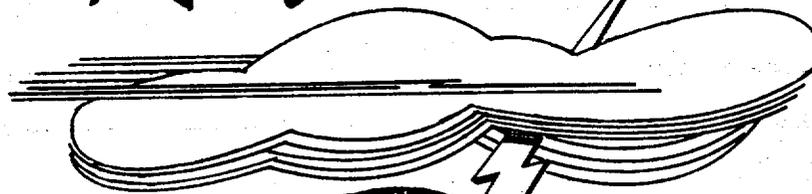


ANNUAL TYPHOON *Report*



19

68



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

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U. S. FLEET WEATHER CENTRAL
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1968
ANNUAL TYPHOON REPORT

U. S. FLEET WEATHER CENTRAL
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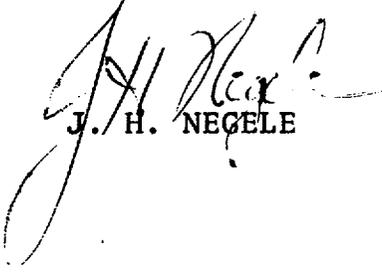
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FWC/JTWC:HLH:rsf
5213/4
Ser: 275

01 MAY 1969

From: Commanding Officer, U. S. Fleet Weather Central/
Joint Typhoon Warning Center, Guam
To: Chief of Naval Operations
Via: Commander, Naval Weather Service Command
Subj: Annual Typhoon Report, 1968 submission of
Ref: (a) OPNAV Instruction 3140.17E of 29 Oct 65
(b) SECNAV Instruction 5600.16 of 2 Nov 60

1. The Annual Typhoon Report, 1968, is submitted herewith in accordance with reference (a).
2. During Calendar year 1968, a total of 20 typhoons, 7 tropical storms and 4 tropical depressions were detected in the Western North Pacific between 180 degrees longitude and the Malay Peninsula. A total of 822 warnings were issued during the 142 calendar days the Joint Typhoon Warning Center, Guam was in "warning status".
3. Reference (a) directs Fleet Weather Centrals at Pearl Harbor and Alameda to forward annual summaries of tropical cyclones in the areas to this command for inclusion in the annual typhoon reports. During 1968, Fleet Weather Central Pearl was in warning status for 12 days and issued a total of 30 warnings on 1 hurricane, 3 tropical storms and 3 tropical depressions. Fleet Weather Central Alameda issued a total of 501 warnings on 6 hurricanes, 13 tropical storms and 5 tropical depressions during 114 days in warning in 1968.
4. This report has been reviewed in accordance with reference (b).


J. H. NEGELE

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NESC SUITLAND (1)	DIA (1)
NAVWEARSCHFAC (2)	COMNAVFORV (1)
FLENUMWEAFAC (2)	FILE (40)

FOREWORD

This report is published annually and summarizes Western North Pacific Tropical cyclones. Annex A summarizes Tropical Cyclones from 180 degrees eastward to the North American Coast.

When directed by CINCPAC in May 1959, CINCPACFLT re-designated Fleet Weather Central Guam as Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC), Guam with the following responsibilities:

1. To provide warnings to U. S. Government agencies for all tropical cyclones west of 180 degrees longitude north of the equator to the Asiatic coast and Malay Peninsula.
2. To determine tropical cyclone reconnaissance requirements and assign priorities.
3. To conduct investigative and post-analysis programs including preparation of the Annual Typhoon Report.
4. To conduct tropical cyclone forecasting and detection research as practicable.

Air Force Asian Weather Central at Fuchu, coordinating with U. S. Navy Fleet Weather Facility Yokosuka was designated as alternate JTWC in case of failure of FWC/JTWC Guam.

The JTWC is an integral section of FWC/JTWC Guam and is authorized to be manned by three Air Force and three Navy officers and five enlisted from each service. The senior Air Force Officer is designated as Director, JTWC.

The Joint Hurricane Warning Center in Hawaii a coordinated agency composed of the U. S. Weather Bureau, Honolulu, the Air Force Kunia Weather Center, and Fleet Weather Central Pearl Harbor is responsible for tropical cyclone surveillance and issuance of warnings in the Central North Pacific area between 180 degrees and 140 degrees west.

U. S. Navy Fleet Weather Central, Alameda, California, is responsible for issuance of warnings from 140 degrees west longitude to the North American Coast.

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CHAPTER I

OPERATIONAL PROCEDURES

A. GENERAL

The primary product of the Joint Typhoon Warning Center (JTWC) is the tropical cyclone warning. Operational procedures preceding issuance of a warning include thorough analysis of all reconnaissance reports and conventional synoptic data and the use of various forecasting aids to assist in forecasting movement and intensity.

Hand analyzed charts from Fleet Weather Central Guam and numerical charts produced by Fleet Numerical Weather Central Monterey and Fleet Weather Central Pearl are supplemented by meso-scale and intermediate time analyses at JTWC. Communications services are provided by the Fleet Weather Central Nimitz Hill division of Naval Communications Station, Guam.

B. ANALYSES AND DATA SOURCES

1. FWC ANALYSES:

a. Surface isobaric; 0000Z, 0600Z, 1200Z, and 1800Z.

b. Surface isobaric; micro-analyses of South China Sea; 0000Z, 0600Z, 1200Z, and 1800Z.

c. Gradient level streamlines; 0000Z, 0600Z**, 1200Z, and 1800Z**.

d. 850 mb streamlines; 0000Z and 1200Z. **

e. 700 mb streamlines; 0000Z and 1200Z. **

f. 500 mb streamlines; 0000Z and 1200Z. **

g. 200 mb streamlines; 0000Z and 1200Z. **

h. Sea Surface Temperature Charts; 5-day mean and daily.

i. Checkerboards (Stidd diagrams) of selected tropical stations.

j. Time cross sections of selected tropical stations. *

k. AROWAGRAM for Guam.

* discontinued 1 July

** discontinued 1 Nov

2. JTWC ANALYSES:

- a. Sectional surface charts; hourly and 3-hourly as required.
- b. Reconnaissance data.
- c. 700 mb meso-scale contours; 0000Z and 1200Z.
- d. 500 mb meso-scale contours; 0000Z and 1200Z.
- e. 300 mb meso-scale contours; 0000Z and 1200Z.
- f. Stidd diagram for selected stations as required when special observations are requested.
- g. 500 mb contour; Western North Pacific; 0000Z and 1200Z.

3. SATELLITE DATA

JTWC received excellent cloud picture coverage in 1968 from ESSA II and ESSA VI satellite systems and from digitized rectified mosaics transmitted from the ATS satellite. These satellite pictures were extremely valuable in detecting and monitoring tropical disturbances before they reached the tropical depression stage. During 1968 exchange of satellite data with FWC Pearl and FWF Sangley over the NEDN data link became a routine operation providing nearly complete satellite picture coverage of the JTWC area of responsibility on a once daily basis. Determination of tropical cyclone reconnaissance requirements was made on the basis of ESSA II and ESSA VI pictures and analysis of conventional data. It was rarely necessary to schedule synoptic flights for initial detection. Investigative reconnaissance missions requested were confined to cloud masses identified as formative tropical cyclones. Some initial investigative flights reported extensive flat-gradient areas with seas "calm enough for water skis" where satellite picture analysis called for surface circulations up to 35 knots. A tendency to overestimate surface winds from satellite pictures in the early stages of a tropical cyclone existed in many storms of 1968.

Addition of infrared sensors to the planned APT satellites for 1969 will increase coverage by providing pictures twice a day, once during daylight and once in

darkness. This addition will be particularly significant while storms are forming and initial recon requirements are being formulated.

4. Land Radar:

Installation of weather radar at FWC Guam was not completed in time for the 1968 typhoon season; but will be an important addition to the tracking capabilities for storms in the vicinity of Guam in 1969. Extensive use of radar from Andersen AFB aided close-in tracking during 1968. Excellent land radar coverage of tropical storm Polly on August 10th and 11th along Japan aided greatly in tracking and forecasting her unusual southwesterly movement. U. S. Navy ship and land radar fixes on Typhoon Bess as she moved in an erratic southwesterly track toward the Tonkin Gulf were valuable aids. Many other radar reports from the Trust Territories, Taiwan, South Vietnam, Okinawa, Japan and the Philippines contributed significantly to a successful 1968 season.

5. Computer products, 0000Z and 1200Z:

a. Hemispheric analyses and barotropic prognoses for 1000mb, 700mb, 500mb, 300mb, and 200mb.

b. Decomposition fields of the 500mb (SD, SR and SL) analyses and prognoses. The SD, SR, and SL fields correspond to small scale disturbances, mean flow and long wave pattern respectively.

c. Tropical persistence fields from FWC Pearl were used during the year. Computer analysis replaced FWC Guam hand analysis of tropical streamlines for the 700mb, 500mb, 400mb, 300mb and 200mb levels.

d. The HATRACK typhoon steering program based on SR analysis and prognostic fields was used on an operational time basis for evaluation and as a forecast aid.

e. The TYRACK typhoon steering program was introduced in October and was operationally used and evaluated for the remainder of the season. This program utilizes the FWC Pearl tropical persistence fields for determining forecast movement.

C. FORECAST AIDS

1. CLIMATOLOGY

The following climatological publications were utilized:

- a. Tropical Cyclones in the Western Pacific and China Sea Area (Royal Observatory, Hong Kong), covering 70 years of typhoon tracks.
- b. Climatological Aid to Forecasting Typhoon Movement (1st Weather Wing).
- c. Climatological 24-Hour Typhoon Movement (McCabe, J. T., 1961).
- d. Western Pacific Typhoon Tracks, 1950-1959 (FWC/JTWC).
- e. Far East Climate Atlas (First Weather Wing February 1963).
- f. Annual Typhoon Report, 1965 (FWC/JTWC), covering tracks for 1953-1965.
- g. Annual Typhoon Report, 1966 (FWC/JTWC), covering tracks for 1965-1966.

2. PERSISTENCE

Extrapolation of storm movement using average speed and mean direction was the most reliable method for 12 to 24 hour forecast.

3. COMPUTER PRODUCTS:

- a. The HATRACK typhoon steering program was run on the FWC Guam computer on an operational basis during 1968. Steering forecasts were made using the decomposition mean Flow Fields (SR) of the 1000mb, 700mb, and 500mb levels for both analysis and prognostic fields through 72 hours. Empirical modification based on apparent error in earlier forecasts was used to obtain improved forecast positions.
- b. TYRACK computer forecast steering from the 700mb 500mb 400mb, 300mb mean 700/500mb and mean

700/500/300mb levels were used in October and November.

4. OBJECTIVE TECHNIQUES

During 1968 the following individual objective forecasting methods were employed:

- a. ARAKAWA - surface pressure grid model.
- b. HATRACK - based on 1000mb SR analysis.
- c. HATRACK - based on 1000mb SR prognosis.
- d. HATRACK - based on 700mb SR analysis.
- e. HATRACK - modified from 700mb SR analysis.
- f. HATRACK - based on 700mb SR prognosis.
- g. HATRACK - modified from 700mb SR prognosis for 12 hr error.
- h. HATRACK - modified from 700mb SR prognosis for 24 hr error.
- i. HATRACK - based on 500mb SR analysis.
- j. HATRACK - based on 500mb SR prognosis.
- k. TYRACK - based on program-selected best steering level from Pearl tropical fields.

Evaluation of these techniques is contained in Chapter III.

D. FORECASTING PROCEDURE

An initial track based on climatology and extrapolation is developed for a 3 to 4 day period. The track is modified by considering the existing and forecast upper air patterns, numerical steering forecasts and the ARAKAWA objective method.

Subsequent forecasts become "educated" by longer period averaging of extrapolation error in speed and direction and through modification of computer forecasts to compensate for errors observed in earlier computer forecasts. A combination of extrapolation and climatol-

ogy is the starting point for each forecast, with meso-scale analysis of the 700, 500 and 300mb charts and the ARAKAWA objective forecast model used to modify or reinforce the extrapolation forecast. Position of tropical cyclones with respect to the 700mb high center and ridge to the north and the 700mb trough or break in the ridge to the west are the primary keys to 24 hour forecasting of recurvature or speed changes. The 200mb level has been used to anticipate changes in intensity through assumptions of divergence in the southeast quadrant and convergence in the southwest quadrant of anticyclones. Tropical cyclones approaching a 200mb anticyclone from the southeast are forecasted to intensify and those emerging from the west side of a 200mb anticyclone are normally forecasted to weaken.

Extended range forecasting is based on extrapolation of the 24 hour track with reversion toward climatology and modified by 500 and 300mb forecast contours.

The resulting official forecast is an integration of both objective and subjective techniques with persistence in speed and direction the weighted favorite for short term forecasts.

E. WARNINGS

Tropical cyclone warnings are numbered consecutively without regard for upgrading or downgrading of the storm between intensity stages. If warnings are discontinued and the storm again intensifies, warnings are numbered consecutively from the last warning issued. Ammended or corrected warnings are given the same number as the warnings they modify. Forecast positions are issued as follows:

Tropical depressions	24 hr
Tropical storms	12, 24 and 48 hr (72 hr at 05Z and 17Z only)
Typhoons	12, 24, and 48 hr (72 hr at 05Z and 17Z only)

Forecast periods are stated with respect to warning time. Thus a 24 hour forecast verifies 26 hours after the aircraft fix data, 29 hours after the latest surface synoptic chart and 29 to 35 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 1968 is presented in Chapter III.

F. PROGNOSTIC REASONING MESSAGE

Whenever warnings are being issued, an amplifying message is issued at 06Z and 18Z. This prognostic reasoning message is intended to provide meteorological units ashore and afloat with technical and non-technical reasoning appropriate to the behavior of current storms and the logic of the latest JTWC warnings.

G. TROPICAL WEATHER SUMMARY

This message is issued daily from May through December and otherwise when significant tropical cyclogenesis is forecasted or observed. It is issued at 0600Z and combined with the prognostic reasoning message when warnings are being issued. It describes the location, intensity and likelihood of development of all tropical low pressure areas and significant cloud "blobs" detected by satellite.

CHAPTER II

RECONNAISSANCE

A. General

Land stations in the tropical Pacific are sparse. Additional observing units have been activated and reports are being received from peace corps stations, but the stations are still widely scattered. Ships which report weather do not usually transit the areas of cyclone formation and, once the cyclone moves into the shipping lanes, it is usually of such intensity that ships will take evasive action to avoid it. Pictures from the ESSA Weather Satellites have proven to be a tremendous aid in the detection of cyclones in the early stages of formation. Interpretation of satellite pictures cannot, however, indicate the center position or the intensity of the cyclone with the accuracy required for issuing warnings and forecasting movement and changes in intensity. Aerial reconnaissance thus remains the only method which can provide surface and upper air data of the accuracy required to issue timely warnings for the safeguarding of life and property. Continuous surveillance of tropical cyclones is of the utmost importance. The accuracy of tropical warnings is directly related to the timeliness, quality, and quantity of data received from reconnaissance aircraft.

Reconnaissance aircraft can remain in the vicinity of a tropical cyclone to report accurate positions and characteristics such as eye shape and orientation, intensity and extent of cloud patterns. By the use of dropsondes or ascent or descent soundings, the aircraft can provide a vertical profile of temperature and dew point, heights of standard levels and sea level pressure.

B. Reconnaissance Responsibility

During the 1968 season two squadrons were assigned the responsibility of tropical cyclone reconnaissance to meet the requirements of the Joint Typhoon Warning Center, Guam. These squadrons were the U. S. Navy Airborne Early Warning Squadron One (VW-1), equipped with the EC 121K aircraft based at Naval Air Station, Agana, Guam and the U. S. Air Force 54th Weather Reconnaissance Squadron (54WRS), equipped with WC-130 aircraft based at Andersen Air Force Base, Guam.

C. Evaluation of Data

Four fixes per day were normally scheduled on typhoons and tropical storms during 1968. Tropical depressions were scheduled for up to four fixes per day depending on location, potential, and feasibility of radar coverage.

In general, low (1500 ft. or below) or intermediate (700 mb) level fixes were made by VW-1 at 0900Z and 1500Z, and intermediate level fixes were made by the 54WRS at 2100Z and 0300Z. High level (500 mb) fixes were made on storms in the vicinity of high terrain. In addition to the fixes, synoptic and investigative flights were flown.

Aerial reconnaissance can be divided, according to data gathered, into three categories: peripheral data, eye data from penetration, and eye data from radar.

Peripheral data is all information reported outside the eye of the storm. It includes a description of sea level pressure, pressure height, a complete description of clouds including types, amounts and heights of tops and bases, flight altitude winds, temperature, dew point, and surface winds. Peripheral data obtained while circumnavigating the storm between fixes often includes dropsonde soundings. This same type of data is also provided on all synoptic and investigative flights.

Eye data from radar provides a description of the radar eye and its location, including a description of spiral bands and height and width of the wall cloud. Also included is the aircraft position at the time the radar observation is taken. Due consideration is given to the distance of the aircraft from the storm center in evaluating the accuracy of the fix since attenuation can distort the image when the distance is considerable. Also, allowance is made for the possibility that the radar or cloud eye may not coincide with the wind eye.

On all eye messages figures are given in nautical miles indicating the accuracy of the location of the center and the navigational accuracy of the fix. The type of navigation used by the aircraft is indicated and figures are given indicating the confidence attached to each of the parameters used to locate the eye, i.e. temperature, pressure, wind, etc. All of this information is used by JTWC in evaluating the fix accuracy.

During 1968, daylight penetrations were made on all but a few of the most severe storms. When possible EC 121K aircraft also penetrated the storms for night fixes. Many of the night penetrations were made at 1500 ft. or below, especially when the storms were too weak for radar coverage. Location of the circulation center with the aid of the aircraft landing lights was not uncommon when the center could not be determined by other means.

Aircraft Reconnaissance Data

(Number of Fixes and Investigations)

<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
350	496	465	772	666	674	845	807*

* 167 preliminary or intermediate (No credit)

fixes not included.

In addition there were 184 synoptic tracts flown in 1968.

The information from the aircraft was continually checked for consistency and accuracy. Where possible, JTWC graphs and other aids were used to check and compare data with previous reports. Verification was immediately requested from the observing aircraft on any apparent discrepancy in the data.

D. Communications

The primary means of communication between ground stations and reconnaissance aircraft was voice single sideband. Commencing with the 1968 season, Andersen Airways (AIE2) was the primary air to ground station for 54WRS and VW-1. The JTWC "Enjoyment" circuit was not used during the 1968 season. The secondary air to ground stations were Clark AFB, Republic of the Philippines; Fuchu Airways, Japan; and Kadena Airways, Okinawa. When the secondary stations were used, the primary method of passing eye data between the aircraft and the Swan monitor was via the Joint Overseas Switch (JOSS). Eye data messages received by Swan monitor by direct phone patch with the aircraft were received simultaneously by JTWC via hotline connection with

Swan monitor. In addition to the hotline patch, a copy of the eye message was transmitted to JTWC from Andersen Airways by local teletype circuit SDE 9.

The routine use of the hotline between Swan monitor and JTWC led to a significant reduction in communications delay times. Fixes continued to be levied only 2 hours prior to warning time. In only 6 cases were the eye messages received after warning time. The cases of excessive delays generally occurred when the aircraft had to communicate through one of the secondary stations. The greatest delays occurred on fixes made in the South China Sea.

The average delay time from the aircraft to JTWC by phone patch was 23 minutes. This includes the delay in the aircraft by the meteorologist, and the time for JTWC to copy the complete eye data message. The maximum delay by phone patch was 1 hour 26 minutes and the minimum delay just a few minutes. Receipt of the eye data message in less than 10 minutes was not uncommon when communications were good. Besides the reduction in delay time, direct communication with the aircraft has the advantage of allowing immediate clarification of doubtful data. Relay of the latest meteorological information, including satellite data, directly to the flight meteorologist on the investigative flights often pinpointed a suspicious area more exactly and thus allowed the aircraft to spend more time in productive reconnaissance.

The following statistics show the delays between time of fix and time of first receipt at JTWC. The methods used in getting the fix to JTWC are shown for comparison.

DELAY IN RECEIPT OF RECONNAISSANCE FIX DATA FOR 1968				
<u>METHOD</u>	<u>NUMBER OF CASES</u>	<u>MAX DELAY TIME</u>	<u>MIN DELAY TIME</u>	<u>AVG DELAY TIME</u>
PHONE PATCH	795	1 HR 26 MIN	0 HR 01 MIN	0 HR 23 MIN
SDE 9	123	1 HR 35 MIN	0 HR 04 MIN	0 HR 36 MIN
OTHER	16	6 HR 25 MIN	0 HR 23 MIN	1 HR 26 MIN

Table 2-1 contains some statistics on communications delays encountered in 1968 along with figures from previous years for comparison.

COMPARISON OF DELAY TIMES WITH PREVIOUS YEARS

	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
MAX DELAY TIME	60 HR 45 MIN	60 HR 09 MIN	4 HR 33 MIN	11 HR 20 MIN	6 HR 25 MIN
AVG DELAY TIME	1 HR 14 MIN	1 HR 05 MIN	1 HR 02 MIN	0 HR 43 MIN	0 HR 25 MIN
MIN DELAY TIME	8 MIN	9 MIN	FEW MINUTES	FEW MINUTES	FEW MINUTES
PERCENT OF EYE MESSAGES DELAYED MORE THAN 1 HOUR	59%	39%	38%	16%	4%
NUMBER OF FIXES RECEIVED AFTER WARNING TIME	46	34	30	23*	6*
PERCENT OF FIXES RECEIVED AFTER WARNING TIME	8.0%	5.7%	5.4%	3.1%	0.7%

*1967 and 1968 fixes scheduled 2 hours prior to warning time vice 3 hours prior to warning time during previous years.

TABLE 2-1

E. SUMMARY OF RECONNAISSANCE REPORT

In an effort to make the crediting of the reconnaissance effort more objective and meaningful, a system was devised in 1965 to credit fixes and investigations. The same system with minor modifications has been in use since that time. The problem of why a fix was early, late, or missed entirely, although of interest and concern to JTWC, belongs to the Tropical Cyclone Reconnaissance Coordinator (TCRC). The time of warning and the inherent delay from scheduled fix times were the determining factors used in the crediting scheme. Obviously, it would be desirable to have the fix made as near warning time as possible. Prior to 1967 it was necessary to schedule the fixes 3 hours before warning time to allow for normal communications delays. More rapid communications in 1967 and 1968 has permitted scheduling of fixes 2 hours prior to warning time. This usually allowed ample time to digest the information after receipt of the data. The crediting system is described in Table 2-2.

DEFINITIONS OF FIX CREDITS

<u>CLASS</u>	<u>DEFINITION</u>	<u>FIX CRITERIA</u>
1	Full Credit	From 1 hour before 1/2 hour after levied time.
2	Full Credit	Aircraft in area requested within 1 hour before to 1/2 hour after levied time but unable to locate a center.
3	Early/Late	Center located to 1 1/2 hours before or 1/2 to 2 hours after levied time.
4	Very Early/Very Late	Greater than 1 1/2 hours before or more than 2 hours after levied time.
5	Attempted but missed fix	Recon provided some useful peripheral data but no fix was made. Reasons may include clearance problems, mechanical trouble, low fuel, etc.
6	Missed fix	Missed fixes not falling into any category above.
7	Full Credit	Fix made on investigative flight or synoptic track.
8	Full Credit	Investigative flight, no fix made.
9	No Credit	Preliminary or intermediate fix made between scheduled fixes.

TABLE 2-2

This system requires subjective evaluation of some fixes. For example, an aircraft could be in the area assigned on time, but unexpected storm acceleration could make the cyclone too distant to be reached within normal

time limits. In this case, full credit is given with no penalty for a late fix.

EVALUATION OF TIMELINESS OF RECONNAISSANCE FOR 1968

<u>CLASS</u>	<u>NUMBER</u>
1	699
2	20
3	22
4	7
5	1
6	5
7	34
8	24
9	167

CHAPTER III

JOINT TYPHOON WARNING CENTER STUDIES

A. A COMPARISON OF OBJECTIVE TECHNIQUES FOR TYPHOON MOVEMENT

1. STATUS

The objective methods forecasting and verification project which was begun in 1967 was continued and expanded in 1968. Forecasts were verified for all four warning times as compared to two daily verifications from the most current upper air synoptic fields in 1967. Objective techniques were also applied to 48 hour forecasts for the first time. Availability of a HATRACK program for the FWC Guam computer facilitated operational use of this program.

The older hurricane and typhoon (HAT) steering program, the TSE method and climatology were discontinued as objective techniques because of their poor performance in 1967.

The manual modification technique successfully used in 1967 on the 700mb Prog was used on both the 700mb analysis and the 700mb Prog for 24 hour forecasts and on the 500mb anal for 48 hour forecasts. A new twist was added by using twice the apparent 12 hour error to obtain a 700mb Prog modified forecast for 24 hour movement.

2. 24HR OBJECTIVE TECHNIQUES

- a. JTWC - official forecast for comparison.
- b. EXTRAPOLATION. a semi objective method by which forecast points are determined by recent past values of speed, direction and intensity.
- c. ARAKAWA - Grid overlay values of surface pressure are entered into regression equations and hand computed.
- d. 1000mb PROG - HATRACK forecast based on 1000mb SR forecast fields.
- e. 700mb PROG - HATRACK forecast based on 700mb SR forecast fields.
- f. 500mb PROG - HATRACK forecast based on 500mb SR forecast fields.
- g. 700mb ANAL - HATRACK forecast based on 700mb analysis SR field.

h. 700mb ANAL MOD (24HR) - HATRACK forecast of (g) above manually modified for apparent 24 hour error.

i. 700mb PROG MOD (12HR) - HATRACK forecast of (e) above manually modified for twice the apparent 12 hour error.

j. 700mb PROG MOD (24HR) - HATRACK forecast of (c) above manually modified for apparent 24 hour error.

3. 48 HR OBJECTIVE TECHNIQUES

a. JTWC - official forecast for comparison

b. 1000mb PROG - same base as 24 hour forecast

c. 700mb PROG - same base as 24 hour forecast

d. 500mb PROG - same base as 24 hour forecast

e. 500mb ANAL - HATRACK forecast based on 500mb SR analysis field.

f. 700mb ANAL MOD (24HR) - HATRACK forecast based on the 700mb SR analysis field modified for twice the apparent 24 hour error at forecast time.

g. 500mb ANAL MOD (24HR) - HATRACK forecast based on the 500mb SR analysis field modified for twice the apparent 24 hour error at forecast time.

h. 700mb PROG MOD (24HR) - HATRACK forecast based on (c) above modified for twice the apparent 24 hour error at forecast time.

4. DISCUSSION OF MODIFICATION TECHNIQUE

The basic assumption of this technique is that forecast errors of the past will continue to occur in the forecast period. A single correction attempts to compensate for all errors such as the use of the wrong steering level and geostrophic rather than actual wind. Position errors averaging 20 miles exist at all warning times. Full correction for these errors tends to multiply their contribution to the total forecast error. Analysis errors are common in tropical areas and are one of the major causes of forecast error. Finally the computer program designed to steer tropical cyclones may not produce a perfect forecast if given accurate analysis, prognoses and positions.

5. TESTING AND RESULTS FOR 24 HOUR FORECASTS (based on results prior to 25 September)

A homogeneous sample of 390 24 hour forecasts was assembled in 1968. Statistical results are presented in Table 3-1. The following observations are made after a study of 1968 verifications:

a. JTWC official forecasts are significantly better than all objective techniques. An average of 104 NM is calculated for this homogeneous sample.

b. Extrapolation continues to be the most reliable short term forecast technique. The average of 111 NM is the best of all supplementary forecasts.

c. ARAKAWA was the best of the truly objective techniques. The ARAKAWA average of 121 NM was better than the 1967 JTWC official average.

d. The 1000mb PROG was the poorest overall objective technique, but was a good performer on storms in their early stages. The HATRACK program has no logical limit on movement speeds. Illogical 1000mb forecasts are interpreted to move typhoons at speeds of over 70 knots.

e. The 700 MB level again gave better results than the 500 MB and 1000 MB levels. The 700 MB prognostic field again showed skill over the 700 MB analysis field. Statistical evidence strongly indicates a detrimental change in the basic numerical fields occurred about 25 September. The 700 MB prognosis verification prior to this date was 134NM compared with an average after this date of 254NM. The annual average of 191NM is then unrepresentative of any portion of the year. Displacement of the verification errors showed a large error to the southwest after September.

f. The 500MB SR HATRACK cyclone movement was slow and showed a distinct tendency toward premature recurvature.

g. The 700 MB ANALYSIS was a close second to the 700 MB prog in accuracy. Persistence of the 700 MB field is a reasonably accurate assumption for predicting typhoon tracks in the absence of prognostic fields.

h. The 700 MB ANALYSIS modified for 24 hr error verified equal to the 700 MB Prog similarly modified. The initial size of the error apparently does not have a completely determining effect on the size of the modified error.

i. The 700 MB Prog was the best of hand modified computer progs. The modification method showing best results in the first half was the 12 hour error modification.

j. The 700 MB prognosis was improved by about 15 percent by vector modifying the forecasts for apparent forecast error over the past 12 or 24 hours.

6. TESTING AND RESULTS FOR 48 HOUR FORECASTS (based on results prior to 25 September) See table 3-2

a. The best objective forecast for 48 hours proved to be the 700 MB prog HATRACK. This bettered the official forecast in 5 of 14 tropical cyclones.

b. Modifying the basic 700 MB prog HATRACK forecast for 24 hour error resulted in increased error in 10 of 14 tropical cyclones and in the overall average. Modifying the 700 MB ANAL HATRACK for 24 hour error failed to improve that forecast. The advantage to error bias correction noted at 24 hours does not apparently continue through the 48 hour forecast period.

c. The 700 MB level shows a decided advantage over the 500 MB level for 48 hour forecasts using the HATRACK program.

7. OBJECTIVE TECHNIQUE FOR 1969

Based on analysis of the 1968 season and expected program improvements the following objective techniques will be operationally used and evaluated in 1969:

- a. Extrapolation
- b. 700 MB PROG HATRACK
- c. 500 MB PROG HATRACK
- d. 700/500 MB PROG RENARD
- e. ARAKAWA
- f. TYRACK
- g. 700 MB PROG MODIFIED FOR 12 HR ERROR (24 hour forecast only).

OBJECTIVE METHODS STATISTICS 1968

STORM	JTWC	EXTRAP	1000P	ARAKAWA	700P	500P	700A	700A MOD24	700P MOD12	700P MOD24
T. LUCY	88	123	162	186	153	175	135	100	90	100
T. MARY	123	98	171	122	131	125	156	96	99	116
T. S. NADINE	159	175	137	166	159	209	175	166	200	178
T. S. POLLY	176	163	134	120	178	241	208	150	124	144
T. S. ROSE	51	92	108	55	38	67	124	176	72	165
T. SHIRLEY	87	81	173	80	83	57	92	83	87	60
T. S. TRIX	59	118	118	148	102	113	100	158	191	176
T. WENDY	105	104	151	115	142	159	164	133	107	129
T. AGNES	109	112	171	129	132	128	132	125	119	129
T. BESS	73	72	114	109	102	109	139	81	92	90
T. DELLA	99	98	238	85	137	160	133	84	73	68
T. CARMEN	71	90	150	48	86	115	113	104	87	80
FIRST HALF MEAN VALUE	106	110	162	115	134	145	145	120	113	120
T. ELAINE	87	73	285	85	226	226	204	120	206	154
T. FAYE	72	97	245	76	154	126	158	123	108	110
T. GLORIA	89	78	332	101	227	255	238	198	157	185
T. IRMA	254	270	382	206	379	264	369	231	364	243
T. JUDY	86	85	301	75	300	309	292	181	176	207
T. KIT	217	195	390	199	379	318	383	199	280	235
T. LOLA	90	110	232	130	232	301	229	168	157	133
T. MAMIE	81	114	326	144	319	336	316	188	270	204
T. NINA	76	92	199	135	202	298	217	208	280	186
T. ORA	116	104	191	157	186	308	199	157	245	141
LAST HALF MEAN VALUE	99	105	282	122	254	282	255	175	218	179
ANNUAL MEAN	103	108	219	119	191	210	197	146	163	148

TABLE 3-1

48 HOUR OBJECTIVE METHODS STATISTICS 1968

STORM	JTWC	1000P	700P	500P	700A	500A	700A MOD24	500A MOD24	700P MOD24
T. JEAN	490	-	311	474	227	535	288	308	393
T. KIM	154	603	263	390	221	374	243	205	304
T. LUCY	218	308	237	224	230	151	216	219	186
T. MARY	246	278	282	297	321	316	246	273	294
T. S. NADINE	324	298	369	497	318	475	431	529	523
T. S. POLLY	492	282	349	488	389	489	411	407	373
T. S. ROSE	284	378	262	202	320	218	360	264	402
T. SHIRLEY	195	333	152	142	187	256	249	361	180
T. S. TRIX	136	231	281	311	315	268	230	341	250
T. WENDY	184	246	235	292	278	341	306	350	273
T. AGNES	266	321	285	282	290	322	317	311	299
T. BESS	162	261	223	247	276	210	167	239	162
T. DELLA	256	452	323	310	289	331	190	275	214
T. CARMEN	169	328	152	241	265	369	245	220	201
FIRST HALF MEAN VALUE	262	309	277	331	294	352	294	328	298
T. ELAINE	222	505	501	546	504	594	246	384	318
T. FAYE	213	564	402	320	416	451	312	348	263
T. GLORIA	256	641	433	493	485	591	456	441	318
T. IRMA	951	628	576	363	549	423	772	514	778
T. JUDY	238	670	643	618	678	644	415	493	528
T. KIT	408	810	738	547	760	596	427	480	403
T. LOLA	265	595	597	464	525	480	328	320	252*
T. MAMIE	155	653	508	755	622	750	429	456	747
T. NINA	116	398	337	785	388	550	775	773	300*
T. ORA	201	476	331	640	390	576	336	440	296*
LAST HALF MEAN	230	666	582	594	527	595	452	484	435

TABLE 3-2

B. EVALUATION OF RENARD METHOD FOR IMPROVING HATRACK FORECASTS

1. Background: Professor Robert Renard of the U. S. Navy Postgraduate School conducted a study based on 1966 data and tested on 1967 data. The results indicated that an improved forecast of typhoon movement could be made by combining the 500 mb latitude and the 700 mb longitude from the HATRACK prognostic fields. The indicated results were superior to forecasts made from either field.

2. Discussion: Because of the small sample sizes involved in the previous studies, it was resolved to test the Renard method using a large sample of independent data from 1968. Accordingly forecasts were reconstructed for 429 individual forecasts covering 15 of the 20 typhoons of 1968. The errors of the reconstructed forecasts were analyzed by the objective methods verification computer program and compared with results of other objective methods.

3. Results (See table 3-3):

a. Improvement of 12% over the sample average of 500 mb HATRACK forecasts.

b. Improvement of 5% over the sample average of 700 mb HATRACK forecasts

c. Improvement in 10 of the 15 individual typhoons over the 700 mb HATRACK and in 11 of the 15 typhoons over the 500 mb HATRACK.

d. Wide variability in effectiveness from a 52% improvement to a 34% loss in individual typhoons.

4. Follow-up: The results verified Professor Renard's findings and suggested the existence of systematic error in HATRACK forecasts. A study using scatter diagrams was designed to identify systematic error. Scatter diagrams were made of the 700 mb HATRACK, the 500 mb HATRACK and the Renard method.

5. Follow-up Results:

a. The 700 mb forecasts were centered southwest of the zero verification point.

b. The 500 mb forecasts were centered northeast of the zero verification point.

c. The Renard method was much better centered, but retained a systematic error of 45 miles to the south on 24 hour forecasts.

6. Follow-up Discussion: The basic numeric fields from which HATRACK forecasts are computed were apparently modified at FNWC Monterey about September 25th resulting in large errors in subsequent forecasts. Only five of the 15 typhoons in this sample occurred prior to 25 September. The actual values of the errors are not representative of the potential of this method, but the technique of combining the latitude and longitude continued to show improvement over the parent fields.

7. Conclusions:

a. Systematic errors exist in the 700 mb HATRACK, the 500 mb HATRACK and the Renard combination of HATRACK forecasts.

b. The Renard method provides a better estimate than the parent fields in two out of three cases.

c. A possible improvement to the Renard forecast involves compensation for systematic error.

d. Further improvement may result from vector correction for apparent error over the last 12 to 24 hours.

8. Action: This method will be used in operational forecasting during 1969. It will be used and refined until the basic HATRACK program is successfully modified to remove systematic errors.

700MB/500MB NUMERICAL TYPHOON FORECAST EVALUATION

	SAMPLE CASE	JTWC	700MB	500MB	700MB/500MB	IMPROVE % OVER 700
WENDY	46	99	134	150	179	-34%
AGNES	46	121	149	139	143	4%
BESS	19	86	107	111	101	6%
CARMEN	24	87	122	147	71	42%
DELLA	31	111	132	160	115	13%
ELAINE	26	95	232	234	243	-5%
FAYE	25	100	212	233	181	15%
GLORIA	30	105	240	256	179	25%
IRMA	13	203	220	270	260	-18%
JUDY	33	110	324	310	293	10%
KIT	17	180	351	341	394	-12%
LOLA	13	141	242	239	128	47%
MAMIE	47	112	345	357	307	11%
NINA	33	79	213	298	280	-31%
ORA	26	111	181	295	169	7%
SAMPLE MEANS	429	104	214	233	204	5%

3-9

TABLE 3-3

C. EVALUATION OF TYRACK, a computerized tropical cyclone movement forecast based on FWC Pearl tropical fields.

1. Background: TYRACK was developed at FWC Pearl by CAPTAIN William HUBERT and LTJG Mark FAZEY. It was completed for operational use in October and was first used at JTWC during Typhoon IRMA. Verification data was gathered from seven typhoons of 1968 and is presented as part of this evaluation.

2. Program Design:

a. The FWC Pearl tropical analysis fields are used to steer point vortex tropical cyclones. The levels used are the 700 mb, 500 mb, 400 mb and 300 mb. In addition to these standard levels a vector mean of the 700 and 500 mb fields is constructed as average #1 and a vector mean of all four levels is constructed as average #2. Operational input to the program is the position of a typhoon at warning time and the 12 hour history position. The reverse steering vector at each of the six levels is used to drive the warning position backward for 12 hours. The smallest vector from the six history forecasts to the 12 hour history position determines the "steering level" for forward motion. The warning position is then driven forward by the selected "steering level" assuming complete persistence of the field during the forecast period. The "error vector" from the 12 hour reverse track is retained and applied to adjust forecast positions. Complete persistence of the error vector and continuation of the selected level as the best steering level are assumed.

3. Evaluation Procedure: A homogeneous sample of 100 forecasts was obtained when the performance of TYRACK could be compared with the JTWC official forecasts and HATRACK forecasts could be made from the same initial points.

4. Results (See Table 3-4):

a. Absolute error was less than unmodified HATRACK fields and the Renard method forecasts, but not quite as good as the bias corrected 700 mb HATRACK forecasts.

b. A scatter diagram of vector error indicated a displacement of the forecast about 140 NM along 230 degrees with a good concentration of points about this displaced center.

5. Discussion:

a. The HATRACK fields were bad during the last three months of 1968. Comparisons in this sample are more favorable to TYRACK than they would be if HATRACK fields had not been unfavorably altered late in September.

b. The scatter of forecast verifications to the southwest seems to indicate a tendency for the circulation around a typhoon to unduely influence the steering flow. Several modifications to TYRACK are currently under development at FWC Pearl. Improved performance in 1969 is anticipated, but the need for continued evaluation is clear.

6. Conclusions:

a. An important new source of tropical cyclone forecasts has been introduced during 1968.

b. TYRACK is still in a developmental stage. Conclusions concerning 1968 performance are clouded by a relatively small sample size and the poor performance of the comparison HATRACK forecasts during the evaluation period.

c. Changes in the program as it develops will require continued evaluation during 1969.

7. Action: TYRACK will be used operationally during 1969. Careful verification records will be continued to aid development of this forecasting tool and to report in the next Annual Typhoon Report.

TYRACK EVALUATION STATISTICS FOR 1968

TYPHOON	Official JTWC			700MB			500MB			Modified 700MB			Renard 700/500			TYRACK		
	Cases	err	avg	Cases	err	avg	Cases	err	avg	Cases	err	avg	Cases	err	avg	Cases	err	avg
IRMA	5	164		5	406		5	276		5	157		5	373		5	260	
JUDY	10	83		10	343		10	321		10	191		10	284		10	130	
KIT	10	148		10	333		10	292		6	195		10	342		10	301	
LOLA	9	90		9	232		9	301		9	133		9	106		9	207	
MAMIE	30	83		30	316		30	374		28	197		30	284		30	168	
NINA	28	83		28	198		28	299		25	182		28	286		28	242	
ORA	13	90		13	164		13	269		10	195		13	171		13	265	
TOTAL	105	95		105	267		105	317		93	184		105	265		105	217	

3-12

TABLE 3-4

D. CLIMATOLOGY

1. Climatology of Fix Requirements

For the purpose of developing a monthly climatology of tropical cyclones related to operational fix requirements, a study of tropical cyclones since 1960 was made. For each cyclone, the fix requirements used in 1968 were applied to produce a statistical fix requirement based on the 1968 operational policy of four fixes per day per cyclone (tropical depression, tropical storm or typhoon). Allowances for cyclones beginning or ending during the day were made, but no allowance was made for storms not picked up in their early stages of development. The climatology developed will be conservative for this reason in years prior to 1965 when satellite data first came into operational use. No allowance was made for fixes scheduled on cloud masses that failed to develop. This problem has been greatly reduced by improved satellite coverage. Figure 3-1 shows the average monthly figures for the 9 year period as well as the figures for 1968. Also shown is the extreme number of fixes required for each month and the year in which this extreme occurred.

2. Climatology of Days with Multiple Storms

In addition to the number of fixes in each month the distribution of these fixes within the month is of importance. A given number of fixes occurring in a short span of time during a period of multiple storms will usually require more aircraft than an equal number of fixes distributed over a longer period without multiple storms. Figure 3-2 shows the average number of days in each month during which warnings were being issued on two or more cyclones. The number by month for the 1968 season is shown as well as the extreme number of multiple storm days that has occurred in each month during the 9 year period.

3. Typhoon Climatology

Direction and speed of movement of typhoons in the Western North Pacific by month from June through November.

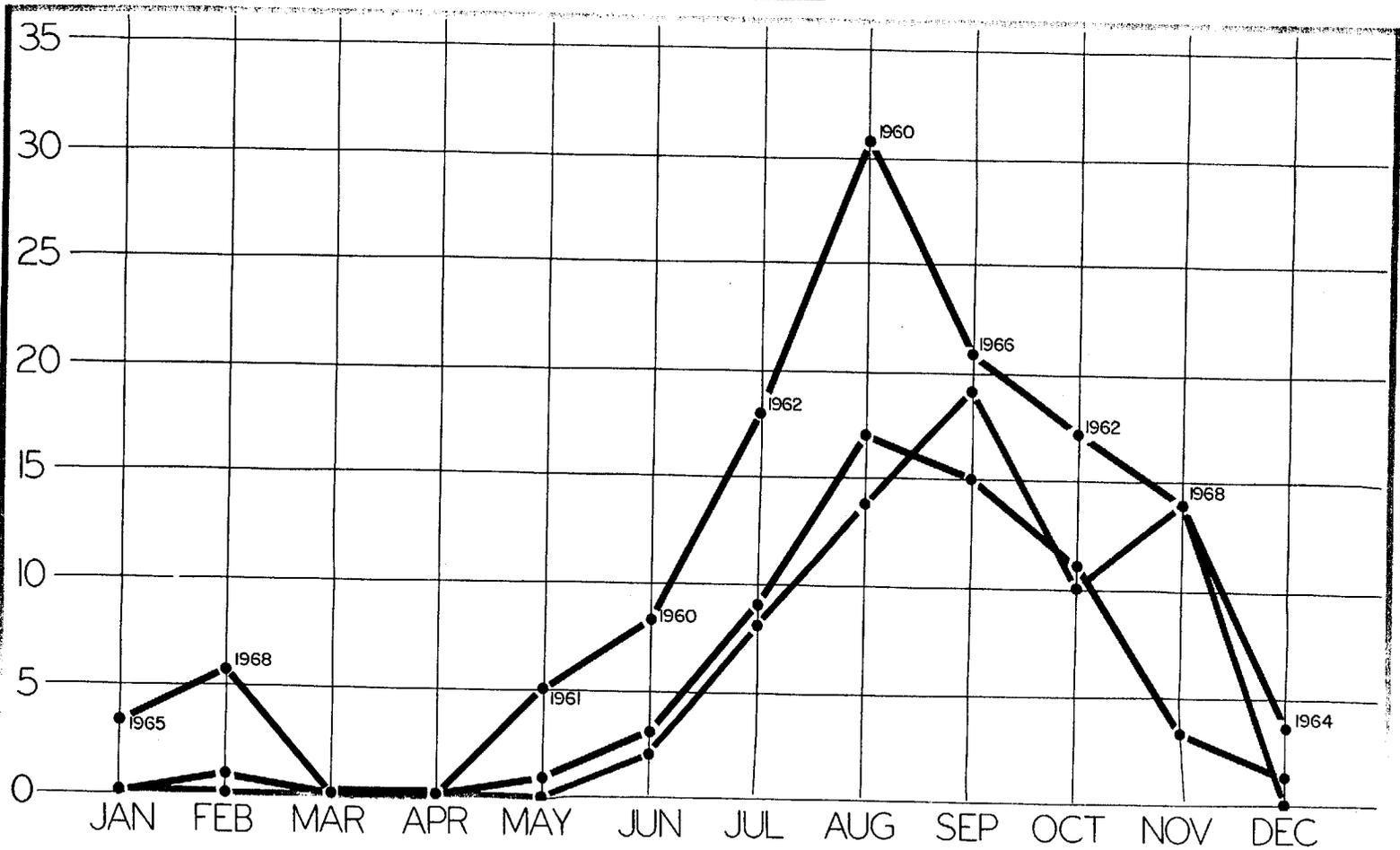
Isotachs of model speed are analyzed as dashed lines and streamlines of model direction are drawn as solid lines. Both analyses are based on values contained in Charts LXIII to LXXIX in Royal Observatory Technical Memo No. 7 which includes 70 years of data. See Figures 3-3 through 3-8.

4. Figure 3-9 presents the actual distribution by months of 334 Western North Pacific typhoons in the 17 years from 1952 through 1968.

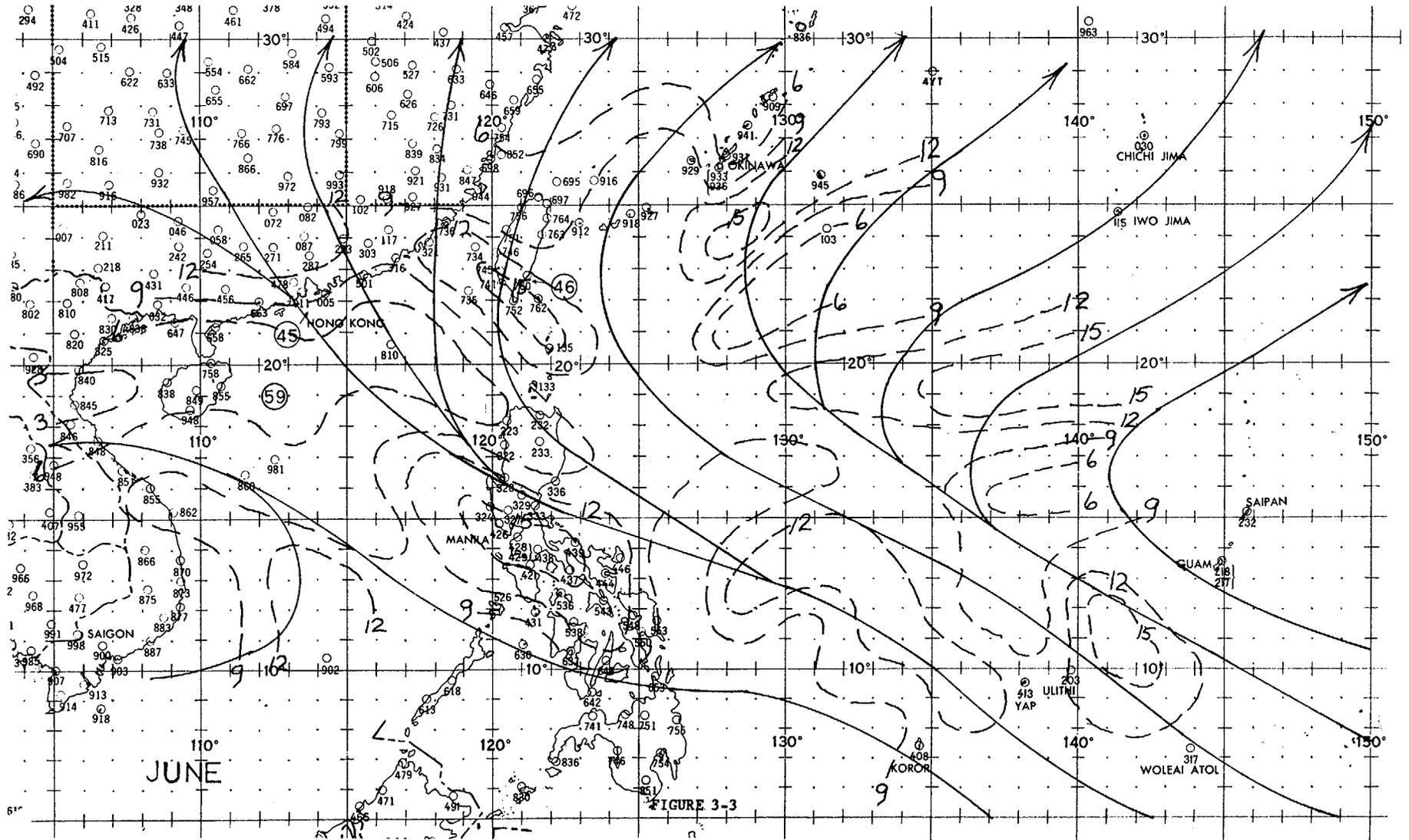
5. Figure 3-10 presents the revised 10 year frequency of typhoons by month.

MONTHLY CLIMATOLOGY OF DAYS WITH MULTIPLE STORMS

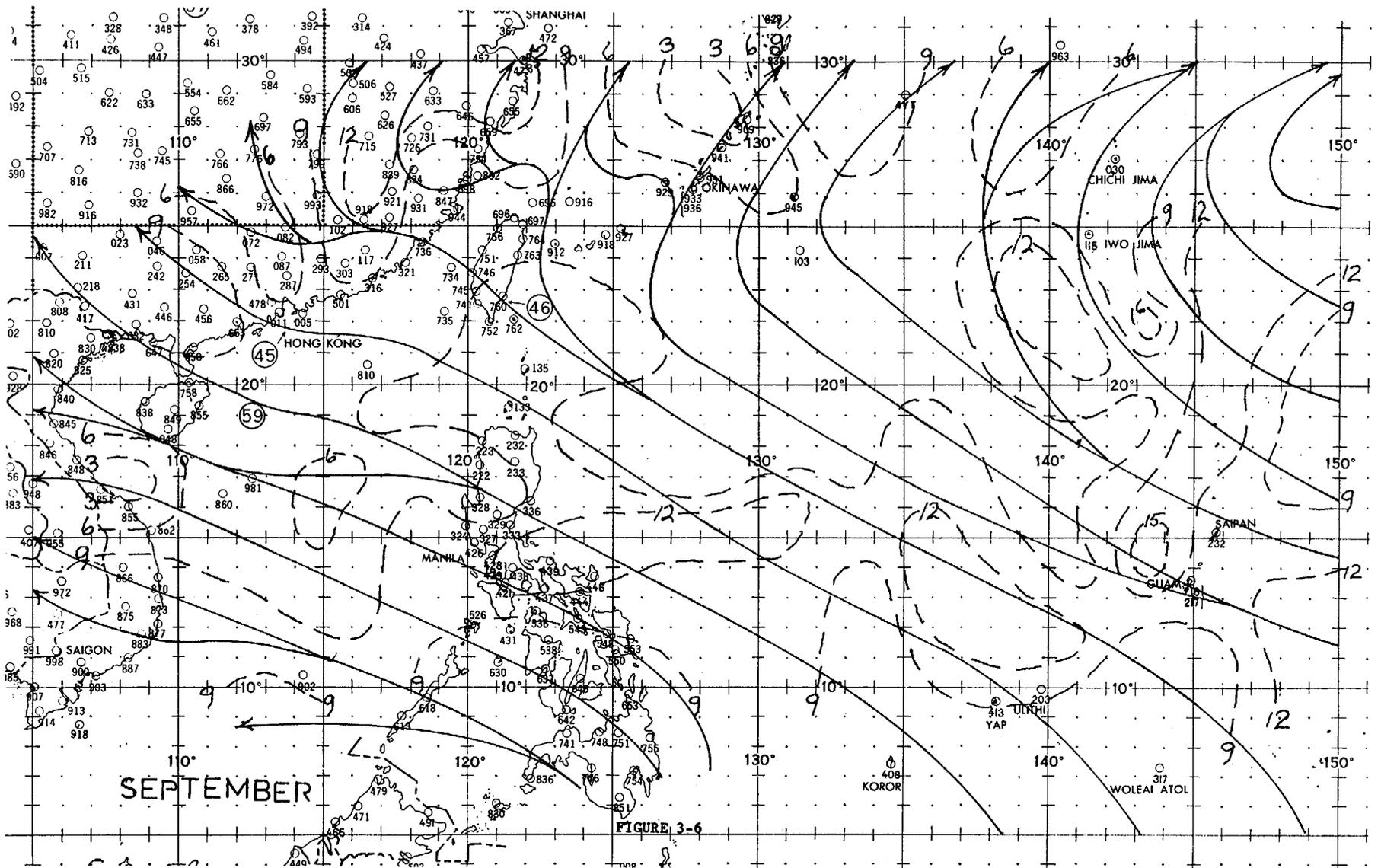
— MAXIMUM
 — AVERAGE
 — 1968



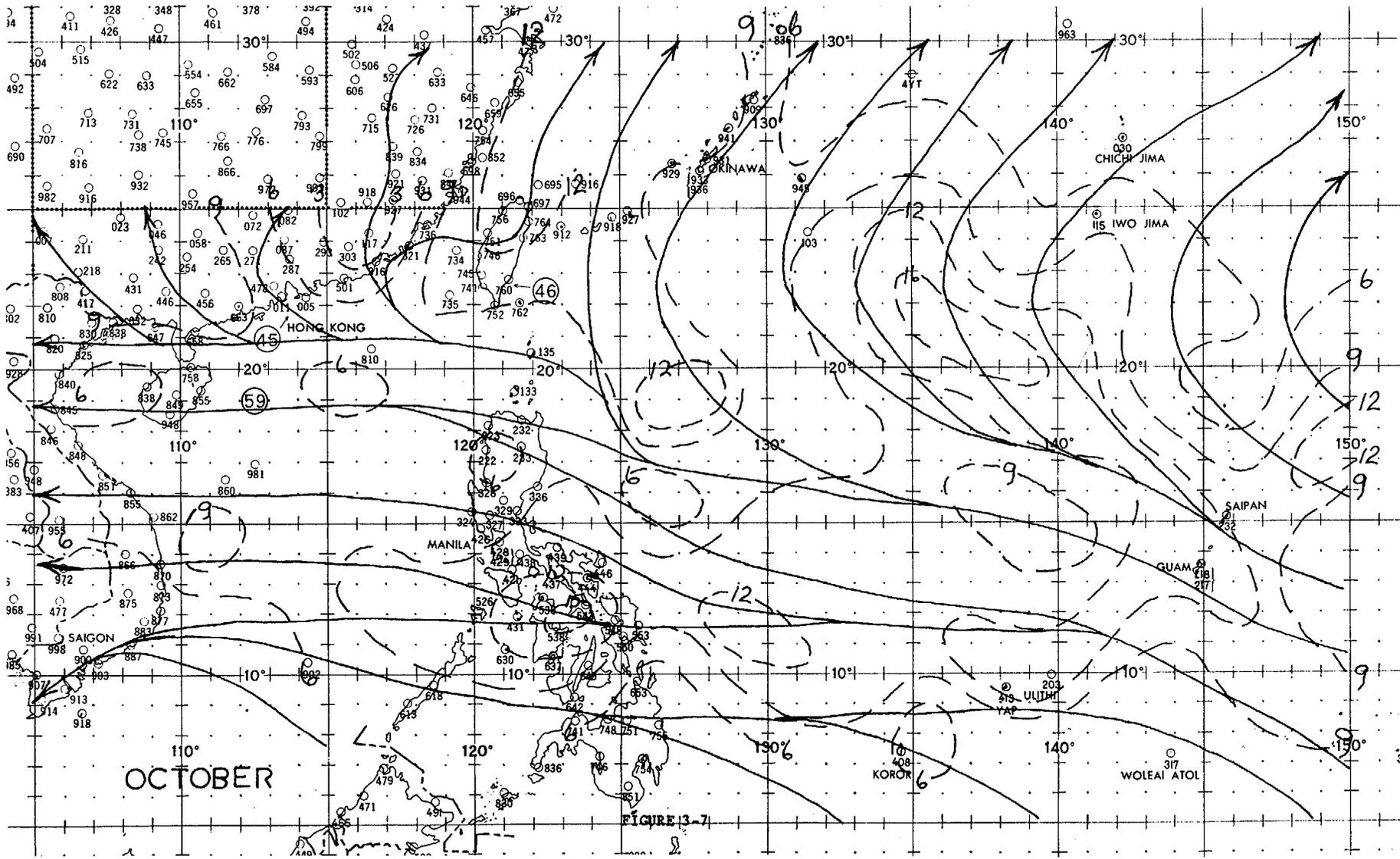
3-17



3-20



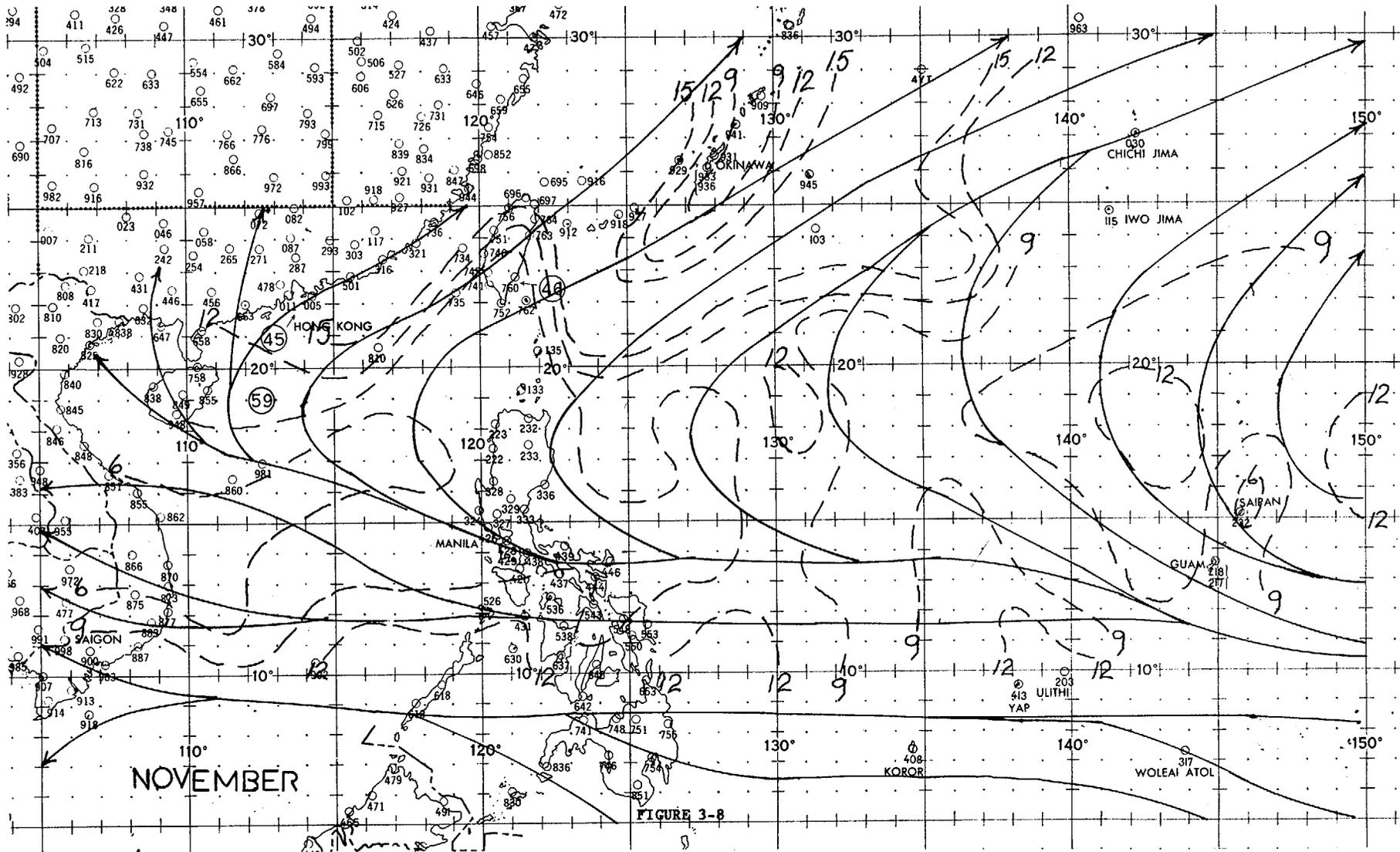
3-21



OCTOBER

FIGURE 3-7

3-22



17 YEAR TYPHOON DISTRIBUTION OF 334 WESTERN PACIFIC TYPHOONS

1952 - 1968

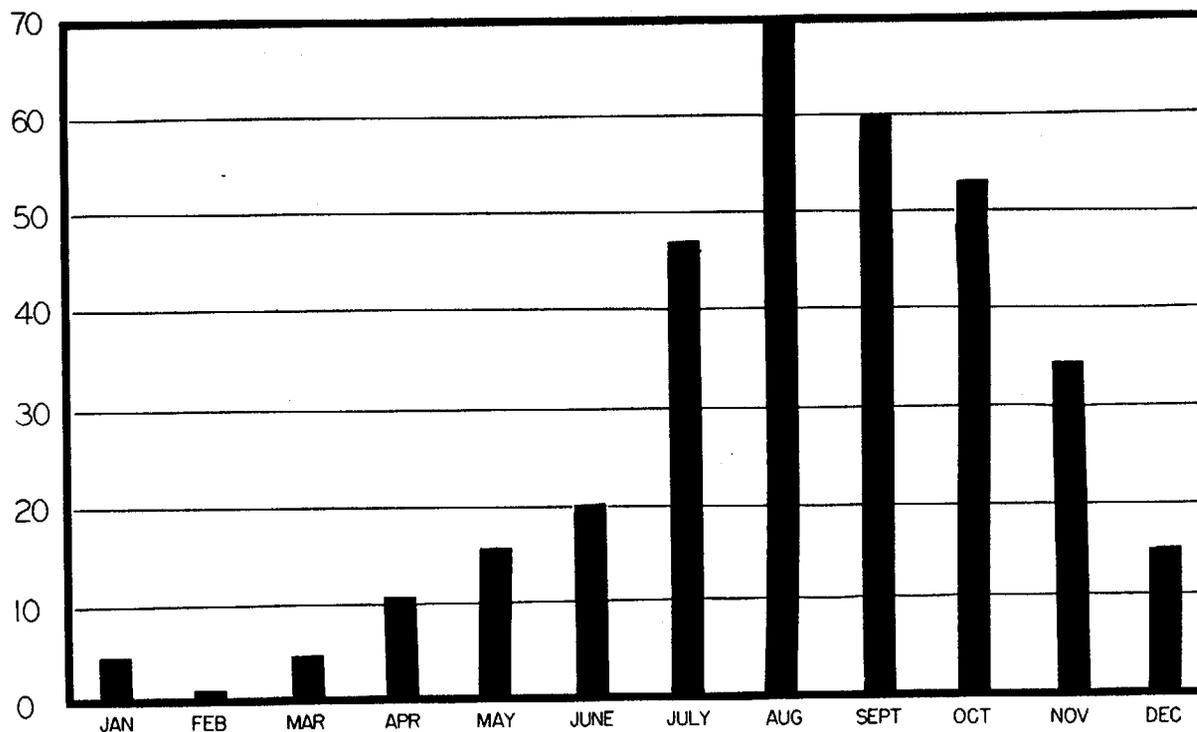


FIGURE 3-9

TYPHOON FREQUENCY
10 YEAR PERIOD

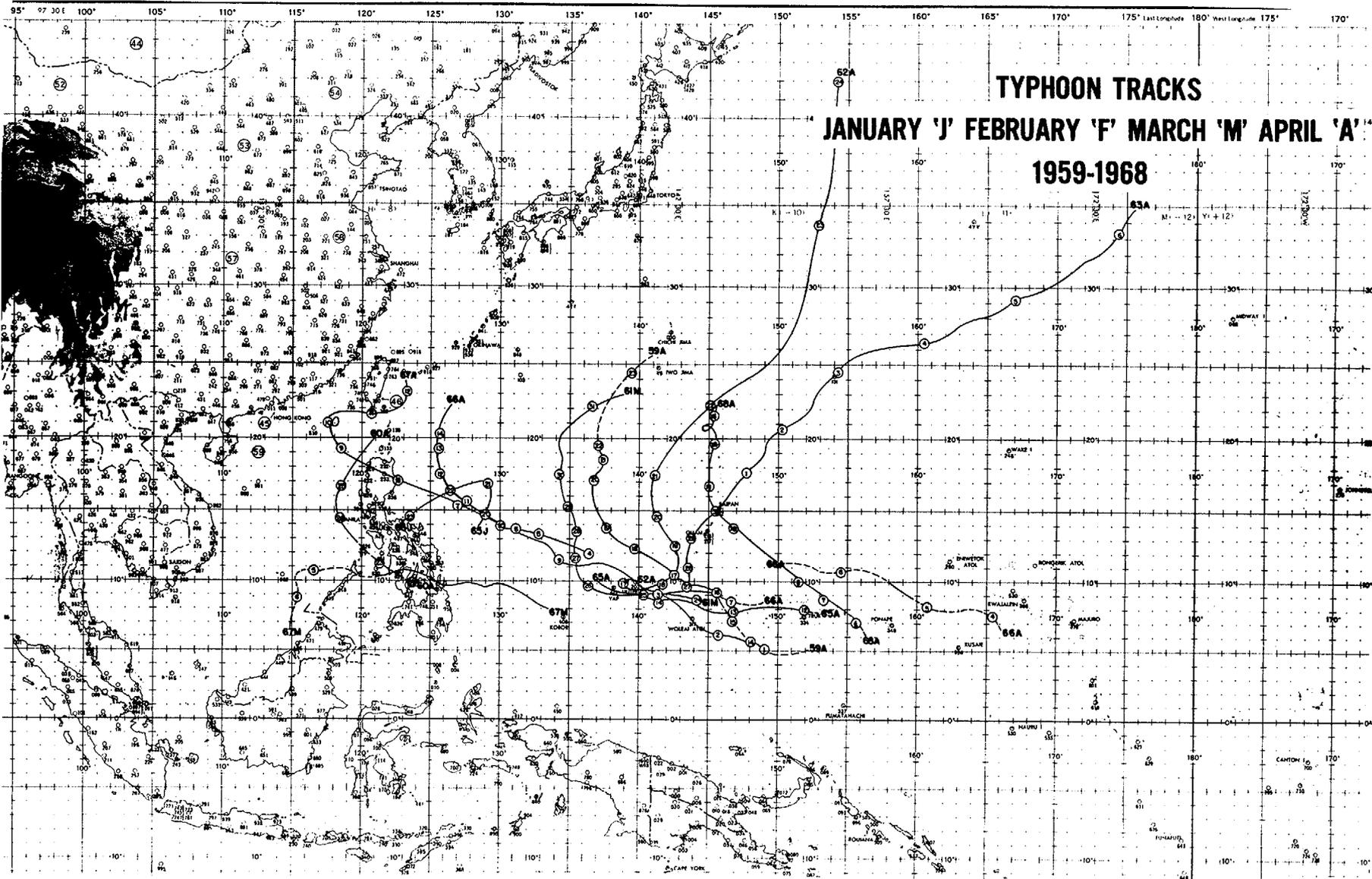
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	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
AVG	.1	0	.2	.8	1.2	1.2	3.1	4.6	3.4	3.3	1.9	.8	20.6

