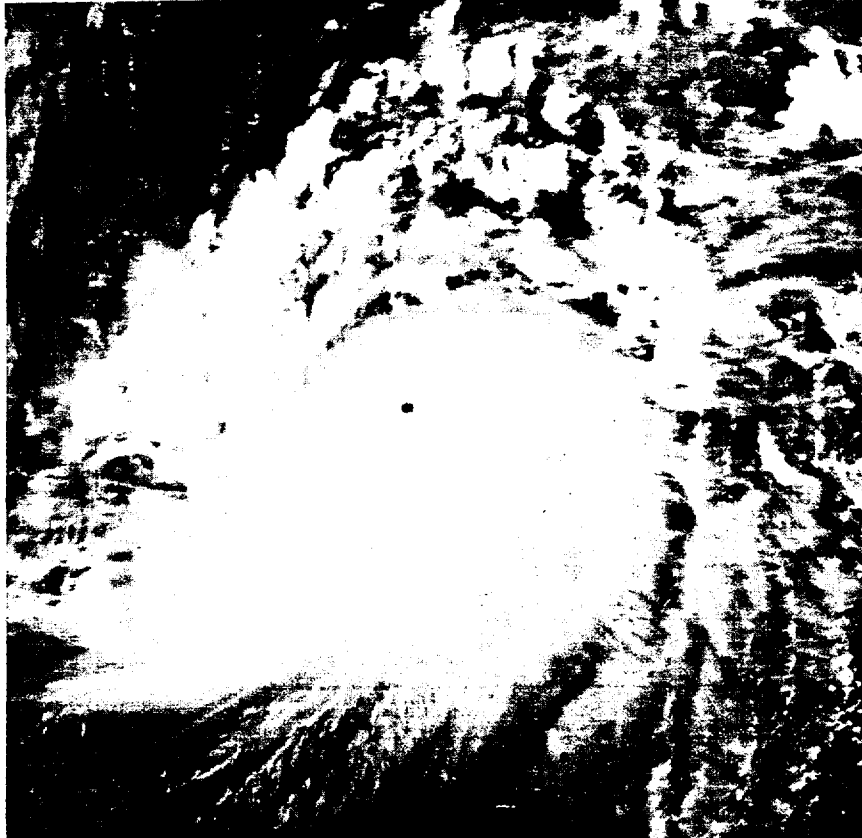


"BEST TRACK" — DEAN SPENCER

ANNUAL TYPHOON Report



Paul R



1973



FLEET WEATHER CENTRAL/JOINT TYPHOON WARNING CENTER
Guam, Mariana Islands

SEE EDGE INDEX
ON BACK COVER



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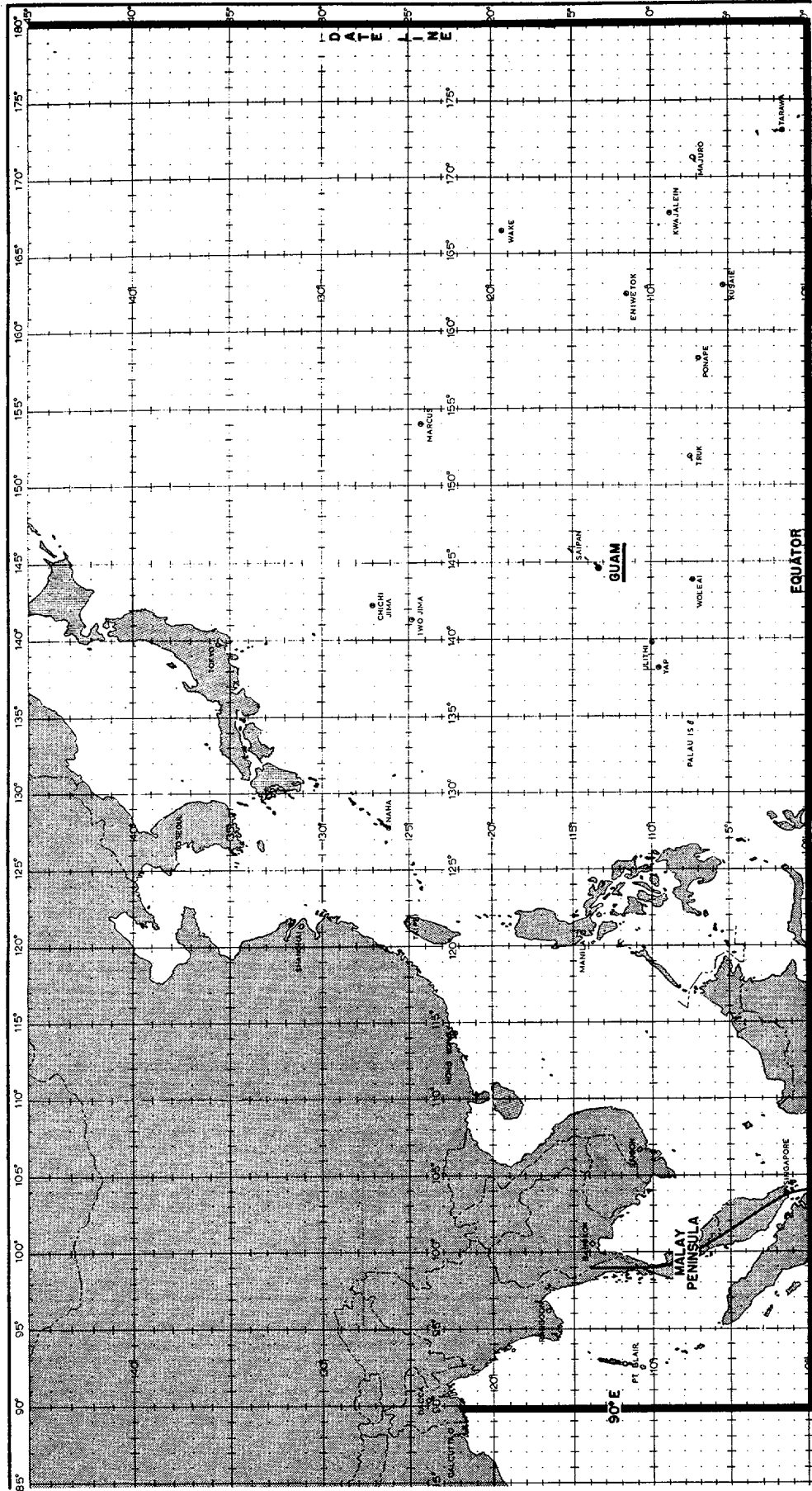
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The body of this annual report summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to 140 degrees west, and Annex B summarizes tropical cyclones in the Bay of Bengal. The eastern North Pacific tropical cyclone summary has been discontinued beginning with the 1973 season; the U.S. National Weather Service will assume responsibility for publication of this summary in Mariner's Weather Log and Pilot Charts.

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 Primary (180° West to Malay Peninsula) Secondary (Malay Peninsula West to 90°E)

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1973
ANNUAL TYPHOON REPORT

FOREWORD

The body of this annual report summarizes western North Pacific tropical cyclones. Annex A summarizes tropical cyclones in the central North Pacific from 180° eastward to 140°W, and Annex B summarizes tropical cyclones in the Bay of Bengal. The eastern North Pacific tropical cyclone summary has been discontinued beginning with the 1973 season; the U.S. National Weather Service will assume responsibility for publication of this summary in Mariner's Weather Log and Pilot Charts.

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

1. Provide warnings to U.S. Government agencies for all tropical cyclones north of the equator and west of 180° longitude to the coast of Asia and the Malay Peninsula;
2. Provide warnings for the area north of the equator from the Malay Peninsula west to 90°E;
3. Determine tropical cyclone reconnaissance requirements and assign priorities;
4. Conduct investigative and post-analysis programs including preparation of the Annual Typhoon Report; and
5. Conduct tropical cyclone analysis and forecasting research.

Asian Tactical Forecast Center, Fuchu (formerly Air Force Asian Weather Central), coordinating with the Naval Weather Service Environmental Detachment, Yokosuka, is designated as the alternate JTWC in case of the incapacitation of FLEWEACEN/JTWC Guam.

The JTWC is an integral part of FLEWEACEN Guam and is manned by four officers and five enlisted men each from the Navy and Air Force. The senior Air Force officer is designated as Director, JTWC.

The western North Pacific Tropical Cyclone Warning System consists of the Joint Typhoon Warning Center and the U.S. Air Force 54th Weather Reconnaissance Squadron stationed at Andersen Air Force Base, Guam.

The Central Pacific Hurricane Center, Honolulu, is responsible for the area from 180° eastward to 140°W and north of the equator. Warnings are issued in coordination with FLEWEACEN Pearl Harbor and the Air Force Central Pacific Forecast Center, Hickam Air Force Base, Hawaii.

CINCPACFLT, CINCUSARPAC, 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

I. GENERAL

Services provided by the Joint Typhoon Warning Center (JTWC) include forecasts of tropical cyclone formation, location, intensity, direction and speed of movement, and horizontal extent of critical wind speeds. This information was disseminated in 1973 by: (1) Tropical Cyclone Formation Alerts issued when formation of a tropical cyclone was anticipated; (2) Tropical Cyclone Warnings issued four times daily whenever a significant tropical cyclone was observed in the JTWC primary area; and (3) Tropical Cyclone Warnings issued twice daily whenever a significant tropical cyclone was observed in the JTWC secondary area.

FLEWEACEN Guam provides manual and computerized meteorological/oceanographic products for the JTWC. Communications support is furnished by the Nimitz Hill Message Center of the Naval Communications Station, Guam.

2. ANALYSES AND DATA SOURCES

a. FLEWEACEN GUAM ANALYSES:

(1) Surface mercator analysis, Northern and Southern Hemispheres, western Pacific and Indian Ocean areas; 0000Z, 0600Z, 1200Z, and 1800Z.

(2) Gradient streamline analysis of Asia and the western Pacific; 0000Z and 1200Z.

(3) Surface meso-analysis of the South China Sea region; 0000Z and 1200Z.

(4) Composite surface analysis of the Indian Ocean area; twice daily.

(5) Sea surface temperature charts; daily.

b. JTWC ANALYSES:

(1) Gradient level (3,000 feet) streamline analysis (south of 20°N) and isobaric analysis (north of 20°N); 0000Z and 1200Z.

(2) 700-mb and 500-mb, contour and streamline analysis; 0000Z and 1200Z.

(3) A composite upper tropospheric streamline analysis utilizing rawinsonde data from 250-mb to 150-mb and AIREPS at or above 29,000 feet; 0000Z and 1200Z.

(4) Reconnaissance data. Observations from weather reconnaissance aircraft are plotted on large-scale sectional charts.

(5) Time cross sections of selected tropical stations.

(6) Additional and more frequent sectional analyses similar to those above during periods of tropical cyclone activity.

c. SATELLITE DATA:

Satellite data, especially DMSP (formerly DAPP) satellite imagery, played a major role in the early detection of tropical cyclones in 1973. This aspect, as well as applications of satellite data to tropical cyclone tracking, is discussed in Chapter II.

d. RADAR:

Land radar reports, when available, were used for tracking tropical cyclones during the 1973 season. Once a storm moved within range of a land radar site, reports were usually received hourly. Use of radar during 1973 is treated in Chapter II.

e. COMPUTER PRODUCTS:

Use of the varian plotter by the FLEWEACEN Guam computer center during 1973 eliminated a significant portion of the JTWC hand plotting effort. Varian charts are produced routinely at synoptic times for the surface, 850-mb, 700-mb, and 500-mb levels. Additionally, a chart of the upper tropospheric circulation is produced. This chart uses 200-mb rawinsonde data and AIREPS above 33,000 feet and within six hours of the 0000Z and 1200Z synoptic times. Data not in the proper format for the computer are hand plotted on the charts. These include pibal gradient level winds, low cloud movement, and missing or late synoptic reports necessary for a detailed analysis.

In addition, the standard array of synoptic-scale computer analyses and prognostic charts from the Fleet Numerical Weather Central at Monterey, California are available.

JTWC utilized extensively the FLEWEACEN Guam computer center for objective typhoon forecasts and for statistical post analysis.

3. FORECAST AIDS

a. CLIMATOLOGY:

Various climatological publications listed in the Annual Typhoon Report, 1972 (FWC/JTWC) were utilized in addition to those received recently which include:

(1) Tropical Cyclone Climatology for the China Seas and Western Pacific from 1884 to 1970 (Royal Observatory, Hong Kong, 1972).

(2) North Pacific Tropical Cyclone Vector Mean Charts (Crutcher, H. L., 1973).

(3) North Indian Tropical Cyclone Vector Mean Charts (Crutcher, H. L. and Nicodemus, M. L., 1973).

(4) A Climatology of Typhoon and Tropical Storm Tracks Arranged by Month and Point of Origin (Ocean Data Systems, Incorporated, 1973).

(5) Tropical Cyclones of the North Indian Ocean (Sadler and Gidley, 1973) ENVPREDRSCHFAC Tech Paper No. 2-73.

(6) The Typhoon Analog Computer Program (TYFOON) described in the 1972 Typhoon Analog Program (TYFOON-72).

b. EXTRAPOLATION:

Extrapolation of storm movement using 12-hour mean speed and direction was the most reliable objective method for both 24- and 48-hour forecasts. Forecasts are determined by simple linear extrapolation using the 12-hour old best track position and the current warning position.

c. OBJECTIVE TECHNIQUES:

During 1973, the following objective forecasting methods were employed:

(1) ARAKAWA - Regression forecasts derived from surface pressure grid values.

(2) MOHATT (Modified HATRACK) - Steering by geostrophic winds derived from smoothed height fields at 850-mb and 700-mb levels modified by 12-hour history inputs.

(3) TYMOD - Program selects best steering level using global band upper air fields (GBUA) from PLENUMWEACEN Monterey modified by 12- or 24-hour history inputs.

(4) TYFOON - Analog weighted mean track.

4. FORECASTING PROCEDURES

a. TRACK FORECASTING:

An initial track based on persistence blended subjectively with climatology is developed for a 3-day period. This initial track is subjectively modified by the following:

(1) Recent steering is evaluated by considering the latest upper air analyses as representative of the average upper air flow over the past 24 hours. (The latest upper air analyses are about 12 hours old, thus roughly representing the mid-point of the last 24-hour time interval). By this technique, actual past 24-hour movement serves to indicate the best steering level as well as the effectiveness of steering.

(2) Objective techniques are considered, with the techniques being ranked according to their past performance on similar storms.

(3) Twenty-four hour height change analyses are evaluated for forecast track/speed changes (Hoover, Devices for Forecasting Movement of Hurricanes, Manuscript of U.S. Weather Bureau, 1957).

(4) The prospects of recurvature are evaluated for all westward moving storms. The basic requisites for this evaluation are accurate continuity on mid-latitude troughs and numerical progs to indicate changes in amplitude or movement. Relative position and strength of the subtropical ridge and northward tendency due

to internal forces are also important considerations.

(5) Finally, a check is made against climatology to ascertain the likelihood of the forecast. If the forecast track is climatologically unusual, a reappraisal of the forecast rationale is conducted and adjustment made if warranted.

b. INTENSITY FORECASTING:

For intensity forecasting, heavy reliance is placed on short term trends, climatology, and the satellite interpretation model developed by Mr. Vernon Dvorak of the National Environmental Satellite Service. After these initial inputs, further factors considered are upper tropospheric evaporation and possible terrain influence.

5. WARNINGS

Tropical cyclone warnings are numbered sequentially. If warnings are discontinued and the storm reintensifies, as Typhoons Dot, Ellen, and Patsy did this year, 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 to indicate it is an amended warning. Forecast positions are issued at 0000Z, 0600Z, 1200Z, and 1800Z. The forecast periods are 12-hr and 24-hr for tropical depressions and 12-hr, 24-hr, 48-hr, and 72-hr for typhoons and tropical storms.

Forecast periods are stated with respect to warning time. Thus, a 24-hour forecast verified 26 1/2 hour after the aircraft fix data, 30 hours after the latest surface synoptic chart, and 30 or 36 hours after the latest upper air charts.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of results from 1973 is presented in Chapter V.

6. PROGNOSTIC REASONING MESSAGE

Whenever warnings on typhoons and tropical storms are being issued, a prognostic reasoning message is released at 0000Z and 1200Z. This message is intended to provide the field meteorologist with the reasoning behind the latest JTWC forecasts.

7. TROPICAL WEATHER SUMMARY

This message is issued daily from 1 May through 31 December and otherwise when tropical cyclone formation is forecast or observed. It is issued at 0600Z and describes the location, intensity, and likelihood of development of all tropical low pressure areas including upper tropospheric lows and significant cloud masses detected by satellite.

8. TROPICAL CYCLONE FORMATION ALERT

Alerts are issued when the formation of a tropical cyclone is anticipated. These messages are issued as required and are valid for up to 24 hours unless cancelled, superseded, or extended.

CHAPTER II — RECONNAISSANCE & COMMUNICATION

1. GENERAL

The Tropical Cyclone Warning Service depends on reconnaissance to fix the location and determine the intensity of tropical cyclones. Due to the vastness of the warning area and the scarcity of reporting stations, land and ship reports are not sufficient for these determinations. In the past, aircraft reconnaissance was used almost exclusively to determine position and intensity. With the increasing satellite capability during the last several years, satellite derived data have assumed greater importance. During the past season Defense Meteorological Satellite Program (DMSP) data were used for positioning and intensity estimates approximately one-fourth of the time.

2. RECONNAISSANCE RESPONSIBILITY AND SCHEDULING

Aircraft weather reconnaissance is performed in the JTWC area of responsibility by the 54th Weather Reconnaissance Squadron (54 WRS). The squadron, equipped with nine WC-130 aircraft, is located at Andersen Air Force Base, Guam. The JTWC reconnaissance requirements are sent daily to the Tropical Cyclone Reconnaissance Coordinator. These requirements include areas to be investigated, forecast position of cyclones to be fixed, and standard synoptic tracks to be flown.

Four fixes per day, at six-hourly intervals, are required (CINCPACINST 3140.1L) on all significant tropical cyclones in the JTWC primary area of responsibility (see inside front cover). Two fixes per day are required in the secondary area. During the past season, extensive use was made of the Selective Reconnaissance Program (SRP) to fulfill these requirements.

The SRP was implemented in 1972 to alleviate pressure on overtaxed aircraft reconnaissance assets. The SRP attempts to optimize the entire reconnaissance system by using each reconnaissance platform (aircraft, satellite, and surface radar) under optimum conditions whenever possible. Various factors are considered in selecting which reconnaissance platform to use for any warning, e.g., the cyclone's location and stage of development, the DMSP satellite times and areal coverage, availability of land radar reports, the cyclone's threat to specific U.S. interests, aircraft operational limitations (e.g., one fix versus two fix missions), etc.

Aircraft reconnaissance continues to be the best method for determining tropical cyclone position, intensity, and structure (i.e., radius of wind speeds of various intensities). Only the aircraft can provide direct measurements of height, temperature, and wind at flight altitude, sea level pressure, and other parameters. The aircraft also provides much greater flexibility in time and space compared to the other platforms. DMSP satellites provide day and night coverage of the JTWC area of responsibility. DMSP satellite imagery provides

estimates of cyclone positions and, for day-time passes, estimates of intensities using the Dvorak technique (NOAA TECHNICAL MEMORANDUM, NESS-45). In addition, satellite data used in conjunction with conventional data can provide estimates of the radii of various wind speeds. The primary disadvantages of satellites is that the coverage is often not timely for warning purposes and the satellite provides no direct measurements of parameters closely related to tropical cyclone intensity. Land radar provides useful positioning data when tropical cyclones are located near the Republic of the Philippines, Hong Kong, Taiwan, or Japan (including the Ryukyus or other islands). It does not, however, provide measurements or estimates of tropical cyclone intensity or structure. The following sections summarize the JTWC utilization of the various reconnaissance platforms during 1973.

3. AIRCRAFT RECONNAISSANCE EVALUATION CRITERIA

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

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

(1) Made not earlier than 1/2 hour before to 1 hour after scheduled fix time.

(2) Aircraft in area requested by scheduled fix time, but unable to locate a 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 restriction, radar fixes are acceptable.

b. Levied 6-Hourly fixes made outside the above limits are scored as follows:

(1) Early - fix made within the interval from 3 hours to 1/2 hour prior to levied fix time. No credit given for early fixes made within 1 1/2 hours of the previous fix.

(2) Late - fix made within the interval from 1 hour to 3 hours after levied fix time.

c. When 3-Hourly fixes are levied, they must satisfy the time criteria of paragraph one in order to be classified as made on time. Three-Hourly fixes made that do not meet the above criteria are classified as follows:

(1) Early - fix made within the interval from 1 1/2 hours to 1/2 hour prior to levied fix time.

(2) Late - fix made within the interval from 1 hour to 1 1/2 hours after levied fix time.

d. Fixes not meeting the criteria of paragraphs one, two, and three are scored as missed. Requirements levied with less than 24 hours notification, if missed, are counted as unfulfilled. If the squadron is in an alert posture, the fix is scored as missed vice unfulfilled.

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

- (1) Sixteen hours plus estimated time enroute after an alert aircraft and crew are levied; or
- (2) Four hours plus estimated time enroute after the DTG of the 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) Aircraft must be within 250nm of the levied investigative point by the specified time.
- (2) The specified flight level 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 when within 250nm of the investigative point.
- (4) Observations are required in all quadrants unless a concentrated investigation in one or more quadrants has been specified.
- (5) Specified investigative track must be flown.
- (6) Aircraft must contact JTWC before terminating the investigative.

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

- (1) Late - aircraft is within 250nm of the investigative point after the specified time, but prior to the specified time plus 2 hours.
- (2) Missed - aircraft fails to be within 250nm of the investigative point by the specified time plus 2 hours.

h. Requirements levied as "resources permitting" are not evaluated.

4. AIRCRAFT RECONNAISSANCE SUMMARY

There were 362 required six-hourly fixes in 1973, representing a record low since establishment of the JTWC. Of the 362 required fixes, 227 or 62.4% were levied upon aircraft. The remaining required fixes were satisfied by satellite, radar, extrapolation, or synoptic data. The SRP made it possible, when there was a choice between aircraft, radar, or satellite, to reduce the aircraft levy. By employing SRP, 45 fixes were levied upon satellite or radar, a savings of 16.5% in the use of aircraft. In addition to the 227 fixes, 28 investigatives were also levied on aircraft.

This total aircraft levy is only 38% of the average levy from 1965 through 1973. The mean deviation from the best track for all aircraft fixes was 16nm. This is a 2nm decrease from the average deviation for the past 3 years.

The total of 227 fixes levied does not include intermediate fixes, which averaged 131 for the past two years. The decrease in the number of intermediate fixes -- 182 in 1971, 81 in 1972, and none in 1973 -- and investigatives -- 179 in 1971, 81 in 1972, and 28 in 1973 -- during the past three years resulted from a CINCPAC request to reduce intermediate fixes and the application of the DMSP satellite data (Section 6).

Table 2-1 summarizes reconnaissance effectiveness. Using the scoring criteria in Section 3, the 13 missed plus unfulfilled fixes, or 5.7% of the total levied fixes, represent a significant decrease from the previous two year average of 13.9%. The percentage of late and early fixes rose from 10.6% in 1972 to 15.3% in 1973.

	NUMBER OF LEVIED FIXES	PERCENT
Completed on time	179	79.0
Early	4	1.7
Late	31	13.6
Missed	11	4.8
Unfulfilled	2	0.9
	227	100.0

	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

Figure 2-1 relates the number of fixes missed/unfulfilled to the monthly fix requirements and multiple-storm days, i.e., a day when two or more storms were active at the same time. The 82 levied fixes in October account for 36% of the total levied fixes. October also included 42% of the multiple storm days and 30% of the missed fixes as compared to August which had 22% of the storm days, but 46% of the missed fixes. August, however, had only 21% of the levied fix requirements.

Figure 2-2 compares the percentage of fixes and investigatives missed/late versus the number of storms per day. The 26 days with 2 or more storms represents only 35% of the calendar days of warning; however, they encompass 75% of the missed/late fixes and investigatives. This indicates, that even in a light season, concurrent storms can overtax current aircraft reconnaissance capabilities.

5. RADAR RECONNAISSANCE SUMMARY

A total of 419 radar reports of tropical cyclones were received during the 1973 season, 409 from land stations, 3 from ships, and 7 from aircraft. This is a significant decrease from 1972 when over 700 radar reports were received. There are two primary reasons for this decrease, the large decrease in tropical cyclone activity from 1972 to 1973 and the significant reduction of military activities in the western North Pacific and South China Sea areas.

To evaluate the 1973 data in terms of quality, the land radar reports received were grouped into three accuracy categories, a method provided for in the WMO code. The categories used are defined as good (less than 6nm), fair (6-20nm), and poor (greater than 20nm). Using this stratification, 32% of the reports were classified as good, 40% as fair, and 28% as poor. In addition to the above accuracy classifications which are derived from the radar operations, all land radar reports were compared to the JTWC best track positions and deviations computed. The mean deviation was 12nm, a 29% decrease from the average of 17nm for the previous three years.

The radar sites that provide some of the most significant coverage to JTWC are those whose surveillance borders within the Air Weather Service no-fly zone. The Royal Observatory at Hong Kong provided valuable positioning information on 7 tropical cyclones during 1973 in which geographical restrictions existed to reconnaissance air-

craft. Other locations which play similar roles are those situated on western Taiwan and Korea, although by the time a tropical cyclone reaches the latitude of Korea its radar presentation is often quite deteriorated. A key station for tracking tropical cyclones in the northwestern South China Sea during the Vietnam conflict was the Monkey Mountain site at Danang. The loss of observations from this site last season proved quite critical during typhoon Anita's trek into the Gulf of Tonkin this past July, adversely affecting units of the 7th Fleet.

The receipt of land radar reports from national meteorological and AC&W sites in the Republic of the Philippines was greatly improved in 1973 compared to previous years. This improvement is attributed to recent improvements in the radar network, better communications, and closer liaison between U.S. military and Philippine officials.

Of 17 tropical cyclones which came within the surveillance range of the Far East radar networks, four typhoons Ellen, Billie, Nora, and Dot accounted for the majority of radar reports. Each of these storms was characterized during periods of observation by slow movement allowing for numerous position reports. Billie while passing through the southern Ryukyus was under coverage of 6 radars simultaneously for a 12 hour period. Radars of National Meteorological Services accounted for 70% of the 419 observations received at the JTWC for tropical cyclones during 1973. AC&W sites furnished 23% and Air Weather Service radars, contributed 8%.

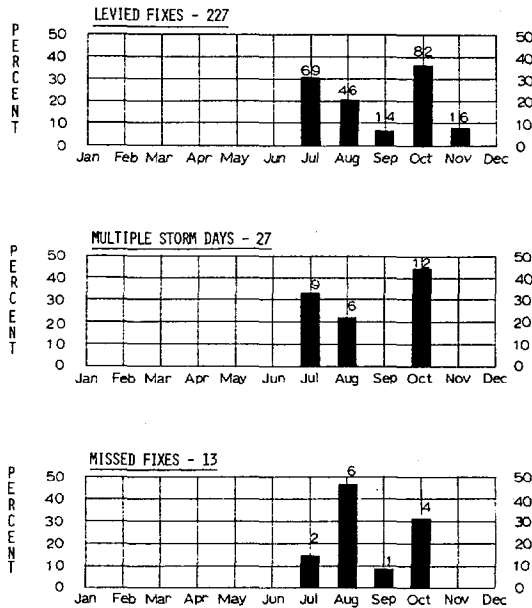


FIGURE 2-1. Missed fixes for 1973 compared to monthly fix requirements and multiple storm days.

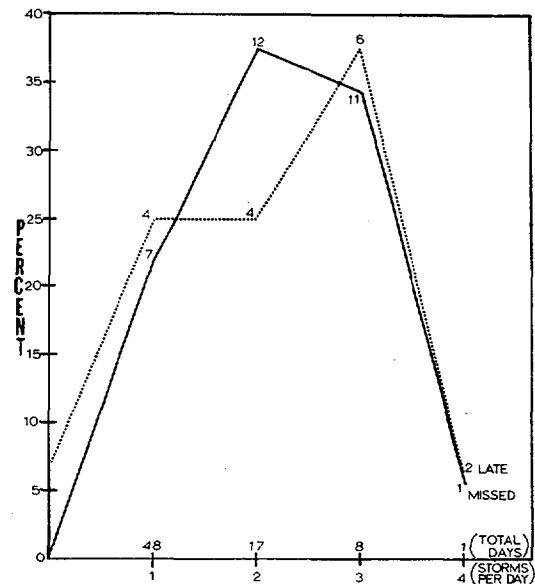


FIGURE 2-2. Percentage of fixes and investigatives missed/late vs. storms per day.

6. SATELLITE RECONNAISSANCE SUMMARY

Satellite reconnaissance information is provided to the JTWC by the Air Force Defense Meteorological Satellite Program (DMSP) site collocated with the JTWC. This site was established in May 1971. During the 1971 storm season, DMSP data were available to the JTWC forecasters but were not authorized by CINCPAC as a substitute for aircraft fixes. Coincident with the site's establishment was the implementation of a Technique Development Program (TDP) designed to determine the potential of DMSP data as an alternative reconnaissance platform. This was necessary as aircraft resources were being reduced and it was possible that the remaining reconnaissance fleet would be subject to further reductions. Hence the SRP concept was introduced. Under the SRP, the JTWC would selectively levy reconnaissance requirements on aircraft, high resolution satellites and land radar with the satellites expected to fulfill an increasingly important role.

By the end of 1971, the TDP had established the viability of satellite derived storm positions and intensity estimates. Plans were then made to implement the SRP. During 1972, techniques used to position tropical cyclones and estimate their intensities from DMSP data were further refined. An organized approach to daily decision making on the use of DMSP data in lieu of aircraft was implemented beginning with Typhoon Phyllis in July 1972. Factors such as satellite coverage of the storm, timeliness of the DMSP data, and quality of the position were considered in this decision process. During the remainder of 1972, satellite fixes were levied in lieu of aircraft 12% of the time. During 1972, the Guam site provided the majority of satellite data used operationally by the JTWC. Data were received from other Pacific DMSP sites and the Air Force Global Weather Central (AFGWC) but there was no formal program to rely on these data.

Prior to the start of the 1973 season, an SRP network was established consisting of Guam; Fuchu, Japan; and Nakon Phanom (NKP), Thailand (primary sites); and Kadena, Okinawa; Osan, Korea; and AFGWC serving as backup sites. The network was designed to provide timely DMSP data to the JTWC through the Guam site which served as clearing house and quality control monitor. The Guam site was also responsible to the JTWC for forecasting which of the primary sites or combination of sites would receive usable fixes. Regardless of whether such fixes were levied in lieu of aircraft, the sites affected would be notified by message to pass the required information to the JTWC. As the data were received, processed, and analysed, data were first passed by phone to the Guam site and followed up by message to the JTWC.

There are six position classes referred to by Position Code Numbers (PCN). The PCN identifies the method of gridding and the type of circulation center; it also has associated with it a set of statistics related to its accuracy. Table 2-2 provides the methods of center determination and gridding for each PCN. The mean error,

standard vector deviation, and sample size are given for the 3 major classes i.e. eye, well-defined circulation center, and poorly-defined circulation center. While no statistically significant difference presently exists between geographical and ephemeris gridded positions, it was decided to retain the gridding method as part of the PCN stratification to provide a check on the accuracy of ephemeris gridding and to isolate any problems growing out of either geographical or ephemeris gridding in the future.

TABLE 2-2. GUAM DMSP SITE TROPICAL CYCLONE POSITIONING STATISTICS, 1973 (1972)

PCN	METHOD OF CENTER DETERMINATION/GRIDDING	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1	Eye/Geography	15.5 (14.7)	17.8 (17.3)	40 (157)
2	Eye/Ephemeris			
3	Well Defined CC/Geography	18.9 (21.0)	22.9 (26.3)	86 (159)
4	Well Defined CC/Geography			
5	Poorly Defined CC/Geography	39.8 (30.2)	54.2 (36.6)	56 (294)
6	Poorly Defined CC/Geography			

NM = Nautical Miles
CC = Circulation Center

The 1972 figures which serve as the standard are given in parentheses. Table 2-3 shows corresponding 1973 figures for NKP and Fuchu respectively. Only PCN's of 1 through 4 are considered as quality fixes, i.e. location accuracy comparable on the average to that expected from the aircraft. It should be noted that only 31% of the positions made during 1973 by the primary DMSP sites were of PCN's 5 or 6, a significant reduction from 1972 when 50% of the positions were classified in the poorly defined category.

With only one operational satellite during the early part of the 1973 season (July and August), satellite coverage during the period 5 1/2 hours before to 1/2 hour after warning time was available for 52% of the warnings. However, during the last part of the season (September, October, and November) with two functional satellites, 87% of the warnings had satellite coverage available during the same time

TABLE 2-3. DMSP TROPICAL CYCLONE POSITIONING STATISTICS 1973

NAKON PHANOM, THAILAND			
PCN	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1&2	16.8	20.0	47
3&4	19.1	25.4	62
5&6	48.1	66.3	85
FUCHU, JAPAN			
PCN	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1&2	15.4	17.7	37
3&4	20.9	25.0	75
5&6	36.2	51.4	26

period. For 24% of the 390 warnings issued by the JTWC, both satellite coverage and timeliness of the data were met simultaneously. In this context, timeliness is defined as having DMSP satellite data with nodal times of 1 1/2 to 3 hours (descending node) or 1 3/4 to 3 hours (ascending node) prior to warning time. When quality PCN's are also stipulated, it was found that for only 14% of the warnings were coverage, timeliness, and quality PCN forecast to occur. When the three criteria given above are anticipated, the forecast is referred to as SRP quality. The verification rate for SRP quality forecasts during the season was 90%. The actual use rate of satellite as the basis for warnings was considerably larger than the 14% which were forecast to be of SRP quality. Altogether, 27% of the JTWC warnings were based on satellite data. Of the forecast SRP quality fixes, 25% were levied equating to 13% of the satellite fixes used for warnings. The remaining 87% of the satellite fixes for warnings consisted of non-SRP quality and some additional SRP quality which were forecast, not levied, but subsequently used. A summary of these SRP statistics is given in Table 2-4.

There were a wide variety of satellite products available from the SRP network during the 1973 season both for real-time analysis by the individual sites and post-analysis conducted by the Guam site and the JTWC. Historically, the types of data from

the DMSP satellites have remained essentially unchanged during the past three years. Satellite meteorologists at the SRP network sites had available Very High Resolution daytime and nighttime infrared (VHR), and High Resolution daytime and nighttime visual (HR) and infrared (IR). Table 2-5 provides the imagery data characteristics.

During daytime, VHR along with IR are the primary data used for positioning and intensity analysis. In addition, visual and IR data enhancement techniques have been developed which often permit the analyst to locate the circulation center when the primary data alone would result in a poorly defined center. Likewise, nighttime position can often be classified as eye fixes or well defined centers as a result of having HR data from moonlight available. Marginal eye centers or well defined centers not visible on VHR can frequently be determined with as little illumination as that provided by a half-moon.

Satellite data are playing an increasingly larger role in tropical cyclone reconnaissance. For example, the operational use of DMSP data has produced a significant decrease in the number of aircraft investigative flights flown. For the two years preceding the establishment of the SRP network (1970 - 1971), the ratio of investigative flights flown to the number of storms was 5.5:1, while for 1973 this ratio was reduced to 1.2:1.

7. COMMUNICATIONS

a. AIR TO GROUND

Aircraft reconnaissance data are normally received by the JTWC via direct phone patch through Andersen, Clark, or Fuchu aeronautical stations. Under degraded propagation conditions, data can be intercepted by a weather monitor located near these stations and relayed by AUTOVON or teletype to the JTWC.

Average communications delays for the preliminary and complete center data messages for past years are compared with 1973 delays in Figure 2-3. Delay times are defined here as the difference between the fix time and the time of message receipt at the JTWC. The preliminary fix message was introduced in 1972 to reduce delays in the receipt by the JTWC of vital position and intensity information. After two years of use, it has proved its effectiveness and permits a significant amount of extra time to be spent in forecast preparation. The 48 minute average delay in the complete center data message during 1973 shows an increase of about 14 minutes over 1972. This increase is attributed to several circumstances which prevailed during the 1973 season: (a) more emphasis was placed upon receipt of the preliminary message during 1973, lessening the need for passing the complete center message to the JTWC as quickly as before, (b) messages were more carefully prepared, and (c) a larger share of the messages were passed through Clark aeronautical station than in previous years due to location of cyclone tracks. This routing of phone patches through Clark places more stringent requirements on radio-telephone quality and has been

TABLE 2-4. SELECTIVE RECONNAISSANCE PROGRAM SUMMARY

PARAMETERS	RATIO	PERCENT
Number of cases where there was DMSP coverage of storm and timeliness for use in warning/total number of warnings issued	95/390	24
Number of cases where there was coverage of storm, timeliness of data, and PCN < 4 (SRP Quality forecasts made)/total number of warning issued	56/390	14
Number of SRP quality forecasts levied/number of SRP quality forecasts made	14/56	25
Number of SRP quality forecasts used as basis for warnings/number of warnings based on satellite	14/107	13
Number of warnings based on satellite/total number of warnings issued	107/390	27

TABLE 2-5. DMSP IMAGERY DATA CHARACTERISTICS

PARAMETER	VISUAL		INFRARED	
	VHR	HR	WHR	IR
Resolution (nautical miles)	0.33	2.0	0.5	2.0
Bandwidth (micrometers)	0.4-1.1	0.4-1.1	8.0-13.0	8.0-13.0
Equivalent blackbody temperature (°Kelvin)			217-307	210-310

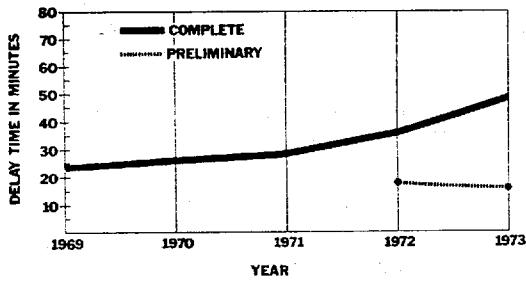


FIGURE 2-3. DELAY TIMES - Receipt of eye data message.

noted in previous years to result in longer delays than a direct phone patch through Andersen aeronautical station.

Table 2-6 depicts the complete center data messages received over one hour after fix time and after warning time. The growth of the percentages in 1973 can be partially attributed to the above mentioned reasons and the increase in the percentage of late fixes (section 4). Nevertheless, only 3% of the messages were delayed more than 80 minutes.

	1967	1968	1969	1970	1971	1972	1973
% COMPLETE FIX MESSAGES DELAYED OVER ONE HOUR	16	4	3	5	6	6	20
% COMPLETE FIX MESSAGES RECEIVED AFTER WARNING TIME	3.1	0.7	0.6	0.9	2.1	5.5	10.1

b. SELECTIVE RECONNAISSANCE PROGRAM

With the advent of the SRP, the importance of radar and satellite fix data has increased from previous years; therefore, a review of the associated communications delays follows. A sampling of radar messages resulted in a considerable variation of receipt delays. Delay times are defined as the differences between the observation time and the time of message entry into the AWN. Several sources were consistently associated with small delay times, while the receipt time of others were highly erratic. AC&W radar site data from the Republic of the Philippines were normally received within 35 minutes. Data from nationally operated radars of the Republic of China, Hong Kong, Japan, and Republic of the Philippines were delayed 20 to 50 minutes depending on country of origin. In the worst cases, the JTWC still received the messages within 90 minutes of observation time. Tropical cyclone radar data is routed to the JTWC over the AWN through the use of a special high precedence collective indicator. Additionally, the AC&W radar messages were phoned to the JTWC from Clark AB, thus providing the information somewhat earlier than indicated.

Over 750 position and intensity estimates were derived from Air Weather Service (AWS) DMSP sites and the aircraft carrier CONSTELLATION during 1973. The data from the AWS DMSP sites were immediately

passed by 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 with message). Average delay times of 51 minutes for telephone and 83 minutes for message resulted from a sampling of the last six storms. These delay times are the difference between satellite equator-crossing time and the time of the telephone call or entry of the message into the AWN. systematic differences in data processing time among the DMSP sites introduces small variations in the above figures which are independent of communications and analysis time. However, it is important to note, that on the average, the data were available to the JTWC within one hour after equator-crossing time.

c. OUTGOING COMMUNICATIONS

Messages originating at the JTWC are handled by the Nimitz Hill Message Center Naval Communications Station, Guam (NHMC). By special agreement, typhoon and tropical storm warnings are placed in the communications system before pending immediate precedence traffic. Manual processing is accomplished as though the warning had flash precedence. Tropical depression warnings are normally handled as immediate messages. Warnings were delivered to the message center an average of 23 minutes before warning time (Figure 2-4). Yearly averages of the parameters described are plotted relative to warning time. The length of the vertical bars represents the average difference between the time typhoon and tropical storm warnings were passed to the NHMC and the time of transmission. Note that the handling time decreased from 31 minutes in 1972 to 15 minutes in 1973. Handling times for tropical depression warning (not shown) were reduced from 51 minutes in 1972 to 25 minutes in 1973.

The dramatic improvement in handling time during 1973 allowed the average message to be placed in the circuits before the established warning time. This was a major improvement over the previous two years when the average message left Guam more than 10 minutes after warning time. The reduced handling time can be attributed primarily to rectification of problems within the NHMC itself. The time of receipt of a warning at a particular station depends on factors beyond the control of both the JTWC and the NHMC.

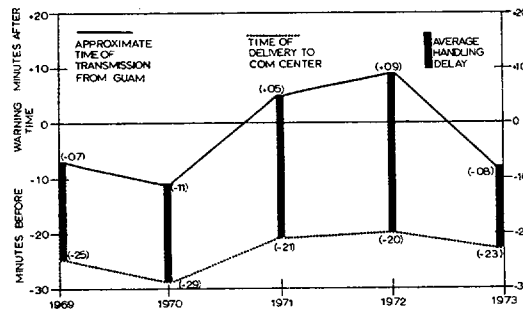


FIGURE 2-4. AUTODIN handling time data for typhoon and tropical storm warnings.

CHAPTER III — RESEARCH SUMMARY

1. GENERAL

In past years, technical notes summarizing research studies made by the JTWC personnel were included in the Annual Typhoon Reports (ATRs). In this and future ATRs, however, only brief synopses of these studies will be given. The complete studies will be published separately as FLEWEACEN/JTWC Technical Notes. It is felt that this procedure offers several advantages. First, it allows the administrative workload associated with publication preparation to be distributed throughout the year rather than concentrated within a few months during preparation of the ATR. Second, it allows authors to include more technical details of their studies than would be appropriate for inclusion in the ATR.

2. INVESTIGATION OF GUST FACTORS IN TROPICAL CYCLONES

(Reference: Atkinson, G.D., FLEWEACEN/JTWC Technical Note 74-1).

The 1972 Tropical Cyclone Conference requested that FLEWEACEN/JTWC include peak gusts in the warnings when sustained surface wind speeds equal or exceed 50 kts. During 1972, a sustained wind/peak gust graph derived by former JTWC personnel was used. Details on how this graph was derived were not available and there was a general feeling among JTWC forecasters that the gust factors derived from this graph were too high for open water conditions. Therefore, at the 1973 Tropical Cyclone Conference, FLEWEACEN/JTWC requested that all 7th Fleet ships equipped with anemometers include peak gusts as well as sustained winds in their weather reports during strong wind conditions. These ship observations and a comprehensive literature survey led to the derivation of a new sustained wind/peak gust relationship which was introduced into operational use by the JTWC during the 1973 season. This study showed that for strong wind conditions, gust factors (i.e., ratio of peak gusts to one-minute average sustained wind speeds) over open water should fall in the range of 1.20 to 1.25. Based on these results, the sustained wind/peak gust relationships shown in Table 3-1 are now used operationally by the JTWC.

TABLE 3-1. JTWC SUSTAINED 1-MINUTE WIND-PEAK GUST (KNOTS) RELATIONSHIPS

WIND(GUST)	WIND(GUST)	WIND(GUST)
50(65)	95(115)	140(170)
55(70)	100(125)	145(175)
60(75)	105(130)	150(180)
65(80)	110(135)	155(190)
70(85)	115(140)	160(195)
75(90)	120(145)	165(200)
80(100)	125(150)	170(205)
85(105)	130(160)	175(210)
90(110)	135(165)	180(220)

3. INTENSITY FORECASTING USING THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-2).

The computerized TYFOON analog program has been used by the JTWC as an aid in forecasting tropical cyclone movement since 1970. This study investigated the usefulness of the TYFOON program for forecasting tropical cyclone intensities at 24-, 48-, and 72-hours. It modified and extended a previous study on this subject by former JTWC personnel. Three parameters which are available on the basic climatological data tape used in the TYFOON program were selected to determine their usefulness in intensity forecasting. These are the minimum sea level pressure, the 12-hour change in minimum sea level pressure, and the maximum sustained surface wind speed. Based on selected values of these criteria, current and analog tropical cyclones were separated into two classes (deepening or weakening) and analog forecasts were computed. During the testing, several changes were made to the classification criteria to obtain better results. Also, it was determined that intensity forecasts computed independently for the various time periods were not consistent. Therefore, the program was modified so that each succeeding intensity forecast used the previous intensity forecast as an input, i.e., initial conditions for the 48-hour forecast would depend on the 24-hour forecast, etc. Verification results based on selected cases from the 1972 tropical cyclone season showed the analog program produced intensity forecasts that were slightly better than the official JTWC forecasts for the 24-hour period but were slightly worse than the official forecasts at 48 and 72 hours. Nevertheless, these preliminary results indicate that further testing of this program is warranted to provide another objective forecast aid to JTWC forecasts.

4. EVALUATION OF THE EXTRAPOLATION FEATURE OF THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-3).

The original version of the TYFOON analog program, first used operationally by the JTWC in 1970 has been modified several times to improve its performance. In the TYFOON-72 version of the program, if a selected analog storm had insufficient positions to provide a forecast out to 72 hours, the program extrapolated up to four additional six-hourly positions. This extrapolation feature was necessary because of premature termination of many tropical cyclones on the original data tape (1945-1969). During 1972, tropical cyclone data for 1970 and 1971 were added to the basic climatological data tape and tracks for all tropical cyclones for the entire period of record (1945-1971) were extended. These modifications to the data tape and reductions of the basic time interval for selection of analog cases from ± 50 days to ± 35 days resulted in the version of the TYFOON

program known as TYFN 73. Since the original tropical cyclone tracks were subsequently extended, it was felt that the extrapolation feature of TYFOON-72 was no longer required. To test this hypothesis, 15 cases from 1972 were selected and 24-, 48-, and 72-hour position forecasts were prepared using both TYFOON-72 and TYFN 73. The overall results showed the average forecast errors for TYFN 73 were slightly lower than TYFOON-72 at all time periods. The most significant fact, however, was that TYFN 73 required 46% less computer time on the average than TYFOON-72. Considering that the JTWC requires hundreds of analog forecasts each year, the savings in computer time will be significant. The JTWC will use the TYFN 73 version of the analog program during the 1974 tropical cyclone season.

5. A COMPARISON OF THE SENSITIVITY OF TWO SIMILAR OBJECTIVE FORECAST TECHNIQUES

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-4).

A number of computerized objective forecast techniques are available to assist the JTWC in the preparation of warnings. Of concern is the sensitivity of these techniques to errors in the warning and history positions. Two techniques, TSGLOB, developed by FLEWEACEN Pearl Harbor, and its successor, TYMOD, developed by FLEWEACEN/JTWC Guam, were chosen for testing. Both techniques utilize the 24-hour global band upper air progs (GBUA) provided by FLENUMWEACEN Monterey. The 03/0000 GMT January 1973 GBUA fields were chosen and a control forecast for each technique was run on Guam's CDC 3100 computer. Errors of six and 12nm were introduced into the warning and history positions, both individually and collectively. Thirty-six cases were run for TYMOD and 20 for TSGLOB the difference being due to TYMOD having a 24-hour history position. The results showed that TYMOD was less sensitive to positioning errors than TSGLOB. In addition, the TYMOD errors tended to reach a maximum about +48 hours and then decrease in magnitude thereafter. Finally, the test results suggest that as much as 30% of the 24-hour forecast error may be caused by warning position errors.

6. INTERANNUAL VARIABILITY OF RAINFALL AND TROPICAL CYCLONE ACTIVITY IN THE WESTERN NORTH PACIFIC

(Reference: Pratte, J.F., FLEWEACEN/JTWC Technical Note 74-5).

In this study, rainfall amounts at various stations in the tropical North Pacific during the dry season (January-April) were correlated with the number of tropical cyclones occurring in the western North Pacific area during the same year. The period of record used was 1959-1973. This period was selected because the JTWC was established in 1959 and satellite coverage of the tropics was available for most of this period. Therefore, it was felt that statistics on the number of tropical cyclones would be highly reliable for this recent period. Correlations were made for each rainfall station individually and for various groups of stations. Results indicate that the best correlation was shown with rainfall on Guam (average of three Guam stations), however, the relationship was poor (correlation coefficient of 0.24) and not sufficient for long-range forecasting purposes. The study also provides a survey of various articles relating tropical circulation patterns and rainfall to sea surface temperature anomalies and other large scale influences.

CHAPTER IV — SUMMARY OF TROPICAL CYCLONES

I. GENERAL RESUME

The western North Pacific remained quiescent for the first six months of 1973 before the first tropical cyclone developed. Since World War II, only in 1952, when five months passed without a single tropical cyclone, has this area experienced such a late start of the tropical cyclone season (Table 4-1). According to statistics compiled by the Royal Observatory of Hong Kong, this dearth of tropical cyclone activity during the first six months of the year has not occurred since 1917. Interestingly, on the average, five tropical cyclones form during the first six months of the year of which three became typhoons.

The development of Tropical Storm Wilda on 1 July marked the beginning of the 1973 season. Within a span of 5 months, a total of only 21 named tropical

cyclones developed, with 12 of these reaching typhoon intensity. Additionally, warnings were issued on two numbered tropical depressions. Typhoon frequency in 1973 was significantly lower than the yearly average of 19 since the establishment of the JTWC in 1959. Only 1969 and 1970 experienced a similar low frequency of typhoons during this period (Table 4-2).

In 1973, warnings were issued on only 77 calendar days, approximately one half of the 14-year average of 145 days. The JTWC remained in warning status 62 days less in 1973 than in 1972, an active tropical cyclone year.

Typhoon days for 1973 dipped to a record low of 42 compared to 121 in 1972 (Table 4-3). Based on the past 15 years, 1973 was 54 days below the average and 20 days below 1969 the next lowest. These facts indicate that there was not only a

TABLE 4-1. FREQUENCY OF TROPICAL STORMS (INCLUDING TYPHOONS) BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	1	1	2	5	7	6	1	3	0	26
1946	0	0	1	0	1	2	3	2	3	1	2	0	15
1947	0	0	1	0	1	1	3	3	5	6	6	1	27
1948	1	0	0	0	2	2	2	5	5	4	3	2	26
1949	1	0	0	0	0	1	5	3	6	1	3	2	22
1950	0	0	0	0	1	2	3	2	3	3	3	1	18
1951	0	0	1	2	1	1	1	2	2	4	1	2	17
1952	0	0	0	0	0	3	3	4	5	6	3	4	28
1953	0	1	0	0	1	2	2	6	3	4	3	1	23
1954	0	0	1	0	1	0	1	6	4	3	3	0	19
1955	1	0	1	1	0	1	6	3	3	4	1	1	22
1956	0	0	1	2	0	1	2	5	5	2	3	1	22
1957	2	0	0	1	1	1	1	3	5	4	3	0	21
1958	1	0	0	0	1	3	5	3	3	3	2	1	22
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
Totals	13	7	13	20	31	45	115	147	131	111	76	33	742
Average	.45	.24	.45	.69	1.07	1.55	3.97	5.07	4.52	3.83	2.62	1.14	25.59

TABLE 4-2. FREQUENCY OF TROPICAL STORMS REACHING TYPHOON INTENSITY BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	0	0	1	2	5	3	1	1	0	13
1946	0	0	1	0	1	1	3	1	3	1	2	0	13
1947	0	0	0	0	1	1	0	3	4	5	4	1	19
1948	1	0	0	0	2	0	2	2	4	1	2	1	15
1949	1	0	0	0	0	1	3	3	3	1	1	1	14
1950	0	0	0	0	1	1	1	2	1	3	2	1	12
1951	0	0	1	2	1	1	1	2	2	3	1	2	16
1952	0	0	0	0	0	3	1	3	3	4	3	2	19
1953	0	1	0	0	1	1	2	4	2	4	1	1	17
1954	0	0	0	0	1	0	1	4	4	2	3	0	15
1955	1	0	1	1	0	1	5	3	3	2	1	1	19
1956	0	0	1	1	0	0	2	4	5	1	3	1	18
1957	1	0	0	1	1	1	1	2	5	3	3	0	18
1958	1	0	0	0	1	3	4	3	3	3	1	1	20
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
Totals	8	2	6	17	24	31	75	103	93	84	52	22	517
Avg	.28	.07	.21	.59	.83	1.07	2.59	3.55	3.21	2.90	1.79	.76	17.83

short period of typhoon activity (July to October) but also the short duration of typhoons notably in August and September. The number of warnings issued totaled only 390 which is 55% of the average over the past 15 years. 1971 and 1972 could be considered "normal" years compared to 1973 since they were only slightly above the average with total number of warnings of 747 and 739, respectively. 1973 was not without multiple storm occurrences with 27 days with two or more cyclones and 9 days with three or more cyclones occurring simultaneously (Table 4-4).

There were only three super typhoons during 1973, Billie, Nora, and Patsy, which is half of the climatological mean of six based on the past 15 years. This is not surprising since most of the tropical cyclones developed outside of the favorable areas for super typhoon occurrence delineated by Holliday (1970).

The 1973 season was marked by another peculiarity. There was a pronounced absence of tropical cyclone activity in the area south of 20°N and east of 135°E which is normally a favorable area for tropical

cyclone development. Except for brief periods during the summer months, the eastward extension of the monsoon trough over the western North Pacific Ocean was noticeably missing. It was not until the latter half of the season that the monsoon trough became firmly established in the area to the south of Guam when 3 successive typhoons were spawned during the first half of October.

The Tropical Upper Tropospheric Trough (TUTT) was well established by mid-May. It initiated the development of Tropical Storm Clara in July and Tropical Storm Hope and Tropical Depression No. 11 in August. Although the TUTT was in evidence throughout the typhoon season, the near-equatorial ridge which normally forms to the south of the TUTT was absent except for brief periods. Consequently, upper level westerlies prevailed over the Caroline and Marshall Islands, an area which would normally be under deep tropospheric easterlies during the primary tropical cyclone season. The resulting strong vertical wind shear over the eastern Trust Territory was unfavorable for tropical cyclone development.

TABLE 4-3. TYPHOON DAYS 1959-1973

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL PER YEAR
1959	---	---	---	8	---	---	3	18	19	18*	10	18	94
1960	---	---	---	2	---	10	13	36*	---	23*	2*	12	98
1961	---	---	8	---	8	2	10*	15	23*	17*	6	6	95
1962	---	---	---	7	4	---	14*	37*	8	30*	19*	---	119
1963	---	---	---	4	5	15	11	23*	14*	24*	---	11	107
1964	---	---	---	---	7	5*	22*	18*	28*	14	11*	6	111
1965	2	---	---	2	5	12*	19*	23*	25*	14	6	---	108
1966	---	---	---	5	11	6	7*	16*	23*	11	4	3	86
1967	---	---	2	7	---	4	14*	10	32*	21*	21*	---	111
1968	---	---	---	6	1	7	6	8	32*	19	18*	---	97
1969	5	---	---	5	---	---	8	6	10	18	10*	---	62
1970	---	5	---	---	---	2	5	24*	16	21*	6	---	79
1971	---	---	---	4	13*	8	20*	27*	21*	11	7	---	111
1972	2	---	---	---	1	6	39*	16	16*	21	9	11	121
1973	---	---	---	---	---	---	11*	7*	4	20*	---	---	42
TOTAL	9	5	10	50	55	77	202	284	271	282	129	67	1441
MEAN	.6	.3	.7	4.0	3.7	5.1	13.5	18.9	18.1	18.8	8.6	4.5	96.1

*Two typhoons occurring on the same day are counted as two typhoon days.

TABLE 4-4. SUMMARY OF JTWC WARNINGS 1969-1973

	1960-1973 (AVG)	1970	1971	1972	1973
TOTAL NUMBER OF WARNINGS	707	533	747	739	390
CALENDAR DAYS OF WARNING	146	127	163	139	77
NUMBER OF WARNING DAYS WITH TWO OR MORE CYCLONES	52	29	54	46	27
NUMBER OF WARNINGS DAYS WITH THREE OR MORE CYCLONES	12	0	6	13	9

Based on available casualty reports, typhoons Nora and Ruth and tropical storms Sarah and Vera accounted for the majority of the tropical cyclone related casualties. Taiwan, South Vietnam, and the Republic of the Philippines bore the brunt of the storm damages and casualties. The Republic of the Philippines was again, as in 1972, particularly hard hit by the passage of Nora, Ruth, and Vera. The main Japanese islands, interestingly, did not experience coastal crossing of a typhoon during 1973 which is a first according to available records since 1945.

Much of the pertinent meteorological data and tropical cyclone damage statistics in this chapter were based on information received from the following

sources: Weather Bureau of the Republic of China; Royal Observatory of Hong Kong; Japan Meteorological Agency; National Weather Service of the Republic of the Philippines; the Environmental Data Service, National Oceanic and Atmospheric Administration and Casualty Returns, Liverpool Underwriters Association.

TABLE 4-5. LIST OF ESTIMATED CASUALTIES FOR THE 1973 SEASON

TYPE	NAME	DEATHS	MISSING
T	DOT	1	--
T	IRIS	2	3
T	NORA	22	48
T	RUTH	27	23
TS	SARAH	50	--
TS	VERA	75	58
total		177	132

NOTE: Only cyclones for which data are available are listed.

