



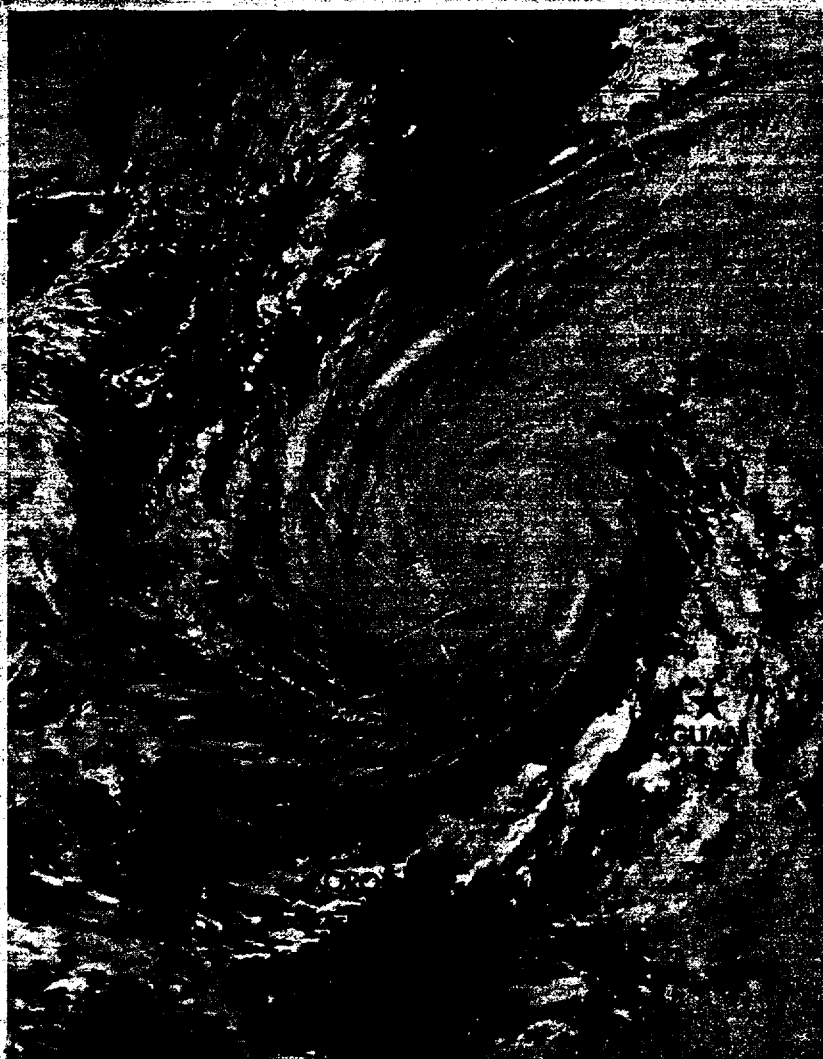
1975



# TYPHOON

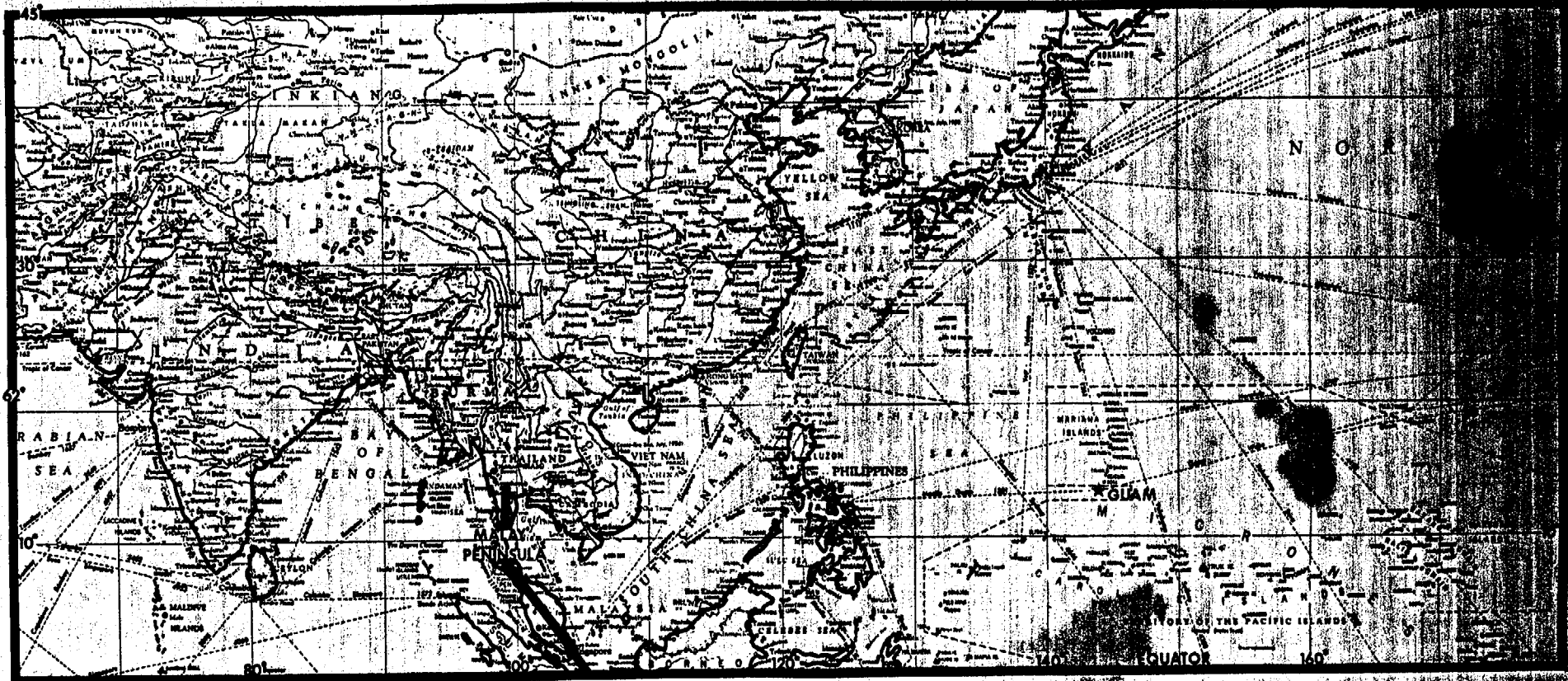
ANNUAL

REPORT



JOINT TYPHOON WARNING CENTER  
GUAM, MARIANA ISLANDS

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Indian Ocean Area (Malay Peninsula West to 62° E)

Pacific Area (Dateline to Malay Peninsula)

# **AREAS OF RESPONSIBILITY - JOINT TYPHOON WARNING CENTER, GUAM**

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1975  
ANNUAL TYPHOON REPORT

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## FOREWORD

The body of this report summarizes the tropical cyclones of the western and central North Pacific and the North Indian Ocean. The U. S. National Weather Service publishes summaries of eastern North Pacific tropical cyclones in the Monthly Weather Review, the Mariners Weather Log, and Pilot Charts.

Fleet Weather Central/Joint Typhoon Warning Center (FLEWEACEN/JTWC), Guam has the responsibility to:

1. Provide warnings for all tropical cyclones north of the equator, west of the Dateline, and east of 62E;
2. Determine tropical cyclone reconnaissance requirements and assign priorities;
3. Conduct post-analysis programs including preparation of the Annual Typhoon Report; and
4. Conduct tropical cyclone analysis and forecasting research.

Detachment 17/Asian Tactical Forecast Unit, 20th Weather Squadron, Yokota AB, Japan with assistance from the Naval Weather Service Facility, Yokosuka, Japan, is designated as the alternate JTWC in the event that FLEWEACEN/JTWC Guam is incapacitated.

JTWC is an integral part of FLEWEACEN Guam and is manned by officers and enlisted men from the Air Force and Navy. The senior Air force officer is designated as the Director, JTWC, and the senior Naval officer is the JTWC Operations Officer.

The PACOM Tropical Cyclone Warning System (western North Pacific and Indian Ocean) consists of the Joint Typhoon Warning Center, the U. S. Air Force 54th Weather Reconnaissance Squadron stationed at Andersen AFB, Guam, and the Air Force Weather Service Defense Meteorological Satellite Program (DMSP) sites at Nimitz Hill, Guam; Yokota AB, Japan; Kadena AB, Japan; Clark AB, Philippines; Hickam AFB, Hawaii; and the Air Force Global Weather Central, Offutt AFB, Nebraska. Additionally satellite support is provided by the Fleet Weather Facility, Suitland, Maryland.

The Central Pacific Hurricane Center, Honolulu, is responsible for the area from the Dateline eastward to 140W and north of the equator. Warnings are issued in coordination with FLEWEACEN Pearl Harbor and Detachment 4, IWW, Hickam AFB, Hawaii.

CINCPACFLT, CDRUSACSG, and CINCPACAF are responsible for further dissemination, and if necessary, local modification of tropical cyclone warnings to U. S. military agencies.

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# **CHAPTER I - OPERATIONAL PROCEDURES**

## **1. GENERAL**

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 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 issued twice daily for all tropical cyclones in the Pacific area.

FLEWEACEN Guam provides computerized meteorological/oceanographical products for JTWC. Communication support is furnished by the Nimitz Hill Naval Telecommunications Center (NTCC) of the Naval Communications Station, Guam.

## **2. ANALYSES AND DATA SOURCES**

### **a. COMPUTER PRODUCTS:**

Varian plotted charts are routinely produced at synoptic times for the surface, 850 mb, 700 mb, and 500 mb. A chart of upper tropospheric data is produced which utilizes 200 mb rawinsonde data and AIREPS above 29,000 ft within 6 hr of the 0000Z and 1200Z synoptic times.

JTWC extensively utilizes the FLEWEACEN Guam Computer Center for objective forecast techniques and statistical post-analysis.

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.

### **b. JTWC ANALYSES:**

(1) Combined surface/gradient-level (3,000 ft) streamline analysis over tropical regions and an isobaric analysis in more northern latitudes and around intense tropical systems at 0000Z and 1200Z. The blend zone between streamlines and isobars fluctuates as the pressure gradient changes from season to season. Low-level wind directions from satellite data are included in the analysis.

(2) 500 mb contour analysis at 0000Z and 1200Z.

(3) Composite upper-tropospheric streamline analysis utilizing rawinsonde data from 300 mb through 100 mb, wind directions extracted from satellite data by Det 1, LWW and AIREPS at or above 29,000 feet at 0000Z and 1200Z.

(4) Additional sectional analyses similar to those above, at intermediate synoptic times, during periods of tropical cyclone activity.

### **c. AIRCRAFT RECONNAISSANCE:**

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

### **d. SATELLITE DATA:**

The Defense Meteorological Satellite Program (DMSP) played a major role in the early detection of tropical cyclones in 1975. A discussion of this role, as well as applications of satellite data to tropical cyclone tracking, is presented in Chapter II.

### **e. RADAR:**

During 1975, land radar coverage was utilized more extensively in the selective reconnaissance program than ever before. Once a storm moved within the range of a land radar site, reports were usually received hourly. Use of radar during 1975 is discussed in Chapter II.

## **3. FORECAST AIDS**

### **a. CLIMATOLOGY:**

Various climatological publications listed in earlier Annual Typhoon Reports were utilized in addition to the following recently received publications:

- (1) Mariner's Worldwide Climatic Guide to Tropical Storms at Sea. (Crutcher, H. L. and R. G. Quayle, 1974)
- (2) Tropical Cyclone Genesis (Gray, W., 1975)
- (3) Annual Typhoon Reports, 1959-1974 (FWC/JTWC).

### **b. OBJECTIVE TECHNIQUES:**

The following objective techniques were employed in tropical cyclone forecasting during 1975. 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) XT24
- (7) INJAH74

#### 4. FORECASTING PROCEDURES

##### a. INITIAL POSITIONING:

An initial center position is determined from a subjective evaluation of center fix data and synoptic data. When these data sources are not available, extrapolation from the previous position is used.

##### 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 positions and amplitude of middle tropospheric mid-latitude troughs from the latest 500 mb analysis and numerical progs.

(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 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 towards persistence while that near the end of the time frame is biased towards analogs 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 discussed above. 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.

#### 5. 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 location, intensity, direction and speed of movement, and the radial extent of 30, 50,

and 100 kt surface winds (when applicable). 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 greater than 33 kt. Forecast intervals are 24- and 48-hr.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of the verification results for 1975 is presented in Chapter V.

#### 6. PROGNOSTIC REASONING MESSAGE

In the Pacific area, prognostic reasoning messages are transmitted at 0000Z and 1200Z. This message is intended to provide field meteorologists with the reasoning behind the latest JTWC forecast. Prognostic reasoning messages are not prepared for the Indian Ocean area.

#### 7. SIGNIFICANT TROPICAL WEATHER ADVISORY

This message, summarizing significant weather in the entire JTWC area of responsibility, is issued at 0600Z daily. It contains a detailed, non-technical description of all significant tropical disturbances, and the JTWC evaluation of potential for tropical cyclone development.

#### 8. TROPICAL CYCLONE FORMATION ALERT

Alerts are issued whenever interpretation of satellite and other meteorological data indicates that formation of a significant tropical cyclone is likely. These alerts are valid for 24 hr unless reissued, cancelled, or superseded by a warning.

## CHAPTER II - RECONNAISSANCE & COMMUNICATIONS

### 1. GENERAL

The Joint Typhoon Warning Center relies primarily on two reconnaissance platforms to provide the required fix data for tropical cyclone warnings. In 1975 these two platforms, namely aircraft and satellite, provided 85.9 percent of the fixes used for tropical cyclone warnings in the western North Pacific with land radar, synoptic data, and extrapolation forming the basis of the remaining 14.1 percent. In addition, another 196 satellite fixes were made in the Indian Ocean. Timely satellite coverage was hampered this year with the loss of local readout capabilities and eventual total loss of an afternoon and an early morning satellite over the western North Pacific.

### 2. RECONNAISSANCE RESPONSIBILITY AND SCHEDULING

Aircraft weather reconnaissance is performed in the JTWC area of responsibility by the 54th Weather Reconnaissance Squadron (54WRS). The squadron, presently equipped with WC-130 aircraft, is located at Andersen Air Force Base, Guam. The JTWC reconnaissance requirements are sent daily during the typhoon season to the Tropical Cyclone Aircraft Reconnaissance Coordinator (TCARC). These requirements include areas to be investigated, fix times and forecast position of cyclones to be fixed, and synoptic tracks to be flown. IAW CINCPACINST 3140.1M, "Usage of reconnaissance assets in acquiring meteorological data from aircraft, satellite, and landbased 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. Vortex fixes will not be levied until maximum sustained winds are estimated to exceed 33 kt and the location and forecast movement imply a threat to DOD interests; (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, and numerous other parameters. These data are vital to the forecaster for indications of changing cyclone characteristics, thus providing a broader basis for tropical cyclone warnings. Another important aspect of this data is its availability for research in tropical cyclone analysis and forecasting.

DMSP satellites provide day and night coverage of the JTWC area of responsibility. Interpretation of this satellite imagery provides cyclone positions and for daytime passes, provides estimates of intensities using the DVORAK technique (NOAA TECHNICAL MEMORANDUM, NESS-45 and

FIRST WEATHER WING PAMPHLET 105-10). This year the readout was only available at JTWC in a timely manner for the 0000Z and 1200Z warnings. However, Air Force Global Weather Central, Offutt AFB provided position data from an afternoon satellite for much of the season until this satellite lost its capability to transmit. As in 1974 satellite coverage of the western North Pacific proved extremely useful in identifying areas of possible tropical cyclone formation, thus reducing the number of aircraft investigative flights on systems that did not later become tropical cyclones.

Land radar provides useful positioning data on well developed cyclones when in the proximity (usually within 200 nm of radar position) of the Republic of the Philippines, Hong Kong, Taiwan, Japan (including the Ryukus), 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 scheduled fix time.

(2) Late-fix is made within the

interval from 1/2 hr to 1 1/2 hr after scheduled fix time.

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

e. Levied fix time on an "as soon as possible" fix is considered to be:

(1) Sixteen hour plus estimated time enroute after an alert aircraft and crew are levied; or

(2) Four hours plus estimated time enroute after the DTG of message levying an ASAP fix if an aircraft and crew, previously alerted, are available for duty.

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 1975 tropical cyclone season 212 six hourly vortex fixes and 5 supplementary vortex fixes were levied (Table 2-1). This is a significant decrease from 1974 and is the lowest number of aircraft levies since the 1965 season. This is due primarily to the low level of storm activity observed in 1975, which was 30% below the long-term average. Continuing heavy reliance on DMSP data is an important contributing factor to this decrease in aircraft levies. In addition to vortex fixes, 21 investigative flights were levied by JTWC in 1975. Approximately 49% of all warnings were based on aircraft fixes, 36% on satellite data and the remaining 15% based on radar, synoptic data or extrapolated positions.

Reconnaissance effectiveness is summarized in Table 2-1. The missed fix

rate of 3.2% is a considerable improvement over 1974.

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

|                   | NUMBER OF<br>FIXES | PERCENT |
|-------------------|--------------------|---------|
| COMPLETED ON TIME | 200                | 92.2    |
| EARLY             | 1                  | 0.5     |
| LATE              | 9                  | 4.1     |
| MISSED            | 7                  | 3.2     |
| TOTAL             | 217                | 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     |

#### 5. SATELLITE RECONNAISSANCE SUMMARY

Satellite reconnaissance of tropical cyclones is performed by the Air Weather Service, using Defense Meteorological Satellite Program (DMSP) Data. A unique network of tactical DMSP readout sites throughout the Pacific (at Nimitz Hill, Guam; Kadena AB, Japan; Yokota AB, Japan; Hickam AFB, Hawaii; and at Clark AB, Philippines, which relocated from Nakon Phanom, Thailand in September 1975) and Air Force Global Weather Central (AFGWC) at Offutt AFB, Nebraska, daily monitor the western North Pacific and Indian Oceans for tropical cyclone activity. When a tropical cyclone matures and is in warning status, this network provides JTWC with positions and intensity estimates (ref. NOAA TM 45). During 1975, 99% reliability in satisfying JTWC warning requirements was achieved by utilizing the dual-site coverage philosophy which insures that two sites are providing inputs for each fix.

Several important developments occurred in 1975. Typhoon Winnie, Tropical Storms Susan and Doris, and Tropical Depressions 05, 24 and 25 were monitored without the use of aircraft reconnaissance. Winnie was the first WESTPAC typhoon to be handled in this manner. At CINCPAC's direction JTWC's Indian Ocean area of responsibility was expanded westward from longitude 80°E to 62°E. As a result, the DMSP network became involved in monitoring a significantly larger portion of the tropical oceans, and AFGWC's role of providing tropical cyclone positions and intensity estimates to JTWC was expanded.

Satellite positions are assigned Position Code Numbers (PCN's), depending on the procedures used to make the position, and the state of the cyclone's circulation. These are shown in Table 2-2.

A comparison of DMSP derived positions and JTWC Best Tracks is shown in Table 2-3.

Table 2-3 is important because it demonstrates that the PCN groupings are statistically stable from year to year, and represent an operationally reproducible system for storm fix classification. It shows that the DMSP analyst can accurately identify the organization of tropical cyclones by cloud signatures, that positioning accuracies are improved by using geographical references to correct the gridding, and that the better a tropical cyclone is organized the more accurately it can be positioned by satellite data. Note that geographical checks on gridding are of particular significance if the eye of the storm is apparent. The small improvement in positioning accuracy in 1975 may be a result of greater operational experience, as well as more reliance on satellite data in Best Track determinations. This is certainly true when the satellite is the only available reconnaissance platform.

TABLE 2-2. POSITION CODE NUMBERS

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

CC=Circulation Center

TABLE 2-3. Mean Deviations (nm) of DMSP Derived Tropical Cyclone Positions from JTWC Best Track Positions, 1973-1975 (all sites). Number of cases shown in parentheses.

| PCN   | 1973<br>(GUAM)            | 1974<br>(ALL SITES)        | 1975<br>(ALL SITES)       |
|-------|---------------------------|----------------------------|---------------------------|
| 1     | 15.5 (129)                | 13.6 (224)                 | 11.8 (214)                |
| 2     | 20.0 (17)                 | 17.4 (37)                  | 20.4 (35)                 |
| 3     | 20.3 (252)                | 20.1 (422)                 | 21.2 (271)                |
| 4     | 20.0 (24)                 | 23.9 (70)                  | 22.4 (50)                 |
| 5     | 45.9 (163)                | 35.4 (342)                 | 34.2 (323)                |
| 6     | 29.6 (20)                 | 49.4 (108)                 | 44.7 (71)                 |
| 1&2   | 16.0 (146)                | 14.2 (261)                 | 13.0 (249)                |
| 3&4   | 20.3 (276)                | 20.6 (492)                 | 21.4 (321)                |
| 5&6   | 44.1 (183)                | 38.8 (450)                 | 36.1 (394)                |
| TOTAL | 26.4 (605)<br>(23 storms) | 26.0 (1203)<br>(35 storms) | 25.2 (964)<br>(25 storms) |

The most significant problem in DMSP reconnaissance support to JTWC is the availability and timeliness of spacecraft. To satisfy the JTWC requirement, DMSP data must be available within a specified time frame. The variable warning time allows for some warning time flexibility so satellite reconnaissance inputs can be maximized, but near real time DMSP inputs continue to be essential. Decreased direct-readout coverage in WESTPAC is reflected by the drop in the DMSP use rate for warnings from 43.8% in 1974 to 36.4% in 1975. The critical impact of direct readout capabilities on the viability of the DMSP support to JTWC is obvious. The future of DMSP reconnaissance will be heavily dependent upon the successful exploitation of the new generation (5D)

DMSP spacecraft in mid-1976.

## 6. RADAR RECONNAISSANCE SUMMARY

During the 1975 typhoon season 446 radar center fixes were received at JTWC; 444 from land stations and 2 from WC-130 aircraft of the 54WRS. This number is less than one-half the number received during the 1974 season (997). The decrease is primarily due to the speed of movement of the systems. Although the number of storms within radar acquisition was similar in 1974 and 1975 (16 and 14 respectively), the speed of the 1975 storms was nearly twice that of those of the previous year. Of the 14 tropical storms and typhoons that came under radar surveillance, seven, Mamie, Nina, Ora, Phyllis, Rita, Betty and Cora, had tracks within range of Japan and/or the Ryukyu Islands, where the Japanese Meteorological Agency has established an extensive and highly reliable radar network. These seven tropical cyclones accounted for 78% of all radar reports. Surprisingly, this is the identical percentage of reports produced by the seven storms that traversed the Japan-Ryukyu region during 1974. Typhoon Rita, which meandered from the southern Ryukus to northern Japan, accounted for 104 reports or 23% of the 1975 total. Four storms, Nina, Ora, Phyllis and Rita, were at some time under the surveillance of four different radar sites. Rita was tracked by eight separate radar stations during her life.

Most radar reports are placed into three categories of accuracy defined in the WMO radar code. The 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)}. Of the 389 reports coded in this manner, 48% were good, 6% were fair and 46% were poor. Radar reports made only while storms were of typhoon intensity had 47% in the good category. All radar reports were compared to the JTWC best track and the mean vector deviation was 10.1 nm, the smallest deviation since the 1970 season. The two aircraft radar fixes deviated 16.1 nm from the JTWC best track.

Of the 444 radar reports, 78% were obtained from sites in the Japan-Ryukyu network, 14% from Taiwan, 4% from the Philippines, 3% from the Royal Observatory at Hong Kong and 1% from Guam. Radars of National Meteorological Agencies accounted for an impressive 90% of all reports while AC&W and U. S. Air Force Weather Service units accounted for 5% each.

During the 1975 season 17 warnings (4.1%) were based on radar.

## 7. COMMUNICATIONS

JTWC receives its data and disseminates its warnings through a variety of communication systems, including AUTOVON, AUTODIN, the Naval Environmental Data Network (NEDN), and the Air Force's Automated Weather Network (AWN). Much of the basic meteorological intelligence is received via the NEDN and graphically displayed by

FWC computers. More timely observations, tailored bulletins, and reports are received by JTWC on a dedicated AWN circuit directly from the AWN switch at Clark AB. Autodin is used for dissemination of warnings which are subsequently also transmitted on the AWN. Some more unique communication procedures are discussed below.

#### a. AIR TO GROUND

Aircraft reconnaissance data are normally received by JTWC via direct phone patch through the Andersen Aeronautical Station, which is the primary station for this purpose. Under degraded radio propagation conditions, the Clark or Yokota Aeronautical Stations can intercept and relay the data via AUTOVON and teletype to JTWC.

The preliminary eye/center data message contains sufficient information to permit JTWC to begin early preparation of individual warnings. Average communication delays for the preliminary and the complete eye/center data messages were 21 and 49 minutes, respectively in 1975. In the past three years, they have stabilized near 19 and 48 minutes, respectively. Delay times are defined as the difference between the fix time and the time of message receipt at JTWC. Table 2-4 depicts the complete eye/center data messages received more than 1 hr after fix time and after warning time.

TABLE 2-4. 1975 AIR/GROUND DELAY STATISTICS FOR AIRCRAFT RECONNAISSANCE

|                                                    | 1971 | 1972 | 1973 | 1974 | 1975 |
|----------------------------------------------------|------|------|------|------|------|
| %Complete fix messages delayed over one hour       | 6    | 6    | 20   | 19   | 20   |
| %Complete fix messages received after warning time | 2.1  | 5.5  | 10.1 | 4.9  | 3.7  |

#### b. SELECTIVE RECONNAISSANCE PROGRAM

With the advent of the SRP, the importance of radar and satellite fix data has continued to increase. Data from the AC&W radar sites in the Republic of the Philippines and from nationally operated radars of the Republic of China, Hong Kong, Japan, and the Philippines are received at JTWC by means of the AWN.

Over 1000 position and intensity estimates were derived from Air Weather Service (AWS) DMSP sites and the Air Force Global Weather Central during 1975. The data from the AWS DMSP sites were immediately passed via AUTOVON followed by an AWN message. AUTOVON provided rapid communication of the essentials and a brief two-way discussion of the data (a benefit not possible by message).

#### c. OUTGOING COMMUNICATIONS

Messages originating at JTWC are processed by the Naval Telecommunications Center (NTCC) of the Naval Communications Station, Guam. By special agreement, all tropical cyclone warnings are placed in the communications system before pending IMMEDIATE precedence traffic. In 1975, warnings were delivered to the message center an average of 25 minutes before warning time with an average handling time of 8 minutes. The time of receipt of a warning at a particular station depends upon factors beyond the control of either JTWC or NTCC.

## CHAPTER III - RESEARCH SUMMARY

### 1. GENERAL

One of the four major tasks of the Joint Typhoon Warning Center is to conduct tropical cyclone post-analysis and forecasting research. In most cases research projects are directly concerned with improvements of either speed or intensity forecast of tropical cyclones. Meteorologists from outside agencies such as the Naval Environmental Prediction Research Facility, the Naval Postgraduate School, the 54th Weather Reconnaissance Squadron, and Detachment 1, 1st Weather Wing often collaborate with JTWC on research projects. The following abstracts summarize research completed during the past year. Research ~~underway, but incomplete, is not reported in this section.~~

### 2. TROPICAL CYCLONES AFFECTING GUAM

(Holliday, C. R., FLEWEACEN/JTWC Tech Note 75-3).

A climatology of tropical storms passing within 180 nm of Guam is presented for the period 1948-1975. A review of all typhoons affecting Guam is carried back to 1800 and some noteworthy typhoons of the 1600's are included. The survey encompasses the frequency, behavior, meteorological effects and descriptive chronicles of Guam tropical storms. The major emphasis is on the period since World War II.

### 3. DOUBLE INTENSIFICATION OF TYPHOON GLORIA, 1974, AND A BRIEF REVIEW OF SIMILAR OCCURRENCES

(Holliday, C. R., FLEWEACEN/JTWC Tech Note 76-1).

In November 1974 Typhoon Gloria displayed unusual intensity fluctuations while traversing the Philippine Sea. The typhoon exhibited two marked intensifications separated by a period of weakening lasting 12 hr. A chronological examination of this unusual behavior utilizing aircraft reconnaissance and satellite data is presented with particular emphasis on the evolution of the central core region. A parallel between observed events, and results demonstrated in a tropical cyclone numerical model responding to artificial enhancement of the convective heating functions is noted. Similar occurrences of double deepening of typhoons in the western Pacific are reviewed to determine Gloria's uniqueness.

### 4. A REEVALUATION OF THE CHANGE IN SPEED AND INTENSITY OF TROPICAL CYCLONES CROSSING THE PHILIPPINES.

(Sikora, C. R., FLEWEACEN/JTWC Tech Note 76-2).

The effects of the Philippines on the

speed (transit time) and intensity of tropical cyclone crossings is examined. The Philippines have been stratified into two areas, north and south of 14.5N. Significant differences in speed are found to exist between the two areas, while the intensity profiles are similar to those from an earlier study (Brand, 1972) which indicated that maximum intensities are attained 6-12 hr prior to landfall. In both areas, storm speeds generally decrease to a minimum 12-24 hr prior to landfall and then increase significantly as storms accelerate across the Philippines.

### 5. AN INVESTIGATION OF EQUIVALENT POTENTIAL TEMPERATURE AS A MEASURE OF TROPICAL CYCLONE INTENSITY.

(Sikora, C. R., FLEWEACEN/JTWC Tech Note 76-3).

Several investigators of tropical and mid-latitude sounding data have attempted to differentiate between the "disturbed" and the "undisturbed" states of the atmosphere. Although small temperature differences and relatively large and variable moisture differences are observed, these two parameters still do not adequately describe the varying energy states. The total energy of a parcel of air may be closely approximated by the equivalent potential temperature ( $\theta_e$ ) and the total static energy ( $\sigma$ ), which are highly conservative with respect to both saturated and unsaturated adiabatic processes.

Sounding data from Clark Air Base in the Republic of the Philippines and tropical cyclone dropsonde data have been analyzed for  $\theta_e$ . It is shown that a mid-tropospheric minimum in total energy vanishes as a tropical cyclone approaches Clark Air Base, with subsequent increases in  $\theta_e$  extending through 400 mb. From an analysis of dropsonde data obtained in tropical cyclone centers, large values as well as rapid increases in  $\theta_e$  are observed near 700 mb for those tropical cyclones which are deepening explosively. Since these changes in  $\theta_e$  are not the result of synoptic scale motions nor horizontal advective processes, it is proposed that they are the result of the direct mechanical lifting of heat and moisture in the form of convective "hot towers". Using these values of  $\theta_e$ , a procedure for forecasting the explosive deepening of tropical cyclones is proposed.

### 6. MODIFIED TWENTY-FOUR HOUR EXTRAPOLATION AS A FORECAST TECHNIQUE FOR THE MOVEMENT OF TROPICAL CYCLONE

(Sikora, C. R., FLEWEACEN/JTWC Tech Note 76-4).

Twelve-hour extrapolation (XTRP) and the TYFOON analog program are the most successful objective techniques used by JTWC for forecasting the movement of tropical cyclones. The critical parameters for both

techniques are the current warning position and the past 12-hr warning position. However, during operational use of these techniques it was observed that these positions based on later data had to be frequently readjusted.

It is proposed that 24-hr extrapolation technique (XT24) based on reconnaissance positions preferably from the same reconnaissance platform, is more realistic: (1) these data are real-time whereas the warning positions are merely extrapolated from the reconnaissance positions and (2) a 24-hr period tends to smooth out erratic short-term movements in the storm track. This technique was applied to 15 typhoons from 1974 and 2 typhoons from 1973. Since initial results were encouraging, an operational evaluation of XT24 was conducted during the 1975 tropical cyclone season.

# CHAPTER IV - SUMMARY OF TROPICAL CYCLONES

## I. GENERAL RESUME

### a. WESTERN NORTH PACIFIC

1975 saw a sharp decrease in tropical cyclone activity from last season (Table 4-1). There were only 20 named tropical cyclones in 1975, a 30% decrease from the long-term average of 28.6 (Table 4-2). Since 1945, only 1973 exceeds 1975 for total number of consecutive days without a named tropical cyclone. The record in 1973 was 183 consecutive days, while in 1975 180 days elapsed between Typhoon Lola in January and Tropical Storm Mamie in

July. Of the 20 named tropical storms occurring between 27 July and 24 November, thirteen became typhoons. Three of these, Nina, Elsie and June became super typhoons with maximum winds exceeding 130 kt. The most noteworthy event of the 1975 season was the occurrence of Super Typhoon June, the most intense tropical cyclone ever recorded. Table 4-3 depicts the distribution of typhoons by month and year.

TABLE 4-1. 1975 TROPICAL CYCLONES

| PACIFIC AREA      |      |         |               |                          |              |             |                       |       |                   |
|-------------------|------|---------|---------------|--------------------------|--------------|-------------|-----------------------|-------|-------------------|
| CYCLONE           | TYPE | NAME    | PRD OF WRNG   | CALENDAR DAYS OF WARNING | MAX SFC WIND | MIN OBS SLP | NO. OF TOTAL WARNINGS | AS TY | DISTANCE TRAVELED |
| 01                | TY   | LOLA    | 22 JAN-28 JAN | 7                        | 70           | 976         | 25                    | 3     | 1800              |
| 02                | TD   | ---     | 23 APR-28 APR | 6                        | 25           | 004         | 19                    | ---   | 605               |
| 03                | TS   | MAMIE   | 27 JUL-29 JUL | 3                        | 40           | 994         | 10                    | ---   | 774               |
| 04                | TY   | NINA    | 31 JUL-04 AUG | 5                        | 135          | 904         | 15                    | 8     | 1084              |
| 05                | TD   | ---     | 06 AUG-07 AUG | 2                        | 30           | ---         | 4                     | ---   | 293               |
| 06                | TY   | ORA     | 10 AUG-12 AUG | 3                        | 65           | 976         | 10                    | 4     | 630               |
| 07                | TY   | PHYLLIS | 12 AUG-18 AUG | 7                        | 120          | 920         | 27                    | 15    | 1622              |
| 08                | TY   | RITA    | 18 AUG-23 AUG | 6                        | 80           | 966         | 23                    | 7     | 1465              |
| 09                | TS   | SUSAN   | *             | 6                        | 50           | ---         | 19                    | ---   | 816               |
| 10                | TY   | TESS    | 02 SEP-10 SEP | 9                        | 95           | 945         | 33                    | 22    | 1613              |
| 11                | TS   | VIOLA   | 05 SEP-07 SEP | 3                        | 45           | 996         | 10                    | ---   | 416               |
| 12                | TY   | WINNIE  | 09 SEP-12 SEP | 4                        | 65           | ---         | 13                    | 4     | 1188              |
| 13                | TY   | ALICE   | 16 SEP-20 SEP | 5                        | 75           | 971         | 18                    | 5     | 1316              |
| 14                | TY   | BETTY   | 17 SEP-23 SEP | 7                        | 95           | 944         | 26                    | 11    | 1785              |
| 15                | TY   | CORA    | 01 OCT-06 OCT | 6                        | 105          | 943         | 21                    | 11    | 2376              |
| 16                | TS   | DORIS   | 03 OCT-06 OCT | 4                        | 55           | ---         | 10                    | ---   | 470               |
| 17                | TY   | ELSIE   | 09 OCT-15 OCT | 7                        | 135          | 900         | 25                    | 14    | 1656              |
| 18                | TD   | ---     | 15 OCT-17 OCT | 3                        | 30           | 002         | 8                     | ---   | 432               |
| 19                | TY   | FLOSSIE | 20 OCT-23 OCT | 4                        | 70           | 977         | 15                    | 4     | 798               |
| 20                | TS   | GRACE   | 25 OCT-02 NOV | 8                        | 60           | 994         | 29                    | ---   | 1940              |
| 21                | TS   | HELEN   | 03 NOV-04 NOV | 2                        | 45           | 998         | 6                     | ---   | 375               |
| 22                | TY   | IDA     | 06 NOV-11 NOV | 6                        | 85           | 959         | 22                    | 8     | 1865              |
| 23                | TY   | JUNE    | 16 NOV-24 NOV | 9                        | 160          | 876         | 32                    | 25    | 2641              |
| 24                | TD   | ---     | 27 DEC-28 DEC | 2                        | 30           | ---         | 5                     | ---   | 211               |
| 25                | TD   | ---     | 27 DEC-29 DEC | 3                        | 30           | ---         | 10                    | ---   | 227               |
| 1975 TOTALS       |      |         |               | 110**                    |              |             | 435                   | 141   |                   |
| INDIAN OCEAN AREA |      |         |               |                          |              |             |                       |       |                   |
| TC 04-75          |      |         | 10 JAN-11 JAN | 2                        | 35           | ---         | 3                     | ---   | 271               |
| TC 24-75          |      |         | 02 MAY-12 MAY | 11                       | 95           | ---         | 21                    | 12    | 842               |
| TC 25-75          |      |         | 05 MAY-08 MAY | 4                        | 70           | ---         | 6                     | 1     | 450               |
| TC 28-75          |      |         | 20 OCT-22 OCT | 3                        | 80           | ---         | 4                     | 1     | 180               |
| TC 29-75          |      |         | 07 NOV-12 NOV | 6                        | 50           | ---         | 10                    | ---   | 799               |
| TC 33-75          |      |         | 25 NOV-01 DEC | 7                        | 35           | ---         | 7                     | ---   | 1310              |
| 1975 TOTALS       |      |         |               | 33**                     |              |             | 51                    | 14    |                   |

\*SUSAN 26 AUG & 27 AUG AND 29 AUG - 01 SEP

\*\*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<br>(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    |
| AVERAGE<br>(1959-75) | 0.5 | 0.4 | 0.5 | 0.8 | 1.2 | 1.6 | 4.6 | 6.1 | 4.9 | 4.1 | 2.6 | 1.1 | 28.6  |

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<br>(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    |
| AVERAGE<br>(1959-75) | 0.2 | 0.1 | 0.1 | 0.7 | 0.9 | 1.1 | 2.9 | 3.8 | 3.2 | 3.2 | 1.6 | 0.6 | 18.7  |

Table 4-4 presents the tropical cyclone formation alert summary. Although the development rate is 74%, it is worthy of note that all 25 tropical cyclones for 1975 were preceded by a formation alert.

There were 110 calendar days in 1975 during which warnings were issued on numbered tropical cyclones. This is well below the average of 145 warning days (Table 4-7).

During most of July, the monsoonal trough was located along 5N, south of its climatological position between 10N and 15N. The trough was masked late in the month by Tropical Storm Mamie and was reestablished near the normal summertime latitudes as Super Typhoon Nina formed in the Philippine Sea. August saw five numbered tropical cyclones. Of these, Typhoon Ora, Phyllis and Rita were spawned in the trough. Throughout September, the trough was again south of the expected long term mean position. Early October saw the return of the trough to its normal latitude, but in mid month it migrated south again, where it remained throughout November. A total of only 14 named tropical cyclones had their beginnings in the monsoonal trough during 1975.

In late July, T.S. Mamie was initiated by a cyclonic circulation in the tropical upper tropospheric trough (TUTT).

The TUTT continued to play an active role, initializing T.S. Susan in August and Typhoons Winnie and Tess in September. The long term statistics show that 15% of WESTPAC tropical cyclones originate in the TUTT. This season's 16% is thus close to a climatological norm.

Various casualty reports indicate that Typhoons Phyllis and Rita accounted for the majority of tropical cyclone related casualties in Japan. Phyllis caused 60 deaths and 146 injuries in mid August. Later in the month, Rita reportedly caused the worst flooding on Hokkaido in ten years. On Taiwan, Typhoon Nina caused 25 deaths and 168 injuries, also sinking a small freighter. Typhoon Betty, in September, caused an additional 12 deaths and injured scores. The Republic of the Philippines suffered casualties from Typhoon Lola in January and TD's 24 and 25 in December. Most deaths were caused by extensive flooding of low lying areas. Lola accounted for the loss of 30 lives and serious damage to sugar producing areas on the southern islands. TD's 24 and 25, although limited in destructive winds, caused torrential rains and 97 lives were lost in the resulting floods. The greatest at-sea disaster occurred in the South China Sea when Typhoon Flossie sank two timber freighters with the loss of 44 lives in late October.

TABLE 4-4.

# PACIFIC AREA TROPICAL CYCLONE FORMATION ALERT SUMMARY

| YEAR | NUMBER<br>OF<br>ALERT<br>SYSTEMS | ALERT SYSTEMS<br>WHICH BECAME<br>NUMBERED<br>TROPICAL CYCLONES | TOTAL<br>NUMBERED<br>TROPICAL<br>CYCLONES | DEVELOPMENT<br>RATE |
|------|----------------------------------|----------------------------------------------------------------|-------------------------------------------|---------------------|
| 1972 | 41                               | 29                                                             | 32                                        | 71%                 |
| 1973 | 26                               | 22                                                             | 23                                        | 85%                 |
| 1974 | 35                               | 30                                                             | 36                                        | 86%                 |
| 1975 | 34                               | 25                                                             | 25                                        | 74%                 |

## MONTHLY DISTRIBUTION

|      | J | F | M | A | M | J | J | A | S | O | N | D |
|------|---|---|---|---|---|---|---|---|---|---|---|---|
| 1975 | 1 | 0 | 0 | 2 | 1 | 0 | 3 | 6 | 7 | 7 | 5 | 2 |

## b. NORTH INDIAN OCEAN

The JTWC area of responsibility was expanded in July 1975 to include the entire area north of the equator between the Malay Peninsula and 62E.

Table 4-5 presents statistical data on the frequency of North Indian Ocean cyclones by month and year. May 1975 was an active month, with one cyclone in the Bay of Bengal and another in the Arabian Sea. Aside from this early spurt of activity the season for the North Indian Ocean was climatologically normal.

There were two cyclones in the Arabian Sea during the 1975 season. One occurred in May during the transition from the northeast to the southwest monsoon. Tropical Cyclone 24-75 formed just off the southwest tip of the Indian subcontinent. It tracked northwest and dissipated over water about 300 nm southeast of Oman. Tropical Cyclone 28-75 formed in late October, during the transition to the northeast monsoon. The storm tracked west and then veered northeast to make landfall on the northwest coast of India, with winds estimated at 65 kt.

Four tropical cyclones were recorded for the Bay of Bengal during the 1975 season. Of these, two struck the central Burma coast. Tropical Cyclone 04-75 formed 150 nm north of Sumatra and described a smoothly recurving track to central Burma, making landfall with surface winds under

34 kt. Tropical Cyclone 25-75 organized in the Andaman Sea. The storm initially tracked northwest, later recurving into central Burma with typhoon force winds. The system caused widespread damage and took approximately 80 lives.

Tropical Cyclone 29-75 formed in the south central Bay, and maintained an initial west-northwest track. The storm then curved to the northeast, passing within 50 nm of the east coast of India. The track continued northeast until the system went ashore east of Dacca on 12 November. Tropical Cyclone 33-75 formed in late November and described an erratic track in the southwest portion of the Bay. The storm dissipated over water on 1 December.

## c. CENTRAL NORTH PACIFIC

During the 1975 season there were no tropical cyclones reported in the Central North Pacific. No detailed study has yet been conducted to ascertain possible causes for such inactivity, however two environmental anomalies were noted. The first was the slightly depressed sea surface temperature that prevailed over this area during most of the season. Secondly, the upper atmospheric westerly flow extended unusually far to the south. The resulting vertical shear tended to inhibit tropical cyclone development. Table 4-6 summarizes frequency of Central Pacific tropical cyclones by month and year.