3-24

FIGURE 3-10

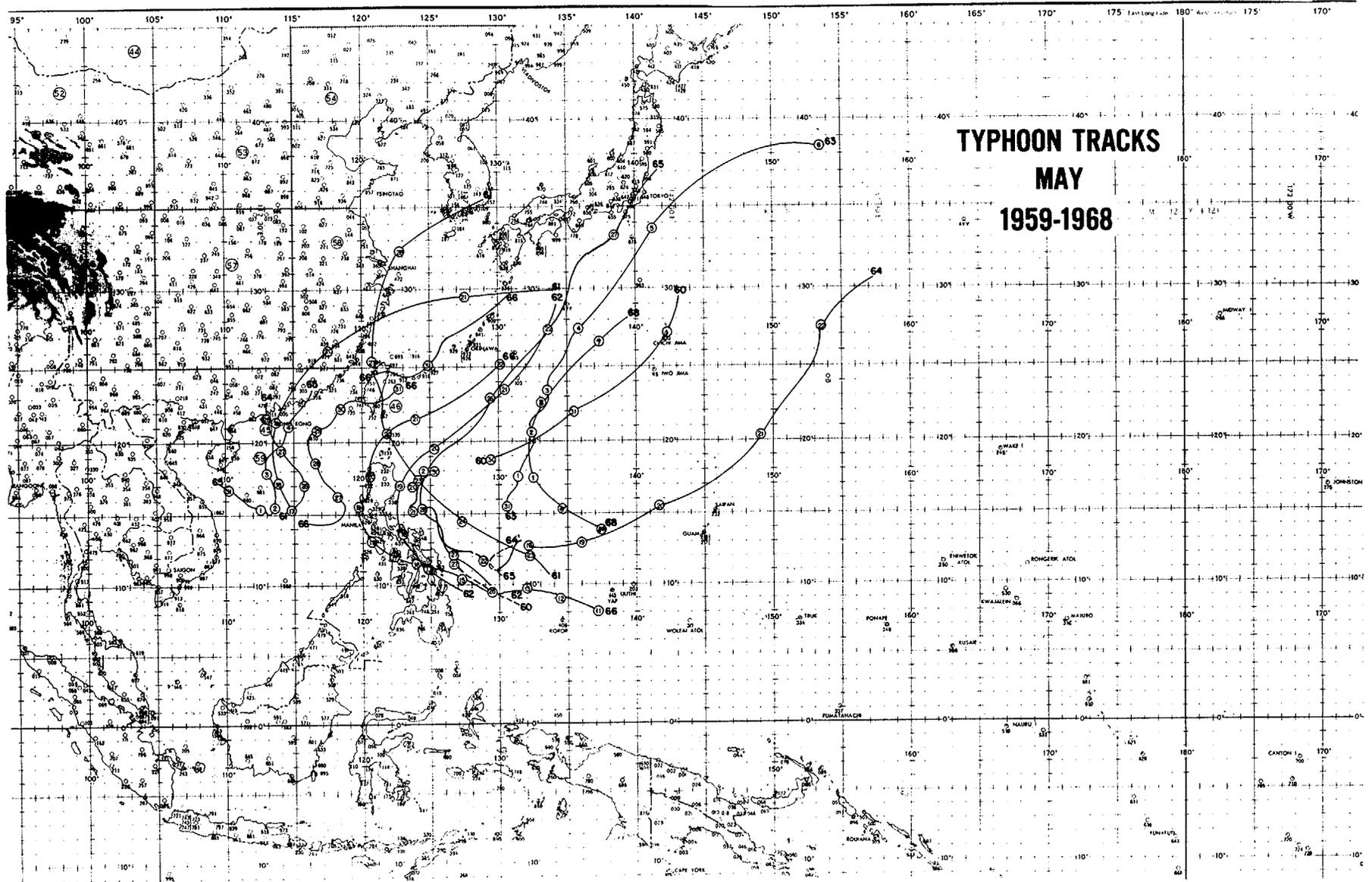
CLIMATOLOGY OF TYPHOON TRACKS

1959 - 1968



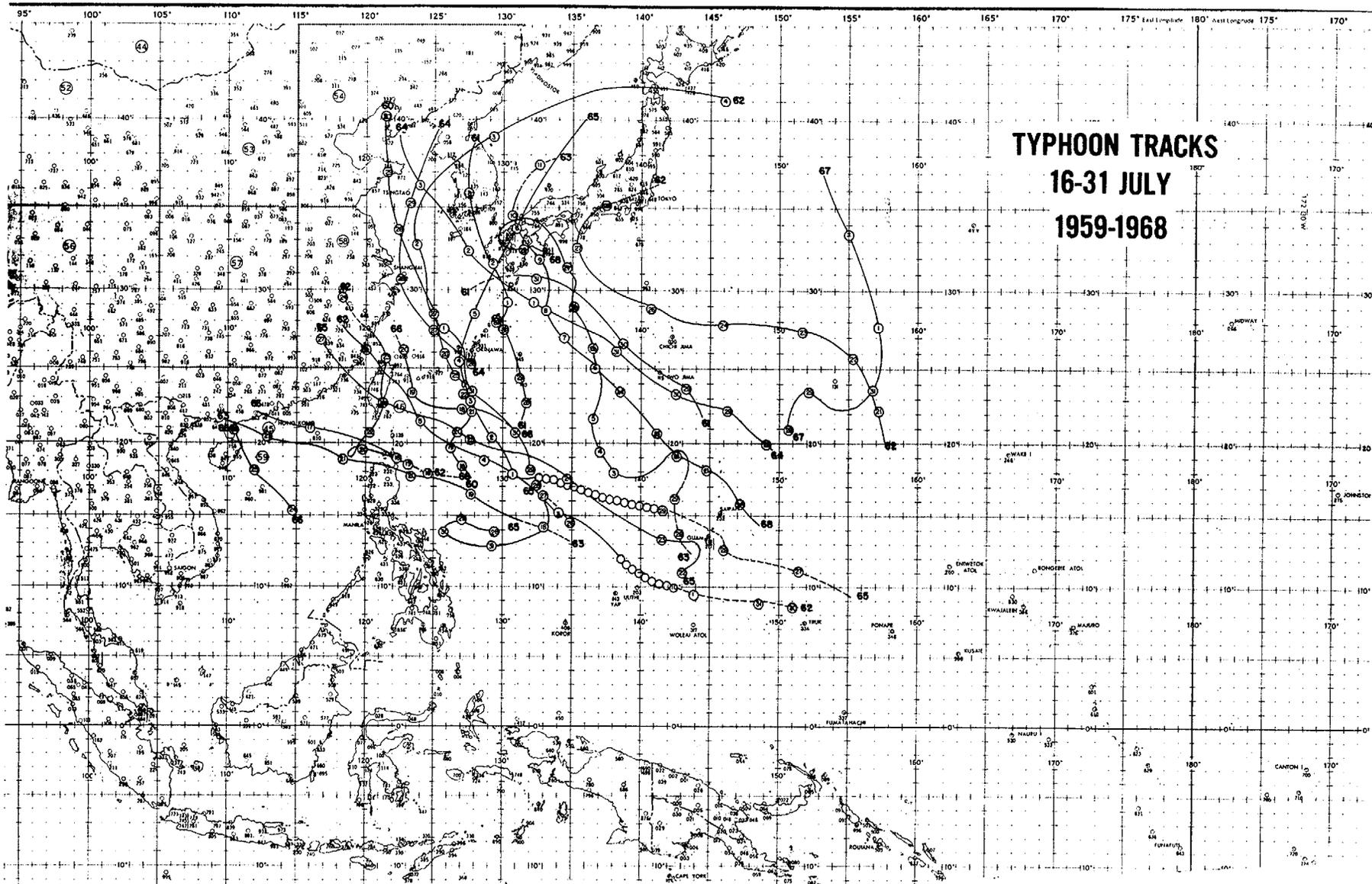
TYPHOON TRACKS
JANUARY 'J' FEBRUARY 'F' MARCH 'M' APRIL 'A'
1959-1968

3-26

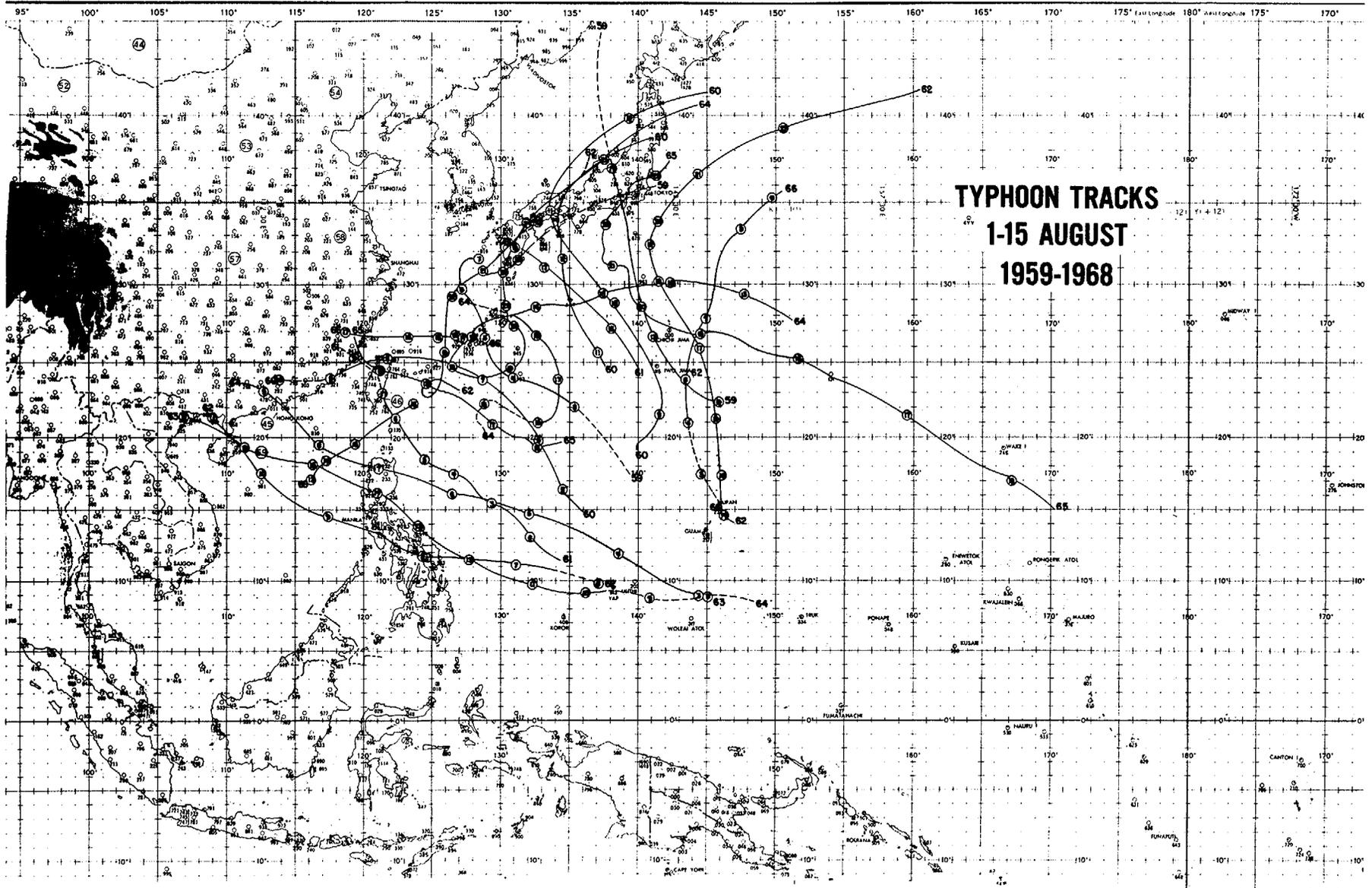


TYPHOON TRACKS MAY 1959-1968

3-30

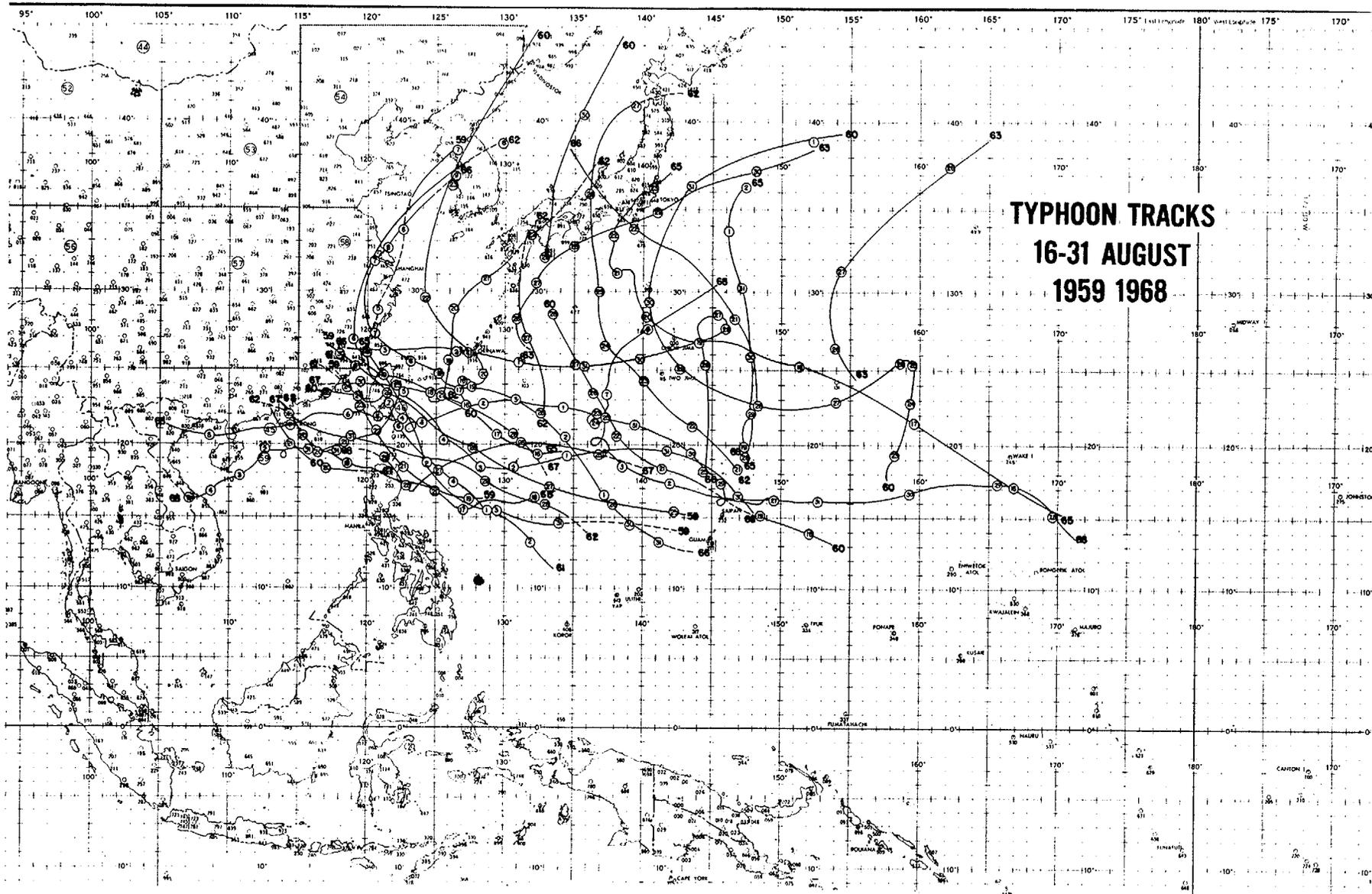


TYPHOON TRACKS
16-31 JULY
1959-1968

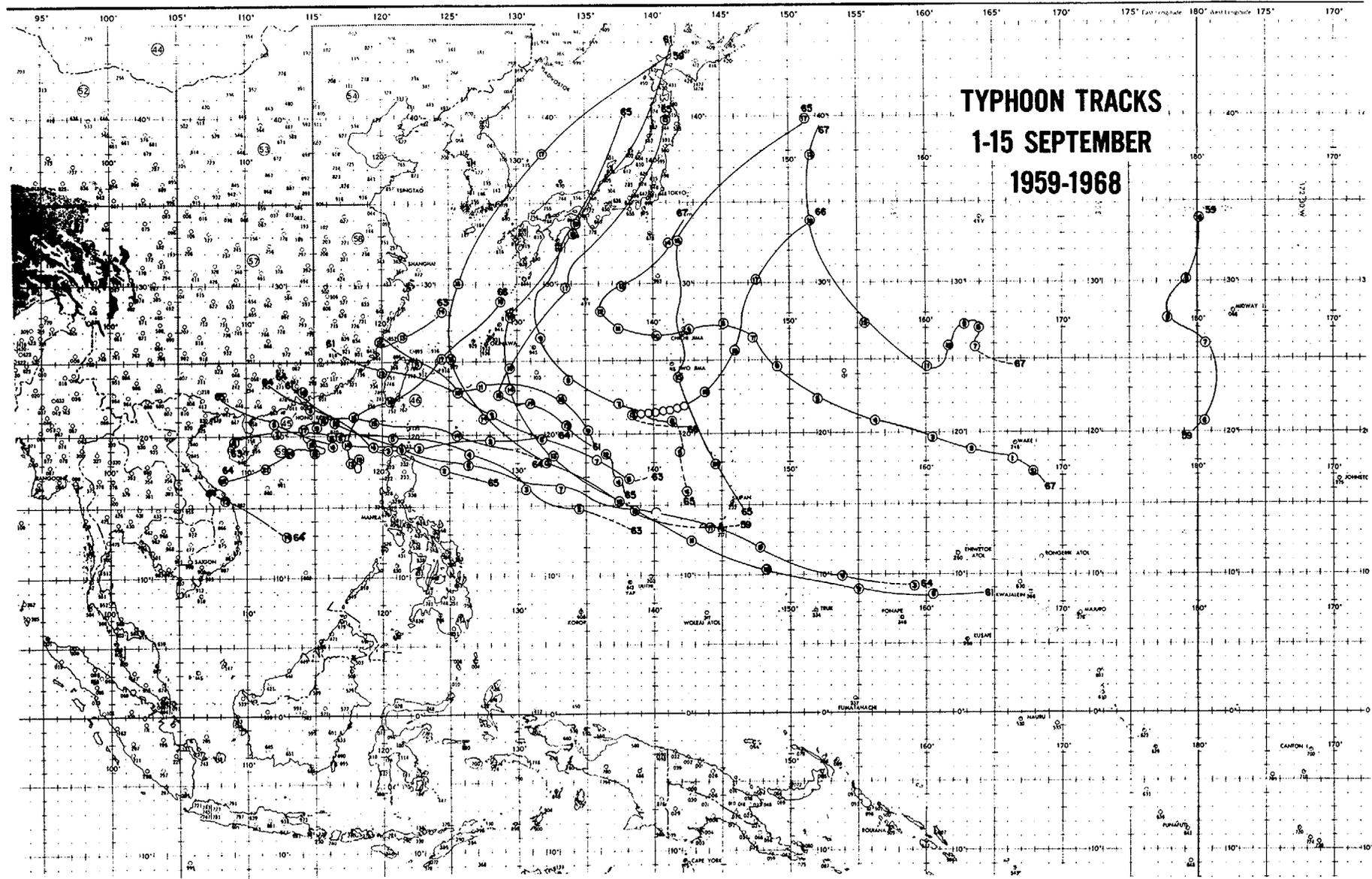


**TYPHOON TRACKS
16-31 AUGUST
1959 1968**

3-52

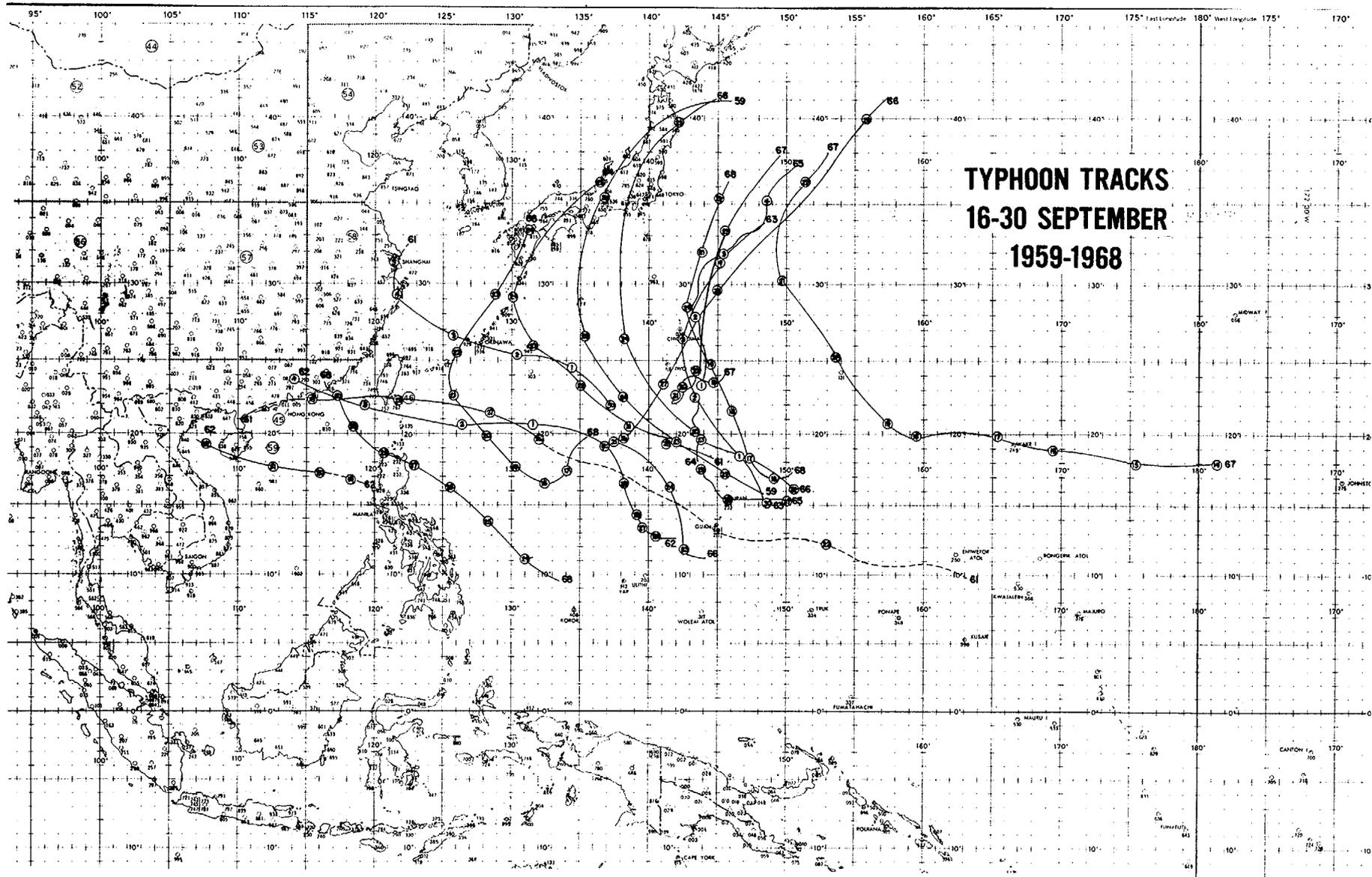


TYPHOON TRACKS 1-15 SEPTEMBER 1959-1968



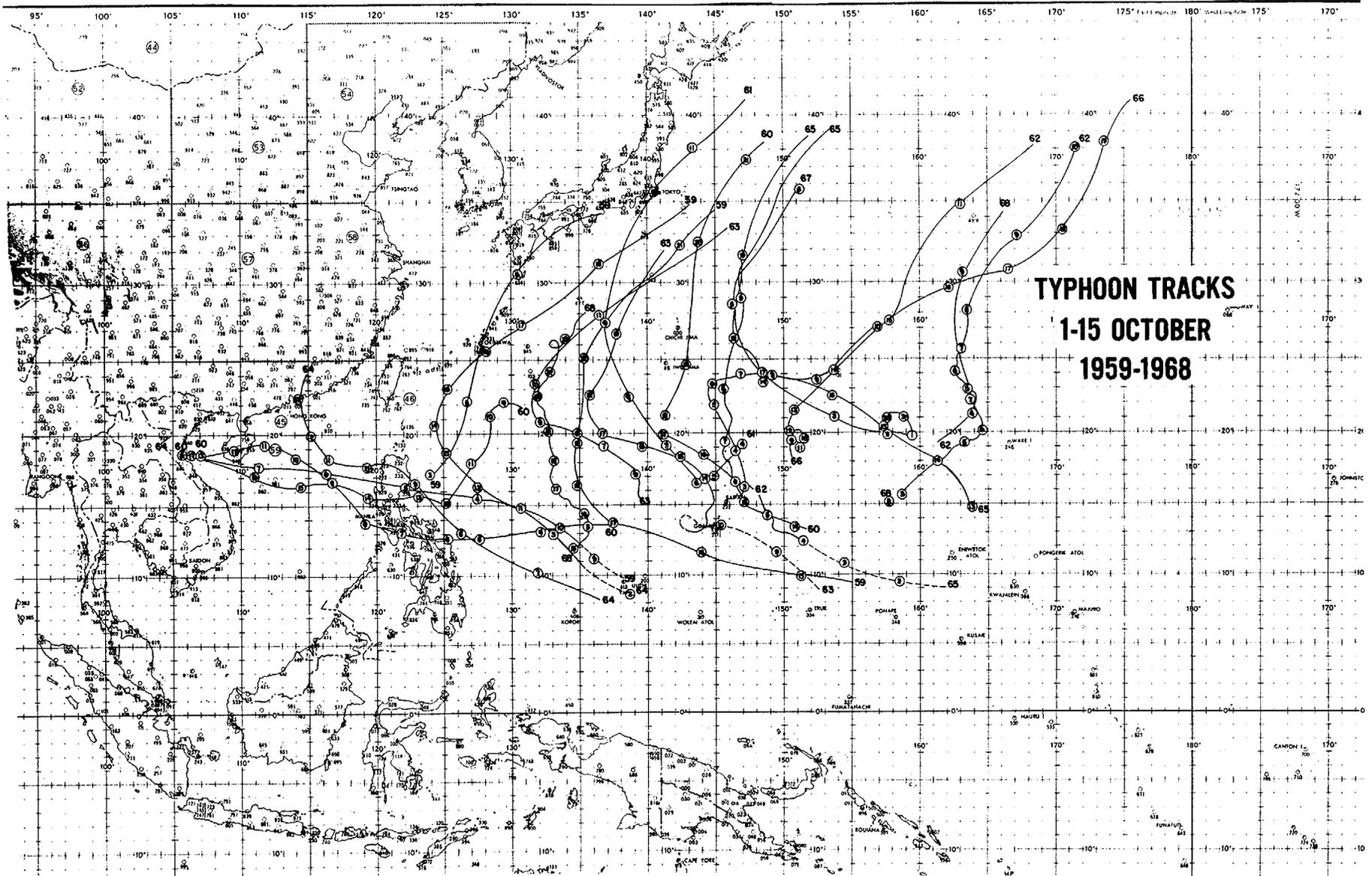
3-33

3-34



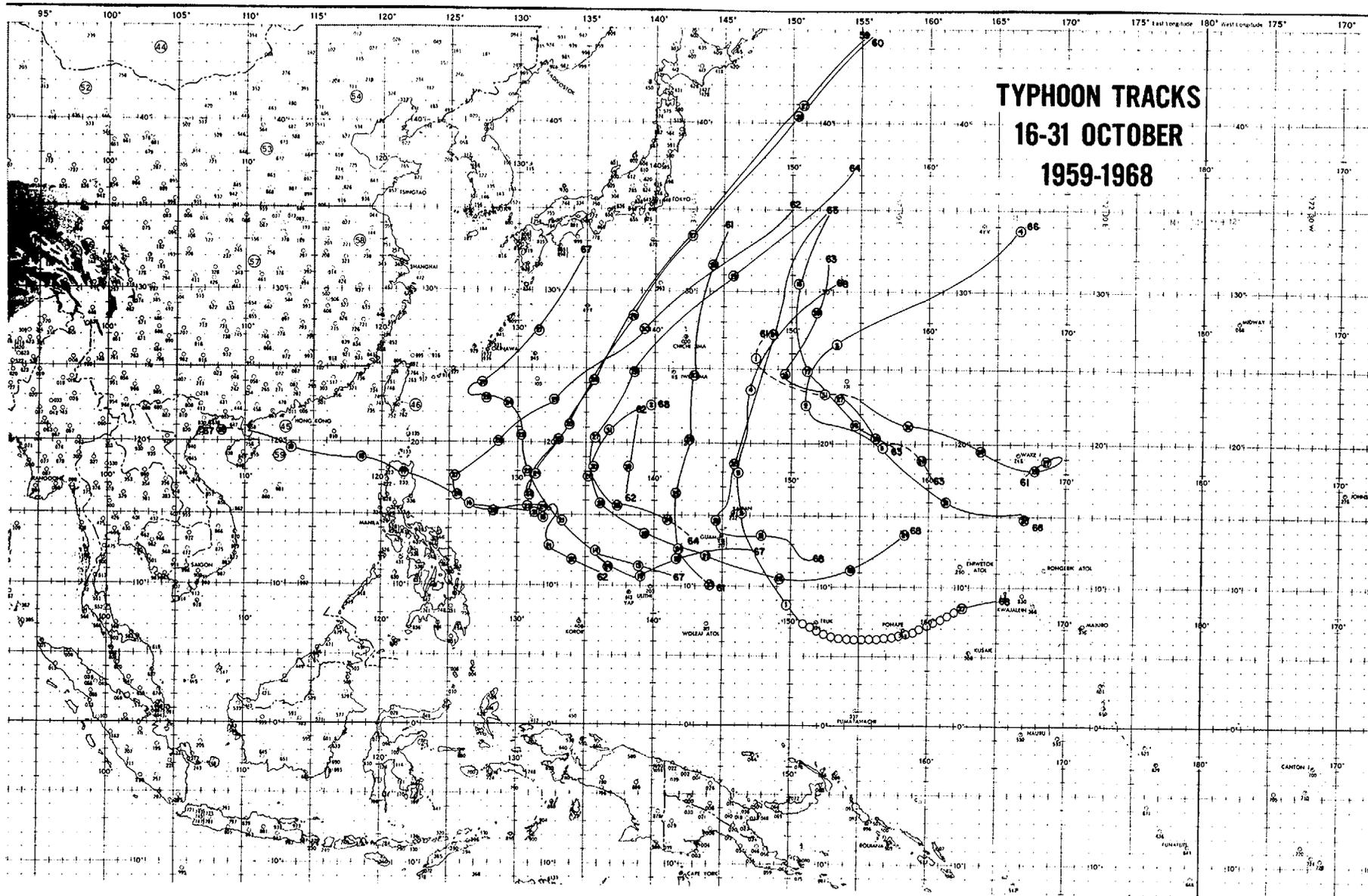
TYPHOON TRACKS
16-30 SEPTEMBER
1959-1968

3-35



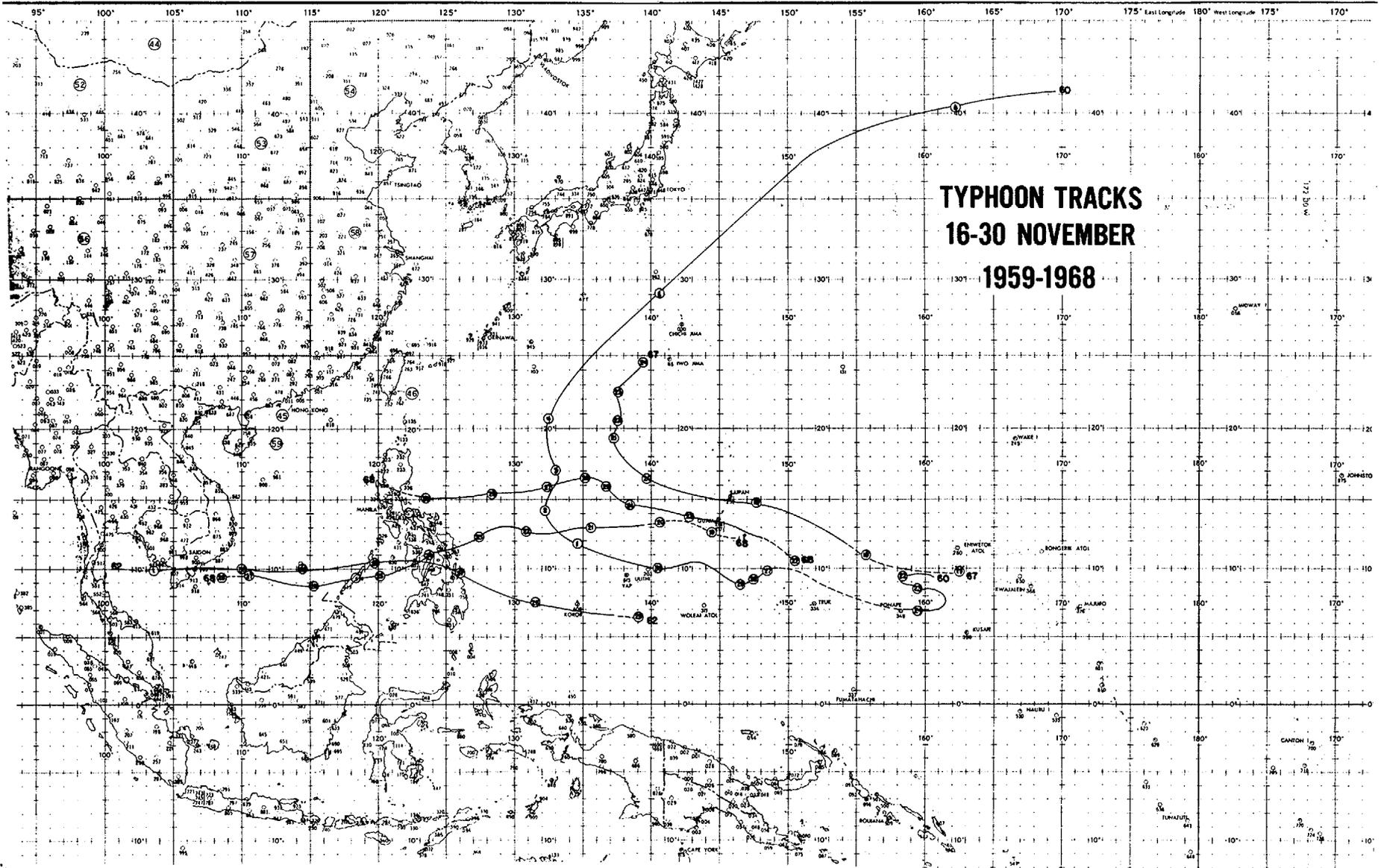
TYPHOON TRACKS
1-15 OCTOBER
1959-1968

TYPHOON TRACKS 16-31 OCTOBER 1959-1968



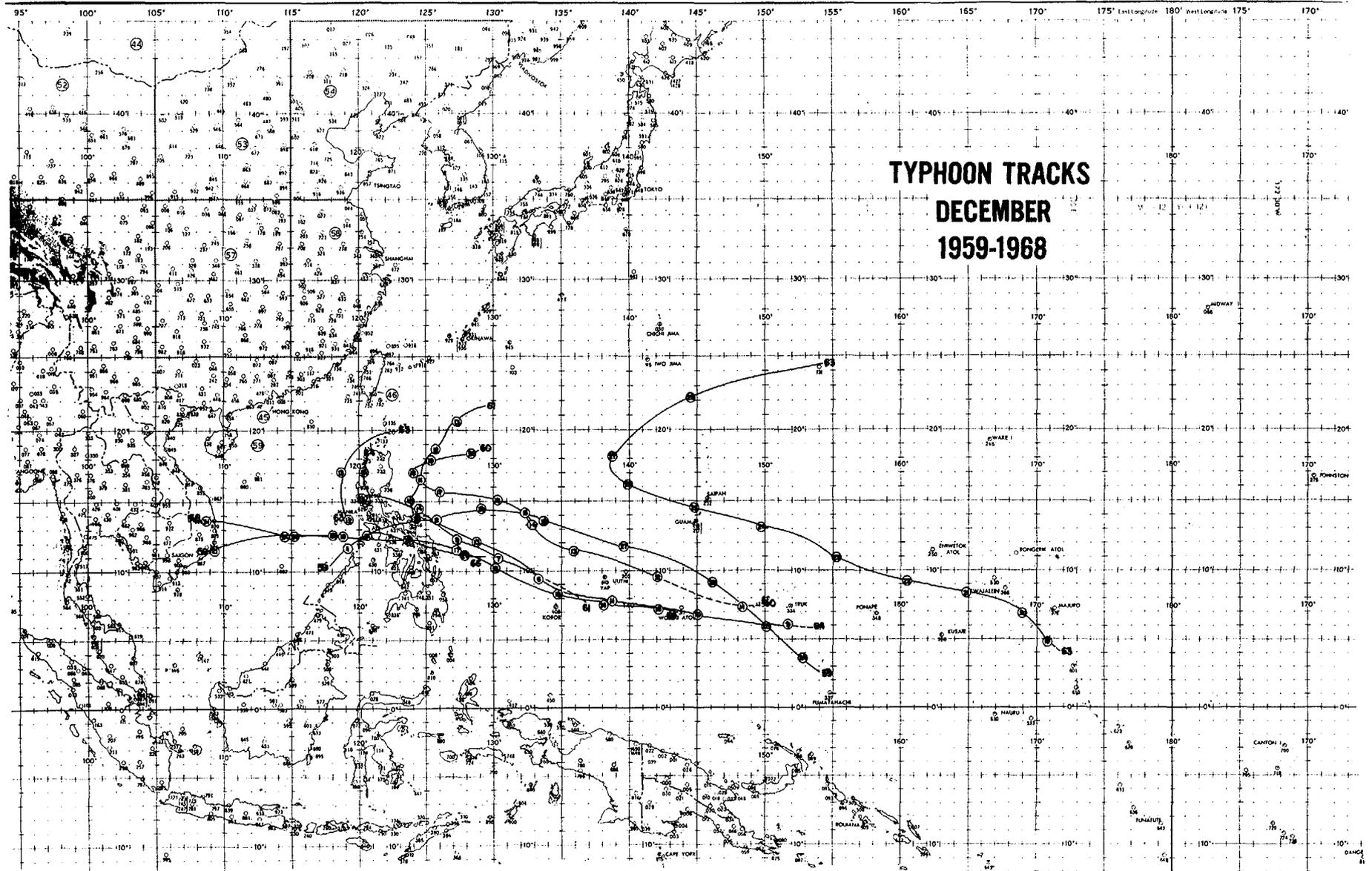
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**TYPHOON TRACKS
16-30 NOVEMBER
1959-1968**

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TYPHOON TRACKS DECEMBER 1959-1968

E. EVALUATION OF THE SEAY GRAPH AND DEVELOPMENT OF AN IMPROVED PRESSURE-WIND CORRELATION GRAPH FOR TROPICAL CYCLONES

The original Seay graph was compiled from reconnaissance data for 1957, 1958 and 1959 and is discussed in the 1960 Annual Typhoon Report. The graph was modified during the 1964 season using additional reconnaissance data from the years 1956 through 1962 and appears in the 1964 Annual Typhoon Report as the JTWC graph.

During 1968 results using this graph were compared with actual land station reports. Although it is realized that this graph was designed to be used with data collected from within the eye, it was felt that an evaluation using data frequently obtained from outside the boundary of the eye could, nevertheless be useful.

The evaluation utilized data taken from CPA reports and land station reports received at JTWC for 1963, 1964, 1967 and 1968. A composite list of these reports and associated data is given in Tables 3-5 through 3-10.

Using the appropriate latitude value and reported Minimum Sea Level Pressure of the station at the time of CPA a surface "Seay" wind was obtained from the Seay graph. The actual wind reported by each station was then subtracted from this computed "Seay" wind. A positive value signifies that the "Seay" wind is greater than the actual wind reported by the station and a negative value signifies that the "Seay" wind is less than the wind reported by the station.

The first attempt to segregate the data involved separating the reports into the following two groups: Group I - Those reports south of 22N; Group II - Those reports north of 22N. For Group I a comparison of the 55 station maximum sustained wind reports and the 41 station maximum gust reports with the "Seay" wind are shown in Table 3-11. For Group II a comparison of the 36 station maximum sustained wind reports and the 28 station maximum gust reports with the "Seay" wind are shown in Table 3-11.

The second attempt to segregate the data, without regard to geographic location, involved a comparison of the 91 station maximum sustained wind reports and the 69 station maximum gust reports with the "Seay" wind, with the results shown in Table 3-11.

The third attempt to segregate the data involved separating the CPA reports into arbitrary distances from the storm center based on the time of the report and best track position of the storm. For the purpose of this study 0 to 20 miles was considered to have been a good range for those stations in or near the eye or close enough to the center to give accurate values using the Seay graph. However, the largest difference between the "Seay" wind and station maximum sustained wind for Group I and II was the 0 to 20 miles range, with the difference decreasing as distance from the storm center increased.

Finally, in order to adhere to the prerequisites established for validity of the Seay graph, station data, especially the Minimum Sea Level Pressure, was compared with available reconnaissance data to determine whether or not a station had been inside the eye. Twenty-two stations were found which fell into this category. The average computed "Seay" wind was found to be 23.4 knots higher than the maximum sustained wind as reported by these stations, with values ranging between -14.9 knots to +51.0 knots. Due to the small sample size no attempt was made to group these reports according to latitude.

Conclusions inferred from this evaluation are: (1) No significant difference was noted between results obtained from stations in the southern range of latitude and results obtained from stations in a more northerly latitude. (2) The present Seay graph corresponds much better with maximum gusts than sustained winds. (3) The Seay graph appears to be about 20 knots too high.

Before modifying the Seay graph using the above results, an attempt was made to derive a new equation for computing maximum sustained surface winds from sea level pressure data. The following equation was found to be very accurate, when compared to actual land data for wind values less than 45 knots.

$$V_{\max} = (12 - \frac{\theta}{8}) \sqrt{1007 - P_{\circ}} \quad (1)$$

where

V_{\max} = Maximum sustained surface wind (knots)

θ = Latitude of tropical cyclone

P_{\circ} = Minimum observed sea level pressure (MB)

Equation (1) was used to compute wind values less than 45 knots and a modified Seay equation (2) was used to compute wind values greater than 45 knots. The resulting graph, Fig (3-11), is a smoothed product utilizing both equations.

$$V_{\max} = \left[\left(19 - \frac{\theta}{5} \right) \sqrt{364 - \frac{H_7}{28}} \right] - 20 \quad (2)$$

where

V_{\max} = Maximum sustained surface wind (knots)

θ = Latitude of tropical cyclone

H_7 = Minimum 700MB height in feet in tropical cyclone center.

This graph will give a better estimate of the maximum sustained surface wind associated with a tropical system of tropical storm intensity or greater than could previously be obtained from the present Seay graph. Evaluation of this graph will continue as additional wind reports are obtained.

STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/ SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
FWC/JTWC	35W	290645	54	87	976.5	932/110	86	+32	T. OLIVE/APR/63	125
ANDERSEN	57N	242359	37	61	992.0	942/120	60	+23	T. SUSAN/DEC/63	120
SANGLEY PT	80NE	132000	28	36	1000.5	990/75	36	+08	T. CARMEN/AUG/63	100
CATANDUANES	12SW	130100	68	95	973.0	898/125	91	+23	T. CARMEN/AUG/63	110
BATAN	40SE	132300	18	30	993.6	---/75	51	+33	T. PHYLLIS/DEC/63	45
USS MAURY	UNK	120310	70	83	988.0	---/---	67	-03	T. PHYLLIS/DEC/63	55
SANGLEY PT	10NE	291620	45	64	976.0	968/75	87	+42	T. WINNIE/JUN/64	65
CUBI PT	15S	292015	40	54	973.0	968/75	91	+51	T. WINNIE/JUN/64	65
CATANDUANES	190NE	060600	14	30	999.5	927/200+	41	+27	T. IDA/AUG/64	135
BATAN	190SW	060801	30	60	995.6	927/200+	47	+17	T. IDA/AUG/64	135
NAULO PT	190NE	071401	40	58	995.1	971/75	51	+11	T. IDA/AUG/64	100
DA NANG	15S	150132	28	48	993.0	---/---	54	+26	T. VIOLET/SEP/64	70
DA NANG	70NE	261700	26	32	999.9	---/---	38	+12	T.S. ANITA/SEP/64	--
CATANDUANES	45S	281401	20	35	1000.6	---/---	38	+18	T.S. BILLIE/SEP/64	--
CUBI PT	105N	042344	13	17	1001.9	999/60	33	+20	T. CLARA/OCT/64	80
CATANDUANES	10N	201801	20	28	1000.8	---/---	37	+17	T.S. GEORGIA/OCT/64	--
TAN SON NHUT	UNK	080400	50	70	1001.0	1000/55	36	-14	T. JOAN/NOV/64	65
CUBI PT	45N	141812	41	51	995.9	975/90	49	+08	T. OPAL/DEC/64	75

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TABLE 3-5 --GROUP I REPORTS SOUTH OF 22N

STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
CATANDUANES	20NE	132200	100	140	963.0	956/200	104	+04	T. OPAL/DEC/64	170
BATAN	170SW	151530	40	66	999.3	992/30	39	-01	T. OPAL/DEC/64	40
ANDERSEN	82N	202135	22	34	1000.7	---/---	36	+14	T.S.THERESE/MAR/67	---
NAULO PT	15SW	041201	45	60	984.4	975/45	71	+26	T. EMMA/NOV/67	60
WAKE	10N	162300	85	116	937.4	946/80	125	+40	T. SARAH/SEP/67	120
ANDERSEN	35N	122330	40	58	980.5	943/75	80	+40	T. GILDA/NOV/67	120
ANDERSEN	91NE	110430	38	54	997.4	932/130	46	+08	T. JEAN/APR/68	110
SAIPAN	35SE	110500	50	--	977.7	932/140	84	+34	T. JEAN/APR/68	110
BATAN	35NW	250300	50	90+	972.3	966/45	86	+36	T.S.NADINE/JUL/68	60
LOANG	10S	191200	25	--	982.1	968/50	73	+48	T. SHIRLEY/AUG/68	45
TUNG SHA TAO	53SE	201700	60	--	978.4	972/60	74	+14	T. SHIRLEY/AUG/68	60
VIGAN	80E	190600	40	--	992.8	962/50	56	+16	T. SHIRLEY/AUG/68	50
VIGAN	35NNE	191200	35	--	989.5	967/50	62	+27	T. SHIRLEY/AUG/68	45
VIGAN	45NW	191500	40	--	991.4	967/50	59	+19	T. SHIRLEY/AUG/68	50
DA NANG	35NNW	051410	35	50	985.0	---/---	70	+35	T. BESS/SEP/68	50
BATAN	70N	042200	45	50	985.1	972/---	67	+22	T. WENDY/SEP/68	80
SAIPAN	76N	020100	25	--	994.0	965/70	53	+28	T. AGNESS/SEP/68	90
TUGUEGARAO	60E	280300	45	--	986.1	930/100	68	+23	T. ELAINE/SEP/68	120

TABLE 3-6-- Group I reports south of 22N

STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/ SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
APARRI	25S	280900	60	--	977.8	---/---	81	+21	T. ELAINE/SEP/68	95
VIGAN	60NE	281800	60	--	988.0	---/---	63	+03	T. ELAINE/SEP/68	75
SAIPAN	37NW	221600	62	85	990.3	977/50	61	-01	T. IRMA/OCT/68	60
ANDERSEN	30N	220825	45	66	989.4	985/40	64	+19	T. IRMA/OCT/68	55
ANDERSEN	103SE	270227	32	50	1005.5	935/130	30	-02	T. JUDY/OCT/68	110
SAIGON	35SE	192000	24	34	1002.3	---/---	30	+06	T.S. HESTER/OCT/68	30
ANDERSEN	07S	221640	45	77	988.3	---/---	66	+21	T. ORA/NOV/68	45
ANDERSEN	85E	012140	26	41	1001.0	984/40	32	+06	T. KIT/NOV/68	50
MACTAN	75N	232300	37	52	996.0	---/---	51	+14	T. NINA/NOV/68	50
MACTAN	20SSE	190200	44	60	1001.0	---/65	32	-12	T. MAMIE/NOV/68	55
TARUMPITAO	50N	201200	30	38	1004.5	972/50	30	00	T. MAMIE/NOV/68	60
PHAN RANG	10S	231650	21	36	1005.0	---/35	30	+09	T. MAMIE/NOV/68	35
CAM RAHN BAY	27S	231450	28	38	1007.1	---/35	30	+02	T. MAMIE/NOV/68	40
SAIPAN	28ENE	020000	45	60	993.4	984/40	54	+09	T. KIT/NOV/68	50
NANSHA	47NNE	210600	35	--	1001.4	976/85	31	-04	T. MAMIE/NOV/68	60
SURIGAO	10N	181800	45	--	1001.0	972/80	31	-14	T. MAMIE/NOV/68	55
CATBALOGAN	30SE	231500	50	--	983.9	---/---	77	+27	T. NINA/NOV/68	50
TACLOBAN	10N	231500	45	--	975.1	---/---	91	+46	T. NINA/NOV/68	50
TARUMPITAO	10E	251000	40	65	988.2	977/60	67	+27	T. NINA/NOV/68	50

TABLE 3-7--Group I reports south of 22N

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STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/ SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
TAIPAI	40SW	160400	40	68	980.0	943/80	70	+30	T. WENDY/JUL/63	60
TAIPAI	40NE	102200	--	84	969.2	932/100	83	--	T. GLORIA/SEP/63	110
ITAZUKE	20NE	090328	25	39	984.5	964/80	56	+31	T. BESS/AUG/63	60
KADENA	160SW	180254	26	44	998.8	962/100	36	+10	T. SHIRLEY/JUN/63	100
KADENA	130W	180600	30	47	989.9	---/---	54	+24	T. SHIRLEY/JUN/63	100
NAHA	135SW	181345	30	49	998.1	---/80	38	+08	T. SHIRLEY/JUN/63	100
KUNSAN	20SE	182154	23	30	995.2	--/---	38	+15	T. SHIRLEY/JUN/63	---
NAHA	30SW	260000	36	52	999.9	988/40	34	-02	T. FLOSSIE/JUL/64	40
KADENA	60SW	260625	27	49	1001.6	983/55	30	+03	T. FLOSSIE/JUL/64	50
KUNSAN	85SW	021700	18	25	990.0	---/---	45	+27	T. HELEN/AUG/64	65
NAHA	35W	161200	26	40	986.7	985/80	59	+33	T. KATHY/AUG/64	70
ITAZUKE	20W	232049	27	41	986.0	973/65	54	+27	T. KATHY/AUG/64	65
KADENA	30W	172000	25	39	989.2	954/100	55	+30	T. KATHY/AUG/64	95
ITAZUKE	100SE	241355	28	41	994.3	---/75	42	+14	T. WILDA/SEP/64	95
NAHA	105SE	070600	23	30	1000.0	995/30	33	+10	T. BILLIE/JUL/67	40
HUALIEN	10S	110615	70	90	970.2	965/75	83	+13	T. CLARA/JUL/67	80
KADENA	128SE	070400	16	30	1000.4	995/30	32	+16	T. BILLIE/JUL/67	45
ILAN	45S	291800	45	47	989.6	982/50	56	+11	T. NORA/AUG/67	45

TABLE 3-8--Group II reports north of 22N

STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/ SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
NAHA	75E	261325	42	58	991.4	965/60	51	+09	T. DINAH/OCT/67	80
KADENA	95E	261355	30	48	991.2	968/55	51	+21	T. DINAH/OCT/67	80
TAIPEI	35SW	180500	44	65	994.7	---/---	45	+01	T. GILDA/NOV/67	50
MUROTOMISAKI	32SW	280900	70	--	978.4	973/35	64	-06	T. MARY/JUL/68	30
SHIMIZU	40E	280900	10	--	978.0	973/35	64	+54	T. MARY/JUL/68	30
HENGCHUN	OVER	251100	--	45	976.7	971/70	78	--	T.S. NADINE/JUL/68	50
KADENA	72ESE	020000	30	--	1002.4	1000/35	30	00	T.LUCY/JUL/68	45
KUNGSAN	10W	280900	40	60	988.3	985/45	59	+19	T.S. NADINE/JUL/68	40
AMAMIO SHIMA	40NW	121800	15	--	996.6	984/40	40	+25	T.S. POLLY/AUG/68	40
TSUSHIMA	14WNW	160600	40	--	977.2	971/75	63	+23	T.S. POLLY/AUG/68	50
HONG KONG	OVER	211200	--	--	970.9	964/80	86	--	T. SHIRLEY/AUG/68	60
AMAMIO SHIMA	14WSW	272000	25	--	984.3	978/35	61	+36	T.S. TRIX/AUG/68	55
KADENA	76E	271627	20	34	989.0	978/35	55	+35	T.S. TRIX/AUG/68	50
ITAZUKE	80NW	160600	28	46	999.1	971/75	30	+02	T.S. POLLY/AUG/68	50
MARCUS	32NNW	071800	35	--	993.1	982/45	50	+15	T.S. POLLY/AUG/68	45
KADENA	46NNW	230800	48	69	991.0	940/100	53	+05	T. DELLA/SEP/68	100
TAINAN	75SSE	060154	32	41	988.2	972/60	58	+26	T. WENDY/SEP/68	65
MIYAKO JIMA	15E	221600	110	150	945.8	---/---	108	-02	T. DELLA/SEP/68	110

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TABLE 3-9--Group II reports north of 22N

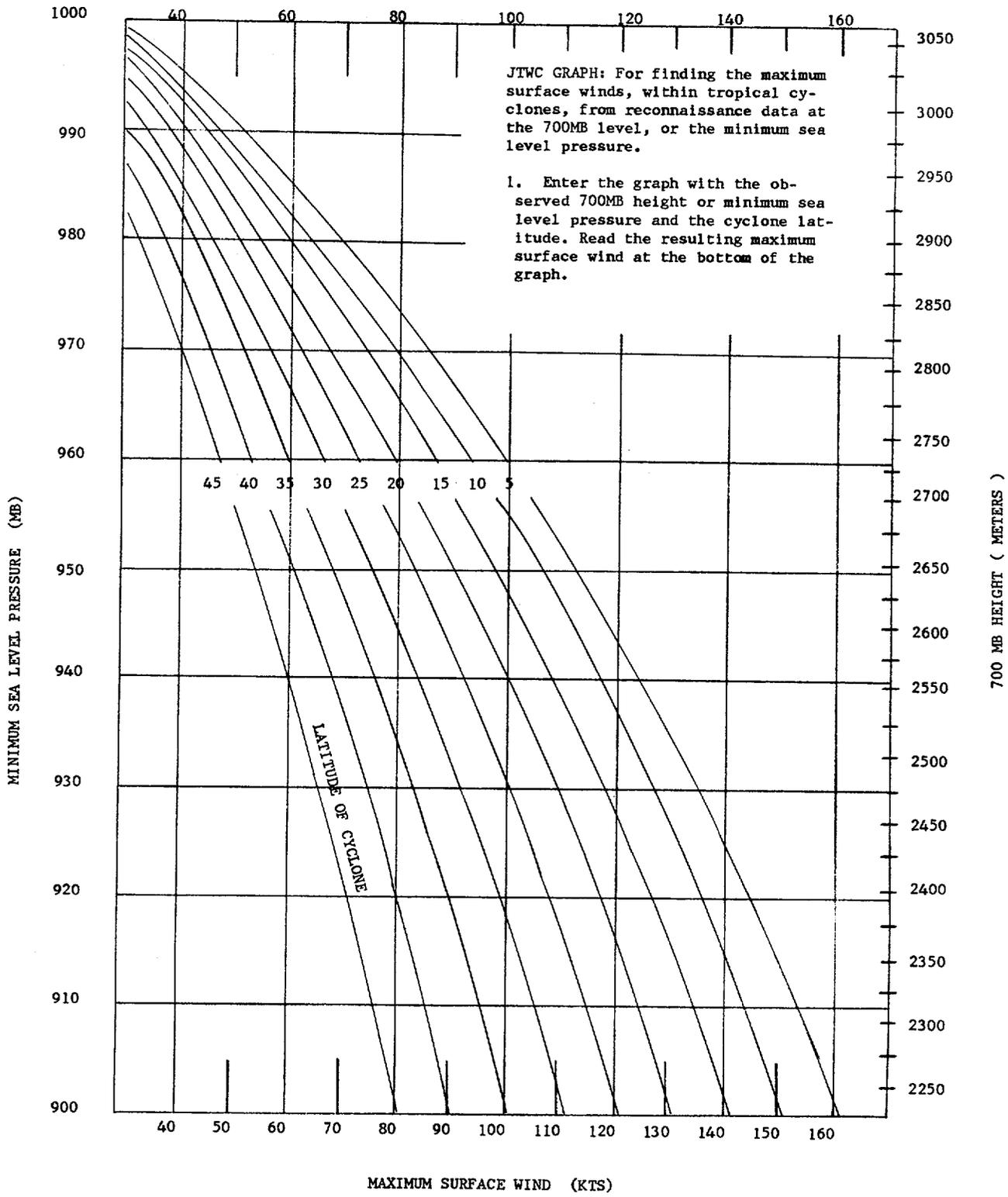
STATION	CPA(NM)	DTG(Z)	MAX WIND (KTS)	PEAK GUST (KTS)	MIN SLP (MB)	ACFT EYE/SLP/ SFC WIND	SEAY WIND	SEAY LESS MAX WIND	STORM/MONTH/YEAR	BEST TRACK(KTS)
HENGCHUN	35SE	051800	35	---	980.4	970/--	72	+37	T. WENDY/SEP/68	70
CHICHI JIMA	86NW	090100	30	---	980.4	976/45	68	+38	T. AGNES/SEP/68	55
KAGOSHIMA	10W	241300	45	---	989.3	---/---	51	+06	T. DELLA/SEP/68	60

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TABLE 3-10--Group II reports north of 22N

	NUMBER OF STATION REPORTS	"SEAY" WIND LESS MAX SUSTAINED WIND (KNOTS)	"SEAY" WIND LESS MAX GUST (KNOTS)
Group 1	$\frac{91}{69}$	$\frac{+17.25}{}$	$\frac{-1.13}{}$
Group II	$\frac{55}{41}$	$\frac{+16.8}{}$	$\frac{-1.6}{}$
Group III	$\frac{36}{28}$	$\frac{+17.9}{}$	$\frac{-0.5}{}$

TABLE 3-11 - - - Comparison of "Seay" wind with reported sustained wind and maximum gusts.



F. COMMENTS ON THE CHARACTERISTICS OF TROPICAL CYCLONES BECOMING EXTRATROPICAL

This study is intended to show, by use of satellite pictures and other synoptic data, characteristics of tropical cyclones that are becoming extratropical.

The term extratropical, as used in this study, is defined as that stage in the life of a tropical cyclone when the cyclone has moved to a position poleward of the belt of tropical easterlies (subtropical ridge) and the characteristic warm core center has become or is rapidly becoming indistinguishable.