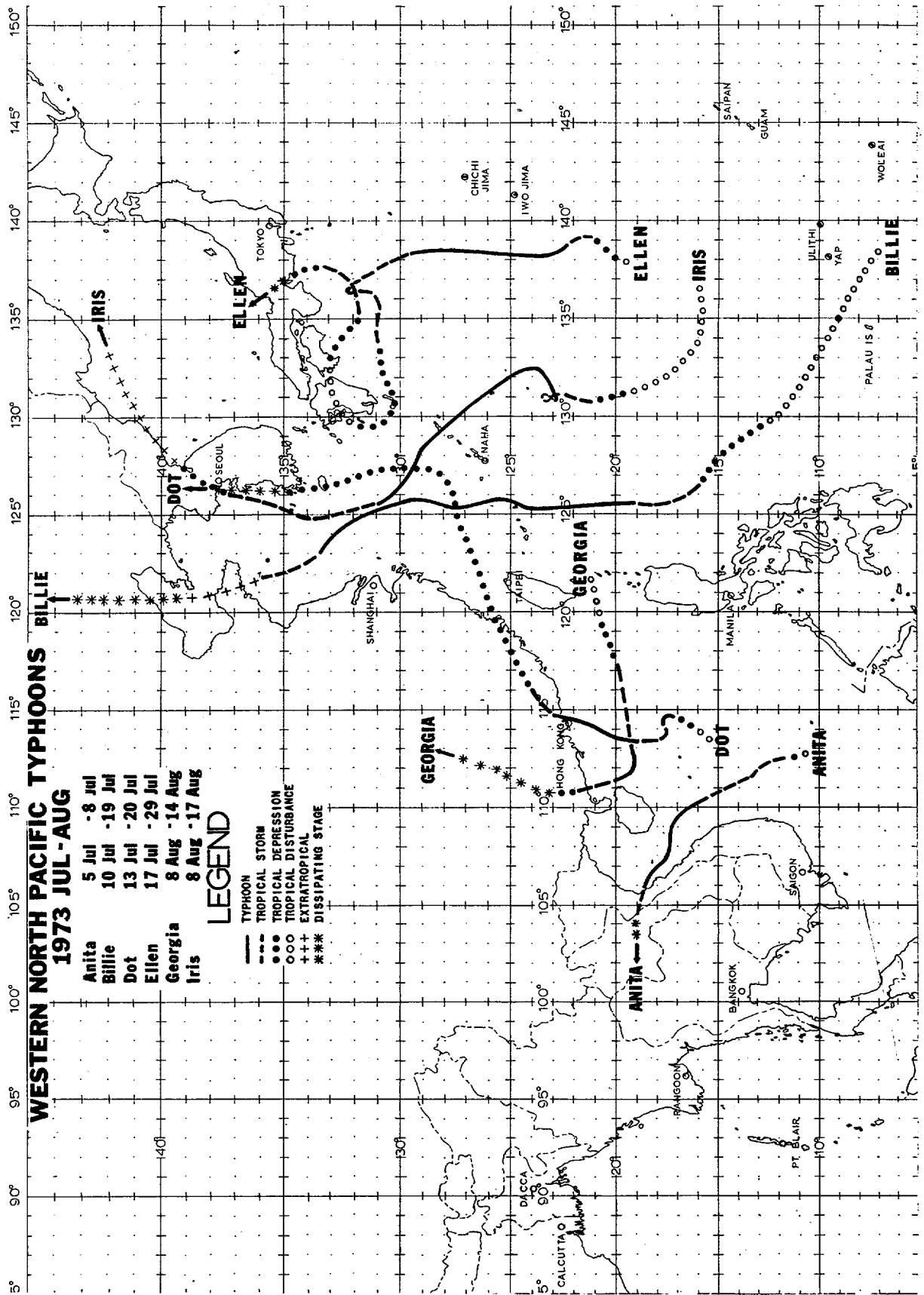
TABLE 4-6. 1973 TROPICAL CYCLONES

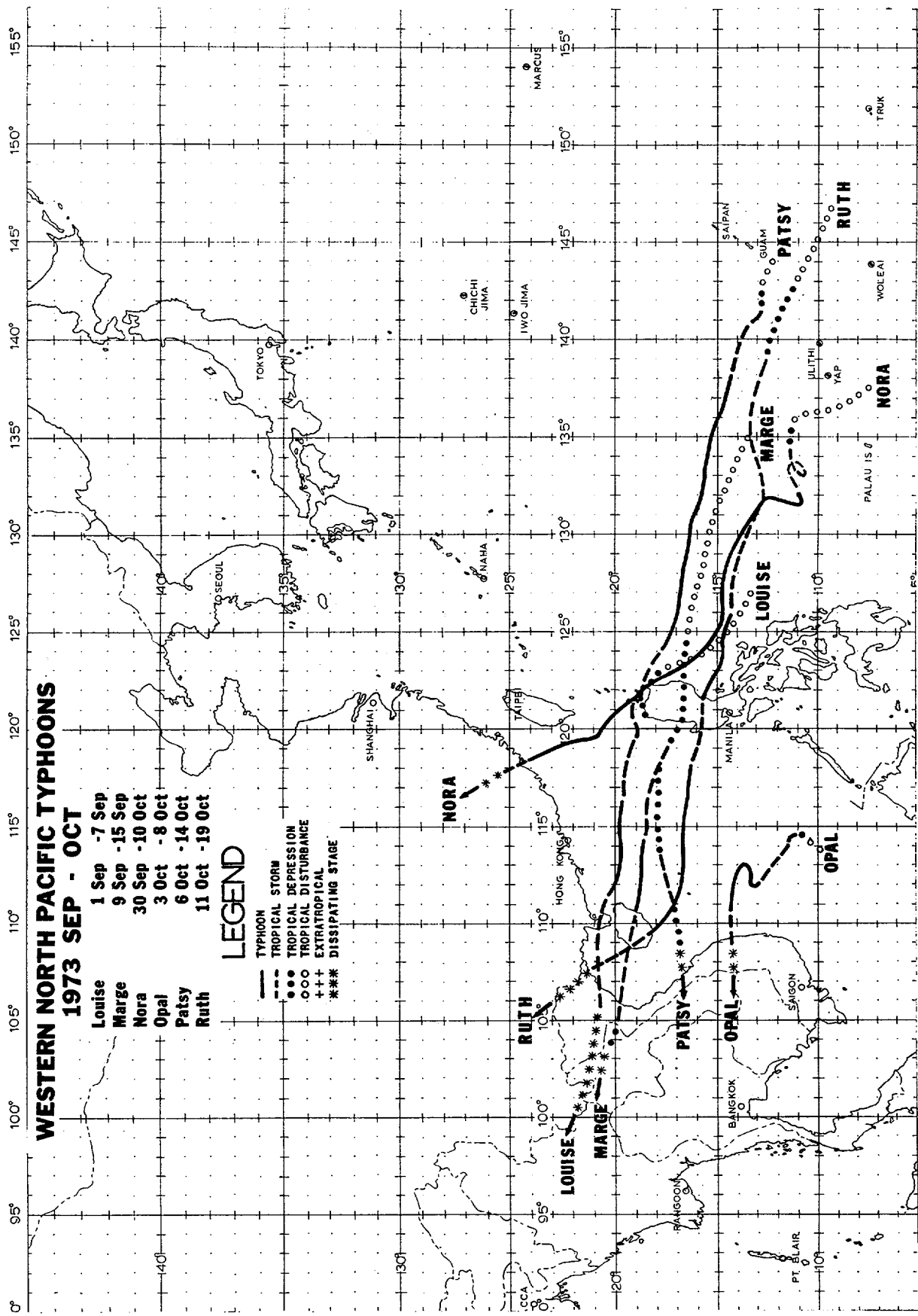
CYCLONE	TYPE	NAME	(PRD OF WRNG)	CALENDAR DAYS OF WARNING	MAX SFC WIND [†]	MIN OBS SLP	WARNINGS ISSUED		
							TOTAL	NO. AS TYPHOONS	DISTANCE TRAVELED
01	TS	WILDA	01 JUL-03 JUL	3	60	982	9	--	384
02	TY	ANITA	05 JUL-08 JUL	4	70	980	13	6	720
03	TS	CLARA	12 JUL-14 JUL	3	50	998	7	--	324
04	TY	BILLIE	13 JUL-19 JUL	7	130	916	27	18	1560
05	TY	DOT	*	6	85	978	19	4	1020
06	TY	ELLEN	*	10	105	941	29	8	1092
07	TS	FRAN	29 JUL-30 JUL	2	40	1002	6	--	330
08	TY	GEORGIA	09 AUG-12 AUG	4	70	976	15	9	504
09	TS	HOPE	09 AUG-12 AUG	4	45	996	15	--	756
10	TY	IRIS	10 AUG-17 AUG	8	85	972	30	16	1218
11	TD	TD-11	13 AUG-14 AUG	2	30	1005	6	--	270
12	TS	JOAN	18 AUG-20 AUG	3	45	990	10	--	648
13	TS	KATE	24 AUG-26 AUG	2	60	983	8	--	294
14	TD	TD-14	01 SEP-02 SEP	2	30	NA	4	--	90
15	TY	LOUISE	03 SEP-07 SEP	5	75	974	18	6	816
16	TY	MARGE	12 SEP-14 SEP	3	80	964	12	4	792
17	TY	NORA	02 OCT-10 OCT	9	160	877	34	25	1584
18	TY	OPAL	04 OCT-08 OCT	5	75	968	16	9	540
19	TY	PATSY	*	10	140	893	34	14	1920
20	TY	RUTH	11 OCT-19 OCT	9	90	957	33	23	2112
21	TS	SARAH	10 NOV-10 NOV	1	55	984	4	--	180
22	TS	THELMA	*	4	55	991	13	--	660
23	TS	VERA	19 NOV-26 NOV	8	50	990	28	--	1134
1973 TOTALS				77**			390	142	

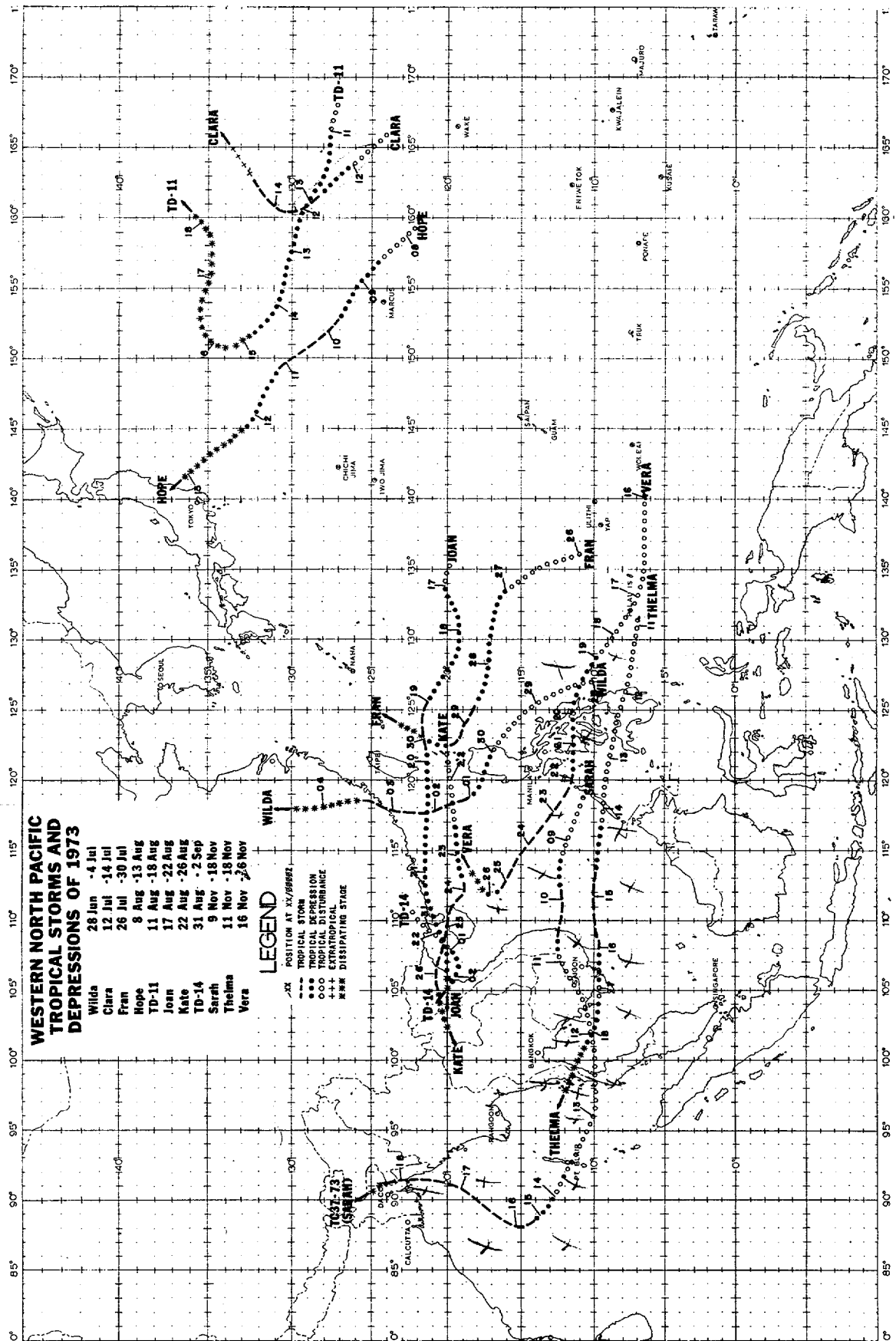
*Dot 14/06Z - 17/06Z and 19/00Z - 20/06Z JUL
 Ellen 17/18Z - 21/06Z and 23/06Z - 25/06Z and 28/00Z - 29/06Z JUL
 Patsy 06/06Z - 12/12Z and 13/12Z - 15/06Z OCT
 Thelma 15/00Z - 17/06Z and 18/06Z - 18/18Z NOV

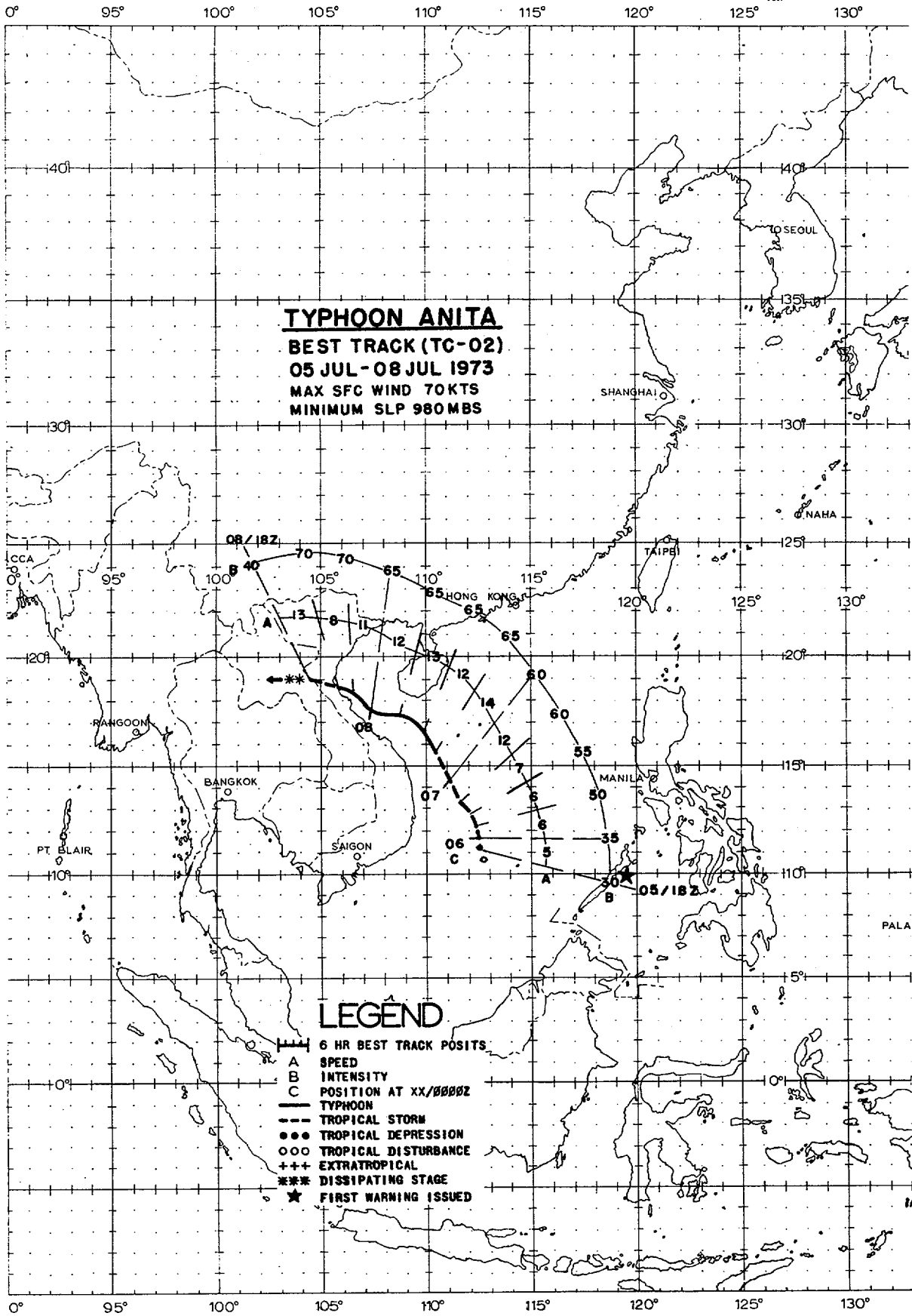
**Overlapping days included only once in sum
 † Over water estimate (one-minute averaging period)

DATA TAKEN FROM BEST TRACK









2. INDIVIDUAL TYPHOONS

ANITA

Anita, the season's first typhoon developed in the monsoon trough late on 5 July under conditions quite similar to those discussed by Ramage (1971). Several days prior to the initial development of Anita, the low level southwesterly flow throughout Indochina, the Malaysian Peninsula, and southern India increased from an average of 10 to 20 knots to speeds of 25 to 35 knots. The satellite mosaic on 4 July revealed that a band of cloudiness extending from the Arabian Sea to the South China Sea had increased markedly in response to the intensifying southwesterly flow (Figure 4-1).

Of particular interest during Anita's initial development were the strong winds (25 to 30 knots) extending more than 400nm from her center to the south with lighter winds (10 to 15 knots) near the large and diffuse center. These strong winds were primarily associated with the increased monsoon flow and not the storm itself, since Anita had not intensified sufficiently to produce the necessary pressure gradient to support such winds. Anita continued to exhibit this unusual wind structure as she intensified to typhoon strength (Figure 4-2). The USNS Washoe County reported winds in excess of 35 knots and mountainous seas over 150nm to the south of Anita (06/0900 GMT). Early

on the 7th, a reconnaissance aircraft reported Anita's sea level pressure had dropped to 983mb with flight level and surface winds of 50 to 80 knots within a band 30 to 60nm from the storm center, while winds within a 30nm radius of her center were 30 knots or less.

The storm initially drifted northnorthwest in response to a weakness in the subtropical ridge to the north caused by the remains of Tropical Storm Wilda. However, by 1200 GMT, 7 July, significant height rises at 500mb indicated the ridge was reforming over southern China. As a result, Anita assumed a more westerly track.

The USS OGDEN (LPD-5) reported eye passage and greater than 60 knot winds (08/0000 GMT) near 17.5N 107.4E as her barometer registered 981mb. The barograph aboard the USS TRIPOLI (LPH-10) recorded eye passage (08/0100 GMT) as the ship steamed near 17.6N 107.2E (Figure 4-3).

A reconnaissance aircraft observed a minimum sea level pressure of 980mb and a well defined closed wall cloud indicating continued intensification as the storm neared the North Vietnamese coast (08/1010 GMT). Anita reached peak intensity of 70 knots prior to going ashore near Vinh, North Vietnam and quickly dissipated over land (Figure 4-4).

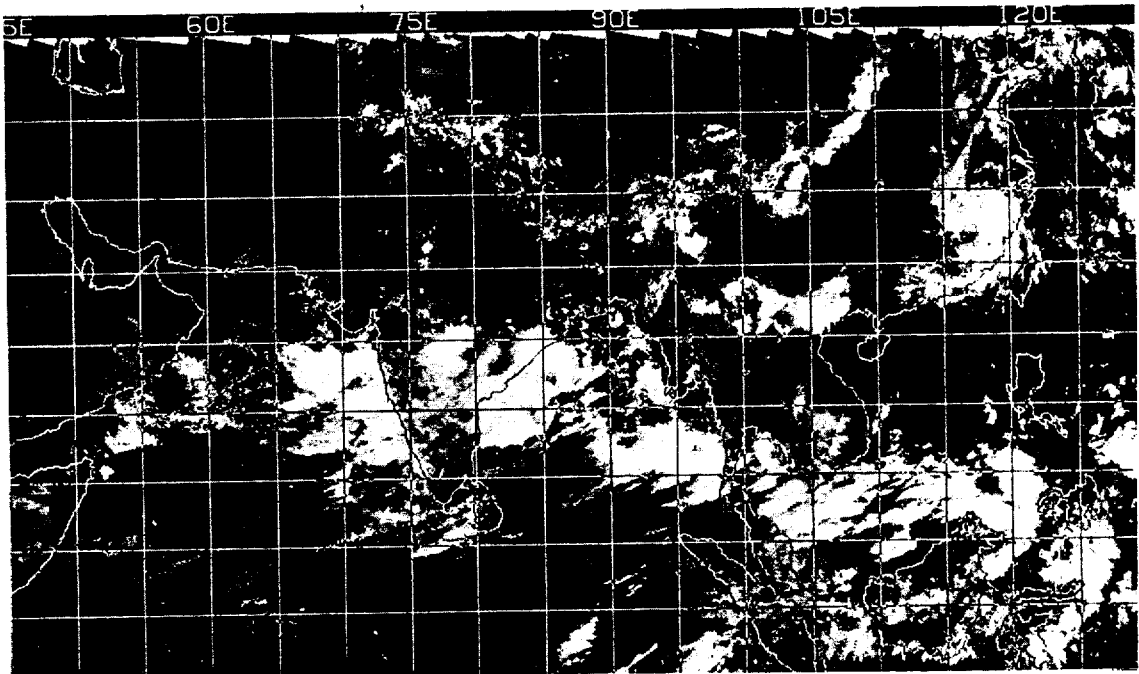


FIGURE 4-1. NOAA-2 satellite mosaic for 3 July 1973 showing cloud band associated with the southwest monsoon extending from the Arabian Sea to the South China Sea. Remnants of Wilda (A).

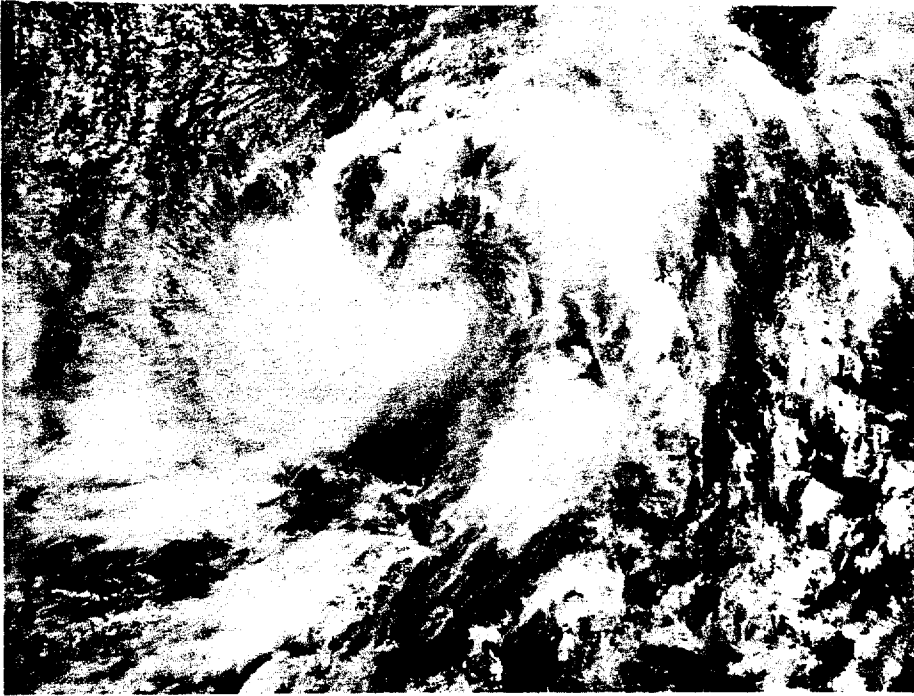


FIGURE 4-2. Tropical Storm Anita near typhoon intensity 110 nm off the coast of the Republic of Vietnam, 7 July 1973, 0444 GMT. (DMSP imagery)

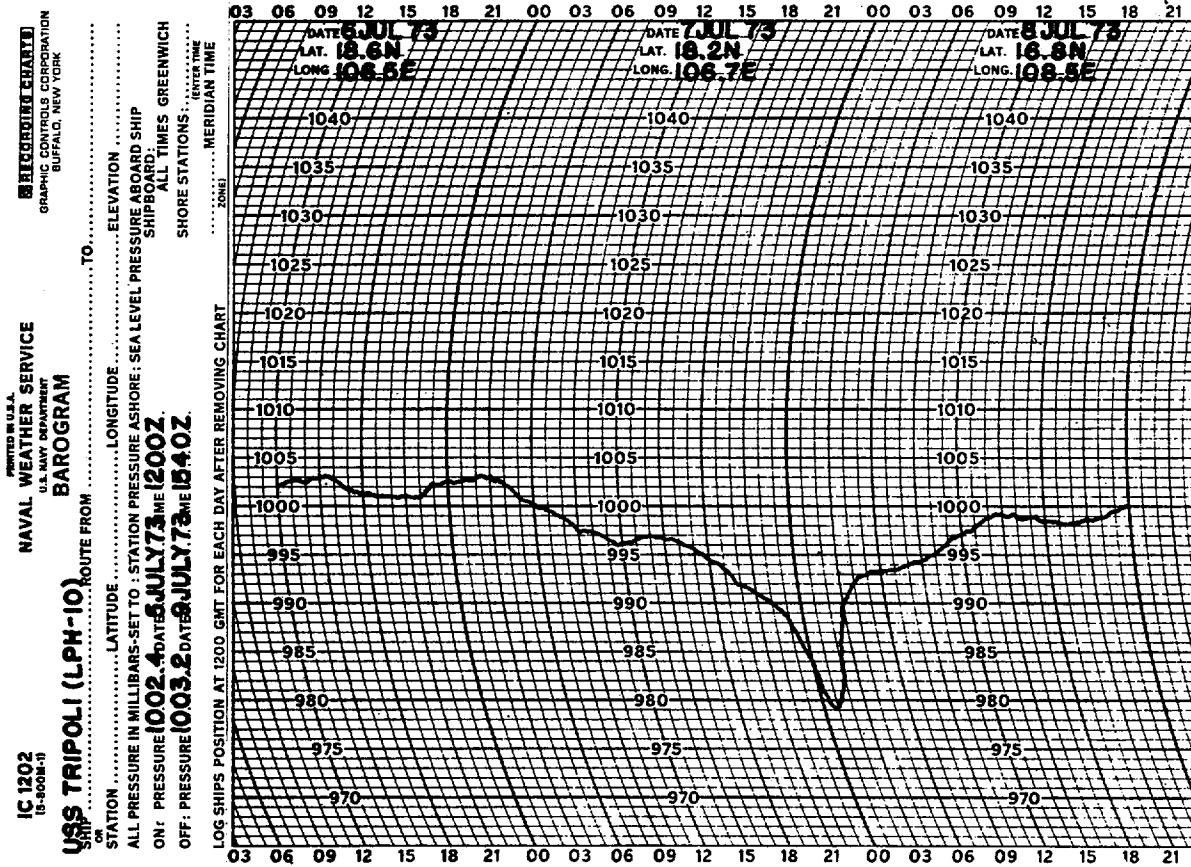


FIGURE 4-3. Reproduction of Barograph trace from the USS Tripoli (LPH-10) as she passed through the eye of Typhoon Anita.

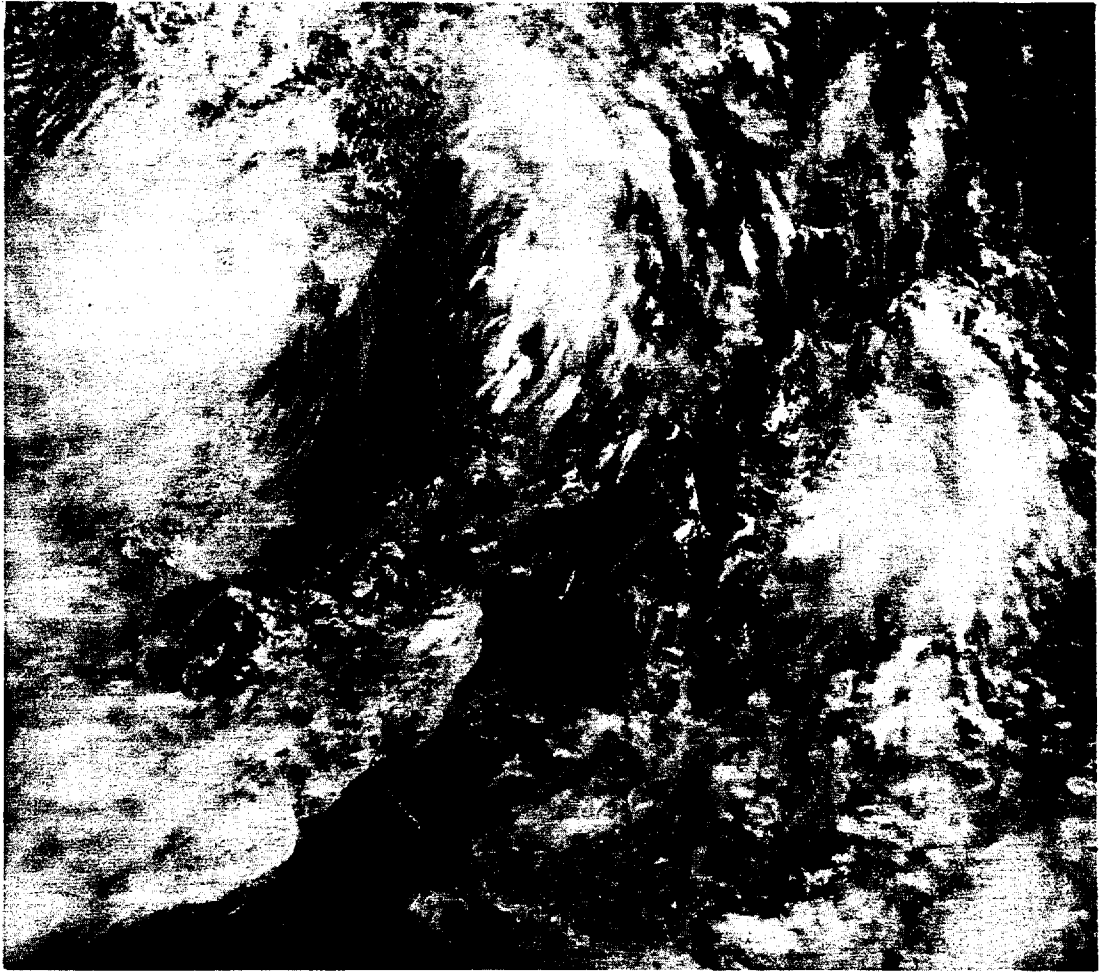
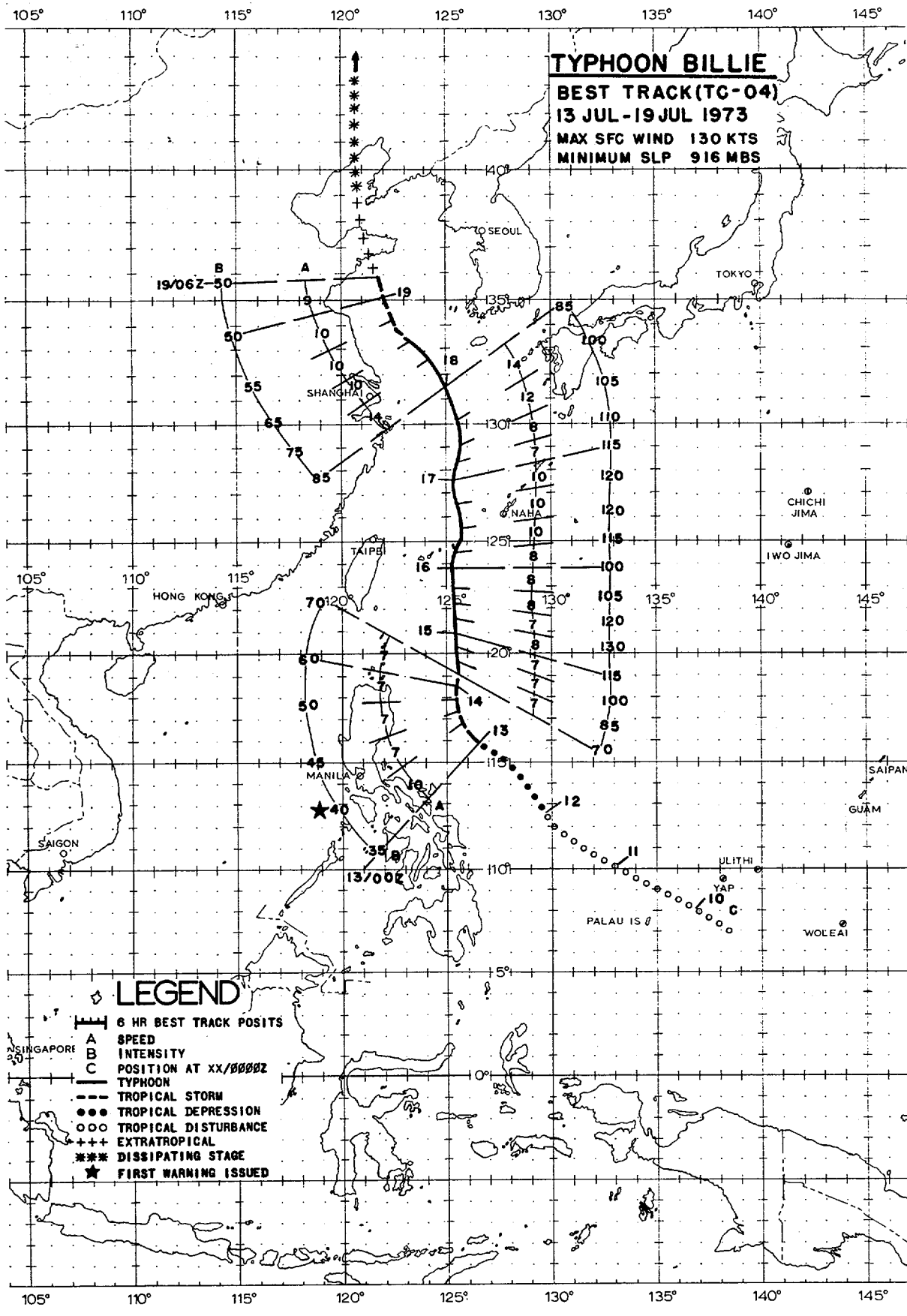


FIGURE 4-4. *Typhoon Anita in the Gulf of Tonkin near peak intensity, 8 July 1973, 0432 GMT. (DMSP imagery)*



BILLIE

Billie, the season's first super typhoon, became a tropical depression in the western Philippine Sea some 250nm east of Luzon on 12 July. Her early history can be traced to the Yap-Palau area on 10 July as a weak circulation in the monsoon trough.

Billie initially tracked westward, gradually shifting to the northwest in response to a long wave, mid-tropospheric trough over eastern China. Reaching tropical storm force late on the 13th, Billie assumed a northerly course at a speed of 7 kts.

The long wave trough remained stationary, influencing Billie to maintain a meridional track at about 8 kts. Her center never deviated more than 30nm either side of 125.5E for 4 days, covering a distance of 720nm. This steadiness in direction for such an extended period of time sets Billie apart from any other northward moving typhoon during the period 1947-1972.

Rapid deepening occurred once typhoon force was attained early on the 14th as Billie's central pressure fell 50mb in 24 hours. At 15/0330 GMT, aircraft reconnaissance indicated that the central pressure had dropped to 916mb within a tightly organized eye 8nm in diameter (Figure 4-5).

Billie's central pressure rose to 954mb during the next 18 hours as she approached the Ryukyus. Commencing an unusual second deepening as she crossed through the island chain, Billie's central pressure dropped to 917mb in the East China Sea (16/1154 GMT).

Billie passed just east of Miyako Jima, where maximum sustained winds of 65 kts with gusts to 104 kts were recorded (16/

0700 GMT). The lowest pressure reading at the Japanese Meteorological Agency Station was 947.5mb (16/0650 GMT).

The island of Okinawa experienced gale force winds as Billie transited northward through the East China Sea. Naha registered maximum sustained winds of 35 kts with gusts to 58 kts (16/1700 GMT) while White Beach Naval Port Facility recorded 45 kts sustained with gusts to 55 kts (16/1900 GMT). Kadena AFB reported lesser winds of 28 kts (16/1640 GMT) with gusts of 43 kts (16/1354 GMT). Based on land radar, Billie's eye passed 105nm west of Okinawa at 16/1800 GMT.

On the 17th, a short wave deepened the northern portion of the long wave trough situated in the Lake Baikal region of Siberia, causing increased ridging over Manchuria and the Sea of Japan. This ridging prevented Billie from recurving. On the 18th, Billie shifted to a northwest course 120nm southsouthwest of Cheju-do Island. Satellite imagery indicated drier air off the Asian Mainland was entering Billie's circulation at this time. She weakened significantly during the 18th, dropping to tropical storm strength late that day while tracking into the Yellow Sea.

Approaching the Gulf of Chihli on the 19th, Billie acquired extratropical characteristics and accelerated to a forward speed greater than 20 kts. Billie finally moved inland near Chin-Chow China and dissipated on the 20th.

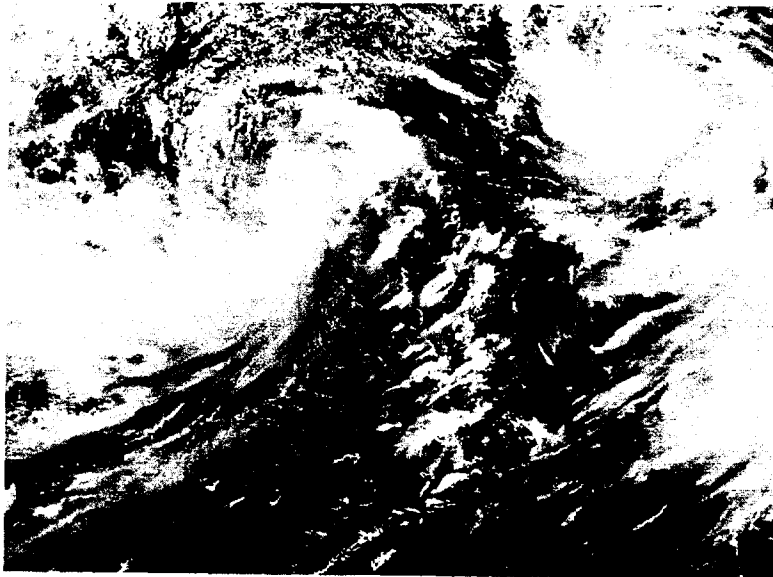
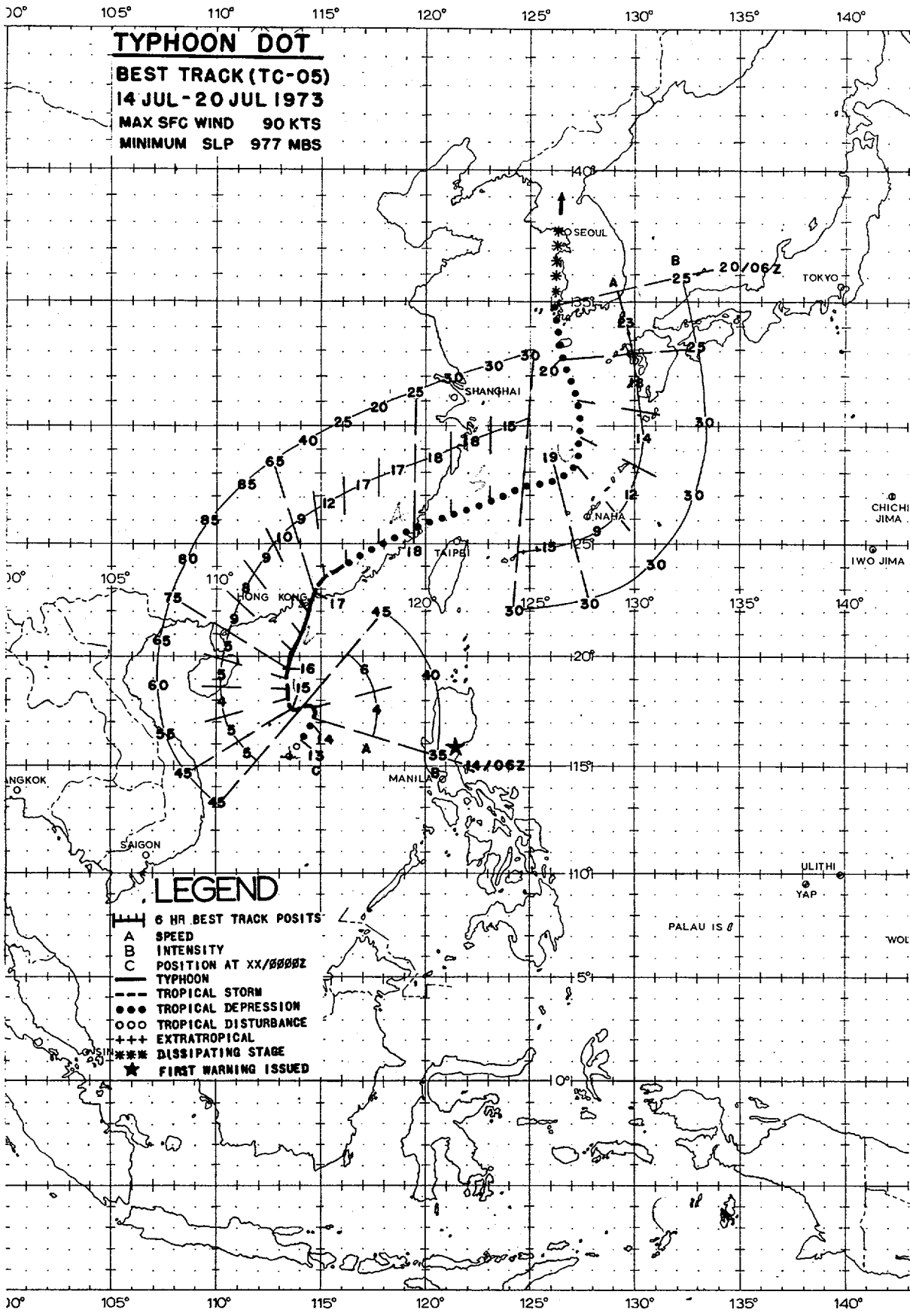


FIGURE 4-5. Typhoon Billie (right) 7 hours prior to an unusual second deepening 190 nm east of Taiwan. Typhoon Dax (left) in the South China Sea, 16 July 1973, 0416 GMT. (DMSP imagery)



The South China Sea spawned its second typhoon of the 1973 season on 13 July with the genesis of Dot. Her development was quite similar to Anita's. A surge in the low level southwesterlies preceded her formation in the monsoonal trough.

Dot formed a few days after Billie. While Billie intensified rapidly in the Philippine Sea to dominate the synoptic situation in the vicinity of both tropical cyclones, Dot drifted slowly northward remaining poorly organized (Figure 4-6). Billie's strong mass divergence aloft effectively blocked Dot's outflow to the subtropical westerlies leaving a good outflow channel only in the southwest semicircle. This may have been a critical factor in explaining Dot's slow rate of intensification during the first three days of her existence.

Late on the 15th, Dot began to increase her rate of intensification. The United Kingdom ship HYRIA, located 60 nautical miles southeast of Dot's center, observed 55 knots of wind and a pressure of 989.3mb (15/0600 GMT). She reached typhoon strength late that evening as she accelerated to a speed of 9 knots towards Hong Kong. During this period, the separation between Dot and Billie began to increase and Billie had reached peak intensity and was starting to weaken. This apparently allowed Dot to intensify at a faster rate.

Besides intensity interaction between Dot and Billie, both storms also experienced the Fujiwhara interaction (Figure 4-7). By subtracting the steering flow from the resultant movement of both storms the interaction is quite pronounced (Brand, 1968). Throughout the period of the interaction Billie remained the stronger of the

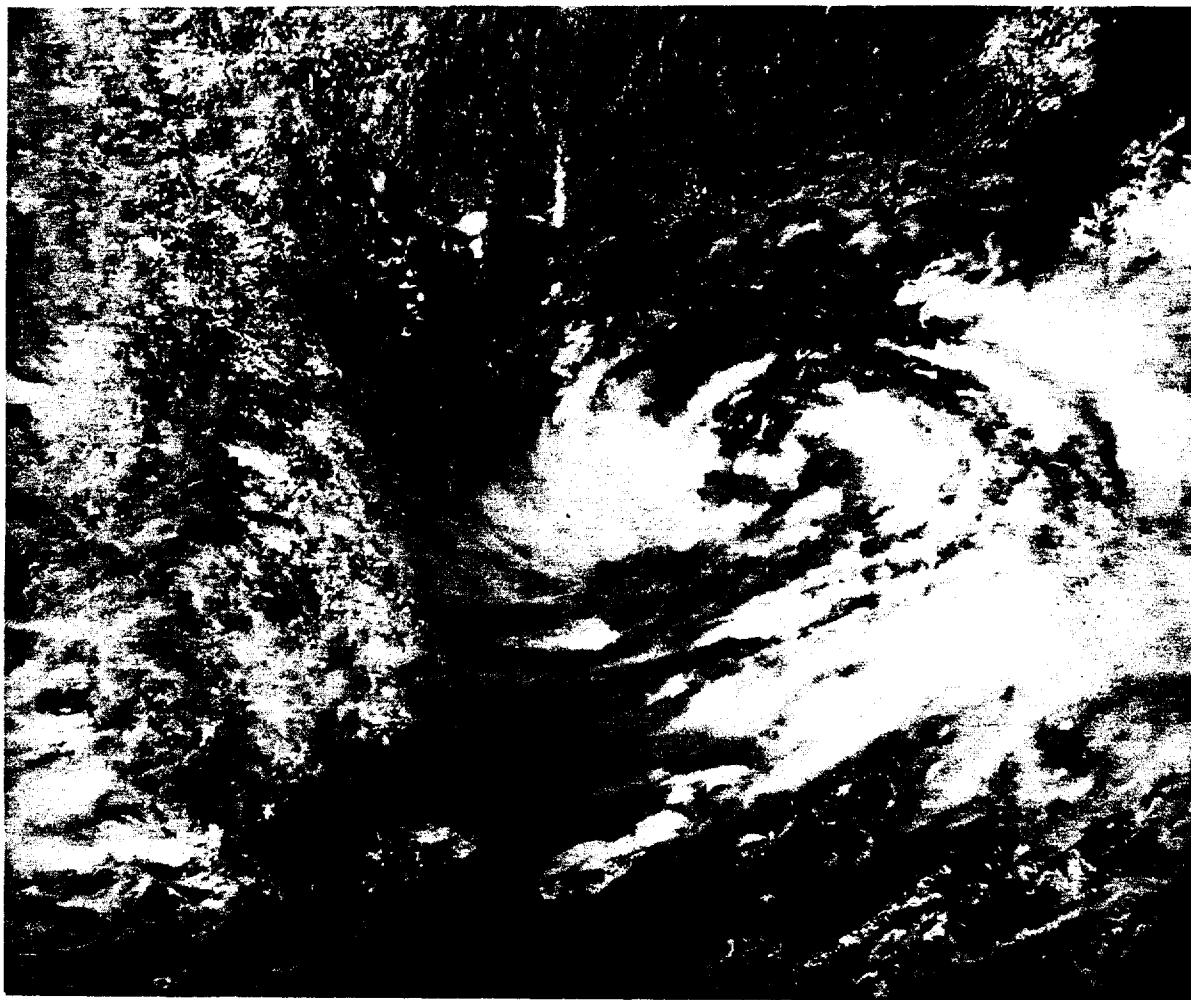


FIGURE 4-6. Dot as a tropical depression in the South China Sea, 14 July 1973, 0446 GMT. (DMSP imagery)

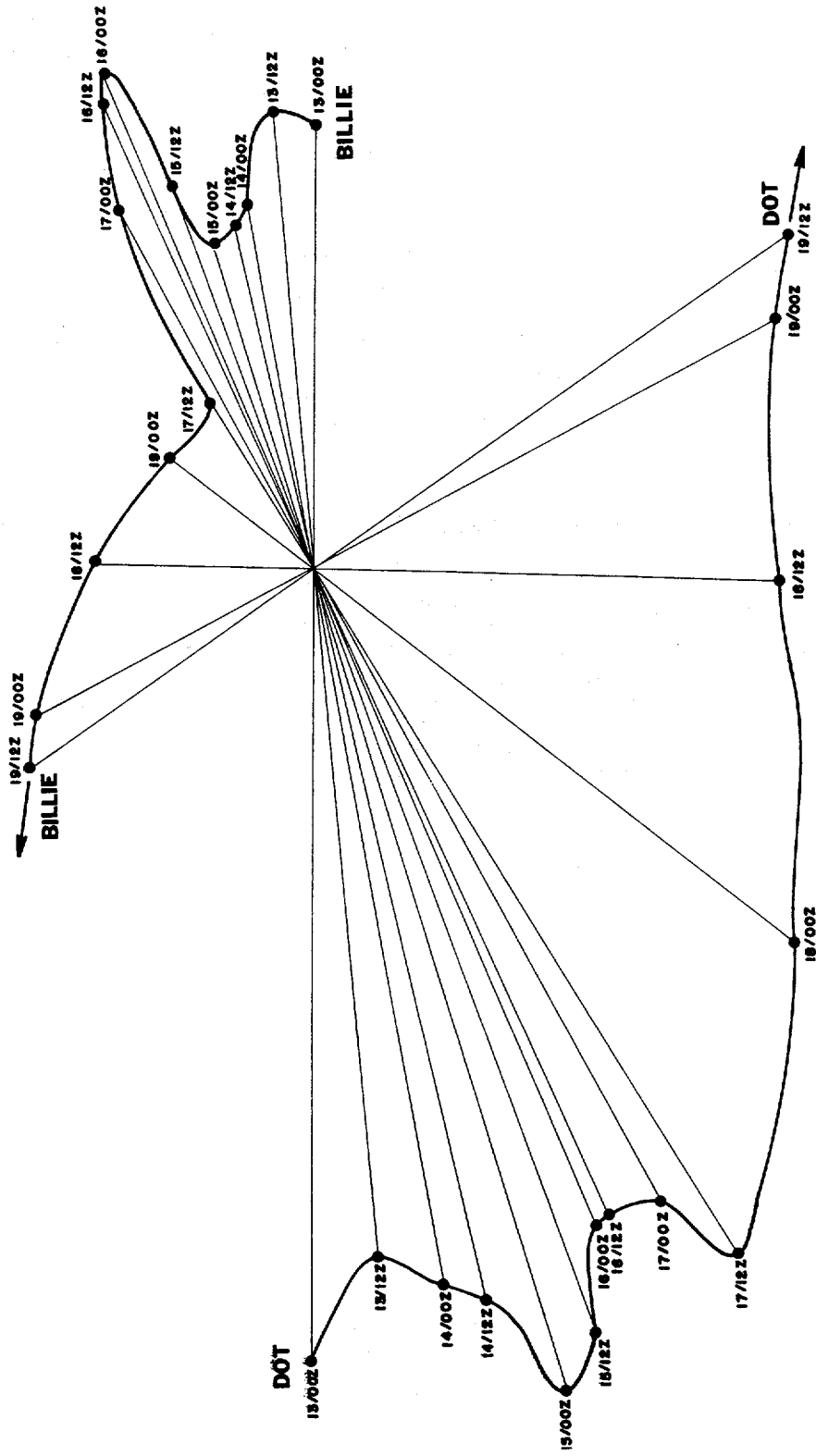


FIGURE 4-7. Depicts Fujiwhana interaction between Typhoon Dot and Typhoon Billie over a period of approximately 6 1/2 days.

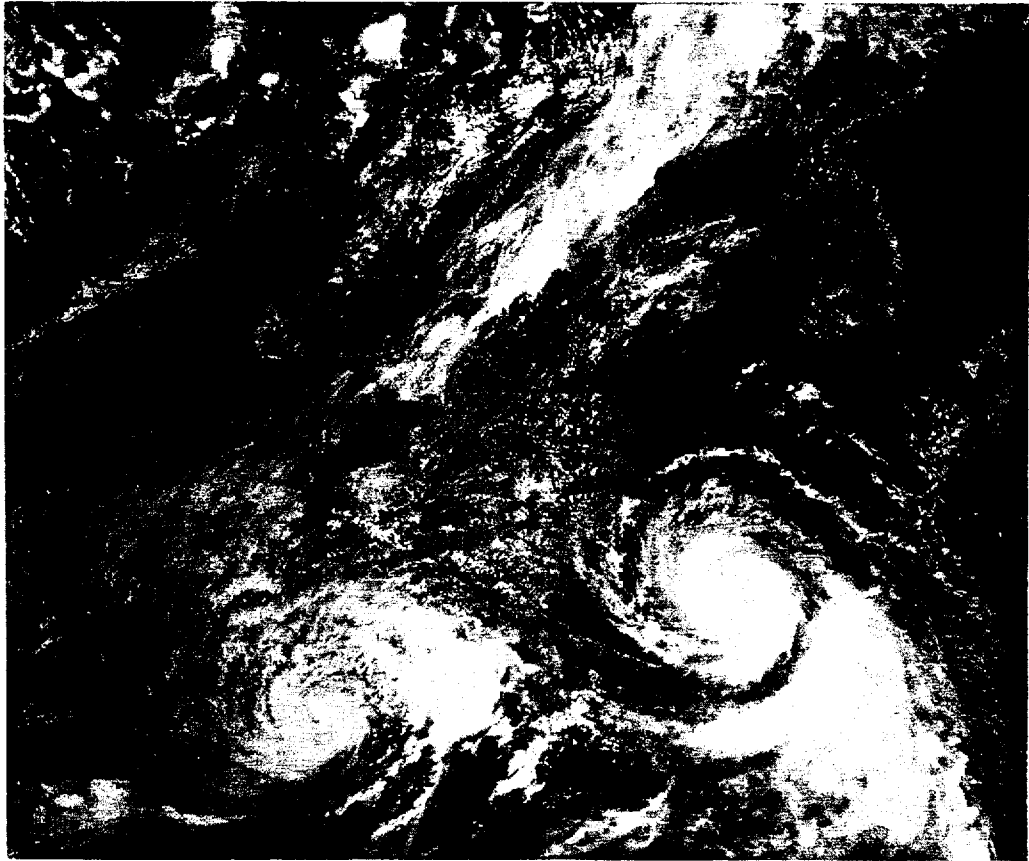


FIGURE 4-8. *Dot* (left) overland 70 nm northeast of Hong Kong and Typhoon *Billie* (right) in the East China Sea, 17 July 1973, 0402 GMT. (DMSP imagery)

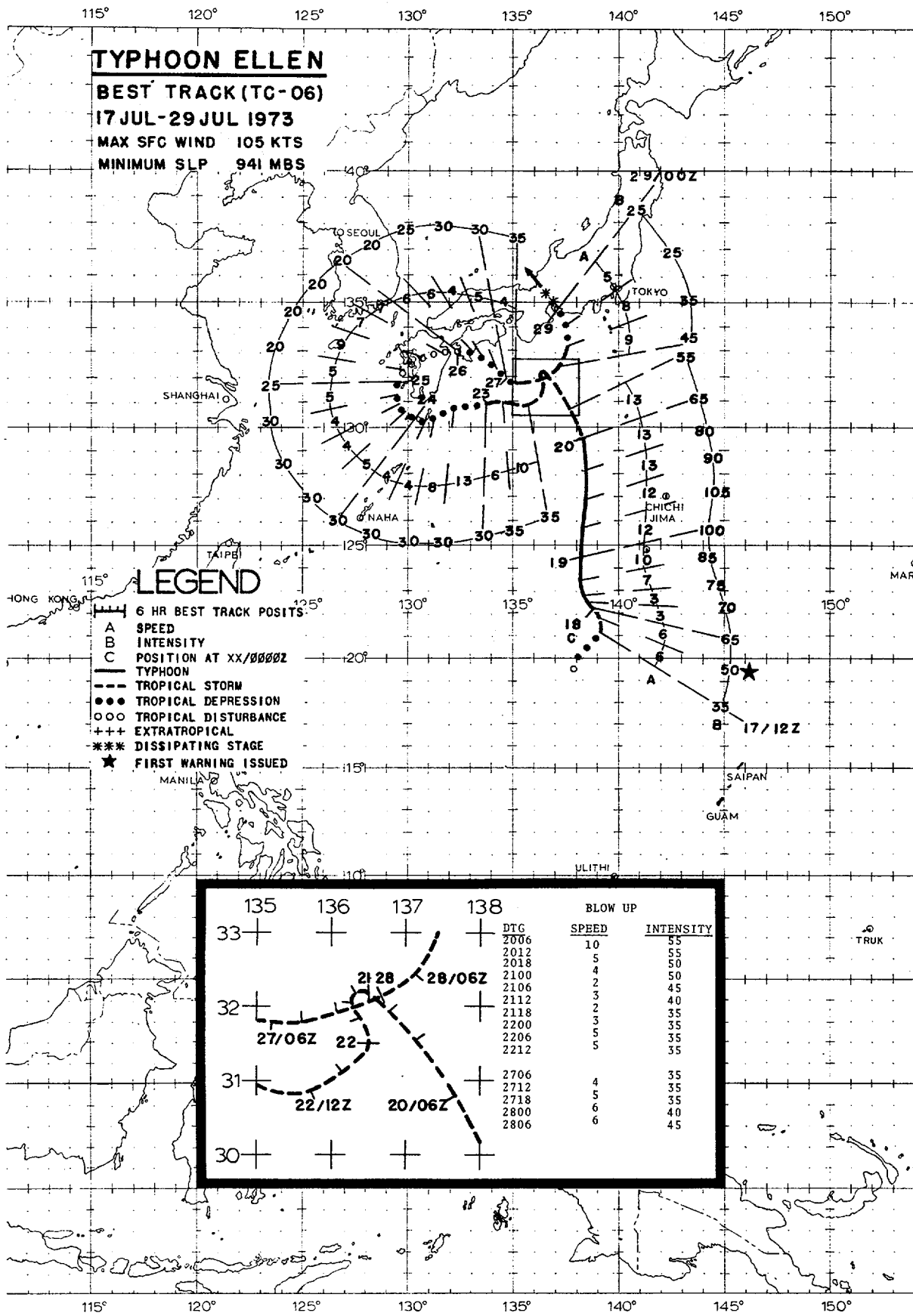
two. As a result, *Dot*'s resultant movement was affected much more significantly. Both storms rotated 124 degrees around the common center of rotation.

Dot reached her peak intensity of 85 knots on the 16th, about 80nm south of Hong Kong. She passed within 12 miles of the Royal Observatory in Hong Kong which experienced maximum sustained winds of 32 knots with a peak gust of 76 knots. Tate's Cairn in the Colony reported the strongest sustained winds of 57 knots with peak gusts of 97 knots.

Dot weakened considerably upon making landfall on the northeastern side of Mirs Bay (Figure 4-8). She tracked toward the eastnortheast over eastern Kwangtung during the night of the 17th as a low pressure area and entered the East China Sea near Foochow as a tropical depression on the morning of the 18th. As *Dot* approached within 120nm northnorthwest of Okinawa, she took an abrupt change of course due north in response to a building ridge to the east and accelerated rapidly, following in the wake of *Billie*. *Dot* dissipated over the Yellow Sea on the 20th.

Damage reports from Hong Kong indicated many low-lying areas in the New Territories were flooded. Hong Kong experienced heavy losses to garden crops, fruit trees, livestock, and farm houses. A landslide killed one person and injured

38 others. Two freighters were beached and six others dragged anchor.



The first indication of what was to become Ellen appeared in the surface data on 15 July as an increased troughing in the extensive convergence zone southeast of Typhoon Billie. By 17 July, high resolution DMSP satellite imagery confirmed the existence of a closed circulation in the trough near 20°N 138°E (Figure 4-9).

Ellen evolved unusually far north in the trailing convergence area of Typhoon Billie. Furthermore, in the early stages of development, the upper tropospheric outflow was most obviously influenced by the TUTT. Post-analysis of 200mb synoptic charts and satellite data indicates that the formation was assisted by a small, but pronounced, ridging induced on the east side of a westward moving cell in the upper tropospheric trough.

Ellen intensified rapidly, reaching typhoon strength by the 18th. Iwo Jima (Japanese Maritime Self Defense Force) reported southeasterlies with maximum gust of 44 knots as she passed to the west within 165nm (19/0200 GMT). Ellen achieved peak intensity as a reconnaissance aircraft observed maximum winds of 105 knots and a central pressure of 941mb (19/0420 GMT).

During the early portion of her life, Ellen tracked almost due north as Billie had done. She moved to the north beneath upper tropospheric northerly flow (35-40 knots). By late on the 19th, the strong vertical shearing environment caused her to deteriorate rapidly over open water (Figure

4-10). By the 20th, the upper level anticyclone over Ellen had sheared off exposing her low level circulation. Convective activity at this time was confined to convergence areas well south and southeast of the center.

As a weak low-level circulation, the remains of Ellen drifted westward under the influence of the troughing left by Billie and Dot and a quasi-stationary anticyclone over the Sea of Japan. Satellite imagery on 23 July indicated a rejuvenation of convection over the circulation which then persisted through 28 July with varying degrees of intensity. Reconnaissance aircraft on 24 July confirmed the presence of a warm core, closed circulation. As a result of the weak steering flow, Ellen's movement was erratic during the period from the 21st to the 28th.