TABLE 4-5. 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     |
| AVG** | 0.1 | *** | 0.1 | 0.3 | 0.7 | 0.7 | 0.6 | 0.4 | 0.5 | 1.0 | 1.1 | 0.5 | 5.7   |

\*1971-1974 REPRESENT BAY OF BENGAL CYCLONES ONLY

\*\*1877-1960 AVERAGE (INCLUDING ARABIAN SEA) MARINERS  
WORLDWIDE CLIMATIC GUIDE TO TROPICAL STORMS AT SEA

(H.L. CRUTCHER AND R. G. QUAYLE)

\*\*\*LESS THAN 0.05 PER MONTH

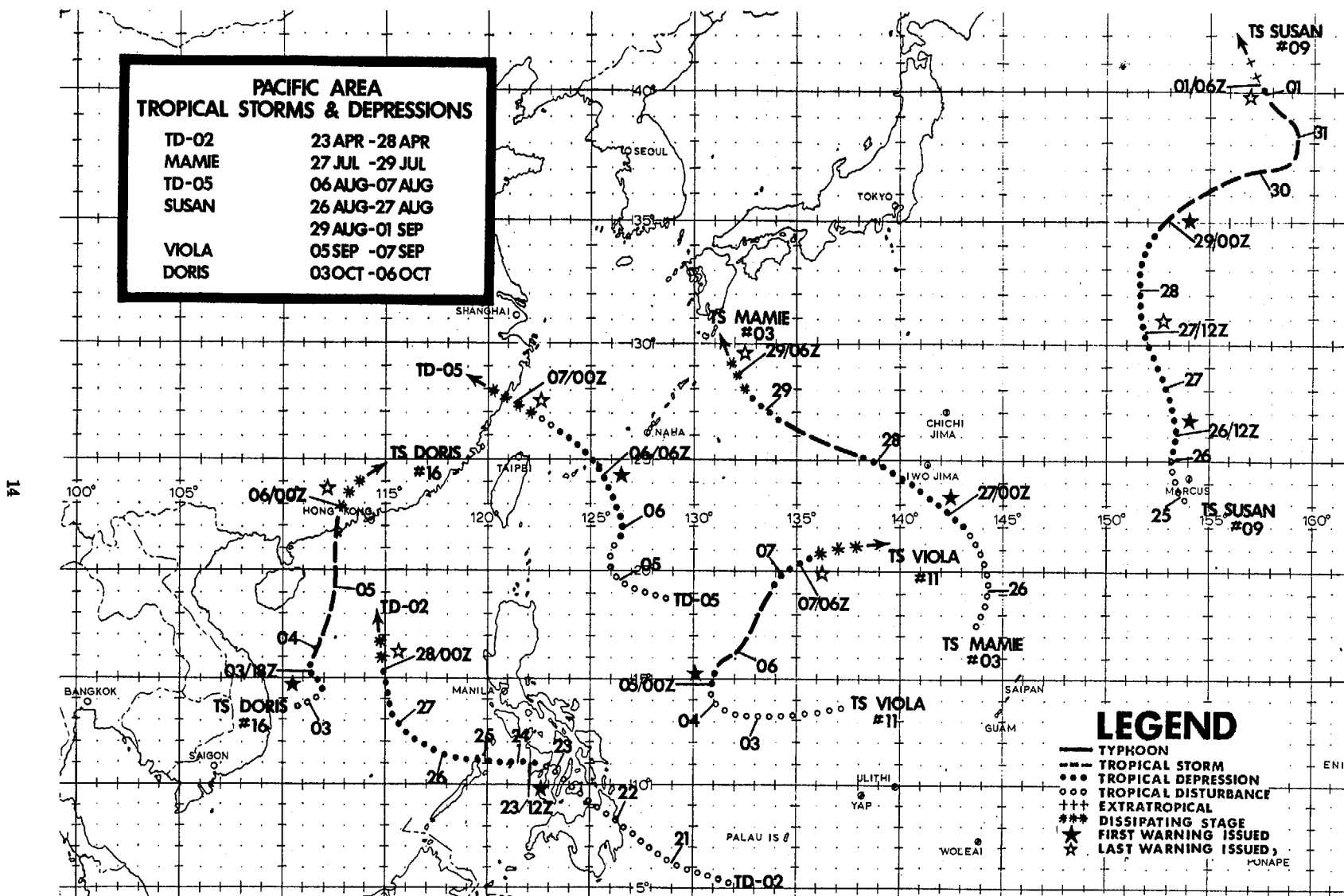
TABLE 4-6. FREQUENCY OF CENTRAL PACIFIC STORMS BY MONTH AND YEAR. (NUMBERS IN PARENTHESIS INDICATE STORMS REACHING HURRICANE INTENSITY)

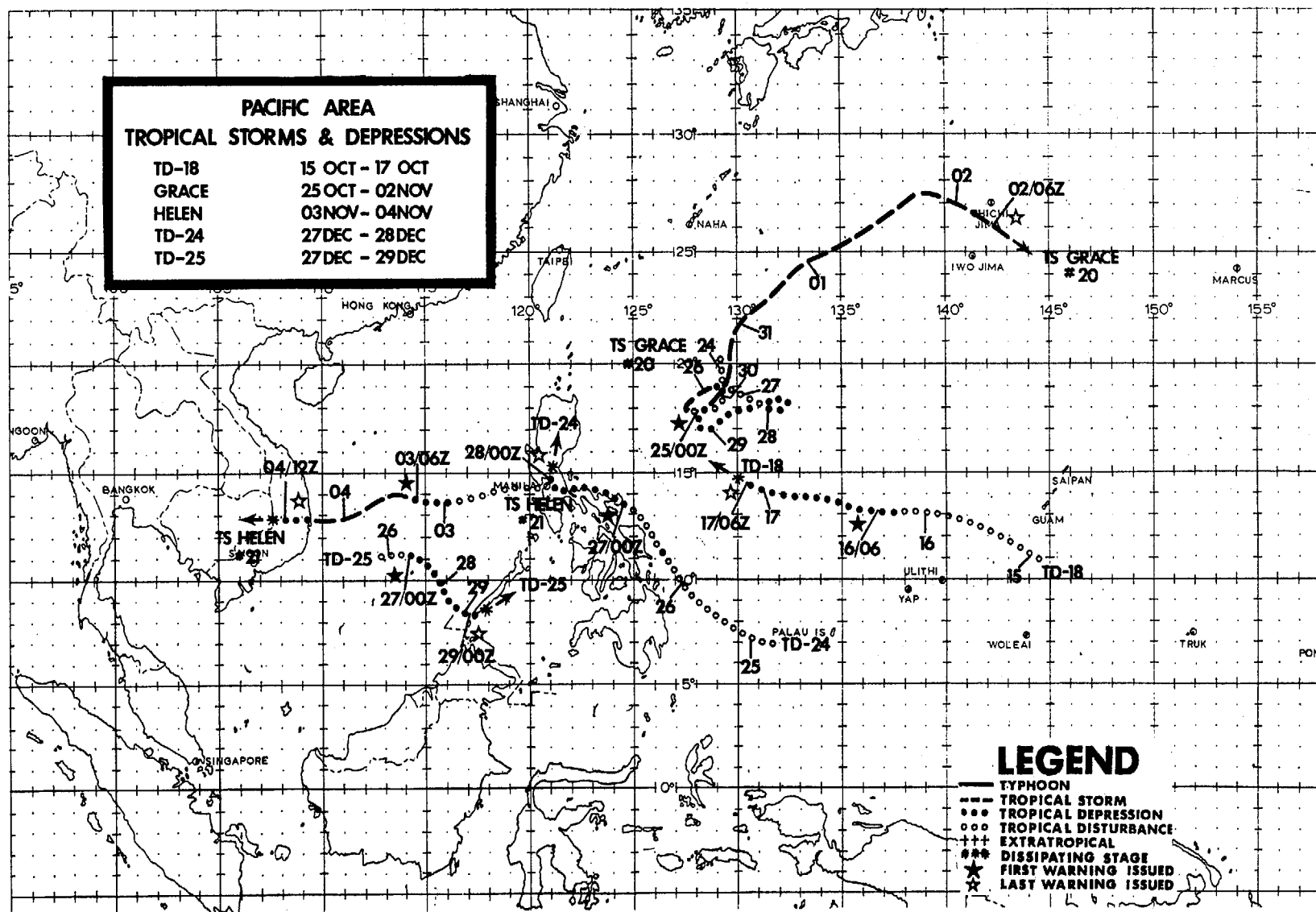
|         | JAN-<br>JUN | JUL     | AUG      | SEP | OCT | NOV-<br>DEC |
|---------|-------------|---------|----------|-----|-----|-------------|
| 1966    | 0           | 0       | 2 (1)    | 0   | 0   | 0           |
| 1967    | 0           | 0       | 0        | 0   | 1   | 0           |
| 1968    | 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           |
| AVERAGE | 0           | .2 (.2) | 1.1 (.3) | .1  | .1  | 0           |

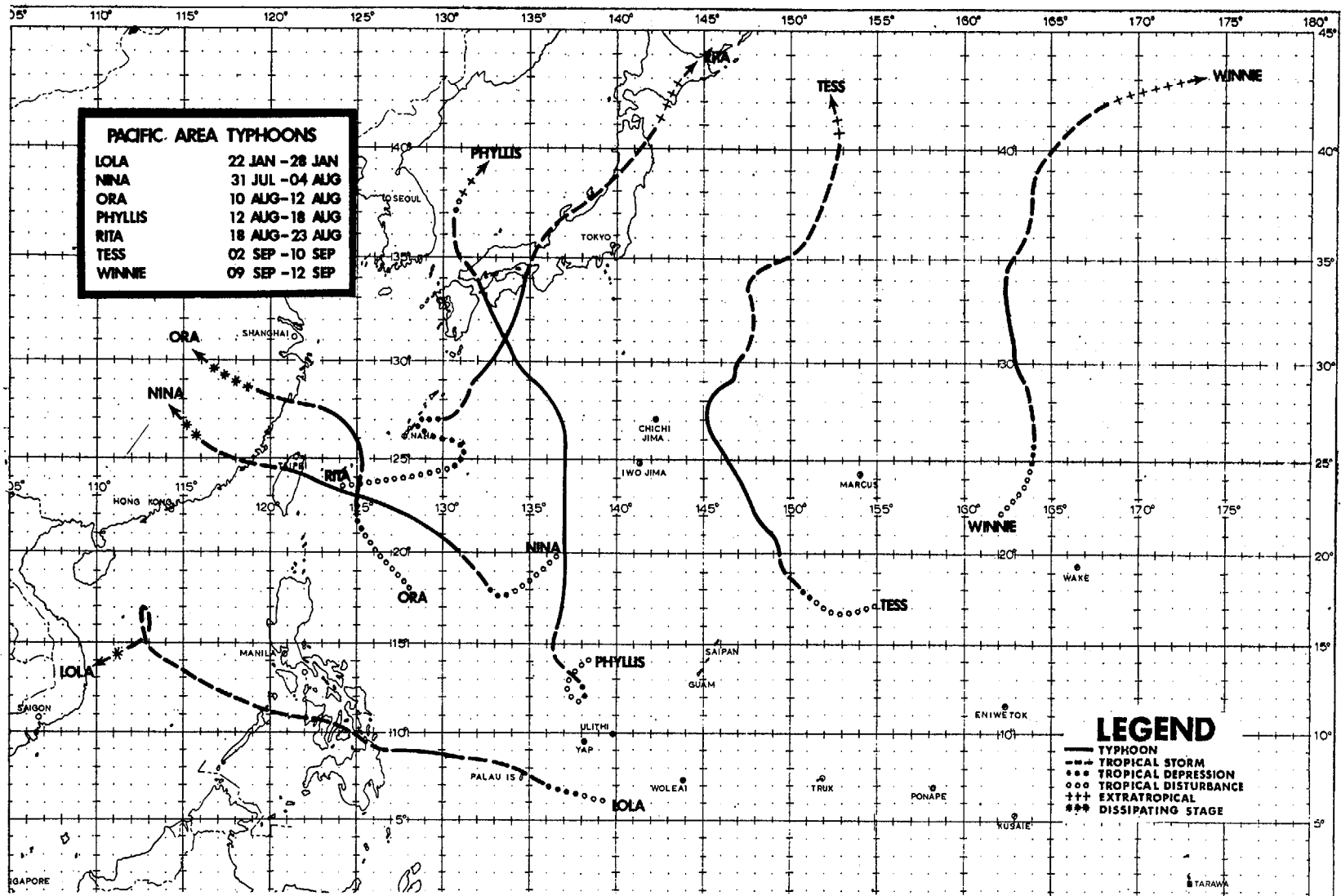
TABLE 4-7. SUMMARY OF JTWC WARNINGS 1959-1975.

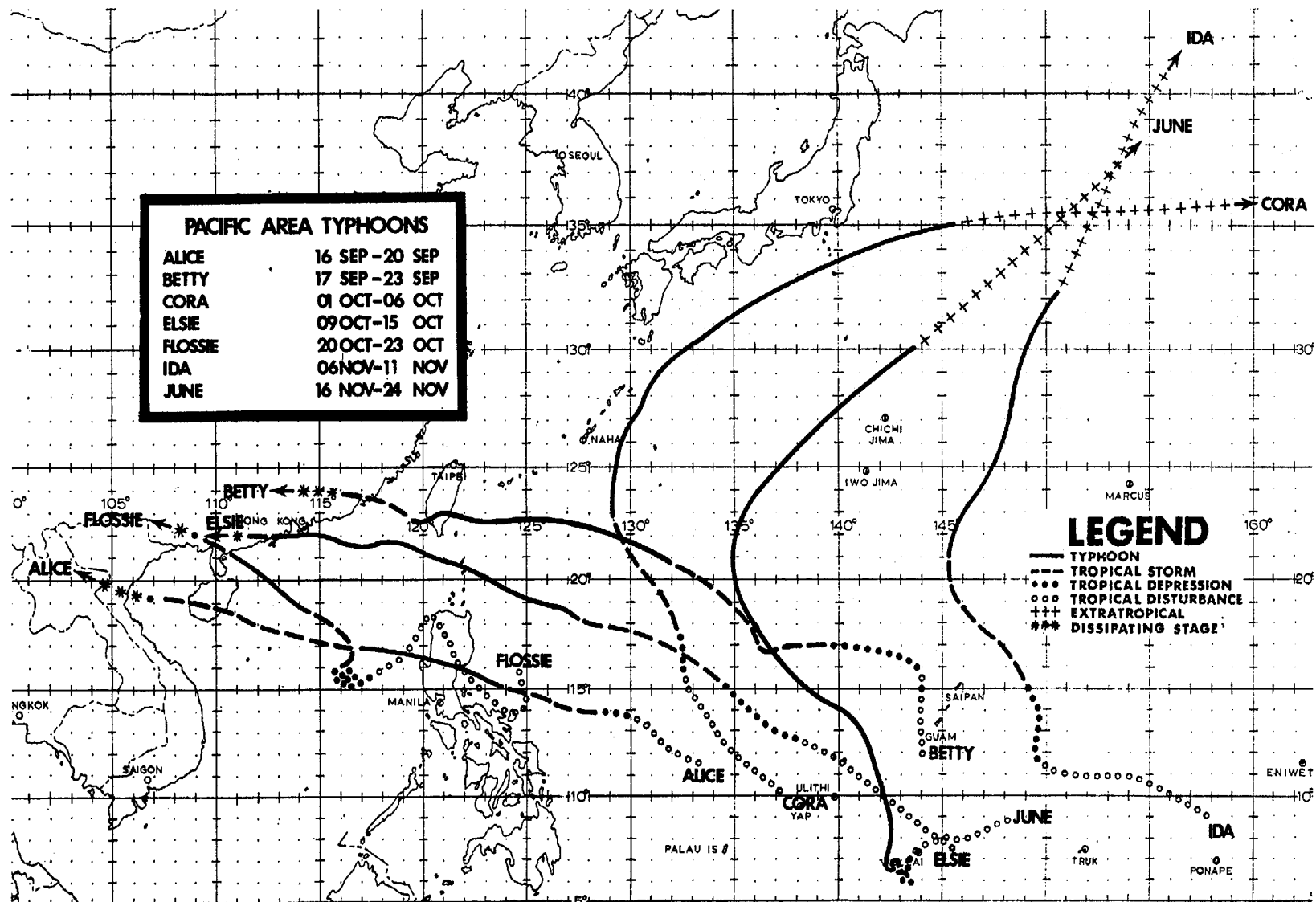
|                                                       | WESTERN<br>NORTH PACIFIC |                      | NORTH<br>INDIAN OCEAN |                       | CENTRAL<br>NORTH PACIFIC |                      |
|-------------------------------------------------------|--------------------------|----------------------|-----------------------|-----------------------|--------------------------|----------------------|
|                                                       | 1975                     | AVERAGE<br>1959-1974 | 1975                  | AVERAGE<br>1971-1974* | 1975                     | AVERAGE<br>1970-1974 |
| TOTAL NUMBER<br>OF WARNINGS                           | 435                      | 696                  | 51                    | 20                    | 0                        | 39                   |
| CALENDAR DAYS OF WARNINGS                             | 110                      | 145                  | 33                    | 12                    | 0                        | 12                   |
| NUMBER OF WARNING DAYS<br>WITH TWO CYCLONES           | 18                       | 50                   | 4                     | 0                     | 0                        | 1                    |
| NUMBER OF WARNING DAYS<br>WITH THREE OR MORE CYCLONES | 0                        | 10                   | 0                     | 0                     | 0                        | 0                    |
| TROPICAL DEPRESSIONS                                  | 5                        | 5                    | --                    | --                    | 0                        | 1                    |
| TROPICAL STORMS                                       | 6                        | 11                   | --                    | --                    | 0                        | 1                    |
| TYPHOONS/HURRICANES                                   | 14                       | 19                   | --                    | --                    | 0                        | 1                    |
| I.O. TROPICAL CYCLONES                                | --                       | --                   | 6                     | 3                     | --                       | --                   |
| TOTAL TROPICAL CYCLONES                               | 25                       | 41                   | 6                     | 3                     | 0                        | 3                    |

\*BAY OF BENGAL ONLY (DOES NOT INCLUDE ARABIAN SEA)

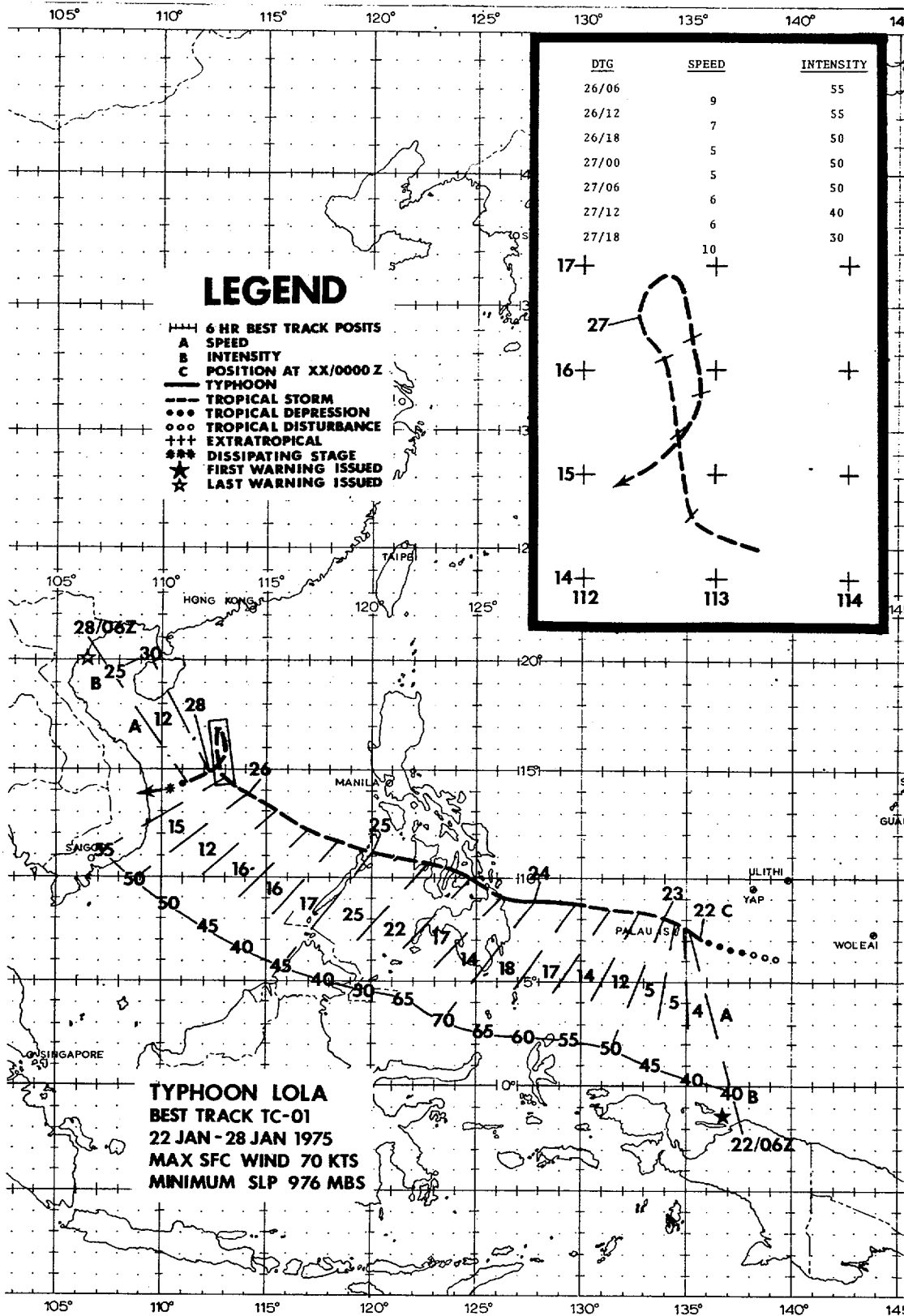








### 3. INDIVIDUAL TYPHOONS



## LOLA

In mid-January, the monsoon trough, normally located south of 5N during this time of year, moved northward. A circulation was first detected in the trough on 18 January approximately 400 nm south of Guam. Over the next five days this tropical disturbance was to develop into Typhoon Lola. Lola was distinguished by being only the ninth typhoon in the month of January since 1945.

From its origin, the circulation tracked west-northwest as it intensified to tropical storm strength on 22 January. At that time Lola was 75 nm east of the Palau Islands with northwesterly winds of 35 kt observed on Koror. Wind, rain, and high seas from Lola lashed the Palau Islands for the next 24 hr as the storm moved through. Major damage to agriculture occurred on the northernmost island of Kayangel, with banana, papaya, coconut, and taro crops nearly totally destroyed.

From the Palau Islands, Lola tracked west under the steering influence of strong 500 mb ridging to the north. With upper-level outflow restricted in the eastern semicircle by strong ridging to the east, Lola developed to minimal typhoon strength late on the 23rd. Aircraft

reconnaissance reports on the 24th indicated the typhoon's central pressure had reached its minimum of 976 mb (Fig. 4-1).

Typhoon Lola struck the central Philippines' sugar producing provinces near peak intensity on the afternoon of the 24th. At least 30 persons were reported killed by landslides and flying debris, with more than 300 houses in the coastal town of Tandog destroyed by the storm surge.

Lola decreased to tropical storm strength while crossing the Philippines and entered the South China Sea. The storm then pursued a west-northwest track as the 500 mb ridge receded eastward. Lola regenerated to a peak intensity of 50 kt on the morning of the 26th. By the following morning, a cold frontal surge from Asia pushed into the South China Sea, weakening the circulation significantly. The remains of Lola moved southward in response to the building high pressure to the north. The final warning was issued on the 28th, when satellite data indicated that the upper-level anticyclone had sheared off, and the remains of the surface circulation had drifted southward.

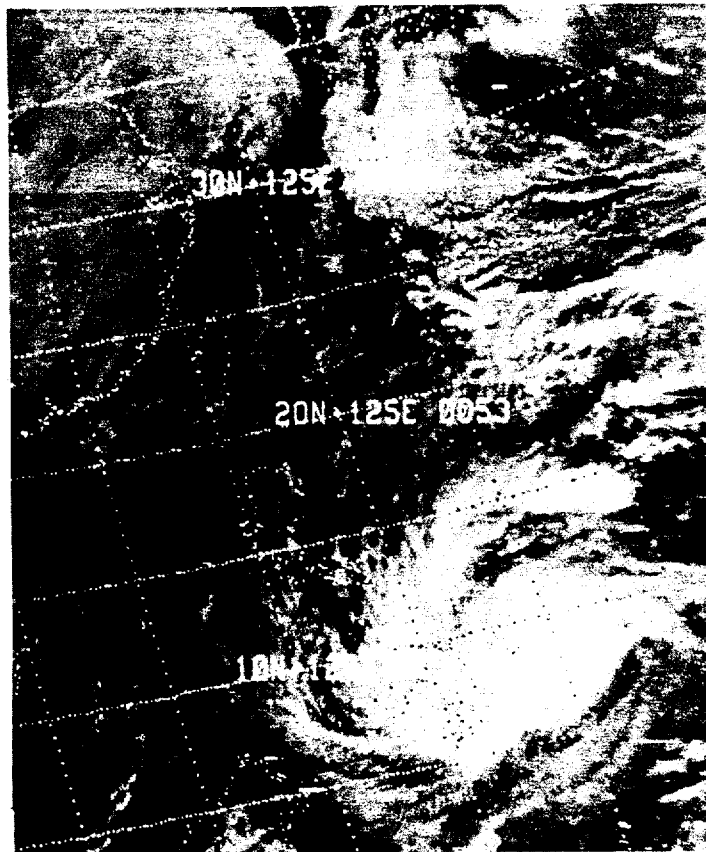
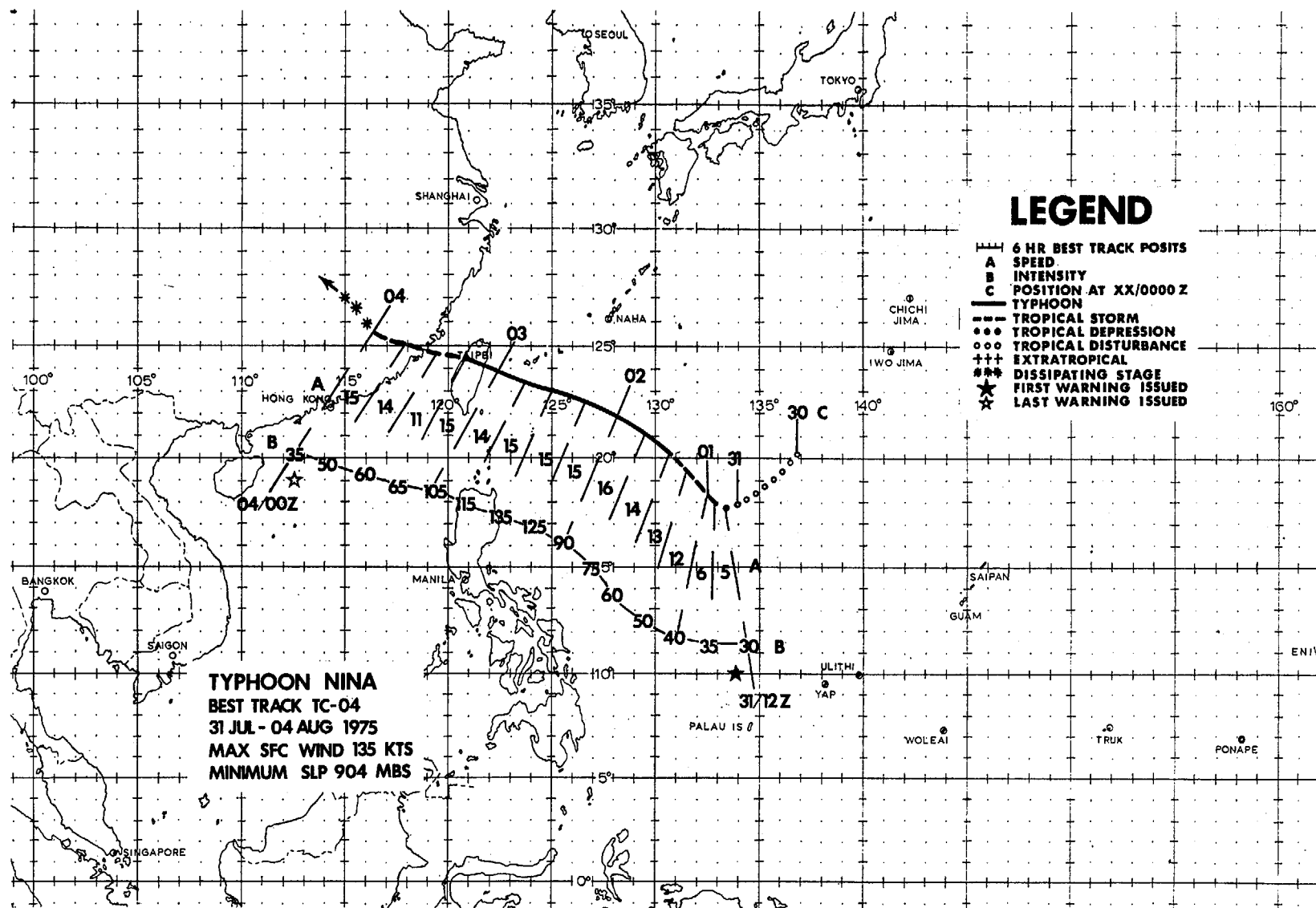


FIGURE 4-1. Typhoon Lola near peak intensity 90 nm east of northern Mindanao, 24 January 1975, 0056Z. (NOAA-4 imagery)



## NINA

As Tropical Storm Mamie dissipated and drifted toward Korea, the monsoon trough migrated northward leaving a well-defined trough line extending southeastward from the remains of Mamie into the Philippine Sea. A tropical disturbance spawned in this trough near 20N 137E on 29 July and rapidly developed into Typhoon Nina, one of the most destructive storms of the 1975 season.

After initial detection by satellite and classification as a tropical disturbance, T.D. 04 moved southwestward for approximately 36 hr as surface and upper-air circulations became organized and vertically aligned. By 1200Z on the 31st the system slowed, intensified rapidly to tropical storm strength, and began turning to the northwest (Fig. 4-2). As the storm made this turn, it responded to mid-tropospheric steering flow and accelerated along the equatorward periphery of the 500 mb subtropical ridge. Continued building of the subtropical ridge to the west forced Nina to take a west-northwesterly track toward Taiwan just prior to reaching typhoon intensity on 1 August.

Nina underwent explosive deepening late on 1 August. Aircraft reconnaissance data indicated a 63 mb drop in sea level pressure at the typhoon center between the 1st at 1437Z and the 2nd at 0830Z, with maximum surface winds increasing from 65

kt to 130 kt during that period. An over-head pass by a DMSP satellite gave a particularly striking view of the typhoon as it was undergoing rapid deepening (Fig. 4-3). A peak intensity of 135 kt was attained on the 2nd at 1200Z, approximately 200 nm east of Taiwan. The typhoon slowly decreased in intensity while approaching the island, making land-fall near the coastal city of Hualien on the 3rd at 0300Z with maximum surface winds of 100 kt.

Much of the typhoon's strength was lost as it battered across Taiwan's central mountain range, fortunately sparing the most populous areas from the more intense winds near the eye. Nevertheless, Nina's trek across Taiwan reportedly left 25 people dead, 4 missing and 168 injured. It was also reported that over 3,000 homes were at least partially collapsed, 39 fishing boats were sunk, and a 16,000 ton Korean freighter, THE SUN STAR, was capsized near Koahsiung harbor. Damage from flooding and landslides was widespread.

Nina entered the Formosa Straits with minimal typhoon strength, and weakened to approximately 60 kt before striking the China mainland on the 3rd at 1500Z. Nina moved inland and lost tropical cyclone characteristics on the 4th of August.

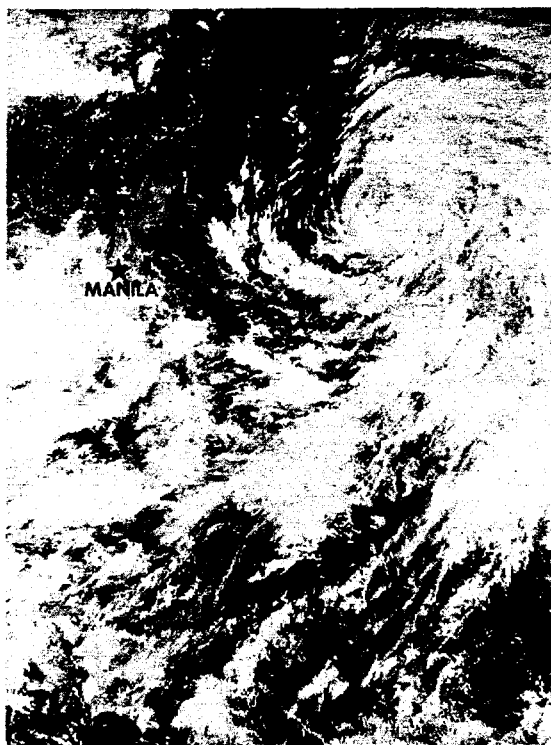


FIGURE 4-2. Nina achieving tropical storm strength in the Philippine Sea 675 nm east-northeast of Manila, 31 July 1975, 2356Z. [DMSP imagery]

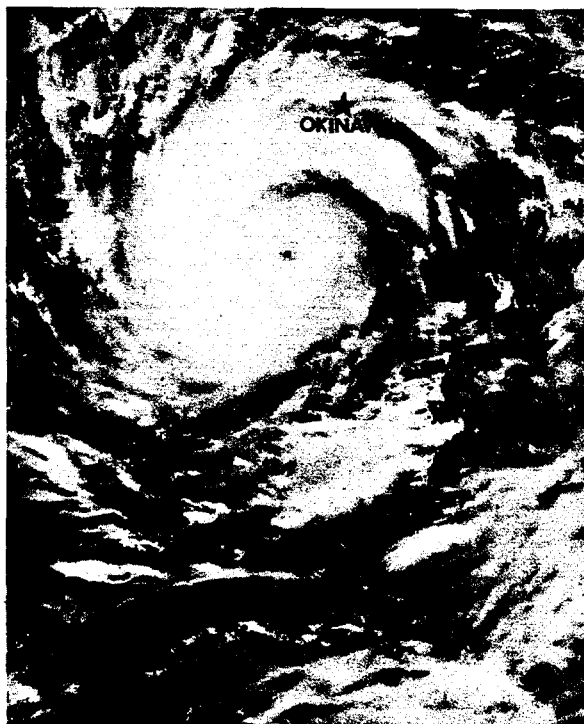
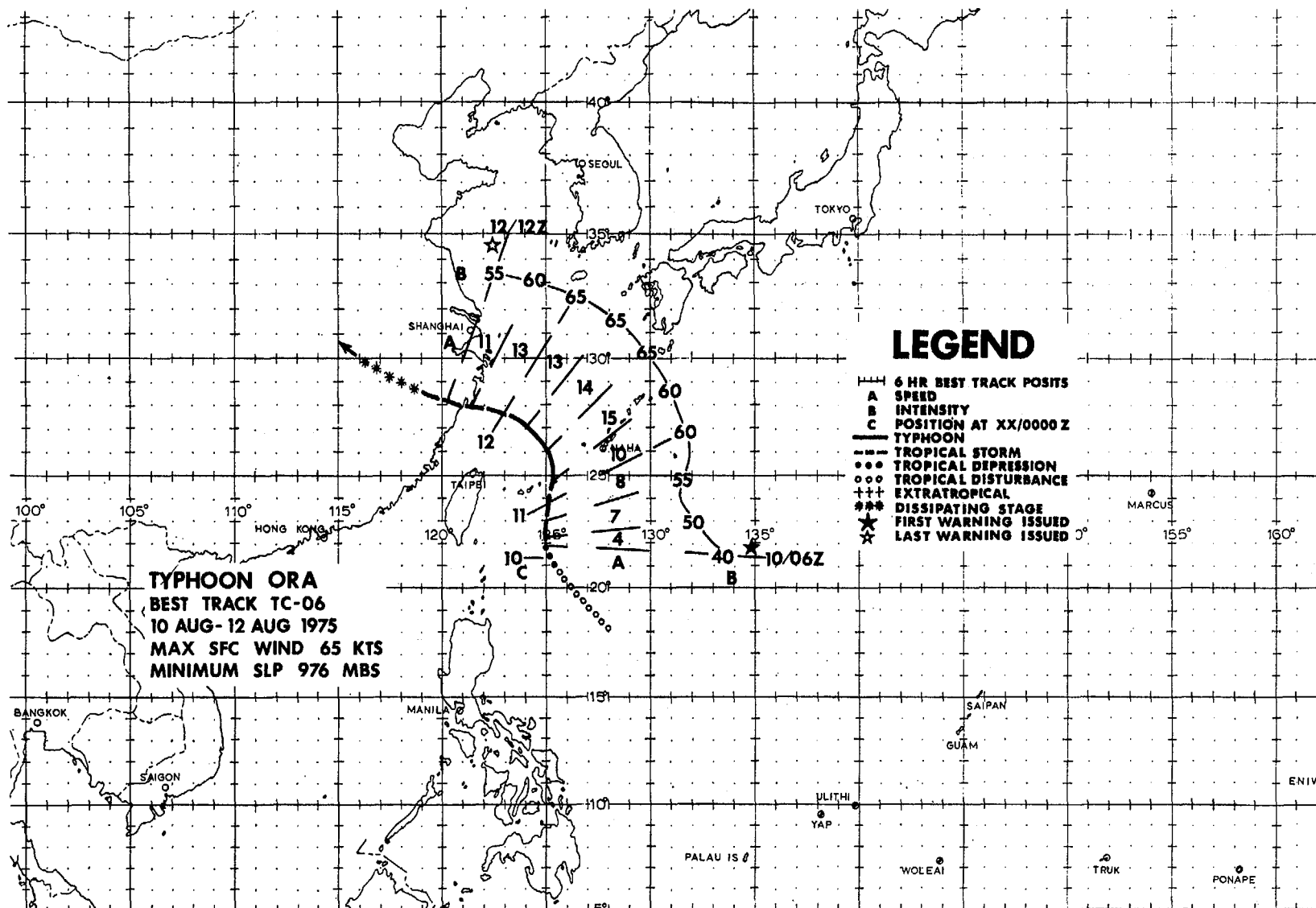


FIGURE 4-3. Direct overhead photograph illustrating concentric wall clouds of Typhoon Nina during explosive deepening 235 nm south of Okinawa, 2 August 1975, 0332Z. [DMSP imagery]



The third typhoon of the season, Ora, was small and short lived. Ora first appeared as a weak circulation in the near equatorial trough (drawn north by the influence of Typhoon Nina and T.D. 05) during the evening of the 8th. During the next 30 hr, this weak circulation moved northwestward at 6 kt showing little intensification.

On the morning of the 10th, a rapidly moving upper-level trough in the mid-latitude westerlies was located to the northwest of the circulation. This trough provided a highly efficient high altitude outflow channel which allowed Ora to grow from a tropical depression (Fig. 4-4) into a typhoon within 30 hr. As this trough moved quickly toward the east, Ora responded with a north-northeastward movement. When Ora's eye passed over Miyako Jima at 0600Z on the 11th, (Fig. 4-5) the weather station recorded 5 kt surface winds and a minimum pressure of 976 mb. Simultaneously, a ship (JL 11) 120 nm to the east reported 55 kt sustained winds.

At 0749Z on the 11th, 50 kt gusts were recorded at Kadena AB, Okinawa, 150 nm northeast of Ora. As the trough passed to the east, the subtropical high over central China built rapidly eastward and Ora shifted northwestward and accelerated to 15 kt. By the morning of the 12th, Ora had turned westward at 13 kt until landfall was made on the 12th at 0800Z near Yung-chia on the central China coast.

From 0000Z on the 11th, until striking the China coast, Ora maintained typhoon strength winds of 65 kt. A surface high pressure cell moving eastward from the sea of Japan into the North Pacific, rendered Ora a highly asymmetric storm with 30 kt winds extending 300 nm to the northeast and only 150 nm to the southwest. Although little destruction was directly attributed to Ora, monsoon rains were spawned over the Philippines and caused widespread flooding and landslides. Choppy waters near Tacloban, Leyte capsized a crowded motorboat leaving 15 dead and 30 missing.



FIGURE 4-4. Ora attaining tropical storm intensity 190 nm south of Miyako Jima with upper level trough to the west, 10 August 1975, 0033Z. (DMSP imagery)

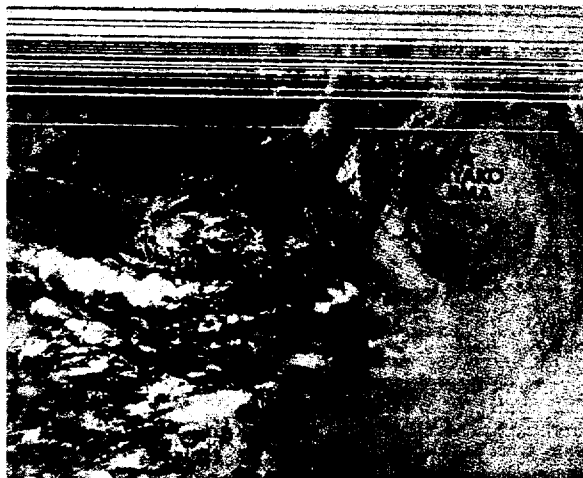
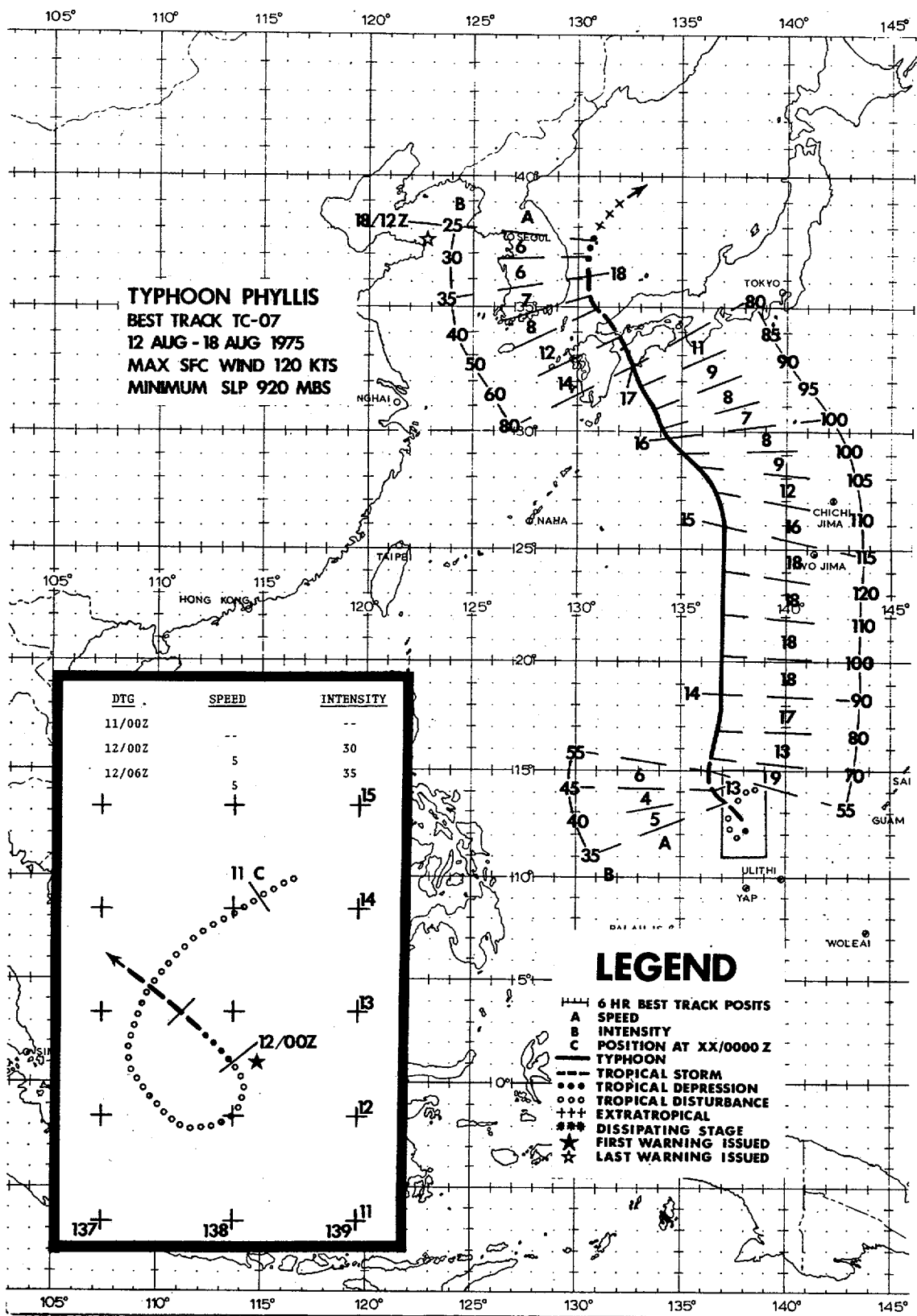


FIGURE 4-5. Tropical Storm Ora 60 nm south of Miyako Jima just prior to reaching typhoon intensity, 11 August 1975, 0015Z. (DMSP imagery)



# PHYLLIS

Since early August, the monsoonal trough had extended from the remains of Typhoon Nina in central China to an area west of Guam. A number of surface circulations appeared in this trough as early as the 8th of August, but it was not until the morning of the 11th that Phyllis first appeared as a tropical disturbance some 380 nm west-southwest of Guam.