Several tropical cyclones during 1968 displayed similar characteristics while becoming extratropical. Comparisons using reconnaissance, upper air and sea surface temperature data with corresponding satellite pictures are made for three tropical cyclones which became extratropical.

I. TYPHOON CARMEN

Tropical Cyclone Carmen (See Chapter V for best track) attained typhoon intensity at 171100Z SEP and reached its maximum intensity at 190500Z*. Table 3-12 lists sea level pressure (SLP), temperature difference at 700MB between inside the eye and outside the eye (ΔT), sea surface temperature (SST) and satellite classification for the corresponding date-time (DT). At the time of maximum intensity the subtropical ridge was located near 28N with a short wave trough located along 147E and another located over China. Both troughs were moving eastward at about 10 degrees of longitude per day.

Carmen passed thru the subtropical ridge and recurved near 28N at 202300Z*. The recurvature was a result of short wave troughs creating a weakness in the subtropical ridge through which Carmen could pass.

By 220000Z* Carmen was well north of the ridge and the 220006Z satellite picture (Fig. 3-12) shows a well defined circulation still present, with a polar front lying along a SW to NE line north of Carmen. Although Carmen was still a typhoon, the intensity was decreasing at a steady rate. Especially of interest is the decrease in the SST and ΔT from the time of recurvature. Much of the decrease in ΔT is probably due to

*See Table 3-12

the entrainment of the cold air associated with the polar front.

Twenty four hours later, at 230000Z*, Carmen had moved further northward into the westerly flow and cyclonic circulation at 300MB was no longer evident (Fig. 3-13). The 230059Z satellite picture (Fig. 3-13) still shows a well defined circulation with Carmen beginning to merge with the polar front. Carmen was now of tropical storm intensity and the SST and ΔT showed further decreases.

The final warning was issued at 231100Z* and by 240000Z* the upper level circulation (Fig. 3-14) had completely dissipated. The 232358Z satellite picture (Fig. 3-14) shows Carmen has merged with the polar front and the circulation has become appreciably disorganized.

II. TYPHOON DELLA

Tropical cyclone Della (See Chapter V for best track) attained typhoon intensity at 182300Z SEP and reached its maximum intensity at 220000Z**. Table 3-13 lists applicable data as defined in above discussion of Carmen. At the time of maximum intensity Della was located immediately south of the subtropical ridge and a short wave trough was located along 120E moving eastward at about 7 degrees longitude per day (Fig. 3-12). Shortly thereafter Della moved into the ridge and recurved near 24N at 220500Z. The 220201Z satellite picture (Fig. 3-12) shows a well organized circulation with a well defined eye visible.

During the following 48 hours Della moved slowly northeastward thru the weakness in the ridge created by the eastward moving trough (Figs 3-13 & 3-14) with the intensity decreasing slowly. The 230059Z satellite picture (Fig. 3-13) shows the same intensity as the 220201Z picture (Fig. 3-12) while the 240153Z satellite picture (Fig. 3-14) shows only a slight decrease in intensity. By 240000Z** ΔT had decreased 2 degrees C and the SST had decreased 4 degrees C.

Della moved over southern Kyushu at 241100Z and her intensity decreased so rapidly, due to the lack of a heat source from the ocean, that by 250500Z**, when the final warning was issued, Della contained maximum winds of only 25 knots. The 250053Z satellite picture (Fig. 3-15) shows only a cloud blob with very little circulation present and the great decrease in intensity which occurred over the preceding 24 hours.

* See Table 3-12

** See Table 3-13

III. TYPHOON GLORIA

Tropical cyclone Gloria (See Chapter V for best track) attained typhoon intensity at 172300Z OCT and reached its maximum intensity at 182300Z***. At the time of maximum intensity the subtropical ridge was located near 24N, a series of short wave troughs were moving eastward north of the ridge and the trailing edge of a polar front was located about 360 NM north of Gloria. Gloria continued moving slightly west of north until she recurved near 23N at 200500Z.

By 220000Z*** Gloria, which was now a tropical storm, was located north of the subtropical ridge and was moving northeastward along the upper level trough line (Fig. 3-15). The 220200Z satellite picture (Fig. 3-15) shows Gloria starting to merge with the trailing edge of the polar front. The SST was now 74 degrees F, a decrease of 8 degrees F since the time of maximum intensity. Twenty four hours later, at 230000Z***, Gloria showed no high level circulation but low level circulation was still present (Fig. 3-16). The 230058Z satellite picture (Fig. 3-16) shows Gloria has merged with the polar front and a decrease in the intensity of the cloud pattern. The SST decreased 1 degree F to 73 degrees F and ΔT decreased 3 degrees C to 2 degrees C in the 24 hours previous to 230000Z.

The final warning was issued at 232300Z***, with maximum winds of 35 knots, and the corresponding satellite picture showed Gloria to be greatly disorganized and rapidly dissipating.

IV. SUMMARY

The impetus for a tropical cyclone going extratropical is usually the eastward moving troughs north of the subtropical ridge creating a weakness in the ridge thru which the cyclone passes. After passing thru the ridge many cyclones maintain their tropical characteristics for as long as 48 hours (the warm core center is still present), although the intensity usually decreases at a very rapid rate.

In two of the cases discussed great decreases in intensity occurred as the cyclones merged with polar fronts (entrainment of cold air into the cyclone) and in the other case the intensity rapidly decreased after the

*** See Table 3-14

cyclone moved over land (loss of ocean heat source). In all three cases, after the cyclone had recurved, a steady decrease in the intensity was associated with a steady decrease in the temperature of the ocean surface over which the cyclone was moving.

DT	SLP (MB)	ΔT ($^{\circ}C$)	SST ($^{\circ}F$)	SATELLITE CLASSIFICATION**	MAX SFC WIND (KNOTS)
190500Z	936	4	82	STG X DIA 6 CAT 4	110
202300Z	952	4	81	STG X DIA 4 CAT 3	90
220000Z	962	2	78	STG X DIA 4 CAT 2	65
230000Z	974	1	74	STG X DIA 4 CAT 2	55
231100Z	980	0	72	NONE	45
240000Z	---	-	70	NONE	--

** See Project FAMOS Research Report (4-67) titled "GUIDE FOR INTERPRETATION OF SATELLITE PHOTOGRAPHY AND NEPHANALYSES".

TABLE 3-12 - TYPHOON CARMEN

DT	SLP (MB)	ΔT ($^{\circ}C$)	SST ($^{\circ}F$)	SATELLITE CLASSIFICATION**	MAX SFC WIND (KNOTS)
220000Z	930	8	83	STG X DIA 5 CAT 4	120
230000Z	939	7	81	STG X DIA 5 CAT 4	110
240000Z	950	6	79	STG X DIA 4 CAT 3	90
250500Z	1000+	-	--	NONE	25

** See Project FAMOS Research Report (4-67)

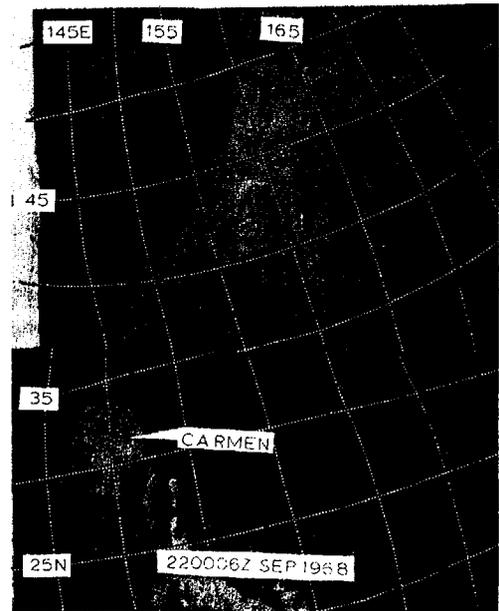
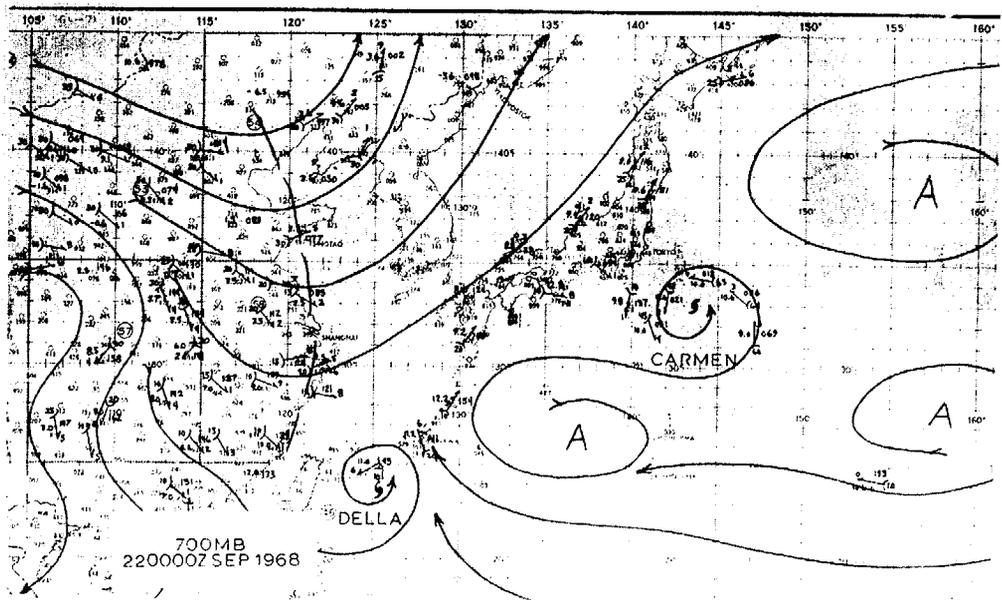
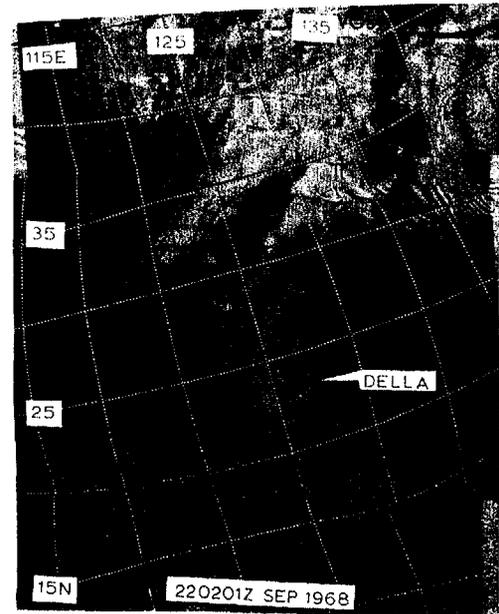
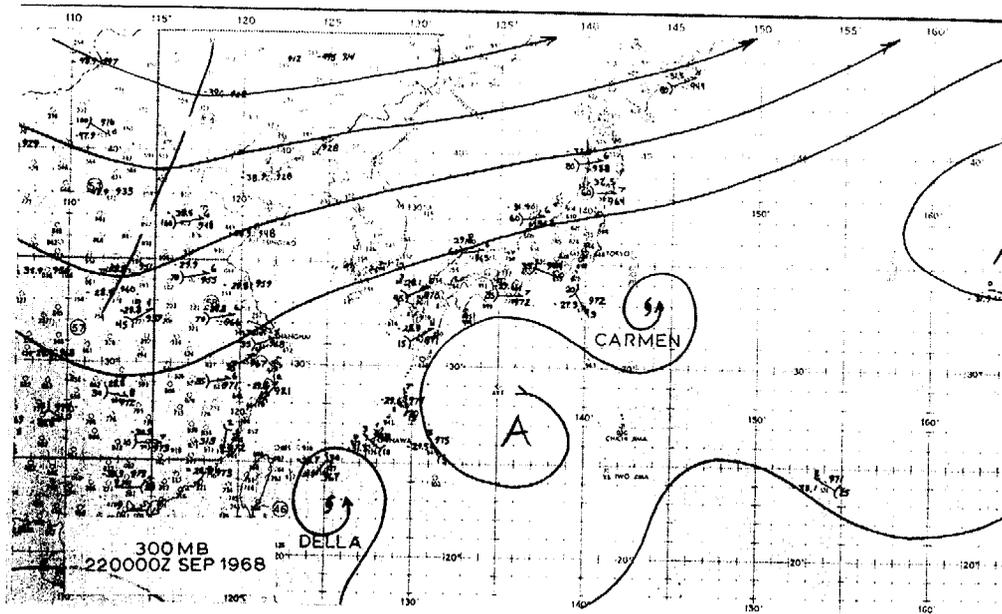
TABLE 3-13 - TYPHOON DELLA

DT	SLP (MB)	ΔT (°C)	SST (°F)	SATELLITE CLASSIFICATION**	MAX SFC WIND (KNOTS)
182300Z	960	6	82	STG X DIA 5 CAT 3	90
220000Z	968	5	74	STG C	50
230000Z	977	2	73	STG C	45
232300Z	987	2	73	NONE	30

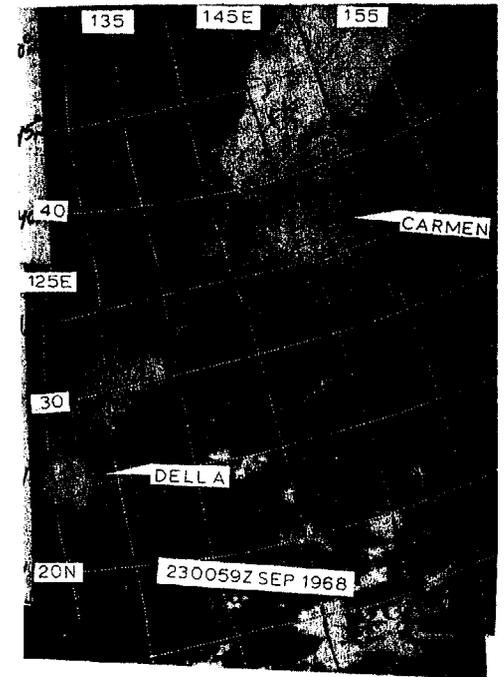
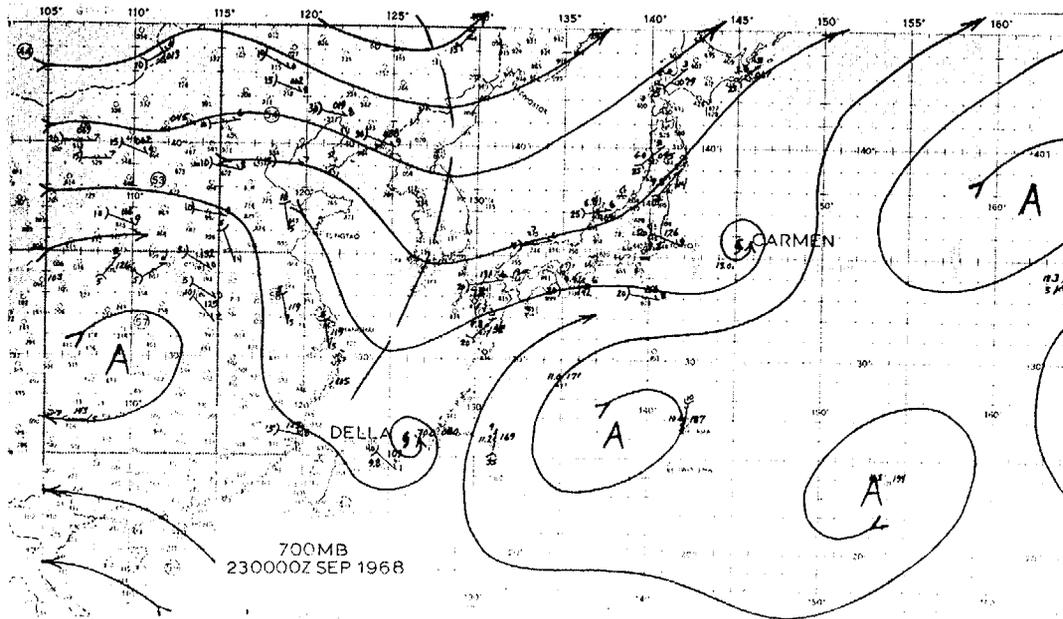
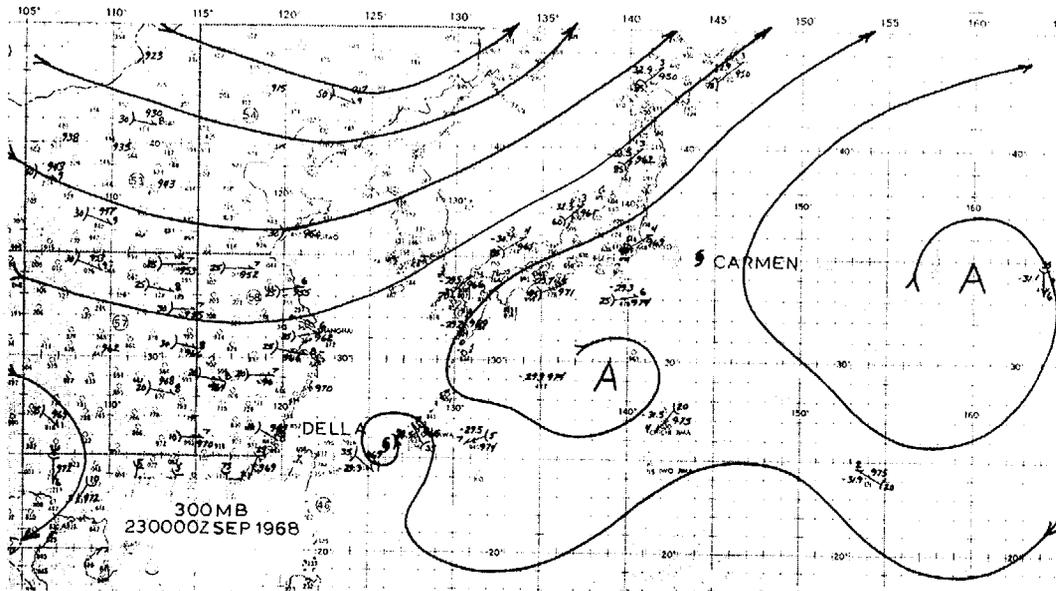
** See Project FAMOS Research Report (4-67)

TABLE 3-14 - TYPHOON GLORIA

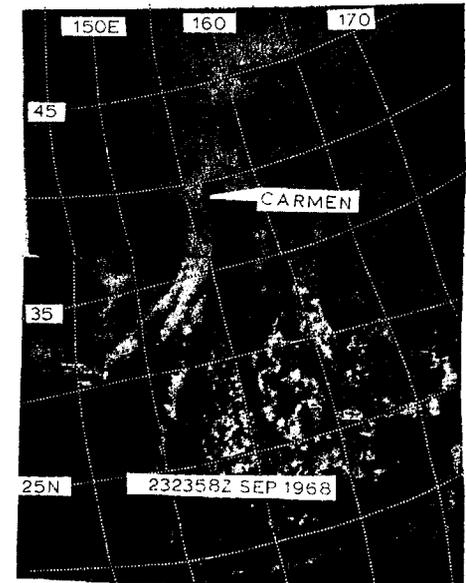
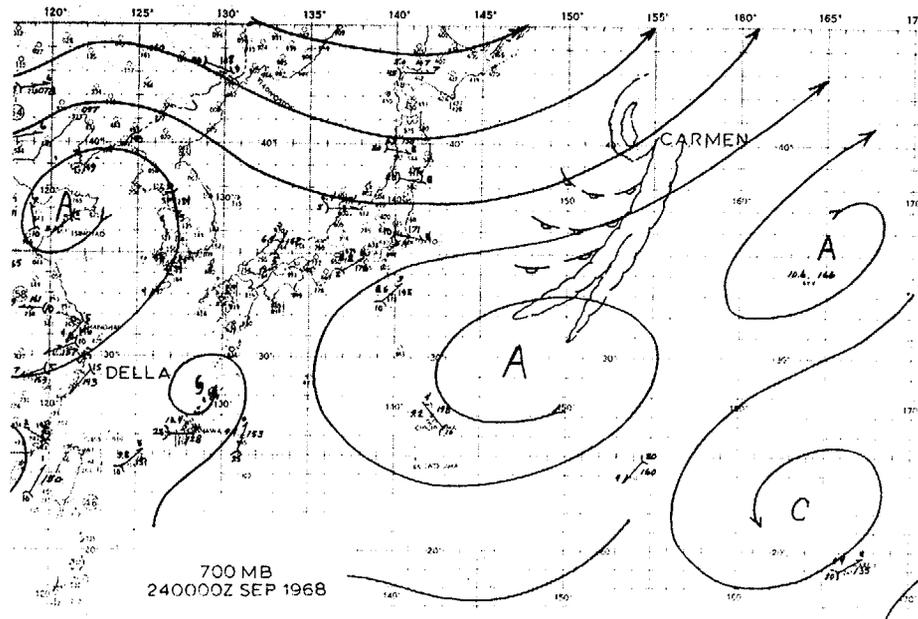
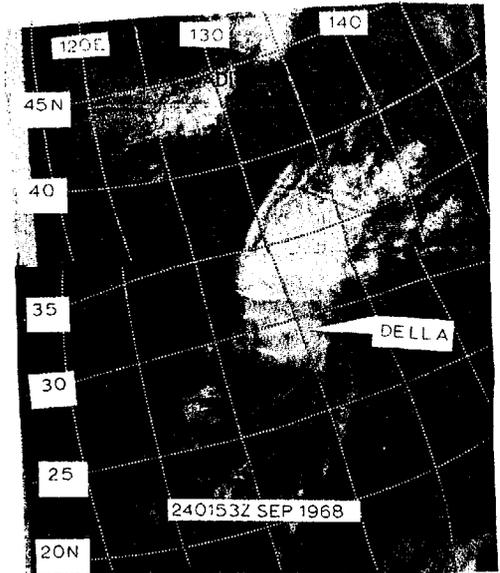
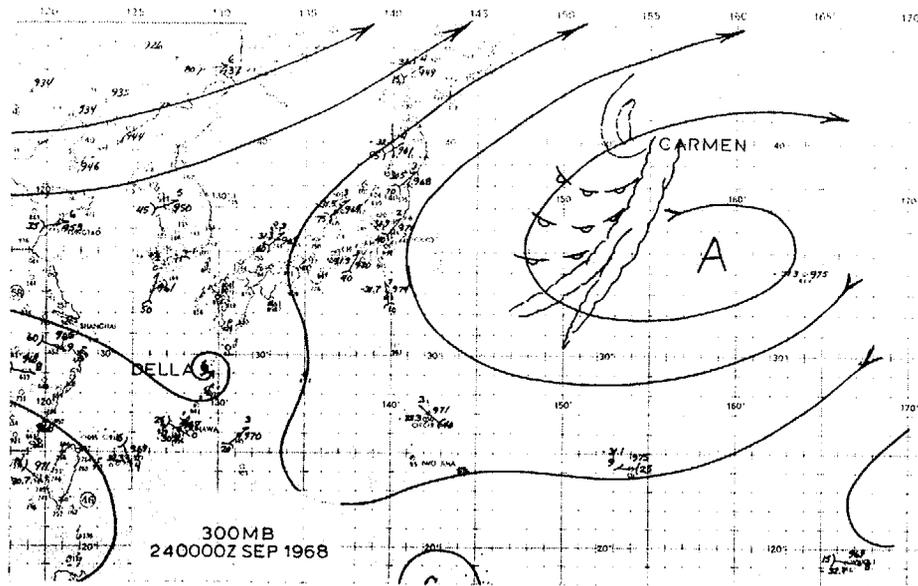
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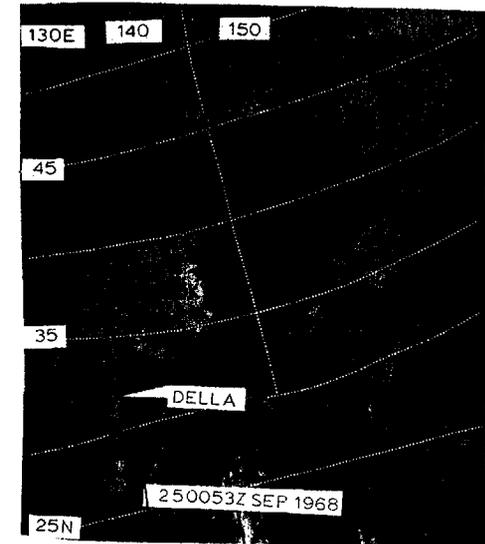
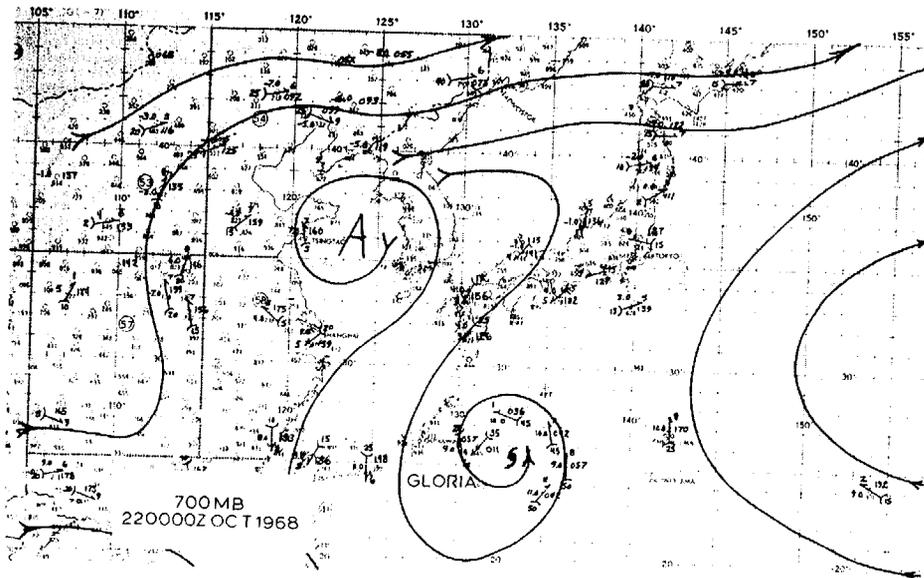
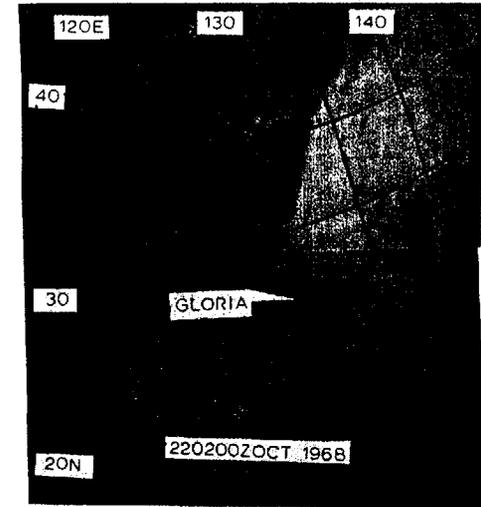
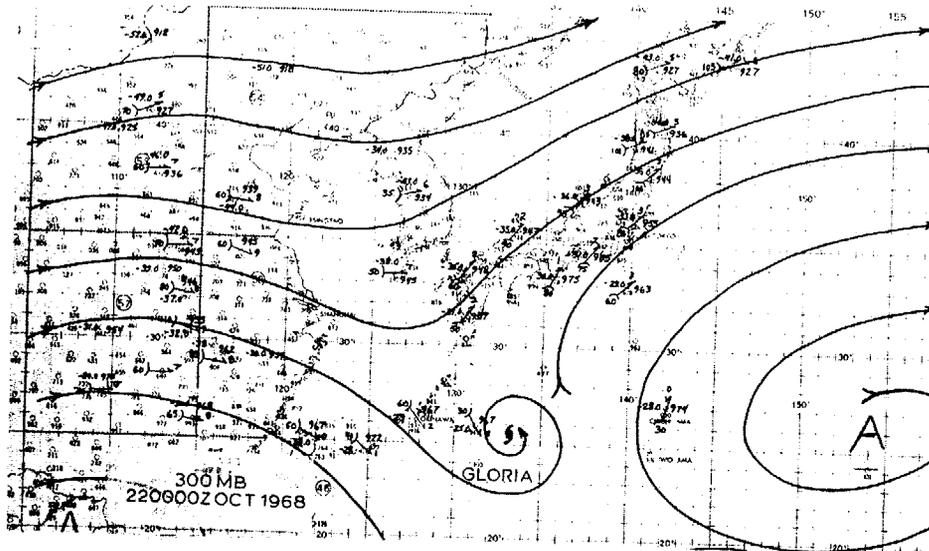


3-58



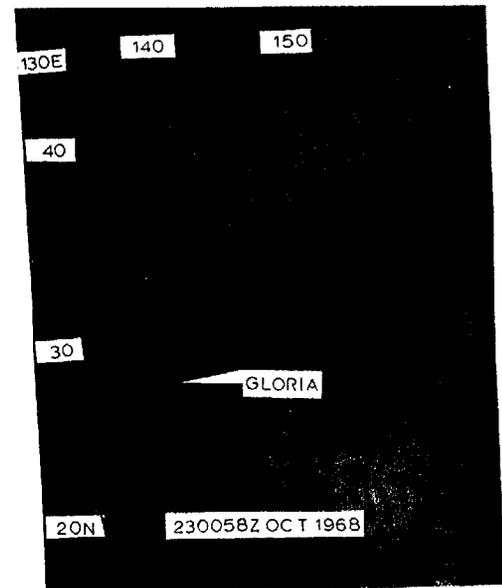
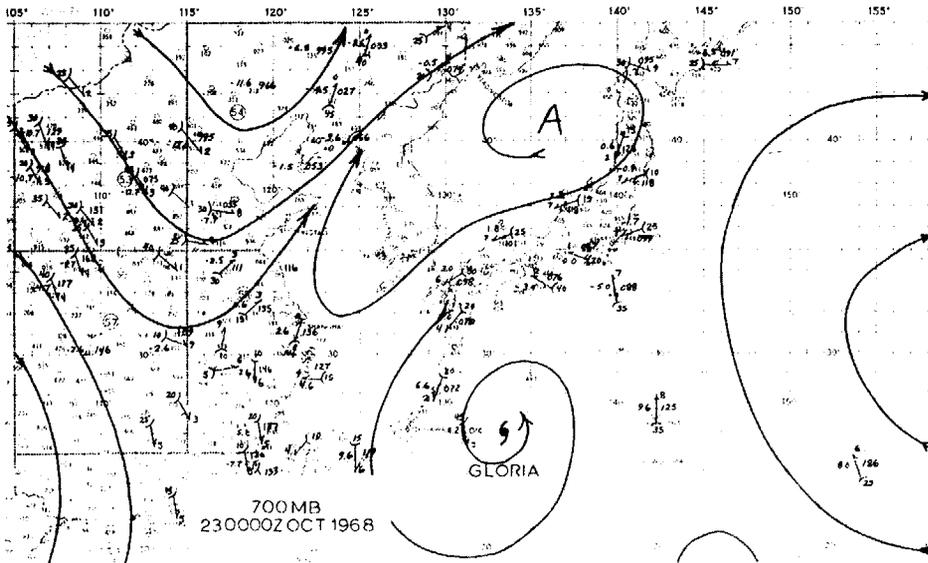
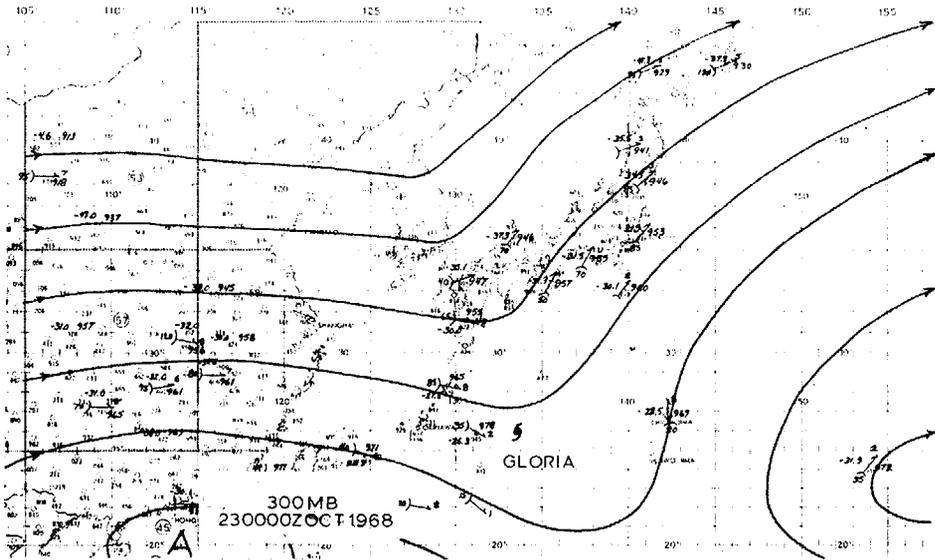
3-59





3-60

3-61



G. Error Distribution in JTWC Official Forecasts

1. Background

The mean JTWC error is an overly simple description of error from an operational point of view. This study was made as a preliminary to making further improvements in individual and average forecasts and forms a basis for describing probable error in a statistical and graphical fashion.

2. Approach

Stratification of forecasts by time showed that the first two forecasts issued on the 20 typhoons of 1968 verified with an average error of 153NM compared with the overall average of 105NM. The initial forecasts thus contribute disproportionately to the mean error and must be accorded a lower level of confidence. Stratification by wind velocity at the time of verification shows increasing skill with higher wind velocities. Winds verifying 50 knots or under recorded an error of 143NM while those over 50 knots verified at 106NM. While it is difficult to separate the contribution of initial forecasts from that of lower wind velocities, it is evident that the motion of more intense storms is more predictable.

Stratification by direction of movement showed best accuracy (110NM) between directions of 260 and 360 degrees and a 20 to 25NM increase in error over the remainder of the compass. This indicates a lower ability to forecast unusual directions of motion. The largest error (139NM) was found in the northeast movers and the second largest in southwest movers.

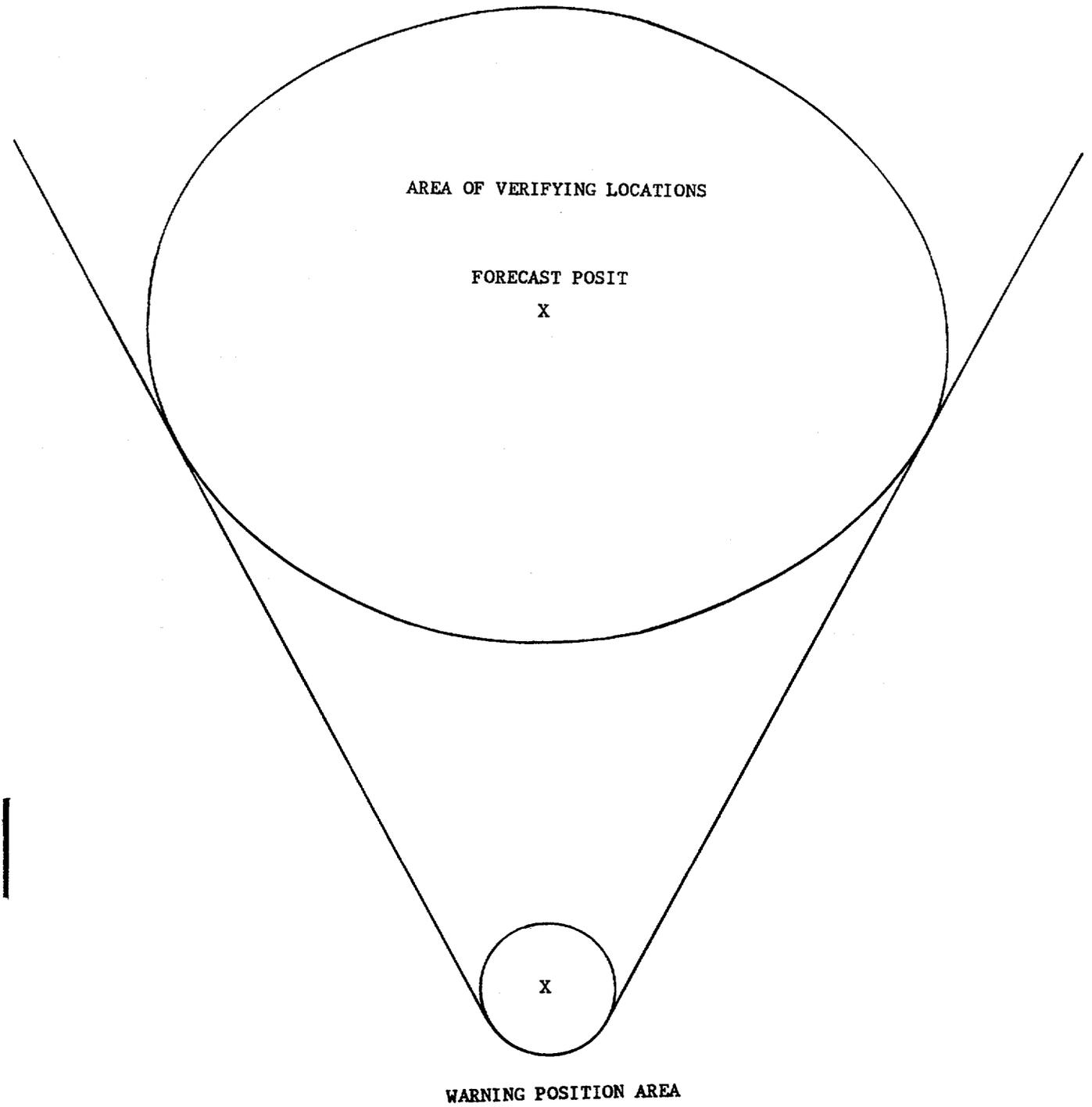
Stratification by intervals of the absolute verification error shows the modal error under 100NM for 24 hours. A relatively small number of forecasts verifying with large errors contribute a disproportionate amount of the mean error and probably have an adverse affect on user confidence in the system. One of the operational efforts in 1969 will be to anticipate and identify forecasts with large potential error. If this can be done successfully on the few difficult forecasts, the level of confidence on the remaining forecasts will be increased.

A graphic approach to official JTWC error was attempted by plotting the verified 24 hour error on a maneuvering board. It was observed that JTWC forecasts are slightly fast 62% of the time and the shape of the error distribution approximates an ellipse whose long axis is perpendicular to the typhoon track and has a ratio with the short axis of 4 to 3. The dimensions of the ellipse yielding an average error of 105NM are 94 X 118NM.

A study of right angle error shows that the ratio of error along the track to error at right angles to the track is 3 to 4 at 48 hours and 72 hours as well as at 24 hours over the last five year period. This indicates stability with time of the shape of the error pattern.

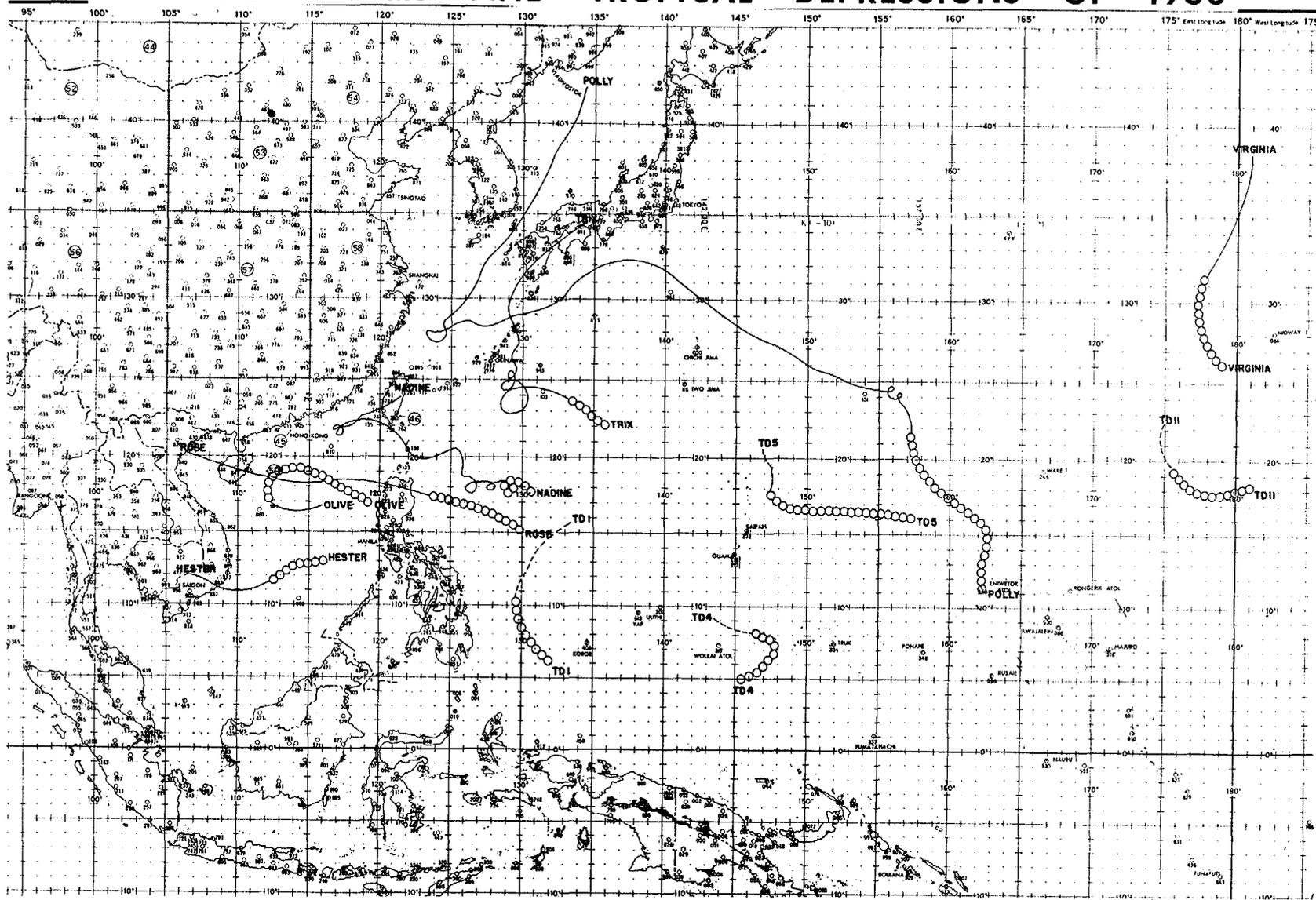
The rate of expansion of this pattern is a constant in relation to distance travelled. The mean track angle error in 1968 was 14 degrees. Over the past 5 years this error has been 18 degrees.

Use of these observations leads to construction of the probable area of verification (figure 3-17). It can be seen that this shape does not lend itself readily to description in terms of forecasting an area of probable storm location, nor does it include the extended area of storm or typhoon force winds extending outward from the center.

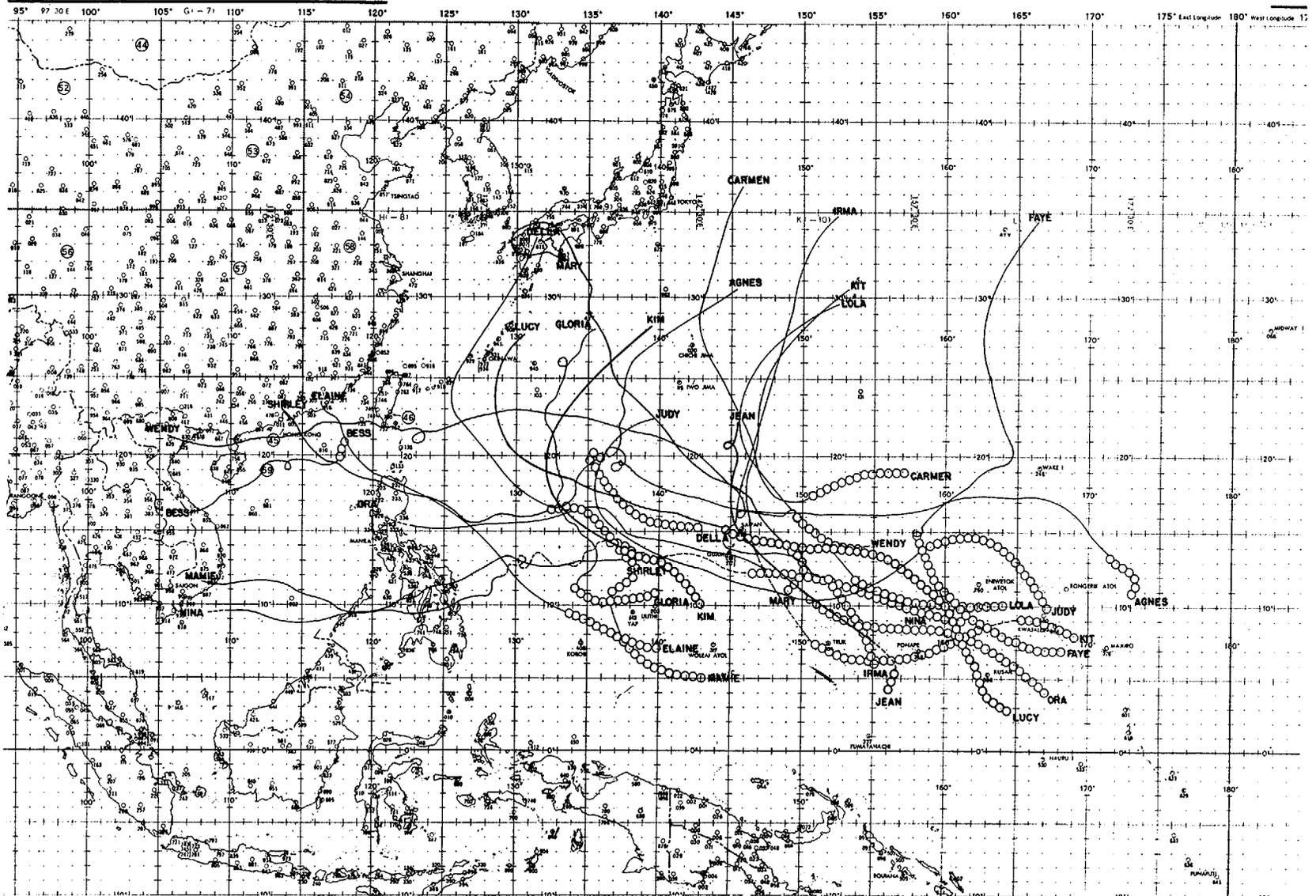


CHAPTER IV
SUMMARY OF TROPICAL CYCLONES 1968

TROPICAL STORMS AND TROPICAL DEPRESSIONS OF 1968



TYPHOONS OF 1968



During 1968, the Joint Typhoon Warning Center issued warnings on a total of 31 Tropical cyclones. Although only in a warning status for 142 days, 48% or 68 of these days JTWC was issuing warnings on two or more cyclones.

JTWC passed one cyclone, Tropical Storm Virginia, to HWO, Pearl Harbor, Hawaii. There were no cyclones passed to JTWC from outside its area of responsibility.

There were five "Super Typhoons" (maximum sustained surface winds of 130 knots or greater) during the 1968 season compared with four during 1967 and three during 1966 (see Table 4-2). Of these super typhoons, Agnes and Elaine were the most intense with maximum sustained surface winds of 150 knots.

The following figures and tables are provided to present representative statistical data from the 1968 tropical cyclone season and provide a ready reference for comparison with past seasons.

SUMMARY OF WESTERN PACIFIC
TROPICAL CYCLONES
OF 1968

	<u>1960-1966</u>	<u>1967</u>	<u>1968</u>
TOTAL NUMBER OF WARNINGS	752	957	822
CALENDAR DAYS OF WARNING	156	185	142
NUMBER OF WARNING DAYS WITH TWO OR MORE CYCLONES	59	62	68
NUMBER OF WARNING DAYS WITH THREE OR MORE CYCLONES	15	17	15
TROPICAL DEPRESSIONS	6	6	4
TROPICAL STORMS	10	15	7
TYPHOONS	21	20	20
TOTAL TROPICAL CYCLONES	37	41	31

TABLE 4-1

* SUPER TYPHOONS DURING 1968

<u>CYCLONE NUMBER</u>	<u>NAME</u>	<u>INCLUSIVE DATES</u>	<u>MAX INTENSITY</u>	<u>MIN SLP</u>	<u>MIN 700MB HT</u>
07	MARY	20 - 30 JULY	130KNOTS	924MB	2441m
16	WENDY	27 AUG - 9 SEP	140KNOTS	917MB	2356m
17	AGNES	28 AUG - 9 SEP	150KNOTS	904MB	2240m
22	ELAINE	24 SEP - 1 OCT	150KNOTS	908MB	2234m
23	FAYE	2 OCT - 9 OCT	145KNOTS	911MB	2298m

* Typhoons with maximum sustained surface winds of 130 knots or greater.

TABLE 4-2

1968 TROPICAL CYCLONES

CYCLONE	TYPE	NAME	*DATE	CALENDAR DAYS OF WARNING	*MAX SFC WND	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	*6HR PERIODS OF TYPHOON INTENSITY	*DISTANCE TRAVELED
01	TD		28 FEB-1 MAR	3	30	997	180	8	0	378
02	T	JEAN	6 APR-15 APR	10	110	932	600	40	20	1374
03	T	KIM	30 MAY-5 JUN	7	100	948	420	23	16	1164
04	TD		2 JUN	1	30	006	240	4	0	192
05	TD		5 JUN-6 JUN	2	30	000	210	5	0	186
06	T	LUCY	27 JUN-2 JUL	6	110	935	360	18	10	1404
07	T	MARY	20 JUL-30 JUL	11	130	924	600	42	22	1932
08	TS	NADINE	21 JUL-28 JUL	8	60	966	420	32	0	1446
09	TS	OLIVE	24 JUL-25 JUL	2	45	987	180	7	0	228
10	TS	POLLY	5 AUG-16 AUG	12	55	964	420	48	0	3336
11	TD		6 AUG-7 AUG	3	30	NR	180	6	0	162
12	TS	ROSE	9 AUG-13 AUG	5	60	962	360	15	0	996
13	T	SHIRLEY	16 AUG-21 AUG	6	65	962	360	20	2	1218
14	TS	TRIX	23 AUG-29 AUG	7	55	977	420	25	0	1392
15	TS	VIRGINIA	25 AUG-26 AUG+	1	50	NR	240	3	0	240
16	T	WENDY	27 AUG-9 SEP	14	140	917	420	51	40	2820
17	T	AGNES	28 AUG-9 SEP	13	150	904	540	50	35	3258
18	**									

TABLE 4-3

1968 TROPICAL CYCLONES (Cont'd)

CYCLONE	TYPE	NAME	*DATE	CALENDAR DAYS OF WARNING	*MAX SFC WND	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	*6HR PERIODS OF TYPHOON INTENSITY	*DISTANCE TRAVELED
19	T	BESS	31 AUG-5 SEP	7	65	965	420	25	2	744
20	T	DELLA	16 SEP-24 SEP	10	120	930	420	37	20	1584
21	T	CARMEN	16 SEP-23 SEP	8	110	935	360	30	17	1380
22	T	ELAINE	24 SEP-1 OCT	8	150	908	540	32	19	1326
23	T	FAYE	2 OCT-9 OCT	8	145	911	600	31	21	1500
24	T	GLORIA	14 OCT-23 OCT	10	90	942	540	37	13	1236
25	TS	HESTER	18 OCT-20 OCT	3	45	987	360	8	0	348
26	T	IRMA	20 OCT-24 OCT	5	80	946	360	19	4	1764
27	T	JUDY	24 OCT-2 NOV	10	120	928	360	37	22	1950
28	T	KIT	26 OCT-4 NOV	7	70	959	360	26	8	1716
29	T	LOLA	7 NOV-12 NOV	6	105	938	300	19	10	1386
30	T	MAMIE	9 NOV-23 NOV	13	65	972	300	52	9	2154
31	T	NINA	18 NOV-27 NOV	10	70	959	360	39	13	2316
32	T	ORA	21 NOV-29 NOV	9	120	931	420	33	23	1884

*DATA TAKEN FROM BEST TRACK

**ISSUED BY PEARL

NR= NO RECON

T PASSED TO HWO, PEARL HARBOR

TABLE 4-3(Cont'd)

TROPICAL DEPRESSIONS 1968
POSITION DATA

TROPICAL DEPRESSION ONE
28 FEB-29 FEB

DTG	LAT	LONG	DTG	LAT	LONG
280600Z	10.6N	129.6E	290600Z	14.ON	131.1E
281200Z	11.3N	129.7E	291200Z	14.9N	132.1E
281800Z	12.1N	130.1E	291800Z	15.6N	133.3E
290000Z	13.ON	130.6E			

TROPICAL DEPRESSION FOUR
2 JUN

DTG	LAT	LONG	DTG	LAT	LONG
020500Z	08.1N	146.2E	021700Z	08.9N	144.2E
021100Z	08.4N	145.0E	022300Z	09.1N	143.2E

TROPICAL DEPRESSION FIVE
5 JUN-6 JUN

DTG	LAT	LONG	DTG	LAT	LONG
052300Z	17.8N	147.5E	061700Z	19.8N	147.1E
060500Z	19.ON	147.6E	062300Z	20.7N	146.9E
061100Z	19.5N	147.4E			

TROPICAL DEPRESSION ONE ONE
6 AUG-7 AUG

DTG	LAT	LONG	DTG	LAT	LONG
062300Z	19.5N	175.3E	071700Z	21.3N	174.8E
070500Z	20.1N	175.0E	072300Z	22.2N	175.0E
071100Z	20.7N	174.8E			

TROPICAL STORMS 1968
POSITION DATA

TROPICAL STORM NADINE
21 JUL-28 JUL

DTG	LAT	LONG	DTG	LAT	LONG
210500Z	18.4N	128.9E	250500Z	21.2N	121.6E
211100Z	18.4N	128.2E	251100Z	22.0N	120.8E
211700Z	18.0N	127.8E	251700Z	22.4N	119.6E
212300Z	18.2N	128.1E	252300Z	22.3N	118.4E
220500Z	18.4N	127.2E	260500Z	22.0N	117.3E
221100Z	18.2N	126.2E	261100Z	21.4N	117.0E
221700Z	17.7N	126.3E	261700Z	21.7N	117.2E
222300Z	18.2N	126.7E	262300Z	21.8N	116.8E
230500Z	18.8N	125.9E	270500Z	21.9N	117.1E
231100Z	19.8N	125.8E	271100Z	22.0N	117.6E
231700Z	20.6N	125.4E	271700Z	22.2N	118.1E
232300Z	20.4N	124.6E	272300Z	22.5N	118.7E
240500Z	20.0N	124.0E	280500Z	22.7N	119.5E
241100Z	19.8N	124.4E	281100Z	23.1N	120.5E
241700Z	19.9N	122.7E	281700Z	23.9N	121.3E
242300Z	20.4N	122.0E			

TROPICAL STORM OLIVE
24 JUL-25 JUL

DTG	LAT	LONG	DTG	LAT	LONG
241100Z	17.0N	112.3E	250500Z	16.3N	114.2E
241700Z	16.6N	112.8E	251100Z	16.4N	115.1E
242300Z	16.4N	113.5E	251700Z	16.8N	116.0E

TROPICAL STORM POLLY
5 AUG-16 AUG

DTG	LAT	LONG	DTG	LAT	LONG
050500Z	21.9N	157.2E	110500Z	31.6N	134.6E
051100Z	22.9N	157.2E	111100Z	31.1N	133.8E
051700Z	23.6N	156.9E	111700Z	30.6N	133.1E
052300Z	23.9N	156.3E	112300Z	30.0N	132.5E
060500Z	24.2N	156.6E	120500Z	29.5N	131.6E
061100Z	24.0N	156.1E	121100Z	29.2N	130.6E
061700Z	24.2N	155.8E	121700Z	29.0N	129.3E
062300Z	24.5N	156.0E	122300Z	28.4N	128.3E
070500Z	24.3N	155.6E	130500Z	28.2N	127.3E
071100Z	24.5N	154.8E	131100Z	28.5N	126.4E
071700Z	24.7N	153.9E	131700Z	28.4N	125.4E
072300Z	25.0N	152.8E	132300Z	28.0N	124.6E
080500Z	25.4N	151.7E	140500Z	27.9N	123.9E
081100Z	25.8N	150.5E	141100Z	28.0N	123.4E
081700Z	26.4N	149.1E	141700Z	27.4N	123.7E
082300Z	27.2N	147.5E	142300Z	27.6N	124.5E
090500Z	28.0N	145.6E	150500Z	28.5N	124.3E
091100Z	29.2N	143.9E	151100Z	29.1N	125.3E
091700Z	30.2N	142.2E	151700Z	30.4N	126.3E
092300Z	31.2N	140.8E	152300Z	32.2N	127.2E
100500Z	31.8N	139.3E	160500Z	34.3N	128.8E
101100Z	32.3N	137.9E	161100Z	36.4N	131.1E
101700Z	32.3N	136.6E	161700Z	39.1N	132.9E
102300Z	31.9N	135.5E	162300Z	41.9N	134.7E

TROPICAL STORM ROSE
9 AUG-13 AUG

DTG	LAT	LONG	DTG	LAT	LONG
092300Z	17.4N	123.5E	112300Z	18.7N	111.9E
100500Z	17.8N	121.9E	120500Z	18.9N	110.9E
101100Z	18.1N	120.0E	121100Z	19.2N	110.0E
101700Z	18.3N	118.3E	121700Z	19.5N	109.1E
102300Z	18.3N	116.8E	122300Z	19.8N	108.2E
110500Z	18.2N	115.5E	130500Z	19.9N	107.2E
111100Z	18.2N	114.2E	131100Z	20.1N	106.3E
111700Z	18.4N	113.1E			

TROPICAL STORM TRIX
23 AUG-29 AUG

DTG	LAT	LONG	DTG	LAT	LONG
230500Z	23.7N	133.2E	261100Z	25.1N	129.1E
231100Z	24.3N	131.9E	261700Z	25.4N	129.5E
231700Z	24.5N	130.8E	262300Z	25.9N	129.3E
232300Z	24.5N	129.8E	270500Z	26.9N	129.2E
240500Z	24.2N	128.9E	271100Z	27.1N	129.6E
241100Z	23.4N	128.6E	271700Z	27.8N	129.6E
241700Z	22.8N	129.4E	272300Z	28.5N	129.2E
242300Z	23.4N	130.2E	280500Z	29.4N	129.0E
250500Z	24.4N	130.2E	281100Z	30.4N	129.3E
251100Z	24.9N	129.4E	281700Z	31.4N	130.2E
251700Z	24.6N	128.7E	282300Z	32.8N	131.6E
252300Z	24.7N	129.4E	290500Z	34.4N	134.2E
260500Z	25.4N	129.3E			

TROPICAL STORM VIRGINIA *
25 AUG-26 AUG

DTG	LAT	LONG	DTG	LAT	LONG
250500Z	31.6N	177.9E	252300Z	35.8N	180.2E
251100Z	32.5N	178.5E	260500Z	38.4N	181.0E
251700Z	33.8N	179.3E			

TROPICAL STORM HESTER
18 OCT-20 OCT

DTG	LAT	LONG	DTG	LAT	LONG
181100Z	11.6N	112.3E	191100Z	10.9N	109.5E
181700Z	11.3N	111.7E	191700Z	11.3N	108.5E
192300Z	11.1N	111.1E	192300Z	11.8N	107.7E
190500Z	10.9N	110.4E	200500Z	12.0N	106.7E

*PASSED TO HWO, PEARL HARBOR AFTER 25/1700Z.

Forecast positions for the 24, 48 and 72 hour forecasts are verified only as long as the best track analysis estimates winds in excess of 33 knots for tropical cyclones which reach typhoon intensity.

In addition to this method of verifying absolute error distance, a computation of closest distance to the best track (right angle error) has been included to indicate the demonstrated ability to forecast the path of motion without regard to speed.

The following tables and figures are presented to graphically depict the distribution of forecasting error in JTWC forecasts.

FORECAST VERIFICATION
AVERAGE ERROR (NAUTICAL MILES)

	<u>24 HR</u>	<u>48 HR</u>	<u>72 HR</u>
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

*FORECAST POSITIONS NORTH OF 35N WERE NOT VERIFIED.

