts or greater. The official 0000Z and 1200Z JTWC warning positions were used in the initialization of the TCM. Final TCM output was received at JTWC approximately 10 1/2 hours after data base time.

b. COMPARISON OF TCM TO BEST TRACK

Table 5-7 summarizes the mean vector errors of the TCM 24, 48 and 72 hour forecast positions as compared to corresponding best track positions. Sample size was limited by several factors including:

1. TCM was run no more than twice daily and only when tropical cyclone intensity was greater than or equal to 50 kt.

2. A low number of storms occurred in WESTPAC during 1977.

3. TCM was often unable to track a storm to 72 hours, therefore output was not complete. Reasons included model boundary limitations and loss of clear definition of center location with time.

c. TCM VERSUS JTWC

Analysis of the mean vector errors of the 1977 tropical cyclone forecasts revealed that the TCM forecasts beyond 24 hours significantly improved upon the official JTWC forecast used in the model initialization. This is depicted in Figure 5-5 (TCM vs. JTWC, same warning time).

The TCM had an advantage over the JTWC forecast for the same warning time. It used the JTWC forecast for initialization, then added the synoptic data (0000Z or 1200Z) analysis which was unavailable to JTWC forecasters prior to warning issuance.

A similar comparison was made between the TCM forecasts and the official JTWC warning produced after receipt of the TCM output at JTWC. Both forecasts had access to the same data base. JTWC also had the TCM output, recent fix data and other aids. Figure 5-5 portrays the JTWC forecast significantly improving on the TCM (same data base).

In the latter comparison, a JTWC 0000Z + 24 hour forecast was matched against the corresponding TCM 1200Z + 36 hour forecast; a JTWC 0000Z + 48 hour forecast was matched against the corresponding TCM 1200Z + 60 hour forecast. A match was not possible for the JTWC 72 hour forecast since the TCM did not provide output beyond 72 hours.

The sample size was insufficient to determine how well the TCM forecast erratic movement or recurvature versus nonrecurvature.

d. CONCLUSION

It appears that use of the TCM as an aid to the official JTWC forecast will improve the forecast. More stringent testing is planned for the 1978 tropical cyclone season.

TABLE 5-7. 1977 TCM 24, 48, AND 72 HOUR FORECAST MEAN VECTOR ERRORS

	24 HR	48 HR	72 HR
ALL TROPICAL CYCLONES	138 NM	262 NM	450 NM
NO. OF CASES	99	70	39
TYPHOONS ONLY	132 NM	255 NM	454 NM
NO. OF CASES	88	64	38

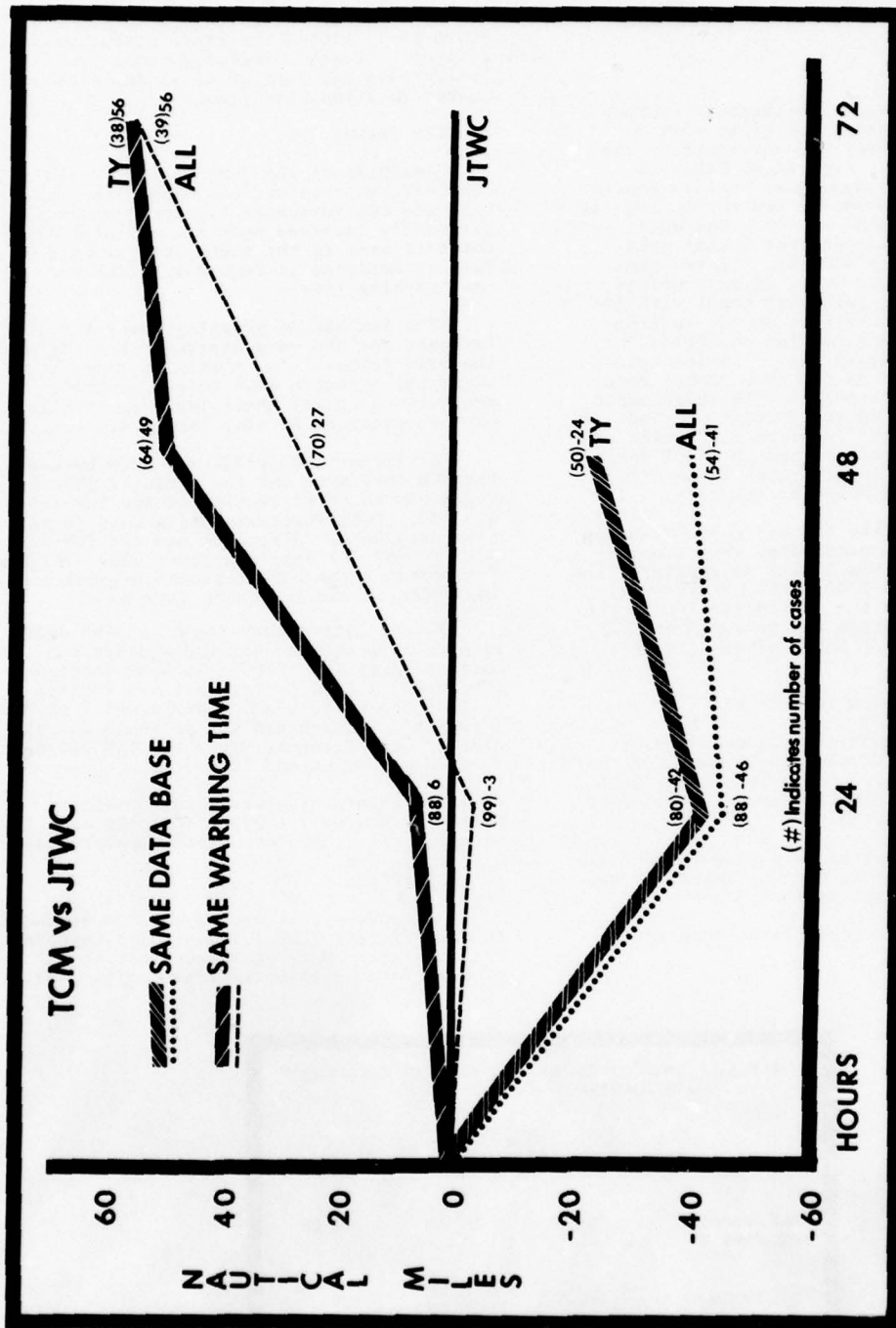


FIGURE 5-5. Comparison of position forecast errors between the TCM and JTWC. The TCM is compared relative to JTWC which is represented by the zero nautical mile line. Comparisons are shown for typhoons (TY) and all tropical cyclones (ALL). (Positive Y-axis values indicate TCM improves JTWC forecasts.)

4. PACIFIC AREA TROPICAL STORM AND DEPRESSION DATA

TROPICAL STORM PATSY
0600Z 23 MAR TO 0000Z 31 MAR

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	#IND	POSIT	#IND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS		
	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND		
230000Z	3.3N 164.2E	30	2.8N 164.8E	25	47	-5	3.5N 163.0E	35	132	15	---	---	---	---	---	---	---	---		
231200Z	4.1N 164.2E	30	3.2N 163.7E	25	61	-5	4.7N 160.7E	30	245	15	---	---	---	---	---	---	---	---		
231800Z	4.0N 165.0E	30	3.6N 162.9E	25	127	-5	5.1N 159.7E	30	351	15	---	---	---	---	---	---	---	---		
240000Z	3.5N 165.2E	25	3.8N 165.2E	25	18	0	5.2N 164.4E	25	144	10	---	---	---	---	4.9N 160.2E	35	184	0		
240600Z	3.2N 165.2E	20	3.9N 164.8E	31	48	10	---	---	---	---	---	---	---	---	4.1N 162.8E	40	283	0		
241200Z	3.1N 165.2E	15	3.9N 164.9E	30	51	15	---	---	---	---	---	---	---	---	4.1N 162.9E	40	280	-5		
241800Z	3.0N 165.2E	15	4.0N 164.9E	31	62	15	---	---	---	---	---	---	---	---	4.2N 162.9E	40	274	-10		
250000Z	2.9N 165.1E	15	4.2N 164.9E	25	79	10	---	---	---	---	---	---	---	---	---	---	---	---		
270000Z	3.4N 161.2E	35	3.5N 161.5E	30	19	-5	5.1N 154.9E	40	81	-10	6.2N 157.9E	45	115	15	7.2N 155.9E	50	122	30		
270600Z	3.9N 160.6E	40	3.9N 160.5E	30	6	-10	5.1N 158.5E	40	79	-5	6.2N 156.5E	45	90	20	7.1N 154.4E	50	104	30		
271200Z	4.4N 160.0E	45	4.2N 159.8E	30	17	-15	5.7N 157.3E	40	61	0	7.1N 154.4E	45	78	25	8.1N 151.8E	55	87	40		
271800Z	5.2N 159.4E	50	4.6N 159.3E	30	36	-20	6.1N 156.7E	40	54	5	7.4N 153.9E	50	76	30	8.4N 151.3E	60	77	45		
280000Z	5.9N 158.8E	50	5.3N 158.9E	50	36	0	7.3N 156.4E	65	6	35	8.4N 153.7E	70	36	50	9.2N 151.0E	70	54	55		
280600Z	6.4N 158.3E	45	6.1N 158.3E	51	18	5	7.8N 155.5E	65	17	40	8.9N 152.4E	70	78	50	---	---	---	---		
281200Z	6.7N 157.5E	40	6.6N 158.1E	50	36	10	8.6N 155.0E	65	38	45	10.1N 152.8E	75	80	60	---	---	---	---		
281800Z	7.0N 156.8E	35	7.2N 157.1E	45	21	10	9.1N 154.0E	50	67	30	10.4N 151.1E	65	122	50	---	---	---	---		
290000Z	7.3N 156.3E	30	7.3N 156.4E	50	6	20	8.8N 153.5E	55	51	35	10.0N 151.0E	65	80	50	---	---	---	---		
290600Z	7.6N 155.7E	25	7.7N 155.7E	35	6	10	9.1N 152.8E	55	58	15	---	---	---	---	---	---	---	---		
291200Z	8.2N 155.1E	20	6.4N 154.3E	35	117	15	9.9N 151.3E	55	125	20	---	---	---	---	---	---	---	---		
291800Z	8.3N 154.8E	20	9.2N 153.3E	35	104	15	10.9N 150.5E	55	168	20	---	---	---	---	---	---	---	---		
300000Z	8.5N 154.3E	20	8.8N 153.4E	35	56	15	10.7N 150.7E	55	124	20	---	---	---	---	---	---	---	---		
300600Z	8.7N 153.7E	20	9.4N 152.0E	30	109	10	---	---	---	---	---	---	---	---	---	---	---	---		
301200Z	8.8N 153.1E	15	9.5N 151.9E	30	82	15	---	---	---	---	---	---	---	---	---	---	---	---		
301800Z	8.9N 152.5E	15	9.6N 151.5E	30	72	15	---	---	---	---	---	---	---	---	---	---	---	---		
310000Z	9.0N 151.9E	15	10.0N 149.6E	25	148	10	---	---	---	---	---	---	---	---	---	---	---	---		

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
55NM 108NM 84NM 163NM
36NM 77NM 54NM 127NM
11KTS 20KTS 39KTS 24KTS
5KTS 18KTS 39KTS 21KTS
25 17 9 9

TROPICAL DEPRESSION 02
0000Z 26 MAY TO 0600Z 27 MAY

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	#IND	POSIT	#IND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS		
	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND	POSIT	#IND	UST	#IND		
260000Z	19.8N 129.3E	30	19.7N 128.9E	30	23	0	21.4N 129.3E	35	206	5	---	---	---	---	---	---	---	---		
260600Z	21.1N 129.1E	30	20.4N 129.0E	30	42	0	23.7N 130.7E	35	128	10	---	---	---	---	---	---	---	---		
261200Z	22.2N 129.6E	30	21.8N 129.4E	30	26	0	---	---	---	---	---	---	---	---	---	---	---	---		
261800Z	23.3N 130.2E	30	23.2N 129.9E	30	18	0	---	---	---	---	---	---	---	---	---	---	---	---		
270000Z	24.6N 130.7E	30	24.5N 130.6E	30	8	0	---	---	---	---	---	---	---	---	---	---	---	---		
270600Z	25.6N 131.8E	25	25.6N 131.9E	25	5	0	---	---	---	---	---	---	---	---	---	---	---	---		

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
20NM 107NM 0NM 0NM
10NM 13NM 0NM 0NM
0KTS 8KTS 0KTS 0KTS
6 2 0 0

TROPICAL STORM RUTH
0600Z 14 JUN TO 1200Z 17 JUN

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST						
	POSIT	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND					
140600Z	16.0N	116.9E	40	15.7N	116.4E	30	34	-10	17.9N	113.7E	45	189	-15	19.0N	111.0E	50	471	10	19.7N	108.2E	40	875	15
141200Z	16.8N	116.6E	50	16.6N	116.7E	35	13	-15	18.8N	114.2E	45	176	-10	19.7N	111.5E	50	484	10	20.0N	109.1E	50	693	30
141800Z	17.7N	116.4E	55	17.3N	116.1E	35	29	-20	19.4N	113.7E	45	223	-5	20.4N	111.0E	50	552	15	---	---	---	---	---
150000Z	18.6N	116.4E	60	18.5N	116.6E	60	13	0	22.0N	117.7E	55	12	10	25.5N	119.5E	50	80	20	---	---	---	---	---
150600Z	19.3N	116.7E	60	19.5N	117.1E	60	26	0	22.9N	119.2E	50	65	10	25.8N	122.0E	45	109	20	---	---	---	---	---
151200Z	20.1N	117.0E	55	20.2N	117.0E	60	6	5	23.7N	118.6E	55	36	15	26.9N	122.4E	45	94	25	---	---	---	---	---
151800Z	21.0N	117.3E	50	21.0N	117.4E	60	6	10	24.5N	119.8E	50	50	15	---	---	---	---	---	---	---	---	---	---
160000Z	22.2N	117.7E	45	22.1N	117.6E	55	8	10	25.7N	120.7E	45	42	15	---	---	---	---	---	---	---	---	---	---
160600Z	23.3N	118.1E	40	23.2N	118.3E	55	12	15	26.9N	122.2E	45	50	20	---	---	---	---	---	---	---	---	---	---
161200Z	24.3N	118.7E	40	24.0N	119.2E	55	33	15	27.0N	123.1E	45	78	25	---	---	---	---	---	---	---	---	---	---
161800Z	25.3N	119.5E	35	24.8N	119.5E	50	30	15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
170000Z	26.4N	120.6E	30	26.8N	120.5E	40	24	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
170600Z	27.6N	121.7E	25	27.4N	121.8E	35	13	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
171200Z	28.3N	123.2E	20	28.5N	123.5E	25	20	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
19NM 92NM 298NM 884NM
16NM 72NM 177NM 447NM
10KTS 14KTS 17KTS 23KTS
4KTS 8KTS 17KTS 23KTS
14 10 6 2

TROPICAL DEPRESSION 04
0000Z 05 JUL TO 0600Z 06 JUL

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST						
	POSIT	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND					
050000Z	17.7N	113.6E	30	17.9N	114.1E	25	31	-5	19.7N	112.2E	45	181	25	---	---	---	---	---	---	---	---	---	---
050600Z	18.7N	112.5E	30	17.7N	112.8E	30	62	0	18.3N	109.6E	40	242	20	---	---	---	---	---	---	---	---	---	---
051200Z	19.8N	111.8E	30	19.3N	111.5E	30	34	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
051800Z	20.4N	110.5E	25	19.5N	110.9E	25	58	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
060000Z	21.2N	109.4E	20	21.1N	109.9E	25	28	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
060600Z	22.3N	109.1E	20	21.6N	109.9E	25	61	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
46NM 211NM 0NM 0NM
31NM 70NM 0NM 0NM
3KTS 23KTS 0KTS 0KTS
6 2 0 0

TROPICAL STORM WANDA
0600Z 31 JUL TO 0600Z 04 AUG

	BEST TRACK				WARNING	24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST									
	POSTI	WIND	POSIT	WIND		ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND								
310600Z	23.5N	140.4E	30	23.2N	140.8E	30	19	0	23.8N	141.3E	40	126	5	24.0N	141.9E	50	169	15	26.0N	142.0E	60	267	15
311200Z	24.0N	140.9E	30	23.8N	140.5E	30	25	0	24.8N	140.4E	40	103	5	26.2N	138.7E	50	245	15	27.2N	135.8E	60	320	20
311800Z	24.5N	140.8E	30	25.0N	141.2E	30	37	0	26.6N	140.7E	40	36	5	27.7N	139.3E	50	221	10	28.2N	136.9E	60	483	25
010000Z	25.1N	140.6E	35	24.5N	140.3E	40	39	5	26.4N	139.8E	55	84	20	28.7N	139.3E	65	232	20	31.4N	138.7E	75	388	45
010600Z	25.7N	140.3E	35	26.3N	140.1E	45	37	10	28.5N	138.0E	60	155	25	31.6N	137.1E	70	369	25	34.0N	136.2E	80	553	50
011200Z	26.5N	140.7E	35	26.8N	140.5E	45	21	10	29.0N	139.9E	55	146	20	31.7N	138.8E	60	325	20	---	---	---	---	---
011800Z	27.2N	140.8E	35	27.3N	140.9E	40	8	5	29.7N	140.0E	50	170	10	32.3N	139.0E	55	353	20	---	---	---	---	---
020000Z	27.7N	140.4E	35	28.0N	140.3E	40	19	5	31.1N	139.5E	50	216	5	33.7N	140.0E	45	351	15	---	---	---	---	---
020600Z	27.7N	141.4E	35	27.5N	140.5E	35	49	-5	29.0N	140.7E	35	200	-10	31.2N	142.2E	40	235	10	---	---	---	---	---
021200Z	28.4N	142.6E	35	28.5N	142.6E	30	6	-5	30.5N	145.0E	35	0	-5	---	---	---	---	---	---	---	---	---	---
021800Z	29.1N	143.2E	40	28.8N	142.9E	30	24	-10	30.8N	145.1E	40	31	5	---	---	---	---	---	---	---	---	---	---
030000Z	30.0N	143.5E	45	30.3N	143.8E	35	24	-10	31.6N	146.0E	40	205	10	---	---	---	---	---	---	---	---	---	---
030600Z	30.4N	144.2E	45	31.0N	144.2E	35	36	-10	31.9N	146.9E	40	203	10	---	---	---	---	---	---	---	---	---	---
031200Z	30.5N	145.0E	40	30.6N	143.9E	35	57	-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
031800Z	30.8N	145.7E	35	30.1N	146.0E	35	45	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
040000Z	31.2N	146.3E	30	31.3N	146.3E	30	6	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
040600Z	31.5N	146.8E	30	31.6N	146.8E	30	6	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
27NM 120NM 270NM 440NM
17NM 84NM 163NM 235NM
5KTS 10KTS 17KTS 21KTS
-1KTS 3KTS 17KTS 31KTS
17 13 9 5

TROPICAL STORM AMY
0000Z 20 AUG TO 1800Z 23 AUG

	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								
200000Z	20.6N	120.6E	25	20.7N	120.6E	30	6	5	20.8N	117.3E	40	28	10	21.4N	114.2E	45	339	15	22.6N	111.7E	40	854	10
200600Z	20.9N	119.8E	30	20.7N	120.3E	30	30	0	21.3N	118.1E	40	25	10	22.4N	115.3E	45	300	15	23.8N	113.2E	35	831	-5
201200Z	21.0N	119.0E	30	21.4N	120.0E	35	61	5	23.3N	119.3E	45	66	15	25.2N	118.7E	40	115	10	26.9N	117.8E	30	581	-10
201800Z	20.4N	118.3E	30	21.3N	119.2E	35	74	5	22.7N	117.7E	40	99	10	24.4N	116.4E	30	302	0	---	---	---	---	---
210000Z	20.8N	117.8E	30	20.4N	118.3E	30	37	0	21.3N	117.0E	30	183	0	22.5N	116.4E	35	658	5	---	---	---	---	---
210600Z	21.7N	118.2E	30	21.4N	119.5E	30	74	0	23.1N	119.0E	35	79	5	24.8N	114.5E	35	522	-5	---	---	---	---	---
211200Z	22.3N	118.8E	30	22.3N	119.1E	30	17	0	24.4N	118.3E	30	139	0	26.3N	118.1E	30	587	-10	---	---	---	---	---
211800Z	22.8N	119.5E	30	22.3N	119.0E	30	41	0	23.0N	118.3E	35	250	5	24.7N	117.2E	25	744	-15	---	---	---	---	---
220000Z	23.5N	119.9E	30	23.3N	119.2E	30	40	0	25.2N	118.5E	30	464	0	---	---	---	---	---	---	---	---	---	---
220600Z	24.2N	120.4E	30	24.2N	119.8E	30	33	0	26.9N	120.3E	35	404	-5	---	---	---	---	---	---	---	---	---	---
221200Z	24.9N	120.8E	30	24.7N	120.4E	30	25	0	27.2N	121.7E	35	404	-5	---	---	---	---	---	---	---	---	---	---
221800Z	25.7N	121.8E	30	25.8N	121.5E	30	17	0	29.4N	124.3E	35	274	-5	---	---	---	---	---	---	---	---	---	---
230000Z	30.1N	125.3E	30	29.0N	124.5E	30	78	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
230600Z	30.7N	126.8E	40	30.5N	126.5E	30	20	-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
231200Z	31.7N	127.5E	40	31.7N	127.2E	30	15	-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
231800Z	31.7N	128.9E	40	32.5N	128.7E	30	49	-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
38NM 201NM 440NM 755NM
19NM 51NM 145NM 285NM
3KTS 6KTS 9KTS 8KTS
-1KTS 3KTS 2KTS -2KTS
16 12 8 3

TROPICAL STORM CARLA
0000Z 03 SEP TO 0000Z 05 SEP

	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								
030000Z	18.54	114.3E	30	17.7N	114.7E	30	53	0	18.1N	111.2E	40	74	5	18.0N	108.7E	50	274	30	---	---	---	---
030000Z	18.4N	113.3E	30	18.0N	113.6E	30	29	0	18.1N	110.2E	40	111	5	---	---	---	---	---	---	---	---	
031200Z	18.2N	112.3E	35	18.0N	112.2E	35	13	0	18.3N	108.2E	40	108	10	---	---	---	---	---	---	---	---	
031800Z	17.8N	111.2E	35	18.0N	111.2E	35	12	0	18.7N	107.3E	40	152	20	---	---	---	---	---	---	---	---	
040000Z	17.6N	110.0E	35	17.8N	110.1E	35	13	0	17.8N	105.8E	30	113	10	---	---	---	---	---	---	---	---	
040000Z	17.4N	108.4E	35	17.8N	109.6E	35	72	0	---	---	---	---	---	---	---	---	---	---	---	---	---	
041200Z	17.2N	106.7E	30	17.9N	108.3E	35	100	5	---	---	---	---	---	---	---	---	---	---	---	---	---	
041800Z	17.0N	105.3E	20	18.0N	107.3E	35	129	15	---	---	---	---	---	---	---	---	---	---	---	---	---	
050000Z	17.0N	104.0E	20	17.0N	105.0E	25	57	5	---	---	---	---	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
53NM 112NM 274NM 0NM
26NM 46NM 33NM 0NM
3KTS 10KTS 30KTS 0KTS
3KTS 10KTS 30KTS 0KTS
9 5 1 0

TROPICAL STORM EMMA
0600Z 15 SEP TO 0600Z 20 SEP

	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									
150000Z	21.2N	143.4E	40	21.1N	142.7E	30	39	-10	22.4N	140.9E	45	275	-5	24.2N	139.2E	60	367	0	25.3N	136.4E	75	369	25
151200Z	22.4N	143.8E	40	22.2N	143.8E	40	12	0	26.1N	143.4E	55	51	0	28.4N	140.0E	65	228	10	29.8N	135.9E	75	260	25
151800Z	23.6N	144.1E	40	23.3N	144.3E	40	21	0	26.9N	145.1E	55	43	0	29.2N	142.2E	65	68	15	29.8N	137.7E	75	152	25
160000Z	24.8N	144.3E	45	24.8N	144.9E	40	33	-5	29.7N	145.9E	50	164	-10	34.8N	147.2E	55	410	5	34.3N	150.0E	55	628	10
160000Z	25.8N	144.3E	50	25.6N	144.0E	45	20	-5	30.9N	144.4E	55	161	-5	35.9N	147.1E	50	479	0	40.2N	151.0E	50	614	5
161200Z	26.4N	144.3E	55	27.0N	144.4E	50	36	-5	32.3N	145.8E	50	212	-5	36.9N	149.2E	50	588	0	39.8N	154.8E	45	654	5
161800Z	26.9N	144.3E	55	27.7N	144.9E	50	57	-5	31.8N	146.4E	45	211	-5	36.0N	149.5E	40	547	-10	---	---	---	---	
170000Z	27.3N	144.4E	60	27.1N	144.3E	50	13	-10	29.8N	143.9E	50	63	0	31.4N	143.9E	45	197	0	34.0N	143.2E	40	355	0
170000Z	28.2N	144.4E	60	27.9N	144.4E	50	18	-10	30.4N	143.8E	50	118	0	33.5N	143.0E	45	124	0	37.0N	143.8E	40	416	5
171200Z	29.0N	144.3E	55	28.6N	144.1E	50	26	-5	31.2N	143.4E	50	150	0	34.4N	143.0E	45	67	5	---	---	---	---	
171800Z	29.3N	143.5E	50	29.5N	143.9E	50	24	0	32.8N	143.1E	50	178	0	36.2N	143.4E	45	60	5	---	---	---	---	
180000Z	29.1N	142.7E	50	28.8N	142.2E	50	32	0	30.0N	139.7E	50	146	5	31.3N	136.3E	50	680	10	---	---	---	---	
180600Z	29.3N	141.7E	50	29.1N	141.7E	50	12	0	30.3N	138.9E	50	243	5	31.4N	135.5E	50	933	15	---	---	---	---	
181200Z	29.9N	140.9E	50	29.5N	141.0E	50	24	0	30.6N	138.1E	50	348	10	---	---	---	---	---	---	---	---		
181800Z	31.0N	140.3E	50	30.1N	140.4E	50	54	0	33.0N	137.8E	50	394	10	---	---	---	---	---	---	---	---		
190000Z	32.4N	140.2E	45	32.4N	140.2E	50	0	5	37.4N	141.5E	50	245	10	---	---	---	---	---	---	---	---		
190000Z	34.1N	140.6E	45	33.7N	140.4E	45	26	0	38.3N	142.5E	40	398	5	---	---	---	---	---	---	---	---		
191200Z	35.3N	142.2E	40	35.2N	141.4E	45	39	5	---	---	---	---	---	---	---	---	---	---	---	---	---		
191800Z	36.9N	144.3E	40	36.3N	143.6E	45	49	5	---	---	---	---	---	---	---	---	---	---	---	---	---		
200000Z	39.54	146.0E	40	39.0N	146.0E	40	30	0	---	---	---	---	---	---	---	---	---	---	---	---	---		
200600Z	42.6N	149.2E	35	41.0N	148.0E	40	109	5	---	---	---	---	---	---	---	---	---	---	---	---	---		

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
32NM 209NM 365NM 431NM
16NM 105NM 146NM 185NM
4KTS 4KTS 6KTS 13KTS
-2KTS 1KTS 4KTS 13KTS
21 17 13 8

TROPICAL STORM FRED A
0000Z 23 SEP TO 0000Z 25 SEP

	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									
230000Z	18.2N	124.3E	30	18.0N	124.0E	30	21	0	20.4N	120.0E	40	239	-5	21.9N	118.0E	50	454	15	---	---	---	---	---	---
230600Z	18.8N	122.4E	30	18.7N	122.8E	30	23	0	20.7N	119.3E	40	254	-10	---	---	---	---	---	---	---	---	---	---	---
231200Z	19.2N	120.5E	30	19.7N	120.5E	30	30	0	21.9N	116.0E	40	220	-15	---	---	---	---	---	---	---	---	---	---	---
231800Z	19.3N	118.5E	40	19.3N	119.0E	50	28	10	21.1N	115.2E	60	219	15	---	---	---	---	---	---	---	---	---	---	---
240000Z	19.7N	116.6E	45	19.6N	117.1E	55	29	10	20.3N	112.0E	60	167	25	---	---	---	---	---	---	---	---	---	---	---
240600Z	20.2N	114.8E	50	19.6N	115.6E	55	57	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
241200Z	20.9N	113.1E	55	21.2N	113.5E	55	29	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
241800Z	21.6N	111.3E	45	21.7N	111.5E	50	13	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
250000Z	22.2N	109.8E	35	22.1N	109.9E	35	8	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
26NM	220NM	454NM	0NM
14KT	82KT	146KT	0NM
3KT	14KT	15KT	0KT
3KT	2KT	15KT	0KT
9	5	1	0