The first warning on what was to become the fourth typhoon of 1975, was issued on the morning of the 12th. Aircraft reconnaissance located T.D. 07 395 nm west-southwest of Guam with center winds of 30 kt. At 0600Z on the 12th, the depression was upgraded to a 35 kt tropical storm. Aircraft reported multiple surface centers and a weak and diffuse 700 mb center.

Initially, the upper-level anticyclone was located 110 nm west of the surface center. However, by the morning of the 13th the upper and lower levels had become vertical. On the 13th at 0833Z, aircraft reported a closed wall cloud with an eye 30 nm in diameter. A Russian research vessel (EREC), reported surface winds of 60 kt 60 nm west-southwest of Phyllis at 1200Z on the 13th; thus, Phyllis was upgraded to typhoon with maximum winds of 70 kt.

By the 13th the mid-tropospheric ridge over China began to weaken while the ridge east of Japan intensified. Twenty-four

hours later, Phyllis' forward speed had increased to 18 kt (Fig. 4-6). The typhoon attained a maximum intensity of 120 kt on the 14th at 1800Z after aircraft had recorded a minimum sea level pressure of 920 mb at 1505Z (Fig. 4-7). By the 15th, Phyllis' movement had slowed to 7 kt, and had become northwestward as the mid-tropospheric ridge built westward across Japan.

After turning to the northwest, Phyllis once again accelerated, and by the afternoon of the 16th, was located 165 nm southeast of the Japanese Island of Shikoku. As Phyllis approached Japan, Shimizu (WMO station 47898, elev 99 ft), recorded sustained surface winds of 77 kt on the 16th at 1800Z and a minimum pressure of 970 mb at 2300Z. Murotomisaki (WMO station 47899, elev 606 ft), recorded sustained surface winds of 73 kt at 2000Z on the 16th. Phyllis, with 80 kt sustained winds, made landfall during the morning of the 17th near the southwestern edge of Shikoku.

In her wake Phyllis left extensive damage and loss of life. On Shikoku alone there were at least 60 dead, 146 injured, and 12 missing due to the combination of heavy rains, flooding and numerous landslides. At least 489 houses were reported collapsed, 577 damaged, 58 washed away and thousands inundated. Phyllis passed 20 nm to the west of Iwakuni MCAS which reported maximum gusts of 38 kt.



FIGURE 4-6. Typhoon Phyllis in the Philippine Sea with 90 kt intensity, 13 August 1975, 2320Z. (DMSP imagery)

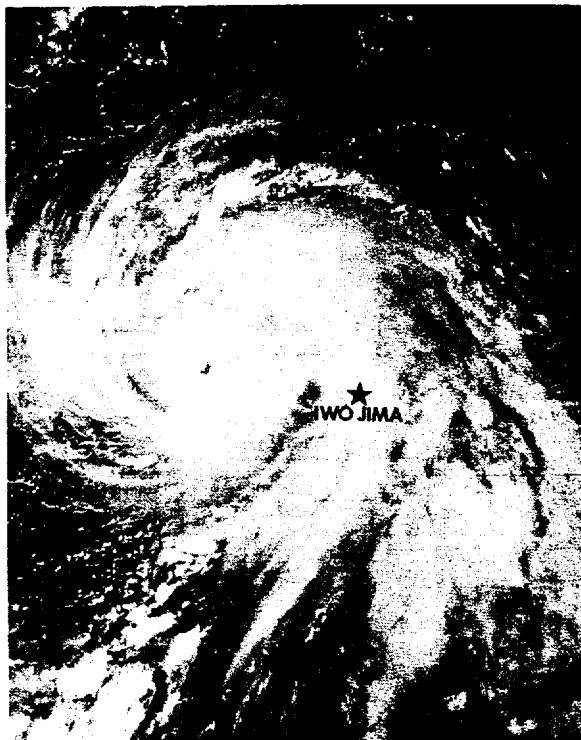
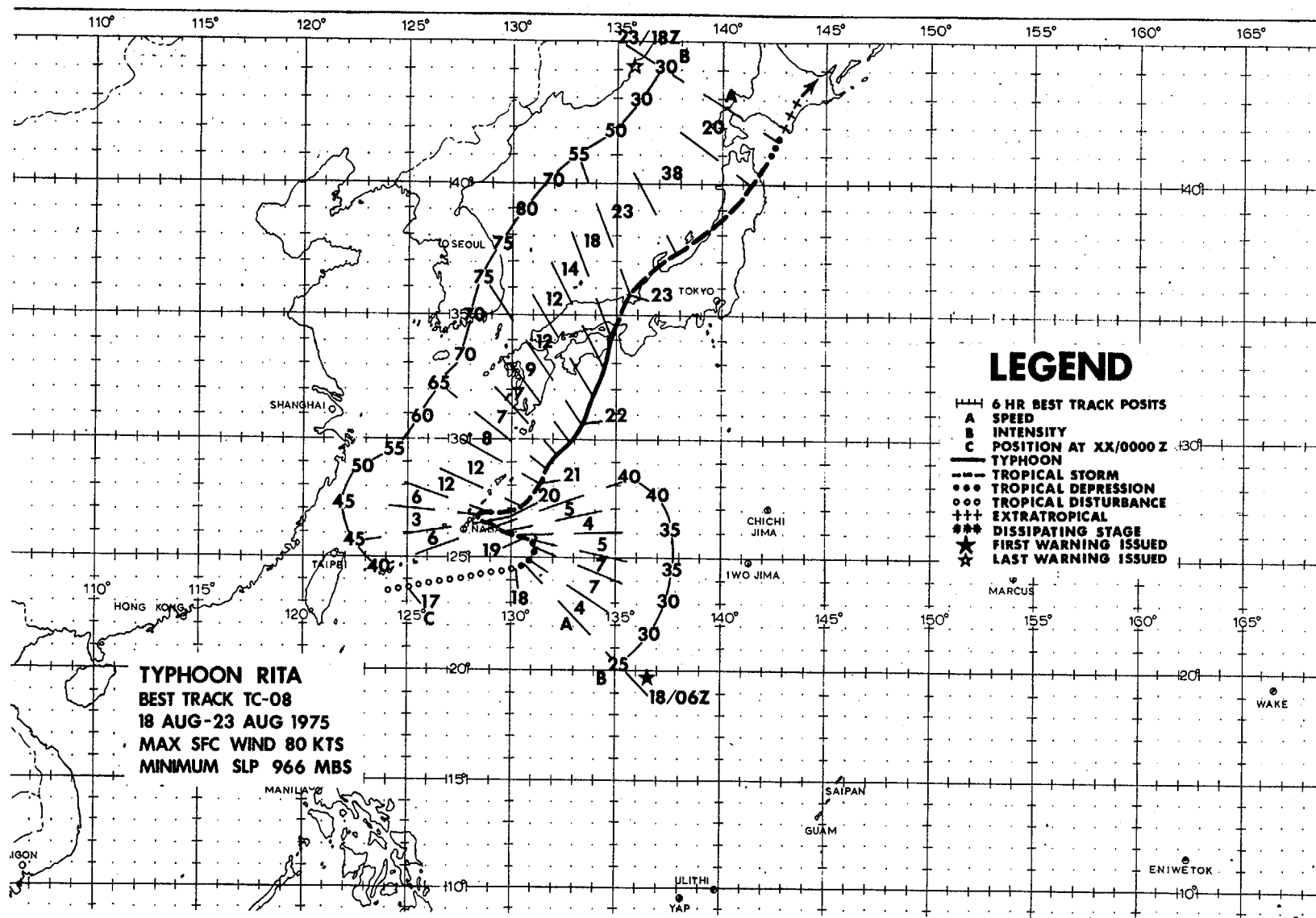


FIGURE 4-7. Typhoon Phyllis near peak intensity 230 nm west of Iwo Jima, 14 August 1975, 2302Z. (DMSP imagery)



# RITA

The third typhoon in August, Rita, made landfall in Japan closely following the wake of Typhoon Phyllis. Due to heavy rains brought by Rita, the storm proved to be the most damaging to affect the northern Japanese islands since 1965.

The typhoon's birth can be traced to the development of a monsoon depression some 180 nm southeast of Okinawa on the 18th. Drifting first east then westward, Rita began to gain strength as aircraft reconnaissance reports verified storm force winds in the circulation on the following day. Due to a weakening subtropical high cell east of Japan, heights began to fall north of Rita. In response, the storm reversed track to an easterly direction a few miles off the northern tip of Okinawa. A minimum pressure of 983.4 mb was registered at Kadena Air Base on the 20th at 0620Z although winds were comparatively light with a peak gust of 37 kt from the northwest recorded at 0514Z.

An approaching short wave over Manchuria began to draw Rita on a more northward course late on the 20th (Fig. 4-8). By the afternoon of the 21st, typhoon force winds were reached and Rita's circulation had grown significantly in size. Due to the building pressure gradient associated with the high cell east of Japan, gale force winds extended some 300 nm in the typhoon's eastern semicircle. As the short wave continued to approach the typhoon, Rita accelerated gradually in a north-northeasterly direction, making land-

fall 30 nm west of Osaka late on the 22nd (Fig. 4-9). Prior to landfall, Rita's 40-60 nm diameter eye passed over Murotomisaki (WMO station 47899, elev 606 ft), Shikoku. The station experienced a pressure reading of 966.3 mb at 1200Z and sustained surface winds of 80 kt.

Quickly crossing central Honshu, Rita veered slightly and accelerated to speeds of 30-35 kt ahead of an advancing cold front in the Sea of Japan. First tracking along the western coast, Rita crossed the northern portion of Honshu, finally emerging back into the Pacific on a northeasterly heading. Strong gusty winds occurred along the exposed southern coast of Honshu between the Kii and Boso peninsulas. Southerly winds gusting near 55 kt were recorded at Yokota Air Base between 0300Z and 0400Z on the 23rd.

Merging with the frontal zone south of Hokkaido, Rita continued to track north-eastward as an extratropical low. Torrential rains swept Hokkaido with amounts totaling near 8.2 inches in 24 hr. Landslides and flash flooding as a result of the rains were responsible for extensive crop and property damage with farmlands inundated and 36,000 houses flooded throughout Japan. At least 26 deaths were attributed to the typhoon. Newspaper reports indicate that it was the worst flooding in 10 years for Hokkaido. Several major rivers on the island overflowed their banks leaving towns marooned and isolated.

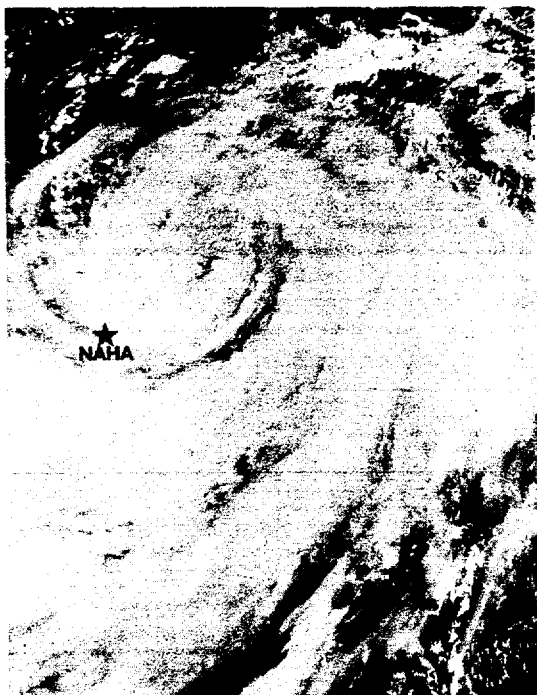


FIGURE 4-8. Rita as a 60 kt tropical storm 190 nm northeast of Okinawa, 20 August 1975, 2253Z. (DMSP imagery)

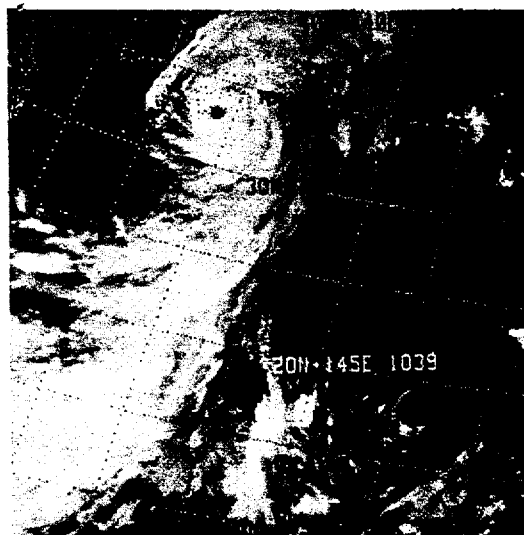
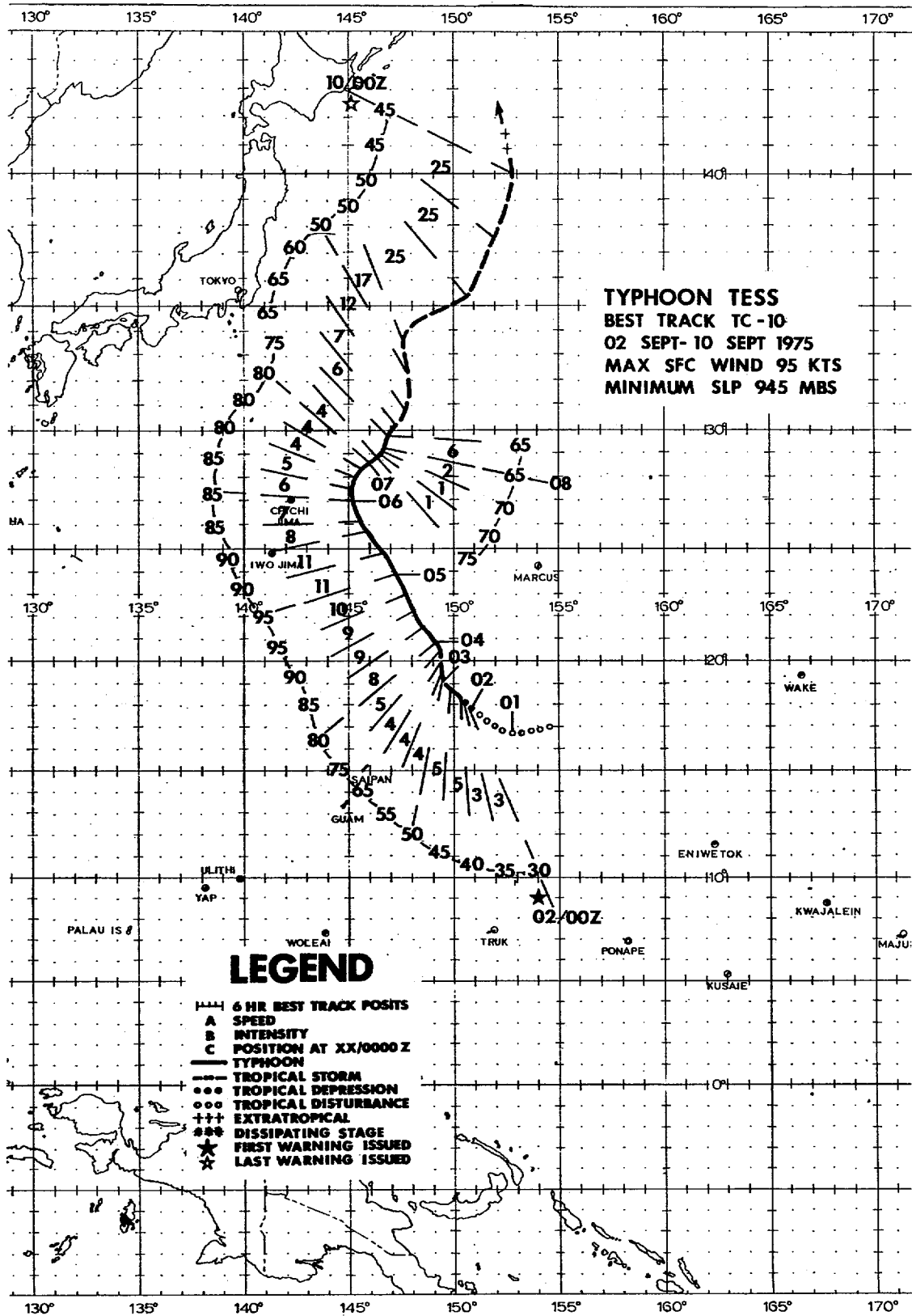


FIGURE 4-9. Infrared photograph of Typhoon Rita just prior to landfall in Japan, 22 August 1975, 1843Z. (NOAA-4 imagery)



Satellite data on the evening of 31 August first showed preliminary upper-level features indicative of a formative outflow pattern. Divergent flow on the southern side of the persistent tropical upper tropospheric trough (TUTT) was enhancing the tropical cyclone formation process and a closed surface circulation was analyzed in the same area the following morning, 600 nm east-northeast of Saipan. Mid-tropospheric ridging from Japan to the Dateline initially caused Tess' embryo to drift west-southwest. As this ridge weakened, the system began tracking west-northwest, developing slowly. As the TUTT migrated toward the north, an anticyclone was established over the surface circulation, which was now located 280 nm east of Pagan Island in the northern Mariana Islands.

The first warning on Tess was issued on the morning of 2 September after reconnaissance aircraft and satellite data indicated rapid development. Tess was upgraded to a typhoon on the 3rd at 1200Z when reconnaissance aircraft reported surface winds of 75 kt approximately 250 nm west of the Maug Islands. The typhoon was now moving in a more northerly direction toward a weakness in the collapsing mid-

tropospheric ridge to the north. Thirty hours later on the 4th at 1800Z, Tess reached a minimum central pressure of 945 mb and maximum sustained surface winds of 95 kt.

Tropical Storm Viola had formed approximately 1200 nm southwest of Tess on the 4th and subsequently moved within 900 nm of Tess before dissipating on the 7th (Fig. 4-10). Viola's presence helps explain Tess' reduced speed of movement and irregular track during this period. On the 7th at 0000Z, the SS OREGON reported estimated surface winds of 65 kt while 60 nm east-southeast of the storm's center (Fig. 4-11). Tess maintained typhoon intensity until the 8th at 1800Z, when it moved into a hostile environment of colder water and began interacting with an approaching frontal system. Satellite data indicated that the typhoon was becoming extratropical, and by the morning of the 10th Tess had merged into the frontal system.

The entire life time of Tess was spent between 153E and 145E, an area of the western North Pacific having few populated islands. This system did little if any damage during its ten day lifespan.

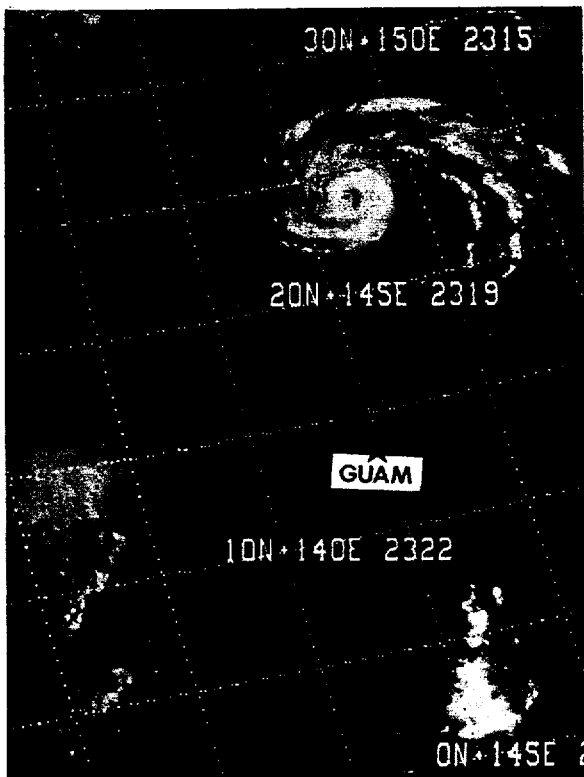


FIGURE 4-10. Typhoon Tess 620 nm north-northeast of Guam. Tropical Depression 11, which developed into Tropical Storm Viola, can be seen approximately 850 nm to the southwest of Tess, 4 September 1975, 2317Z. (NOAA-4 imagery)

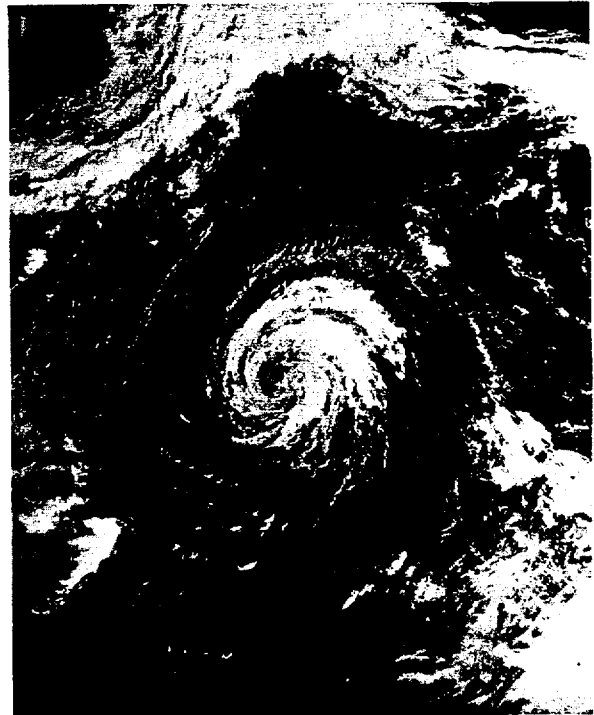
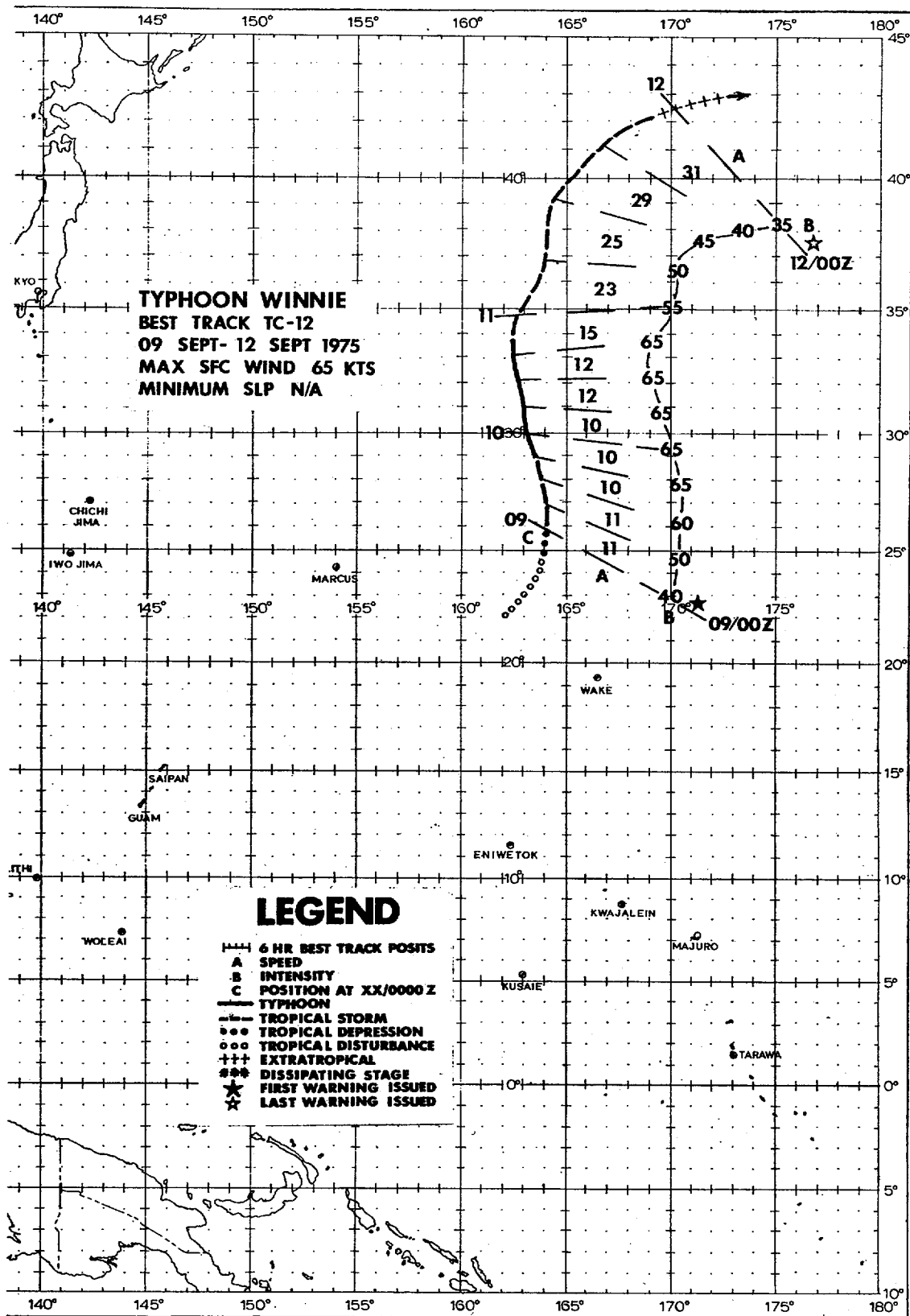


FIGURE 4-11. Typhoon Tess 265 nm east-northeast of Chichi Jima, 7 September 1975, 2227Z. (DMSP imagery)



## WINNIE

Winnie was first detected by satellite on 5 September as a weak tropical disturbance approximately 300 nm northwest of Wake Island. At this time Typhoon Tess was approximately 900 nm to the northwest of Winnie with a surface trough extending southeastward to Wake Island. The combination of surface troughing and a favorable upper air pattern allowed this disturbance to develop. The first warning was issued early on the morning of the 9th based on satellite data.

From her initial detection as a disturbance, Winnie moved slowly north-northeastward, attaining minimal tropical storm intensity at 2100Z on the 8th. The storm was now 400 nm north-northwest of Wake Island and posed no significant threat to any inhabited islands. However, as reported by the Pacific Stars and Stripes, Winnie did represent a threat to shipping and in fact sank a 44 ft sailboat, THE FLATBUSH MAN, on a pleasure cruise from Marcus Island to Hawaii. The four people aboard were adrift for 13 days in a rubber raft until 21 September when a

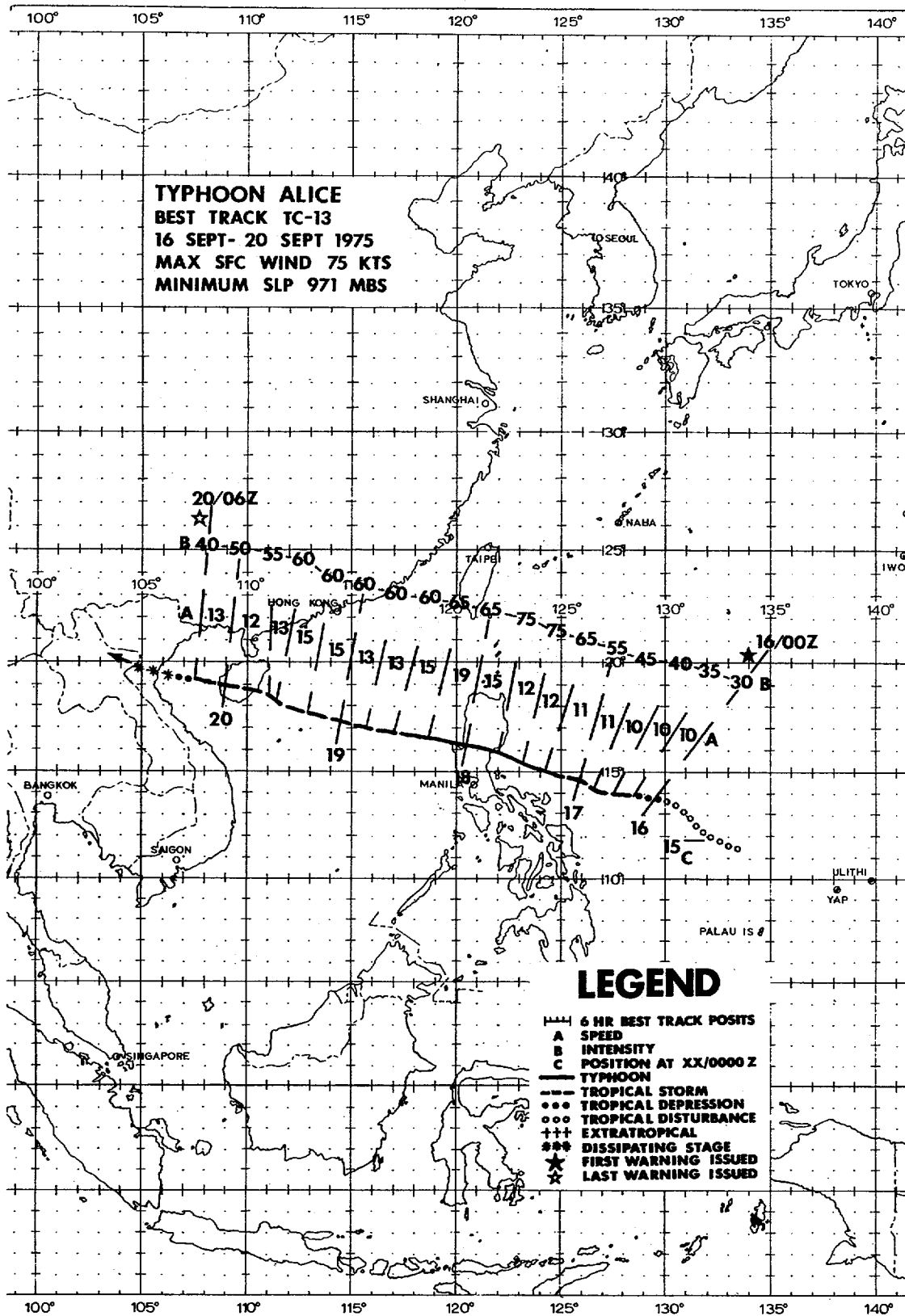
Russian whaling vessel picked them up.

From the time of initial tropical storm strength until 1200Z on the 11th, Winnie was steered on a northerly course by the combination of a sharp mid-tropospheric trough to the west and a blocking ridge to the east. A 200 mb trough extending to the west of Winnie inhibited development past minimal typhoon strength with typhoon force winds persisting only for a 24 hr period from 1800Z on the 9th to 1800Z on the 10th (Fig. 4-12). A Japanese ship (JEEU), located approximately 35 nm north of Winnie, reported sustained winds of 65 kt at 1800Z on the 9th.

Approaching a frontal system near 35N, Winnie came under stronger steering flow, accelerated to near 20 kt, and began to weaken. A short wave trough moving through the long wave ridge diminished its amplitude and Winnie assumed a more northeasterly track while continuing to accelerate. By 0000Z on the 12th, Winnie was absorbed into the frontal system and became an extratropical system with maximum winds of 30 kt.



FIGURE 4-12. Typhoon Winnie 650 nm north-northwest of Wake Island, 9 September 1975, 2151Z. (DMSP imagery)



## ALICE

On 11 September, the TUTT extended westward across the western North Pacific into the South China Sea with several cyclonic cells apparent along the trough axis. On the morning of the 12th, a tropical disturbance was identified on satellite data to the south of the TUTT, near 12N 148E. Outflow weakened over the disturbance as the TUTT moved to the northwest rendering upper-level divergence insufficient to induce a surface vortex and stimulate further development. The anticyclone drifted westward with little apparent change until the 15th, when it moved over a small vortex in the monsoon trough near 13N 131E. As this upper-level anticyclone became vertically aligned over the surface cyclone, the system underwent rapid tropical cyclone development.

This system became Tropical Storm Alice on the afternoon of the 16th and intensified to typhoon strength within 24 hr (Fig. 4-13). On the 17th at 1430Z, aircraft reconnaissance data indicated a 32 mb drop in central pressure during the previous 21 hr, and maximum flight level winds of 105 kt were recorded on this eye penetration.



FIGURE 4-13. Alice as a 55 kt tropical storm 90 nm east-northeast of Catanduanes Island, 16 September 1975, 2205Z. [DMSP imagery]

Reduced inflow resulting from the development of Typhoon Betty (1200 nm to the east) inhibited further development as Alice approached central Luzon. At 2000Z on the 17th the typhoon made landfall near Casiguran, Luzon with maximum surface winds of 75 kt.

Alice passed Luzon near 16N, and entered the South China Sea at 0400Z on the 18th with surface winds of 65 kt (Fig. 4-14). Wallace Air Station reported winds of 40 kt with gusts to 60 kt at 0129Z and a peak gust of 42 kt was recorded at Baguio at 0432Z. No significant damage was reported during the Luzon crossing.

Alice continued to a west-northwest track across the South China Sea in response to moderate steering flow along the southern periphery of the 500 mb subtropical ridge. Maximum surface winds decreased to 60 kt at 1200Z on the 18th and Alice maintained that intensity until just prior to striking the Hainan coast at 1800Z on the 19th. Alice was still well-organized as she entered the Gulf of Tonkin with 50 kt winds, but weakened rapidly thereafter and dissipated upon moving inland over North Vietnam.

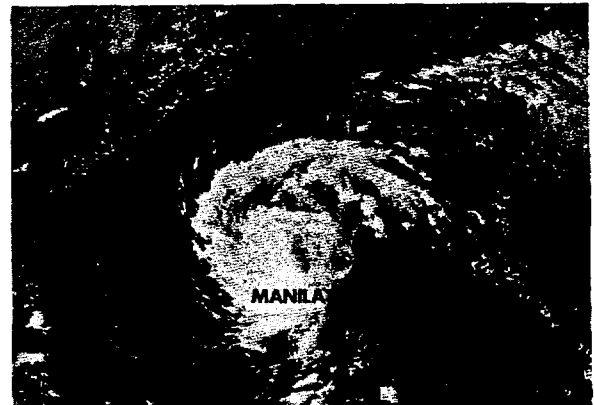
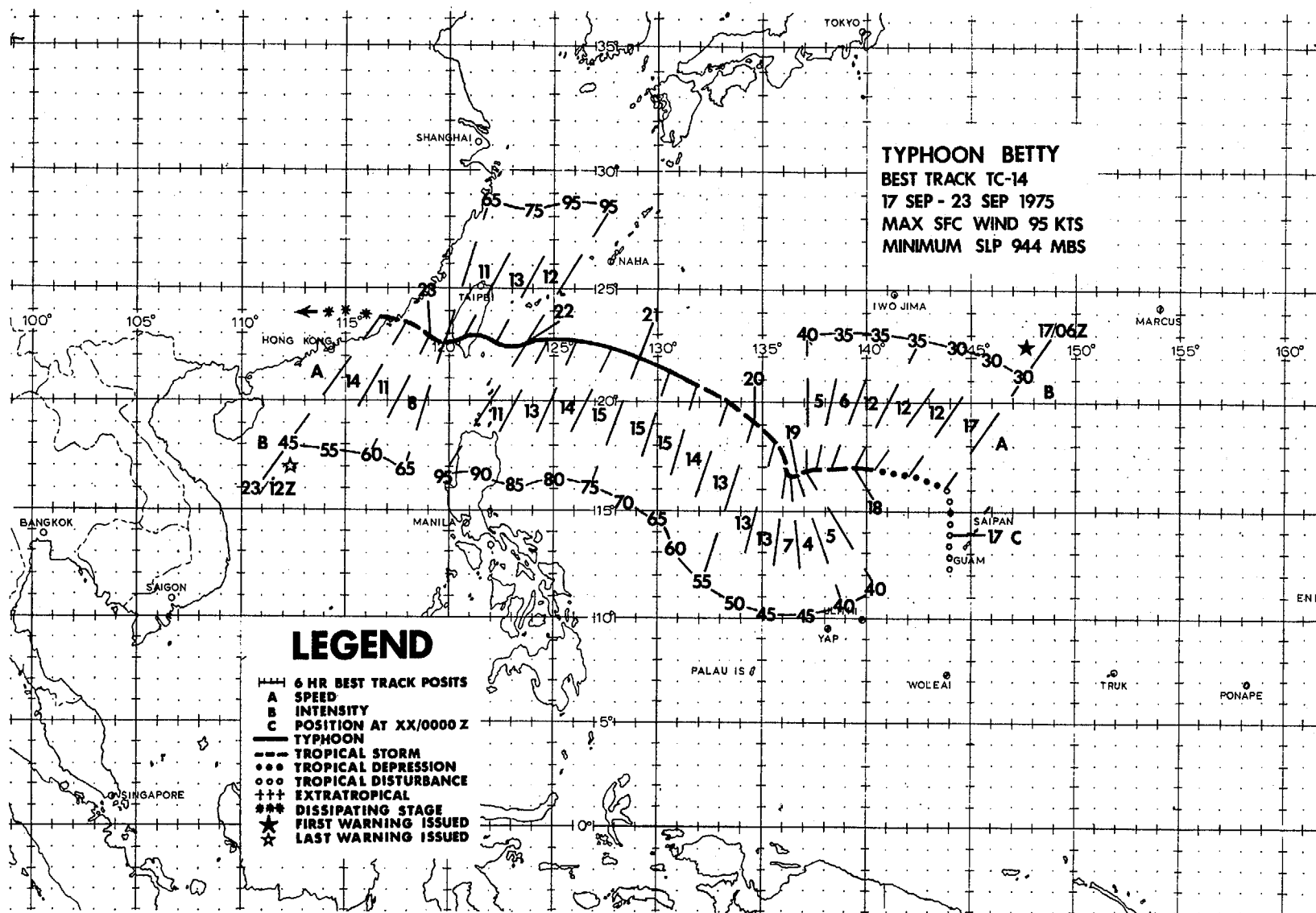


FIGURE 4-14. Typhoon Alice entering the South China Sea after traversing central Luzon, 18 September 1975, 0411Z. [DMSP imagery]



# BETTY

As Typhoon Alice approached the Philippine Islands on the 16th of September, another tropical circulation was detected in the monsoonal trough some 200 nm south of Guam. Moving northward at nearly 20 kt, this disturbance passed within 50 nm of Guam early on the 17th. By the afternoon of the 17th the circulation, now T.D. 14, turned sharply to the west as it approached the southern periphery of the subtropical ridge. T.D. 14 attained tropical storm intensity on the morning of the 18th while moving westward at 12 kt.

The subtropical ridge to the west of T.S. Betty was weakened by a series of middle tropospheric short wave troughs. This produced weak steering currents for the storm and the westward movement slowed to 5 kt. By the 19th the subtropical ridge, influenced by Typhoon Alice, intensified and

receded to the north. In response, Betty began moving northwestward and accelerated to 13 kt.

On the 19th, as a weak upper tropospheric trough to the west deepened, and created a highly efficient outflow channel to the mid-latitude westerlies, Betty began to intensify (Fig. 4-15). By the 20th, Alice had weakened, allowing the subtropical ridge northwest of Betty to build southward. Betty again responded by moving westward. At 0230Z on the 22nd, Typhoon Betty attained a maximum intensity of 95 kt as reconnaissance aircraft recorded a minimum sea-level pressure of 944 mb. The outflow channel to the north (evident on the 19th) was severed by the 21st (Fig. 4-16), but by then Betty had established an outflow channel to the upper tropospheric monsoon easterlies to the south; thus, Betty continued to intensify until the 22nd.

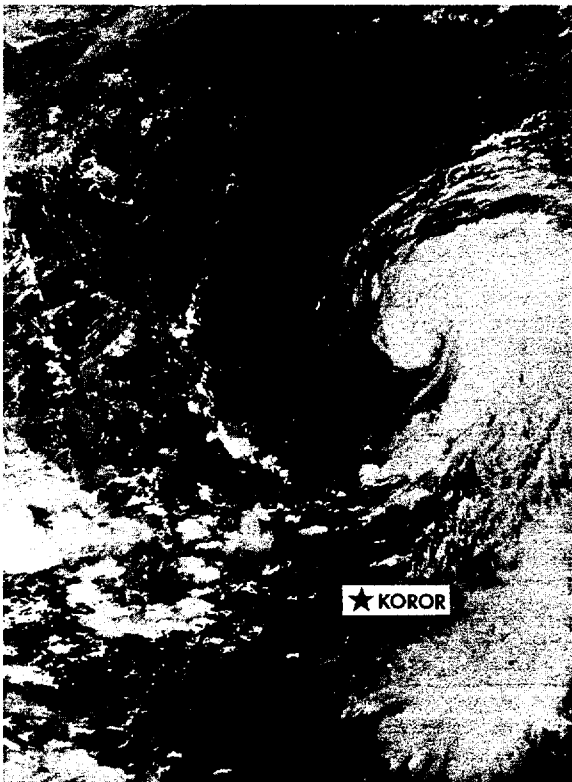


FIGURE 4-15. Betty as a 55 kt tropical storm in the Philippine Sea 720 nm north of Koror, 19 September 1975, 2352Z. (DMSP imagery)

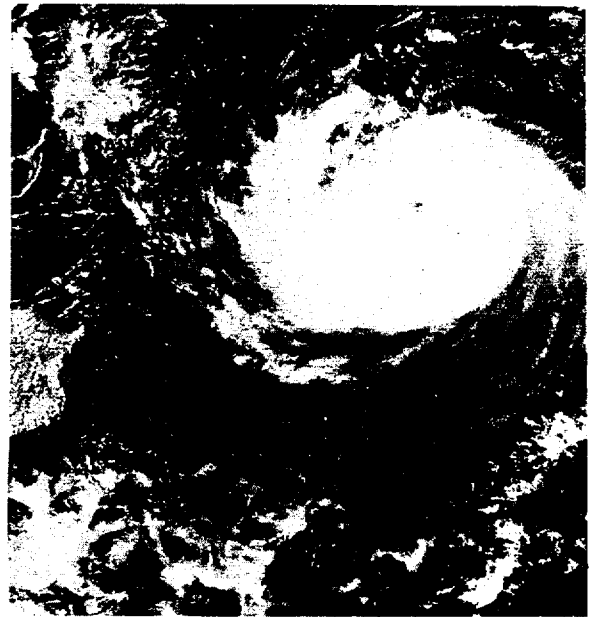


FIGURE 4-16. Typhoon Betty as she heads toward Taitung, Taiwan 400 nm to the west, 21 September 1975, 0315Z. (DMSP imagery)

At 1200Z on the 21st, a ship located 140 nm northeast of the storm estimated winds at 55 kt and seas of 27 ft. The 22 September 0000Z rawinsonde at Ishigakishima (110 nm NNE of Betty) showed 70 kt winds from the 3,000 ft through the 18,000 ft level.