TABLE 4-4

FORECAST VERIFICATION AVERAGE ERROR IN NAUTICAL MILES

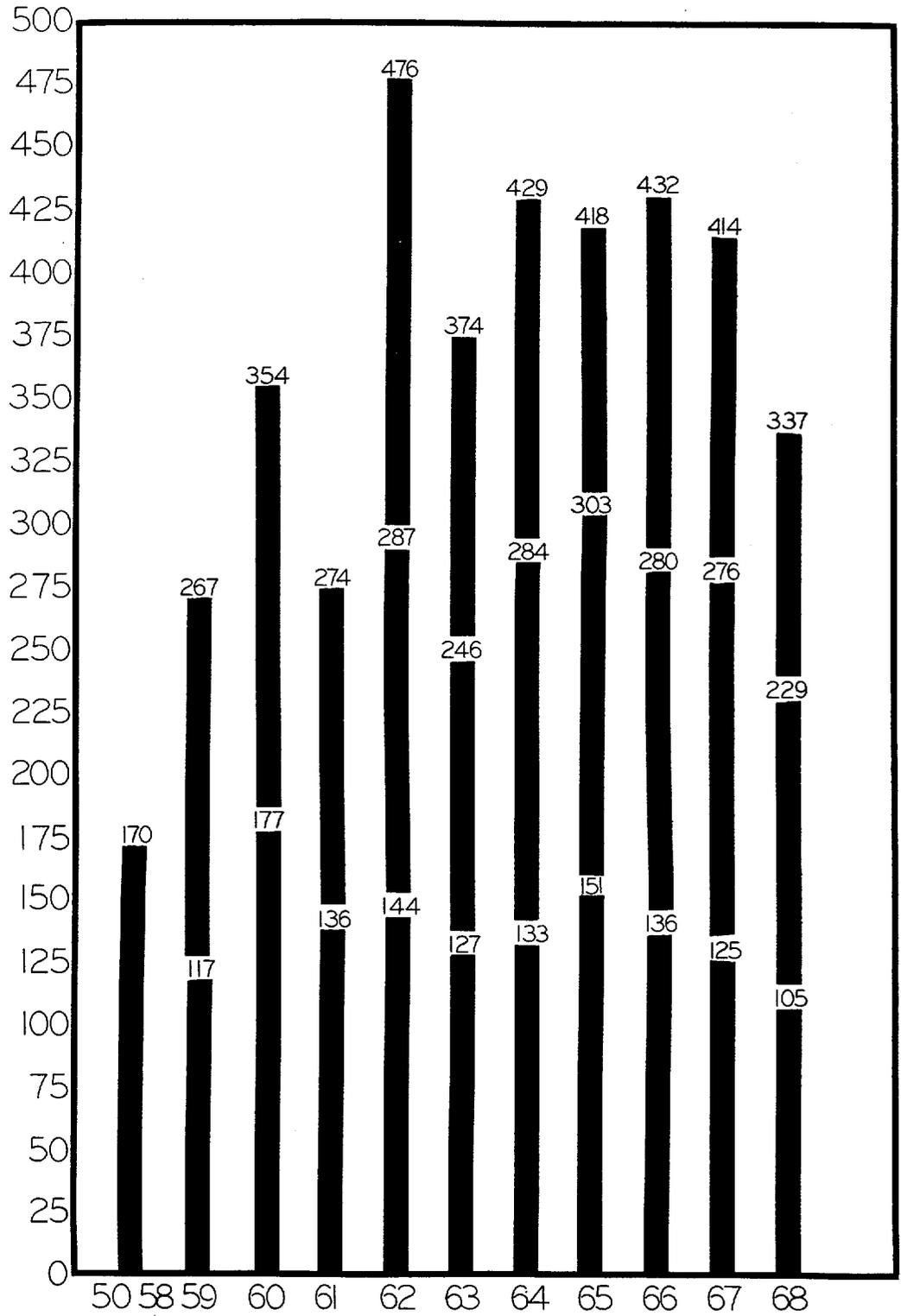


FIG 4-3

FORECAST ERROR TABULATION (MI) - 1968

<u>24 Hour</u>	<u>NUMBER OF CASES</u>	<u>MEAN ERROR (MI)</u>
Total cases and overall average	516	105
Below 20N	308	103
20N-30N	185	105
Below 30N	493	104
Above 30N	23	130
 <u>48 Hour</u>		
Total cases and overall average	378	229
Below 20N	172	201
20N-30N	183	244
Below 30N	355	223
Above 30N	23	325
 <u>72 Hour</u>		
Total cases and overall average	144	337
Below 20N	55	268
20N-30N	78	383
Below 30N	133	335
Above 30N	11	357

TABLE 4-5

DISTANCE BETWEEN OPERATIONAL WARNING
POSITS AND BEST TRACK POSITS

CYCLONE	CASES	CYCLONE		
		AVERAGE (MI)	MAX (MI)	MIN (MI)
1. T. D.	7	39	80	3
2. JEAN	38	13	47	3
3. KIM	23	17	62	2
4. T. D.	4	56	78	28
5. T. D.	5	19	25	10
6. LUCY	18	13	42	1
7. MARY	42	28	143	2
8. NADINE	31	25	56	1
9. OLIVE	6	11	24	2
10. POLLY	48	23	91	3
11. T. D.	5	133	153	70
12. ROSE	15	32	115	9
13. SHIRLEY	20	20	42	6
14. TRIX	25	32	108	5
15. VIRGINIA	3	4	10	0
16. WENDY	51	16	55	0
17. AGNES	50	20	55	1
18. *				
19. BESS	24	20	94	1
20. DELLA	36	18	93	1
21. CARMEN	29	18	70	2
22. ELAINE	30	23	86	4
23. FAYE	31	14	32	1
24. GLORIA	37	26	156	2
25. HESTER	8	24	67	5
26. IRMA	19	22	44	2
27. JUDY	37	18	85	1
28. KIT	26	42	205	2
29. LOLA	19	14	27	4
30. MAMIE	52	22	126	3
31. NINA	39	20	83	1
32. ORA	32	13	40	1
OVERALL AVERAGE:		21.8		

* NUMBER 18 ISSUED BY PEARL

TABLE 4-6

1968 AVERAGE FORECAST ERRORS (MI)*

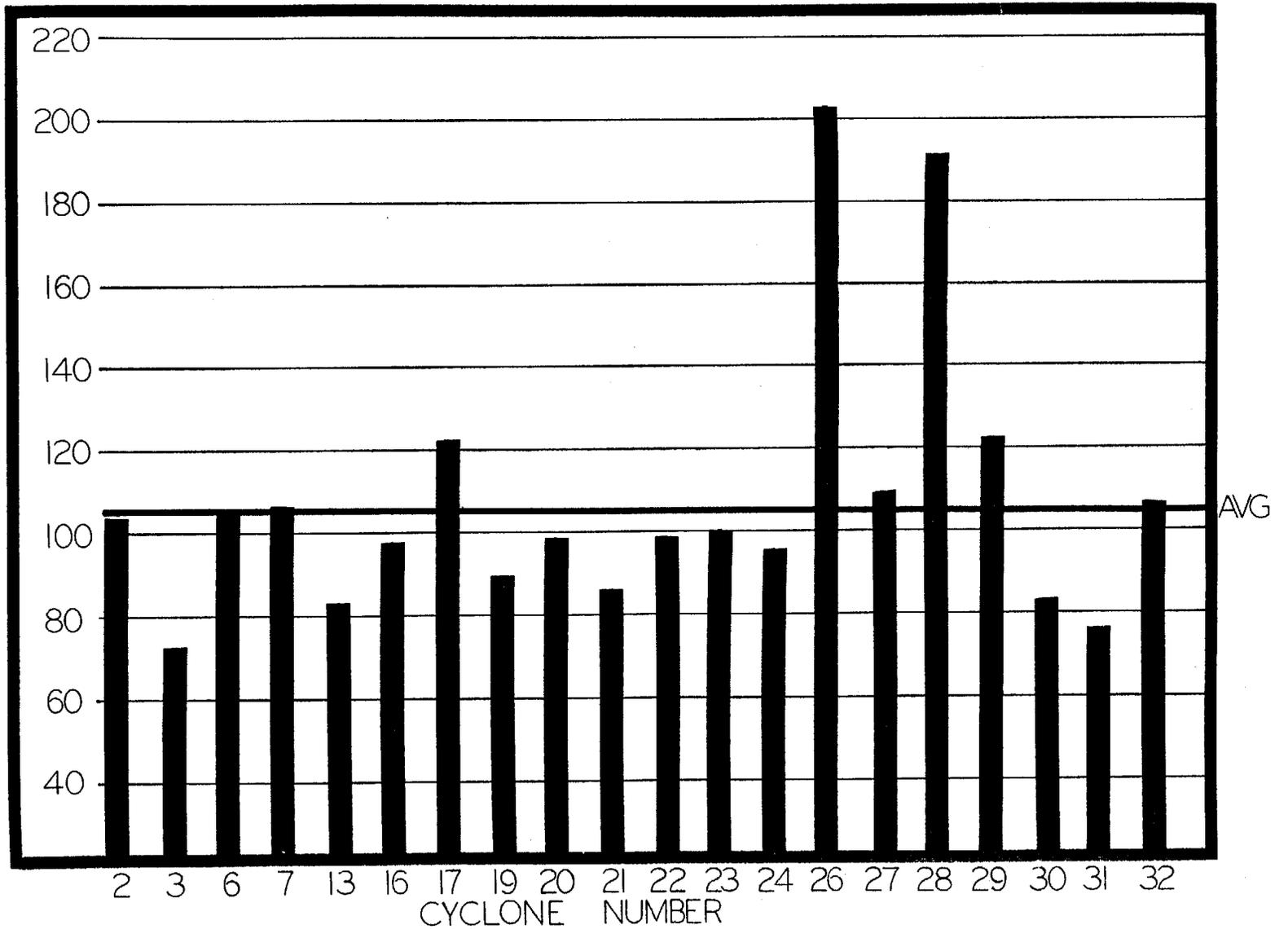
TYPHOON	24 HR FORECASTS		48 HR FORECASTS		72 HR FORECASTS	
	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR
JEAN	33	114	25	329	10	556
KIM	19	72	13	161	4	238
LUCY	13	105	9	160	2	240
MARY	29	106	22	241	9	502
SHIRLEY	16	84	8	171	2	336
WENDY	46	97	42	196	18	282
AGNES	45	122	35	275	15	394
BESS	19	89	14	179	5	274
DELLA	29	98	21	270	8	352
CARMEN	25	87	20	172	8	305
ELAINE	25	98	18	229	7	348
FAYE	27	100	20	211	8	284
GLORIA	29	95	21	238	6	379
IRMA	15	203	5	880	--	---
JUDY	33	110	26	208	11	297
KIT	15	189	8	375	2	672
LOLA	15	122	10	262	3	490
MAMIE	28	83	19	174	8	183
NINA	29	75	21	126	9	185
ORA	26	107	21	194	9	280

AVERAGE ERROR - 24 HR FORECASTS (516 CASES)...105
 AVERAGE ERROR - 48 HR FORECASTS (378 CASES)...229
 AVERAGE ERROR - 72 HR FORECASTS (144 CASES)...337

*INCLUDES FORECAST ERRORS DURING TROPICAL STORM INTENSITY

TABLE 4-7

INDIVIDUAL TYPHOONS OF 1968
24 HOUR VERIFICATION ERROR



4-17

FIG 4-4

1968 FORECAST ERRORS*
(IN TERMS OF CLOSEST DISTANCE TO BEST TRACK)

TYPHOON	24 HR FORECASTS		48 HR FORECASTS		72 HR FORECASTS	
	NO. OF CASES	MEAN ERROR(MI)	NO. OF CASES	MEAN ERROR(MI)	NO. OF CASES	MEAN ERROR(MI)
JEAN	30	87	19	206	8	428
KIM	18	46	12	89	4	133
LUCY	14	45	10	90	3	104
MARY	26	77	22	195	9	439
SHIRLEY	16	74	8	166	2	296
WENDY	47	50	43	103	18	151
AGNES	46	54	35	158	15	259
BESS	20	40	15	134	5	250
DELLA	32	59	18	98	8	135
CARMEN	25	60	20	147	8	271
ELAINE	26	75	19	205	7	335
FAYE	27	50	20	109	8	172
GLORIA	32	48	11	104	4	102
IRMA	15	97	5	276	-	---
JUDY	33	85	22	128	10	164
KIT	18	86	8	126	2	195
LOLA	15	77	10	143	2	222
MAMIE	24	35	20	78	8	78
NINA	35	60	24	93	10	141
ORA	28	81	23	117	10	130

AVERAGE ERROR - 24 HR FORECASTS (527 CASES)...64 MI
AVERAGE ERROR - 48 HR FORECASTS (364 CASES)...138 MI
AVERAGE ERROR - 72 HR FORECASTS (141 CASES)...211 MI

*INCLUDES FORECAST ERRORS DURING TROPICAL STORM INTENSITY.

TABLE 4-8

RIGHT ANGLE ERROR

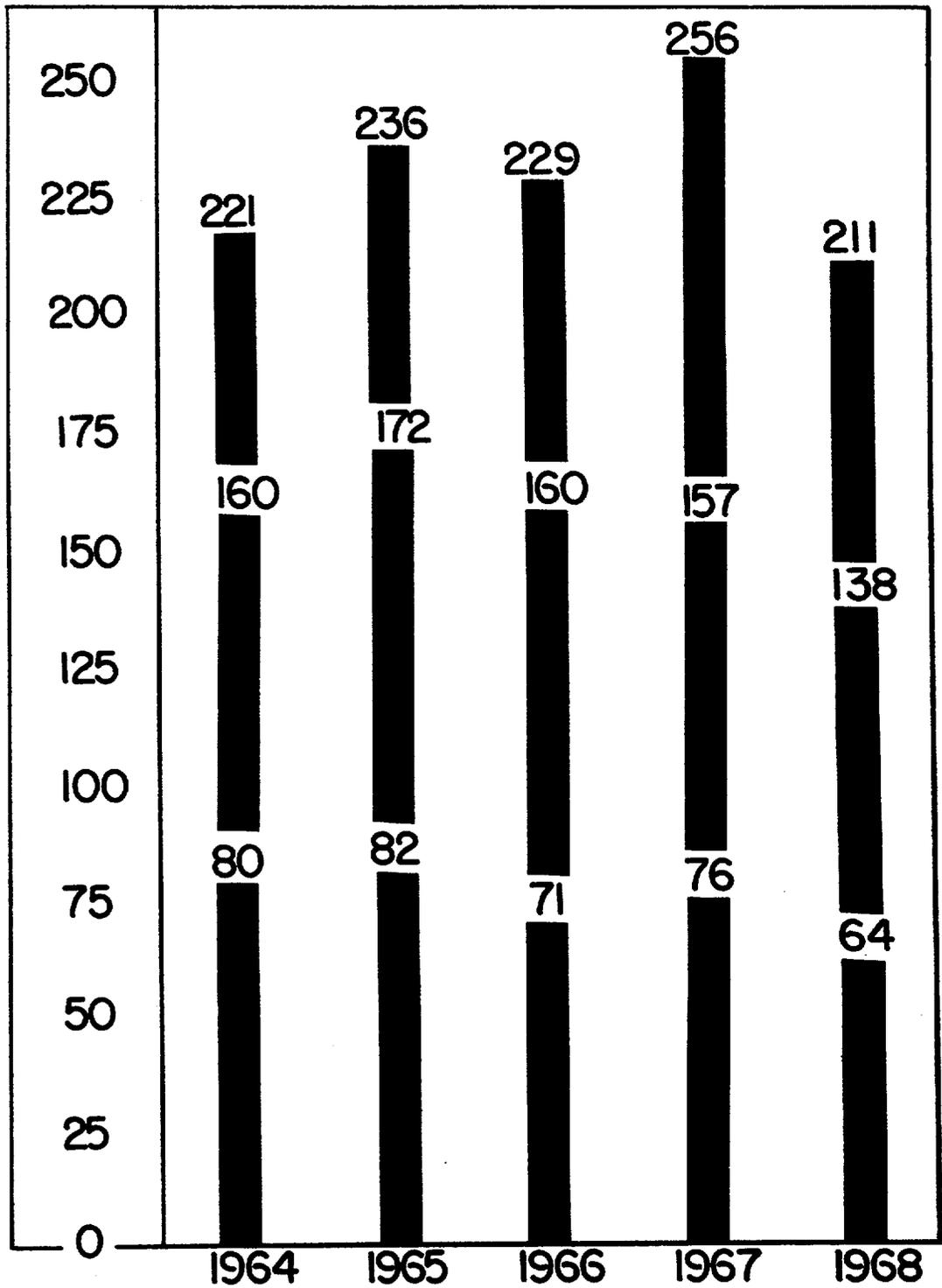


FIG 4 - 5

CHAPTER V
INDIVIDUAL TYPHOONS OF 1968

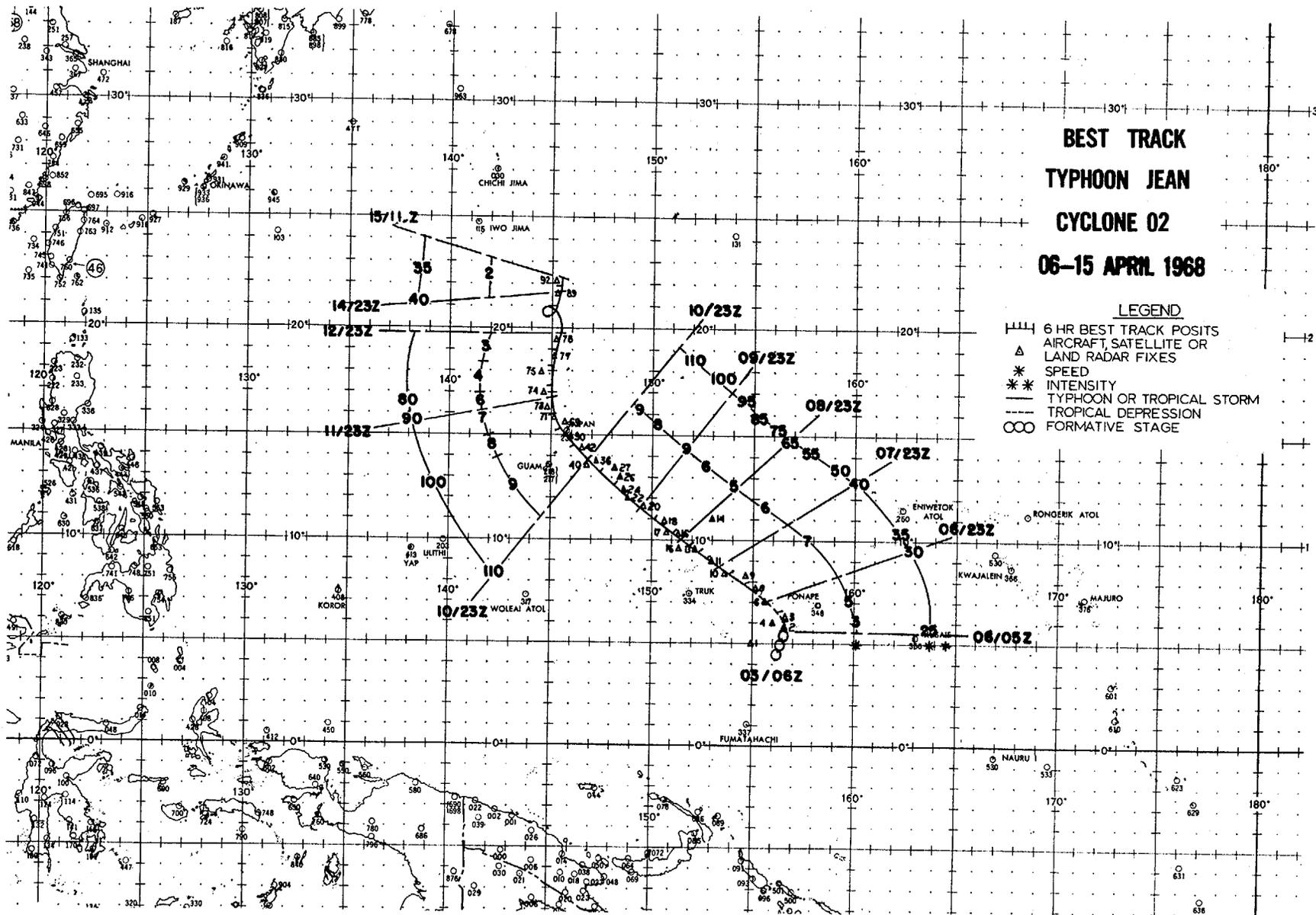
NOTE. See Appendix A for definitions or clarification of words or phrases that appear in this chapter.

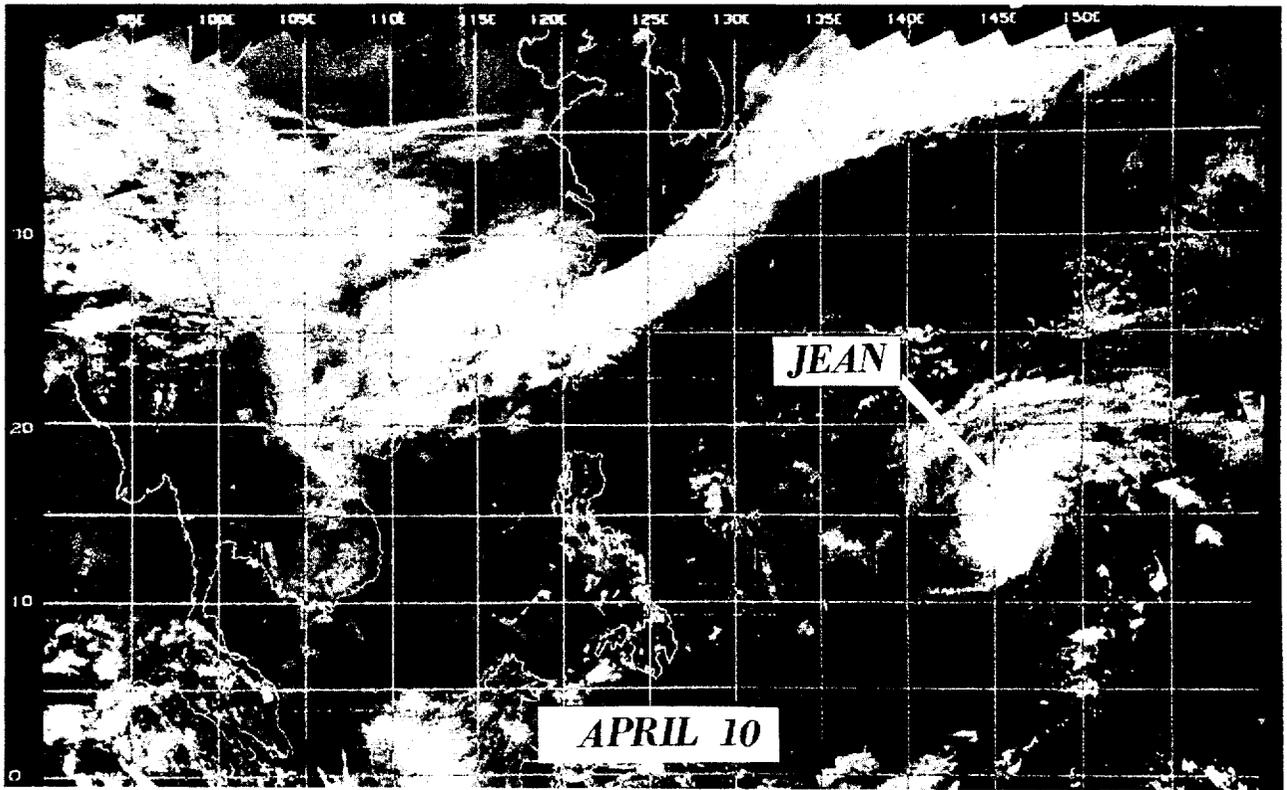
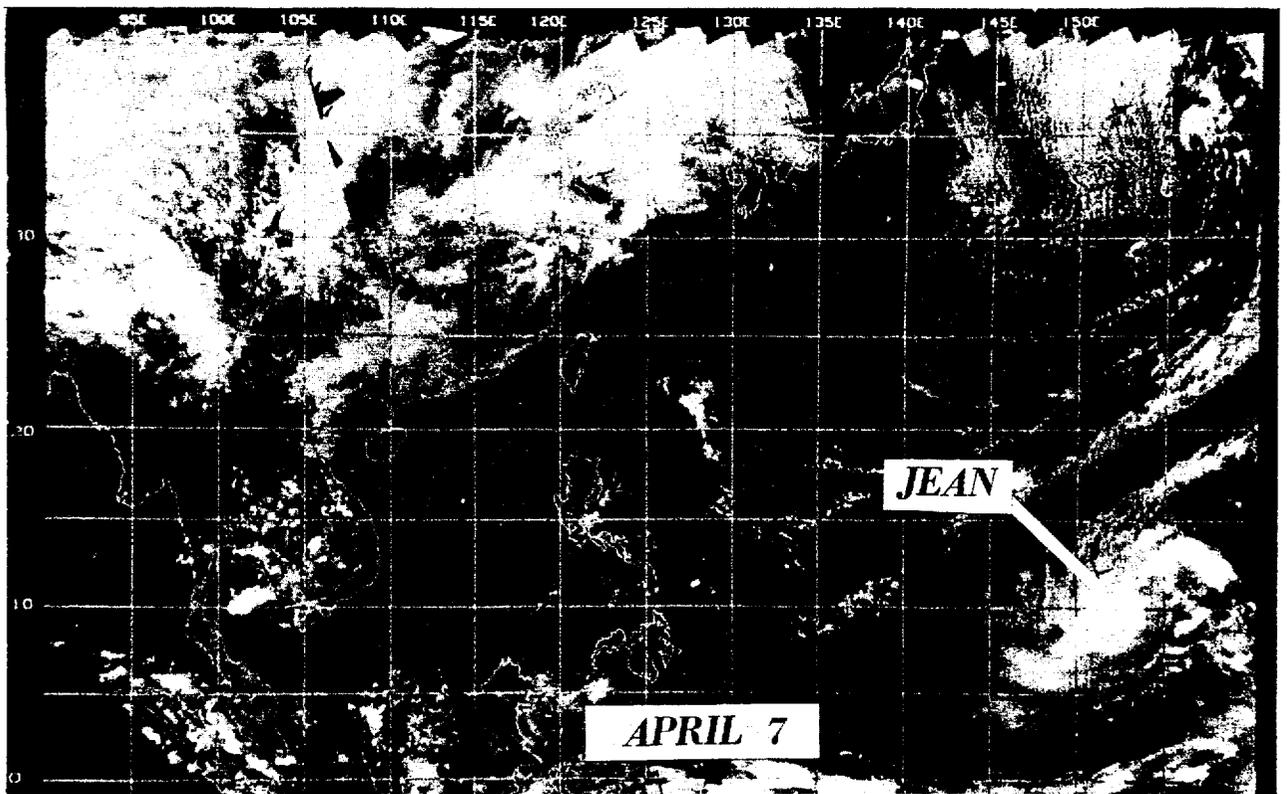
TROPICAL CYCLONE 02 - 04/06/0500Z TO 04/15/1100Z
(JEAN)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 40
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 20
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1374 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 932MBS AT 110300Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2493M. AT 110300Z
 3. MAXIMUM SURFACE WIND - 110 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 600 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL
 - B. INITIAL SURFACE VORTEX
 1. EMBEDDED VORTEX AT 030600Z
 2. SURFACE PRESSURE LESS THAN 1005MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - VARIABLE
 2. UPON REACHING TYPHOON INTENSITY - VARIABLE
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

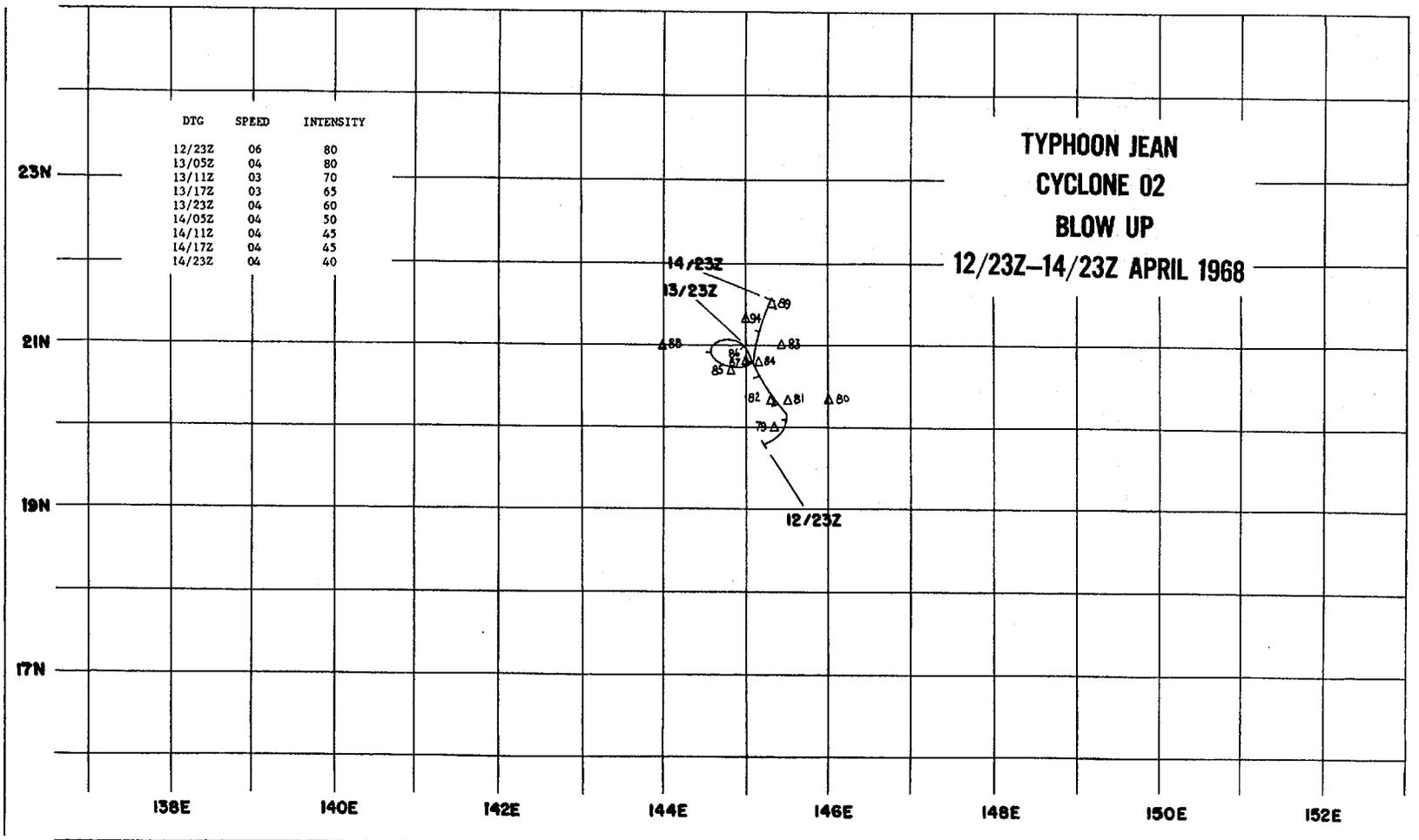
**BEST TRACK
 TYPHOON JEAN
 CYCLONE 02
 06-15 APRIL 1968**

- LEGEND**
- 6 HR BEST TRACK POSITS
 - △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - * SPEED
 - ** INTENSITY
 - TYPHOON OR TROPICAL STORM
 - - - TROPICAL DEPRESSION
 - OOO FORMATIVE STAGE





S-4



5-5

FIX NO.	TIME	POSIT		UNIT- METHOD -ACCY	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
					FLT LVL	FLT LVL WND	02 OBS MIN								
1	050113Z	05.0N	155.0E	SLTLS	STG B	DIA	--	BNDS	-						
2	060144Z	06.0N	156.0E	SLTLS	STG C	DIA	--	BNDS	-						
3	060425Z	05.7N	156.6E	54-P-05-01	0460M	025	025	000	3063	22/23	ELIP	NW-SE	70X40	N.F.B.	
4	061220Z	06.1N	156.7E	VW-P-05-01	0310M	025	022	000	---	24/--	----			F.B.	
5	061440Z	06.3N	156.3E	VW-P-05-01	0340M	030	025	000	---	23/21	----			N.F.B.	
6	062100Z	07.0N	155.6E	54-P-05-01	700MB	040	025	994	3042	13/10	ELIP	NE-SW	40X30	N.F.B.	
7	070240Z	07.4N	155.3E	54-P-00-01	700MB	040	038	994	3039	12/11	ELIP	NE-SW	45X20	N.F.B.	
8	070900Z	07.8N	155.1E	VW-P-05-10	0310M	030	028	998	---	25/22	----			F.B.	
9	071440Z	08.3N	154.7E	VW-P-05-03	700MB	034	035	993	3074	13/09	ELIP	NE-SW	40X12	F.B.	
10	072105Z	08.3N	153.6E	54-P-25-10	0450M	047	035	992	3011	24/23	CIRC	----	40	F.B.	
11	080300Z	09.0N	153.0E	54-P-05-05	0460M	035	045	989	3011	26/23	CIRC	----	30	F.B.	
12	080835Z	10.0N	152.6E	VW-P-10-05	0400M	045	050	987	3010	24/21	CIRC	----	30	F.B.	
13	081043Z	11.0N	153.0E	SLTLS	STG X	DIA	04	BNDS	2						
14	081408Z	09.6N	152.1E	VW-P-10-10	700MB	040	---	991	2996	17/13	CIRC	----	30	F.B.	
15	082105Z	09.7N	151.3E	54-P-10-05	700MB	078	055	975	2883	17/13	CONC		35-10	F.B.	
16	090233Z	10.5N	151.5E	SLTLS	STG X	DIA	03	BNDS	4						
17	090235Z	10.2N	151.3E	54-P-10-01	700MB	070	070	967	2816	17/14	CONC		35-05	--	
18	090900Z	10.3N	150.8E	VW-P-05-03	0350M	---	105	960	2770	24/21	CIRC	----	10	08	
19	091402Z	10.9N	150.6E	VW-P-15-01	700MB	---	---	954	2710	17/10	CIRC	----	35	07	
20	092100Z	11.6N	149.6E	54-P-02-01	700MB	070	090	950	2667	17/14	CIRC	----	40	--	
21	100000Z	11.8N	149.2E	54-P-01-01	700MB	075	065	950	2637	17/08	CIRC	----	30	--	
22	100200Z	12.0N	148.9E	54-P-01-01	700MB	085	120	948	2591	18/10	CIRC	----	30	--	
23	100400Z	12.2N	148.8E	54-P-03-03	700MB	095	095	940	2542	20/11	CIRC	----	30	10	
24	100600Z	12.3N	148.7E	54-P-03-02	700MB	112	095	935	2539	19/11	CIRC	----	30	--	

FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND								
25	100740Z	12.6N 148.5E	VW-R-05---	0260M	---	---	---	--/--	---			--	
26	100840Z	13.0N 148.4E	VW-P-05-02	700MB	085	100	944	2579	24/14	CIRC	----	25	--
27	100945Z	12.8N 147.8E	LND RDR		---	---	---	---	--/--	---			--
28	101200Z	13.3N 148.1E	VW-R-05-05	700MB	---	---	---	---	--/--	CIRC	----	30	--
29	101258Z	12.9N 147.9E	LND RDR		---	---	---	---	--/--	---			--
30	101348Z	13.1N 147.7E	LND RDR		---	---	---	---	--/--	---			14
31	101441Z	13.2N 147.6E	LND RDR		---	---	---	---	--/--	---			--
32	101505Z	13.6N 147.6E	VW-P-10-02	700MB	120	---	938	2591	18/09	CIRC	----	25	--
33	101549Z	13.4N 147.5E	LND RDR		---	---	---	---	--/--	---			--
34	101653Z	13.5N 147.4E	LND RDR		---	---	---	---	--/--	---			--
35	101720Z	13.5N 147.3E	LND RDR		---	---	---	---	--/--	---			--
36	101800Z	13.8N 147.2E	VW-R-10-02	700MB	---	---	---	---	--/--	CIRC	----	25	--
37	101829Z	13.5N 147.1E	ACFT RDR		---	---	---	---	--/--	---			--
38	101905Z	13.6N 147.1E	LND RDR		---	---	---	---	--/--	---			10
39	101921Z	13.6N 147.1E	LND RDR		---	---	---	---	--/--	---			--
40	102037Z	13.7N 146.9E	LND RDR		---	---	---	---	--/--	---			--
41	102100Z	13.7N 146.9E	54-P-02-03	700MB	113	110	940	2502	21/15	ELIP	NW-SE	70X40	--
42	102330Z	14.3N 146.5E	LND RDR		---	---	---	---	--/--	---			--
43	102330Z	13.9N 146.6E	54-P-02-02	700MB	103	120	934	2515	19/12	CIRC	----	30	--
44	110000Z	14.1N 146.4E	LND RDR		---	---	---	---	--/--	---			--
45	110100Z	14.2N 146.4E	LND RDR		---	---	---	---	--/--	---			--
46	110200Z	14.3N 146.3E	LND RDR		---	---	---	---	--/--	---			--
47	110223Z	15.0N 146.5E	SLTLS	STG X	DIA 04	BNDS 4							
48	110300Z	14.4N 146.2E	54-P-01-01	700MB	112	130	932	2493	20/08	CIRC	----	30	--

5-7

FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS 02								
49	110305Z	14.4N 146.2E	LND RDR							--/--				--
50	110400Z	14.5N 146.1E	LND RDR							--/--				--
51	110430Z	14.6N 146.1E	LND RDR							--/--				--
52	110500Z	14.7N 146.0E	LND RDR							--/--				--
53	110524Z	14.9N 146.0E	54-P-01-01	700MB	105	140		2472	20/14	CIRC	----	30		--
54	110530Z	14.7N 146.0E	LND RDR							--/--				--
55	110600Z	14.8N 146.0E	LND RDR							--/--				--
56	110630Z	14.9N 145.9E	LND RDR							--/--				--
57	110700Z	14.9N 145.9E	LND RDR							--/--				--
58	110732Z	15.0N 145.8E	LND RDR							--/--				--
59	110800Z	15.0N 145.8E	LND RDR							--/--				--
60	110830Z	15.1N 145.8E	LND RDR							--/--				--
61	110900Z	15.2N 145.8E	LND RDR							--/--				--
62	110900Z	15.2N 145.7E	VW-P-01-01	700MB	100	050	937	2464	20/13	CIRC	----	34		06
63	110930Z	15.2N 145.7E	LND RDR							--/--				--
64	111000Z	15.3N 145.7E	LND RDR							--/--				--
65	111000Z	15.2N 145.6E	VW-R-----	700MB						--/--				--
66	111030Z	15.3N 145.7E	LND RDR							--/--				--
67	111100Z	15.4N 145.7E	LND RDR							--/--				--
68	111100Z	15.4N 145.4E	VW-R-----	700MB						--/--				--
69	111130Z	15.4N 145.6E	LND RDR							--/--				--
70	111200Z	15.5N 145.6E	LND RDR							--/--				--
71	111200Z	15.6N 145.3E	VW-R-----	700MB						--/--				--
72	111515Z	15.9N 145.1E	VW-P-02-01	700MB	080		950	2591	19/11	CIRC	----	35		05

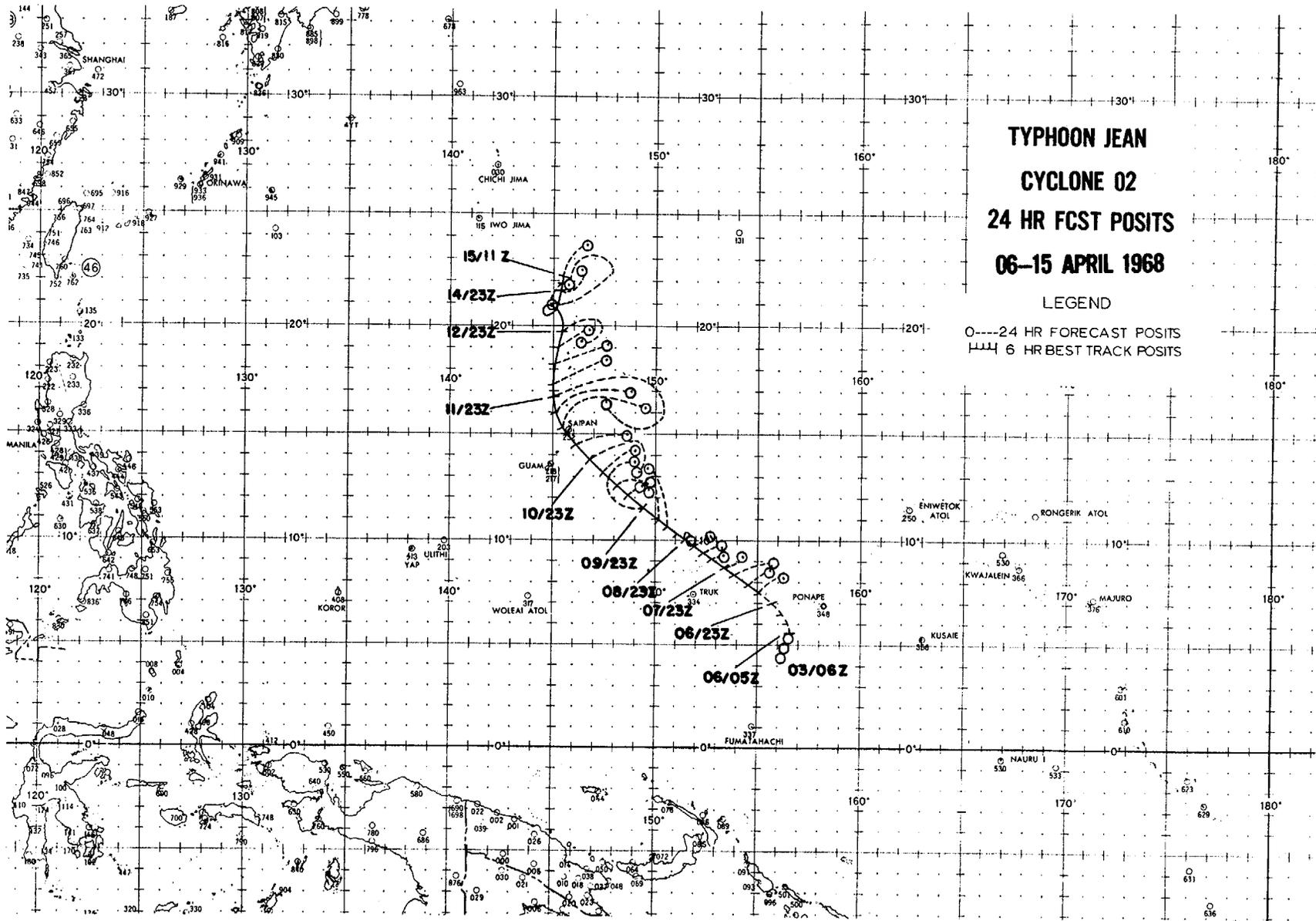
FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			02		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WIND	OBS SFC WIND	OBS MIN SLP						
73	112100Z	16.2N	144.9E	54-P-03-05	700MB	050	080	947	2630	15/11	CIRC	----	35	--
74	120230Z	17.0N	144.8E	54-P-03-03	700MB	085	100	952	2682	16/11	CIRC	----	30	--
75	120740Z	18.0N	144.5E	ACFT RDR	500MB	050	---	---	---	--/--	----			--
76	120830Z	17.9N	144.9E	VW-P-03-05	0350M	---	100	959	2769	24/20	ELIP	NE-SW	70X40	07
77	121402Z	18.7N	145.1E	VW-P-03-05	700MB	---	---	---	2759	17/12	ELIP	NW-SE	54X35	--
78	122105Z	19.5N	145.2E	54-P-01-03	700MB	100	070	962	2771	15/12	CIRC	----	10	--
79	130240Z	20.0N	145.3E	54-P-01-08	700MB	080	100	966	2795	18/12	CIRC	----	20	--
80	130820Z	20.3N	146.0E	VW-R----10		---	---	---	---	--/--	----			--
81	130910Z	20.3N	145.5E	VW-P-02-02	0140M	110	110	972	2950	24/21	ELIP	NW-SE	20X10	--
82	131415Z	20.3N	145.3E	VW-P-02-05	700MB	075	110	980	2941	18/14	ELIP	NW-SE	15X10	--
83	132000Z	21.0N	145.4E	54-P-----	700MB	---	---	---	---	--/--	----			--
84	132104Z	20.8N	145.2E	54-P-02-03	700MB	065	060	982	2935	15/14	CIRC	----	30	--
85	140259Z	21.0N	144.0E	SLTLS	STG C	DIA	--	BNDS -						
86	140301Z	20.7N	144.8E	54-P-01-05	700MB	070	040	986	2960	16/14	CIRC	----	30	--
87	140915Z	20.8N	145.0E	VW-P-02-03	0310M	020	040	993	3040	24/22	CIRC	----	32	F.B.
88	141415Z	20.8N	145.0E	VW-P-02-05	700MB	060	---	988	3072	15/12	CIRC	----	30	F.B.
89	142100Z	21.5N	145.3E	54-P-02-05	700MB	040	060	997	3066	13/11	----			N.F.B.
90	150155Z	21.5N	144.5E	SLTLS	STG C	DIA	--	BNDS -						
91	150300Z	21.8N	145.3E	54-P-02-05	700MB	030	040	999	3082	13/11	----			N.F.B.
92	150830Z	22.0N	145.4E	VW-P-02-02	0310M	024	025	000	---	23/21	----			N.F.B.
93	151440Z	22.1N	145.4E	VW-P-04-10	700MB	---	---	---	3087	13/08	----			--
94	152300Z	21.3N	145.0E	54-P-05-05	0330M	025	035	003	---	22/21	----			N.F.B.

TROPICAL CYCLONE 02 -- 04/06/0500Z TO 04/15/1100Z
 POSITION AND FORECAST VERIFICATION DATA

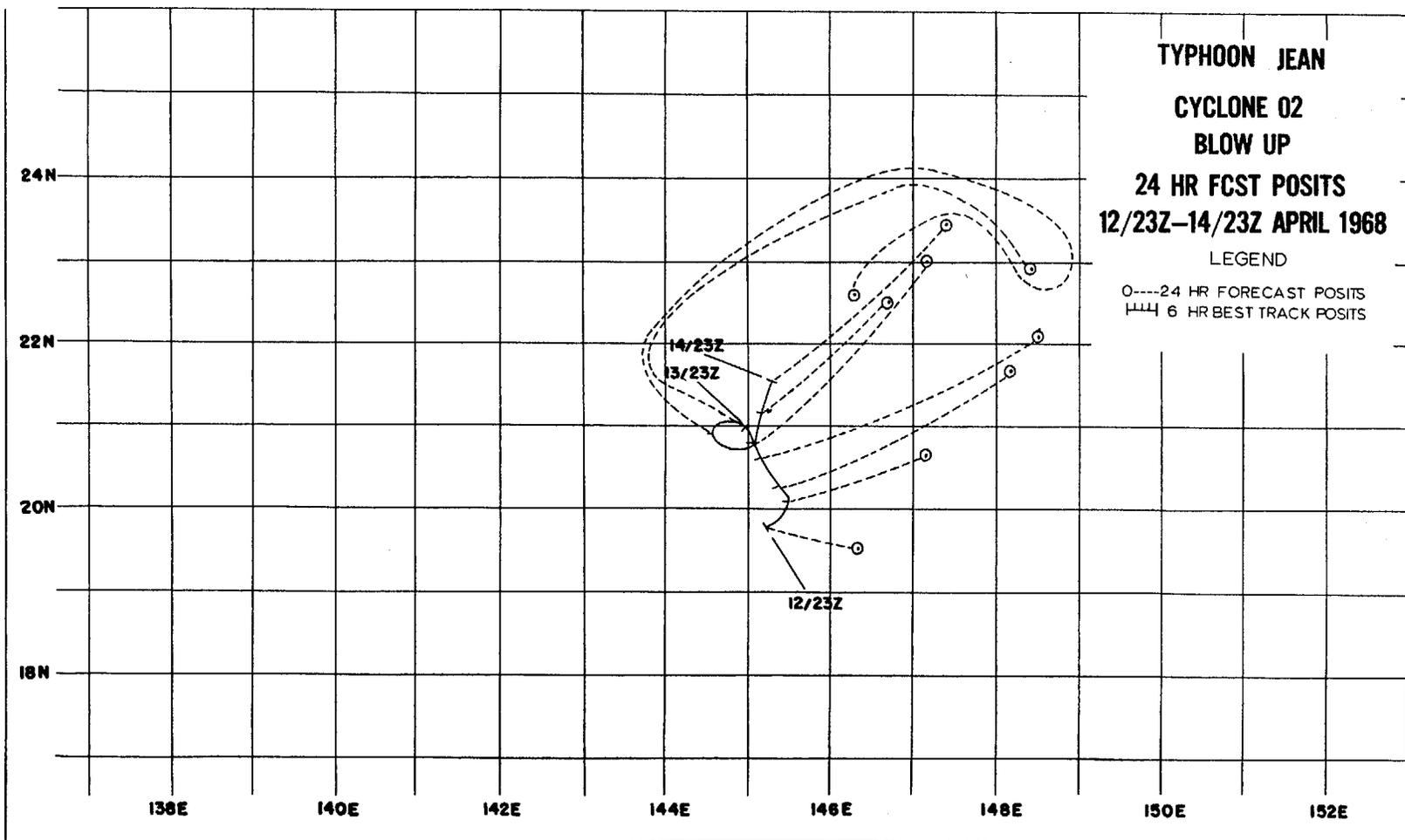
DTG	STORM POSITION		24 HR. ERROR		48 HR. ERROR		72 HR. ERROR	
	LAT.	LONG.	DEG.	DIST.	DEG.	DIST.	DEG.	DIST.
070500Z	07.5N	155.1E	056	0072	-----	-----		
071100Z	07.9N	154.5E	060	0078	-----	-----		
071700Z	08.3N	153.9E	070	0102	-----	-----		
072300Z	08.7N	153.3E	064	0048	-----	-----		
080500Z	09.2N	152.7E	090	0030	-----	-----		
081100Z	09.4N	152.3E	078	0054	-----	-----		
081700Z	09.7N	151.8E	067	0054	-----	-----		
082300Z	10.0N	151.4E	090	0012	-----	-----		
090500Z	10.3N	151.1E	333	0132	031	0030	-----	
091100Z	10.6N	150.6E	344	0174	053	0066	-----	
091700Z	11.0N	150.1E	346	0102	052	0072	-----	
092300Z	11.6N	149.4E	064	0012	090	0024	-----	
100500Z	12.2N	148.7E	084	0054	004	0204	072-0072	
101100Z	12.8N	148.1E	104	0072	024	0258	-----	
101700Z	13.3N	147.4E	096	0102	033	0174	081-0138	
102300Z	13.8N	146.6E	083	0138	088	0138	-----	
110500Z	14.7N	146.1E	084	0150	090	0186	053-0420	
111100Z	15.3N	145.5E	077	0234	096	0204	-----	
111700Z	16.0N	145.0E	075	0228	092	0258	069-0468	
112300Z	16.7N	144.8E	112	0174	084	0336	-----	
120500Z	17.4N	144.8E	068	0174	083	0414	079-0468	
121100Z	18.2N	145.0E	071	0156	086	0456	-----	
121700Z	19.0N	145.1E	061	0108	088	0492	088-0498	
122300Z	19.8N	145.2E	106	0060	100	0390	-----	
130500Z	20.1N	145.5E	069	0096	077	0498	085-0750	
131100Z	20.3N	145.4E	062	0174	074	0510	-----	
131700Z	20.6N	145.3E	063	0192	072	0498	088-0810	
132300Z	21.0N	145.0E	059	0216	076	0390	-----	
140500Z	20.9N	144.6E	047	0216	060	0456	-----	
141100Z	20.8N	145.1E	041	0174	058	0528	-----	
141700Z	21.2N	145.2E	046	0108	058	0600	074-1014	
142300Z	21.6N	145.3E	042	0078	056	0558	-----	
150500Z	21.9N	145.4E	116	0012	049	0492	059-0924	

AVERAGE 24 HOUR ERROR - 0114 MI.
 AVERAGE 48 HOUR ERROR - 0329 MI.
 AVERAGE 72 HOUR ERROR - 0556 MI.

S-10



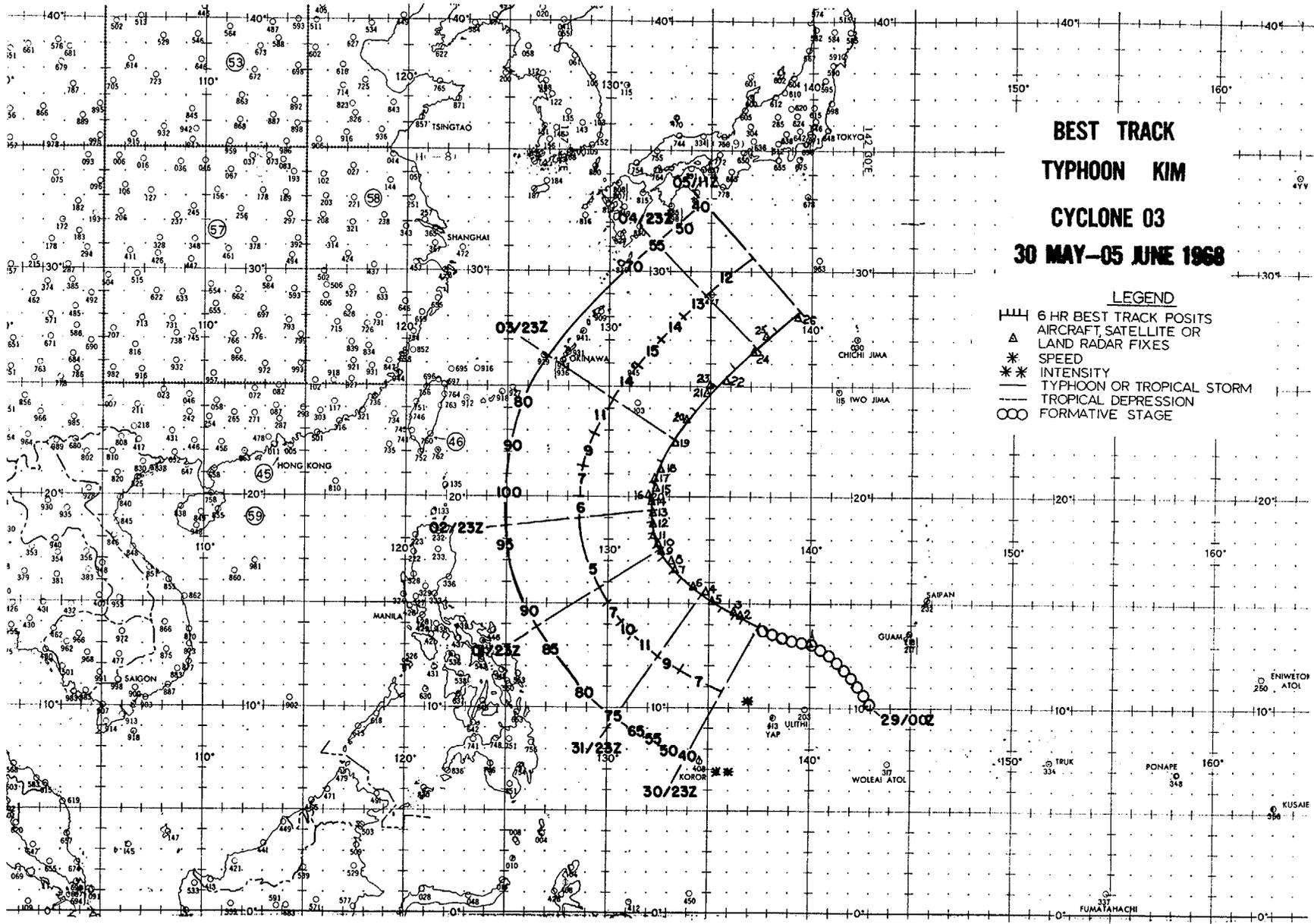
S-11



TROPICAL CYCLONE 03 - 05/30/2300Z TO 06/05/1100Z
(KIM)

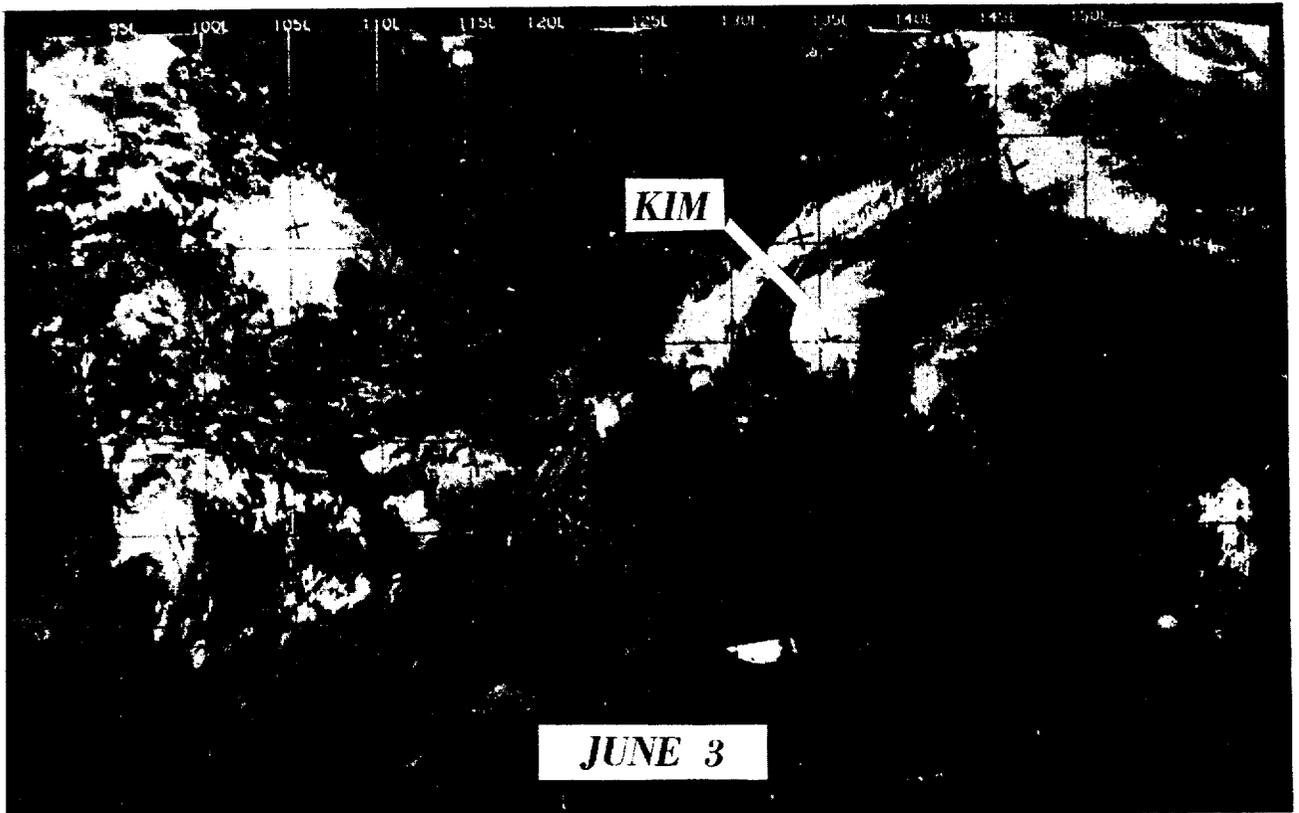
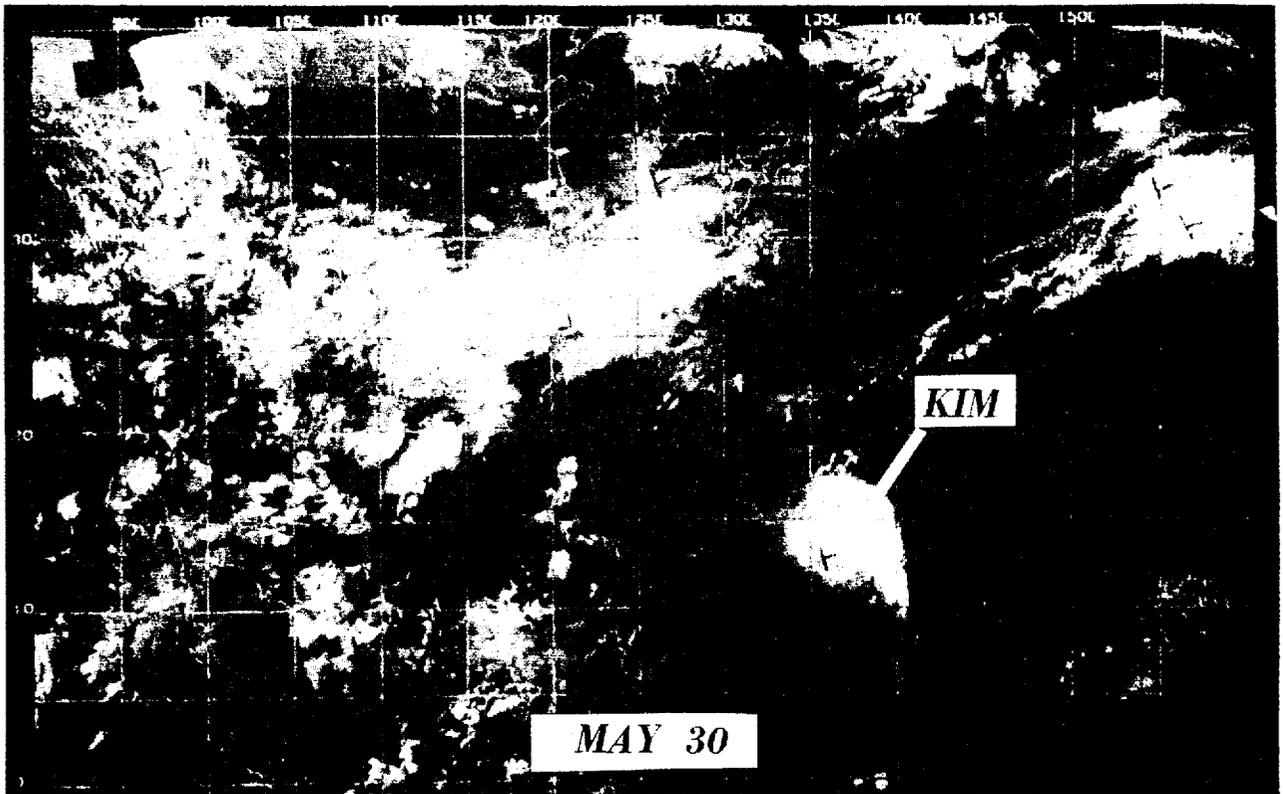
- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 23
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 16
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1164 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 948MBS AT 030240Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2654M. AT 030856Z
 - 3. MAXIMUM SURFACE WIND - 100 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 420 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - UNSTABLE EASTERLY WAVE UNDER 200MB DIVERGENCE
 - B. INITIAL SURFACE VORTEX
 - 1. EMBEDDED VORTEX AT 290000Z
 - 2. SURFACE PRESSURE LESS THAN 1009MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - SOUTHWEST
 - 2. UPON REACHING TYPHOON INTENSITY - NORTHEAST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

S-14



BEST TRACK
TYPHOON KIM
CYCLONE 03
30 MAY-05 JUNE 1968

- LEGEND**
- 6 HR BEST TRACK POSITS
 - △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - * SPEED
 - ** INTENSITY
 - TYPHOON OR TROPICAL STORM
 - - - TROPICAL DEPRESSION
 - FORMATIVE STAGE



FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			03		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN							
1	300739Z	13.0N 140.0E	SLTLS	STG X	DIA	05	BNDS 1							
2	310743Z	14.3N 136.5E	54-P-03-01	0460M	090	070	994	---	24/22	CIRC	----	05	--	
3	310916Z	14.5N 136.2E	VW-P-05-01	2890M	040	060	---	---	19/14	CIRC	----	10	--	
4	312000Z	15.5N 134.9E	54-R-----	3290M	045	---	---	---	--/--	----			--	
5	312050Z	15.1N 135.1E	54-P-05-02	2940M	080	070	972	2862	19/16	CIRC	----	20	05	
6	010221Z	15.8N 134.2E	54-P-05-02	700MB	085	080	974	2862	20/14	CIRC	----	25	--	
7	010900Z	16.5N 133.2E	VW-P-02-02	0270M	065	065	981	---	27/24	CIRC	----	25	--	
8	011430Z	17.0N 133.1E	VW-P-02-05	700MB	---	---	981	2947	17/11	CIRC	----	25	--	
9	012101Z	17.3N 132.6E	54-P-03-01	700MB	058	070	974	2883	16/09	CIRC	----	20	--	
10	020200Z	17.8N 132.4E	54-P-03-01	700MB	070	070	972	2853	17/09	CIRC	----	20	--	
11	020850Z	18.1N 132.2E	VW-P-05-03	0230M	110	100	968	---	27/24	CIRC	----	20	--	
12	021430Z	18.7N 132.1E	VW-R-03-10	700MB	---	---	---	---	--/--	CIRC	----	30	--	
13	022100Z	19.2N 132.2E	54-P-03-03	700MB	090	100	958	2737	19/07	CIRC	----	20	--	
14	030240Z	19.8N 132.1E	54-P-03-01	700MB	105	110	948	2658	18/08	CIRC	----	20	--	
15	030603Z	20.0N 132.0E	SLTLS	STG X	DIA	04	BNDS 4							
16	030800Z	20.3N 132.3E	VW-R-10---	0590M	---	---	---	---	--/--	----			--	
17	030856Z	20.8N 132.2E	VW-P-05-05	700MB	---	085	949	2654	19/09	CIRC	----	14	--	
18	031415Z	21.1N 132.4E	VW-P-05-05	700MB	---	---	956	2711	16/09	CIRC	----	15	--	
19	032050Z	22.3N 133.2E	54-P-03-05	700MB	095	075	954	2691	15/13	CIRC	----	25	--	
20	040205Z	23.4N 133.8E	54-P-01-03	700MB	090	090	958	2719	15/10	CIRC	----	35	--	
21	040700Z	25.0N 135.0E	SLTLS	STG X	DIA	04	BNDS 3							
22	040910Z	24.8N 134.9E	VW-P-05-05	0450M	---	100	971	---	24/23	CIRC	----	33	--	
23	041510Z	25.2N 135.9E	VW-P-03-05	700MB	---	---	983	2948	18/10	CIRC	----	35	--	
24	042119Z	26.5N 137.1E	54-P-03-03	700MB	033	075	982	2923	16/13	----			F.8.	