TROPICAL STORM HARRIET
0600Z 16 OCT TO 1800Z 20 OCT

	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									
160600Z	15.8N	135.1E	35	15.7N	135.0E	30	8	-5	16.9N	129.2E	50	156	5	17.4N	124.7E	60	402	10	14.7N	120.6E	65	485	15	
161200Z	16.3N	134.0E	35	16.3N	134.2E	30	11	-5	17.4N	128.7E	40	172	-5	17.4N	124.0E	50	538	0	17.5N	120.3E	55	1154	0	
161800Z	17.0N	133.3E	40	16.3N	133.1E	30	43	-10	16.8N	128.0E	40	260	-10	17.3N	123.0E	50	654	0	17.4N	119.4E	50	1268	0	
170000Z	17.5N	132.5E	40	17.4N	132.5E	35	6	-5	20.2N	129.6E	45	179	-5	23.5N	128.9E	55	342	5	27.4N	132.0E	60	428	15	
170600Z	17.7N	131.8E	45	17.9N	131.7E	45	13	0	20.7N	129.1E	60	202	10	24.2N	129.3E	65	403	15	24.0N	132.4E	65	479	25	
171200Z	18.2N	131.6E	45	18.3N	131.3E	45	18	0	20.7N	129.1E	60	202	10	24.2N	129.3E	65	514	10	24.1N	132.5E	65	580	25	
171800Z	18.5N	132.2E	50	18.1N	132.2E	45	24	-5	21.7N	132.5E	60	100	10	24.8N	134.9E	65	326	15	27.8N	139.0E	60	407	25	
180000Z	19.2N	132.6E	50	19.0N	132.4E	50	16	0	22.5N	132.8E	65	198	15	25.4N	135.7E	65	327	20	---	---	---	---	---	
180600Z	19.9N	132.6E	50	20.4N	132.6E	55	30	5	24.5N	134.3E	65	171	15	27.8N	138.6E	55	189	15	---	---	---	---	---	
181200Z	21.1N	132.7E	50	21.2N	132.8E	55	8	5	24.8N	134.8E	60	259	5	28.0N	139.3E	50	245	10	---	---	---	---	---	
181800Z	23.1N	133.5E	50	23.2N	133.5E	50	6	0	27.1N	137.7E	40	127	-10	30.0N	143.6E	40	140	5	---	---	---	---	---	
190000Z	25.2N	134.9E	50	24.4N	134.2E	50	61	0	27.8N	138.6E	40	119	-5	---	---	---	---	---	---	---	---	---	---	
190600Z	26.8N	136.2E	50	26.8N	136.1E	50	5	0	31.5N	145.4E	40	231	0	---	---	---	---	---	---	---	---	---	---	
191200Z	28.2N	137.8E	55	28.6N	138.7E	50	53	-5	33.4N	149.5E	40	370	0	---	---	---	---	---	---	---	---	---	---	
191800Z	29.0N	138.8E	50	29.3N	138.7E	50	19	0	33.8N	147.3E	40	221	5	---	---	---	---	---	---	---	---	---	---	
200000Z	29.5N	139.8E	45	30.4N	140.4E	50	62	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
200600Z	29.9N	141.3E	40	30.0N	140.9E	50	22	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
201200Z	30.8N	143.4E	40	30.1N	142.8E	45	32	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
201800Z	30.2N	140.3E	35	30.6N	145.2E	45	61	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
13NM	191NM	376NM	757NM
4KT	7KT	10KT	15KT
0KT	3KT	10KT	15KT
19	15	11	7

5. PACIFIC AREA TYPHOON DATA

TYPHOON SARAH

1200Z 16 JUL TO 1200Z 21 JUL

REST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS		
161200Z	10.5N 128.1E	30	10.4N 128.4E	25	19	-5	12.4N 123.6E	35	69	-5	14.3N 119.2E	45	109	-5	16.2N 114.6E	55	189	-5	
161800Z	11.2N 126.4E	35	11.0N 127.3E	30	54	-5	12.8N 122.7E	35	93	-5	14.7N 118.0E	45	130	-5	16.6N 113.3E	55	174	-15	
170000Z	12.2N 125.2E	40	12.0N 125.5E	35	21	-5	14.9N 119.6E	35	62	-5	18.2N 115.2E	45	68	-5	21.4N 111.6E	40	222	-35	
170600Z	13.1N 124.4E	40	12.8N 124.4E	35	18	-5	15.8N 119.1E	35	34	-10	18.7N 114.6E	50	100	-5	22.4N 110.7E	30	241	-45	
171200Z	13.4N 123.2E	40	13.5N 123.1E	40	8	0	15.8N 117.7E	30	35	0	18.0N 113.3E	55	51	-5	20.5N 110.2E	45	14	-25	
171800Z	14.2N 122.0E	40	13.9N 122.2E	40	21	0	16.2N 118.2E	30	78	0	18.3N 114.3E	60	126	-10	20.8N 111.2E	45	123	-25	
180000Z	15.3N 120.8E	40	15.4N 121.5E	40	41	0	17.5N 117.6E	30	133	0	19.9N 113.7E	60	166	-15	21.3N 109.8E	55	98	-10	
180600Z	15.8N 119.7E	45	16.0N 120.5E	40	47	-5	18.5N 116.4E	35	155	0	20.4N 112.4E	55	137	-20	21.8N 108.3E	40	94	-20	
181200Z	15.9N 118.3E	50	16.4N 118.4E	45	30	-5	18.9N 112.6E	35	102	-5	21.8N 108.3E	40	193	-30	---	---	---	---	
181800Z	16.6N 116.9E	50	16.5N 116.8E	45	8	-5	18.8N 111.6E	30	104	-20	20.7N 106.6E	40	178	-30	---	---	---	---	
190000Z	17.1N 115.5E	50	17.3N 115.7E	50	17	0	19.7N 111.7E	45	120	-30	21.7N 109.2E	40	98	-25	---	---	---	---	
190600Z	17.1N 114.1E	55	17.1N 113.7E	60	23	5	18.3N 108.0E	30	182	-25	21.0N 105.0E	35	125	-25	---	---	---	---	
191200Z	17.2N 113.0E	60	17.2N 112.5E	60	29	0	18.7N 107.3E	30	184	-20	21.0N 104.0E	25	90	-10	---	---	---	---	
191800Z	17.4N 112.3E	70	17.3N 112.4E	60	8	-10	17.5N 109.9E	35	122	-15	---	---	---	---	---	---	---	---	
200000Z	17.7N 111.9E	75	17.7N 112.1E	75	11	0	17.9N 109.7E	40	153	5	---	---	---	---	---	---	---	---	
200600Z	18.4N 111.2E	75	18.3N 111.5E	75	18	0	20.2N 109.2E	45	114	-15	---	---	---	---	---	---	---	---	
201200Z	19.3N 110.5E	70	19.7N 110.6E	70	25	0	24.3N 109.6E	45	280	-10	---	---	---	---	---	---	---	---	
201800Z	19.5N 109.5E	70	19.4N 109.7E	60	13	-10	---	---	---	---	---	---	---	---	---	---	---	---	
210000Z	20.2N 108.5E	65	20.2N 108.7E	60	11	-5	---	---	---	---	---	---	---	---	---	---	---	---	
210600Z	20.6N 107.2E	60	20.7N 107.5E	60	18	0	---	---	---	---	---	---	---	---	---	---	---	---	
211200Z	21.3N 105.7E	35	21.1N 105.9E	50	16	15	---	---	---	---	---	---	---	---	---	---	---	---	

TYPHOONS WHILE WIND OVER 35KTS

WARNING	24-HR	48-HR	72-HR
22NM	11NM	12NM	12NM
12NM	7NM	8NM	9NM
4KTS	1KTS	15KTS	23KTS
-2KTS	-9KTS	-15KTS	-23KTS
NUMBER OF FORECASTS	20	17	13

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
22NM	11NM	12NM	12NM
12NM	7NM	8NM	9NM
4KTS	1KTS	15KTS	23KTS
-2KTS	-9KTS	-15KTS	-23KTS
NUMBER OF FORECASTS	21	17	13

TYPHOON THELMA

0000Z 21 JUL TO 0000Z 26 JUL

REST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS		
210000Z	14.6N 130.1E	30	14.7N 130.2E	30	8	0	16.6N 127.6E	45	37	-5	18.4N 124.8E	50	78	-20	20.1N 122.1E	60	84	-25	
210600Z	15.1N 129.0E	35	15.3N 129.4E	30	26	-5	17.4N 126.3E	40	48	-10	19.3N 123.2E	50	78	-30	21.0N 120.0E	60	66	-25	
211200Z	15.6N 128.1E	40	15.8N 128.1E	45	12	5	17.8N 124.6E	40	87	0	19.9N 121.2E	70	103	-10	22.3N 118.9E	75	122	-10	
211800Z	15.8N 127.7E	45	15.8N 127.6E	50	6	5	17.1N 124.5E	40	8	-5	18.4N 121.7E	70	38	-10	20.1N 119.0E	80	84	0	
220000Z	16.2N 127.1E	50	16.0N 127.6E	50	31	0	16.4N 126.6E	40	173	-10	17.5N 124.0E	70	225	-15	19.3N 120.2E	75	173	-5	
220600Z	16.6N 126.3E	50	16.5N 126.5E	50	13	0	17.3N 124.0E	40	66	-20	18.2N 120.4E	65	103	-20	18.4N 116.1E	70	367	0	
221200Z	16.9N 125.4E	60	17.2N 125.4E	55	18	-5	18.7N 121.9E	45	29	-15	19.4N 118.6E	70	86	-15	19.8N 115.0E	70	394	5	
221800Z	17.2N 124.6E	65	17.3N 124.5E	60	8	-5	18.3N 121.0E	40	50	-10	18.8N 117.3E	75	205	-5	19.5N 113.6E	80	491	20	
230000Z	17.5N 123.8E	70	17.5N 123.8E	65	0	-5	18.5N 120.4E	40	66	-15	19.2N 117.6E	75	231	-5	19.6N 113.9E	80	512	30	
230600Z	18.0N 123.1E	80	18.3N 123.2E	75	19	-5	19.7N 119.8E	45	21	0	19.9N 116.0E	90	305	20	---	---	---	---	
231200Z	18.6N 122.4E	80	18.7N 122.2E	80	13	0	19.8N 118.3E	40	86	5	20.2N 114.7E	95	382	30	---	---	---	---	
231800Z	19.0N 121.5E	80	19.2N 121.2E	80	21	0	20.0N 117.3E	40	160	10	20.2N 113.8E	95	454	35	---	---	---	---	
240000Z	19.6N 120.7E	85	19.7N 120.5E	80	13	-5	21.5N 117.6E	40	150	10	23.2N 115.2E	80	306	30	---	---	---	---	
240600Z	19.9N 120.1E	85	20.1N 119.8E	80	21	-5	21.8N 117.0E	45	195	15	---	---	---	---	---	---	---	---	
241200Z	20.4N 119.7E	85	20.7N 119.6E	85	19	0	22.7N 117.2E	45	182	20	---	---	---	---	---	---	---	---	
241800Z	21.3N 119.8E	80	21.4N 119.8E	85	6	5	20.5N 120.5E	45	282	25	---	---	---	---	---	---	---	---	
250000Z	22.2N 120.2E	80	22.3N 120.3E	85	8	5	20.2N 119.8E	40	8	20	---	---	---	---	---	---	---	---	
250600Z	23.2N 120.2E	70	23.5N 120.2E	80	18	10	---	---	---	---	---	---	---	---	---	---	---	---	
251200Z	24.2N 120.1E	65	24.2N 120.1E	65	0	0	---	---	---	---	---	---	---	---	---	---	---	---	
251800Z	25.2N 120.0E	60	25.4N 120.0E	45	12	-15	---	---	---	---	---	---	---	---	---	---	---	---	
260000Z	26.3N 119.7E	50	27.5N 119.4E	30	73	-20	---	---	---	---	---	---	---	---	---	---	---	---	

TYPHOONS WHILE WIND OVER 35KTS

WARNING	24-HR	48-HR	72-HR
17NM	9NM	20NM	25NM
5KTS	1KTS	19KTS	13KTS
-2KTS	1KTS	-1KTS	-1KTS
NUMBER OF FORECASTS	20	17	13

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
16NM	9NM	20NM	25NM
9NM	5NM	13NM	15NM
5KTS	1KTS	19KTS	13KTS
-2KTS	1KTS	-1KTS	-1KTS
NUMBER OF FORECASTS	21	17	13

TYPHOON DINAH

1200Z 14 SEP TO 1800Z 23 SEP

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST						
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS					
	UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND					
141200Z	21.4N	127.8E	50	21.5N	127.9E	30	8	-20	22.3N	122.4E	45	245	-15	23.3N	119.1E	35	376	-15	24.4N	116.4E	30	450	-20
141800Z	20.5N	126.2E	55	20.7N	126.7E	30	30	-25	20.3N	121.4E	45	150	-10	21.3N	118.2E	50	277	0	22.5N	115.3E	50	316	-5
150000Z	19.4N	124.6E	60	19.3N	124.4E	50	13	-10	19.4N	118.9E	60	140	20	21.1N	115.2E	60	263	10	23.0N	111.5E	35	433	-25
150600Z	18.7N	123.6E	65	18.8N	123.6E	60	6	-5	19.1N	119.4E	65	116	20	20.8N	115.6E	60	200	10	22.9N	111.9E	45	412	-15
151200Z	18.2N	122.6E	60	18.3N	122.6E	70	6	10	18.1N	118.2E	70	62	20	19.1N	114.1E	80	157	30	21.0N	110.2E	80	443	20
151800Z	17.8N	121.1E	65	17.8N	121.4E	65	17	10	18.0N	117.2E	70	73	20	19.3N	113.3E	80	208	25	21.3N	109.8E	75	473	10
160000Z	17.3N	120.0E	40	17.3N	120.0E	60	0	20	17.4N	114.6E	60	94	30	18.1N	109.7E	75	420	15	18.6N	104.8E	60	770	-5
160600Z	17.2N	119.0E	45	17.4N	119.3E	55	21	10	17.5N	114.1E	65	120	15	17.8N	109.0E	60	484	0	18.3N	104.8E	55	800	-10
161200Z	17.1N	117.9E	50	17.2N	118.2E	55	18	5	17.5N	113.0E	65	104	15	18.1N	109.4E	60	474	0	19.4N	105.4E	55	786	-10
161800Z	16.8N	117.0E	50	17.2N	117.0E	55	24	5	17.5N	112.0E	65	200	10	18.2N	108.7E	60	531	-5	19.7N	104.8E	45	804	-25
170000Z	16.8N	116.2E	50	16.8N	115.8E	60	23	10	16.7N	111.0E	65	323	5	17.0N	107.9E	60	615	-5	18.2N	104.3E	30	854	-45
170600Z	17.5N	116.2E	50	17.2N	116.4E	60	21	10	17.5N	113.3E	65	245	-5	18.4N	110.0E	50	490	-15	19.7N	106.9E	40	697	-35
171200Z	16.9N	115.6E	50	17.3N	115.8E	60	26	10	17.7N	112.9E	65	288	-5	18.4N	109.6E	50	536	-15	19.9N	106.3E	40	718	-30
171800Z	17.3N	116.3E	55	17.4N	115.2E	55	63	0	17.9N	112.4E	60	329	-15	18.5N	109.5E	45	547	-25	19.9N	106.4E	40	701	-25
180000Z	18.0N	117.1E	60	17.2N	117.3E	55	49	-5	19.1N	115.0E	60	150	-5	20.7N	114.1E	55	293	-20	22.6N	111.8E	40	399	-25
180600Z	18.4N	117.5E	60	18.5N	117.2E	55	18	-5	20.5N	116.4E	60	140	-5	22.7N	114.6E	50	301	-25	---	---	---	---	---
181200Z	19.0N	117.8E	60	19.0N	117.6E	60	11	0	21.2N	118.0E	60	111	-5	23.9N	117.6E	60	236	-10	26.2N	117.4E	45	368	-15
181800Z	19.4N	118.0E	65	19.5N	117.9E	60	8	-5	21.6N	118.2E	60	119	-10	24.4N	118.0E	50	256	-15	26.3N	117.8E	45	449	-10
190000Z	19.6N	118.4E	65	19.8N	118.3E	60	13	-5	21.6N	119.3E	60	90	-15	24.0N	119.5E	50	247	-15	26.5N	119.2E	45	521	-5
190600Z	19.6N	118.7E	65	19.9N	118.6E	60	19	-5	21.6N	119.0E	60	85	-15	24.1N	119.8E	50	240	-15	26.3N	118.8E	35	524	-15
191200Z	19.6N	119.0E	65	20.3N	118.9E	60	42	-5	22.1N	119.0E	70	120	0	24.2N	120.1E	65	310	5	26.0N	119.6E	60	619	15
191800Z	19.8N	119.1E	70	19.9N	119.0E	60	8	-10	21.2N	119.0E	70	78	5	23.2N	120.1E	65	329	10	25.0N	119.5E	60	631	15
200000Z	20.1N	119.3E	75	20.0N	119.1E	65	13	-10	21.3N	119.0E	70	110	5	23.2N	120.0E	65	374	15	25.0N	119.4E	60	693	20
200600Z	20.2N	119.3E	75	20.2N	119.4E	70	6	-5	21.4N	120.3E	70	169	5	23.3N	120.0E	65	439	15	24.7N	118.6E	60	721	25
201200Z	20.2N	119.1E	70	20.3N	119.4E	70	18	0	21.0N	120.1E	70	175	10	22.5N	120.2E	65	474	20	24.1N	120.0E	60	824	40
201800Z	20.2N	118.9E	65	20.2N	118.9E	70	0	5	20.6N	119.0E	70	216	15	22.1N	120.3E	65	534	20	23.9N	120.0E	60	892	35
210000Z	20.0N	118.4E	65	19.9N	118.8E	70	23	5	20.3N	119.9E	60	262	10	22.0N	121.1E	55	631	15	---	---	---	---	---
210600Z	19.8N	117.8E	65	20.1N	118.0E	65	21	0	21.6N	117.9E	60	286	10	23.5N	118.4E	55	657	20	---	---	---	---	---
211200Z	19.7N	117.3E	60	19.7N	117.3E	65	0	5	19.7N	114.0E	65	163	10	20.8N	113.0E	45	449	25	---	---	---	---	---
211800Z	18.9N	116.4E	55	19.6N	116.2E	65	43	10	19.8N	113.0E	65	209	10	20.7N	111.1E	45	468	20	---	---	---	---	---
220000Z	18.4N	115.7E	50	18.2N	115.6E	55	13	5	18.0N	113.4E	45	70	5	---	---	---	---	---	---	---	---	---	---
220600Z	17.8N	114.8E	50	17.7N	114.9E	55	8	5	18.1N	111.9E	45	88	10	---	---	---	---	---	---	---	---	---	---
221200Z	17.1N	113.9E	45	17.2N	113.9E	60	6	15	15.7N	110.9E	50	123	30	---	---	---	---	---	---	---	---	---	---
221800Z	16.3N	113.1E	45	16.5N	113.1E	60	12	15	15.3N	109.9E	50	138	25	---	---	---	---	---	---	---	---	---	---
230000Z	15.5N	112.3E	40	15.7N	112.4E	50	13	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
230600Z	14.7N	111.4E	35	14.7N	110.8E	50	35	15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
231200Z	13.7N	110.4E	20	14.0N	110.1E	50	25	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
231800Z	13.1N	109.1E	25	13.5N	108.5E	35	42	10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TYPHOONS WHILE WIND OVER 35KTS

	WARNING				24-HR				48-HR				72-HR			
	18NM	161NM	391NM	592NM	11NM	107NM	255NM	409NM	8KTS	11KTS	14KTS	18KTS	2KTS	5KTS	1KTS	-9KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	36	32	28	23												

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	19NM	159NM	396NM	613NM	13NM	106NM	254NM	398NM	9KTS	12KTS	15KTS	20KTS	3KTS	6KTS	3KTS	-6KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	38	34	30	25												

TYPHOON JEAN

1200Z 28 OCT TO 1200 03 NOV

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST						
	POSIT	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	US1	WIND	POSIT	WIND	US1	WIND					
281200Z	19.4N	156.9E	30	19.3N	156.9E	30	6	0	23.2N	153.1E	45	221	-15	27.9N	158.2E	40	210	-15	30.9N	171.3E	30	1007	-5
281800Z	19.8N	156.5E	35	20.4N	155.9E	30	49	-5	25.0N	152.6E	45	297	-20	28.6N	161.2E	40	324	-10	---	---	---	---	---
290000Z	20.4N	156.2E	40	20.3N	156.4E	35	13	-5	23.2N	156.1E	45	68	-20	27.5N	160.8E	40	312	-5	---	---	---	---	---
290600Z	20.8N	156.2E	50	20.9N	156.0E	55	13	5	24.0N	156.4E	60	92	0	28.0N	161.3E	50	398	10	---	---	---	---	---
291200Z	21.4N	156.6E	60	20.9N	156.1E	60	41	0	22.3N	155.3E	80	220	25	25.8N	157.0E	70	200	35	---	---	---	---	---
291800Z	22.1N	157.0E	65	21.9N	157.2E	65	16	0	24.6N	158.6E	80	62	30	28.0N	162.0E	65	579	35	---	---	---	---	---
300000Z	22.9N	157.3E	65	23.0N	157.8E	65	28	0	26.7N	160.3E	50	262	5	28.3N	166.9E	45	942	15	---	---	---	---	---
300600Z	23.5N	158.0E	60	23.6N	157.6E	65	23	5	27.0N	159.0E	55	263	15	29.2N	165.4E	45	950	15	---	---	---	---	---
301200Z	24.4N	158.6E	55	24.7N	158.6E	60	18	5	27.7N	162.0E	45	488	10	---	---	---	---	---	---	---	---	---	---
301800Z	24.3N	157.5E	50	23.6N	157.9E	55	47	5	25.2N	160.9E	35	508	5	---	---	---	---	---	---	---	---	---	---
310000Z	24.2N	156.3E	45	24.0N	156.3E	30	12	-15	23.0N	152.5E	25	237	-5	---	---	---	---	---	---	---	---	---	---
310600Z	24.6N	154.9E	40	24.2N	155.2E	30	29	-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
311200Z	25.0N	153.4E	35	25.0N	153.5E	30	5	-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
311800Z	25.5N	151.5E	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
010000Z	25.8N	149.4E	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
010600Z	26.0N	147.8E	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
011200Z	26.2N	146.8E	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
011800Z	26.3N	146.3E	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
020000Z	26.5N	146.0E	30	26.6N	146.1E	30	8	0	29.3N	146.3E	40	133	10	---	---	---	---	---	---	---	---	---	---
020600Z	26.9N	146.2E	30	27.2N	145.8E	30	28	0	30.1N	147.2E	35	226	10	---	---	---	---	---	---	---	---	---	---
021200Z	27.1N	146.4E	30	27.0N	147.0E	30	32	0	27.7N	150.0E	30	261	5	---	---	---	---	---	---	---	---	---	---
021800Z	27.4N	146.4E	30	27.0N	146.8E	30	32	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
030000Z	27.1N	146.7E	30	27.7N	146.1E	30	48	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
030600Z	26.4N	146.3E	25	27.2N	146.6E	30	50	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
031200Z	25.8N	145.6E	25	26.0N	146.0E	25	25	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

	TYPHOONS WHILE WIND OVER 35KTS			
	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	24NM	219NM	289NM	1007NM
AVERAGE RIGHT ANGLE ERROR	16NM	141NM	212NM	775NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	16KTS	15KTS	5KTS
AVERAGE BIAS OF WIND ERROR	-2KTS	3KTS	3KTS	-5KTS
NUMBER OF FORECASTS	12	9	5	1

	ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	26NM	239NM	489NM	1007NM
AVERAGE RIGHT ANGLE ERROR	14NM	140NM	288NM	775NM
AVERAGE MAGNITUDE OF WIND ERROR	3KTS	13KTS	18KTS	5KTS
AVERAGE BIAS OF WIND ERROR	-1KTS	4KTS	10KTS	-5KTS
NUMBER OF FORECASTS	20	14	8	1

TYPHOON KIM

0600Z 06 NOV TO 0000Z 17 NOV

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST						
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS UST WIND						
060000Z	10.8N	153.2E	25	11.0N	152.9E	25	21	0	13.0N	149.7E	35	25	-5	14.2N	145.4E	45	67	-10	15.1N	140.0E	55	66	-50
061200Z	11.2N	152.4E	30	11.6N	152.7E	30	30	0	13.6N	150.0E	40	40	0	14.3N	145.9E	50	66	-15	14.3N	141.4E	60	181	-50
061800Z	11.6N	151.5E	35	11.8N	151.5E	35	12	0	13.3N	148.7E	45	39	0	14.3N	144.9E	55	114	-25	14.3N	140.3E	65	201	-50
070000Z	12.1N	150.7E	40	11.9N	151.1E	40	26	0	12.9N	148.6E	50	83	0	14.2N	144.5E	60	188	-35	14.5N	139.5E	70	234	-50
070600Z	12.6N	149.8E	40	12.5N	150.0E	40	13	0	13.8N	146.6E	50	50	-5	14.5N	142.7E	60	188	-45	14.8N	137.8E	70	202	-50
071200Z	12.8N	148.9E	40	12.9N	149.1E	40	13	0	14.2N	145.6E	50	78	-15	14.6N	141.5E	60	185	-50	14.8N	136.0E	70	202	-55
071800Z	13.0N	148.2E	45	13.1N	148.6E	40	24	-5	14.2N	145.3E	50	135	-30	14.6N	141.1E	60	244	-55	14.8N	136.2E	70	231	-55
080000Z	13.2N	147.4E	50	13.3N	147.2E	55	13	5	14.0N	143.2E	70	110	-25	14.5N	138.2E	75	160	-45	15.3N	133.2E	85	103	-35
080600Z	13.3N	146.1E	55	13.3N	146.0E	60	6	5	14.4N	141.1E	70	75	-35	15.1N	135.9E	75	92	-45	15.6N	130.8E	85	54	-30
081200Z	13.6N	144.6E	65	13.6N	144.6E	65	0	0	14.5N	139.2E	75	53	-35	15.5N	133.7E	80	50	-45	16.8N	126.0E	90	174	-20
081800Z	13.8N	143.0E	80	13.9N	143.2E	70	13	-10	15.0N	137.7E	80	46	-35	16.4N	132.3E	85	96	-40	18.1N	127.2E	95	245	-15
090000Z	14.0N	141.3E	95	14.0N	141.5E	80	12	-15	15.3N	134.9E	95	37	-25	16.2N	129.5E	105	233	-15	21.4N	129.5E	110	527	0
090600Z	14.3N	139.8E	105	14.2N	140.2E	95	24	-10	15.7N	134.0E	110	45	-10	16.4N	129.1E	115	263	0	24.4N	130.3E	115	597	10
091200Z	14.7N	138.3E	110	14.6N	138.5E	100	13	-10	16.7N	132.4E	110	115	-15	20.4N	128.8E	115	348	5	24.4N	130.5E	115	612	10
091800Z	15.0N	136.9E	115	15.0N	137.0E	105	6	-10	17.2N	131.2E	115	154	-10	20.4N	128.8E	115	367	5	25.0N	131.0E	115	673	5
100000Z	15.1N	135.5E	120	15.3N	135.6E	110	13	-10	17.9N	130.2E	120	200	0	21.9N	128.9E	120	436	10	25.5N	131.5E	110	733	0
100600Z	15.0N	134.3E	120	14.8N	134.1E	115	17	-5	14.6N	128.0E	125	162	10	15.3N	123.1E	125	297	20	16.8N	119.4E	100	303	-15
101200Z	14.9N	133.1E	125	14.8N	132.9E	120	13	-5	14.7N	127.9E	130	127	20	15.4N	122.9E	130	258	25	17.0N	119.1E	105	268	-10
101800Z	14.8N	132.2E	125	14.7N	132.2E	120	6	-5	14.8N	127.4E	130	127	20	15.4N	122.9E	130	268	20	17.0N	119.0E	105	226	0
110000Z	14.8N	131.5E	120	14.7N	131.3E	120	13	0	14.8N	127.4E	130	47	20	15.3N	123.1E	130	132	20	14.8N	119.3E	95	130	5
110600Z	14.7N	130.8E	115	14.7N	130.7E	120	6	5	14.8N	127.3E	130	53	25	15.4N	123.1E	130	76	15	14.9N	119.3E	95	96	30
111200Z	14.7N	130.1E	110	14.7N	130.1E	120	0	10	14.8N	126.7E	125	37	20	15.5N	122.3E	125	60	10	17.2N	118.8E	95	85	50
111800Z	14.7N	129.6E	110	14.7N	129.6E	110	0	0	14.8N	126.4E	100	12	-10	15.5N	122.4E	100	43	-5	17.0N	119.0E	70	66	35
120000Z	14.6N	128.9E	110	14.7N	129.1E	105	13	-5	14.8N	126.4E	95	64	-15	15.3N	123.1E	95	139	5	15.6N	119.3E	70	91	35
120600Z	14.6N	128.2E	105	14.6N	128.1E	105	6	0	14.4N	126.6E	95	29	-20	14.2N	120.4E	70	84	5	13.4N	116.8E	70	235	35
121200Z	14.6N	127.3E	105	14.6N	127.4E	105	6	0	14.5N	126.0E	95	53	-20	14.5N	119.8E	70	108	30	14.4N	116.0E	70	217	30
121800Z	14.6N	126.4E	110	14.6N	126.2E	105	12	-5	14.6N	122.6E	95	26	-10	14.9N	118.6E	70	81	35	15.1N	115.0E	65	302	25
130000Z	14.7N	125.3E	110	14.4N	125.5E	110	21	0	14.4N	122.2E	90	96	0	14.4N	118.6E	70	111	35	15.1N	115.3E	65	371	25
130600Z	14.7N	124.2E	115	14.6N	124.2E	110	6	-5	14.8N	120.3E	70	55	5	15.0N	117.0E	70	145	35	15.1N	113.8E	65	518	30
131200Z	14.7N	123.1E	115	14.6N	123.1E	120	6	5	14.7N	119.4E	85	84	45	14.8N	115.7E	75	228	35	14.8N	112.4E	70	672	40
131800Z	14.8N	122.2E	105	14.7N	122.1E	115	8	10	14.8N	118.5E	80	85	45	14.8N	115.1E	75	310	35	14.8N	111.8E	70	789	40
140000Z	15.1N	120.7E	90	15.2N	120.7E	95	6	5	15.7N	117.2E	80	75	45	15.7N	114.0E	75	405	35	15.7N	110.8E	70	902	40
140600Z	15.3N	119.5E	65	15.6N	119.6E	90	19	25	15.7N	115.7E	80	166	45	15.7N	112.3E	75	570	40	---	---	---	---	---
141200Z	15.8N	118.5E	40	15.5N	118.1E	65	29	25	15.4N	114.1E	50	279	10	15.3N	110.9E	40	731	10	---	---	---	---	---
141800Z	16.2N	118.2E	35	15.9N	117.7E	55	34	20	16.1N	114.1E	50	311	10	16.1N	110.8E	40	803	10	---	---	---	---	---
150000Z	16.6N	118.1E	35	16.4N	118.0E	45	13	10	17.5N	116.4E	40	212	0	16.4N	114.3E	35	704	5	---	---	---	---	---
150600Z	17.1N	118.2E	35	16.5N	118.0E	40	38	5	16.2N	116.6E	30	354	-5	---	---	---	---	---	---	---	---	---	---
151200Z	17.6N	118.4E	40	17.6N	118.1E	40	17	0	19.1N	117.0E	30	277	0	---	---	---	---	---	---	---	---	---	---
151800Z	18.4N	119.0E	40	18.7N	118.6E	35	29	-5	22.5N	121.3E	30	161	0	---	---	---	---	---	---	---	---	---	---
160000Z	19.5N	119.9E	40	19.9N	119.3E	35	41	-5	23.6N	122.5E	30	193	0	---	---	---	---	---	---	---	---	---	---
160600Z	20.3N	121.1E	35	20.5N	121.2E	30	13	-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
161200Z	20.8N	122.4E	30	21.0N	122.0E	30	25	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
161800Z	21.3N	123.9E	30	21.4N	123.2E	30	39	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
170000Z	21.8N	125.4E	30	21.5N	125.6E	25	21	-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TYPHOONS WHILE WIND OVER 35KTS