The typhoon, when some 120 nm from Taiwan, was placed under constant surveillance by the radar at Hualien, Taiwan (Fig. 4-17). Figures 4-17a and 4-17b enable comparison of the microwave (radar) presentation and the visible (satellite) presentation. Upon reaching Taiwan, Betty began to weaken. The typhoon's track became west-northwestward as the storm interacted with a lee-side trough created by the high mountain ranges on Taiwan. Packing winds near 80 kt,

Betty crossed into southern Taiwan about 15 nm north of Taitung. Unofficial reports indicated 12 dead, scores injured, and hundreds homeless in the typhoon's wake. Nearly a thousand tourists were stranded as mud slides covered highways. In addition, more than 200 homes were leveled and hundreds of others damaged.

After crossing the mountains of southern Taiwan, the storm's track became west-southwestward. Weakened by the rugged terrain, Betty entered the Taiwan Strait as a minimal typhoon. It continued to weaken and crossed the Chinese coast on the evening of the 23rd with 50 kt winds. By the 24th, Betty had degenerated into a low pressure area some 100 nm north of Hong Kong.

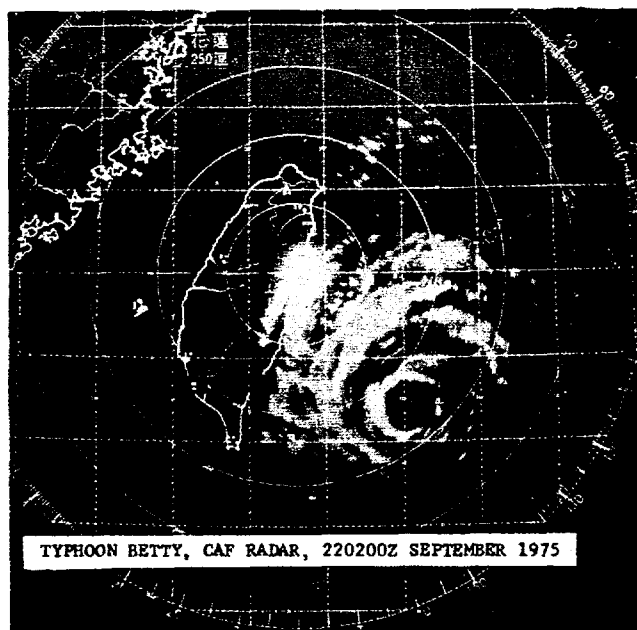


FIGURE 4-17. Radar presentation of Typhoon Betty near peak intensity some 135 nm east of Taitung, 22 September 1975, 0200Z.

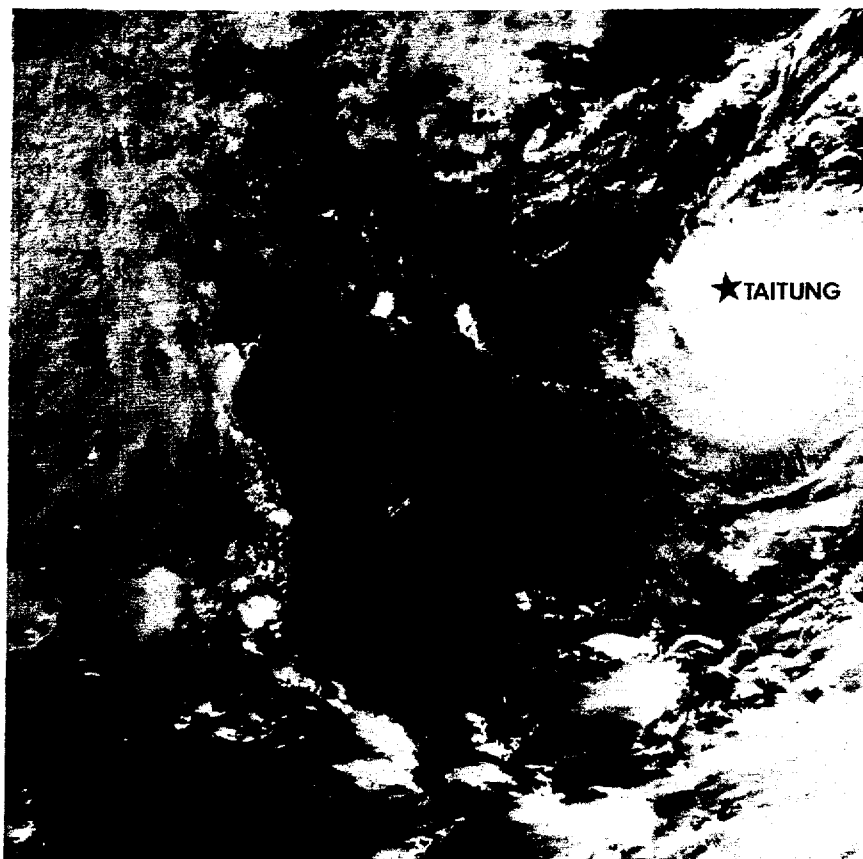


FIGURE 4-17a. Typhoon Betty at 95 kt peak intensity some 135 nm east of Taitung, Taiwan, 22 Sept 1975, 0057Z. (DMSP imagery)

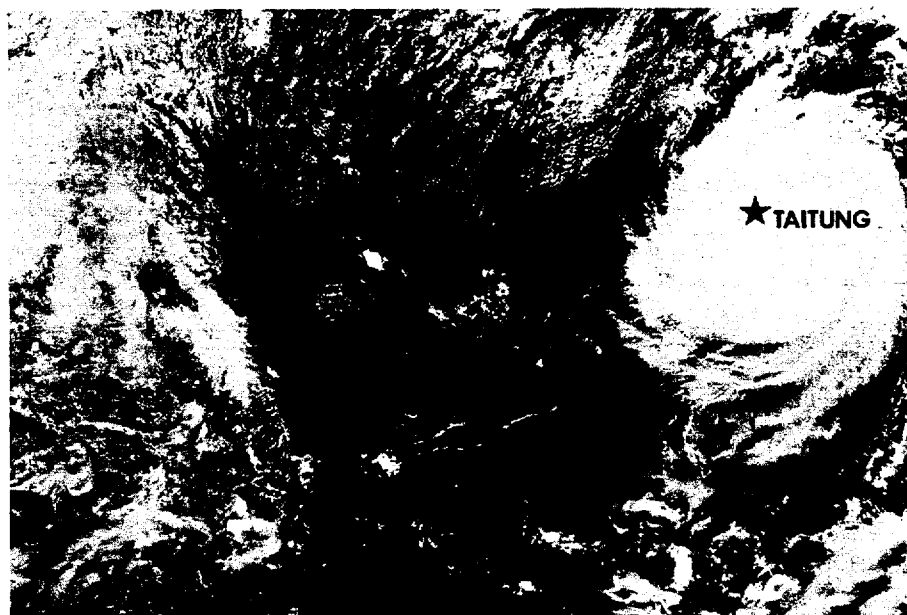
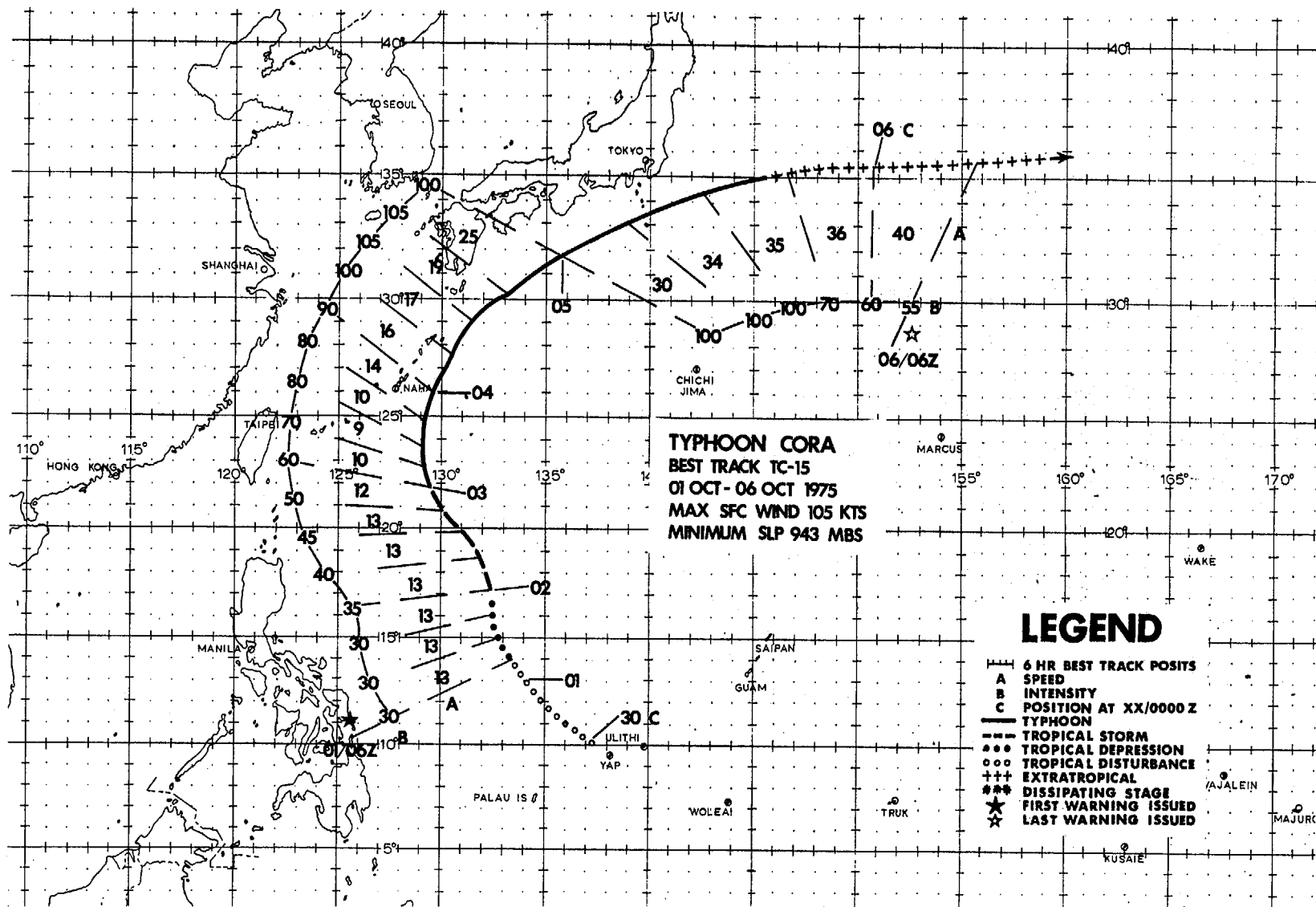


FIGURE 4-17b. Typhoon Betty at peak intensity some 95 nm east of Taitung, 22 Sept 1975, 0438Z. (DMSP imagery)



Weak troughing in the low level easterlies spawned a disturbance near 10N 142E on the morning of 29 September, as indicated by satellite and synoptic data. This disturbance drifted west-northwest for the next several days; on 1 October, aircraft reconnaissance reported surface winds of 30 kt.

For the next 24 hr, the 700 mb center was displaced as much as 25 nm to the northwest of the large and diffuse surface center. This center had a diameter as large as 80 nm with weak temperature and pressure gradients, and correspondingly light winds. From initial detection until the evening of the 3rd, development of a good outflow channel to the west and northwest was restricted by an upper tropospheric trough to the west. Despite this lack of outflow, the storm continued to develop. Cora was upgraded to typhoon strength on the 3rd when aircraft reconnaissance reported 70 kt surface winds and a closed wall cloud. The system continued to lack good vertical structure through the evening of the 3rd when the 700 mb center was still displaced east of the surface center.

For the first 48 hr, Cora was situated between two large high pressure cells and moved toward the northwest at 13 kt. On the 3rd, the high pressure cell north of Taiwan began to weaken rapidly and collapsed. Strong ridging was now building to the east of Cora. At this time (Fig. 4-

18), Cora began to slow down prior to a gradual recurvature near 25N.

As Cora passed 100 nm to the east of Okinawa on the morning of the 4th, Kadena AB recorded a peak gust of 31 kt. The system now began a gradual acceleration as it entered an area of strong westerlies to the northeast of the high pressure cell. That evening Cora attained a minimum central pressure of 943 mb and maximum sustained surface winds of 105 kt (Fig. 4-19). Both satellite and synoptic data indicated excellent outflow in all quadrants except the northwest where a minor trough was still restricting the outflow.

By the morning of the 5th, satellite and synoptic data indicated that the primary upper-level outflow was now confined to the north-northeast. Although Cora was in an area of strong vertical shear, typhoon strength winds were still maintained for the next 24 hr. Moving to the northeast at 30 kt, the typhoon continued to come into increasingly strong westerly steering flow. Cora passed 120 nm south-southeast of Tokyo on the evening of the 5th.

Satellite data on the 6th indicated that there was very little upper-level outflow, but an apparent low-level circulation was still visible. The remains of Cora were now moving to the east at 40 kt as an extratropical system with surface winds of 55 kt.

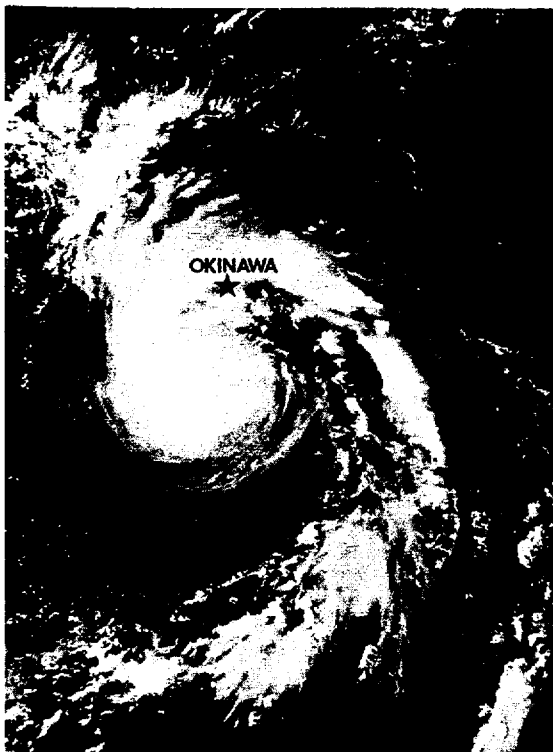


FIGURE 4-18. Cora just prior to attaining typhoon intensity 255 nm south-southeast of Okinawa, 3 October 1975, 0254Z. [DMSP imagery]

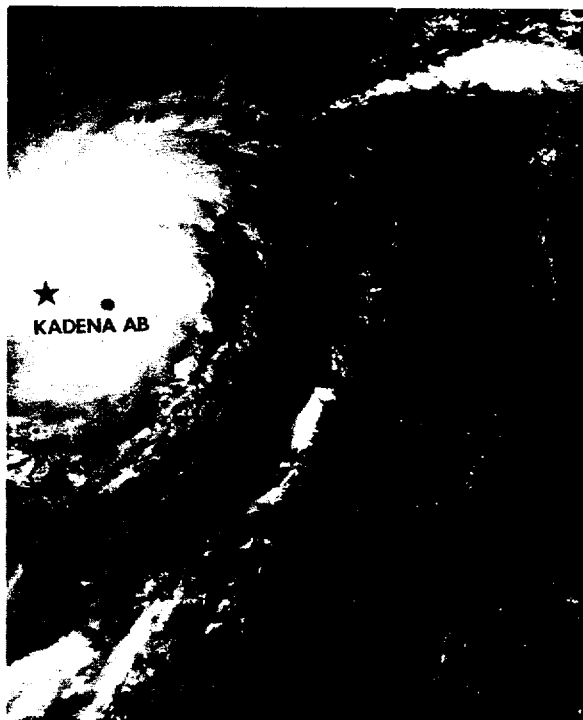
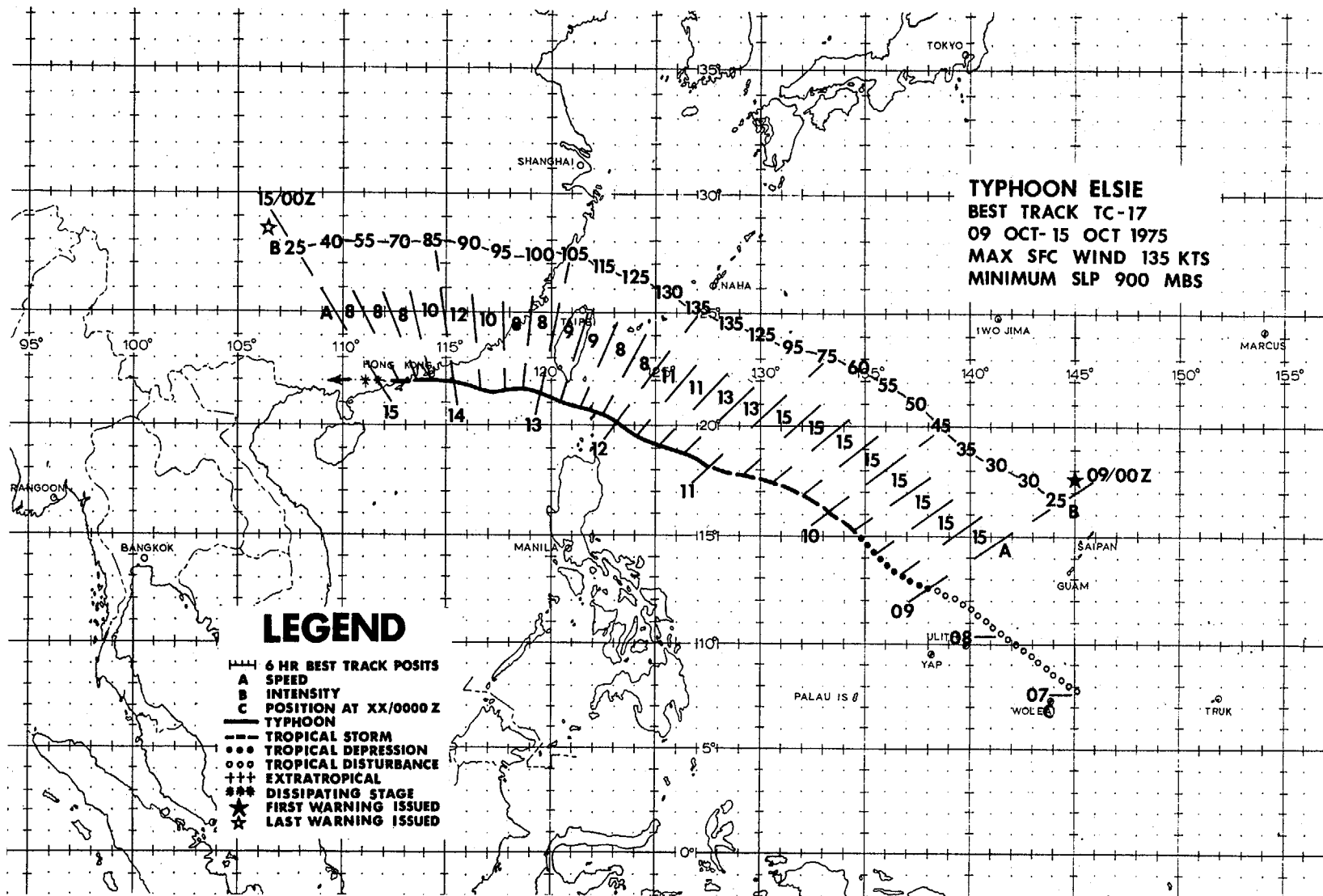


FIGURE 4-19. Typhoon Cora near 95 kt 115 nm east of Kadena AB, Okinawa, 4 October 1975, 0236Z. [DMSP imagery]



# ELSIE

By the 6th of October, the monsoonal trough had become quite active and was oriented east-west along 8N from the Philippines to 160E. Typhoon Elsie developed in this trough with a well-defined surface circulation located approximately 250 nm southwest of Guam on the 8th. The first warning was issued on the morning of the 9th and Elsie attained typhoon strength 48 hr later. At this point, Elsie began slowing down as the storm approached the western extent of the mid-tropospheric subtropical ridge.

Elsie then underwent explosive deepening (Fig. 4-20) and aircraft reconnaissance recorded a 69 mb drop in the central pressure at the typhoon center between the 102052Z and 111430Z fixes. The maximum surface winds increased from 65 kt to 135 kt during this period.

As Elsie approached the Bashi Channel, Basco, in the Bataan Islands (WMO station 98135, elev 184 ft), 40 nm east of Elsie's center, reported maximum sustained winds of 65 kt. Elsie continued moving west-northwest through the Bataan Islands on the 12th. As the sub-tropical ridge then built westward, Elsie began a more westerly track into the South China Sea. As the typhoon entered the South China Sea (Fig. 4-21), it began to weaken with inflow restricted to the north by the Asian continent. Still, the Royal Observatory, Hong Kong, reported that typhoon Elsie was one of the most intense typhoons ever to affect Hong Kong in the month of October. Royal Observatory radar began tracking the storm by late afternoon on the 13th and Elsie passed 35 nm to the south of Hong Kong on the 14th. At that time the maximum sustained winds recorded at Hong Kong were 70 kt with gusts up to 118 kt. Fortunately, the maximum winds occurred at a low tide, thus reducing flooding. Seven ocean going vessels drifted from their moorings and one small craft and a fishing junk capsized. The lowest pressure recorded in Hong Kong was 987.5 mb. There were no fatalities reported, but 46 people were injured by flying debris.

After passing south of Hong Kong, Elsie continued westward, making landfall on the southern China coast at approximately 1500Z on the 14th. Elsie then dissipated rapidly over the Asian mainland.

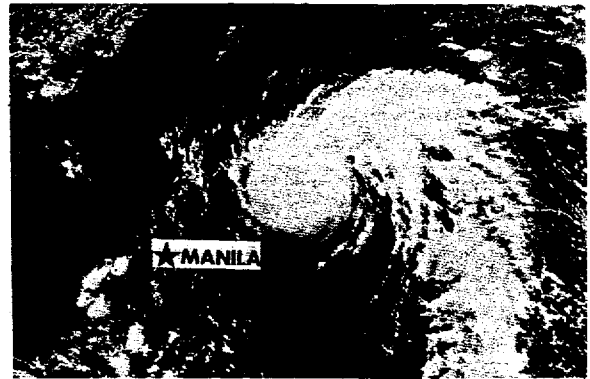


FIGURE 4-20. Typhoon Elsie beginning explosive deepening some 420 nm northeast of Manila, 11 October 1975, 0348Z. (DMSP imagery)

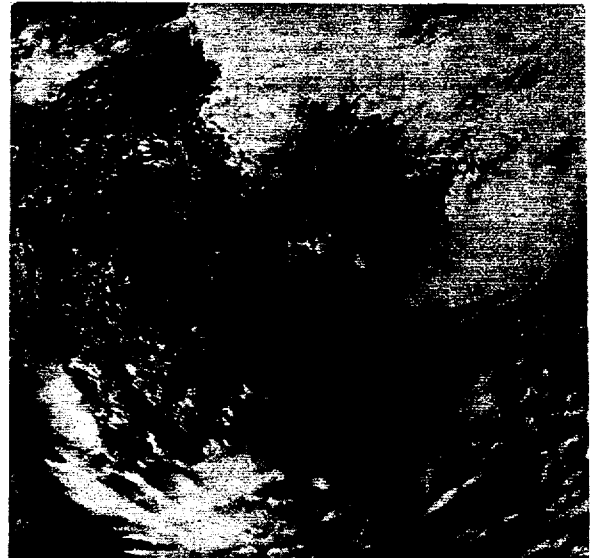
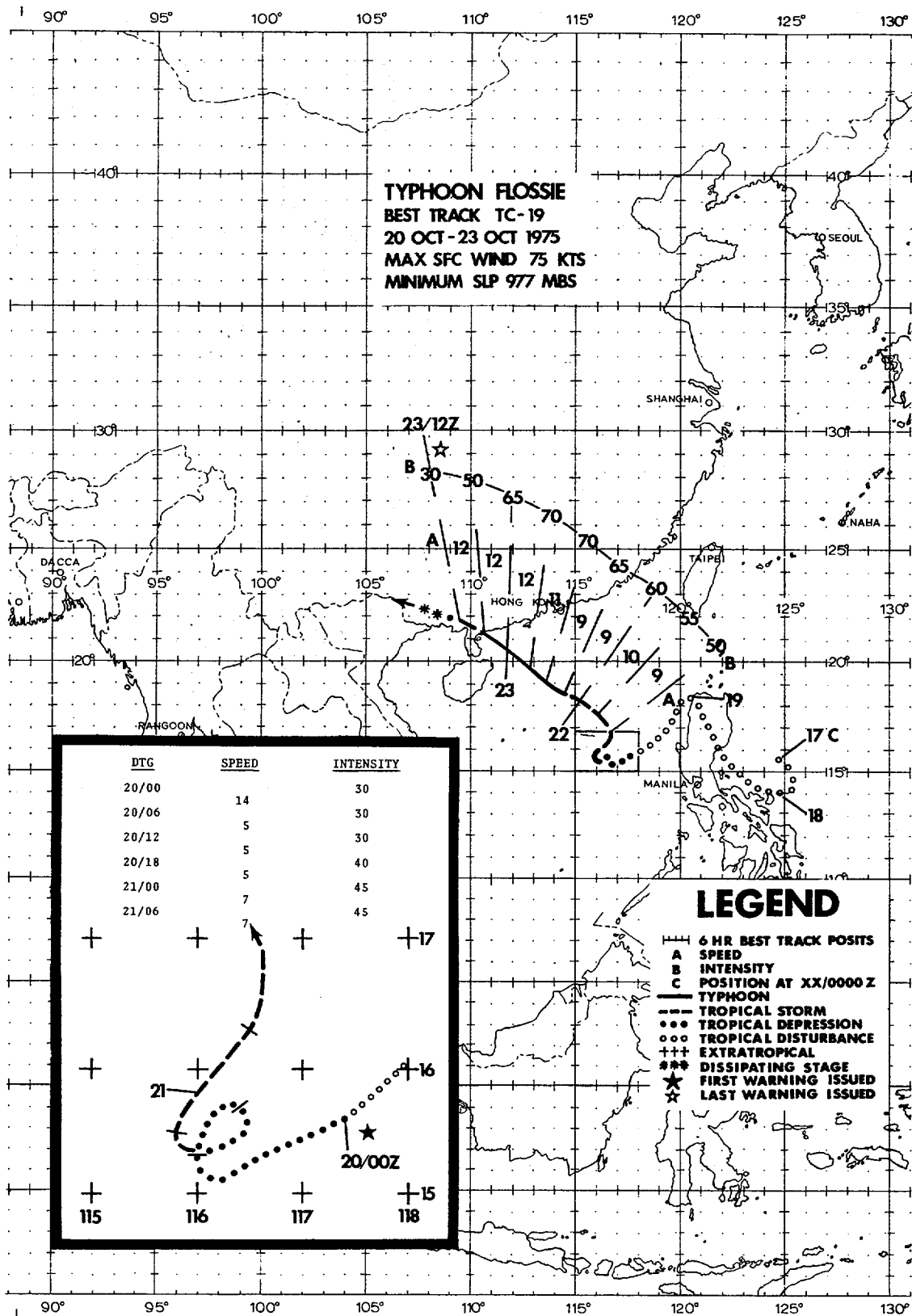


FIGURE 4-21. Typhoon Elsie entering the South China Sea 260 nm east of Hong Kong, 13 October 1975, 0452Z. (DMSP imagery)



## FLOSSIE

The circulation which was to become Typhoon Flossie was first analyzed 500 nm west-southwest of Guam on the 0000Z surface analysis of 14 October. This disturbance, apparently initiated by an upper tropospheric cyclone, then began drifting west. Its development was somewhat retarded on the 15th and 16th by the presence of T.D. 18 420 nm to the north-northeast. On the 19th the disturbance moved into the South China Sea after crossing Luzon and began to intensify.

The first warning was issued on the morning of the 20th based on satellite and synoptic data. Early the next morning reconnaissance aircraft reported a central pressure of 989 mb and T.D. 19 was upgraded to Tropical Storm Flossie.

Mid-tropospheric ridging extending from the central North Pacific to the northern portion of the South China Sea was the controlling factor in steering Flossie. A weakness developed in this ridge during the next few days, producing extremely weak steering flow. This caused the storm to follow an erratic track during the period from 200000Z to 211200Z (Fig. 4-22).

A container ship, the SS Mayaguez, reported a pressure of 980 mb and 60 kt

winds on the afternoon of the 21st. At that time the Mayaguez was 40 nm south-southwest of the storm center. Flossie was upgraded to typhoon on the afternoon of the 22nd when located about 250 nm south of Hong Kong. Two timber freighters, the Ming Sing and Kinabalu Satu, sunk between Flossie and the southern approaches to Hong Kong on the 21st and 22nd, respectively. Due to the high seas and typhoon force winds, all rescue efforts failed and a total of 44 men were lost. Three survivors were picked up in a life boat a week later.

Flossie reached a maximum intensity of 70 kt on the evening of the 22nd. By the 23rd, the mid-tropospheric ridging was reestablished, and Flossie tracked northwest in the expected climatological direction for this area and time of year. As the typhoon approached landfall on the 23rd, its circulation was disrupted in the northeast quadrant by the terrain and its intensity began to diminish rapidly. Flossie made landfall on the afternoon of the 23rd on the northeast portion of the Luichow Peninsula (Fig. 4-23). Winds at that time were down to 50 kt.

Although Typhoon Flossie's maximum winds were only 70 kt, the seas generated in the northern South China Sea remained a threat to shipping for several days.



FIGURE 4-22. Flossie as a 45 kt tropical storm approximately 225 nm east-southeast of the Paracel Islands, 21 October 1975, 0032Z. (DMSP imagery)

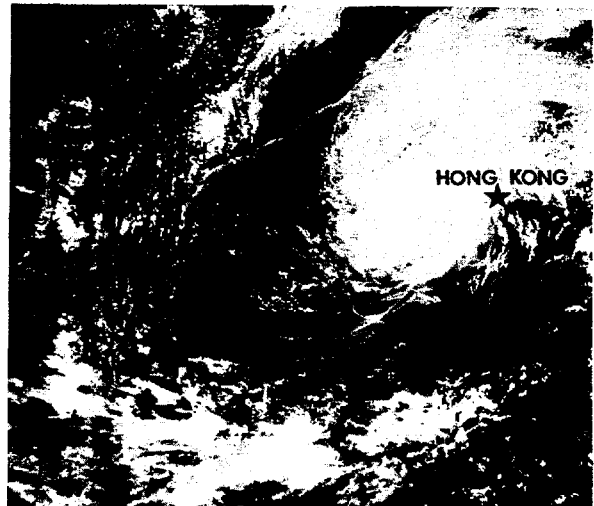
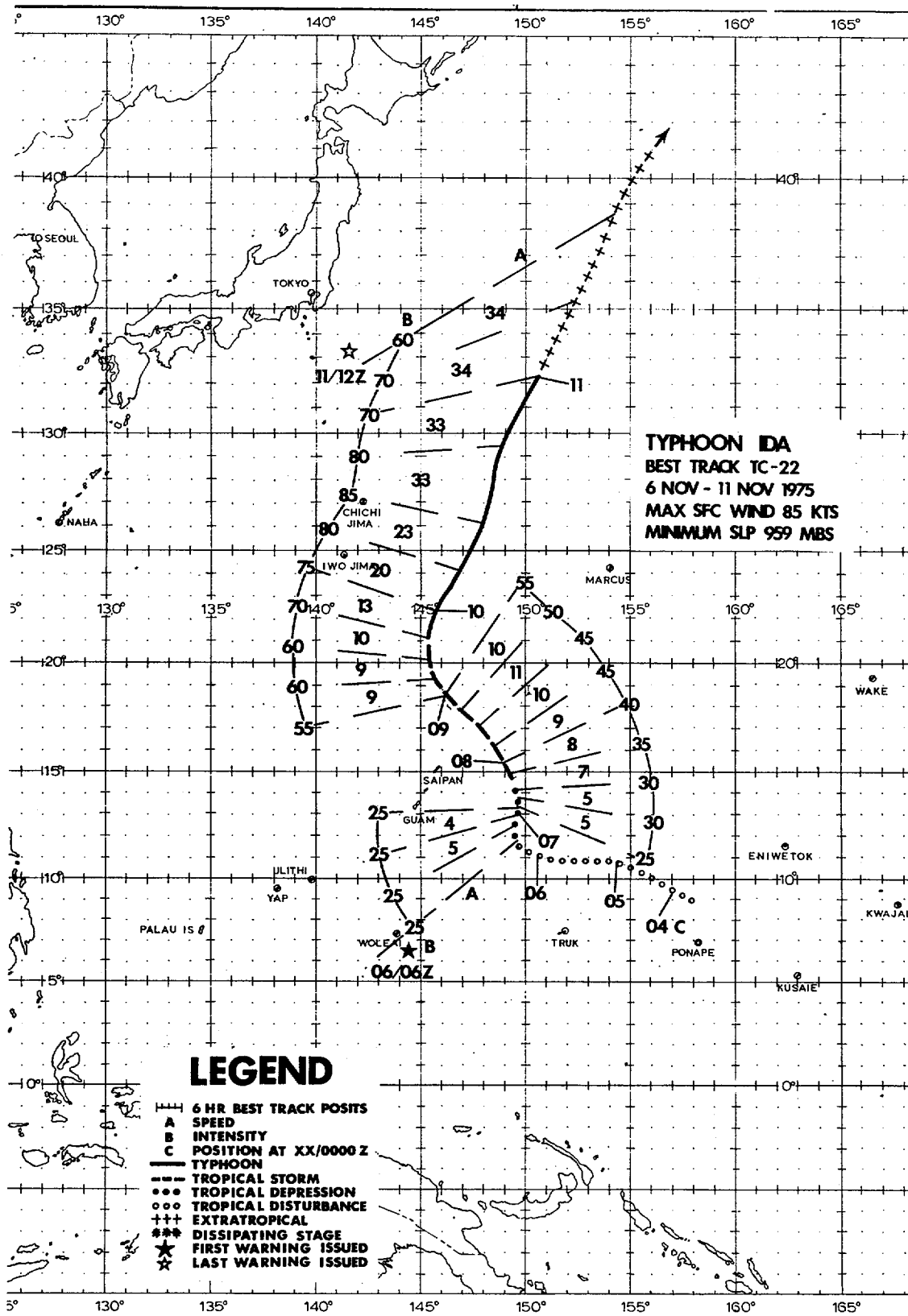


FIGURE 4-23. Flossie just prior to making landfall on Luichow Peninsula some 200 nm west-southwest of Hong Kong. (DMSP imagery)



Destined to spend its entire life cycle at sea, Typhoon Ida was first observed as a tropical disturbance on the 4th of November, 150 nm northwest of Ponape. The disturbance initially tracked westward at 8 kt with dual circulation centers oriented along a northeast to southwest axis. The disturbance became a tropical depression at 0600Z on the 6th and then began moving toward the north through a weakness in the mid-tropospheric subtropical ridge. The depression continued to move north at 4-5 kt for the next 24 hr while the two circulation centers consolidated into one.

Early on the morning of the 8th, the depression was upgraded to Tropical Storm Ida (Fig. 4-24) and it accelerated toward the northwest at 10 kt. Ida continued to intensify as the center passed near the Southern Mariana Islands, with wind gusts of 32 kt reported on Guam on the 7th. On the 9th Pagan Island in the Northern Marianas reported 40 kt winds.

By the 9th, Ida came under the influence of a deep mid-latitude trough centered 600 nm to the west and began to recurve. The storm attained typhoon intensity (Fig. 4-25) by 1800Z on the 9th and began tracking toward the north-northeast at an accelerated rate. A minimum central pressure of 959 mb was observed by aircraft reconnaissance at 1437Z on the 10th. By 0000Z on the 11th, Ida was moving toward the north-northeast at 33 kt and had lost much of her tropical cyclone characteristics as evidenced by satellite data (Fig. 4-26). Twelve hours later, Ida had combined with a frontal system and continued to move rapidly northeastward as an extra-tropical system.



FIGURE 4-24. Ida just prior to achieving tropical storm intensity 255 nm east-northeast of Guam, 7 November 1975, 2224Z. [DMSP imagery]



FIGURE 4-25. Typhoon Ida near 75 kt during recurvature 420 nm north of Saipan, 9 November 1975, 2329Z. [DMSP imagery]

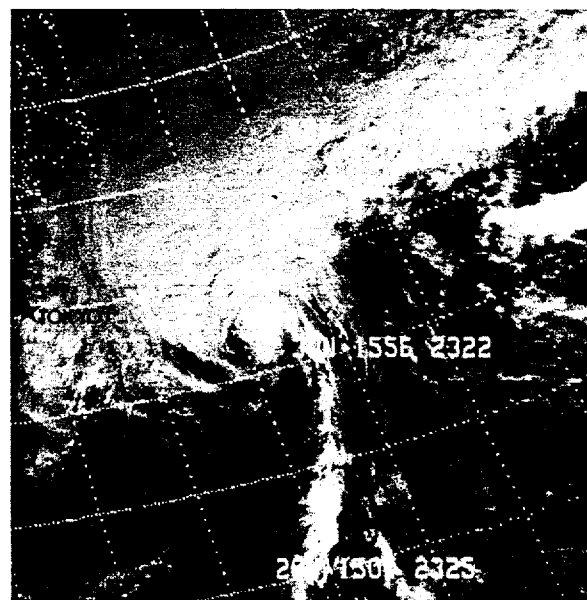
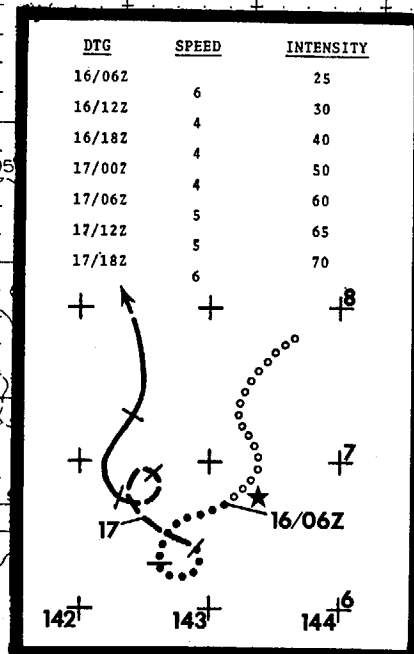


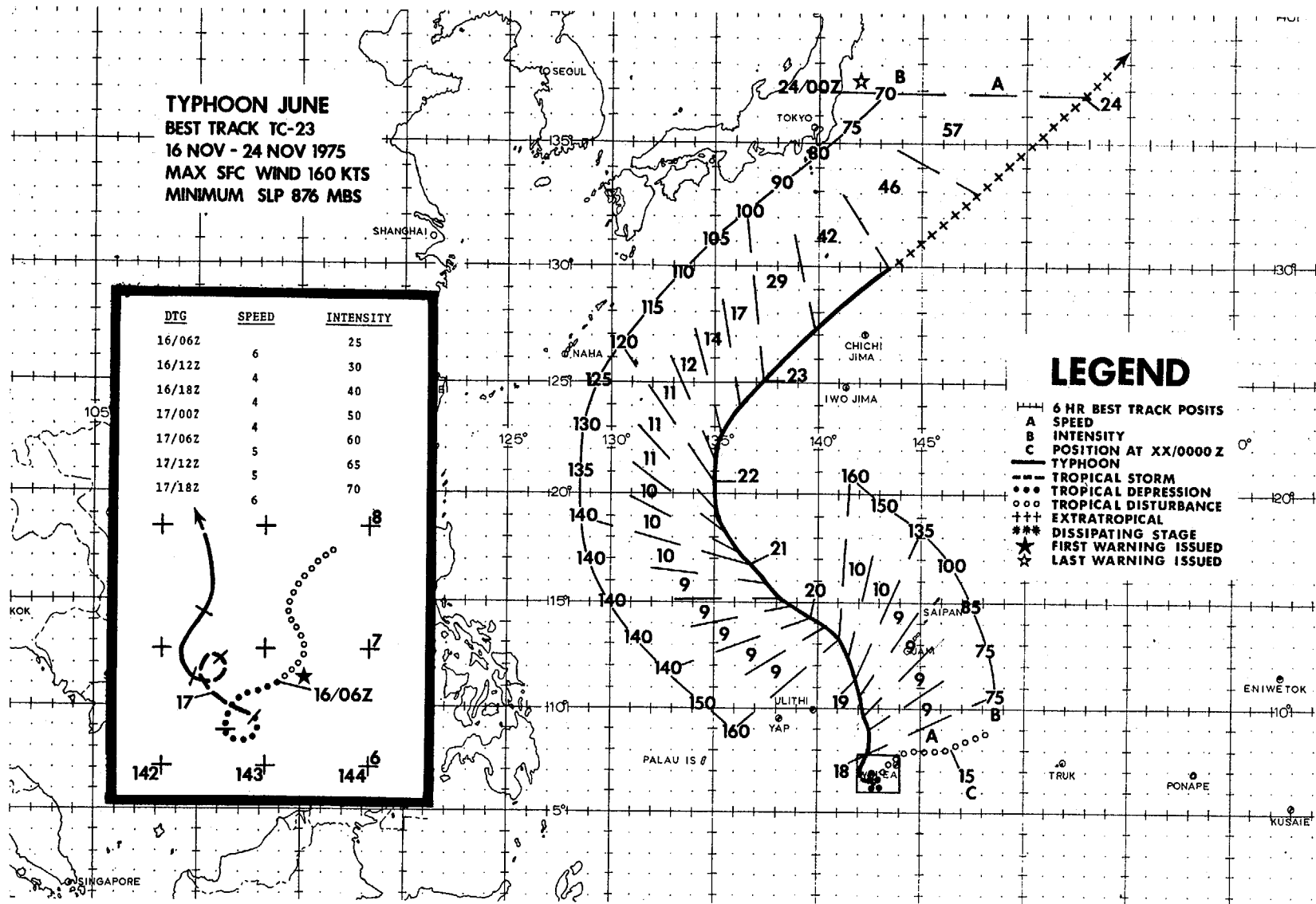
FIGURE 4-26. Typhoon Ida becoming extra-tropical 575 nm east-southeast of Tokyo, 10 November 1975, 2321Z. [NOAA-4 imagery]

**TYPHOON JUNE**  
**BEST TRACK TC-23**  
**16 NOV - 24 NOV 1975**  
**MAX SFC WIND 160 KTS**  
**MINIMUM SLP 876 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



## JUNE

The last typhoon of the year was to become the most intense on record. At 0843Z on 19 November, reconnaissance aircraft measured a record low 700 mb height of 1984 m while traversing the eye and obtained a coincident minimum sea level pressure (MSLP) of 876 mb (25.87 in) by dropsonde near the cloud wall. This observation was the lowest on record, slightly lower (1 mb) than Typhoons Ida in 1958 and Nora in 1973. June's central pressure well surpasses the lowest Western Hemisphere reading (892.3 mb), and that obtained by aircraft in Hurricane Camille (905 mb).