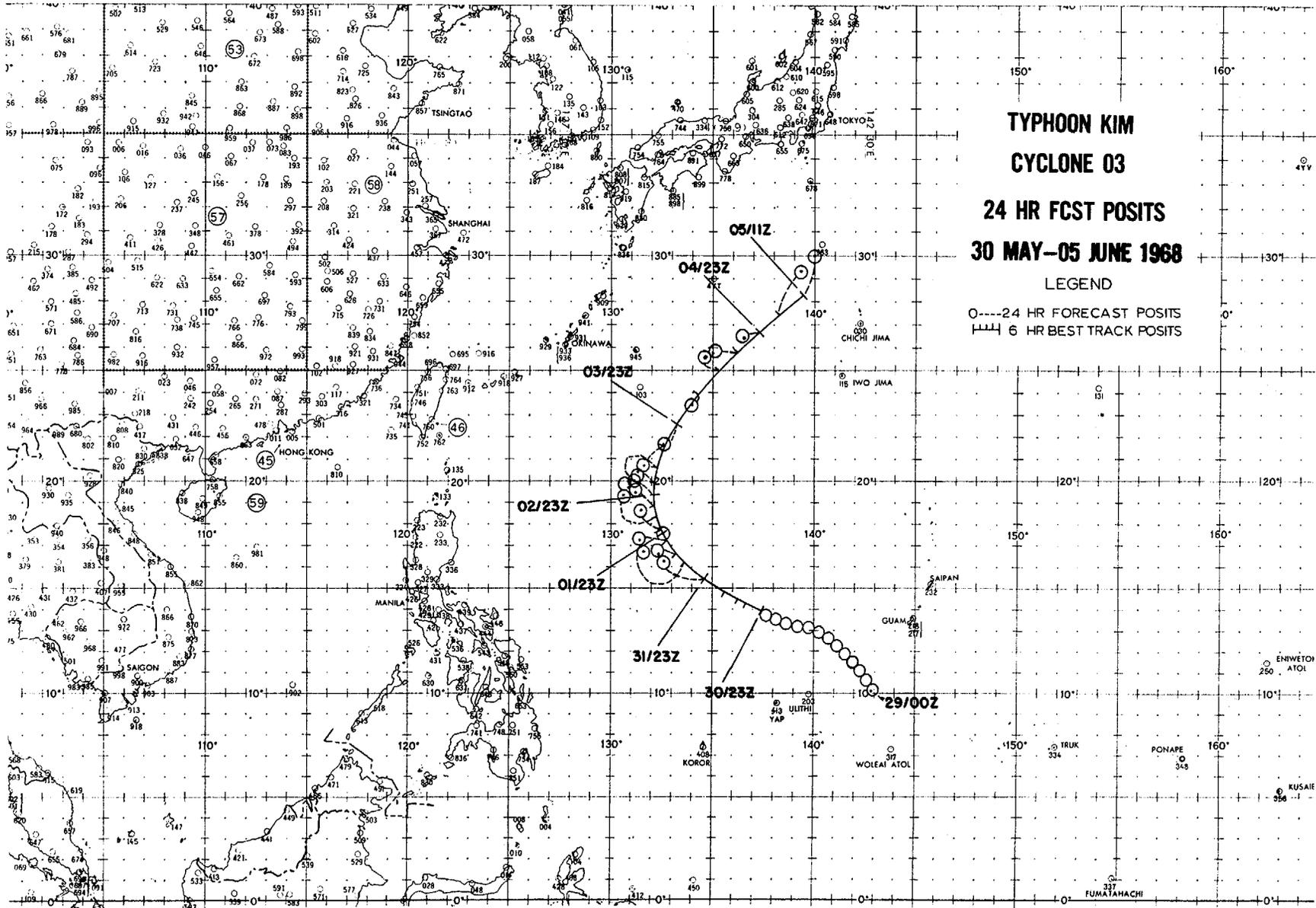
5-16

FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			03		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP						
25	050230Z	27.1N	137.8E	54-P-03-10	700MB	050	070	988	3021	17/09	---			F.B.
26	050900Z	28.0N	139.3E	VW-P-05-05	0270M	---	055	996	---	22/18	---			--

TROPICAL CYCLONE 03 -- 05/30/2300Z TO 06/05/1100Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
302300Z	13.9N	137.5E	-----	-----	-----
310500Z	14.2N	136.8E	-----	-----	-----
311100Z	14.5N	136.1E	-----	-----	-----
311700Z	14.8N	135.5E	-----	-----	-----
312300Z	15.5N	134.6E	290-0120	-----	-----
010500Z	16.1N	133.7E	290-0120	-----	-----
011100Z	16.7N	133.1E	255-0042	-----	-----
011700Z	17.1N	132.7E	270-0078	-----	-----
012300Z	17.5N	132.5E	----0000	-----	-----
020500Z	17.8N	132.4E	311-0072	-----	-----
021100Z	18.4N	132.3E	299-0108	280-0126	-----
021700Z	18.9N	132.2E	296-0066	295-0138	-----
022300Z	19.4N	132.2E	279-0072	333-0048	-----
030500Z	20.0N	132.1E	296-0048	293-0102	-----
031100Z	20.8N	132.3E	232-0072	289-0138	-----
031700Z	21.6N	132.6E	231-0084	268-0138	324-0120
032300Z	22.7N	133.3E	207-0078	255-0180	-----
040500Z	24.0N	134.2E	190-0036	247-0174	256-0192
041100Z	25.0N	135.3E	324-0048	230-0306	-----
041700Z	25.8N	136.3E	270-0066	229-0324	255-0282
042300Z	26.7N	137.3E	247-0042	218-0186	-----
050500Z	27.4N	138.3E	024-0114	150-0048	247-0360
051100Z	28.2N	139.5E	013-0108	024-0192	-----

AVERAGE 24 HOUR ERROR - 0072 MI.
 AVERAGE 48 HOUR ERROR - 0161 MI.
 AVERAGE 72 HOUR ERROR - 0238 MI.

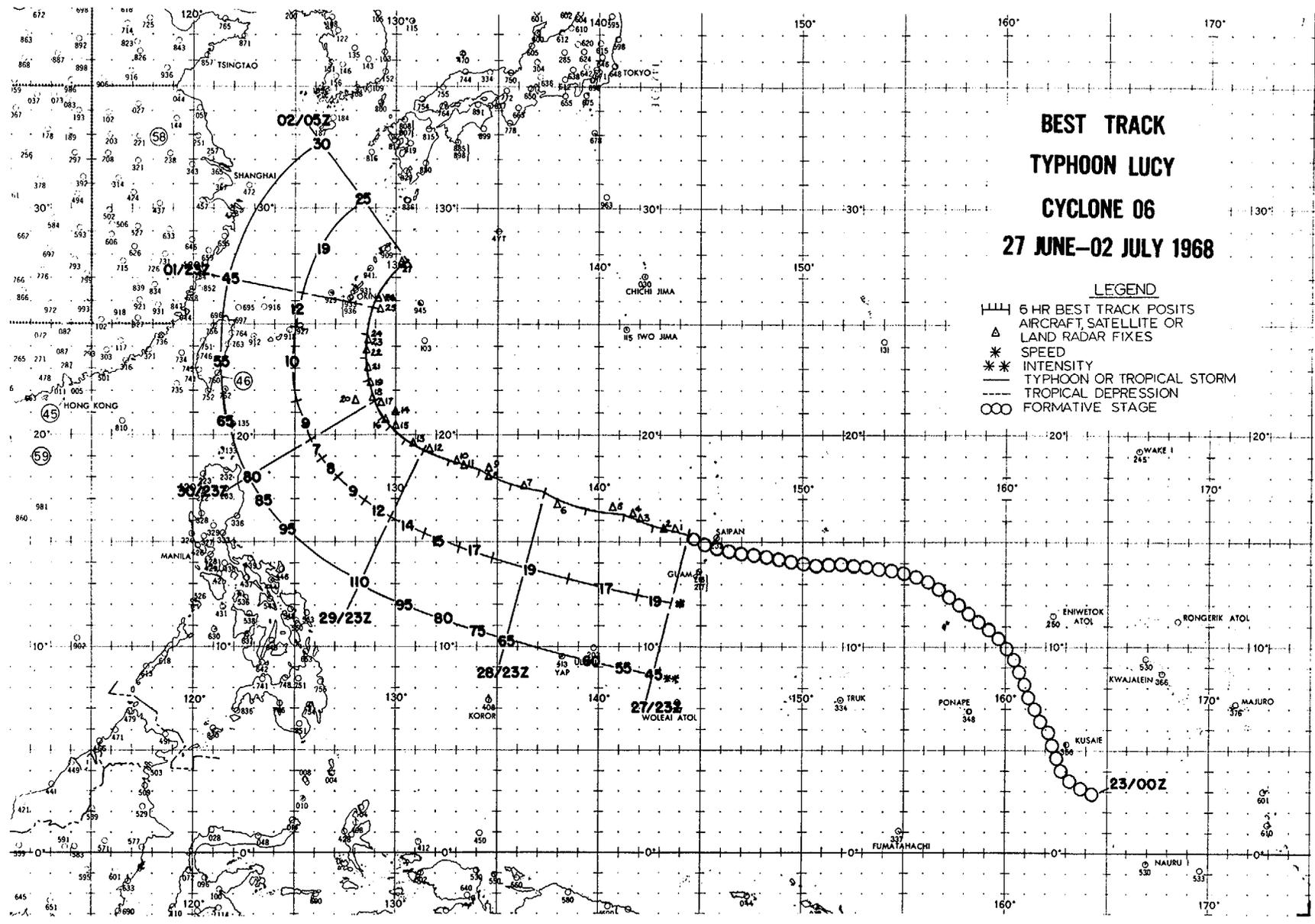


TROPICAL CYCLONE 06 - 06/27/2300Z TO 07/02/0500Z
(LUCY)

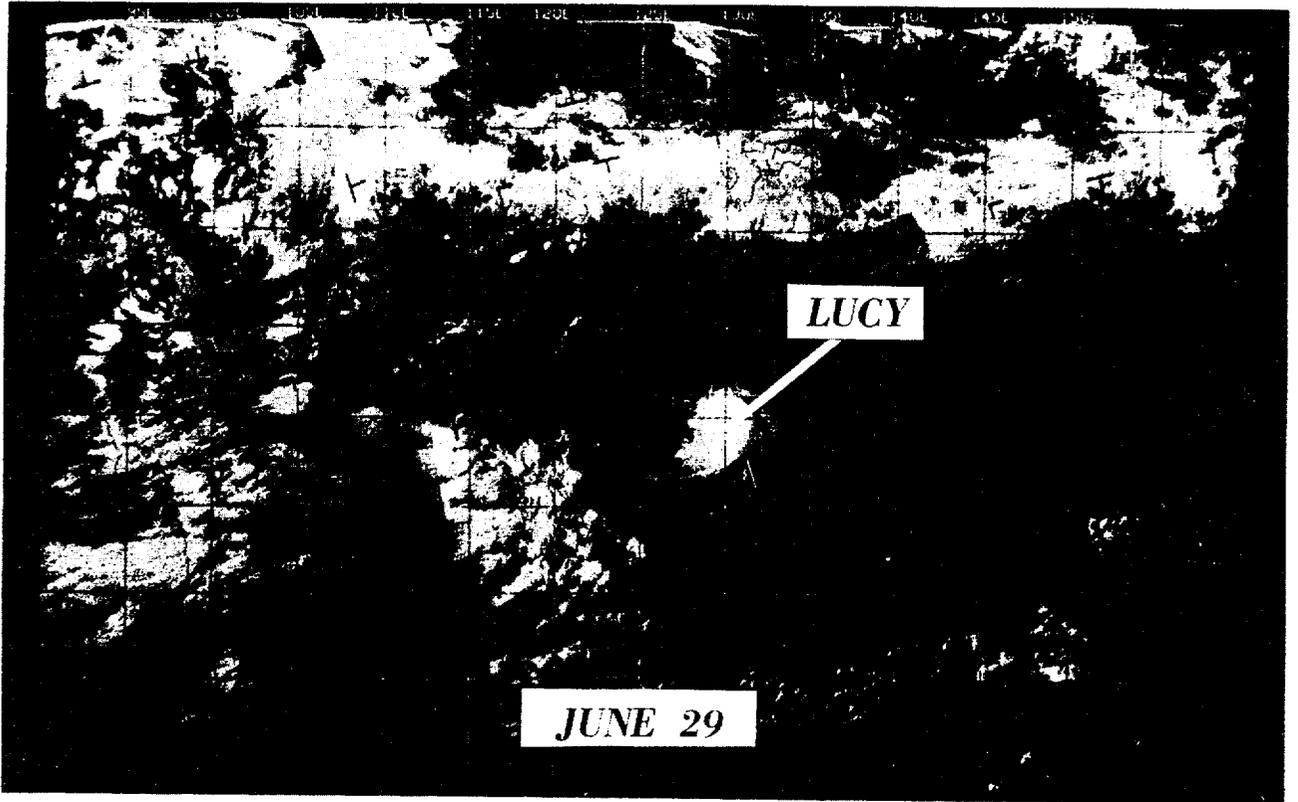
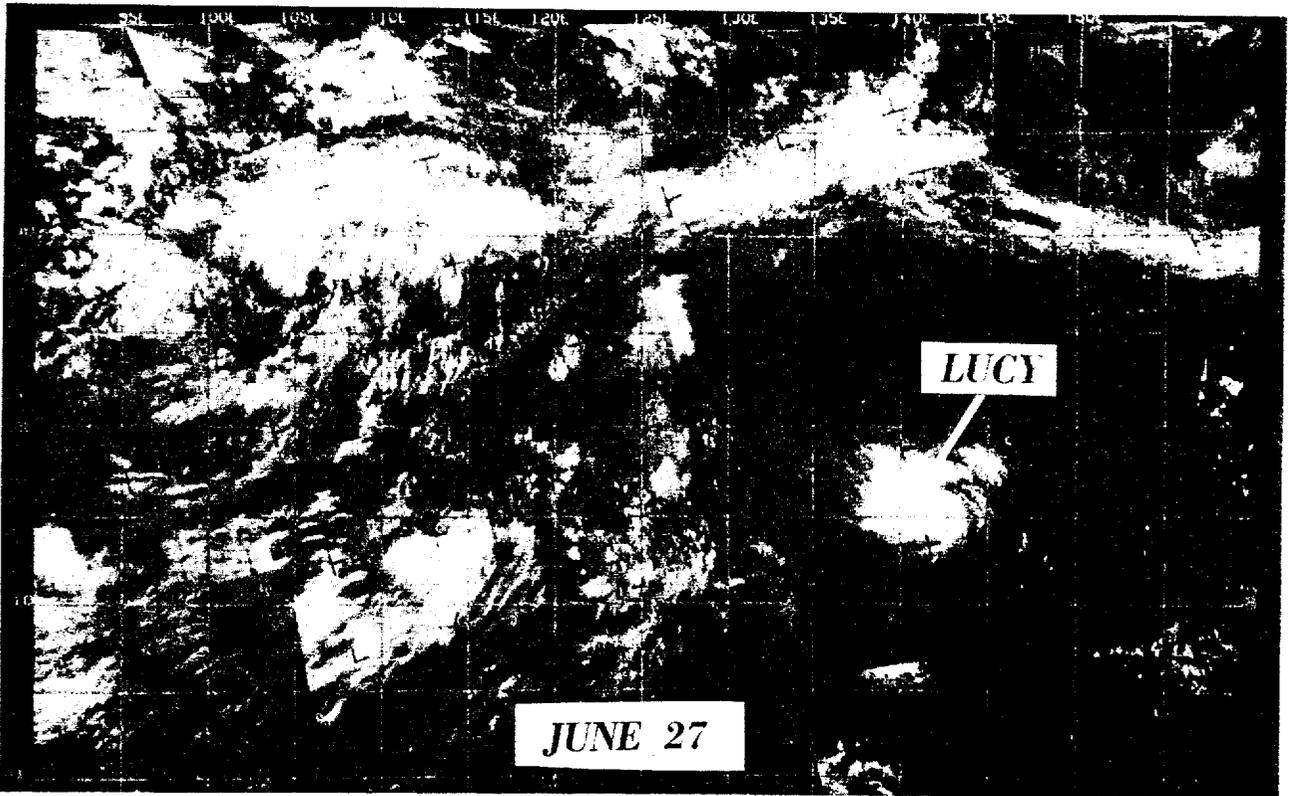
- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 18
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 10
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1404 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 935MBS AT 292113Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2536M. AT 292113Z
 - 3. MAXIMUM SURFACE WIND - 110 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 - 1. EMBEDDED VORTEX AT 230000Z
 - 2. SURFACE PRESSURE LESS THAN 1008MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - NORTHEAST
 - 2. UPON REACHING TYPHOON INTENSITY - SOUTHEAST
- III. FINAL DISPOSITION - DISSIPATED OVER WATER

**BEST TRACK
 TYPHOON LUCY
 CYCLONE 06
 27 JUNE-02 JULY 1968**

- LEGEND**
- 6 HR BEST TRACK POSITS
 - △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - SPEED
 - * * INTENSITY
 - TYPHOON OR TROPICAL STORM
 - TROPICAL DEPRESSION
 - ○ ○ FORMATIVE STAGE



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FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			06		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
1	280130Z	15.5N 143.8E	54-P-02-02	700MB	055	045	999	3054	11/--	CIRC	----	20	--	
2	280355Z	15.5N 143.2E	54-P-02-01	700MB	050	055	993	3011	12/08	CIRC	----	15	--	
3	280628Z	16.0N 142.0E	SLTLS	STG X	DIA 02	BNDS 2								
4	280830Z	16.2N 141.8E	VW-P-05-03	0290M	070	070	997	---	28/23	CIRC	----	20	--	
5	281400Z	16.5N 140.7E	VW-R-10-05	700MB	---	---	---	---	--/14	CIRC	----	18	--	
6	282059Z	16.8N 138.0E	54-P-03-02	700MB	047	055	987	2984	14/08	CIRC	----	10	--	
7	290246Z	17.5N 136.2E	54-P-03-03	700MB	065	065	976	2874	13/10	CIRC	----	14	--	
8	290705Z	18.0N 134.5E	SLTLS	STG X	DIA 03	BNDS 3								
9	290910Z	18.2N 134.6E	VW-P-05-05	700MB	---	085	976	2859	14/--	----			--	
10	291345Z	18.8N 133.0E	VW-R-05---	700MB	---	---	---	---	--/--	----			--	
11	291430Z	18.6N 133.3E	VW-R-05---	700MB	---	---	---	---	--/10	CIRC	----	07	--	
12	292113Z	19.2N 131.7E	54-P-02-02	700MB	070	120	935	2536	21/09	CIRC	----	10	--	
13	300245Z	19.6N 130.9E	54-P-02-01	700MB	085	080	947	2661	25/09	CIRC	----	15	--	
14	300742Z	21.0N 130.0E	SLTLS	STG X	DIA 03	BNDS 2								
15	300910Z	20.3N 130.0E	VW-P-03-05	700MB	---	100	965	2832	18/14	CIRC	----	20	--	
16	301430Z	20.7N 129.4E	VW-P-03-05	700MB	---	---	968	---	16/12	CIRC	----	14	07	
17	302115Z	21.3N 129.2E	54-P-03-03	700MB	065	120	974	2862	13/12	----			F.B.	
18	010006Z	21.7N 128.9E	54-P-03-03	700MB	063	065	976	2899	20/13	----			F.B.	
19	010300Z	22.2N 128.8E	54-P-03-03	700MB	041	070	979	2911	19/13	----			F.B.	
20	010819Z	21.5N 128.0E	SLTLS	STG X	DIA 03	BNDS 3								
21	010830Z	23.0N 128.7E	VW-P-03-01	0440M	060	045	983	---	27/25	----			N.F.B.	
22	011200Z	23.9N 128.5E	VW-P-09-01	700MB	037	---	989	2913	14/13	----			N.F.B.	
23	011430Z	24.1N 128.6E	VW-P-02---	700MB	047	---	---	3018	--/--	----			--	
24	011507Z	24.2N 128.6E	VW-P-03-03	700MB	047	---	989	3018	17/12	----			F.B.	

5-24

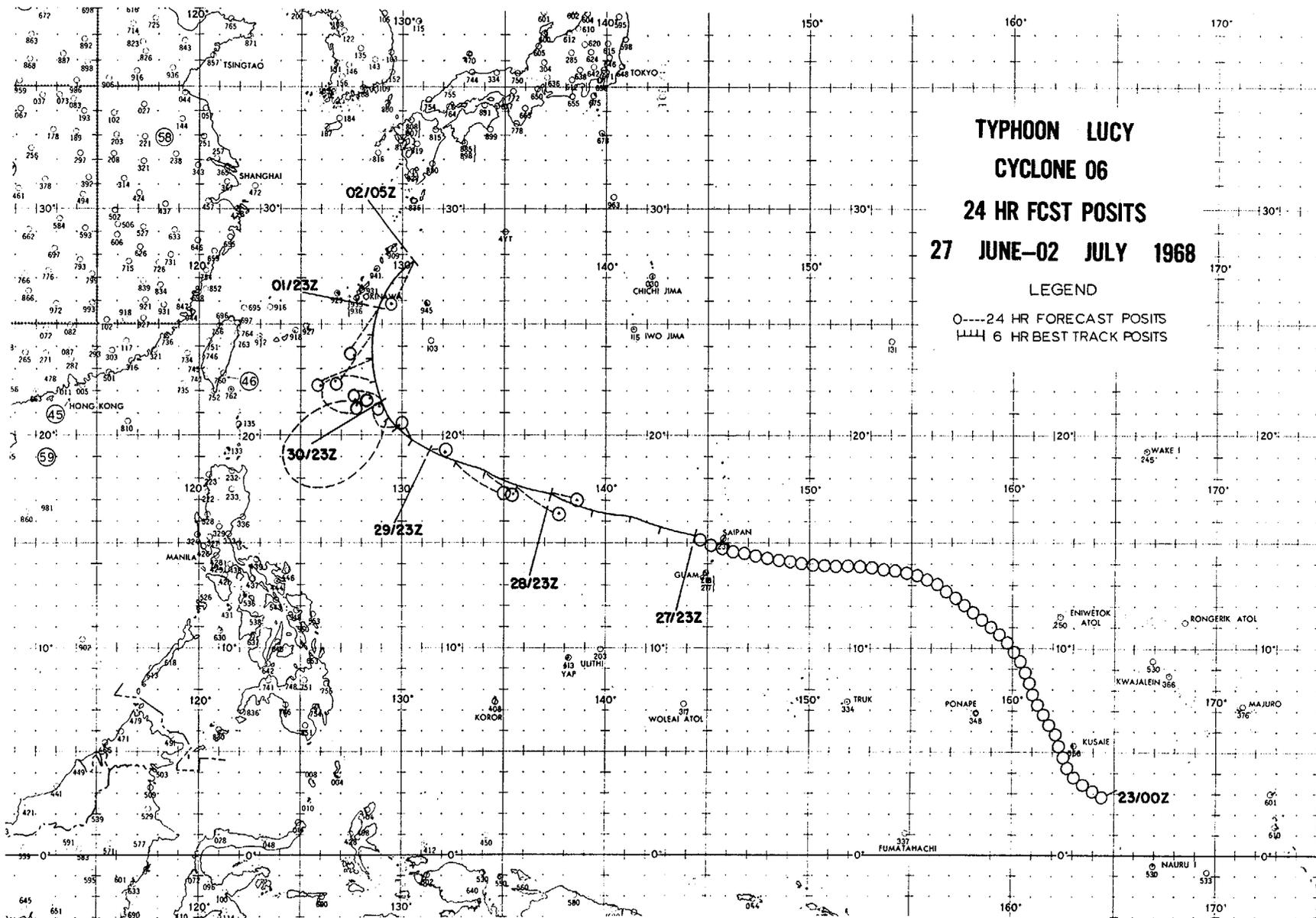
FIX NO.	TIME	POSIT	EYE FIXES CYCLONE				06		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
25	012125Z	25.6N 129.2E	54-P-05-25	0430M	045	045	997	3039	--/22	----			N.F.B.	
26	020000Z	26.0N 129.1E	54-P-03-10	700MB	040	035	000	3176	15/12	----			N.F.B.	
27	020345Z	27.6N 130.3E	54-P-02-10	700MB	030	040	001	3060	13/08	----			N.F.B.	

TROPICAL CYCLONE 06 -- 06/27/2300Z TO 07/02/0500Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
272300Z	15.1N	144.5E	-----	-----	-----
280500Z	15.8N	142.8E	-----	-----	-----
281100Z	16.2N	141.2E	-----	-----	-----
281700Z	16.5N	139.3E	-----	-----	-----
282300Z	17.1N	137.3E	094-0084	-----	-----
290500Z	17.7N	135.6E	123-0150	-----	-----
291100Z	18.3N	134.1E	119-0144	-----	-----
291700Z	18.8N	132.7E	121-0156	-----	-----
292300Z	19.3N	131.4E	108-0036	102-0168	-----
300500Z	19.9N	130.5E	308-0036	123-0228	-----
301100Z	20.3N	129.8E	318-0072	129-0174	-----
301700Z	20.8N	129.3E	314-0072	134-0186	-----
302300Z	21.5N	128.9E	270-0066	237-0018	-----
010500Z	22.5N	128.6E	213-0078	276-0108	151-0222
011100Z	23.5N	128.6E	240-0162	270-0138	-----
011700Z	24.5N	128.7E	223-0168	267-0186	177-0258
012300Z	25.8N	128.9E	208-0150	232-0234	-----

AVERAGE 24 HOUR ERROR - 0105 MI.
 AVERAGE 48 HOUR ERROR - 0160 MI.
 AVERAGE 72 HOUR ERROR - 0240 MI.

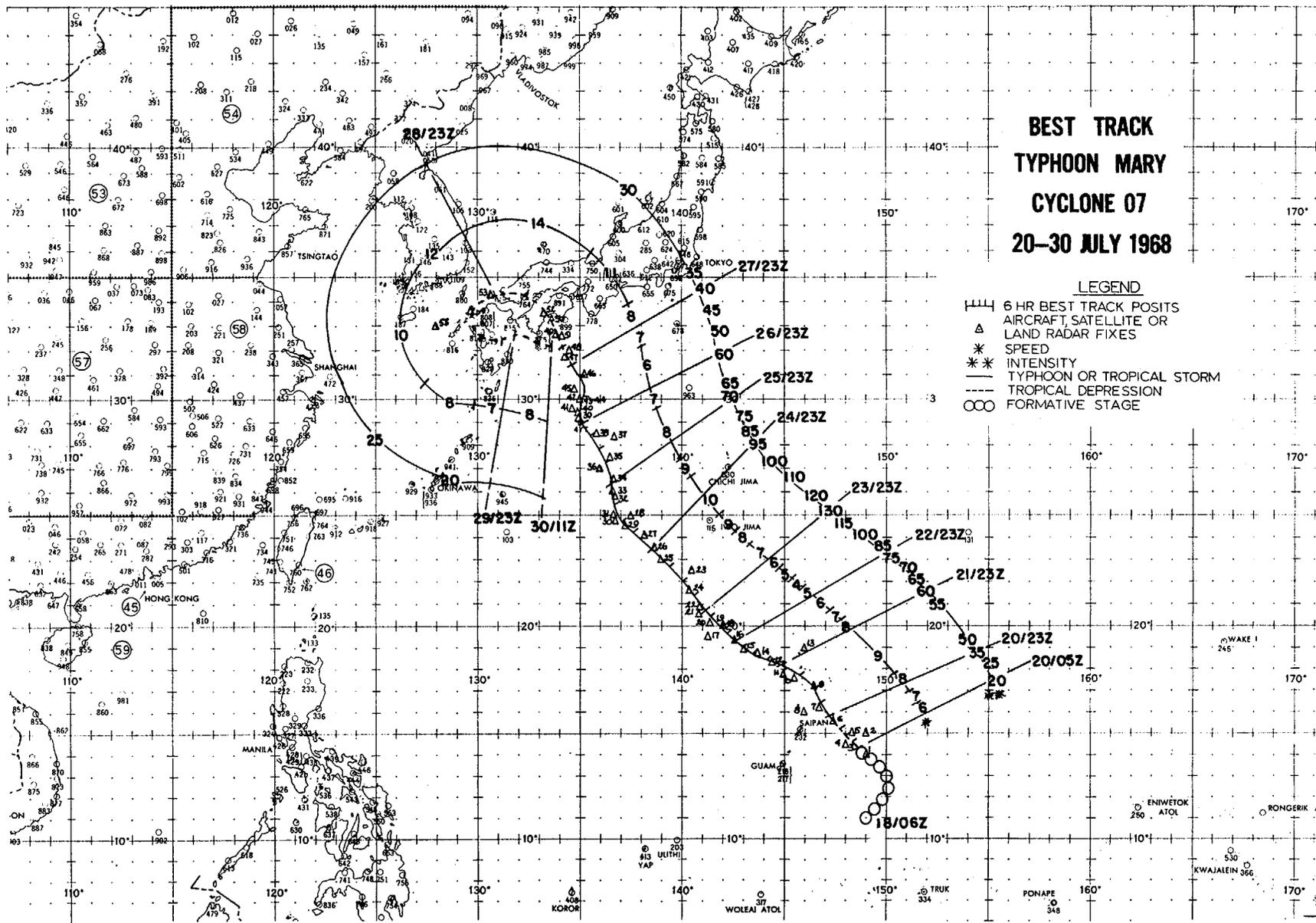
5-27



TROPICAL CYCLONE 07 - 07/20/0500Z TO 07/30/1100Z
(MARY)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 42
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 22
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1932 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 924MBS AT 232100Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2441M. AT 240230Z
 3. MAXIMUM SURFACE WIND - 130 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 600 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 1. JUNCTION VORTEX AT 180600Z
 2. SURFACE PRESSURE LESS THAN 1007MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - SOUTHEAST
 2. UPON REACHING TYPHOON INTENSITY - NORTH
- III. FINAL DISPOSITION - DISSIPATED OVER WATER

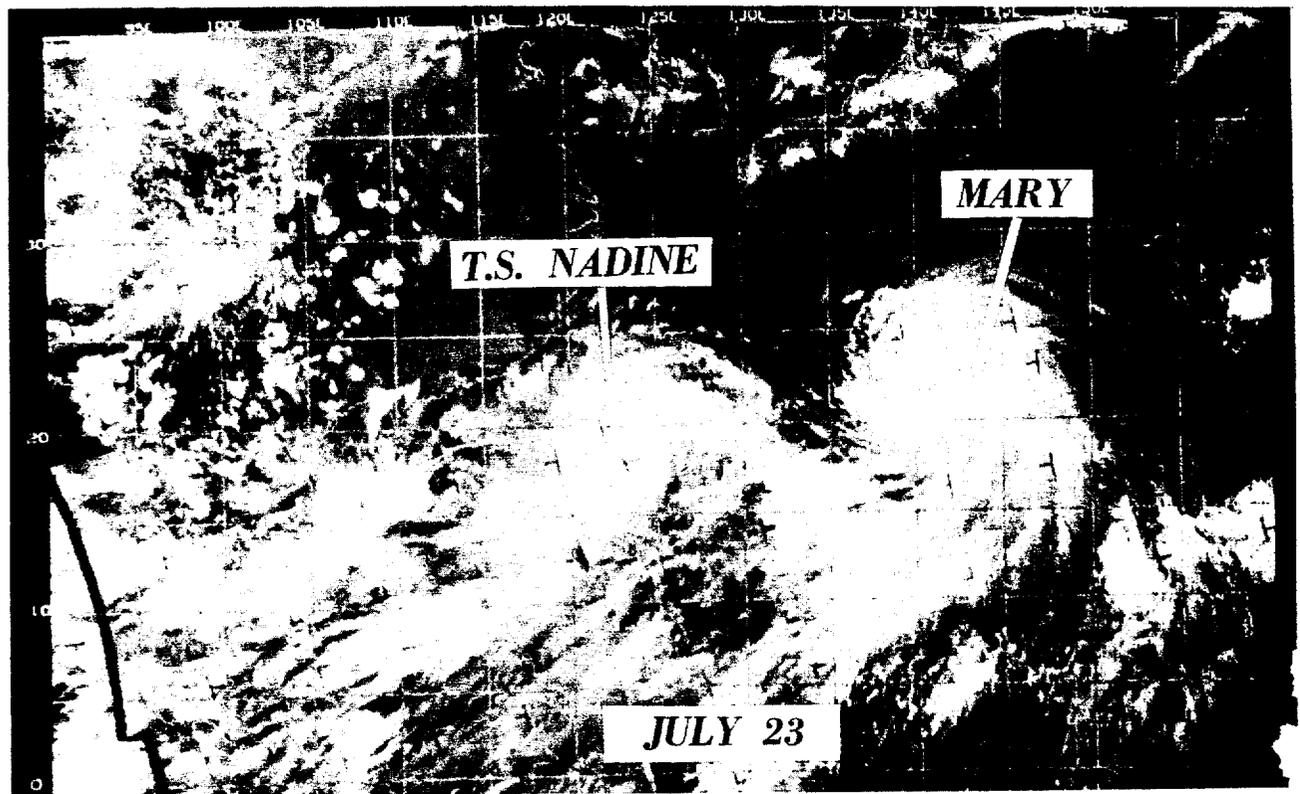
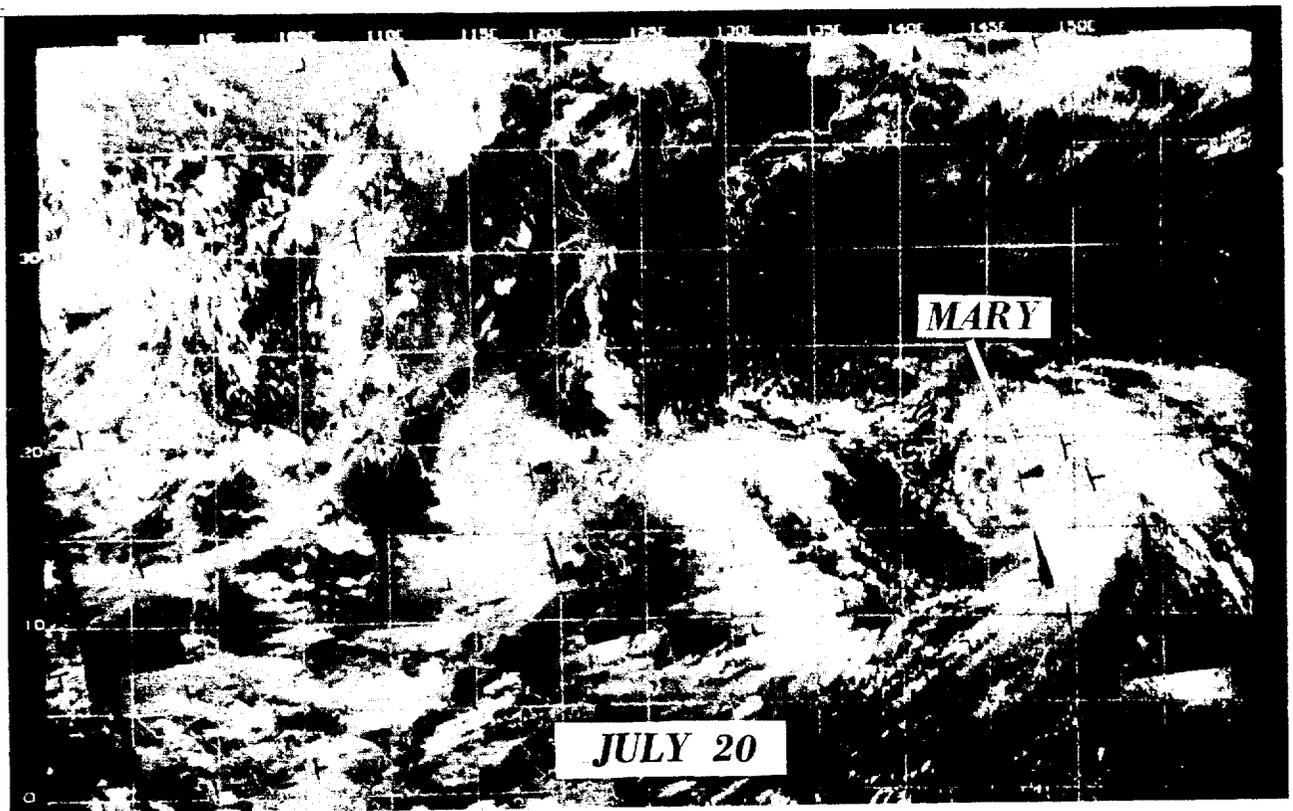
S-30



**BEST TRACK
TYPHOON MARY
CYCLONE 07
20-30 JULY 1968**

LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- FORMATIVE STAGE



FIX NO.	TIME	POSIT		UNIT- METHOD -ACCY	EYE FIXES CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
					FLT LVL	WND								
1	200110Z	14.0N	149.0E	54-P-----	0430M	020	020	002	---	--/--	----			N.F.B.
2	200641Z	15.0N	149.0E	SLTLS	STG X	DIA 02	BNDS 2							
3	200905Z	14.5N	148.0E	VW-P-05-05	0460M	016	020	998	3102	24/25	CIRC	----	--	F.B.
4	201230Z	14.5N	148.0E	VW-R-----		---	---	---	---	--/--	----			--
5	201520Z	15.0N	148.2E	VW-P-05-15	700MB	020	---	004	3078	10/09	ELIP	NW-SE	40X28	N.F.B.
6	202130Z	15.6N	147.3E	54-P-03-10	700MB	035	025	994	3030	09/--	ELIP	N-S	40X25	F.B.
7	210255Z	16.1N	146.8E	54-P-10-05	700MB	035	050	986	2987	12/10	ELIP	N-S	30X15	--
8	210718Z	16.0N	146.0E	SLTLS	STG X	DIA 03	BNDS 2							
9	210926Z	17.2N	146.4E	VW-P-03-03	0460M	039	040	985	---	24/23	CIRC	----	18	--
10	211415Z	17.6N	145.6E	VW-R-05-15	0460M	048	---	---	---	--/--	CIRC	----	30	--
11	212105Z	17.8N	145.0E	54-P-03-03	700MB	045	050	983	2926	16/12	ELIP	N-S	40X30	--
12	220241Z	18.2N	144.4E	54-P-03-03	700MB	050	055	976	2887	16/12	CIRC	----	25	--
13	220559Z	19.0N	146.0E	SLTLS	STG X	DIA 04	BNDS -							
14	220835Z	18.8N	143.8E	VW-P-03-03	0450M	085	085	964	2842	26/33	CIRC	----	45	04
15	221440Z	18.9N	143.0E	VW-R-02-03	700MB	---	---	---	---	--/--	CIRC	----	10	06
16	222043Z	19.3N	142.6E	54-P-03-02	700MB	080	080	952	2676	20/15	CIRC	----	10	--
17	230247Z	19.5N	141.2E	54-P-03-05	700MB	060	080	951	2667	17/15	CIRC	----	15	--
18	230638Z	20.0N	142.0E	SLTLS	STG X	DIA 05	BNDS 4							
19	230847Z	20.0N	142.2E	VW-P-05-05		---	090	947	---	26/25	ELIP	NE-SW	20X14	--
20	231130Z	20.0N	125.8E	VW-P-05-10	700MB	---	---	---	3012	15/11	CIRC	----	20	F.B.
21	231430Z	20.2N	141.5E	VW-P-05-05	700MB	065	---	941	2595	18/15	CIRC	----	15	--
22	232100Z	20.7N	140.9E	54-P-01-01	700MB	100	115	924	2445	20/14	CIRC	----	20	08
23	240230Z	20.9N	140.9E	54-P-03-01	700MB	135	130	924	2441	20/14	CIRC	----	10	--
24	240715Z	22.5N	140.5E	SLTLS	STG X	DIA 07	BNDS 4							

3-32

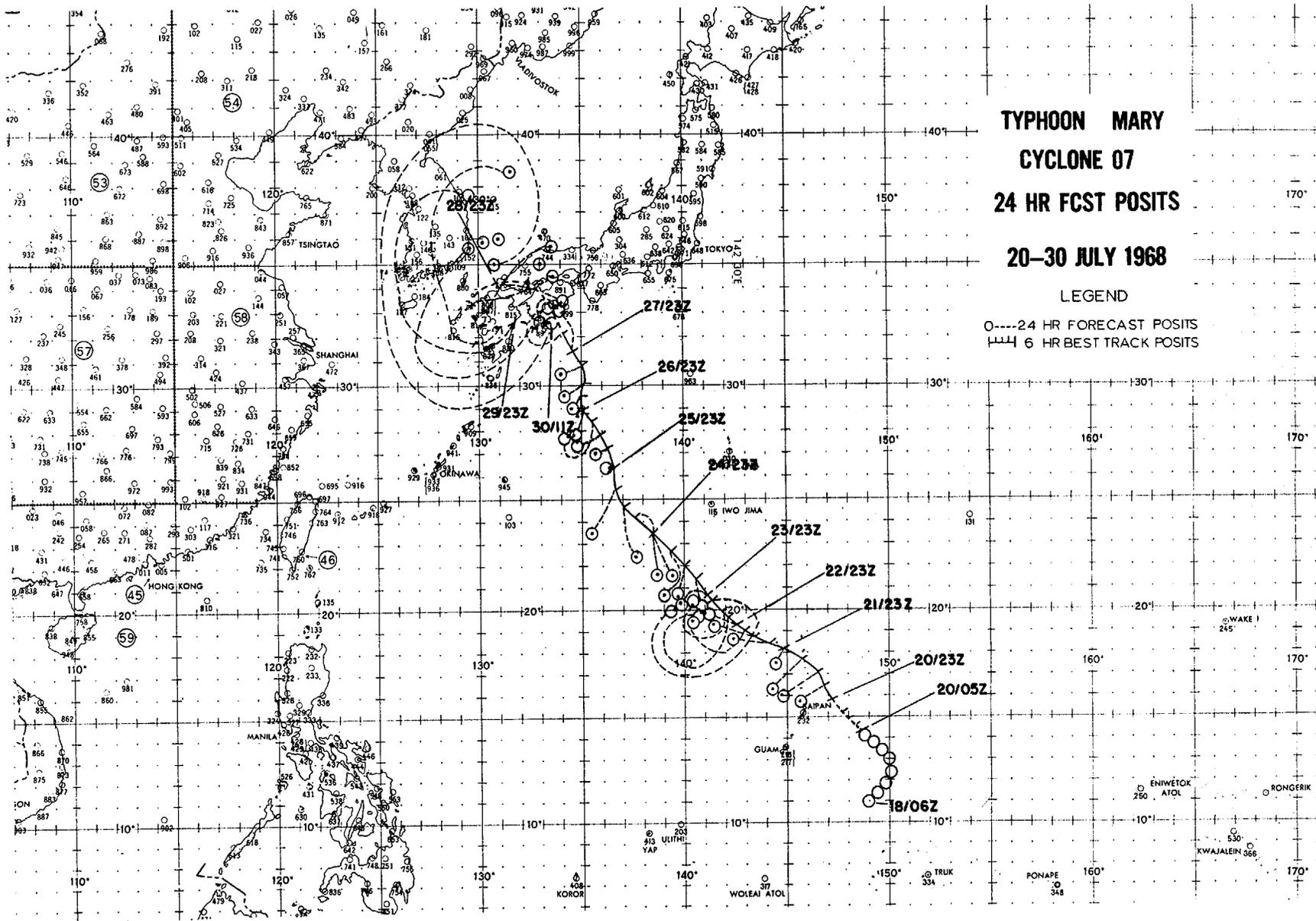
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	FLT LVL WND	FLT LVL WND								
25	240807Z	21.6N 140.4E	VW-R-01-05										12	--
26	241453Z	23.0N 139.0E	VW-P-10-05	700MB	080		950	2560	18/14	CIRC	----		12	--
27	242112Z	23.6N 138.7E	54-P-05-05	700MB	070	040	933	2563	18/12	CONC			70-20	--
28	250230Z	24.1N 138.1E	54-P-05-05	700MB	080	055	946	2624	16/12	CIRC	----		70	--
29	250602Z	25.0N 137.5E	SLTLS	STG X	DIA	07	BNDS 4							
30	250910Z	24.7N 137.2E	VW-P-05-05	0240M	080	065	951	2738	25/24	ELIP	NW-SE		60X45	N.F.B.
31	251200Z	24.8N 136.8E	VW-R-05-10							CIRC	----		70	F.B.
32	251515Z	24.9N 136.7E	VW-R-05-10							ELIP	NE-SW		60X50	F.B.
33	252110Z	25.8N 136.8E	54-P-04-10	700MB	065		951	2682	17/12	CIRC	----		30	--
34	252350Z	26.0N 136.6E	54-P-02-05	700MB	050	045	957	2704	16/11	CIRC	----		30	--
35	260210Z	26.5N 136.8E	54-P-03-10	700MB	055	040	958	2713	16/11	CIRC	----		30	--
36	260639Z	27.5N 136.5E	SLTLS	STG X	DIA	05	BNDS 3							
37	260910Z	27.0N 136.0E	VW-P-03-10	0460M		065	963		26/25	CIRC	----		10	--
38	261230Z	28.4N 136.8E	VW-P-30-15	700MB			972	2847	16/14	CIRC	----		20	--
39	261415Z	28.5N 135.9E	VW-P-30-20	700MB			966	2806	17/15	CIRC	----		30	--
40	262101Z	29.2N 135.0E	54-P-03-15	700MB	040	040	966	2810	14/14	CIRC	----		30	F.B.
41	270001Z	29.5N 134.9E	54-P-01-06	700MB	065		966	2816	15/13	CIRC	----		30	F.B.
42	270253Z	29.7N 134.7E	54-P-01-15	700MB	040	035	967	2835	15/13					F.B.
43	270716Z	30.0N 135.0E	SLTLS	STG X	DIA	04	BNDS 3							
44	270850Z	30.0N 135.0E	VW-P-05-10	0150M	035	035	971	2896	25/24					F.B.
45	271210Z	30.1N 135.0E	VW-P-05-10	700MB	045		964	2914	15/12					--
46	271410Z	30.4N 134.8E	VW-P-05-10	700MB				2911	16/15					--
47	271600Z	30.7N 134.7E	54-P-03-05	700MB	045	035	960	2811	16/12	CIRC	----		10	--

FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		07		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
49	280753Z	32.0N 134.5E	SLTLS		STG X	DIA 04	BND5 2							
50	280800Z	32.7N 133.9E	LND RDR			---	---	---	---	--/--	----			--
51	281000Z	33.2N 133.6E	LND RDR			---	---	---	---	--/--	----			--
52	281045Z	32.7N 134.1E	VW-P-10-10		700MB	030	---	---	2970	14/13	CIRC	----	25	--
53	281100Z	33.6N 133.2E	LND RDR			---	---	---	---	--/--	----			--
54	281800Z	35.2N 130.7E	LND RDR			---	---	---	---	--/--	----			--
55	290000Z	33.6N 129.8E	LND RDR			---	---	---	---	--/--	----			--
56	290636Z	33.0N 128.0E	SLTLS		STG X	DIA 03	BND5 1							

TROPICAL CYCLONE 07 -- 07/20/0500Z TO 07/30/1100Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HR. ERROR	48 HR. ERROR	72 HR. ERROR
	LAT.	LONG.	DEG. DIST.	DEG. DIST.	DEG. DIST.
202300Z	15.7N	147.2E	-----	-----	-----
210500Z	16.4N	146.8E	242-0072	-----	-----
211100Z	17.2N	146.2E	228-0102	-----	-----
211700Z	17.6N	145.5E	221-0108	-----	-----
212300Z	18.1N	144.8E	199-0036	-----	-----
220500Z	18.4N	144.1E	283-0102	-----	-----
221100Z	18.7N	143.5E	284-0114	-----	-----
221700Z	19.0N	143.0E	281-0150	-----	-----
222300Z	19.4N	142.6E	288-0090	263-0048	-----
230500Z	19.8N	142.3E	274-0078	275-0342	-----
231100Z	20.0N	142.0E	273-0090	273-0378	-----
231700Z	20.4N	141.4E	257-0102	275-0402	-----
232300Z	20.8N	141.1E	242-0072	270-0342	-----
240500Z	21.4N	140.6E	254-0288	261-0204	262-0594
241100Z	22.0N	140.0E	255-0294	248-0174	-----
241700Z	22.7N	139.3E	249-0312	234-0210	263-0636
242300Z	23.4N	138.4E	169-0096	198-0156	-----
250500Z	24.1N	137.6E	147-0174	240-0438	240-0312
251100Z	24.8N	137.0E	165-0144	241-0450	-----
251700Z	25.5N	136.8E	214-0138	239-0498	219-0354
252300Z	26.3N	136.5E	270-0006	177-0240	-----
260500Z	27.1N	136.1E	252-0018	177-0288	235-0708
261100Z	27.8N	135.7E	247-0042	190-0318	-----
261700Z	28.4N	135.4E	237-0060	213-0354	224-0822
262300Z	29.0N	135.1E	196-0066	262-0042	-----
270500Z	29.6N	135.0E	214-0042	244-0036	192-0444
271100Z	30.1N	135.1E	238-0054	260-0096	-----
271700Z	30.7N	135.1E	258-0054	244-0120	218-0594
272300Z	31.3N	134.7E	341-0108	223-0114	-----
280500Z	32.1N	134.2E	333-0066	236-0072	254-0060
AVERAGE 24 HOUR ERROR - 0106 MI.					
AVERAGE 48 HOUR ERROR - 0241 MI.					
AVERAGE 72 HOUR ERROR - 0502 MI.					

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TROPICAL CYCLONE 13 - 08/16/2300Z TO 08/21/1700Z
(SHIRLEY)

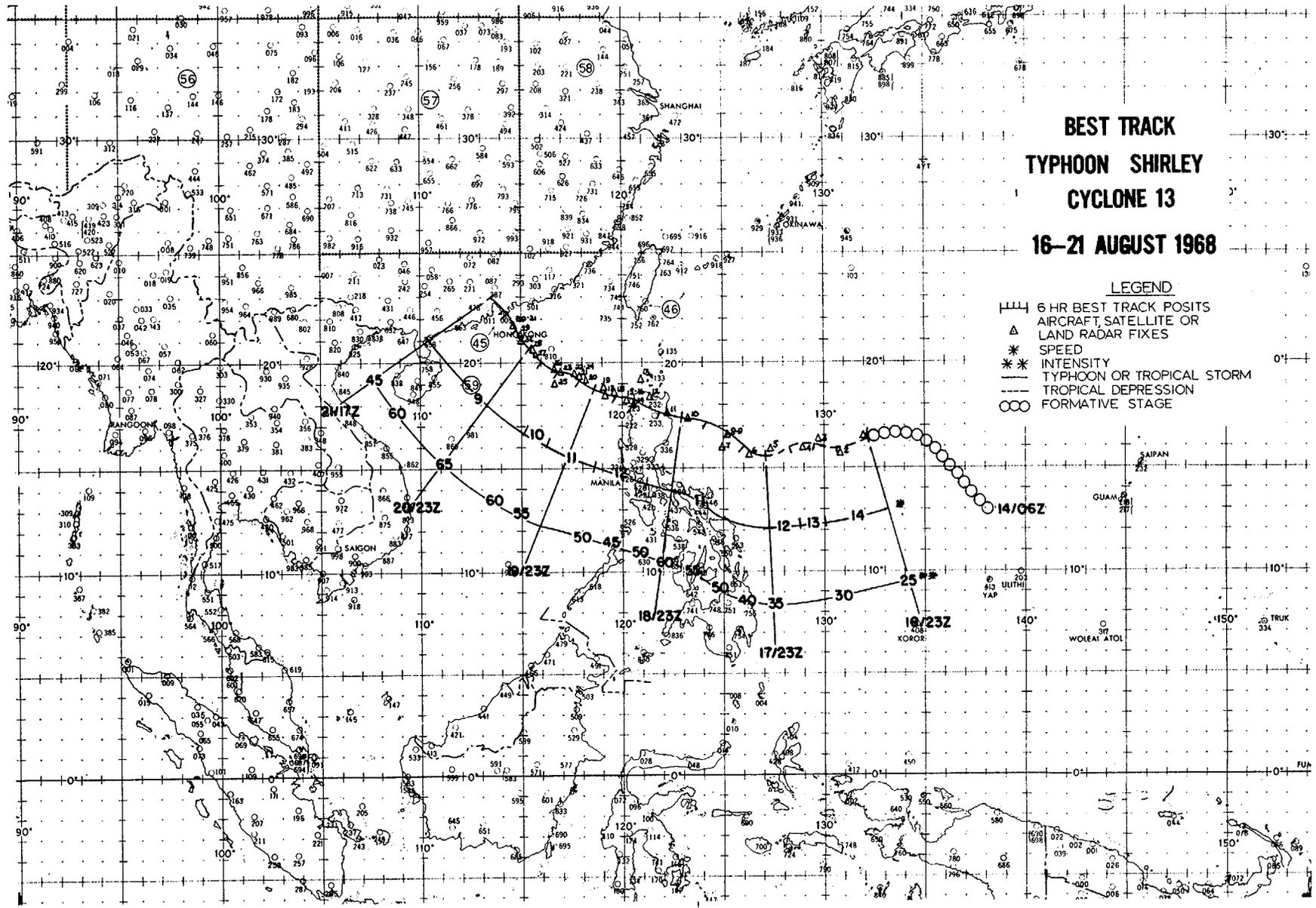
- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 20
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 02
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1218 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 962MBS AT 182130Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2790M. AT 210320Z
 - 3. MAXIMUM SURFACE WIND - 065 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 140600Z
 - 2. SURFACE PRESSURE LESS THAN 1006MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - EAST
 - 2. UPON REACHING TYPHOON INTENSITY - NORTHEAST
- III. FINAL DISPOSITION - DISSIPATED OVER LAND

BEST TRACK TYPHOON SHIRLEY CYCLONE 13

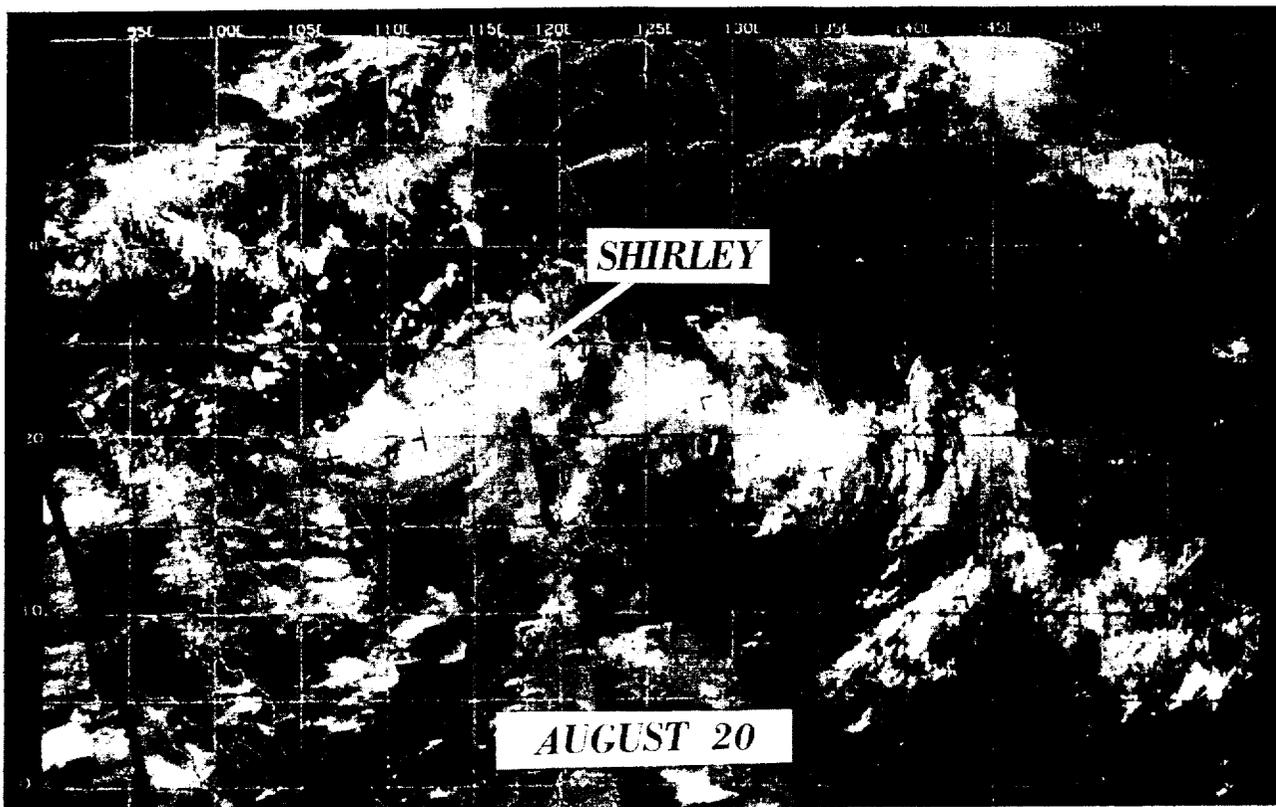
16-21 AUGUST 1968

LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- * * INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE



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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND								
1	162345Z	16.4N	132.0E	54-P-02-05	0390M	030	030	001	---	26/25	CIRC	----	30	--
2	170303Z	15.6N	130.9E	54-P-02-10	700MB	037	030	005	3103	11/10	CIRC	----	20	--
3	170900Z	16.4N	129.8E	VW-P-10-10	0250M	025	025	997	---	27/26	----			--
4	171400Z	16.0N	129.0E	VW-P-10-10	0250M	---	025	996	---	26/28	----			--
5	172103Z	15.9N	127.3E	54-P-05-03	700MB	050	---	991	2996	14/13	----			--
6	180209Z	15.7N	126.2E	54-P-05-03	700MB	050	040	987	2987	14/13	CIRC	----	10	--
7	180725Z	16.0N	125.0E	SLTLS	STG -	DIA 03	BNDS 2							
8	181010Z	16.6N	125.3E	VW-P-03-05	0300M	---	075	979	---	28/24	CIRC	----	25	--
9	181202Z	16.7N	125.2E	VW-P-04-05	0260M	---	---	978	---	28/25	CIRC	----	30	--
10	182130Z	17.3N	123.3E	54-P-03-15	700MB	050	---	962	2795	17/09	CIRC	----	50	--
11	190247Z	17.5N	122.3E	54-P-03-10	500MB	061	050	---	---	00/02	CIRC	----	40	--
12	190800Z	18.4N	121.3E	LND RDR		---	---	---	---	---/--	----			--
13	191000Z	19.1N	121.0E	LND RDR		---	---	---	---	---/--	----			--
14	191018Z	18.0N	120.5E	54-UN-----	700MB	---	---	---	---	---/--	----			--
15	191300Z	18.1N	120.2E	LND RDR		---	---	---	---	---/--	----			--
16	191310Z	18.4N	120.2E	LND RDR		---	---	---	---	---/--	----			--
17	191550Z	18.4N	119.2E	VW-R-10---	1800M	---	---	---	---	---/--	----			--
18	191556Z	18.6N	119.6E	VW-P-02-05	700MB	---	---	968	2809	13/00	CIRC	----	40	--
19	192012Z	18.7N	119.1E	VW-P-03-03	700MB	---	---	982	2880	12/08	CIRC	----	40	--
20	200300Z	19.1N	118.2E	54-P-06-02	700MB	---	045	980	2941	16/12	ELIP	N-S	70x30	--
21	200451Z	19.2N	117.9E	54-P-06-02	700MB	---	045	977	2917	18/--	CIRC	----	30	--
22	200649Z	19.3N	117.6E	54-P-04-05	700MB	---	065	976	2887	18/--	CIRC	----	30	--
23	200839Z	19.5N	117.0E	SLTLS	STG X	DIA 04	BNDS 3							
24	200850Z	19.5N	117.5E	54-P-03-10	700MB	078	060	966	2819	18/10	CIRC	----	50	--

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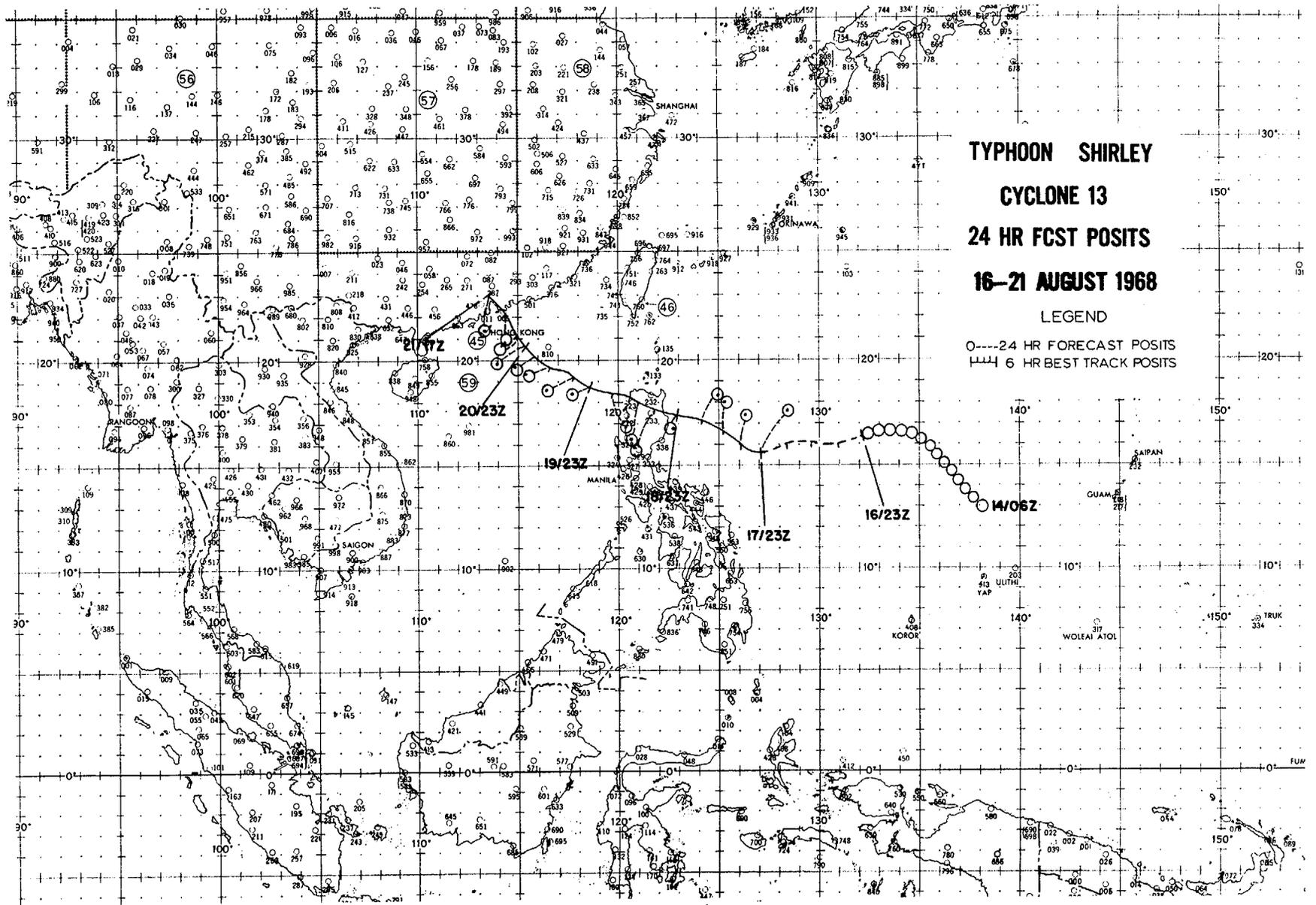
FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		13		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WNO	OBS SFC WNO	OBS MIN SLP							
25	201345Z	19.0N 116.0E	VW-R-10---	0380M	---	---	---	---	---	---/--	----			--
26	201427Z	19.8N 116.7E	VW-P-01-01	0380M	---	---	060	972	---	27/27	CIRC	----	22	--
27	202000Z	20.4N 115.8E	VW-R----05		---	---	---	---	---	---/--	----			--
28	202025Z	20.5N 115.7E	VW-P-01-01	700MB	---	---	968	2841	20/18	CIRC	----		35	--
29	210320Z	21.2N 115.0E	54-P-02-02	700MB	075	075	964	2790	18/14	CIRC	----		50	--
30	210558Z	21.6N 114.7E	54-P-05-02	700MB	055	070	963	2792	18/14	CIRC	----		50	--
31	210845Z	21.9N 114.8E	54-P-02-10	700MB	070	080	964	2801	18/14	CIRC	----		50	--
32	210916Z	21.0N 115.0E	SLTLS	STG -	DIA	05	BND5	2						

TROPICAL CYCLONE 13 -- 08/16/2300Z TO 08/21/1700Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
172300Z	15.7N	127.1E	029-0132	-----	-----
180500Z	15.9N	126.0E	008-0090	-----	-----
181100Z	16.7N	125.2E	000-0078	-----	-----
181700Z	17.1N	124.1E	037-0078	-----	-----
182300Z	17.3N	123.0E	192-0030	-----	-----
190500Z	17.7N	121.9E	207-0120	-----	-----
191100Z	18.2N	120.8E	180-0126	-----	-----
191700Z	18.4N	119.6E	158-0096	-----	-----
192300Z	18.8N	118.6E	235-0048	180-0084	-----
200500Z	19.3N	117.7E	240-0078	209-0186	-----
201100Z	19.6N	116.8E	253-0078	186-0186	-----
201700Z	20.1N	116.0E	254-0060	175-0210	-----
202300Z	20.7N	115.4E	239-0090	227-0120	-----
210500Z	21.5N	114.8E	210-0060	231-0168	219-0324
211100Z	22.2N	114.3E	180-0084	235-0198	-----
211700Z	23.0N	113.8E	197-0102	236-0216	193-0348

AVERAGE 24 HOUR ERROR - 0084 MI.
 AVERAGE 48 HOUR ERROR - 0171 MI.
 AVERAGE 72 HOUR ERROR - 0336 MI.