	WARNING				24-HR				48-HR				72-HR			
	14NM	103NM	193NM	274NM	9NM	52NM	104NM	165NM	6KTS	17KTS	26KTS	28KTS	0KTS	-0KTS	+6KTS	
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	39	37	33	29												

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	16NM	111NM	239NM	322NM	10NM	57NM	129NM	186NM	6KTS	16KTS	24KTS	29KTS	0KTS	+0KTS	0KTS	
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	44	40	36	32												

TYPHOON LUCY

0600Z 28 NOV TO 1800Z 07 DEC

	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	POSIT	WIND	ERRORS DST WIND					
280600Z	6.8N	160.0E	30	6.7N	160.4E	30	24 0	7.5N	155.7E	45	113 15	8.6N	151.0E	50	127 25	9.9N	146.5E	55	376 20					
281200Z	6.8N	158.3E	30	6.8N	158.4E	30	6 0	7.7N	152.1E	45	48 10	8.7N	146.2E	40	97 15	9.7N	140.7E	45	130 10					
281800Z	7.0N	156.6E	30	6.9N	156.8E	30	13 0	7.5N	150.7E	40	86 20	8.6N	144.9E	45	57 20	9.6N	139.5E	50	153 10					
290000Z	7.4N	155.2E	30	7.0N	154.3E	30	58 0	7.9N	148.3E	40	163 20	9.2N	143.6E	45	86 15	10.7N	139.0E	50	192 5					
290600Z	7.6N	153.8E	30	7.7N	153.5E	30	19 0	9.2N	147.2E	45	168 10	10.9N	141.5E	40	165 5	13.1N	136.1E	45	138 -10					
291200Z	7.3N	152.8E	25	8.1N	152.0E	30	67 5	9.6N	145.7E	45	157 10	11.5N	139.9E	40	135 5	13.8N	134.7E	45	147 -20					
291800Z	7.1N	152.1E	20	8.4N	150.5E	30	122 10	10.0N	144.4E	40	145 15	12.0N	138.7E	45	113 5	14.5N	133.5E	50	144 -25					
300000Z	6.9N	150.9E	20	7.4N	151.4E	30	42 10	8.1N	147.0E	45	284 5	8.9N	142.8E	40	438 -5	9.9N	138.1E	45	434 -50					
300600Z	7.3N	149.3E	25	7.0N	150.0E	30	45 5	7.2N	145.8E	45	313 0	8.1N	141.2E	40	441 -15	9.0N	136.6E	45	438 -65					
301200Z	7.5N	147.3E	25	7.6N	147.7E	30	24 5	8.5N	143.4E	45	298 0	9.3N	139.3E	45	375 -20	10.5N	135.0E	50	350 -80					
301800Z	7.7N	145.2E	25	7.6N	146.0E	30	48 5	8.4N	141.1E	45	271 -5	9.6N	137.0E	40	322 -35	11.2N	133.3E	50	296 -65					
010000Z	8.0N	142.8E	30	7.7N	144.7E	30	114 0	8.9N	139.2E	45	251 -10	10.3N	134.0E	40	217 -55	11.7N	130.0E	50	167 -65					
010600Z	8.4N	140.3E	35	8.2N	140.8E	40	32 5	9.5N	134.9E	40	116 5	11.4N	130.1E	70	103 -40	13.0N	126.4E	75	193 -35					
011200Z	9.7N	138.5E	35	10.3N	138.7E	45	38 10	14.2N	133.4E	40	149 -5	16.7N	129.2E	70	200 -40	17.7N	124.9E	75	221 -30					
011800Z	10.8N	137.2E	40	11.1N	136.6E	50	39 10	15.0N	131.0E	45	171 -10	17.4N	126.7E	70	246 -45	18.7N	122.9E	75	362 -25					
020000Z	11.4N	135.8E	45	11.5N	135.6E	50	13 5	11.9N	128.8E	45	155 -30	12.9N	122.8E	65	351 -50	13.9N	116.6E	45	816 -55					
020600Z	11.4N	134.5E	55	11.5N	134.0E	55	30 0	11.2N	127.4E	45	209 -45	13.4N	121.6E	60	418 -50	13.7N	115.5E	45	966 -45					
021200Z	11.7N	133.4E	65	11.5N	132.9E	55	32 -10	11.7N	127.7E	45	159 -45	13.2N	122.8E	60	392 -45	13.7N	117.6E	45	970 -35					
021800Z	12.4N	132.3E	75	11.5N	132.3E	60	54 -15	11.8N	126.3E	70	139 -45	12.4N	124.4E	70	417 -30	13.5N	120.7E	55	910 -15					
030000Z	12.8N	131.3E	85	12.9N	131.4E	85	8 -10	13.7N	126.9E	110	109 -5	14.6N	122.4E	100	497 0	15.8N	119.0E	60	1027 -5					
030600Z	13.1N	130.4E	110	13.1N	131.2E	105	47 -5	14.1N	126.2E	160	157 10	15.4N	122.0E	110	586 20	15.6N	118.3E	70	1181 10					
031200Z	13.4N	129.8E	110	13.4N	129.9E	110	6 0	14.4N	126.7E	160	171 15	15.0N	123.2E	110	658 30	16.3N	120.6E	70	1162 15					
031800Z	14.0N	129.1E	115	13.9N	129.1E	120	12 5	14.9N	125.8E	160	252 20	16.4N	123.4E	110	885 40	18.7N	123.7E	95	1075 40					
040000Z	14.2N	128.7E	115	14.5N	128.7E	120	18 5	17.4N	127.2E	160	175 20	19.7N	126.9E	105	524 40	22.4N	129.8E	85	827 30					
040600Z	15.5N	128.5E	110	15.2N	128.2E	110	25 0	17.7N	127.0E	190	271 10	20.0N	127.2E	90	617 30	22.8N	130.5E	80	910 30					
041200Z	16.6N	128.6E	105	16.3N	128.7E	110	19 5	19.7N	130.4E	190	163 20	22.8N	134.2E	90	332 35	25.0N	140.0E	75	561 35					
041800Z	17.7N	129.1E	100	18.0N	129.2E	105	19 5	22.0N	132.7E	90	72 20	24.8N	138.3E	70	265 15	27.8N	146.5E	60	521 20					
050000Z	18.8N	129.9E	100	18.6N	129.5E	100	26 0	22.3N	133.2E	85	149 20	25.1N	139.4E	65	331 10	---	---	---	---					
050600Z	20.2N	131.0E	90	19.8N	130.6E	100	33 10	23.7N	135.3E	80	170 20	25.8N	142.8E	60	306 10	---	---	---	---					
051200Z	21.6N	132.5E	80	21.6N	132.1E	95	22 15	26.3N	138.7E	75	247 20	28.9N	149.6E	50	412 10	---	---	---	---					
051800Z	22.0N	134.0E	70	22.4N	133.7E	90	29 20	28.3N	140.4E	60	249 5	---	---	---	---	---	---	---	---					
060000Z	22.2N	135.9E	65	22.9N	136.3E	65	47 0	26.0N	146.5E	45	223 -20	---	---	---	---	---	---	---	---					
060600Z	22.3N	138.0E	50	22.4N	137.9E	75	8 15	23.7N	147.1E	45	78 -5	---	---	---	---	---	---	---	---					
061200Z	22.4N	140.2E	55	22.5N	140.2E	70	6 15	24.3N	149.9E	30	138 -10	---	---	---	---	---	---	---	---					
061800Z	22.6N	142.5E	55	22.8N	142.5E	60	12 5	---	---	---	---	---	---	---	---	---	---	---	---					
070000Z	22.6N	144.8E	55	22.8N	144.8E	50	12 -5	---	---	---	---	---	---	---	---	---	---	---	---					
070600Z	22.4N	147.0E	50	22.5N	146.8E	45	13 -5	---	---	---	---	---	---	---	---	---	---	---	---					
071200Z	22.0N	149.7E	40	22.5N	149.7E	40	30 0	---	---	---	---	---	---	---	---	---	---	---	---					
071800Z	21.3N	152.9E	40	22.2N	152.0E	35	73 -5	---	---	---	---	---	---	---	---	---	---	---	---					

TYPHOONS WHILE WIND OVER 35KTS

	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	26NM	18NM	367NM	543NM
AVERAGE RIGHT ANGLE ERROR	15NM	107NM	187NM	255NM
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	16KTS	26KTS	31KTS
AVERAGE BIAS OF WIND ERROR	3KTS	-2KTS	-7KTS	-14KTS
NUMBER OF FORECASTS	27	26	26	27

ALL FORECASTS

	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	33NM	178NM	330NM	543NM
AVERAGE RIGHT ANGLE ERROR	18NM	97NM	172NM	255NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	15KTS	25KTS	31KTS
AVERAGE BIAS OF WIND ERROR	3KTS	2KTS	-3KTS	-14KTS
NUMBER OF FORECASTS	39	34	30	27

TYPHOON MARY

0600Z 20 DEC TO 1800Z 03 JAN

Table with columns: BEST TRACK, WARNING, 24 HOUR FORECAST, 48 HOUR FORECAST, 72 HOUR FORECAST. Rows contain time-stamped meteorological data including position (POS), wind speed (WIND), and error statistics (ERRORS).

TYPHOONS WHILE WIND OVER 35KTS. Summary statistics for typhoon warnings, categorized by duration (24-HR, 48-HR, 72-HR) and forecast error (5KTS, 10KTS, 15KTS, 20KTS, 24KTS).

ALL FORECASTS. Summary statistics for all forecasts, categorized by duration (34-HR, 135-HR, 250-HR, 299-HR) and forecast error (23-NM, 86-NM, 140-NM, 132-NM).

6. INDIAN OCEAN AREA CYCLONE DATA

TROPICAL CYCLONE 17-77
2000Z 11 MAY TO 0800Z 13 MAY

	BEST TRACK				WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	
112000Z	17.6N	88.9E	55	17.1N	89.5E	35	45	-20	19.7N	91.4E	50	137	10	---	---	---	---	---	---
120800Z	20.2N	89.2E	60	20.1N	89.2E	65	6	5	24.1N	89.4E	35	117	10	---	---	---	---	---	---
122000Z	21.8N	90.4E	40	21.7N	89.3E	70	61	30	---	---	---	---	---	---	---	---	---	---	---
130800Z	24.8N	91.4E	25	25.0N	92.0E	35	13	10	---	---	---	---	---	---	---	---	---	---	---

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
31NM 127NM 0NM 0NM
16KTS 10KTS 0KTS 0KTS
4KTS 10KTS 0KTS 0KTS
4 2 0 0

TROPICAL CYCLONE 18-77
2000Z 10 JUN TO 0800Z 13 JUN

	BEST TRACK				WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST							
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
102000Z	19.0N	66.8E	35	19.0N	66.8E	40	0	5	21.0N	64.5E	45	41	-10	23.4N	62.2E	50	214	-5	---	---	---	---
110800Z	19.7N	65.2E	50	20.4N	65.0E	55	43	5	23.1N	62.4E	65	182	5	25.7N	59.7E	65	326	25	---	---	---	---
112000Z	19.8N	63.5E	55	19.4N	64.0E	60	28	5	19.9N	60.7E	55	66	0	---	---	---	---	---	---	---	---	
120800Z	20.2N	61.4E	60	20.1N	61.2E	61	13	0	20.4N	57.0E	45	28	5	---	---	---	---	---	---	---	---	
122000Z	20.6N	59.8E	55	20.4N	59.8E	60	12	5	---	---	---	---	---	---	---	---	---	---	---	---	---	
130800Z	20.4N	58.3E	40	20.9N	58.3E	45	30	5	---	---	---	---	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
21NM 92NM 270NM 0NM
21NM 85NM 250NM 0NM
4KTS 5KTS 15KTS 0KTS
4KTS 0KTS 10KTS 0KTS
6 4 2 0

TROPICAL CYCLONE 19-77
2000Z 29 OCT TO 2000Z 31 OCT

	BEST TRACK				WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST							
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
292000Z	13.0N	85.2E	35	13.2N	85.1E	35	13	0	13.8N	82.5E	45	56	10	14.5N	80.0E	55	122	25	---	---	---	---
300800Z	13.9N	83.4E	35	14.7N	84.3E	35	71	0	17.3N	82.5E	45	182	5	---	---	---	---	---	---	---	---	
302000Z	14.7N	82.8E	35	15.0N	82.0E	40	50	5	16.5N	79.0E	30	12	0	---	---	---	---	---	---	---	---	
310800Z	15.6N	80.3E	40	15.2N	80.4E	40	25	0	---	---	---	---	---	---	---	---	---	---	---	---	---	
312000Z	16.3N	79.0E	30	15.8N	78.0E	30	65	0	---	---	---	---	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
45NM 77NM 122NM 0NM
44NM 71NM 68NM 0NM
1KTS 5KTS 25KTS 0KTS
1KTS 5KTS 25KTS 0KTS
5 3 1 0

TROPICAL CYCLONE 21-77
2000Z 10 NOV TO 2000Z 21 NOV

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	#IND	POSIT	#IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND		
10z000Z	11.4N	83.9E	40	11.4N	84.3E	35	23	-5	12.0N	80.7E	40	67	-5	---	---	---	---	---		
110800Z	11.3N	82.0E	40	11.3N	82.1E	45	6	5	11.2N	78.0E	40	33	0	---	---	---	---	---		
112000Z	11.0N	80.2E	45	11.0N	80.1E	55	6	10	---	---	---	---	---	---	---	---	---	---		
120800Z	10.8N	78.4E	40	11.0N	78.2E	30	17	-10	---	---	---	---	---	---	---	---	---	---		
14z000Z	13.6N	68.2E	45	12.7N	68.5E	35	57	-10	13.2N	64.5E	50	116	0	14.0N	61.2E	50	354	-15		
150800Z	14.5N	66.6E	50	14.4N	66.4E	45	13	-5	15.5N	62.3E	50	292	-10	16.1N	58.5E	55	555	-15		
15z000Z	13.8N	66.4E	50	14.1N	66.4E	60	18	10	14.3N	64.2E	60	184	-5	14.7N	61.2E	50	400	-20		
160800Z	13.3N	66.8E	60	14.2N	66.2E	60	64	0	14.3N	65.1E	60	175	-10	14.6N	62.3E	50	344	-20		
16z000Z	12.7N	66.9E	65	14.0N	67.2E	65	80	0	15.5N	66.2E	65	227	-5	16.8N	64.7E	60	456	-5		
170800Z	12.2N	67.2E	70	13.0N	67.2E	70	48	0	13.9N	67.2E	65	171	15	14.9N	65.5E	95	401	40		
17z000Z	11.8N	67.4E	70	12.1N	66.8E	70	39	0	12.9N	66.2E	60	227	15	15.1N	65.3E	90	472	40		
180800Z	11.2N	68.2E	70	11.6N	67.4E	65	53	-5	11.1N	68.0E	60	148	5	13.3N	64.7E	70	288	25		
18z000Z	10.6N	69.3E	65	10.5N	69.5E	60	13	-5	12.2N	71.1E	55	144	5	14.3N	69.4E	65	322	20		
190800Z	10.1N	70.3E	55	10.1N	71.0E	50	41	-5	11.4N	73.0E	50	93	5	13.8N	73.0E	60	155	15		
19z000Z	9.8N	71.3E	50	9.9N	70.4E	50	53	0	11.2N	71.0E	50	138	5	13.4N	69.2E	60	275	25		
200800Z	10.0N	72.3E	45	10.8N	71.7E	50	59	5	13.2N	72.4E	55	158	10	---	---	---	---	---		
20z000Z	10.4N	73.2E	45	11.5N	73.7E	45	72	0	14.0N	75.0E	50	125	-5	---	---	---	---	---		
210800Z	11.8N	74.7E	45	10.9N	74.1E	45	64	0	---	---	---	---	---	---	---	---	---	---		
21z000Z	14.5N	73.8E	35	15.3N	74.2E	40	53	5	---	---	---	---	---	---	---	---	---	---		

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF #IND ERROR
NUMBER OF FORECASTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
41NM	153NM	371NM	0NM
29NM	108NM	250NM	0NM
4KTS	7KTS	22KTS	0KTS
-1KTS	1KTS	8KTS	0KTS
19	15	11	0

TROPICAL CYCLONE 22-77
0800Z 15 NOV TO 2000Z 19 NOV

	BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	#IND	POSIT	#IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND	ERRORS OST #IND		
150800Z	6.0N	87.0E	50	6.1N	87.0E	50	6	0	6.6N	83.6E	65	107	-15	6.2N	80.7E	65	233	-30		
15z000Z	6.5N	85.7E	65	6.2N	84.8E	60	56	-5	7.7N	81.3E	70	206	-20	8.4N	78.4E	55	324	-45		
160800Z	7.2N	85.3E	80	7.0N	85.0E	70	21	-10	7.9N	83.1E	80	162	-15	8.6N	81.2E	90	264	-15		
16z000Z	8.0N	84.6E	90	8.5N	84.5E	85	19	-5	10.0N	83.0E	100	108	0	11.5N	81.3E	100	157	-10		
170800Z	10.5N	83.9E	95	10.4N	83.9E	95	6	0	13.0N	82.4E	100	12	-5	13.3N	81.5E	90	26	-20		
17z000Z	11.8N	83.1E	100	12.3N	82.9E	100	32	0	13.5N	81.4E	90	85	-20	16.3N	81.8E	40	80	-50		
180800Z	13.0N	82.2E	105	13.3N	82.1E	110	19	5	15.9N	80.0E	100	27	-10	---	---	---	---	---		
18z000Z	14.1N	81.7E	110	14.2N	81.4E	105	18	-5	16.6N	80.2E	80	58	-10	---	---	---	---	---		
190800Z	15.5N	81.1E	110	15.5N	81.6E	105	29	-5	---	---	---	---	---	---	---	---	---	---		
19z000Z	17.2N	81.0E	90	16.3N	79.7E	90	92	0	---	---	---	---	---	---	---	---	---	---		

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF #IND ERROR
NUMBER OF FORECASTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
30NM	96NM	182NM	0NM
29NM	74NM	161NM	0NM
4KTS	12KTS	28KTS	0KTS
-3KTS	-12KTS	-28KTS	0KTS
10	4	6	0

CHAPTER VI - TROPICAL CYCLONE CENTER FIX DATA

1. INTRODUCTION

During the 1977 storm season, 2373 fixes on the 21 northwest Pacific area tropical cyclones and 180 fixes on the North Indian Ocean area tropical cyclones were collected at Fleet Weather Central/Joint Typhoon Warning Center, Guam. Table 6-1, Fix Platform Summary, delineates the number of fixes by platform for each tropical cyclone as well as season

totals. A discussion of the various reconnaissance platforms is presented in Chapter II.

Fix totals as listed in Table 6-1 include all fixes received from primary and secondary sources whether real-time or after-the-fact of which all were used for post-storm analyses. Therefore, totals are in some instances, larger than those listed and evaluated in previous chapters of this report.

TABLE 6-1. FIX PLATFORM SUMMARY

	FIX PLATFORM							TOTAL NO. OF FIXES
	AIRCRAFT	DMSP	NOAA	SMS	LRDR	SHIP RADAR	ACR	
<u>WESTERN PACIFIC</u>								
TS PATSY	7	18	39	5	-	-	-	69
TD 02	4	22	5	-	-	-	-	31
TS RUTH	2	38	21	-	8	-	1	70
TD 04	2	21	6	2	-	-	-	31
TY SARAH	13	52	24	-	1	-	-	90
TY THELMA	10	74	22	-	20	-	-	126
TY VERA	13	54	26	-	67	-	-	160
TS WANDA	8	39	26	-	-	-	-	73
TS AMY	3	50	18	-	39	-	-	110
TY BABE	19	141	39[3]	-	88	-	-	287
TS CARLA	1	44	10[1]	-	-	-	-	55
TY DINAH	14	123	43[4]	-	41	4	-	225
TS EMMA	8	71	25[1]	-	14	-	-	118
TS FREDA	2	32	8[1]	-	11	1	-	54
TY GILDA	12	47	36[5]	-	-	-	-	95
TS HARRIET	11	36	21[4]	-	-	-	-	68
TY IVY	9	57	13[1]	-	-	-	-	79
TY JEAN	3	59	12[1]	-	-	-	-	74
TY KIM	31	71	51[3]	-	70	-	-	223
TY LUCY	19	64	43[1]	-	-	-	-	126
TY MARY	20	86	54[7]	23	26	-	-	209
TOTAL	211	1199	542[32]	30	385	5	1	2373
% OF TOTAL NO. OF FIXES	8.9%	50.5%	22.8%	1.26%	16.2%	.2%	.04%	100%
<u>TROPICAL CYCLONE</u>								
17-77		13	8					21
18-77		13	8					21
19-77		27	8					35
21-77		46	20[3]					66
22-77		26	11[2]					37
TOTAL		125	55[5]					180
% OF TOTAL NO. OF FIXES		69.4%	30.6%					100%

[] - FIXES RECEIVED FROM FWF SUITLAND IN END-OF-STORM SUMMARY PACKET AFTER BEST-TRACK COMPLETED AND ARE LISTED AT THE END OF SECTIONS 3 AND 4 RESPECTIVELY.

2. FORMAT

The fix data are divided into two groups by geographical area and sequentially ordered within each group. For all types of fixes, the first four columns tabulate information in the following format:

FIX NO. - Fixes are numbered sequentially.

TIME - Day, hour and minutes (GMT) of fix.

POSIT - Position of storm center in degrees and tenths.

FIXCAT - Type of fix used (SAT - satellite, P - aircraft penetration, LRDR - land radar, ACR - aircraft radar, SRDR - ship radar).

The format of the remainder of the print-out varies with the type of fix.

a. SATELLITE - Intensity estimates and trends from visual data (when available) are listed as derived from the Dvorak technique (NOAA TM; NESS - 45). Fix data from NOAA-4 and NOAA-5 satellites are appropriately labeled and indicate confidence numbers (CONF) if the U. S. Navy Fleet Weather Facility, Suitland, MD provided the data (see Table 6-2), or Position Code Number (PCN) if USAF DMSP sites provided the data. Fixes based on IR data are appropriately annotated with IR DATA. Geosynchronous Meteorological Satellite (SMS-2) data are noted as such and may contain occasional narrative comments and accuracy estimates.

b. RADAR - The latitude and longitude of the radar sites are given in the POSIT OF RADAR column. If available, plain language remarks regarding the size, accuracy, and echo characteristics of the fix appear as received. Radar data sites using the standard World Meteorological Organization (WMO)

Code include a five-digit code group for reporting tropical cyclone characteristics of size, appearance and accuracy of location of the center or eye.

c. AIRCRAFT PENETRATION - Complete eye/center fix reports are obtained at levied fix times. Supplemental fixes are sometimes made during peripheral data gathering legs between scheduled fixes. These normally provide date, time and location only.

The categories of aircraft reconnaissance information are as follows:

(1) ACCRY (Accuracy): The estimated navigation (first number) and meteorological (second number) accuracies are expressed in nautical miles.

(2) FIX LVL (Fix level): A constant-pressure-surface flight level (listed in mb) is normally maintained during a tropical cyclone fix mission. Low-level missions are usually flown at 1500 feet (457 m). This altitude, however, is not normally constant due to maneuvers to avoid turbulence and to maintain visual contact of the ocean surface.

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

TABLE 6-2. CONFIDENCE (CONF) NUMBERS AS A FUNCTION OF DVORAK T NUMBER AND RADIUS OF 90% PROBABILITY AREA (NM).

TROPICAL CYCLONE INTENSITY	CONF (1)	CONF (2)	CONF (3)
T1.5	60	120	170
T2.0	60	120	170
T2.5	60	120	170
T3.0	50	100	150
T3.5	45	90	140
T4.0	45	90	140
T4.5	45	90	140
T5.0	40	90	130
T5.5	40	80	130
T6.0	40	80	130
T6.5	30	70	120
T7.0	30	70	120
T7.5	30	60	100
T8.0	30	60	100

stricts wind measurements to drift angles less than or equal to 27 degrees if the wind is normal to the aircraft heading.

(4) MAX OBS SFC WIND: The maximum surface wind (knots) is an estimate made by the Airborne Weather Reconnaissance Officer (ARWO) based on sea state. This observation is limited to the region of the flight path, and may not be representative of the entire storm. 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) OBS MIN SLP: The minimum observed sea level pressure on a 700 mb fix mission is obtained by applying the minimum 700 mb height to the following regression equation:

$$\text{SLP (MB)} = .115 (700 \text{ mb HGT [M]}) + 645$$

This relationship is accurate within +3 mb in most cases. However, if the 700 mb center and the surface center are not vertically aligned, the minimum sea level pressure will be erroneously high. If the surface center can be visually detected (e.g.

in the eye), the minimum sea level pressure is obtained by a dropsonde released above the surface vortex center.

If the fix is made at the 1500 foot level, the sea level pressure is extrapolated from that level.

(6) MIN 700 MB HGT: The minimum height of the 700 mb surface in the vortex center is recorded in decameters.

(7) FLT LVL TI/TO: This category denotes the maximum temperature measured in the center (TI) and the ambient temperature outside the center (TO). The outside temperature is measured just prior to entering the wall cloud. Both temperature observations are in degrees Celsius and are made at flight level. Reconnaissance aircraft seldom penetrate on the same azimuth from one fix to another; thus, the position of TO normally varies both in bearing and range from the center.

(8) EYE FORM/ORIENTATION/DIA: The shape and diameter (nm) of the eye is determined by visual observation or by radar presentation analysis. This is reported only if the center is 50% or more surrounded by wall cloud. For elliptical eyes, the size of both major and minor axes are given in nm.