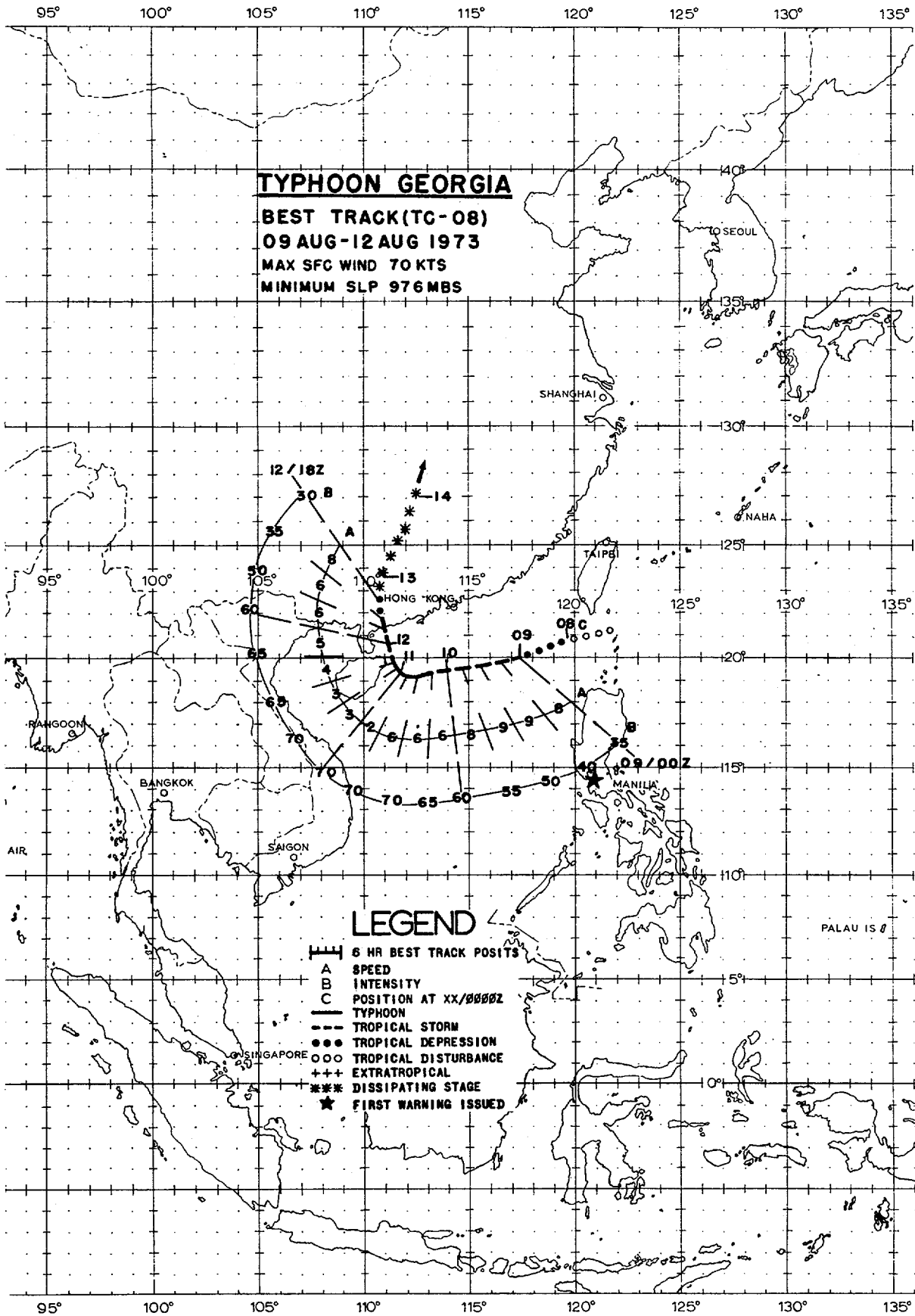
On the 28th, she reintensified once more 90nm from the south coast of Honshu. The Japanese weather ship OJIKA and two other ships reported winds of 30 to 35 knots around Ellen (28/0000Z). She reached a peak of 45 knots as a shortwave trough over the Sea of Japan caused her to move on a northward course over south central Japan dissipating over land on the 29th.



FIGURE 4-9. Formative stages of Ellen centered 300 nm southwest of Iwo Jima, 17 July 1973, 0221 GMT. (DMSP imagery)



FIGURE 4-10. Typhoon Ellen (right) at peak intensity. Dot (left) as a tropical depression, 19 July 1973, 0333 GMT. (DMSP imagery)



GEORGIA

During early August, the tropical upper tropospheric trough (TUTT) remained to the north of and in close proximity to the monsoon trough in the South China Sea. As a result, Georgia's formation and subsequent development cannot be easily attributed to the monsoon trough or the TUTT independently, but more as an interaction between the two. Sadler (1973) suggests that westward moving cells in the TUTT provide an upper level westerly outflow channel which enhances development of disturbances in the monsoon trough. This type of influence was apparent during the development of Georgia.

Georgia reached minimum tropical storm intensity on 9 August as she transited on a westsouthwest course across the South China Sea at a moderate speed. She passed within 170nm of Hong Kong late on the 9th. Maximum sustained winds experienced at Hong Kong were 41 knots with a peak gust of

73 knots. Georgia reached typhoon intensity on 10 August (Figure 4-11).

Maintaining her westerly track at 8 knots until early on the 11th, Georgia then turned north in response to a weakness in the high cell over eastern China. She made landfall north of Hainan Island on 12 August and dissipated over China. Georgia was the third tropical cyclone originating in the South China Sea to reach typhoon intensity in 1973.

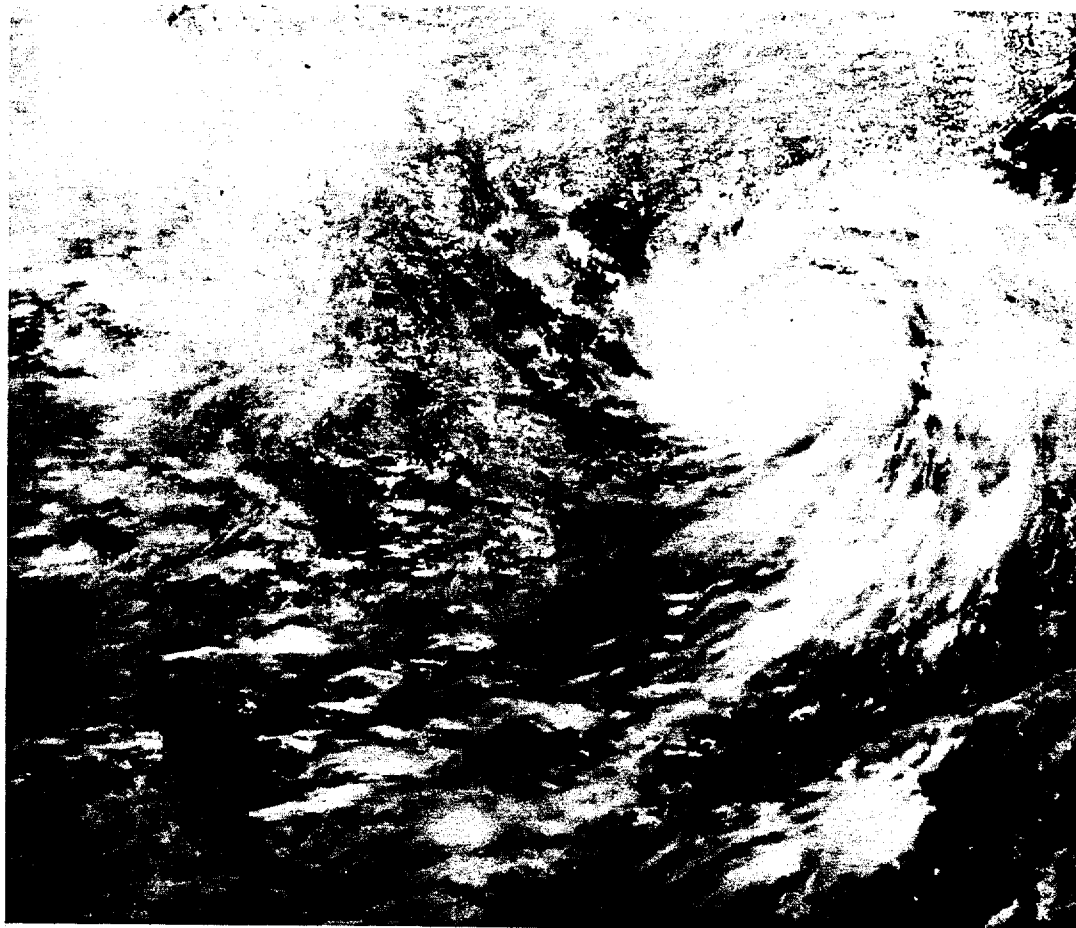
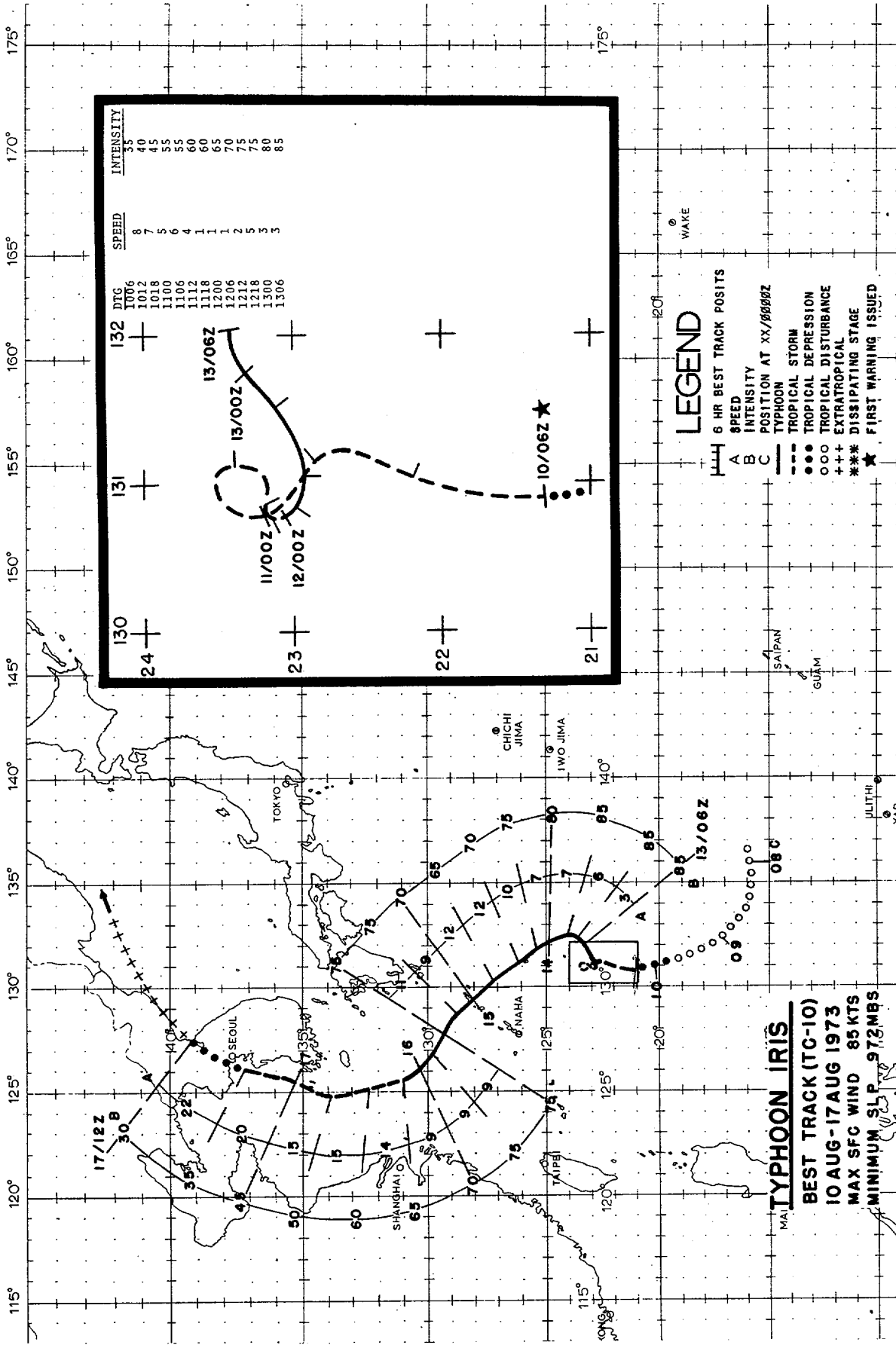


FIGURE 4-11. Typhoon Georgia in the South China Sea 140 nm east of Hainan Island, 10 August 1973, 0500 GMT. (DMSP imagery)



On the 8th of August, the monsoon trough extended 1500 nautical miles southeast from the Luzon Strait to a position just west of Truk with a weak surface cyclonic circulation imbedded in the trough 420 nautical miles north of Yap. Only 24 hours previously, its eastward extent had been restricted to the northern part of the South China Sea.

During the next two days, the disturbance drifted northwestward with little development. By the 10th, the disturbance had intensified to Tropical Storm Iris. She continued to move northward at 8 knots.

On the morning of the 11th, the complex upper air and weak steering flow patterns resulting from the presence of the subtropical ridge to the north and the near equatorial ridge to the south of Iris forced her to remain essentially quasi-stationary for the next 48 hours. However, she continued to intensify during this period and by early on the 12th, developed typhoon strength winds.

Early on the 13th, Iris began to move toward the northeast under the influence of the near equatorial ridge reaching her maximum intensity of 85 knots that afternoon (Figure 4-12).

As Hope dissipated to the east, the subtropical ridge returned to its climatological position and the near equatorial ridge weakened. This forced Iris to alter her course to the northwest on the 14th in

response to the change in the steering flow. The Japanese meteorological station at Minami Daito Jima measured a minimum pressure of 974.7mb during the passage of Iris (14/0707 GMT). Approximately 11 1/2 hours (1830 GMT) after passage of the surface center, the station reported peak gusts of 63 knots out of the southwest. She gradually weakened to minimum typhoon intensity prior to crossing the island of Amami O-Shima. Two fishing vessels were reported lost in the vicinity of the island during her passage.

After crossing the island she reintensified briefly to 75 knots. By the 16th, Iris weakened to tropical storm force and took a more northerly course (Figure 4-13).

On the morning of the 17th, Iris began recurving. Kunsan Air Base in the Republic of Korea experienced maximum sustained winds of 46 knots with a peak gust of 64 knots as Iris passed within 25nm (17/0646 GMT). She made landfall near Kaesong, Korea about 17/0800 GMT with maximum winds of 35 knots. Iris continued across Korea, entering the Sea of Japan near Wonsan where the maximum winds were still 30 knots. She became extratropical over the Sea of Japan as she merged with a front moving off Manchuria.

Initial reports from Korea indicated two persons were killed, three missing and hundreds were left homeless. A barge carrying six persons sank in the sea off Kijang - Myon, Yangsangun; 3 were rescued.



FIGURE 4-12. Typhoon Iris (left) near peak intensity 285 nm southeast of Okinawa. Remnants of Hope (right) just off the coast of Honshu, 13 August 1973, 0234 GMT. [DMSP imagery]

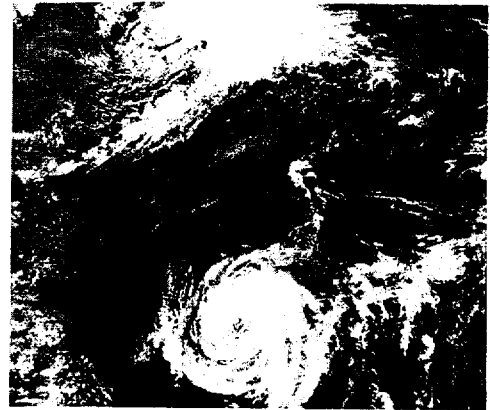
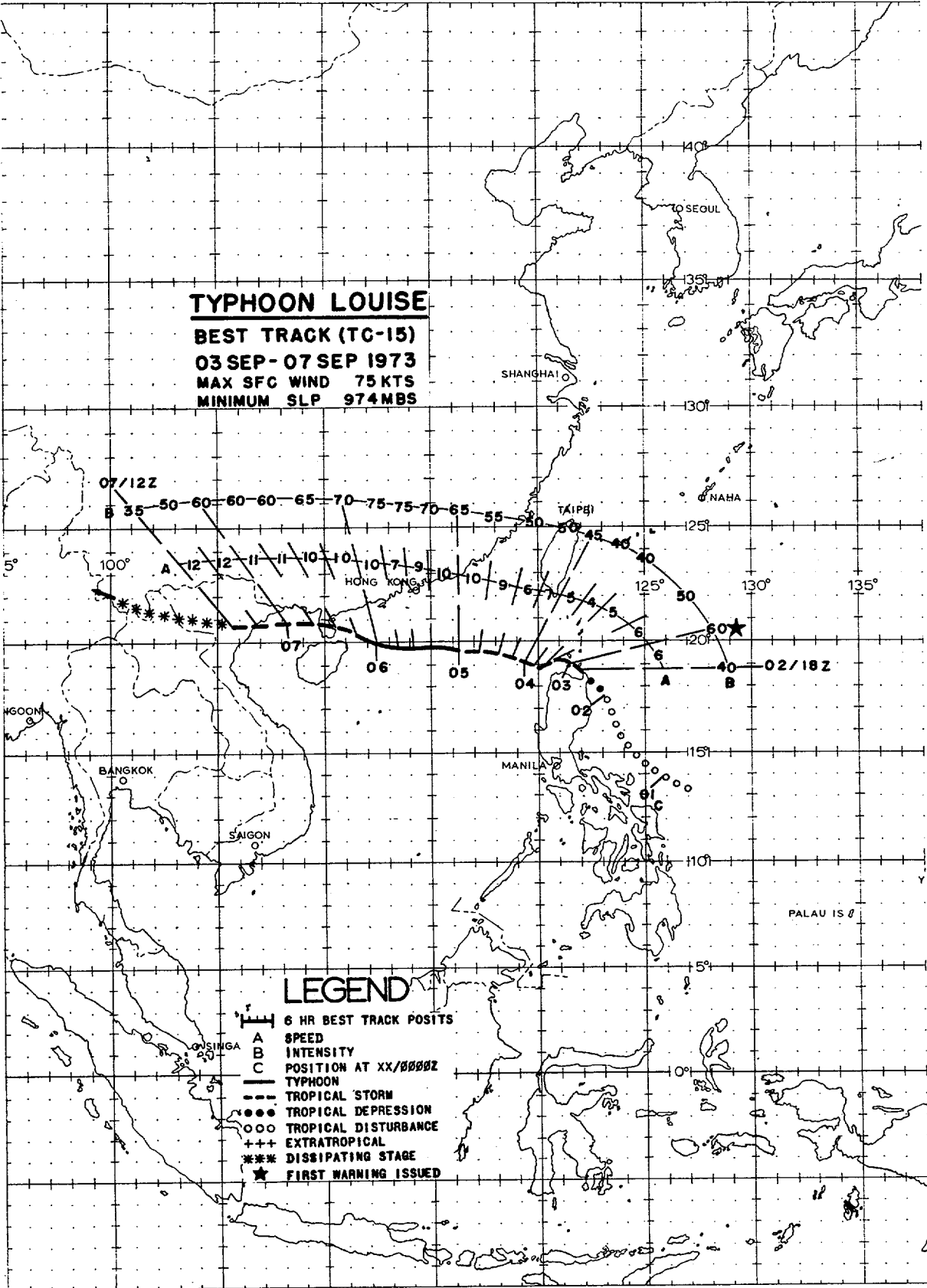


FIGURE 4-13. Typhoon Iris 165 nm south of Cheju Do, 16 August 1973, 0332 GMT. [DMSP imagery]

5° 100° 105° 110° 115° 120° 125° 130° 135°

TYPHOON LOUISE
BEST TRACK (TC-15)
03 SEP - 07 SEP 1973
MAX SFC WIND 75 KTS
MINIMUM SLP 974 MBS



LEGEND

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

5° 100° 105° 110° 115° 120° 125° 130° 135°

LOUISE

Louise began as a low level circulation in the monsoon trough first noted on 30 August in the Philippine Sea to the east of Catanduanes Island. An organized cloud pattern became apparent the next day but the surface circulation remained weak. The weak surface low drifted towards the northwest for the next 72 hours.

By 3 September, an aircraft investigative mission reported a narrow band of 65 to 75 knot surface winds north of the low center although the minimum sea level pressure was only 998mb (03/0350 GMT). A 60 knot wind report from the United Kingdom ship SHEAF TYNE 30nm to the north of Louise confirmed the aircraft observation. Satellite imagery at approximately the same time showed Louise to be poorly organized. The near-typhoon force winds appear to have been a transitory phenomenon induced by the channeling effect of the Luzon Strait. By the evening of the 3rd, a reconnaissance

aircraft reported maximum winds of only 40 knots as Louise entered the South China Sea.

On the 4th, Louise had become a better organized tropical storm well on her way to becoming a typhoon (Figure 4-14). The mid-tropospheric ridge to the north of Louise kept her on a westerly course at 10 kts across the South China Sea.

She passed 150nm to the south of Hong Kong late on the 5th just as she reached peak intensity of 75 kts. Throughout her life, Louise remained a relatively small typhoon. Louise crossed the Luichow Peninsula during the night of the 6th. Eighteen hours later she made landfall and dissipated rapidly over North Vietnam.

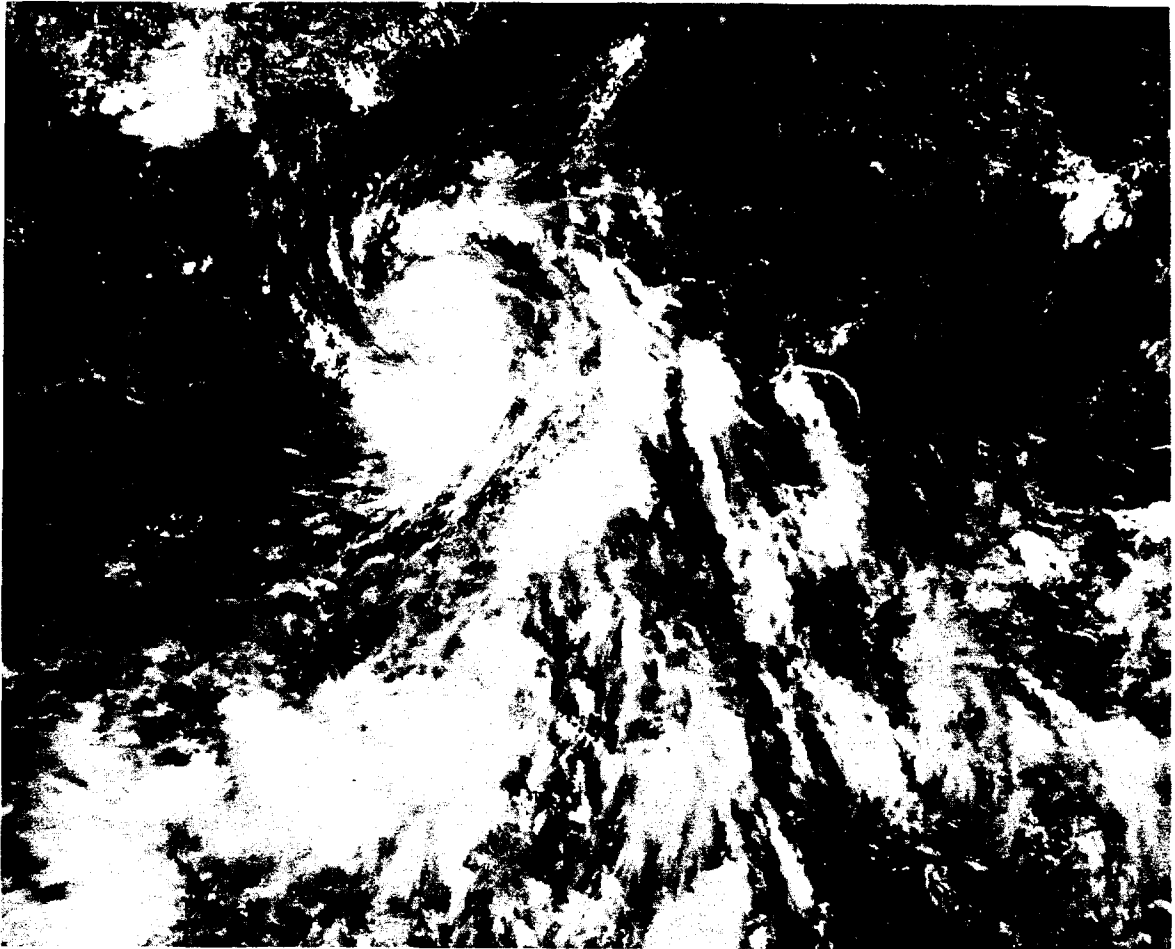


FIGURE 4-14. Tropical Storm Louise 105 nm northwest of Luzon, 4 September 1973, 0401 GMT. (DMSP imagery)

Marge entered the South China Sea on 12 September as a tropical depression, after crossing northern Luzon (Figure 4-15). She quickly developed to tropical storm strength 125 nm northwest of Cape Bolinao. The early stages of Marge can be traced to a weak circulation in the monsoon trough appearing on the synoptic surface analysis 750 miles east-southeast of Luzon (08/0000 GMT). This system tracked westward during the next four days as it accelerated to a speed of 11 to 12 knots before making landfall on northern Luzon.

A narrow, mid-tropospheric, subtropical ridge was positioned over southern China as Marge emerged into the South China Sea. Little change in intensity or orientation of the ridge occurred during the next few days, dictating a westerly course which eventually caused Marge to strike North Vietnam 2 1/2 days later.

Maintaining a forward speed of 11 knots, Marge intensified steadily after entering the open waters of the South China Sea, reaching typhoon force as she

passed 200 nm south of Hong Kong on the morning of the 13th (Figure 4-16). The minimum measured central pressure by aircraft reconnaissance, prior to the typhoon crossing the no-fly line, was 964 mb early in the evening of 13 September.

Striking central Hainan Island early on the morning of the 14th with sustained winds estimated near 80 knots, Marge emerged into the Gulf of Tonkin with tropical storm force some 12 hours later. Eventual landfall was made 60 nm north of Vinh, North Vietnam during the early morning hours of the 15th. Subsequently, Marge dissipated rapidly inland over the highlands of Laos.

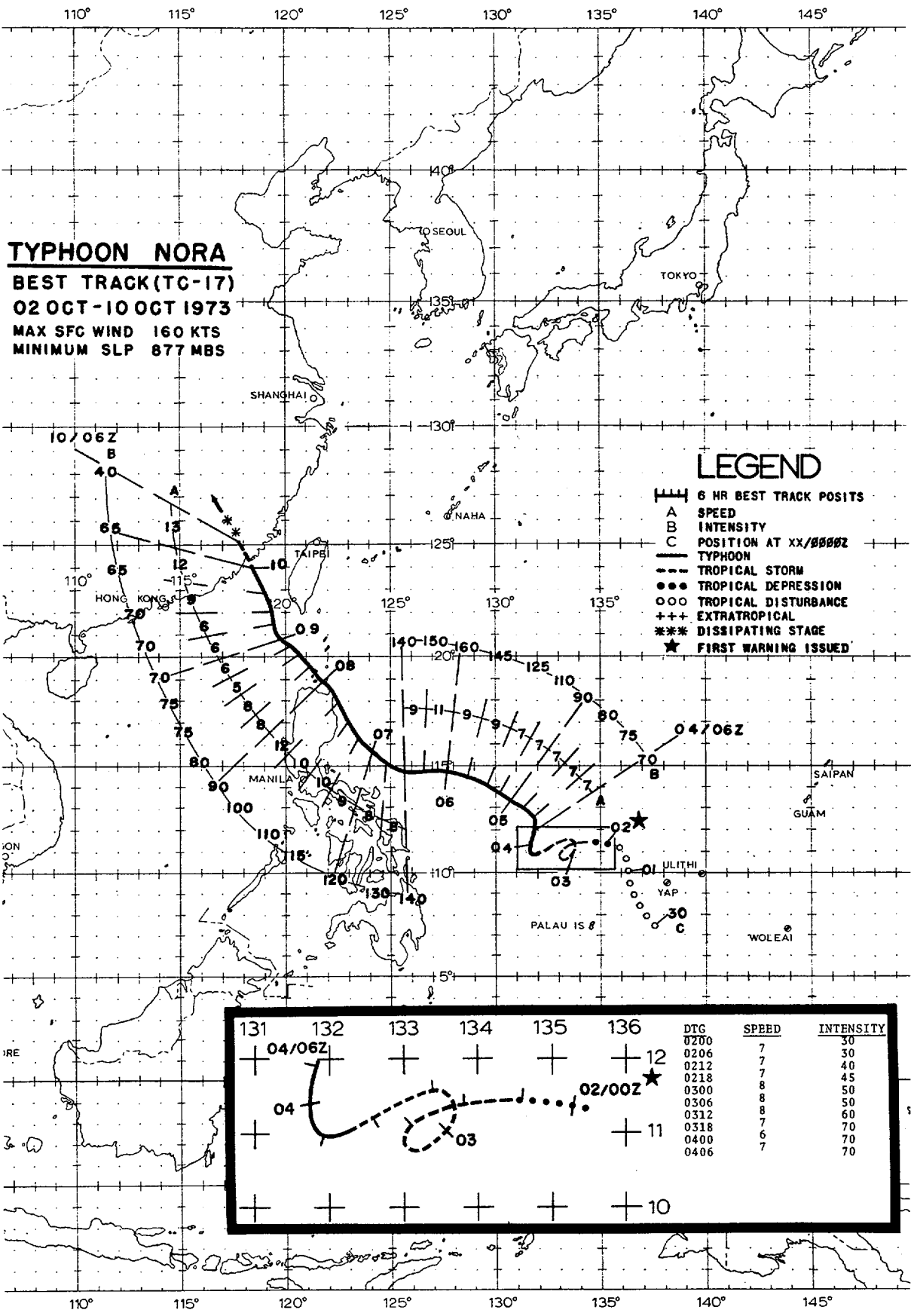
One interesting feature of Marge during her transit of the South China Sea was her small size. Similar to Louise, as a typhoon, her circulation did not appear to exceed 150 miles in diameter as evidenced by ship and aircraft reconnaissance data. Typhoon strength winds were probably confined to the wall cloud region.



FIGURE 4-15. Marge as a tropical depression 20 nm west of Luzon, 11 September 1973, 2342 GMT. (DMSp imagery)



FIGURE 4-16. Tropical Storm Marge near typhoon strength 225 nm south of Hong Kong, 13 September 1973, 0106 GMT. (DMSp imagery)



DTG	SPEED	INTENSITY
0200	7	30
0206	7	30
0212	7	40
0218	8	45
0300	8	50
0306	8	50
0312	8	60
0318	7	70
0400	6	70
0406	7	70

NORA

A weak surface low formed in the monsoon trough, 120 miles south of Yap, on 30 September, and drifted northwest for the next two days. By the evening of 2 October, the tropical disturbance had intensified to Tropical Storm Nora. Reconnaissance aircraft reported maximum flight level winds of 45 kts and a minimum sea level pressure of 987 mb.

Nora continued a gradual intensification until early on the afternoon of the 5th when her winds exceeded 100 kts. During the next 20 hours, as she moved westward at 9 kts toward the Republic of the Philippines, Nora's central pressure plummeted 66mb to 877mb with maximum surface winds of 160 kts (Figure 4-17). Her

central pressure ranked among the lowest on record (Jordon, 1961).

On the evening of the 6th, the high resolution DMSP infrared imagery revealed the typical anticyclonic outflow pattern in the cirrus. The infrared data was then "thresholded" to display only the colder portion of the infrared spectrum sensed by the radiometer (Figure 4-18). It revealed what appeared to be a tightly wound band spiraling out from the eye wall. Nora was a super typhoon at this time with estimated maximum winds of 140 kts.

When Nora was 225 miles east of Manila on the morning of the 6th, she took a more northwesterly track in response to an

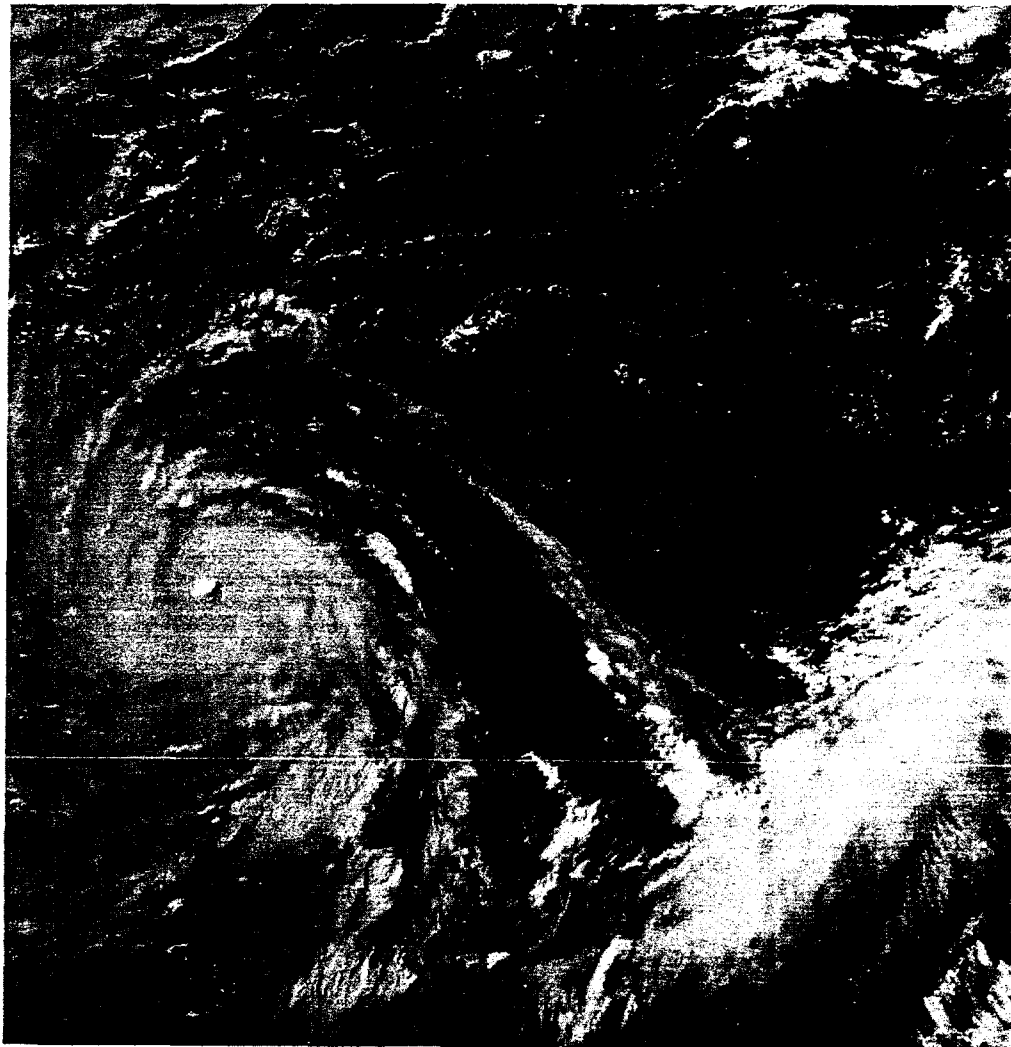


FIGURE 4-17. Super Typhoon Nora (left) at peak intensity 200 nm eastnortheast of Catanduanes Island. Formative stages of Patsy (right) with low level circulation center exposed, 5 October 1973, 2312 GMT. (DMSP imagery)

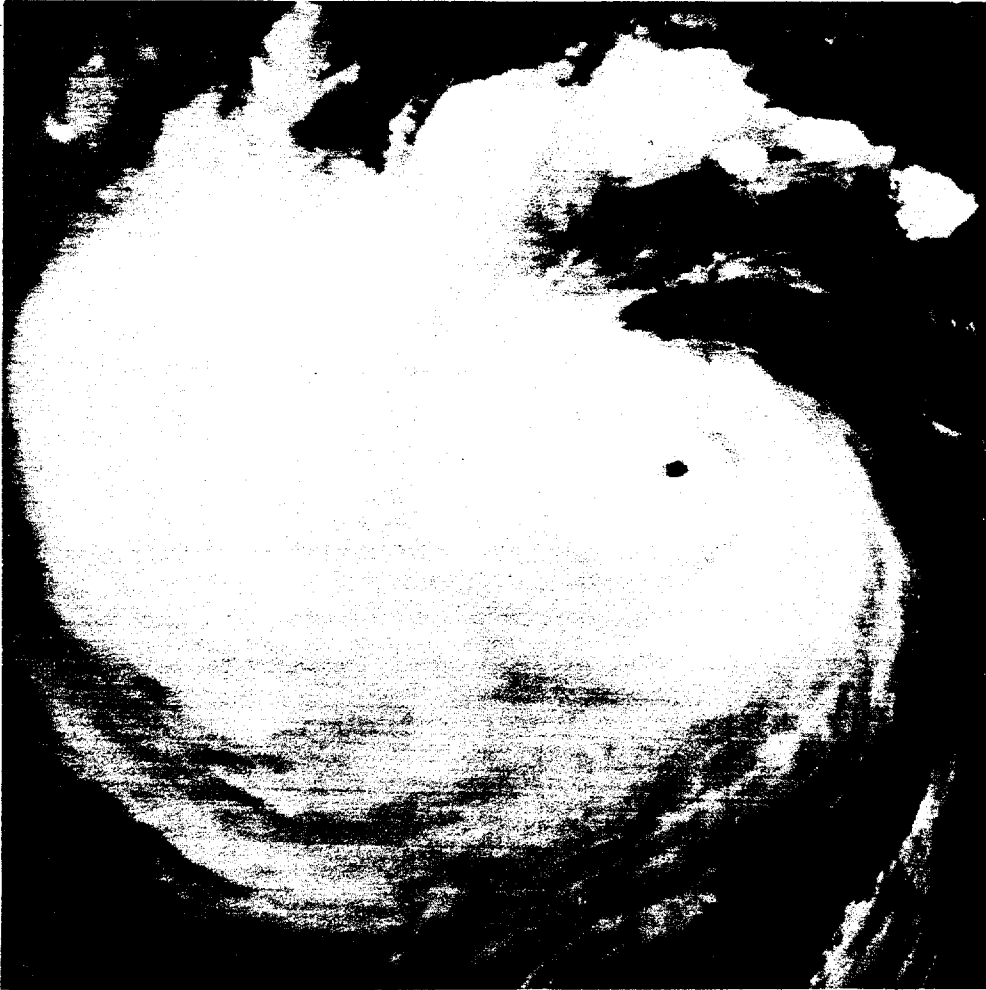


FIGURE 4-18. Thresholded infrared imagery of Nora displaying only the colder portion of the infrared spectrum sensed by the radiometer, 6 October 1973, 1153 GMT. (DMSP imagery)

approaching shortwave trough over China. Nora skirted the northeast tip of Luzon with maximum sustained winds of 100 kts and weakening.

As she transited the Luzon Strait on the 8th a dramatic rescue operation was occurring in the Taiwan Strait. In thirty foot seas and 50 kt winds, the Missile Frigate USS WORDEN rescued seven fishermen aboard the Taiwanese fishing vessel JAI TAI NR3 from the approaching typhoon. One Taiwanese crewman was lost at sea. The fishing vessel had been floundering in heavy seas with the forward section split lengthwise (Figure 4-19).

Nora passed within 60nm of Kaohsiung, Taiwan as she accelerated to a speed of 12 kts toward the northwest. She made landfall near Amoy in southern China on the morning of the 10th and degenerated into a low pressure area.

Luzon in the Republic of the Philippines suffered considerable damage. It was reported that 6 persons were killed and over a hundred thousand people were left homeless. Estimates of over \$2 million in

damage to crops, public and private property were reported. A Philippine freighter ASIAN MARINER was reported sunk by Typhoon Nora in the Taiwan Straits. All 38 crew members were rescued. The Greek freighter BALTIC KLIF was also capsized and sunk by Nora some 80nm southwest of the Pescadores. Three of the crew were drowned with several missing and presumed lost. Taiwan also suffered extensive damage from Nora. Twelve persons were reported dead and 28 unaccounted for. Nearly 8,000 people were left homeless with Nora destroying over a thousand houses and damaging hundreds of others.

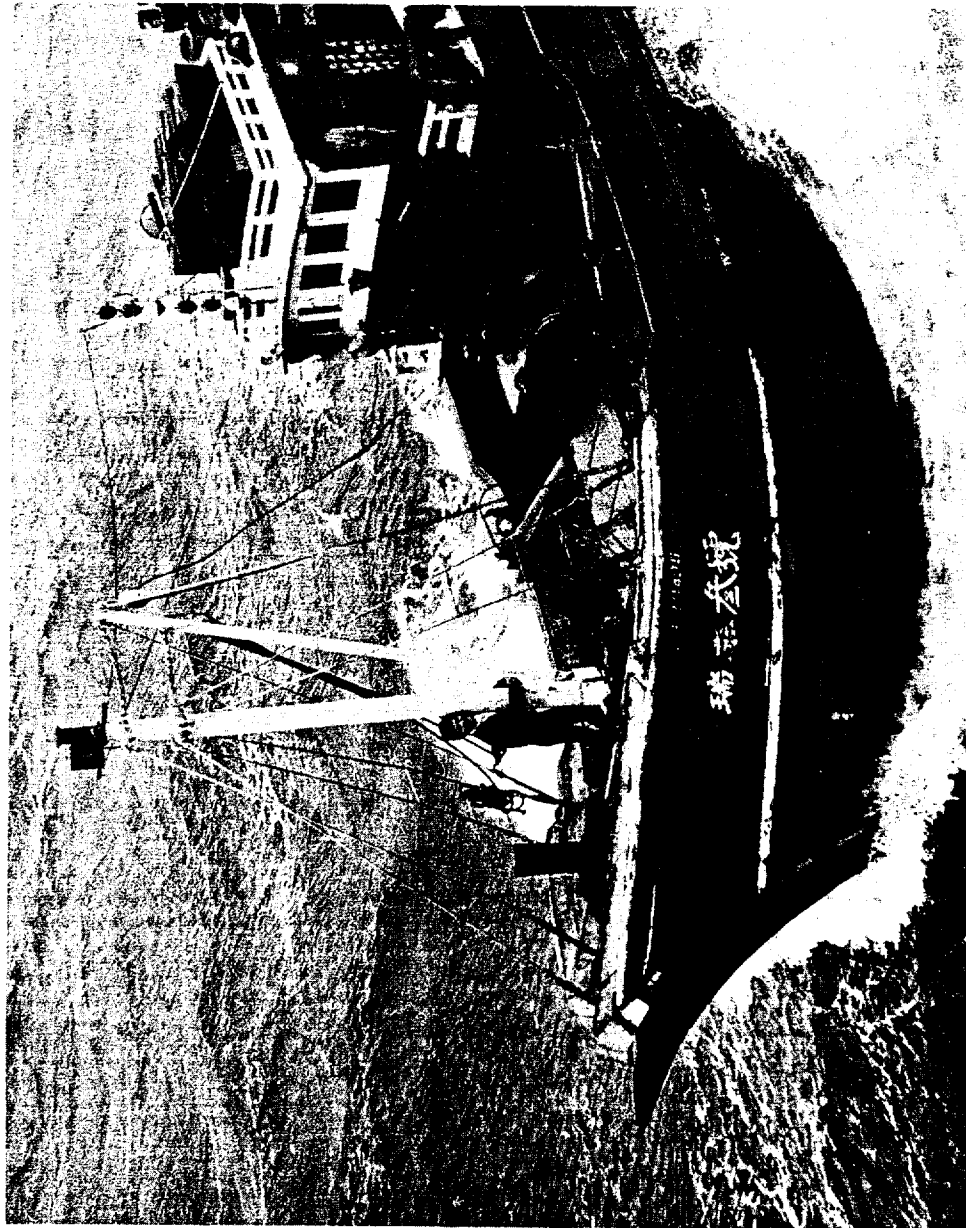
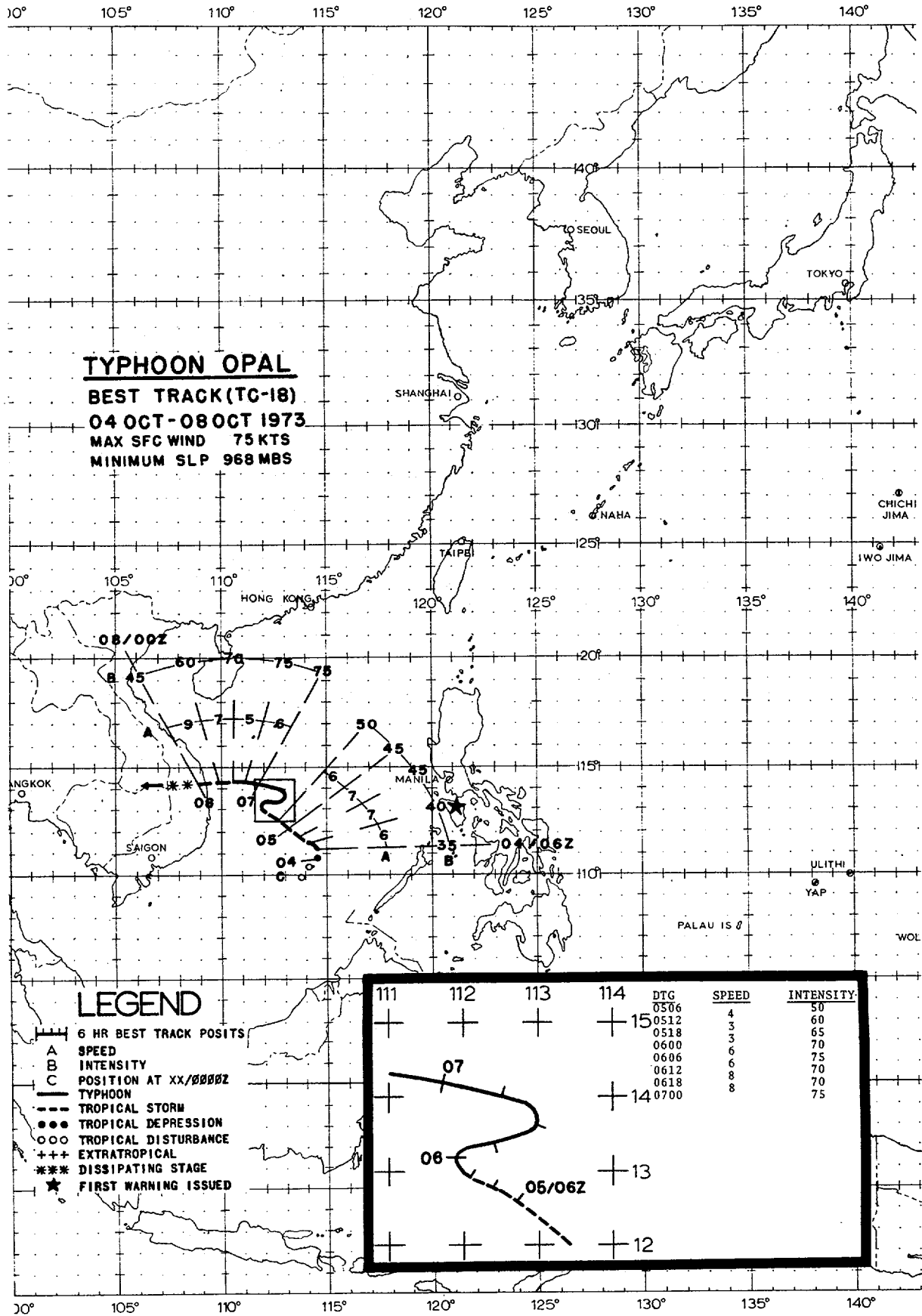


FIGURE 4-19. Fishing trawler JAI TAI NR. 3 floundering in high winds and heavy seas generated by Typhoon Noxa. -- U.S. Navy photo



OPAL

Opal formed in an active monsoon trough in the South China Sea. The first evidence of a weak surface low appeared in the trough on the 1st of October. However, it wasn't until late on the 3rd that significant cloudiness associated with the incipient storm became apparent.

Early on 4 October, Opal reached minimal tropical storm intensity about 75 nm northwest of Nanshan Island. She moved to the northwest at 6 to 7 knots in response to the high pressure cell over eastern China. By the 5th, she had developed typhoon strength winds (Figure 4-20).

On the morning of the 6th, Opal abruptly changed her course and moved northeastward. She remained on this course for the next 12 hours before resuming a westnorthwesterly heading. A reasonable explanation for the temporary eastward movement may rest in a Fujiwhara interaction with typhoon Nora. Nora was positioned in the Philippine Sea about 750 nautical miles from Opal and

reached maximum intensity almost coincidentally with the eastward shift in Opal. Also, Nora turned to a more northerly track at this time. Brand (1968) reports a maximum distance for interaction of about 750 nautical miles. He demonstrates that the angular change rate of a line connecting the storms at this distance should be very small, only 3 degrees per 12 hours. The actual change was somewhat smaller, indicating the weakness of the interaction. The short period of the interaction may be due to the terrain effects of the intervening Republic of the Philippines, among other factors, as Brand suggests that the binary rotation is due to the circulation of the inflow layer which occupies only the lowest few thousand feet.

Maximum winds of 70 to 75 knots were observed during the 6th and early on the 7th as Opal resumed her westnorthwest movement. Opal moved ashore north of Qui Nhon, Republic of Vietnam late on 7 October and rapidly dissipated.

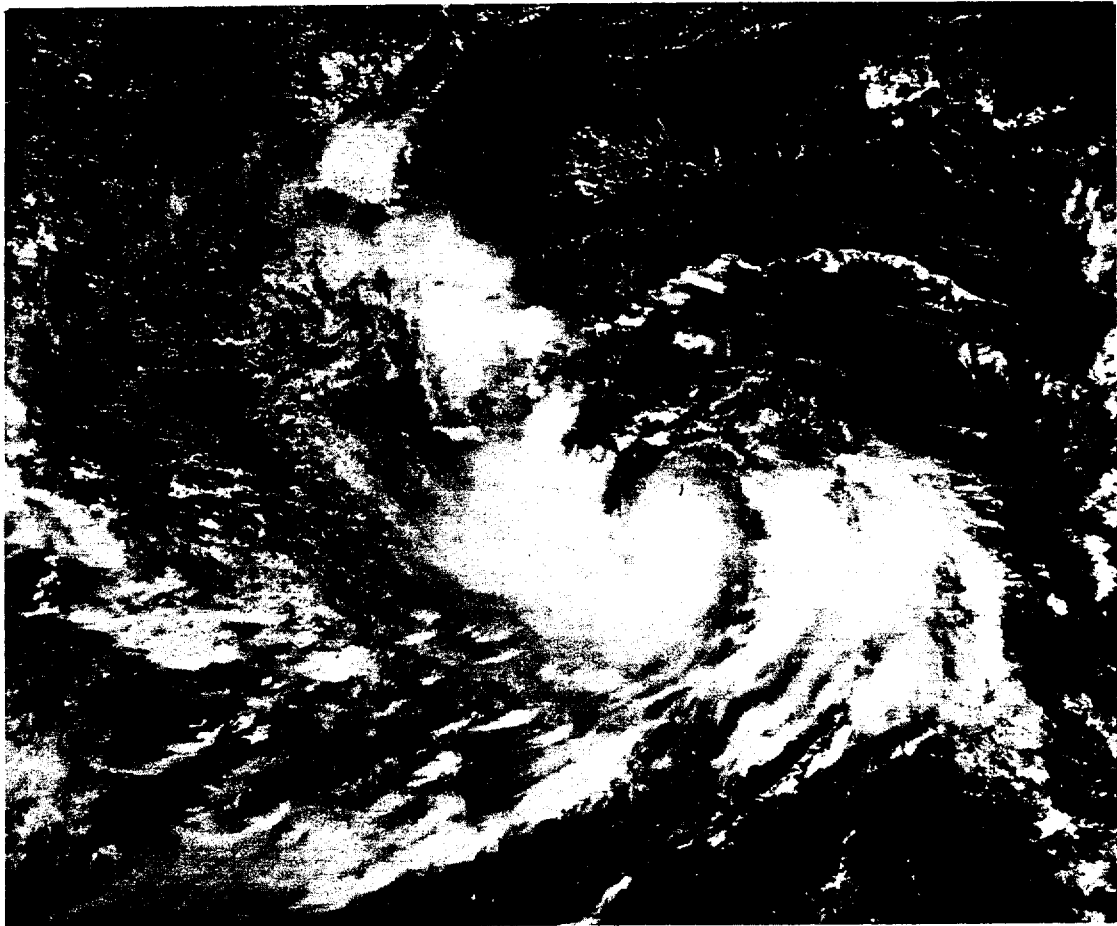
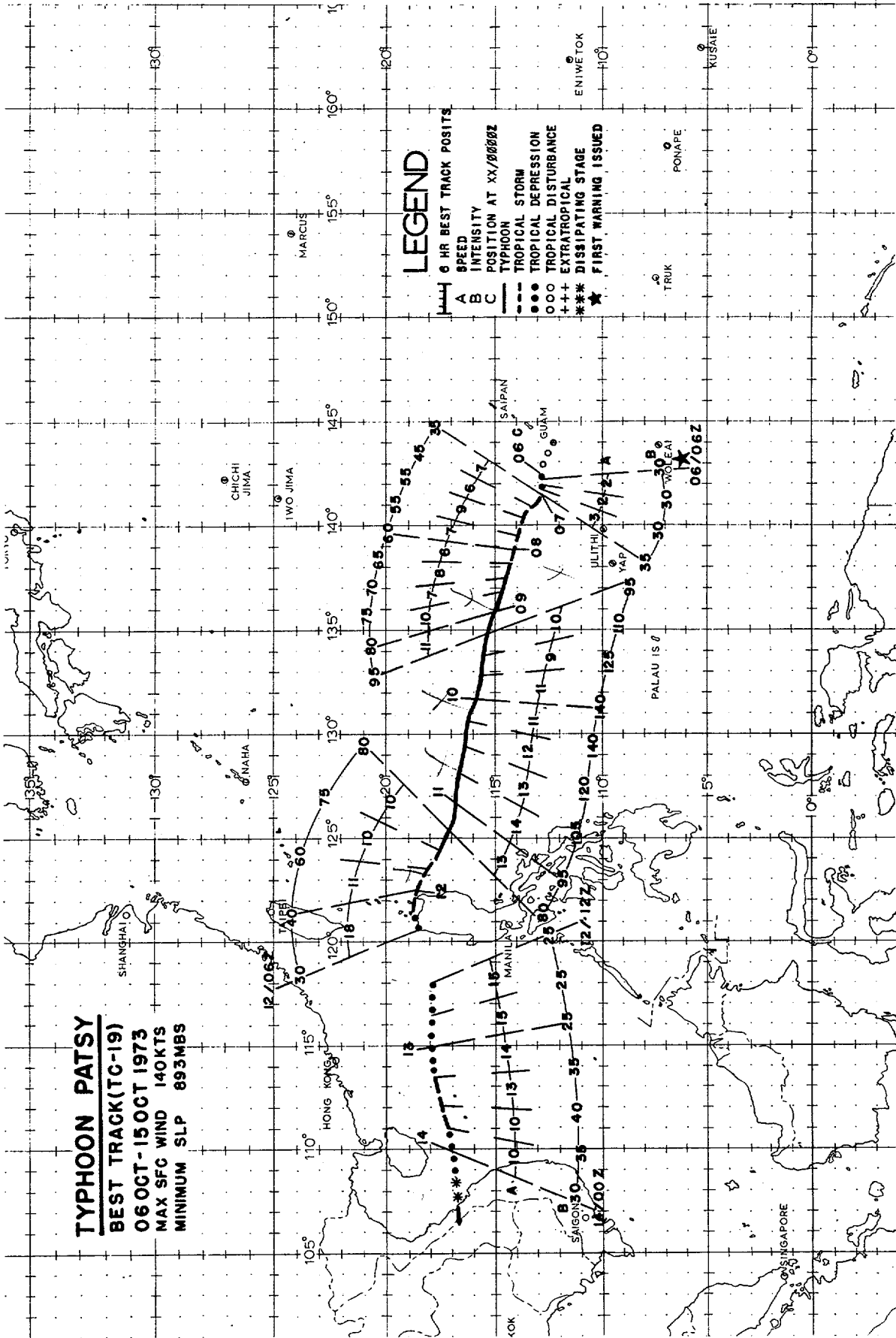


FIGURE 4-20. Tropical Storm Opal in the South China Sea 225 nm southeast of Qui Nhon, 5 October 1973, 0458 GMT. (DMSP imagery)

TYPHOON PATSY
BEST TRACK(TC-19)
06 OCT - 15 OCT 1973
MAX SFC WIND 140KTS
MINIMUM SLP 893MBS



A weak disturbance formed in the monsoon trough 300nm south of Guam on the 3rd of October. The weak vortex drifted westward in the wake of Nora. Until the 6th, it underwent only minor development due to the strong vertical shear caused by Nora's vigorous upper tropospheric outflow. Reconnaissance aircraft, investigating the disturbance on that day, reported maximum surface winds of 35 kts, heralding the arrival of Tropical Storm Patsy.

For the next two days she followed a westnorthwest course at 6-8 kts under the influence of the steering flow of the mid-tropospheric ridge to the north. Patsy was characteristically a small storm throughout her life. By the 8th she had developed typhoon force winds as she began to accelerate to a speed of 10-12 kts.

A reconnaissance aircraft reported that Patsy had rapidly intensified into a super typhoon with estimated maximum surface winds of 150 kts and a central pressure of 893mb (10/0020 GMT). Her central pressure had dropped 57mb in a span of 22 hours (Figure 4-21).

Patsy continued unerringly toward the northern tip of Luzon as she began to weaken late on the 10th. Interestingly, on

the evening of the 11th, DMSP satellite imagery revealed that Patsy's low level circulation had separated from the upper level portion of the cyclone (Figure 4-22). The low level portion took a more northwesterly course and weakened to a tropical disturbance as it crossed the southern Luzon Strait. Meanwhile, a radar site in the Republic of the Philippines continued to follow the upper level cloudiness as it tracked due west towards Luzon. A similar situation occurred with Susan in 1972.

The upper level circulation drifted over Luzon and out into the South China Sea. It apparently became superimposed over a low level vortex that had been situated in the South China Sea for several days. This system developed to tropical storm intensity as it passed to the north of the Paracel Islands. It weakened to a tropical depression just prior to making landfall in the Republic of Vietnam.

Patsy was the 3rd and final super typhoon of the year. She was only the 2nd storm to form in the western Caroline Islands area in the 1973 season.