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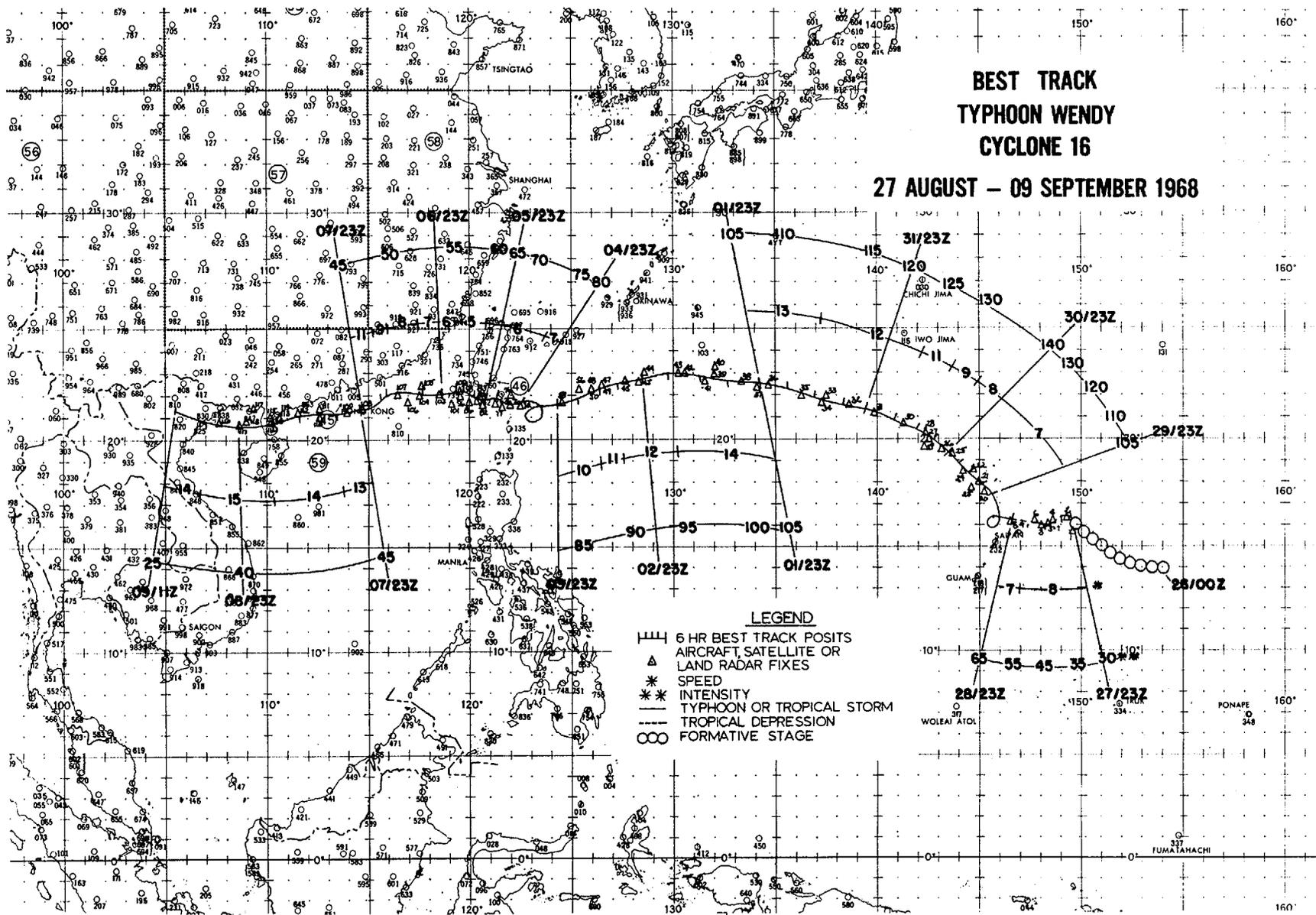
TROPICAL CYCLONE 16 - 08/27/2300Z TO 09/09/1100Z
(WENDY)

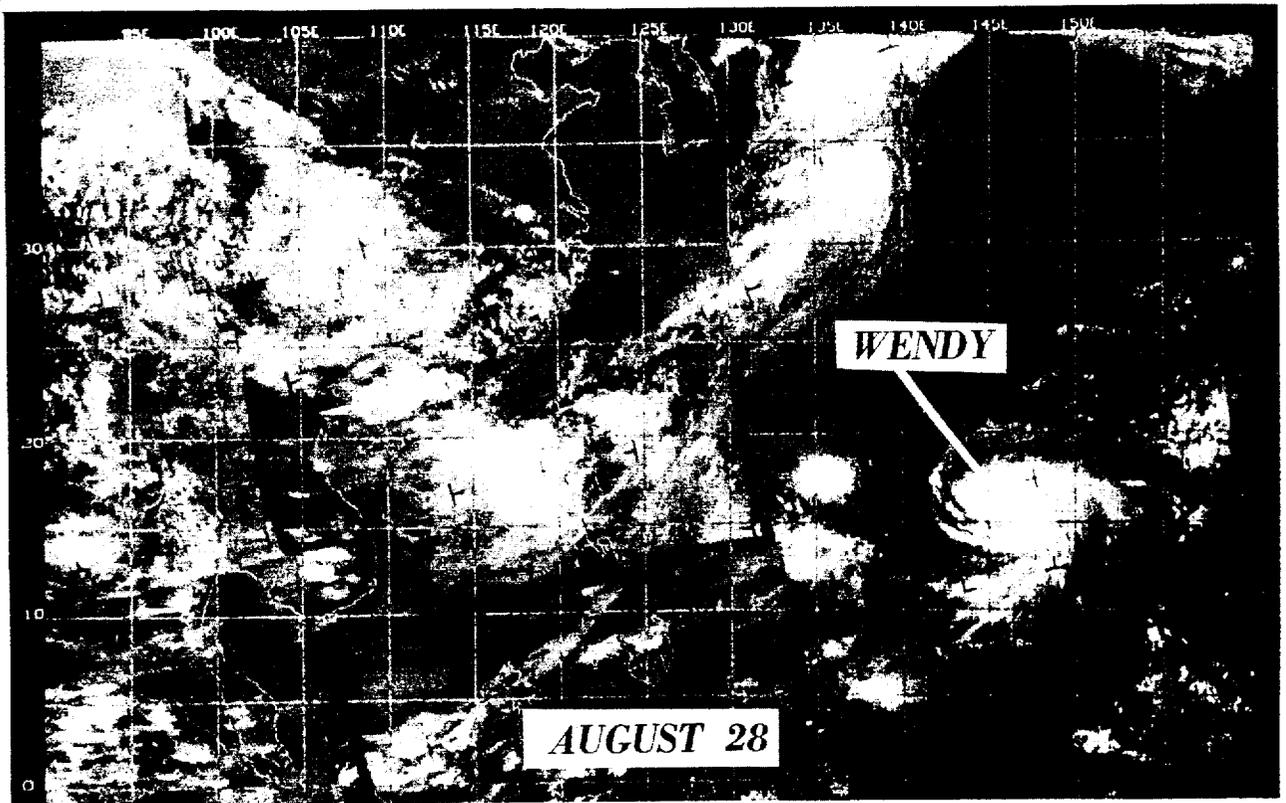
- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 51
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 40
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2820 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 917MBS AT 302100Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2356M. AT 302100Z
 3. MAXIMUM SURFACE WIND - 140 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 420 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 1. INDUCED VORTEX AT 260000Z
 2. SURFACE PRESSURE LESS THAN 1010MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - NORTH
 2. UPON REACHING TYPHOON INTENSITY - EAST
- III. FINAL DISPOSITION - DISSIPATED OVER LAND

BEST TRACK TYPHOON WENDY CYCLONE 16

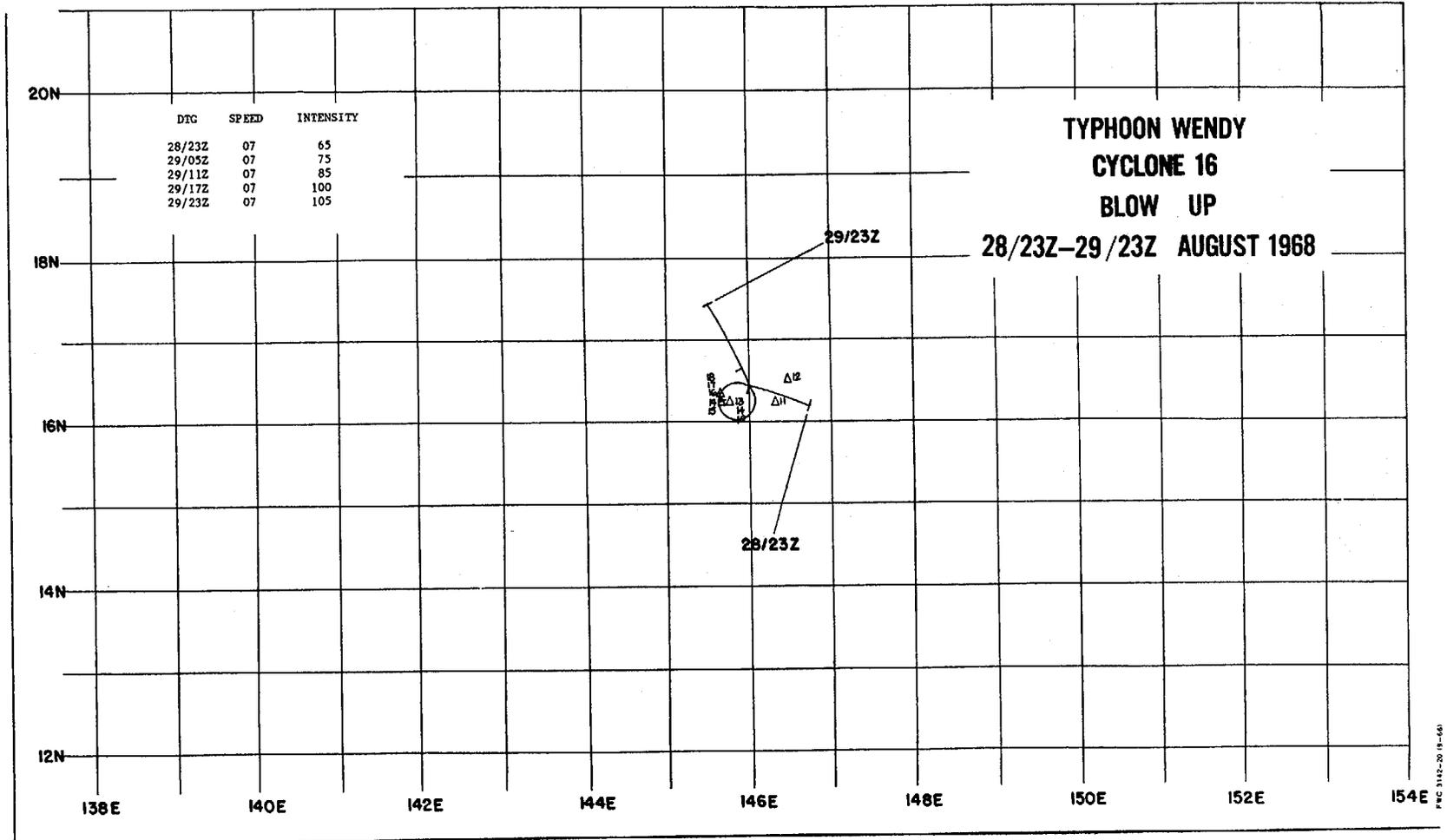
27 AUGUST - 09 SEPTEMBER 1968

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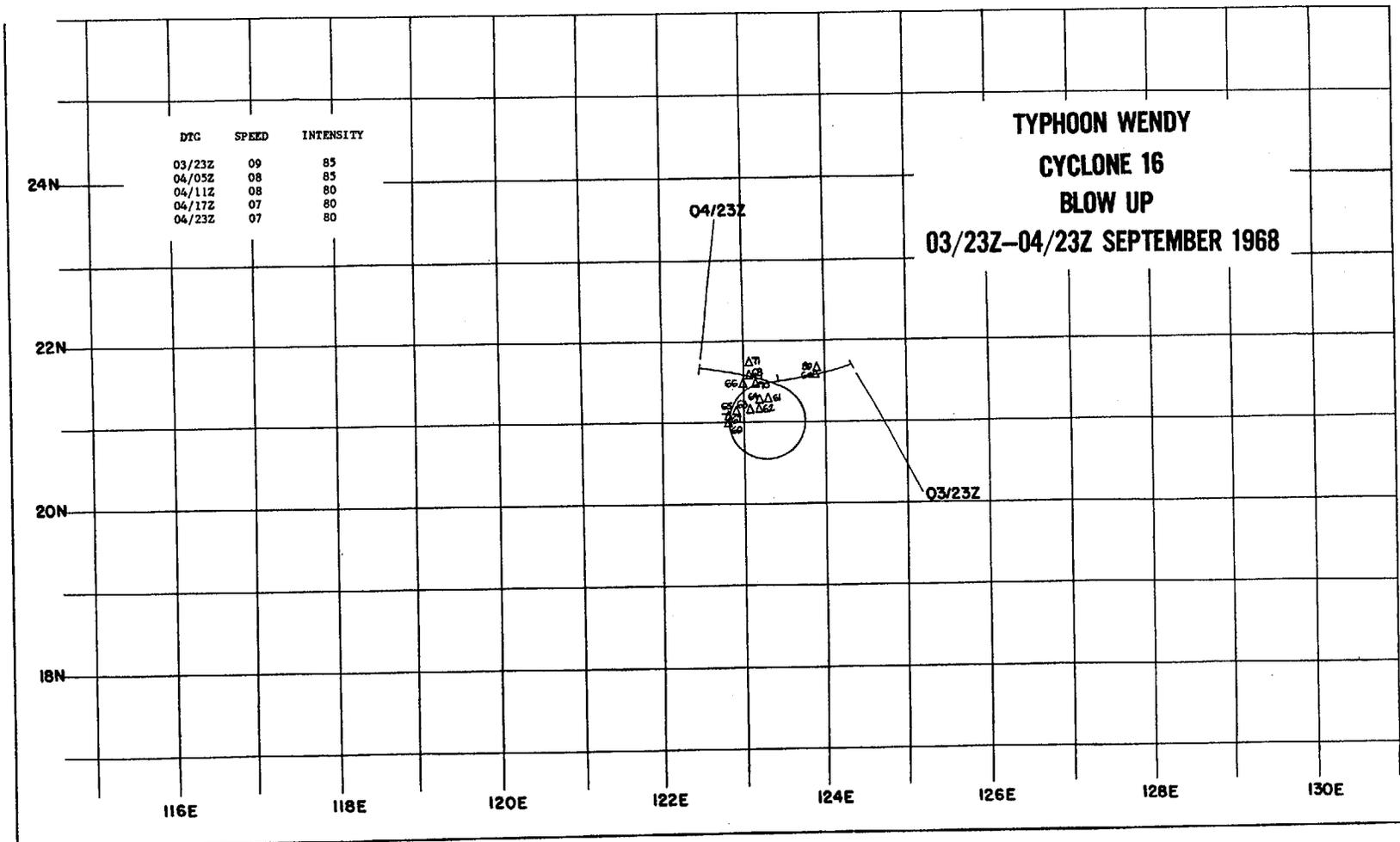




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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			16		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS	
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							WALL CLOUD	
1	272100Z	15.8N	149.8E	54-P-03-02	0460M	030	030	994	---	24/23	----					--
2	280248Z	16.3N	149.3E	54-P-04-02	700MB	045	065	993	3024	12/10	----					--
3	280558Z	16.0N	148.0E	SLTLS	STG X	DIA 02	BNDS 2									
4	280745Z	16.1N	148.5E	VW-R----	10	---	---	---	---	--/--	----					--
5	280822Z	16.0N	148.2E	VW-P-10-03	0450M	---	035	984	---	24/24	CIRC	----	10			--
6	281445Z	16.1N	147.7E	VW-P-01-03	700MB	---	---	978	2902	11/10	CIRC	----	15			--
7	282049Z	16.1N	146.8E	54-P-10-03	700MB	070	070	974	2819	16/06	CIRC	----	30			--
8	282145Z	16.1N	146.5E	LND RDR		---	---	---	---	--/--	----					--
9	282330Z	16.1N	146.5E	LND RDR		---	---	---	---	--/--	----					--
10	282330Z	16.1N	146.6E	LND RDR		---	---	---	---	--/--	----					--
11	290200Z	16.2N	146.3E	54-P-01-05	700MB	055	065	967	2801	15/10	CIRC	----	15			--
12	290635Z	16.5N	145.5E	SLTLS	STG X	DIA 04	BNDS 4									
13	290815Z	16.3N	145.8E	VW-R----	03	---	---	---	---	--/--	----					--
14	290858Z	16.3N	145.8E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	15			--
15	291015Z	16.3N	145.7E	LND RDR		---	---	---	---	--/--	----					--
16	291250Z	16.4N	145.7E	VW-R----	03	---	---	---	---	--/--	----					--
17	291305Z	16.4N	145.7E	VW-R-----		---	---	---	---	--/--	----					--
18	291410Z	16.4N	145.7E	VW-P-01-02	700MB	---	---	960	2732	17/12	CIRC	----	17			--
19	292100Z	17.3N	145.8E	54-P-02-01	700MB	---	080	926	2448	20/16	CIRC	----	10			--
20	300310Z	17.6N	145.2E	54-P-05-05	700MB	115	110	926	2453	20/12	CIRC	----	15			--
21	300712Z	18.0N	145.0E	SLTLS	STG -	DIA 05	BNDS 4									
22	300803Z	18.6N	144.7E	VW-R----	15	---	---	---	---	--/--	----					--
23	300840Z	17.8N	144.7E	VW-R-05-05		---	110	---	---	--/--	ELIP	N-S	20X15			06
24	301400Z	18.6N	144.2E	VW-R-03-01		---	---	---	---	--/--	CIRC	----	20			06

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE		16		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD	
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND							OBS MIN SLP
25	302100Z	19.2N	143.7E	54-P-03-02	700MB	085	130	917	2356	25/18	CIRC	----	20	--
26	310210Z	19.5N	143.1E	54-P-05-02	700MB	108	130	919	2384	25/15	CIRC	----	20	--
27	310555Z	20.0N	142.5E	SLTLS	STG X	DIA 04	BNDS 4							
28	310745Z	20.3N	142.3E	VW-R----05		---	---	---	---	---/--	----			--
29	310910Z	19.7N	142.3E	VW-P-01-04	700MB	---	080	927	2433	20/13	ELIP	NE-SW	23X12	--
30	311410Z	20.8N	141.2E	VW-P-05-03	700MB	---	---	934	2497	18/13	CIRC	----	12	--
31	312103Z	21.1N	139.9E	54-P-05-05	700MB	112	085	934	2539	18/12	CIRC	----	15	--
32	010300Z	21.4N	138.5E	54-P-03-05	700MB	100	110	939	2570	17/13	CIRC	----	30	--
33	010631Z	22.0N	137.5E	SLTLS	STG X	DIA 05	BNDS 4							
34	010925Z	21.7N	137.3E	VW-P-03-05	0450M	---	100	941	2601	27/24	CIRC	----	26	--
35	011410Z	22.0N	136.2E	VW-P-01-05	700MB	---	---	938	2595	20/14	CIRC	----	30	--
36	012101Z	22.4N	134.7E	54-P-03-05	700MB	105	080	939	2566	16/14	CIRC	----	30	--
37	012350Z	22.3N	134.1E	54-P-05-05	700MB	078	055	943	2588	17/14	CIRC	----	30	--
38	020234Z	22.7N	133.3E	54-P-05-05	700MB	090	080	935	2530	18/14	CIRC	----	30	--
39	020712Z	23.0N	132.0E	SLTLS	STG X	DIA 05	BNDS 4							
40	020825Z	23.1N	132.1E	VW-R----05		---	---	---	---	---/--	----			--
41	020920Z	22.8N	131.6E	VW-P-10-05	700MB	---	110	941	2571	20/--	CIRC	----	40	--
42	021205Z	23.0N	130.8E	VW-P-05-05	700MB	---	---	---	2571	20/12	ELIP	NE-SW	25X23	--
43	021403Z	23.0N	130.3E	VW-P-02-05	700MB	---	---	944	2610	18/12	CIRC	----	30	--
44	022059Z	23.0N	128.7E	54-P-05-05	700MB	070	---	945	2612	18/12	CIRC	----	40	--
45	030015Z	22.8N	128.2E	54-P-05-03	700MB	075	065	945	2621	18/12	CIRC	----	40	--
46	030200Z	22.7N	127.8E	54-P-05-05	700MB	095	060	944	2615	18/11	CIRC	----	40	15
47	030745Z	22.5N	126.5E	SLTLS	STG X	DIA 05	BNDS 4							
48	030830Z	22.3N	126.2E	LND RDR		---	---	---	---	---/--	----			--

FIX NO.	TIME	POSIT		EYE FIXES		CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
				UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND									
49	030840Z	22.4N	126.5E	VW-P-02-01	0450M	---	---	110	945	---	27/23	CIRC	----	65	10
50	030930Z	22.3N	126.3E	LND RDR		---	---	---	---	---	---/---	----			--
51	031030Z	22.2N	126.1E	LND RDR		---	---	---	---	---	---/---	----			--
52	031130Z	22.2N	126.0E	LND RDR		---	---	---	---	---	---/---	----			--
53	031210Z	22.1N	125.9E	VW-P-02-02	700MB	055	---	---	950	2630	18/11	CIRC	----	65	10
54	031230Z	22.2N	125.8E	LND RDR		---	---	---	---	---	---/---	----			--
55	031330Z	22.1N	125.7E	LND RDR		---	---	---	---	---	---/---	----			--
56	031430Z	22.1N	125.5E	LND RDR		---	---	---	---	---	---/---	----			--
57	031430Z	22.1N	125.4E	VW-P-02-05	700MB	---	---	---	951	2656	19/--	CIRC	----	65	10
58	032109Z	21.8N	124.4E	54-P-03-05	700MB	085	---	---	944	2624	18/14	CIRC	----	60	--
59	040000Z	21.7N	123.9E	LND RDR		---	---	---	---	---	---/---	----			--
60	040205Z	21.6N	123.9E	54-P-03-05	700MB	078	045	946	2658	18/13	CIRC	----	50	--	
61	040330Z	21.3N	123.3E	LND RDR		---	---	---	---	---	---/---	----			--
62	040430Z	21.2N	123.2E	LND RDR		---	---	---	---	---	---/---	----			--
63	040530Z	21.2N	123.1E	LND RDR		---	---	---	---	---	---/---	----			--
64	040630Z	21.3N	123.2E	LND RDR		---	---	---	---	---	---/---	----			--
65	040740Z	21.2N	122.9E	LND RDR		---	---	---	---	---	---/---	----			--
66	040822Z	21.5N	123.0E	SLTLS	STG X	DIA	05	BNDS	3						
67	040830Z	21.1N	122.8E	LND RDR		---	---	---	---	---	---/---	----			--
68	040903Z	21.6N	123.1E	VW-P-05-05	0450M	---	---	---	110	950	---	26/23	ELIP	NW-SE	60X28
69	040930Z	21.0N	122.8E	LND RDR		---	---	---	---	---	---/---	----			--
70	041145Z	21.5N	123.2E	VW-P-02-05	700MB	---	---	---	---	2702	18/--	ELIP	NW-SE	70X25	--
71	041412Z	21.7N	123.1E	VW-R-02-05	700MB	---	---	---	---	2738	19/--	CIRC	----	50	--
72	041930Z	21.5N	122.5E	LND RDR		---	---	---	---	---	---/---	----			--

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			16		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENT- TATION	EYE DIA	TKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLY LVL	OBS SFC WND	OBS MIN SLP						
73	042130Z	21.4N	121.7E	54-P-04-05	500MB	065	---	972	---	00/52	CIRC	----	40	--
74	050030Z	21.5N	121.7E	LND RDR		---	---	---	---	--/--	----			--
75	050130Z	21.5N	121.8E	LND RDR		---	---	---	---	--/--	----			--
76	050205Z	21.6N	122.0E	54-P-01-01	500MB	070	045	966	2804	03/00	CIRC	----	40	--
77	050530Z	21.4N	121.4E	LND RDR		---	---	---	---	--/--	----			--
78	050600Z	21.6N	121.3E	LND RDR		---	---	---	---	--/--	----			--
79	050859Z	22.0N	122.0E	SLTLS	STG X	DIA 04	BNDS 3							
80	050905Z	21.7N	121.6E	VW-R-02-10		---	---	---	---	--/--	CIRC	----	50	--
81	051000Z	21.8N	121.7E	LND RDR		---	---	---	---	--/--	----			--
82	051130Z	21.8N	121.7E	LND RDR		---	---	---	---	--/--	----			--
83	051210Z	21.9N	121.4E	VW-P-02-02	700MB	---	---	970	2854	17/13	CIRC	----	50	--
84	051400Z	22.0N	121.5E	VW-P-02-02	700MB	---	---	---	2860	19/13	CIRC	----	50	--
85	051800Z	21.8N	121.0E	LND RDR		---	---	---	---	--/--	----			--
86	052115Z	21.7N	120.7E	54-P-02-10	500MB	042	---	941	2788	04/00	----			--
87	052350Z	21.7N	120.6E	LND RDR		---	---	---	---	--/--	----			--
88	060222Z	21.8N	120.4E	54-P-02-03	500MB	060	060	972	2870	06/00	ELIP	NW-SE	12X07	--
89	060400Z	21.8N	120.2E	LND RDR		---	---	---	---	--/--	----			--
90	060653Z	22.0N	120.0E	SLTLS	STG X	DIA 03	BNDS 2							
91	060700Z	21.9N	120.2E	LND RDR		---	---	---	---	--/--	----			--
92	060800Z	21.8N	120.0E	LND RDR		---	---	---	---	--/--	----			--
93	060900Z	22.0N	120.0E	LND RDR		---	---	---	---	--/--	----			--
94	060928Z	22.0N	120.2E	VW-R-05-10		---	---	---	---	--/--	CIRC	----	30	--
95	060950Z	21.9N	120.1E	VW-P-----		---	085	980	---	--/--	----			--
96	061100Z	22.0N	119.7E	LND RDR		---	---	---	---	--/--	----			--

FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	16								
97	061200Z	22.0N 120.0E	LND RDR							--/--				--
98	061215Z	22.1N 119.8E	VW-R-05-15							--/--	CIRC		30	--
99	061400Z	22.0N 120.0E	LND RDR							--/--				--
100	061400Z	22.1N 119.6E	VW-R----10							--/--	CIRC		30	--
101	061800Z	21.6N 119.1E	LND RDR							--/--				--
102	062130Z	21.9N 119.9E	54-P-01-15	500MB	055		950	2260	01/53		CIRC		30	10
103	070255Z	22.0N 118.5E	54-P-01-03	500MB	065	075	958		01/52		CIRC		30	--
104	070557Z	22.0N 117.5E	SLTLS	STG C	DIA	--	BNDS -							
105	070928Z	22.3N 117.7E	VW-R-10-10							--/--	CIRC		30	--
106	071200Z	21.8N 117.0E	VW-R-05-05							--/--	CIRC		30	10
107	071408Z	22.0N 116.5E	VW-R-05-05							--/--	CIRC		30	--
108	072130Z	21.3N 114.9E	54-P-03-05	700MB	055		983	2929	15/12		CIRC		15	10
109	080240Z	21.1N 114.0E	54-R-03-10		055	025				--/--	CIRC		15	--
110	080652Z	21.0N 112.5E	SLTLS	STG X	DIA	02	BNDS 2							
111	080905Z	21.3N 112.5E	VW-R-02-05	0490M	010					--/--	CIRC		20	--
112	081205Z	21.1N 111.5E	VW-R-05-05	0450M						--/--	CIRC		14	--
113	081425Z	21.0N 110.6E	VW-R-05-05	0450M						--/--	CIRC		15	--
114	081500Z	21.0N 110.6E	VW-R----10							--/--				--
115	081630Z	21.0N 110.2E	VW-R-----							--/--				--
116	081710Z	20.9N 110.2E	VW-R-----							--/--				--
117	081912Z	21.3N 109.3E	SHIP RDR							--/--				--
118	082100Z	20.9N 109.0E	VW-R----10							--/--	CIRC		25	--
119	082300Z	20.8N 108.6E	VW-R----10							--/--	CIRC		18	--
120	090100Z	20.9N 107.8E	SHIP RDR							--/--				--

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TROPICAL CYCLONE 16 -- 08/27/2300Z TO 09/09/1100Z
 POSITION AND FORECAST VERIFICATION DATA

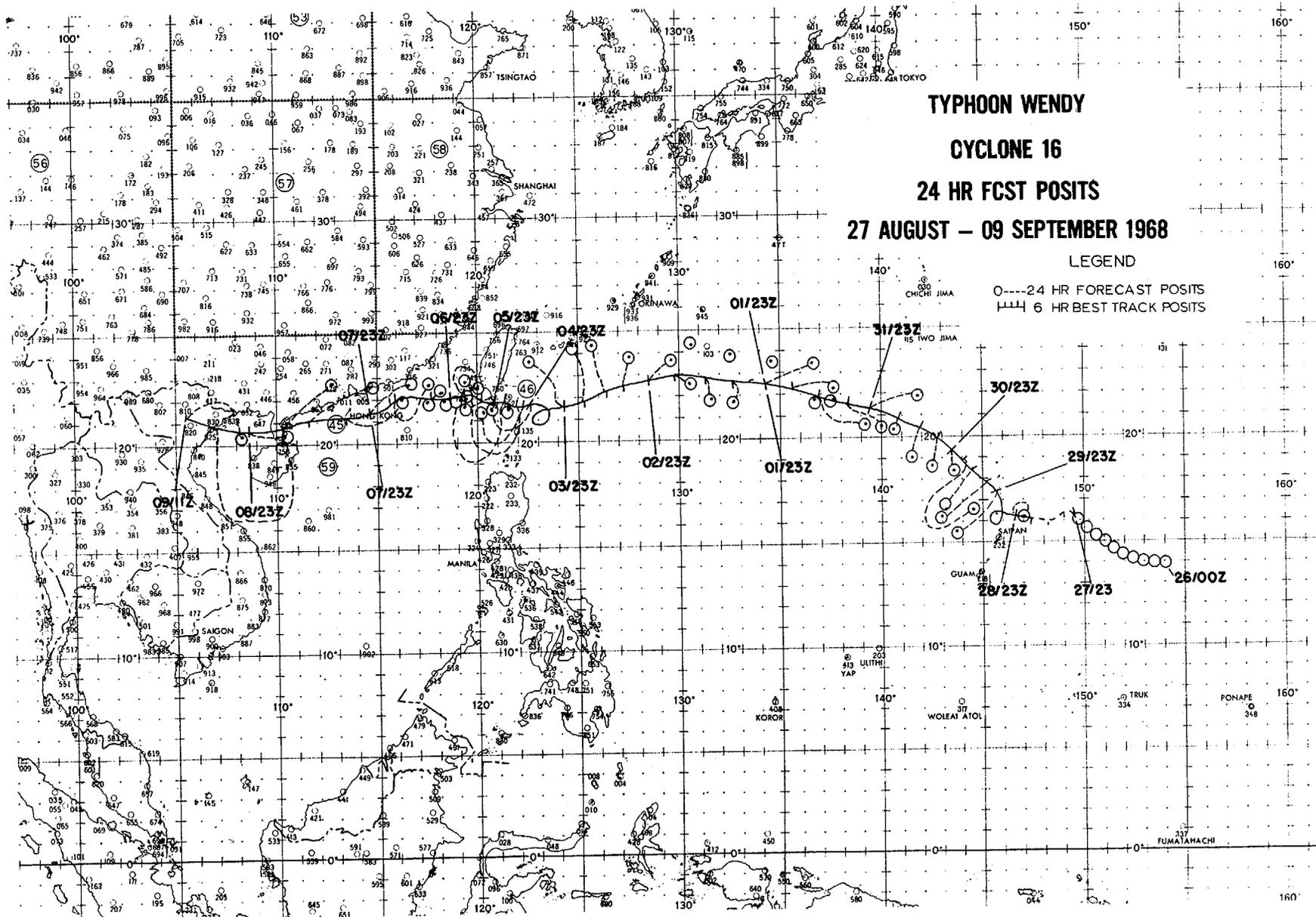
DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
280500Z	16.3N	149.0E	-----	-----	-----
281100Z	16.0N	148.2E	-----	-----	-----
281700Z	16.1N	147.4E	-----	-----	-----
282300Z	16.2N	146.7E	116-0012	-----	-----
290500Z	16.4N	146.0E	050-0054	-----	-----
291100Z	16.3N	145.6E	197-0060	-----	-----
291700Z	16.7N	145.9E	221-0108	-----	-----
292300Z	17.4N	145.5E	218-0156	232-0162	-----
300500Z	17.9N	145.0E	227-0156	222-0132	-----
301100Z	18.4N	144.5E	216-0132	220-0264	-----
301700Z	18.9N	144.0E	168-0150	218-0276	-----
302300Z	19.4N	143.5E	170-0072	216-0288	-----
310500Z	20.0N	142.8E	185-0078	228-0258	229-0318
311100Z	20.5N	141.9E	188-0090	218-0204	-----
311700Z	20.9N	140.7E	180-0042	169-0234	217-0348
312300Z	21.2N	139.4E	074-0144	136-0126	-----
010500Z	21.5N	138.2E	122-0108	134-0114	217-0198
011100Z	21.9N	136.9E	123-0150	122-0096	-----
011700Z	22.2N	135.5E	092-0126	097-0096	142-0282
012300Z	22.5N	134.2E	071-0144	070-0336	-----
020500Z	22.8N	132.7E	174-0060	096-0276	093-0222
021100Z	22.9N	131.2E	163-0060	097-0312	-----
021700Z	23.0N	129.7E	129-0042	080-0336	066-0342
022300Z	22.8N	128.4E	062-0072	066-0372	-----
030500Z	22.6N	127.2E	009-0078	104-0090	077-0486
031100Z	22.3N	126.2E	348-0114	086-0084	-----
031700Z	21.9N	125.2E	353-0150	043-0102	064-0558
032300Z	21.7N	124.3E	323-0150	035-0180	-----
040500Z	21.5N	123.4E	067-0090	008-0186	052-0144
041100Z	21.1N	122.8E	360-0066	341-0222	-----
041700Z	21.5N	123.2E	285-0084	322-0234	007-0156
042300Z	21.7N	122.4E	259-0090	315-0288	-----
050500Z	21.6N	121.8E	255-0084	344-0084	331-0198
051100Z	21.9N	121.4E	273-0102	316-0126	-----

TROPICAL CYCLONE 16 -- 08/27/2300Z TO 09/09/1100Z
 POSITION AND FORECAST VERIFICATION DATA (CONT)

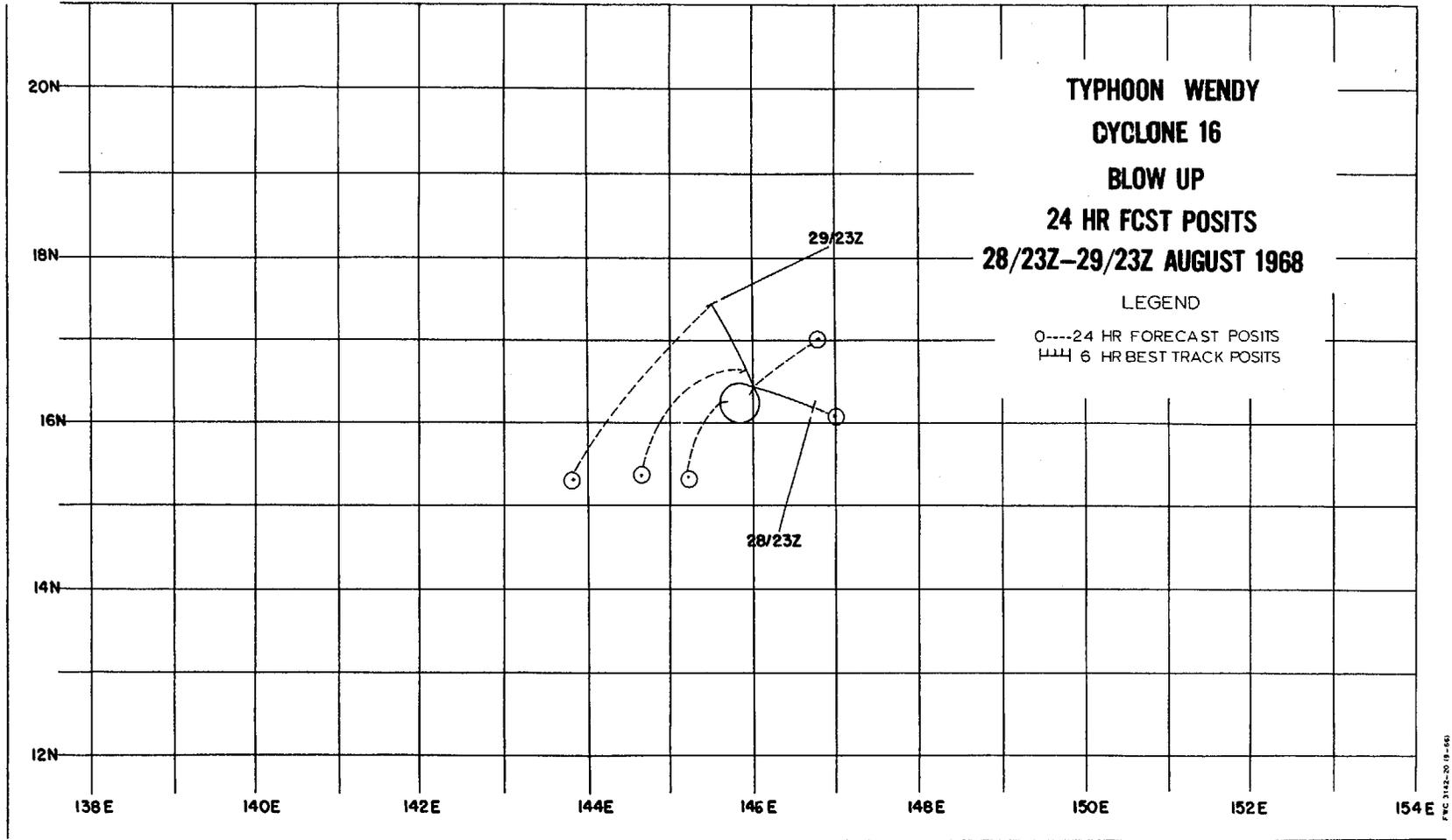
DTG	STORM POSITION		24 HR. ERROR	48 HR. ERROR	72 HR. ERROR
	LAT.	LONG.	DEG. DIST.	DEG. DIST.	DEG. DIST.
051700Z	21.8N	121.3E	276-010R	282-0156	300-0270
052300Z	21.7N	120.7E	266-0072	283-0174	-----
060500Z	21.9N	120.2E	108-0072	283-0150	316-0174
061100Z	22.1N	119.7E	344-0042	300-0234	-----
061700Z	22.1N	119.2E	075-0042	287-0174	285-0222
062300Z	22.0N	118.5E	090-0018	260-0066	-----
070500Z	22.0N	117.8E	076-0024	104-0096	319-0204
071100Z	22.0N	116.9E	050-0054	015-0096	-----
071700Z	21.7N	115.8E	038-0066	062-0132	-----
072300Z	21.2N	114.6E	076-0162	041-0114	-----
080500Z	21.2N	113.3E	074-0168	052-0150	083-0234
081100Z	21.2N	111.7E	066-0180	058-0198	-----
081700Z	20.9N	110.2E	053-0186	056-0222	067-0354
082300Z	20.8N	108.6E	108-0090	080-0408	-----
090500Z	20.9N	107.0E	106-0186	081-0390	066-0372

AVERAGE 24 HOUR ERROR - 0097 MI.
 AVERAGE 48 HOUR ERROR - 0196 MI.
 AVERAGE 72 HOUR ERROR - 0282 MI.

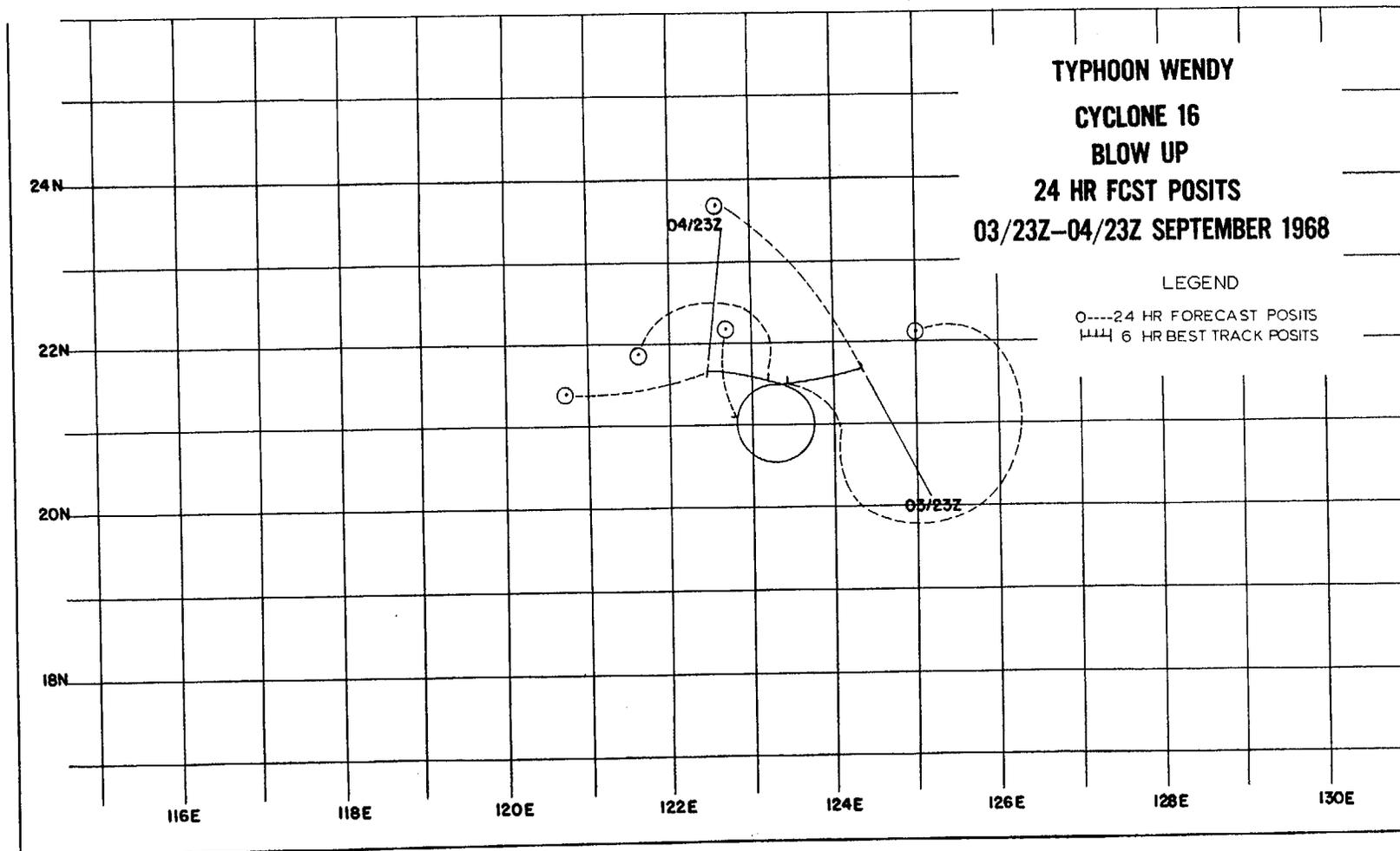
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TROPICAL CYCLONE 17 - 08/28/0500Z TO 09/09/1100Z
(AGNES)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 50
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 35
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 3258 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 904MBS AT 032050Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2240M. AT 032050Z
 3. MAXIMUM SURFACE WIND - 150 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 540 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 1. INDUCED VORTEX AT 261800Z
 2. SURFACE PRESSURE LESS THAN 1010MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - VARIABLE
 2. UPON REACHING TYPHOON INTENSITY - NORTHEAST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

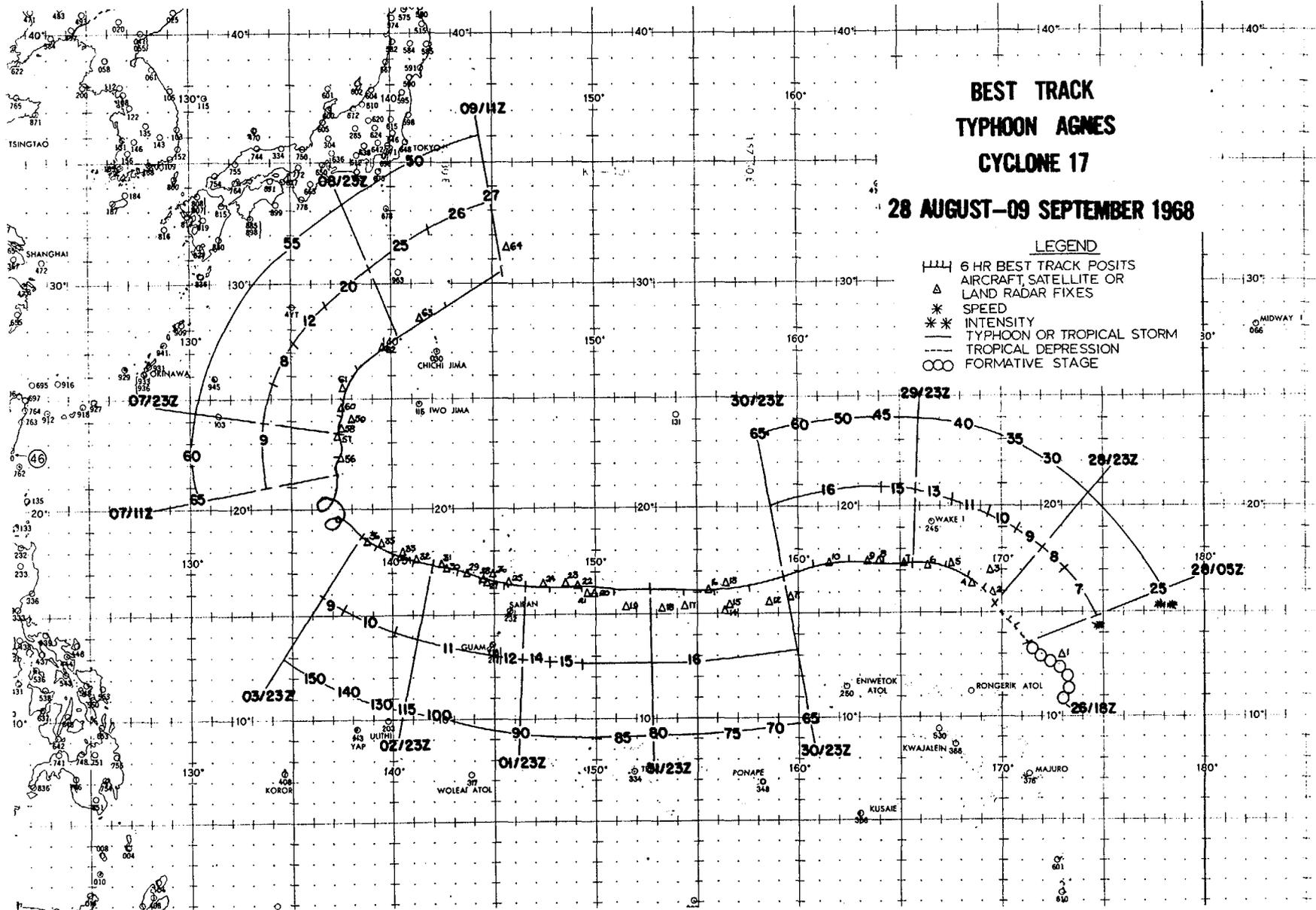
BEST TRACK TYPHOON AGNES CYCLONE 17

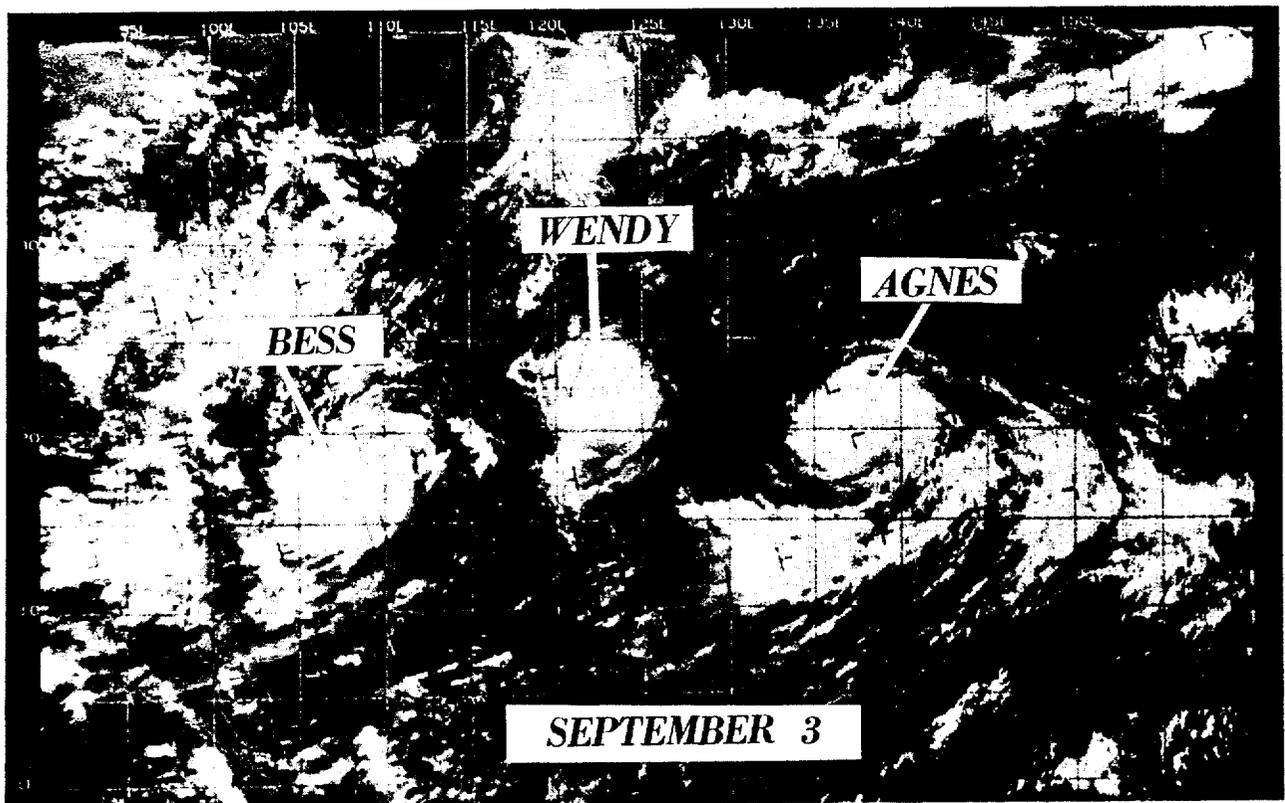
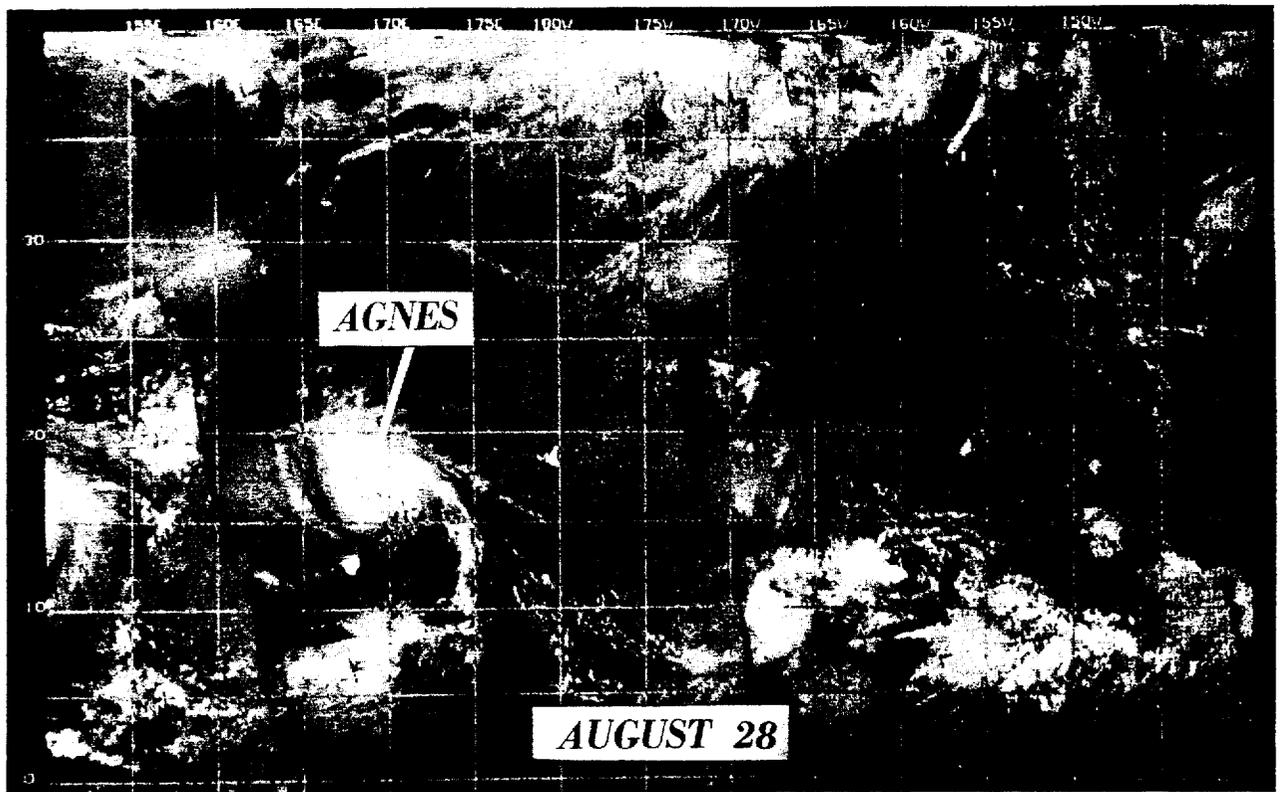
28 AUGUST-09 SEPTEMBER 1968

LEGEND

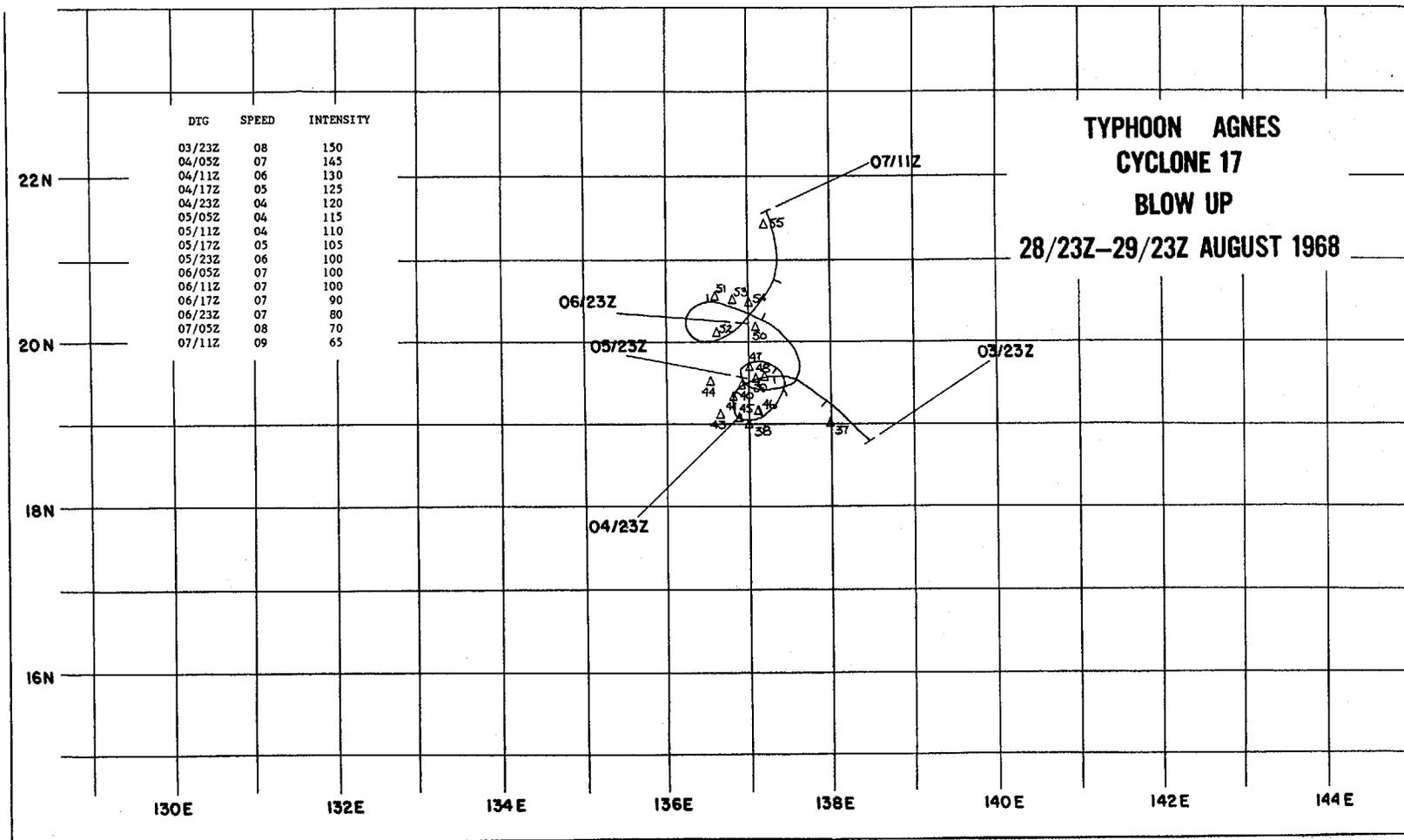
- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE

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FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	FLT LVL WND	17 OBS SFC WND								
1	280405Z	13.0N 173.0E	SLTLS	STG C	DIA	--	BNDS -							
2	290314Z	16.0N 169.6E	54-P-04-05	0440M	022	025	998	---	24/24	----				--
3	290442Z	17.0N 169.5E	SLTLS	STG X	DIA	02	BNDS 3							
4	290900Z	16.4N 168.5E	VW-P-03-02	0320M	025	---	999	---	24/23	CIRC	----	40		--
5	291415Z	17.3N 167.7E	VW-R-03-01		---	---	---	---	--/--	----				--
6	292037Z	17.1N 166.3E	54-P-03-05	0420M	060	075	995	---	26/24	----				--
7	300237Z	17.3N 165.1E	54-P-01-05	700MB	070	065	988	2981	12/10	ELIP	NW-SE	40X20		--
8	300518Z	17.5N 164.0E	SLTLS	STG X	DIA	02	BNDS 3							
9	300830Z	17.4N 163.4E	VW-P-12-05	700MB	050	040	992	2982	12/--	CIRC	----	25		--
10	301430Z	17.3N 161.6E	VW-P-10-05	700MB	---	---	987	2965	17/12	CIRC	----	25		--
11	302100Z	16.9N 159.8E	54-P-05-10	700MB	080	100	970	2856	16/09	CIRC	----	25		--
12	310200Z	16.7N 158.6E	54-P-10-05	700MB	075	100	967	2813	20/11	CIRC	----	25		--
13	310555Z	16.5N 156.5E	SLTLS	STG X	DIA	04	BNDS 3							
14	310800Z	16.1N 156.4E	VW-R-15---		---	---	---	---	--/--	----				--
15	310900Z	16.2N 156.6E	VW-R-03-10	0400M	055	065	---	---	--/--	CIRC	----	30		--
16	311200Z	16.1N 155.6E	VW-R-03-05		---	---	---	---	--/--	ELIP	NW-SE	40X35		--
17	311430Z	16.3N 154.4E	VW-R-05-10		---	---	---	---	--/--	ELIP	NW-SE	40X30	08	
18	312044Z	16.1N 153.2E	54-P-05-05	700MB	165	120	949	2670	26/12	ELIP	NW-SE	40X30	10	
19	010220Z	16.2N 151.5E	54-P-05-05	700MB	110	120	963	2798	24/14	ELIP	NW-SE	35X25		--
20	010631Z	16.0N 150.0E	SLTLS	STG X	DIA	05	BNDS 3							
21	010910Z	16.0N 149.7E	VW-P-05-03	700MB	100	---	963	2770	22/19	ELIP	NW-SE	35X25	15	
22	011140Z	16.3N 149.1E	VW-R-03-03		---	---	---	---	--/--	----				--
23	011430Z	16.5N 148.6E	VW-R-03-05		---	---	---	---	--/--	ELIP	NW-SE	45X35	12	
24	012100Z	16.3N 147.3E	54-P-07-05	700MB	110	070	965	2804	20/17	CIRC	----	35		--

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE		OBS 17		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD	
				UNIT- METHOD -ACCY	FLT LVL	FLY LVL WNO	SFC WND							OBS MIN SLP
25	020300Z	16.6N	145.8E	54-P-10-05	700MB	103	080	963	2780	18/15	CIRC	----	30	--
26	020708Z	17.0N	145.0E	SLTLS	STG X	DIA	03	BNDS 3						
27	020750Z	16.6N	144.8E	VW-R-05-15		---	---	---	---	---/--	----			--
28	020900Z	16.8N	144.5E	VW-R-05-05	0310M	045	050	---	---	---/--	ELIP	NW-SE	43X35	--
29	021405Z	17.0N	143.8E	VW-R-05-10	2970M	060	---	---	---	---/--	ELIP	NW-SE	40X30	--
30	022000Z	17.2N	142.8E	54-R-05-05		---	---	---	---	---/--	----			--
31	022100Z	17.3N	142.4E	54-P-02-03	7000M	095	050	956	2728	17/10	CIRC	----	45	--
32	030247Z	17.8N	141.1E	54-P-02-03	7000M	120	110	950	2664	18/13	CONC		60-25	05
33	030745Z	18.0N	140.5E	SLTLS	STG X	DIA	03	BNDS 2						
34	030850Z	17.9N	140.4E	VW-P-03-03	700MB	120	---	940	2768	22/11	CIRC	----	22	12
35	031405Z	18.4N	139.4E	VW-P-03-03	700MB	---	---	918	2357	22/12	CIRC	----	21	06
36	032050Z	18.5N	138.9E	54-P-05-05	700MB	080	---	904	2240	26/16	CIRC	----	10	05
37	040315Z	19.0N	138.0E	54-P-05-05	700MB	170	120	906	2265	24/16	CIRC	----	15	05
38	040628Z	19.0N	137.0E	SLTLS	STG X	DIA	05	BNDS 3						
39	040900Z	19.5N	137.1E	VW-R-01-05		---	075	---	---	---/--	CONC		78-24	10
40	041200Z	19.4N	136.9E	VW-R-02-05	1330M	080	055	---	---	---/--	CONC		65-23	--
41	041430Z	19.3N	136.8E	VW-R-05-05		---	060	---	---	---/--	CONC		65-20	08
42	042053Z	19.3N	136.6E	54-P-03-05	700MB	082	---	925	2417	16/13	CIRC	----	20	05
43	050300Z	19.1N	136.6E	54-P-03-05	700MB	070	070	934	2515	16/12	CONC		45-20	--
44	050705Z	19.5N	136.5E	SLTLS	STG X	DIA	04	BNDS 3						
45	050925Z	19.1N	136.9E	VW-R-02-05	0450M	---	---	---	---	---/--	ELIP	N-S	25X15	--
46	051400Z	19.2N	137.1E	VW-P-04-02	700MB	060	---	935	2541	17/14	CIRC	----	19	F.B.
47	052040Z	19.7N	137.0E	54-P-07-05	700MB	065	---	940	2554	16/10	CIRC	----	20	--
48	060300Z	19.5N	137.2E	54-P-05-05	700MB	060	060	943	2582	15/11	CIRC	----	15	--

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FIX NO.	TIME	POSIT	EYE FIXES CYCLONE				OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	17 OBS SFC WND								
49	060458Z	19.5N 137.0E	SLTLS	STG X	DIA 04	BNDS 3								
50	060925Z	20.2N 137.1E	VW-R-02-10	0530M	---	---	---	---	--/--	CIRC	----	20	10	
51	061420Z	20.5N 136.6E	VW-P-02-05	700MB	040	---	960	2716	13/11	----			--	
52	062115Z	20.1N 136.6E	54-P-05-05	700MB	045	---	958	2704	14/12	CIRC	----	06	--	
53	070320Z	20.6N 136.8E	54-P-03-03	700MB	065	060	964	2758	12/11	CIRC	----	15	--	
54	070557Z	20.5N 137.0E	SLTLS	STG X	DIA 04	BNDS 2								
55	070928Z	21.4N 137.2E	VW-P-05-05	0460M	---	035	969	2848	24/24	CIRC	----	15	02	
56	071400Z	22.2N 137.5E	VW-P-02-05	700MB	---	---	973	2866	15/14	CIRC	----	15	15	
57	072110Z	23.2N 137.2E	54-P-05-10	700MB	017	030	---	2783	13/12	----			F.B.	
58	080245Z	23.8N 137.5E	54-P-03-10	700MB	060	060	---	2862	12/10	----			--	
59	080456Z	24.0N 138.0E	SLTLS	STG C	DIA --	BNDS -								
60	080920Z	24.7N 137.5E	VW-P-02-05	0400M	065	060	979	2923	24/20	----			--	
61	081415Z	25.4N 137.5E	VW-P-02-06	700MB	050	---	980	2934	13/10	----			--	
62	082100Z	27.1N 139.6E	54-P-05-05	700MB	045	045	976	2896	14/12	----			F.B.	
63	090230Z	28.5N 141.4E	54-P-05-10	700MB	085	095	975	2871	15/14	----			F.B.	
64	091148Z	31.6N 145.8E	VW-P-02-20	700MB	---	---	984	2938	13/13	----			F.B.	