3. WESTERN NORTH PACIFIC FIX DATA

TROPICAL STORM FAIST																		
FIX POSITIONS FOR CYCLONE NO. 1																		
0000Z 23 MAR TO 0000Z 31 MAR																		
FIA NO.	TIME	POSIT	FIA CAL	ACQRY NAV-MET	FIA LVL	FLT DIR	MAX UHS WIND VEL	MAX UHS WIND DIR	MAX UHS WIND HGT	MAX UHS WIND HGT	UHS SLP	MIN 700MB MG!	FLT LVL 11/10	EYE FORM	ORIENT- TAILON	EYE DIR	POSIT OF RADAR	MSN NMBR
1	212127	1.14 166.4E	SAT	(T2.0/2.0 / / HMS)														
2	212127	1.54 166.3E	SAT	(T1.0/1.0 / / HMS)														
3	221007	1.64 166.0E	SAT	(IR DATA)														
4	221007	1.94 166.1E	SAT	(IR DATA)														
5	222051Z	2.44 166.2E	SAT	(T2.0/2.0 / / HMS)														
6	222237	4.04 163.8E	SAT	(T2.5/2.5 /D0.5/25HMS)														
7	222247Z	2.64 166.2E	SAT	(IR DATA)														
8	230237Z	2.64 165.1E	P	15 5 1500 280 42 190														
9	230753Z	3.04 163.5E	SAT	(IR DATA)														
10	230921Z	3.54 163.1E	SAT	(IR DATA)														
11	230927Z	3.64 162.1E	SAT	(IR DATA)														
12	230927Z	3.54 163.0E	SAT	(IR DATA)														
13	232017Z	3.44 163.5E	SAT	(IR DATA)														
14	232037Z	2.74 166.5E	SAT	(T1.5/2.0 / / HMS)														
15	232037Z	3.44 162.2E	SAT	(T2.0/2.0 /S /24HMS)														
16	232156Z	3.84 162.5E	SAT	(T1.5/2.0 /W1.0/24HMS)														
17	232156Z	3.64 163.4E	SAT	(IR DATA)														
18	232156Z	3.54 163.0E	SAT	(T1.5/2.0 / / HMS)														
19	240406Z	3.74 166.8E	P	20 15 700 290 45 220														
20	240747Z	3.44 166.2E	SAT	(IR DATA)														
21	240834Z	3.84 165.1E	SAT	(IR DATA)														
22	241034Z	3.74 165.1E	SAT	(IR DATA)														
23	241034Z	3.54 163.0E	SAT	(IR DATA)														
24	242027Z	4.14 165.3E	SAT	(IR DATA)														
25	242027Z	4.14 165.5E	SAT	(T 0/1.0 /W1.5/24HMS)														
26	242114Z	4.14 165.5E	SAT	(T 0/1.0 /W2.0 /24HMS)														
27	242114Z	4.14 165.4E	SAT	(IR DATA)														
28	250951Z	4.14 165.3E	SAT	(IR DATA)														
29	250950Z	2.34 166.0E	SAT	(IR DATA)														
30	252224Z	2.04 163.0E	SAT	(T2.0/2.0 /D0.5/24HMS)														
31	252224Z	2.04 163.2E	SAT	(T2.0/2.0 /D2.0/24HMS)														
32	260115Z	1.74 163.2E	SAT	(T1.0/2.0 / / HMS)														
33	260457Z	2.14 162.5E	SAT	(IR DATA)														
34	260457Z	2.04 162.3E	SAT	(IR DATA)														
35	260406Z	2.24 162.3E	SAT	(IR DATA)														
36	262019Z	2.44 161.8E	SAT	(T2.5/2.5 / / HMS)														
37	262142Z	3.54 161.6E	SAT	(T3.0/3.0 /D1.0/24HMS)														
38	262142Z	3.34 161.5E	SAT	(T3.0/3.0 /D1.0/24HMS)														
39	262142Z	2.94 161.7E	SAT	(T2.5/2.5 / / HMS)														
40	270115Z	3.74 161.1E	SAT	(T3.0/3.0 /D2.0/24HMS)														
41	270447Z	4.14 160.6E	SAT	(IR DATA)														
42	270447Z	4.04 160.2E	SAT	(IR DATA)														
43	271018Z	4.24 160.0E	SAT	(IR DATA)														
44	272019Z	4.44 159.0E	SAT	(T2.5/2.5 /S /24HMS)														
45	27225 7	5.64 159.2E	SAT	(T4.5/4.5 /D1.5/24HMS)														
46	272257Z	5.54 159.3E	SAT	(IR DATA)														
47	272257Z	5.34 159.2E	SAT	(T3.5/3.5 /D0.5/25HMS)														
48	272311Z	5.74 159.1E	P	7 5 700 320 60 240														
49	280415Z	6.34 158.4E	P	10 4 700 30 30 250														
50	280834Z	6.64 158.4E	SAT	(IR DATA)														
51	280834Z	6.24 158.4E	SAT	(IR DATA)														
52	280934Z	6.34 158.2E	SAT	(IR DATA)														
53	281437Z	6.94 157.2E	P	10 4 700 230 50 150														
54	282127Z	7.14 156.6E	SAT	(IR DATA)														
55	282207Z	7.54 156.5E	SAT	(T1.5/2.5 /W3.0/24HMS)														
56	282211Z	7.14 156.6E	SAT	(T3.5/3.5 /S /24HMS)														
57	290407Z	8.14 156.6E	P	4 25 700 200 28 90														
58	290827Z	8.34 156.8E	SAT	(IR DATA)														
59	290857Z	9.04 156.0E	SAT	(IR DATA)														
60	291047Z	8.64 156.6E	SAT	(IR DATA)														
61	291447Z	8.84 153.8E	P	1 20 700 990 15 360														
62	292107Z	8.24 156.1E	SAT	(T1.0/1.0 / / HMS)														
63	292104Z	8.64 156.5E	SAT	(T1.0/2.0 /W2.5 /23HMS)														
64	292314Z	9.94 156.5E	SAT	(T2.0/2.5 /D0.5 /25HMS)														
65	292321Z	8.04 155.0E	SAT	(IR DATA)														
66	301003Z	8.24 155.0E	SAT	(IR DATA)														
67	301006Z	10.04 156.3E	SAT	(IR DATA)														
68	302056Z	8.04 149.0E	SAT	(T 0/1.0 /W1.0/24HMS)														
69	302236Z	9.64 151.0E	SAT	(T1.0/1.5 /W1.0/23HMS)														

TROPICAL DEPRESSION 2
 FIX POSITIONS FOR CYCLONE NO. 2
 0000Z 26 MAY TO 0600Z 27 MAY

FIX NO.	TIME	POSIT	FIX CAT	ACRY NAV-MET	FIX LVL	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	ORIENT IATION	EYE DIA	POSIT OF RADAR	MSN NUMB
						FL1 UIM	LVL VEL	WIND BRG RNG	SFC WIND VEL	WIND BRG RNG									
1	232344Z	18.3N 124.8E	SAT	(T 0 / 0 /															
2	240206Z	18.3N 125.0E	SAT	(IR DATA															
3	242322Z	15.2N 128.2E	SAT	(T1.0/1.0 /															
4	250054Z	16.5N 128.5E	SAT	(T1.0/1.0 /															
5	250100Z	16.5N 128.4E	SAT	(T1.0/1.0 /D1.0/25HRS)															
6	251025Z	16.6N 128.3E	SAT	(IR DATA															
7	251025Z	15.9N 127.7E	SAT	(IR DATA															
8	251140Z	16.3N 128.2E	SAT	(IR DATA															
9	251145Z	16.5N 128.0E	SAT	(IR DATA															
10	251440Z	17.0N 128.3E	SAT	(IR DATA															
11	252309Z	18.7N 127.4E	SAT	(T2.0/2.0-/D1.0/24HRS)															
12	252310Z	18.5N 127.4E	SAT	(IR DATA															
13	260010Z	18.1N 127.5E	SAT	(IR DATA															
14	260017Z	19.8N 129.2E	SAT	(T2.0/2.0-/D1.0/23HRS)															
15	260030Z	19.8N 128.7E	P	6 5 1500 180 30 100															
16	260320Z	20.4N 129.0E	P	5 5 700 - - -															
17	260322Z	20.6N 129.0E	SAT	(IR DATA															
18	260322Z	20.8N 129.1E	SAT	(IR DATA															
19	261056Z	21.8N 129.5E	SAT	(IR DATA															
20	261155Z	21.2N 129.4E	SAT	(IR DATA															
21	261155Z	22.0N 129.3E	SAT	(IR DATA															
22	261254Z	20.0N 126.9E	SAT	(IR DATA															
23	261644Z	21.8N 129.4E	SAT	(IR DATA															
24	261644Z	22.8N 129.8E	SAT	(IR DATA															
25	261811Z	23.3N 130.2E	P	5 15 700 210 28 110															
26	262254Z	23.8N 130.5E	SAT	(IR DATA															
27	262258Z	21.5N 130.3E	SAT	(T2.0/2.0 /S /24HRS)															
28	262333Z	24.5N 130.6E	SAT	(T1.0/2.0 /W1.0/24HRS)															
29	270304Z	24.4N 131.0E	SAT	(T1.0/1.0 /															
30	270305Z	24.7N 130.8E	SAT	(IR DATA															
31	270415Z	25.3N 131.6E	P	5 2 1500 50 25 290															

TROPICAL STORM NIMITZ
 FIX POSITIONS FOR CYCLONE NO. 3
 0000Z 14 JUN 10 1200Z 17 JUN

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	MAX OBS				MAX OBS SFC WIND	OBS MIN SLP	MIN 700MB HG	FLI LVL 11/10	EYE FORM	UNIDEN- TATION	EYE DIA	POSIT OF KAUAH	MSN NUMB
						DIR	VEL	HRG	RNG									
1	100051Z	5.3N 129.0E	SAT			(11.0/1.0 / / HRS)												
2	100055Z	6.3N 130.4E	SAT			(11.0 / 0 / / HRS)				PCN 5								
3	101135Z	7.0N 128.2E	SAT			(IR DATA)				PCN 6								
4	101134Z	4.5N 129.0E	SAT			(IR DATA)												
5	110004Z	7.5N 127.5E	SAT			(11.0/1.0 /S /24HRS)												
6	110011Z	7.2N 126.4E	SAT			(11.0/1.0 /D1.0/24HRS)				PCN 5								
7	110204Z	7.4N 127.2E	SAT			(IR DATA)				PCN 5								
8	111247Z	8.8N 125.7E	SAT			(IR DATA)												
9	111444Z	9.6N 126.3E	SAT			(IR DATA)				PCN 6								
10	120114Z	12.5N 123.5E	SAT			(12.0/2.0 /D1.0/25HRS)												
11	120123Z	13.1N 123.1E	SAT			(11.0/1.0 /W1.0/25HRS)				PCN 5								
12	120327Z	11.3N 125.5E	SAT			(11.0/1.0 / / HRS)				PCN 5								
13	121277Z	11.9N 123.0E	SAT			(IR DATA)												
14	130034Z	13.1N 114.5E	SAT			(11.5/1.5 /W0.5 / 24 HRS)												
15	130034Z	12.4N 114.0E	SAT			(11.0 / 0 /S /23HRS)				PCN 5								
16	130107Z	12.9N 119.3E	SAT			(12.0/2.0 /D1.0/24HRS)				PCN 5								
17	131139Z	14.0N 117.9E	SAT			(IR DATA)				PCN 6								
18	131147Z	14.7N 118.1E	SAT			(IR DATA)				PCN 6								
19	132242Z	15.6N 117.6E	SAT			(12.5/2.5 / / HRS)				PCN 5								
20	132247Z	14.8N 117.6E	SAT			(12.5/2.5 / / HRS)				PCN 5								
21	132247Z	14.9N 117.3E	SAT			(13.0/3.0 /D1.0/20HRS)				PCN 5								
22	140146Z	15.9N 117.0E	SAT			(13.0/3.0 /D1.5/25HRS)				PCN 5								
23	141129Z	16.6N 116.8E	SAT			(IR DATA)												
24	141234Z	17.0N 116.5E	SAT			(IR DATA)												
25	141355Z	16.8N 116.5E	SAT			(IR DATA)				PCN 6								
26	141534Z	17.7N 116.5E	SAT			(IR DATA)				PCN 5								
27	141535Z	18.0N 116.5E	SAT			(IR DATA)				PCN 6								
28	142237Z	18.2N 116.6E	SAT			(14.0/4.0 /D1.0/24HRS)				PCN 5								
29	142237Z	17.2N 115.9E	SAT			(13.5/3.5 /D1.0/24HRS)				PCN 6								
30	142230Z	18.0N 116.2E	SAT			(IR DATA)				PCN 5								
31	150012Z	18.2N 116.2E	SAT			(IR DATA)				PCN 5								
32	150055Z	18.7N 116.8E	P	5	5	700 250 75 270	12	75	330		7	980	291	19	15	CINC	20	
33	150107Z	18.3N 116.6E	SAT			(13.0/3.0 /S /23HRS)												
34	150107Z	18.6N 116.9E	SAT			(IR DATA)				PCN 3								
35	150402Z	19.2N 117.0E	P	1	5	700 190 52 140	30	60	60		10	980	291	22	12	-	-	-
36	150417Z	19.2N 116.7E	SAT			(14.0/4.0 / / HRS)				PCN 3								
37	150620Z	19.6N 116.8E	LHUR			- 20800												
38	151115Z	19.4N 116.8E	SAT			(IR DATA)				PCN 6								
39	151115Z	19.8N 116.9E	SAT			(IR DATA)				PCN 6								
40	151115Z	19.5N 116.5E	SAT			(IR DATA)				PCN 6								
41	151144Z	20.0N 116.8E	SAT			(IR DATA)				PCN 5								
42	151504Z	21.0N 117.7E	LHUR			- 5777												
43	151517Z	20.5N 117.1E	SAT			(IR DATA)				PCN 5								
44	151517Z	20.4N 117.4E	SAT			(IR DATA)				PCN 5								
45	151517Z	20.8N 117.3E	SAT			(IR DATA)				PCN 5								
46	151654Z	21.1N 117.2E	SAT			(IR DATA)				PCN 5								
47	151722Z	21.1N 117.8E	AC R															
48	160000Z	21.3N 117.1E	SAT			(IR DATA)				PCN 3								
49	160000Z	21.1N 117.5E	LHUR			- 6577												
50	160017Z	22.0N 116.9E	SAT			(12.0/3.0 /W1.0/23HRS)												
51	160024Z	22.2N 117.7E	SAT			(13.0/4.0 / / HRS)				PCN 5								
52	160359Z	22.8N 118.4E	SAT			(14.0/4.0 / / HRS)				PCN 6								
53	160359Z	22.8N 118.2E	SAT			(13.0/3.5 /W0.5/30HRS)				PCN 5								
54	160359Z	23.2N 118.3E	SAT			(13.5/4.0 /W0.5/24HRS)				PCN 3								
55	160500Z	22.9N 118.0E	LHUR			- 25977												
56	161103Z	23.9N 119.2E	SAT			(IR DATA)				PCN 6								
57	161103Z	23.8N 118.7E	SAT			(IR DATA)				PCN 6								
58	161103Z	23.5N 118.7E	SAT			(IR DATA)				PCN 6								
59	161104Z	23.7N 118.3E	LHUR			- 7777												
60	161204Z	23.9N 118.5E	LHUR			- 7777												
61	161307Z	23.0N 118.0E	SAT			(IR DATA)												
62	161304Z	24.3N 118.8E	LHUR			- 7777												
63	161404Z	24.6N 118.9E	LHUR			- 7777												
64	161641Z	24.7N 119.4E	SAT			(IR DATA)				PCN 5								
65	161641Z	23.7N 118.9E	SAT			(IR DATA)				PCN 5								
66	162348Z	25.3N 119.2E	SAT			(12.0/3.0 /W1.0/24HRS)				PCN 5								
67	162344Z	25.2N 120.2E	SAT			(IR DATA)				PCN 5								
68	170134Z	26.7N 120.6E	SAT			(12.0/3.0 /W1.0/25HRS)				PCN 5								
69	170347Z	26.6N 121.2E	SAT			(IR DATA)				PCN 5								
70	170342Z	26.8N 121.5E	SAT			(12.0/3.0 /W1.0/24HRS)				PCN 5								

TROPICAL DEPRESSION 4
 FIX POSITIONS FOR CYCLONE NO. 4
 0000Z 05 JUL 10 0600Z 06 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACRY NAV-MET	FIX LVL	MAX OBS			SFC WIND			UWS MIN SLP	MIN 1000MB HG!	FLT LVL TI/TO	EYE FORM	UNEN- IATION	EYE DIA	PUSIT UP RADAR	MSN NMGR
						UIN	VEL	BRG	RNG	VEL	BRG									RNG
1	021254Z	15.3N 120.6E	SAT	(IR DATA															
2	022357Z	13.8N 116.5E	SAT	(T1.0/1.0 / /															
3	030131Z	11.9N 116.0E	SAT	(T1.0/1.0 / /															
4	030405Z	11.8N 116.1E	SAT	(IR DATA															
5	031210Z	12.7N 115.9E	SAT	(IR DATA															
6	031647Z	11.7N 114.1E	SAT	(IR DATA															
7	032345Z	15.0N 113.0E	SAT	(IR DATA															
8	032345Z	13.4N 113.5E	SAT	(T1.0/1.0 /S /24HMS)															
9	040047Z	16.5N 116.4E	SAT	(T1.0/1.0 /S /24HMS)															
10	040347Z	16.9N 115.7E	SAT	(T1.0/1.0 / /															
11	040347Z	15.2N 113.2E	SAT	(IR DATA															
12	041127Z	17.7N 116.0E	SAT	(IR DATA															
13	041230Z	18.3N 116.2E	SAT	(IR DATA															
14	041230Z	14.6N 114.5E	SAT	(IR DATA															
15	041629Z	18.4N 116.1E	SAT	(IR DATA															
16	041629Z	17.6N 114.8E	SAT	(IR DATA															
17	042227Z	17.8N 114.2E	P	10 30 1500 150 28 90								50	991	-	25	25	-	-	-
18	042333Z	18.1N 114.0E	SAT	(T1.0/1.0 /S /20HMS)															
19	042333Z	18.4N 112.7E	SAT	(T1.0/1.0 /S /24HMS)															
20	050330Z	18.1N 113.0E	SAT	(T2.0/2.0 /D1.0/28HMS)															
21	050330Z	18.5N 113.1E	SAT	(IR DATA															
22	050347Z	17.5N 133.1E	P	10 10 700 170 30 70								150	995	30*	11	-	-	-	-
23	051217Z	20.1N 111.9E	SAT	(IR DATA															
24	051217Z	20.0N 110.5E	SAT	(IR DATA															
25	051230Z	20.3N 111.3E	SAT	(IR DATA															
26	051246Z	19.0N 111.5E	SAT	(IR DATA															
27	051612Z	20.4N 111.5E	SAT	(IR DATA															
28	051612Z	19.5N 110.5E	SAT	(IR DATA															
29	052321Z	22.0N 109.6E	SAT	(T 0/1.0 /W1.0/24HMS)															
30	060115Z	22.5N 110.2E	SAT	(T 0/1.0 / /															
31	060114Z	20.9N 109.4E	SAT	(T1.0/1.0 / /															

TYPHOON SARAH
FIX POSITIONS FOR CYCLONE NO. 5
1200Z 16 JUL TO 1200Z 21 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	MAX OBS			SPL #IND			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	ORIENT-ATION	EYE DIA	POSIT UP KAUAH	MSN NMBR
						DIR	VEL	BRG	RNG	VEL	BRG									RNG
1	130000Z	6.7N 137.5E	SAT	(T 0/ 0 /															
2	131040Z	7.7N 138.2E	SAT	(IR DATA															
3	132316Z	8.0N 136.9E	SAT	(T 0/ 0 /S															
4	140233Z	7.8N 136.8E	SAT	(IR DATA															
5	141152Z	7.2N 134.1E	SAT	(IR DATA															
6	142147Z	7.5N 132.7E	SAT	(IR DATA															
7	150026Z	6.2N 130.0E	SAT	(T2.0/2.0 /															
8	150029Z	6.7N 132.3E	SAT	(T 0/ 0 /S															
9	150215Z	7.0N 132.6E	SAT	(IR DATA															
10	150215Z	6.2N 132.0E	SAT	(T1.0/1.5 /															
11	151029Z	9.2N 130.5E	SAT	(IR DATA															
12	151029Z	7.6N 129.8E	SAT	(IR DATA															
13	151108Z	7.5N 129.6E	SAT	(IR DATA															
14	151110Z	7.3N 132.0E	SAT	(IR DATA															
15	151457Z	7.8N 128.6E	SAT	(IR DATA															
16	151457Z	8.0N 128.6E	SAT	(IR DATA															
17	152130Z	9.2N 126.9E	SAT	(IR DATA															
18	152130Z	8.4N 127.1E	SAT	(T2.0/2.0 /D1.0/19HMS)															
19	152301Z	9.1N 126.7E	SAT	(IR DATA															
20	152342Z	8.3N 126.4E	SAT	(T3.0/3.0 /D1.0/23HMS)															
21	152345Z	9.0N 126.5E	SAT	(T2.0/2.0 /D2.0/23HMS)															
22	160042Z	9.3N 130.4E	P	5 5 1500															
23	160154Z	9.4N 130.5E	SAT	(IR DATA															
24	160644Z	9.9N 129.4E	P	7 12 700															
25	160943Z	10.2N 128.8E	P	5 7 700															
26	161012Z	10.4N 127.8E	SAT	(IR DATA															
27	161012Z	10.1N 127.1E	SAT	(IR DATA															
28	161221Z	10.6N 127.5E	SAT	(IR DATA															
29	162249Z	12.2N 124.9E	SAT	(T2.0/2.0 /															
30	162249Z	12.2N 125.0E	SAT	(T2.5/2.5 /															
31	162254Z	11.6N 125.5E	SAT	(T3.0/3.0 /D1.0/25HMS)															
32	170045Z	12.1N 125.3E	P	5 10 700															
33	170052Z	12.4N 125.0E	SAT	(T3.5/3.5 /D0.5/25HMS)															
34	170057Z	12.3N 125.0E	SAT	(T3.0/3.0 /D1.0/25HMS)															
35	170415Z	12.7N 125.2E	P	2 7 700															
36	170938Z	13.4N 124.0E	P	3 10 500															
37	170954Z	12.8N 123.4E	SAT	(IR DATA															
38	170954Z	12.9N 123.2E	SAT	(IR DATA															
39	171133Z	13.4N 123.7E	SAT	(IR DATA															
40	171133Z	13.3N 123.3E	SAT	(IR DATA															
41	171137Z	13.4N 123.3E	SAT	(IR DATA															
42	171147Z	14.0N 123.7E	SAT	(IR DATA															
43	171604Z	13.8N 123.7E	SAT	(IR DATA															
44	171604Z	14.1N 123.3E	SAT	(IR DATA															
45	171632Z	13.6N 122.7E	P	2 12 500															
46	172139Z	13.8N 121.6E	P	2 12 500															
47	172234Z	15.0N 121.1E	SAT	(T3.0/3.0 /S															
48	172237Z	14.6N 121.4E	SAT	(T3.0/3.0 /D1.0/24HMS)															
49	172237Z	14.2N 121.9E	SAT	(T4.0/4.0 /D1.0/24HMS)															
50	180013Z	15.4N 120.9E	SAT	(IR DATA															
51	180422Z	15.6N 121.2E	P	5 10 700															
52	180430Z	15.5N 121.3E	LMUR																
53	181030Z	16.2N 118.7E	P	5 5 700															
54	181102Z	15.8N 118.1E	SAT	(IR DATA															
55	181102Z	15.8N 118.7E	SAT	(IR DATA															
56	181121Z	16.3N 118.0E	SAT	(IR DATA															
57	181249Z	16.1N 117.6E	SAT	(IR DATA															
58	181544Z	16.4N 117.2E	SAT	(IR DATA															
59	181544Z	16.3N 117.2E	SAT	(IR DATA															
60	181544Z	16.0N 116.1E	SAT	(IR DATA															
61	181623Z	16.3N 117.3E	P	3 12 700															
62	182130Z	17.0N 116.3E	P	2 5 700															
63	182221Z	16.9N 115.7E	SAT	(T3.5/3.5 /D0.5/24HMS)															
64	190006Z	17.1N 116.0E	SAT	(IR DATA															
65	190054Z	17.0N 116.0E	SAT	(T3.5/3.5 /															
66	190125Z	17.0N 115.4E	SAT	(IR DATA															
67	190428Z	17.0N 114.9E	SAT	(T4.0/4.0 /S															
68	190432Z	16.9N 114.0E	P	10 6 700															
69	191102Z	17.2N 113.7E	SAT	(IR DATA															
70	191102Z	16.9N 112.3E	SAT	(IR DATA															
71	191102Z	17.3N 112.7E	SAT	(IR DATA															
72	191205Z	17.1N 112.9E	SAT	(IR DATA															
73	191359Z	17.6N 112.0E	SAT	(IR DATA															
74	191528Z	17.3N 112.4E	SAT	(IR DATA															
75	191528Z	17.7N 112.4E	SAT	(IR DATA															
76	192345Z	17.6N 112.2E	SAT	(T5.0/5.0 /D1.0/20HMS)															
77	200010Z	17.4N 111.5E	SAT	(T4.5/4.5 /D1.0/23HMS)															
78	200412Z	17.7N 112.7E	SAT	(T5.0/5.0 /															
79	200411Z	18.4N 111.8E	SAT	(T4.0/4.0 /															
80	200411Z	18.1N 111.7E	SAT	(IR DATA															
81	201227Z	18.8N 110.1E	SAT	(IR DATA															
82	201652Z	19.1N 108.7E	SAT	(IR DATA															
83	201652Z	19.1N 109.7E	SAT	(IR DATA															
84	202327Z	20.3N 108.8E	SAT	(T3.0/4.0 /W1.0/19HMS)															
85	202327Z	20.2N 108.8E	SAT	(T4.5/5.0 /W0.5/24HMS)															
86	210154Z	20.5N 108.0E	SAT	(T3.5/4.5 /W1.5/23HMS)															
87	210352Z	20.4N 107.6E	SAT	(IR DATA															
88	210352Z	20.4N 107.8E	SAT	(IR DATA															
89	211208Z	21.2N 105.6E	SAT	(IR DATA															
90	211210Z	20.8N 105.4E	SAT	(IR DATA															

LYPHOON THELMA
 FIX POSITIONS FOR CYCLONE NO. 6
 0000Z 21 JUL 10 0000Z 26 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACCRY	FIX LVL	MAX OBS			MAX UHS			UHS MIN SLP	MIN 700MB MG1	FLT LVL TI/TU	EYE FORM	UMIEN- TATION	EYE DIA	POSIT OF HADAM	MSW NMBR
						UIN	VEL	BRG	RNG	SFL	WIND									VEL	BRG	RNG
1	192203Z	13.0N 129.5E	SAI	(T 0 / 0 /															
2	192203Z	13.7N 129.5E	SAI	(T 0 / 0 /															
3	192203Z	13.6N 133.7E	SAI	(T1.0/1.0 /															
4	200145Z	13.8N 130.1E	SAI	(IR DATA															
5	200229Z	13.5N 133.4E	SAI	(IR DATA															
6	201040Z	13.2N 132.1E	SAI	(IR DATA															
7	201121Z	14.5N 131.2E	SAI	(IR DATA															
8	201125Z	15.0N 131.5E	SAI	(IR DATA															
9	202146Z	14.4N 130.9E	SAI	(T2.0/2.0 /D2.0/24HMS)															
10	202146Z	14.2N 130.5E	SAI	(T2.0/2.0 /D2.0/24HMS)															
11	202146Z	14.9N 130.0E	SAI	(T2.0/2.0 /D1.0/24HMS)															
12	202357Z	14.6N 130.2E	SAI	(IR DATA															
13	210211Z	14.8N 129.7E	SAI	(IR DATA															
14	210211Z	15.4N 129.9E	SAI	(IR DATA															
15	210211Z	15.3N 129.8E	SAI	(IR DATA															
16	210217Z	15.6N 128.5E	P	1 5 700 170 50 130 150 55 130															
17	211027Z	15.6N 128.2E	SAI	(IR DATA															
18	211027Z	15.6N 128.6E	SAI	(IR DATA															
19	211027Z	15.7N 128.3E	SAI	(IR DATA															
20	211054Z	15.6N 128.2E	P	3 10 700 - - - - -															
21	211234Z	15.5N 127.4E	SAI	(IR DATA															
22	211234Z	15.2N 127.3E	SAI	(IR DATA															
23	211453Z	15.7N 127.7E	SAI	(IR DATA															
24	211453Z	15.3N 127.7E	SAI	(IR DATA															
25	211511Z	15.5N 128.0E	P	3 10 700 290 33 210 50 - -															
26	212120Z	15.9N 127.7E	SAI	(T3.5/3.5 /D1.5/24HMS)															
27	212120Z	15.9N 128.0E	SAI	(T3.0/3.0 /D1.0/24HMS)															
28	212120Z	16.9N 127.7E	SAI	(T3.0/3.0 /D1.0/24HMS)															
29	220110Z	16.1N 127.7E	SAI	(IR DATA															
30	220331Z	16.4N 126.7E	P	5 5 700 190 40 150 220 50 180															
31	220335Z	17.2N 127.1E	SAI	(IR DATA															
32	220335Z	16.5N 126.9E	SAI	(IR DATA															
33	221011Z	17.0N 125.7E	SAI	(IR DATA															
34	221011Z	17.5N 125.9E	SAI	(IR DATA															
35	221033Z	17.1N 125.4E	SAI	(IR DATA															
36	22115 7	17.3N 125.1E	SAI	(IR DATA															
37	221435Z	17.0N 125.0E	SAI	(IR DATA															
38	221434Z	17.3N 124.9E	SAI	(IR DATA															
39	221544Z	17.0N 124.4E	P	3 5 700 200 55 110 50 - -															
40	222057Z	17.3N 124.3E	P	3 3 700 40 60 360 8 - -															
41	222253Z	17.7N 124.1E	SAI	(T4.0/4.0 /D1.0/25HMS)															
42	222254Z	17.5N 124.2E	SAI	(T4.0/4.0 /D1.0/25HMS)															
43	222254Z	17.5N 124.2E	SAI	(T4.0/4.0 / / HMS)															
44	222314Z	17.6N 123.8E	SAI	(IR DATA															
45	230024Z	17.7N 123.8E	SAI	(T4.5/4.5 / / HMS)															
46	230216Z	17.6N 122.5E	SAI	(T4.5/4.5 / / HMS)															
47	230300Z	17.5N 123.4E	LHUR	- 3260/															
48	230314Z	18.1N 123.5E	SAI	(IR DATA															
49	230317Z	18.2N 123.4E	SAI	(T4.0/4.0 / / HMS)															
50	230317Z	17.9N 123.5E	SAI	(IR DATA															
51	230317Z	18.2N 123.5E	SAI	(IR DATA															
52	230317Z	18.1N 123.4E	SAI	(IR DATA															
53	230322Z	18.1N 123.4E	P	3 4 700 120 84 50 15 100 50															
54	230400Z	17.7N 123.3E	LHUR	- 20610															
55	230500Z	17.8N 123.2E	LHUR	- 21640															
56	230600Z	18.0N 123.1E	LHUR	- 21610															
57	230700Z	18.4N 122.6E	LHUR	- 20611															
58	230800Z	18.6N 122.5E	LHUR	- 20451															
59	231104Z	18.3N 122.2E	SAI	(IR DATA															
60	231134Z	18.8N 122.2E	SAI	(IR DATA															
61	231135Z	18.8N 122.5E	SAI	(IR DATA															
62	231201Z	18.8N 122.5E	SAI	(IR DATA															
63	231202Z	18.8N 122.3E	SAI	(IR DATA															
64	231302Z	18.7N 122.1E	SAI	(IR DATA															
65	231554Z	19.0N 121.8E	SAI	(IR DATA															
66	231554Z	19.0N 121.5E	P	2 2 700 180 60 140 30 - -															
67	231600Z	19.0N 121.5E	SAI	(IR DATA															
68	231600Z	19.2N 121.8E	SAI	(IR DATA															
69	232135Z	19.6N 120.9E	P	1 3 700 340 55 270 40 75 270															
70	232234Z	19.5N 121.0E	SAI	(IR DATA															
71	23223 7	19.3N 120.7E	SAI	(T5.0/5.0 /D1.0/24HMS)															
72	232305Z	19.4N 120.9E	SAI	(T5.0/5.0 / / HMS)															
73	23230 7	19.4N 121.1E	SAI	(T5.0/5.0 /D1.0/24HMS)															
74	240100Z	19.6N 120.7E	LHUR	- 51111															
75	240100Z	19.7N 120.4E	LHUR	- 51111															
76	240131Z	18.6N 120.2E	SAI	(T5.0/5.0 /D0.5/23HMS)															
77	240134Z	19.7N 120.7E	SAI	(IR DATA															
78	240200Z	19.7N 120.4E	LHUR	-															
79	240300Z	19.8N 120.3E	SAI	(IR DATA															
80	240300Z	19.8N 120.3E	SAI	(T5.0/5.0 /D1.0/24HMS)															
81	240300Z	19.9N 120.2E	SAI	(IR DATA															
82	240500Z	19.8N 120.2E	LHUR	- 51111															
83	240500Z	19.9N 120.2E	LHUR	- 51111															
84	240700Z	20.0N 120.1E	LHUR	- 51111															
85	240900Z	20.3N 119.4E	LHUR	- 51111															
86	240942Z	20.5N 119.4E	P	3 5 700 270 80 190 15 80 310															
87	241100Z	20.5N 119.7E	LHUR	- 51111															
88	241114Z	20.1N 119.5E	SAI	(IR DATA															
89	241150Z	20.1N 119.4E	SAI	(IR DATA															
90	241150Z	20.1N 119.7E	SAI	(IR DATA															