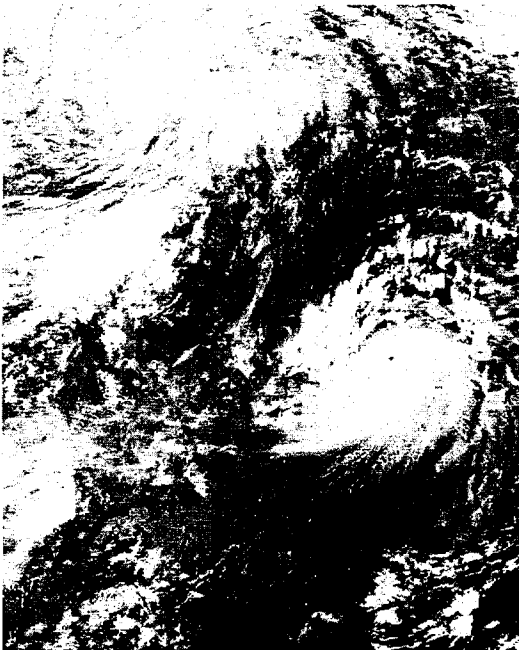


FIGURE 4-21. Super Typhoon Patsy (right) at peak intensity. Typhoon Nora (left) in the Taiwan Strait, 9 October 1973, 2341 GMT. (DMSP imagery)

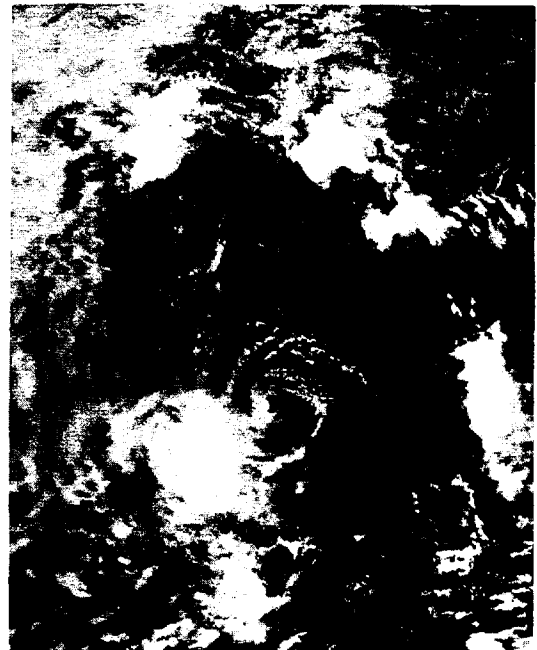


FIGURE 4-22. Moonlight visual of Tropical Storm Patsy. Spiral cumulus pattern depicts the low level circulation with the cirrus canopy displaced to the southwest, 11 October 1973, 1613 GMT. (DMSP imagery)

TYPHOON RUTH

BEST TRACK (TC-20)

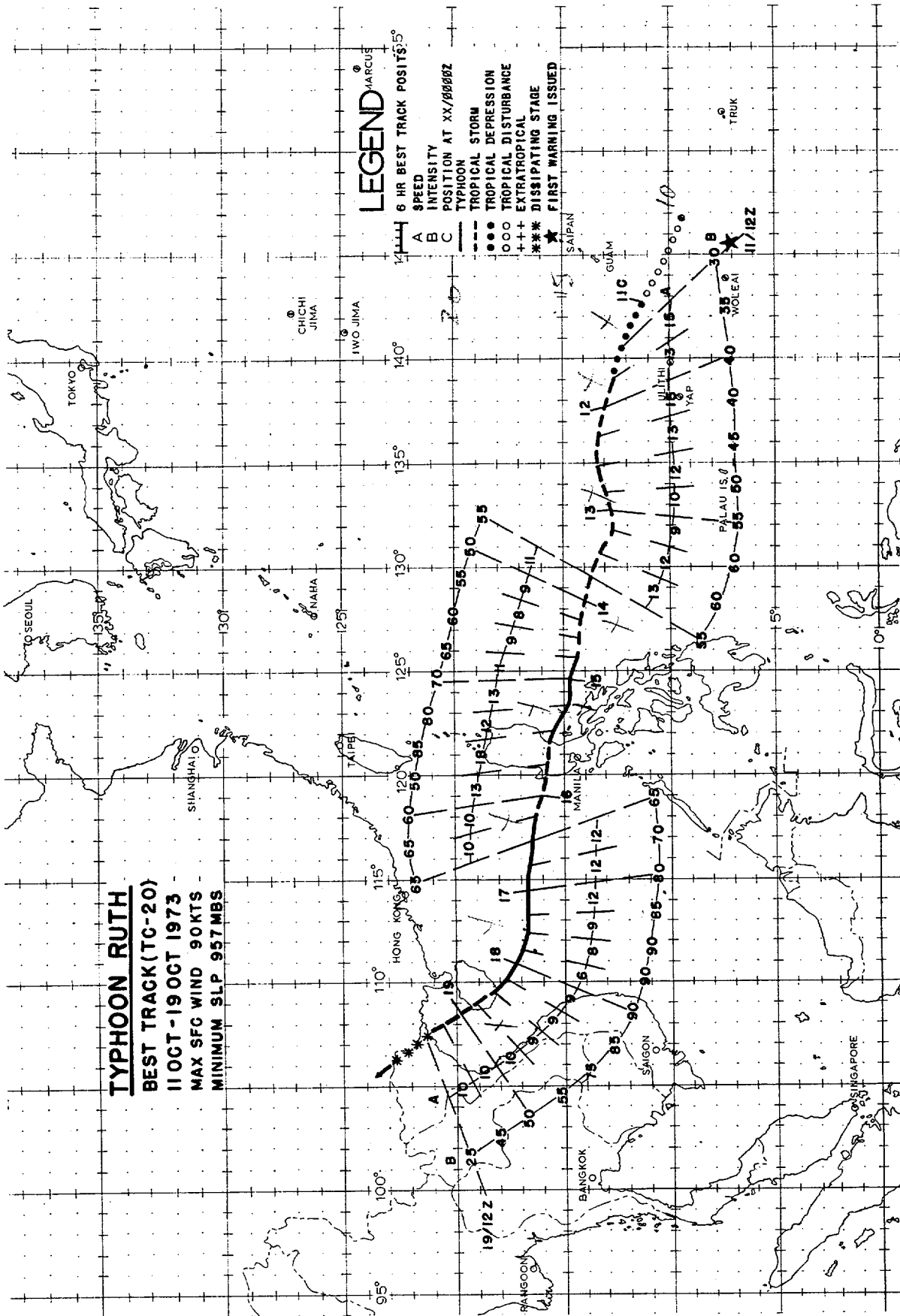
11 OCT-19 OCT 1973

MAX SFC WIND 90KTS

MINIMUM SLP 957MBS

LEGEND

- ① 6 HR BEST TRACK POSITS:5'
- A SPEED
- B INTENSITY
- C POSITION AT XX/YYZZ
- TYPHOON
- TROPICAL STORM
- TROPICAL DEPRESSION
- TROPICAL DISTURBANCE
- +++ EXTRATROPICAL
- *** DISSIPATING STAGE
- ★ FIRST WARNING ISSUED



The formative stage of Ruth appeared early on 10 October as a weak circulation in the monsoon trough in the western Caroline Islands. By the 11th, an area of enhanced convective activity associated with the cyclonic circulation became evident from satellite imagery. Ship reports on the afternoon of the 11th located Tropical Storm Ruth about 250nm westsouthwest of Guam with maximum winds of 35 kts.

Ruth followed 3 days behind Patsy. She tracked approximately 120nm to the south of but parallel to Patsy's track across the Philippine Sea. It is interesting to note that although Patsy intensified rapidly to super typhoon strength, Ruth developed slowly and reached typhoon intensity three days after she became a tropical storm. (Figure 4-23). The satellite data for this period showed little or no convective activity on the north side of Ruth. The strong upper tropospheric northeast flow from the subtropical ridge may have contributed to suppressing the outflow from Ruth on the north side and thereby inhibiting her development.

She continued her westerly movement with slow intensification until landfall on Luzon on the 15th, with maximum sustained wind speeds of 85 kts. Rapid weakening then occurred as the low level inflow was disrupted by terrain effects. Her maximum sustained wind had decreased to 50 kts by the time she reached central Luzon.

Ruth passed 42 miles north of Clark AB late on the night of the 15th where

maximum sustained winds of 30 kts and peak gusts of 43 kts were recorded. Only minor damage was reported at Clark AB. Baler recorded maximum peak gust of 95 kts from the north (15/1355 GMT) while Casiguran 50 nm further north on the coast experienced a gust to 98 kts three hours later (15/1700 GMT).

On the 16th Ruth entered the South China Sea and tracked westward toward the Paracel Islands, still under the steering influence of the subtropical ridge (Figure 4-24). A Japanese ship IDEMITSU MARU reported 50 kts of wind and a surface pressure of 995mb as she passed 90nm northwest of Ruth (16/0000 GMT). She reintensified on her sojourn across the South China Sea reaching a maximum intensity of 90 kts on the afternoon of the 17th just east of the Paracels. Shortly after attaining her maximum intensity, Ruth turned to a northwesterly course in response to a weakness in the subtropical ridge. She then crossed Hainan Island and entered the Tonkin Gulf with maximum sustained winds of 50 kts. Ruth continued to weaken rapidly as upper tropospheric support waned, and dissipated completely as she moved inland along the North Vietnam coast on the afternoon of the 19th.

Damage reports indicate that while Ruth was crossing Luzon, 27 people were killed, 30 people were injured and 23 people were missing. Property damage amounted to more than five million dollars (U.S.) with thousands of homes destroyed.

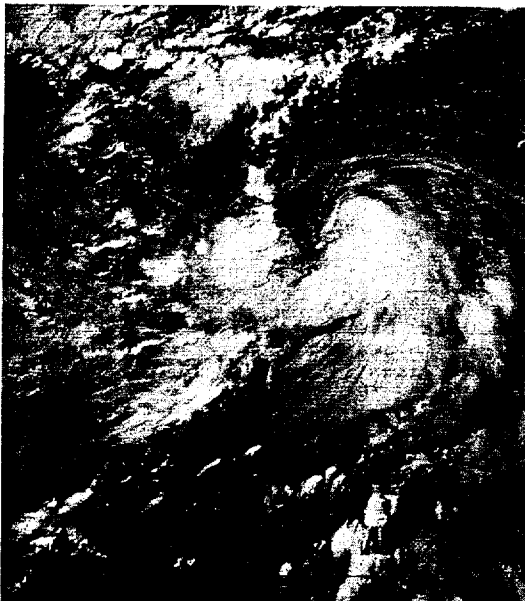


FIGURE 4-23. Tropical Storm Ruth in the Philippine Sea 225 nm east of Catanduanes Island, 14 October 1973, 0009 GMT. (DMSP imagery)

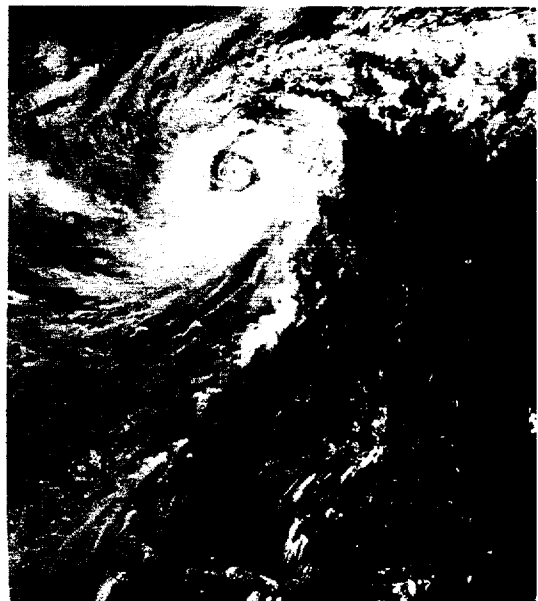


FIGURE 4-24. Tropical Storm Ruth reintensifying after crossing Luzon, 16 October 1973, 0359 GMT. (DMSP imagery)

3. TROPICAL CYCLONE CENTER FIX DATA

a. DISCUSSION OF DATA:

Fix data from all sources are included for each tropical cyclone. The first four columns of the print-out list the same information regardless of platform.

FIX NO.- Fixes are numbered sequentially.
TIME - GMT time in day, hour, and minutes of fix.
POSIT - Position of the storm in degrees and tenths.
FIX CAT- Fix platform used (SAT - satellite, P - penetration, LRDR - land radar, AC R - aircraft radar, SRDR - ship radar, CPA - station experiencing center passage, SCF - synoptic chart fix).

The format of the remainder of the print-out varies with the platform.

(1) SATELLITE - These data were derived from bulletins received from FLEWEAFAC and NESS Suitland, Maryland (NOAA-2), the APT site at U-Tapao, Thailand (ESSA-8), or DMSP (formerly DAPP) data from various sites (Chapter II). Intensity estimates (when available) are listed using the NESS classification system (NOAA Technical Memorandum NESS 45). If the source were DMSP (DAPP) data, the PCN (Position Code Number) appears followed by the name DMSP. If the platform were NOAA-2 or ESSA-8, that name will appear after the intensity information along with the site name and location confidence number (NOAA-2 only), (NHOP, 1973). NOAA-2 fixes without a site name will be assumed to be FLEWEAFAC Suitland fixes.

(2) RADAR - The latitude and longitude of land-based radars are given in the POSIT OF RADAR column. The position of mobile radar platforms are included if available. Plain language remarks appear after AC&W radar reports regarding tropical cyclone characteristics, size, and accuracy of fix (CINCPACINST 3140.1L, 1973). All other land radar reports contain a 5-digit code group identical to the WMO radar code for reporting tropical cyclone characteristics as regards to size, development, and accuracy of location of the center or the eye. A list of land-based radars providing data in the fix print-out is given in Table 4-7.

(3) CPA - If a station experiences center passage, maximum surface wind observed and minimum sea level pressure recorded are listed.

(4) SCF - If synoptic data is dense and consistent enough to provide accurate fix information, the derived storm position is listed. Maximum surface wind and minimum sea level pressure values are included, if possible.

(5) AIRCRAFT PENETRATION - These data were normally obtained at scheduled fix times. Additional reconnaissance aircraft fixes are made during the peripheral

data gathering legs between scheduled fixes. These fixes normally provide date, time, and position data only.

The categories containing information from reconnaissance aircraft fixes are:

(a) ACCXY (Accuracy)

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

(b) FIX LVL (Fix Level)

A constant-pressure-surface flight level (listed in millibars) is normally maintained during a tropical cyclone fix mission. Low-level missions (1500 feet) are conducted at a constant, true altitude.

(c) MAX OBS FLT LVL WND

Wind speed (kt) at flight level is measured by the AN/APN-82 doppler radar system aboard the WC-130 aircraft. The values entered in this category represent the maximum wind measured prior to obtaining a scheduled fix. This measurement may not represent the maximum wind because the aircraft samples only those portions of the central core region along the flight path. For this reason, the maximum observed may be significantly lower than the true maximum wind in the circulation (i.e., penetration through weak semicircle on first fix).

A limitation of the doppler radar system occasionally prevents the measurement of the maximum wind in intense typhoons. In areas of heavy rainfall, the radar may track energy reflected from precipitation rather than the sea surface, preventing accurate wind measurement. Also, the doppler radar mount on the WC-130 restricts wind measurements to drift angles $<27^\circ$ if wind is normal to heading of aircraft.

(d) MAX OBS SFC WND

The maximum surface wind (kt) observed from flight level is entered in this column. The observation is an estimate based on the state of the sea (refer to 9WRWGM 105-1, Vol II, pp 2-27-28). The sampling limitation noted in paragraph (c) also exists for this category. In addition, availability of these data is dependent on the absence of undercast conditions. The position relative to the vortex center of items (c) and (d) need not coincide.

(e) OBS MIN SLP

The minimum observed sea level pressure is normally obtained from a dropsonde released in the vortex center. If the ocean surface is visible, the dropsonde will be released over the center of the area of calm seas; otherwise it is released at the flight level wind center. If the fix is made at 1500 feet, the sea level pressure is extrapolated from that level.

(f) MIN 700 MB HT

The minimum height of the 700mb surface in the vortex center is recorded in decameters.

(g) FLT LVL T_i/T_o

This denotes maximum temperature measured in the center (T_i) and ambient temperature outside the center (T_o). Ambient temperature is measured just prior to entering the wall cloud. Both temperature observations are in degrees celsius and are made at a flight level of constant pressure surface (700, 500-mb).

Reconnaissance aircraft seldom penetrate on the same azimuth from one fix to another. Thus, the position of T_o normally varies from the center, both in bearing and range. The distance is directly dependent on radar definition of the storm.

(h) EYE FORM/ORIENTATION/DIA

The shape and diameter (nautical miles) of the eye are determined by radar. This is reported only if the center is 50% or more surrounded by wall cloud (see definition in Appendix). The orientation of the major axis is for elliptical cases. Abbreviations for the eye form are:

CIRC - Circular
ELIP - Elliptical
CONC - Concentric

REFERENCES:

- Brand, S., "Interaction of Binary Tropical Cyclones of the Western North Pacific Ocean," NAVWEARSCHFAC Tech. Paper No. 26-68, September 1968.
- CINCPACINST 3140.1L, "Tropical Cyclone Operations Manual," June 1973.
- FLEWEACEN/JTWC, Annual Typhoon Report, Guam, Marianas Islands, 1970.
- Ramage, C.S., Monsoon Meteorology, Academic Press, New York and London, 1971, pp. 189-190.
- Sadler, J.C., "The Role of the Upper Tropospheric Trough (TUTT) in Early Season Development," ENVPREDRSCHFAC Tech. Paper, 1973 (in press).
- U.S. Dept. of Commerce, NOAA, Federal Coordinator for Meteorological Services and Supporting Research, "National Hurricane Operations Plan," May 1973.

TABLE 4-7. LAND RADAR SITES

<u>Location</u>	<u>Station No.</u>	<u>ICAO</u>	<u>Station Name</u>
10.3N 124.0E	98646	RPMT	Mactan
	98440		
14.4N 120.6E	98425		Manila
16.4N 120.6E	98328		Baguio
17.4N 104.7E	48357	VTUW	Nakhon Phanom West (USAF)
26.1N 127.8E	47937		Itokau
26.4N 127.8E		RODN	Kadena AB (USAF)
26.2N 127.7E		ROAHJ	Naha AB (JASDF)
24.3N 124.2E	47918		Ishigakijima
28.4N 129.5E	47909		Naze
33.3N 134.2E	47899		Murotomisaki
30.6N 131.0E	47869		Tanegashima/Naka
33.6N 130.5E		RJFFJ	Itazuke Airport (JASDF)
33.4N 130.4E	47806		Fukuoka/Sefurisan
35.9N 126.6E	47141	RKJK	Kunsan AB (USAF)
37.5N 127.0E	47116		Kwanaksan Myn
34.6N 135.7E	47773		Osaka/Takayasuyama
24.3N 120.6E	46770	RCMQ	CCK AB/Taiwan
22.6N 120.3E	46744		Kaohsiung
23.0N 120.2E		RCNN	Tainan (AC&W)
22.6N 120.4E		RCKH	Kaohsiung Int'l Airport (AC&W)
23.5N 119.6E		RCQC	Makung (AC&W)
24.0N 121.6E	46699		Hwalien
22.3N 114.2E	45005		Hong Kong Obsr.
18.1N 120.5E			Paredes (AC&W)
16.6N 120.3E			Wallace AS (AC&W)
14.4N 122.6E			Paranal AS (AC&W)

b. FIX DATA PRINTOUT:

TROPICAL STORM WILUA																		
FIX POSITIONS FOR CYCLONE NO. 1																		
01 JUL 10 03 JUL																		
FIX NO.	TIME	POSIT	FIX CAT	ACQNY	FIX LVL	FLI DIR	LVL VEL	WIND DIR	WIND SFC	WIND MIN	WIND MAX	OBS SLP	MIN MGT	FLT LVL	EYE FORM	EYE DIA	FUSIL OF NAUAP	MSA NMRB
1	200124Z	11.0N 124.5E	SAI															
2	200124Z	11.0N 124.5E	SAI															
3	200124Z	15.0N 125.0E	SAI															
4	200319Z	15.2N 124.4E	SAI															
5	200319Z	16.4N 124.2E	SAI															
6	201903Z	15.3N 122.4E	SAI															
7	201903Z	15.8N 123.7E	SAI															
8	201903Z	15.3N 123.5E	SAI															
9	300117Z	17.3N 121.8E	SAI															
10	300118Z	17.3N 121.5E	SAI															
11	300440Z	17.3N 121.5E	SAI															
12	300447Z	17.3N 122.0E	SAI															
13	300447Z	17.3N 121.2E	SAI															
14	301548Z	17.3N 119.0E	SAI															
15	301548Z	16.3N 120.4E	SAI															
16	010615Z	18.0N 117.5E	P															
17	010615Z	18.0N 117.5E	P															
18	010632Z	18.0N 118.3E	SAI															
19	010632Z	18.0N 118.3E	SAI															
20	010709Z	19.2N 118.3E	P															
21	011503Z	20.0N 118.3E	P															
22	011710Z	20.3N 118.2E	SAI															
23	011710Z	20.3N 118.0E	SAI															
24	020133Z	21.2N 117.4E	K															
25	020133Z	21.2N 117.4E	K															
26	020202Z	21.2N 117.7E	SAI															
27	020500Z	21.2N 117.8E	P															
28	020517Z	21.2N 117.1E	SAI															
29	020517Z	21.2N 117.2E	SAI															
30	020517Z	21.2N 117.5E	SAI															
31	020517Z	21.2N 117.5E	SAI															
32	020500Z	21.2N 117.9E	LKUR															
33	020500Z	21.2N 117.9E	LKUR															
34	020500Z	21.2N 117.9E	AC H															
35	021200Z	22.0N 117.7E	LKUR															
36	021500Z	22.3N 117.7E	LKUR															
37	021500Z	22.3N 117.6E	AC H															
38	021701Z	22.4N 117.7E	SAI															
39	021701Z	22.4N 117.8E	SAI															
40	021701Z	22.2N 117.5E	SAI															
41	021701Z	22.3N 117.5E	SAI															
42	021902Z	22.2N 117.8E	LKUR															
43	022100Z	23.1N 118.0E	LKUR															
44	030202Z	23.0N 117.7E	LKUR															
45	030110Z	23.1N 117.1E	LKUR															
46	030400Z	23.0N 118.0E	LKUR															
47	030500Z	23.0N 117.5E	SAI															
48	030500Z	24.3N 119.3E	LKUR															
49	030500Z	24.3N 119.3E	LKUR															
50	030400Z	24.3N 118.3E	LKUR															
51	030500Z	24.3N 118.0E	LKUR															
52	030400Z	24.2N 118.0E	SAI															
53	030400Z	24.1N 118.1E	SAI															
54	030400Z	24.3N 118.0E	LKUR															
55	030400Z	24.3N 118.0E	LKUR															
56	030500Z	24.3N 117.8E	LKUR															
57	030500Z	24.3N 118.3E	LKUR															
58	030500Z	24.3N 118.3E	LKUR															
59	030400Z	24.2N 118.3E	LKUR															
60	030700Z	24.2N 118.3E	LKUR															
61	030700Z	24.0N 118.0E	LKUR															
62	030600Z	25.0N 118.2E	LKUR															
63	030810Z	25.0N 118.0E	LKUR															
64	030800Z	25.1N 118.0E	LKUR															
65	031200Z	25.2N 118.8E	LKUR															
66	031200Z	25.2N 118.8E	SAI															
67	031000Z	24.4N 119.4E	SAI															
68	010600Z	18.9N 118.0E	SCF															
69	020600Z	21.8N 117.5E	SCF															
70	030000Z	24.8N 118.5E	SCF															
71	031200Z	25.6N 118.7E	SCF															

TYPHOON ANITA
FIX POSITION FOR CYCLONE NO. 2
05 JUL TO 08 JUL

FIX NO.	TIME	POSIT	FJA CAT	ACCKY NAV-MET	Fix Lvl	MAX OBS FLI LVL WIND DIR VEL DRG HNG	MAX OBS SFC WIND VEL DRG HNG	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/TU	EYE FURM	DLEN- ATION	EYE DIA	FOSSIL OF RADAR	MSA NMEP
1	050207Z	10.5N 111.0E	SAI			(11.5/1.5 / 00.5/250KTS)	NUAA 2				(OCNF 03)				
2	050617Z	12.0N 111.0E	SAI			(11.5/1.5 / 00.5/240KTS)	NUAA 2 (MESS)								
3	050916Z	12.2N 113.0E	SAI			(11.0/1.0 / 5 / 240KTS)	PCN 5 UMSF								
4	060103Z	11.5N 112.5E	SAI			(12.0/2.0 / 00.5/230KTS)	NUAA 2 (MESS)								
5	060107Z	11.5N 112.5E	SAI			(12.0/2.0 / 00.5/230KTS)	NUAA 2 (OCNF 03)								
6	060230Z	12.3N 112.5E	SAI			(12.5/2.5 / 0 / 0KTS)	PCN 3 UMSF								
7	060300Z	12.3N 111.2E	SAI			(12.5/2.5 / 0 / 0KTS)	PCN 3 UMSF								
8	060301Z	11.8N 111.2E	SAI			(12.5/2.5 / 01.5/240KTS)	PCN 3 UMSF								
9	060915Z	12.5N 112.5E	P			3 10 700 170 50 70	RU 50 70 75	991	300	13	-	-	-	-	
10	061730Z	13.3N 111.7E	P			5 15 700 180 60 40	PCN 4 UMSF								
11	061740Z	13.2N 111.7E	SAI				PCN 4 UMSF								
12	062130Z	14.0N 111.4E	P			5 10 700 180 60 30	30 - - -	983	295	14	13	-	-	-	
13	070150Z	15.3N 110.2E	SAI			(13.0/3.0 / 01.0/230KTS)	NUAA 2 (MESS)								
14	070201Z	15.3N 110.2E	SAI			(13.0/3.0 / 01.0/230KTS)	NUAA 2 (OCNF 01)								
15	070255Z	15.0N 110.4E	SAI			(13.0/4.0 / 0 / 240KTS)	ESSA 8 (VIBU)								
16	070250Z	15.4N 110.3E	P			10 20 700 230 50 140	40 80 130 30	984	295	12	-	-	-	-	
17	070444Z	14.5N 110.0E	SAI			(12.5/2.5 / 5 / 240KTS)	PCN 5 UMSF								
18	070850Z	15.7N 110.4E	SAI			(13.5/3.5 / 5 / 160 / 0KTS)	PCN 3 UMSF								
19	070855Z	15.7N 110.2E	SAI			(13.5/3.5 / 5 / 160 / 0KTS)	PCN 3 UMSF								
20	071130Z	17.4N 108.7E	SAI				PCN 4 UMSF								
21	071130Z	17.3N 108.8E	SAI				PCN 3 UMSF								
22	072330Z	17.8N 107.7E	SHUM												
23	080255Z	18.7N 106.0E	SAI			(14.0/4.0 / 01.0/230KTS)	NUAA 2 (OCNF 01)								
24	080312Z	19.0N 107.2E	SAI			(14.0/4.0 / 5 / 230KTS)	ESSA 8 (VIBU)								
25	080425Z	18.2N 106.5E	SAI			(13.5/3.5 / 01.0/230KTS)	PCN 1 UMSF								
26	080446Z	18.1N 106.3E	SAI			(13.5/3.5 / 01.0/230KTS)	PCN 1 UMSF								
27	081010Z	18.3N 105.2E	P			1 5 100 120 60 30	30 60 - -	980	292	14	-	CIRC	30		
28	081644Z	18.8N 105.0E	LRUK			- POSSIBLE EYE 15 DEG DIRECTION, GOOD FIX									17.4N 104.7E
29	081335Z	18.8N 105.3E	LRUK			- POSSIBLE EYE 15 DEG DIRECTION, GOOD FIX									17.4N 104.7E
30	081435Z	18.8N 105.2E	LRUK			- CIRC EYE, GOOD FIX, 70 PCT, DIAMETER 20									17.4N 104.7E
31	081335Z	18.8N 105.0E	LRUK			- CIRC EYE, GOOD FIX, 50 PCT, DIAMETER 15									17.4N 104.7E
32	081930Z	19.0N 104.7E	LRUK			- CIRC EYE, GOOD FIX, 50 PCT, DIAMETER 15									17.4N 104.7E
33	081710Z	19.0N 104.1E	SAI				PCN 3 UMSF								
34	081740Z	19.0N 104.5E	LRUK			- CIRC EYE, FAIR FIX, EYE FILLING, DIAMETER 10									17.4N 104.7E
35	081910Z	19.1N 104.2E	LRUK			- CIRC EYE, GOOD FIX, DIAMETER 10									17.4N 104.7E
36	081835Z	19.1N 104.1E	LRUK			- CIRC EYE, GOOD FIX, DIAMETER 10									17.4N 104.7E
37	081910Z	19.1N 103.9E	LRUK			- CIRC EYE, FAIR FIX, DIAMETER 10									17.4N 104.7E
38	082102Z	18.9N 103.7E	LRUK			- NO FILL DEFINED EYE, POOR FIX									17.4N 104.7E
39	080100Z	17.6N 107.5E	CFA			EYE PARACENTERS 0800N 107.5E	40	982							
40	080230Z	17.5N 107.5E	CFA				47	982							

TYPHOON CLAMA
FIX POSITION FOR CYCLONE NO. 3
12 JUL TO 14 JUL

FIX NO.	TIME	POSIT	FJA CAT	ACCKY NAV-MET	Fix Lvl	MAX OBS FLI LVL WIND DIR VEL DRG HNG	MAX OBS SFC WIND VEL DRG HNG	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/TU	EYE FURM	DLEN- ATION	EYE DIA	FOSSIL OF RADAR	MSA NMEP
1	120156Z	27.0N 105.7E	SAI			(1 0/2.0 / / KTS)	PCN 6 UMSF								
2	120156Z	26.5N 103.7E	SAI			(12.0/2.0 / / KTS)	PCN 3 UMSF								
3	120156Z	25.8N 104.1E	SAI			(11.5/1.5 / / KTS)	PCN 5 UMSF								
4	121430Z	27.0N 102.3E	SAI				PCN 4 UMSF								
5	121430Z	26.9N 102.1E	SAI				PCN 4 UMSF								
6	122130Z	29.2N 101.0E	SAI			(12.5/2.5 / 01.5/240KTS)	NUAA 2 (MESS)								
7	122151Z	29.2N 101.0E	SAI			(13.0/3.0 / 01.5/240KTS)	NUAA 2 (OCNF 02)								
8	130131Z	29.5N 100.5E	SAI			(12.0/2.0 / 02.0/240KTS)	PCN 6 UMSF								
9	130131Z	29.5N 100.5E	SAI			(12.0/2.0 / 02.0/240KTS)	PCN 4 UMSF								
10	130131Z	28.8N 100.2E	SAI			(13.0/3.0 / 0 / KTS)	PCN 3 UMSF								
11	130455Z	29.0N 100.4E	P			5 10 - 350 40 270	35 40 200	25	998	-	20 22	-	-	-	
12	131821Z	29.9N 100.2E	SAI				PCN 4 UMSF								
13	131821Z	30.0N 100.4E	SAI				PCN 4 UMSF								
14	132640Z	31.3N 100.9E	SAI			(12.5/2.5 / 00.5/230KTS)	NUAA 2 (OCNF 01)								
15	132925Z	31.3N 100.9E	P			15 15 700 - - -	- NUAA 2	35 240	35	1001	308	13	-	-	-
16	140155Z	31.0N 100.9E	SAI			(12.0/3.0 / 01.0/240KTS)	PCN 6 UMSF								
17	140155Z	31.0N 102.0E	SAI			(12.5/3.0 / 00.5/240KTS)	PCN 6 UMSF								
18	140124Z	31.3N 101.7E	SAI			(12.5/3.0 / 02.0/240KTS)	PCN 3 UMSF								
19	141600Z	32.0N 103.1E	SAI				PCN 5 UMSF								

TYPMYON DUJ
FIX POSITIONS FOR CYCLONE NO. 5
14 JUL 10 20 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLI DIR	LVL VEL	MIN DRG	MAX UWS WIND	SFC WIND	MAX UWS WIND	OBS SLP	MIN HGT	LVL 11/10	EYE FORM	DIRECTION	EYE DIA	FOS11 OF FADAN	MSA NMBR
51	102000Z	22.2N 114.4E	LKUH	-														22.3N 114.4E	
52	102100Z	22.3N 114.4E	LKUH	-														22.3N 114.4E	
53	102300Z	22.6N 114.5E	LKUH	-														22.3N 114.4E	
54	100000Z	22.7N 114.0E	LKUH	-														22.3N 114.4E	
55	100100Z	22.7N 114.0E	LKUH	-														22.3N 114.4E	
56	100000Z	23.0N 114.0E	LKUH	-														22.3N 114.4E	
57	100300Z	23.3N 113.0E	LKUH	-														22.3N 114.4E	
58	100400Z	23.2N 113.4E	SAI																
59	100500Z	23.4N 114.9E	SAI																
60	100400Z	25.0N 112.4E	SAI																
61	101600Z	25.0N 110.4E	SAI																
62	101600Z	25.0N 110.4E	SAI																
63	101030Z	27.9N 125.7E	SAI																
64	101030Z	27.9N 125.7E	SAI																
65	101290Z	28.0N 126.0E	SAI																
66	101300Z	28.0N 126.0E	SAI																
67	101330Z	28.2N 127.1E	SAI																
68	100330Z	28.3N 126.4E	SAI																
69	100330Z	28.3N 127.0E	SAI																
70	100330Z	28.7N 126.0E	SAI																
71	100400Z	28.0N 126.0E	CHUR															26.4N 121.0E	
72	100510Z	27.0N 126.9E	LHUR															26.4N 121.0E	
73	100500Z	28.3N 127.3E	LHUR															26.4N 121.0E	
74	100500Z	28.7N 127.3E	LHUR															26.4N 121.0E	
75	101000Z	30.7N 127.1E	P																
76	101610Z	31.0N 127.0E	SAI																
77	101610Z	30.0N 126.3E	SAI																
78	101600Z	31.3N 127.1E	SAI																
79	101600Z	31.3N 127.1E	LHUR																
80	102100Z	31.3N 127.2E	LHUR																
81	102200Z	32.1N 127.0E	LHUR																
82	102300Z	32.0N 127.0E	LHUR																
83	200020Z	33.2N 126.2E	SAI																
84	200020Z	33.0N 126.3E	SAI																
85	200310Z	33.0N 126.3E	SAI																
86	201600Z	37.0N 126.3E	SAI																
87	102300Z	22.7N 114.7E	CPA																
88	102300Z	22.7N 114.7E	CPA																
89	100000Z	22.0N 114.0E	SCF																
90	100000Z	22.0N 114.0E	SCF																

TYPMYON ELLEN
FIX POSITIONS FOR CYCLONE NO. 6
1 JUL 10 29 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLI DIR	LVL VEL	MIN DRG	MAX UWS WIND	SFC WIND	MAX UWS WIND	OBS SLP	MIN HGT	LVL 11/10	EYE FORM	DIRECTION	EYE DIA	FOS11 OF FADAN	MSA NMBR
1	102300Z	20.3N 138.0E	SAI																
2	102300Z	20.0N 138.0E	SAI																
3	100210Z	20.3N 138.3E	SAI																
4	100210Z	20.3N 138.3E	SAI																
5	101300Z	21.0N 139.3E	SAI																
6	101300Z	21.0N 139.3E	SAI																
7	102300Z	22.2N 139.0E	P																
8	100330Z	22.2N 138.2E	SAI																
9	100330Z	22.2N 138.2E	SAI																
10	100330Z	22.2N 138.6E	SAI																
11	100200Z	22.2N 138.0E	SAI																
12	100200Z	22.2N 138.0E	SAI																
13	100330Z	22.0N 138.3E	P																
14	100330Z	22.3N 138.4E	SAI																
15	100300Z	22.3N 138.2E	SAI																
16	100330Z	22.7N 138.4E	P																
17	101500Z	23.0N 137.4E	SAI																
18	101500Z	23.0N 138.1E	SAI																
19	101500Z	22.9N 138.0E	SAI																
20	101500Z	23.1N 138.4E	SAI																
21	101300Z	23.1N 137.0E	SAI																
22	101300Z	23.1N 138.0E	SAI																
23	102300Z	24.0N 138.2E	SAI																
24	102300Z	24.0N 138.0E	SAI																
25	100330Z	24.0N 138.0E	SAI																
26	100400Z	24.7N 138.2E	ACUR																
27	101510Z	25.1N 138.1E	SAI																
28	101510Z	24.0N 138.0E	SAI																
29	100330Z	25.3N 138.2E	SAI																
30	100330Z	25.2N 138.0E	SAI																
31	100330Z	25.3N 138.5E	SAI																
32	100330Z	25.3N 138.3E	SAI																
33	101030Z	28.0N 138.2E	P																
34	101030Z	28.0N 138.2E	P																
35	101610Z	27.0N 138.5E	SAI																
36	101610Z	27.0N 138.3E	SAI																
37	101600Z	27.7N 138.5E	SAI																
38	101600Z	28.0N 138.4E	SAI																
39	102100Z	28.0N 138.3E	P																
40	200020Z	29.4N 138.0E	SAI																
41	200330Z	29.7N 139.0E	SAI																
42	200330Z	30.2N 137.9E	SAI																
43	200330Z	30.2N 138.1E	SAI																
44	200330Z	30.2N 137.0E	SAI																
45	200330Z	30.0N 137.9E	P																
46	200330Z	31.1N 137.0E	P																
47	201600Z	32.1N 138.0E	SAI																
48	201600Z	32.1N 138.0E	SAI																
49	201000Z	32.0N 136.5E	P																
50	202100Z	32.3N 136.5E	P																

TYPHOON ELLEN
FIX POSITIONS FOR CYCLONE NO. 6

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix LVL	Fix DIR	Fix VEL	WIND DIR	WIND RING	SFC WIND VEL	MAX OBS WIND RING	OBS SLP	MIN PRES	FLT TYP	EYE FORM	DIRECTION	EYE DIA	POSIT OF RADAR	MSL NUM
51	210421Z	32.0N 135.0E	SAT																
52	210500Z	32.1N 136.2E	SAT																
53	210504Z	31.9N 136.2E	SAT																
54	210515Z	32.0N 136.5E	P																
55	210540Z	31.9N 136.6E	SAT																
56	210600Z	32.2N 135.0E	SAT																
57	220022Z	31.2N 136.0E	SAT																
58	220600Z	31.4N 136.4E	SAT																
59	220400Z	31.5N 136.3E	SAT																
60	221530Z	30.8N 132.7E	SAT																
61	221535Z	30.8N 135.5E	SAT																
62	230000Z	31.1N 134.9E	P																
63	230100Z	31.1N 131.1E	SAT																
64	230110Z	31.2N 132.0E	SAT																
65	230235Z	30.7N 132.0E	SAT																
66	230237Z	30.7N 132.0E	SAT																
67	230237Z	30.7N 132.0E	SAT																
68	230300Z	30.8N 132.5E	LKUH															39.6N 131.0E	
69	230300Z	30.8N 132.5E	LKUH															39.6N 131.0E	
70	230400Z	30.9N 132.4E	LKUH															33.4N 130.4E	
71	230400Z	30.9N 132.4E	LKUH															33.4N 130.4E	
72	230500Z	30.9N 132.2E	LKUH															33.6N 131.0E	
73	230500Z	30.9N 132.2E	LKUH															33.6N 131.0E	
74	230600Z	30.8N 132.1E	LKUH															30.6N 131.0E	
75	230600Z	30.9N 132.0E	LKUH															33.4N 130.4E	
76	230600Z	30.8N 131.0E	LKUH															33.2N 131.0E	
77	230600Z	30.8N 131.0E	LKUH															30.6N 131.0E	
78	230700Z	30.7N 131.0E	LKUH															33.4N 130.4E	
79	230700Z	30.7N 131.7E	LKUH															33.4N 130.4E	
80	231200Z	30.4N 131.2E	LKUH															33.4N 130.4E	
81	231200Z	30.4N 131.2E	LKUH															33.4N 130.4E	
82	231200Z	30.1N 130.8E	LKUH															33.4N 130.4E	
83	231200Z	30.1N 131.4E	LKUH															30.6N 131.0E	
84	231200Z	29.8N 130.8E	LKUH															33.4N 130.4E	
85	231210Z	30.1N 130.8E	SAT															30.6N 131.0E	
86	231210Z	29.9N 130.9E	SAT															33.4N 130.4E	
87	231210Z	30.0N 131.5E	SAT															30.6N 131.0E	
88	231200Z	30.1N 131.2E	LKUH															30.6N 131.0E	
89	231700Z	30.1N 131.0E	LKUH															28.4N 129.5E	
90	231700Z	30.1N 131.0E	LKUH															30.6N 131.0E	
91	231701Z	29.9N 131.2E	SAT															28.4N 129.5E	
92	231701Z	29.9N 131.2E	SAT															30.6N 131.0E	
93	231702Z	30.2N 130.9E	LKUH															28.4N 129.5E	
94	231700Z	30.1N 130.9E	LKUH															28.4N 129.5E	
95	231700Z	30.2N 130.9E	LKUH															30.6N 131.0E	
96	231700Z	30.2N 130.9E	LKUH															30.6N 131.0E	
97	231700Z	30.2N 130.9E	LKUH															28.4N 129.5E	
98	232000Z	30.2N 130.7E	LKUH															28.4N 129.5E	
99	232100Z	30.2N 130.0E	LKUH															30.6N 131.0E	
100	232100Z	30.2N 130.7E	LKUH															28.4N 129.5E	
101	232200Z	30.3N 130.0E	LKUH															30.6N 131.0E	
102	232200Z	30.3N 130.0E	LKUH															28.4N 129.5E	
103	232200Z	30.3N 130.0E	LKUH															30.6N 131.0E	
104	232200Z	30.3N 130.4E	LKUH															28.4N 129.5E	
105	240000Z	30.4N 130.2E	LKUH															30.6N 131.0E	
106	240000Z	30.4N 130.3E	LKUH															30.6N 131.0E	
107	240010Z	30.1N 129.1E	SAT															28.4N 129.5E	
108	240010Z	30.1N 129.0E	SAT															30.6N 131.0E	
109	240100Z	30.3N 130.1E	LKUH															28.4N 129.5E	
110	240100Z	30.3N 130.3E	LKUH															30.6N 131.0E	
111	240200Z	30.3N 129.0E	LKUH															28.4N 129.5E	
112	240200Z	30.3N 130.0E	LKUH															30.6N 131.0E	
113	240200Z	29.7N 129.0E	SAT															28.4N 129.5E	
114	240200Z	30.1N 130.0E	SAT															30.6N 131.0E	
115	240200Z	30.0N 129.0E	SAT															28.4N 129.5E	
116	240200Z	30.0N 129.0E	SAT															30.6N 131.0E	
117	240300Z	30.3N 129.0E	LKUH															28.4N 129.5E	
118	240310Z	30.3N 129.0E	LKUH															30.6N 131.0E	
119	240400Z	30.3N 129.0E	LKUH															28.4N 129.5E	
120	240400Z	30.3N 129.0E	SAT															30.6N 131.0E	
121	240400Z	30.3N 129.0E	SAT															28.4N 129.5E	
122	240400Z	30.3N 129.0E	SAT															30.6N 131.0E	
123	240700Z	30.6N 129.0E	LKUH															28.4N 129.5E	
124	240700Z	30.7N 129.7E	LKUH															30.6N 131.0E	
125	240800Z	30.7N 129.7E	LKUH															28.4N 129.5E	
126	240800Z	30.7N 129.0E	LKUH															30.6N 131.0E	
127	241000Z	30.7N 129.0E	LKUH															28.4N 129.5E	
128	241100Z	30.7N 129.0E	LKUH															30.6N 131.0E	
129	241100Z	30.7N 129.0E	LKUH															28.4N 129.5E	
130	241100Z	30.7N 129.0E	LKUH															30.6N 131.0E	
131	241200Z	30.7N 129.0E	LKUH															28.4N 129.5E	
132	241200Z	30.7N 129.0E	LKUH															30.6N 131.0E	
133	241300Z	30.7N 129.0E	LKUH															28.4N 129.5E	
134	241300Z	30.7N 129.0E	LKUH															30.6N 131.0E	
135	241400Z	30.7N 129.0E	LKUH															28.4N 129.5E	
136	241400Z	31.0N 129.0E	LKUH															30.6N 131.0E	
137	241500Z	31.1N 129.0E	LKUH															28.4N 129.5E	
138	241500Z	31.2N 129.4E	P															30.6N 131.0E	
139	241500Z	31.3N 129.0E	LKUH															28.4N 129.5E	
140	241500Z	31.4N 129.0E	SAT															30.6N 131.0E	
141	241600Z	31.0N 129.3E	SAT															28.4N 129.5E	
142	241700Z	31.3N 129.5E	LKUH															30.6N 131.0E	
143	242000Z	31.0N 129.0E	LKUH															28.4N 129.5E	
144	242000Z	31.0N 129.0E	LKUH															30.6N 131.0E	
145	242100Z	31.0N 129.0E	LKUH															28.4N 129.5E	
146	242200Z	31.0N 129.0E	LKUH															30.6N 131.0E	
147	242200Z	31.0N 129.0E	P															28.4N 129.5E	
148	242300																		

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 ITPHYUN ELLEN
 FIA POSITIONS FOR CYCLONE NO. 6

FIA NO.	TIME	POSIT	FIA CAT	ACCY-MET	Fix LVL	FLI DIR	LVL VEL	WIND DRG	RNG	MAX OBS	OBS	MIN	FLT	EYE FORM	RIEN- ACTION	EYE LIA	FOSI		MSA NPPH
																	UP	FADAN	
151	250110Z	32.2N 128.9E	3A1	(12.0/2.5 /W0.5/24MRS)						NOAA 2 (NESS)									
152	250111Z	32.2N 129.0E	3A1	{12.0/2.5 /S /24MRS}						NOAA 2 (NESS)									
153	250347Z	32.1N 129.0E	3A1	{13.0/3.0 /W /24MRS}						NOAA 2 (NESS)									
154	250500Z	32.1N 129.0E	3A1	{13.5/3.5 /S /24MRS}						NOAA 2 (NESS)									
155	250500Z	32.2N 129.0E	LKUN	- 10407														33.4N	130.4E
156	250500Z	32.3N 130.7E	LKUN	- 10823														33.4N	130.4E
157	250500Z	32.3N 130.7E	LKUN	- 10823														33.4N	130.4E
158	250500Z	32.3N 130.7E	LKUN	- 20312														33.4N	130.4E
159	250900Z	32.3N 130.5E	LKUN	- 11211														33.4N	130.4E
160	251100Z	32.3N 130.4E	LKUN	- 45771														33.4N	130.4E
161	251100Z	32.3N 130.4E	LKUN	- 45771														33.4N	130.4E
162	251200Z	32.7N 130.4E	LKUN	- 45771														33.4N	130.4E
163	251300Z	32.8N 130.4E	LKUN	- 45771														33.4N	130.4E
164	251300Z	32.7N 131.0E	LKUN	- 45770														33.4N	130.4E
165	251300Z	32.7N 131.1E	LKUN	- 55770														33.3N	130.2E
166	251300Z	32.7N 131.1E	LKUN	- 45770														33.4N	130.4E
167	251300Z	32.7N 131.1E	LKUN	- 45770														33.4N	130.4E
168	251300Z	32.7N 131.1E	LKUN	- 45770														33.4N	130.4E
169	251700Z	32.7N 131.1E	LKUN	- 55770														33.3N	130.2E
170	251800Z	33.0N 131.1E	LKUN	- 55770														33.3N	130.2E
171	251800Z	32.7N 131.5E	LKUN	- 52011														30.6N	131.0E
172	251800Z	33.0N 131.1E	LKUN	- 35771														33.3N	130.2E
173	251800Z	33.0N 131.1E	LKUN	- 35771														33.3N	130.2E
174	260010Z	32.4N 132.0E	3A1	{12.5/2.5 /W0.5/23MRS}						NOAA 2 (NESS)									
175	260011Z	33.3N 132.0E	3A1	{12.5/2.5 /W0.5/23MRS}						NOAA 2 (NESS)									
176	260010Z	33.0N 132.0E	LKUN	-														33.3N	130.2E
177	260010Z	33.0N 132.0E	LKUN	-														33.3N	130.2E
178	260400Z	33.0N 132.7E	LKUN	-														33.3N	130.2E
179	260400Z	32.7N 132.7E	LKUN	-														33.3N	130.2E
180	260500Z	33.0N 133.0E	LKUN	-														33.3N	130.2E
181	260500Z	33.0N 133.1E	LKUN	-														33.3N	130.2E
182	260500Z	32.7N 133.5E	LKUN	-														33.3N	130.2E
183	261040Z	32.6N 133.7E	LKUN	-														33.3N	130.2E
184	261200Z	32.1N 134.5E	LKUN	-														33.3N	130.2E
185	261450Z	32.6N 133.9E	LKUN	-														33.3N	130.2E
186	262100Z	32.1N 134.5E	LKUN	-														33.3N	130.2E
187	262300Z	32.0N 134.0E	LKUN	-														33.3N	130.2E
188	270000Z	31.7N 134.7E	LKUN	- 57771														33.3N	130.2E
189	270100Z	31.7N 134.0E	LKUN	- 57771														33.3N	130.2E
190	270100Z	32.0N 135.0E	3A1	{12.5/2.5 /W0.5/23MRS}						NOAA 2 (NESS)									
191	270100Z	32.0N 135.0E	3A1	{12.5/2.5 /W0.5/23MRS}						NOAA 2 (NESS)									
192	270500Z	31.7N 134.8E	LKUN	- 57771														33.3N	130.2E
193	270500Z	31.7N 134.8E	LKUN	- 57771														33.3N	130.2E
194	280000Z	32.5N 136.7E	3A1	{12.5/2.5 /S /23MRS}						NOAA 2 (NESS)									
195	280000Z	32.5N 136.7E	3A1	{12.5/2.5 /S /23MRS}						NOAA 2 (NESS)									
196	280300Z	32.1N 136.9E	LKUN	- 20911														35.4N	136.7E
197	280300Z	32.2N 136.0E	3A1	{12.0/3.0 /W1.0/24MRS}						NOAA 2 (NESS)									
198	280300Z	32.4N 136.5E	3A1	{11.5/1.5 / /MRS}						NOAA 2 (NESS)									
199	280300Z	32.3N 137.1E	LKUN	- 20911														35.4N	136.7E
200	280500Z	32.3N 137.2E	LKUN	- 10871														35.4N	136.7E
201	280700Z	32.0N 137.4E	LKUN	- 20711														35.4N	136.7E
202	280900Z	32.7N 137.4E	LKUN	- 20811														35.4N	136.7E
203	281100Z	33.1N 137.4E	LKUN	- 20901														35.4N	136.7E
204	281200Z	33.3N 137.4E	LKUN	- 20522														35.4N	136.7E
205	281500Z	33.3N 137.4E	LKUN	- 20542														35.4N	136.7E
206	281500Z	33.9N 137.4E	LKUN	- 10372														35.4N	136.7E
207	281500Z	33.7N 137.4E	LKUN	- 20772														35.4N	136.7E
208	281540Z	33.0N 137.4E	3A1																
209	281540Z	33.7N 137.2E	3A1																
210	281700Z	34.3N 137.0E	LKUN	- 11374														34.6N	136.7E
211	282500Z	34.3N 137.0E	LKUN	- 10272														35.2N	137.0E
212	282500Z	34.3N 137.0E	LKUN	- 10272														35.2N	137.0E
213	290100Z	32.7N 136.0E	3A1	{12.0/2.0 /S /25MRS}						NOAA 2 (NESS)									
214	290200Z	34.0N 136.0E	LKUN	- 21422														35.2N	137.0E
215	290200Z	35.0N 137.1E	3A1	{11.5/2.0 /W0.5/24MRS}						NOAA 2 (NESS)									
216	290200Z	32.3N 136.0E	3A1	{11.5/1.5 / /MRS}						NOAA 2 (NESS)									
217	290300Z	34.0N 136.7E	LKUN	- 20402														35.2N	137.0E
218	290000Z	32.1N 136.5E	SCF																
219	290600Z	32.7N 137.5E	SCF																

TROPICAL STORM FRANK
FIX POSITIONS FOR CYCLONE NO. 7
29 JUL TO 30 JUL

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix Lvl	FLI DIR	LVL VEL	OBS WIND BKG RNG	MAX OBS SFC WIND VEL BKG RNG	OBS SLP	MIN 700MB HGT	LT LVL/TU	EYE FORM	DIEN-TION	EYE DIA	POSIT OF RADAR	MSL MPPH
1	242342Z	12.0N 130.0E	SAI						(11.5/1.5 / 00.5/24MRS)								
2	250342Z	11.4N 130.0E	SAI						(11.5/1.5 / 0 / MRS)								
3	250342Z	11.2N 135.0E	SAI						(12.0/2.0 / 01.0/24MRS)								
4	260018Z	11.5N 130.5E	SAI						(11.5/1.5 / 00.5/23MRS)								
5	270333Z	11.3N 136.0E	SAI						(11.5/1.5 / 0 / MRS)								
6	270112Z	16.3N 132.3E	SAI						(12.0/2.0 / 00.5/25MRS)								
7	270310Z	16.7N 132.0E	SAI						(12.0/2.0 / 0 / MRS)								
8	270310Z	16.7N 132.5E	SAI						(11.5/1.5 / 0 / 24MRS)								
9	270427Z	17.2N 124.1E	SAI						(12.0/2.0 / 0 / 24MRS)								
10	280010Z	19.0N 127.5E	SAI						(12.0/2.0 / 0 / 24MRS)								
11	280304Z	17.7N 127.3E	SAI						(12.0/2.0 / 0 / 24MRS)								
12	280304Z	17.7N 127.3E	SAI						(12.0/2.0 / 0 / 24MRS)								
13	280304Z	17.7N 127.3E	SAI						(11.5/1.5 / 0 / 24MRS)								
14	281340Z	17.7N 124.7E	SAI						(11.5/1.5 / 0 / 24MRS)								
15	281340Z	18.1N 124.7E	SAI						(11.5/1.5 / 0 / 24MRS)								
16	282350Z	19.2N 123.5E	SAI						(11.5/1.5 / 0 / 24MRS)								
17	290100Z	19.7N 124.0E	SAI						(12.5/2.5 / 00.5/25MRS)								
18	290300Z	19.2N 123.7E	SAI						(12.0/2.0 / 0 / 24MRS)								
19	290331Z	19.4N 122.9E	SAI						(13.0/3.0 / 0 / MRS)								
20	291140Z	19.3N 122.9E	SAI						(13.0/3.0 / 0 / MRS)								
21	291310Z	19.3N 122.9E	SAI						(13.0/3.0 / 0 / MRS)								
22	291310Z	20.4N 120.0E	SAI						(13.0/3.0 / 0 / MRS)								
23	292221Z	19.7N 122.3E	SAI						(11.5/1.5 / 0 / 24MRS)								
24	300000Z	22.0N 124.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
25	300400Z	22.1N 121.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
26	300410Z	19.5N 119.3E	SAI						(11.5/1.5 / 0 / 24MRS)								

TYPHOON GEORGIA
FIX POSITIONS FOR CYCLONE NO. 8
09 AUG TO 12 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix Lvl	FLI DIR	LVL VEL	OBS WIND BKG RNG	MAX OBS SFC WIND VEL BKG RNG	OBS SLP	MIN 700MB HGT	LT LVL/TU	EYE FORM	DIEN-TION	EYE DIA	POSIT OF RADAR	MSL MPPH
1	080040Z	20.0N 119.0E	SAI						(12.0/2.0 / 01.0/24MRS)								
2	080040Z	20.0N 119.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
3	080040Z	21.0N 117.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
4	080340Z	20.0N 119.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
5	081031Z	20.0N 117.0E	SAI						(11.5/1.5 / 0 / 24MRS)								
6	081332Z	20.0N 119.0E	SAI						(13.0/3.0 / 01.0/24MRS)								
7	081332Z	20.0N 117.0E	SAI						(13.0/3.0 / 01.0/24MRS)								
8	081332Z	20.0N 117.0E	SAI						(13.0/3.0 / 01.0/24MRS)								
9	081332Z	20.0N 117.0E	SAI						(13.0/3.0 / 01.0/24MRS)								
10	081332Z	20.0N 117.0E	SAI						(13.0/3.0 / 01.0/24MRS)								
11	081332Z	20.0N 117.0E	SAI						(12.0/2.0 / 00.5/23MRS)								
12	081332Z	19.7N 116.7E	SAI						(12.5/2.5 / 01.0/24MRS)								
13	081332Z	19.7N 117.0E	SAI						(13.0/3.0 / 0 / MRS)								
14	081332Z	20.0N 119.0E	SAI						(12.5/2.5 / 0 / 24MRS)								
15	081332Z	19.7N 117.0E	SAI						(12.0/2.0 / 01.0/24MRS)								
16	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
17	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
18	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
19	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
20	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
21	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
22	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
23	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
24	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
25	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
26	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
27	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
28	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
29	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
30	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
31	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
32	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
33	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
34	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
35	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
36	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
37	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
38	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
39	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
40	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
41	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
42	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
43	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
44	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
45	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
46	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
47	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
48	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
49	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
50	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
51	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
52	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
53	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
54	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
55	081332Z	19.7N 116.0E	SAI						(12.0/2.0 / 0 / MRS)								
56	081332Z	19.7N 116.0E	SAI														

TROPICAL STORM HOPE
FIX POSITIONS FOR CYCLONE NO. 9
09 AUG TO 12 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FL DIR	LVL WIND VEL	MIND BRG	MAX OBS WIND BRG	SFC WIND VEL	MIN SLP	700MB HGT	FLT LVL	EYE FORM	DIREN- TION	EYE DIA	POSIT OF RADAR	MSL NDBH
1	060200Z	23.0N 156.3E	SAI	(11.0/1.0 / /					PCN 3	UMSP								
2	062300Z	25.0N 156.0E	SAI	(12.0/2.0 /01.0/24PRS)					NUAA 2	(INSS)								
3	062300Z	25.0N 156.1E	SAI	(12.0/2.0 /01.0/24PRS)					PCN 4	UMSP								
4	062300Z	25.0N 156.1E	SAI	(12.0/2.0 /01.0/24PRS)					PCN 3	UMSP								
5	061451Z	25.0N 155.4E	SAI	(12.0/2.0 /0 / /24PRS)					PCN 4	UMSP								
6	091430Z	27.0N 152.2E	SAI						PCN 4	UMSP								
7	091430Z	27.0N 152.2E	SAI						PCN 4	UMSP								
8	092224Z	27.0N 152.2E	P	20 5 700 180 30 90					PCN 4	UMSP	20	996	305	13	-	-	-	
9	092230Z	27.0N 152.0E	SAI	(13.0/3.0 /01.0/24PRS)					NUAA 2	(INSS)								
10	092230Z	27.0N 152.0E	SAI	(13.0/3.0 /01.0/24PRS)					NUAA 2	(INSS)								
11	100136Z	27.0N 151.7E	SAI	(13.5/3.5 /01.0/24PRS)					PCN 3	UMSP								
12	100136Z	27.0N 151.7E	SAI	(13.5/3.5 /01.0/24PRS)					PCN 3	UMSP								
13	101227Z	29.0N 150.3E	P	15 10 - 300 40 180					PCN 3	UMSP		1006	310	-	-	-	-	2
14	101227Z	29.0N 150.3E	SAI						PCN 3	UMSP								
15	101230Z	29.0N 150.3E	SAI						PCN 3	UMSP								
16	102130Z	30.0N 149.0E	P	5 5 700 150 30 50					PCN 4	UMSP	25	1001	309	10	14	-	-	3
17	102330Z	30.0N 149.0E	SAI	(13.0/3.0 / /24PRS)					NUAA 2	(INSS)								
18	102330Z	30.0N 149.0E	SAI	(12.0/3.0 /01.0/24PRS)					NUAA 2	(INSS)								
19	110121Z	30.0N 149.4E	SAI	(13.5/3.5 / /24PRS)					PCN 4	UMSP								
20	110121Z	30.0N 149.3E	SAI	(14.0/4.0 /01.0/24PRS)					PCN 4	UMSP								
21	110230Z	31.0N 148.3E	P	5 10 - 210 20 120					PCN 4	UMSP	40	999	305	11	-	-	-	4
22	111400Z	31.0N 148.3E	SAI						PCN 4	UMSP								
23	111400Z	31.0N 148.3E	SAI						PCN 3	UMSP								
24	120230Z	31.0N 145.8E	SAI	(13.0/3.0 / /24PRS)					PCN 3	UMSP								
25	120230Z	31.0N 145.8E	SAI	(13.0/3.0 / /24PRS)					PCN 3	UMSP								
26	120230Z	31.0N 145.8E	SAI	(14.0/4.0 / /24PRS)					PCN 3	UMSP								
27	120230Z	31.0N 145.8E	SAI	(14.0/4.0 / /24PRS)					PCN 3	UMSP								
29	121200Z	32.0N 144.0E	P	5 10 - 200 20 140					PCN 3	UMSP	30	-	-	-	-	-	-	5
30	121200Z	32.0N 142.1E	LHUN						PCN 3	UMSP								
31	121230Z	34.0N 143.0E	SAI						PCN 3	UMSP								
32	121230Z	34.0N 143.0E	SAI						PCN 3	UMSP								
33	121230Z	34.0N 143.0E	SAI						PCN 3	UMSP								