TROPICAL CYCLONE 17 -- 08/28/0500Z TO 09/09/1100Z
 POSITION AND FORECAST VERIFICATION DATA

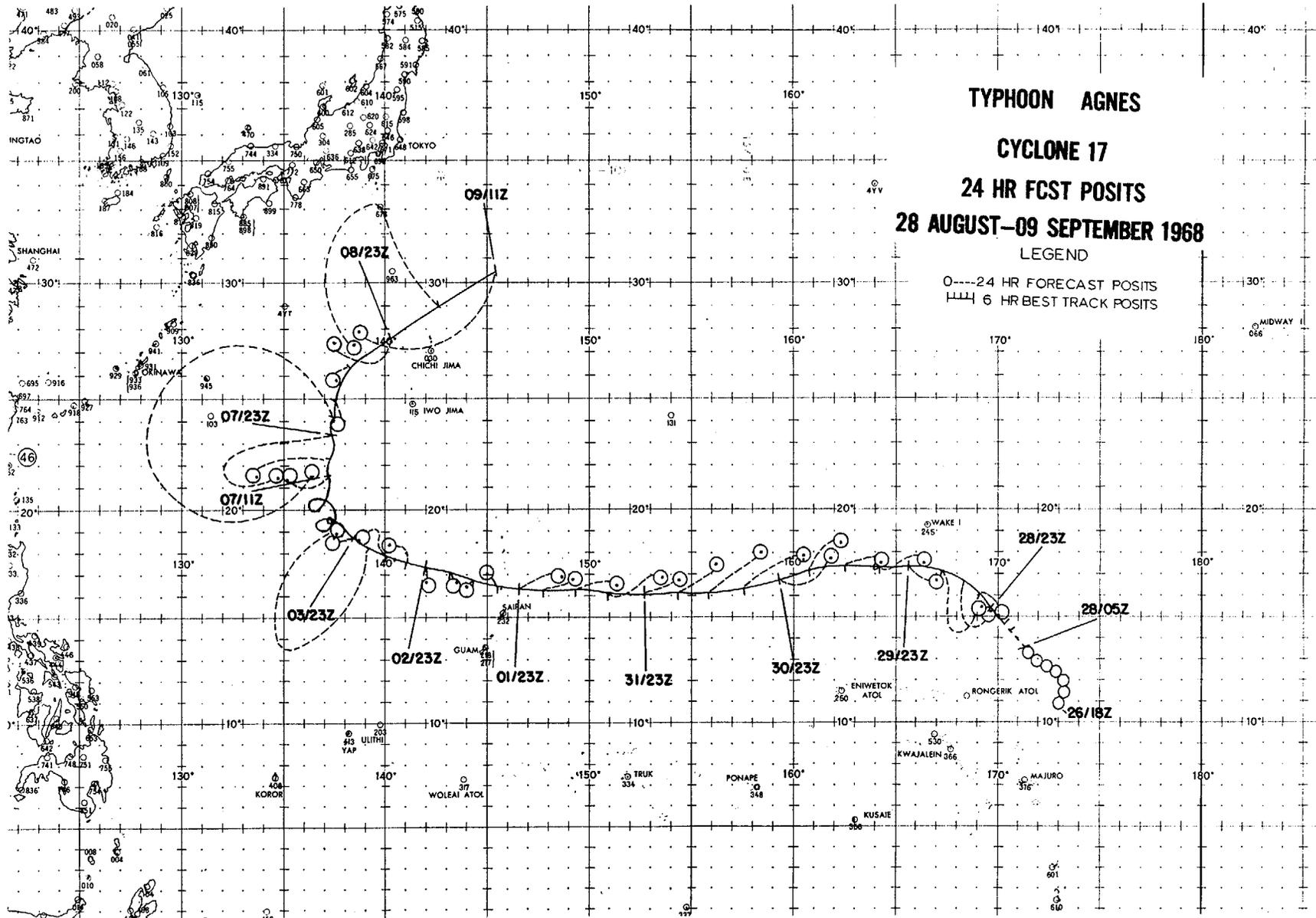
DTG	STORM POSITION		24 HR. ERROR	48 HR. ERROR	72 HR. ERROR
	LAT.	LONG.	DEG. DIST.	DEG. DIST.	DEG. DIST.
291100Z	16.7N	168.3E	143-0120	-----	-----
291700Z	17.2N	167.2E	134-0156	-----	-----
292300Z	17.3N	165.7E	112-0078	-----	-----
300500Z	17.4N	164.2E	090-0120	-----	-----
301100Z	17.3N	162.5E	087-0096	-----	-----
301700Z	17.2N	160.8E	050-0108	-----	-----
302300Z	16.8N	159.2E	069-0156	-----	-----
310500Z	16.4N	157.5E	061-0180	-----	-----
311100Z	16.1N	155.9E	050-0174	-----	-----
311700Z	16.1N	154.2E	055-0132	-----	-----
312300Z	16.1N	152.6E	067-0102	071-0360	-----
010500Z	16.1N	150.9E	073-0156	070-0372	-----
011100Z	16.2N	149.2E	085-0120	067-0354	-----
011700Z	16.3N	147.8E	068-0078	068-0312	-----
012300Z	16.4N	146.5E	078-0132	078-0294	-----
020500Z	16.6N	145.4E	323-0030	086-0300	076-0516
021100Z	16.8N	144.2E	195-0024	089-0222	-----
021700Z	17.1N	143.1E	149-0030	075-0156	069-0408
022300Z	17.3N	142.0E	180-0030	083-0228	-----
030500Z	17.6N	141.0E	311-0060	000-0024	093-0420
031100Z	17.9N	140.0E	298-0084	165-0048	-----
031700Z	18.3N	139.1E	294-0084	163-0060	081-0264
032300Z	18.8N	138.4E	270-0048	180-0078	-----
040500Z	19.3N	137.9E	293-0162	284-0048	250-0048
041100Z	19.6N	137.3E	270-0126	274-0144	-----
041700Z	19.4N	136.8E	289-0108	285-0180	189-0084
042300Z	19.1N	136.8E	289-0108	282-0192	-----
050500Z	19.1N	137.2E	292-0168	294-0348	289-0246
051100Z	19.4N	137.4E	289-0234	282-0312	-----
051700Z	19.7N	137.3E	286-0252	284-0312	282-0414
052300Z	19.6N	136.9E	279-0150	282-0312	-----
060500Z	19.6N	137.6E	265-0060	282-0372	285-0528
061100Z	20.3N	137.2E	246-0084	276-0372	-----
061700Z	20.5N	136.5E	180-0012	284-0360	283-0420

TROPICAL CYCLONE 17 -- 08/28/0500Z TO 09/09/1100Z
 POSITION AND FORECAST VERIFICATION DATA (CONT)

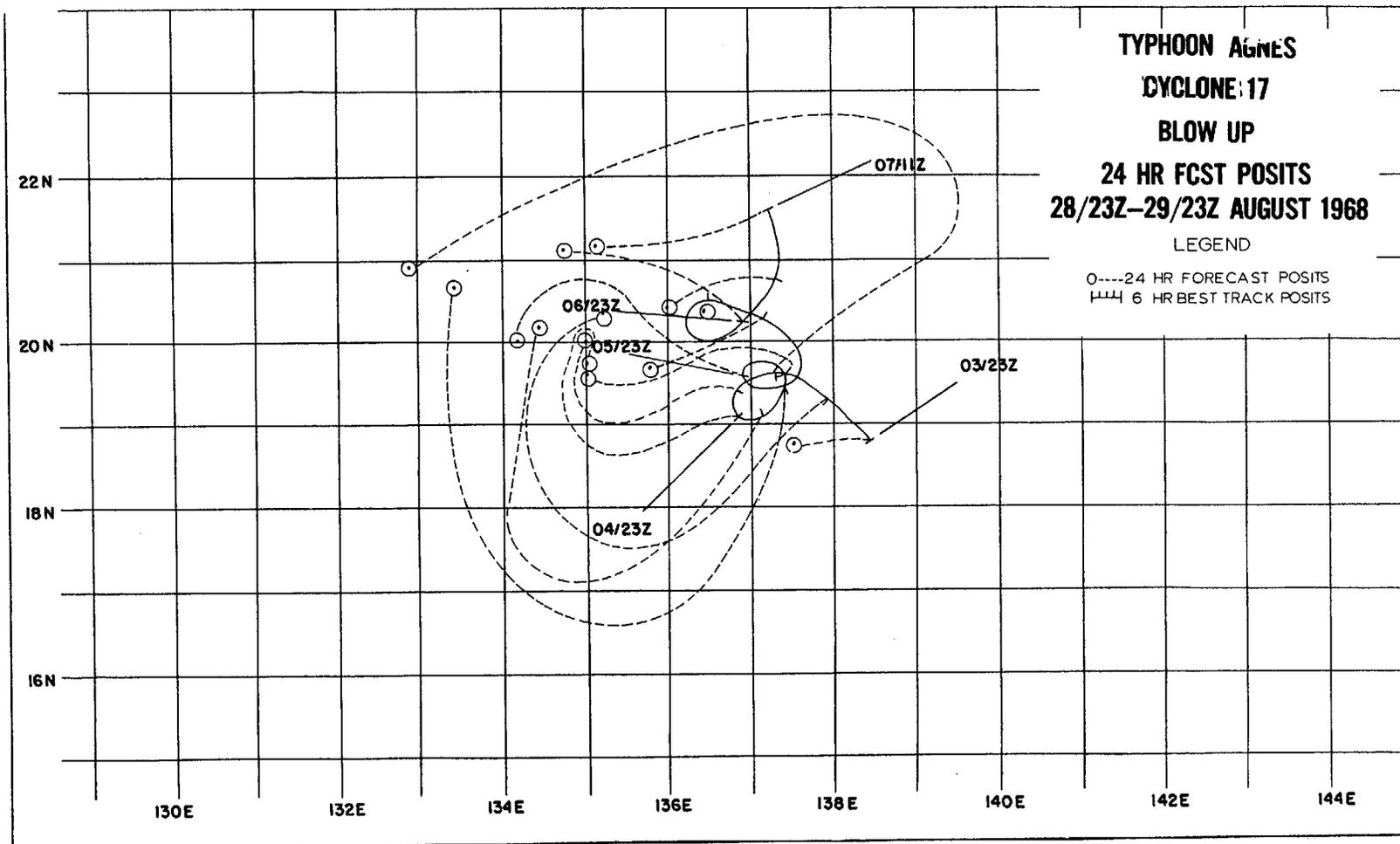
DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
062300Z	20.3N	136.9E	291-0126	272-0270	-----
070500Z	20.8N	137.3E	252-0072	257-0150	272-0540
071100Z	21.6N	137.2E	259-0114	251-0192	-----
071700Z	22.4N	137.4E	255-0204	248-0168	270-0534
072300Z	23.4N	137.2E	228-0174	258-0312	-----
080500Z	24.1N	137.5E	203-0174	238-0264	234-0324
081100Z	24.9N	137.5E	187-0054	239-0306	-----
081700Z	26.2N	138.2E	237-0042	243-0498	237-0408
082300Z	27.7N	140.2E	264-0150	232-0540	-----
090500Z	29.0N	142.7E	245-0246	229-0606	241-0762
091100Z	30.8N	145.3E	244-0378	241-0564	-----

AVERAGE 24 HOUR ERROR - 0122 MI.
 AVERAGE 48 HOUR ERROR - 0275 MI.
 AVERAGE 72 HOUR ERROR - 0394 MI.

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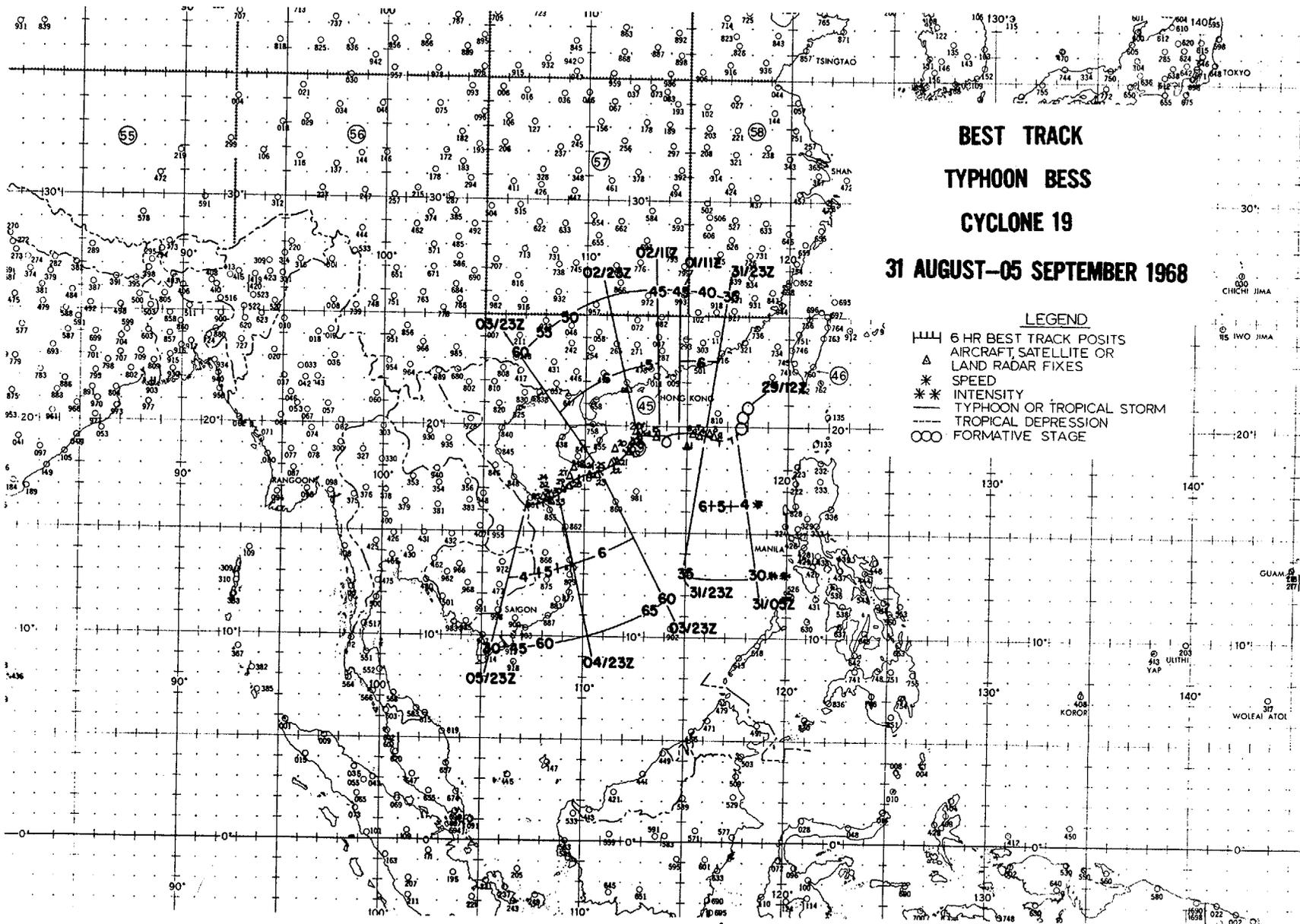
5-71

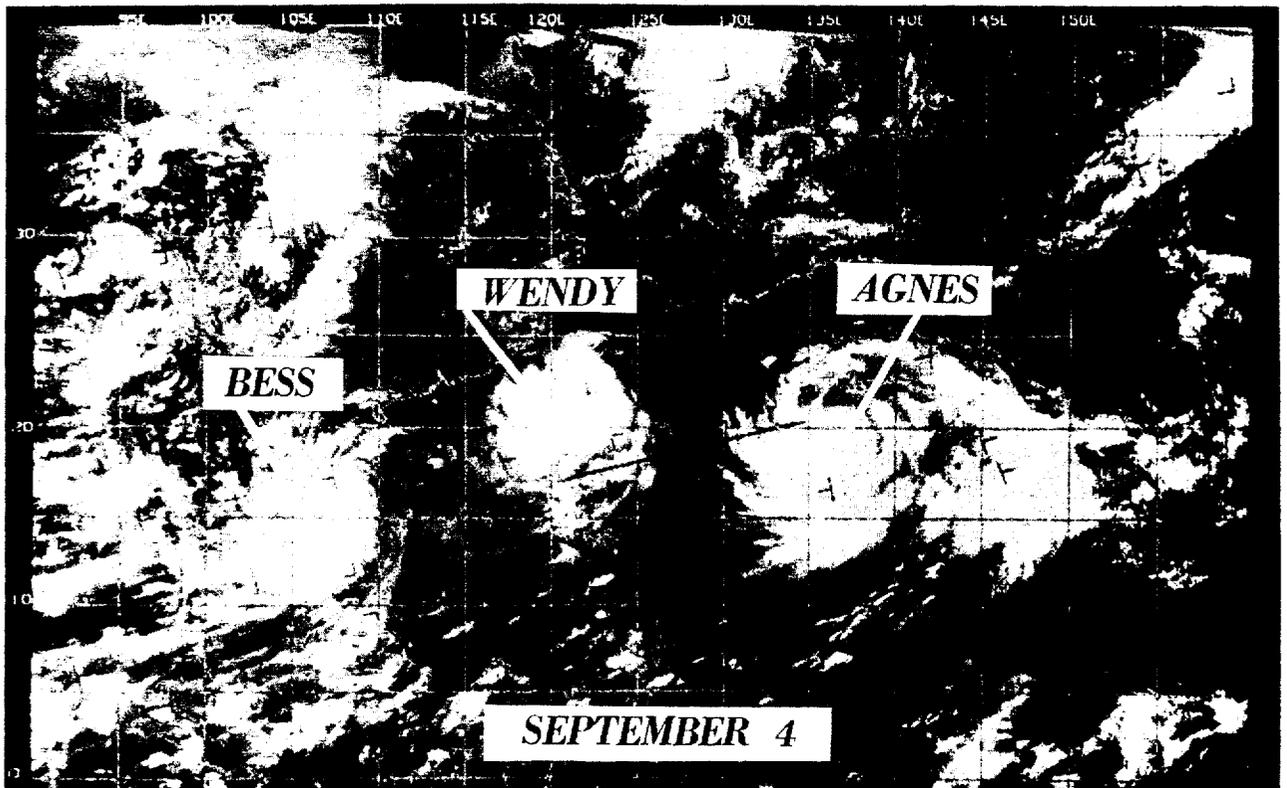
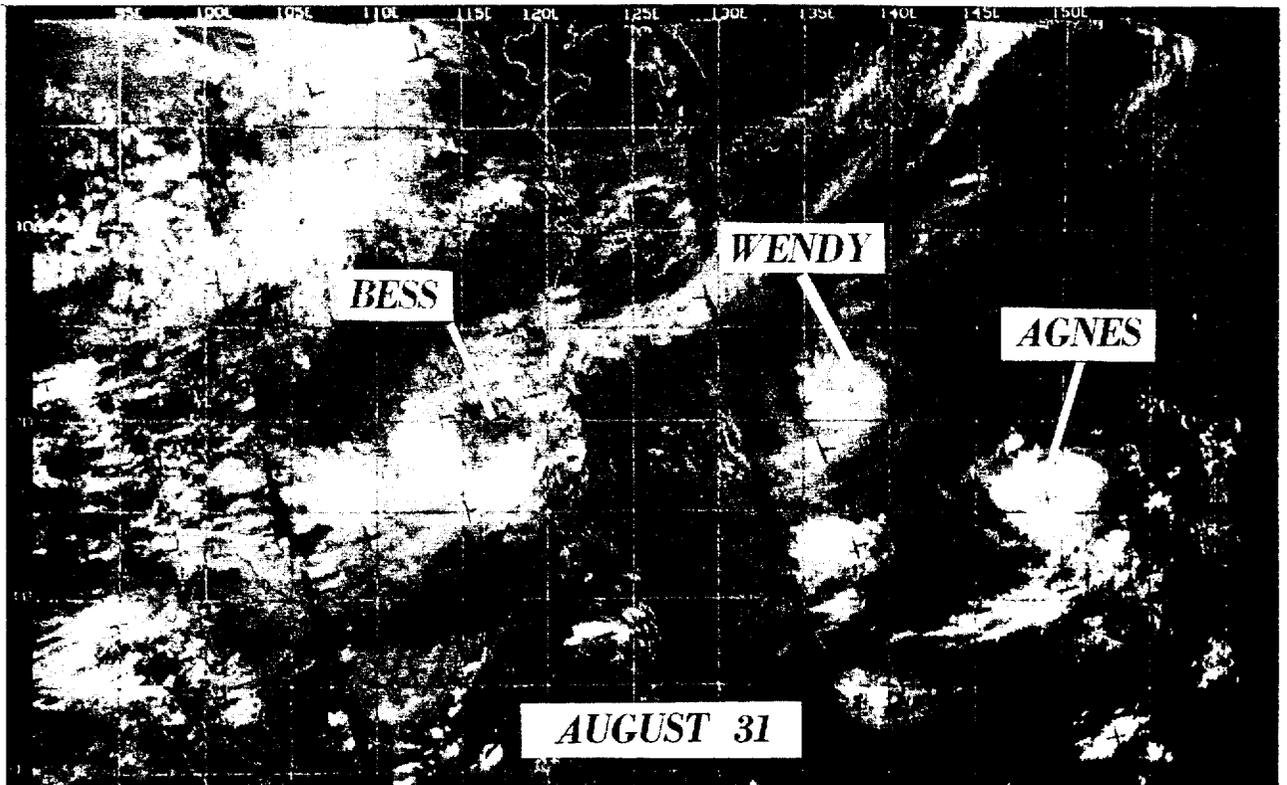


TROPICAL CYCLONE 19 - 08/31/0500Z TO 09/05/2300Z
(BESS)

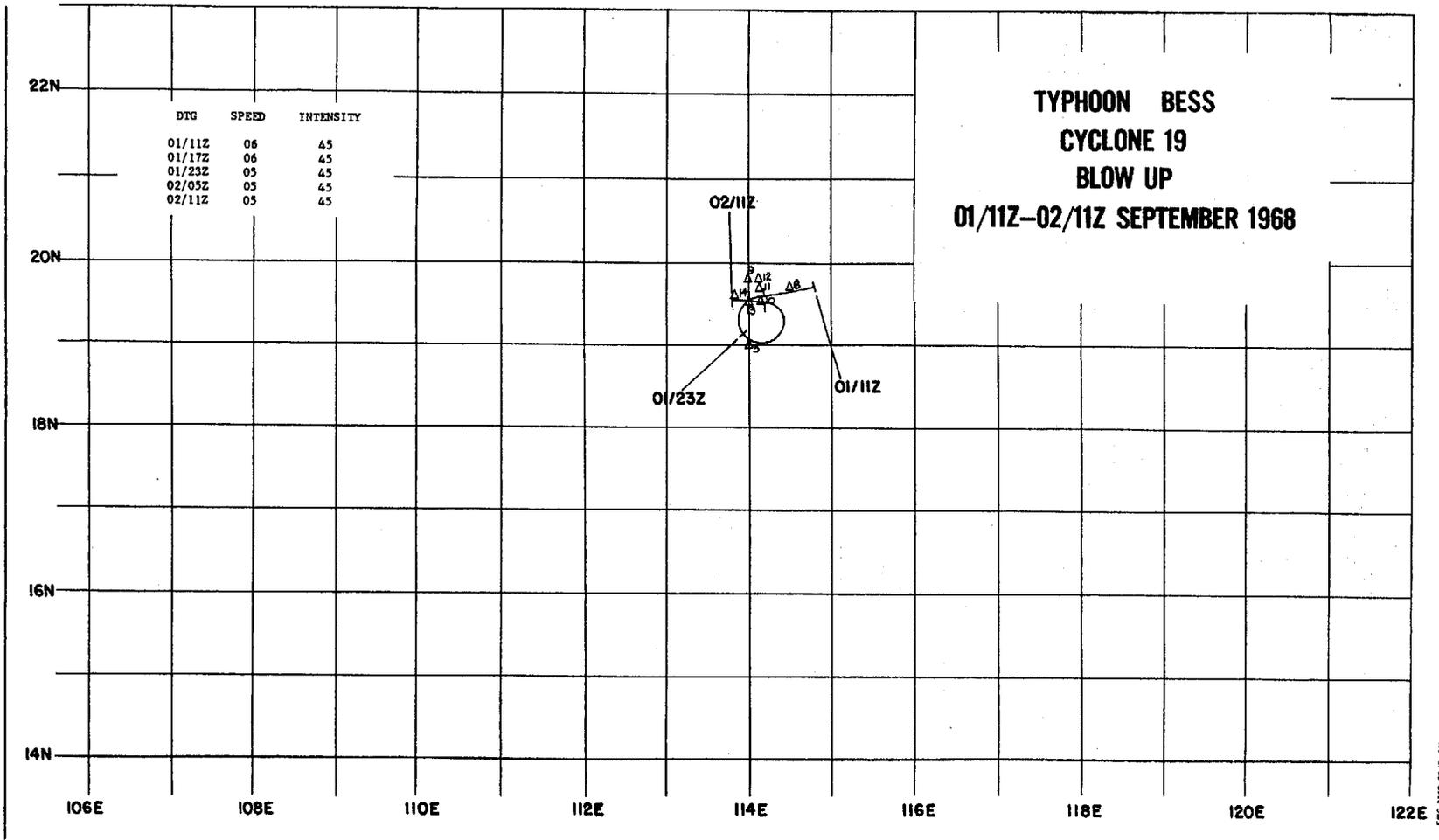
- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 25
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 02
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 0744 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 965MBS AT 041514Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2816M. AT 042015Z
 3. MAXIMUM SURFACE WIND - 065 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 420 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - MONSOONAL SURGE WITH SUBSEQUENT DEVELOPMENT OF 200MB DIVERGENCE
 - B. INITIAL SURFACE VORTEX
 1. INDUCED VORTEX AT 291200Z
 2. SURFACE PRESSURE LESS THAN 1002MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - EAST
 2. UPON REACHING TYPHOON INTENSITY - NORTHEAST
- III. FINAL DISPOSITION - DISSIPATED OVER LAND

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FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES CYCLONE		19		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
1	310751Z	19.0N 115.0E	SLTLS	STG X	DIA 03	BND5 1								
2	311900Z	19.5N 116.3E	VW-R----	10	700MB	---	---	---	---	--/--	----			--
3	312030Z	19.6N 116.2E	VW-P-20-	10	0350M	---	025	992	---	26/26	----			--
4	010200Z	19.7N 115.6E	VW-P-10-	10	0350M	---	030	989	3048	28/26	----			--
5	010400Z	19.0N 114.0E	SLTLS	STG X	DIA 02	BND5 1								
6	010830Z	19.7N 115.3E	VW-R----	10		---	---	---	---	--/--	----			--
7	010845Z	19.8N 115.3E	VW-P-10-	05	0450M	---	035	986	---	27/25	CIRC	----	25	--
8	011425Z	19.7N 114.5E	VW-P-15-	10	700MB	---	---	984	3057	22/16	ELIP	NE-SW	30X24	--
9	012025Z	19.8N 114.0E	VW-R----	20		---	---	---	---	--/--	----			--
10	012104Z	19.5N 114.2E	VW-P-05-	03	0420M	055	---	985	---	24/21	CIRC	----	10	--
11	020110Z	19.7N 114.2E	VW-R----	03		---	---	---	---	--/--	----			--
12	020202Z	19.8N 114.2E	VW-P-03-	01	700MB	---	040	988	3006	18/15	CIRC	----	10	F.B.
13	020902Z	19.5N 114.0E	SLTLS	STG X	DIA 02	BND5 2								
14	020928Z	19.6N 113.8E	VW-P-05-	05	0230M	055	050	983	2978	26/23	----			--
15	021400Z	19.5N 113.5E	VW-P-10-	10	700MB	---	---	992	2960	16/14	----			F.B.
16	022015Z	19.5N 112.8E	VW-R----	10		---	---	---	---	--/--	----			--
17	022100Z	19.6N 112.7E	VW-P-10-	10	0450M	---	---	981	---	27/25	CIRC	----	25	--
18	030215Z	19.4N 112.4E	VW-P----	10	0450M	---	050	983	3008	28/26	CIRC	----	40	--
19	030925Z	18.9N 112.1E	VW-P-03-	01	700MB	---	055	980	2520	14/11	CIRC	----	10	F.B.
20	030939Z	19.0N 111.5E	SLTLS	STG X	DIA 04	BND5 2								
21	031405Z	18.3N 111.7E	VW-P-02-	01	700MB	064	---	977	2907	14/09	CIRC	----	08	--
22	032055Z	18.2N 111.4E	VW-P-05-	05	700MB	050	---	980	2905	17/12	----			F.B.
23	040445Z	17.8N 110.6E	VW-R-----			---	---	---	---	--/--	----			--
24	040520Z	17.8N 110.4E	VW-P-10-	05	0450M	---	070	967	---	26/26	CIRC	----	30	--

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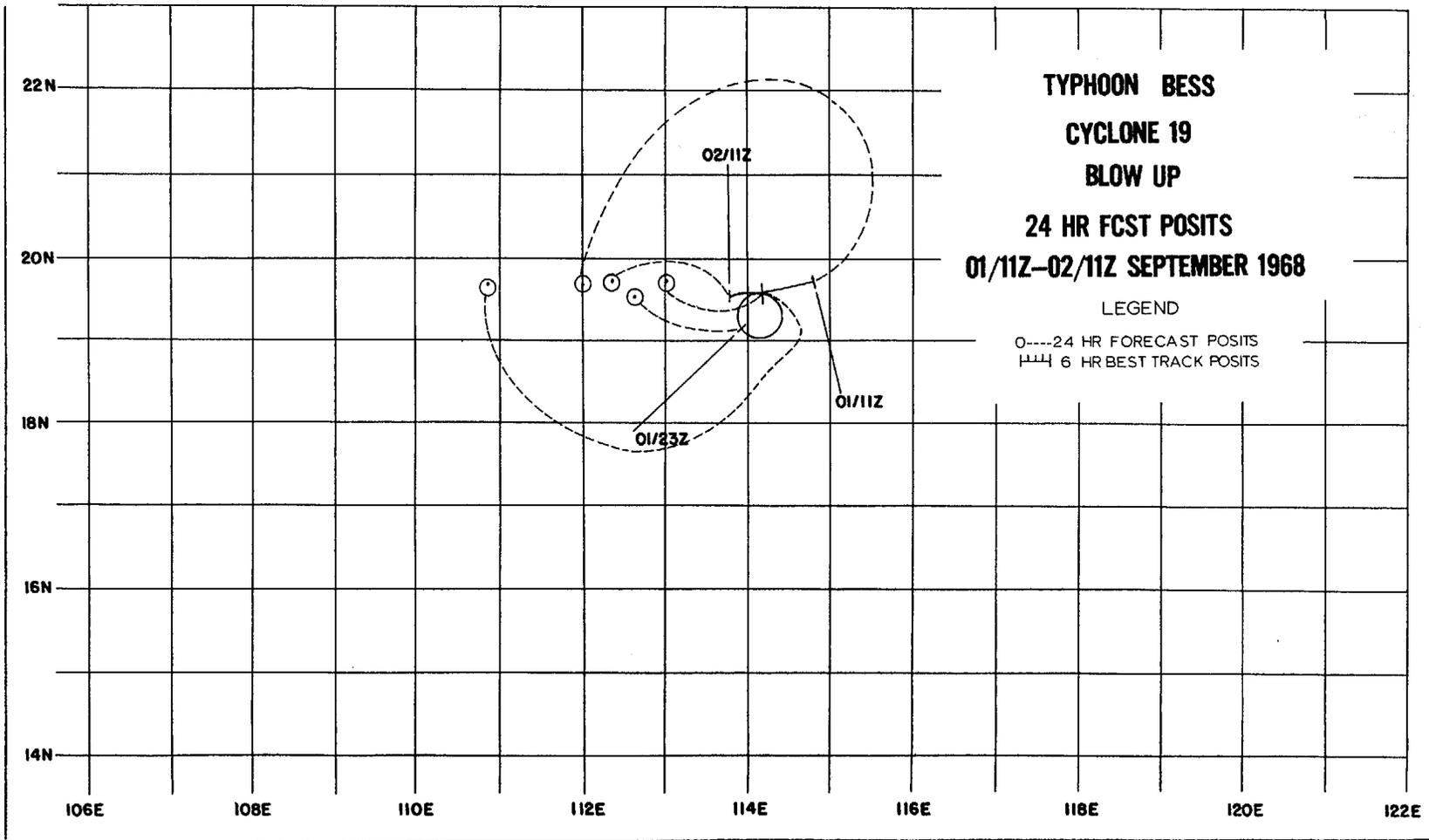
FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES		CYCLONE		19		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD	
				FLT LVL	FLT LVL WND	QbS SFC WND	QbS MIN SLP									
25	040700Z	17.8N 110.4E	SHIP RDR								---/---	CIRC	----	29	--	
26	040822Z	18.0N 109.5E	SLTLS	STG X	DIA	03	BNDS	3								
27	040825Z	17.8N 110.2E	VW-P-05-05	0460M				075	966	---	25/23	CIRC	----	35	10	
28	041514Z	17.1N 109.2E	VW-P-05-01	0450M				075	965	---	22/21	CIRC	----	08	--	
29	042015Z	17.0N 109.0E	VW-P-05-01	700MB	072				968	2816	16/12	CIRC	----	10	--	
30	050300Z	16.8N 108.4E	VW-R-02-05								---/24	CIRC	----	30	--	
31	050500Z	16.5N 108.1E	LND RDR								---/---	----			--	
32	050500Z	16.5N 108.1E	VW-R-----10								---/---	----			--	
33	050830Z	16.6N 108.4E	VW-R-02-10	0290M							---/---	----			--	
34	051125Z	16.5N 108.2E	LND RDR								---/---	----			--	
35	051305Z	16.6N 108.0E	LND RDR								---/---	----			--	

TROPICAL CYCLONE 19 -- 08/31/0500Z TO 09/05/2300Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
312300Z	19.6N	116.0E	-----	-----	-----
010500Z	19.7N	115.4E	076-0192	-----	-----
011100Z	19.7N	114.8E	270-0156	-----	-----
011700Z	19.6N	114.2E	271-0186	-----	-----
012300Z	19.2N	113.9E	284-0072	-----	-----
020500Z	19.5N	114.2E	280-0066	-----	-----
021100Z	19.5N	113.7E	278-0078	282-0336	-----
021700Z	19.5N	113.2E	278-0084	283-0312	-----
022300Z	19.6N	112.6E	281-0030	280-0186	-----
030500Z	19.2N	112.3E	073-0096	290-0132	-----
031100Z	18.6N	112.0E	029-0084	302-0168	-----
031700Z	18.2N	111.5E	016-0066	305-0180	303-0390
032300Z	17.9N	110.9E	329-0102	326-0138	-----
040500Z	17.8N	110.3E	008-0096	037-0162	315-0270
041100Z	17.5N	109.7E	042-0150	020-0162	-----
041700Z	17.2N	109.2E	039-0036	014-0126	311-0288
042300Z	16.8N	108.8E	037-0060	326-0186	-----
050500Z	16.6N	108.4E	000-0042	005-0168	016-0228
051100Z	16.4N	107.9E	007-0054	026-0198	-----
051700Z	16.3N	107.5E	252-0054	006-0060	353-0198

AVERAGE 24 HOUR ERROR - 0089 MI.
 AVERAGE 48 HOUR ERROR - 0179 MI.
 AVERAGE 72 HOUR ERROR - 0274 MI.

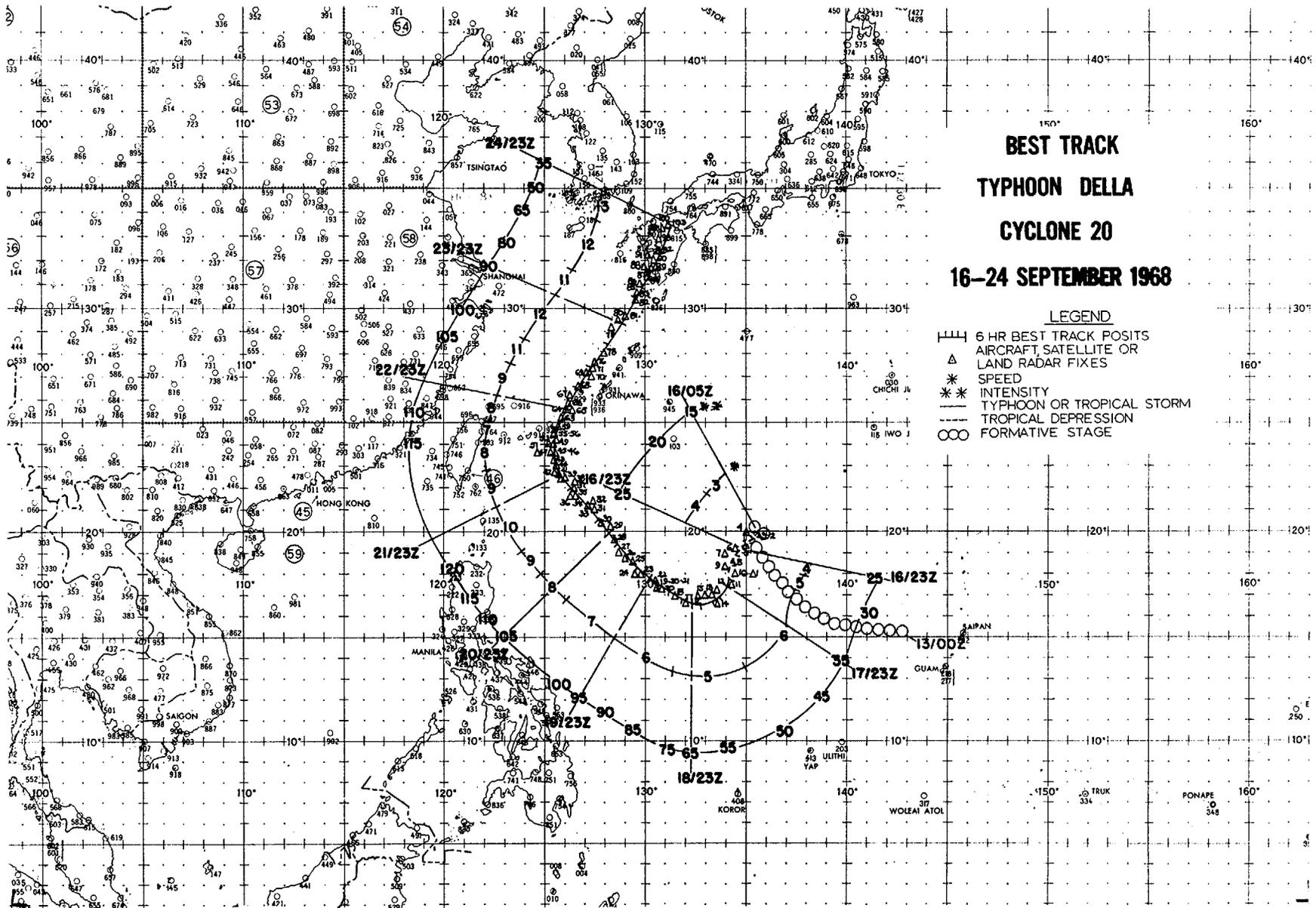
5-81



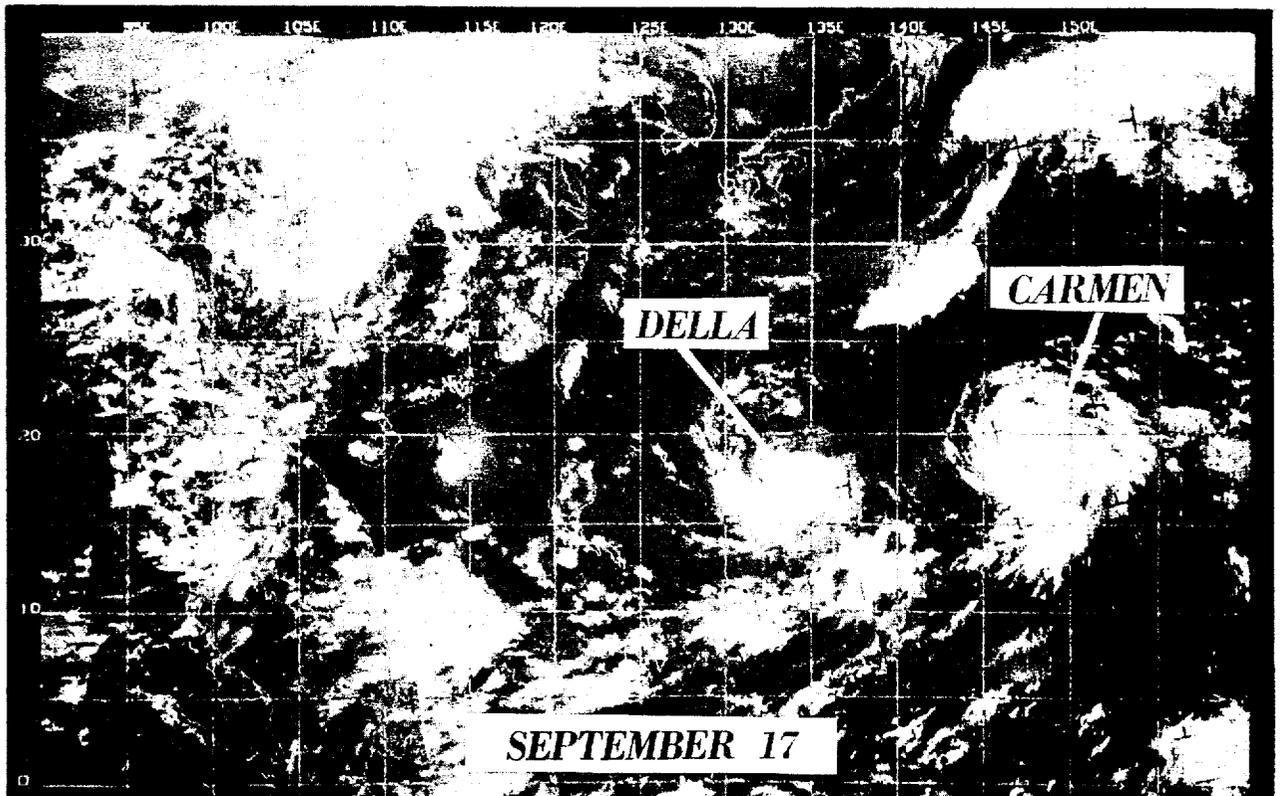
TROPICAL CYCLONE 20 - 09/16/0500Z TO 09/24/2300Z
(DELLA)

- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 37
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 20
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1584 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 930MBS AT 212359Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2478M. AT 212359Z
 - 3. MAXIMUM SURFACE WIND - 120 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 420 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 - 1. EMBEDDED VORTEX AT 130000Z
 - 2. SURFACE PRESSURE LESS THAN 1009MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - NORTHEAST
 - 2. UPON REACHING TYPHOON INTENSITY - VARIABLE
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

S-84



E
250
10°
110°
120°
130°
140°
150°
160°
WOLEAI ATOL
TRUK
PONAPE



FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	TKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WNU								
1	150230Z	18.0N 136.2E	54-P-03-10	0410M	040	020	005	---	23/22	CIRC	----	30	N.F.B.
2	150536Z	19.0N 134.0E	SLTLS	STG 8	DIA	--	BNDS -						
3	160205Z	19.9N 135.7E	54-P-03-10	0500M	018	015	001	---	24/24	CIRC	----	40	N.F.B.
4	160436Z	20.0N 135.0E	SLTLS	STG X	DIA	02	BNDS 1						
5	162120Z	19.3N 135.0E	54-P-10-05	0350M	030	020	997	3033	23/22	CIRC	----	10	--
6	170235Z	19.1N 134.5E	54-P-03-02	700MB	040	020	997	3027	12/11	CIRC	----	10	--
7	170531Z	19.0N 134.0E	SLTLS	STG X	DIA	04	BNDS 1						
8	170900Z	18.5N 134.3E	VW-P-10-10	0290M	022	025	995	---	25/23	CIRC	----	20	F.B.
9	171400Z	18.2N 134.0E	VW-P-10-10	0290M	040	025	994	3066	25/23	CIRC	----	20	F.B.
10	172000Z	18.0N 134.5E	54-R-----		---	---	---	---	--/--	----			--
11	172115Z	17.5N 134.2E	54-P-05-05	0460M	045	040	988	---	25/24	CIRC	----	12	--
12	180236Z	17.1N 133.7E	54-P-05-03	700MB	030	045	984	2941	11/10	CIRC	----	15	--
13	180626Z	17.0N 133.0E	SLTLS	STG X	DIA	03	BNDS 3						
14	180858Z	16.6N 133.7E	VW-P-08-03	0400M	080	070	979	---	21/19	CIRC	----	45	--
15	181417Z	17.0N 133.2E	VW-R-03-05		---	---	---	---	--/--	CIRC	----	40	07
16	182130Z	17.0N 132.8E	54-P-04-01	700MB	070	050	965	2798	19/12	CIRC	----	35	--
17	190325Z	16.7N 132.0E	54-P-03-02	700MB	087	060	964	2801	19/11	CIRC	----	20	--
18	190526Z	17.0N 131.5E	SLTLS	STG X	DIA	04	BNDS 4						
19	190905Z	17.2N 131.4E	VW-P-05-05	0340M	---	090	958	2817	24/23	CIRC	----	32	05
20	191220Z	17.2N 130.9E	VW-R----10		---	---	---	---	--/--	----			--
21	191404Z	17.2N 130.8E	VW-R-05-05		---	---	---	---	--/--	CIRC	----	30	--
22	192125Z	17.7N 130.4E	54-P-03-05	700MB	---	060	951	2673	18/13	ELIP	NW-SE	25X20	--
23	200200Z	18.0N 129.9E	54-P-03-05	700MB	---	080	950	2673	20/10	CIRC	----	22	--
24	200621Z	18.0N 129.5E	SLTLS	STG X	DIA	03	BNDS 4						

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FIX NO.	TIME	POSIT	EYE FIXES CYCLONE				20		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
25	200910Z	18.7N 129.4E	VW-P-05-02	700MB	092	075	943	2676	22/10	CIRC	----	22	--	
26	201200Z	18.9N 129.0E	VW-R-05-05		---	---	---	---	---/--	CIRC	----	20	--	
27	201400Z	19.0N 128.8E	VW-R-05-05		---	---	---	---	---/--	CIRC	----	25	--	
28	202045Z	19.7N 128.5E	54-P-03-01	700MB	070	---	948	2630	17/12	CIRC	----	20	03	
29	210000Z	20.1N 128.2E	54-P-03-01	700MB	095	100	945	2621	17/11	ELIP	NW-SE	30X20	--	
30	210230Z	20.4N 127.9E	54-P-03-01	700MB	089	075	946	2630	16/11	ELIP	NE-SW	--X--	--	
31	210521Z	21.0N 127.5E	SLTLS	STG X	DIA	05	BNDS 4							
32	210930Z	21.3N 127.4E	VW-P-20-02	700MB	100	105	947	2657	13/08	ELIP	NW-SE	25X15	--	
33	211010Z	21.1N 127.2E	VW-R----07		---	---	---	---	---/--	----			--	
34	211201Z	21.4N 126.8E	VW-R-07-05	700MB	---	---	---	---	---/11	ELIP	N-S	60X50	--	
35	211410Z	21.6N 126.5E	VW-R----10		---	---	---	---	---/--	CIRC	----	60	--	
36	211500Z	21.7N 126.2E	VW-R-02-05	700MB	060	---	---	---	---/--	ELIP	N-S	53X48	--	
37	211700Z	22.0N 126.5E	LND RDR		---	---	---	---	---/--	----			--	
38	211815Z	22.1N 126.5E	LND RDR		---	---	---	---	---/--	----			--	
39	211910Z	22.4N 125.9E	LND RDR		---	---	---	---	---/--	----			--	
40	212015Z	22.5N 126.0E	LND RDR		---	---	---	---	---/--	----			--	
41	212045Z	22.6N 125.7E	54-P-01-05	700MB	118	---	931	2481	17/11	CIRC	----	45	--	
42	212359Z	22.8N 125.5E	54-P-02-05	700MB	100	085	930	2478	20/12	CIRC	----	40	--	
43	220300Z	23.0N 125.5E	LND RDR		---	---	---	---	---/--	----			--	
44	220300Z	23.2N 125.3E	54-P-02-05	700MB	100	100	931	2481	20/11	CIRC	----	40	--	
45	220515Z	23.5N 125.5E	LND RDR		---	---	---	---	---/--	----			--	
46	220616Z	23.5N 125.0E	SLTLS	STG X	DIA	05	BNDS 4							
47	220630Z	23.7N 125.3E	LND RDR		---	---	---	---	---/--	----			--	
48	220700Z	23.6N 125.4E	LND RDR		---	---	---	---	---/--	----			--	

FIX NO.	TIME	POSIT	EYE UNIT-		FIXES		CYCLONE		OBS 20 SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			METHOD -ACCY		FLT LVL	FLT LVL WND										
49	220715Z	24.0N 125.3E	LND	RDR								--/--	----			--
50	220730Z	23.7N 124.8E	LND	RDR								--/--	----			--
51	220800Z	23.8N 125.4E	LND	RDR								--/--	----			--
52	220900Z	23.9N 125.4E	LND	RDR								--/--	----			--
53	220900Z	24.0N 125.3E	VW-R-02-05		700MB	060	055					--/--	ELIP	NE-SW	45X38	05
54	221000Z	24.0N 125.3E	LND	RDR								--/--	----			--
55	221010Z	24.2N 125.5E	VW-R----	05								--/--	----			--
56	221200Z	24.2N 125.5E	VW-R-02-05		700MB	105						--/--	CIRC	----	45	12
57	221300Z	24.3N 125.4E	LND	RDR								--/--	----			--
58	221400Z	24.3N 125.4E	LND	RDR								--/--	----			--
59	221400Z	24.4N 125.4E	VW-R-02-05		700MB							--/--	CIRC	----	50	--
60	221500Z	24.4N 125.5E	LND	RDR								--/--	----			--
61	221600Z	24.7N 125.5E	LND	RDR								--/--	----			--
62	221750Z	24.8N 125.7E	LND	RDR								--/--	----			--
63	222100Z	25.3N 125.9E	54-P-05-05		500MB	080		937	2547		05/58	CIRC	----	40	--	
64	230000Z	25.7N 126.0E	54-P-03-03		500MB	050	100	943	2590		05/58	CIRC	----	45	--	
65	230025Z	25.7N 126.3E	LND	RDR								--/--	----			--
66	230100Z	25.8N 126.2E	LND	RDR								--/--	----			--
67	230300Z	26.1N 126.2E	54-P-03-05		500MB	085	100	940			05/58	CIRC	----	40	15	
68	230520Z	26.5N 126.5E	SLTLS		STG X	OIA	05	BNDS	4							
69	230900Z	27.2N 127.1E	LND	RDR								--/--	----			--
70	230900Z	27.0N 127.2E	LND	RDR								--/--	----			--
71	230930Z	27.2N 127.3E	LND	RDR								--/--	----			--
72	230930Z	27.0N 127.4E	VW-R-02-10									--/--	CIRC	----	42	--

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FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES FLT LVL	CYCLONE FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS
													WALL CLOUD
73	231000Z	27.2N 127.3E	LND RDR						--/--	----			--
74	231005Z	27.1N 127.5E	VW-R-01-05						--/--	CIRC	----	38	--
75	231100Z	27.4N 127.4E	LND RDR						--/--	----			--
76	231215Z	27.6N 127.5E	VW-R-02-05						--/--	CIRC	----	35	--
77	231500Z	27.9N 127.9E	LND RDR						--/--	----			--
78	231500Z	28.0N 128.1E	VW-R-02-05						--/--	CIRC	----	38	--
79	232130Z	29.2N 128.3E	54-P-05-05	700MB	080		950	2649	20/--	CIRC	----	40	--
80	240000Z	29.5N 128.8E	54-P-05-05	700MB	090	080	955	2688	17/11	CIRC	----	80	--
81	240230Z	29.7N 129.0E	54-P-05-05	700MB	085		957	2688	16/08	CIRC	----	80	10
82	240600Z	30.4N 129.5E	LND RDR						--/--	----			--
83	240600Z	30.6N 129.5E	LND RDR						--/--	----			--
84	240611Z	30.5N 129.5E	SLTLS	STG X	DIA 04	BNDS 3							
85	240900Z	30.8N 129.8E	LND RDR						--/--	----			--
86	240900Z	31.0N 129.9E	LND RDR						--/--	----			--
87	241135Z	31.2N 130.2E	VW-R-01-03	7000M					--/11	CIRC	----	25	N.F.B.
88	241300Z	31.8N 130.0E	LND RDR						--/--	----			--
89	241300Z	31.7N 130.3E	LND RDR						--/--	----			--
90	241400Z	32.0N 130.4E	LND RDR						--/--	----			--
91	241400Z	32.2N 130.2E	LND RDR						--/--	----			--
92	241440Z	32.4N 130.7E	LND RDR						--/--	----			--
93	241500Z	32.2N 130.6E	LND RDR						--/--	----			--
94	241500Z	32.2N 130.0E	LND RDR						--/--	----			--
95	241600Z	32.6N 130.9E	LND RDR						--/--	----			--
96	241700Z	32.5N 130.9E	LND RDR						--/--	----			--

FIX NO.	TIME	POSIT	UNIT		EYE FIXES CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			METHOD -ACCY	FLT LVL	FLT LVL WND	20								
97	241810Z	32.6N 131.0E	LND	RDR			---	---	---	---/--	----			--
98	242000Z	32.9N 130.5E	LND	RDR			---	---	---	---/--	----			--
99	242000Z	33.0N 130.6E	LND	RDR			---	---	---	---/--	----			--
100	242100Z	33.3N 130.9E	LND	RDR			---	---	---	---/--	----			--
101	242100Z	33.2N 130.5E	LND	RDR			---	---	---	---/--	----			--
102	242200Z	33.4N 130.2E	LND	RDR			---	---	---	---/--	----			--
103	242200Z	33.5N 131.1E	LND	RDR			---	---	---	---/--	----			--

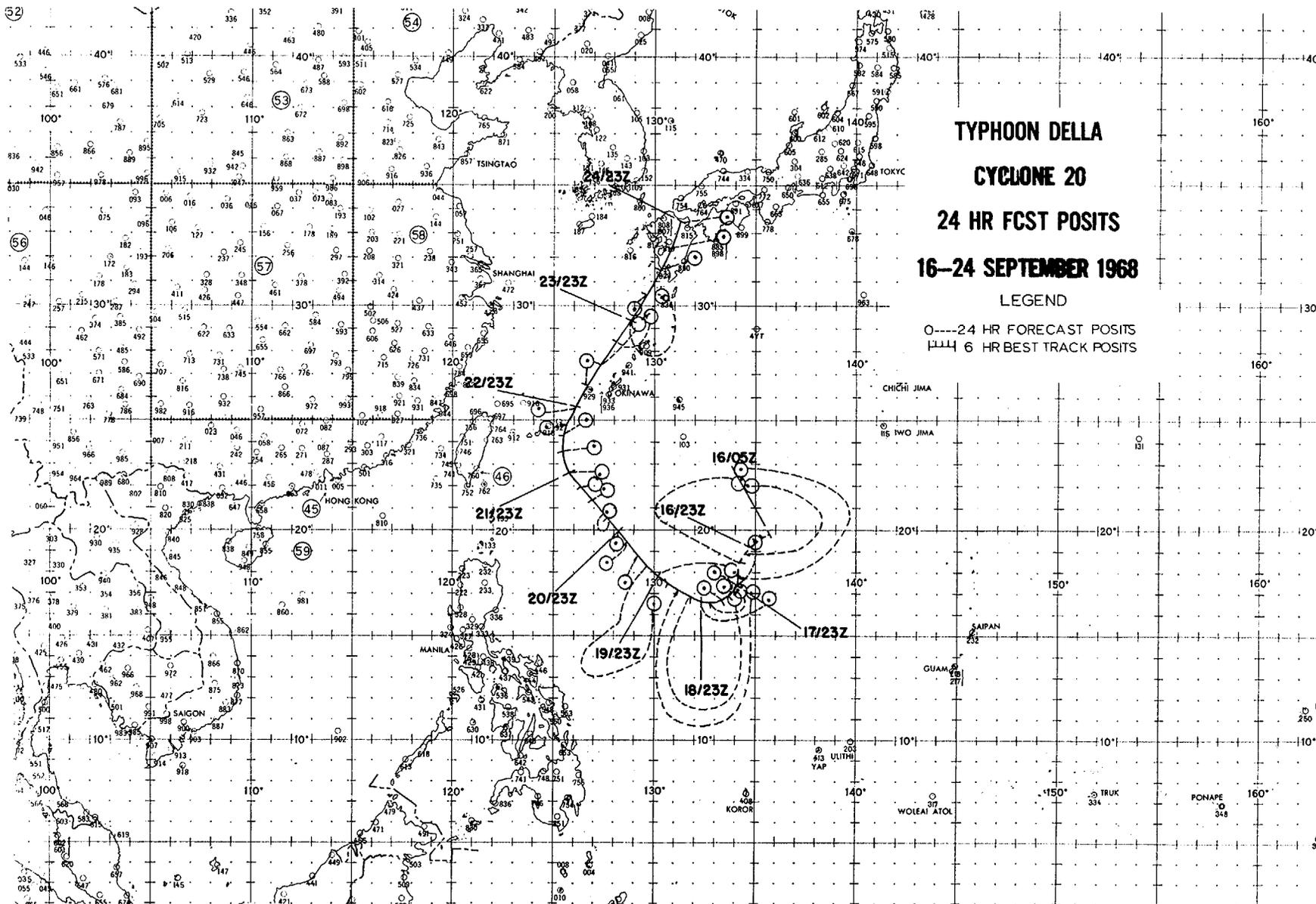
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TROPICAL CYCLONE 20 -- 09/16/0500Z TO 09/24/2300Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
172300Z	17.3N	134.1E	020-0138	-----	-----
180500Z	16.9N	133.7E	331-0072	-----	-----
181100Z	16.7N	133.3E	299-0048	-----	-----
181700Z	16.5N	132.8E	064-0078	-----	-----
182300Z	16.6N	132.3E	087-0198	-----	-----
190500Z	16.8N	131.8E	085-0126	-----	-----
191100Z	17.1N	131.2E	091-0204	-----	-----
191700Z	17.4N	130.7E	094-0156	-----	-----
192300Z	17.8N	130.2E	087-0216	094-0438	-----
200500Z	18.3N	129.6E	170-0108	094-0360	-----
201100Z	18.8N	129.1E	198-0078	093-0444	-----
201700Z	19.3N	128.6E	226-0072	102-0420	-----
202300Z	19.9N	128.1E	180-0036	090-0474	-----
210500Z	20.6N	127.6E	019-0018	168-0234	098-0582
211100Z	21.3N	126.9E	034-0042	190-0174	-----
211700Z	22.0N	126.2E	061-0060	206-0198	099-0714
212300Z	22.7N	125.6E	102-0084	165-0072	-----
220500Z	23.5N	125.3E	076-0090	052-0114	167-0396
221100Z	24.2N	125.4E	057-0084	050-0108	-----
221700Z	24.8N	125.6E	270-0048	046-0114	213-0396
222300Z	25.6N	126.0E	267-0096	131-0072	-----
230500Z	26.4N	126.6E	005-0072	042-0144	044-0294
231100Z	27.3N	127.3E	042-0156	042-0204	-----
231700Z	28.4N	128.1E	051-0090	278-0084	052-0072
232300Z	29.4N	128.7E	058-0096	248-0108	-----
240500Z	30.3N	129.4E	217-0030	049-0378	057-0306
241100Z	31.3N	130.2E	065-0096	057-0588	-----
241700Z	32.4N	130.6E	078-0132	062-0522	090-0060
242300Z	33.6N	131.2E	088-0120	068-0438	-----

AVERAGE 24 HOUR ERROR - 0098 MI.
 AVERAGE 48 HOUR ERROR - 0270 MI.
 AVERAGE 72 HOUR ERROR - 0352 MI.