91	241200Z	20.5N	119.6E	LRUR	- 4////						
92	241218Z	20.5N	119.6E	SAT	(IR DATA)	)	PCN 3 NOAA-5			-	-
93	241249Z	20.6N	119.6E	SAT	(IR DATA)	)	NOAA-5	(CONF 02)			
94	241400Z	20.6N	119.6E	LRUR	- 4////					-	-
95	241542Z	22.0N	119.6E	SAT	(IR DATA)	)	PCN 3 UMSP				
96	241542Z	20.7N	119.3E	SAT	(IR DATA)	)	PCN 3 UMSP				
97	241600Z	21.0N	119.8E	LRDR	- 4////					-	-
98	241700Z	22.1N	119.8E	LRUR	- 4////					-	-
99	241800Z	21.4N	119.8E	LRDR	- 1020//					-	-
100	242219Z	21.8N	120.0E	SAT	(15.0/5.0-/5	/23HRS)	PCN 1 UMSP				
101	242219Z	21.6N	120.2E	SAT	(15.0/5.0 /5	/24HRS)	PCN 1 UMSP				
102	242253Z	22.0N	120.1E	SAT	(IR DATA)	)	PCN 1 UMSP				
103	242253Z	22.2N	120.1E	SAT	(IR DATA)	)	PCN 1 UMSP				
104	242300Z	21.7N	119.9E	LRDR	- 10535					-	-
105	250045Z	22.7N	120.0E	SAT	(14.5/4.5 /WJ.5/23HRS)	)	NOAA-5	(CONF 01)			
106	250054Z	22.4N	120.4E	SAT	(IR DATA)	)	PCN 1 NOAA-5				
107	250242Z	22.0N	122.3E	SAT	(15.0/5.0 / / HRS)	)	PCN 1 UMSP				
108	250243Z	22.9N	120.2E	SAT	(IR DATA)	)	PCN 3 UMSP				
109	250243Z	23.1N	120.1E	SAT	(14.0/5.0-/W1.0/24HRS)	)	PCN 3 UMSP				
110	250243Z	22.9N	120.3E	SAT	(15.0/5.0 /5	/28HRS)	PCN 3 UMSP				
111	251101Z	24.1N	120.1E	SAT	(IR DATA)	)	PCN 6 UMSP				
112	251101Z	24.1N	120.2E	SAT	(IR DATA)	)	PCN 6 UMSP				
113	251134Z	24.0N	119.9E	SAT	(IR DATA)	)	PCN 5 NOAA-5				
114	251138Z	24.0N	120.0E	SAT	(IR DATA)	)	PCN 3 UMSP				
115	251142Z	23.7N	121.0E	SAT	(IR DATA)	)	NOAA-5	(CONF 01)			
116	251524Z	25.8N	122.2E	SAT	(IR DATA)	)	PCN 5 UMSP				
117	251525Z	25.3N	120.0E	SAT	(IR DATA)	)	PCN 6 UMSP				
118	252202Z	27.1N	119.5E	SAT	(12.5/3.5-/W2.5/24HRS)	)	PCN 5 UMSP				
119	252202Z	26.1N	119.8E	SAT	(13.5/4.5-/W1.5/24HRS)	)	PCN 6 UMSP				
120	252202Z	26.6N	120.4E	SAT	(13.5/4.5-/W1.5/19HRS)	)	PCN 6 UMSP				
121	252202Z	27.1N	119.6E	SAT	(IR DATA)	)	PCN 6 UMSP				
122	260001Z	26.0N	121.6E	SAT	(13.5/4.0 /W1.0/23HRS)	)	NOAA-5	(CONF 01)			
123	260010Z	27.4N	119.3E	SAT	(IR DATA)	)	PCN 5 NOAA-5				
124	260225Z	28.1N	119.4E	SAT	(IR DATA)	)	PCN 5 UMSP				
125	260227Z	28.3N	119.5E	SAT	(IR DATA))	PCN 3 UMSP				
126	270123Z	33.1N	116.5E	SAT	(IR DATA))	PCN 5 NOAA-5				

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FLEET WEATHER CENTRAL/JOINT TYPHOON WARNING CENTER FP--ETC F/G 4/2
ANNUAL TYPHOON REPORT 1977.(U)
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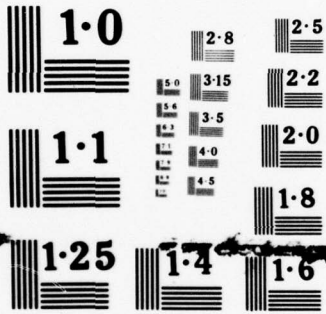
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NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

91	3020007	24.1N 124.1E	LHUR	- 11631	-	-	-	-	-	-	-	24.0N 124.2E	-
92	3020007	24.1N 124.2E	LHUR	- 11613	-	-	-	-	-	-	-	24.0N 124.3E	-
93	3021007	24.3N 124.1E	LHUR	- 10575	-	-	-	-	-	-	-	24.0N 121.0E	-
94	3021002	24.2N 124.1E	LHUR	- 10511	-	-	-	-	-	-	-	24.0N 124.2E	-
95	3021002	24.1N 124.0E	LHUR	- 11613	-	-	-	-	-	-	-	24.0N 125.3E	-
96	3021427	24.2N 124.0E	P	3 5 700	20V 105 160 20	-	-	-	420	247	20 12	CIMC	15
97	3022002	24.4N 124.0E	LHUR	- 10382	-	-	-	-	-	-	-	24.0N 121.0E	-
98	3022007	24.3N 124.0E	LHUR	- 12511	-	-	-	-	-	-	-	24.0N 124.2E	-
99	3022002	24.3N 124.0E	LHUR	- 10511	-	-	-	-	-	-	-	24.0N 125.3E	-
100	3022192	24.2N 124.0E	SAT	(16.5/6.0 / D1.0 / 21HRS)	PCN 1	UMSP	-	-	-	-	-	-	-
101	3022192	24.3N 123.9E	SAT	(16.0/6.0 / D1.0 / 24HRS)	PCN 1	UMSP	-	-	-	-	-	-	-
102	3023002	24.4N 123.4E	LHUR	- 10492	-	-	-	-	-	-	-	24.0N 121.0E	-
103	3023002	24.4N 123.4E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 124.2E	-
104	3023007	24.3N 123.4E	LHUR	- 10612	-	-	-	-	-	-	-	24.0N 125.3E	-
105	3023222	24.1N 123.6E	SAT	(1R DATA)	PCN 1	UMSP	-	-	-	-	-	-	-
106	3100002	24.4N 123.7E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 124.2E	-
107	3100002	24.4N 123.4E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 125.3E	-
108	3100152	24.8N 123.9E	SAT	(16.0/6.0 / D1.0 / 23HRS)	NOAA-5	(CONF 01)	-	-	-	-	-	-	-
109	3100237	24.5N 123.7E	SAT	(1R DATA)	PCN 1	NOAA-5	-	-	-	-	-	-	-
110	3101002	24.5N 123.6E	LHUR	- 12512	-	-	-	-	-	-	-	24.0N 124.2E	-
111	3101007	24.5N 123.6E	LHUR	- 10513	-	-	-	-	-	-	-	24.0N 125.3E	-
112	3101402	24.5N 123.7E	LHUR	- 11533	-	-	-	-	-	-	-	24.0N 121.0E	-
113	3102002	24.6N 123.5E	LHUR	- 11512	-	-	-	-	-	-	-	24.0N 121.0E	-
114	3102002	24.6N 123.5E	LHUR	- 10413	-	-	-	-	-	-	-	24.0N 124.2E	-
115	3102002	24.6N 123.5E	LHUR	- 11513	-	-	-	-	-	-	-	24.0N 125.3E	-
116	3102342	24.8N 123.4E	SAT	(16.5/6.0 / D1.0 / 28HRS)	PCN 1	UMSP	-	-	-	-	-	-	-
117	3102342	24.8N 123.5E	SAT	(1R DATA)	PCN 1	UMSP	-	-	-	-	-	-	-
118	3103002	24.8N 123.3E	LHUR	- 11513	-	-	-	-	-	-	-	24.0N 121.0E	-
119	3103002	24.7N 123.3E	LHUR	- 11511	-	-	-	-	-	-	-	24.0N 124.2E	-
120	3103002	24.7N 123.4E	LHUR	- 10533	-	-	-	-	-	-	-	24.0N 125.3E	-
121	3104002	24.8N 123.1E	LHUR	- 10511	-	-	-	-	-	-	-	24.0N 124.2E	-
122	3104002	24.8N 123.1E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 125.3E	-
123	3105007	24.9N 122.9E	LHUR	- 11573	-	-	-	-	-	-	-	24.0N 121.0E	-
124	3105007	24.9N 122.9E	LHUR	- 11512	-	-	-	-	-	-	-	24.0N 124.2E	-
125	3105007	24.9N 122.9E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 125.3E	-
126	3106007	25.0N 122.7E	LHUR	- 10512	-	-	-	-	-	-	-	24.0N 124.2E	-
127	3106007	24.9N 122.7E	LHUR	- 11634	-	-	-	-	-	-	-	24.0N 125.3E	-
128	3107007	25.1N 122.6E	LHUR	- 10482	-	-	-	-	-	-	-	24.0N 121.0E	-
129	3107007	25.0N 122.5E	LHUR	- 12612	-	-	-	-	-	-	-	24.0N 124.2E	-
130	3107007	25.0N 122.5E	LHUR	- 12634	-	-	-	-	-	-	-	24.0N 125.3E	-
131	3104002	25.2N 122.3E	LHUR	- 10412	-	-	-	-	-	-	-	24.0N 121.0E	-
132	3104002	25.2N 122.3E	LHUR	- 25142	-	-	-	-	-	-	-	24.0N 124.2E	-
133	3104007	25.1N 122.2E	LHUR	- 20643	-	-	-	-	-	-	-	24.0N 125.3E	-
134	3104202	25.2N 122.0E	LHUR	- 25761	-	-	-	-	-	-	-	24.0N 121.0E	-
135	3105507	25.2N 121.9E	P	3 3 700	15U 78 60 15	-	-	-	931	247	20 15	ELIP	E-W 12X10
136	3104002	25.0N 122.0E	LHUR	- 711/5	-	-	-	-	-	-	-	24.0N 125.3E	-
137	3110007	25.2N 121.0E	LHUR	- 20711	-	-	-	-	-	-	-	24.0N 124.2E	-
138	3111007	25.2N 121.3E	SAT	(1R DATA)	PCN 2	UMSP	-	-	-	-	-	-	-
139	3111002	25.0N 121.5E	SAT	(1R DATA)	PCN 1	UMSP	-	-	-	-	-	-	-
140	3111007	25.3N 121.4E	LHUR	- 55111	-	-	-	-	-	-	-	24.0N 124.2E	-
141	3112007	25.3N 121.4E	LHUR	- 51111	-	-	-	-	-	-	-	22.0N 120.3E	-
142	3112007	25.1N 122.2E	SAT	(1R DATA)	PCN 2	UMSP	-	-	-	-	-	-	-
143	3112072	24.9N 121.1E	SAT	(1R DATA)	PCN 1	UMSP	-	-	-	-	-	-	-
144	3112072	24.8N 121.0E	SAT	(1R DATA)	PCN 1	UMSP	-	-	-	-	-	-	-
145	3112507	24.4N 121.5E	SAT	(1R DATA)	PCN 4	NOAA-5	-	-	-	-	-	-	-
146	3113072	24.0N 121.0E	SAT	(1R DATA)	NOAA-5	(CONF 02)	-	-	-	-	-	-	-
147	3114002	25.1N 121.0E	LHUR	- 51111	-	-	-	-	-	-	-	22.0N 120.3E	-
148	3115007	24.8N 120.7E	LHUR	- 41111	-	-	-	-	-	-	-	22.0N 120.3E	-
149	3115207	25.3N 120.4E	SAT	(1R DATA)	PCN 3	UMSP	-	-	-	-	-	-	-
150	3115202	25.3N 120.7E	SAT	(1R DATA)	PCN 3	UMSP	-	-	-	-	-	-	-
151	3117002	24.8N 120.4E	LHUR	- 20811	-	-	-	-	-	-	-	22.0N 120.3E	-
152	3122017	24.9N 119.5E	SAT	(14.0/5.0 / W2.5 / 24HRS)	PCN 1	UMSP	-	-	-	-	-	-	-
153	3122017	25.0N 119.5E	SAT	(14.5/5.5 / W1.5 / 24HRS)	PCN 1	UMSP	-	-	-	-	-	-	-
154	0101002	24.9N 119.1E	LHUR	- 11412	-	-	-	-	-	-	-	22.0N 120.3E	-
155	0101262	24.8N 119.1E	SAT	(15.0/5.5 / W1.0 / 25HRS)	NOAA-5	(CONF 01)	-	-	-	-	-	-	-
156	0101367	25.1N 119.0E	SAT	(1R DATA)	PCN 3	NOAA-5	-	-	-	-	-	-	-
157	0102007	25.0N 118.5E	LHUR	- 50111	-	-	-	-	-	-	-	-	-
158	0110437	25.0N 118.3E	SAT	(1R DATA)	PCN 6	UMSP	-	-	-	-	-	-	-
159	0112277	23.6N 118.0E	SAT	(1R DATA)	NOAA-5	(CONF 01)	-	-	-	-	-	-	-
160	0200527	25.2N 113.0E	SAT	(1R DATA)	PCN 5	NOAA-5	-	-	-	-	-	-	-

INOUPICAL STORM #ANUA
 FIX POSITIONS FOR CYCLONE NO. 8
 0600Z 31 JUL TO 0600Z 04 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	FLT DIM	OBS VEL	MAX OBS WIND BRG	MAX OBS SFC WIND BRG	OBS MIN SLP	MIN 700MB MG!	FLT LVL TI/TO	EYE FORM	ORIENT- IATION	EYE DIA	POSIT OF RAUAF	MSN NMBR
1	291414Z	19.9N 140.3E	SAT	(IR DATA	)				PCN 5 UMSP								
2	292311Z	23.0N 139.5E	SAT	(T 0/ 70 /	/	HMS)			PCN 5 NOAA-5								
3	300036Z	22.6N 139.5E	SAT	(IR DATA	)				PCN 6 UMSP								
4	310014Z	23.7N 141.0E	SAT	(T1.5/1.5 /	/	HMS)			NOAA-5								(CONF 02)
5	310023Z	23.0N 141.0E	SAT	(T2.0/2.0 /D2.0/25HMS)					PCN 5 NOAA-5								
6	310239Z	23.2N 140.3E	SAT	(IR DATA	)				PCN 5 UMSP								
7	310918Z	23.7N 140.5E	SAT	(IR DATA	)				PCN 6 UMSP								
8	310919Z	25.8N 140.3E	SAT	(IR DATA	)				PCN 6 UMSP								
9	3111.3Z	24.1N 141.5E	SAT	(IR DATA	)				PCN 5 NOAA-5								
10	311103Z	23.6N 140.0E	SAT	(IR DATA	)				PCN 6 NOAA-5								
11	31111.2Z	23.6N 141.5E	SAT	(IR DATA	)				NOAA-5								(CONF 02)
12	311339Z	25.0N 141.9E	SAT	(IR DATA	)				PCN 6 UMSP								
13	311339Z	26.3N 142.3E	SAT	(IR DATA	)				PCN 6 UMSP								
14	312027Z	24.8N 141.0E	SAT	(IR DATA	)				PCN 6 UMSP								
15	312326Z	24.5N 140.3E	P	5 15 700	-	-	-	-	45 40	90	996	300	13	-	CIMC		1
16	31233.7Z	26.4N 141.4E	SAT	(T2.5/2.5 /D1.0/23HMS)					NOAA-5								(CONF 01)
17	312339Z	25.2N 141.2E	SAT	(T3.0/3.0 /D1.0/23HMS)					PCN 5 NOAA-5								
18	010004Z	25.8N 140.5E	P	10 10 700	-	-	-	-	45 50	80	994	300	13	-	CIMC		1
19	010302Z	26.0N 140.1E	P	5 10 700	80	43	360		65 25 270	40	993	300	13	13	CIMC		1
20	010901Z	25.1N 141.0E	SAT	(IR DATA	)				PCN 6 UMSP								
21	010902Z	25.8N 141.6E	SAT	(IR DATA	)				PCN 6 UMSP								
22	011013Z	25.9N 141.5E	SAT	(IR DATA	)				PCN 6 UMSP								
23	011019Z	26.1N 142.0E	SAT	(IR DATA	)				PCN 6 NOAA-5								
24	011043Z	26.5N 139.8E	SAT	(IR DATA	)				PCN 6 UMSP								
25	011503Z	26.8N 141.8E	SAT	(IR DATA	)				PCN 5 UMSP								
26	011503Z	26.7N 140.4E	SAT	(IR DATA	)				PCN 4 UMSP								
27	011628Z	27.2N 141.1E	P	8 10 700	210	40	120		- - -	993	300	13	13	-	- - -		2
28	012003Z	27.4N 140.7E	SAT	(IR DATA	)				PCN 5 UMSP								
29	012043Z	27.6N 140.3E	P	2 5 700	160	20	60		25 30 60	25	992	300	14	13	-	- - -	3
30	012144Z	27.8N 140.4E	SAT	(T3.0/3.0 /	/	HMS)			PCN 3 UMSP								
31	012144Z	27.8N 140.5E	SAT	(T3.0/3.0 /	/	HMS)			PCN 3 UMSP								
32	012245Z	27.2N 140.4E	SAT	(T2.5/2.5 /S	/	23HMS)			NOAA-5								(CONF 01)
33	012255Z	27.8N 140.4E	SAT	(IR DATA	)				PCN 3 NOAA-5								
34	020052Z	27.7N 140.4E	SAT	(IR DATA	)				PCN 3 NOAA-5								
35	020203Z	27.5N 140.5E	SAT	(IR DATA	)				PCN 3 UMSP								
36	020203Z	27.6N 140.5E	SAT	(IR DATA	)				PCN 3 UMSP								
37	020957Z	28.2N 142.4E	P	10 5 700	240	35	200		10 45 150	10	990	300	16	15	CIMC		4
38	021026Z	28.2N 142.5E	SAT	(IR DATA	)				PCN 5 UMSP								
39	021026Z	28.4N 142.5E	SAT	(IR DATA	)				PCN 3 UMSP								
40	021132Z	27.8N 142.2E	SAT	(IR DATA	)				PCN 5 NOAA-5								
41	021132Z	28.2N 143.0E	SAT	(IR DATA	)				PCN 6 NOAA-5								
42	021445Z	28.6N 142.7E	SAT	(IR DATA	)				PCN 5 UMSP								
43	021445Z	28.3N 143.0E	SAT	(IR DATA	)				PCN 4 UMSP								
44	022120Z	30.0N 143.5E	P	2 2 700	290	30	190		10 - -	-	986	290	14	11	-	- - -	5
45	022127Z	29.7N 143.4E	SAT	(T3.0/3.0 /S	/	24HMS)			PCN 5 UMSP								
46	022127Z	29.3N 143.4E	SAT	(T2.5/2.5 /	/	HMS)			PCN 3 UMSP								
47	022200Z	29.8N 143.7E	SAT	(T3.0/3.0 /D0.5/23HMS)					NOAA-5								(CONF 01)
48	030004Z	30.0N 143.3E	SAT	(IR DATA	)				PCN 3 NOAA-5								
49	030144Z	30.2N 143.5E	SAT	(IR DATA	)				PCN 3 UMSP								
50	030146Z	30.3N 143.5E	SAT	(T2.5/3.0 /W0.5/28HMS)					PCN 3 UMSP								
51	031009Z	30.5N 143.9E	SAT	(IR DATA	)				PCN 5 UMSP								
52	031009Z	30.8N 144.3E	SAT	(IR DATA	)				PCN 6 UMSP								
53	031048Z	29.5N 143.4E	SAT	(IR DATA	)				PCN 5 NOAA-5								
54	031056Z	29.4N 144.3E	SAT	(IR DATA	)				NOAA-5								(CONF 02)
55	031213Z	30.6N 145.8E	P	4 6 700	350	30	270		15 - -	-	991	300	16	16	-	- - -	6
56	031428Z	29.9N 145.3E	SAT	(IR DATA	)				PCN 5 UMSP								
57	031428Z	30.0N 145.4E	SAT	(IR DATA	)				PCN 6 UMSP								
58	032110Z	31.0N 146.1E	SAT	(T1.0/2.0 /W2.0/24HMS)					PCN 3 UMSP								
59	032110Z	31.0N 146.8E	SAT	(T1.0/2.0 /W1.5/20HMS)					PCN 3 UMSP								
60	032313Z	31.7N 146.5E	SAT	(T1.5/2.0 /W1.5/25HMS)					NOAA-5								(CONF 01)
61	032324Z	31.1N 146.2E	SAT	(IR DATA	)				PCN 3 NOAA-5								
62	040124Z	31.2N 146.5E	SAT	(IR DATA	)				PCN 3 UMSP								
63	040124Z	31.0N 146.6E	SAT	(IR DATA	)				PCN 3 UMSP								
64	040952Z	31.4N 146.9E	SAT	(IR DATA	)				PCN 6 UMSP								
65	041014Z	32.0N 147.0E	SAT	(IR DATA	)				NOAA-5								(CONF 02)
66	042039Z	32.1N 148.1E	SAT	(T 0/1.5 /W1.0/24HMS)					PCN 3 UMSP								
67	042053Z	31.8N 148.3E	SAT	(IR DATA	)				PCN 3 UMSP								
68	042229Z	32.2N 149.0E	SAT	(T1.0/1.5 /W0.5/23HMS)					NOAA-5								(CONF 01)
69	042239Z	31.7N 148.5E	SAT	(IR DATA	)				PCN 3 NOAA-5								
70	050034Z	31.6N 148.4E	SAT	(IR DATA	)				PCN 3 NOAA-5								
71	050419Z	31.4N 148.8E	SAT	(IR DATA	)				PCN 6 NOAA-5								
72	061037Z	34.2N 153.0E	SAT	(IR DATA	)				PCN 6 NOAA-5								
73	052352Z	33.7N 150.4E	SAT	(T 0/ 0 /S	/	27HMS)			PCN 3 UMSP								

TROPICAL STORM AMY
FIX POSITIONS FOR CYCLONE NO. 9
0000Z 20 AUG TO 1800Z 23 AUG

FLX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	UNIDEN- IATION	EYE DIA	PUSII UP RADAR	MSH NMBH		
						DIR	VEL	BRG	RNG	VEL	BRG									RNG	
1	172300Z	19.9N 128.4E	P	10	5	700	260	30	180	20	30	180	20	996	-	27	25	-	-	-	1
2	180050Z	20.2N 127.7E	P	5	10	700	130	18	30	40	35	90	60	1001	30Z	13	14	-	-	-	1
3	190151Z	21.0N 122.0E	SAT				(T1.5/1.5 /														
4	190250Z	22.0N 121.1E	SAT				(T1.5/1.5 /														
5	191040Z	20.9N 119.8E	SAT				(IR DATA														
6	191139Z	21.0N 119.5E	SAT				(IR DATA														
7	191239Z	20.6N 120.7E	SAT				(IR DATA														
8	192142Z	20.6N 121.0E	SAT				(T1.0/1.0 /														
9	192200Z	20.7N 120.9E	LRDR				- 40274														
10	192300Z	20.7N 120.8E	LRDR				- 45/5/														
11	200100Z	20.7N 120.6E	LRDR				- 1011/														
12	200107Z	21.5N 121.0E	SAT				(T1.5/1.5 /S														
13	200115Z	20.6N 120.6E	SAT				(IR DATA														
14	200200Z	20.7N 120.6E	LRDR				- 1022/														
15	200300Z	20.7N 120.6E	LRDR				- 25/1/														
16	200333Z	20.7N 120.0E	SAT				(T1.0/1.0 /														
17	200333Z	20.8N 119.9E	SAT				(T1.0/1.0 /														
18	200400Z	20.7N 120.5E	LRDR				- 1/1/1/														
19	200700Z	21.3N 120.5E	LRDR				- 1/1/1/														
20	200800Z	21.3N 120.2E	LRDR				- 1/1/1/														
21	201000Z	21.3N 120.1E	LRDR				- 1/1/1/														
22	201024Z	20.0N 118.4E	SAT				(IR DATA														
23	201024Z	21.8N 119.3E	SAT				(IR DATA														
24	201030Z	21.2N 120.1E	P	2	2	1500	40	40	310	10	35	310	10	986	-	25	26	-	-	-	2
25	201100Z	21.3N 119.9E	LRDR				- 1/1/1/														
26	201127Z	20.2N 118.7E	SAT				(IR DATA														
27	201155Z	21.0N 119.6E	SAT				(IR DATA														
28	201200Z	21.4N 119.8E	LRDR				- 1/1/1/														
29	201202Z	21.5N 119.0E	SAT				(IR DATA														
30	201205Z	21.0N 119.2E	SAT				(IR DATA														
31	201300Z	21.3N 119.3E	LRDR				- 1/1/1/														
32	201400Z	21.3N 119.0E	LRDR				- 1/1/1/														
33	201500Z	20.7N 119.0E	LRDR				- 1/1/1/														
34	201615Z	20.4N 118.6E	SAT				(IR DATA														
35	201615Z	20.0N 118.1E	SAT				(IR DATA														
36	202230Z	20.8N 117.7E	SAT				(IR DATA														
37	202300Z	20.3N 118.3E	LRDR				- 4/1/1/														
38	202306Z	20.7N 117.3E	SAT				(IR DATA														
39	202306Z	20.4N 117.8E	SAT				(IR DATA														
40	202306Z	19.0N 118.0E	SAT				(T2.5/2.5 /D1.0/20HRS)														
41	210031Z	20.7N 117.9E	SAT				(T2.0/2.0 /														
42	210100Z	20.4N 118.3E	LRDR				- 4/1/1/														
43	210200Z	20.4N 118.3E	LRDR				- 4/1/1/														
44	210300Z	20.9N 119.0E	LRDR				- 1/1/1/														
45	210315Z	20.7N 119.3E	SAT				(IR DATA														
46	210315Z	20.8N 119.2E	SAT				(T2.0/2.0 /														
47	210315Z	20.5N 119.3E	SAT				(T2.5/2.5 /D1.5/24HRS)														
48	210315Z	20.3N 119.4E	SAT				(T1.0/1.0 /S														
49	210315Z	21.0N 119.1E	SAT				(IR DATA														
50	211000Z	22.6N 119.4E	LRDR				- 1010Z														
51	211100Z	22.6N 119.1E	LRDR				- 1011/														
52	211111Z	21.8N 118.9E	SAT				(IR DATA														
53	211115Z	22.0N 118.9E	SAT				(IR DATA														
54	211115Z	22.5N 118.4E	SAT				(IR DATA														
55	211149Z	21.2N 119.1E	SAT				(IR DATA														
56	211149Z	22.4N 118.9E	SAT				(IR DATA														
57	211200Z	22.5N 118.9E	LRDR				- 4/1/1/														
58	211300Z	22.3N 118.7E	LRDR				- 4/1/1/														
59	211400Z	22.2N 118.6E	LRDR				- 4/1/1/														
60	211557Z	21.3N 118.8E	SAT				(IR DATA														
61	211557Z	22.3N 119.3E	SAT				(IR DATA														
62	211600Z	22.2N 118.8E	LRDR				- 4/1/1/														
63	211700Z	22.2N 118.8E	LRDR				- 4/1/1/														
64	211800Z	21.9N 118.9E	LRDR				- 4/1/1/														
65	212000Z	22.2N 119.5E	LRDR				- 4/1/1/														
66	212200Z	22.0N 119.5E	LRDR				- 1140/														
67	212214Z	23.2N 118.9E	SAT				(T2.0/2.0 /														
68	212244Z	22.1N 118.0E	SAT				(T2.0/2.5 /W0.5/24HRS)														
69	212249Z	22.6N 119.6E	SAT				(T2.5/ 2.5- /D1.5/ 24 HRS)														
70	212249Z	23.0N 119.9E	SAT				(T2.0/2.0 /D1.0/20HRS)														
71	220100Z	22.3N 120.0E	LRDR				- 1/1/1/														
72	220134Z	24.0N 120.1E	SAT				(T2.0/2.0 /														
73	220143Z	23.5N 120.2E	SAT				(IR DATA														
74	220200Z	22.4N 120.3E	LRDR				- 1/1/1/														
75	220254Z	23.7N 119.8E	SAT				(IR DATA														
76	220254Z	23.9N 119.6E	SAT				(T2.5/2.5 /D0.5/24HRS)														
77	220300Z	22.3N 120.3E	LRDR				- 1/1/1/														
78	220500Z	22.1N 120.2E	LRDR				- 1/1/1/														
79	220600Z	22.1N 120.3E	LRDR				- 1/1/1/														
80	220700Z	23.5N 119.8E	LRDR				- 1/1/1/														
81	221100Z	24.2N 121.1E	LRDR				- 1/1/1/														
82	221103Z	24.5N 120.3E	SAT				(IR DATA														
83	221103Z	25.5N 120.1E	SAT				(IR DATA														
84	221131Z	25.0N 120.6E	SAT				(IR DATA														
85	221131Z	23.9N 119.5E	SAT				(IR DATA														
86	221200Z	24.7N 121.1E	LRDR				- 1/1/1/														
87	221223Z	24.7N 120.6E	SAT				(IR DATA														
88	221237Z	24.6N 119.9E	SAT				(IR DATA														
89	221547Z	25.3N 121.1E	SAT				(IR DATA														
90	221540Z	25.0N 121.3E	SAT				(IR DATA														