June had been under frequent surveillance by satellite and aircraft since her birth in the central Carolines on the 16th. Initially, the system moved slowly west-

ward, becoming quasi-stationary near 6N 143E (445 nm south of Guam), the result of weak steering flow near the equator (Fig. 4-27).

On the 18th, June began to move northward, perhaps in response to a weakness in the 500 mb ridge caused by a deep trough approaching from the west. Simultaneously, June began to rapidly deepen, her surface pressure plummeting 52 mb in 11 hr and 90 mb in 24 hr. By the 19th, the winds of Super Typhoon June had increased to an estimated 160 kt as the typhoon reached its lowest pressure, some 230 nm west-southwest of Guam (Fig. 4-28). As June tracked north-northwest toward a weakness in the 500 mb ridge, the system reached exceptionally large proportions. Sustained

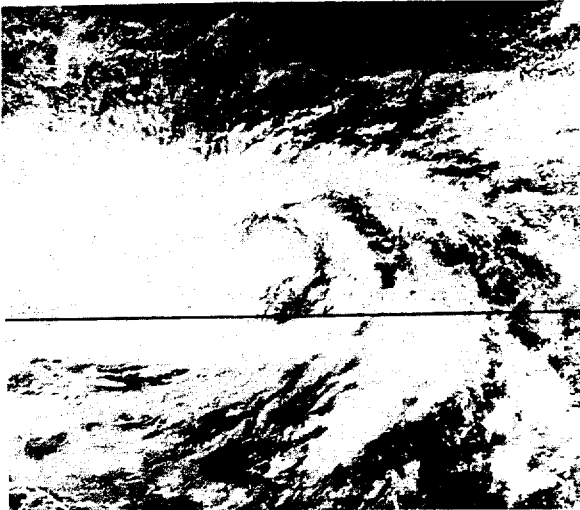


FIGURE 4-27. June at tropical storm intensity 420 nm south-southwest of Guam, 16 November 1975, 2302Z. (DMSP imagery)

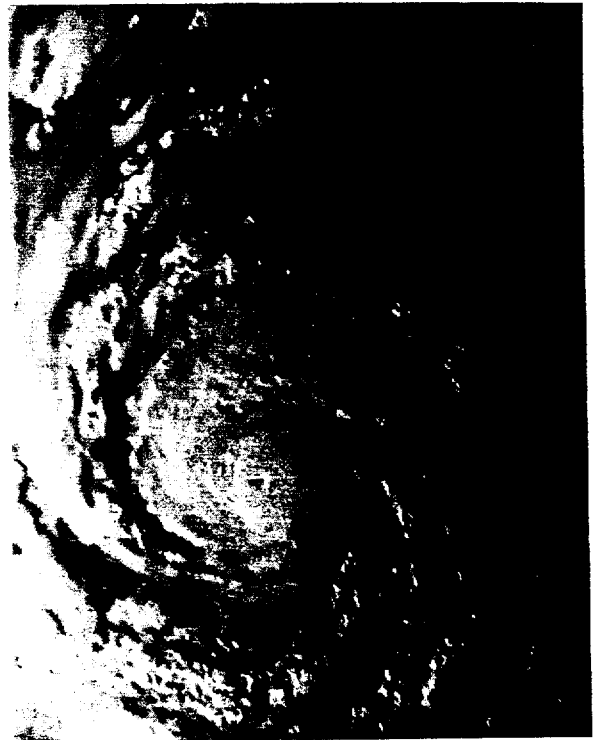


FIGURE 4-28. Super Typhoon June near 160 kt peak intensity 210 nm west of Guam. Lightning discharge can be seen across the eye of the moonlight photograph, 19 November 1975, 1002Z. (DMSP imagery)

surface winds of 50 kt or greater extended 200 nm outward from the center.

On the evening of the 19th, June passed approximately 200 nm to the west of Guam. More than 3,200 island residents fled into evacuation centers. There was severe flooding in low-lying areas, with several buildings and homes damaged or destroyed by gale force winds and storm surge. A peak gust of 70 kt was recorded at Andersen AFB. Island losses amounted to an estimated \$300,000 with most of the damage to crops.

Eauripik Atoll in Yap district suffered severe property and crop damage. Newspaper reports stated that "sizable

portions" of the island were washed away by the heavy seas, but that no deaths or injuries occurred. Flooding and crop damage were also reported on Woleai Atoll and on other low-lying islands in Yap district; however, no casualties were reported on any of the islands.

After passing abeam of Guam, Super Typhoon June turned northwest (Fig. 4-29). On the 22nd, June began recurving toward the northeast with maximum winds down to 100 kt. On the 23rd (Fig. 4-30), the storm began accelerating rapidly in the strong westerlies and its forward speed reached nearly 60 kt. With an influx of cold air, June became extratropical above 30N, still possessing winds of typhoon intensity.

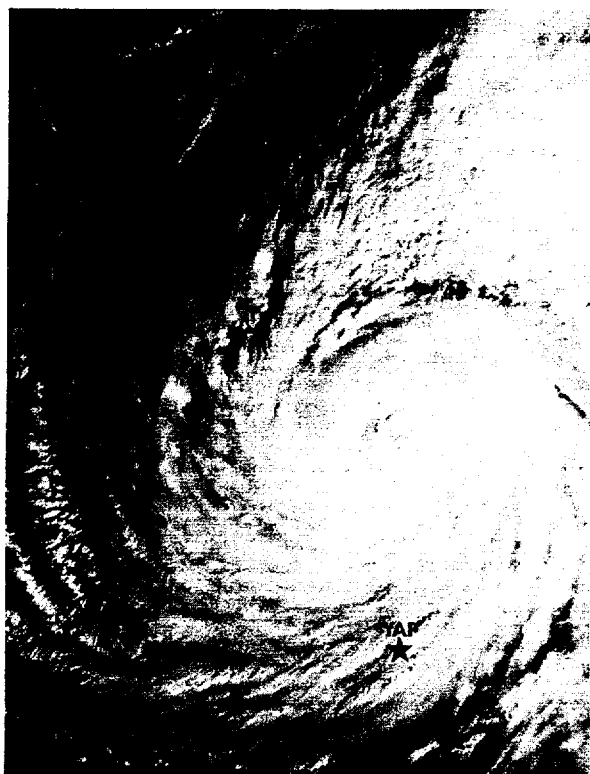


FIGURE 4-29. Super Typhoon June at 145 kt heading to the northwest away from Guam, 19 November 1975, 2348Z. [DMSP imagery]

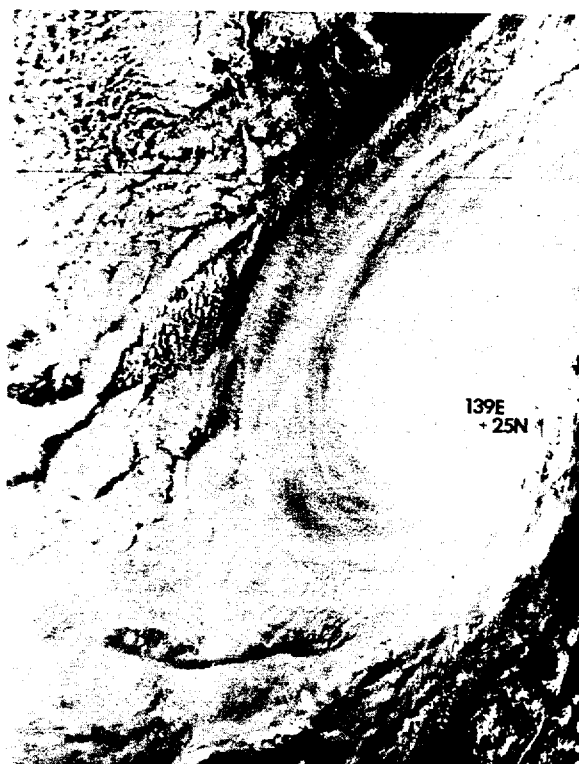
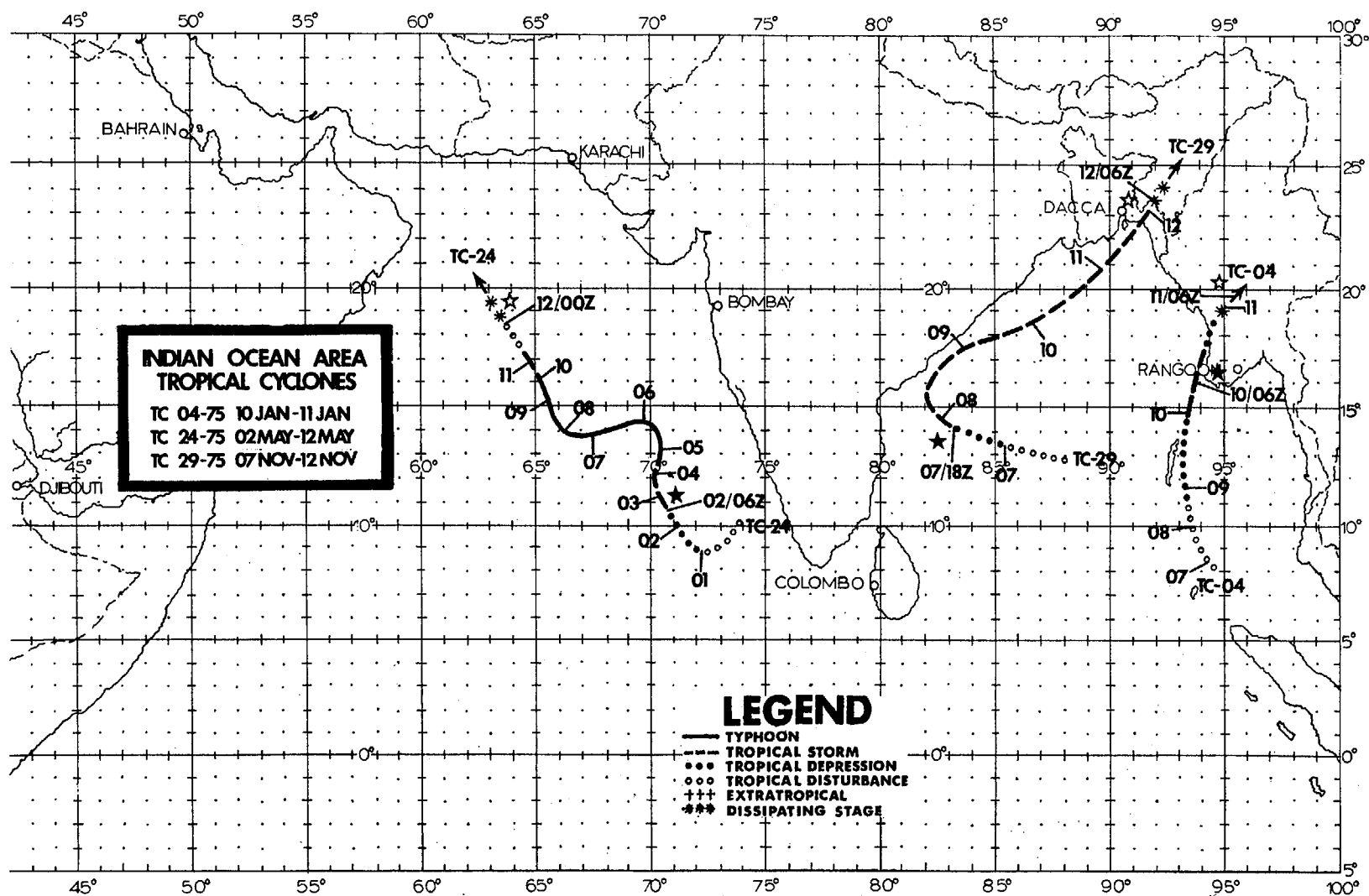
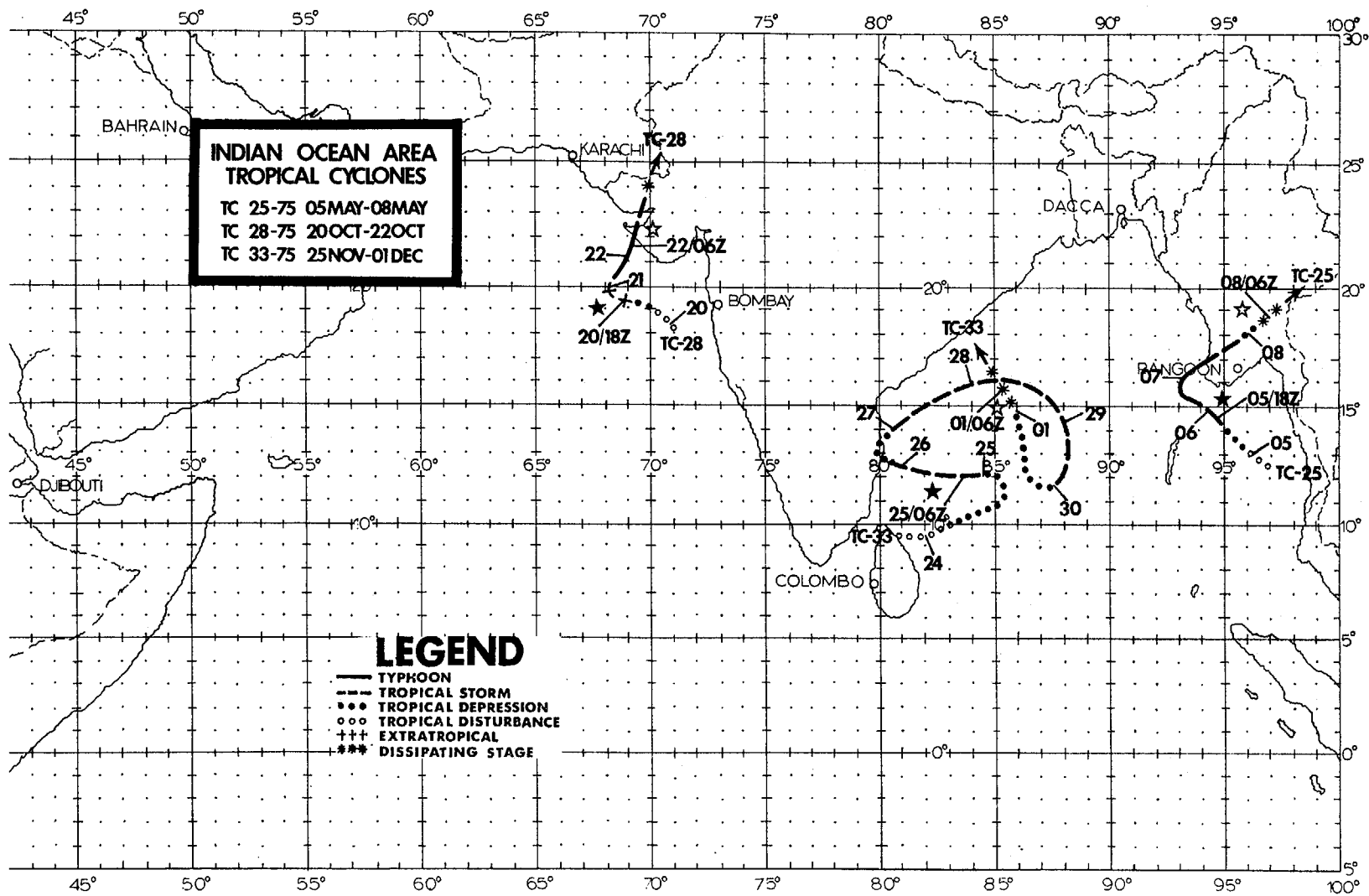


FIGURE 4-30. June maintaining 100 kt winds as she accelerates after recurvature, 22 November 1975, 2252Z. [DMSP imagery]





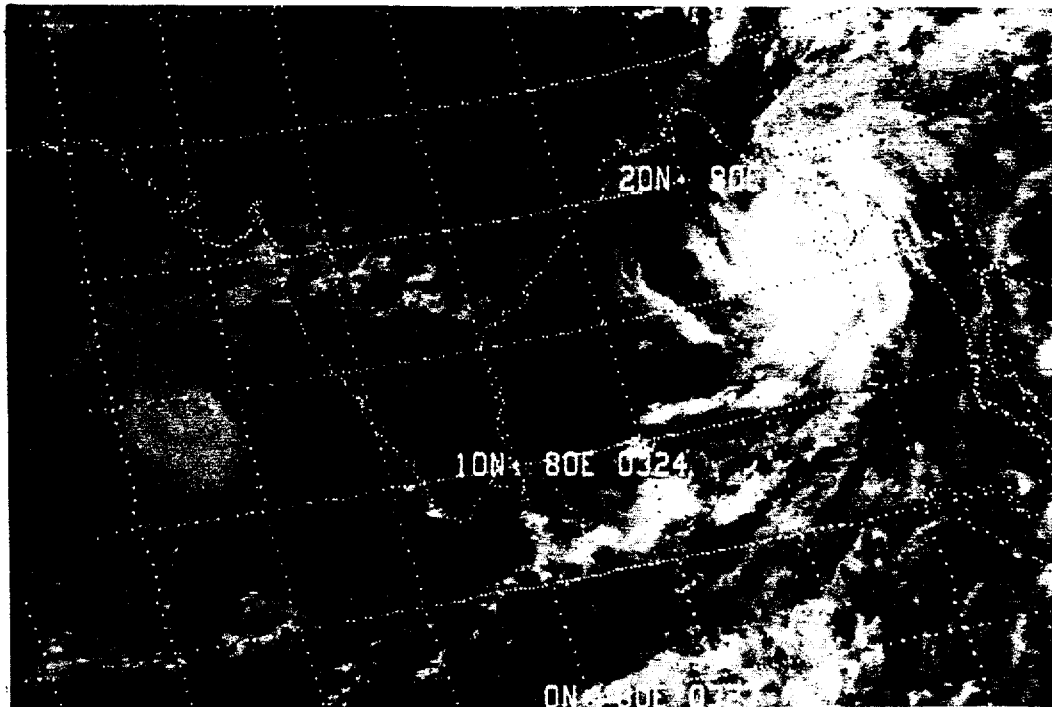


FIGURE 4-31. Tropical cyclones 24-75 (Arabian Sea) and 25-75 (Bay of Bengal), 7 May 1975, 0322Z. T.C. 24-75, near 75 kt, is some 450 nm southwest of Bombay. T.C. 25-75, near its 75 kt peak intensity, is 65 nm west of the Burma coast. (NOAA-4 imagery)

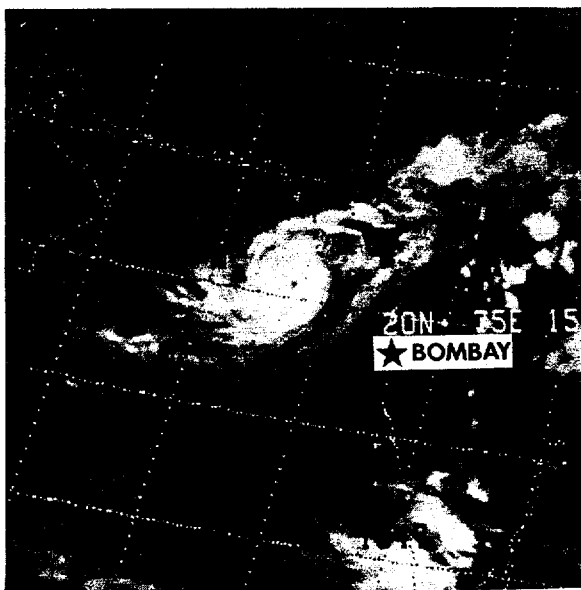


FIGURE 4-32. Infrared imagery of Tropical Cyclone 28-75 near 65 kt some 270 nm west-northwest of Bombay, 21 October 1975, 1550Z. (NOAA-4 imagery)

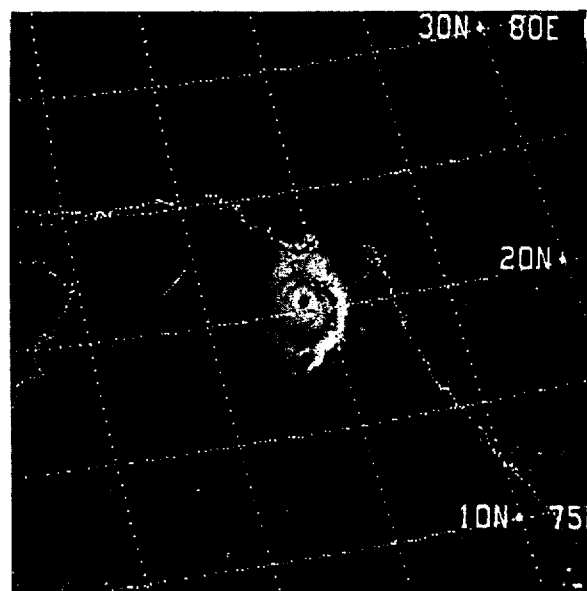


FIGURE 4-33. Tropical Cyclone 28-75 at 80 kt peak intensity some 40 nm south-southwest of landfall on northwestern India, 22 October 1975, 0404Z. (NOAA-4 imagery)

## 5. TROPICAL CYCLONE CENTER FIX DATA

Fix data for 1975 will be published in a separate Technical Note. This Tech Note will include fix data for all storms in the PACOM area west of 140W and north of the equator. To obtain a copy of this report write:

Commanding Officer  
Fleet Weather Central/JTWC  
COMNAVMARIANAS Box 12  
FPO San Francisco 96630

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.

# CHAPTER V - SUMMARY OF FORECAST VERIFICATION DATA

## 1. ANNUAL FORECAST VERIFICATION

### a. POSITION FORECAST VERIFICATION

Forecast positions for the warning, 24-, 48-, and 72-hour forecasts are verified against the best track. Positions for storms over land, dissipated or extratropical 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. 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 5-3 and Figure 5-2.

### 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 kt) over the past two seasons. This in turn has contributed to smaller 24-, 48-, and 72-hour intensity forecast deviations from the JTWC best track.

## 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. 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. 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 pre-

TABLE 5-1. 1975 JTWC ERROR SUMMARY FOR THE WESTERN NORTH PACIFIC

| CYCLONE        | WARNING        |                   |            | 24 HOUR       |                   |            | 48 HOUR       |                   |            | 72 HOUR       |                   |            |
|----------------|----------------|-------------------|------------|---------------|-------------------|------------|---------------|-------------------|------------|---------------|-------------------|------------|
|                | POSIT<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS | FCST<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS | FCST<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS | FCST<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS |
| 1. TY LOLA     | 20             | 12                | 23         | 166           | 98                | 19         | 290           | 125               | 15         | 455           | 129               | 11         |
| 2. TD 02       | 25             | 10                | 16         | 78            | 44                | 13         | --            | --                | --         | --            | --                | --         |
| 3. TS MAMIE    | 31             | 12                | 9          | 161           | 38                | 5          | --            | --                | --         | --            | --                | --         |
| 4. TY NINA     | 16             | 11                | 15         | 135           | 75                | 11         | 299           | 170               | 5          | 424           | 41                | 1          |
| 5. TD 05       | 41             | 39                | 4          | --            | --                | --         | --            | --                | --         | --            | --                | --         |
| 6. TY ORA      | 22             | 8                 | 9          | 167           | 92                | 5          | 32            | 31                | 1          | --            | --                | --         |
| 7. TY PHYLLIS  | 20             | 12                | 27         | 166           | 114               | 23         | 351           | 257               | 19         | 495           | 403               | 12         |
| 8. TY RITA     | 22             | 12                | 22         | 132           | 66                | 18         | 283           | 168               | 14         | 433           | 280               | 10         |
| 9. TS SUSAN    | 36             | 27                | 19         | 176           | 139               | 10         | 513           | 456               | 2          | --            | --                | --         |
| 10. TY TESS    | 21             | 15                | 30         | 113           | 78                | 26         | 243           | 180               | 22         | 387           | 330               | 18         |
| 11. TS VIOLA   | 31             | 18                | 10         | 203           | 113               | 6          | 518           | 344               | 2          | --            | --                | --         |
| 12. TY WINNIE  | 22             | 16                | 10         | 119           | 67                | 6          | 276           | 115               | 2          | --            | --                | --         |
| 13. TY ALICE   | 22             | 10                | 18         | 101           | 54                | 15         | 209           | 71                | 11         | 341           | 125               | 7          |
| 14. TY BETTY   | 18             | 11                | 26         | 123           | 77                | 22         | 230           | 152               | 17         | 274           | 206               | 14         |
| 15. TY CORA    | 22             | 16                | 18         | 153           | 83                | 14         | 415           | 230               | 10         | 825           | 420               | 6          |
| 16. TS DORIS   | 27             | 19                | 10         | 124           | 91                | 6          | 321           | 257               | 2          | --            | --                | --         |
| 17. TY ELSIE   | 19             | 13                | 25         | 80            | 54                | 21         | 181           | 134               | 17         | 452           | 330               | 12         |
| 18. TD 18      | 39             | 24                | 7          | 148           | 102               | 3          | 374           | 374               | 1          | --            | --                | --         |
| 19. TY FLOSSIE | 23             | 12                | 14         | 142           | 83                | 10         | 258           | 176               | 6          | 333           | 324               | 2          |
| 20. TS GRACE   | 29             | 17                | 28         | 184           | 92                | 20         | 344           | 143               | 14         | 580           | 156               | 8          |
| 21. TS HELEN   | 27             | 25                | 6          | 92            | 81                | 2          | --            | --                | --         | --            | --                | --         |
| 22. TY IDA     | 51             | 41                | 19         | 211           | 150               | 15         | 421           | 299               | 11         | 775           | 596               | 7          |
| 23. TY JUNE    | 17             | 9                 | 29         | 119           | 81                | 25         | 255           | 190               | 21         | 371           | 286               | 17         |
| 24. TD 24      | 38             | 20                | 5          | 128           | 79                | 1          | --            | --                | --         | --            | --                | --         |
| 25. TD 25      | 33             | 19                | 10         | 122           | 63                | 6          | 271           | 122               | 2          | --            | --                | --         |
| ALL FORECASTS  | 25             | 16                | 408        | 138           | 84                | 301        | 288           | 181               | 194        | 450           | 290               | 125        |
| TYPHOONS ONLY  | 19             | 11                | 250        | 129           | 78                | 221        | 279           | 178               | 165        | 442           | 300               | 113        |

selected analysis or smoothed prognostic fields at the designated upper-levels in six-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) FCSTINT-Intensity forecast program which utilizes statistical regression equations to provide 24-, 48-, and 72-hour forecast intensities.

(4) 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.

(5) 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.

(6) XT24-Similar to 12-HR EXTRAPOLATION, except 24 hr old preliminary best

track and latest fix position are used. Rather than linear extrapolation, the actual forecast speed of movement is used.

(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 TYFS. In the 54 cases available for comparison, the average 24 hour vector error for TYFC was 126 nm, while that for TYFS was 136 nm. The difference of -1 nm is shown in the lower right.

TABLE 5-2. JTWC ANNUAL AVERAGE POSITION FORECAST ERROR FOR TROPICAL CYCLONES WHILE WIND OVER 35 KNOTS

|         | WESTERN<br>24-HR | NORTH<br>48-HR | PACIFIC**<br>72-HR | INDIAN<br>24-HR | OCEAN***<br>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              | 282            | 336                | 148             | 190               |

\*FORECAST POSITIONS NORTH OF 35°N WERE NOT VERIFIED.

\*\*FOR TYPHOONS ONLY

\*\*\*1971-1974 DOES NOT INCLUDE ARABIAN SEA

TABLE 5-3. 1975 JTWC ERROR SUMMARY FOR THE NORTH INDIAN OCEAN

|           | WARNINGS       |                   |            | 24 HOUR       |                   |            | 48 HOUR       |                   |            |
|-----------|----------------|-------------------|------------|---------------|-------------------|------------|---------------|-------------------|------------|
|           | POSIT<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS | FCST<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS | FCST<br>ERROR | RT ANGLE<br>ERROR | #<br>WRNGS |
| TC 04-75  | 179            | 149               | 4          | --            | --                | --         | --            | --                | --         |
| TC 24-75  | 58             | 48                | 21         | 119           | 83                | 19         | 206           | 136               | 17         |
| TC 25-75  | 33             | 11                | 6          | 183           | 131               | 4          | 328           | 305               | 2          |
| TC 28-75  | 32             | 26                | 4          | 138           | 96                | 2          | --            | --                | --         |
| TC 29-75  | 50             | 27                | 10         | 142           | 78                | 8          | 271           | 133               | 5          |
| TC 33-75  | 98             | 65                | 6          | 243           | 187               | 4          | 175           | 5                 | 1          |
| ALL FCSTS | 61             | 43                | 51         | 145           | 99                | 37         | 228           | 144               | 25         |

TABLE 5-4. JTWC ANNUAL AVERAGE INTENSITY FORECAST ERROR

|      | WESTERN NORTH PACIFIC* |       |       |       | INDIAN OCEAN**      |       |       |
|------|------------------------|-------|-------|-------|---------------------|-------|-------|
|      | WARNING<br>POSITION    | 24-HR | 48-HR | 72-HR | WARNING<br>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    | 10                  | 19    | 20    |
| AVE  | 5                      | 13    | 19    | 23    | 8                   | 14    | 18    |
| AVE  | 6                      | 14    | 19    | 23    | 8                   | 14    | 18    |

\*FOR TYPHOONS ONLY

\*\*1971-1974 DOES NOT INCLUDE ARABIAN SEA

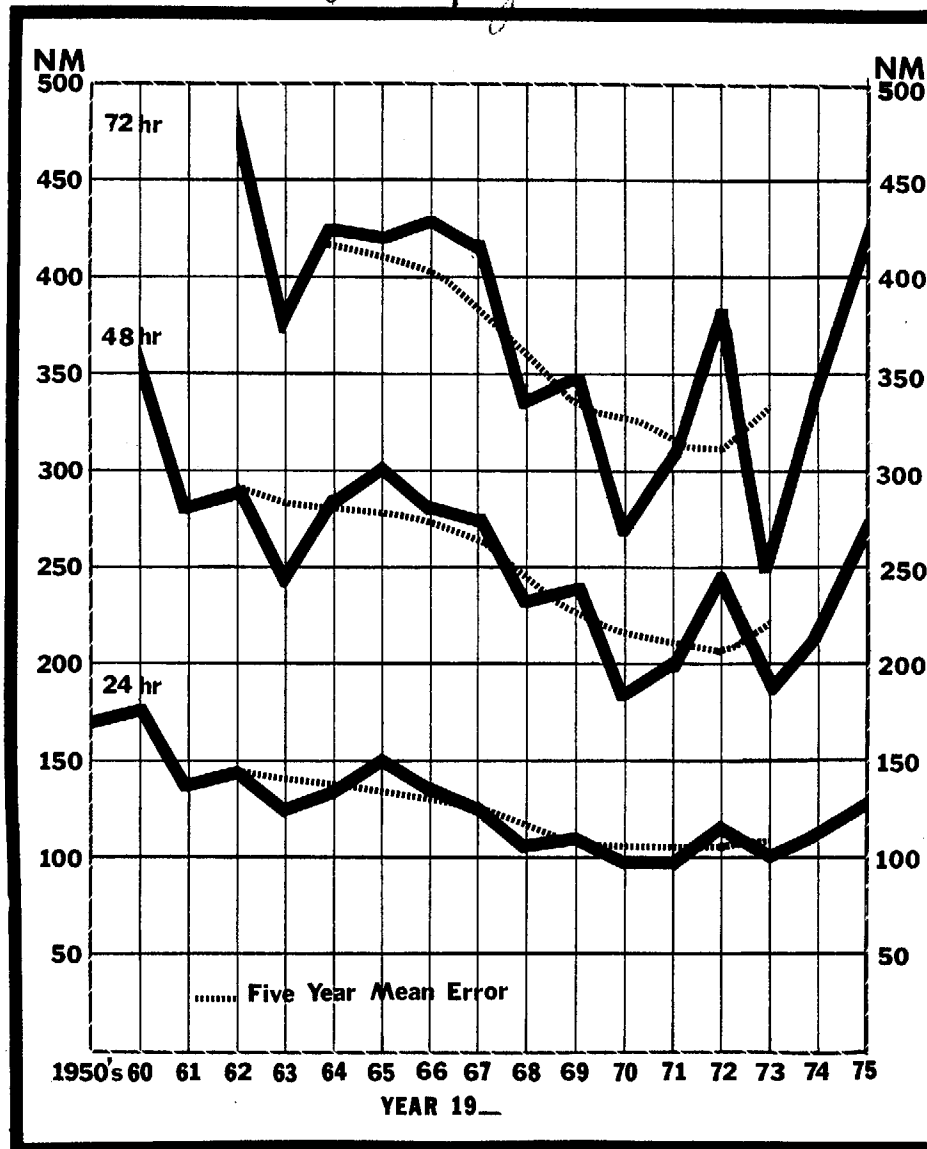


FIGURE 5-1. Mean vector error for Pacific Area.

*new*

*new page*

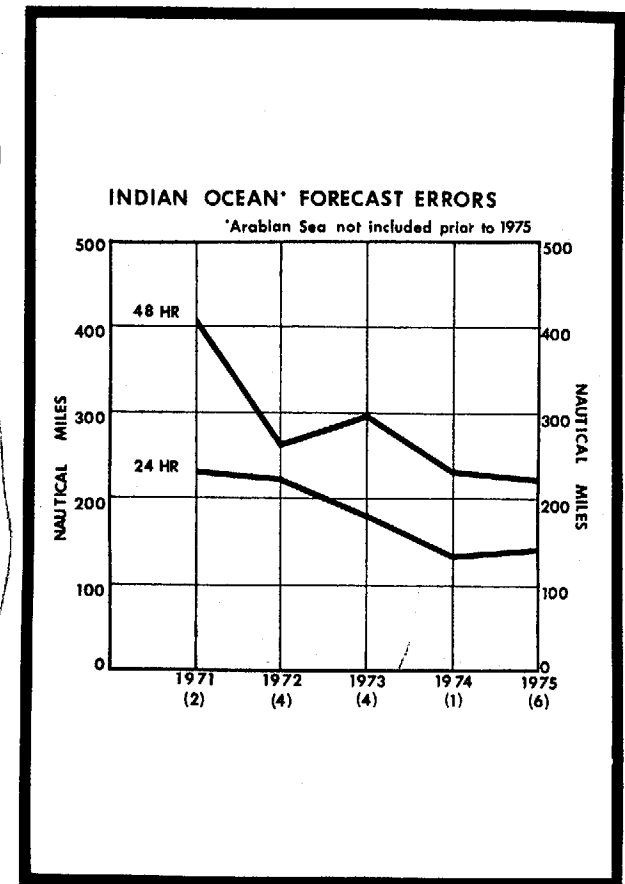


FIGURE 5-2. Mean vector error for Indian Ocean Area.

*new*

TABLE 5-5. 1975 OBJECTIVE TECHNIQUES FOR WESTERN NORTH PACIFIC TYPHOONS

| 24-HOUR |                   |                   |                   |                  |                    |                   |                    |                  |  |
|---------|-------------------|-------------------|-------------------|------------------|--------------------|-------------------|--------------------|------------------|--|
|         | JTWC              | XTRP              | HPAC              | TYFC             | TYFS               | TYFR              | MH70               | MH50             |  |
| JTWC    | 221 129<br>129 0  |                   |                   |                  |                    |                   |                    |                  |  |
| XTRP    | 205 130<br>142 12 | 205 142<br>142 0  |                   |                  |                    |                   |                    |                  |  |
| HPAC    | 183 128<br>135 7  | 182 138<br>135 -3 | 183 135<br>135 0  |                  |                    |                   |                    |                  |  |
| TYFC    | 59 121<br>134 13  | 57 145<br>134 -11 | 53 121<br>132 11  | 59 134<br>134 0  |                    |                   |                    |                  |  |
| TYFS    | 195 127<br>144 18 | 184 135<br>144 10 | 165 130<br>140 11 | 54 137<br>138 11 | 195 144<br>144 0   |                   |                    |                  |  |
| TYFR    | 204 130<br>144 14 | 193 141<br>143 2  | 177 136<br>140 5  | 59 134<br>146 12 | 190 144<br>144 0   | 204 144<br>144 0  |                    |                  |  |
| MH70    | 144 133<br>159 26 | 143 148<br>159 12 | 126 137<br>145 8  | 37 101<br>141 40 | 128 149<br>148 -1  | 137 142<br>154 12 | 144 159<br>159 0   |                  |  |
| MH50    | 138 133<br>144 11 | 136 148<br>143 -5 | 119 137<br>134 -3 | 37 102<br>115 13 | 122 151<br>137 -13 | 131 143<br>143 0  | 137 160<br>143 -17 | 138 144<br>144 0 |  |

|                              |                              |
|------------------------------|------------------------------|
| NUMBER<br>OF<br>CASES        | X-AXIS<br>TECHNIQUE<br>ERROR |
| Y-AXIS<br>TECHNIQUE<br>ERROR | ERROR<br>DIFFERENCE<br>Y-X   |

| 48-HOUR |                    |                    |                   |                   |                    |                  |                  |                 |  |
|---------|--------------------|--------------------|-------------------|-------------------|--------------------|------------------|------------------|-----------------|--|
|         | JTWC               | XTRP               | HPAC              | TYFC              | TYFS               | TYFR             | MH70             | MH50            |  |
| JTWC    | 165 279<br>279 0   |                    |                   |                   |                    |                  |                  |                 |  |
| XTRP    | 153 289<br>321 32  | 153 321<br>321 0   |                   |                   |                    |                  |                  |                 |  |
| HPAC    | 133 280<br>251 -30 | 132 288<br>252 -37 | 133 251<br>251 0  |                   |                    |                  |                  |                 |  |
| TYFC    | 49 300<br>341 41   | 47 369<br>341 -28  | 41 249<br>289 41  | 49 341<br>341 0   |                    |                  |                  |                 |  |
| TYFS    | 153 285<br>359 74  | 144 318<br>351 42  | 125 243<br>338 94 | 48 344<br>442 98  | 154 358<br>358 0   |                  |                  |                 |  |
| TYFR    | 157 289<br>300 11  | 148 319<br>298 -21 | 129 250<br>274 24 | 49 341<br>358 16  | 153 358<br>298 -59 | 158 300<br>300 0 |                  |                 |  |
| MH70    | 98 291<br>357 66   | 97 343<br>360 18   | 81 249<br>299 50  | 26 341<br>521 180 | 91 377<br>354 -23  | 95 299<br>354 55 | 98 357<br>357 0  |                 |  |
| MH50    | 96 292<br>356 64   | 94 344<br>358 14   | 78 249<br>276 27  | 26 347<br>443 96  | 89 381<br>357 -24  | 93 302<br>358 56 | 95 358<br>355 -3 | 96 356<br>356 0 |  |

JTWC-OFFICIAL JTWC SUBJECTIVE FORECAST  
 XTRP-12-HOUR EXTRAPOLATION  
 HPAC-MEAN OF XTRP AND CLIMATOLOGY  
 TYFC-TYFN75 (WEIGHTED CLIMO) COMBINED  
 TYFS-TYFN75 (WEIGHTED CLIMO) STRAIGHT  
 TYFR-TYFN75 (WEIGHTED CLIMO) RECURVE  
 MH70-MOHATT 700-MB PROG  
 MH50-MOHATT 500-MB PROG

| 72-HOUR |                    |                   |                    |                  |                   |                 |
|---------|--------------------|-------------------|--------------------|------------------|-------------------|-----------------|
|         | JTWC               | TYFC              | TYFS               | TYFR             | MH70              | MH50            |
| JTWC    | 113 442<br>442 0   |                   |                    |                  |                   |                 |
| TYFC    | 34 472<br>520 48   | 35 520<br>520 0   |                    |                  |                   |                 |
| TYFS    | 108 444<br>545 101 | 35 520<br>588 69  | 110 538<br>538 0   |                  |                   |                 |
| TYFR    | 108 444<br>440 -4  | 35 520<br>572 52  | 110 538<br>444 -94 | 111 445<br>445 0 |                   |                 |
| MH70    | 57 432<br>504 72   | 15 511<br>664 153 | 57 529<br>508 -21  | 58 454<br>504 50 | 59 498<br>498 0   |                 |
| MH50    | 58 435<br>485 50   | 17 520<br>531 11  | 58 534<br>497 -37  | 59 462<br>495 33 | 58 497<br>484 -13 | 60 488<br>488 0 |

TABLE 5-6. 1975 OBJECTIVE TECHNIQUES FOR ALL WESTERN NORTH PACIFIC FORECASTS

| 24-HOUR |                   |                    |                    |                  |                    |                   |                    |                  |
|---------|-------------------|--------------------|--------------------|------------------|--------------------|-------------------|--------------------|------------------|
|         | JTWC              | XTRP               | HPAC               | TYFC             | TYFS               | TYFR              | MH70               | MH50             |
| JTWC    | 301 138<br>138 0  |                    |                    |                  |                    |                   |                    |                  |
| XTRP    | 275 137<br>148 10 | 275 148<br>148 0   |                    |                  |                    |                   |                    |                  |
| HPAC    | 235 134<br>144 10 | 234 143<br>144 1   | 235 144<br>144 0   |                  |                    |                   |                    |                  |
| TYFC    | 84 128<br>143 15  | 82 150<br>143 -7   | 76 138<br>143 5    | 84 143<br>143 0  |                    |                   |                    |                  |
| TYFS    | 246 135<br>155 20 | 232 144<br>155 -11 | 208 139<br>151 -12 | 76 145<br>153 -8 | 246 155<br>155 0   |                   |                    |                  |
| TYFR    | 258 137<br>147 11 | 244 147<br>146 -1  | 223 144<br>144 -0  | 84 143<br>151 7  | 237 154<br>148 -6  | 258 147<br>147 0  |                    |                  |
| MH70    | 182 144<br>164 21 | 178 156<br>164 7   | 152 146<br>153 7   | 49 122<br>157 36 | 155 163<br>157 -6  | 168 149<br>160 11 | 182 164<br>164 0   |                  |
| MH50    | 174 143<br>151 8  | 170 157<br>150 -7  | 144 146<br>144 -3  | 49 123<br>132 9  | 147 165<br>148 -16 | 160 150<br>150 0  | 173 165<br>151 -14 | 174 151<br>151 0 |

| 48-HOUR |                    |                    |                   |                   |                    |                   |                    |
|---------|--------------------|--------------------|-------------------|-------------------|--------------------|-------------------|--------------------|
|         | JTWC               | XTRP               | HPAC              | TYFC              | TYFS               | TYFR              | MH70               |
| JTWC    | 194 288<br>288 0   |                    |                   |                   |                    |                   |                    |
| XTRP    | 179 294<br>333 39  | 191 322<br>322 0   |                   |                   |                    |                   |                    |
| HPAC    | 153 287<br>266 -21 | 161 292<br>257 -34 | 163 256<br>256 0  |                   |                    |                   |                    |
| TYFC    | 57 311<br>344 33   | 62 363<br>319 -44  | 56 251<br>279 28  | 65 317<br>317 0   |                    |                   |                    |
| TYFS    | 178 292<br>372 80  | 173 321<br>363 42  | 152 260<br>343 93 | 64 319<br>429 110 | 187 361<br>361 0   |                   |                    |
| TYFR    | 183 297<br>303 6   | 178 319<br>291 -28 | 156 255<br>270 15 | 64 321<br>320 -0  | 184 361<br>293 69  | 193 294<br>294 0  |                    |
| MH70    | 119 306<br>358 52  | 117 344<br>360 16  | 97 266<br>313 47  | 32 341<br>521 180 | 109 391<br>351 -40 | 115 304<br>350 47 | 121 355<br>355 0   |
| MH50    | 116 304<br>349 45  | 114 349<br>347 -2  | 93 267<br>281 14  | 32 346<br>413 67  | 105 394<br>350 -45 | 111 306<br>351 45 | 116 360<br>347 -13 |