TYPHOON IMAE
FIX POSITIONS FOR CYCLONE NO. 10
10 AUG TO 17 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FL DIR	LVL WIND VEL	MIND BRG	MAX OBS WIND BRG	SFC WIND VEL	MIN SLP	700MB HGT	FLT LVL	EYE FORM	DIREN- TION	EYE DIA	POSIT OF RADAR	MSL NDBH
1	090300Z	19.0N 132.0E	SAI	(11.5/1.5 / /24PRS)					NUAA 2	(INSS)								
2	090300Z	19.0N 132.0E	SAI	(11.5/1.5 / /24PRS)					PCN 3	UMSP								
3	090300Z	17.0N 132.4E	SAI	(11.5/1.5 / /24PRS)					PCN 3	UMSP								
4	090300Z	17.0N 132.3E	SAI	(12.0/2.0 / /24PRS)					PCN 3	UMSP								
5	090300Z	17.0N 132.3E	SAI	(12.0/2.0 / /24PRS)					PCN 3	UMSP								
6	090300Z	17.0N 132.0E	SAI	(12.0/2.0 / /24PRS)					PCN 3	UMSP								
7	091010Z	18.0N 131.7E	SAI						PCN 3	UMSP								
8	091010Z	17.0N 132.1E	SAI						PCN 3	UMSP								
9	091010Z	18.0N 131.6E	SAI						PCN 3	UMSP								
10	091010Z	18.0N 131.6E	SAI						PCN 3	UMSP								
11	100300Z	24.0N 130.0E	SAI	(11.5/1.5 / /24PRS)					NUAA 2	(INSS)								
12	100300Z	22.0N 131.0E	SAI	(12.5/2.5 / /24PRS)					PCN 3	UMSP								
13	100300Z	21.0N 130.9E	SAI	(12.5/2.5 / /24PRS)					PCN 3	UMSP								
14	100300Z	21.0N 130.9E	SAI	(12.5/2.5 / /24PRS)					PCN 3	UMSP								
15	100300Z	21.0N 130.9E	SAI	(12.0/2.0 / /24PRS)					PCN 3	UMSP								
16	101230Z	21.0N 130.9E	P	3 8 700 210 30 120					PCN 3	UMSP	1002	307	10	14	-	-	-	4
17	101230Z	22.0N 131.0E	P	5 10 700 240 50 150					PCN 3	UMSP	999	306	14	-	-	-	-	4
18	101230Z	23.0N 131.0E	SAI						PCN 3	UMSP								
19	101230Z	23.0N 131.0E	SAI						PCN 3	UMSP								
20	101230Z	23.0N 131.0E	SAI						PCN 3	UMSP								
21	102500Z	23.0N 131.0E	P	1 5 700 320 20 230					NUAA 2	(INSS)	15	987	299	10	11	-	-	5
22	102500Z	23.0N 131.0E	SAI	(13.0/3.0 / /24PRS)					NUAA 2	(INSS)								
23	110300Z	23.0N 130.3E	P	1 (14.0/4.0 / /24PRS)					PCN 3	UMSP	60	989	300	10	14	-	-	5
24	110300Z	23.0N 130.3E	SAI	(14.0/4.0 / /24PRS)					PCN 3	UMSP								
25	110300Z	23.0N 130.3E	SAI	(15.0/5.0 / /24PRS)					PCN 3	UMSP								
26	110300Z	23.0N 130.3E	SAI	(15.0/5.0 / /24PRS)					PCN 3	UMSP								
27	110300Z	23.0N 130.1E	SAI	(14.0/4.0 / /24PRS)					PCN 1	UMSP								
28	110300Z	23.0N 130.1E	P	2 15 700 310 40 200					PCN 1	UMSP	40	984	295	14	-	-	-	6
29	110300Z	23.0N 130.1E	P	2 15 700 310 40 200					PCN 1	UMSP	982	294	10	-	-	-	-	6
30	110300Z	22.0N 131.2E	SAI						PCN 3	UMSP								
31	110300Z	23.0N 131.0E	SAI						PCN 3	UMSP								
32	110300Z	22.0N 131.0E	SAI						PCN 3	UMSP								
33	120230Z	23.0N 131.0E	SAI	(13.0/3.0 / /24PRS)					NUAA 2	(INSS)								
34	120230Z	23.0N 131.0E	SAI	(13.0/3.0 / /24PRS)					PCN 3	UMSP								
35	120230Z	23.0N 131.0E	SAI	(14.5/4.5 / /24PRS)					PCN 3	UMSP								
36	120230Z	23.0N 131.0E	SAI	(14.0/4.0 / /24PRS)					PCN 3	UMSP								
37	120900Z	23.0N 130.9E	P	2 5 700 310 30 300					PCN 3	UMSP	60	979	288	14	15	-	-	8
39	121230Z	22.0N 131.4E	SAI						PCN 3	UMSP								
40	121230Z	22.0N 131.4E	SAI						PCN 3	UMSP								
41	121230Z	22.0N 131.4E	SAI						PCN 1	UMSP								
42	121230Z	23.0N 131.0E	P	5 3 700 210 60 130					NUAA 2	(INSS)	974	287	10	-	-	-	-	9
43	122110Z	23.0N 131.0E	P	5 2 700 240 60 160					NUAA 2	(INSS)	974	286	14	-	-	-	-	9
44	122300Z	23.0N 130.0E	SAI	(15.0/5.0 / /24PRS)					NUAA 2	(INSS)								
45	130230Z	23.0N 131.0E	SAI	(15.0/5.0 / /24PRS)					PCN 1	UMSP								
46	130230Z	22.0N 131.0E	SAI	(15.0/5.0 / /24PRS)					PCN 1	UMSP								
47	130230Z	23.0N 132.1E	SAI	(15.0/5.0 / /24PRS)					PCN 3	UMSP								
48	131140Z	23.0N 132.3E	P	2 15 700 360 60 260					PCN 3	UMSP	972	285	14	-	-	-	-	10
49	131310Z	23.0N 131.9E	SAI						PCN 3	UMSP								
50	131310Z	23.0N 131.9E	SAI						PCN 3	UMSP								

TYPHOON IRIS CYCLONE NO. 10																				
FIX POSITIONS FOR 10 AUG TO 17 AUG																				
FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVI	FLI DIR	ORS VEL	WIND BRG	MAX SFC WIND	OBS VEL	MIN BRG	OBS SLP	MIN HGT	FLT LVL	EYE FORM	ORIEN- TATION	EYE DIA	POSIT OF RADAR	MSW NWP	
																				MAX ORS WIND
51	131218Z	23.0N 132.3E	SAT																	
52	131207Z	24.0N 132.1E	P	10 10	-	330	04 240	30	-	-	-	974	287	14	-	-	-	-		11
53	140620Z	24.5N 132.3E	SAT																	
54	140627Z	24.5N 132.0E	SAT																	
55	140627Z	24.5N 132.1E	SAT																	
56	140627Z	25.0N 132.3E	SAT																	
57	140627Z	25.2N 132.0E	SAT																	
58	140701Z	25.5N 131.0E	SAT																	
59	140701Z	25.1N 132.1E	SAT																	
60	140701Z	25.2N 131.0E	SAT																	
61	140701Z	25.1N 132.2E	SAT																	
62	140701Z	24.5N 132.0E	SAT																	
63	141030Z	27.0N 130.0E	P	2 10	700	240	04 130	100	50	130	120	972	286	13	13	-	-	-		12
64	141030Z	27.0N 130.0E	P	5 10	700	140	04 00	80	-	-	-	979	291	14	14	-	-	-		13
65	141043Z	26.0N 131.1E	SAT																	
66	141043Z	27.0N 130.0E	SAT																	
67	141043Z	26.0N 130.0E	SAT																	
68	141043Z	26.0N 130.0E	SAT																	
69	141043Z	26.0N 130.0E	SAT																	
70	141000Z	27.5N 131.3E	LKUH																	28.4N 129.0E
71	141900Z	28.2N 130.0E	LKUH																	28.4N 129.0E
72	142000Z	28.0N 130.0E	LKUH																	28.4N 129.0E
73	142200Z	27.0N 129.7E	LKUH																	
74	150120Z	28.5N 129.0E	SAT																	33.6N 130.0E
75	150120Z	28.5N 129.0E	SAT																	
76	150500Z	28.5N 129.0E	LKUH																	28.4N 129.0E
77	150500Z	28.5N 129.0E	LKUH																	28.4N 129.0E
78	150347Z	26.2N 128.0E	SAT																	
79	150347Z	26.2N 129.0E	SAT																	
80	150347Z	26.2N 129.0E	SAT																	
81	150347Z	26.2N 128.7E	SAT																	
82	150347Z	26.2N 129.1E	SAT																	
83	150400Z	28.4N 129.0E	LKUH																	
84	150413Z	28.5N 129.0E	P	1 15	700	230	04 160	90	40	150	110	978	289	14	-	-	-			15
85	150600Z	29.3N 129.3E	LKUH																	33.6N 130.0E
86	150700Z	29.7N 129.3E	LKUH																	33.6N 130.0E
87	150600Z	28.5N 128.0E	LKUH																	28.4N 129.0E
88	150700Z	29.1N 128.7E	LKUH																	28.4N 129.0E
89	150755Z	28.5N 128.7E	P	10 15	700	220	30 170	30	-	-	-	977	291	10	-	-	-			16
90	151000Z	29.2N 128.2E	LKUH																	28.4N 129.0E
91	151200Z	29.5N 128.0E	LKUH																	33.6N 130.0E
92	151200Z	29.3N 128.0E	LKUH																	28.4N 129.0E
93	151200Z	29.5N 128.1E	LKUH																	33.6N 130.0E
94	151200Z	29.3N 127.0E	LKUH																	28.4N 129.0E
95	151200Z	30.1N 127.0E	LKUH																	33.6N 130.0E
96	151200Z	30.3N 127.0E	LKUH																	33.6N 130.0E
97	151200Z	29.5N 127.0E	LKUH																	33.6N 130.0E
98	151200Z	30.3N 127.0E	SAT																	
99	151200Z	29.5N 126.0E	SAT																	
100	152114Z	30.0N 126.0E	P	1 15	700	250	04 140	60	30	140	85	972	286	10	14	-	-	-		17
101	160019Z	30.1N 126.5E	SAT																	
102	160332Z	31.0N 125.0E	SAT																	
103	160332Z	31.0N 125.0E	SAT																	
104	160332Z	31.1N 125.0E	SAT																	
105	160332Z	31.1N 125.0E	SAT																	
106	160332Z	30.5N 126.0E	SAT																	
107	160332Z	30.5N 126.5E	SAT																	
108	160714Z	31.3N 125.1E	P	5 5	700	140	04 50	50	-	-	-	976	287	10	-	CIRC				18
109	161010Z	33.1N 125.0E	SAT																	
110	161010Z	32.3N 125.1E	SAT																	
111	161010Z	34.3N 124.0E	LKUH																	35.9N 126.0E
112	161010Z	34.7N 124.0E	LKUH																	35.9N 126.0E
113	162200Z	35.7N 124.5E	LKUH																	35.9N 126.0E
114	162400Z	35.0N 125.1E	SAT																	35.9N 126.0E
115	162400Z	35.0N 126.0E	LKUH																	37.5N 127.0E
116	170300Z	35.5N 126.1E	LKUH																	
117	170319Z	36.3N 126.0E	SAT																	
118	170700Z	36.1N 125.7E	LKUH																	
119	170700Z	36.1N 125.0E	LKUH																	
120	171001Z	34.5N 130.1E	SAT																	

TROPICAL DEPRESSION 11																				
FIX POSITIONS FOR CYCLONE NO. 11																				
13 AUG TO 14 AUG																				
FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVI	FLI DIR	ORS VEL	WIND BRG	MAX SFC WIND	OBS VEL	MIN BRG	OBS SLP	MIN HGT	FLT LVL	EYE FORM	ORIEN- TATION	EYE DIA	POSIT OF RADAR	MSW NWP	
																				MAX ORS WIND
1	162130Z	28.0N 167.0E	SAT																	
2	162137Z	28.0N 167.0E	SAT																	
3	162121Z	28.0N 167.0E	SAT																	
4	162121Z	27.5N 165.0E	SAT																	
5	162121Z	27.5N 165.5E	SAT																	
6	162121Z	27.5N 165.5E	SAT																	
7	162121Z	28.0N 162.0E	SAT																	
8	162121Z	28.0N 162.5E	SAT																	
9	162121Z	28.0N 162.5E	S																	

TROPICAL STORM JOAN
FIX POSITIONS FOR CYCLONE NO. 12
18 AUG TO 20 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TU	EYE FORM	RICH-TATION	EYE DIA	FOSII OF FADAB	MSW NMPH
						FL1 DIR	LVL VFL	WIND HPG RRG								
1	170117Z	20.1N 133.1E	SAI			(11.5/1.5 /D1.0/24NRS)										
2	170318Z	20.0N 134.3E	SAI			(11.5/1.5 /D0.5/24NRS)										
3	170518Z	19.9N 134.2E	SAI			(11.5/1.5 /D /24NRS)										
4	171001Z	20.3N 132.9E	SAI													
5	180010Z	21.0N 131.0E	SAI			(11.5/1.5 /S /24NRS)										
6	180017Z	21.0N 131.0E	SAI			(11.5/1.5 /S /24NRS)										
7	180303Z	19.3N 130.4E	SAI			(12.0/2.0 /D0.5/24NRS)										
8	180303Z	19.3N 131.0E	SAI			(12.5/2.5 /D1.0/24NRS)										
9	181347Z	18.3N 129.0E	SAI													
10	181347Z	18.3N 129.9E	SAI													
11	182224Z	18.4N 127.7E	P	3	10	700	270	1W	200							3
12	190111Z	22.0N 124.2E	SAI			(12.0/2.0 /D0.5/24NRS)										
13	190400Z	21.9N 125.9E	SAI			(12.0/2.0 / / NRS)										
14	190430Z	21.7N 123.9E	SAI													
15	191112Z	23.0N 122.4E	SAI													
16	191112Z	23.0N 123.7E	SAI													
17	192116Z	20.8N 121.3E	P	10	15	-	120	3W	50	157						5
18	200013Z	20.5N 121.0E	SAI			(11.5/2.0 /W0.5/24NRS)										
19	200014Z	20.3N 121.0E	SAI			(11.5/2.0 /W0.5/24NRS)										
20	200410Z	21.9N 119.0E	SAI			(11.5/1.5 / / NRS)										
21	200410Z	21.2N 120.0E	SAI			(12.0/2.0 / / NRS)										
22	200430Z	20.5N 118.0E	SAI			(12.0/2.0 /W0.5/24NRS)										
23	210130Z	20.4N 122.3E	LKUN													7
24	210130Z	21.4N 113.2E	LKUN													
25	210430Z	21.4N 112.4E	LKUN													
26	210600Z	21.5N 111.9E	LKUN													

TROPICAL STORM KATE
FIX POSITIONS FOR CYCLONE NO. 13
24 AUG TO 26 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TU	EYE FORM	RICH-TATION	EYE DIA	FOSII OF FADAB	MSW NMPH
						FL1 DIR	LVL VFL	WIND HPG RRG								
1	221400Z	19.9N 116.4E	LKUN			- 2070)										22.3N 114.2E
2	221600Z	19.8N 115.0E	LKUN			- 2077)										22.3N 114.2E
3	222030Z	19.4N 114.2E	LKUN													22.3N 114.2E
4	230014Z	19.3N 114.0E	SAI			(12.0/2.0 /D1.0/24NRS)										
5	230514Z	19.2N 114.3E	SAI			(11.5/1.5 /S /13NRS)										
6	230700Z	19.4N 114.2E	LKUN			- 0577)										22.3N 114.2E
7	231200Z	19.2N 113.1E	LKUN													22.3N 114.2E
8	240024Z	18.4N 112.2E	SAI			(13.0/3.0 /D1.0/24NRS)										
9	240054Z	18.0N 112.5E	SAI			(13.0/3.0 /D1.0/24NRS)										
10	240154Z	18.8N 112.5E	SAI			(13.0/3.0 /D1.0/24NRS)										
11	240457Z	18.9N 112.0E	SAI			(13.0/3.0 /D /24NRS)										
12	240507Z	18.4N 111.9E	SAI			(12.0/2.0 /D1.0/24NRS)										
13	240459Z	18.4N 112.0E	SAI			(13.5/3.5 /D2.0/24NRS)										
14	241647Z	20.0N 107.3E	SAI													
15	241505Z	19.1N 111.3E	SAI													
16	241746Z	18.9N 109.9E	SAI			(13.5/3.5 /D2.0/ NRS)										
17	250005Z	19.0N 109.4E	SAI													
18	250007Z	20.0N 109.6E	SAI			(14.0/4.0 / / NRS)										
19	250420Z	20.1N 108.0E	SAI			(13.0/3.0 /D /24NRS)										
20	250400Z	20.3N 109.0E	SAI			(12.0/3.0 /W1.0/27NRS)										
21	250443Z	20.2N 109.1E	SAI			(14.0/4.0 /D2.0/24NRS)										
22	250443Z	21.0N 109.0E	SAI			(13.0/3.5 /W0.5/24NRS)										
23	251247Z	20.2N 107.4E	SAI													
24	251247Z	20.5N 107.6E	SAI													

TROPICAL DEPRESSION 14
FIX POSITIONS FOR CYCLONE NO. 14
01 SEP TO 02 SEP

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	FIX LVL	MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TU	EYE FORM	RICH-TATION	EYE DIA	FOSII OF FADAB	MSW NMPH
						FL1 DIR	LVL VFL	WIND HPG RRG								
1	300137Z	19.3N 114.1E	SAI			(11.5/1.5 /D0.5/24NRS)										
2	310227Z	20.5N 111.0E	SAI			(11.5/1.5 /S /24NRS)										
3	310233Z	20.3N 111.5E	SAI			(11.5/1.5 /S /24NRS)										
4	020103Z	19.7N 106.5E	SAI			(11.5/1.5 /S /24NRS)										
5	020430Z	19.0N 105.7E	SAI			(11.2/2.0 /D1.0/24NRS)										

TYPHOON LOUISE
FIX POSITIONS FOR CYCLONE NO. 15
03 SEP 10 07 SEP

FIX NO.	TIME	POSIT	FIX	ACQNY	FIX	FIX	MAX OBS	MAX OBS	OBS	MIN	FLT	EYE	ORION	EYE	POSIT	NC
				AV	DIR	VEL	WIND	SFC WIND	MIN	700MB	FLY	FORM	ORION	DIA	OF	NC
				MET	100	DIR	WIND	WIND	SLP	HGT	11/10	FORM	ORION	DIA	RADAR	NC
1	010100Z	13.0N 122.0E	SAI													
2	010130Z	12.0N 122.0E	SAI													
3	012521Z	17.0N 122.7E	SAI													
4	012521Z	17.0N 122.7E	SAI													
5	020133Z	17.0N 122.5E	SAI													
6	020130Z	17.0N 123.0E	SAI													
7	020130Z	17.0N 122.7E	SAI													
8	020130Z	17.0N 122.7E	SAI													
9	020130Z	17.0N 122.7E	SAI													
10	021203Z	18.0N 122.7E	SAI													
11	021300Z	18.0N 121.0E	SAI													
12	030040Z	18.0N 120.3E	SAI													
13	030050Z	19.0N 121.0E	SAI													
14	030050Z	19.0N 120.4E	SAI													
15	030050Z	19.0N 120.8E	SAI													
16	030130Z	19.0N 120.5E	SAI													
17	030200Z	19.0N 120.5E	SAI													
18	030410Z	19.0N 120.0E	SAI													
19	030410Z	19.0N 120.0E	SAI													
20	030410Z	19.0N 120.0E	SAI													
21	030410Z	19.0N 120.0E	SAI													
22	030410Z	19.0N 120.0E	SAI													
23	031200Z	18.0N 120.2E	SAI													
24	031200Z	18.0N 120.5E	SAI													
25	031200Z	19.0N 119.0E	SAI													
26	032200Z	19.0N 119.3E	SAI													
27	032200Z	19.0N 119.3E	SAI													
28	032200Z	19.0N 119.3E	SAI													
29	040020Z	19.0N 119.1E	SAI													
30	040020Z	19.0N 120.2E	SAI													
31	040030Z	18.0N 119.1E	SAI													
32	040030Z	18.0N 119.2E	SAI													
33	040030Z	19.0N 118.0E	SAI													
34	040040Z	19.0N 118.0E	SAI													
35	040040Z	19.0N 118.0E	SAI													
36	040040Z	19.0N 118.0E	SAI													
37	040040Z	19.0N 118.0E	SAI													
38	040040Z	19.0N 118.0E	SAI													
39	041300Z	19.0N 117.0E	SAI													
40	041300Z	19.0N 117.0E	SAI													
41	041000Z	19.0N 117.0E	SAI													
42	041040Z	19.0N 117.0E	SAI													
43	041040Z	19.0N 117.0E	SAI													
44	041040Z	19.0N 117.0E	SAI													
45	042100Z	19.0N 116.0E	SAI													
46	042100Z	20.0N 116.0E	SAI													
47	042100Z	19.0N 116.0E	SAI													
48	042300Z	19.0N 116.0E	SAI													
49	042300Z	19.0N 116.0E	SAI													
50	050000Z	19.0N 115.0E	SAI													
51	050000Z	19.0N 116.0E	SAI													
52	050100Z	19.0N 115.0E	SAI													
53	050121Z	19.0N 115.0E	SAI													
54	050120Z	20.0N 115.0E	SAI													
55	050120Z	19.0N 115.0E	SAI													
56	050120Z	19.0N 115.0E	SAI													
57	050120Z	19.0N 115.0E	SAI													
58	050120Z	19.0N 115.0E	SAI													
59	050120Z	19.0N 115.0E	SAI													
60	050120Z	19.0N 115.0E	SAI													
61	050120Z	19.0N 115.0E	SAI													
62	050120Z	19.0N 114.0E	SAI													
63	050120Z	19.0N 114.0E	SAI													
64	050120Z	19.0N 114.0E	SAI													
65	050120Z	19.0N 114.0E	SAI													
66	051100Z	19.0N 114.0E	SAI													
67	051100Z	19.0N 114.0E	SAI													
68	051200Z	19.0N 114.0E	SAI													
69	051200Z	19.0N 114.0E	SAI													
70	051200Z	19.0N 114.0E	SAI													
71	051500Z	19.0N 113.0E	SAI													
72	051500Z	19.0N 113.0E	SAI													
73	051500Z	19.0N 113.0E	SAI													
74	051500Z	19.0N 112.0E	SAI													
75	051800Z	19.0N 113.0E	SAI													
76	052100Z	20.0N 112.0E	SAI													
77	052200Z	20.0N 112.0E	SAI													
78	052300Z	20.0N 112.0E	SAI													
79	052300Z	19.0N 112.0E	SAI													
80	052300Z	19.0N 112.0E	SAI													
81	052300Z	20.0N 112.0E	SAI													
82	060000Z	20.0N 112.0E	SAI													
83	060100Z	20.0N 112.0E	SAI													
84	060100Z	20.0N 112.0E	SAI													
85	060100Z	20.0N 112.0E	SAI													
86	060100Z	20.0N 112.0E	SAI													
87	060100Z	20.0N 112.0E	SAI													
88	060100Z	20.0N 112.0E	SAI													
89	060100Z	20.0N 112.0E	SAI													
90	060100Z	20.0N 112.0E	SAI													
91	060100Z	20.0N 112.0E	SAI													
92	060100Z	20.0N 112.0E	SAI													
93	060100Z	20.0N 112.0E	SAI													
94	060100Z	20.0N 112.0E	SAI													
95	060100Z	20.0N 112.0E	SAI													
96	060100Z	20.0N 112.0E	SAI													

TYPHOON NAME
FIX POSITIONS FOR CYCLONE NO. 16
12 SEP 10 14 SEP

FIX NO.	TIME	POSIT	FIX	ACQY	FLI LVL	DIR	VEL	DRG	RNG	MAX OBS	OBS MIN	MIN 700MB	FLT LVL	EYE	EYE DIA	EYE DIA	POSIT OF RADAR	MSA
										SFC WIND								
1	082255Z	13.8N 134.5E	SAI							(11.0/1.0 / / NRS)								
2	082255Z	14.0N 134.0E	SAI							(11.0/1.0 / / NRS)								
3	090248Z	13.8N 134.2E	SAI							(11.0/1.0 /S / 4NRS)								
4	092237Z	15.3N 130.8E	SAI							(11.0/1.0 / / NRS)								
5	110001Z	16.9N 125.0E	SAI							(11.5/1.5 /00.5/24NRS)								
6	110001Z	16.1N 125.8E	SAI							(11.0/1.0 / / NRS)								
7	110109Z	16.5N 124.5E	SAI							(11.5/1.5 /00.5/24NRS)								(CCNF 01)
8	110400Z	16.7N 123.0E	SAI							(11.0/1.0 / / NRS)								
9	110400Z	17.0N 124.3E	SAI							(11.5/1.5 /00.5/24NRS)								
10	111242Z	16.9N 122.3E	SAI							(11.5/1.5 / / NRS)								
11	111242Z	16.9N 122.5E	SAI							(11.5/1.5 / / NRS)								
12	111242Z	17.4N 122.5E	SAI							(11.5/1.5 / / NRS)								
13	111844Z	16.8N 121.0E	SAI							(12.0/2.0 /00.5/24NRS)								
14	111844Z	17.0N 121.9E	SAI							(12.5/2.5 /01.5/24NRS)								
15	112442Z	17.0N 119.5E	SAI							(12.0/2.0 /00.5/24NRS)								
16	112442Z	16.5N 119.8E	SAI							(12.5/2.5 /01.5/24NRS)								
17	112442Z	16.9N 119.5E	SAI							(11.8/1.5 /S /24NRS)								
18	120008Z	16.8N 119.0E	SAI							(12.0/2.0 /00.5/24NRS)								(CCNF 02)
19	120317Z	17.9N 119.3E	SAI							(12.0/2.0 /00.5/24NRS)								
20	120328Z	17.3N 118.8E	SAI							(12.5/2.5 /01.5/24NRS)								
21	120340Z	17.7N 118.9E	SAI							(12.0/2.0 /00.5/24NRS)								
22	120340Z	17.0N 118.8E	SAI							(12.5/2.5 /01.5/24NRS)								
23	120407Z	17.0N 118.8E	SAI							(12.5/2.5 /01.5/24NRS)								
24	120407Z	17.8N 119.0E	LRUH							- POSSIBLE CENTER, 90								
25	121030Z	18.3N 117.4E	P	10	8	700	50	40	30	15								
26	121242Z	18.1N 117.0E	SAI							ESSA 8 (VTBU)								
27	121242Z	18.3N 116.9E	SAI							10 35 240 18	1003	309	-	-	-	-	-	1
28	121242Z	18.2N 117.0E	SAI															
29	121500Z	18.2N 117.0E	P	5	3	700	150	60	20	25								
30	121827Z	18.3N 116.2E	SAI															
31	121827Z	18.3N 116.4E	SAI															
32	121827Z	18.6N 116.4E	SAI															
33	122210Z	18.4N 115.0E	P	30	5	700	150	60	90	25								
34	122330Z	18.5N 114.8E	LRUH															
35	130000Z	18.6N 114.7E	LRUH															
36	130103Z	18.7N 114.7E	SAI							(14.5/4.5 /03.0/24NRS)								
37	130106Z	18.7N 114.6E	SAI							(14.5/4.5 /01.5/24NRS)								
38	130106Z	18.7N 114.7E	SAI							(12.5/2.5 /01.0/24NRS)								
39	130107Z	18.7N 114.6E	SAI							(14.0/4.0 /02.0/25NRS)								
40	130150Z	18.6N 114.4E	LRUH							- 20517								
41	130300Z	18.6N 114.1E	LRUH							- 20517								
42	130321Z	18.7N 114.3E	SAI							(13.0/3.0 /01.0/25NRS)								
43	130513Z	18.8N 113.8E	SAI							(14.5/4.5 /02.0/24NRS)								
44	130513Z	18.8N 113.7E	SAI							(14.0/4.0 /02.0/25NRS)								
45	130800Z	18.7N 113.5E	LRUH															
46	130900Z	18.9N 113.1E	P	5	3	700	170	60	90	10	100	90	20	964	281	2	12	
47	130900Z	18.9N 112.9E	LRUH															
48	131200Z	18.9N 112.3E	LRUH															
49	131347Z	18.8N 111.6E	SAI															
50	131347Z	19.2N 112.4E	SAI															
51	131510Z	18.9N 111.7E	LRUH															
52	131750Z	18.9N 111.0E	SAI															
53	131750Z	19.2N 111.0E	SAI															
54	140047Z	18.9N 109.3E	SAI							(14.0/4.0 /W /24NRS)								
55	140156Z	19.1N 109.1E	SAI							(13.5/4.5 /W1.0/25NRS)								
56	140437Z	19.3N 108.5E	SAI							(15.0/5.0 /S0.5/24NRS)								
57	140437Z	19.3N 108.5E	SAI							(15.0/5.0 /S0.5/24NRS)								
58	141327Z	19.1N 107.6E	SAI															
59	141742Z	19.2N 106.9E	SAI															
60	150444Z	19.1N 102.4E	SAI							(15.0/5.0 / / NRS)								

TYPHOON NORA
FIX POSITIONS FOR CYCLONE NO. 17

ROW	TIME	POSIT	CLAS	MAGNET	EV	DIR	VEL	DIR	VEL	MAX OBS	OBS	MIN	FLT	FORN	ORIGIN	EYE	POSIT	NO. OF	
1	242322Z	7.0N 137.0E	SAT	(11.5/1.5 /00.5/23MRS)						NOAA 2									
2	242331Z	7.0N 137.0E	SAT	(11.5/1.5 /00.5/24MRS)						NOAA 2 (NESS)									
3	302501Z	10.0N 136.0E	SAT	(11.0/1.0 /0 / 24MRS)						PCN 5 DMSP									
4	010433Z	10.0N 136.1E	SAT	(11.0/1.0 /0 / MRS)						PCN 5 DMSP									
5	011510Z	10.0N 136.3E	SAT							PCN 6 DMSP									
6	012443Z	11.0N 136.6E	SAT	(12.5/2.5 /01.5/24MRS)						PCN 5 DMSP									
7	012324Z	11.0N 136.5E	SAT	(11.5/1.5 /00.5/24MRS)						NOAA 2 (CONF 02)									
8	020130Z	11.0N 136.4E	P	5 15 - - 70 30 310						80 50 30 290 60 1001									
10	020400Z	11.0N 134.0E	SAT	(11.5/1.5 /00.5/ MRS)						PCN 5 DMSP									
11	020400Z	11.0N 135.6E	SAT	(12.5/2.5 /01.5/ MRS)						PCN 3 DMSP									
12	021123Z	12.0N 133.7E	SAT							PCN 5 DMSP									
13	021139Z	11.0N 133.9E	P	5 5 700 130 40 90						15 - - - 987 298 10 9 - - -									
14	021201Z	12.0N 133.0E	SAT							PCN 5 DMSP									
15	021202Z	11.0N 133.3E	P	5 5 700 10 40 350						20 - - - 989 299 14 13 CIRC									
19	022523Z	11.0N 133.5E	SAT	(13.0/3.0 /01.5/24MRS)						NOAA 2 (NESS) (CONF 01)									
19	022523Z	11.0N 133.5E	SAT	(11.5/1.5 /00.5/24MRS)						PCN 5 DMSP									
19	030000Z	11.0N 132.0E	SAT	(11.5/1.5 /00.5/24MRS)						PCN 5 DMSP									
20	030010Z	11.0N 133.6E	SAT	(13.0/3.0 /01.5/24MRS)						NOAA 2 (CONF 01)									
21	030045Z	11.0N 133.0E	SAT	(13.0/3.0 /01.5/24MRS)						PCN 1 DMSP									
22	030400Z	11.0N 133.5E	SAT	(13.5/3.5 /01.0/ MRS)						PCN 3 DMSP									
23	031030Z	11.0N 133.2E	P	10 10 700 180 50 160					10 - - - 978 292 10 12 CIRC										
25	031500Z	11.0N 132.0E	SAT							PCN 1 DMSP									
26	031500Z	11.0N 132.0E	SAT	5 5 700 160 40 70						25 - - - 978 293 10 - - -									
27	031820Z	11.0N 132.0E	SAT							PCN 3 DMSP									
27	031820Z	11.0N 132.0E	SAT							PCN 3 DMSP									
28	032400Z	11.0N 131.5E	P	5 5 700 330 70 250						20 80 360 30 976 293 10 14 CIRC									
29	032519Z	11.0N 131.2E	SAT	(14.5/4.5 /01.5/23MRS)						NOAA 2 (CONF 01)									
30	032520Z	11.0N 131.7E	SAT	(14.0/4.0 /01.0/24MRS)						NOAA 2 (NESS) (CONF 02)									
30	032520Z	11.0N 131.7E	SAT	(13.0/3.0 /01.5/24MRS)						PCN 3 DMSP									
32	032540Z	12.0N 131.2E	SAT	(14.5/4.5 /01.0/24MRS)						PCN 3 DMSP									
33	040050Z	11.0N 132.0E	P	- - - 90 - - -						90 - - - 978 290 - - -									
35	040331Z	11.0N 131.0E	SAT	(14.5/4.5 /01.5/24MRS)						PCN 1 DMSP									
35	040331Z	11.0N 131.0E	SAT	(14.5/4.5 /01.0/24MRS)						PCN 1 DMSP									
36	041020Z	12.0N 131.0E	P	5 3 700 240 50 160						30 - - - 969 284 11 14 CIRC									
37	041250Z	12.0N 132.1E	SAT							PCN 1 DMSP									
38	041300Z	12.0N 132.4E	SAT	5 2 700 210 60 180						40 - - - 964 279 11 14 ELIP									
39	041500Z	12.0N 131.4E	P	- - - - -						PCN 1 DMSP									
40	041814Z	12.0N 131.9E	SAT							PCN 1 DMSP									
40	041814Z	12.0N 131.3E	SAT							PCN 5 DMSP									
42	042300Z	13.0N 130.7E	SAT	(14.5/4.5 /5 /24MRS)						PCN 1 DMSP									
43	042350Z	13.0N 130.7E	P	5 10 700 90 90 360						20 70 90 20 949 267 10 12 CIRC									
44	050018Z	13.0N 130.0E	SAT	(15.5/5.5 /01.0/24MRS)						NOAA 2 (NESS) (CONF 01)									
45	050019Z	13.0N 130.0E	SAT	(15.5/5.5 /01.5/24MRS)						NOAA 2 (NESS) (CONF 01)									
46	050310Z	13.0N 130.0E	SAT	(14.5/4.5 /5 /24MRS)						PCN 1 DMSP									
47	050310Z	13.0N 130.0E	P	5 10 700 90 110 360						30 100 360 10 940 259 11 12 CIRC									
48	050720Z	14.0N 129.0E	P	5 5 700 180 80 80						30 90 90 5 910 230 20 16 CIRC									
49	051210Z	14.0N 129.0E	SAT							PCN 1 DMSP									
50	051520Z	14.0N 129.2E	P	5 5 700 60 110 30						15 - - - 893 209 20 14 CIRC									
51	051550Z	14.0N 128.0E	SAT							PCN 1 DMSP									
52	052316Z	14.0N 127.0E	SAT	(17.0/7.0 /0 /24MRS)						PCN 2 DMSP									
53	060250Z	14.0N 127.0E	SAT	(16.5/6.5 /02.0/ MRS)						PCN 1 DMSP									
54	060250Z	14.0N 126.2E	P	5 5 700 110 150 20						40 140 20 15 877 201 30 10 CIRC									
55	060107Z	14.0N 127.4E	SAT	(16.5/6.5 /01.0/25MRS)						NOAA 2 (NESS) (CONF 01)									
56	060100Z	14.0N 127.4E	SAT	(17.0/7.0 /01.5/24MRS)						NOAA 2 (NESS) (CONF 01)									
57	060301Z	14.0N 126.0E	SAT	(17.0/7.0 /0 /24MRS)						PCN 1 DMSP									
58	060301Z	14.0N 126.0E	SAT	(16.5/6.5 /02.0/24MRS)						PCN 1 DMSP									
59	060320Z	14.0N 125.0E	P	5 5 700 350 90 270						30 80 300 100 894 214 21 13 CIRC									
60	060320Z	14.0N 125.0E	SAT							PCN 1 DMSP									
61	061153Z	14.0N 125.4E	SAT							PCN 1 DMSP									
62	061230Z	14.0N 125.5E	LDRH	- APPARENT EYE, SOLID															
63	061400Z	14.0N 125.4E	LDRH	-															
64	061410Z	14.0N 125.4E	LDRH	-															
65	061500Z	14.0N 125.1E	P	5 2 700 190 100 100						47 PCN 3 DMSP - 903 224 19 12 CIRC									
66	061545Z	14.0N 125.2E	SAT																
67	061600Z	13.0N 125.0E	LDRH	- WELL DEFINED EYE, U20															
68	061600Z	13.0N 124.0E	LDRH	-															
69	062100Z	13.0N 124.0E	LDRH	- EYE: 100 PCT, D5															
70	062500Z	13.0N 124.0E	LDRH	- EYE: CIRCULAR, U15															
71	070000Z	15.0N 124.0E	SAT	(17.0/7.0 /00.5/23MRS)						NOAA 2 (NESS) (CONF 03)									
72	070000Z	15.0N 124.0E	SAT	(16.0/7.0 /01.0/24MRS)						NOAA 2 (NESS) (CONF 02)									
73	070018Z	15.0N 124.0E	P	5 120 120 90						20 130 90 10 - - - 24 10 CIRC									
74	070035Z	15.0N 124.0E	SAT	(17.0/7.0 /02.5/24MRS)						PCN 3 DMSP									
75	070045Z	15.0N 124.0E	LDRH	- EYE: 75 PCT, CIRCULAR OPEN N: 030															
76	070130Z	15.0N 124.0E	LDRH	- EYE: 75 PCT, CIRCULAR OPEN N: 030															
77	070400Z	15.0N 124.0E	LDRH	- EYE: 75 PCT, CIRCULAR OPEN N: 035															
78	070550Z	15.0N 124.0E	LDRH	- EYE: 75 PCT, CIRCULAR OPEN N: 035															
79	070530Z	15.0N 124.0E	LDRH	- EYE: 75 PCT, CIRCULAR OPEN N: 035															
80	070550Z	15.0N 124.0E	LDRH																

TYPHOON MORA
FIX POSITIONS FROM CYCLONE NO. 17

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix Lvl	U4 VCI TO DR UCI			MAX OBS			OBS SLP	MIN HGT	FLT 1/10	EYE FURM	DICH- ATION	EYE DIA	FOSLI OF RADAR	MSA NMMR
						FLI DIR	LVL VEL	WIND DRG	WIND RNG	SFC WIND VEL	WIND DRG								
101	080017Z	18.0N 122.0E	SAI																
102	080017Z	18.0N 121.7E	SAI																
103	080059Z	18.0N 121.9E	SAI																
104	080100Z	18.0N 121.8E	SAI																
105	080300Z	19.1N 121.3E	P																
109	080314Z	18.0N 122.2E	SAI																
109	080314Z	18.0N 122.0E	SAI																
109	080300Z	19.0N 120.0E	LKUH																
109	081000Z	20.0N 120.0E	LKUH																
110	081030Z	20.0N 120.0E	P																
110	081250Z	20.0N 120.0E	SAI																
112	081200Z	20.0N 121.0E	SAI																
113	081342Z	20.0N 120.0E	P																
114	081300Z	20.0N 120.2E	P																
115	081057Z	20.0N 120.1E	SAI																
116	082112Z	20.0N 119.0E	P																
117	082359Z	20.0N 119.0E	SAI																
118	082300Z	20.0N 119.0E	SAI																
118	082359Z	20.0N 120.0E	SAI																
120	090150Z	21.0N 119.0E	SAI																
121	090150Z	21.0N 119.0E	SAI																
122	090300Z	21.0N 119.0E	SAI																
123	090359Z	21.0N 119.0E	SAI																
124	090300Z	21.0N 119.0E	SAI																
124	090300Z	21.0N 119.0E	LKUH																
126	090300Z	21.0N 119.0E	LKUH																
127	090310Z	21.0N 119.0E	LKUH																
128	090800Z	21.0N 119.0E	LKUH																
130	090730Z	21.0N 119.0E	LKUH																
131	090730Z	21.0N 119.0E	LKUH																
132	090300Z	21.0N 119.0E	LKUH																
133	090900Z	21.0N 119.0E	LKUH																
134	090300Z	21.0N 119.0E	LKUH																
135	090730Z	21.0N 119.0E	P																
136	091000Z	22.0N 119.0E	SAI																
137	091200Z	22.0N 119.0E	SAI																
138	091000Z	22.0N 119.0E	SAI																
139	091500Z	22.0N 119.0E	LKUH																
140	091300Z	22.0N 119.0E	LKUH																
141	091400Z	22.0N 119.0E	LKUH																
142	091500Z	22.0N 119.0E	LKUH																
143	091500Z	22.0N 119.0E	LKUH																
144	091800Z	22.0N 119.0E	SAI																
145	091800Z	22.0N 119.0E	SAI																
146	091800Z	22.0N 119.0E	SAI																
147	091700Z	22.0N 119.0E	LKUH																
148	091800Z	22.0N 119.0E	LKUH																
149	091900Z	22.0N 119.0E	LKUH																
150	092100Z	23.0N 118.0E	LKUH																
151	092000Z	23.0N 118.0E	LKUH																
152	092300Z	23.0N 118.0E	SAI																
153	092300Z	23.0N 118.0E	SAI																
154	092300Z	23.0N 118.0E	SAI																
155	100300Z	24.0N 118.0E	SAI																
156	100300Z	24.0N 118.0E	SAI																
157	100300Z	24.0N 118.0E	SAI																

TYPHOON UPAL
FIX POSITIONS FROM CYCLONE NO. 18

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix Lvl	U4 VCI TO DR UCI			MAX OBS			OBS SLP	MIN HGT	FLT 1/10	EYE FURM	DICH- ATION	EYE DIA	FOSLI OF RADAR	MSA NMMR	
						FLI DIR	LVL VEL	WIND DRG	WIND RNG	SFC WIND VEL	WIND DRG									WIND RNG
1	040110Z	10.0N 114.2E	SAI																	
2	040110Z	10.0N 114.0E	SAI																	
3	040130Z	11.0N 114.0E	SAI																	
4	040200Z	11.0N 114.0E	SAI																	
5	040200Z	11.0N 114.0E	P																	
6	041000Z	11.0N 113.1E	SAI																	
7	041014Z	11.0N 113.1E	SAI																	
8	040600Z	12.0N 112.7E	P																	
9	040600Z	12.0N 112.7E	P																	
10	040110Z	11.0N 112.2E	SAI																	
11	040200Z	12.0N 112.2E	SAI																	
12	040200Z	12.0N 112.2E	SAI																	
13	040200Z	12.0N 112.2E	SAI																	
14	040300Z	12.0N 112.0E	P																	
15	040400Z	12.0N 112.0E	SAI																	
16	051400Z	12.0N 112.0E	P																	
17	051350Z	12.0N 111.8E	SAI																	
18	051300Z	12.0N 112.2E	P																	
19	051741Z	12.0N 112.7E	SAI																	
20	052300Z	13.0N 112.0E	SAI																	
21	060050Z	13.0N 111.7E	SAI																	
22	060100Z	13.0N 111.8E	SAI																	
23	060100Z	13.0N 111.5E	SAI																	
24	060200Z	13.0N 112.0E	P																	
25	060200Z	13.0N 112.0E	SAI																	
26	061500Z	13.0N 113.3E	SAI																	
27	061500Z	14.0N 112.4E	SAI																	
28	061720Z	14.0N 112.2E	SAI																	
30	070000Z	14.0N 111.0E	SAI																	
31	070200Z	14.0N 111.1E	SAI																	
32	070300Z	14.0N 111.0E	SAI																	
33	070400Z	14.0N 111.1E	P																	
34	070420Z	14.0N 111.0E	SAI																	
35	070900Z	14.0N 111.0E	P																	
36	071300Z	14.0N 110.5E	SAI																	
37	071712Z	14.0N 109.3E	SAI																	
38	071820Z	14.0N 110.0E	P																	
39	072100Z	14.0N 109.7E	P																	

TYPHOON PATH
FIX POSITIONS FOR CYCLONE NO. 19

FIX NO.	TIME	POSIT	CAT	ACCHY NAV-MET	Fix LVI	FLI DIR	LVL VLG	IND DMC	MAX UBS	OBS SFC WIND VLG	MIN SLP	FLT 700MB HGT	EYE FURM	EYE DIA	FOCAL OF RADAR	MSA				
																	U6 UCI TO 15 011	MAX UBS	SFC WIND VLG	MIN SLP
1	050019Z	14.5N 143.0E	SAT	(T1.5/1.5 / D0.5/24PRS)						NUAA 2 (NESS)	(CNF 02)									
2	052316Z	13.5N 142.4E	SAT	(T1.5/1.5 / D0.5/24PRS)						PCN 3 UMSP										
3	052315Z	13.5N 142.0E	SAT	(T2.0/2.0 / D0.5/24PRS)						NUAA 2 (NESS)										
4	060301Z	13.0N 142.1E	SAT	(T1.5/1.5 / / PRS)						PCN 3 UMSP										
5	061532Z	13.0N 142.6E	SAT	(T1.5/1.5 / / PRS)						PCN 3 UMSP										
6	062233Z	12.5N 142.3E	SAT	(T3.0/3.0 / D1.5/24PRS)						PCN 3 UMSP										
8	070007Z	12.5N 141.7E	SAT	(T3.5/3.5 / D1.5/24PRS)						NUAA 2 (NESS)	(CNF 02)									
9	070007Z	12.5N 141.2E	SAT	(T3.5/3.5 / D1.5/24PRS)						NUAA 2 (NESS)	(CNF 01)									
10	070547Z	12.5N 140.5E	SAT	(T3.0/3.0 / D1.5/24PRS)						PCN 3 UMSP										
12	070310Z	13.0N 141.0E	P		2	8	150	50	50	40	50	40	30	-	-	20	CIRC	50	2	
13	071000Z	13.7N 140.0E	P		10	2	-	150	50	35	-	-	-	-	-	-	CIRC	2	2	
14	071133Z	13.5N 140.3E	SAT							PCN 0 UMSP										
16	071530Z	13.7N 139.9E	SAT							PCN 4 UMSP										
17	071530Z	14.1N 139.9E	SAT							PCN 3 UMSP										
18	072235Z	14.0N 139.2E	SAT	(T2.0/2.0 / D1.0/24PRS)						PCN 3 UMSP										
19	072235Z	14.0N 139.2E	SAT	(T2.0/2.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 01)									
20	072235Z	14.0N 139.2E	SAT	(T2.0/2.0 / D1.0/24PRS)						PCN 1 UMSP										
22	082237Z	13.5N 138.3E	SAT	(T4.0/4.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 01)									
23	082237Z	13.5N 138.3E	SAT	(T4.0/4.0 / D1.0/24PRS)						PCN 4 UMSP										
24	080426Z	14.1N 138.3E	SAT	(T4.0/4.0 / D1.0/24PRS)						PCN 3 UMSP										
25	080426Z	14.2N 138.2E	P		2	5	700	150	70	40	30	40	20	974	289	10	11	CIRC	30	
26	080426Z	14.3N 138.1E	P		5	10	700	180	50	100	-	-	-	976	290	10	13	CIRC	30	
27	081117Z	14.0N 137.0E	SAT							PCN 5 UMSP										
28	081117Z	14.0N 137.0E	SAT							PCN 0 UMSP										
29	081117Z	14.0N 137.2E	SAT							PCN 1 UMSP										
30	082718Z	14.5N 137.1E	SAT		5	5	700	130	50	330										
31	082718Z	14.5N 137.1E	SAT							PCN 1 UMSP										
32	082718Z	14.5N 137.1E	SAT							PCN 1 UMSP										
33	082718Z	14.5N 137.1E	SAT							PCN 2 UMSP										
34	082718Z	14.5N 137.1E	SAT							PCN 2 UMSP										
35	082557Z	15.0N 135.7E	SAT	(T3.0/3.0 / D1.0/24PRS)						PCN 1 UMSP										
36	082557Z	15.0N 135.8E	SAT	(T3.0/3.0 / D1.0/24PRS)						PCN 1 UMSP										
37	090004Z	15.0N 135.9E	SAT	(T3.0/3.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 01)									
38	090004Z	15.0N 135.9E	SAT	(T3.0/3.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 01)									
39	090118Z	15.2N 135.1E	SAT	(T3.0/3.0 / D1.0/24PRS)						PCN 1 UMSP										
40	090118Z	15.2N 135.1E	SAT	(T3.0/3.0 / D1.0/24PRS)						PCN 1 UMSP										
41	090300Z	15.0N 132.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						PCN 1 UMSP										
42	090300Z	15.0N 132.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						PCN 1 UMSP										
43	090300Z	15.1N 135.1E	AC N							PCN 1 UMSP										
44	091057Z	15.0N 133.0E	SAT							PCN 1 UMSP										
45	091057Z	15.0N 133.1E	SAT							PCN 5 UMSP										
46	091218Z	15.5N 133.6E	P		7	2	-	360	90	270										
47	091240Z	15.4N 133.8E	SAT							PCN 1 UMSP										
48	091240Z	15.4N 133.8E	SAT							PCN 1 UMSP										
49	091501Z	15.5N 133.3E	SAT							PCN 1 UMSP										
50	091501Z	15.5N 133.3E	SAT							PCN 1 UMSP										
51	092401Z	16.0N 131.8E	SAT	(T6.0/6.0 / D1.0/24PRS)						PCN 1 UMSP										
52	092401Z	16.1N 131.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						PCN 1 UMSP										
53	092401Z	16.0N 131.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						PCN 1 UMSP										
54	100020Z	15.5N 131.0E	P		1	1	700	240	100	-	-	150	-	893	214	20	12	CIRC	5	
55	100020Z	16.0N 131.1E	P		10	1	700	240	100	-	-	150	-	893	214	20	12	CIRC	5	
56	100300Z	16.0N 131.0E	SAT	(T6.0/6.0 / D1.0/24PRS)						PCN 1 UMSP										
57	100300Z	16.0N 130.9E	SAT	(T6.0/6.0 / D1.0/24PRS)						PCN 1 UMSP										
58	100300Z	16.0N 130.9E	SAT	(T6.0/6.0 / D1.0/24PRS)						PCN 1 UMSP										
59	100300Z	16.0N 130.9E	P		5	3	700	120	120	50				4	911	230	20	13	CIRC	8
60	101222Z	16.5N 129.3E	SAT							PCN 5 UMSP										
61	101222Z	16.5N 129.0E	SAT							PCN 5 UMSP										
62	101222Z	16.5N 129.4E	SAT							PCN 2 UMSP										
63	101222Z	16.5N 128.3E	SAT							PCN 3 UMSP										
64	101222Z	16.5N 128.3E	SAT							PCN 3 UMSP										
65	101222Z	16.5N 128.3E	SAT							PCN 3 UMSP										
66	102147Z	16.0N 127.1E	P		5	3	700	40	70	330				30	962	276	20	20	ELIP	8
67	102322Z	17.1N 126.0E	SAT	(T6.5/6.5 / D1.5/24PRS)						PCN 4 UMSP										
68	102322Z	16.0N 126.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						PCN 3 UMSP										
69	102322Z	16.0N 126.0E	SAT	(T5.0/5.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 02)									
70	110330Z	17.1N 126.2E	SAT	(T4.5/4.5 / D2.0/24PRS)						PCN 4 UMSP										
71	110330Z	17.0N 126.2E	SAT	(T5.5/5.5 / D0.5/24PRS)						PCN 3 UMSP										
72	110330Z	17.1N 126.2E	SAT	(T7.0/7.0 / D1.0/24PRS)						PCN 3 UMSP										
73	110330Z	17.3N 124.9E	P		15	10	-	-	-	-	140	270	10	-	286	10	-	CIRC	10	9
74	110330Z	17.2N 124.9E	LHROR	= EYE: D10																
75	110330Z	17.3N 124.5E	LHROR	= CENTER 15 DEG SPINAL OVERLAY																
76	111330Z	17.2N 124.5E	LHROR	= CENTER 15 DEG SPINAL OVERLAY																
77	111330Z	17.1N 123.8E	LHROR	= CENTER 15 DEG SPINAL OVERLAY																
78	111330Z	17.2N 123.8E	SAT							PCN 3 UMSP										
79	111330Z	17.2N 123.8E	SAT							PCN 3 UMSP										
80	111330Z	17.2N 123.8E	LHROR	=																
81	111330Z	17.2N 123.8E	LHROR	=																
82	111330Z	17.2N 123.8E	LHROR	=																
83	111330Z	16.2N 123.9E	SAT	(T6.5/6.5 / D1.5/24PRS)						PCN 3 UMSP										
84	111613Z	17.7N 124.2E	SAT							PCN 3 UMSP										
85	111613Z	17.0N 124.0E	SAT							PCN 3 UMSP										
86	112304Z	16.0N 122.0E	SAT	(T2.5/2.5 / D2.0/24PRS)						PCN 3 UMSP										
87	112304Z	16.5N 122.0E	SAT	(T4.5/4.5 / D2.0/24PRS)						PCN 3 UMSP										
88	120053Z	19.0N 122.4E	SAT	(T3.0/3.0 / D3.0/24PRS)						PCN 3 UMSP										
89	120053Z	19.0N 122.0E	SAT	(T3.0/3.0 / D3.0/24PRS)						NUAA 2 (NESS)	(CNF 01)									
90	120053Z	19.0N 122.0E	SAT	(T2.0/2.0 / D2.5/24PRS)						NUAA 2 (NESS)	(CNF 01)									
91	120310Z	19.0N 121.4E	SAT	(T2.0/2.0 / D2.5/24PRS)						PCN 5 UMSP										
92	120310Z	18.3N 121.2E	SAT	(T1.5/1.5 / D1.0/11PRS)						PCN 6 UMSP										
93	120310Z	19.0N 121.0E	SAT	(T5.0/5.0 / D2.0/24PRS)						PCN 5 UMSP										
94	130149Z	19.0N 111.0E	SAT	(T2.0/2.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 02)									
95	130149Z	17.5N 111.0E	SAT	(T3.0/3.0 / D1.0/24PRS)						NUAA 2 (NESS)	(CNF 02)									
96	130447Z	19.0N 112.0E	SAT																	