231	091400Z	27.6N	128.4E	LMUR	= GOOD FIX 80% WALL CLD CIRC D20	-	-	-	26.4N	127.8E	-
232	091430Z	27.7N	128.4E	LRDR	= GOOD FIX 75% WALL CLD CIRC D20	-	-	-	26.4N	127.8E	-
233	091500Z	27.8N	128.5E	LRDR	= 10811	-	-	-	26.2N	127.8E	-
234	091500Z	27.8N	128.5E	LRDR	= 10712	-	-	-	26.4N	129.5E	-
235	091500Z	28.0N	128.3E	LRDR	= GOOD FIX 70% WALL CLD CIRC D20	-	-	-	26.4N	127.8E	-
236	091527Z	27.5N	128.6E	SAT	(IR DATA) PCN 1 UMSP						
237	091527Z	28.2N	128.4E	SAT	(IR DATA) PCN 3 UMSP						
238	091527Z	27.9N	128.5E	SAT	(IR DATA) PCN 1 UMSP						
239	091527Z	27.3N	128.2E	SAT	(IR DATA) PCN 1 UMSP						
240	091534Z	28.1N	128.3E	LRDR	= GOOD FIX 70% WALL CLD CIRC D20	-	-	-	26.4N	127.8E	-
241	091600Z	28.2N	128.3E	LRDR	= 10811	-	-	-	26.2N	127.8E	-
242	091600Z	28.2N	128.4E	LRDR	= 10622	-	-	-	28.4N	129.5E	-
243	091605Z	28.4N	128.1E	LMUR	= GOOD FIX 60% WALL CLD CIRC D20	-	-	-	26.4N	127.8E	-
244	091630Z	28.4N	128.1E	LRDR	= POOR FIX 15% WALL CLD CIRC D19	-	-	-	26.4N	127.8E	-
245	091650Z	28.0N	128.7E	P	5 5 700 260 95 180 15 - - - 910 230 25 13 CIMC	-	-	-	13		13
246	091700Z	28.6N	128.1E	LRDR	= 11811	-	-	-	26.2N	127.8E	-
247	091700Z	28.7N	128.2E	LRDR	= 10632	-	-	-	28.4N	129.5E	-
248	091800Z	29.1N	127.9E	LMUR	= 2194/	-	-	-	26.2N	127.8E	-
249	091800Z	29.1N	127.9E	LRDR	= 10612	-	-	-	28.4N	129.5E	-
250	091900Z	29.5N	127.5E	LRDR	= 3111/	-	-	-	26.2N	127.8E	-
251	091900Z	29.4N	127.6E	LRDR	= 20762	-	-	-	26.4N	129.5E	-
252	092000Z	29.7N	127.1E	LRDR	= 31864	-	-	-	28.4N	129.5E	-
253	092100Z	29.9N	126.8E	LRDR	= 20814	-	-	-	28.4N	129.5E	-
254	092150Z	31.0N	126.9E	SAT	(IR DATA) PCN 4 UMSP						
255	092151Z	30.7N	126.8E	SAT	(TS.0/6.0 /W1.0/25HMS) PCN 6 UMSP						
256	092200Z	30.2N	126.2E	LRDM	= 35/5						
257	092220Z	30.2N	126.6E	P	10 10 700 180 123 150 15 130 310 10 930 250 26 15 CIMC	-	-	-	18		13
258	092229Z	30.3N	126.3E	SAT	(TS.0/6.0/W2.0/24HMS) PCN 5 UMSP						
259	092229Z	30.9N	126.9E	SAT	(TS.5/6.5 /W1.5/24HMS) PCN 5 UMSP						
260	092229Z	30.3N	126.8E	SAT	(TS.5/6.5 /W1.0/24HMS) PCN 3 UMSP						
261	100111Z	30.0N	125.0E	SAT	(TS.5/6.5 /S /25HMS) NOAA-5 (CONF 02)						
262	100122Z	31.2N	125.4E	SAT	(IR DATA) PCN 5 NOAA-5						
263	100228Z	30.7N	124.7E	SAT	(IR DATA) PCN 5 UMSP						
264	100228Z	30.8N	124.8E	SAT	(IR DATA) PCN 3 UMSP						
265	100228Z	30.9N	124.8E	SAT	(IR DATA) PCN 3 UMSP						
266	100405Z	30.5N	124.5E	P	- - 700 - 90 - - 80 - - - - - - - - - -						14
267	101035Z	31.0N	123.5E	SAT	(IR DATA) PCN 5 UMSP						
268	101112Z	31.1N	123.3E	SAT	(IR DATA) PCN 3 UMSP						
269	101112Z	31.2N	123.4E	SAT	(IR DATA) PCN 3 UMSP						
270	101112Z	31.2N	123.0E	SAT	(IR DATA) PCN 1 UMSP						
271	101112Z	31.0N	122.9E	SAT	(IR DATA) PCN 4 UMSP						
272	101202Z	31.0N	123.4E	SAT	(IR DATA) PCN 3 NOAA-5						
273	101212Z	31.1N	123.2E	SAT	(IR DATA) NOAA-5 (CONF 01)						
274	101510Z	31.3N	122.9E	SAT	(IR DATA) PCN 5 UMSP						
275	101510Z	31.2N	122.6E	SAT	(IR DATA) PCN 5 UMSP						
276	102211Z	31.9N	121.7E	SAT	(IR DATA) PCN 3 UMSP						
277	102211Z	31.9N	121.9E	SAT	(IR DATA) PCN 3 UMSP						
278	102212Z	31.6N	121.6E	SAT	(IR DATA) PCN 5 UMSP						
279	110027Z	31.8N	121.8E	SAT	(TS.0/6.5 /W1.5/23HMS) NOAA-5 (CONF 02)						
280	110038Z	31.9N	121.0E	SAT	(IR DATA) PCN 5 NOAA-5						
281	110210Z	32.1N	120.7E	SAT	(IR DATA) PCN 3 UMSP						
282	110210Z	31.8N	120.8E	SAT	(IR DATA) PCN 3 UMSP						
283	111054Z	31.7N	119.3E	SAT	(IR DATA) PCN 3 UMSP						
284	112154Z	31.1N	117.2E	SAT	(IR DATA) PCN 5 UMSP						
285	120151Z	30.9N	116.2E	SAT	(IR DATA) PCN 5 NOAA-5						
286	121230Z	30.0N	113.4E	SAT	(IR DATA) PCN 6 NOAA-5						
287	130107Z	29.7N	110.0E	SAT	(IR DATA) PCN 5 NOAA-5						

TROPICAL STORM CAMLA
 FIX POSITIONS FOR CYCLONE NO. 11
 0000Z 03 SEP TO 0000Z 05 SEP

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	MAX OBS				OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	ORIENT- IAT ION	EYE DIA	POSIT OF RADAR	MSN NMBR				
						DIR	VEL	BRG	RNG									SFC WIND VEL	# WIND BRG	RNG	
1	302156Z	13.6N 131.9E	SAT			(T1.0/1.0 / / HRS)															
2	310056Z	13.7N 131.4E	SAT			(IR DATA)															
3	310201Z	14.6N 129.6E	SAT			(IR DATA)															
4	311039Z	14.8N 130.0E	SAT			(IR DATA)															
5	311136Z	14.0N 129.6E	SAT			(IR DATA)															
6	311442Z	15.0N 129.4E	SAT			(IR DATA)															
7	312141Z	15.1N 128.7E	SAT			(T 0/0.5 /W1.0/24HRS)															
8	010325Z	14.2N 126.6E	SAT			(T1.0/1.0 / / HRS)															
9	011022Z	17.8N 122.9E	SAT			(IR DATA)															
10	011043Z	14.5N 125.1E	SAT			(IR DATA)															
11	011249Z	18.2N 122.7E	SAT			(IR DATA)															
12	011607Z	16.5N 122.1E	SAT			(IR DATA)															
13	011607Z	16.3N 121.9E	SAT			(IR DATA)															
14	012304Z	18.3N 120.1E	SAT			(T2.0/2.0 / / HRS)															
15	012304Z	17.5N 120.9E	SAT			(T2.0/2.0 /D1.0/20HRS)															
16	012304Z	17.5N 121.0E	SAT			(T2.0/2.0 / / HRS)															
17	012328Z	18.3N 119.9E	SAT			(IR DATA)															
18	012328Z	17.6N 120.6E	SAT			(IR DATA)															
19	020125Z	18.3N 119.6E	SAT			(T2.0/2.0 / / HRS)															
20	021147Z	18.7N 116.1E	SAT			(IR DATA)															
21	021147Z	17.9N 116.2E	SAT			(IR DATA)															
22	021205Z	18.2N 116.4E	SAT			(IR DATA)															
23	021213Z	18.8N 116.0E	SAT			(IR DATA)															
24	021549Z	18.3N 114.6E	SAT			(IR DATA)															
25	021549Z	18.2N 115.3E	SAT			(IR DATA)															
26	022247Z	18.3N 112.6E	SAT			(T2.0/2.0 / / HRS)															
27	022247Z	18.4N 113.7E	SAT			(IR DATA)															
28	022247Z	19.5N 115.0E	SAT			(IR DATA)															
29	022316Z	19.9N 114.9E	SAT			(IR DATA)															
30	022316Z	18.4N 111.7E	SAT			(T2.5/2.5 /D0.5/24HRS)															
31	030010Z	18.5N 112.5E	SAT			(T2.5/2.5 / / HRS)															
32	030045Z	17.7N 114.7E	P	5	5	700	100	35	50	50	45	50	50	992	-	27	25	-	-	-	1
33	030431Z	19.0N 113.0E	SAT			(IR DATA)															
34	031130Z	17.7N 110.5E	SAT			(IR DATA)															
35	031206Z	16.0N 112.6E	SAT			(IR DATA)															
36	032230Z	17.8N 110.3E	SAT			(T2.5/2.5 /D0.5/24HRS)															
37	032230Z	17.4N 111.0E	SAT			(T3.0/3.0 / / HRS)															
38	032230Z	17.0N 111.0E	SAT			(IR DATA)															
39	032304Z	17.2N 110.0E	SAT			(IR DATA)															
40	040122Z	17.0N 110.0E	SAT			(T3.5/3.5 /D1.0/24HRS)															
41	040413Z	17.8N 110.3E	SAT			(IR DATA)															
42	040413Z	16.9N 110.0E	SAT			(T2.5/2.5 /S /29HRS)															
43	041112Z	18.2N 108.5E	SAT			(IR DATA)															
44	041112Z	17.8N 108.8E	SAT			(IR DATA)															
45	041148Z	17.8N 108.7E	SAT			(IR DATA)															
46	041148Z	17.6N 108.4E	SAT			(IR DATA)															
47	041233Z	17.1N 106.4E	SAT			(IR DATA)															
48	041254Z	17.3N 106.2E	SAT			(IR DATA)															
49	041655Z	17.5N 106.2E	SAT			(IR DATA)															
50	042354Z	16.9N 103.8E	SAT			(IR DATA)															
51	050033Z	16.8N 103.7E	SAT			(IR DATA)															
52	050038Z	17.0N 104.0E	SAT			(T1.5/1.5 /W2.0/24HRS)															
53	050109Z	16.8N 103.6E	SAT			(T2.0/2.0 / W0.5/26 HRS)															
54	050355Z	17.1N 104.0E	SAT			(T1.0/2.0 /W1.5/24HRS)															
55	050356Z	16.5N 105.2E	SAT			(IR DATA)															

TYPHOON DINAH
 FIX POSITIONS FOR CYCLONE NO. 12
 1200Z 14 SEP TO 1800Z 23 SEP

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	ORIENT IATION	EYE DIA	POSIT OF RAUAR	MSN NMBR
						DIR	VEL	BRG								
1	101011Z	18.3N 150.0E	SAT	(IR DATA)												
2	102030Z	15.5N 151.9E	SAT	(T 0/ 0 / / HRS)				PCN 5	UMSP							(CONF 02)
3	102234Z	18.6N 151.0E	SAT	(T1.0/1.0 / / HRS)												(CONF 02)
4	110913Z	15.2N 150.5E	SAT	(IR DATA)				PCN 5	UMSP							
5	111124Z	19.4N 146.3E	SAT	(IR DATA)												(CONF 02)
6	112013Z	19.9N 147.0E	SAT	(T 0/ 0 /S /24HRS)				PCN 5	UMSP							
7	120103Z	20.0N 145.5E	SAT	(IR DATA)				PCN 5	UMSP							
8	121011Z	21.5N 142.3E	SAT	(IR DATA)				PCN 5	UMSP							
9	121037Z	21.5N 142.1E	SAT	(IR DATA)				PCN 5	UMSP							
10	121044Z	21.2N 141.4E	SAT	(IR DATA)												(CONF 01)
11	121435Z	21.8N 141.2E	SAT	(IR DATA)				PCN 5	UMSP							
12	122113Z	21.8N 139.6E	SAT	(IR DATA)				PCN 6	UMSP							
13	122138Z	21.7N 139.2E	SAT	(T1.0/1.0 /D1.0/25HRS)				PCN 5	UMSP							
14	122138Z	20.3N 139.1E	SAT	(T 0/ 0 / / HRS)				PCN 5	UMSP							
15	122310Z	22.1N 137.1E	SAT	(IR DATA)				PCN 5	NOAA-5							
16	130134Z	22.6N 138.2E	SAT	(IR DATA)				PCN 5	UMSP							
17	130959Z	22.4N 136.0E	SAT	(IR DATA)				PCN 6	UMSP							
18	130959Z	23.1N 135.9E	SAT	(IR DATA)				PCN 6	UMSP							
19	131020Z	22.1N 135.8E	SAT	(IR DATA)				PCN 5	UMSP							
20	131020Z	23.1N 135.8E	SAT	(IR DATA)				PCN 6	UMSP							
21	131020Z	23.0N 136.0E	SAT	(IR DATA)				PCN 6	UMSP							
22	131144Z	22.3N 135.5E	SAT	(IR DATA)				PCN 5	NOAA-5							
23	131172Z	22.5N 135.0E	SAT	(IR DATA)				PCN 5	UMSP							
24	132121Z	21.7N 131.5E	SAT	(T2.0/2.0 /D1.0/24HRS)				PCN 5	UMSP							
25	132121Z	21.7N 131.4E	SAT	(T2.0/2.0 / / HRS)				PCN 5	UMSP							
26	132121Z	21.8N 132.2E	SAT	(T1.0/1.0 /D1.0/24HRS)				PCN 5	UMSP							
27	140023Z	21.6N 131.3E	SAT	(IR DATA)				PCN 5	NOAA-5							
28	140254Z	22.3N 129.9E	SAT	(T2.5/2.5 / / HRS)				PCN 3	UMSP							
29	140259Z	21.6N 130.5E	SAT	(IR DATA)				PCN 5	UMSP							
30	140259Z	22.2N 130.8E	SAT	(IR DATA)				PCN 5	UMSP							
31	140259Z	21.7N 130.7E	SAT	(IR DATA)				PCN 6	UMSP							
32	141003Z	21.7N 128.6E	SAT	(IR DATA)				PCN 5	UMSP							
33	141003Z	21.4N 128.0E	SAT	(IR DATA)				PCN 6	UMSP							
34	141003Z	21.3N 128.7E	SAT	(IR DATA)				PCN 6	UMSP							
35	141003Z	21.5N 127.9E	SAT	(IR DATA)				PCN 4	UMSP							
36	141103Z	21.6N 128.2E	SAT	(IR DATA)				PCN 5	NOAA-5							
37	141128Z	21.7N 127.9E	SAT	(IR DATA)				PCN 5	UMSP							
38	141129Z	21.6N 128.1E	SAT	(IR DATA)				PCN 5	UMSP							
39	141129Z	21.5N 127.4E	SAT	(IR DATA)				PCN 4	UMSP							
40	141204Z	21.5N 127.8E	SAT	(IR DATA)				PCN 2	NOAA-4							
41	141541Z	20.8N 127.1E	SAT	(IR DATA)				PCN 3	UMSP							
42	141541Z	20.8N 127.0E	SAT	(IR DATA)				PCN 3	UMSP							
43	142231Z	19.4N 124.5E	SAT	(IR DATA)				PCN 6	UMSP							
44	142245Z	19.4N 124.7E	SAT	(T4.0/4.0 /D2.0/25HRS)				PCN 5	UMSP							
45	142245Z	19.9N 124.3E	SAT	(T4.0/4.0 /D2.0/25HRS)				PCN 5	UMSP							
46	142245Z	19.3N 124.9E	SAT	(T3.5/3.5 / / HRS)				PCN 3	UMSP							
47	142245Z	18.7N 124.0E	SAT	(T3.5/3.5 /D1.0/21HRS)				PCN 5	UMSP							
48	150129Z	19.1N 125.1E	SAT	(T4.0/4.0 / / HRS)												(CONF 02)
49	150135Z	19.2N 124.4E	SAT	(IR DATA)				PCN 5	NOAA-5							
50	150241Z	19.0N 124.0E	SAT	(IR DATA)				PCN 1	UMSP							
51	150241Z	18.9N 123.6E	SAT	(T3.5/3.5 / / HRS)				PCN 5	UMSP							
52	150241Z	19.0N 124.0E	SAT	(IR DATA)				PCN 5	UMSP							
53	150241Z	18.9N 123.9E	SAT	(IR DATA)				PCN 3	UMSP							
54	150450Z	18.9N 123.9E	P	5 5 700 180 65 100			15	65 100								3
55	150935Z	18.4N 123.1E	P	5 5 700 120 76 40			45	75 330								3
56	151104Z	18.3N 122.7E	SAT	(IR DATA)				PCN 5	NOAA-4							
57	151116Z	18.3N 122.5E	SAT	(IR DATA)				PCN 5	UMSP							
58	151116Z	18.6N 120.7E	SAT	(IR DATA)				PCN 5	UMSP							
59	151124Z	17.7N 122.4E	SAT	(IR DATA)				PCN 5	UMSP							
60	151124Z	18.0N 122.5E	SAT	(IR DATA)				PCN 5	UMSP							
61	151215Z	18.0N 122.4E	SAT	(IR DATA)				PCN 5	NOAA-5							
62	151221Z	18.3N 122.8E	SAT	(IR DATA)												(CONF 02)
63	151523Z	17.8N 121.8E	SAT	(IR DATA)				PCN 5	UMSP							
64	151523Z	17.8N 121.7E	SAT	(IR DATA)				PCN 5	UMSP							
65	152224Z	17.3N 120.3E	SAT	(T4.0/4.0 /S /24HRS)				PCN 3	UMSP							
66	152224Z	17.4N 120.1E	SAT	(T4.0/4.0 /S /24HRS)				PCN 3	UMSP							
67	152224Z	17.3N 120.4E	SAT	(T4.5/4.5 /D1.0/24HRS)				PCN 3	UMSP							
68	152224Z	17.9N 119.8E	SAT	(T4.5/4.5 /D1.0/24HRS)				PCN 3	UMSP							
69	160045Z	16.3N 119.9E	SAT	(T4.0/4.0 /S /23HRS)												(CONF 01)
70	160224Z	17.0N 119.2E	SAT	(IR DATA)				PCN 3	UMSP							
71	160346Z	17.4N 119.7E	P	2 5 700 180 45 150			60	40 150								4
72	160405Z	17.1N 119.0E	SAT	(IR DATA)				PCN 3	UMSP							
73	160935Z	17.2N 118.7E	P	2 5 700 280 50 250			25	-								4
74	161104Z	16.9N 118.4E	SAT	(IR DATA)				PCN 5	UMSP							
75	161104Z	17.1N 118.5E	SAT	(IR DATA)				PCN 5	UMSP							
76	161104Z	17.0N 118.0E	SAT	(IR DATA)				PCN 4	UMSP							
77	161111Z	16.9N 118.3E	SAT	(IR DATA)				PCN 5	UMSP							
78	161111Z	16.9N 118.1E	SAT	(IR DATA)				PCN 5	UMSP							
79	161203Z	17.0N 118.5E	SAT	(IR DATA)				PCN 6	NOAA-4							
80	161257Z	17.2N 117.8E	SAT	(IR DATA)												(CONF 01)
81	161506Z	17.2N 117.6E	SAT	(IR DATA)				PCN 5	UMSP							
82	161506Z	17.4N 117.8E	SAT	(IR DATA)				PCN 5	UMSP							
83	161647Z	17.1N 117.6E	SAT	(IR DATA)				PCN 5	UMSP							
84	162211Z	16.7N 116.2E	SAT	(T5.0/5.0 /D1.0/24HRS)				PCN 5	UMSP							
85	162211Z	16.9N 116.1E	SAT	(T5.0/5.0 / / HRS)				PCN 3	UMSP							
86	162349Z	16.8N 116.2E	SAT	(T4.0/4.0 /S /25HRS)				PCN 6	UMSP							
87	162349Z	16.5N 117.8E	SAT	(T4.0/4.0 /S /25HRS)				PCN 5	UMSP							
88	170157Z	17.8N 116.3E	SAT	(T4.0/4.0 /S /25HRS)												(CONF 01)
89	170450Z	17.3N 116.6E	P	5 5 700 100 45 350			30	40 20								5
90	170945Z	17.3N 116.0E	P	5 5 700 230 58 140			110	80 140								5

91 091325Z 41.3N 156.9E SAT (IR DATA) PCN 5 UMSP
 92 092043Z 40.1N 160.1E SAT (IR DATA) PCN 5 UMSP
 93 092233Z 41.2N 161.6E SAT (11.5/1.5 /w1.5/24HMS) PCN 5 NOAA-5 (CONF 01)
 94 092247Z 41.2N 161.0E SAT (12.0/3.0 / / HMS) PCN 5 NOAA-5
 95 100927Z 41.7N 168.6E SAT (IR DATA) PCN 6 NOAA-5

TROPICAL STORM HANNIET
 FIX POSITIONS FOR CYCLONE NO. 16
 0600Z 16 OCT TO 1800Z 20 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	FLT DIR	LVL VEL	WIND HRG	MAX UMS	SFC WIND VEL	WIND HRG	UMS SLP	MIN 700MB HG	FLT LVL TI/TO	EYE FORM	UNEN- TATION	EYE DI-	POSIT OF RADAR	MSM NMBR
1	132116Z	10.4N 150.9E	SAT	(T 0 / 0 / / HMS)															
2	140057Z	10.8N 149.2E	SAT	(IR DATA)															
3	140604Z	13.3N 137.1E	P	3 15 1500	200	28	100		55	20	80	150	1001	-	26	26	-	-	1
4	140954Z	10.2N 147.3E	SAT	(IR DATA)															
5	141023Z	10.4N 147.1E	SAT	(IR DATA)															
6	141339Z	10.4N 144.8E	SAT	(IR DATA)															
7	142059Z	11.8N 142.6E	SAT	(11.0/1.0*/D1.0/24HMS)															
8	142300Z	12.2N 141.9E	SAT	(IR DATA)															
9	142327Z	12.2N 142.0E	SAT	(IR DATA)															
10	150221Z	13.0N 141.1E	SAT	(IR DATA)															
11	150823Z	11.8N 133.9E	P	3 30 1500	90	30	360		100	25	360	100	1003	-	25	25	-	-	2
12	151136Z	14.4N 140.4E	SAT	(IR DATA)															
13	151503Z	14.7N 139.6E	SAT	(IR DATA)															
14	152042Z	15.6N 138.8E	SAT	(IR DATA)															
15	152223Z	15.4N 136.7E	SAT	(12.0/2.0 /D1.0/25HMS)															
16	160012Z	15.5N 136.5E	SAT	(IR DATA)															
17	160203Z	15.9N 136.2E	SAT	(IR DATA)															
18	160245Z	15.7N 135.8E	P	2 30 1500	120	52	-		-	35	-	-	999	-	25	25	-	-	3
19	161057Z	16.6N 134.6E	SAT	(IR DATA)															
20	161059Z	17.0N 135.0E	SAT	(IR DATA)															
21	161445Z	16.8N 133.7E	SAT	(IR DATA)															
22	161512Z	15.9N 133.7E	P	5 30 700	190	28	110		90	-	-	-	-	30Y	10	10	-	-	4
23	162206Z	17.4N 133.2E	SAT	(12.0/2.0*/5 /24HMS)															
24	162206Z	17.8N 132.6E	SAT	(13.5/3.5 / / HMS)															
25	162206Z	17.2N 133.0E	SAT	(12.5/2.5 / / HMS)															
26	162206Z	17.2N 133.0E	SAT	(13.0/3.0 / / HMS)															
27	162328Z	17.7N 132.7E	SAT	(IR DATA)															
28	170145Z	17.6N 132.1E	SAT	(IR DATA)															
29	170145Z	17.4N 132.3E	SAT	(IR DATA)															
30	170332Z	17.6N 132.1E	P	3 5 700	350	40	220		55	40	180	15	989	29Y	15	11	-	-	5
31	171048Z	18.2N 131.5E	SAT	(IR DATA)															
32	171049Z	18.1N 131.5E	SAT	(IR DATA)															
33	171204Z	18.4N 131.4E	SAT	(IR DATA)															
34	171209Z	18.7N 131.2E	SAT	(IR DATA)															
35	171427Z	18.2N 131.6E	SAT	(IR DATA)															
36	171507Z	17.4N 131.8E	P	5 5 700	180	45	90		10	-	-	-	990	30Y	16	15	-	-	6
37	172032Z	18.4N 132.6E	P	5 2 700	40	50	280		26	50	90	10	988	29Y	19	15	-	-	6
38	172149Z	18.5N 132.0E	SAT	(13.5/3.5 /D1.0/24HMS)															
39	172149Z	18.5N 131.9E	SAT	(14.5/4.5 /D1.0/24HMS)															
40	180040Z	19.3N 132.7E	SAT	(IR DATA)															
41	180309Z	19.5N 132.6E	SAT	(IR DATA)															
42	180914Z	20.6N 132.5E	SAT	(IR DATA)															
43	181031Z	20.7N 132.4E	SAT	(IR DATA)															
44	181120Z	20.6N 132.9E	SAT	(IR DATA)															
45	181412Z	21.1N 132.9E	SAT	(IR DATA)															
46	181522Z	22.8N 133.4E	P	5 30 700	310	45	210		50	-	-	-	994	30Y	11	11	-	-	8
47	182132Z	24.0N 134.2E	SAT	(14.0/4.0 /D0.5 /24HMS)															
48	182348Z	24.0N 134.9E	SAT	(13.0/3.5 / / HMS)															
49	182356Z	24.8N 135.1E	SAT	(IR DATA)															
50	190252Z	26.1N 135.8E	SAT	(IR DATA)															
51	190350Z	26.3N 135.6E	P	10 15 700	230	50	190		30	45	210	70	985	29Y	12	12	-	-	9
52	190945Z	28.0N 138.3E	SAT	(IR DATA)															
53	191014Z	28.1N 138.2E	SAT	(IR DATA)															
54	191036Z	28.2N 138.8E	SAT	(IR DATA)															
55	191045Z	29.0N 137.8E	SAT	(IR DATA)															
56	191352Z	28.5N 138.3E	SAT	(IR DATA)															
57	191534Z	28.6N 138.0E	P	5 5 700	190	72	80		190	-	-	-	984	29Y	19	17	-	-	10
58	192115Z	30.1N 140.0E	SAT	(12.5/3.5 /w1.5/24HMS)															
59	192115Z	29.5N 139.5E	SAT	(12.5/2.5 / / HMS)															
60	192312Z	30.3N 140.5E	SAT	(IR DATA)															
61	200054Z	30.2N 141.0E	SAT	(12.5/2.5 /w0.5/25HMS)															
62	200313Z	29.5N 140.3E	P	3 5 700	220	60	90		80	50	220	60	990	30Y	13	10	-	-	11
63	200952Z	29.6N 142.3E	SAT	(IR DATA)															
64	200957Z	29.6N 142.4E	SAT	(IR DATA)															
65	200957Z	31.0N 143.7E	SAT	(IR DATA)															
66	201040Z	30.0N 142.4E	SAT	(IR DATA)															
67	201334Z	30.6N 144.2E	SAT	(IR DATA)															
68	201514Z	30.5N 144.3E	SAT	(IR DATA)															

17PHOON IVY
FIX POSITIONS FOR CYCLONE NO. 17
0600Z 21 OCT TO 0000Z 21 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	ORIENT- IATION	EYE DIA	POSIT UP RAOAK	MSN NRGW
						FLY LVL	WIND DIR	WIND VEL	WIND BRG	SFC WIND VLL	# WIND BRG									RNG
1	191014Z	13.7N 146.1E	SAT	(IR DATA)														
2	191036Z	13.8N 146.0E	SAT	(IR DATA)														
3	192115Z	15.0N 146.5E	SAT	(T2-0/2.0 /	/ HRS)														
4	192306Z	16.1N 148.0E	SAT	(T1.5/1.5 /	/ HRS)														
5	192312Z	15.1N 146.4E	SAT	(IR DATA)														
6	200053Z	15.8N 146.6E	SAT	(IR DATA)														
7	200952Z	17.8N 147.5E	SAT	(IR DATA)														
8	200957Z	17.0N 147.5E	SAT	(IR DATA)														
9	200957Z	17.7N 147.7E	SAT	(IR DATA)														
10	201334Z	18.8N 146.9E	SAT	(IR DATA)														
11	201334Z	17.7N 146.2E	SAT	(IR DATA)														
12	202054Z	18.5N 147.1E	SAT	(T2-0/2.0 /5	/24HRS)														
13	202212Z	17.1N 146.0E	SAT	(T2-0/2.0 /00.5/23HRS))														
14	202224Z	18.5N 147.2E	SAT	(IR DATA)														
15	210219Z	16.5N 147.2E	P	5 5 1500	110 32 30														
16	210324Z	16.2N 147.4E	P	3 15 700	- - -														
17	210940Z	17.0N 147.8E	SAT	(IR DATA)														
18	210940Z	16.4N 147.7E	SAT	(IR DATA)														
19	211105Z	17.4N 147.5E	SAT	(IR DATA)														
20	211110Z	16.7N 147.6E	SAT	(IR DATA)														
21	211545Z	17.0N 147.0E	P	3 20 700	140 38 40														
22	212141Z	17.8N 146.8E	SAT	(T2-0/2.0 /5	/24HRS)														
23	212141Z	17.6N 146.8E	SAT	(T2-0/2.0 /	/ HRS)														
24	212217Z	17.9N 146.9E	SAT	(IR DATA)														
25	212334Z	17.1N 145.7E	SAT	(T2-5/2.5 /00.5/25HRS))														
26	212341Z	17.9N 146.4E	SAT	(IR DATA)														
27	220250Z	17.3N 145.5E	P	5 20 700	24 20 30														
28	220922Z	16.6N 144.9E	SAT	(IR DATA)														
29	220923Z	17.2N 144.8E	SAT	(IR DATA)														
30	221016Z	16.8N 145.0E	SAT	(IR DATA)														
31	221021Z	17.1N 144.4E	SAT	(IR DATA)														
32	221557Z	17.0N 146.1E	P	2 5 700	290 45 220														
33	222023Z	17.2N 146.3E	SAT	(T3-5/3.5 /01.5/24HRS))														
34	222124Z	17.7N 146.4E	SAT	(T3-5/3.5 /01.5/24HRS))														
35	222445Z	17.5N 146.5E	P	5 5 700	10 48 280														
36	222448Z	17.9N 147.6E	SAT	(T4-0/4.0 /01.5/23HRS))														
37	222557Z	17.8N 146.5E	SAT	(IR DATA)														
38	230905Z	18.6N 147.8E	SAT	(IR DATA)														
39	230906Z	18.6N 147.9E	SAT	(IR DATA)														
40	230937Z	18.6N 147.8E	SAT	(IR DATA)														
41	230942Z	18.6N 148.6E	SAT	(IR DATA)														
42	232006Z	21.1N 149.6E	SAT	(T4-5/4.5 /01.0/24HRS))														
43	232006Z	20.8N 150.0E	SAT	(IR DATA)														
44	232132Z	21.2N 150.0E	SAT	(IR DATA)														
45	240341Z	21.5N 151.2E	P	10 20 700	320 75 240														
46	240442Z	22.9N 152.1E	SAT	(IR DATA)														
47	240842Z	22.6N 152.0E	SAT	(IR DATA)														
48	241044Z	23.0N 152.4E	SAT	(IR DATA)														
49	241056Z	23.0N 152.5E	SAT	(IR DATA)														
50	241504Z	24.2N 153.7E	P	5 2 700	280 93 200														
51	241444Z	24.8N 153.8E	SAT	(T5-0/5.0 /00.5/24HRS))														
52	241449Z	24.6N 153.6E	SAT	(IR DATA)														
53	242257Z	25.2N 154.5E	SAT	(IR DATA)														
54	242315Z	25.4N 154.5E	SAT	(T5-0/5.0 /	/ HRS)														
55	242357Z	25.1N 154.4E	SAT	(IR DATA)														
56	250104Z	26.0N 154.6E	SAT	(IR DATA)														
57	250104Z	25.3N 154.6E	SAT	(T4-5/4.5 /	/ HRS)														
58	250233Z	25.8N 154.4E	P	3 2 700	290 90 180														
59	250831Z	27.5N 154.9E	SAT	(IR DATA)														
60	250832Z	26.7N 155.0E	SAT	(IR DATA)														
61	251005Z	27.0N 155.5E	SAT	(IR DATA)														
62	251013Z	26.6N 155.5E	SAT	(IR DATA)														
63	251327Z	27.4N 155.8E	SAT	(IR DATA)														
64	251344Z	27.2N 155.8E	SAT	(IR DATA)														
65	251932Z	28.6N 155.9E	SAT	(IR DATA)														
66	251932Z	28.0N 156.2E	SAT	(IR DATA)														
67	252157Z	28.7N 156.2E	SAT	(IR DATA)														
68	252230Z	28.7N 156.1E	SAT	(T5-0/5.0 /5	/23HRS)														
69	252241Z	28.7N 156.4E	SAT	(T4-5/5.0 /	/ HRS)														
70	260044Z	29.2N 156.5E	SAT	(IR DATA)														
71	260048Z	29.4N 156.6E	SAT	(T4-0/4.5 /00.5/24HRS))														
72	260814Z	31.5N 157.4E	SAT	(IR DATA)														
73	260830Z	30.0N 157.2E	SAT	(IR DATA)														
74	260921Z	31.0N 158.2E	SAT	(IR DATA)														
75	260931Z	31.0N 159.0E	SAT	(IR DATA)														
76	260954Z	30.9N 158.1E	SAT	(IR DATA)														
77	261330Z	32.0N 161.1E	SAT	(IR DATA)														
78	262157Z	37.2N 164.9E	SAT	(T3-0/3.5 /01.5/23HRS))														
79	262253Z	38.7N 164.4E	SAT	(IR DATA)														