JTWC-OFFICIAL JTWC SUBJECTIVE FORECAST  
 XTRP-12-HOUR EXTRAPOLATION  
 HPAC-MEAN OF XTRP AND CLIMATOLOGY  
 TYFC-TYPN75 (WEIGHTED CLIMO) COMBINED  
 TYFS-TYPN75 (WEIGHTED CLIMO) STRAIGHT  
 TYFR-TYPN75 (WEIGHTED CLIMO) RECURVE  
 MH70-MOHATT 700-MB PROG  
 MH50-MOHATT 500-MB PROG

| 72-HOUR |                    |                   |                    |                  |                   |                 |
|---------|--------------------|-------------------|--------------------|------------------|-------------------|-----------------|
|         | JTWC               | TYFC              | TYFS               | TYFR             | MH70              | MH50            |
| JTWC    | 125 450<br>450 0   |                   |                    |                  |                   |                 |
| TYFC    | 40 510<br>518 7    | 47 511<br>511 0   |                    |                  |                   |                 |
| TYFS    | 123 465<br>574 109 | 47 511<br>641 130 | 132 564<br>564 0   |                  |                   |                 |
| TYFR    | 123 465<br>435 -29 | 47 511<br>513 1   | 132 564<br>435-128 | 135 435<br>435 0 |                   |                 |
| MH70    | 71 465<br>554 89   | 21 543<br>700 157 | 72 583<br>555 -29  | 74 454<br>552 98 | 77 551<br>551 0   |                 |
| MH50    | 71 467<br>499 32   | 23 547<br>530 -17 | 72 584<br>502 -82  | 74 458<br>503 45 | 75 547<br>499 -48 | 77 502<br>502 0 |

### 3. PACIFIC AREA TROPICAL STORM AND DEPRESSION DATA

#### TROPICAL DEPRESSION 02 1200Z 23 APR TO 0000Z 28 APR

|         | BEST TRACK |        | WARNING |       | ERRORS |      | 24 HOUR FORECAST |      | ERRORS |        | 48 HOUR FORECAST |      | ERRORS |      | 72 HOUR FORECAST |      | ERRORS |      |
|---------|------------|--------|---------|-------|--------|------|------------------|------|--------|--------|------------------|------|--------|------|------------------|------|--------|------|
|         | POSIT      | WIND   | POSIT   | WIND  | DST    | WIND | POSIT            | WIND | DST    | WIND   | POSIT            | WIND | DST    | WIND | POSIT            | WIND | DST    | WIND |
| 231800Z | 11.0N      | 121.8E | 20      | 11.0N | 121.0E | 25   | 47               | 5    | 11.7N  | 118.7E | 40               | 100  | 20     | ---  | ---              | ---  | ---    | ---  |
| 240000Z | 11.0N      | 121.5E | 20      | 10.8N | 120.5E | 25   | 60               | 5    | 11.2N  | 118.7E | 35               | 71   | 15     | ---  | ---              | ---  | ---    | ---  |
| 240600Z | 11.0N      | 121.1E | 20      | 11.0N | 120.9E | 25   | 12               | 5    | 11.6N  | 119.3E | 35               | 32   | 15     | ---  | ---              | ---  | ---    | ---  |
| 241200Z | 11.0N      | 120.7E | 20      | 11.0N | 120.4E | 25   | 18               | 5    | 11.4N  | 118.1E | 35               | 56   | 15     | ---  | ---              | ---  | ---    | ---  |
| 241800Z | 11.1N      | 120.3E | 20      | ---   | ---    | ---  | ---              | ---  | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 250000Z | 11.1N      | 119.9E | 20      | 11.1N | 120.0E | 25   | 6                | 5    | 11.9N  | 118.4E | 35               | 46   | 10     | ---  | ---              | ---  | ---    | ---  |
| 250600Z | 11.1N      | 119.5E | 20      | 11.1N | 119.7E | 20   | 12               | 0    | 11.8N  | 118.2E | 30               | 65   | 5      | ---  | ---              | ---  | ---    | ---  |
| 251200Z | 11.1N      | 119.0E | 20      | 11.3N | 119.2E | 25   | 17               | 5    | 12.7N  | 117.0E | 30               | 50   | 5      | ---  | ---              | ---  | ---    | ---  |
| 251800Z | 11.2N      | 118.4E | 25      | 11.1N | 118.6E | 20   | 13               | -5   | 11.7N  | 116.7E | 20               | 63   | -5     | ---  | ---              | ---  | ---    | ---  |
| 260000Z | 11.4N      | 117.8E | 25      | 11.1N | 118.1E | 20   | 25               | -5   | 11.7N  | 116.2E | 30               | 72   | 5      | ---  | ---              | ---  | ---    | ---  |
| 260600Z | 11.7N      | 117.1E | 25      | 11.7N | 116.7E | 25   | 23               | 0    | 13.1N  | 114.3E | 35               | 66   | 15     | ---  | ---              | ---  | ---    | ---  |
| 261200Z | 12.1N      | 116.4E | 25      | 12.2N | 116.3E | 25   | 8                | 0    | 13.8N  | 114.2E | 35               | 61   | 15     | ---  | ---              | ---  | ---    | ---  |
| 261800Z | 12.5N      | 116.0E | 25      | 12.2N | 115.3E | 25   | 45               | 0    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 270000Z | 12.8N      | 115.7E | 25      | 12.7N | 115.7E | 25   | 6                | 0    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 270600Z | 13.4N      | 115.4E | 20      | 13.0N | 115.1E | 25   | 30               | 5    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 271200Z | 14.1N      | 115.2E | 20      | 13.5N | 114.9E | 25   | 40               | 5    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |

#### TROPICAL STORM HANIE 0000Z 27 JUL TO 0600Z 29 JUL

|         | BEST TRACK |        | WARNING |       | ERRORS |      | 24 HOUR FORECAST |      | ERRORS |        | 48 HOUR FORECAST |      | ERRORS |      | 72 HOUR FORECAST |      | ERRORS |      |
|---------|------------|--------|---------|-------|--------|------|------------------|------|--------|--------|------------------|------|--------|------|------------------|------|--------|------|
|         | POSIT      | WIND   | POSIT   | WIND  | DST    | WIND | POSIT            | WIND | DST    | WIND   | POSIT            | WIND | DST    | WIND | POSIT            | WIND | DST    | WIND |
| 270000Z | 22.6N      | 142.4E | 30      | 22.5N | 142.6E | 30   | 13               | 0    | 23.1N  | 141.0E | 45               | 153  | 15     | ---  | ---              | ---  | ---    | ---  |
| 270600Z | 23.2N      | 141.5E | 30      | 22.7N | 142.2E | 30   | 49               | 0    | 24.0N  | 140.0E | 45               | 135  | 10     | ---  | ---              | ---  | ---    | ---  |
| 271200Z | 23.9N      | 140.8E | 30      | 22.8N | 141.6E | 30   | 79               | 0    | 24.1N  | 140.2E | 45               | 205  | 5      | ---  | ---              | ---  | ---    | ---  |
| 271800Z | 24.4N      | 139.9E | 30      | 24.4N | 140.2E | 30   | 16               | 0    | 26.6N  | 137.8E | 45               | 144  | 10     | ---  | ---              | ---  | ---    | ---  |
| 280000Z | 24.8N      | 138.9E | 30      | 24.9N | 139.4E | 35   | 28               | 5    | 26.8N  | 136.5E | 50               | 166  | 25     | ---  | ---              | ---  | ---    | ---  |
| 280600Z | 25.2N      | 137.9E | 35      | 25.2N | 138.7E | 35   | 43               | 0    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 281200Z | 25.6N      | 136.8E | 40      | 25.7N | 137.0E | 35   | 12               | -5   | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 281800Z | 26.0N      | 135.2E | 35      | 26.0N | 135.2E | 35   | 0                | 0    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 290000Z | 27.1N      | 133.4E | 25      | 26.5N | 133.7E | 30   | 39               | 5    | ---    | ---    | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |

#### TROPICAL DEPRESSION 05 0600Z 06 AUG TO 0000Z 07 AUG

|         | BEST TRACK |        | WARNING |       | ERRORS |      | 24 HOUR FORECAST |      | ERRORS |      | 48 HOUR FORECAST |      | ERRORS |      | 72 HOUR FORECAST |      | ERRORS |      |
|---------|------------|--------|---------|-------|--------|------|------------------|------|--------|------|------------------|------|--------|------|------------------|------|--------|------|
|         | POSIT      | WIND   | POSIT   | WIND  | DST    | WIND | POSIT            | WIND | DST    | WIND | POSIT            | WIND | DST    | WIND | POSIT            | WIND | DST    | WIND |
| 060600Z | 24.4N      | 125.5E | 30      | 23.3N | 126.5E | 30   | 85               | 0    | ---    | ---  | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 061200Z | 25.6N      | 124.3E | 25      | 26.1N | 124.3E | 30   | 30               | 5    | ---    | ---  | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 061800Z | 26.6N      | 122.9E | 20      | 27.0N | 123.4E | 30   | 36               | 10   | ---    | ---  | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |
| 070000Z | 27.4N      | 121.4E | 20      | 27.2N | 121.5E | 20   | 13               | 0    | ---    | ---  | ---              | ---  | ---    | ---  | ---              | ---  | ---    | ---  |

TROPICAL STORM SUSAN  
1200Z 26 AUG TO 0600Z 01 SEP

| BEST TRACK |       |        |    | WARNING |        |    |        | 24 HOUR FORECAST |       |        |    | 48 HOUR FORECAST |      |       |        | 72 HOUR FORECAST |        |    |  |
|------------|-------|--------|----|---------|--------|----|--------|------------------|-------|--------|----|------------------|------|-------|--------|------------------|--------|----|--|
|            | POSIT | WIND   |    | POSIT   | WIND   |    | ERRORS |                  | POSIT | WIND   |    | ERRORS           |      | POSIT | WIND   |                  | ERRORS |    |  |
|            |       |        |    |         |        |    | DST    | WIND             |       |        |    | DST              | WIND |       |        | DST              | WIND   |    |  |
| 261200Z    | 26.1N | 153.4E | 30 | 25.0N   | 153.5E | 30 | 66     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 261800Z    | 27.0N | 153.2E | 30 | 25.7N   | 153.3E | 30 | 78     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 270000Z    | 28.1N | 152.8E | 30 | 27.2N   | 152.9E | 30 | 54     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 270600Z    | 29.4N | 152.3E | 30 | 28.7N   | 151.9E | 30 | 47     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 271200Z    | 30.5N | 151.8E | 30 | 30.9N   | 152.0E | 30 | 26     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 290000Z    | 35.2N | 153.0E | 35 | 35.0N   | 152.7E | 35 | 19     | 0                | 38.3N | 156.8E | 30 | 87               | -20  | --    | --     | --               | --     | -- |  |
| 290600Z    | 35.8N | 154.1E | 40 | 35.8N   | 153.4E | 35 | 34     | -5               | 38.7N | 157.9E | 30 | 103              | -20  | --    | --     | --               | --     | -- |  |
| 291200Z    | 36.3N | 155.3E | 45 | 36.5N   | 155.0E | 35 | 19     | -10              | 39.2N | 159.4E | 30 | 117              | -15  | --    | --     | --               | --     | -- |  |
| 291800Z    | 36.7N | 156.3E | 50 | 37.7N   | 156.3E | 35 | 60     | -15              | 40.4N | 163.2E | 25 | 249              | -15  | --    | --     | --               | --     | -- |  |
| 300000Z    | 36.9N | 157.3E | 50 | 36.9N   | 157.1E | 35 | 10     | -15              | 38.2N | 162.3E | 35 | 146              | -5   | 40.0N | 168.0E | 30               | 471    | 0  |  |
| 300600Z    | 37.0N | 158.2E | 50 | 37.4N   | 158.2E | 55 | 24     | 5                | 38.8N | 163.3E | 45 | 200              | 10   | 40.6N | 169.5E | 35               | 554    | 5  |  |
| 301200Z    | 37.3N | 158.8E | 45 | 37.2N   | 159.0E | 55 | 11     | 10               | 37.7N | 163.6E | 45 | 247              | 10   | --    | --     | --               | --     | -- |  |
| 301800Z    | 37.7N | 159.1E | 40 | 37.2N   | 160.2E | 55 | 60     | 15               | 38.2N | 165.5E | 45 | 352              | 10   | --    | --     | --               | --     | -- |  |
| 310000Z    | 38.3N | 159.2E | 40 | 37.9N   | 159.2E | 45 | 24     | 5                | 39.1N | 161.4E | 35 | 177              | 5    | --    | --     | --               | --     | -- |  |
| 310600Z    | 38.7N | 159.0E | 35 | 38.4N   | 159.0E | 35 | 18     | 0                | 39.8N | 159.0E | 30 | 86               | 0    | --    | --     | --               | --     | -- |  |
| 311200Z    | 39.0N | 158.6E | 35 | 39.2N   | 159.0E | 35 | 22     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 311800Z    | 39.4N | 158.1E | 35 | 39.7N   | 159.0E | 35 | 45     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 010000Z    | 39.9N | 157.7E | 30 | 39.8N   | 157.3E | 35 | 19     | 5                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |
| 010600Z    | 40.4N | 157.3E | 30 | 41.0N   | 158.2E | 30 | 54     | 0                | --    | --     | -- | --               | --   | --    | --     | --               | --     | -- |  |

TROPICAL STORM VIOLA  
0000Z 05 SEP TO 0600Z 07 SEP

| BEST TRACK |       |        |    | WARNING |        |        |      | 24 HOUR FORECAST |       |        |      | 48 HOUR FORECAST |      |        |        | 72 HOUR FORECAST |      |        |      |
|------------|-------|--------|----|---------|--------|--------|------|------------------|-------|--------|------|------------------|------|--------|--------|------------------|------|--------|------|
| TIME       | POSIT | WIND   |    | POSIT   | WIND   | ERRORS |      | POSIT            | WIND  | ERRORS |      | POSIT            | WIND | ERRORS |        | POSIT            | WIND | ERRORS |      |
|            |       |        |    |         |        | DST    | WIND |                  |       | DST    | WIND |                  |      | DST    | WIND   |                  |      | DST    | WIND |
| 050000Z    | 14.9N | 130.9E | 30 | 14.8N   | 131.1E | 30     | 13   | 0                | 16.1N | 129.0E | 40   | 178              | 0    | 17.6N  | 125.6E | 50               | 511  | 20     | --   |
| 050600Z    | 15.3N | 131.1E | 30 | 15.2N   | 130.7E | 30     | 24   | 0                | 16.6N | 128.7E | 40   | 231              | -5   | 18.5N  | 126.0E | 50               | 525  | 20     | --   |
| 051200Z    | 15.7N | 131.3E | 35 | 15.8N   | 131.2E | 35     | 8    | 0                | 17.4N | 129.5E | 45   | 213              | 5    | --     | --     | --               | --   | --     | --   |
| 051800Z    | 15.9N | 131.6E | 35 | 16.3N   | 130.8E | 35     | 52   | 0                | 18.1N | 129.2E | 45   | 262              | 10   | --     | --     | --               | --   | --     | --   |
| 060000Z    | 16.3N | 132.1E | 40 | 16.2N   | 131.8E | 40     | 18   | 0                | 17.7N | 132.9E | 50   | 153              | 20   | --     | --     | --               | --   | --     | --   |
| 060600Z    | 17.2N | 132.7E | 45 | 16.8N   | 132.5E | 45     | 26   | 0                | 17.7N | 133.8E | 50   | 177              | 20   | --     | --     | --               | --   | --     | --   |
| 061200Z    | 18.2N | 133.2E | 40 | 16.7N   | 133.0E | 45     | 32   | 5                | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 061800Z    | 19.1N | 133.7E | 35 | 19.6N   | 133.3E | 40     | 23   | 5                | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 070000Z    | 19.9N | 134.3E | 30 | 19.5N   | 133.9E | 40     | 33   | 10               | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 070600Z    | 20.4N | 135.1E | 30 | 19.3N   | 134.2E | 30     | 83   | 0                | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |

TROPICAL STORM DORIS  
1800Z 03 OCT TO 0000Z 06 OCT

| BEST TRACK |       |        |    | WARNING |        |        |      | 24 HOUR FORECAST |       |        |      | 48 HOUR FORECAST |      |        |        | 72 HOUR FORECAST |      |        |      |
|------------|-------|--------|----|---------|--------|--------|------|------------------|-------|--------|------|------------------|------|--------|--------|------------------|------|--------|------|
| TIME       | POSIT | WIND   |    | POSIT   | WIND   | ERRORS |      | POSIT            | WIND  | ERRORS |      | POSIT            | WIND | ERRORS |        | POSIT            | WIND | ERRORS |      |
|            |       |        |    |         |        | DST    | WIND |                  |       | DST    | WIND |                  |      | DST    | WIND   |                  |      | DST    | WIND |
| 031800Z    | 15.4N | 111.2E | 30 | 15.0N   | 111.8E | 30     | 42   | 0                | 16.5N | 109.8E | 50   | 186              | 5    | 18.5N  | 108.3E | 55               | 311  | 5      | --   |
| 040000Z    | 16.3N | 111.6E | 35 | 15.3N   | 111.3E | 35     | 62   | 0                | 17.6N | 109.0E | 55   | 215              | 5    | 20.8N  | 107.2E | 55               | 330  | 25     | --   |
| 040600Z    | 17.1N | 111.9E | 40 | 17.1N   | 111.8E | 40     | 6    | 0                | 19.1N | 110.3E | 55   | 128              | 0    | --     | --     | --               | --   | --     | --   |
| 041200Z    | 17.8N | 112.1E | 40 | 17.8N   | 111.8E | 45     | 17   | 5                | 20.2N | 112.2E | 60   | 29               | 5    | --     | --     | --               | --   | --     | --   |
| 041800Z    | 18.5N | 112.3E | 45 | 18.5N   | 112.2E | 45     | 6    | 0                | 20.7N | 113.2E | 60   | 74               | 10   | --     | --     | --               | --   | --     | --   |
| 050000Z    | 19.2N | 112.4E | 50 | 19.6N   | 112.9E | 45     | 37   | -5               | 22.6N | 114.7E | 60   | 112              | 30   | --     | --     | --               | --   | --     | --   |
| 050600Z    | 19.9N | 112.4E | 55 | 19.7N   | 113.0E | 50     | 36   | -5               | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 051200Z    | 20.6N | 112.5E | 55 | 20.7N   | 113.0E | 50     | 29   | -5               | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 051800Z    | 21.3N | 112.6E | 50 | 21.5N   | 112.5E | 50     | 19   | 0                | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |
| 060000Z    | 22.9N | 112.7E | 30 | 23.0N   | 113.0E | 40     | 18   | 10               | --    | --     | --   | --               | --   | --     | --     | --               | --   | --     | --   |

TROPICAL DEPRESSION 18  
0600Z 15 OCT TO 0600Z 17 OCT

| BEST TRACK |       |        |    | WARNING |        |      |     | 24 HOUR FORECAST |       |        |     | 48 HOUR FORECAST |     |        |        | 72 HOUR FORECAST |     |      |     |       |     |      |     |        |  |
|------------|-------|--------|----|---------|--------|------|-----|------------------|-------|--------|-----|------------------|-----|--------|--------|------------------|-----|------|-----|-------|-----|------|-----|--------|--|
| POSIT      |       | WIND   |    | POSIT   |        | WIND |     | ERRORS           |       | POSIT  |     | WIND             |     | ERRORS |        | POSIT            |     | WIND |     | POSIT |     | WIND |     | ERRORS |  |
|            |       |        |    |         |        |      |     |                  |       |        |     |                  |     |        |        |                  |     |      |     |       |     |      |     |        |  |
| 150600Z    | 13.2N | 136.7E | 30 | 13.0N   | 136.0E | 30   | 42  | 0                | 13.2N | 130.0E | 45  | 145              | 25  | 13.7N  | 124.2E | 60               | 374 | 35   | --- | ---   | --- | ---  | --- | ---    |  |
| 151200Z    | 13.3N | 135.6E | 25 | 13.0N   | 135.1E | 30   | 34  | 5                | 13.1N | 130.1E | 40  | 120              | 20  | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 151800Z    | 13.7N | 134.5E | 25 | 13.0N   | 133.6E | 30   | 67  | 5                | 13.1N | 128.8E | 40  | 179              | 20  | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 160000Z    | 13.8N | 133.2E | 20 | 13.4N   | 132.8E | 25   | 33  | 5                | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 160600Z    | 13.9N | 132.4E | 20 | 13.5N   | 131.3E | 20   | 68  | 0                | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 161200Z    | 14.1N | 131.9E | 20 | ---     | ---    | ---  | --- | ---              | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 161800Z    | 14.1N | 131.7E | 20 | ---     | ---    | ---  | --- | ---              | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 170000Z    | 14.1N | 131.4E | 25 | 14.3N   | 131.6E | 30   | 17  | 5                | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |
| 170600Z    | 14.5N | 130.6E | 25 | 14.5N   | 130.8E | 25   | 12  | 0                | ---   | ---    | --- | ---              | --- | ---    | ---    | ---              | --- | ---  | --- | ---   | --- | ---  | --- | ---    |  |

TROPICAL STORM HELEN  
0600Z 03 NOV TO 1200Z 04 NOV

| BEST TRACK |              |       |              | WARNING |       |      |              | 24 HOUR FORECAST |      |        |       | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|------------|--------------|-------|--------------|---------|-------|------|--------------|------------------|------|--------|-------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT      | WIND         | POSIT | WIND         | ERRORS  | POSIT | WIND | ERRORS       | POSIT            | WIND | ERRORS | POSIT | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 030600Z    | 13.7N 114.4E | 35    | 14.0N 115.0E | 35      | 39    | 0    | 14.2N 110.8E | 50               | 101  | 20     | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 031200Z    | 13.9N 113.1E | 40    | 14.0N 113.2E | 35      | 8     | -5   | 14.3N 108.3E | 35               | 84   | 10     | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 031800Z    | 13.3N 112.1E | 45    | 14.0N 111.9E | 35      | 43    | -10  | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 040000Z    | 12.9N 111.0E | 40    | 13.2N 111.2E | 35      | 21    | -5   | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 040600Z    | 12.9N 109.7E | 30    | 12.6N 109.9E | 30      | 21    | 0    | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 041200Z    | 12.9N 108.3E | 25    | 13.0N 107.8E | 25      | 30    | 0    | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |

TROPICAL DEPRESSION 24  
0000Z 27 DEC TO 0000Z 28 DEC

| BEST TRACK |              |       |              | WARNING |       |      |              | 24 HOUR FORECAST |      |        |       | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|------------|--------------|-------|--------------|---------|-------|------|--------------|------------------|------|--------|-------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT      | WIND         | POSIT | WIND         | ERRORS  | POSIT | WIND | ERRORS       | POSIT            | WIND | ERRORS | POSIT | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 270000Z    | 13.6N 124.5E | 30    | 13.2N 124.6E | 30      | 25    | 0    | 15.6N 123.2E | 35               | 128  | 10     | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 270600Z    | 14.1N 123.5E | 30    | 12.8N 124.2E | 30      | 88    | 0    | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 271200Z    | 14.4N 122.3E | 30    | 14.2N 122.7E | 30      | 26    | 0    | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 271800Z    | 14.1N 121.6E | 30    | 14.4N 122.2E | 25      | 39    | -5   | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 280000Z    | 14.5N 121.3E | 25    | 14.5N 121.1E | 25      | 12    | 0    | ---          | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |

TROPICAL DEPRESSION 25  
0000Z 27 DEC TO 0600Z 29 DEC

| BEST TRACK |              |       |              | WARNING |       |      |              | 24 HOUR FORECAST |      |        |              | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|------------|--------------|-------|--------------|---------|-------|------|--------------|------------------|------|--------|--------------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT      | WIND         | POSIT | WIND         | ERRORS  | POSIT | WIND | ERRORS       | POSIT            | WIND | ERRORS | POSIT        | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 270000Z    | 11.2N 114.5E | 30    | 11.2N 114.3E | 30      | 12    | 0    | 11.2N 114.3E | 40               | 117  | 10     | 12.1N 115.2E | 45               | 232    | 20    | ---  | ---              | ---   | ---  | ---    |
| 270600Z    | 10.9N 114.9E | 30    | 11.3N 114.6E | 30      | 30    | 0    | 12.4N 115.4E | 40               | 180  | 10     | 13.4N 115.9E | 45               | 310    | 20    | ---  | ---              | ---   | ---  | ---    |
| 271200Z    | 10.6N 115.3E | 30    | 11.1N 114.9E | 30      | 38    | 0    | 11.9N 115.6E | 40               | 174  | 10     | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 271800Z    | 10.3N 115.5E | 30    | 9.5N 115.0E  | 30      | 56    | 0    | 7.9N 115.4E  | 20               | 72   | -10    | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 280000Z    | 9.8N 115.7E  | 30    | 9.4N 115.8E  | 30      | 25    | 0    | 7.5N 116.3E  | 20               | 64   | -5     | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 280600Z    | 9.4N 115.7E  | 30    | 9.2N 115.4E  | 30      | 21    | 0    | 8.3N 115.2E  | 20               | 124  | -5     | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 281200Z    | 9.0N 115.4E  | 30    | 9.3N 115.9E  | 30      | 18    | 0    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 281800Z    | 8.7N 116.3E  | 30    | 8.6N 115.4E  | 30      | 53    | 0    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 290000Z    | 8.5N 116.7E  | 25    | 9.0N 116.2E  | 30      | 42    | 5    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 290600Z    | 8.4N 117.3E  | 25    | 8.6N 117.8E  | 25      | 32    | 0    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |

#### 4. PACIFIC AREA TYPHOON DATA

##### TYPHOON LOLA

0600Z 22 JAN TO 0600Z 28 JAN

|         | BEST TRACK   |      |              |      | WARNING |      |              |      | 24 HOUR FORECAST |      |              |      | 48 HOUR FORECAST |      |              |      | 72 HOUR FORECAST |      |       |      |
|---------|--------------|------|--------------|------|---------|------|--------------|------|------------------|------|--------------|------|------------------|------|--------------|------|------------------|------|-------|------|
|         | POSIT        | WIND | POSIT        | WIND | POSIT   | WIND | POSIT        | WIND | POSIT            | WIND | POSIT        | WIND | POSIT            | WIND | POSIT        | WIND | POSIT            | WIND | POSIT | WIND |
| 220600Z | 7.4N 135.2E  | 40   | 7.5N 134.8E  | 40   | 24      | 0    | 8.6N 131.3E  | 50   | 89               | -5   | 9.7N 127.8E  | 60   | 95               | -5   | 10.6N 124.3E | 35   | 346              | -5   |       |      |
| 221200Z | 7.7N 134.9E  | 40   | 7.3N 134.8E  | 40   | 25      | 0    | 8.3N 132.4E  | 40   | 56               | -20  | 9.4N 128.7E  | 50   | 233              | 0    | 10.0N 125.5E | 40   | 517              | -5   |       |      |
| 221800Z | 7.9N 134.4E  | 45   | 7.7N 134.4E  | 40   | 12      | -5   | 9.1N 132.2E  | 40   | 143              | -25  | 10.7N 128.7E | 55   | 352              | 15   | 11.3N 124.9E | 40   | 558              | -10  |       |      |
| 230000Z | 8.1N 134.0E  | 50   | 8.0N 133.9E  | 50   | 8       | 0    | 9.5N 131.1E  | 60   | 191              | -10  | 10.9N 128.2E | 70   | 469              | 30   | 12.3N 125.4E | 60   | 658              | 10   |       |      |
| 230600Z | 8.4N 132.8E  | 55   | 8.4N 133.4E  | 55   | 35      | 0    | 10.2N 130.5E | 65   | 256              | 0    | 11.4N 127.6E | 75   | 533              | 35   | 12.7N 124.7E | 50   | 700              | 0    |       |      |
| 231200Z | 8.6N 131.9E  | 60   | 9.0N 132.0E  | 60   | 38      | 0    | 10.7N 128.3E | 70   | 289              | 20   | 11.9N 125.2E | 60   | 479              | 15   | 13.0N 122.2E | 35   | 568              | -15  |       |      |
| 231800Z | 8.8N 129.8E  | 65   | 9.1N 130.1E  | 65   | 25      | 0    | 9.9N 125.3E  | 50   | 160              | 10   | 9.9N 121.6E  | 40   | 402              | -10  | 9.4N 118.0E  | 40   | 509              | -5   |       |      |
| 240000Z | 9.0N 127.9E  | 70   | 8.9N 128.1E  | 70   | 13      | 0    | 8.9N 122.2E  | 35   | 185              | -5   | 9.4N 117.0E  | 45   | 310              | -5   | 10.7N 112.7E | 45   | 347              | 5    |       |      |
| 240600Z | 9.1N 126.3E  | 65   | 9.0N 126.8E  | 70   | 30      | 5    | 9.0N 121.3E  | 35   | 230              | -5   | 9.4N 116.2E  | 45   | 369              | -5   | 10.9N 111.9E | 45   | 361              | 15   |       |      |
| 241200Z | 10.1N 124.8E | 50   | 9.9N 124.8E  | 45   | 12      | -5   | 12.6N 119.7E | 35   | 158              | -10  | 15.3N 116.2E | 35   | 202              | -15  | 18.7N 114.0E | 25   | 159              | -5   |       |      |
| 241800Z | 10.7N 122.7E | 40   | 10.4N 123.2E | 40   | 34      | 0    | 13.5N 118.1E | 35   | 154              | -15  | 16.6N 114.6E | 30   | 118              | -15  | 20.4N 113.7E | 25   | 278              | -5   |       |      |
| 250000Z | 11.3N 120.2E | 40   | 11.2N 120.2E | 40   | 6       | 0    | 13.6N 113.6E | 45   | 37               | -5   | 17.4N 112.0E | 35   | 58               | -5   | ---          | ---  | ---              | ---  |       |      |
| 250600Z | 11.7N 118.9E | 40   | 11.7N 118.8E | 40   | 18      | 0    | 14.2N 113.7E | 45   | 57               | -5   | 17.4N 111.2E | 35   | 85               | 5    | ---          | ---  | ---              | ---  |       |      |
| 251200Z | 12.3N 117.0E | 45   | 12.3N 117.1E | 45   | 6       | 0    | 14.9N 111.9E | 40   | 55               | -10  | 17.9N 109.2E | 30   | 227              | 0    | ---          | ---  | ---              | ---  |       |      |
| 251800Z | 13.0N 115.9E | 50   | 13.0N 115.1E | 45   | 23      | -5   | 15.5N 109.5E | 35   | 182              | -10  | 19.2N 106.5E | 25   | 417              | -5   | ---          | ---  | ---              | ---  |       |      |
| 260000Z | 13.8N 114.2E | 50   | 13.9N 114.0E | 50   | 13      | 0    | 18.1N 109.9E | 35   | 172              | -5   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 260600Z | 14.6N 112.4E | 50   | 14.7N 112.5E | 45   | 18      | -5   | 18.6N 107.5E | 25   | 387              | -5   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 261200Z | 15.4N 112.7E | 50   | 15.3N 112.9E | 40   | 13      | -10  | 19.5N 113.5E | 30   | 195              | 4    | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 261800Z | 16.1N 112.0E | 45   | 16.4N 112.9E | 40   | 25      | -5   | 21.0N 114.6E | 35   | 325              | 5    | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 270000Z | 16.5N 112.4E | 40   | 16.7N 112.3E | 35   | 13      | -5   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 270600Z | 16.9N 112.6E | 30   | 16.9N 112.2E | 50   | 23      | 20   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 271200Z | 16.3N 112.8E | 30   | 16.8N 112.6E | 50   | 32      | 20   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 271800Z | 15.8N 112.9E | 30   | 16.0N 112.7E | 40   | 17      | 10   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |

|                                 | TYPHOONS WHILE WIND OVER 35KTS |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|--------------------------------|-------|-------|-------|---------------|-------|-------|-------|
|                                 | WARNING                        | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 20NM                           | 146NM | 302NM | 525NM | 20NM          | 160NM | 290NM | 455NM |
| AVERAGE RIGHT ANGLE ERROR       | 12NM                           | 70NM  | 103NM | 107NM | 12NM          | 70NM  | 125NM | 129NM |
| AVERAGE MAGNITUDE OF WIND ERROR | 2KTS                           | 10KTS | 13KTS | 7KTS  | 4KTS          | 9KTS  | 11KTS | 7KTS  |
| AVERAGE BIAS OF WIND ERROR      | -2KTS                          | -6KTS | 3KTS  | -3KTS | 1KTS          | -5KTS | 2KTS  | -2KTS |
| NUMBER OF FORECASTS             | 20                             | 16    | 12    | 8     | 23            | 14    | 15    | 11    |

##### TYPHOON NINA

1200Z 31 JUL TO 0000Z 04 AUG

|         | BEST TRACK   |      |              |      | WARNING |      |              |      | 24 HOUR FORECAST |      |              |      | 48 HOUR FORECAST |      |              |      | 72 HOUR FORECAST |      |       |      |
|---------|--------------|------|--------------|------|---------|------|--------------|------|------------------|------|--------------|------|------------------|------|--------------|------|------------------|------|-------|------|
|         | POSIT        | WIND | POSIT        | WIND | POSIT   | WIND | POSIT        | WIND | POSIT            | WIND | POSIT        | WIND | POSIT            | WIND | POSIT        | WIND | POSIT            | WIND | POSIT | WIND |
| 311200Z | 17.7N 133.2E | 30   | 17.6N 133.0E | 30   | 13      | 0    | 17.4N 131.6E | 45   | 179              | -15  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---   | ---  |
| 311800Z | 17.9N 132.8E | 35   | 17.9N 132.8E | 30   | 0       | -5   | 18.3N 130.9E | 50   | 183              | -25  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---   | ---  |
| 010000Z | 18.4N 132.4E | 40   | 18.0N 132.2E | 50   | 26      | 10   | 18.7N 129.6E | 70   | 289              | -20  | 20.3N 126.3E | 85   | 304              | -20  | 22.6N 123.0E | 95   | 424              | 60   |       |      |
| 010600Z | 19.3N 131.7E | 50   | 19.1N 131.8E | 50   | 13      | 0    | 21.0N 129.7E | 75   | 194              | -50  | 22.9N 127.3E | 85   | 367              | 20   | ---          | ---  | ---              | ---  |       |      |
| 011200Z | 20.3N 130.0E | 60   | 20.1N 130.7E | 60   | 13      | 0    | 23.2N 127.4E | 90   | 127              | -45  | 26.1N 124.3E | 105  | 269              | 45   | ---          | ---  | ---              | ---  |       |      |
| 011800Z | 21.1N 129.6E | 75   | 21.1N 129.6E | 70   | 0       | -5   | 25.0N 125.5E | 165  | 145              | -10  | 28.3N 121.6E | 90   | 272              | 40   | ---          | ---  | ---              | ---  |       |      |
| 020000Z | 21.9N 128.1E | 90   | 22.4N 128.3E | 80   | 32      | -10  | 26.6N 123.6E | 105  | 181              | 0    | 29.5N 119.4E | 30   | 284              | -5   | ---          | ---  | ---              | ---  |       |      |
| 020600Z | 22.5N 126.6E | 125  | 22.8N 126.5E | 100  | 19      | -25  | 25.7N 121.0E | 100  | 78               | 35   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 021200Z | 23.0N 125.1E | 135  | 23.3N 125.3E | 130  | 21      | -5   | 24.5N 120.3E | 90   | 38               | 30   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 021800Z | 23.3N 123.6E | 115  | 23.3N 123.6E | 135  | 0       | 20   | 23.8N 117.5E | 45   | 79               | -5   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 030000Z | 23.8N 122.3E | 105  | 23.6N 122.5E | 120  | 16      | 15   | 24.6N 117.4E | 45   | 73               | 10   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 030600Z | 24.4N 120.4E | 65   | 24.5N 121.0E | 70   | 12      | 5    | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 031200Z | 24.6N 119.6E | 60   | 24.4N 119.6E | 70   | 12      | 10   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 031800Z | 25.0N 118.1E | 50   | 25.0N 118.6E | 55   | 27      | 5    | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |
| 040000Z | 25.5N 116.5E | 35   | 25.3N 117.0E | 30   | 30      | -5   | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  | ---          | ---  | ---              | ---  |       |      |

|                                 | TYPHOONS WHILE WIND OVER 35KTS |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|--------------------------------|-------|-------|-------|---------------|-------|-------|-------|
|                                 | WARNING                        | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 16NM                           | 135NM | 294NM | 424NM | 16NM          | 135NM | 290NM | 424NM |
| AVERAGE RIGHT ANGLE ERROR       | 11NM                           | 75NM  | 170NM | 41NM  | 11NM          | 75NM  | 170NM | 41NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 9KTS                           | 22KTS | 26KTS | 60KTS | 8KTS          | 22KTS | 26KTS | 60KTS |
| AVERAGE BIAS OF WIND ERROR      | 1KTS                           | -9KTS | 16KTS | 60KTS | 1KTS          | -9KTS | 16KTS | 60KTS |
| NUMBER OF FORECASTS             | 14                             | 11    | 5     | 1     | 15            | 11    | 5     | 1     |

TYPHOON ORA

0600Z 10 AUG TO 1200Z 12 AUG

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |      | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND | POSIT            | WIND | POSIT | WIND |
| 100600Z    | 21.9N 124.4E | 40    | 21.8N 124.9E | 40      | 6    | 0     | 24.4N 122.3E | 50               | 169  | -15   | 27.4N 121.1E | 55               | 32   | -5    | ---  | ---              | ---  | ---   | ---  |
| 101200Z    | 22.3N 124.4E | 50    | 22.4N 124.8E | 50      | 8    | 0     | 24.1N 122.9E | 65               | 161  | 0     | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 101800Z    | 22.9N 124.4E | 55    | 23.2N 125.0E | 60      | 19   | 5     | 26.2N 125.0E | 75               | 76   | 10    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 110000Z    | 23.7N 125.2E | 60    | 23.9N 125.3E | 65      | 13   | 5     | 26.4N 125.7E | 85               | 163  | 20    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 110600Z    | 24.7N 125.4E | 65    | 24.5N 124.5E | 70      | 13   | 5     | 27.3N 126.3E | 85               | 267  | 25    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 111200Z    | 26.0N 125.0E | 65    | 25.9N 125.3E | 70      | 17   | 5     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 111800Z    | 27.1N 124.0E | 65    | 27.1N 124.2E | 70      | 11   | 5     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 120000Z    | 27.7N 122.8E | 65    | 27.2N 123.8E | 60      | 61   | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 120600Z    | 27.9N 121.3E | 60    | 28.3N 122.1E | 50      | 48   | -10   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |

| TYPHOONS WHILE WIND OVER 35KTS |       |       |       | ALL FORECASTS |       |       |       |
|--------------------------------|-------|-------|-------|---------------|-------|-------|-------|
| WARNING                        | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| 22NM                           | 167NM | 32NM  | 0NM   | 22NM          | 107NM | 32NM  | 0NM   |
| 8NM                            | 92NM  | 31NM  | 0NM   | 8NM           | 92NM  | 31NM  | 0NM   |
| 4KTS                           | 14KTS | 5KTS  | 0KTS  | 4KTS          | 14KTS | 5KTS  | 0KTS  |
| 1KTS                           | 8KTS  | -5KTS | 0KTS  | 1KTS          | 8KTS  | -5KTS | 0KTS  |
| 9                              | 5     | 1     | 0     | 9             | 5     | 1     | 0     |