TYPHOON KATH
FIX POSITIONS FOR CYCLONE NO. 20
11 OCT 19 UCT

FIX NO.	TIME	MUSIT	FIX LAT	ACCHY MAY-MET	Fix LVL	FLI DIR	LVL VEL	MINU DRG	RNG	MAX OBS VEL	OBS SLP	MIN HGT	FLT TL/TO	EYE FORM	DIAM-TION	EYE DIA	POSIT OF RADAR	MSA NMPH
1	110200Z	10.2N	140.4E	SAI	(11.5/1.5 /00.5/24MRS)	PCN 5	UMSP											
2	110330Z	10.2N	139.7E	SAI	(11.5/1.5 /00.5/24MRS)	PCN 5	UMSP											
3	110440Z	12.0N	138.5E	SAI		PCN 5	UMSP											
4	110540Z	12.1N	140.5E	SAI		PCN 5	UMSP											
5	110720Z	12.2N	140.6E	AC M														
6	110830Z	12.2N	139.9E	SAI		PCN 5	UMSP											
7	110930Z	11.0N	137.2E	SAI	(12.0/2.0 /01.0/24MRS)	NOAA 2	(NESS)	(CONF 02)										
8	110930Z	12.0N	137.0E	SAI	(12.5/2.5 /01.5/24MRS)	NOAA 2	(NESS)	(CONF 02)										
9	110940Z	12.0N	137.4E	SAI	(12.5/2.5 /01.0/24MRS)	PCN 3	UMSP											
10	112300Z	12.0N	137.3E	SAI	(13.0/3.0 /00.5/11MRS)	PCN 3	UMSP											
11	120000Z	13.3N	137.7E	P	5 5 - 100 30 40	50	30	40	50	995	-	20	24	-	-	-	-	2
12	120300Z	13.1N	137.4E	P	5 5 - 100 30 40	50	30	40	50	995	-	20	24	-	-	-	-	2
13	120310Z	13.1N	137.1E	SAI	(12.5/2.5 /01.0/ MRS)	PCN 3	UMSP											
14	121400Z	13.2N	135.1E	SAI		PCN 5	UMSP											
15	121500Z	13.3N	134.7E	P	2 20 - 150 41 100	15	-	-	-	1001	309	10	14	-	-	-	-	3
16	121500Z	13.3N	134.7E	P	2 20 - 150 41 100	15	-	-	-	1001	309	10	14	-	-	-	-	3
17	121510Z	13.4N	134.2E	P	2 15 - 110 44 30	25	-	-	-	996	305	10	-	-	-	-	-	3
18	121500Z	13.4N	134.2E	SAI		PCN 3	UMSP											
19	121500Z	13.7N	134.0E	SAI		PCN 0	UMSP											
20	122200Z	12.7N	132.3E	SAI	(13.0/3.0 /00.5/24MRS)	PCN 3	UMSP											
21	122200Z	12.0N	132.0E	SAI	(13.5/3.5 /00.5/24MRS)	PCN 4	UMSP											
22	122300Z	12.5N	133.0E	SAI	(13.5/3.5 /01.5/25MRS)	NOAA 2	(CONF 01)											
23	122300Z	12.0N	132.0E	SAI	(13.5/3.5 /01.0/24MRS)	NOAA 2	(NESS)	(CONF 02)										
24	123000Z	12.7N	131.0E	SAI	(13.0/3.0 /00.5/ MRS)	PCN 3	UMSP											
25	130300Z	12.7N	131.7E	SAI	(13.5/3.5 /00.5/ MRS)	PCN 4	UMSP											
26	130420Z	12.7N	132.0E	P	10 2 700 110 50 360	15	80	300	17	975	290	11	14	CIRC			4	
27	130700Z	12.7N	131.4E	P	10 5 700 100 50 30	30	80	30	25	982	292	10	13	CIRC			4	
28	131120Z	13.1N	130.7E	SAI		PCN 3	UMSP											
29	131210Z	13.2N	130.3E	SAI		PCN 4	UMSP											
30	131540Z	13.4N	130.0E	SAI		PCN 3	UMSP											
31	131540Z	13.4N	130.0E	SAI		PCN 3	UMSP											
32	131540Z	13.4N	130.0E	SAI	5 10 - 40 30 330	30	-	-	-	-	11	-	-	CIRC			5	
33	131540Z	13.4N	130.0E	SAI	5 5 - 120 50 50	60	-	-	-	-	10	-	-	CIRC			5	
34	140000Z	13.7N	129.0E	SAI	(13.5/3.5 /02.5/ MRS)	PCN 5	UMSP											
35	140000Z	14.0N	128.5E	SAI	(14.0/4.0 /01.0/24MRS)	PCN 3	UMSP											
36	140040Z	14.0N	128.0E	SAI	(13.0/3.5 /00.5/25MRS)	NOAA 2	(CONF 01)											
37	140500Z	14.0N	128.2E	SAI	(14.0/3.5 /00.5/24MRS)	NOAA 2	(NESS)											
38	140500Z	14.0N	128.1E	SAI	(14.0/4.0 /01.0/ MRS)	PCN 5	UMSP											
39	140500Z	14.2N	127.8E	P	5 10 700 60 60 350	40	60	350	35	987	298	10	14	-	-	-	6	
40	140520Z	14.5N	127.8E	SAI	(13.5/3.5 /02.5/ MRS)	PCN 3	UMSP											
41	140730Z	14.2N	126.8E	P	5 10 700 30 60 260	50	60	260	70	983	294	11	-	CIRC			7	
42	141250Z	14.5N	126.6E	SAI		PCN 5	UMSP											
43	141510Z	14.4N	126.7E	SAI		PCN 3	UMSP											
44	141410Z	14.2N	126.0E	P	5 10 700 110 60 20	50	-	-	-	982	294	20	-	CIRC			7	
45	141300Z	14.2N	126.0E	SAI		PCN 4	UMSP											
46	141300Z	14.2N	126.3E	SAI		PCN 1	UMSP											
47	142130Z	14.4N	125.2E	LHUK	- EYE, 10 DEG SPINAL OVERLAY, 100 PCT, ELLIPTICAL, AXIS 44X32												14.4N 125.0E	
48	142330Z	14.2N	124.0E	LHUK	- EYE, 80 PCT, CIRCULAR OPEN SW, 032												14.4N 122.0E	
49	142350Z	14.2N	124.0E	SAI	(14.5/4.5 /00.5/24MRS)	PCN 3	UMSP											
50	142350Z	14.2N	124.0E	SAI	(14.0/4.0 /00.5/24MRS)	PCN 3	UMSP											
51	142350Z	14.2N	124.2E	SAI	(15.5/5.5 /02.0/ MRS)	PCN 1	UMSP											
52	150000Z	14.0N	124.7E	LHUK	- EYE, 75 PCT, CIRCULAR OPEN N, 060												14.4N 122.0E	
53	150130Z	14.0N	124.7E	LHUK	- EYE, 75 PCT, CIRCULAR OPEN SW, 032												14.4N 122.0E	
54	150130Z	14.0N	124.5E	SAI	(15.0/5.0 /02.0/24MRS)	NOAA 2	(NESS)	(CONF 01)										
55	150130Z	14.0N	124.5E	SAI	(15.0/5.0 /01.5/24MRS)	NOAA 2	(NESS)	(CONF 01)										
56	150300Z	14.7N	124.1E	LHUK	- EYE, 70 PCT, CIRCULAR OPEN N, 065												14.4N 122.0E	
57	150300Z	14.8N	124.2E	P	10 10 700 350 70 250	15	70	250	60	972	286	10	12	CIRC		30	8	
58	150330Z	14.8N	124.0E	LHUK	- EYE, 70 PCT, CIRCULAR OPEN N, 055												14.4N 122.0E	
59	150410Z	14.7N	123.0E	SAI	(14.0/4.0 /00.5/ MRS)	PCN 1	UMSP											
60	150410Z	14.7N	123.5E	SAI	(14.5/4.5 /00.5/ MRS)	PCN 1	UMSP											
61	150900Z	15.0N	122.7E	LHUK	- EYE													
62	150740Z	15.1N	122.7E	P	5 700 110 60 20	54	60	20	40	961	277	10	13	CIRC			25	
63	151000Z	15.1N	122.7E	LHUK	- EYE													
64	151100Z	15.3N	122.5E	LHUK	- EYE													
65	151130Z	15.0N	122.3E	LHUK	- EYE													
66	151200Z	15.4N	122.1E	LHUK	- EYE													
67	151230Z	15.0N	122.1E	LHUK	- EYE													
68	151230Z	15.3N	122.0E	SAI		PCN 1	UMSP											
69	151230Z	15.0N	122.0E	SAI		PCN 1	UMSP											
70	151300Z	15.7N	121.0E	LHUK	- EYE												14.4N 120.0E	
71	151400Z	15.7N	121.0E	LHUK	- EYE												14.4N 120.0E	
72	151300Z	15.0N	121.0E	LHUK	- EYE, 100 PCT, CIRCULAR, 033												14.4N 120.0E	
73	151300Z	15.0N	121.4E	LHUK	- EYE												14.4N 120.0E	
74	151300Z	15.7N	120.8E	LHUK	- POSSIBLE EYE, 100 PCT, CIRCULAR, D20												18.2N 120.5E	
75	151000Z	15.7N	120.9E	LHUK	- EYE												14.4N 120.0E	
76	151020Z	15.7N	120.8E	LHUK	- EYE												14.4N 120.0E	
77	151030Z	15.5N	120.7E	P	3 15 - 80 80 360	35	-	-	-	-	-	1	1	CIRC		30	10	
78	151030Z	15.5N	120.7E	LHUK	- POSSIBLE EYE, U24													
79	151050Z	15.7N	120.7E	SAI		PCN 1	UMSP											
80	151050Z	15.7N	120.7E	LHUK	- EYE													
81	151000Z	15.7N	120.5E	LHUK	- EYE, U20													
82	151000Z	15.0N	120.0E	LHUK	- EYE, U14													
83	151000Z	15.0N	120.0E	LHUK	- EYE, U20													
84	152030Z	15.9N	119.9E	LHUK	- EYE, U14													
85	152130Z	15.0N	119.5E	LHUK	- EYE, U14													
86	152130Z	15.0N	119.5E	LHUK	- EYE, U14													
87	152330Z	16.1N	119.1E	SAI	(14.5/4.5 /00.5/ MRS)	PCN 3	UMSP											
88	152330Z	16.0N	119.1E	SAI	(14.0/4.0 /5 /24MRS)	PCN 3	UMSP											
89	152340Z	16.0N	119.1E	SAI	(14.0/4.0 /5 /24MRS)	PCN 3	UMSP											
90	152340Z	16.1N	119.1E	SAI	(15.5/5.5 /02.0/24MRS)	NOAA 2	(NESS)	(CONF 01)										
91	150500Z	10.2N	119.0E	SAI	(14.0/3.0 /01.0/24MRS)	NOAA 2	(NESS)	(CONF 01)										
92	150330Z	10.3N	118.8E	LHUK	- EYE, ELLIPTICAL DIFFUSE, U32												18.2N 120.5E	
93	150330Z	10.2N	118.8E	SAI														

TYPHOON RUTH
FIX POSITIONS FOR CYCLONE NO. 20
11 OCT TO 19 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCHY	FIX DIR	FLI VEL	LVL BRG	WIND RNG	MAX OBS SFC WIND VEL	OBS MIN SLP	MIN HGT	FLT TI/TO	EYE FORM	DIEN- TATION	EYE DIA	'POSIT OF RADAR	MSL NMR	
																		NAV-MET
101	102100Z	16.8N 115.2E	P	5 5	700	130	70	60	35	-	-	-	-	-	-	-	21	19
102	170550Z	16.7N 114.3E	SAT	(15.0/5.0 / D1.0/24MRS)					PCN 1 DMSP									
103	170130Z	16.7N 114.5E	SAT	(15.0/5.0 / D0.5/25MRS)					NOAA 2 (CONF 01)									
104	170410Z	16.5N 114.5E	SAT	(15.0/5.0 / D1.0/24MRS)					PCN 3 DMSP									
105	170340Z	16.5N 113.4E	SAT	(14.5/4.5 / D1.0/24MRS)					NOAA 2 (NESS)									
108	170540Z	17.0N 113.0E	SAT	(13.5/4.5 / D0.5/24MRS)					PCN 2 DMSP									
109	170340Z	17.0N 113.0E	SAT	(13.5/4.5 / D0.5/24MRS)					PCN 2 DMSP									
108	170200Z	16.7N 113.5E	SAT	(15.0/5.0 / D1.0/24MRS)					PCN 3 DMSP									
109	170550Z	16.8N 112.0E	P	5 10	700	150	90	70	80	40	70	100	957	273	10 14	CIRC	40	13
110	171000Z	16.8N 112.0E	P	5 8	700	130	100	40	30	-	-	-	-	-	-	-	35	13
111	171020Z	16.7N 111.9E	SAT						PCN 5 DMSP									
112	171020Z	17.1N 112.0E	SAT						PCN 1 DMSP									
113	171020Z	17.0N 112.2E	SAT						PCN 3 DMSP									
114	170200Z	17.1N 111.1E	P	5 5	700	-	-	-	PCN 1 DMSP				-	-	-	-	33	14
115	180030Z	17.2N 110.8E	SAT	(15.0/5.0 / S / 24MRS)					PCN 1 DMSP									
116	180230Z	17.2N 110.7E	SAT	(15.0/5.0 / D0.5/25MRS)					ESSA 4 (VTBU)									
117	180230Z	18.0N 110.3E	SAT	(15.0/5.0 / S / 24MRS)					NOAA 2 (CONF 02)									
118	181700Z	17.1N 109.4E	SAT	(15.0/5.0 / S / MRS)					PCN 1 DMSP									
119	181755Z	18.1N 109.3E	SAT						PCN 5 DMSP									
120	190020Z	20.0N 107.9E	SAT	(14.0/4.0 / D0.5/24MRS)					PCN 4 DMSP									
121	190130Z	20.0N 108.0E	SAT	(14.0/4.0 / D1.0/23MRS)					NOAA 2 (CONF 02)									
122	190330Z	19.8N 108.9E	SAT	(14.0/4.0 / D1.0/23MRS)					NOAA 2 DMSP									
123	190330Z	19.8N 108.9E	SAT	(14.0/4.0 / D1.0/23MRS)					NOAA 2 DMSP									
124	190510Z	20.0N 108.0E	SAT	(13.0/4.0 / D2.0/27MRS)					PCN 1 DMSP									

TROPICAL STORM SARAH
FIX POSITIONS FOR CYCLONE NO. 21

FIX NO.	TIME	POSIT	FIX CAT	ACCHY	FIX DIR	FLI VEL	LVL BRG	WIND RNG	MAX OBS SFC WIND VEL	OBS MIN SLP	MIN HGT	FLT TI/TO	EYE FORM	DIEN- TATION	EYE DIA	'POSIT OF RADAR	MSL NMR	
																		NAV-MET
1	090040Z	10.8N 118.5E	SAT	(12.0/2.0 / D0.5/24MRS)					NOAA 2 (NESS)									
2	090440Z	12.0N 115.4E	SAT	(11.5/1.5 / D0.5/ MRS)					PCN 5 DMSP									
3	090140Z	11.0N 115.0E	SAT	(12.0/2.0 / D1.0/24MRS)					NOAA 2 (CONF 01)									
4	090140Z	11.0N 115.0E	SAT	(12.5/2.5 / D0.5/24MRS)					NOAA 2 (NESS)									
5	090500Z	12.7N 114.5E	SAT	(11.5/1.5 / D0.5/ MRS)					PCN 3 DMSP									
6	091230Z	13.2N 113.2E	SAT						PCN 3 DMSP									
7	091730Z	13.5N 113.1E	SAT						PCN 3 DMSP									
8	100020Z	12.2N 111.4E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP									
9	100041Z	12.0N 111.0E	SAT	(13.0/3.0 / D1.0/24MRS)					NOAA 2 (CONF 02)									
10	100330Z	12.1N 110.8E	SAT	(13.5/3.5 / D1.0/24MRS)					NOAA 2 (NESS)									
11	100410Z	12.1N 110.8E	P	10 5	700	120	40	350	50	45	300	15	992	301	14 10	CIRC	25	1
12	100530Z	12.2N 109.8E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP									
13	100530Z	12.2N 109.8E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP									
14	101200Z	12.2N 109.7E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP									
15	101200Z	12.2N 109.7E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP									
16	110140Z	12.2N 107.6E	SAT	(13.0/3.0 / D / 24MRS)					PCN 5 DMSP									
17	140227Z	13.0N 89.5E	SAT	(11.5/1.5 / D0.5/24MRS)					NOAA 2 (CONF 01)									
18	140227Z	13.2N 89.5E	SAT	(12.0/2.0 / D1.0/24MRS)					NOAA 2 (NESS)									
19	140255Z	13.1N 89.7E	SAT	(12.0/2.0 / D1.0/24MRS)					PCN 5 DMSP									
20	140227Z	13.2N 89.6E	SAT	(12.0/2.0 / D1.0/ MRS)					PCN 5 DMSP									
21	141800Z	14.2N 89.5E	SAT	(12.0/2.0 / / MRS)					PCN 3 DMSP									
22	150217Z	14.1N 89.1E	SAT	(12.0/2.0 / / MRS)					PCN 3 DMSP									
23	150340Z	14.0N 88.7E	SAT	(12.5/2.5 / D0.5/24MRS)					NOAA 2 (CONF 01)									
24	150230Z	14.0N 88.7E	SAT	(12.5/2.5 / D0.5/24MRS)					NOAA 2 (NESS)									
25	150500Z	15.1N 88.0E	SAT	(12.0/2.0 / / MRS)					PCN 3 DMSP									
26	151450Z	14.6N 87.4E	SAT						PCN 5 DMSP									
27	160250Z	15.2N 87.4E	SAT	(13.0/3.0 / D1.0/24MRS)					PCN 3 DMSP									
28	160220Z	15.2N 87.4E	SAT	(13.0/3.0 / D1.0/24MRS)					NOAA 2 (NESS)									
29	160130Z	15.3N 88.5E	SAT	(12.5/3.5 / D1.0/24MRS)					NOAA 2 (CONF 02)									
30	160330Z	15.3N 88.0E	SAT	(14.0/4.0 / D2.0/24MRS)					PCN 1 DMSP									
31	160330Z	15.3N 88.0E	SAT	(14.0/4.0 / / MRS)					PCN 3 DMSP									
32	160330Z	15.3N 88.0E	SAT						PCN 3 DMSP									
33	161410Z	17.0N 89.0E	SAT						PCN 3 DMSP									
34	170141Z	17.3N 90.9E	SAT	(14.0/4.0 / / MRS)					PCN 3 DMSP									
35	170141Z	17.3N 90.9E	SAT	(14.0/4.0 / / MRS)					PCN 3 DMSP									
36	170310Z	18.0N 91.0E	SAT	(14.0/4.0 / D0.5/23MRS)					PCN 4 DMSP									
37	170310Z	18.0N 91.0E	SAT	(14.0/4.0 / D0.5/23MRS)					NOAA 2 (CONF 02)									
38	170510Z	19.0N 91.4E	SAT	(14.0/4.0 / S / 24MRS)					PCN 3 DMSP									
38	170622Z	20.2N 91.4E	SAT	(14.0/4.0 / S / 24MRS)					PCN 3 DMSP									

TROPICAL STORM IELMA
FIX POSITIONS FOR CYCLONE NO. 22

FIX NO.	TIME	POSIT	FIX CAT	ACCHY	FIX DIR	FLI VEL	LVL BRG	WIND RNG	MAX OBS SFC WIND VEL	OBS MIN SLP	MIN HGT	FLT TI/TO	EYE FORM	DIEN- TATION	EYE DIA	'POSIT OF RADAR	MSL NMR		
																		NAV-MET	LVI
1	100040Z	9.1N 132.5E	SAT	(11.5/1.5 / D0.5/24MRS)					NOAA 2 (CONF 01)										
2	100040Z	8.3N 132.8E	SAT	(11.5/1.5 / D0.5/24MRS)					NOAA 2 (NESS)										
3	102340Z	8.0N 130.0E	SAT	(11.5/1.5 / S / 23MRS)					NOAA 2 (CONF 02)										
4	120030Z	9.0N 125.5E	SAT	(12.0/2.0 / D0.5/25MRS)					NOAA 2 (CONF 02)										
5	120040Z	9.8N 126.5E	SAT	(12.0/2.0 / D0.5/24MRS)					NOAA 2 (NESS)										
6	130130Z	9.3N 121.0E	SAT	(13.0/3.0 / D1.0/23MRS)					NOAA 2 (CONF 01)										
7	130040Z	9.0N 121.0E	SAT	(13.0/3.0 / D1.0/23MRS)					NOAA 2 (NESS)										
8	140034Z	10.1N 117.4E	SAT	(13.5/3.5 / D0.5/25MRS)					NOAA 2 (CONF 02)										
9	140034Z	10.2N 117.4E	SAT	(13.0/3.0 / S / 23MRS)					NOAA 2 (NESS)										
10	140034Z	10.2N 117.4E	SAT	(11.5/1.5 / S / 25MRS)					PCN 5 DMSP										
11	140240Z	10.5N 118.2E	SAT	(11.5/1.5 / S / 25MRS)					PCN 5 DMSP										
12	141330Z	12.0N 113.0E	SAT						PCN 5 DMSP										
13	141020Z	12.0N 112.8E	SAT						PCN 5 DMSP										
14	150030Z	10.3N 109.9E	SAT	(11.5/1.5 / S / 23MRS)					PCN 3 DMSP										
15	150030Z	10.3N 110.3E	SAT	(13.0/3.0 / / MRS)					PCN 3 DMSP										
16	150120Z	10.3N 110.0E	SAT	(13.5/3.5 / S / 25MRS)					NOAA 2 (CONF 01)										
17	150120Z	10.0N 110.0E	SAT	(13.5/3.5 / D0.5/24MRS)					NOAA 2 (NESS)										
18	150300Z	9.8N 109.7E	P	5 11	700	150	90	60	70	30	20	993	304	17 15	-	-	-	1	
19	150310Z	10.0N 109.7E	SAT	(13.0/3.0 / 150 / MRS)					PCN 3 DMSP										
20	150310Z	9.9N 109.7E	SAT	(13.0/3.0 / D1.5/24MRS)					PCN 3 DMSP										
21	150310Z	9.9N 109.7E	P	1 15	700	150	90	360	15	60	300	10	991	301	18 17	-	-	-	1
22	151310Z	9.7N 105.7E	SAT						PCN 5 DMSP										
23	151310Z	9.7N 105.7E	SAT						PCN 5 DMSP										
24																			

TROPICAL STORM VENA
FIX POSITIONS FOR CYCLONE NO. 23

FIX NO.	TIME	POSIT	FIX CAT	ACQHY	ELEV	DIR	19 NOV 10 26 NOV		OBS	MIN	FLT	EYE	RANGE	ELEV	RANGE	MIN SLP	700MB HGT	LVL T/TO	FOSSIL OF RADAR	MSL NDRM
							MAX OBS	MAX OBS												
1	162324Z	7.3N 141.9E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2												
2	162334Z	7.3N 139.2E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (NESS)												
3	160024Z	11.0N 138.5E	SAT				(T1.5/2.5 /D1.0/25MRS)	NOAA 2 (NESS)												
4	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
5	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
6	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
7	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
8	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
9	190112Z	10.3N 127.3E	SAT				(T1.5/1.5 /D0.5/23MRS)	NOAA 2 (CONF 02)												
10	200024Z	12.0N 124.2E	SAT				(T3.0/3.0 /D0.5/23MRS)	NOAA 2 (NESS)												
11	200024Z	12.0N 124.2E	SAT				(T3.0/3.0 /D0.5/23MRS)	NOAA 2 (NESS)												
12	200040Z	12.0N 124.2E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
13	200040Z	12.0N 124.2E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
14	200040Z	12.0N 124.2E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
15	200040Z	12.0N 124.2E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
16	200040Z	12.0N 124.2E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
17	201146Z	12.0N 123.0E	SAT				(T2.5/2.5 /D2.5/ MRS)	PCN 5 DMSP												
18	201844Z	12.0N 121.7E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
19	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
20	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
21	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
22	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
23	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
24	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
25	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
26	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
27	210132Z	11.0N 120.8E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
28	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
29	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
30	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
31	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
32	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
33	220112Z	11.0N 119.3E	SAT				(T2.0/2.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
34	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
35	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
36	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
37	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
38	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
39	221611Z	12.0N 117.9E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
40	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
41	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
42	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
43	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
44	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
45	230109Z	13.0N 117.5E	SAT				(T3.0/3.0 /D0.5/24MRS)	NOAA 2 (CONF 01)												
46	231734Z	14.0N 114.8E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
47	231734Z	14.0N 114.8E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
48	231734Z	14.0N 114.8E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
49	231734Z	14.0N 114.8E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
50	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
51	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
52	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
53	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
54	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
55	240112Z	14.0N 115.2E	SAT				(T4.0/4.0 /D1.0/24MRS)	NOAA 2 (CONF 02)												
56	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
57	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
58	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
59	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
60	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
61	241611Z	15.0N 113.3E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
62	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
63	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
64	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
65	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
66	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
67	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
68	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
69	250027Z	16.0N 113.1E	SAT				(T2.5/3.5 /D1.5/24MRS)	NOAA 2 (CONF 02)												
70	251027Z	17.0N 111.0E	SAT				(T1.5/2.5 /D1.0/24MRS)	NOAA 2 (CONF 02)												
71	260036Z	17.0N 111.0E	SAT				(T1.5/2.5 /D1.0/24MRS)	NOAA 2 (CONF 02)												
72	260036Z	17.0N 111.0E	SAT				(T1.5/2.5 /D1.0/24MRS)	NOAA 2 (CONF 02)												

CHAPTER V — SUMMARY OF FORECAST VERIFICATION DATA

I. COMPARISON OF OBJECTIVE TECHNIQUES

a. GENERAL:

Objective techniques have been verified yearly since 1967. Year-to-year modifications and improvements have prevented any long period comparisons of the various objective techniques except for EXTRAPOLATION and ARAKAWA (1963). All of the dynamic objective forecast techniques used during the past season employed the simple steering concept of a point vortex in a smoothed flow field with adjustments based on past movement. None of the techniques provided intensity forecasts with their associated relationship to movement.

b. DISCUSSION OF OBJECTIVE TECHNIQUES:

(1) EXTRAPOLATION - Past 12-hour movement derived from current warning position and 12-hour old best track position is linearly extrapolated to 24 and 48 hours.

(2) ARAKAWA (1963) - Grid overlay values of surface pressure are entered into regression equations. Previously hand computed, computations were computerized during the latter half of the 1972 season.

(3) MOHATT 850/700 - A modification to the basic HATRACK program which advects a point vortex on a pre-selected analysis or prognostic SR (space mean) field at designated levels in six-hour time steps out through 84 hours. Utilizing the 12-hour history position, MOHATT computes the previous 12-hour forecast error and applies a bias correction to the forecasted positions out to 72 hours.

(4) TYMOD 12/24 - A modification to FLEWEACEN Pearl Harbor's objective technique TSGLOB. TYMOD advects a weighted point source using FNWC Monterey's global band upper air progs out to 72 hours. Outputs are provided for both 12- and 24-hour history. Bias corrections are applied to the forecast positions based on the previous 12- and 24-hour forecast errors.

(5) TYFOON-72 - Modified version (Jarrell and Wagoner, 1973) of the basic TYFOON program (Jarrell and Somervell, 1970). The program outputs forecast positions as the centers of probability ellipses out to 72 hours based on a group of analog storms which occurred within a time/

space envelope centered about the date and position of the storm being forecast. Ellipses are based on the analog population weighted according to their similarity to the existing storms.

c. TESTING AND RESULTS:

In past years only one or two objective techniques provided 72-hour forecasts. For the first time, during 1973, the JTWC had five objective techniques to assist in formulating the 72-hour outlook. Although some of the objective techniques showed certain skill at various time frames, research is continuing in an effort to improve all of the objective techniques used by the JTWC.

(1) Table 5-1 presents a comparison of all objective techniques for all forecasts. Each objective technique is compared to the best track, each of the other objective techniques, and the official JTWC forecast. A comparison of the various techniques shows EXTRAPOLATION to be superior to all other techniques at both 24 and 48 hours. When compared to the official JTWC forecast, EXTRAPOLATION was only slightly higher at 24 hours and equal at 48 hours. TYFOON-72 was the second best technique at 24 and 48 hours and superior to the other techniques at 72 hours. When compared to the official JTWC forecast at 72 hours, TYFOON-72 was only slightly higher.

(2) Table 5-2 presents a comparison of all objective techniques for all typhoons where the maximum sustained surface wind was 35 knots or greater. Once again, EXTRAPOLATION was superior to all other techniques at both 24 and 48 hours and TYFOON-72 was best at 72 hours. When compared to the official JTWC forecast, however, EXTRAPOLATION was equal at 24 hours and slightly better at 48 hours. This indicates the regular tracks most typhoons described once they became well developed plus the lack of major recurvers during the 1973 season.

II. SUMMARY OF TROPICAL CYCLONE FORMATION ALERTS

For the fourth consecutive year, the JTWC issued Tropical Cyclone Formation Alert messages as a means of alerting Department of Defense interests to potentially dangerous tropical disturbances which normally had not reached the tropical depression stage.

Of the 26 tropical disturbances in the western North Pacific during 1973 for which alerts were issued, 22 were placed in warning status. Only Tropical Storm Hope, which developed from an upper tropospheric low, was not preceded by a formation alert. Including revisions, extensions, and regenerations a total of 43 formation alert messages were issued.

The high ratio of tropical cyclones to formation alerts, 85%, can be attributed to the improved satellite interpretation procedures employed by the JTWC. Of the

SUMMARY				
	NO. OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE
1970	32	18	27	56%
1971	48	33	37	69%
1972	41	29	32	71%
1973	26	22	23	85%

MONTHLY DISTRIBUTION											
J	F	M	A	M	J	J	A	S	O	N	D
0	0	0	0	1	1	6	6	5	4	3	0

43 alerts issued, 30 were based solely on satellite data, three on aircraft investigations, and two on synoptic data. The remaining eight alerts were based on a combination of satellite plus aircraft, synoptic data, or land radar. Thus, 88% of all alerts issued during 1973 employed satellite data as their basis.

3. ANNUAL FORECAST VERIFICATION

Forecast positions for the warning, 24-, 48-, and 72-hour forecasts are verified against the best track using two criteria:

a. Only those forecasts for tropical cyclones which reach typhoon intensity and the best track winds are 35 kts or greater are verified; and

b. All forecasts for which best track positions exist are verified.

No verification statistics are computed for the 12-hour forecast positions. However, the 12-hour forecast position errors may be estimated by adding half the difference between the warning and 24-hour forecast position errors to the warning position error.

In addition to the methods described above for verifying absolute error distance, a computation of closest distance to the best track (right angle error) is also calculated for both methods. This is used to measure the demonstrated ability of the JTWC to forecast the path of motion without regard to speed.

Unless otherwise indicated, the following tables and figures depict the distribution of the typhoon criteria forecasting errors in the JTWC forecasts.

TABLE 5-1. JTWC ANNUAL AVERAGE FORECAST ERROR

	24-HR	48-HR	72-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
1972	116	245	382
1973	102	193	245

*Forecast positions north of 35°N were not verified

4. REFERENCES

- Arakawa, H., "Statistical Method to Forecast the Movement and the Central Pressure of Typhoons in the Western North Pacific," Japan Meteorological Agency, Meteorological Research Institute Final Report, October 1963.
- Jarrell, J.D., and W.L. Somervell, Jr., "A Computer Technique for Using Typhoon Analogs as a Forecast Aid," NAVWEARSCHFAC Tech. Paper No. 6-70, June 1970.
- Jarrell, J.D., and R.A. Wagoner, "The 1972 Typhoon Analog Program (TYFOON-72)," ENVPREDRSCHFAC Tech. Paper No. 1-73, January 1973.

TABLE 5-2. 1973 OBJECTIVE TECHNIQUES VERIFICATION FOR TYPHOONS ONLY (see criterion a)

24-HOUR

	JTWC	XTRP	ARKW	TY24	TY12	TYFN	MH85	MH70
JTWC	195 102 102 0							
XTRP	164 100 100 0	164 100 100 0						
ARKW	42 92 120 28	40 102 122 21	42 120 120 0					
TY24	144 98 216 118	136 97 220 123	38 124 195 71	144 216 216 0				
TY12	150 99 181 82	140 97 182 85	38 124 166 42	142 216 181 -36	150 181 181 0			
TYFN	170 99 116 17	154 98 117 19	41 121 106 -15	143 215 115 -101	148 181 115 -65	170 116 116 0		
MH85	135 102 147 44	129 97 146 49	35 124 131 8	120 223 146 -77	126 177 145 -31	132 119 145 26	135 147 147 0	
MH70	125 101 125 25	119 95 124 28	34 126 120 -6	113 192 123 -69	118 158 123 -35	122 105 124 20	124 131 125 -6	125 125 125 0

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

48-HOUR

	JTWC	XTRP	ARKW	TY24	TY12	TYFN	MH85	MH70
JTWC	136 193 193 0							
XTRP	120 192 190 -2	124 191 191 0						
ARKW	33 187 280 95	31 191 276 85	33 280 280 0					
TY24	104 187 389 202	102 185 395 210	30 283 360 77	109 392 392 0				
TY12	108 186 352 165	106 183 358 175	30 283 330 47	107 393 356 -37	115 360 360 0			
TYFN	125 190 210 20	117 189 214 25	32 287 222 -65	108 391 203 -189	113 357 205 -152	132 215 215 0		
MH85	98 196 314 118	96 188 314 127	27 264 266 2	91 400 308 -92	97 357 311 -46	101 210 308 98	103 312 312 0	
MH70	92 195 294 99	91 186 293 107	27 264 251 -13	87 399 282 -117	92 355 288 -67	95 209 288 79	97 311 291 -20	97 291 291 0

JTWC - OFFICIAL JTWC SUBJECTIVE FORECAST
 XTRP - EXTRAPOLATION
 ARKW - ARAKAWA
 TY24 - TYMOD WITH 24-HR HISTORY
 TY12 - TYMOD WITH 12-HR HISTORY
 TYFN - TYFOON (WEIGHTED CLIMO)
 MH85 - MOHATT 850-MB PROG
 MH70 - MOHATT 700-MB PROG

72 HOUR

	JTWC	TY24	TY12	TYFN	MH85	MH70
JTWC	88 245 245 0					
TY24	71 252 616 364	76 618 618 0				
TY12	73 247 546 300	76 618 556 -62	80 563 563 0			
TYFN	82 246 267 21	75 615 271 -344	79 566 278 -288	92 291 291 0		
MH85	63 254 525 270	60 613 501 -112	64 532 504 -28	6 276 507 231	69 513 513 0	
MH70	61 254 499 246	58 605 477 -128	62 527 489 -38	65 277 493 216	67 494 499 4	67 499 499 0

TABLE 5-3. 1973 OBJECTIVE TECHNIQUES VERIFICATION FOR ALL FORECASTS (see criterion b)

24-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	267	108														
	108	0														
XTRP	218	104	218	109												
	109	5	109	0												
ARKW	45	97	43	110	45	127										
	127	30	130	20	127	0										
TY24	184	102	176	105	41	132	184	208								
	208	106	211	106	201	69	208	0								
TY12	192	103	182	105	41	132	182	208	192	175						
	175	72	175	70	175	43	175	-34	175	0						
TYFN	215	103	198	106	44	128	183	207	190	174	215	120				
	120	16	120	14	112	-16	119	-89	119	-55	120	0				
MH85	161	106	155	105	37	130	143	218	151	176	158	124	161	148		
	148	42	147	42	136	6	147	-71	147	-29	147	23	148	0		
MH70	149	105	143	104	36	132	134	191	141	159	146	112	148	134	149	128
	128	24	127	24	124	-8	126	-65	126	-33	128	15	128	-6	128	0

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

48-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	153	197														
	197	0														
XTRP	157	197	150	201												
	197	0	201	0												
ARKW	33	187	31	191	33	280										
	280	93	276	85	280	0										
TY24	116	192	120	192	30	283	128	398								
	397	205	402	210	360	77	398	0								
TY12	120	192	125	190	30	283	126	399	135	361						
	358	166	361	171	330	47	358	-41	361	0						
TYFN	157	195	136	194	32	287	127	397	133	358	152	212				
	209	14	212	18	222	-65	203	-194	204	-154	212	0				
MH85	105	203	107	196	27	264	101	413	108	367	112	213	114	311		
	311	108	313	117	266	2	308	-105	310	-57	307	95	311	0		
MH70	99	202	102	195	27	264	97	413	103	366	106	212	108	310	108	291
	293	91	293	98	251	-13	285	-128	288	-78	289	76	291	-19	291	0

JTWC - OFFICIAL JTWC SUBJECTIVE FORECAST
 XTRP - EXTRAPOLATION
 ARKW - ARAKAWA
 TY24 - TYMOD WITH 24-HR HISTORY
 TY12 - TYMOD WITH 12-HR HISTORY
 TYFN - TYFOON (WEIGHTED CLIMO)
 MH85 - MOHATT 850-MB PROG
 MH70 - MOHATT 700-MB PROG

72 HOUR

	JTWC		TY24		TY12		TYFN		MH85		MH70	
JTWC	97	253										
	253	0										
TY24	79	261	95	617								
	611	350	617	0								
TY12	81	256	95	617	100	577						
	550	294	570	-47	577	0						
TYFN	90	254	94	615	99	579	112	319				
	266	12	305	-310	313	-267	319	0				
MH85	68	264	73	625	78	572	81	325	83	535		
	529	265	521	-104	526	-45	528	203	535	0		
MH70	66	264	70	617	75	571	78	323	80	513	80	526
	506	242	505	-113	519	-52	522	199	526	12	526	0

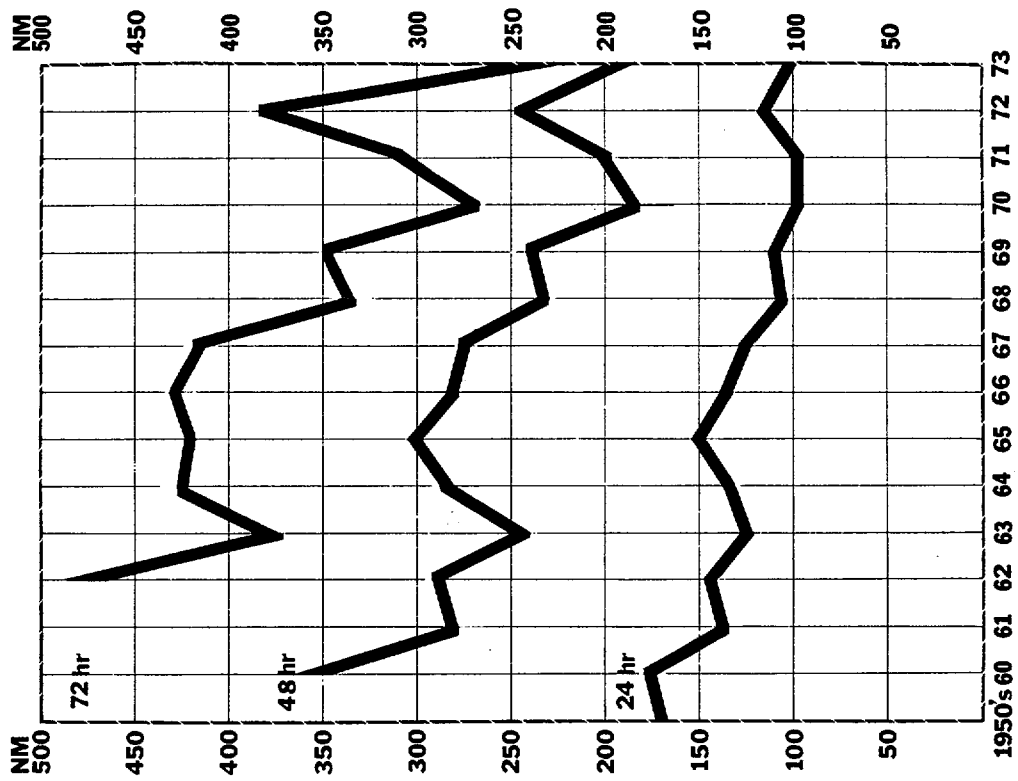


FIGURE 5-1. Mean vector error.

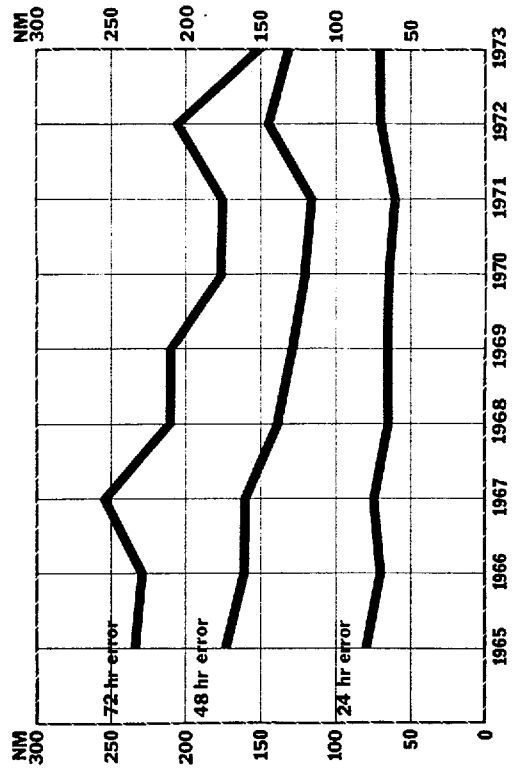


FIGURE 5-2. Mean right angle error.

4. SUMMARY OF INDIVIDUAL TROPICAL STORM VERIFICATION

TABLE 5-4. 1973 JTWC ERROR SUMMARY

(Average errors are given in nautical miles)

CYCLONE	WARNING			24 HOUR			48 HOUR			72 HOUR		
	POSIT ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES
1. TS WILDA	12	7	9	63	50	5	---	---	---	---	---	---
2. TY ANITA	22	13	13	157	104	9	240	96	3	---	---	---
3. TY BILLIE	20	17	24	79	65	20	151	123	16	210	171	12
4. TS CLARA	28	20	7	92	88	3	---	---	---	---	---	---
5. TY DOT	25	15	19	123	79	11	256	156	2	---	---	---
6. TY ELLEN	17	13	28	135	90	16	201	116	6	55	53	2
7. TS FRAN	58	27	5	172	142	1	---	---	---	---	---	---
8. TY GEORGIA	17	12	15	114	96	11	255	225	7	279	243	1
9. TS HOPE	32	27	13	114	96	9	9	181	155	2	---	---
10. TY IRIS	24	15	30	138	96	26	265	153	21	328	157	17
11. TD 11	23	15	6	155	88	2	---	---	---	---	---	---
12. TS JOAN	65	43	10	191	139	6	---	---	---	---	---	---
13. TS KATE	31	21	8	114	71	4	---	---	---	---	---	---
14. TD 14	16	16	4	---	---	---	---	---	---	---	---	---
15. TY LOUISE	21	14	18	104	71	14	225	180	9	294	173	3
16. TY MARGE	18	10	12	77	67	8	224	166	3	---	---	---
17. TY NORA	17	10	34	104	77	30	192	156	24	267	218	20
18. TY OPAL	26	12	15	98	62	11	177	89	5	---	---	---
19. TY PATSY	21	14	29	65	37	22	212	122	21	318	170	17
20. TY RUTH	19	12	33	84	51	29	126	78	24	163	90	21
21. TS SARAH	13	10	4	---	---	---	---	---	---	---	---	---
22. TS THELMA	35	15	10	146	35	6	263	68	2	283	283	1
23. TS VERA	39	19	28	116	78	24	172	151	8	236	221	3
ALL FORECASTS	24	15	374	108	74	267	197	134	153	253	162	97
*TYPHOONS	19	12	239	102	71	195	193	131	136	245	153	88

*Includes only forecasts on cyclones that became typhoons and only when verifying best track wind was 35 kt.

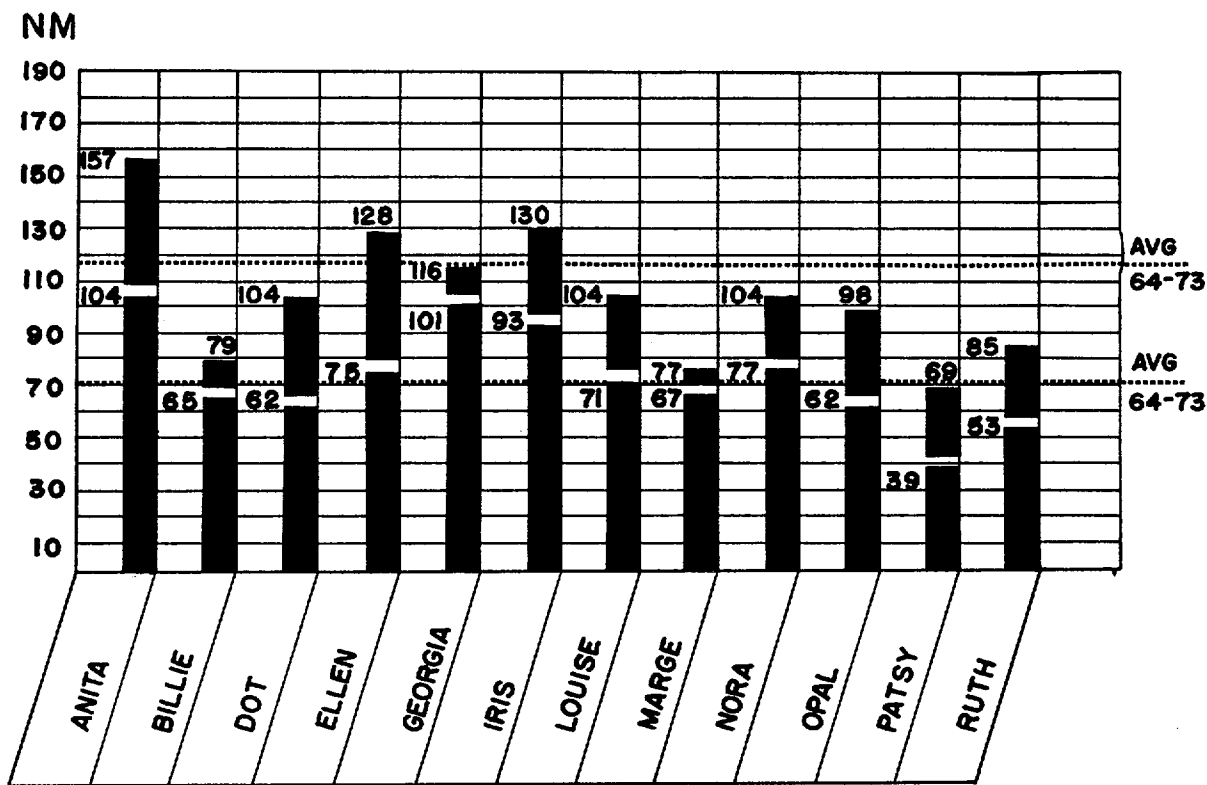


FIGURE 5-3. 1973 average vector and right angle errors of 24-hr forecasts.

5. TROPICAL STORM AND DEPRESSION DATA

TROPICAL STORM WILDA
1200Z 1 JUL TO 1200Z 3 JUL

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
011200Z	19.6N	118.3E	45	19.3N	118.0E	30	25	-13	20.6N	115.0E	50	126	-10				
011800Z	20.3N	118.0E	50	20.2N	118.0E	40	6	-10	22.5N	117.0E	50	39	-10				
020000Z	20.9N	117.7E	55	20.7N	117.8E	50	13	-5	23.0N	116.8E	65	70	5				
020600Z	21.5N	117.0E	55	21.3N	117.7E	55	6	0	24.3N	117.9E	45	47	-15				
021200Z	22.0N	117.7E	50	22.1N	117.7E	55	6	-5	25.1N	118.1E	40	32	0				
021800Z	22.6N	117.7E	60	22.8N	117.7E	55	12	-5									
030000Z	23.6N	117.9E	60	23.4N	117.9E	50	12	-10									
030600Z	24.6N	118.3E	60	24.7N	118.2E	40	8	-20									
031200Z	25.5N	118.5E	40	25.8N	118.5E	40	18	0									

TROPICAL STORM CLARA
1800Z 12 JUL TO 0600Z 14 JUL

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
121800Z	28.1N	161.0E	35	27.6N	161.7E	30	30	-5	30.9N	159.4E	45	57	0				
130000Z	28.7N	160.9E	40	28.3N	161.0E	30	24	-10	31.4N	159.2E	40	80	0				
130600Z	29.3N	160.4E	50	29.2N	160.2E	45	12	-5	32.8N	159.2E	50	138	15				
131200Z	29.8N	160.2E	45	30.0N	159.7E	45	54	0									
131800Z	30.5N	160.4E	45	30.3N	160.2E	45	16	0									
140000Z	31.0N	160.7E	40	30.9N	160.2E	45	26	5									
140600Z	31.7N	161.0E	35	31.8N	161.0E	40	31	5									

TROPICAL STORM FMAN
0000Z 29 JUL TO 0000Z 30 JUL

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
290000Z	18.9N	124.0E	35	19.3N	123.5E	25	37	-10	20.6N	120.0E	45	172	20				
290600Z	19.2N	123.9E	35	19.3N	123.6E	35	18	-5									
291200Z	19.8N	122.5E	35	19.4N	122.7E	35	18	0									
291800Z	20.8N	122.0E	30	19.4N	122.1E	35	88	5									
300000Z	21.6N	122.9E	25	19.7N	122.1E	30	122	5									

TROPICAL STORM MUPE

0600Z 9 AUG TO 0600Z 12 AUG

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
090600Z	26.1N	154.0E	30	26.4N	154.7E	30	19	0	30.0N	152.7E	40	122	-5				
091200Z	26.9N	153.0E	30	27.2N	154.2E	30	47	0	30.7N	153.9E	40	169	0				
091800Z	27.0N	152.0E	35	27.2N	152.7E	30	13	-5	30.8N	149.7E	40	78	0				
100000Z	27.7N	152.0E	40	27.3N	152.0E	40	12	0	30.2N	150.0E	45	12	5	32.0N	149.0E	45	158
100600Z	28.3N	151.9E	45	28.0N	151.1E	45	20	0	31.0N	148.8E	50	19	15	35.4N	147.0E	40	204
101200Z	29.0N	150.9E	40	28.7N	150.3E	50	32	10	32.3N	148.2E	50	60	20				
101800Z	29.6N	150.3E	40	29.8N	150.2E	50	13	10	33.7N	149.1E	50	147	20				
110000Z	30.3N	149.9E	40	30.4N	149.9E	40	8	0	34.2N	149.5E	35	212	5				
110600Z	30.8N	149.1E	35	31.2N	149.2E	40	24	5	34.6N	148.4E	35	206	5				
111200Z	31.3N	148.3E	30	31.2N	148.5E	40	12	10									
111800Z	31.7N	147.4E	30	32.5N	148.1E	40	59	10									
120000Z	32.2N	146.0E	30	33.5N	148.0E	40	127	10									
120600Z	32.9N	144.8E	30	32.3N	144.8E	40	36	10									

TROPICAL DEPRESSION 11

0000Z 13 AUG TO 0000Z 14 AUG

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
130000Z	30.0N	157.0E	30	30.0N	158.2E	30	31	0	31.4N	156.0E	45	148	20				
130600Z	30.2N	156.0E	30	30.3N	157.0E	30	52	0	32.1N	156.0E	45	162	20				
131200Z	30.3N	155.0E	30	30.2N	155.9E	30	8	0									
131800Z	30.5N	154.4E	25	30.5N	154.4E	30	21	5									
140000Z	30.8N	153.8E	25	30.7N	153.7E	30	8	5									
140600Z	31.2N	153.0E	25	31.2N	152.6E	25	20	0									

TROPICAL STORM JOAN

0600Z 18 AUG TO 1200Z 20 AUG

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	UST	WIND	POSIT	WIND	
180600Z	19.4N	129.3E	30	19.2N	129.3E	30	12	0	19.8N	126.0E	45	141	5				
181200Z	19.8N	128.0E	30	18.8N	129.3E	30	95	0	18.7N	125.9E	45	224	0				
181800Z	20.7N	126.0E	30	18.6N	128.4E	30	161	0	18.8N	124.9E	40	221	5				
190000Z	21.4N	125.5E	35	18.3N	127.2E	30	208	-5	18.9N	123.4E	40	195	10				
190600Z	21.7N	124.3E	40	22.2N	125.0E	30	41	-10	24.8N	120.0E	35	219	5				
191200Z	21.7N	123.3E	45	22.0N	123.5E	40	18	-5	23.6N	118.4E	35	148	5				
191800Z	21.5N	122.2E	35	22.0N	122.0E	45	32	10									
200000Z	21.5N	121.3E	30	21.7N	120.8E	45	55	15									
200600Z	21.3N	119.4E	30	21.0N	119.4E	30	18	0									
201200Z	21.3N	117.4E	30	21.1N	117.5E	15	13	-15									

TROPICAL STORM KATE
0000Z 24 AUG TO 0000Z 26 AUG

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
240000Z	19.1N	111.7E	45	18.3N	111.7E	30	48	-10	17.8N	109.2E	40	149	-20	---	---	---	---	---
241200Z	19.4N	111.3E	50	18.8N	111.3E	30	48	-20	18.8N	108.8E	25	117	-35	---	---	---	---	---
241800Z	19.7N	110.8E	55	18.9N	110.9E	30	48	-20	19.2N	108.7E	25	136	-35	---	---	---	---	---
250000Z	20.0N	109.3E	55	19.9N	109.9E	40	23	-10	20.8N	107.1E	40	56	5	---	---	---	---	---
250600Z	20.2N	109.3E	60	20.2N	108.9E	60	22	0	---	---	---	---	---	---	---	---	---	---
251200Z	20.4N	107.6E	60	20.5N	108.2E	60	34	0	---	---	---	---	---	---	---	---	---	---
251800Z	20.6N	106.8E	60	20.7N	107.0E	60	13	0	---	---	---	---	---	---	---	---	---	---
260000Z	20.8N	106.1E	40	21.0N	106.1E	30	12	-5	---	---	---	---	---	---	---	---	---	---

TROPICAL DEPRESSION 14
1200Z 1 SEP TO 0000Z 2 SEP

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
011200Z	19.2N	106.8E	30	19.6N	107.5E	30	46	0	---	---	---	---	---	---	---	---	---	---
011800Z	19.2N	106.4E	30	19.4N	106.5E	30	13	0	---	---	---	---	---	---	---	---	---	---
020000Z	19.4N	105.9E	30	19.3N	105.9E	30	6	0	---	---	---	---	---	---	---	---	---	---
020600Z	19.7N	105.5E	25	19.7N	105.5E	30	0	0	---	---	---	---	---	---	---	---	---	---

TROPICAL STORM SARAH
0000Z 10 NOV TO 1800Z 10 NOV

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
100000Z	12.2N	111.0E	40	12.2N	111.5E	30	6	-10	---	---	---	---	---	---	---	---	---	---
100600Z	12.2N	110.5E	50	12.1N	110.4E	50	8	0	---	---	---	---	---	---	---	---	---	---
101200Z	12.4N	109.5E	55	12.2N	109.4E	55	13	0	---	---	---	---	---	---	---	---	---	---
101800Z	12.5N	108.5E	35	12.2N	108.8E	35	25	0	---	---	---	---	---	---	---	---	---	---

TROPICAL STORM THELMA
0000Z 15 NOV TO 0600Z 16 NOV

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
150000Z	10.0N	111.7E	40	10.4N	110.0E	40	103	0	10.4N	104.8E	35	192	0	10.4N	100.1E	55	297	35
150600Z	10.0N	110.1E	30	9.9N	109.7E	55	24	0	9.6N	104.0E	50	159	20	9.9N	100.5E	65	230	45
151200Z	9.9N	108.8E	55	9.6N	108.7E	55	8	0	9.6N	103.9E	50	148	25	---	---	---	---	---
151800Z	9.8N	108.3E	45	9.7N	107.7E	55	36	10	9.6N	102.9E	55	165	30	---	---	---	---	---
160000Z	9.8N	108.0E	35	9.6N	108.3E	30	21	-5	9.6N	108.3E	30	189	10	---	---	---	---	---
160600Z	9.8N	107.3E	30	9.7N	107.3E	30	6	0	9.7N	108.0E	30	24	10	---	---	---	---	---
161200Z	9.8N	106.9E	25	9.8N	106.3E	30	6	0	---	---	---	---	---	---	---	---	---	---
161800Z	9.7N	105.7E	25	9.8N	105.4E	25	19	0	---	---	---	---	---	---	---	---	---	---
170000Z	9.7N	105.1E	20	9.0N	104.3E	25	63	0	---	---	---	---	---	---	---	---	---	---
170600Z	9.7N	104.4E	20	9.0N	105.3E	20	68	0	---	---	---	---	---	---	---	---	---	---
180000Z	10.4N	101.4E	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TROPICAL STORM VERA
1200Z 19 NOV TO 0600Z 26 NOV

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND				
191200Z	10.0N	126.5E	30	10.6N	126.9E	30	43	0	12.0N	123.9E	35	40	5	---	---	---	---	---
191800Z	11.3N	125.5E	30	11.7N	125.9E	30	33	0	13.5N	122.5E	35	130	5	---	---	---	---	---
200000Z	11.5N	124.0E	30	12.1N	125.1E	25	46	-5	13.5N	122.7E	25	126	-5	---	---	---	---	---
200600Z	11.4N	124.1E	30	11.8N	122.8E	30	80	0	12.7N	118.5E	40	250	10	---	---	---	---	---
201200Z	11.4N	123.0E	30	11.7N	123.3E	30	25	0	12.4N	119.7E	40	111	10	---	---	---	---	---
201800Z	11.4N	123.1E	30	11.5N	122.0E	30	65	0	11.6N	117.9E	40	158	10	---	---	---	---	---
210000Z	11.4N	122.0E	30	11.5N	121.0E	30	94	0	11.5N	116.9E	40	182	5	---	---	---	---	---
210600Z	11.4N	121.0E	30	11.5N	121.3E	30	41	0	11.5N	118.9E	35	38	0	---	---	---	---	---
211200Z	11.4N	121.3E	30	11.6N	122.5E	30	71	0	11.6N	121.4E	30	156	-10	---	---	---	---	---
211800Z	11.5N	120.8E	30	11.6N	121.6E	30	59	0	11.6N	120.4E	30	136	-10	---	---	---	---	---
220000Z	11.6N	120.0E	35	11.6N	120.3E	30	18	-5	11.6N	117.3E	40	81	-5	---	---	---	---	---
220600Z	11.9N	119.4E	35	11.6N	119.6E	30	21	-5	11.6N	116.9E	40	109	-5	---	---	---	---	---
221200Z	12.2N	118.0E	40	12.6N	119.4E	40	42	0	13.0N	117.0E	55	40	5	13.4N	114.0E	45	144	5
221800Z	12.6N	118.3E	40	12.6N	118.8E	40	31	0	13.2N	116.3E	50	55	0	13.4N	113.0E	45	155	0
230000Z	12.9N	117.7E	45	13.1N	117.3E	40	26	-5	13.8N	114.2E	50	80	0	14.1N	110.9E	45	154	0
230600Z	13.2N	117.3E	45	13.4N	116.5E	40	48	-5	13.9N	113.4E	40	100	-10	14.1N	110.1E	35	191	0
231200Z	13.6N	116.7E	50	13.4N	116.0E	40	14	-10	13.9N	114.3E	40	120	-10	14.1N	111.0E	35	150	0
231800Z	14.1N	116.1E	50	13.6N	116.3E	40	21	-10	14.6N	113.8E	35	88	-10	14.8N	111.5E	35	128	10
240000Z	14.6N	115.3E	30	14.5N	115.4E	40	8	-5	15.6N	112.2E	55	43	10	15.7N	109.3E	45	174	20
240600Z	15.2N	114.5E	50	15.2N	114.2E	50	17	0	16.9N	110.4E	60	118	25	17.3N	107.2E	50	274	30
241200Z	15.7N	113.0E	50	15.6N	113.3E	50	18	0	16.9N	110.1E	60	116	30	---	---	---	---	---
241800Z	15.9N	113.1E	45	16.2N	113.3E	50	21	0	16.4N	110.4E	60	124	35	---	---	---	---	---
250000Z	16.2N	112.6E	45	16.8N	112.5E	55	36	10	16.8N	109.6E	40	162	15	---	---	---	---	---
250600Z	16.4N	112.4E	35	16.8N	111.7E	45	47	10	16.7N	108.1E	30	231	10	---	---	---	---	---
251200Z	16.6N	112.1E	30	17.3N	111.5E	45	54	15	---	---	---	---	---	---	---	---	---	---
251800Z	16.9N	111.9E	25	17.5N	110.6E	30	82	0	---	---	---	---	---	---	---	---	---	---
260000Z	17.2N	111.9E	25	17.2N	111.8E	30	9	0	---	---	---	---	---	---	---	---	---	---
260600Z	17.6N	112.0E	20	17.4N	111.9E	25	13	0	---	---	---	---	---	---	---	---	---	---

6. TYPHOON DATA

TYPHOON ANITA

18004 5 JUL TO 18002 8 JUL

	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		
0518002	11.1N	112.4E	30	11.5N	112.0E	30	42	0	12.5N	109.7E	35	128	-25	---	---	---	---	---		
0608002	11.6N	112.4E	35	11.7N	111.4E	30	59	-5	12.8N	109.2E	30	150	-30	---	---	---	---	---		
0806002	12.8N	112.7E	55	12.3N	112.5E	50	21	-5	13.9N	110.8E	60	104	-5	15.7N	108.3E	55	186	-15		
0819002	12.8N	112.7E	55	12.3N	112.5E	50	19	-5	13.3N	110.4E	60	206	-5	14.5N	108.4E	55	297	-15		
0618002	13.4N	111.7E	60	13.3N	111.5E	55	13	-5	14.7N	109.7E	65	168	0	16.5N	107.8E	50	244	10		
0700002	14.5N	111.1E	60	14.3N	111.0E	60	13	0	16.8N	109.5E	70	129	5	---	---	---	---	---		
0706002	15.2N	110.4E	65	15.8N	110.1E	70	21	5	20.7N	108.5E	45	182	-25	---	---	---	---	---		
0718002	19.3N	108.8E	85	19.5N	108.8E	75	13	10	21.3N	108.8E	45	154	-25	---	---	---	---	---		
0800002	17.6N	107.4E	65	17.7N	107.7E	65	18	0	---	---	---	---	---	---	---	---	---	---		
0819002	18.7N	106.8E	70	18.5N	106.8E	65	17	-5	---	---	---	---	---	---	---	---	---	---		
0818002	19.1N	104.5E	40	19.2N	104.5E	50	6	10	---	---	---	---	---	---	---	---	---	---		

	TYPHOONS WHILE WIND OVER 35KTS					ALL FORECASTS				
	WARNING	24-HR	48-HR	72-HR	0NN	WARNING	24-HR	48-HR	72-HR	0NN
AVERAGE FORECAST ERROR	22NN	15NN	24NN	0NN	0NN	22NN	15NN	24NN	0NN	0NN
AVERAGE RIGHT ANGLE ERROR	13NN	10NN	9NN	0NN	0NN	13NN	14NN	9NN	0NN	0NN
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	14KTS	20KTS	0KTS	0KTS	5KTS	14KTS	20KTS	0KTS	0KTS
AVERAGE BIAS OF WIND ERROR	1KTS	-1KTS	-1KTS	0KTS	0KTS	1KTS	-1KTS	-1KTS	0KTS	0KTS
NUMBER OF FORECASTS	13	9	3	0	0	13	9	3	0	0