TYPHOON JEAN
 FIX POSITIONS FOR CYCLONE NO. 14
 1200Z 28 OCT 10 1200Z 03 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACRY NAV-MET	FIX LVL	FLT DIM	OBS WIND BRG	MAX OBS SPL WIND	MAX OBS WIND BRG	UBS MIN SLP	MIN 700MB HG!	FLT LVL	EYE FORM	UNIDIRECTION	EYE DIA	POSIT UP RADAR	MSN NMB
1	242124Z	7.3N 171.9E	SAI														
2	252157Z	12.2N 165.9E	SAI														
3	262157Z	13.6N 163.7E	SAI														
4	270031Z	15.8N 160.3E	SAI														
5	272307Z	17.8N 159.1E	SAI														
6	272314Z	17.5N 159.5E	SAI														
7	280921Z	19.1N 157.4E	SAI														
8	280921Z	20.0N 156.3E	SAI														
9	280950Z	14.1N 157.0E	SAI														
10	280956Z	18.6N 157.0E	SAI														
11	281254Z	19.6N 156.9E	SAI														
12	282022Z	20.0N 156.3E	SAI														
13	282023Z	20.1N 156.6E	SAI														
14	282218Z	20.1N 156.1E	SAI														
15	282226Z	20.0N 156.3E	SAI														
16	282248Z	20.1N 156.3E	SAI														
17	290511Z	20.8N 156.1E	P														
18	290904Z	20.8N 156.5E	SAI														
19	290905Z	20.9N 156.3E	SAI														
20	290906Z	20.7N 156.2E	SAI														
21	290912Z	20.7N 156.0E	SAI														
22	291237Z	21.5N 156.7E	SAI														
23	291237Z	21.4N 156.4E	SAI														
24	291451Z	21.7N 156.9E	P														
25	292005Z	22.7N 157.5E	SAI														
26	292006Z	22.8N 157.4E	SAI														
27	292102Z	22.9N 157.6E	SAI														
28	292324Z	24.1N 157.3E	SAI														
29	300110Z	23.2N 156.2E	SAI														
30	300307Z	23.2N 157.3E	P														
31	300847Z	24.5N 158.4E	SAI														
32	300848Z	24.3N 158.5E	SAI														
33	301014Z	24.2N 156.4E	SAI														
34	301024Z	24.5N 159.0E	SAI														
35	301401Z	23.5N 157.8E	SAI														
36	301401Z	25.5N 159.2E	SAI														
37	301948Z	24.0N 157.1E	SAI														
38	301948Z	23.8N 157.2E	SAI														
39	302254Z	24.0N 156.5E	SAI														
40	302345Z	23.8N 156.5E	SAI														
41	310102Z	24.2N 156.1E	SAI														
42	310102Z	24.2N 155.9E	SAI														
43	310830Z	24.8N 154.3E	SAI														
44	310830Z	24.8N 154.4E	SAI														
45	310934Z	24.9N 154.0E	SAI														
46	310947Z	26.3N 153.7E	SAI														
47	311344Z	25.1N 153.0E	SAI														
48	312112Z	25.4N 149.8E	SAI														
49	312113Z	25.8N 150.4E	SAI														
50	312357Z	26.1N 144.3E	SAI														
51	010850Z	25.5N 147.0E	SAI														
52	011044Z	26.3N 146.3E	SAI														
53	012056Z	26.6N 145.9E	SAI														
54	012323Z	26.5N 146.1E	SAI														
55	020208Z	26.9N 146.1E	SAI														
56	020937Z	27.3N 146.6E	SAI														
57	020938Z	26.9N 146.9E	SAI														
58	021002Z	27.0N 146.4E	SAI														
59	021012Z	26.0N 147.0E	SAI														
60	021450Z	27.0N 146.6E	SAI														
61	021450Z	26.4N 146.9E	SAI														
62	022030Z	27.5N 146.2E	SAI														
63	022030Z	27.1N 146.1E	SAI														
64	022230Z	27.8N 146.4E	SAI														
65	022337Z	27.3N 146.6E	SAI														
66	030025Z	27.0N 147.0E	SAI														
67	030151Z	26.9N 146.5E	SAI														
68	030918Z	26.1N 146.1E	SAI														
69	030420Z	26.1N 145.6E	SAI														
70	030921Z	26.1N 146.1E	SAI														
71	032351Z	24.0N 143.5E	SAI														
72	041031Z	24.1N 141.3E	SAI														
73	042307Z	23.6N 139.2E	SAI														
74	060010Z	23.2N 134.5E	SAI														

141	131937	15.0N 121.0E	LNUR	- EYE GOOD FIX 90% WALL CLD CIRC D6 1212	-	-	-	15.2N 120.6E	-
142	132000	15.0N 121.7E	LNUR	- 1015/	-	-	-	16.3N 120.6E	-
143	132100	15.0N 121.5E	LNUR	- 1011/	-	-	-	16.3N 120.6E	-
144	132130	15.0N 121.3E	LNUR	- PSBL EYE 10° SPRL OVRLAY POOR FIX CIRC D6 EYE 70% FILLED	-	-	-	15.2N 120.6E	-
145	132235	15.1N 121.1E	SAT	(14.0/5.0 / #1.0/24HMS) PCN 5 UMSP	-	-	-	-	-
146	132300	15.0N 121.0E	LNUR	- PSBL CENT APPROX 120/29 FROM RPHK	-	-	-	16.0N 120.3E	-
147	140011	15.1N 120.6E	SAT	(15.0/5.5 / 5 / 23HMS) NOAA-5 (CONF 01)	-	-	-	-	-
148	140017	15.3N 120.7E	SAT	(IR DATA) NOAA-5	-	-	-	-	-
149	140200	15.2N 120.0E	LNUR	- 1060/	-	-	-	16.3N 120.6E	-
149	140300	15.2N 119.7E	LNUR	- 1083/	-	-	-	16.3N 120.6E	-
141	140430	15.5N 119.9E	LNUR	- PSBL EYE 55PCT MOVING NW 10	-	-	-	16.0N 120.3E	-
142	140500	15.4N 119.3E	LNUR	- 1048/	-	-	-	16.3N 120.6E	-
143	140600	15.5N 119.0E	LNUR	- 1153/	-	-	-	16.3N 120.6E	-
144	140630	15.8N 119.0E	LNUR	- PSBL CENT 35%	-	-	-	16.0N 120.3E	-
145	140947	15.5N 118.6E	P	5 5 700 120 51 30 20 25 20 120 994 302 14 11	-	-	-	-	19
146	141253	15.8N 118.3E	SAT	(IR DATA) NOAA-5	-	-	-	-	-
147	141257	16.5N 118.1E	SAT	(IR DATA) NOAA-5 (CONF 02)	-	-	-	-	-
148	141534	16.0N 118.3E	P	2 5 700 140 64 40 120 - - -	-	-	-	-	20
149	141623	15.8N 118.2E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
200	142047	16.2N 118.2E	P	3 10 700 60 41 320 135 - - -	-	-	-	-	20
201	142214	16.3N 118.1E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
202	150057	16.5N 118.0E	SAT	(IR DATA) PCN 6 NOAA-4	-	-	-	-	-
203	150124	16.4N 118.0E	SAT	(12.5/3.5 / / HMS) PCN 5 NOAA-5	-	-	-	-	-
204	150920	17.3N 118.1E	P	5 5 700 190 55 60 120 40 200 20 - 302 13 11 ELIP SE-NW 15X 4	-	-	-	-	21
205	151100	17.4N 118.1E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
206	151207	17.7N 118.0E	SAT	(IR DATA) PCN 5 NOAA-5	-	-	-	-	-
207	151215	17.0N 118.2E	SAT	(IR DATA) NOAA-5 (CONF 02)	-	-	-	-	-
208	151605	18.3N 120.1E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
209	151605	17.8N 118.0E	SAT	(IR DATA) PCN 6 UMSP	-	-	-	-	-
210	151605	17.7N 120.2E	SAT	(IR DATA) PCN 6 UMSP	-	-	-	-	-
211	152154	19.5N 119.2E	P	2 15 700 220 25 90 130 - - -	-	-	-	-	22
212	152201	19.9N 120.7E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
213	160030	19.8N 121.5E	SAT	(12.0/2.0 / / HMS) PCN 5 NOAA-5 (CONF 02)	-	-	-	-	-
214	160045	19.5N 120.3E	SAT	(11.0/2.0 / #1.0/23HMS) PCN 5 NOAA-5	-	-	-	-	-
215	160234	20.3N 120.9E	P	2 20 700 240 11 160 25 25 260 150 994 302 12 10	-	-	-	-	22
216	160302	20.0N 120.8E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
217	160302	19.8N 120.8E	SAT	(11.0/1.0 / / HMS) PCN 5 UMSP	-	-	-	-	-
218	161043	20.6N 121.5E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
219	161125	20.8N 122.2E	SAT	(IR DATA) PCN 5 NOAA-5	-	-	-	-	-
220	161542	21.0N 122.9E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
221	161542	21.6N 124.5E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
222	162146	21.3N 124.9E	SAT	(IR DATA) PCN 5 UMSP	-	-	-	-	-
223	170011	21.5N 125.7E	SAT	(11.0/1.0 / 5 / 25HMS) PCN 5 NOAA-5	-	-	-	-	-

41	041153Z	15.5N	128.5E	SAT	(IR DATA	)	NOAA-5	(CONF 01)													
42	041448Z	17.8N	128.5E	P	2	5	700	260	125	180	45	-	-	943	260	16	16	ELIP	N-5	40X30	11	
43	041535Z	17.1N	128.9E	SAT	(IR DATA	)	PCN 1	UMSP													
44	042140Z	18.3N	129.6E	SAT	(IR DATA	)	PCN 3	UMSP													
45	042140Z	18.4N	129.7E	SAT	(T4.5/4.5 /	/	HMS)	PCN 3	UMSP													
46	042144Z	18.2N	129.4E	P	5	5	700	90	60	350	15	100	250	8	942	250	17	14	CIRC	40	11	
47	050017Z	19.3N	129.9E	SAT	(T5.0/5.5 /W1.0/25HRS)		NOAA-5	(CONF 01)														
48	050024Z	18.8N	129.9E	SAT	(T4.5/5.0 /W0.5/23HRS)		PCN 3	NOAA-5														
49	050236Z	19.3N	130.3E	SAT	(IR DATA	)	PCN 1	UMSP													
100	050236Z	19.3N	130.3E	SAT	(IR DATA	)	PCN 3	UMSP													
101	050245Z	19.4N	130.2E	P	10	5	700	240	135	140	35	130	140	30	940	261	17	14	CIRC	40	12	
102	051022Z	21.2N	131.9E	SAT	(IR DATA	)	PCN 5	UMSP													
103	051022Z	21.7N	132.1E	SAT	(IR DATA	)	PCN 5	UMSP													
104	051104Z	21.4N	132.4E	SAT	(IR DATA	)	PCN 5	NOAA-5													
105	051110Z	21.2N	132.3E	SAT	(IR DATA	)	NOAA-5	(CONF 02)													
106	051517Z	21.9N	133.0E	SAT	(IR DATA	)	PCN 5	UMSP													
107	051518Z	21.9N	133.1E	SAT	(IR DATA	)	PCN 5	UMSP													
108	052123Z	22.8N	135.5E	SAT	(T2.5/2.5 /	/	HMS)	PCN 5	UMSP													
109	052123Z	22.8N	135.5E	SAT	(IR DATA	)	PCN 6	UMSP													
110	052340Z	22.0N	135.6E	SAT	(IR DATA	)	PCN 5	NOAA-5													
111	060255Z	22.1N	136.8E	P	4	10	700	340	50	270	90	130	270	50	988	290	15	16	-	-	-	13
112	061005Z	22.2N	139.5E	SAT	(IR DATA	)	PCN 5	UMSP													
113	061005Z	21.8N	139.3E	SAT	(IR DATA	)	PCN 5	UMSP													
114	061020Z	22.4N	139.7E	SAT	(IR DATA	)	PCN 5	NOAA-5													
115	061027Z	23.0N	139.0E	SAT	(IR DATA	)	NOAA-5	(CONF 01)													
116	061500Z	22.6N	141.5E	SAT	(IR DATA	)	PCN 6	UMSP													
117	061500Z	22.6N	141.5E	SAT	(IR DATA	)	PCN 5	UMSP													
118	062106Z	22.7N	143.7E	SAT	(T1.0/2.0 /W1.5/24HRS)		PCN 5	UMSP														
119	062106Z	22.7N	143.8E	SAT	(T2.0/2.0 /	/	HMS)	PCN 5	UMSP													
120	062248Z	22.5N	144.8E	SAT	(T1.0/1.0 /	/	HMS)	NOAA-5	(CONF 01)													
121	062256Z	23.1N	144.4E	SAT	(IR DATA	)	PCN 5	NOAA-5													
122	070450Z	22.4N	146.4E	P	5	2	1500	10	70	270	10	50	280	25	997	-	24	19	-	-	-	14
123	070949Z	22.0N	149.1E	SAT	(IR DATA	)	PCN 6	UMSP													
124	071442Z	21.9N	150.2E	SAT	(IR DATA	)	PCN 5	UMSP													
125	072049Z	21.0N	154.9E	SAT	(T 0/1.0 /W1.0/24HRS)		PCN 5	UMSP														
126	072212Z	20.9N	155.4E	SAT	(IR DATA	)	PCN 5	NOAA-5													

TYPHOON MARY
FIX POSITIONS FOR CYCLONE NO. 21
0600Z 20 DEC TO 1800Z 03 JAN

FIX NO.	TIME	POSIT	FIA CAT	ACRY NAV-MET	FIA LVL	MAX OBS				MAX OBS			OBS MIN SLP	MIN MG!	FLT LVL TI/TO	EYE FORM	UMIEN-LATIUN	EYE DIA	PUSIT OF RADAR	MSN NMHR
						UIM	VEL	BRG	RNG	SFC	#IND	VEL									BRG	RNG
1	1908347	8.9N 177.0E	SAT	(IR DATA)																
2	191117	8.6N 177.8E	SAT	(IR DATA)																
3	1913157	9.0N 177.5E	SAT	(IR DATA)																
4	1915457	9.5N 179.8E	SAT	(IR DATA)																
5	1919292	9.0N 176.6E	SAT	(IR DATA)																
6	1920467	9.6N 177.8E	SAT	(T1.0/1.0 / / HRS)																
7	1921062	9.2N 178.5E	SAT	(T2.5/2.5 / / HRS)																
8	192117	9.1N 178.3E	SAT	(T1.0/1.0 / / HRS)																
9	1923527	11.4N 180.4E	SAT	(IR DATA)																
10	1923522	9.8N 178.9E	SAT	(IR DATA)																
11	2004152	9.6N 179.0E	SAT	(IR DATA)																
12	2007477	9.7N 178.9E	SAT	(IR DATA)																
13	2007532	10.0N 179.0E	SAT	(IR DATA)																
14	2010522	10.2N 179.6E	SAT	(IR DATA)																
15	2010572	10.1N 179.1E	SAT	(IR DATA)																
16	2011152	9.5N 179.1E	SAT	(IR DATA)																
17	2018482	10.0N 179.3E	SAT	(IR DATA)																
18	2019497	9.5N 178.9E	SAT	(IR DATA)																
19	2020222	9.0N 180.0E	SAT	(T3.0/3.0 /D0.5/23HRS)																
20	2102152	9.5N 179.0E	SAT	(IR DATA)																
21	2103152	9.7N 178.7E	SAT	(IR DATA)																
22	2107297	10.3N 179.7E	SAT	(T2.0/3.0 / / HRS)																
23	2107302	10.1N 179.2E	SAT	(IR DATA)																
24	2109027	10.0N 178.8E	SAT	(IR DATA)																
25	2109027	10.2N 179.2E	SAT	(IR DATA)																
26	2112152	10.0N 178.2E	SAT	(IR DATA)																
27	2112162	9.8N 179.0E	SAT	(T2.0/3.0 /W1.0/12 HRS)																
28	2112172	10.5N 179.0E	SAT	(IR DATA)																
29	2115152	9.8N 178.0E	SAT	(IR DATA)																
30	2118312	10.4N 176.7E	SAT	(T3.0/3.0 / / HRS)																
31	2121337	10.0N 177.6E	SAT	(T3.5/3.5 /D0.5/25HRS)																
32	2121382	9.6N 177.1E	SAT	(T3.0/3.0 / / HRS)																
33	2123172	10.2N 177.1E	SAT	(T3.0/3.0 / / HRS)																
34	2123172	10.9N 176.2E	SAT	(T3.0/3.0 / / HRS)																
35	2207132	10.2N 175.1E	SAT	(IR DATA)																
36	2207452	9.9N 174.9E	SAT	(IR DATA)																
37	2208182	10.2N 174.9E	SAT	(IR DATA)																
38	2211152	10.5N 174.2E	SAT	(IR DATA)																
39	2211592	10.6N 173.5E	SAT	(T3.0/3.0 / HRS)																
40	2218452	11.0N 174.0E	SAT	(IR DATA)																
41	2219552	11.1N 173.4E	SAT	(T4.5/4.5 / / HRS)																
42	2219552	11.1N 173.5E	SAT	(T4.5/4.5 /D1.5/21HRS)																
43	2220152	11.1N 173.3E	SAT	(T4.0/4.0 / / HRS)																
44	2220512	11.6N 173.3E	SAT	(T5.0/5.0 /D1.5/23HRS)																
45	2220542	11.1N 173.3E	SAT	(IR DATA)																
46	2220542	11.4N 173.3E	SAT	(T4.0/4.0 /D1.0/22HRS)																
47	2222592	11.2N 172.1E	SAT	(T5.0/5.0 /D2.0/24HRS)																
48	2302192	11.5N 172.0E	SAT	(IR DATA)																
49	2308372	11.6N 171.7E	SAT	(IR DATA)																
50	2308372	12.4N 171.6E	SAT	(IR DATA)																
51	2309312	12.1N 171.6E	SAT	(IR DATA)																
52	2309342	11.6N 171.3E	SAT	(IR DATA)																
53	2311412	12.6N 173.2E	SAT	(IR DATA)																
54	2319382	12.3N 170.3E	SAT	(T4.0/4.5 /W0.5/24HRS)																
55	2319452	12.8N 169.8E	SAT	(T3.0/4.0 /W1.0/24HRS)																
56	2322077	12.6N 170.5E	SAT	(T4.0/4.5 / / HRS)																
57	2400237	12.9N 170.2E	SAT	(IR DATA)																
58	2400237	12.8N 170.2E	SAT	(IR DATA)																
59	2401152	12.5N 169.8E	P	4 2 700 330 75 240																
60	2408152	13.0N 169.1E	SAT	(IR DATA)																
61	2408202	12.9N 169.3E	SAT	(IR DATA)																
62	2408202	12.9N 169.5E	SAT	(IR DATA)																
63	2408472	12.9N 169.1E	SAT	(IR DATA)																
64	2408472	12.7N 169.2E	SAT	(IR DATA)																
65	2413052	12.9N 169.4E	SAT	(IR DATA)																
66	2413052	12.7N 169.4E	SAT	(IR DATA)																
67	2413152	13.0N 168.8E	SAT	(IR DATA)																
68	2420492	12.6N 169.1E	SAT	(IR DATA)																
69	242127	12.4N 169.4E	SAT	(T5.0/5.0 / / HRS)																
70	2421232	12.4N 169.3E	SAT	(T5.0/5.0 /D1.0/23HRS)																
71	2500062	12.2N 169.1E	SAT	(IR DATA)																
72	2502492	12.3N 169.1E	SAT	(IR DATA)																
73	2503142	11.9N 169.4E	P	5 5 700 300 115 210																
74	2508032	11.8N 169.0E	SAT	(IR DATA)																
75	2508032	11.9N 168.9E	SAT	(IR DATA)																
76	2508032	11.6N 168.7E	SAT	(IR DATA)																
77	2509592	11.8N 168.7E	SAT	(IR DATA)																
78	2510022	12.0N 169.0E	SAT	(IR DATA)																
79	2512482	11.8N 168.7E	SAT	(IR DATA)																
80	2514152	11.3N 168.5E	SAT	(IR DATA)																
81	2515592	11.1N 168.4E	P	2 4 700 340 82 260 45																
82	2516252	11.1N 168.9E	LRRR	- 150 SPRL OVRLY PSBL EYE POOR FIX																
83	2517252	11.2N 168.6E	LRRR	- 150 SPRL OVRLY PSBL EYE POOR FIX																
84	2518252	10.8N 168.6E	LRRR	- 150 SPRL OVRLY PSBL EYE POOR FIX																
85	2520257	10.9N 168.0E	LRRR	- 150 SPRL OVRLY PSBL EYE POOR FIX																
86	2520392	10.4N 168.0E	SAT	(T5.0/5.0 / / HRS)																
87	2520452	10.4N 165.6E	SAT	(IR DATA)																
88	2520452	10.7N 167.5E	SAT	(T4.0/4.5 / / HRS)																
89	2520502	10.5N 167.3E	SAT	(T3.5/4.5 / / HRS)																
90	2522312	10.5N 168.0E	SAT	(T4.0/5.0 /W1.0/25HRS)																

181	3122267	9.7N 132.3E	SAT	(T3.0/3.0 /S /24HRS)	PCN 5 UMSP															
182	3123597	8.1N 131.2E	SAT	(IR DATA)	PCN 5 NOAA-5															
18J	010400Z	10.0N 131.0E	P	10 2 1500 270 40 180	50 *5 180	35	99*	-	27	25	-	-	-	-	-	-	-	-	-	16
18*	011104Z	10.3N 129.0E	SAT	(IR DATA)	PCN 6 UMSP															
185	011104Z	10.4N 128.5E	SAT	(IR DATA)	PCN 6 UMSP															
186	011237Z	9.6N 128.5E	SAT	(IR DATA)	PCN 6 NOAA-5															
187	011239Z	10.0N 128.6E	SAT	(IR DATA)	NOAA-5															
188	011457	9.0N 128.3E	P	5 30 700 170 40 20 40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
189	011549Z	10.3N 127.0E	SAT	(IR DATA)	PCN 6 UMSP															
190	012209Z	9.9N 126.4E	SAT	(T3.0/3.0 /D1.0/24HRS)	PCN 5 UMSP															
191	012209Z	9.9N 126.3E	SAT	(T3.5/3.5 /DU.5/24HRS)	PCN 3 UMSP															
192	020104Z	9.5N 126.5E	SAT	(T2.0/2.0 / / HRS)	NOAA-5															
19J	020113Z	9.6N 125.9E	SAT	(IR DATA)	PCN 5 NOAA-5															
19*	020610Z	10.4N 125.7E	LHUR	- EYE D10-15 KMS																
195	020800Z	10.6N 125.0E	LHUR	- EYE D10-15 KMS																
196	021000Z	10.4N 124.5E	LHUR	- EYE D10-15 KMS																
197	021051Z	10.5N 124.7E	SAT	(IR DATA)	PCN 5 UMSP															
198	021051Z	10.7N 124.6E	SAT	(IR DATA)	PCN 6 UMSP															
199	021153Z	10.7N 124.5E	SAT	(IR DATA)	PCN 6 NOAA-5															
200	021155Z	10.5N 124.1E	SAT	(IR DATA)	NOA UMSP															
201	021531Z	10.7N 123.5E	SAT	(IR DATA)	PCN 5 UMSP															
202	021531Z	10.7N 123.4E	SAT	(IR DATA)	PCN 6 UMSP															
20J	022333Z	10.4N 122.0E	SAT	(T2.0/3.0 /w1.5/25HRS)	PCN 5 UMSP															
20*	030029Z	9.9N 121.7E	SAT	(T2.0/2.5 / / HRS)	PCN 6 NOAA-5															
205	030232Z	9.9N 121.3E	SAT	(IR DATA)	PCN 5 UMSP															
206	030232Z	10.0N 121.6E	SAT	(T2.0/2.0+ / / HRS)	PCN 5 UMSP															
207	031034Z	10.3N 124.6E	SAT	(IR DATA)	PCN 3 UMSP															
208	031305Z	10.2N 124.2E	SAT	(IR DATA)	PCN 6 NOAA-5															
209	031514Z	10.0N 124.2E	SAT	(IR DATA)	PCN 5 UMSP															

4. NORTH INDIAN OCEAN FIX DATA

FIX POSITIONS FOR TROPICAL CYCLONE NO. 17-77
2000Z 11 MAY TO 0800Z 13 MAY

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL	EYE FORM	ORIENTATION	EYE DIA	POSIT OF RADAR	MSN NMBR
						DIR	VEL	BRG	RNG	SFC	WIND									RNG
1	080515Z	7.1N 82.2E	SAT	(T .5/0.5 / / HRS)					PCN 6	UMSP									
2	080657Z	7.5N 71.6E	SAT	(IR DATA)					PCN 6	UMSP									
3	090302Z	9.0N 77.5E	SAT	(IR DATA)						NOAA-5									
4	100410Z	14.0N 87.0E	SAT	(T .5/1.5 / / HRS)						NOAA-5	(CONF 01)								
5	100440Z	11.9N 86.3E	SAT	(IR DATA)					PCN 6	UMSP									
6	101459Z	14.5N 87.3E	SAT	(IR DATA)						NOAA-5	(CONF 02)								
7	110026Z	14.8N 88.5E	SAT	(T3.0/3.0 / / HRS)					PCN 5	UMSP									
8	110324Z	15.8N 88.1E	SAT	(T2.5/2.5 /D1.0/23HRS)						NOAA-5	(CONF 01)								
9	111303Z	17.0N 89.3E	SAT	(IR DATA)					PCN 5	UMSP									
10	111415Z	16.7N 89.7E	SAT	(IR DATA)						NOAA-5	(CONF 03)								
11	111704Z	15.4N 88.5E	SAT	(IR DATA)					PCN 4	UMSP									
12	111705Z	16.4N 89.5E	SAT	(IR DATA)					PCN 5	UMSP									
13	120018Z	18.4N 89.0E	SAT	(T4.0/4.0 /D1.0/24HRS)					PCN 4	UMSP									
14	120200Z	18.4N 88.2E	SAT	(T4.0/4.0 / / HRS)					PCN 6	UMSP									
15	120240Z	18.8N 89.0E	SAT	(T3.5/3.5 /D1.0/23HRS)						NOAA-5	(CONF 01)								
16	120547Z	20.3N 89.3E	SAT	(T4.0/4.0 / / HRS)						NOAA-5									
17	121303Z	20.8N 89.2E	SAT	(IR DATA)					PCN 3	UMSP									
18	121333Z	21.4N 89.4E	SAT	(IR DATA)						NOAA-5	(CONF 02)								
19	121828Z	22.2N 90.9E	SAT	(T4.0/4.0 /S /24HRS)					PCN 2	UMSP									
20	130006Z	23.8N 90.9E	SAT	(T3.5/4.0 /W0.5/24HRS)					PCN 3	UMSP									
21	130144Z	23.6N 91.7E	SAT	(T4.0/4.0 /S /24HRS)					PCN 4	UMSP									