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

TYPHOON PHYLLIS

0000Z 12 AUG TO 1200Z 18 AUG

| BEST TRACK |              |      |  | WARNING      |     |      |  | 24 HOUR FORECAST |     |              |     | 48 HOUR FORECAST |     |      |  | 72 HOUR FORECAST |     |      |     |     |  |              |     |  |     |     |
|------------|--------------|------|--|--------------|-----|------|--|------------------|-----|--------------|-----|------------------|-----|------|--|------------------|-----|------|-----|-----|--|--------------|-----|--|-----|-----|
| POSIT      |              | WIND |  | POSIT        |     | WIND |  | POSIT            |     | WIND         |     | POSIT            |     | WIND |  | POSIT            |     | WIND |     |     |  |              |     |  |     |     |
| DST        |              | WIND |  | DST          |     | WIND |  | DST              |     | WIND         |     | DST              |     | WIND |  | DST              |     | WIND |     |     |  |              |     |  |     |     |
| 120000Z    | 12.6N 138.0E | 30   |  | 12.7N 137.9E | 30  |      |  | 8                | 0   | 14.3N 134.2E | 40  |                  | 134 | -5   |  | 18.2N 130.5E     | 50  |      | 397 | -40 |  | 18.0N 127.3E | 65  |  | 719 | -50 |
| 120600Z    | 13.0N 137.0E | 35   |  | 13.1N 137.1E | 35  |      |  | 30               | 0   | 14.9N 133.5E | 50  |                  | 168 | -5   |  | 17.0N 130.0E     | 65  |      | 445 | -35 |  | 18.9N 126.0E | 75  |  | 743 | -35 |
| 121200Z    | 13.4N 137.2E | 35   |  | 13.7N 137.0E | 35  |      |  | 21               | 0   | 16.1N 134.4E | 50  |                  | 124 | -20  |  | 18.9N 131.1E     | 65  |      | 397 | -45 |  | 20.9N 127.6E | 75  |  | 631 | -30 |
| 121800Z    | 13.8N 136.0E | 40   |  | 14.1N 136.6E | 40  |      |  | 21               | 0   | 16.5N 134.0E | 55  |                  | 162 | -25  |  | 19.1N 130.8E     | 70  |      | 460 | -50 |  | 21.5N 127.4E | 80  |  | 611 | -20 |
| 130000Z    | 14.1N 136.5E | 45   |  | 14.6N 136.0E | 45  |      |  | 42               | 0   | 16.7N 133.0E | 65  |                  | 254 | -25  |  | 18.8N 129.4E     | 75  |      | 600 | -40 |  | 20.3N 125.6E | 80  |  | 739 | -20 |
| 130600Z    | 14.8N 136.4E | 55   |  | 14.5N 136.1E | 50  |      |  | 25               | -5  | 16.4N 133.5E | 75  |                  | 310 | -25  |  | 18.5N 130.0E     | 80  |      | 646 | -30 |  | 20.1N 126.2E | 90  |  | 739 | -5  |
| 131200Z    | 15.6N 136.5E | 70   |  | 15.7N 136.5E | 60  |      |  | 6                | -10 | 18.6N 134.8E | 80  |                  | 248 | -30  |  | 21.7N 132.4E     | 85  |      | 440 | -20 |  | 24.4N 129.4E | 90  |  | 450 | 0   |
| 131800Z    | 16.9N 136.0E | 80   |  | 16.6N 136.5E | 70  |      |  | 25               | -10 | 20.4N 135.2E | 85  |                  | 245 | -35  |  | 23.1N 132.1E     | 90  |      | 387 | -10 |  | 25.9N 128.5E | 95  |  | 467 | 10  |
| 140000Z    | 18.6N 137.0E | 90   |  | 18.5N 137.0E | 85  |      |  | 6                | -5  | 23.7N 135.8E | 105 |                  | 149 | -10  |  | 27.9N 132.7E     | 105 |      | 143 | 5   |  | 31.3N 129.9E | 95  |  | 160 | 15  |
| 140600Z    | 20.4N 137.0E | 100  |  | 20.2N 137.0E | 100 |      |  | 12               | 0   | 26.0N 135.4E | 120 |                  | 109 | 10   |  | 31.8N 132.0E     | 100 |      | 144 | 5   |  | 35.5N 130.8E | 50  |  | 110 | -10 |
| 141200Z    | 22.4N 137.0E | 110  |  | 22.2N 137.0E | 110 |      |  | 0                | 0   | 29.2N 135.9E | 115 |                  | 48  | 10   |  | 34.0N 133.4E     | 60  |      | 233 | -30 |  | 38.6N 133.8E | 40  |  | 266 | -10 |
| 141800Z    | 24.1N 137.1E | 120  |  | 24.2N 137.0E | 115 |      |  | 8                | -5  | 30.6N 136.1E | 110 |                  | 109 | 10   |  | 34.0N 134.3E     | 60  |      | 195 | -25 |  | 38.4N 135.7E | 40  |  | 307 | 0   |
| 150000Z    | 25.9N 137.1E | 115  |  | 26.0N 137.0E | 115 |      |  | 8                | 0   | 34.3N 135.8E | 70  |                  | 283 | -30  |  | 40.5N 136.7E     | 50  |      | 506 | -30 |  | ---          | --- |  | --- | --- |
| 150600Z    | 27.4N 136.7E | 110  |  | 27.5N 137.0E | 110 |      |  | 17               | 0   | 34.7N 134.2E | 70  |                  | 269 | -25  |  | 40.4N 138.3E     | 40  |      | 493 | -20 |  | ---          | --- |  | --- | --- |
| 151200Z    | 28.4N 135.0E | 105  |  | 28.6N 135.7E | 100 |      |  | 13               | -5  | 33.4N 132.0E | 70  |                  | 172 | -20  |  | 38.7N 135.4E     | 45  |      | 317 | -5  |  | ---          | --- |  | --- | --- |
| 151800Z    | 29.0N 135.1E | 100  |  | 29.2N 134.7E | 100 |      |  | 24               | 0   | 33.2N 130.3E | 60  |                  | 167 | -25  |  | 38.2N 134.2E     | 40  |      | 243 | 0   |  | ---          | --- |  | --- | --- |
| 160000Z    | 29.7N 134.5E | 100  |  | 29.8N 134.2E | 100 |      |  | 17               | 0   | 33.2N 130.9E | 55  |                  | 90  | -25  |  | 38.0N 134.0E     | 45  |      | 202 | 10  |  | ---          | --- |  | --- | --- |
| 160600Z    | 30.2N 134.1E | 95   |  | 30.1N 133.9E | 100 |      |  | 12               | 5   | 32.7N 131.2E | 55  |                  | 80  | -6   |  | 37.3N 132.9E     | 45  |      | 123 | 15  |  | ---          | --- |  | --- | --- |
| 161200Z    | 30.9N 133.7E | 90   |  | 30.9N 133.8E | 90  |      |  | 5                | 0   | 34.4N 133.5E | 55  |                  | 130 | 5    |  | 39.7N 136.3E     | 40  |      | 297 | 15  |  | ---          | --- |  | --- | --- |
| 161800Z    | 31.7N 133.1E | 85   |  | 31.8N 133.2E | 85  |      |  | 8                | 0   | 35.5N 132.7E | 55  |                  | 112 | 15   |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 170000Z    | 32.7N 132.6E | 80   |  | 32.7N 132.8E | 85  |      |  | 10               | 5   | 36.5N 133.0E | 45  |                  | 126 | 10   |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 170600Z    | 33.9N 131.9E | 60   |  | 34.3N 131.9E | 65  |      |  | 24               | 5   | 39.8N 133.4E | 30  |                  | 228 | 0    |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 171200Z    | 34.8N 130.9E | 50   |  | 34.8N 130.9E | 55  |      |  | 0                | 5   | 38.3N 128.6E | 30  |                  | 106 | 5    |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 171800Z    | 35.5N 130.4E | 40   |  | 35.4N 130.0E | 50  |      |  | 20               | 10  | ---          | --- |                  | --- | ---  |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 180000Z    | 36.2N 130.4E | 35   |  | 36.6N 130.4E | 40  |      |  | 24               | 5   | ---          | --- |                  | --- | ---  |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 180600Z    | 36.8N 130.4E | 30   |  | 37.8N 130.1E | 35  |      |  | 61               | 5   | ---          | --- |                  | --- | ---  |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |
| 181200Z    | 37.5N 130.0E | 25   |  | 38.8N 130.0E | 25  |      |  | 83               | 0   | ---          | --- |                  | --- | ---  |  | ---              | --- |      | --- | --- |  | ---          | --- |  | --- | --- |

| TYPHOONS WHILE WIND OVER 35KTS |        |        |        | ALL FORECASTS |        |        |        |
|--------------------------------|--------|--------|--------|---------------|--------|--------|--------|
| WARNING                        | 24-HR  | 48-HR  | 72-HR  | WARNING       | 24-HR  | 48-HR  | 72-HR  |
| 16NM                           | 166NM  | 368NM  | 495NM  | 20NM          | 100NM  | 351NM  | 495NM  |
| 9NM                            | 111NM  | 263NM  | 403NM  | 12NM          | 114NM  | 257NM  | 403NM  |
| 3KTS                           | 18KTS  | 24KTS  | 17KTS  | 3KTS          | 16KTS  | 23KTS  | 17KTS  |
| -0KTS                          | -12KTS | -21KTS | -13KTS | 0KTS          | -11KTS | -17KTS | -13KTS |
| 24                             | 21     | 17     | 12     | 27            | 23     | 19     | 12     |

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

## 0600Z 18 AUG TO 1800Z 23 AUG

0000Z 02 SEP TO 0000Z 10 SEP

| WARNING | 24-HR | 48-HR | 72-HR |
|---------|-------|-------|-------|
| 21NM    | 113NM | 243NM | 387NM |
| 15NM    | 70NM  | 180NM | 330NM |
| 3KTS    | 6KTS  | 13KTS | 13KTS |
| 0KTS    | 2KTS  | 5KTS  | 11KTS |
| 30      | 26    | 22    | 16    |

TYPHOON WINNIE  
0000Z 09 SEP TO 0000Z 12 SEP

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |      | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND | POSIT            | WIND | POSIT | WIND |
| 090000Z    | 25.8N 164.4E | 40    | 25.8N 163.9E | 30      | 5    | -10   | 27.7N 164.2E | 40               | 151  | -25   | 29.7N 164.6E | 45               | 315  | -10   | ---  | ---              | ---  | ---   | ---  |
| 090600Z    | 26.9N 164.4E | 50    | 26.5N 164.2E | 35      | 26   | -15   | 29.6N 164.7E | 45               | 129  | -20   | 33.1N 165.6E | 55               | 236  | 5     | ---  | ---              | ---  | ---   | ---  |
| 091200Z    | 28.0N 163.7E | 60    | 27.8N 164.1E | 45      | 24   | -15   | 31.7N 163.5E | 55               | 55   | -10   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 091800Z    | 29.0N 163.4E | 65    | 28.8N 164.0E | 50      | 34   | -15   | 32.8N 163.5E | 60               | 67   | -5    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 100000Z    | 30.0N 163.4E | 65    | 30.1N 162.7E | 65      | 17   | 0     | 34.0N 160.4E | 65               | 116  | 10    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 100600Z    | 31.0N 162.4E | 65    | 31.2N 162.2E | 65      | 33   | 0     | 35.2N 160.4E | 65               | 194  | 15    | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 101200Z    | 32.2N 162.4E | 65    | 32.2N 162.8E | 65      | 10   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 101800Z    | 33.3N 162.3E | 65    | 33.3N 162.9E | 65      | 30   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 110000Z    | 34.7N 162.6E | 55    | 34.7N 162.5E | 55      | 5    | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |
| 110600Z    | 36.8N 163.4E | 50    | 36.5N 163.3E | 50      | 34   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---  | ---              | ---  | ---   | ---  |

| TYPHOONS WHILE WIND OVER 35KTS  |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|-------|-------|-------|---------------|-------|-------|-------|
| WARNING                         | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 22NM  | 17NM  | 27NM  | 0NM           | 22NM  | 17NM  | 27NM  |
| AVERAGE RIGHT ANGLE ERROR       | 16NM  | 67NM  | 115NM | 0NM           | 16NM  | 67NM  | 115NM |
| AVERAGE MAGNITUDE OF WIND ERROR | 6KTS  | 14KTS | 8KTS  | 0KTS          | 6KTS  | 14KTS | 8KTS  |
| AVERAGE BIAS OF WIND ERROR      | -6KTS | -6KTS | -3KTS | 0KTS          | -6KTS | -6KTS | -3KTS |
| NUMBER OF FORECASTS             | 10    | 6     | 2     | 0             | 10    | 6     | 2     |

TYPHOON ALICE  
0000Z 16 SEP TO 0600Z 20 SEP

| BEST TRACK |        |        |        | WARNING |        |        |        | 24 HOUR FORECAST |        |        |        | 48 HOUR FORECAST |        |        |        | 72 HOUR FORECAST |        |        |        |        |     |     |    |
|------------|--------|--------|--------|---------|--------|--------|--------|------------------|--------|--------|--------|------------------|--------|--------|--------|------------------|--------|--------|--------|--------|-----|-----|----|
| POSIT      |        | WIND   |        | POSIT   |        | WIND   |        | POSIT            |        | WIND   |        | POSIT            |        | WIND   |        | POSIT            |        | WIND   |        |        |     |     |    |
| ERRORS     | ERRORS | ERRORS | ERRORS | ERRORS  | ERRORS | ERRORS | ERRORS | ERRORS           | ERRORS | ERRORS | ERRORS | ERRORS           | ERRORS | ERRORS | ERRORS | ERRORS           | ERRORS | ERRORS | ERRORS |        |     |     |    |
| U          | W      | U      | W      | U       | W      | U      | W      | U                | W      | U      | W      | U                | W      | U      | W      | U                | W      | U      | W      |        |     |     |    |
| 160000Z    | 13.8N  | 129.4E | 30     | 13.8N   | 129.7E | 30     | 17     | 0                | 16.0N  | 127.4E | 45     | 144              | -10    | 17.9N  | 124.3E | 60               | 242    | -5     | 19.5N  | 120.5E | 70  | 375 | 10 |
| 160600Z    | 13.9N  | 128.4E | 35     | 13.9N   | 128.4E | 35     | 0      | 0                | 15.9N  | 125.7E | 50     | 102              | -15    | 18.1N  | 122.8E | 60               | 254    | -5     | 20.1N  | 119.7E | 70  | 415 | 10 |
| 161200Z    | 14.1N  | 127.4E | 40     | 14.2N   | 127.6E | 35     | 13     | -5               | 16.2N  | 124.4E | 55     | 89               | -20    | 17.9N  | 121.3E | 60               | 252    | 0      | 19.7N  | 118.1E | 65  | 394 | 5  |
| 161800Z    | 14.3N  | 126.4E | 45     | 14.4N   | 126.5E | 45     | 8      | 0                | 16.1N  | 122.8E | 65     | 47               | -10    | 17.3N  | 118.9E | 55               | 189    | -5     | 18.6N  | 115.9E | 65  | 277 | 10 |
| 170000Z    | 14.7N  | 125.3E | 55     | 14.7N   | 125.3E | 45     | 0      | -10              | 16.2N  | 120.8E | 50     | 24               | -15    | 17.8N  | 116.8E | 60               | 144    | 0      | 18.9N  | 113.3E | 65  | 254 | 15 |
| 170600Z    | 15.0N  | 124.2E | 65     | 14.9N   | 124.3E | 60     | 8      | -5               | 16.1N  | 120.4E | 50     | 109              | -15    | 17.5N  | 116.5E | 65               | 211    | 5      | 19.1N  | 113.4E | 70  | 333 | 30 |
| 171200Z    | 15.4N  | 123.1E | 75     | 15.3N   | 123.3E | 65     | 13     | -10              | 16.4N  | 119.4E | 55     | 137              | -5     | 17.8N  | 115.7E | 65               | 251    | 5      | 18.6N  | 112.1E | 70  | 337 | 35 |
| 171800Z    | 15.9N  | 122.0E | 75     | 15.8N   | 122.2E | 75     | 13     | 0                | 17.2N  | 118.2E | 65     | 149              | 5      | 18.0N  | 114.5E | 70               | 202    | 15     | ---    | ---    | --- | --- |    |
| 180000Z    | 16.3N  | 120.4E | 65     | 16.1N   | 121.0E | 65     | 36     | 0                | 17.3N  | 116.8E | 75     | 143              | 15     | 18.3N  | 113.2E | 75               | 252    | 25     | ---    | ---    | --- | --- |    |
| 180600Z    | 16.7N  | 118.6E | 65     | 16.7N   | 119.1E | 65     | 29     | 0                | 17.9N  | 114.8E | 75     | 114              | 15     | 18.8N  | 110.7E | 65               | 183    | 25     | ---    | ---    | --- | --- |    |
| 181200Z    | 16.9N  | 117.0E | 60     | 16.9N   | 116.8E | 65     | 11     | 5                | 17.9N  | 110.8E | 70     | 34               | 10     | 18.1N  | 104.6E | 40               | 119    | 5      | ---    | ---    | --- | --- |    |
| 181800Z    | 17.0N  | 115.6E | 60     | 16.8N   | 116.0E | 55     | 26     | -5               | 16.8N  | 111.1E | 45     | 108              | -10    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 190000Z    | 17.3N  | 114.3E | 60     | 17.1N   | 114.9E | 55     | 36     | -5               | 17.1N  | 110.0E | 45     | 127              | -5     | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 190600Z    | 17.7N  | 112.8E | 60     | 17.6N   | 112.9E | 55     | 8      | -5               | 17.8N  | 106.7E | 40     | 100              | 0      | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 191200Z    | 18.2N  | 111.3E | 60     | 18.1N   | 111.0E | 60     | 18     | 0                | 20.3N  | 104.9E | 25     | 91               | -10    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 191800Z    | 18.6N  | 111.0E | 55     | 19.1N   | 109.6E | 50     | 85     | -5               | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 200000Z    | 18.9N  | 108.8E | 50     | 19.2N   | 108.5E | 50     | 25     | 0                | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 200600Z    | 19.3N  | 107.5E | 40     | 19.9N   | 107.1E | 40     | 42     | 0                | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |
| 201200Z    | 19.4N  | 106.2E | 35     | ---     | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---              | ---    | ---    | ---    | ---    | --- | --- |    |

| TYPHOONS WHILE WIND OVER 35KTS  |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|-------|-------|-------|---------------|-------|-------|-------|
| WARNING                         | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 22NM  | 101NM | 209NM | 341NM         | 22NM  | 101NM | 209NM |
| AVERAGE RIGHT ANGLE ERROR       | 10NM  | 54NM  | 71NM  | 125NM         | 10NM  | 54NM  | 71NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 3KTS  | 11KTS | 9KTS  | 16KTS         | 3KTS  | 11KTS | 9KTS  |
| AVERAGE BIAS OF WIND ERROR      | -3KTS | -5KTS | 6KTS  | 16KTS         | -3KTS | -5KTS | 6KTS  |
| NUMBER OF FORECASTS             | 17    | 15    | 11    | 7             | 18    | 15    | 11    |

**TYPHOON BETTY**  
0600Z 17 SEP TO 1200Z 23 SEP

| BEST TRACK |              |       |              | WARNING |       |      |              | 24 HOUR FORECAST |      |        |              | 48 HOUR FORECAST |        |       |              | 72 HOUR FORECAST |       |      |        |
|------------|--------------|-------|--------------|---------|-------|------|--------------|------------------|------|--------|--------------|------------------|--------|-------|--------------|------------------|-------|------|--------|
| POSIT      | WIND         | POSIT | WIND         | ERRORS  | POSIT | WIND | ERRORS       | POSIT            | WIND | ERRORS | POSIT        | WIND             | ERRORS | POSIT | WIND         | ERRORS           | POSIT | WIND | ERRORS |
| 170600Z    | 16.2N 143.7E | 30    | 16.3N 143.7E | 25      | 6     | -5   | 17.1N 139.6E | 35               | 81   | 0      | 17.7N 135.4F | 50               | 83     | 5     | 18.1N 131.2E | 65               | 168   | 5    |        |
| 171200Z    | 16.7N 142.0E | 30    | 16.5N 142.0E | 25      | 12    | -5   | 17.0N 138.0E | 35               | 24   | 0      | 17.3N 133.9F | 50               | 126    | 5     | 17.6N 129.8E | 65               | 223   | 0    |        |
| 171800Z    | 16.9N 140.7E | 30    | 16.9N 141.1E | 25      | 23    | -5   | 17.7N 137.0E | 35               | 54   | -5     | 18.3N 132.9E | 50               | 147    | 0     | 18.8N 128.6E | 65               | 192   | -5   |        |
| 180000Z    | 17.0N 139.4E | 35    | 16.9N 139.8E | 35      | 24    | 0    | 17.7N 135.2E | 55               | 103  | 15     | 18.4N 130.2F | 70               | 248    | 15    | 19.0N 125.2E | 85               | 282   | 10   |        |
| 180600Z    | 16.9N 138.2E | 35    | 17.1N 137.9E | 35      | 21    | 0    | 18.2N 132.5E | 55               | 237  | 10     | 18.8N 127.1F | 75               | 362    | 15    | 19.7N 121.5E | 90               | 376   | 0    |        |
| 181200Z    | 16.9N 137.6E | 35    | 17.1N 137.2E | 40      | 26    | 5    | 17.6N 133.1E | 60               | 173  | 15     | 18.0N 128.5F | 75               | 255    | 10    | 19.2N 123.3E | 85               | 261   | 0    |        |
| 181800Z    | 16.8N 137.1E | 40    | 16.8N 137.1E | 40      | 0     | 0    | 16.6N 134.2E | 60               | 126  | 10     | 17.0N 130.6F | 75               | 263    | 5     | 17.6N 126.5E | 85               | 321   | -5   |        |
| 190000Z    | 16.6N 136.6E | 40    | 16.7N 136.6E | 45      | 6     | 5    | 16.9N 133.0E | 65               | 162  | 10     | 17.3N 128.6E | 75               | 282    | 0     | 17.9N 124.4E | 90               | 284   | -5   |        |
| 190600Z    | 16.6N 136.3E | 45    | 16.8N 135.6E | 50      | 42    | 5    | 17.0N 132.2E | 65               | 192  | 5      | 17.4N 127.9F | 80               | 299    | 0     | 18.2N 123.1E | 90               | 276   | -5   |        |
| 191200Z    | 17.2N 136.1E | 45    | 16.8N 135.6E | 50      | 37    | 5    | 16.7N 133.4E | 65               | 252  | 0      | 16.8N 130.1E | 85               | 418    | 0     | 17.2N 126.0E | 95               | 448   | 20   |        |
| 191800Z    | 18.3N 135.5E | 50    | 18.1N 135.5E | 50      | 12    | 0    | 18.1N 133.4E | 70               | 252  | 0      | 18.1N 130.1E | 85               | 408    | -5    | 18.5N 126.0E | 95               | 422   | 30   |        |
| 200000Z    | 19.2N 134.5E | 55    | 19.4N 134.5E | 55      | 12    | 0    | 20.8N 130.4E | 75               | 102  | 0      | 22.0N 126.2E | 90               | 148    | -5    | 23.2N 122.1E | 100              | 171   | 40   |        |
| 200600Z    | 20.0N 133.4E | 60    | 20.0N 133.5E | 55      | 6     | -5   | 22.4N 129.5E | 80               | 105  | 0      | 23.9N 125.6F | 100              | 202    | 5     | 25.2N 121.5E | 90               | 216   | 35   |        |
| 201200Z    | 20.7N 132.0E | 65    | 20.5N 132.2E | 60      | 16    | -5   | 22.3N 127.9E | 85               | 102  | 0      | 23.0N 123.9F | 90               | 178    | 15    | 25.1N 119.8E | 95               | 193   | 10   |        |
| 201800Z    | 21.4N 130.6E | 70    | 21.7N 130.2E | 65      | 29    | -5   | 23.7N 125.1E | 80               | 64   | -10    | 25.2N 121.1F | 60               | 184    | -5    | ---          | ---              | ---   | ---  |        |
| 210000Z    | 22.0N 129.1E | 75    | 21.8N 129.5E | 65      | 25    | -10  | 23.2N 125.2E | 75               | 95   | -20    | 24.3N 121.1F | 65               | 142    | 5     | ---          | ---              | ---   | ---  |        |
| 210600Z    | 22.4N 127.6E | 80    | 22.7N 127.5E | 75      | 19    | -5   | 24.5N 121.9E | 80               | 115  | -15    | 25.3N 115.9E | 35               | 157    | -20   | ---          | ---              | ---   | ---  |        |
| 211200Z    | 22.7N 126.1E | 85    | 22.9N 126.2E | 80      | 13    | -5   | 24.2N 119.9E | 50               | 92   | -25    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 211800Z    | 22.7N 124.7E | 90    | 22.8N 124.9E | 85      | 13    | -5   | 23.1N 119.5E | 55               | 43   | -10    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 220000Z    | 22.6N 123.6E | 95    | 22.6N 123.3E | 90      | 17    | -5   | 22.3N 117.2E | 70               | 106  | 10     | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 220600Z    | 22.6N 122.2E | 95    | 22.5N 122.1E | 90      | 8     | -5   | 22.3N 116.3E | 70               | 118  | 15     | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 221200Z    | 22.9N 120.8E | 75    | 22.7N 120.9E | 90      | 13    | 15   | 22.3N 115.3E | 65               | 110  | 20     | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 221800Z    | 22.4N 119.7E | 65    | 22.7N 119.3E | 70      | 28    | 5    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 230000Z    | 22.9N 119.0E | 60    | 22.7N 118.7E | 70      | 20    | 10   | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 230600Z    | 23.5N 118.0E | 55    | 23.5N 117.8E | 70      | 11    | 15   | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 231200Z    | 23.7N 116.6E | 45    | 24.0N 116.8E | 45      | 21    | 0    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |

TYPHOONS WHILE WIND OVER 35KTS  
 WARNING 24-HR 48-HR 72-HR  
 18NM 123NM 230NM 274NM  
 12NM 77NM 152NM 206NM  
 5KTS 9KTS 7KTS 12KTS  
 1KTS 1KTS 3KTS 9KTS  
 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  
 18NM 123NM 230NM 274NM  
 11NM 77NM 152NM 206NM  
 5KTS 9KTS 7KTS 12KTS  
 0KTS 1KTS 3KTS 9KTS  
 26 22 17 14

**TYPHOON CORA**  
0600Z 01 OCT TO 0600Z 06 OCT

| BEST TRACK |              |       |              | WARNING |       |      |              | 24 HOUR FORECAST |      |        |              | 48 HOUR FORECAST |        |       |              | 72 HOUR FORECAST |       |      |        |
|------------|--------------|-------|--------------|---------|-------|------|--------------|------------------|------|--------|--------------|------------------|--------|-------|--------------|------------------|-------|------|--------|
| POSIT      | WIND         | POSIT | WIND         | ERRORS  | POSIT | WIND | ERRORS       | POSIT            | WIND | ERRORS | POSIT        | WIND             | ERRORS | POSIT | WIND         | ERRORS           | POSIT | WIND | ERRORS |
| 010600Z    | 14.0N 133.5E | 30    | 14.1N 133.1E | 30      | 24    | 0    | 17.2N 128.9E | 45               | 188  | 10     | 18.7N 124.7E | 55               | 351    | -15   | 19.7N 121.2E | 70               | 689   | -30  |        |
| 011200Z    | 15.0N 132.8E | 30    | 14.9N 132.0E | 30      | 47    | 0    | 18.0N 127.6E | 45               | 233  | 0      | 19.5N 123.6F | 55               | 399    | -25   | 20.7N 120.0E | 65               | 794   | -40  |        |
| 011800Z    | 16.2N 132.4E | 30    | 16.0N 132.2E | 30      | 17    | 0    | 19.2N 129.9E | 40               | 91   | -10    | 21.5N 126.8F | 55               | 235    | -25   | 23.3N 123.7E | 65               | 656   | -40  |        |
| 020000Z    | 17.5N 132.2E | 30    | 17.5N 131.5E | 30      | 40    | 0    | 21.4N 128.6E | 40               | 55   | -20    | 23.5N 125.0F | 50               | 291    | -40   | 24.7N 121.8E | 65               | 842   | -35  |        |
| 020600Z    | 18.7N 131.1E | 35    | 19.3N 131.1E | 35      | 53    | 0    | 23.7N 127.7E | 55               | 98   | -15    | 24.8N 123.6F | 65               | 401    | -35   | 25.1N 119.6E | 55               | 1108  | -45  |        |
| 021200Z    | 19.9N 131.2E | 45    | 19.8N 131.4E | 40      | 13    | -5   | 24.0N 129.7E | 55               | 33   | -25    | 27.0N 126.8F | 65               | 275    | -40   | 30.5N 126.0E | 55               | 861   | -45  |        |
| 021800Z    | 20.7N 130.2E | 50    | 20.6N 130.6E | 40      | 23    | -10  | 24.3N 128.7E | 55               | 40   | -25    | 27.9N 126.5F | 55               | 378    | -50   | ---          | ---              | ---   | ---  |        |
| 030000Z    | 21.8N 129.5E | 60    | 21.8N 129.8E | 45      | 17    | -15  | 25.2N 127.6E | 55               | 118  | -35    | 28.8N 125.8F | 55               | 539    | -45   | ---          | ---              | ---   | ---  |        |
| 030600Z    | 22.8N 129.2E | 70    | 22.7N 129.2E | 60      | 6     | -10  | 26.1N 127.0E | 80               | 202  | -20    | 29.9N 125.8F | 80               | 689    | -20   | ---          | ---              | ---   | ---  |        |
| 031200Z    | 23.7N 129.2E | 80    | 23.6N 129.0E | 85      | 12    | 5    | 27.0N 126.3E | 100              | 207  | -5     | 30.4N 131.8E | 80               | 988    | -20   | ---          | ---              | ---   | ---  |        |
| 031800Z    | 24.7N 129.3E | 80    | 25.0N 129.2E | 85      | 19    | 5    | 29.0N 131.0E | 90               | 138  | -15    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 040000Z    | 26.0N 129.4E | 90    | 25.8N 129.4E | 95      | 16    | 5    | 29.7N 131.7E | 100              | 238  | 0      | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 040600Z    | 27.6N 130.4E | 100   | 27.2N 130.3E | 100     | 24    | 0    | 31.3N 134.4E | 100              | 247  | 0      | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 041200Z    | 29.0N 131.5E | 105   | 29.1N 131.4E | 105     | 8     | 0    | 34.4N 137.3E | 100              | 256  | 0      | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 041800Z    | 30.3N 133.2E | 105   | 30.0N 132.8E | 105     | 27    | 0    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 050000Z    | 31.7N 135.7E | 100   | 31.4N 135.6E | 105     | 19    | 5    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 050600Z    | 33.1N 138.8E | 100   | 33.3N 138.3E | 110     | 28    | 10   | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |
| 051200Z    | 34.3N 142.5E | 100   | 34.3N 142.3E | 105     | 10    | 5    | ---          | ---              | ---  | ---    | ---          | ---              | ---    | ---   | ---          | ---              | ---   | ---  |        |

TYPHOONS WHILE WIND OVER 35KTS  
 WARNING 24-HR 48-HR 72-HR  
 20NM 153NM 415NM 825NM  
 12NM 83NM 230NM 420NM  
 5KTS 13KTS 32KTS 39KTS  
 0KTS 11KTS 32KTS 39KTS  
 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  
 22NM 153NM 415NM 825NM  
 16NM 83NM 230NM 420NM  
 4KTS 13KTS 32KTS 39KTS  
 0KTS 11KTS 32KTS 39KTS  
 18 14 10 6

TYPHOON ELSIE

0000Z 09 OCT TO 0000Z 15 OCT

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |              | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND |
| 090000Z    | 12.7N 138.1E | 25    | 12.9N 138.2E | 25      | 13   | 0     | 15.6N 135.1E | 35               | 115  | -10   | 17.9N 131.8E | 50               | 245  | -25   | 19.9N 128.8E | 65               | 326  | -70   |      |
| 090600Z    | 13.2N 136.4E | 30    | 12.9N 136.3E | 30      | 25   | 0     | 13.9N 132.4E | 45               | 181  | -5    | 15.1N 128.5E | 55               | 254  | -40   | 16.3N 125.3E | 70               | 303  | -60   |      |
| 091200Z    | 14.2N 135.4E | 30    | 13.1N 134.9E | 30      | 72   | 0     | 13.6N 129.8E | 45               | 218  | -10   | 14.8N 125.0E | 60               | 263  | -65   | 16.0N 121.1E | 70               | 287  | -55   |      |
| 091800Z    | 15.3N 134.4E | 35    | 13.9N 133.9E | 30      | 88   | -5    | 15.5N 129.5E | 50               | 140  | -10   | 16.8N 125.6E | 65               | 190  | -70   | 18.0N 121.5E | 70               | 195  | -45   |      |
| 100000Z    | 16.2N 133.2E | 45    | 16.2N 133.5E | 50      | 17   | 5     | 19.3N 129.8E | 80               | 146  | 5     | 21.4N 127.7E | 90               | 274  | -45   | 23.1N 126.4E | 100              | 400  | -5    |      |
| 100600Z    | 16.9N 131.4E | 50    | 17.1N 132.0E | 55      | 13   | 5     | 20.5N 128.0E | 80               | 139  | -15   | 23.0N 125.9E | 90               | 249  | -40   | 24.7N 124.8E | 100              | 385  | 0     |      |
| 101200Z    | 17.4N 130.4E | 55    | 17.5N 130.5E | 55      | 8    | 0     | 20.2N 126.2E | 80               | 86   | -45   | 24.6N 125.9E | 90               | 340  | -35   | 29.2N 133.0E | 90               | 941  | -5    |      |
| 101800Z    | 17.8N 129.0E | 60    | 17.8N 129.1E | 60      | 6    | 0     | 20.4N 124.5E | 80               | 55   | -55   | 25.0N 123.2E | 85               | 279  | -30   | 29.2N 130.7E | 80               | 882  | -10   |      |
| 110000Z    | 18.2N 127.5E | 75    | 18.4N 127.5E | 70      | 12   | -5    | 21.3N 122.2E | 85               | 84   | -50   | 25.8N 121.6E | 85               | 289  | -20   | 30.2N 128.7E | 80               | 872  | -5    |      |
| 110600Z    | 18.8N 126.3E | 95    | 18.7N 126.1E | 70      | 13   | -25   | 20.6N 120.9E | 85               | 79   | -45   | 24.1N 119.1E | 75               | 146  | -25   | 28.3N 121.4E | 60               | 541  | -10   |      |
| 111200Z    | 19.2N 125.1E | 125   | 19.3N 124.9E | 120     | 13   | -5    | 21.3N 120.0E | 130              | 78   | 5     | 23.0N 116.0E | 100              | 126  | 5     | ---          | ---              | ---  | ---   |      |
| 111800Z    | 19.6N 124.0E | 135   | 19.7N 124.0E | 140     | 6    | 5     | 21.2N 120.0E | 120              | 23   | 5     | 21.7N 115.0E | 100              | 89   | 10    | 21.6N 110.0E | 50               | 141  | 10    |      |
| 120000Z    | 20.1N 123.0E | 155   | 20.1N 123.0E | 140     | 0    | 5     | 21.6N 119.1E | 120              | 21   | 15    | 21.9N 113.9E | 100              | 78   | 15    | 21.7N 108.9E | 45               | 156  | 10    |      |
| 120600Z    | 20.5N 122.3E | 140   | 20.5N 122.1E | 130     | 11   | 0     | 21.8N 118.1E | 120              | 28   | 20    | 22.2N 113.0E | 90               | 67   | 20    | ---          | ---              | ---  | ---   |      |
| 121200Z    | 20.8N 121.3E | 125   | 20.9N 121.7E | 125     | 23   | 0     | 22.0N 118.5E | 110              | 50   | 15    | 22.7N 114.2E | 90               | 61   | 35    | ---          | ---              | ---  | ---   |      |
| 121800Z    | 21.1N 120.4E | 115   | 21.1N 120.6E | 120     | 11   | 5     | 22.2N 117.2E | 100              | 45   | 10    | 23.1N 112.6E | 60               | 66   | 20    | ---          | ---              | ---  | ---   |      |
| 130000Z    | 21.4N 119.4E | 105   | 21.4N 119.3E | 110     | 6    | 5     | 22.5N 115.2E | 90               | 36   | 5     | 22.8N 111.0E | 35               | 61   | 0     | ---          | ---              | ---  | ---   |      |
| 130600Z    | 21.7N 118.6E | 100   | 21.6N 118.3E | 100     | 18   | 0     | 22.5N 114.2E | 90               | 30   | 20    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 131200Z    | 21.6N 117.7E | 95    | 21.7N 117.4E | 95      | 18   | 0     | 21.9N 112.8E | 75               | 34   | 20    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 131800Z    | 21.7N 116.6E | 90    | 21.8N 116.3E | 90      | 18   | 0     | 21.9N 111.5E | 60               | 56   | 20    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 140000Z    | 21.9N 115.3E | 85    | 21.8N 115.3E | 80      | 6    | -5    | 21.8N 111.3E | 65               | 25   | 30    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 140600Z    | 22.0N 114.2E | 70    | 21.9N 114.1E | 65      | 8    | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 141200Z    | 22.0N 113.4E | 55    | 21.9N 113.3E | 55      | 8    | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 141800Z    | 22.0N 112.5E | 40    | 21.9N 113.0E | 40      | 28   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 150000Z    | 22.0N 111.7E | 35    | 22.0N 112.5E | 20      | 44   | -15   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |

TYPHOONS WHILE WIND OVER 35KTS

|                                 | WARNING | 24-HR | 48-HR  | 72-HR  |
|---------------------------------|---------|-------|--------|--------|
| AVERAGE FORECAST ERROR          | 17NM    | 80NM  | 181NM  | 452NM  |
| AVERAGE RIGHT ANGLE ERROR       | 10NM    | 54NM  | 134NM  | 370NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 4KTS    | 20KTS | 29KTS  | 24KTS  |
| AVERAGE BIAS OF WIND ERROR      | -2KTS   | -4KTS | -17KTS | -20KTS |
| NUMBER OF FORECASTS             | 22      | 21    | 17     | 12     |

ALL FORECASTS

|                                 | WARNING | 24-HR | 48-HR  | 72-HR  |
|---------------------------------|---------|-------|--------|--------|
| AVERAGE FORECAST ERROR          | 19NM    | 80NM  | 181NM  | 452NM  |
| AVERAGE RIGHT ANGLE ERROR       | 13NM    | 54NM  | 134NM  | 370NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 4KTS    | 20KTS | 29KTS  | 24KTS  |
| AVERAGE BIAS OF WIND ERROR      | -1KTS   | -4KTS | -17KTS | -20KTS |
| NUMBER OF FORECASTS             | 25      | 21    | 17     | 12     |

TYPHOON FLOSSIE

0000Z 20 OCT TO 1200Z 23 OCT

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |              | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND |
| 200000Z    | 15.6N 117.4E | 30    | 15.6N 117.0E | 30      | 26   | 0     | 16.2N 114.9E | 45               | 68   | 0     | 16.3N 112.4E | 50               | 196  | -10   | 15.8N 110.0E | 50               | 297  | -15   |      |
| 200600Z    | 15.3N 116.0E | 30    | 15.7N 116.0E | 30      | 24   | 0     | 16.0N 113.1E | 45               | 196  | 0     | 16.2N 110.1E | 50               | 284  | -15   | 15.8N 107.4E | 35               | 370  | -15   |      |
| 201200Z    | 15.7N 116.4E | 30    | 15.7N 115.5E | 30      | 52   | 0     | 15.8N 113.3E | 45               | 200  | -5    | 16.0N 110.9E | 50               | 236  | -20   | ---          | ---              | ---  | ---   |      |
| 201800Z    | 15.5N 115.4E | 40    | 15.6N 115.8E | 40      | 6    | 0     | 15.7N 114.1E | 55               | 157  | 0     | 16.0N 111.7E | 60               | 230  | -10   | ---          | ---              | ---  | ---   |      |
| 210000Z    | 15.8N 116.0E | 45    | 15.6N 115.8E | 45      | 17   | 0     | 15.8N 115.2E | 50               | 143  | -10   | 16.4N 114.1E | 55               | 280  | -10   | ---          | ---              | ---  | ---   |      |
| 210600Z    | 16.3N 116.5E | 45    | 15.9N 115.9E | 45      | 42   | 0     | 16.4N 115.6E | 50               | 148  | -15   | 17.4N 114.7E | 55               | 324  | 5     | ---          | ---              | ---  | ---   |      |
| 211200Z    | 16.9N 116.6E | 50    | 16.8N 116.5E | 50      | 8    | 0     | 16.6N 116.2E | 65               | 149  | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 211800Z    | 17.6N 116.0E | 55    | 17.7N 116.6E | 55      | 35   | 0     | 19.9N 115.7E | 65               | 163  | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 220000Z    | 18.2N 115.2E | 60    | 18.9N 115.0E | 60      | 43   | 0     | 20.8N 112.2E | 65               | 33   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 220600Z    | 18.6N 114.4E | 65    | 18.5N 114.3E | 65      | 8    | 0     | 18.7N 111.8E | 75               | 184  | 25    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 221200Z    | 19.0N 113.6E | 70    | 18.8N 113.6E | 70      | 12   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 221800Z    | 19.7N 112.8E | 70    | 19.2N 112.7E | 70      | 30   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 230000Z    | 20.5N 111.7E | 65    | 20.4N 111.7E | 70      | 6    | 5     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 230600Z    | 21.2N 110.6E | 50    | 21.1N 110.9E | 50      | 18   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |

TYPHOONS WHILE WIND OVER 35KTS

|                                 | WARNING | 24-HR | 48-HR  | 72-HR  |
|---------------------------------|---------|-------|--------|--------|
| AVERAGE FORECAST ERROR          | 20NM    | 142NM | 258NM  | 333NM  |
| AVERAGE RIGHT ANGLE ERROR       | 12NM    | 83NM  | 176NM  | 324NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 0KTS    | 7KTS  | 12KTS  | 15KTS  |
| AVERAGE BIAS OF WIND ERROR      | 0KTS    | -2KTS | -10KTS | -15KTS |
| NUMBER OF FORECASTS             | 11      | 10    | 6      | 2      |

ALL FORECASTS

|                                 | WARNING | 24-HR | 48-HR  | 72-HR  |
|---------------------------------|---------|-------|--------|--------|
| AVERAGE FORECAST ERROR          | 23NM    | 142NM | 258NM  | 333NM  |
| AVERAGE RIGHT ANGLE ERROR       | 12NM    | 83NM  | 176NM  | 324NM  |
| AVERAGE MAGNITUDE OF WIND ERROR | 0KTS    | 7KTS  | 12KTS  | 15KTS  |
| AVERAGE BIAS OF WIND ERROR      | 0KTS    | -2KTS | -10KTS | -15KTS |
| NUMBER OF FORECASTS             | 14      | 10    | 6      | 2      |

TYPHOON IDA  
0600Z 06 NOV TO 1200Z 11 NOV

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |              | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND |
| 060600Z    | 11.7N 149.6E | 25    | 10.1N 149.2E | 25      | 98   | 0     | 11.2N 145.5E | 45               | 287  | 15    | 11.0N 140.2E | 55               | 543  | 10    | 12.0N 134.8E | 65               | 75R  | 5     |      |
| 061200Z    | 12.4N 149.5E | 25    | 11.9N 146.6E | 25      | 172  | 0     | 13.4N 142.5E | 45               | 408  | 15    | 14.0N 137.7E | 55               | 604  | 10    | 14.3N 132.3E | 65               | 823  | 5     |      |
| 061800Z    | 12.9N 149.6E | 25    | 11.2N 147.7E | 25      | 150  | 0     | 13.1N 143.5E | 40               | 346  | 10    | 14.1N 139.2E | 55               | 494  | 5     | 14.3N 134.7E | 65               | 727  | -5    |      |
| 070000Z    | 13.3N 149.7E | 25    | 12.7N 148.5E | 25      | 78   | 0     | 14.0N 144.5E | 40               | 268  | 5     | 15.2N 140.5E | 55               | 376  | 0     | 16.2N 136.4E | 65               | 647  | -10   |      |
| 070600Z    | 13.7N 149.7E | 30    | 13.0N 149.2E | 30      | 51   | 0     | 13.6N 147.3E | 45               | 168  | 0     | 14.5N 144.1E | 60               | 299  | 0     | 15.5N 140.1E | 70               | 641  | -10   |      |
| 071200Z    | 14.1N 149.5E | 30    | 13.8N 148.9E | 35      | 39   | 5     | 14.6N 146.3E | 45               | 172  | 0     | 15.0N 142.6E | 60               | 318  | 0     | 16.0N 137.6E | 70               | 848  | -15   |      |
| 071800Z    | 14.8N 149.2E | 30    | 14.6N 148.5E | 35      | 40   | 5     | 15.2N 146.3E | 45               | 159  | -5    | 15.0N 142.8E | 60               | 347  | -10   | 16.1N 138.0E | 70               | 993  | -10   |      |
| 080000Z    | 15.4N 148.9E | 35    | 14.8N 148.5E | 40      | 43   | 5     | 15.4N 146.5E | 60               | 187  | 5     | 16.4N 142.4E | 75               | 404  | 0     | ---          | ---              | ---  | ---   |      |
| 080600Z    | 16.2N 148.4E | 45    | 15.3N 148.3E | 45      | 54   | 0     | 16.7N 146.1E | 65               | 187  | 5     | 17.4N 142.6E | 80               | 469  | 0     | ---          | ---              | ---  | ---   |      |
| 081200Z    | 17.1N 147.8E | 45    | 16.5N 147.7E | 45      | 36   | 0     | 18.9N 145.5E | 65               | 72   | 5     | 21.2N 143.9E | 70               | 373  | -15   | ---          | ---              | ---  | ---   |      |
| 081800Z    | 17.8N 146.9E | 50    | 17.6N 147.0E | 45      | 13   | -5    | 20.3N 144.5E | 65               | 65   | -5    | 23.0N 144.7E | 70               | 402  | -10   | ---          | ---              | ---  | ---   |      |
| 090000Z    | 18.5N 146.1E | 55    | 18.5N 146.3E | 55      | 11   | 0     | 21.6N 144.3E | 70               | 91   | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 090600Z    | 19.3N 145.6E | 60    | 19.1N 145.8E | 60      | 16   | 0     | 22.1N 144.2E | 65               | 190  | -15   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 091200Z    | 20.1N 145.4E | 60    | 20.1N 145.2E | 60      | 11   | 0     | 23.4N 143.8E | 65               | 283  | -20   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 091800Z    | 21.1N 145.3E | 70    | 21.3N 144.9E | 65      | 25   | -5    | 25.5N 145.9E | 65               | 281  | -15   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 100000Z    | 22.4N 145.7E | 75    | 22.3N 145.7E | 70      | 6    | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 100600Z    | 24.2N 146.8E | 80    | 23.4N 146.1E | 80      | 61   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 101200Z    | 26.2N 148.0E | 85    | 26.1N 146.3E | 80      | 17   | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 101800Z    | 29.5N 148.7E | 80    | 28.7N 148.9E | 80      | 49   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |

TYPHOONS WHILE WIND OVER 35KTS  
 WARNING 24-HR 48-HR 72-HR  
 29NM 177NM 421NM 775NM  
 17NM 108NM 299NM 596NM  
 2KTS 7KTS 5KTS 9KTS  
 -1KTS -4KTS -1KTS -6KTS  
 12- 12 11 7  
 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  
 51NM 211NM 421NM 775NM  
 41NM 150NM 299NM 596NM  
 2KTS 7KTS 5KTS 9KTS  
 -0KTS -0KTS -1KTS -6KTS  
 19 15 11 7

TYPHOON JUNE  
0600Z 16 NOV TO 0000Z 24 NOV

| BEST TRACK |              |       |              | WARNING |      |       |              | 24 HOUR FORECAST |      |       |              | 48 HOUR FORECAST |      |       |              | 72 HOUR FORECAST |      |       |      |
|------------|--------------|-------|--------------|---------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|--------------|------------------|------|-------|------|
| POSIT      | WIND         | POSIT | WIND         | POSIT   | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND         | POSIT            | WIND | POSIT | WIND |
| 160600Z    | 6.7N 143.1E  | 25    | 7.2N 142.9E  | 25      | 32   | 0     | 7.5N 139.0E  | 35               | 216  | -25   | 8.5N 134.2E  | 45               | 490  | -30   | 10.1N 128.4E | 55               | 779  | -95   |      |
| 161200Z    | 6.3N 142.6E  | 30    | 6.6N 142.4E  | 30      | 21   | 0     | 6.7N 138.8E  | 40               | 208  | -25   | 8.0N 134.1E  | 50               | 493  | -35   | 9.9N 129.0E  | 60               | 729  | -100  |      |
| 161800Z    | 6.4N 142.9E  | 40    | 6.3N 142.3E  | 35      | 36   | -5    | 6.1N 140.5E  | 45               | 124  | -25   | 6.8N 137.3E  | 55               | 359  | -45   | 8.5N 132.7E  | 65               | 546  | -85   |      |
| 170000Z    | 6.6N 142.5E  | 50    | 6.5N 142.7E  | 40      | 13   | -10   | 6.4N 141.0E  | 55               | 122  | -20   | 7.1N 137.0E  | 65               | 378  | -70   | 8.7N 132.5E  | 75               | 533  | -70   |      |
| 170600Z    | 6.9N 142.6E  | 60    | 6.8N 142.2E  | 50      | 24   | -10   | 6.8N 140.2E  | 70               | 181  | -5    | 7.3N 136.2E  | 80               | 432  | -70   | 9.1N 131.7E  | 70               | 532  | -70   |      |
| 171200Z    | 6.7N 142.3E  | 65    | 6.8N 142.2E  | 60      | 8    | -5    | 7.1N 140.9E  | 80               | 171  | -5    | 8.2N 137.0E  | 100              | 380  | -60   | 9.4N 132.5E  | 120              | 480  | -20   |      |
| 171800Z    | 7.3N 142.2E  | 70    | 7.3N 142.1E  | 65      | 6    | -5    | 7.9N 140.9E  | 85               | 171  | -15   | 9.5N 137.2E  | 105              | 314  | -45   | 11.0N 132.6E | 125              | 412  | -15   |      |
| 180000Z    | 7.9N 142.4E  | 75    | 7.5N 142.2E  | 70      | 27   | -5    | 9.0N 141.5E  | 100              | 139  | -35   | 10.8N 137.9E | 120              | 231  | -25   | 11.5N 133.1E | 130              | 377  | -10   |      |
| 180600Z    | 8.8N 142.5E  | 75    | 8.6N 142.7E  | 75      | 17   | 0     | 11.4N 143.2E | 100              | 113  | -50   | 13.8N 141.8E | 110              | 189  | -30   | 15.6N 138.3E | 110              | 174  | -25   |      |
| 181200Z    | 9.6N 142.3E  | 85    | 9.7N 142.3E  | 80      | 6    | -5    | 12.4N 142.3E | 100              | 90   | -60   | 14.2N 141.2E | 110              | 191  | -30   | 16.0N 137.5E | 120              | 182  | -10   |      |
| 181800Z    | 10.5N 142.1E | 100   | 10.4N 142.3E | 90      | 13   | -10   | 13.2N 142.3E | 125              | 122  | -25   | 16.2N 139.8E | 130              | 133  | -10   | 17.3N 135.8E | 110              | 132  | -15   |      |
| 190000Z    | 11.3N 141.8E | 135   | 11.5N 142.0E | 105     | 17   | -30   | 14.9N 141.1E | 130              | 94   | -15   | 17.1N 137.7E | 130              | 57   | -10   | 17.5N 133.5E | 110              | 204  | -10   |      |
| 190600Z    | 12.3N 141.5E | 150   | 12.3N 141.6E | 140     | 6    | -10   | 15.7N 140.7E | 150              | 127  | 10    | 19.2N 140.3E | 125              | 264  | -10   | 23.5N 141.3E | 100              | 358  | -15   |      |
| 191200Z    | 13.2N 141.0E | 160   | 13.3N 141.2E | 150     | 13   | -10   | 16.9N 140.1E | 150              | 149  | 10    | 20.4N 139.3E | 125              | 253  | -5    | 24.4N 140.9E | 100              | 316  | -10   |      |
| 191800Z    | 13.8N 140.3E | 150   | 13.9N 140.2E | 160     | 8    | 10    | 17.0N 138.3E | 150              | 75   | 10    | 20.6N 137.7E | 125              | 163  | 0     | 24.5N 139.7E | 100              | 193  | -5    |      |
| 200000Z    | 14.3N 139.6E | 145   | 14.7N 139.6E | 145     | 24   | 0     | 17.9N 138.1E | 115              | 103  | -25   | 21.6N 137.7E | 90               | 157  | -30   | 25.0N 140.4E | 80               | 163  | -20   |      |
| 200600Z    | 14.8N 138.7E | 140   | 14.8N 138.6E | 140     | 6    | 0     | 17.5N 136.0E | 115              | 0    | -20   | 21.0N 135.3E | 90               | 43   | -25   | 24.7N 137.7E | 80               | 190  | -10   |      |
| 201200Z    | 15.3N 138.1E | 140   | 15.2N 138.1E | 140     | 6    | 0     | 17.2N 135.3E | 120              | 66   | -10   | 20.1N 134.5E | 105              | 169  | -5    | ---          | ---              | ---  | ---   |      |
| 201800Z    | 16.0N 137.5E | 140   | 15.8N 137.6E | 140     | 13   | 0     | 17.9N 135.0E | 125              | 90   | 0     | 20.7N 133.7E | 110              | 241  | 5     | ---          | ---              | ---  | ---   |      |
| 210000Z    | 16.7N 136.8E | 140   | 16.5N 136.6E | 135     | 17   | -5    | 19.2N 134.2E | 115              | 98   | -5    | 23.3N 134.3E | 90               | 207  | -10   | ---          | ---              | ---  | ---   |      |
| 210600Z    | 17.5N 136.0E | 135   | 17.6N 136.0E | 135     | 6    | 0     | 21.1N 134.2E | 115              | 62   | 0     | 25.1N 136.9E | 90               | 204  | 0     | ---          | ---              | ---  | ---   |      |
| 211200Z    | 18.3N 135.4E | 130   | 18.3N 135.4E | 130     | 0    | 0     | 21.7N 133.7E | 105              | 115  | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 211800Z    | 19.4N 135.1E | 125   | 19.2N 134.8E | 120     | 21   | -5    | 22.6N 133.5E | 95               | 170  | -10   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 220000Z    | 20.6N 135.1E | 120   | 20.5N 135.1E | 120     | 6    | 0     | 25.1N 136.8E | 95               | 35   | -5    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 220600Z    | 21.7N 135.1E | 115   | 21.5N 135.2E | 120     | 13   | 5     | 26.1N 137.5E | 95               | 144  | 5     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 221200Z    | 22.8N 135.4E | 110   | 22.7N 135.5E | 110     | 8    | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 221800Z    | 24.0N 136.2E | 105   | 23.7N 135.6E | 105     | 37   | 0     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 230000Z    | 25.3N 137.4E | 100   | 25.6N 138.0E | 105     | 37   | 5     | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |
| 230600Z    | 27.2N 139.9E | 90    | 26.6N 139.5E | 100     | 42   | 10    | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   | ---          | ---              | ---  | ---   |      |

TYPHOONS WHILE WIND OVER 35KTS  
 WARNING 24-HR 48-HR 72-HR  
 16NM 119NM 255NM 371NM  
 9NM 17NM 190NM 286NM  
 5KTS 17KTS 26KTS 34KTS  
 -3KTS -14KTS -26KTS -34KTS  
 27 25 21 17  
 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  
 17NM 119NM 255NM 371NM  
 9NM 17NM 190NM 286NM  
 5KTS 17KTS 26KTS 34KTS  
 -3KTS -14KTS -26KTS -34KTS  
 29 25 21 17

# 5. INDIAN OCEAN AREA CYCLONE DATA

## TROPICAL CYCLONE 04-75

0800Z 10 JAN TO 0800Z 11 JAN

| BEST TRACK |       |       |      | WARNING |       |      |        | 24 HOUR FORECAST |      |        |       | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|------------|-------|-------|------|---------|-------|------|--------|------------------|------|--------|-------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT      | WIND  | POSIT | WIND | ERRORS  | POSIT | WIND | ERRORS | POSIT            | WIND | ERRORS | POSIT | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 100600Z    | 16.2N | 93.8E | 35   | 16.2N   | 99.3E | 35   | 315    | 0                | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 101200Z    | 17.3N | 94.3E | 30   | ---     | ---   | ---  | ---    | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 101800Z    | 18.4N | 94.8E | 25   | 17.8N   | 94.4E | 30   | 42     | 5                | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |
| 110000Z    | 19.3N | 95.3E | 20   | ---     | ---   | ---  | ---    | ---              | ---  | ---    | ---   | ---              | ---    | ---   | ---  | ---              | ---   | ---  | ---    |

| TYPHOONS WHILE WIND OVER 35KTS  |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|-------|-------|-------|---------------|-------|-------|-------|
| WARNING                         | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| 0NM                             | 0NM   | 0NM   | 0NM   | 179NM         | 0NM   | 0NM   | 0NM   |
| 0NM                             | 0NM   | 0NM   | 0NM   | 149NM         | 0NM   | 0NM   | 0NM   |
| AVERAGE FORECAST ERROR          | 0KTS  | 0KTS  | 0KTS  | 3KTS          | 0KTS  | 0KTS  | 0KTS  |
| AVERAGE RIGHT ANGLE ERROR       | 0KTS  | 0KTS  | 0KTS  | 3KTS          | 0KTS  | 0KTS  | 0KTS  |
| AVERAGE MAGNITUDE OF WIND ERROR | 0     | 0     | 0     | 2             | 0     | 0     | 0     |
| AVERAGE BIAS OF WIND ERROR      | 0     | 0     | 0     | 0             | 0     | 0     | 0     |
| NUMBER OF FORECASTS             | 0     | 0     | 0     | 0             | 0     | 0     | 0     |

## TROPICAL CYCLONE 24-75

0600Z 02 MAY TO 0000Z 12 MAY

| BEST TRACK |       |       |      | WARNING |       |      |        | 24 HOUR FORECAST |       |        |       | 48 HOUR FORECAST |        |       |       | 72 HOUR FORECAST |       |      |        |
|------------|-------|-------|------|---------|-------|------|--------|------------------|-------|--------|-------|------------------|--------|-------|-------|------------------|-------|------|--------|
| POSIT      | WIND  | POSIT | WIND | ERRORS  | POSIT | WIND | ERRORS | POSIT            | WIND  | ERRORS | POSIT | WIND             | ERRORS | POSIT | WIND  | ERRORS           | POSIT | WIND | ERRORS |
| 020600Z    | 10.4N | 70.9E | 35   | 11.3N   | 72.0E | 35   | 84     | 0                | 13.9N | 71.7E  | 50    | 165              | 0      | 16.3N | 70.2E | 60               | 245   | -5   | ---    |
| 021200Z    | 10.7N | 70.7E | 40   | 11.6N   | 72.0E | 40   | 93     | 0                | 14.2N | 71.6E  | 55    | 175              | 0      | 16.8N | 71.0E | 65               | 266   | -5   | ---    |
| 021800Z    | 10.9N | 70.6E | 45   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 030000Z    | 11.2N | 70.4E | 50   | 12.1N   | 70.9E | 50   | 61     | 0                | 13.6N | 69.6E  | 60    | 100              | -5     | 15.3N | 67.3E | 70               | 227   | -5   | ---    |
| 030600Z    | 11.5N | 70.3E | 50   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 031200Z    | 11.6N | 70.2E | 55   | 12.2N   | 70.9E | 60   | 54     | 5                | 13.5N | 69.9E  | 70    | 70               | 0      | 14.9N | 68.5E | 70               | 128   | -15  | ---    |
| 031800Z    | 11.8N | 70.2E | 60   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 040000Z    | 12.0N | 70.1E | 65   | 13.1N   | 68.9E | 60   | 96     | -5               | 14.3N | 67.1E  | 70    | 210              | -5     | 15.6N | 65.3E | 70               | 273   | -10  | ---    |
| 040600Z    | 12.2N | 70.2E | 65   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 041200Z    | 12.4N | 70.3E | 70   | 13.2N   | 69.8E | 70   | 56     | 0                | 14.5N | 69.1E  | 75    | 86               | -10    | 16.1N | 68.3E | 80               | 122   | 10   | ---    |
| 041800Z    | 12.7N | 70.4E | 70   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 050000Z    | 13.1N | 70.5E | 75   | 14.9N   | 70.4E | 70   | 48     | -5               | 15.4N | 69.9E  | 75    | 72               | -5     | 17.7N | 69.4E | 80               | 257   | 10   | ---    |
| 050600Z    | 13.5N | 70.5E | 80   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 051200Z    | 13.8N | 70.4E | 85   | 13.3N   | 70.2E | 75   | 32     | -10              | 14.0N | 70.2E  | 85    | 87               | 15     | 15.4N | 70.6F | 85               | 247   | 5    | ---    |
| 051800Z    | 14.0N | 70.2E | 85   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 060000Z    | 14.2N | 69.8E | 80   | 14.4N   | 70.0E | 75   | 17     | -5               | 15.8N | 70.4E  | 85    | 206              | 15     | 17.3N | 71.2E | 85               | 352   | -5   | ---    |
| 060600Z    | 14.2N | 69.4E | 75   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 061200Z    | 14.1N | 68.7E | 70   | 15.2N   | 69.2E | 65   | 72     | -5               | 17.0N | 69.5E  | 50    | 295              | -30    | 19.1N | 70.8E | 35               | 401   | -55  | ---    |
| 061800Z    | 14.0N | 68.1E | 65   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 070000Z    | 13.8N | 67.5E | 70   | 15.9N   | 68.9E | 65   | 149    | -5               | 17.6N | 69.4E  | 55    | 288              | -35    | 19.5N | 70.6F | 45               | 392   | -35  | ---    |
| 070600Z    | 13.7N | 66.4E | 75   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 071200Z    | 13.7N | 66.7E | 80   | 14.1N   | 66.8E | 70   | 25     | -10              | 14.7N | 66.1E  | 75    | 25               | -15    | 15.5N | 65.5F | 75               | 8     | 5    | ---    |
| 071800Z    | 13.8N | 66.4E | 85   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 080000Z    | 13.9N | 66.2E | 90   | 14.0N   | 66.7E | 75   | 30     | -15              | 14.8N | 65.2E  | 80    | 26               | 0      | 16.0N | 63.4E | 85               | 104   | 25   | ---    |
| 080600Z    | 14.1N | 66.0E | 95   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 081200Z    | 14.4N | 65.8E | 90   | 14.9N   | 66.0E | 65   | 32     | -25              | 16.0N | 65.0E  | 65    | 33               | -5     | 17.4N | 63.9E | 65               | 83    | 15   | ---    |
| 081800Z    | 14.6N | 65.7E | 85   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 090000Z    | 15.0N | 65.6E | 80   | 15.4N   | 65.4E | 65   | 27     | -15              | 16.6N | 64.5E  | 65    | 47               | 5      | 18.3N | 63.2E | 65               | 124   | 25   | ---    |
| 090600Z    | 15.3N | 65.5E | 75   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 091200Z    | 15.6N | 65.4E | 70   | 15.8N   | 64.5E | 65   | 53     | -5               | 17.0N | 63.4E  | 65    | 96               | 15     | 18.1N | 62.3E | 65               | 125   | 35   | ---    |
| 091800Z    | 15.9N | 65.3E | 65   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 100000Z    | 16.2N | 65.2E | 60   | 15.5N   | 64.5E | 65   | 58     | 5                | 16.5N | 62.8E  | 65    | 117              | 25     | 17.8N | 61.1E | 60               | 156   | 35   | ---    |
| 100600Z    | 16.4N | 65.1E | 55   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 101200Z    | 16.5N | 65.0E | 50   | 16.6N   | 64.0E | 60   | 58     | 10               | 17.4N | 62.5E  | 50    | 108              | 20     | ---   | ---   | ---              | ---   | ---  | ---    |
| 101800Z    | 16.7N | 64.4E | 45   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 110000Z    | 16.9N | 64.8E | 40   | 16.9N   | 63.3E | 50   | 86     | 10               | 17.8N | 62.2E  | 35    | 96               | 10     | ---   | ---   | ---              | ---   | ---  | ---    |
| 110600Z    | 17.2N | 64.6E | 35   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 111200Z    | 17.5N | 64.4E | 30   | 17.0N   | 63.7E | 40   | 50     | 10               | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 111800Z    | 17.9N | 64.1E | 25   | ---     | ---   | ---  | ---    | ---              | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |
| 120000Z    | 18.3N | 63.8E | 25   | 18.5N   | 64.5E | 25   | 41     | 0                | ---   | ---    | ---   | ---              | ---    | ---   | ---   | ---              | ---   | ---  | ---    |

| TYPHOONS WHILE WIND OVER 35KTS  |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|-------|-------|-------|---------------|-------|-------|-------|
| WARNING                         | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| 0NM                             | 0NM   | 0NM   | 0NM   | 58NM          | 119NM | 206NM | 0NM   |
| 0NM                             | 0NM   | 0NM   | 0NM   | 48NM          | 83NM  | 136NM | 0NM   |
| AVERAGE FORECAST ERROR          | 0KTS  | 0KTS  | 0KTS  | 7KTS          | 11KTS | 18KTS | 0KTS  |
| AVERAGE RIGHT ANGLE ERROR       | 0KTS  | 0KTS  | 0KTS  | -3KTS         | -0KTS | 2KTS  | 0KTS  |
| AVERAGE MAGNITUDE OF WIND ERROR | 0     | 0     | 0     | 21            | 19    | 17    | 0     |
| AVERAGE BIAS OF WIND ERROR      | 0     | 0     | 0     | 0             | 0     | 0     | 0     |
| NUMBER OF FORECASTS             | 0     | 0     | 0     | 0             | 0     | 0     | 0     |

TROPICAL CYCLONE 25-75  
2000Z 05 MAY TO 0800Z 08 MAY

| BEST TRACK                      |             |       |             | WARNING |       |       |               | 24 HOUR FORECAST |      |        |             | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|---------------------------------|-------------|-------|-------------|---------|-------|-------|---------------|------------------|------|--------|-------------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT                           | WIND        | POSIT | WIND        | ERRORS  | POSIT | WIND  | ERRORS        | POSIT            | WIND | ERRORS | POSIT       | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 051800Z                         | 14.3N 94.9E | 35    | 15.2N 93.8E | 40      | 83    | 5     | 18.9N 92.2E   | 55               | 192  | -20    | 23.0N 93.0E | 20               | 347    | -20   | --   | --               | --    | --   | --     |
| 060000Z                         | 14.8N 94.4E | 40    | --          | --      | --    | --    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 060600Z                         | 15.1N 93.9E | 50    | 15.5N 93.9E | 45      | 24    | -5    | 18.0N 92.7E   | 55               | 98   | -15    | 21.3N 92.3E | 55               | 308    | 35    | --   | --               | --    | --   | --     |
| 061200Z                         | 15.4N 93.5E | 65    | --          | --      | --    | --    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 061800Z                         | 15.8N 93.1E | 75    | 15.9N 93.0E | 50      | 8     | -25   | 17.8N 91.6E   | 55               | 194  | 15     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 070000Z                         | 16.3N 93.2E | 75    | --          | --      | --    | --    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 070600Z                         | 16.6N 93.6E | 70    | 16.6N 93.3E | 65      | 17    | -5    | 18.9N 92.7E   | 75               | 249  | 55     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 071200Z                         | 17.0N 94.2E | 65    | --          | --      | --    | --    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 071800Z                         | 17.5N 95.0E | 40    | 17.3N 94.2E | 60      | 47    | 20    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 080000Z                         | 18.1N 96.0E | 25    | --          | --      | --    | --    | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| 080600Z                         | 18.8N 97.1E | 20    | 18.9N 97.4E | 25      | 18    | 5     | --            | --               | --   | --     | --          | --               | --     | --    | --   | --               | --    | --   | --     |
| TYPHOONS WHILE WIND OVER 35KTS  |             |       |             |         |       |       |               |                  |      |        |             |                  |        |       |      |                  |       |      |        |
| WARNING                         |             |       |             | 24-HR   | 48-HR | 72-HR | ALL FORECASTS |                  |      |        |             |                  |        |       |      |                  |       |      |        |
| AVERAGE FORECAST ERROR          |             |       |             | 0NM     | 0NM   | 0NM   | WARNING       |                  |      |        | 24-HR       | 48-HR            | 72-HR  |       |      |                  |       |      |        |
| AVERAGE RIGHT ANGLE ERROR       |             |       |             | 0NM     | 0NM   | 0NM   | 32NM          |                  |      |        | 16NM        | 16NM             | 32NM   | 0NM   |      |                  |       |      |        |
| AVERAGE MAGNITUDE OF WIND ERROR |             |       |             | 0KTS    | 0KTS  | 0KTS  | 11NM          |                  |      |        | 11NM        | 11NM             | 305NM  | 0NM   |      |                  |       |      |        |
| AVERAGE BIAS OF WIND ERROR      |             |       |             | 0KTS    | 0KTS  | 0KTS  | 11KTS         |                  |      |        | 11KTS       | 11KTS            | 28KTS  | 0KTS  |      |                  |       |      |        |
| NUMBER OF FORECASTS             |             |       |             | 0       | 0     | 0     | -1KTS         |                  |      |        | 6           | 4                | 2      | 0     |      |                  |       |      |        |

TROPICAL CYCLONE 28-75  
2000Z 20 OCT TO 0800Z 22 OCT

| BEST TRACK                      |             |       |             | WARNING |       |       |               | 24 HOUR FORECAST |      |        |       | 48 HOUR FORECAST |        |       |      | 72 HOUR FORECAST |       |      |        |
|---------------------------------|-------------|-------|-------------|---------|-------|-------|---------------|------------------|------|--------|-------|------------------|--------|-------|------|------------------|-------|------|--------|
| POSIT                           | WIND        | POSIT | WIND        | ERRORS  | POSIT | WIND  | ERRORS        | POSIT            | WIND | ERRORS | POSIT | WIND             | ERRORS | POSIT | WIND | ERRORS           | POSIT | WIND | ERRORS |
| 201800Z                         | 19.4N 68.9E | 35    | 19.9N 69.9E | 35      | 64    | 0     | 21.4N 67.5E   | 35               | 83   | -35    | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 210000Z                         | 19.5N 68.6E | 40    | --          | --      | --    | --    | --            | --               | --   | --     | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 210600Z                         | 19.6N 68.3E | 50    | 19.8N 67.8E | 40      | 31    | -10   | 19.9N 66.2E   | 45               | 193  | -35    | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 211200Z                         | 19.8N 68.2E | 60    | --          | --      | --    | --    | --            | --               | --   | --     | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 211800Z                         | 20.3N 68.4E | 70    | 20.7N 68.4E | 55      | 24    | -15   | --            | --               | --   | --     | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 220000Z                         | 20.8N 68.8E | 80    | --          | --      | --    | --    | --            | --               | --   | --     | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| 220600Z                         | 21.5N 69.2E | 80    | 21.4N 69.1E | 85      | 8     | 5     | --            | --               | --   | --     | --    | --               | --     | --    | --   | --               | --    | --   | --     |
| TYPHOONS WHILE WIND OVER 35KTS  |             |       |             |         |       |       |               |                  |      |        |       |                  |        |       |      |                  |       |      |        |
| WARNING                         |             |       |             | 24-HR   | 48-HR | 72-HR | ALL FORECASTS |                  |      |        |       |                  |        |       |      |                  |       |      |        |
| AVERAGE FORECAST ERROR          |             |       |             | 0NM     | 0NM   | 0NM   | WARNING       |                  |      |        | 24-HR | 48-HR            | 72-HR  |       |      |                  |       |      |        |
| AVERAGE RIGHT ANGLE ERROR       |             |       |             | 0NM     | 0NM   | 0NM   | 32NM          |                  |      |        | 16NM  | 16NM             | 0NM    | 0NM   |      |                  |       |      |        |
| AVERAGE MAGNITUDE OF WIND ERROR |             |       |             | 0KTS    | 0KTS  | 0KTS  | 26NM          |                  |      |        | 96NM  | 0NM              | 0NM    | 0NM   |      |                  |       |      |        |
| AVERAGE BIAS OF WIND ERROR      |             |       |             | 0KTS    | 0KTS  | 0KTS  | 8KTS          |                  |      |        | 8KTS  | 95KTS            | 0KTS   | 0KTS  |      |                  |       |      |        |
| NUMBER OF FORECASTS             |             |       |             | 0       | 0     | 0     | -5KTS         |                  |      |        | 4     | 2                | 0      | 0     |      |                  |       |      |        |

TROPICAL CYCLONE 29-75  
2000Z 07 NOV TO 0800Z 12 NOV

|         | BEST TRACK |       |    | WARNING |       |    | 24 HOUR FORECAST |       |    | 48 HOUR FORECAST |       |    | 72 HOUR FORECAST |       |    |
|---------|------------|-------|----|---------|-------|----|------------------|-------|----|------------------|-------|----|------------------|-------|----|
|         | POSIT      | WIND  |    | POSIT   | WIND  |    | POSIT            | WIND  |    | POSIT            | WIND  |    | POSIT            | WIND  |    |
| 071800Z | 14.1N      | 83.4E | 35 | 14.6N   | 83.0E | 30 | 16.1N            | 80.1E | 30 | 18.0N            | 78.1E | 20 | 18.0N            | 78.1E | 20 |
| 080000Z | 14.6N      | 82.7E | 35 | 14.6N   | 81.8E | 40 | 15.7N            | 79.9E | 30 | 16.7N            | 78.0E | 20 | 16.7N            | 78.0E | 20 |
| 080600Z | 15.2N      | 82.2E | 35 | 14.9N   | 81.8E | 40 | 15.7N            | 79.9E | 30 | 16.7N            | 78.0E | 20 | 16.7N            | 78.0E | 20 |
| 081200Z | 16.1N      | 82.3E | 35 | 14.9N   | 81.8E | 40 | 15.7N            | 79.9E | 30 | 16.7N            | 78.0E | 20 | 16.7N            | 78.0E | 20 |
| 081800Z | 16.8N      | 82.9E | 40 | 16.3N   | 81.5E | 35 | 17.9N            | 79.4E | 20 | 18.0N            | 78.1E | 20 | 18.0N            | 78.1E | 20 |
| 090000Z | 17.4N      | 83.0E | 40 | 17.7N   | 85.3E | 35 | 18.6N            | 86.1E | 45 | 19.6N            | 86.8E | 55 | 19.6N            | 86.8E | 55 |
| 090600Z | 17.7N      | 84.5E | 40 | 17.7N   | 85.3E | 35 | 18.6N            | 86.1E | 45 | 19.6N            | 86.8E | 55 | 19.6N            | 86.8E | 55 |
| 091200Z | 18.0N      | 85.3E | 45 | 18.0N   | 86.1E | 35 | 20.8N            | 88.1E | 35 | 22.7N            | 90.4E | 30 | 22.7N            | 90.4E | 30 |
| 091800Z | 18.3N      | 85.9E | 45 | 18.0N   | 86.1E | 35 | 20.8N            | 88.1E | 35 | 22.7N            | 90.4E | 30 | 22.7N            | 90.4E | 30 |
| 100000Z | 18.6N      | 86.0E | 50 | 18.3N   | 86.1E | 35 | 20.8N            | 88.1E | 35 | 22.7N            | 90.4E | 30 | 22.7N            | 90.4E | 30 |
| 100600Z | 19.1N      | 87.5E | 50 | 19.1N   | 87.9E | 45 | 20.9N            | 90.1E | 45 | 22.4N            | 92.6E | 30 | 22.4N            | 92.6E | 30 |
| 101200Z | 19.7N      | 88.4E | 45 | 20.3N   | 89.4E | 45 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 101800Z | 20.3N      | 89.0E | 45 | 20.3N   | 89.4E | 45 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 110000Z | 20.9N      | 89.7E | 40 | 20.5N   | 88.6E | 45 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 110600Z | 21.5N      | 90.4E | 40 | 20.5N   | 88.6E | 45 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 111200Z | 22.1N      | 90.9E | 35 | 21.9N   | 90.7E | 45 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 111800Z | 22.5N      | 91.3E | 35 | 21.9N   | 90.7E | 45 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 120000Z | 22.9N      | 91.6E | 30 | 22.3N   | 91.6E | 35 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |
| 120600Z | 23.3N      | 91.8E | 25 | 22.3N   | 91.6E | 35 | 22.5N            | 92.2E | 35 | 23.1N            | 92.5E | 35 | 23.1N            | 92.5E | 35 |

|                                 | TYPHOONS WHILE WIND OVER 35KTS |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|--------------------------------|-------|-------|-------|---------------|-------|-------|-------|
|                                 | WARNING                        | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 0NM                            | 0NM   | 0NM   | 0NM   | 50NM          | 142NM | 271NM | 0NM   |
| AVERAGE RIGHT ANGLE ERROR       | 0NM                            | 0NM   | 0NM   | 0NM   | 27NM          | 18NM  | 133NM | 0NM   |
| AVERAGE MAGNITUDE OF WIND ERROR | 0KTS                           | 0KTS  | 0KTS  | 0KTS  | 6KTS          | 9KTS  | 16KTS | 0KTS  |
| AVERAGE BIAS OF WIND ERROR      | 0KTS                           | 0KTS  | 0KTS  | 0KTS  | 0KTS          | -6KTS | -8KTS | 0KTS  |
| NUMBER OF FORECASTS             | 0                              | 0     | 0     | 0     | 10            | 8     | 5     | 0     |

TROPICAL CYCLONE 33-75  
0800Z 25 NOV TO 0800Z 01 DEC

|         | BEST TRACK |       |    | WARNING |       |    | 24 HOUR FORECAST |       |    | 48 HOUR FORECAST |       |    | 72 HOUR FORECAST |       |    |
|---------|------------|-------|----|---------|-------|----|------------------|-------|----|------------------|-------|----|------------------|-------|----|
|         | POSIT      | WIND  |    | POSIT   | WIND  |    | POSIT            | WIND  |    | POSIT            | WIND  |    | POSIT            | WIND  |    |
| 250600Z | 12.0N      | 83.8E | 35 | 12.4N   | 84.0E | 35 | 14.0N            | 83.4E | 40 | 16.1N            | 84.1E | 50 | 17.5N            | 85.1E | 50 |
| 251200Z | 12.1N      | 82.9E | 35 | 12.4N   | 84.0E | 35 | 14.0N            | 83.4E | 40 | 16.1N            | 84.1E | 50 | 17.5N            | 85.1E | 50 |
| 251800Z | 12.2N      | 82.9E | 35 | 13.5N   | 81.9E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 260000Z | 12.5N      | 81.0E | 35 | 13.5N   | 81.9E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 260600Z | 12.8N      | 80.2E | 40 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 261200Z | 13.2N      | 80.0E | 30 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 261800Z | 13.4N      | 80.1E | 30 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 270000Z | 13.9N      | 80.5E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 270600Z | 14.6N      | 81.5E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 271200Z | 15.2N      | 82.4E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 271800Z | 15.8N      | 83.5E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 280000Z | 16.1N      | 84.7E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 280600Z | 16.0N      | 85.9E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 281200Z | 15.8N      | 86.9E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 281800Z | 15.2N      | 87.6E | 35 | 13.8N   | 80.2E | 35 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 | 17.2N            | 80.0E | 20 |
| 290000Z | 14.4N      | 88.0E | 35 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 290600Z | 13.6N      | 88.1E | 35 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 291200Z | 12.9N      | 88.2E | 35 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 291800Z | 12.3N      | 88.1E | 35 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 300000Z | 11.7N      | 87.7E | 30 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 300600Z | 11.6N      | 86.8E | 30 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 301200Z | 12.5N      | 86.6E | 25 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 301800Z | 13.4N      | 86.4E | 25 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 010000Z | 14.6N      | 85.9E | 20 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |
| 010600Z | 15.6N      | 85.4E | 20 | 13.7N   | 90.5E | 35 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 | 14.2N            | 93.7E | 45 |

|                                 | TYPHOONS WHILE WIND OVER 35KTS |       |       |       | ALL FORECASTS |       |       |       |
|---------------------------------|--------------------------------|-------|-------|-------|---------------|-------|-------|-------|
|                                 | WARNING                        | 24-HR | 48-HR | 72-HR | WARNING       | 24-HR | 48-HR | 72-HR |
| AVERAGE FORECAST ERROR          | 0NM                            | 0NM   | 0NM   | 0NM   | 98NM          | 243NM | 175NM | 0NM   |
| AVERAGE RIGHT ANGLE ERROR       | 0NM                            | 0NM   | 0NM   | 0NM   | 65NM          | 187NM | 5NM   | 0NM   |
| AVERAGE MAGNITUDE OF WIND ERROR | 0KTS                           | 0KTS  | 0KTS  | 0KTS  | 3KTS          | 15KTS | 15KTS | 0KTS  |
| AVERAGE BIAS OF WIND ERROR      | 0KTS                           | 0KTS  | 0KTS  | 0KTS  | 3KTS          | 10KTS | 15KTS | 0KTS  |
| NUMBER OF FORECASTS             | 0                              | 0     | 0     | 0     | 6             | 4     | 1     | 0     |

# APPENDIX

## ABBREVIATIONS, ACRONYMS AND DEFINITIONS

Abbreviations, acronyms and definitions which apply for the purpose of this report.

WMO

World Meteorological Organization

### 1. ABBREVIATIONS AND ACRONYMS

|                |                                                                           |
|----------------|---------------------------------------------------------------------------|
| AC&W           | Aircraft Control and Warning                                              |
| AIREP          | Aircraft Weather Reports (Commercial and Military)                        |
| AJTWC          | Alternate Joint Typhoon Warning Center                                    |
| APT            | Automatic Picture Transmission                                            |
| AWN            | Automatic Weather Network                                                 |
| AWS            | Air Weather Service                                                       |
| CINCPAC        | Commander in Chief Pacific                                                |
| CINCPACAF      | Commander in Chief Pacific Air Force                                      |
| CINCPACFLT     | Commander in Chief U. S. Pacific Fleet                                    |
| CDRUSACSG      | Commander, U. S. Army CINCPAC Support Group                               |
| DMSP           | Defense Meteorological Satellite Program                                  |
| ENVPREDRSCHFAC | Environmental Prediction Research Facility                                |
| FLEWEACEN/JTWC | Fleet Weather Central/ Joint Typhoon Warning Center                       |
| NAVWEASERVCOM  | Naval Weather Service Command                                             |
| NESS           | National Environmental Satellite Service                                  |
| NOAA/NWS       | National Oceanic and Atmospheric Administration, National Weather Service |
| PACOM          | Pacific Command                                                           |
| SLP (MSLP)     | Sea Level Pressure (Minimum Sea Level Pressure)                           |
| TCARC          | Tropical Cyclone Aircraft Reconnaissance Coordinator                      |
| TC             | Tropical Cyclone                                                          |
| TD             | Tropical Depression                                                       |
| TS             | Tropical Storm                                                            |
| TY             | Typhoon                                                                   |

### 2. DEFINITIONS

**ALTERNATE JOINT TYPHOON WARNING CENTER-** The AJTWC is Detachment 17/Asian Tactical Forecast Unit, 20th Weather Squadron, Yokota AB, Japan with assistance from the Naval Weather Service Facility, Yokosuka, Japan.

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

**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 implication 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, over water, in a cyclone averaged over a 1-minute period of time. Wind speed is subject to gusts which bring a sudden temporary increase in speed (i.e., on the order of a few seconds). Peak gusts over water average 20 to 25 percent higher than the sustained 1-minute wind speed.

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

**SUSPICIOUS AREA-**An area suspected of containing a developing or existing tropical cyclone.

**TROPICAL CYCLONE-A** nonfrontal low pressure system of synoptic scale developing over tropical or subtropical waters and having 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 nonfrontal migratory character, and having maintained its identity for 24 hr 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, storm or typhoon.

TROPICAL STORM-A warm-core tropical cyclone in which the maximum sustained surface wind (1-minute mean) ranges from 34 to 63 kt inclusive.

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

SUPER TYPHOON-A warm core tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 130 kt or greater.

WALL CLOUD-An organized band of cumuliiform clouds immediately surrounding the central area of a tropical cyclone.

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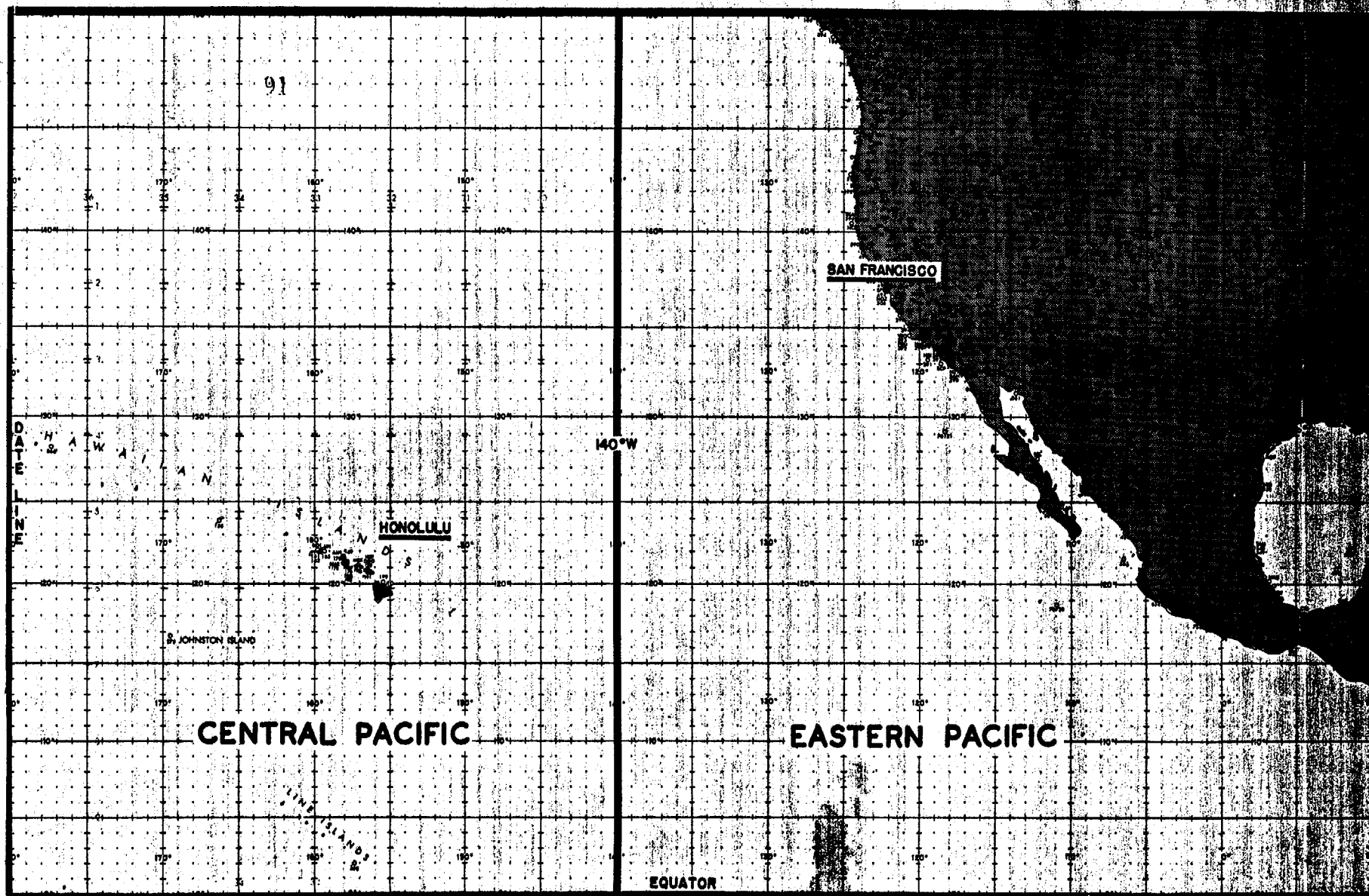
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**Areas of Responsibility - Central and Eastern Pacific Hurricane Centers**

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**THE WORST TYPHOON** yet recorded, according to Detachment 1, is Weather Wing officials of Nimitz Hill, Guam, is Typhoon June. This "superphoon" attained maximum winds estimated at 160 knots and had a record low sea-level pressure of 876 millibars. June passed within 200 nautical miles of Guam on Nov. 19, 1975, lashing the small island with galeforce winds and high seas. June was watched by the Defense Meteorological Satellite Program and the 54th Weather Reconnaissance Squadron, which flew out of Andersen AFB, Guam. (DMSF photo courtesy of Det. 1, 1WW)