TYPHOON BILLIE

06004 13 JUL TO 18002 19 JUL

	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		
1306002	16.7N	125.9E	40	16.8N	125.0E	45	52	5	19.9N	122.1E	70	193	0	22.6N	119.4E	80	337	-50		
1318002	17.3N	125.4E	45	17.9N	125.7E	55	24	5	20.8N	123.8E	65	124	-20	21.8N	121.5E	80	220	-40		
1400002	18.5N	125.3E	60	18.5N	125.1E	65	11	5	21.2N	124.2E	80	64	-35	24.1N	123.3E	90	104	-10		
1406002	19.1N	125.5E	70	19.2N	125.2E	70	18	0	22.0N	124.9E	80	33	-50	24.8N	124.1E	90	77	-25		
1417002	19.7N	125.4E	85	19.5N	125.4E	75	13	-10	21.8N	124.9E	90	37	-30	24.4N	123.8E	95	124	-25		
1418002	20.3N	125.4E	100	20.2N	125.4E	80	6	-20	23.2N	124.9E	95	18	-10	26.0N	124.0E	95	83	-25		
1500002	20.9N	125.7E	115	21.1N	125.3E	110	12	-5	24.0N	124.6E	135	33	35	26.7N	123.8E	130	97	15		
1506002	21.5N	125.3E	120	21.5N	125.3E	110	18	-10	25.1N	124.1E	100	57	-20	27.8N	123.9E	125	124	-15		
1519002	22.9N	125.3E	130	22.7N	125.2E	110	18	-10	25.1N	124.1E	100	87	-20	27.8N	123.9E	125	124	-15		
1518002	23.1N	125.7E	105	23.2N	125.0E	110	13	5	26.0N	123.7E	100	98	-20	28.5N	122.2E	80	184	-20		
1600002	23.9N	125.7E	100	23.8N	125.2E	100	6	0	26.6N	124.9E	95	62	-20	29.5N	124.2E	85	125	0		
1606002	24.6N	125.5E	115	24.6N	125.2E	105	16	-10	27.8N	124.7E	95	44	-15	30.8N	124.3E	85	114	10		
1617002	25.6N	125.7E	120	25.5N	125.7E	100	6	-20	28.8N	126.2E	90	39	-15	32.1N	126.0E	80	156	15		
1618002	26.6N	125.4E	120	26.8N	125.6E	100	16	-20	30.5N	125.2E	90	21	-10	33.7N	125.7E	80	165	25		
1702002	26.9N	125.7E	115	26.8N	125.5E	100	22	-5	31.8N	124.5E	90	31	-5	36.5N	123.9E	55	141	5		
1712002	29.0N	125.5E	105	29.2N	125.2E	95	20	-10	32.5N	125.0E	70	101	5	---	---	---	---	---		
1718002	30.2N	125.4E	100	30.2N	125.5E	90	8	-10	35.8N	125.5E	65	158	10	---	---	---	---	---		
1800002	31.5N	124.9E	85	31.9N	125.4E	80	20	-5	36.3N	126.2E	55	216	-5	---	---	---	---	---		
1812002	34.1N	122.7E	55	34.2N	122.7E	50	18	-5	---	---	---	---	---	---	---	---	---	---		
1900002	35.1N	122.0E	50	34.9N	120.8E	50	60	0	---	---	---	---	---	---	---	---	---	---		

	TYPHOONS WHILE WIND OVER 35KTS					ALL FORECASTS				
	WARNING	24-HR	48-HR	72-HR	0NN	WARNING	24-HR	48-HR	72-HR	0NN
AVERAGE FORECAST ERROR	20NN	7NN	15NN	210NN	0NN	20NN	7NN	15NN	210NN	0NN
AVERAGE RIGHT ANGLE ERROR	17NN	6NN	12NN	17NN	0NN	17NN	6NN	12NN	17NN	0NN
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	9KTS	12KTS	31KTS	0KTS	8KTS	9KTS	12KTS	31KTS	0KTS
AVERAGE BIAS OF WIND ERROR	-6KTS	-1KTS	-1KTS	-1KTS	0KTS	-6KTS	-1KTS	-1KTS	-1KTS	0KTS
NUMBER OF FORECASTS	24	20	16	12	0	24	20	16	12	0

TYPHOON DOT

0600Z 14 JUL TO 0600Z 20 JUL

BEST TRACK	WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
140400Z	17.2N 114.4E	35	17.3N 112.8E	30	103	-5	19.3N 111.8E	45	120	-10	---	---	---	---	---	
141200Z	17.9N 112.9E	42	17.7N 112.9E	30	26	-18	18.2N 112.2E	45	178	-25	---	---	---	---	---	
150000Z	17.6N 113.4E	45	17.5N 113.8E	40	13	-5	18.2N 112.7E	50	82	-25	20.1N 110.4E	55	267	-70	---	
150400Z	18.1N 113.4E	55	18.1N 113.4E	50	6	-5	19.7N 112.5E	60	76	-20	21.7N 111.2E	45	245	5	---	
151200Z	18.5N 113.4E	60	18.4N 113.5E	60	6	0	20.3N 112.4E	65	89	-20	---	---	---	---	---	
151800Z	18.5N 113.4E	60	18.4N 113.5E	60	6	-5	20.3N 112.4E	65	119	-20	---	---	---	---	---	
160000Z	19.4N 113.4E	75	19.2N 113.3E	70	13	-5	20.7N 112.5E	80	171	15	---	---	---	---	---	
160400Z	20.3N 113.7E	80	20.4N 113.5E	75	13	-5	23.0N 113.3E	50	108	10	---	---	---	---	---	
161200Z	21.0N 114.0E	85	21.0N 113.5E	80	28	-18	---	---	---	---	---	---	---	---	---	
161800Z	21.0N 114.0E	85	21.0N 113.5E	80	6	-10	---	---	---	---	---	---	---	---	---	
170000Z	22.7N 114.7E	65	22.6N 114.4E	50	18	-15	---	---	---	---	---	---	---	---	---	
170400Z	23.5N 115.7E	40	23.7N 115.1E	35	13	-5	---	---	---	---	---	---	---	---	---	
180000Z	27.8N 129.7E	30	28.2N 127.9E	30	93	0	32.4N 129.3E	45	283	20	---	---	---	---	---	
180400Z	27.8N 129.7E	30	28.2N 127.9E	30	20	0	---	---	---	---	---	---	---	---	---	
191200Z	29.6N 127.3E	30	29.8N 127.0E	30	20	0	---	---	---	---	---	---	---	---	---	
191800Z	31.0N 127.2E	30	30.0N 127.0E	40	61	10	---	---	---	---	---	---	---	---	---	
200000Z	32.6N 126.6E	25	32.6N 127.1E	35	25	10	---	---	---	---	---	---	---	---	---	
200400Z	34.8N 126.1E	25	34.7N 126.2E	25	8	0	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE NIGHT ANGL E ERROR	75NM	123NM	256NM	0NM	75NM	123NM	256NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	18KTS	3KTS	0KTS	6KTS	18KTS	3KTS	0KTS
AVERAGE BIAS OF WIND ERROR	-4KTS	-6KTS	-3KTS	0KTS	-4KTS	-6KTS	-3KTS	0KTS
NUMBER OF FORECASTS	19	11	2	0	19	11	2	0

TYPHOON ELLEN

1800Z 17 JUL TO 0600Z 29 JUL

BEST TRACK	WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND	POSIT	WIND	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	ERRORS	
171800Z	21.7N 139.1E	50	21.1N 139.1E	30	36	-20	22.2N 137.9E	40	78	-25	---	---	---	---	---	
180000Z	22.3N 138.4E	65	22.0N 138.8E	55	18	-10	26.1N 137.7E	75	99	-25	29.2N 136.9E	80	70	15	32.3N 136.4E	
180400Z	22.5N 138.4E	72	22.7N 138.0E	95	25	-5	25.7N 136.2E	75	113	-30	28.4N 135.0E	75	189	20	31.4N 134.5E	
181200Z	22.5N 138.4E	72	22.7N 138.0E	95	25	-5	25.7N 136.2E	75	113	-30	28.4N 135.0E	75	189	20	31.4N 134.5E	
181800Z	23.5N 138.1E	85	23.0N 137.9E	70	32	-15	24.3N 136.8E	80	248	0	26.0N 135.7E	75	356	25	---	
190000Z	24.5N 138.2E	100	24.4N 138.0E	100	32	0	27.9N 137.7E	110	105	45	31.4N 136.1E	100	157	50	---	
190400Z	25.7N 138.7E	105	26.0N 137.9E	100	28	-5	30.3N 136.8E	95	52	40	34.7N 135.3E	65	157	20	---	
191200Z	26.9N 138.4E	90	26.7N 138.3E	95	13	5	30.9N 137.5E	90	52	35	---	---	---	---	---	
191800Z	28.2N 138.4E	80	28.3N 138.4E	95	6	15	32.4N 137.5E	90	50	40	---	---	---	---	---	
200000Z	29.5N 138.2E	65	29.3N 138.3E	75	13	10	33.5N 137.9E	60	105	10	---	---	---	---	---	
200400Z	30.7N 137.7E	55	30.9N 137.9E	60	17	-5	36.9N 136.0E	35	287	-10	---	---	---	---	---	
201200Z	31.6N 137.1E	55	31.7N 137.7E	45	31	-10	---	---	---	---	---	---	---	---	---	
201800Z	31.9N 136.7E	50	32.4N 136.4E	45	33	-5	---	---	---	---	---	---	---	---	---	
210000Z	32.2N 136.4E	50	32.6N 136.4E	40	24	-10	---	---	---	---	---	---	---	---	---	
210400Z	32.2N 136.3E	45	32.0N 136.5E	20	16	-25	---	---	---	---	---	---	---	---	---	
230000Z	30.8N 132.1E	30	30.9N 131.8E	30	17	0	33.9N 127.8E	35	216	5	---	---	---	---	---	
231200Z	30.3N 131.4E	30	30.4N 131.1E	30	5	0	32.9N 127.9E	35	143	5	---	---	---	---	---	
231800Z	30.1N 130.9E	30	30.1N 130.8E	30	5	0	30.9N 126.9E	35	135	5	---	---	---	---	---	
240000Z	30.2N 130.4E	30	30.2N 129.2E	30	2	0	30.2N 129.0E	25	121	0	---	---	---	---	---	
240400Z	30.2N 130.4E	30	30.2N 129.2E	30	2	0	---	---	---	---	---	---	---	---	---	
241200Z	30.9N 129.4E	30	30.9N 129.5E	30	8	0	---	---	---	---	---	---	---	---	---	
241800Z	30.9N 129.4E	30	30.9N 129.5E	30	8	0	---	---	---	---	---	---	---	---	---	
250000Z	31.7N 129.4E	25	32.0N 129.5E	25	19	5	---	---	---	---	---	---	---	---	---	
250400Z	32.2N 129.9E	20	32.3N 129.5E	25	21	5	---	---	---	---	---	---	---	---	---	
280400Z	32.5N 137.1E	45	32.0N 137.2E	40	8	-5	---	---	---	---	---	---	---	---	---	
281200Z	33.3N 137.5E	35	33.4N 137.4E	40	5	5	---	---	---	---	---	---	---	---	---	
281800Z	34.1N 137.5E	25	34.0N 137.4E	40	8	15	---	---	---	---	---	---	---	---	---	
290000Z	34.6N 137.2E	25	34.8N 137.5E	30	19	5	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR	TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE NIGHT ANGL E ERROR	13NM	9NM	116NM	53NM	13NM	9NM	116NM	53NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	10KTS	25KTS	30KTS	6KTS	10KTS	25KTS	30KTS
AVERAGE BIAS OF WIND ERROR	-2KTS	4KTS	25KTS	30KTS	-2KTS	4KTS	25KTS	30KTS
NUMBER OF FORECASTS	28	14	6	2	28	14	6	2

TYPHOON GEORGIA

0600Z 09 AUG TO 1800Z 12 AUG

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			
				DST	WIND			DST	WIND			DST	WIND			DST	WIND		
091800Z	19.9N 118.9E	58	19.9N 118.9E	35	18	-5	20.6N 112.4E	60	25	-5	20.7N 109.5E	50	145	30	22.8N 106.3E	25	279	-25	
091800Z	19.5N 114.9E	55	19.5N 114.9E	60	6	5	19.7N 111.3E	55	62	-15	21.0N 107.7E	35	219	30					
100000Z	19.5N 114.9E	60	19.3N 113.8E	60	16	0	19.1N 110.2E	55	96	-15	19.8N 106.1E	40	289	20					
101200Z	18.3N 112.9E	95	18.3N 112.2E	85	39	-5	18.3N 108.9E	25	188	-25	20.8N 106.3E	25	304	-10					
101800Z	19.1N 112.2E	70	18.9N 111.9E	65	21	-5	18.9N 108.1E	40	197	-25	20.3N 104.5E	25	369	5					
110200Z	18.3N 111.9E	70	18.1N 111.3E	65	13	-5	18.6N 108.4E	25	131	-25									
111200Z	20.6N 111.2E	65	19.3N 111.3E	65	39	0	21.5N 110.2E	40	186	18									
120200Z	20.5N 111.2E	68	20.5N 111.5E	65	17	5													
121800Z	21.7N 110.7E	35	21.5N 110.7E	45	18	10													

TYPHOONS WHILE WIND OVER 35KTS

ALL FORECASTS

AVERAGE FORECAST ERROR	WARNING				ALL FORECASTS			
	24-HR	48-HR	72-HR		24-HR	48-HR	72-HR	
AVERAGE RIGHT ANGLE ERROR	17NM	14NM	25NM	27NM	17NM	14NM	25NM	27NM
AVERAGE MAGNITUDE OF WIND ERROR	12NM	9NM	22NM	24NM	12NM	9NM	22NM	24NM
AVERAGE BIAS OF WIND ERROR	5KTS	1KTS	17KTS	25KTS	5KTS	1KTS	17KTS	25KTS
NUMBER OF FORECASTS	15	11	7	1	15	11	7	1

TYPHOON IRIS

0600Z 10 AUG TO 1200Z 17 AUG

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			
				DST	WIND			DST	WIND			DST	WIND			DST	WIND		
100600Z	21.3N 130.9E	35	21.0N 130.8E	30	19	-5	25.3N 130.1E	50	126	-5									
101200Z	22.2N 131.0E	40	21.8N 130.8E	40	26	0						26.1N 127.2E	80	285	5	27.8N 123.3E	80	545	
101800Z	22.8N 131.1E	45	23.0N 131.0E	50	13	5	26.2N 129.3E	70	202	10	28.3N 125.5E	85	448	10	29.6N 121.3E	85	678	0	
111000Z	23.2N 130.9E	55	23.4N 130.7E	50	13	-5	26.1N 128.9E	75	207	10	28.3N 125.8E	85	436	5	29.6N 122.0E	85	613	5	
111600Z	23.4N 131.1E	55	23.4N 130.6E	50	36	-5	26.5N 128.7E	75	195	-5	28.1N 125.3E	80	472	-5	31.3N 122.7E	75	509	0	
111600Z	23.1N 130.9E	60	23.2N 130.8E	50	6	-10	26.5N 130.1E	70	128	-5	28.7N 127.8E	80	294	-5	31.3N 122.7E	60	509	15	
120200Z	23.1N 130.9E	65	23.5N 131.1E	55	34	-10	24.9N 131.3E	75	162	-10	26.7N 127.1E	80	287	0	28.8N 124.5E	80	295	10	
121200Z	23.7N 131.1E	75	23.3N 131.3E	70	12	-5	23.8N 130.8E	80	115	5	28.8N 127.3E	85	187	35	28.8N 124.5E	180	284	25	
130000Z	23.3N 131.7E	80	23.4N 131.6E	75	8	-5	24.9N 130.6E	90	87	10	26.7N 129.0E	95	86	25	29.4N 127.2E	95	78	25	
130600Z	23.4N 132.0E	85	23.2N 131.6E	85	25	0	24.6N 130.9E	105	64	30	26.7N 129.2E	110	127	35	29.3N 127.4E	100	138	35	
131200Z	23.6N 132.2E	85	23.5N 132.2E	85	20	0	25.1N 132.4E	95	96	25	27.4N 131.8E	85	265	10	31.3N 130.9E	85	335	35	
131200Z	23.2N 132.2E	85	23.5N 132.2E	85	20	0	25.0N 132.2E	90	128	25	28.6N 131.8E	85	265	10	31.3N 130.9E	85	335	35	
140000Z	24.8N 132.2E	80	24.8N 132.2E	85	0	5	27.4N 131.8E	90	134	20	30.2N 131.2E	80	263	10	33.3N 130.2E	45	265	0	
140500Z	25.2N 131.7E	75	25.2N 131.7E	85	32	18	28.8N 131.5E	70	188	-5	32.9N 131.7E	65	387	0	33.2N 131.2E	35	308	18	
141000Z	27.3N 130.3E	65	27.0N 130.6E	80	24	15	32.4N 130.2E	60	229	-15	36.7N 131.5E	40	367	-10					
150000Z	28.1N 129.4E	70	28.4N 129.9E	70	32	0	33.2N 128.0E	55	198	-15	38.5N 130.6E	35	313	-10					
150500Z	28.9N 129.9E	75	28.2N 128.8E	65	29	18	31.9N 125.8E	55	59	-15	37.1N 124.8E	48	238	5					
151000Z	29.8N 126.9E	75	29.7N 127.2E	65	17	-10	32.5N 124.1E	55	91	5									
160000Z	30.3N 126.1E	70	30.2N 126.1E	60	6	-10	33.6N 123.0E	45	156	0									
160500Z	32.0N 125.9E	65	31.3N 125.4E	55	18	-15	35.2N 122.8E	48	172	10									
161000Z	33.9N 124.9E	50	33.3N 125.5E	55	50	5													
170000Z	35.3N 125.4E	45	35.0N 126.1E	55	39	10													
170500Z	37.3N 125.2E	35	36.2N 126.9E	35	31	15													

TYPHOONS WHILE WIND OVER 35KTS

ALL FORECASTS

AVERAGE FORECAST ERROR	WARNING				ALL FORECASTS			
	24-HR	48-HR	72-HR		24-HR	48-HR	72-HR	
AVERAGE RIGHT ANGLE ERROR	16NM	14NM	26NM	32NM	16NM	14NM	26NM	32NM
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	1KTS	11KTS	14KTS	7KTS	1KTS	11KTS	14KTS
NUMBER OF FORECASTS	29	25	21	17	29	25	21	17

TYPHOON LULUISE

00004 3 SEP TO 0000Z 7 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		
				DST	WIND			DST	WIND			DST	WIND			DST	WIND	
030000Z	18.2N 121.7E	58	18.2N 121.9E	55	25	-5	21.2N 118.3E	75	176	30	20.5N 117.8E	35	363	35	---	---	---	---
031200Z	18.0N 119.2E	40	18.2N 119.9E	55	79	0	18.0N 117.8E	75	299	25	20.2N 115.9E	70	434	45	23.4N 114.7E	35	334	-25
040000Z	19.1N 119.4E	45	19.1N 119.0E	50	23	5	19.6N 116.6E	60	29	-5	20.6N 114.0E	65	102	-5	22.4N 112.1E	35	234	-25
040600Z	19.3N 118.7E	50	19.4N 118.9E	45	8	-5	20.2N 116.4E	60	81	10	21.5N 113.9E	65	157	0	23.4N 111.8E	30	314	-20
041200Z	19.5N 118.1E	50	19.8N 118.2E	50	19	0	21.5N 116.3E	65	159	10	23.4N 114.2E	45	265	110	---	---	---	---
041800Z	19.7N 117.2E	55	19.9N 117.2E	50	12	-5	21.1N 114.2E	70	86	-5	22.6N 111.7E	45	167	110	---	---	---	---
050000Z	19.9N 116.2E	65	19.8N 116.1E	60	30	-5	22.5N 112.6E	40	150	30	---	---	---	---	---	---	---	---
050600Z	19.9N 116.0E	65	19.9N 114.9E	70	30	0	22.4N 111.2E	85	113	20	21.8N 108.1E	45	90	-5	---	---	---	---
051200Z	19.8N 113.4E	75	19.9N 113.2E	80	8	5	20.2N 109.9E	95	45	25	---	---	---	---	---	---	---	---
060000Z	20.3N 112.7E	70	20.2N 112.4E	80	8	10	21.7N 109.3E	50	164	-10	---	---	---	---	---	---	---	---
061200Z	20.7N 109.4E	60	20.9N 109.8E	65	30	0	---	---	---	---	---	---	---	---	---	---	---	---
070000Z	20.9N 108.2E	60	21.2N 109.4E	55	11	-5	---	---	---	---	---	---	---	---	---	---	---	---
070600Z	20.8N 108.9E	50	21.2N 109.1E	55	26	-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	21NM	104NM	225NM	294NM	21NM	164NM	225NM	294NM
AVERAGE RIGHT ANGLE ERROR	14NM	71NM	180NM	173NM	14NM	71NM	180NM	173NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	16KTS	17KTS	23KTS	6KTS	16KTS	17KTS	23KTS
AVERAGE BIAS OF WIND ERROR	3KTS	6KTS	-17KTS	-23KTS	3KTS	6KTS	-17KTS	-23KTS
NUMBER OF FORECASTS	18	14	9	3	18	14	9	3

TYPHOON MARGE

00004 12 SEP TO 1800Z 14 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		
				DST	WIND			DST	WIND			DST	WIND			DST	WIND	
120000Z	17.7N 118.2E	30	17.9N 118.3E	35	29	-5	17.2N 115.1E	45	87	-15	19.8N 117.6E	65	159	25	---	---	---	---
121200Z	18.2N 113.4E	45	18.2N 113.9E	55	8	0	21.2N 112.9E	70	178	-10	22.2N 108.2E	45	302	-25	---	---	---	---
130000Z	18.6N 114.7E	60	18.8N 114.7E	60	12	0	20.8N 110.8E	70	111	10	---	---	---	---	---	---	---	---
131200Z	18.8N 112.4E	75	18.9N 112.5E	85	0	-10	20.2N 108.4E	50	93	10	---	---	---	---	---	---	---	---
131800Z	19.0N 111.8E	80	19.0N 111.1E	85	6	5	19.9N 106.8E	60	31	5	---	---	---	---	---	---	---	---
140000Z	19.2N 109.8E	60	19.4N 109.5E	65	21	5	---	---	---	---	---	---	---	---	---	---	---	---
140600Z	19.4N 108.8E	40	19.3N 108.2E	55	34	15	---	---	---	---	---	---	---	---	---	---	---	---
141200Z	19.5N 107.8E	50	19.6N 107.0E	55	45	5	---	---	---	---	---	---	---	---	---	---	---	---
141800Z	19.7N 106.3E	50	20.0N 105.8E	55	33	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	18NM	77NM	224NM	0NM	18NM	77NM	224NM	0NM
AVERAGE RIGHT ANGLE ERROR	10NM	67NM	166NM	0NM	10NM	67NM	166NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	11KTS	22KTS	0KTS	5KTS	11KTS	22KTS	0KTS
AVERAGE BIAS OF WIND ERROR	3KTS	-3KTS	-5KTS	0KTS	2KTS	-3KTS	-5KTS	0KTS
NUMBER OF FORECASTS	12	8	3	0	12	8	3	0

TYPHOON NURA

0000Z 2 OCT TO 0600Z 10 OCT

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST									
	POSIT	WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND								
020000Z	11.4N	135.3E	30	11.4N	135.3E	30	0	12.4N	132.7E	50	99	0	11.3N	127.0E	65	102	-25	11.8N	124.2E	65	107	-25
020600Z	11.4N	134.4E	30	11.7N	134.7E	30	19	13.1N	131.5E	50	143	-5	11.3N	127.0E	65	102	-25	11.8N	124.2E	65	107	-25
021200Z	11.4N	133.7E	48	11.3N	133.8E	45	25	12.6N	129.3E	80	166	10	13.7N	126.2E	85	321	10	13.7N	123.4E	100	321	10
030000Z	11.8N	133.6E	50	11.3N	133.5E	50	19	11.2N	131.5E	70	177	0	11.3N	127.0E	65	102	-25	11.8N	124.2E	65	107	-25
030600Z	11.8N	132.7E	50	11.3N	132.5E	50	19	11.3N	131.5E	70	177	0	11.3N	127.0E	65	102	-25	11.8N	124.2E	65	107	-25
031200Z	11.3N	131.9E	50	11.3N	132.1E	55	29	11.3N	130.0E	75	97	0	11.3N	127.0E	65	102	-25	11.7N	121.7E	50	128	-40
040000Z	11.4N	131.7E	70	11.1N	131.2E	75	34	11.4N	127.4E	100	227	10	11.6N	123.4E	70	310	-90	12.7N	119.0E	60	347	-60
040600Z	11.6N	131.9E	78	11.2N	131.5E	75	29	11.7N	129.8E	90	126	-10	13.0N	126.4E	110	168	-40	13.8N	122.6E	80	202	-40
041200Z	13.0N	131.7E	80	12.8N	131.1E	80	17	13.6N	128.9E	95	56	-50	13.5N	124.4E	110	100	-20	13.9N	120.9E	65	262	-75
050000Z	13.4N	130.7E	90	13.4N	130.6E	80	6	13.5N	127.6E	100	72	-60	13.6N	123.9E	90	121	-30	14.1N	119.9E	65	308	-75
050600Z	13.8N	130.1E	110	13.2N	129.9E	105	13	14.6N	126.3E	125	17	-25	14.7N	122.4E	120	125	5	15.4N	118.1E	75	393	-15
051200Z	14.2N	129.9E	125	14.2N	129.7E	130	12	15.5N	127.7E	125	128	-15	16.2N	124.7E	115	94	5	17.8N	121.1E	60	139	-15
051800Z	14.5N	128.6E	145	14.6N	128.7E	145	8	16.3N	125.8E	120	88	-10	17.4N	122.7E	115	34	15	18.8N	119.4E	65	113	-10
060000Z	14.7N	127.7E	160	14.8N	127.9E	150	13	16.8N	124.3E	145	13	25	16.6N	120.4E	90	139	0	17.7N	116.2E	90	247	-20
060600Z	14.8N	126.9E	150	14.8N	127.3E	155	40	18.2N	123.5E	140	66	75	15.8N	119.3E	90	241	10	16.9N	114.1E	60	365	-20
061200Z	14.8N	125.4E	140	14.9N	125.7E	145	8	19.4N	121.7E	120	126	10	16.2N	117.9E	80	269	5	16.7N	114.9E	90	406	-20
061800Z	15.1N	124.9E	130	14.9N	124.5E	140	26	20.9N	120.2E	90	208	-10	15.6N	116.4E	90	359	15	16.3N	113.3E	95	508	-30
070000Z	15.6N	124.2E	120	15.7N	124.2E	140	6	21.4N	121.4E	110	85	20	15.8N	118.7E	80	96	10	22.5N	116.9E	60	137	-25
070600Z	16.3N	123.4E	115	16.1N	123.4E	135	17	23.7N	120.8E	70	104	-10	20.1N	118.1E	80	110	10	23.5N	116.9E	65	161	-25
071200Z	17.1N	122.0E	110	17.2N	122.0E	125	6	26.0N	121.9E	100	74	25	25.0N	123.4E	85	275	15	26.4N	123.6E	85	317	-15
071800Z	18.0N	122.0E	100	18.1N	122.6E	125	8	27.9N	121.9E	100	130	25	25.4N	123.6E	85	317	15	26.4N	123.6E	85	317	-15
080000Z	18.8N	121.7E	90	18.7N	121.8E	95	8	31.1N	120.0E	80	25	10	23.3N	118.6E	70	47	5	26.4N	123.6E	85	317	-15
080600Z	19.5N	121.2E	95	19.3N	121.8E	95	11	33.5N	117.6E	90	101	-20	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
081200Z	20.4N	120.2E	75	20.8N	120.0E	65	26	33.0N	117.4E	45	88	-20	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
090000Z	20.8N	119.7E	70	20.8N	119.8E	70	6	34.9N	118.8E	75	127	10	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
090600Z	21.4N	118.7E	70	21.7N	118.3E	75	16	37.7N	118.0E	65	158	25	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
091200Z	22.9N	119.0E	65	23.0N	119.1E	75	8	40.0N	117.4E	45	88	-20	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
100000Z	24.0N	118.4E	65	23.8N	118.7E	70	20	42.0N	117.4E	45	88	-20	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15
100600Z	25.2N	117.7E	40	25.3N	117.7E	50	6	43.0N	117.4E	45	88	-20	23.6N	114.4E	35	213	-5	26.4N	123.6E	85	317	-15

TYPHOONS WHILE WIND OVER 35KTS					ALL FORECASTS				
AVERAGE FORECAST ERROR	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR	
1.7NM	17NM	104NM	192NM	267NM	17NM	104NM	192NM	267NM	
AVERAGE RIGHT ANGLE ERROR	10NM	77NM	156NM	218NM	10NM	77NM	156NM	218NM	
AVERAGE MAGNITUDE OF WIND ERROR	7KTS	14KTS	20KTS	38KTS	7KTS	14KTS	20KTS	38KTS	
AVERAGE BIAS OF WIND ERROR	3KTS	-1KTS	-9KTS	-22KTS	3KTS	-1KTS	-9KTS	-22KTS	
NUMBER OF FORECASTS	34	30	4	20	34	30	24	20	

TYPHOON OPAL

1200Z 4 OCT TO 0600Z 8 OCT

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST										
	POSIT	WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND									
041200Z	11.5N	113.2E	48	11.3N	113.8E	38	18	-10	12.5N	118.2E	50	87	-18	14.2N	108.5E	35	232	-55	14.2N	108.5E	35	232	-55
050000Z	12.2N	113.1E	45	12.7N	113.4E	45	18	0	14.5N	110.4E	65	117	-5	16.2N	107.1E	35	291	-40	16.2N	107.1E	35	291	-40
051200Z	12.8N	112.7E	68	13.1N	112.3E	60	13	-5	14.2N	111.7E	70	138	0	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
060000Z	13.2N	111.9E	70	13.1N	112.0E	70	8	0	13.5N	111.3E	85	48	10	14.6N	108.9E	65	18	20	14.6N	108.9E	65	18	20
060600Z	13.4N	112.4E	75	13.6N	111.8E	75	37	0	15.1N	110.9E	90	49	15	16.2N	107.1E	35	291	-40	16.2N	107.1E	35	291	-40
061200Z	13.6N	113.0E	70	13.9N	111.7E	75	76	5	15.3N	110.7E	90	60	20	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
061800Z	14.0N	112.5E	70	14.1N	112.7E	75	13	5	15.3N	111.7E	80	125	20	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
070000Z	14.2N	111.7E	75	14.3N	112.4E	75	41	0	15.8N	110.4E	80	125	35	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
070600Z	14.3N	111.1E	75	14.2N	110.7E	75	24	0	16.0N	110.4E	80	125	35	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
071200Z	14.3N	110.8E	70	14.2N	111.0E	75	8	5	16.0N	110.4E	80	125	35	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20
080000Z	14.3N	108.9E	45	14.2N	109.4E	65	30	20	16.0N	110.4E	80	125	35	16.4N	108.0E	30	181	-20	16.4N	108.0E	30	181	-20

TYPHOONS WHILE WIND OVER 35KTS					ALL FORECASTS				
AVERAGE FORECAST ERROR	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR	
2.6NM	12NM	62NM	89NM	0NM	2.6NM	12NM	62NM	89NM	0NM
AVERAGE RIGHT ANGLE ERROR	5KTS	12KTS	27KTS	0KTS	5KTS	12KTS	27KTS	0KTS	
AVERAGE MAGNITUDE OF WIND ERROR	1KTS	6KTS	-11KTS	0KTS	1KTS	6KTS	-11KTS	0KTS	
NUMBER OF FORECASTS	15	11	5	0	15	11	5	0	

TYPHOON PATSY

0600Z 6 OCT TO 0600Z 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		
060000Z	12.9N	142.1E	3p	13.2N	141.8E	35	14.0N	140.1E	45	15.3N	137.6E	55	16.9N	135.2E	75	18.3N	132.7E	90	203	
061000Z	12.9N	141.9E	3p	13.0N	142.6E	35	13.6N	140.8E	45	14.7N	138.7E	55	16.2N	136.2E	75	18.0N	134.0E	90	201	
061000Z	12.9N	141.7E	3p	13.1N	142.1E	35	13.4N	141.3E	45	14.2N	139.4E	55	15.4N	137.3E	75	17.0N	134.0E	90	202	
070000Z	12.9N	141.4E	3p	13.0N	141.2E	40	13.5N	139.5E	60	14.1N	137.4E	70	15.4N	135.2E	90	16.4N	132.7E	100	203	
070000Z	13.4N	140.4E	45	13.0N	140.7E	50	13.5N	138.5E	70	14.1N	136.0E	75	15.0N	134.0E	90	16.0N	132.7E	100	203	
071000Z	13.8N	140.4E	55	13.5N	140.2E	55	14.0N	138.2E	70	14.8N	136.3E	75	15.9N	134.0E	90	17.0N	131.0E	100	201	
071000Z	13.9N	139.5E	55	14.0N	139.6E	55	14.1N	137.3E	70	14.8N	134.4E	75	15.5N	131.0E	90	16.2N	129.1E	100	202	
080000Z	14.1N	138.4E	60	14.1N	138.7E	60	14.5N	135.5E	85	15.8N	132.3E	95	17.0N	129.1E	100	18.0N	126.7E	110	203	
080000Z	14.2N	138.2E	65	14.3N	138.9E	70	14.8N	135.2E	95	16.7N	132.1E	100	18.0N	128.8E	110	19.0N	126.7E	120	208	
081000Z	14.5N	137.6E	70	14.7N	137.7E	70	15.2N	134.3E	100	17.0N	130.2E	110	18.0N	128.8E	120	19.0N	126.7E	130	210	
081000Z	14.7N	136.9E	75	15.0N	137.0E	75	15.6N	134.1E	100	17.2N	129.9E	110	18.2N	128.8E	120	19.2N	126.7E	130	211	
090000Z	15.1N	135.9E	80	15.2N	135.7E	80	15.8N	132.5E	100	17.6N	130.2E	100	18.9N	128.0E	110	19.9N	126.0E	120	212	
090000Z	15.3N	134.9E	95	15.2N	135.9E	90	15.8N	132.6E	110	18.0N	130.2E	100	19.0N	128.0E	110	20.0N	126.0E	120	213	
091000Z	15.5N	133.7E	110	15.6N	133.7E	90	16.2N	129.5E	110	18.0N	127.9E	110	19.0N	126.0E	110	20.0N	124.0E	120	214	
091000Z	15.7N	132.9E	125	15.7N	132.8E	95	16.3N	129.3E	110	18.0N	127.0E	110	19.0N	125.0E	110	20.0N	123.0E	120	215	
100000Z	15.9N	131.7E	140	15.9N	131.7E	140	16.4N	128.1E	160	18.5N	125.6E	145	19.5N	123.0E	145	20.5N	121.0E	150	216	
100000Z	16.2N	130.4E	140	16.2N	130.5E	145	16.8N	128.8E	160	19.0N	123.7E	145	20.0N	121.0E	150	21.0N	119.0E	150	217	
101000Z	16.4N	129.4E	120	16.5N	129.5E	130	17.0N	128.2E	120	19.0N	123.7E	145	20.0N	121.0E	150	21.0N	119.0E	150	218	
101000Z	16.7N	128.1E	105	16.7N	128.0E	130	17.3N	126.6E	120	19.5N	123.7E	145	20.5N	121.0E	150	21.5N	117.0E	150	219	
110000Z	16.9N	126.7E	80	17.0N	126.6E	130	17.6N	125.1E	90	19.5N	123.7E	145	20.5N	121.0E	150	21.5N	117.0E	150	220	
110000Z	17.1N	125.4E	60	17.0N	125.3E	80	17.6N	123.8E	65	19.5N	123.7E	145	20.5N	121.0E	150	21.5N	117.0E	150	221	
120000Z	18.6N	122.5E	40	18.7N	122.8E	45	19.4N	120.9E	35	20.6N	117.7E	25	22.0N	115.5E	25	23.0N	113.0E	25	222	
120000Z	18.7N	120.4E	30	19.4N	120.9E	35	20.6N	117.7E	25	22.0N	115.5E	25	23.0N	113.0E	25	23.0N	113.0E	25	223	
121000Z	18.0N	118.0E	25	18.0N	119.0E	25	19.0N	117.0E	25	20.0N	115.0E	25	21.0N	113.0E	25	22.0N	111.0E	25	224	
131000Z	17.5N	112.1E	40	17.5N	112.0E	30	18.5N	110.0E	30	19.5N	108.0E	30	20.5N	106.0E	30	21.5N	104.0E	30	225	
131000Z	17.2N	111.0E	35	17.5N	109.6E	30	18.5N	107.6E	30	19.5N	105.6E	30	20.5N	103.6E	30	21.5N	101.6E	30	226	
140000Z	17.0N	109.9E	30	16.5N	109.4E	30	17.5N	107.4E	30	18.5N	105.4E	30	19.5N	103.4E	30	20.5N	101.4E	30	227	

TYPHOONS WHILE WIND OVER 35KTS

	WARNING				24-HR				48-HR				72-HR			
	14NM	37NM	122NM	170NM	24HR	24HR	48HR	72HR	24HR	24HR	48HR	72HR	24HR	24HR	48HR	72HR
AVERAGE FORECAST ERROR	29	22	21	17	29	22	21	17	29	22	21	17	29	22	21	17
AVERAGE NIGHT ANGLF ERROR																
AVERAGE MAGNITUDE OF WIND ERROR	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS
AVERAGE BIAS OF WIND ERROR																
NUM-FR OF FORECASTS	29	22	21	17	29	22	21	17	29	22	21	17	29	22	21	17

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	14NM	37NM	122NM	170NM	24HR	24HR	48HR	72HR	24HR	24HR	48HR	72HR	24HR	24HR	48HR	72HR
AVERAGE FORECAST ERROR	29	22	21	17	29	22	21	17	29	22	21	17	29	22	21	17
AVERAGE NIGHT ANGLF ERROR																
AVERAGE MAGNITUDE OF WIND ERROR	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS	2KTS	10KTS	30KTS	42KTS
AVERAGE BIAS OF WIND ERROR																
NUM-FR OF FORECASTS	29	22	21	17	29	22	21	17	29	22	21	17	29	22	21	17

TYPHOON RUTH

1200Z 11 OCT TO 1200Z 19 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		
111000Z	12.2N	139.5E	3p	12.3N	139.8E	35	13.5N	137.8E	55	14.8N	135.8E	75	16.2N	133.7E	90	17.6N	131.6E	100	190	
120000Z	13.0N	137.9E	4p	12.7N	137.2E	45	13.2N	136.8E	65	14.2N	134.8E	85	15.2N	132.8E	105	16.2N	130.8E	125	180	
121000Z	13.3N	136.9E	4p	13.2N	136.8E	50	13.8N	135.8E	70	14.8N	133.8E	90	15.8N	131.8E	110	16.8N	129.8E	130	195	
121000Z	13.1N	133.4E	5p	13.0N	134.0E	45	13.6N	133.0E	65	14.6N	131.0E	85	15.6N	129.0E	105	16.6N	127.0E	125	185	
130000Z	12.9N	132.7E	5p	13.0N	132.2E	50	13.7N	126.9E	65	14.7N	124.9E	85	15.7N	122.9E	105	16.7N	120.9E	125	190	
130000Z	13.9N	130.4E	6p	13.8N	130.3E	70	14.5N	129.3E	90	15.5N	127.3E	110	16.5N	125.3E	130	17.5N	123.3E	150	200	
131000Z	13.7N	129.4E	5p	13.5N	130.0E	65	14.2N	126.4E	75	15.2N	124.4E	95	16.2N	122.4E	115	17.2N	120.4E	135	205	
140000Z	14.0N	128.7E	5p	14.2N	128.5E	65	14.9N	124.4E	80	15.9N	122.4E	100	16.9N	120.4E	120	17.9N	118.4E	140	210	
140000Z	14.2N	127.4E	5p	14.3N	127.4E	65	15.0N	123.4E	80	16.0N	121.4E	100	17.0N	119.4E	120	18.0N	117.4E	140	215	
141000Z	14.4N	125.4E	6p	14.4N	125.4E	65	15.2N	121.4E	85	16.2N	119.4E	105	17.2N	117.4E	125	18.2N	115.4E	145	220	
150000Z	14.6N	124.4E	7p	14.4N	124.7E	65	15.1N	120.7E	85	16.1N	118.7E	105	17.1N	116.7E	125	18.1N	114.7E	145	225	
150000Z	14.9N	123.7E	8p	14.9N	123.3E	75	15.8N	118.8E	95	16.8N	116.8E	115	17.8N	114.8E	135	18.8N	112.8E	155	230	
151000Z	15.5N	122.1E	8p	15.4N	122.4E	80	16.3N	116.1E	100	17.3N	114.1E	120	18.3N	112.1E	140	19.3N	110.1E	160	235	
151000Z	15.9N	120.4E	5p	16.0N	120.4E	65	16.9N	116.0E	85	17.9N	114.0E	105	18.9N	112.0E	125	19.9N	110.0E	145	240	
160000Z	15.9N	119.0E	6p	15.8N	119.1E	65	16.7N	115.9E	85	17.7N	113.9E	105	18.7N	111.9E	125	19.7N	109.9E	145	245	
160000Z	16.3N	118.0E	6p	16.2N	117.9E	70	17.0N	113.9E	90	18.0N	111.9E	110	19.0N	109.9E	130	20.0N	107.9E	150	250	
161000Z	16.4N	116.9E	6p	16.7N	116.0E	70	17.6N	112.9E	90	18.6N	110.9E	110	19.6N	108.9E	130	20.6N	106.9E	150	255	
170000Z	16.8N	114.5E	8p	16.8N	114.															

ANNEX A

SUMMARY OF TROPICAL CYCLONES IN THE CENTRAL NORTH PACIFIC

1. GENERAL RESUME

Fleet Weather Central, Pearl Harbor, issued warnings on two tropical cyclones in 1973 for the Central Pacific as shown in Table A-1. Warnings were coordinated with the Central Pacific Hurricane Center, Honolulu, and the Eastern Pacific Hurricane Center, San Francisco, in accordance with the National Hurricane Operations Plan.

TABLE A-1. COMPARISON OF CENTRAL PACIFIC ANNUAL WARNING AND CLIMATOLOGY DATA

	1969	1970	1971	1972	1973
TOTAL NUMBER OF WARNINGS	0	27	19	76	43
CALENDAR DAYS OF WARNING	0	8	8	21	13
TROPICAL DEPRESSIONS	0	1	1	0	1
TROPICAL STORMS	0	1	1	3	0
HURRICANES	0	1	1	1	1
TOTAL	0	3	3	4	2

2. INDIVIDUAL CASES ¹

Two tropical cyclones entered the Central Pacific from the east during 1973. Both Doreen and Katherine were fully developed hurricanes in the Eastern North Pacific before crossing 140°W longitude. Only Doreen was still of hurricane intensity upon entering the Central North Pacific.

Doreen, the first hurricane of the year to invade the Central North Pacific, was first located on 16 July by weather satellite near 10°N 101°W over the warm waters off Panama. Throughout her life cycle, Doreen followed a path strikingly similar to that of Hurricane Celeste of August 1972.

The small storm rapidly intensified to hurricane strength as she moved westnorthwestward toward Hawaii. On the ninth day after detection, about 800 miles southeast of Hawaii, Doreen weakened to a tropical storm, turned to the southwest, and decelerated.

On the afternoon of the 27th, the 144-foot Greek ship, CORNELIA, sailed into the storm's path and sent out an emergency call for help when it lost its rudder while being lashed by 50 kt winds and 35-foot waves. A sea level pressure of 971mb was

reported. The ship managed to clear the storm and continued to Panama after deciding not to return to Honolulu with Coast Guard assistance.

After the slowdown, Doreen accelerated toward the westnorthwest attaining 85kt winds near her center. She passed 300 miles southsouthwest of South Point, Hawaii on the afternoon of the 30th.

On the afternoon of the 29th, nine-foot ocean swells and three and a half foot surf generated by Doreen were observed at Kapoho, the easternmost town on the island of Hawaii.

On the afternoon of 1 August, a weak Doreen passed 100 miles north of Johnston Island. Doreen dissipated under an upper trough two days later as she crossed the International Date Line. No damage was incurred at Hawaii or Johnston Island.

Beginning as a weak cloud circulation seen by weather satellite on 28 September, Katherine, the second and last Central North Pacific storm of 1973, developed over the warm waters off Panama in the same area as Doreen. However, Katherine did not follow the same path. She moved towards the northwest, intensifying to hurricane strength on 1 October, but then curved to the southwest between 120 and 125°E longitude.

Weakening to tropical storm strength, Katherine turned to the southwest on the 3rd. By the 6th, she began to follow a more westerly course near 13°N 130°W, dissipating a few days later 600 miles east-southeast of the island of Hawaii under a cold upper trough.

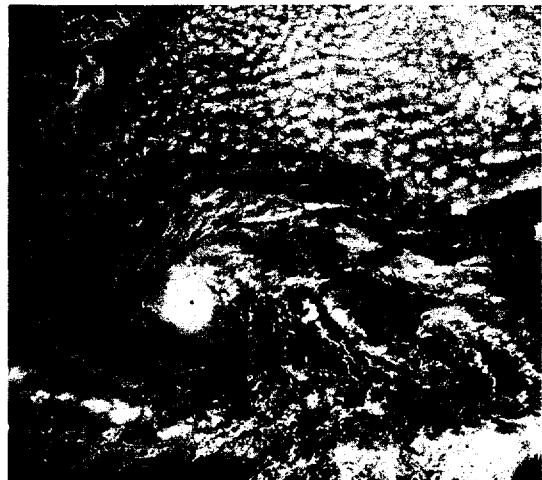
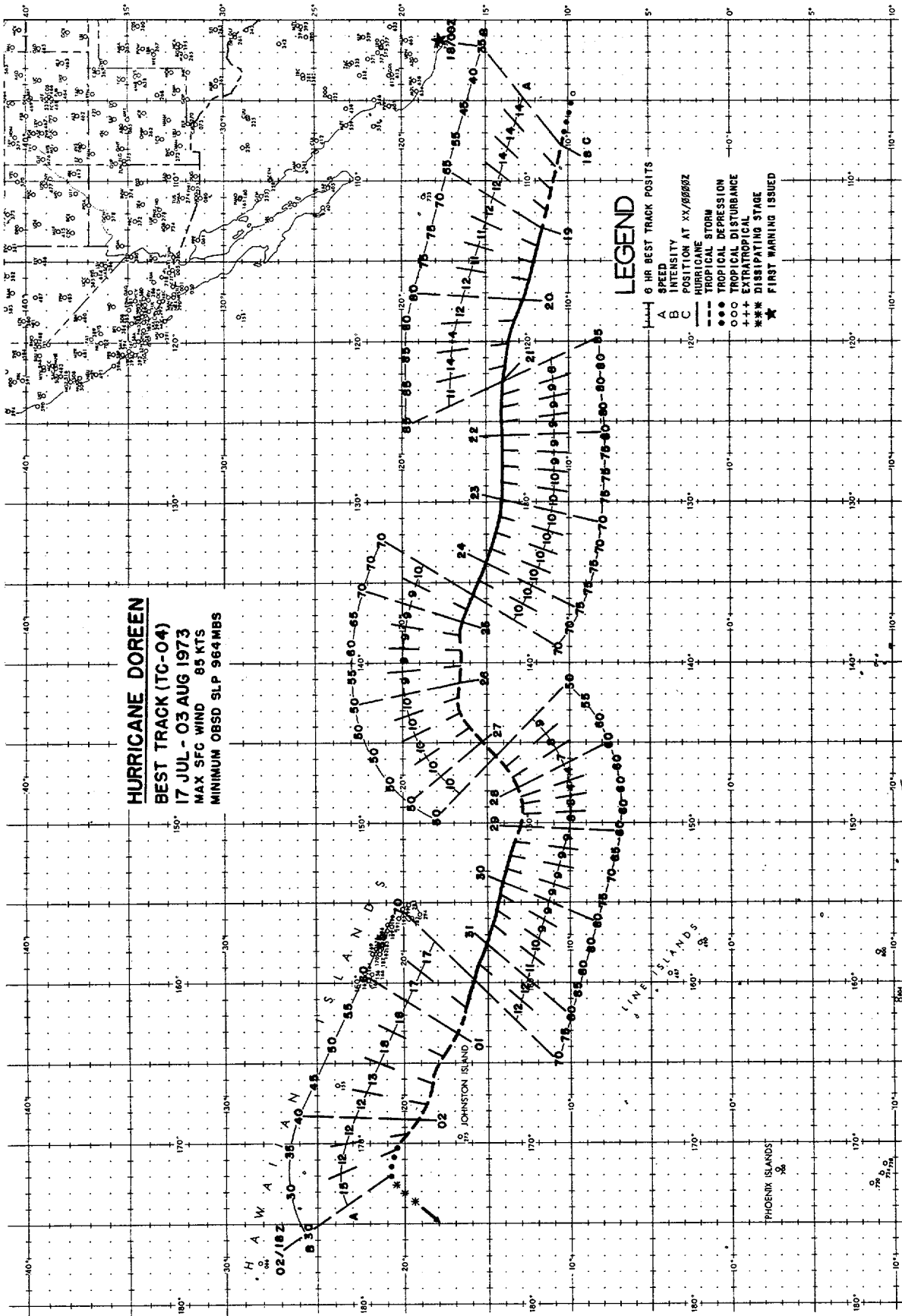
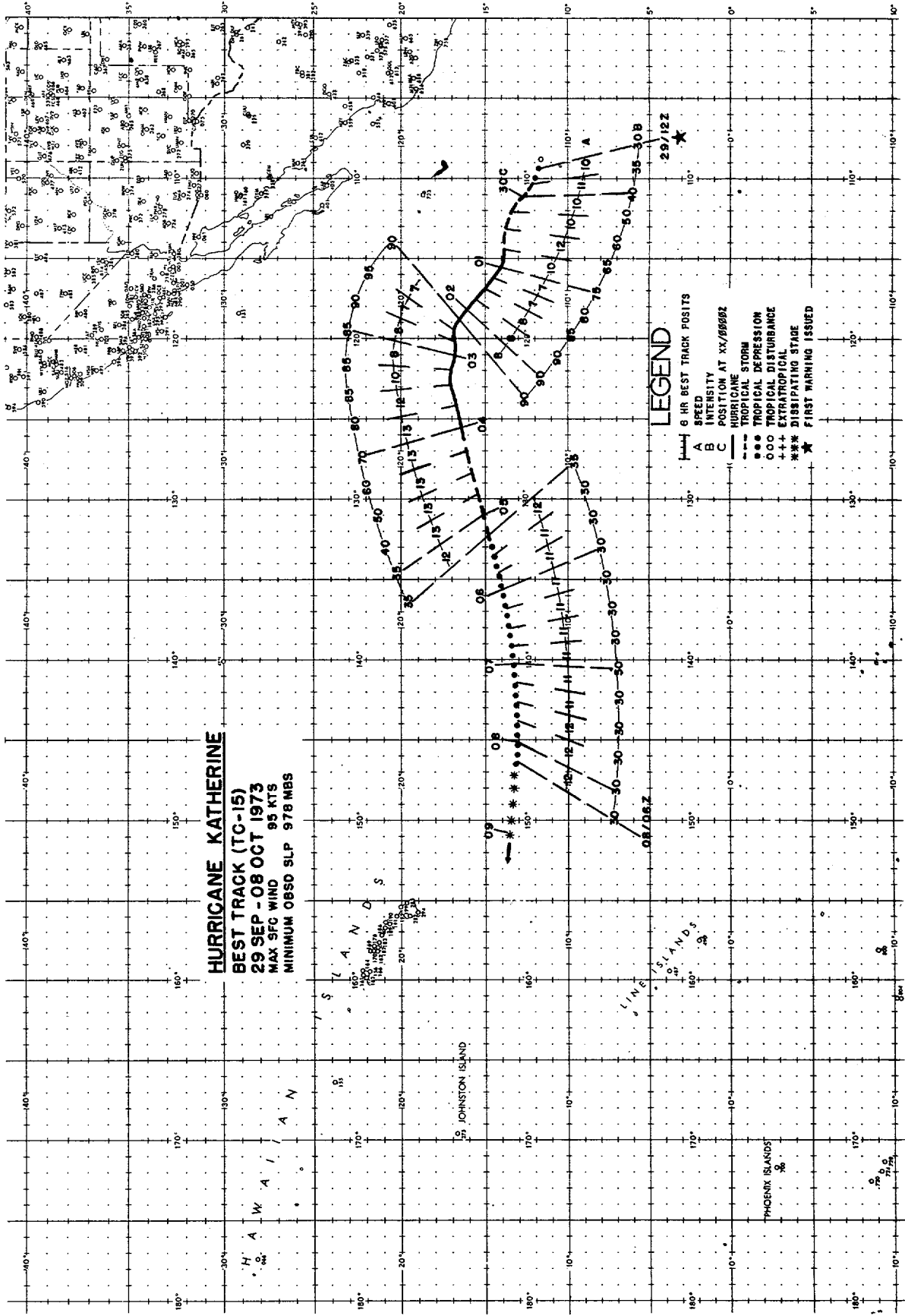


FIGURE A-1. Tropical Storm Doreen, 28 July 1973, 2149 GMT. (DMSP imagery)

¹Report submitted by Meteorologist in Charge, NWS Forecast Office, Honolulu, Hawaii.