FIX POSITIONS FOR TROPICAL CYCLONE NO. 18-77
2000Z 10 JUN TO 0800Z 13 JUN

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HG!	FLT LVL	EYE FORM	ORIENTATION	EYE DIA	POSIT OF RADAR	MSN NMBR
						DIR	VEL	BRG	RNG	SFC	WIND									RNG
1	090329Z	16.0N 69.0E	SAT	(T1.0/1.0 / / HRS)						NOAA-5	(CONF 01)								
2	091617Z	16.9N 69.4E	SAT	(IR DATA)						NOAA-5	(CONF 02)								
3	100440Z	17.9N 68.3E	SAT	(T2.5/2.5 /D1.5/25HRS)						NOAA-5	(CONF 01)								
4	100448Z	18.7N 68.6E	SAT	(T3.5/1.5 / / HRS)					PCN 4	UMSP									
5	101540Z	18.3N 66.8E	SAT	(IR DATA)					PCN 6	UMSP									
6	102008Z	19.2N 66.1E	SAT	(T3.5/3.5 / / HRS)					PCN 6	UMSP									
7	110242Z	19.5N 66.6E	SAT	(T4.5/3.5 /D1.0/24HRS)					PCN 3	UMSP									
8	110357Z	19.7N 66.0E	SAT	(T3.5/3.5 /D1.0/23HRS)						NOAA-5	(CONF 01)								
9	110404Z	20.2N 65.6E	SAT	(IR DATA)					PCN 4	UMSP									
10	110709Z	19.6N 64.8E	SAT	(IR DATA)					PCN 3	UMSP									
11	111528Z	19.7N 65.9E	SAT	(IR DATA)					PCN 6	UMSP									
12	111954Z	19.6N 61.8E	SAT	(IR DATA)					PCN 5	UMSP									
13	120234Z	20.1N 62.6E	SAT	(T3.5/3.5 /S /24HRS)					PCN 3	UMSP									
14	120251Z	20.1N 61.4E	SAT	(T4.0/4.0 /D0.5/24HRS)					PCN 1	UMSP									
15	120504Z	20.2N 62.3E	SAT	(T5.0/5.0 /D1.5/25HRS)						NOAA-5	(CONF 01)								
16	121515Z	21.1N 60.5E	SAT	(IR DATA)					PCN 6	UMSP									
17	121602Z	20.3N 59.8E	SAT	(IR DATA)						NOAA-5	(CONF 02)								
18	121933Z	20.6N 59.9E	SAT	(IR DATA)					PCN 2	UMSP									
19	130219Z	20.8N 59.1E	SAT	(IR DATA)					PCN 6	UMSP									
20	130425Z	20.5N 58.5E	SAT	(T3.0/4.0 /W2.0/23HRS)						NOAA-5	(CONF 01)								
21	140534Z	20.1N 54.9E	SAT	(T1.0/1.0 /W2.0/25HRS)						NOAA-5	(CONF 01)								

FIX POSITIONS FOR TROPICAL CYCLONE NO. 19-77
2000Z 29 OCT TO 2000Z 31 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACRY NAV-MET	FIX LVL	MAX OBS				PCN	UMSP	UBS MIN SLP	MIN 700MB MG!	FLT LVL TI/10	EYE FORM	UMIEN- IAIUN DIA	EYE DIA	POSIT OF RADAR	MSN NMBR
						FLY UIR	LVL VEL	WIND BRG	RNG										
1	270020Z	12.0N 91.0E	SAT	(IR DATA					)	PCN 6	UMSP								
2	270027Z	12.4N 92.4E	SAT	(T2.0/2.0 /					/ HMS)	PCN 5	UMSP								
3	270535Z	11.4N 92.1E	SAT	(T2.0/2.0 /					/ HMS)	PCN 6	UMSP								
4	271302Z	11.4N 92.3E	SAT	(IR DATA					)	PCN 6	UMSP								
5	271429Z	10.8N 90.4E	SAT	(IR DATA					)		NOAA-5								(CONF 02)
6	271817Z	11.8N 92.6E	SAT	(IR DATA					)	PCN 6	UMSP								
7	280144Z	11.5N 88.2E	SAT	(IR DATA					)	PCN 6	UMSP								
8	280254Z	11.0N 94.0E	SAT	(T2.0/2.0 /					/ HMS)		NOAA-5								(CONF 02)
9	280517Z	13.0N 89.1E	SAT	(T2.0/2.0 /S					/24HMS)	PCN 5	UMSP								
10	281245Z	12.1N 89.2E	SAT	(IR DATA					)	PCN 5	UMSP								
11	281245Z	12.2N 88.1E	SAT	(IR DATA					)	PCN 5	UMSP								
12	281345Z	13.0N 89.8E	SAT	(IR DATA					)		NOAA-5								(CONF 02)
13	281800Z	11.3N 88.0E	SAT	(IR DATA					)	PCN 5	UMSP								
14	290127Z	11.3N 88.1E	SAT	(IR DATA					)	PCN 6	UMSP								
15	290409Z	11.8N 87.8E	SAT	(T2.0/2.0 /S					/25HMS)		NOAA-5								(CONF 01)
16	290500Z	13.5N 87.9E	SAT	(T2.0/2.0 /S					/24HMS)	PCN 4	UMSP								
17	291409Z	12.1N 85.9E	SAT	(IR DATA					)	PCN 6	UMSP								
18	291500Z	12.2N 85.1E	SAT	(IR DATA					)		NOAA-5								(CONF 01)
19	291742Z	13.2N 85.4E	SAT	(IR DATA					)	PCN 3	UMSP								
20	300110Z	14.2N 85.0E	SAT	(IR DATA					)	PCN 3	UMSP								
21	300326Z	14.3N 84.1E	SAT	(T2.0/2.0 /S					/23HMS)		NOAA-5								
22	300624Z	13.6N 84.6E	SAT	(IR DATA					)	PCN 5	UMSP								
23	301352Z	14.6N 83.2E	SAT	(IR DATA					)	PCN 4	UMSP								
24	301415Z	14.0N 83.0E	SAT	(IR DATA					)		NOAA-5								
25	301724Z	14.7N 82.4E	SAT	(IR DATA					)	PCN 6	UMSP								
26	301904Z	14.9N 82.2E	SAT	(IR DATA					)	PCN 6	UMSP								
27	310053Z	15.0N 82.1E	SAT	(IR DATA					)	PCN 6	UMSP								
28	310242Z	14.5N 81.5E	SAT	(T3.0/3.0 /D1.0/23HMS)					)		NOAA-5								
29	310607Z	15.0N 80.6E	SAT	(T3.0/3.0 /					/ HMS)	PCN 5	UMSP								
30	311357Z	15.8N 79.2E	SAT	(IR DATA					)	PCN 6	UMSP								
31	030143Z	16.5N 65.0E	SAT	(IR DATA					)	PCN 6	UMSP								
32	030655Z	16.3N 63.0E	SAT	(T1.5/1.5 /					/ HMS)	PCN 6	UMSP								
33	031425Z	16.6N 61.2E	SAT	(IR DATA					)	PCN 6	UMSP								
34	040304Z	16.7N 58.2E	SAT	(IR DATA					)	PCN 6	UMSP								
35	040637Z	15.7N 58.4E	SAT	(IR DATA					)	PCN 6	UMSP								

FIX POSITIONS FOR TROPICAL CYCLONE NO. 21-77
2000Z 10 NOV 10 2000Z 21 NOV

FIX NO.	TIME	POSIT	FIA CAT	ACCRV NAV-MET	FIX LVL	MAX OBS				MAX OBS				OBS MIM SLP	MIM 700MB MG!	FLT LVL TI/TO	EYE FORM	ORIENT- IATIUN	EYE DIA	POSIT OF RADAR	MSN NMBR
						FLT LVL	WIND UIN	WIND VEL	BRG	RNG	SFC WIND VEL	WIND BRG	RNG								
1	091242Z	11.5N	90.0E	SAT	(IR DATA																
2	091439Z	11.3N	88.3E	SAT	(IR DATA																(CONF 02)
3	100307Z	10.8N	86.3E	SAT	(T3.0/3.0 /																(CONF 01)
4	101356Z	11.6N	84.8E	SAT	(IR DATA																(CONF 02)
5	101407Z	11.5N	85.2E	SAT	(IR DATA																
6	101733Z	11.7N	84.7E	SAT	(IR DATA																
7	110108Z	11.4N	82.7E	SAT	(T3.5/3.5 /																
8	110224Z	10.5N	82.5E	SAT	(T4.0/4.0 /D1.0/23HMS)																(CONF 01)
9	110615Z	10.9N	82.3E	SAT	(T3.0/3.5 /																
10	111356Z	11.0N	81.1E	SAT	(IR DATA																
11	111507Z	11.0N	80.0E	SAT	(IR DATA																(CONF 01)
12	111857Z	11.2N	80.7E	SAT	(IR DATA																
13	120051Z	11.0N	79.5E	SAT	(T3.0/3.5 /W0.5/24HMS)																(CONF 01)
14	120336Z	10.6N	80.0E	SAT	(T4.5/4.5 /D0.5/25HMS)																
15	120558Z	10.7N	78.8E	SAT	(T3.0/3.5 /S /24HMS)																
16	130215Z	10.5N	75.0E	SAT	(T1.5/2.5 /W1.5/25HMS)																
17	131437Z	12.4N	74.0E	SAT	(IR DATA																
18	131822Z	12.0N	73.0E	SAT	(IR DATA																
19	140158Z	12.7N	72.0E	SAT	(T2.0/2.0 /D0.5/24HMS)																
20	140404Z	12.6N	71.4E	SAT	(T2.0/2.0 /																(CONF 01)
21	140704Z	12.7N	71.2E	SAT	(T3.0/3.0 /																
22	141417Z	12.7N	69.6E	SAT	(IR DATA																
23	141537Z	13.3N	67.8E	SAT	(IR DATA																(CONF 01)
24	141946Z	13.2N	69.3E	SAT	(IR DATA																
25	150117Z	13.9N	66.8E	SAT	(T3.5/3.5 /D1.5/24HMS)																
26	150320Z	13.9N	67.8E	SAT	(T4.0/4.0 /D2.0/23HMS)																(CONF 01)
27	150646Z	14.4N	66.7E	SAT	(T4.0/3.5 /D1.0/24HMS)																
28	151423Z	14.3N	66.4E	SAT	(IR DATA																
29	151617Z	13.5N	65.6E	SAT	(IR DATA																(CONF 01)
30	151928Z	14.0N	66.4E	SAT	(IR DATA																
31	160305Z	13.7N	66.5E	SAT	(T4.0/4.0 /D0.5/25HMS)																
32	160431Z	13.0N	66.8E	SAT	(T4.5/4.5 /D0.5/25HMS)																(CONF 01)
33	160624Z	13.4N	66.6E	SAT	(T4.0/4.0 /S /24HMS)																
34	161521Z	13.0N	66.5E	SAT	(IR DATA																(CONF 01)
35	161911Z	13.5N	67.0E	SAT	(IR DATA																
36	170248Z	12.2N	67.2E	SAT	(T4.5/4.5 /D0.5/24HMS)																
37	170349Z	13.1N	66.9E	SAT	(T5.0/5.0 /D0.5/23HMS)																(CONF 01)
38	170611Z	12.1N	66.8E	SAT	(IR DATA																
39	171437Z	12.5N	67.3E	SAT	(IR DATA																(CONF 01)
40	171536Z	12.0N	67.0E	SAT	(IR DATA																
41	171853Z	12.4N	66.6E	SAT	(IR DATA																
42	180231Z	11.7N	67.3E	SAT	(T3.5/4.5 /W1.0/24HMS)																
43	180502Z	10.4N	67.4E	SAT	(T5.0/5.0 /S /25HMS)																(CONF 01)
44	180735Z	11.4N	67.5E	SAT	(IR DATA																
45	181514Z	10.6N	69.4E	SAT	(IR DATA																
46	181549Z	10.3N	69.0E	SAT	(IR DATA																(CONF 01)
47	181836Z	10.3N	70.2E	SAT	(IR DATA																
48	190214Z	10.3N	70.2E	SAT	(T3.5/3.5 /S /24HMS)																
49	190414Z	10.3N	69.6E	SAT	(T3.0/4.0 /W2.0/23HMS)																(CONF 01)
50	190717Z	10.0N	70.5E	SAT	(IR DATA																
51	191456Z	9.8N	70.3E	SAT	(IR DATA																
52	191818Z	9.7N	70.5E	SAT	(IR DATA																
53	200157Z	10.3N	71.4E	SAT	(T3.5/3.5 /S /24HMS)																
54	200335Z	10.2N	72.8E	SAT	(T3.5/4.0 /D0.5/23HMS)																(CONF 01)
55	200700Z	10.8N	71.9E	SAT	(IR DATA																
56	201439Z	10.0N	74.0E	SAT	(IR DATA																
57	201800Z	9.8N	73.2E	SAT	(IR DATA																
58	210140Z	10.5N	73.6E	SAT	(T3.5/3.5 /S /24HMS)																
59	210622Z	11.6N	73.6E	SAT	(IR DATA																
60	211422Z	13.2N	73.5E	SAT	(IR DATA																
61	211556Z	14.9N	73.6E	SAT	(IR DATA																(CONF 01)
62	211926Z	15.2N	74.1E	SAT	(IR DATA																
63	220123Z	15.1N	74.4E	SAT	(T2.5/3.0 /W1.0/24HMS)																
64	220401Z	15.9N	75.0E	SAT	(T1.0/1.5 /																(CONF 01)
65	220626Z	16.7N	74.6E	SAT	(IR DATA																
66	221405Z	17.5N	74.6E	SAT	(IR DATA																

FIX POSITIONS FOR TROPICAL CYCLONE NO. 22-71

0800Z 15 NOV 10 2000Z 19 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	FLT DIR	LVL VEL	WIND BRG	RNG	MAX OBS		OBS MIN SLP	MIN 700MB HG!	FLT LVL TI/TO	EYE FORM	URIEN- IATION	EYE DIA	POSIT OF RADAR	MSN NMBH
										SPC WIND VEL	WIND BRG								
1	1400147	6.1N 91.6E	SAT								PCN 6 UMSP								
2	1402107	5.9N 91.7E	SAT								NOAA-5	(CONF 01)							
3	1405257	5.9N 91.0E	SAT								UMSP								
4	1414517	6.5N 91.2E	SAT								PCN 6 UMSP	(CONF 01)							
5	1419047	6.0N 90.0E	SAT								UMSP								
6	1501417	6.1N 89.3E	SAT								PCN 4 UMSP								
7	1503237	6.7N 89.8E	SAT								NOAA-5	(CONF 01)							
8	1505057	6.0N 87.5E	SAT								PCN 4 UMSP								
9	1512417	6.2N 85.9E	SAT								UMSP								
10	1514077	6.1N 86.3E	SAT								NOAA-5	(CONF 02)							
11	1517477	6.4N 86.7E	SAT								PCN 6 UMSP								
12	1601247	7.0N 85.6E	SAT								PCN 6 UMSP								
13	1602397	6.8N 85.5E	SAT								NOAA-5	(CONF 01)							
14	1606297	7.0N 85.4E	SAT								PCN 2 UMSP								
15	1614467	8.2N 86.9E	SAT								PCN 2 UMSP								
16	1615237	8.0N 86.2E	SAT								NOAA-5	(CONF 01)							
17	1617247	8.7N 86.5E	SAT								PCN 2 UMSP								
18	1701077	9.6N 86.5E	SAT								PCN 2 UMSP								
19	1703507	9.1N 83.7E	SAT								NOAA-5	(CONF 01)							
20	1706117	10.2N 83.9E	SAT								PCN 2 UMSP								
21	1713297	11.4N 83.3E	SAT								PCN 2 UMSP								
22	1714377	11.4N 83.7E	SAT								NOAA-5	(CONF 01)							
23	1718537	11.7N 83.1E	SAT								PCN 2 UMSP								
24	1800507	12.3N 82.7E	SAT								PCN 2 UMSP								
25	1803057	12.5N 82.9E	SAT								NOAA-5	(CONF 01)							
26	1805537	12.6N 82.5E	SAT								PCN 2 UMSP								
27	1815517	13.5N 81.9E	SAT								NOAA-5	(CONF 01)							
28	1818377	13.8N 81.7E	SAT								PCN 2 UMSP								
29	1900327	14.5N 81.6E	SAT								PCN 2 UMSP								
30	1902147	14.8N 81.6E	SAT								PCN 2 UMSP								
31	1904167	15.1N 81.9E	SAT								NOAA-5	(CONF 01)							
32	1905367	15.2N 81.3E	SAT								PCN 2 UMSP								
33	1913147	16.1N 80.0E	SAT								PCN 2 UMSP								
34	1918147	16.9N 80.8E	SAT								PCN 2 UMSP								
35	2001577	18.2N 81.2E	SAT								PCN 6 UMSP								
36	2005147	19.2N 81.9E	SAT								PCN 6 UMSP								
37	2018007	19.5N 80.9E	SAT								PCN 6 UMSP								

LATE FIXES LISTED AS [] IN TABLE 6-1.

TYPHOON BABE - 0000Z 02 SEP TO 1800Z 10 SEP

01	060020Z	13.0N 130.0E	SAT	(T4.0/4.0 /S /24HRS)	NOAA-5	(CONF 01)
02	061109Z	14.0N 129.2E	SAT	(IR DATA)	NOAA-5	(CONF 03)
03	081141Z	22.0N 127.0E	SAT	(IR DATA)	NOAA-5	(CONF 01)

TROPICAL STORM CARLA - 0000Z 03 SEP TO 0000Z 05 SEP

01	020118Z	18.3N 118.0E	SAT	(T1.5/1.5 /D1.0/24HRS)	NOAA-5	(CONF 02)
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TYPHOON DINAH - 1200Z 14 SEP TO 1800Z 23 SEP

01	122303Z	(SEE COMMENT)	SAT	(T2.0/2.0 /S /24HRS)	NOAA-5	(CONF 01) - 02 DEG EITHER SIDE OF A LINE FM 22N-135E
02	131157Z	22.7N 134.3E	SAT	(IR DATA)	NOAA-5	(CONF 01) TO 22N-142E
03	140015Z	22.0N 131.5E	SAT	(T3.0/3.0 /D1.0/25HRS)	NOAA-5	(CONF 01)
04	141110Z	21.6N 128.0E	SAT	(IR DATA)	NOAA-5	(CONF 02)

TROPICAL STORM EMMA - 0600Z 15 SEP TO 0600Z 20 SEP

01	141108Z	19.0N 144.5E	SAT	(IR DATA)	NOAA-5	(CONF 02)
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TROPICAL STORM FREDA - 0000Z 23 SEP TO 0000Z 25 SEP

01	241330Z	20.4N 111.0E	SAT	(IR DATA)	NOAA-5	(CONF 02)
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TYPHOON GILDA - 0000Z 03 OCT TO 0600Z 10 OCT

01	042227Z	19.2N 152.7E	SAT	(T3.5/3.5 /D1.0/23HRS)	NOAA-5	(CONF 02)
02	052315Z	23.5N 150.0E	SAT	(T4.0/4.0 /D0.5/25HRS)	NOAA-5	(CONF 01)
03	070027Z	26.5N 147.8E	SAT	(T4.5/4.5 /D0.5/24HRS)	NOAA-5	(CONF 01)
04	080004Z	30.0N 147.7E	SAT	(T5.0/5.0 /D0.5/24HRS)	NOAA-5	(CONF 01)
05	091024Z	41.2N 165.4E	SAT	(IR DATA)	NOAA-5	(CONF 01)

TROPICAL STORM HARRIET - 0600Z 16 OCT TO 1800Z 20 OCT

01	160006Z	15.1N 136.1E	SAT	(T2.0/2.0 /D2.0/24HRS)	NOAA-5	(CONF 01)
02	170117Z	17.1N 131.9E	SAT	(T3.0/3.0 /D1.0/25HRS)	NOAA-5	(CONF 01)
03	180034Z	18.9N 132.5E	SAT	(T3.5/3.5 /D0.5/23HRS)	NOAA-5	(CONF 02)
04	181126Z	19.5N 133.3E	SAT	(IR DATA)	NOAA-5	(CONF 02)

TYPHOON IVY - 0600Z 21 OCT TO 0000Z 27 OCT

01	240000Z	21.2N 151.1E	SAT	(T4.5/4.5 /D0.5/25HRS)	NOAA-5	(CONF 01)
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TYPHOON JEAN - 1200Z 28 OCT TO 1200Z 03 NOV

01	012313Z	26.7N 146.1E	SAT	(T3.0/3.0 /D1.0/23HRS)	NOAA-5	(CONF 01)
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TYPHOON KIM - 0600Z 06 NOV TO 0000Z 17 NOV

01	071018Z	12.3N 149.0E	SAT	(IR DATA)	NOAA-5	(CONF 01)
02	131145Z	14.3N 123.2E	SAT	(IR DATA)	NOAA-5	(CONF 01)
03	150122Z	16.9N 118.8E	SAT	(T3.5/3.5 /W1.5/25HRS)	NOAA-5	(CONF 01)

TYPHOON LUCY - 0600Z 28 NOV TO 1800Z 07 DEC

01	281025Z	06.9N 157.0E	SAT	(IR DATA)	NOAA-5	(CONF 02)
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TYPHOON MARY - 0600Z 20 DEC TO 1800Z 03 JAN

01	232159Z	12.6N 170.5E	SAT	(T3.5/4.5 /W1.0/25HRS)	NOAA-5	(CONF 01)
02	260918Z	09.5N 165.0E	SAT	(IR DATA)	NOAA-5	(CONF 01)
03	290011Z	11.4N 149.5E	SAT	(T3.5/3.5 /S /25HRS)	NOAA-5	(CONF 01)
04	291059Z	11.1N 145.5E	SAT	(IR DATA)	NOAA-5	(CONF 01)
05	292328Z	11.1N 143.0E	SAT	(VIS DATA)	NOAA-5	(CONF 01)
06	311127Z	09.4N 134.6E	SAT	(IR DATA)	NOAA-5	(CONF 02)
07	030025Z	09.9N 122.3E	SAT	(T1.5/1.5 /W1.0/24HRS)	NOAA-5	(CONF 01)

LATE FIXES LISTED AS [] IN TABLE 6-1.

TROPICAL CYCLONE NO. 21-77 - 2000Z 10 NOV TO 2000Z 21 NOV

01	191505Z	09.4N	070.0E	SAT	(IR DATA	)	NOAA-5	(CONF 01)
02	201618Z	10.0N	072.9E	SAT	(IR DATA	)	NOAA-5	(CONF 02)
03	210445Z	11.2N	074.8E	SAT	(T2.5/3.0 /W1.0/25HRS)	)	NOAA-5	(CONF 02)

TROPICAL CYCLONE NO. 22-77 - 0800Z 15 NOV TO 2000Z 19 NOV

01	191507Z	15.9N	080.9E	SAT	(IR DATA	)	NOAA-5	(CONF 01)
02	200331Z	19.6N	082.2E	SAT	(VIS DATA	)	NOAA-5	(CONF 02)

APPENDIX

I. CONTRACTIONS

AC&W	Aircraft Control and Warning System	KM	Kilometer(s)
ACCRY	Accuracy	KT	Knot(s)
ACFT	Aircraft	LRDR	Land Radar
ACR	Aircraft Radar	LVL	Level
AIREP	Aircraft Weather Report(s) (Commercial and Military)	M/SEC	Meters per Second
ANT	Antenna	MAX	Maximum
ARWO	Airborne Weather Reconnaissance Officer	MB	Millibar(s)
ATT	Attenuation	MET	Meteorological
AVG	Average	MH50	MOHATT 500 mb Prog
AWN	Automated Weather Network	MH70	MOHATT 700 mb Prog
BRG	Bearing	MIN	Minimum
CAT	Category	MOHATT	Modified Hatrack
CIRC	Circular	MSN	Mission
CLD	Cloud	NAV	Navigational
CLSD	Closed	NEDN	Naval Environmental Data Network
CNTR	Center	NEDS	Naval Environmental Display Station
CONC	Concentric	NET	Near Equatorial Trough
CONF	Confidence (number)	NM	Nautical Mile(s)
DEG	Degree(s)	OBS	Observation
D/DIA	Diameter	P	Penetration (by aircraft)
DIR	Direction	PC	Percent (%)
DMSP	Defense Meteorological Satellite Program	PCN	Position Code Number
ELEV	Elevation	PSBL	Possible
ELIP	Elliptical	PTLY	Partly
FLT	Flight	QUAD	Quadrant
GOES	Geostationary Operational Environmental Satellite	RECON	Reconnaissance
HATRACK	Hurricane and Typhoon Tracking (numerical forecast)	RNG	Range
HGT	Height	RPD	Rapid
HPAC	Mean of XTRP and Climatology	SAT	Satellite
HUR	Hurricane	SFC	Surface
HR(S)	Hour(s)	SLP (MSLP)	Sea Level Pressure (Minimum Sea Level Pressure)
HVY	Heavy	SMS	Synchronous Meteorological Satellite
IR	Infrared	SPOL	Spiral Overlay
		SRDR	Ship Radar

SRP	Selective Reconnaissance Program
STNRY	Stationary
STY	Super Typhoon
TC	Tropical Cyclone
TCARC	Tropical Cyclone Aircraft Reconnaissance Coordinator
TCM	Tropical Cyclone Model
TD	Tropical Depression
TI	Temperature Inside Eye
TO	Temperature Outside Eye
TS	Tropical Storm
TY	Typhoon
TUTT	Tropical Upper Tropospheric Trough
VEL	Velocity
VIS	Visual
VSBL	Visible
WESTPAC	Western Pacific
WMO	World Meteorological Organization
WRS	Weather Reconnaissance Squadron
XTRP	Extrapolation
Z	Zulu Time (Greenwich mean time)

2. DEFINITIONS

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

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

EPHEMERIS-Position of a body (satellite) in space as a function of time. When no geographical reference is available for gridding satellite imagery, then only ephemeris gridding is possible which is solely based on the theoretical satellite position and is susceptible to errors from satellite pitch, orbit eccentricity and the non-spherical earth.

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/CENTER-Refers to the roughly circular central area of a well developed tropical

cyclone usually characterized by comparatively light winds and fair weather. If more than half surrounded by wall cloud, the word "eye" is used, otherwise the area is referred to as a center.

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

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

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

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

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

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

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

TROPICAL DISTURBANCE-A discrete system of apparently organized convection--generally 100 to 300 miles 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.

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

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

TYPHOON/HURRICANE-A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 64 kt or greater.

WALL CLOUD-An organized band of cumuloform clouds immediately surrounding the central area of tropical cyclone. Wall clouds may entirely enclose the eye or only partially surround the center.

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ABSTRACT

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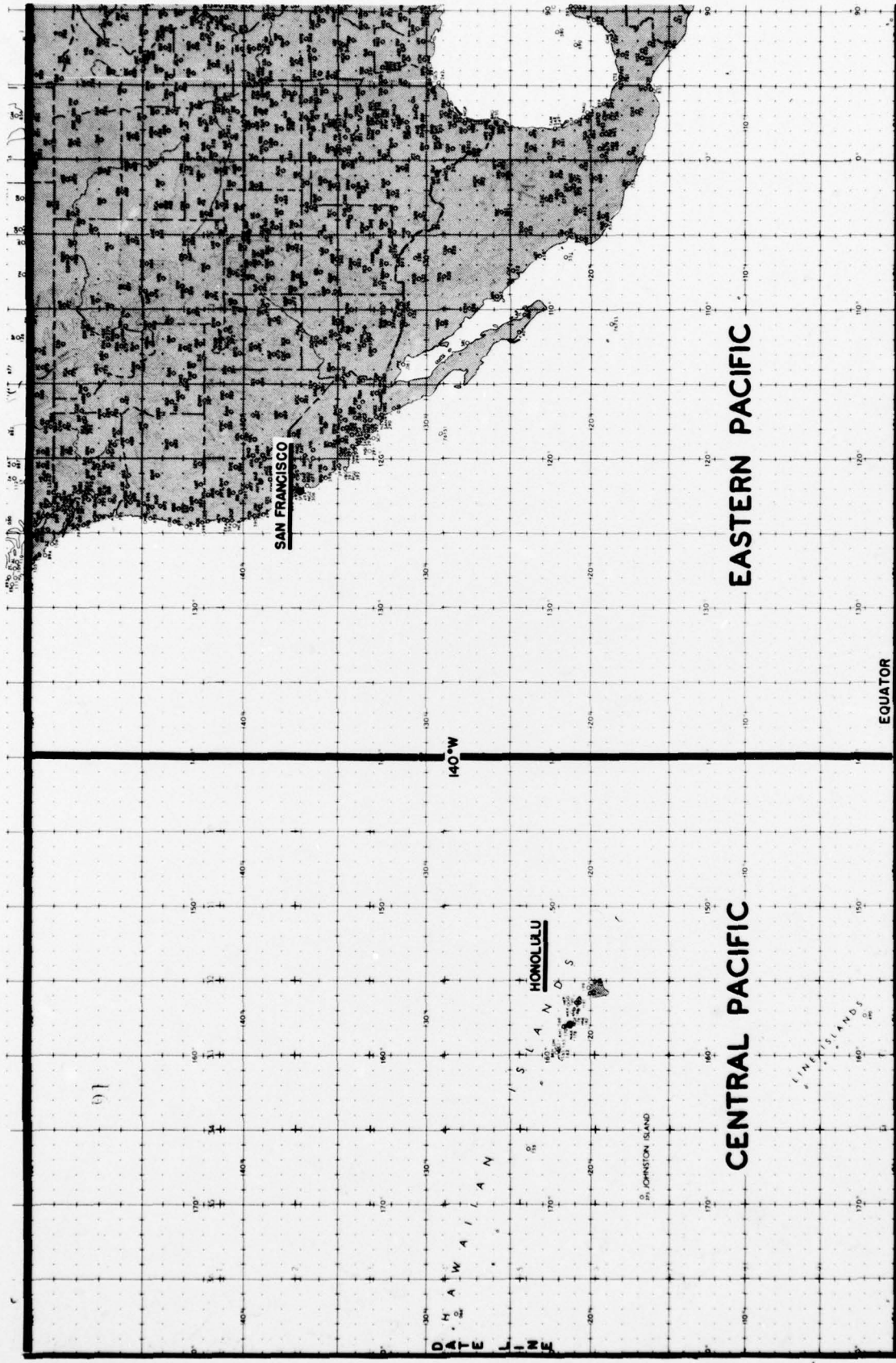
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