3. HURRICANE TRACKS





4. CENTER FIX DATA - HURRICANES

HURRICANE DOREEN
FIX POSITIONS FOR CYCLONE NO. 4
0600Z 18 JUL TO 0000Z 03 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVI	FLT DIR	LVL VET	WIND BRG	RNG	MAX OBS SFC WIND VEL	MAX OBS WIND BRG	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/T0	EYE FORM	ORLEN- TATION	EYE DIA	POSIT OF RADAR	MSW NMBR	
1	171059Z	10.4N 125.0E	SAT							NUN	DAPP									
2	181559Z	11.2N 111.5E	SAT							NUN	DAPP									
3	181653Z	12.6N 116.5E	SAT							NUN	DAPP									
4	201737Z	14.1N 121.5E	P	10	5	700	90	102	340	70	120	300	30	972	285	15	8	CIRC	20	1
5	201747Z	14.0N 122.2E	SAT							NUN	DAPP									
6	202024Z	14.3N 121.0E	P	15	5	700	10	95	330	10	60	330	45	968	283	17	7	CIRC	23	2
7	211647Z	14.0N 125.5E	SAT							NUN	DAPP									
8	211906Z	14.1N 125.2E	P	5	5	700	50	90	310	18	80	310	818	968	281	10	9	ELIP	SE-NW 15x 5	3
9	221741Z	14.4N 129.6E	SAT							NUN	DAPP									
10	231007Z	14.4N 131.8E	SAT							PCN 1	DAPP									
11	231836Z	14.4N 133.8E	SAT							(14.5/4.5 /00.5/25HRS)	NUN	DAPP								
12	241737Z	15.7N 135.5E	SAT							NUN	DAPP									
13	241737Z	15.7N 135.5E	SAT							NUN	DAPP									
14	242106Z	15.4N 137.0E	SAT							(14.5/4.5 / / HRS)	PCN 1	DAPP								
15	250930Z	16.7N 138.9E	SAT							PCN 1	DAPP									
16	251830Z	16.4N 140.2E	SAT							(13.5/4.5 /W1.0/25HRS)	NUN	DAPP								
17	251830Z	16.4N 140.2E	SAT							(13.5/4.5 /W1.0/25HRS)	NUN	DAPP								
18	260923Z	16.4N 143.2E	SAT							PCN 1	DAPP									
19	261927Z	15.4N 144.6E	SAT							(11.5/3.5 /S /25HRS)	NUN	DAPP								
20	262218Z	15.4N 144.8E	SAT							(12.5/2.5 /S1.0/24HRS)	PCN 1	DAPP								
21	271051Z	14.2N 146.2E	SAT							PCN 1	DAPP									
22	271827Z	13.4N 147.3E	SAT							(14.0/4.0 /D0.5/23HRS)	NUN	DAPP								
23	281724Z	13.0N 152.4E	SAT							NUN	DAPP									
24	281730Z	13.0N 152.4E	P	5	2	700	40	350	260	12	80	50	8	967	280	10	10	CIRC	12	4
25	291824Z	13.7N 152.4E	SAT							(14.0/4.0 /S /23HRS)	NUN	DAPP								
26	301830Z	14.4N 156.4E	P	10	2	700	40	78	300	12	85	90	3	962	278	20	11	CIRC	10	5
27	301918Z	14.4N 156.4E	SAT							(14.0/4.0 /W /25HRS)	NUN	DAPP								
28	302900Z	15.0N 157.6E	SAT							(14.5/5.5 /W1.0/24HRS)	PCN 1	DAPP								
29	311136Z	15.4N 160.0E	SAT							PCN 1	DAPP									
30	312045Z	16.4N 162.0E	P	10	5	700	180	70	90	4	65	90	6	994	301	10	9	CIRC	20	6
31	011120Z	18.0N 162.0E	SAT							PCN 1	DAPP									
32	011600Z	18.0N 162.0E	SAT							(12.0/3.0 /W1.0/24HRS)	NUN	DAPP								
33	021939Z	20.3N 172.4E	SAT							(12.0/2.0 /S /23HRS)	NUN	DAPP								

HURRICANE KATHERINE
FIX POSITIONS FOR CYCLONE NO. 15
0600Z 30 SEP TO 1800Z 08 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVI	FLT DIR	LVL VET	WIND BRG	RNG	MAX OBS SFC WIND VEL	MAX OBS WIND BRG	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/T0	EYE FORM	ORLEN- TATION	EYE DIA	POSIT OF RADAR	MSW NMBR	
1	291559Z	12.0N 110.2E	SAT							NUN	DAPP									
2	300943Z	13.4N 113.0E	SAT							PCN 1	DAPP									
3	301853Z	13.4N 114.4E	SAT							NUN	DAPP									
4	301945Z	14.0N 115.4E	SAT							PCN 1	DAPP									
5	301948Z	14.1N 114.4E	P	5	3	700	340	70	330	40	40	330	20	978	290	14	12	CIRC	20	1
6	011957Z	15.2N 117.2E	SAT							PCN 1	DAPP									
7	011743Z	15.4N 117.2E	SAT							NUN	DAPP									
8	021539Z	16.9N 119.0E	SAT							PCN 1	DAPP									
9	022103Z	16.4N 120.4E	SAT							(15.0/5.5 / / HRS)	PCN 1	DAPP								
10	022103Z	16.4N 120.5E	SAT							(15.0/5.0 / 0.5/ HRS)	PCN 1	DAPP								
11	031707Z	16.4N 124.0E	SAT							PCN 1	DAPP									
12	031737Z	16.4N 124.4E	SAT							NUN	DAPP									
13	051736Z	14.1N 134.5E	SAT							NUN	DAPP									
14	080606Z	13.2N 146.4E	SAT							(12.0/2.5 /W0.5/24HRS)	PCN 1	DAPP								
15	082459Z	13.4N 150.4E	SAT							(11.5/2.0 /W0.5/22HRS)	PCN 1	DAPP								

5. POSITION AND VERIFICATION DATA - HURRICANES

HURRICANE DOREEN

1800Z 17 JUN TO 0000Z 3 AUG

	BEST TRACK		WARNING		24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST					
	POSIT	WIND	POSIT	WIND	ERRORS OST WIND	POSIT	WIND	ERRORS OST WIND	POSIT	WIND	ERRORS OST WIND	POSIT	WIND	ERRORS OST WIND	POSIT	WIND	ERRORS OST WIND	
171800Z	10.1N 106.2W	30	9.0N 105.0W	30	97	0	9.0N 109.0W	35	211	-20	---	---	---	---	---	---	---	
180000Z	10.3N 107.7W	35	10.5N 107.0W	40	43	5	11.4N 113.7W	60	71	-5	12.3N 116.3W	75	86	-5	13.0N 121.0W	75	110	-10
180600Z	10.6N 109.0W	40	10.7N 108.1W	45	53	5	11.5N 113.0W	60	63	-5	12.5N 117.3W	75	84	-5	13.0N 122.0W	75	105	-10
181200Z	10.9N 110.4W	45	11.1N 110.9W	55	26	10	11.7N 116.4W	65	75	-10	11.8N 120.0W	75	114	-10	12.2N 125.5W	75	130	-5
181800Z	11.2N 111.4W	55	11.0N 111.3W	60	32	5	11.3N 116.4W	80	72	-5	11.6N 121.0W	85	143	-10	11.8N 127.0W	85	170	-5
190000Z	11.6N 112.9W	65	11.6N 112.3W	65	35	0	12.5N 117.0W	80	34	0	13.5N 127.0W	100	50	15	14.0N 127.0W	100	64	20
190600Z	11.9N 114.0W	70	12.0N 113.5W	70	30	0	12.8N 118.0W	90	52	10	13.5N 123.0W	100	43	15	14.3N 128.0W	100	72	25
191200Z	12.1N 115.1W	75	12.2N 114.7W	100	24	25	13.0N 119.3W	100	63	15	13.8N 124.0W	90	21	10	14.6N 128.7W	80	63	5
191800Z	12.5N 116.7W	75	12.6N 116.1W	100	13	25	14.0N 121.4W	100	12	15	15.3N 124.0W	85	112	5	16.7N 131.6W	75	230	0
200000Z	12.8N 117.4W	80	13.0N 117.4W	100	13	20	14.2N 122.7W	100	8	15	15.5N 127.0W	85	142	5	16.8N 133.0W	75	245	5
200600Z	13.2N 118.4W	80	13.2N 118.7W	100	6	20	14.4N 123.9W	100	34	15	15.8N 124.0W	85	166	10	17.1N 134.1W	75	257	5
201200Z	13.7N 120.1W	85	13.5N 120.9W	100	13	15	14.7N 125.2W	100	68	20	16.1N 130.3W	80	191	5	17.5N 137.5W	60	274	-10
201800Z	14.0N 121.4W	85	14.1N 121.3W	100	18	35	15.5N 126.5W	100	116	20	16.5N 133.0W	80	205	5	17.5N 137.5W	60	260	-10
210000Z	14.1N 122.4W	85	14.5N 122.6W	110	24	25	16.0N 127.5W	90	151	10	17.2N 133.5W	75	242	5	18.5N 137.5W	60	289	-15
210600Z	14.1N 123.4W	85	14.7N 123.7W	90	40	5	16.1N 128.7W	60	152	-15	17.3N 132.5W	50	223	-20	18.6N 139.0W	40	242	-30
211200Z	14.1N 125.1W	80	14.6N 125.0W	80	30	0	15.0N 130.0W	60	92	-15	15.5N 134.0W	40	79	-15	15.5N 138.2W	30	91	-40
220000Z	14.0N 125.9W	80	14.6N 126.3W	80	43	0	15.0N 130.6W	55	71	-15	15.5N 136.5W	45	91	-20	15.7N 139.7W	35	126	-35
220600Z	14.0N 126.4W	75	14.5N 127.5W	80	50	5	14.7N 131.7W	50	60	-20	15.0N 136.0W	40	64	-20	15.0N 140.5W	35	163	-30
221200Z	14.0N 127.4W	75	14.8N 128.5W	75	54	0	14.8N 133.3W	50	49	-25	15.0N 137.0W	40	81	-20	15.0N 141.5W	35	162	-30
221800Z	14.0N 128.4W	75	14.8N 129.1W	65	51	-10	15.3N 133.3W	50	39	-25	15.5N 137.0W	40	55	-20	16.0N 141.5W	35	178	-20
230000Z	14.1N 129.4W	70	15.2N 130.2W	65	70	-5	16.4N 134.0W	50	84	-25	17.6N 137.0W	50	78	-20	18.8N 141.7W	40	134	-10
230600Z	14.2N 130.4W	70	15.3N 132.0W	65	80	-10	16.5N 134.7W	50	173	-20	18.3N 142.0W	50	104	-30	18.3N 142.0W	30	186	-30
231200Z	14.7N 132.9W	75	14.8N 132.7W	60	13	-15	15.0N 136.0W	50	72	-20	15.0N 136.0W	40	121	-15	15.0N 142.5W	30	117	-20
240000Z	15.0N 134.0W	75	14.9N 134.8W	60	47	-15	14.9N 138.8W	60	108	-10	14.9N 142.8W	55	137	5	14.9N 146.8W	45	100	-5
240600Z	15.4N 134.9W	70	15.0N 134.5W	65	33	-5	15.0N 137.5W	65	104	0	15.0N 136.5W	60	190	10	15.0N 141.5W	60	251	10
241200Z	15.7N 135.9W	70	15.0N 135.0W	65	62	-5	15.0N 137.0W	65	167	5	15.0N 136.0W	60	265	5	15.0N 141.0W	60	325	5
241800Z	16.0N 136.7W	70	15.8N 136.7W	55	12	-15	16.6N 141.0W	45	40	-10	17.0N 142.5W	40	122	-10	17.0N 144.0W	35	283	-25
250000Z	16.3N 137.4W	70	15.8N 137.5W	70	30	0	16.3N 141.4W	70	21	20	17.0N 146.3W	65	104	15	17.7N 149.4W	65	288	5
250600Z	16.7N 138.2W	65	16.8N 138.0W	70	30	5	16.7N 143.0W	65	23	10	17.3N 145.0W	60	117	10	18.0N 152.7W	60	302	0
251200Z	16.6N 140.1W	55	17.0N 140.1W	55	26	0	18.5N 144.1W	40	156	-10	19.5N 147.0W	35	366	-25	20.8N 151.0W	30	479	-30
260000Z	16.6N 141.2W	50	16.6N 141.1W	50	6	0	17.7N 145.1W	40	149	-10	18.7N 148.8W	35	338	-25	20.0N 152.3W	30	433	-30
260600Z	16.7N 142.3W	50	16.8N 142.0W	50	18	0	17.0N 147.2W	35	292	-15	18.0N 149.9W	30	491	-20	20.0N 153.4W	30	569	-45
261200Z	16.5N 143.3W	50	16.8N 143.9W	50	15	0	18.0N 148.6W	35	286	-25	19.7N 155.4W	25	437	-25	20.5N 153.4W	30	569	-45
261800Z	15.9N 144.3W	50	17.0N 144.5W	45	67	-5	18.0N 148.6W	35	286	-25	19.7N 155.4W	25	437	-25	20.5N 153.4W	30	569	-45
270000Z	15.2N 145.1W	50	15.5N 145.2W	40	19	-10	15.5N 149.3W	40	165	-20	16.3N 154.5W	35	270	-25	16.9N 157.6W	35	284	-45
270600Z	15.4N 146.9W	50	15.5N 146.2W	40	70	-10	15.8N 150.5W	40	215	-20	16.5N 154.6W	35	274	-20	17.1N 158.8W	35	297	-45
271200Z	13.4N 147.7W	60	13.7N 147.3W	40	12	-15	13.4N 150.6W	40	116	-20	14.3N 154.7W	35	162	-35	14.4N 158.8W	35	203	-45
271800Z	13.4N 147.7W	60	13.7N 147.3W	40	19	-20	13.3N 151.6W	40	119	-20	13.3N 156.9W	40	182	-45	14.0N 160.0W	40	201	-45
280000Z	13.1N 147.9W	60	13.3N 148.0W	75	13	15	13.3N 152.2W	85	112	25	13.3N 154.3W	85	157	5	13.9N 160.5W	75	162	-5
280600Z	12.9N 148.7W	60	13.3N 149.0W	75	47	15	13.3N 153.2W	85	116	20	13.4N 157.4W	85	169	5	14.0N 161.5W	75	172	-5
281200Z	12.8N 148.7W	60	12.7N 148.8W	75	8	15	12.5N 153.0W	85	80	15	12.8N 157.2W	85	146	5	13.5N 161.3W	75	159	-5
281800Z	12.9N 149.6W	60	12.5N 149.7W	75	25	15	12.5N 153.1W	85	80	15	12.7N 154.5W	85	120	0	13.3N 159.7W	75	211	25
290000Z	13.0N 150.3W	60	13.0N 150.3W	90	0	30	13.6N 153.7W	90	24	10	14.5N 157.0W	90	55	10	15.6N 160.2W	90	186	30
290600Z	13.3N 151.2W	65	13.1N 151.2W	90	12	25	13.7N 154.6W	90	30	10	14.8N 157.9W	90	68	15	15.7N 161.2W	90	281	30
291200Z	13.8N 152.4W	70	13.2N 152.5W	100	37	20	14.1N 155.4W	100	47	20	15.3N 162.8W	100	123	20	16.8N 169.2W	100	313	50
300000Z	14.0N 153.7W	80	13.9N 153.2W	100	30	20	15.4N 156.6W	100	73	20	16.9N 159.9W	100	189	40	18.4N 163.5W	100	296	60
300600Z	14.2N 154.6W	80	14.2N 154.0W	100	35	20	15.4N 157.1W	100	104	25	16.7N 164.2W	100	262	45	17.9N 163.3W	100	374	65
301200Z	14.5N 155.4W	80	14.4N 155.8W	90	24	10	15.4N 159.8W	90	25	20	16.3N 164.8W	80	178	40	17.2N 163.8W	80	245	60
301800Z	14.7N 156.4W	85	14.5N 156.8W	90	17	5	15.6N 160.9W	90	63	25	16.6N 164.9W	90	183	45	17.5N 169.0W	90	255	60
310000Z	15.0N 157.4W	80	15.1N 157.8W	75	6	-5	16.8N 162.1W	65	63	5	18.5N 164.3W	60	139	20	20.2N 170.6W	55	169	30
310600Z	15.4N 158.3W	75	15.5N 158.9W	75	6	0	17.2N 163.2W	65	89	10	18.9N 167.4W	60	125	25	20.5N 171.0W	55	172	-5
311200Z	15.8N 159.3W	70	15.8N 160.1W	75	11	0	17.2N 164.3W	70	124	20	18.6N 168.6W	60	152	30	20.5N 171.0W	55	172	-5
311800Z	16.2N 161.4W	65	16.3N 161.4W	75	24	10	17.9N 166.2W	65	80	20	19.6N 171.0W	60	86	40	20.5N 171.0W	55	172	-5
010000Z	16.8N 163.7W	60	16.8N 163.1W	65	6	5	18.7N 169.1W	65	29	25	20.6N 174.2W	55	116	30	20.5N 171.0W	55	172	-5
010600Z	17.0N 164.7W	55	17.3N 164.6W	65	19	10	19.1N 170.6W	65	70	30	20.6N 174.2W	55	116	30	20.5N 171.0W	55	172	-5
011200Z	18.2N 169.2W	50	18.3N 168.2W	60	5	10	19.4N 172.8W	50	109	20	20.6N 174.2W	55						

HURRICANE KATHERINE

1200Z 29 SEP TU 1800Z 8 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					
291200Z	11.8N	109.4W	30	11.7N	110.0W	30	13.4N	113.6W	30	33	-30	17.4N	114.0W	60	150	-30	21.2N	116.3W	50	343	-40		
291800Z	12.1N	110.2W	35	11.8N	110.6W	40	29	5	14.0N	113.9W	60	47	-5	17.4N	114.0W	60	220	-30	23.0N	116.3W	60	453	-25
300000Z	12.8N	111.3W	40	12.1N	111.2W	45	42	5	15.0N	115.0W	65	61	-10	19.4N	114.5W	60	220	-30	23.0N	116.3W	60	453	-25
300600Z	13.3N	112.2W	50	13.1N	112.1W	50	17	-10	16.2N	115.4W	70	104	-10	19.8N	115.5W	75	256	-15	23.5N	115.3W	60	530	-25
301200Z	13.8N	113.2W	50	13.6N	113.0W	50	17	-10	16.2N	115.4W	70	129	-25	20.7N	115.5W	55	313	-40	23.7N	115.9W	60	641	-25
301800Z	13.9N	114.7W	65	13.9N	114.8W	60	6	-5	15.3N	119.5W	55	104	-35	16.5N	124.2W	50	230	-40	16.8N	129.3W	45	292	-35
010000Z	14.1N	115.5W	75	14.3N	116.0W	60	31	-15	15.5N	120.7W	75	148	-15	16.4N	125.0W	70	259	-15	16.6N	130.5W	65	275	-5
010600Z	14.7N	116.2W	80	14.6N	116.3W	70	8	-10	15.8N	120.4W	75	98	-15	16.3N	124.8W	70	171	-15	16.8N	129.0W	65	115	5
011200Z	15.0N	117.9W	85	15.3N	118.5W	70	24	-10	17.1N	120.2W	80	200	-25	18.5N	127.3W	95	231	-20	22.0N	129.5W	60	456	10
011800Z	15.5N	117.7W	90	15.3N	117.3W	80	26	-10	17.1N	120.2W	80	200	-25	18.5N	127.3W	95	231	-20	22.0N	129.5W	60	456	10
020000Z	16.1N	118.2W	90	16.0N	118.0W	85	13	-5	18.5N	120.0W	75	114	-10	21.5N	121.5W	60	386	-10	25.0N	122.0W	40	777	5
020600Z	16.6N	118.9W	90	16.2N	118.8W	85	25	-5	18.0N	122.5W	80	99	-5	19.5N	124.5W	65	330	25	20.5N	129.5W	45	254	10
021200Z	16.9N	119.4W	95	16.0N	118.5W	85	25	-5	18.0N	122.5W	80	99	-5	19.5N	124.5W	65	330	25	20.5N	129.5W	45	254	10
021800Z	16.8N	120.7W	90	16.5N	120.3W	85	19	-5	18.0N	123.0W	75	99	-5	19.3N	124.7W	60	330	40	21.0N	129.0W	50	512	20
030000Z	16.9N	121.1W	95	17.1N	120.9W	80	17	-5	18.5N	124.0W	55	158	-15	20.0N	127.0W	40	371	5	21.0N	130.5W	30	510	0
030600Z	17.0N	121.9W	95	17.3N	121.5W	75	29	-10	18.8N	124.7W	50	207	-10	20.3N	124.0W	40	406	25	21.5N	131.5W	30	553	0
031200Z	17.0N	122.9W	95	17.7N	122.4W	75	51	-10	19.0N	125.4W	55	261	5	19.9N	124.7W	45	424	15	20.0N	132.0W	30	518	0
031800Z	16.8N	124.2W	80	16.8N	124.7W	65	29	-15	15.9N	129.1W	55	50	15	15.2N	131.5W	50	83	20	14.6N	138.0W	45	96	15
040000Z	16.4N	125.7W	70	16.6N	125.7W	65	12	-5	15.7N	130.0W	55	68	20	15.0N	135.0W	50	76	20	14.0N	139.0W	45	86	15
040600Z	16.2N	127.1W	60	16.4N	127.0W	60	13	0	15.5N	132.0W	45	43	10	15.0N	137.0W	40	72	10	14.5N	142.0W	40	83	10
041200Z	15.7N	128.4W	50	16.1N	128.2W	55	27	5	15.2N	133.3W	40	48	10	14.2N	134.2W	30	43	0	13.5N	143.2W	25	29	-5
041800Z	15.4N	129.4W	40	15.7N	129.7W	55	19	15	15.0N	135.5W	40	75	10	17.0N	141.0W	35	241	5	20.0N	146.0W	35	429	-5
050000Z	15.1N	131.0W	35	15.7N	129.9W	50	73	15	15.0N	137.0W	40	92	10	17.5N	142.0W	35	269	5	20.5N	147.0W	30	455	0
050600Z	14.8N	132.2W	35	15.2N	132.0W	50	27	15	15.0N	137.5W	45	80	15	17.0N	142.0W	40	229	40	19.0N	146.0W	35	347	5
051200Z	14.4N	133.4W	30	15.3N	132.2W	50	88	20	14.9N	138.7W	45	93	15	15.5N	143.0W	40	145	10	18.0N	147.7W	35	281	10
051800Z	14.2N	134.5W	30	14.2N	134.5W	50	0	20	13.0N	138.3W	40	52	10	12.0N	142.2W	40	119	10	15.4N	162.3W	35	767	10
060000Z	14.0N	135.4W	30	14.1N	135.6W	45	13	15	12.5N	141.0W	35	63	5	12.0N	144.0W	30	84	0	11.0N	150.0W	25	110	0
060600Z	13.8N	136.9W	30	14.0N	137.9W	40	27	10	12.8N	142.5W	35	75	-5	12.0N	145.0W	25	131	-5	11.0N	150.0W	25	110	0
061200Z	13.5N	138.0W	30	14.0N	138.7W	40	27	10	12.8N	142.5W	35	75	-5	12.0N	145.0W	25	131	-5	11.0N	150.0W	25	110	0
061800Z	13.4N	139.1W	30	13.0N	139.8W	50	47	20	12.5N	143.8W	50	36	20	11.8N	147.7W	50	130	25	11.0N	150.0W	25	110	0
070000Z	13.3N	140.3W	30	12.6N	141.0W	50	58	20	11.8N	146.5W	50	113	20	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
070600Z	13.2N	141.4W	30	12.5N	142.0W	45	51	15	12.5N	147.0W	40	58	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
071200Z	13.2N	142.9W	30	13.1N	143.2W	40	24	10	13.0N	148.2W	35	43	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
071800Z	13.1N	143.9W	30	12.9N	144.1W	35	17	5	13.0N	148.2W	35	63	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
080000Z	13.1N	145.1W	30	13.3N	146.3W	35	71	5	13.0N	148.2W	35	63	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
080600Z	13.2N	146.3W	30	13.4N	146.8W	35	31	5	13.0N	148.2W	35	63	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
081200Z	13.3N	147.4W	25	13.6N	148.2W	35	29	10	13.0N	148.2W	35	63	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0
081800Z	13.4N	149.2W	25	13.5N	148.0W	30	70	5	13.0N	148.2W	35	63	10	11.0N	150.0W	25	110	0	11.0N	150.0W	25	110	0

HURRICANES WHILE WIND OVER 35KTS

	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	30NM	104NM	278NM	442NM
AVERAGE RIGHT ANGLE ERROR	19NM	65NM	176NM	326NM
AVERAGE MAGNITUDE OF WIND ERROR	3KTS	14KTS	17KTS	20KTS
AVERAGE BIAS OF WIND ERROR	-3KTS	-9KTS	-10KTS	-10KTS
NUMBER OF FORECASTS	23	20	15	11

ALL FORECASTS

	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	35NM	62NM	222NM	405NM
AVERAGE RIGHT ANGLE ERROR	19NM	62NM	157NM	308NM
AVERAGE MAGNITUDE OF WIND ERROR	10KTS	13KTS	15KTS	13KTS
AVERAGE BIAS OF WIND ERROR	3KTS	-1KTS	-1KTS	-0KTS
NUMBER OF FORECASTS	38	34	29	25

ANNEX B

BAY OF BENGAL TROPICAL CYCLONES

1. SUMMARY OF DATA ¹

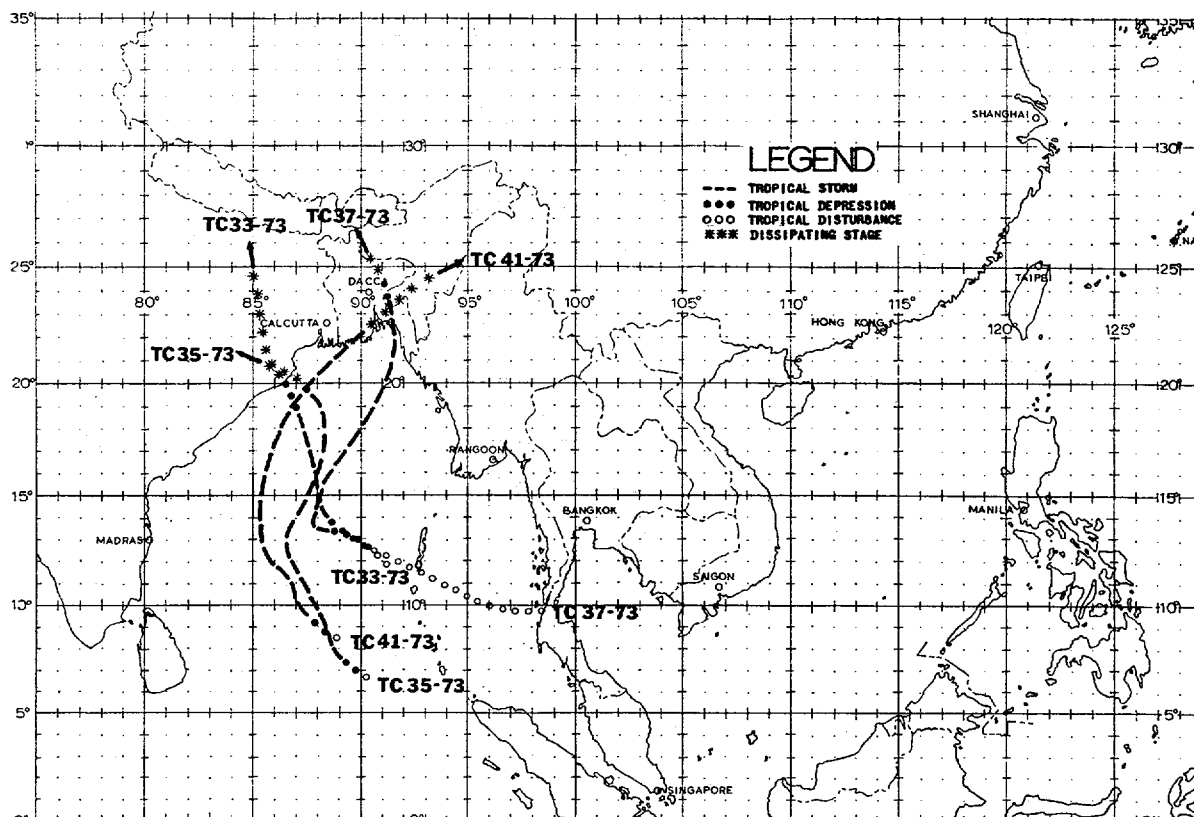


FIGURE B-1. Composite chart of best tracks for the Bay of Bengal.

TABLE B-1. 1973 BAY OF BENGAL TROPICAL CYCLONES					
CYCLONE	INCLUSIVE DATES	MAX SFC WND	MIN OBS SLP	NO. OF WARNINGS ISSUED	REMARKS
33-73	08 OCT - 12 OCT	40	---	9	-----
35-73	04 NOV - 09 NOV	70	988	13	-----
37-73	15 NOV - 17 NOV	55	---	4	FORMERLY TS SARAH
41-73	05 DEC - 09 DEC	60	---	8	-----

¹Tropical cyclones in the Bay of Bengal are numbered consecutively from the beginning of the calendar year and are included with those developing in the South Pacific and Indian oceans. The JTWC area of responsibility in the Bay of Bengal includes the area north of the equator from the Malay Peninsula to 90°E. The JTWC issued two warnings in the Bay of Bengal during 1973 when T.C. 33-73 went ashore east of Dacca and when T.C. 35-73 was forecast to recurve and move eastward into the JTWC's area of responsibility. All other warnings were issued by FLEWEACEN Guam. All Bay of Bengal cyclones for 1973 are included in Annex B.

2. TROPICAL CYCLONE TRACKS

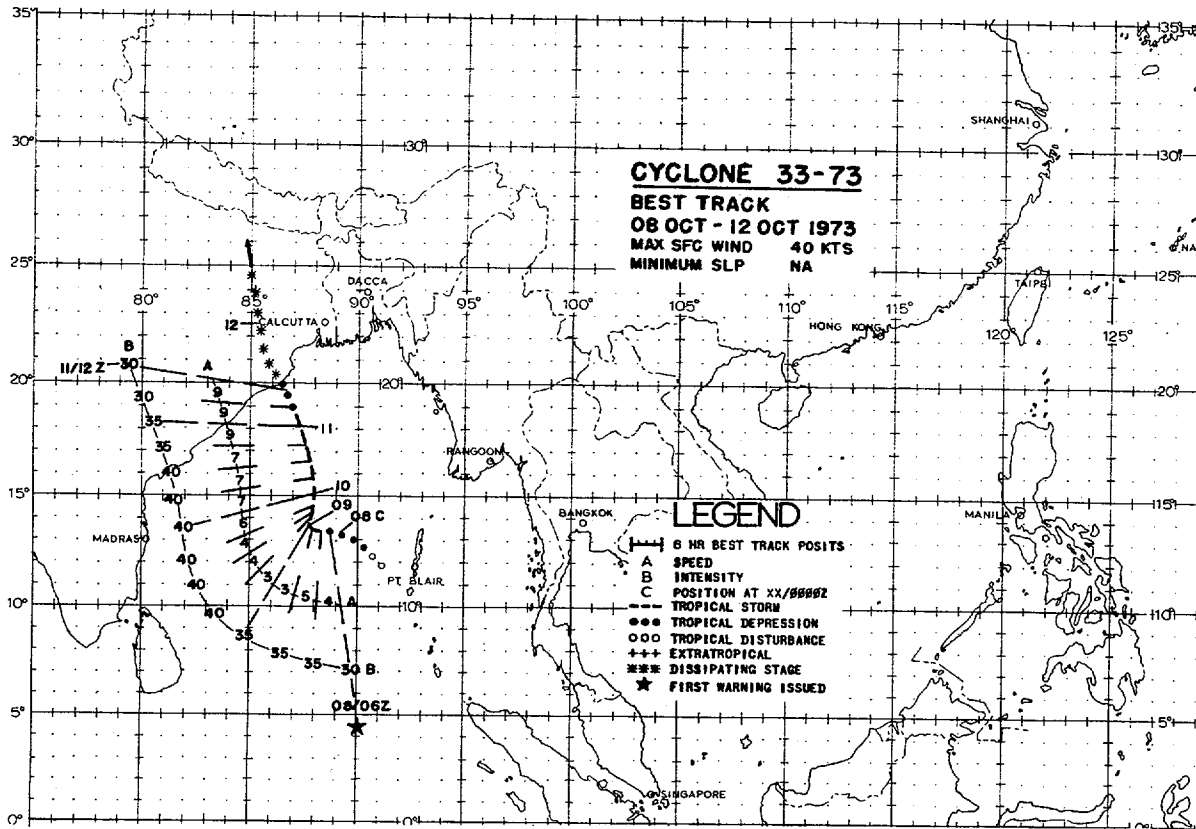


FIGURE B-2. Best track chart for Tropical Cyclone 33-73.

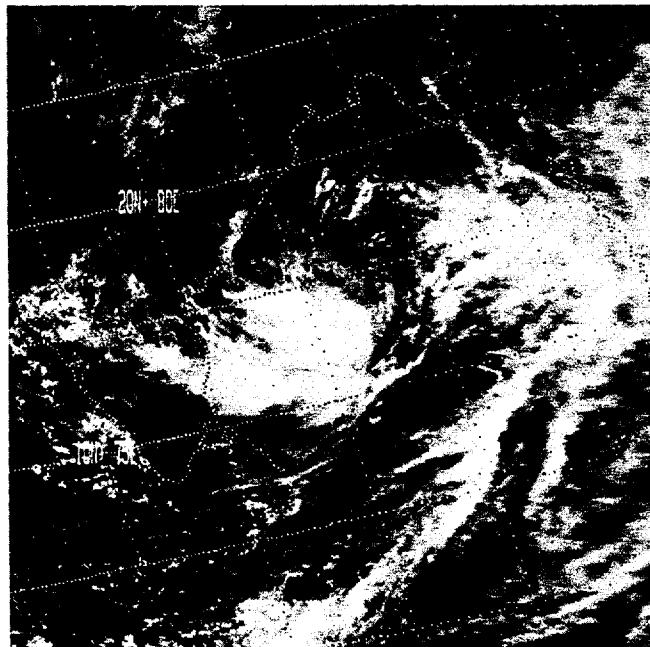


FIGURE B-3. NOAA-2 imagery of Tropical Cyclone 33-73, 9 October 1973, 0353 GMT.

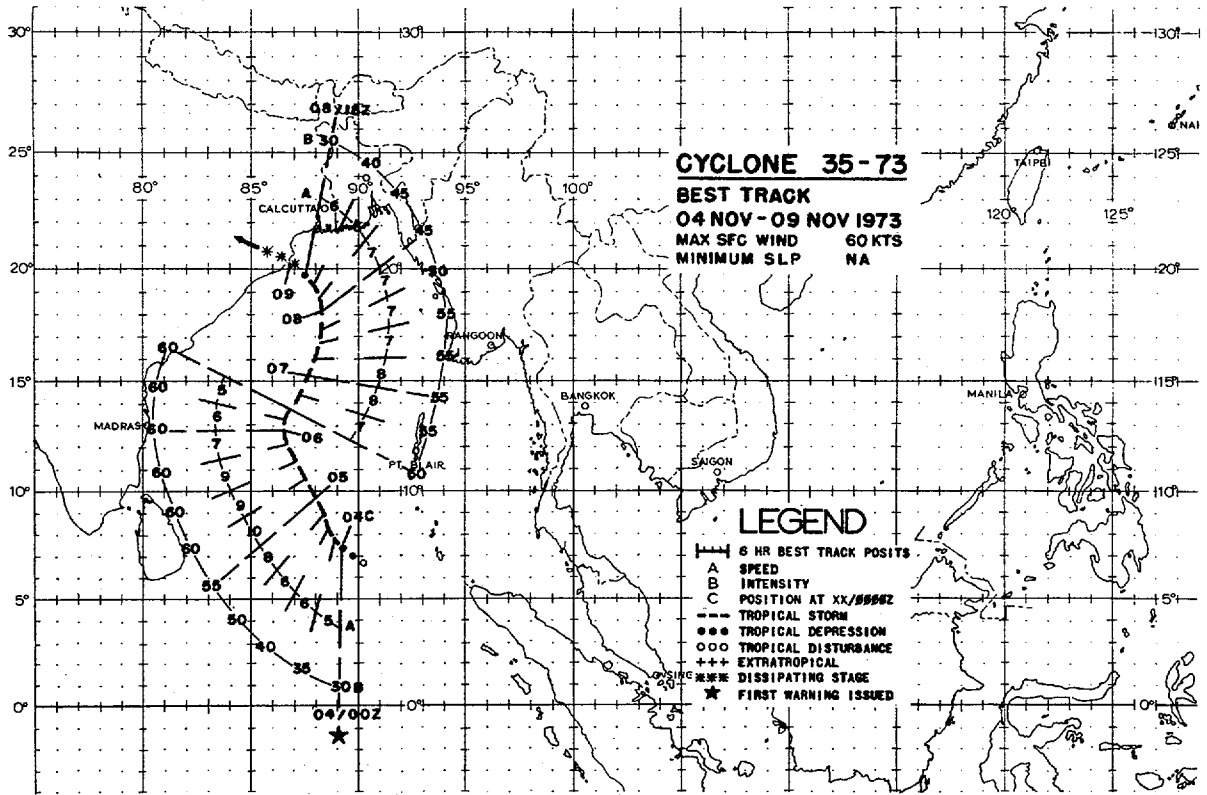


FIGURE B-4. Best track chart for Tropical Cyclone 35-73.



FIGURE B-5. DMSP imagery of Tropical Cyclone 35-73, 8 November 1973, 0243 GMT.

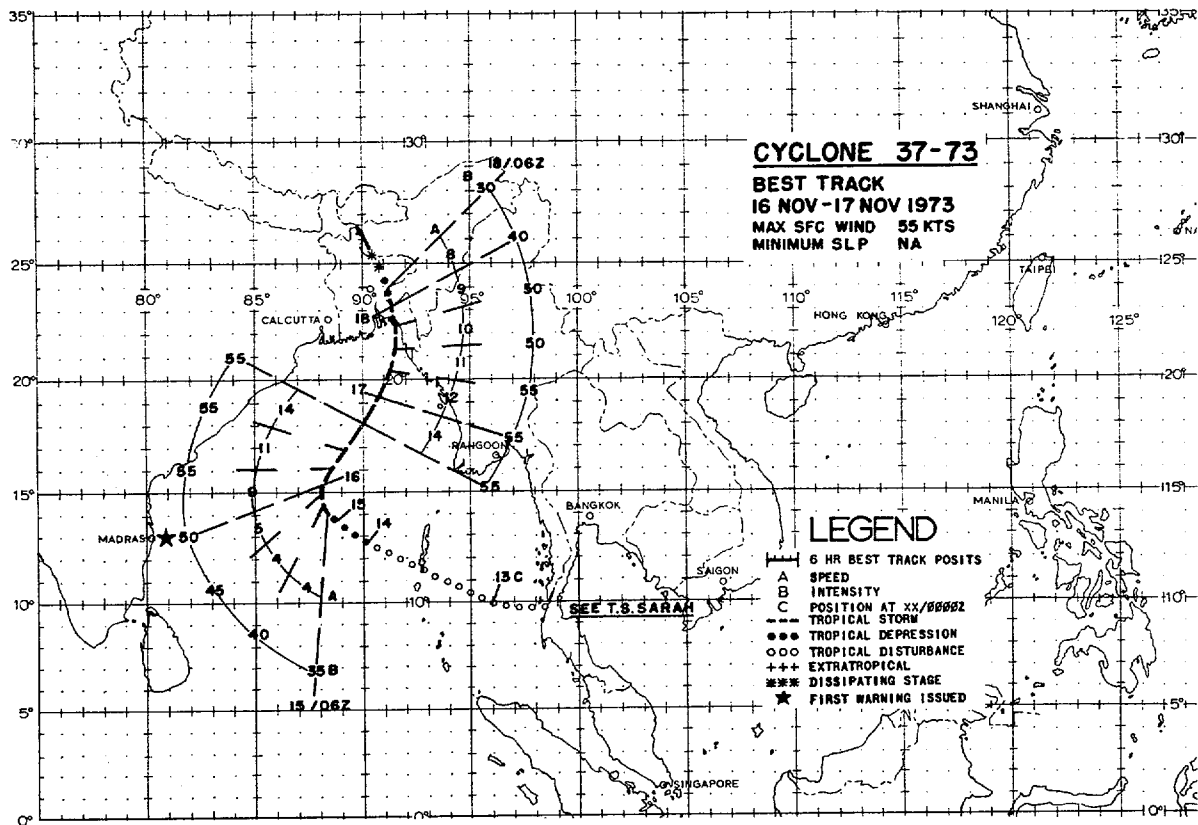


FIGURE B-6. Best track chart for Tropical Cyclone 37-73.

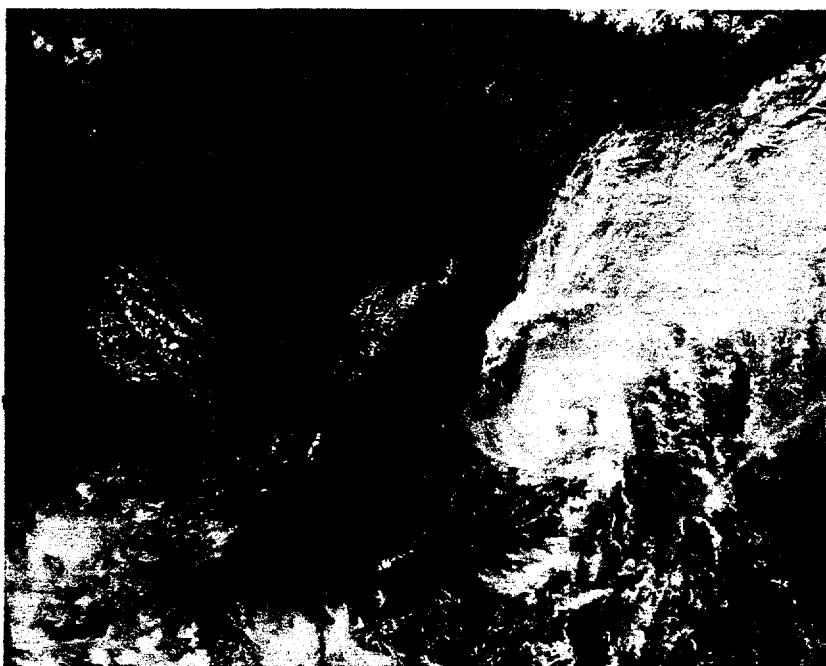


FIGURE B-7. DMSP imagery of Tropical Cyclone 37-73, 16 November 1973, 0159 GMT.

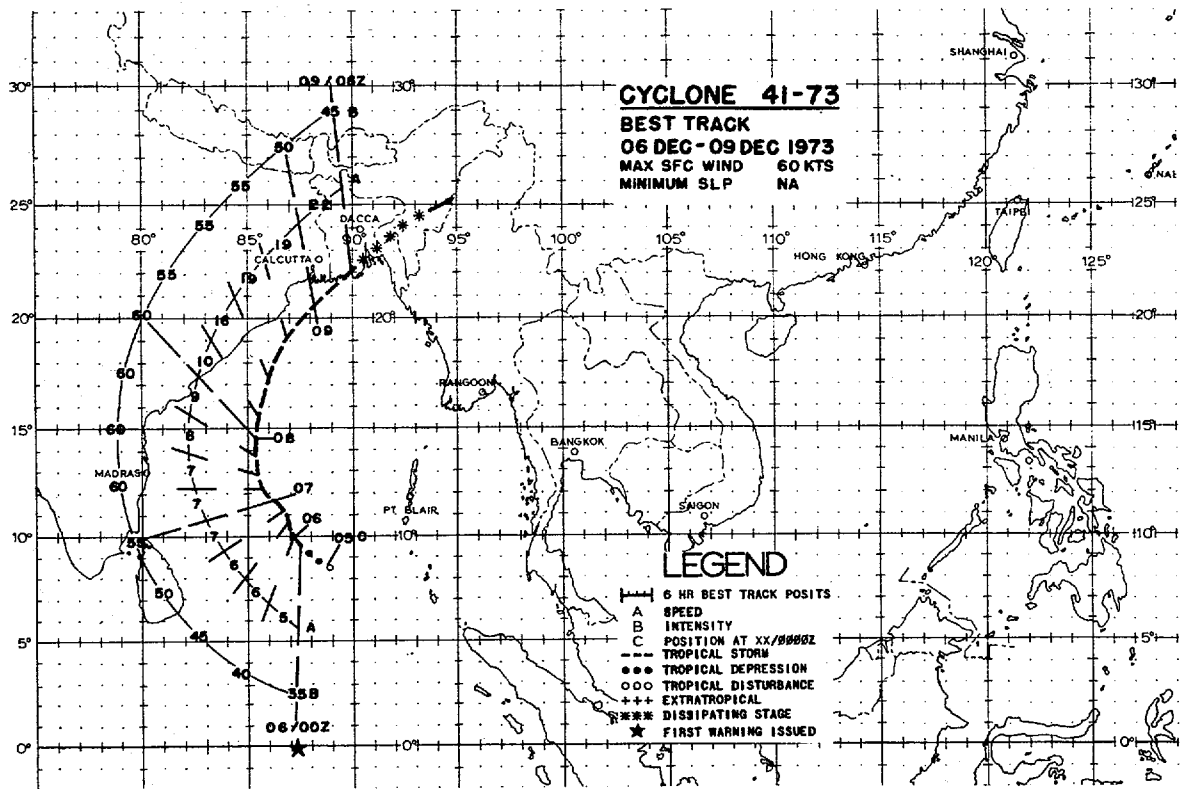


FIGURE B-8. Best track chart for Tropical Cyclone 41-73.

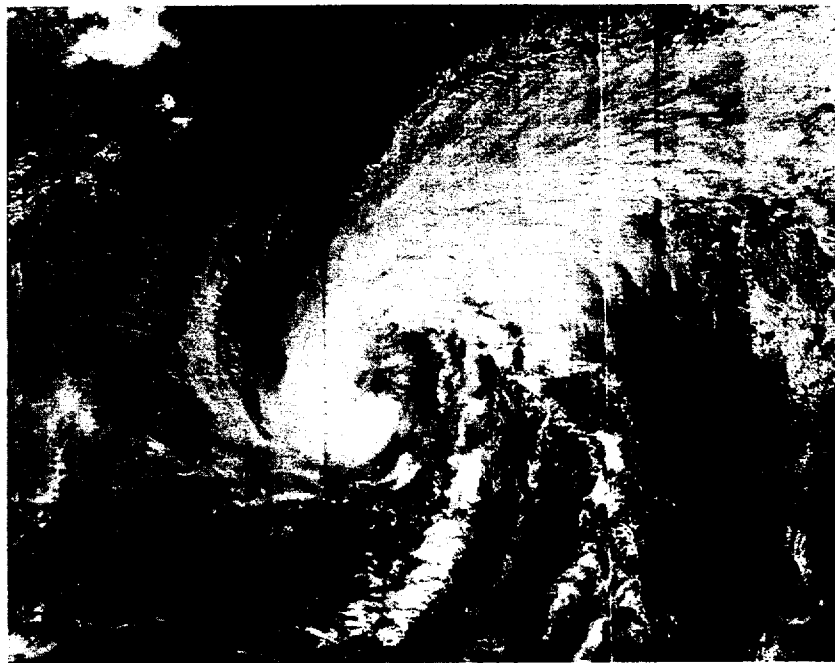


FIGURE B-9. DMSP imagery of Tropical Cyclone 41-73, 8 December 1973, 0621 GMT.

3. CENTER FIX DATA

TROPICAL CYCLONE 33-73
FIX POSITIONS FOR CYCLONE NO. 33-73
0600Z 08 OCT TO 0000Z 12 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	Fix Lvl	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBLEN-TATION	EYE DIA	'POSIT OF RADAR	MCA NUMB
						DIR	VEL	BRG	RNG	SFC WIND VEL	WIND BRG								
1	000137	18.8N 927.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
2	012137	28.8N 527.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
3	010137	38.8N 30.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
4	000137	58.7N 833.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
5	000137	88.7N 801.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
6	012147	28.7N 901.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
7	010147	58.8N 103.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
8	1000157	18.8N 136.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
9	1000157	88.7N 335.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
10	1012167	58.7N 835.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
11	1010177	38.7N 634.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
12	1100187	18.7N 434.0E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
13	1106187	98.7N 33.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
14	1112197	78.6N 533.5E	SAT	(T 0/ 0 / /	/	MRS)	PCN 3	DMSP											
15	1110207	98.5N 833.0E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
16	1200237	58.5N 234.5E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											

TROPICAL CYCLONE 35-73
FIX POSITIONS FOR CYCLONE NO. 35-73
0000Z 04 NOV TO 1200Z 09 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	Fix Lvl	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBLEN-TATION	EYE DIA	'POSIT OF RADAR	MCA NUMB
						DIR	VEL	BRG	RNG	SFC WIND VEL	WIND BRG								
1	400077	58.9N 131.5E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
2	406077	88.8N 832.5E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
3	412007	38.8N 533.5E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
4	410087	98.8N 334.0E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
5	500097	78.8N 33.5E	SAT	(T 0/ 6.0 / /	/	MRS)	PCN 3	DMSP											
6	0500107	68.7N 533.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
7	512117	38.7N 133.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
8	510127	18.6N 633.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
9	600127	88.6N 536.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
10	600137	38.6N 602.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
11	612137	88.6N 803.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
12	610147	48.7N 303.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
13	700157	28.7N 702.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
14	700107	18.8N 2.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
15	712167	78.8N 200.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
16	710177	48.8N 300.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
17	800187	28.8N 335.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
18	806107	88.8N 133.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
19	800187	98.8N 133.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
20	812197	38.7N 933.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
21	810197	78.7N 531.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
22	900207	28.6N 930.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											

TROPICAL CYCLONE 37-73
FIX POSITIONS FOR CYCLONE NO. 37-73
0000Z 16 NOV TO 0800Z 17 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	Fix Lvl	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBLEN-TATION	EYE DIA	'POSIT OF RADAR	MCA NUMB
						DIR	VEL	BRG	RNG	SFC WIND VEL	WIND BRG								
1	1600157	38.8N 136.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
2	1605167	18.8N 504.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
3	1612167	98.9N 103.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
4	1610187	8.9N 903.5E	SAT	(T 0/ 2.5 / /	/	MRS)	PCN 3	DMSP											
5	1700197	29.8N 703.0E	SAT	(T 0/ 2.5 / /	/	MRS)	PCN 3	DMSP											
6	1708207	29.1N 201.5E	SAT	(T 0/ 2.0 / /	/	MRS)	PCN 3	DMSP											
7	1708207	49.1N 301.5E	SAT	(T 0/ 2.0 / /	/	MRS)	PCN 3	DMSP											
8	1712217	39.1N 401.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
9	1718227	39.1N 536.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
10	1800237	15.1N 435.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
11	1800237	39.1N 232.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
12	1812247	69.0N 933.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											

TROPICAL CYCLONE 41-73
FIX POSITIONS FOR CYCLONE NO. 41-73
0000Z 06 DEC TO 1200Z 09 DEC

FIX NO.	TIME	POSIT	FIX CAT	ACCRY NAV-MET	Fix Lvl	MAX OBS			MAX OBS			OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBLEN-TATION	EYE DIA	'POSIT OF RADAR	MCA NUMB
						DIR	VEL	BRG	RNG	SFC WIND VEL	WIND BRG								
1	600097	78.7N 531.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
2	600107	18.7N 232.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
3	612107	68.6N 933.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
4	610117	28.6N 632.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
5	700117	78.6N 231.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
6	700127	28.5N 732.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
7	712127	98.5N 534.5E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
8	710137	78.5N 336.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
9	0800147	68.5N 301.0E	SAT	(T 0/ 1.0 / /	/	MRS)	PCN 3	DMSP											
10	0800157	68.5N 601.5E	SAT	(T 0/ 2.5 / /	/	MRS)	PCN 3	DMSP											
11	0812177	38.6N 1.5E	SAT	(T 0/ 2.5 / /	/	MRS)	PCN 3	DMSP											
12	0810197	28.6N 803.0E	SAT	(T 0/ 5.5 / /	/	MRS)	PCN 3	DMSP											
13	0900207	68.6N 105.0E	SAT	(T 0/ 6.5 / /	/	MRS)	PCN 3	DMSP											
14	0900227	18.9N 905.0E	SAT	(T 0/ 7.0 / /	/	MRS)	PCN 3	DMSP											
15	0912237	49.1N 505.0E	SAT	(T 0/ 7.0 / /	/	MRS)	PCN 3	DMSP											

4. POSITION AND VERIFICATION DATA

TROPICAL CYCLONE 33-73 0600Z 08 OCT TO 0000Z 12 OCT

	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		
080600Z	13.1N	88.9E	30	13.1N	88.6E	35	17	5	13.9N	86.2E	45	93	5	15.2N	83.5E	55	256	15				
081200Z	13.2N	88.5E	35	14.0N	88.0E	35	56	0	16.1N	85.7E	45	170	5	18.5N	83.9E	45	252	5				
081800Z	13.3N	88.0E	35																			
090000Z	13.5N	87.8E	35	13.3N	87.5E	35	21	0	14.2N	86.1E	45	127	5	15.0N	84.7E	45	241	10				
090600Z	13.8N	87.8E	40																			
091200Z	14.2N	87.9E	40	13.8N	87.3E	40	42	0	14.4N	86.1E	60	159	20	15.2N	85.0E	65	287	35				
091800Z	14.5N	88.1E	40																			
100000Z	15.1N	88.1E	40	14.4N	88.1E	40	42	0	15.4N	88.7E	60	178	25	16.6N	89.0E	65	464	40				
100600Z	15.8N	87.9E	40																			
101200Z	16.5N	87.8E	40	16.0N	88.3E	40	41	0	17.6N	88.5E	45	169	15									
101800Z	17.3N	87.8E	35																			
110000Z	18.1N	87.4E	35	17.5N	86.8E	40	49	5	19.8N	86.3E	50	229	25									
110600Z	18.9N	87.0E	30																			
111200Z	19.7N	86.5E	30	18.7N	86.5E	45	60	15														
111800Z	20.9N	85.8E	25																			
120000Z	23.5N	85.7E	25	21.5N	86.8E	35	149	10														

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

ALL FORECASTS
 WARNING 24-HR 48-HR 72-HR
 53NM 161NM 29NM 0NM
 26NM 82NM 17NM 0NM
 4KTS 14KTS 21KTS 0KTS
 9 7 5 0

TROPICAL CYCLONE 35-73 0000Z 04 NOV TO 1200Z 09 NOV

	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		
040000Z	7.5N	89.1E	30	7.2N	89.4E	35	25	5	7.7N	87.1E	40	131	15	8.2N	85.5E	45	287	15				
040600Z	7.8N	88.8E	35																			
041200Z	8.3N	88.5E	40	7.7N	87.5E	40	69	0	8.9N	84.8E	60	197	0	9.8N	82.5E	75	347	15				
041800Z	8.3N	88.3E	40																			
050000Z	9.7N	88.0E	55	8.3N	85.8E	45	154	-10	9.8N	82.5E	65	295	5	10.8N	79.1E	40	565	-15				
050600Z	10.6N	87.5E	60	10.7N	87.4E	50	8	-10	14.3N	88.2E	70	110	10	18.1N	89.3E	80	141	25				
051200Z	11.3N	87.1E	60	11.6N	87.7E	55	39	-5	15.3N	88.4E	75	129	15	19.0N	89.7E	80	167	25				
051800Z	12.1N	86.6E	60																			
060000Z	12.8N	86.5E	60	13.4N	87.9E	60	89	0	17.2N	89.1E	75	144	20	20.5N	90.2E	80	194	35				
060600Z	13.3N	86.6E	60																			
061200Z	13.8N	86.8E	60	14.2N	86.2E	70	42	10	17.8N	86.6E	80	112	25	21.0N	87.8E	80	107	10				
061800Z	14.4N	87.3E	55																			
070000Z	15.2N	87.7E	55	15.4N	86.4E	80	76	25	19.4N	89.5E	70	99	25									
070600Z	16.3N	88.3E	55																			
071200Z	16.7N	88.3E	55	17.1N	87.3E	75	57	20	21.5N	93.1E	40	319	0									
071800Z	17.4N	88.3E	50																			
080000Z	18.2N	88.3E	45	19.3N	90.2E	70	126	25														
080600Z	18.9N	88.1E	45	18.6N	90.5E	60	137	15														
081200Z	19.3N	87.4E	40																			
081800Z	19.7N	87.5E	30	19.6N	88.9E	55	79	25														
090000Z	20.2N	86.9E	25	19.5N	88.5E	55	99	30														

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
 77NM 171NM 25NM 0NM
 68NM 132NM 18NM 0NM
 14KTS 13KTS 21KTS 0KTS
 13 5 7 0

TROPICAL CYCLONE 37-73
0000Z 16 NOV TO 0800Z 17 NOV

	BEST TRACK			WARNING			24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND		POSIT	WIND		POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	
160000Z	15.3N	88.1E	50	15.0N	87.9E	60	21	10	16.5N	86.8E	75	274	20						
160600Z	16.1N	88.5E	55	16.3N	88.2E	60	63	5											
161200Z	16.9N	89.1E	55																
161800Z	18.0N	89.9E	55																
170000Z	19.2N	90.7E	55	18.6N	89.1E	60	29	5											
170800Z	20.4N	91.3E	55	20.5N	91.8E	60													

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
52MM 21MM 0MM 0MM
38MM 27MM 0MM 0MM
6KTS 20KTS 0KTS 0KTS
6KTS 20KTS 0KTS 0KTS
4 1 0 0

TROPICAL CYCLONE 41-73
0000Z 06 DEC TO 1200Z 09 DEC

	BEST TRACK			WARNING			24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST				
	POSIT	WIND		POSIT	WIND		POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	POSIT	WIND	ERRORS DST WIND	
060000Z	9.7N	87.5E	35	7.1N	87.0E	40	158	5	7.8N	85.2E	50	240	-5	8.5N	83.5E	60	379	0	
060600Z	10.1N	87.2E	40	10.4N	87.2E	40	4	0	10.8N	85.3E	50	87	-10	12.6N	85.1E	60	245	5	
061200Z	10.6N	86.6E	45	10.2N	87.6E	40	48	-3	11.2N	82.5E	55	117	-18	12.6N	85.1E	60	314	20	
061800Z	11.2N	86.6E	50																
070000Z	11.7N	86.2E	55	11.4N	87.1E	45	53	-10	13.9N	87.1E	50	112	-10	15.7N	88.2E	65	293	15	
070600Z	12.2N	85.7E	60	12.7N	85.0E	45													
071200Z	12.6N	85.5E	60				31	-15	15.2N	83.9E	60	174	5	17.3N	83.9E	65	560	75	
071800Z	13.7N	85.3E	60																
080000Z	14.6N	85.7E	60	14.0N	85.1E	60	38	0	16.8N	84.6E	65	301	15						
080600Z	15.6N	85.6E	55	15.2N	85.3E	60	77	5	19.2N	86.0E	65	396	35						
081200Z	17.3N	86.0E	55	16.2N	85.3E	60													
081800Z	19.2N	86.8E	55																
090000Z	20.6N	88.1E	50	21.3N	87.8E	50	45	0											
090600Z	22.1N	89.4E	45																
091200Z	23.4N	91.5E	30	23.3N	91.6E	40	8	10											

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

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
52MM 20MM 35MM 0MM
38MM 28MM 110MM 0MM
6KTS 12KTS 15KTS 0KTS
-1KTS 4KTS 15KTS 0KTS
9 7 0 0

APPENDIX

ABBREVIATIONS AND DEFINITIONS

The following abbreviations and definitions apply for the purpose of this report.

1. ABBREVIATIONS

AC&W	Aircraft Control and Warning
AIREPS	Commerical and Military Aircraft Weather Report
AJTWC	Alternate Joint Typhoon Warning Center (Asian Tactical Forecast Center, Fuchu, Japan)
APT	Automatic Picture Transmission
AWN	Automatic Weather Network
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Forces
CINCPACFLT	Commander in Chief, Pacific Fleet
CINCUSARPAC	Commander in Chief, U.S. Army Pacific
DAPP	Data Acquisition and Processing Program (Renamed DMSP)
DMSP	Defense Meteorological Satellite Program
ENVPREDRSCHFAC	Environmental Prediction Research Facility (Naval Postgraduate School, Monterey, California)
NESS	National Environmental Satellite Service (Suitland, Maryland)
NWS/NOAA	National Weather Service, National Oceanic and Atmospheric Administration
PACOM	Pacific Command
SLP (MSLP)	Sea Level Pressure (Minimum Sea Level Pressure)
TCRC	Tropical Cyclone Reconnaissance Coordinator
WMO	World Meteorological Organization

2. DEFINITIONS

CYCLONE - An atmospheric closed circulation rotating counterclockwise in the northern hemisphere.

TROPICAL CYCLONE - A non-frontal cyclone of synoptic scale, developing over tropical or sub-tropical waters and having

a definite organized circulation and warm core.

TROPICAL DEPRESSION - A tropical cyclone in which the maximum sustained surface wind is 33 kt or less.

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds in the range 34 to 63 kt inclusive.

TYPHOON/HURRICANE - A tropical cyclone with maximum sustained surface wind speeds 64 kt or greater. West of 180 degrees longitude the name TYPHOON is used and east of 180 degrees longitude the name HURRICANE is used. All descriptive references to typhoons apply equally to hurricanes.

SUPER TYPHOON - A typhoon with maximum sustained winds greater than or equal to 130 kt.

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

EYE/CENTER - EYE 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.

WALL CLOUD - A densely organized, roughly circular structure of cumuliform clouds completely or partially surrounding the eye or center of a tropical cyclone.

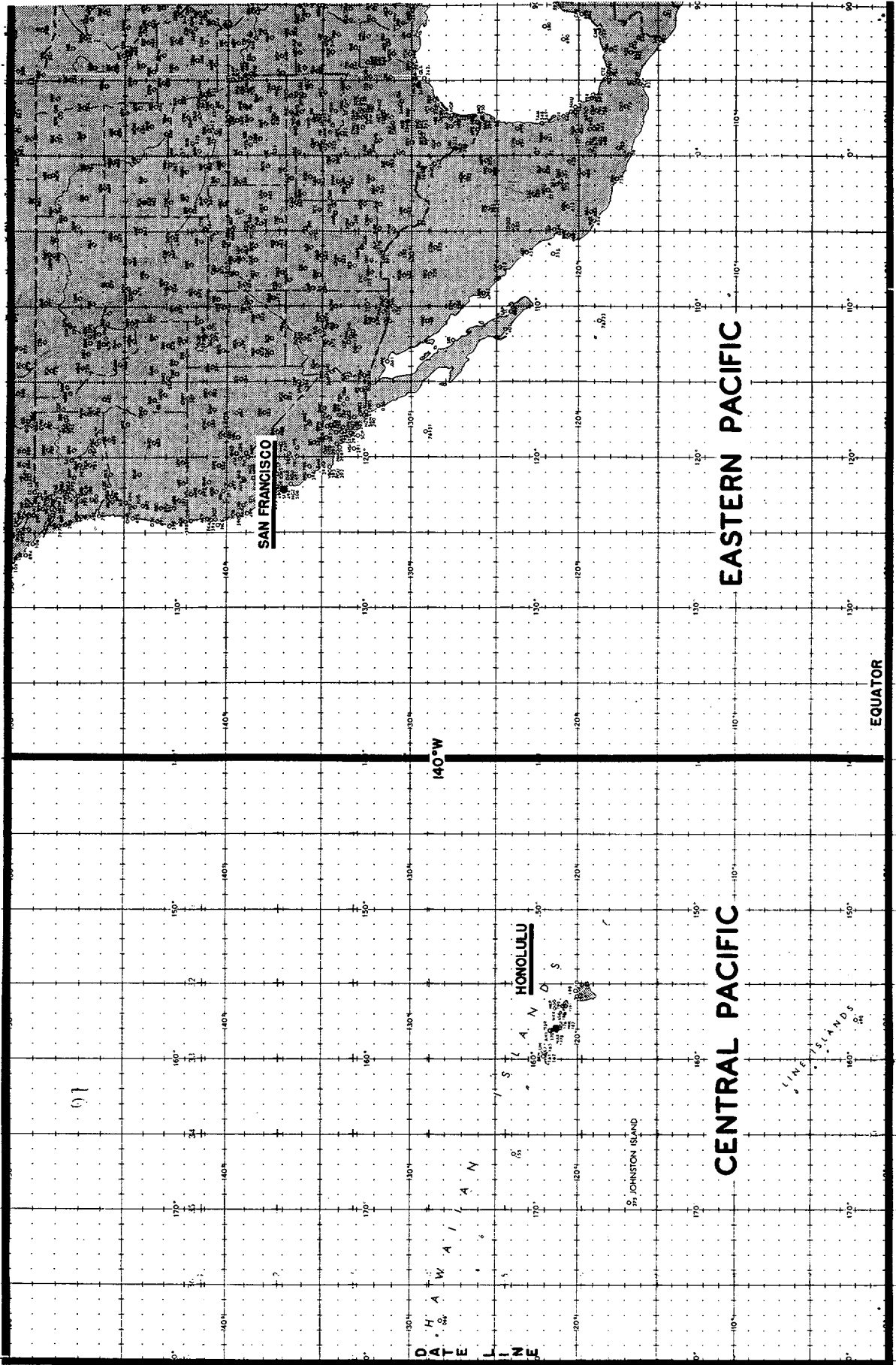
MAXIMUM SUSTAINED WIND - Highest surface wind speed of a cyclone averaged over a one minute period of time.

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 dominant energy source from latent heat of condensation release to baroclinic processes.

TROPICAL CYCLONE RECONNAISSANCE COORDINATOR - A CINCPACAF representative designated to levy tropical cyclone weather reconnaissance requirements on CINCPACAF reconnaissance units within a designated area of PACOM and to function as a coordinator between CINCPACAF, weather reconnaissance units, and JTWC.

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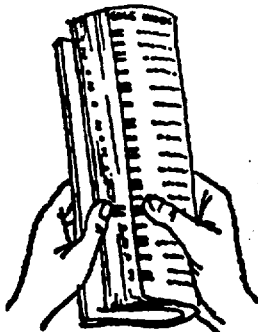
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COMUSNAVPHIL (1)
DDC (10)
DIA (1)
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ECAFE (2)
EDS (D54) (1)
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NAVAL ACADEMY (1)
NAVOCEANO (2)
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NAVPGSCOL (LIBRARY) (1)
NAVWEASERFAC ALAMEDA (1)
NAVWEASERFAC JACKSONVILLE (1)
NAVWEASERFAC SAN DIEGO (1)
NESS (2)
NHRL (2)
NHC (2)
NWSER ASHEVILLE (2)
NWSER ATSUGI (1)
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NWSER IWAKUNI (1)
NWSER NAHA (1)
NWSER YOKOSUKA (1)
ODDR&E (1)
OKINAWA MET OBS (1)
OL A, 10WSQ (1)
OL B, 1WWG (4)
PAGASA (3)
ROYAL OBSERVATORY (3)
TEXAS A&M (1)
TYPHOON COMM SECR (1)
TTPI (1)
UNIV OF GUAM (1)
UNIV OF HAWAII (DEPT OF MET) (2)
UNIV OF HAWAII (LIBR) (1)
UNIV OF MEXICO (1)
UNIV OF PI (1)
VQ-1 (1)
WEARECONRON FOUR (1)
20WSQ (11)
53WRS (2)
54WRS (10)
55WRS (2)
3345TH TECH SCHOOL (1)



Areas of Responsibility - Central and Eastern Pacific Hurricane Centers

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CHAPTER I Operational Procedures

CHAPTER II Reconnaissance and Communication

CHAPTER III Research Summary

CHAPTER IV Summary of Tropical Cyclones

CHAPTER V Summary of Forecast Verification Data

ANNEX A Summary of Tropical Cyclones in the Central North Pacific

ANNEX B Bay of Bengal Tropical Cyclones

APPENDIX Abbreviations, Definitions and Distribution