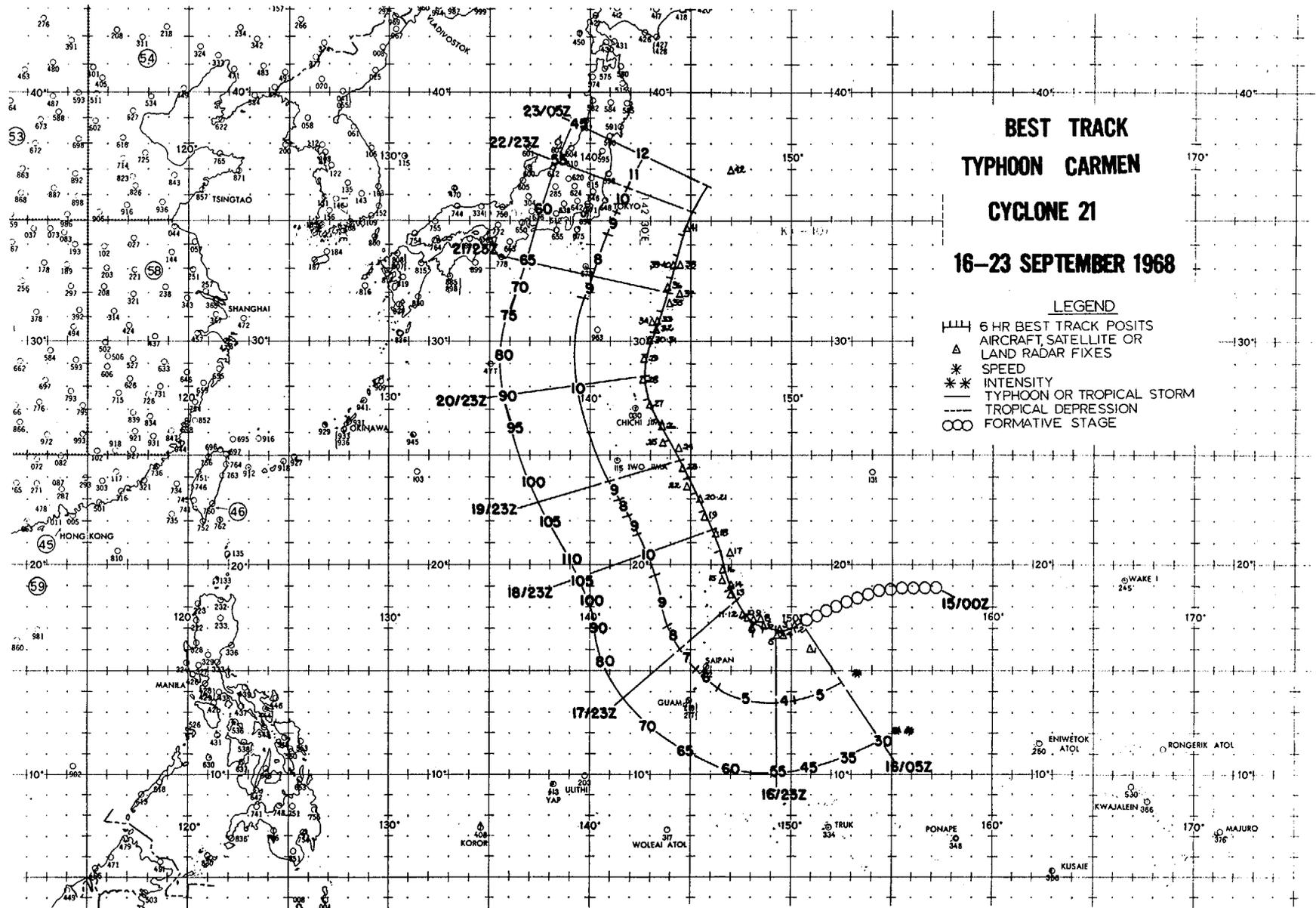
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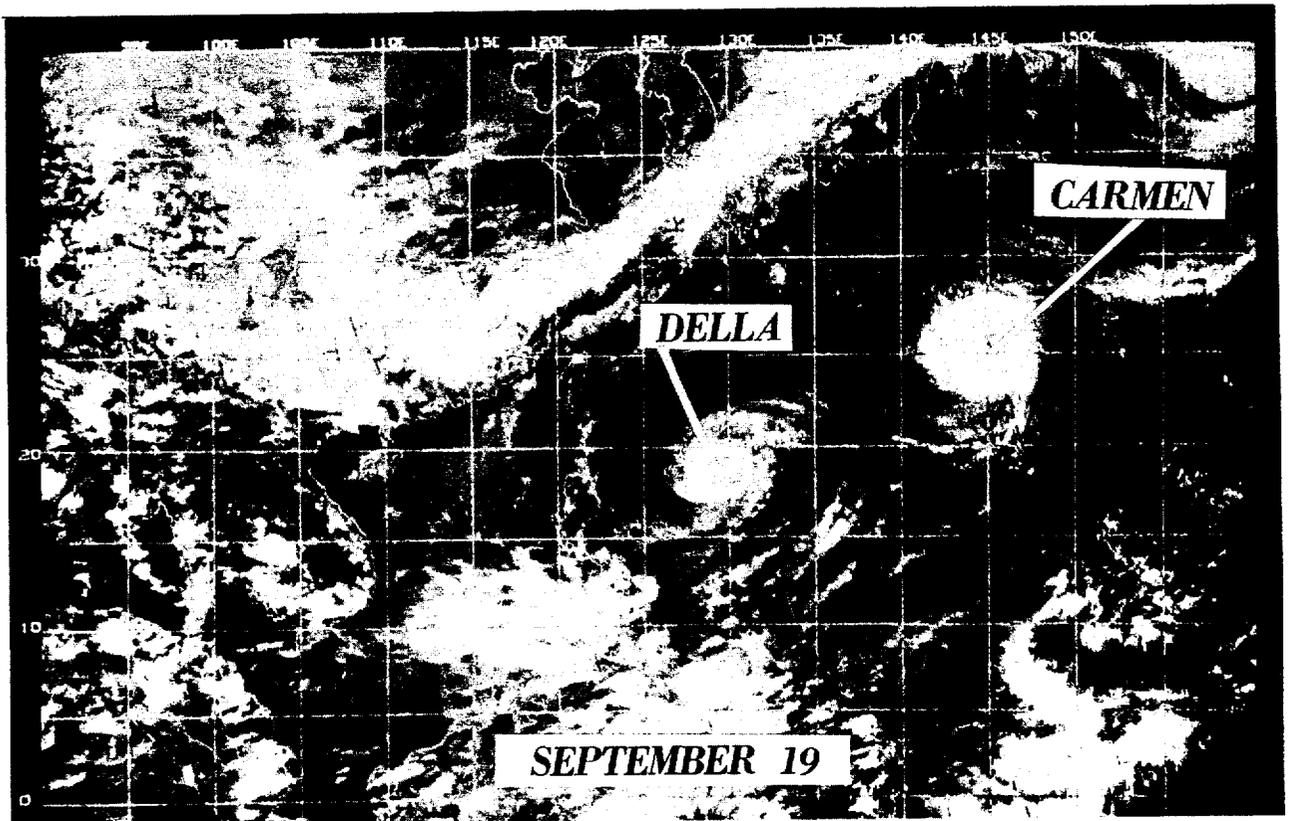
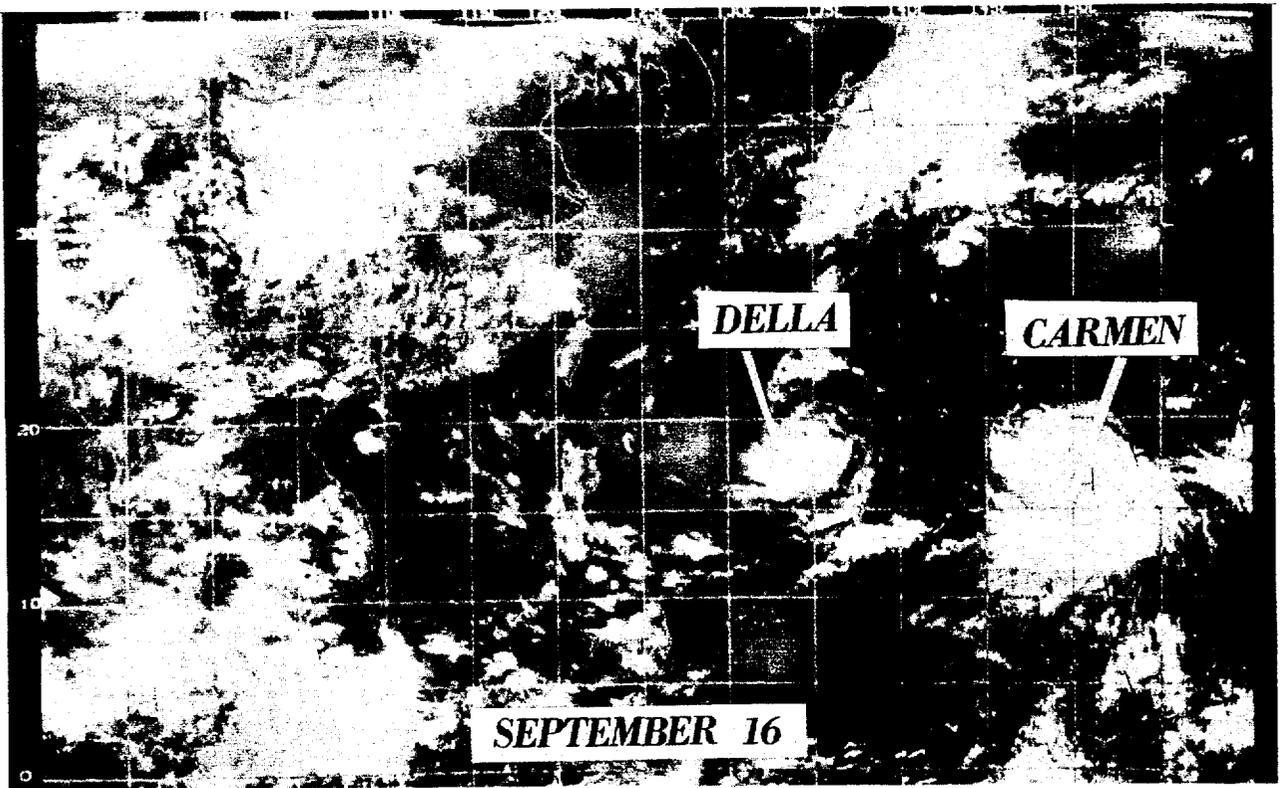


TROPICAL CYCLONE 21 - 09/16/0500Z TO 09/23/0500Z
(CARMEN)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 30
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 17
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1380 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 935MBS AT 190300Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2530M. AT 190300Z
 3. MAXIMUM SURFACE WIND - 110 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 1. JUNCTION VORTEX AT 150000Z
 2. SURFACE PRESSURE LESS THAN 1010MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - NORTHEAST
 2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

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FIX NO.	TIME	POSIT	EYE FIXES CYCLONE				21		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	BND5						
1	160436Z	16.0N 151.0E	SLTLS	STG -	DIA --	BND5 -								
2	160835Z	17.1N 150.1E	VW-P-05-05	0300M	047	045	991	---	24/22	CIRC	----	40	--	
3	161230Z	17.0N 149.5E	VW-R----15		---	---	---	---	--/--	----			--	
4	161435Z	16.8N 149.7E	VW-P-05-15	0330M	040	---	990	3005	24/22	CIRC	----	50	--	
5	162100Z	16.9N 149.3E	54-P-02-03	0460M	050	040	985	---	26/20	----			--	
6	170300Z	17.1N 148.6E	54-P-10-05	700MB	055	040	981	2899	15/10	----			--	
7	170531Z	17.0N 148.0E	SLTLS	STG X	DIA 04	BND5 4								
8	170720Z	17.2N 148.5E	VW-R----10		---	---	---	---	--/--	----			--	
9	170820Z	17.4N 148.1E	VW-P-03-01		---	050	---	---	24/22	CIRC	----	35	--	
10	171200Z	17.4N 147.8E	VW-R-03-05		---	---	---	---	--/--	CIRC	----	30	--	
11	171405Z	17.5N 147.8E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	30	--	
12	172100Z	17.9N 147.4E	54-P-05-01	700MB	063	070	950	2664	20/11	CIRC	----	20	--	
13	180300Z	18.6N 147.0E	54-P-05-05	700MB	080	080	944	2539	23/12	CIRC	----	18	05	
14	180431Z	19.0N 147.0E	SLTLS	STG X	DIA 05	BND5 3								
15	180837Z	19.2N 146.7E	VW-P-03-05	700MB	090	090	956	2412	16/10	CIRC	----	12	--	
16	181210Z	19.8N 146.6E	VW-R-05-10		---	---	---	---	--/--	CIRC	----	12	08	
17	181410Z	20.5N 147.0E	VW-R-02-05		---	---	---	---	--/--	----			--	
18	182120Z	21.4N 146.2E	54-P-05-05	700MB	065	080	950	2560	17/14	CIRC	----	20	--	
19	190300Z	22.1N 145.8E	54-P-05-05	700MB	090	085	935	2530	17/13	CIRC	----	20	--	
20	190526Z	23.0N 145.5E	SLTLS	STG X	DIA 06	BND5 4								
21	190915Z	23.0N 145.4E	VW-P-05-03	0450M	---	100	939	2632	26/22	CIRC	----	35	05	
22	191410Z	23.6N 144.9E	VW-R-10-10	3300M	050	---	---	---	--/--	CIRC	----	30	08	
23	192100Z	24.4N 144.7E	54-P-03-05	700MB	080	085	936	2536	19/14	CIRC	----	30	--	
24	200230Z	25.3N 144.3E	54-P-03-10	700MB	090	085	939	2554	18/12	CIRC	----	40	--	

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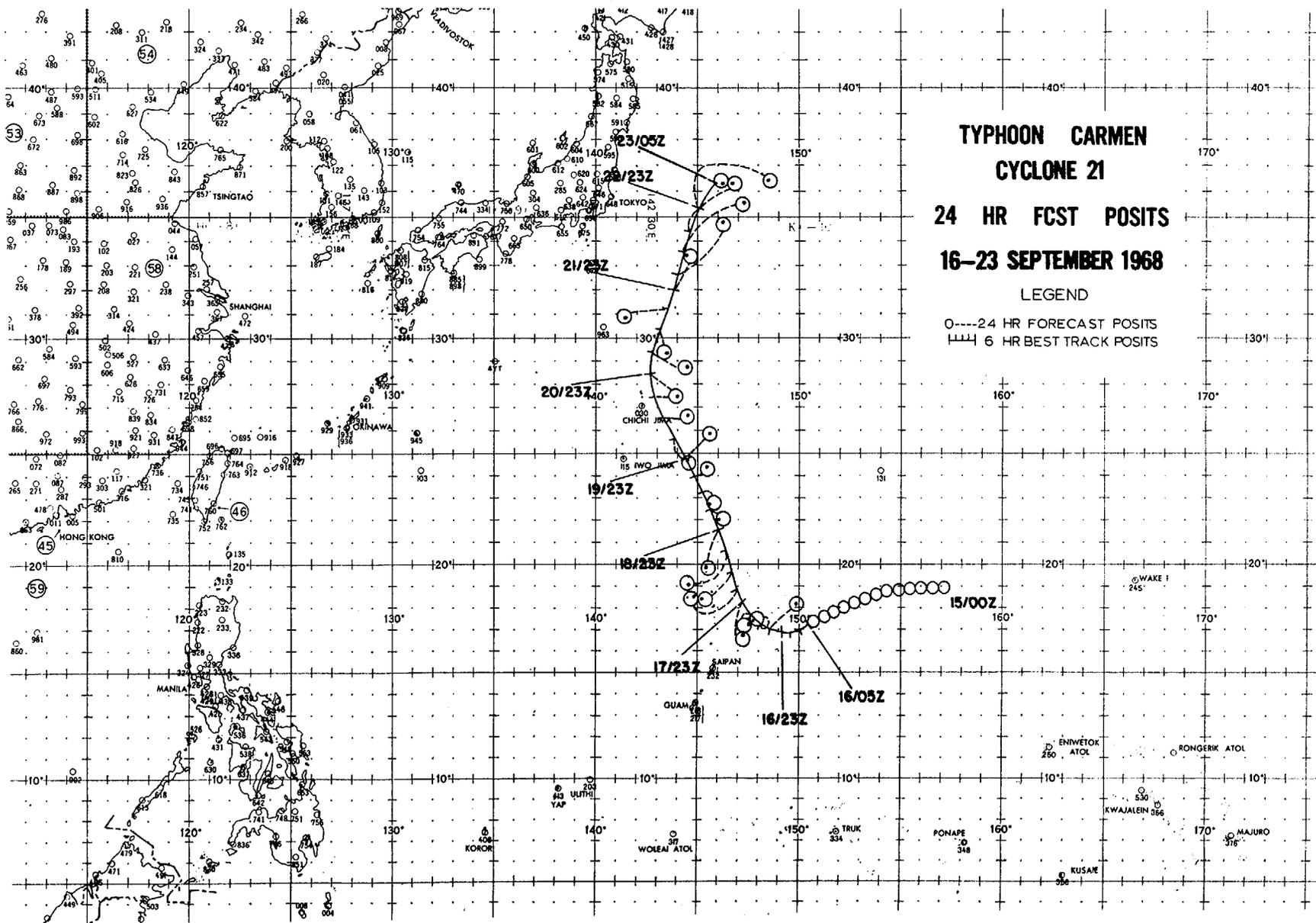
FIX NO.	TIME	POSIT		UNIT- METHOD -ACCY	EYE FIXES CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
					FLT LVL	FLY WND								
25	200426Z	25.5N	143.5E	SLTLS	STG X	DIA 05	BND5 4							
26	200910Z	26.2N	143.7E	VW-P-05-03	700MB	100	---	942	2628	17/13	CONC		70-20	10
27	201405Z	27.1N	143.0E	VW-R-03-03		---	---	---	---	--/--	CONC		65-25	10
28	202115Z	28.3N	142.7E	54-P-03-03	700MB	080	055	958	2722	16/--	CONC		70-30	--
29	210200Z	29.2N	142.8E	54-P-03-03	700MB	070	065	953	2685	16/12	CIRC	----	30	--
30	210521Z	30.0N	143.0E	SLTLS	STG X	DIA 04	BND5 3							
31	210800Z	30.0N	143.0E	VW-R----15		---	---	---	---	--/--	----			--
32	210910Z	30.5N	143.2E	VW-P-05-05	0280M	052	065	957	2816	24/23	CONC		70-30	--
33	211222Z	30.7N	143.4E	ACFT RDR		---	---	---	---	--/--	----			--
34	211405Z	30.8N	143.2E	VW-P-10-10	700MB	---	---	964	2792	16/13	CIRC	----	50	--
35	212107Z	31.7N	144.0E	54-P-05-05	700MB	062	050	959	2729	16/14	CIRC	----	40	--
36	220240Z	32.2N	143.9E	54-P-05-10	700MB	075	060	963	2762	16/14	----			--
37	220426Z	32.0N	144.5E	SLTLS	STG X	DIA 04	BND5 2							
38	220905Z	33.1N	144.5E	VW-R----10		---	---	---	---	--/--	----			--
39	220925Z	33.2N	144.2E	VW-P-03-06	0450M	---	055	974	---	24/22	CIRC	----	50	--
40	221420Z	33.1N	144.3E	VW-R-04-08		---	---	---	---	--/--	CIRC	----	50	F.8.
41	222100Z	34.8N	144.9E	54-P-05-05	700MB	062	025	972	2871	13/12	CIRC	----	50	--
42	230520Z	37.0N	147.0E	SLTLS	STG X	DIA 04	BND5 2							

TROPICAL CYCLONE 21 -- 09/16/0500Z TO 09/23/0500Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HR. ERROR	48 HR. ERROR	72 HR. ERROR
	LAT.	LONG.	DEG. DIST.	DEG. DIST.	DEG. DIST.
161100Z	17.0N	150.0E	-----	-----	-----
161700Z	16.9N	149.6E	-----	-----	-----
162300Z	16.9N	149.2E	-----	-----	-----
170500Z	17.0N	148.6E	048-009	-----	-----
171100Z	17.2N	148.2E	288-0018	-----	-----
171700Z	17.6N	147.6E	180-0030	-----	-----
172300Z	18.2N	147.2E	180-0084	-----	-----
180500Z	18.9N	146.9E	258-0108	-----	-----
181100Z	19.8N	146.7E	226-0114	215-0180	-----
181700Z	20.7N	146.5E	226-0144	208-0228	-----
182300Z	21.7N	146.1E	199-0108	191-0288	-----
190500Z	22.5N	145.7E	158-0030	245-0264	-----
191100Z	23.2N	145.3E	153-0024	231-0264	-----
191700Z	23.9N	144.9E	037-0030	231-0276	211-0366
192300Z	24.7N	144.4E	040-0090	216-0102	-----
200500Z	25.6N	143.9E	150-0060	112-0078	239-0330
201100Z	26.5N	143.4E	085-0060	093-0102	-----
201700Z	27.4N	142.9E	090-0054	064-0102	227-0372
202300Z	28.4N	142.7E	132-0084	069-0180	-----
210500Z	29.4N	142.9E	111-0096	160-0192	116-0144
211100Z	30.4N	143.2E	175-0072	104-0120	-----
211700Z	31.2N	143.5E	261-0108	098-0114	069-0240
212300Z	32.0N	143.8E	023-0078	119-0120	-----
220500Z	32.7N	144.1E	039-0162	091-0174	178-0294
221100Z	33.5N	144.3E	051-0186	167-0084	-----
221700Z	34.3N	144.7E	044-0156	234-0030	107-0258
222300Z	35.2N	145.2E	068-0174	062-0318	-----
230500Z	36.3N	145.9E	244-0012	074-0234	092-0438

AVERAGE 24 HOUR ERROR - 0087 MI.
 AVERAGE 48 HOUR ERROR - 0172 MI.
 AVERAGE 72 HOUR ERROR - 0305 MI.

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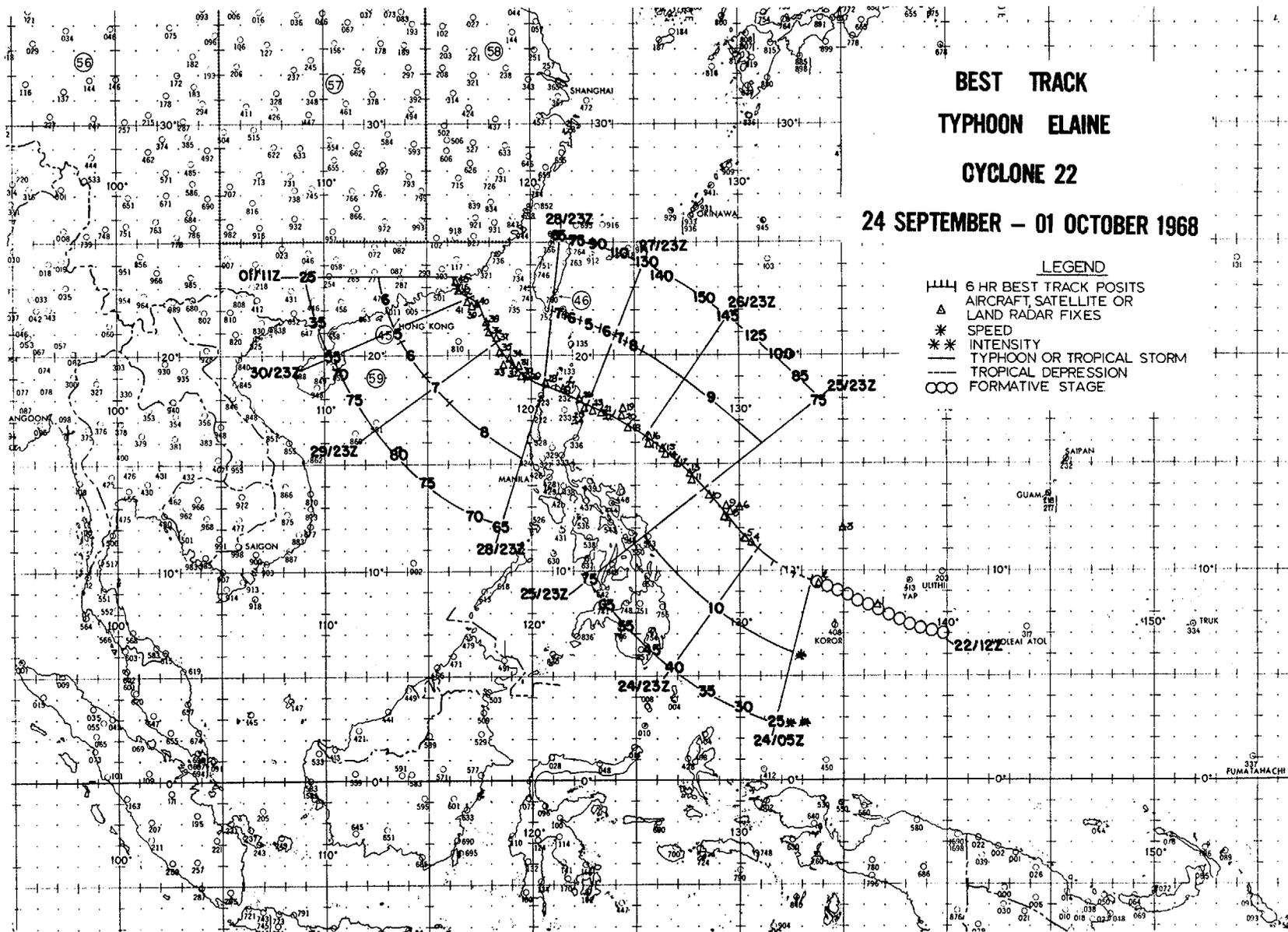
TROPICAL CYCLONE 22 - 09/24/0500Z TO 10/01/1100Z
(ELAINE)

- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 32
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 19
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1326 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 908MBS AT 270300Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2234M. AT 270820Z
 - 3. MAXIMUM SURFACE WIND - 150 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 540 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 221200Z
 - 2. SURFACE PRESSURE LESS THAN 1008MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - EAST
 - 2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC
- III. FINAL DISPOSITION - DISSIPATED OVER LAND

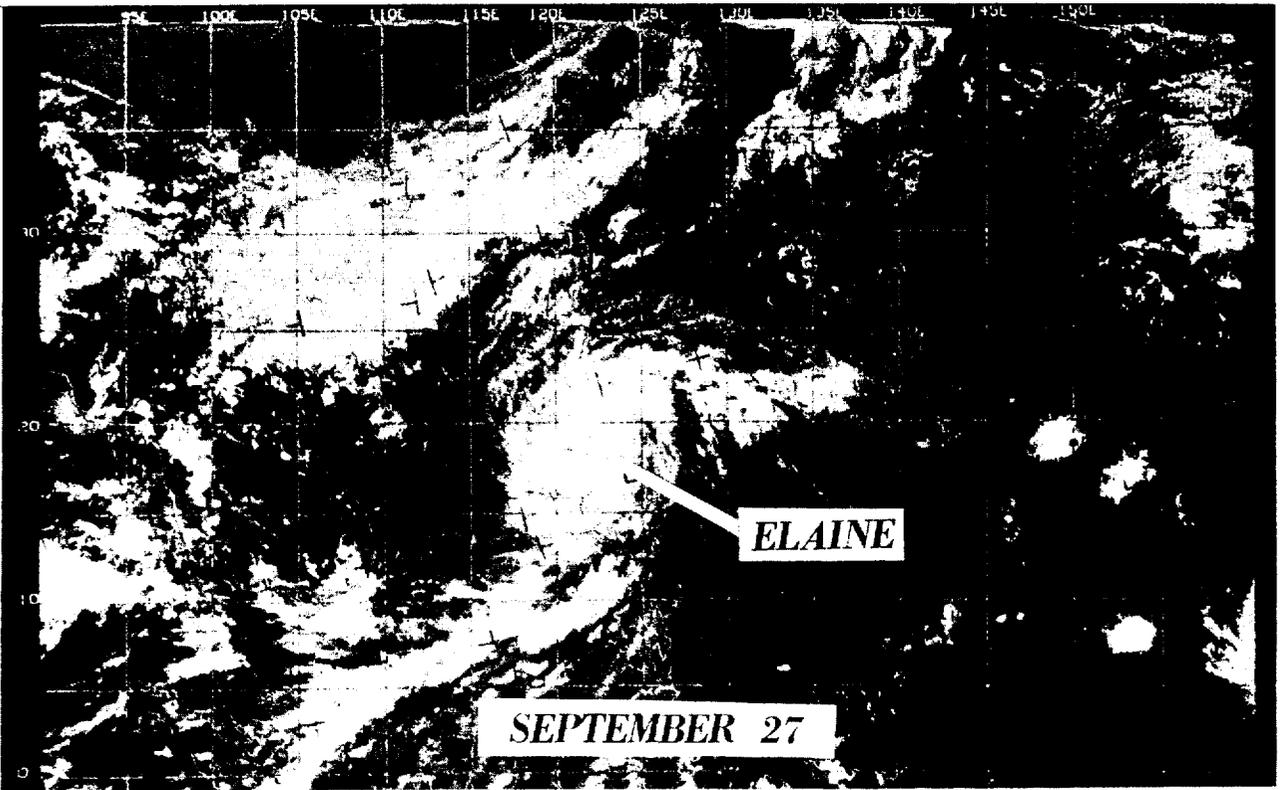
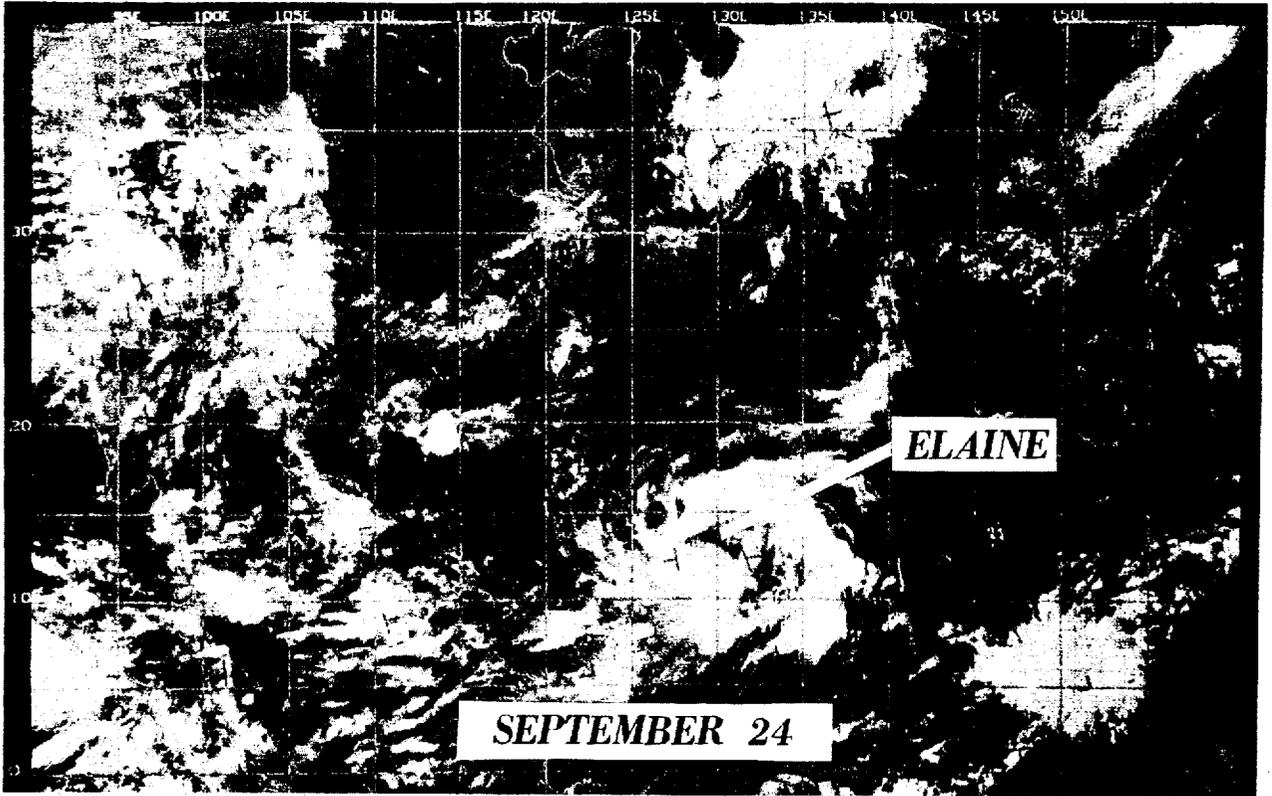
**BEST TRACK
TYPHOON ELAINE
CYCLONE 22**

24 SEPTEMBER - 01 OCTOBER 1968

- LEGEND**
- 6 HR BEST TRACK POSITS
 - △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - * SPEED
 - * * INTENSITY
 - TYPHOON OR TROPICAL STORM
 - TROPICAL DEPRESSION
 - ○ ○ FORMATIVE STAGE



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Fix NO.	TIME	POSIT	EYE FIXES CYCLONE			22		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
1	230555Z	08.4N 136.8E	VW-P-10-10	0450M	---	025	004	---	25/26	CIRC	----	45	--	
2	240230Z	09.3N 133.9E	54-P-03-20	0500M	013	020	003	---	25/--	CIRC	----	60	--	
3	240607Z	12.0N 135.0E	SLTLS	STG B	DIA	--	BNDS -							
4	242100Z	11.3N 130.5E	54-P-05-05	700MB	043	---	981	2908	15/12	----			--	
5	250230Z	11.5N 130.3E	54-P-10-05	700MB	057	050	976	2899	17/11	CIRC	----	09	--	
6	250511Z	13.0N 130.0E	SLTLS	STG B	DIA	--	BNDS -							
7	251115Z	12.6N 129.2E	VW-R----	15	---	---	---	---	--/--	----			--	
8	251200Z	12.8N 129.5E	VW-P-15-05	0270M	040	035	986	---	24/23	CIRC	----	12	--	
9	251400Z	13.0N 129.3E	VW-P-10-05	0460M	050	045	987	---	24/23	----			--	
10	252032Z	13.5N 128.6E	VW-P-03-03	0400M	---	045	984	---	24/22	CIRC	----	20	--	
11	260300Z	14.2N 127.8E	54-P-03-03	700MB	050	060	961	2755	17/12	CIRC	----	10	10	
12	260602Z	15.0N 127.0E	SLTLS	STG X	DIA	02	BNDS 2							
13	260815Z	14.7N 127.7E	54-P-03-01	700MB	075	080	955	2694	17/12	CIRC	----	10	--	
14	261325Z	15.5N 126.4E	VW-R----	10	---	---	---	---	--/--	----			--	
15	261400Z	15.6N 126.4E	VW-R-02-03	2130M	038	---	---	---	--/--	CIRC	----	03	05	
16	261830Z	16.2N 125.8E	VW-R----	05	---	---	---	---	--/--	CIRC	----	03	--	
17	262100Z	16.0N 125.7E	VW-R-03-02		---	---	---	---	--/--	CONC		15-05	--	
18	270300Z	16.8N 124.7E	54-P-05-02	700MB	075	100	908	2271	26/20	CIRC	----	05	03	
19	270657Z	17.5N 124.5E	SLTLS	STG X	DIA	04	BNDS 2							
20	270820Z	17.2N 124.4E	54-P-03-02	700MB	065	100	---	2234	20/14	CIRC	----	05	03	
21	271620Z	17.2N 123.3E	VW-R----	15	---	---	---	---	--/--	----			--	
22	271645Z	17.2N 123.2E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	07	--	
23	272000Z	17.4N 123.0E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	08	--	
24	280300Z	17.6N 122.6E	54-P-00-01	500MB	065	100	930	---	08/02	CIRC	----	03	03	

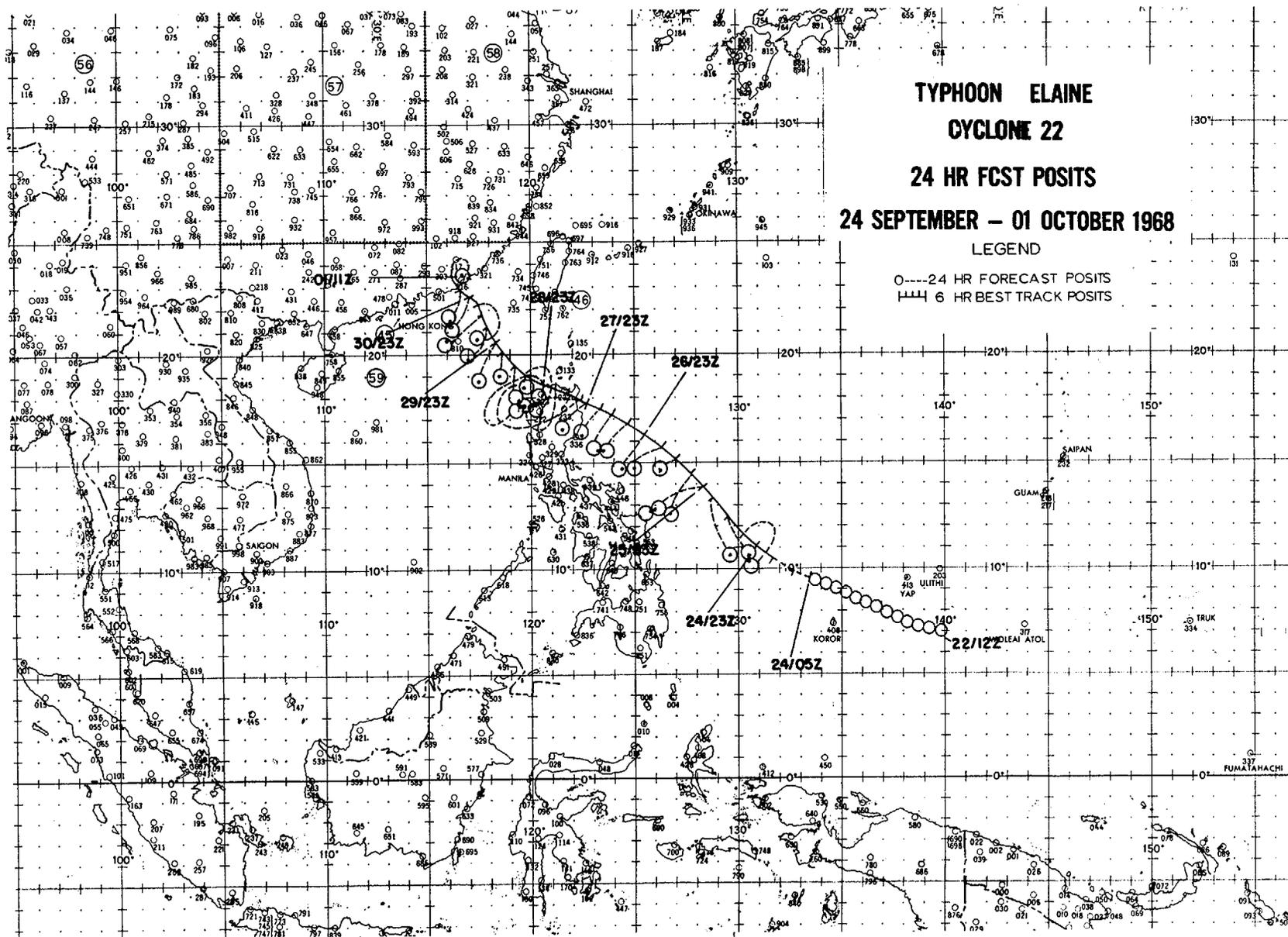
5-104

TROPICAL CYCLONE 22 -- 09/24/0500Z TO 10/01/1100Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
241700Z	10.5N	131.7E	-----	-----	-----
242300Z	11.0N	130.9E	-----	-----	-----
250500Z	11.7N	130.1E	171-0084	-----	-----
251100Z	12.5N	129.4E	153-0132	-----	-----
251700Z	13.3N	128.8E	163-0168	-----	-----
252300Z	13.9N	128.2E	245-0138	-----	-----
260500Z	14.5N	127.6E	203-0108	-----	-----
261100Z	15.1N	126.9E	237-0042	-----	-----
261700Z	15.8N	126.3E	231-0090	-----	-----
262300Z	16.3N	125.5E	214-0108	240-0240	-----
270500Z	16.8N	124.7E	221-0102	196-0198	-----
271100Z	17.1N	124.0E	201-0102	224-0186	-----
271700Z	17.3N	123.3E	214-0084	230-0234	-----
272300Z	17.6N	122.7E	226-0090	230-0228	-----
280500Z	17.8N	122.3E	273-0108	236-0168	208-0222
281100Z	18.1N	121.8E	278-0120	234-0168	-----
281700Z	18.3N	121.2E	246-0084	224-0204	243-0378
282300Z	18.6N	120.5E	222-0072	234-0192	-----
290500Z	19.0N	119.8E	171-0078	243-0216	242-0186
291100Z	19.5N	119.2E	172-0096	237-0294	-----
291700Z	20.1N	118.7E	191-0066	221-0300	220-0276
292300Z	20.7N	118.3E	203-0120	217-0312	-----
300500Z	21.2N	118.0E	213-0096	193-0252	232-0420
301100Z	21.8N	117.7E	234-0108	196-0252	-----
301700Z	22.2N	117.4E	180-0090	212-0252	228-0540
302300Z	22.5N	117.0E	212-0090	221-0258	-----
010500Z	22.9N	116.5E	191-0096	206-0174	202-0420

AVERAGE 24 HOUR ERROR - 0098 MI.
 AVERAGE 48 HOUR ERROR - 0229 MI.
 AVERAGE 72 HOUR ERROR - 0348 MI.

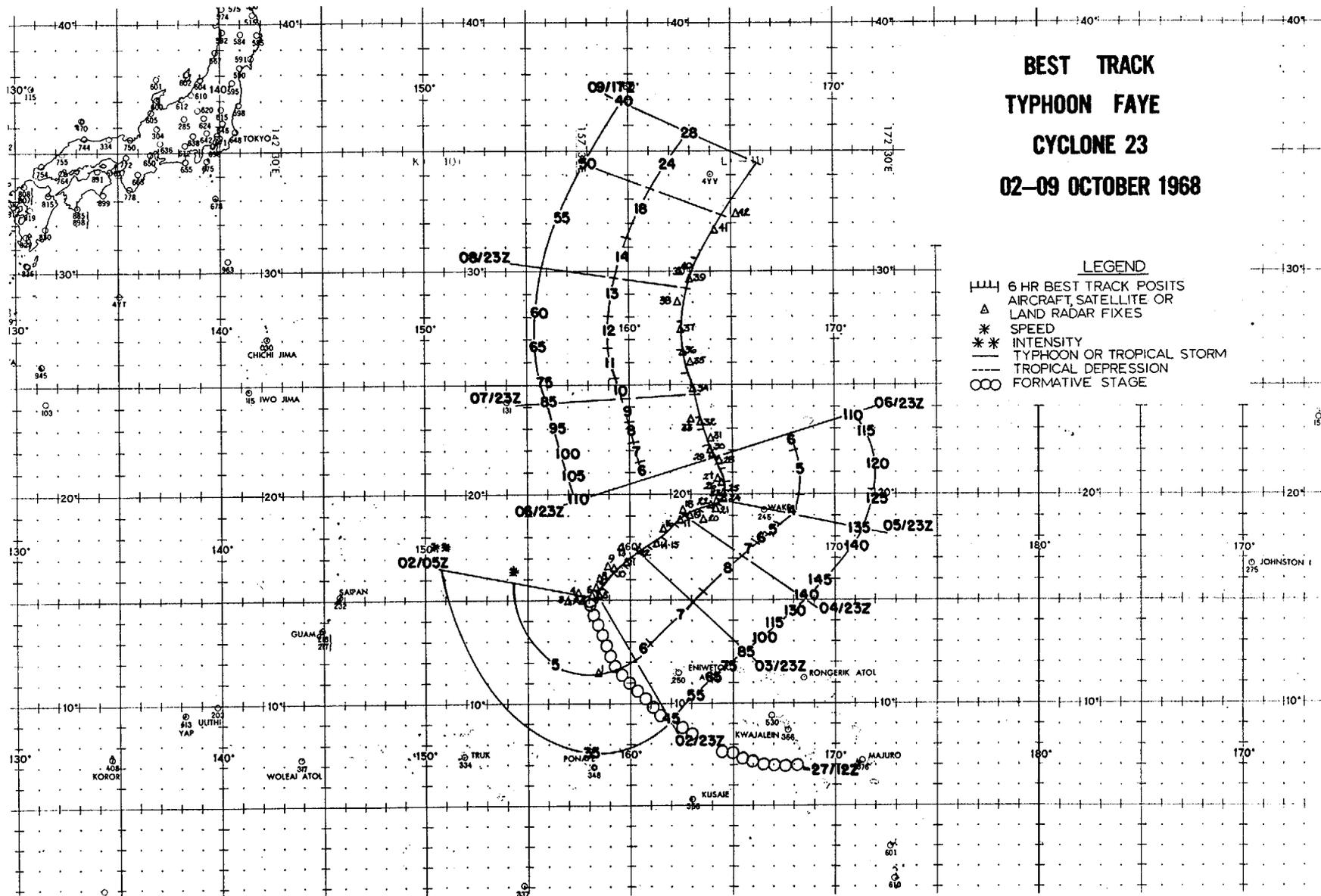
S-107

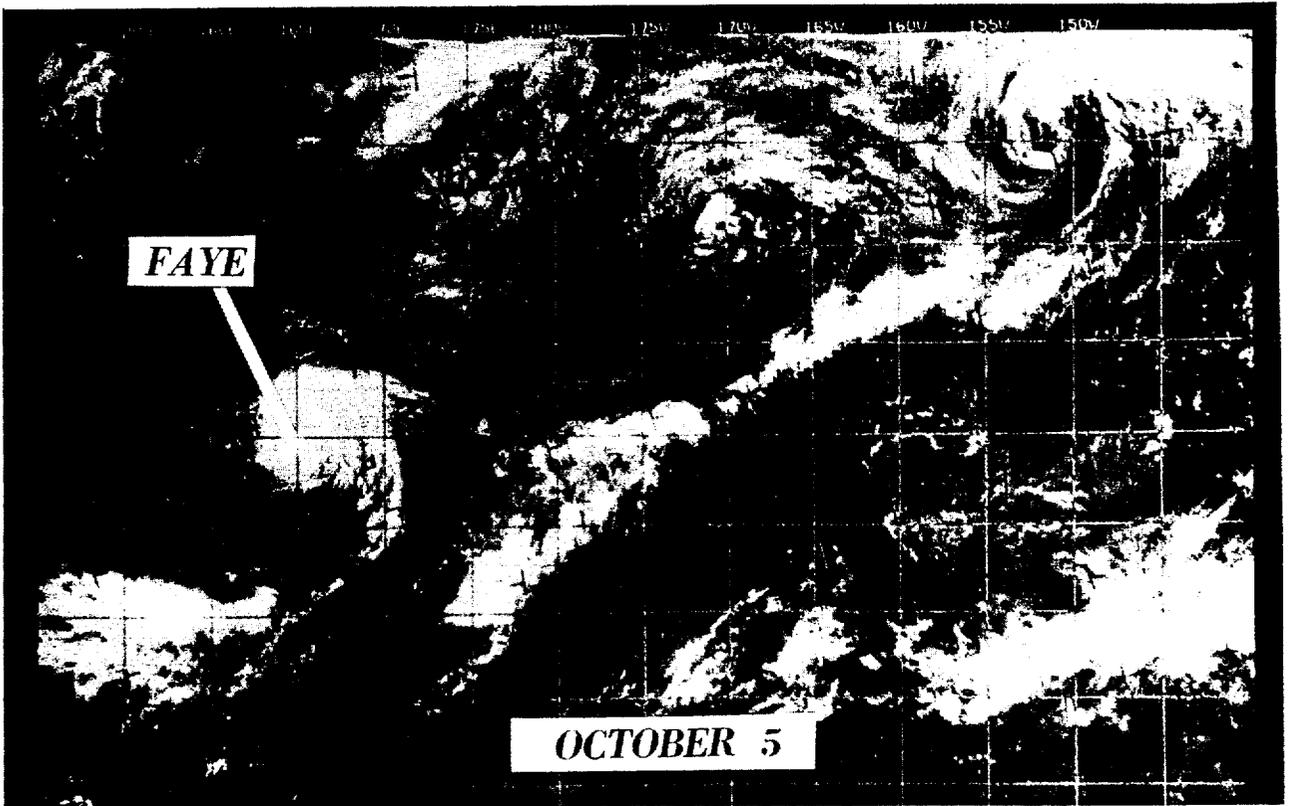
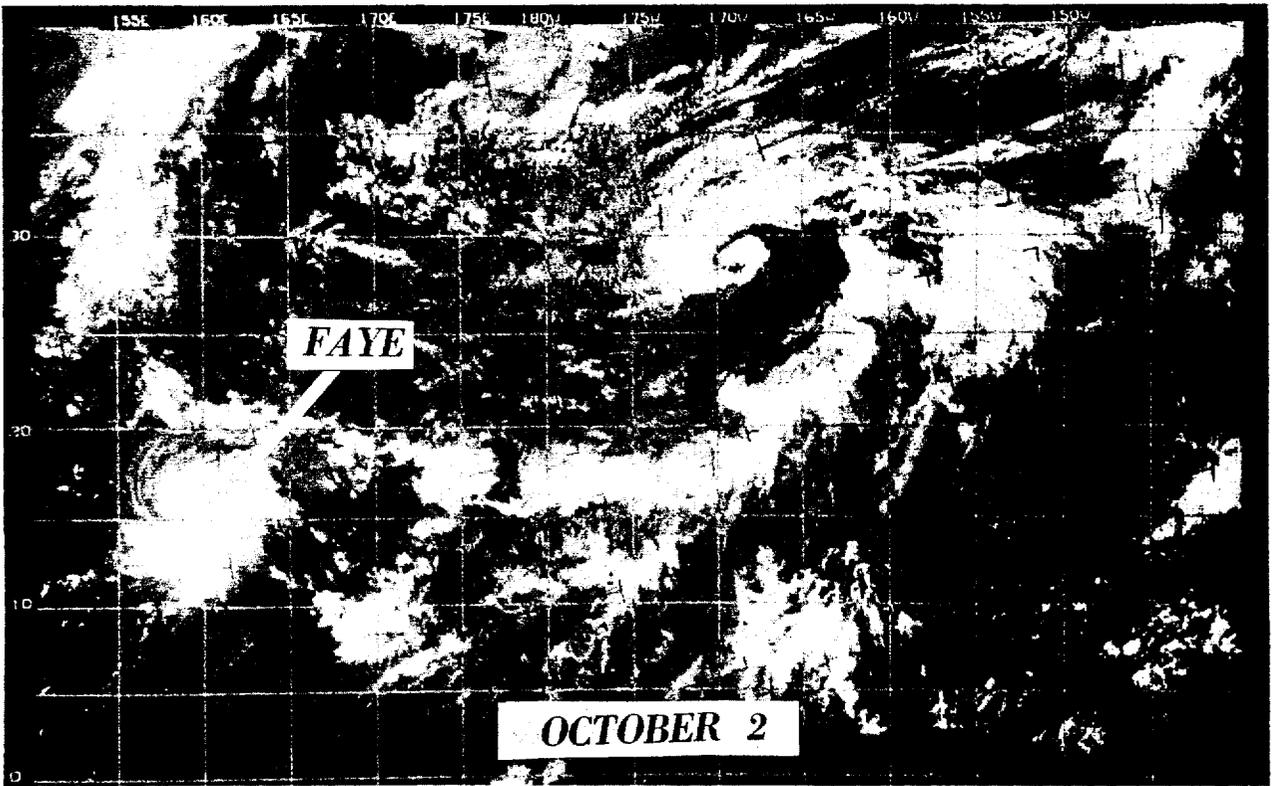


TROPICAL CYCLONE 23 - 10/02/0500Z TO 10/09/1700Z
(FAYE)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 31
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 21
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1500 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 911MBS AT 050200Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2298M. AT 050200Z
 3. MAXIMUM SURFACE WIND - 145 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 600 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION
 - B. INITIAL SURFACE VORTEX
 1. JUNCTION VORTEX AT 271200Z
 2. SURFACE PRESSURE LESS THAN 1007MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - EAST
 2. UPON REACHING TYPHOON INTENSITY - NORTHWEST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

S-110





FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND								
1	010301Z	11.5N 158.5E	SLTLS	STG C	DIA --	BNDS -							
2	020350Z	15.0N 157.8E	54-P-10-03	0470M	035	035	996	---	28/25	CIRC	----	03	F.B.
3	020352Z	15.0N 157.0E	SLTLS	STG B	DIA --	BNDS -							
4	021006Z	15.2N 157.5E	VW-P-05-01	0410M	---	030	000	---	27/24	CIRC	----	03	F.B.
5	021450Z	15.2N 158.4E	VW-P-10-01	0510M	---	035	998	3087	27/24	CIRC	----	03	F.B.
6	022130Z	15.2N 158.1E	54-P-06-02	700MB	050	055	982	2951	17/--	CIRC	----	20	--
7	030230Z	15.5N 158.3E	54-P-06-02	700MB	041	070	976	2883	18/12	CIRC	----	20	--
8	030447Z	16.0N 158.5E	SLTLS	STG X	DIA 03	BNDS 2							
9	030850Z	15.8N 159.0E	VW-R-05-05		---	---	---	---	--/--	CIRC	----	14	--
10	031400Z	16.5N 159.1E	VW-R-05-02		---	---	---	---	--/--	CIRC	----	14	--
11	032125Z	16.9N 159.9E	54-P-12-02	700MB	050	075	952	2688	17/12	CIRC	----	14	--
12	040215Z	17.3N 160.4E	54-P-05-01	700MB	085	080	933	2530	21/13	CIRC	----	15	--
13	040351Z	17.5N 160.5E	SLTLS	STG X	DIA 03	BNDS 3							
14	040820Z	17.8N 161.4E	VW-R----15		---	---	---	---	--/--	----			--
15	040925Z	17.8N 161.4E	VW-P-10-03	700MB	070	---	944	2542	18/11	CIRC	----	10	07
16	041400Z	18.3N 161.8E	VW-R-05-05		---	---	---	---	--/--	CIRC	----	10	--
17	042100Z	18.9N 162.4E	54-P-10-01	700MB	065	090	919	2368	16/11	CIRC	----	07	--
18	050200Z	19.2N 162.7E	54-P-10-01	700MB	130	100	911	2298	17/11	CIRC	----	08	--
19	050215Z	19.0N 163.0E	SLTLS	STG X	DIA 04	BNDS 3							
20	050925Z	18.9N 163.8E	VW-R-10-05		---	---	---	---	--/--	CIRC	----	30	05
21	051200Z	19.2N 164.1E	VW-R-----		---	---	---	---	--/--	----			--
22	051400Z	19.5N 164.0E	VW-R-08-05		---	---	---	---	--/--	CIRC	----	30	--
23	052055Z	19.6N 164.2E	54-P-03-05	700MB	125	130	923	2411	16/10	CIRC	----	20	--
24	060300Z	19.9N 164.5E	54-P-01-03	700MB	152	120	918	2351	16/11	CIRC	----	15	04

5-112

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	FLY LVL WND	FLY LVL WND								
25	060346Z	20.0N 164.5E	SLTLS	STG X	DIA 03	BND5 4								
26	060929Z	20.5N 164.3E	VW-P-05-03	700MB	100	---	940	2560	21/11	CIRC	----	20	--	
27	061302Z	20.6N 164.3E	VW-R-03-10		---	---	---	---	--/--	CIRC	----	25	10	
28	062130Z	21.5N 164.4E	54-P-10-05	700MB	080	080	945	2530	18/11	CIRC	----	20	--	
29	070140Z	21.9N 164.0E	54-P-10-05	700MB	085	090	938	2570	21/12	----			--	
30	070246Z	22.0N 164.0E	SLTLS	STG X	DIA 04	BND5 3								
31	070900Z	22.7N 164.0E	VW-P-05-05	0270M	090	085	949	---	27/22	----			--	
32	071400Z	23.2N 163.4E	VW-R-05-10		---	---	---	---	--/--	----			--	
33	072100Z	24.4N 163.2E	54-P-05-04	700MB	050	045	956	2716	17/12	CIRC	----	20	--	
34	080300Z	24.9N 163.1E	54-P-15-05	700MB	075	050	959	2734	17/12	----			F.B.	
35	080340Z	26.0N 163.0E	SLTLS	STG X	DIA 04	BND5 3								
36	080825Z	26.4N 162.7E	VW-P-04-05	700MB	030	---	974	2833	16/12	----			F.B.	
37	081450Z	27.4N 162.4E	VW-P-05-05	700MB	065	---	974	2843	16/12	CIRC	----	35	F.B.	
38	082110Z	28.8N 162.3E	54-P-10-05	700MB	055	045	965	2798	16/--	----			--	
39	090200Z	29.8N 163.0E	54-P-15-10	700MB	070	---	966	2804	16/12	----			--	
40	090245Z	30.0N 162.5E	SLTLS	STG C	DIA --	BND5 -								
41	090915Z	31.8N 164.2E	VW-P-10-05	0240M	065	050	966	2824	24/20	----			--	
42	091300Z	33.3N 165.2E	VW-P-10-10	700MB	065	---	---	2798	13/11	----			--	
43	100336Z	41.0N 168.0E	SLTLS	STG C	DIA --	BND5 -								

TROPICAL CYCLONE 23 -- 10/02/0500Z TO 10/09/1700Z
 POSITION AND FORECAST VERIFICATION DATA

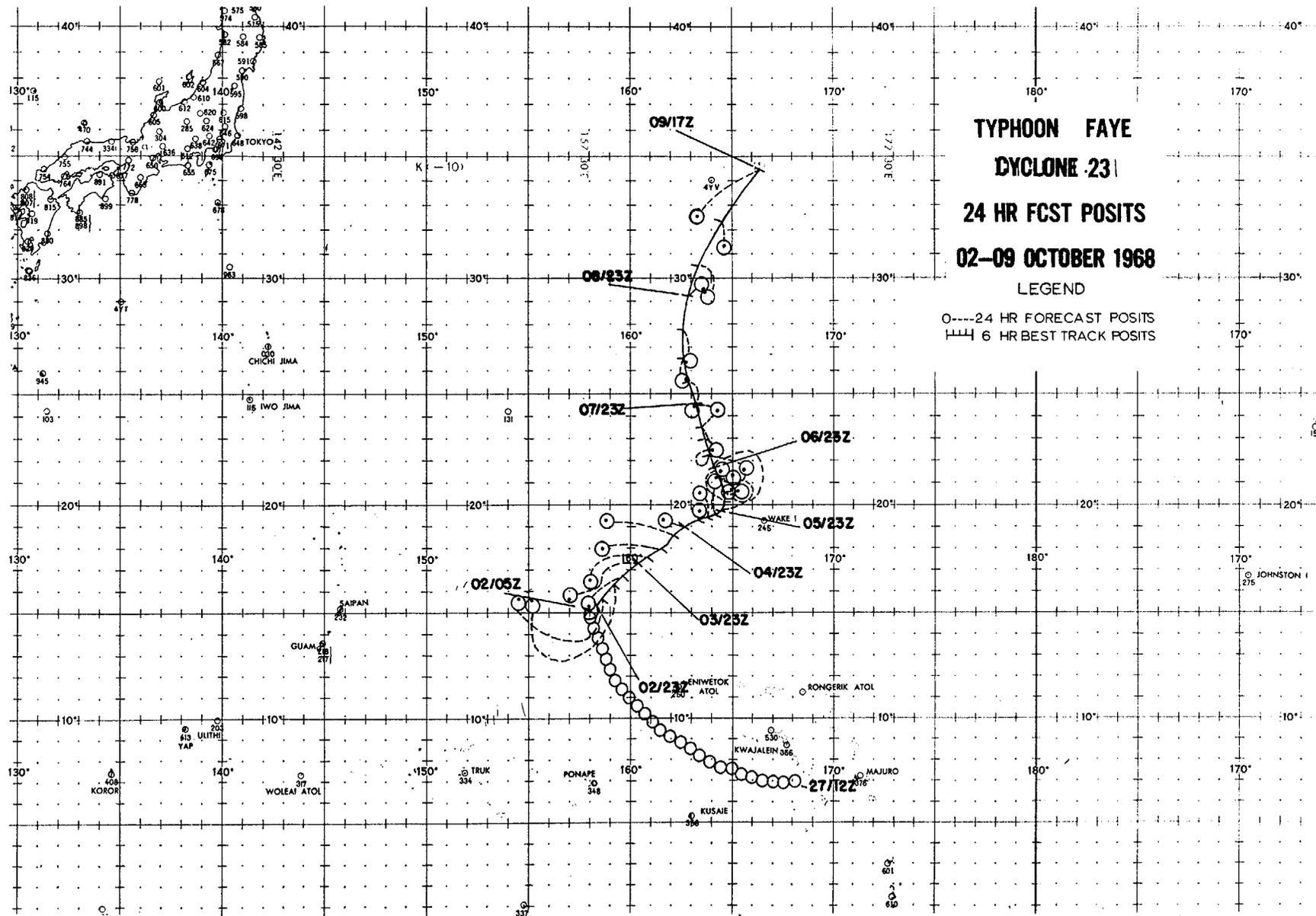
DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
021700Z	14.8N	158.1E	-----	-----	-----
022300Z	15.2N	158.3E	-----	-----	-----
030500Z	15.7N	158.6E	271-0234	-----	-----
031100Z	16.3N	159.1E	262-0228	-----	-----
031700Z	16.7N	159.6E	224-0126	-----	-----
032300Z	17.1N	160.2E	245-0198	-----	-----
040500Z	17.5N	160.8E	249-0162	-----	-----
041100Z	18.0N	161.5E	270-0150	-----	-----
041700Z	18.6N	162.1E	281-0180	-----	-----
042300Z	19.0N	162.6E	285-0042	255-0444	-----
050500Z	19.2N	163.3E	010-0036	270-0348	-----
051100Z	19.4N	163.8E	344-0066	285-0354	-----
051700Z	19.5N	164.1E	004-0096	296-0330	-----
052300Z	19.7N	164.4E	019-0090	324-0150	-----
060500Z	20.1N	164.5E	360-0084	009-0084	283-0486
061100Z	20.6N	164.5E	090-0036	356-0102	-----
061700Z	21.1N	164.4E	055-0048	013-0132	305-0378
062300Z	21.7N	164.1E	141-0072	049-0144	-----
070500Z	22.3N	163.9E	115-0096	042-0072	056-0072
071100Z	23.0N	163.7E	158-0030	115-0108	-----
071700Z	23.7N	163.4E	157-0078	095-0132	042-0156
072300Z	24.6N	163.1E	116-0066	137-0192	-----
080500Z	25.5N	162.8E	169-0066	124-0198	101-0090
081100Z	26.7N	162.5E	170-0072	149-0150	-----
081700Z	27.9N	162.3E	165-0096	156-0222	125-0258
082300Z	29.2N	162.6E	070-0048	150-0192	-----
090500Z	30.6N	163.4E	167-0078	188-0228	153-0330
091100Z	32.3N	164.5E	168-0060	197-0270	-----
091700Z	34.7N	166.1E	229-0186	202-0384	190-0504

AVERAGE 24 HOUR ERROR - 0100 MI.

AVERAGE 48 HOUR ERROR - 0211 MI.

AVERAGE 72 HOUR ERROR - 0284 MI.

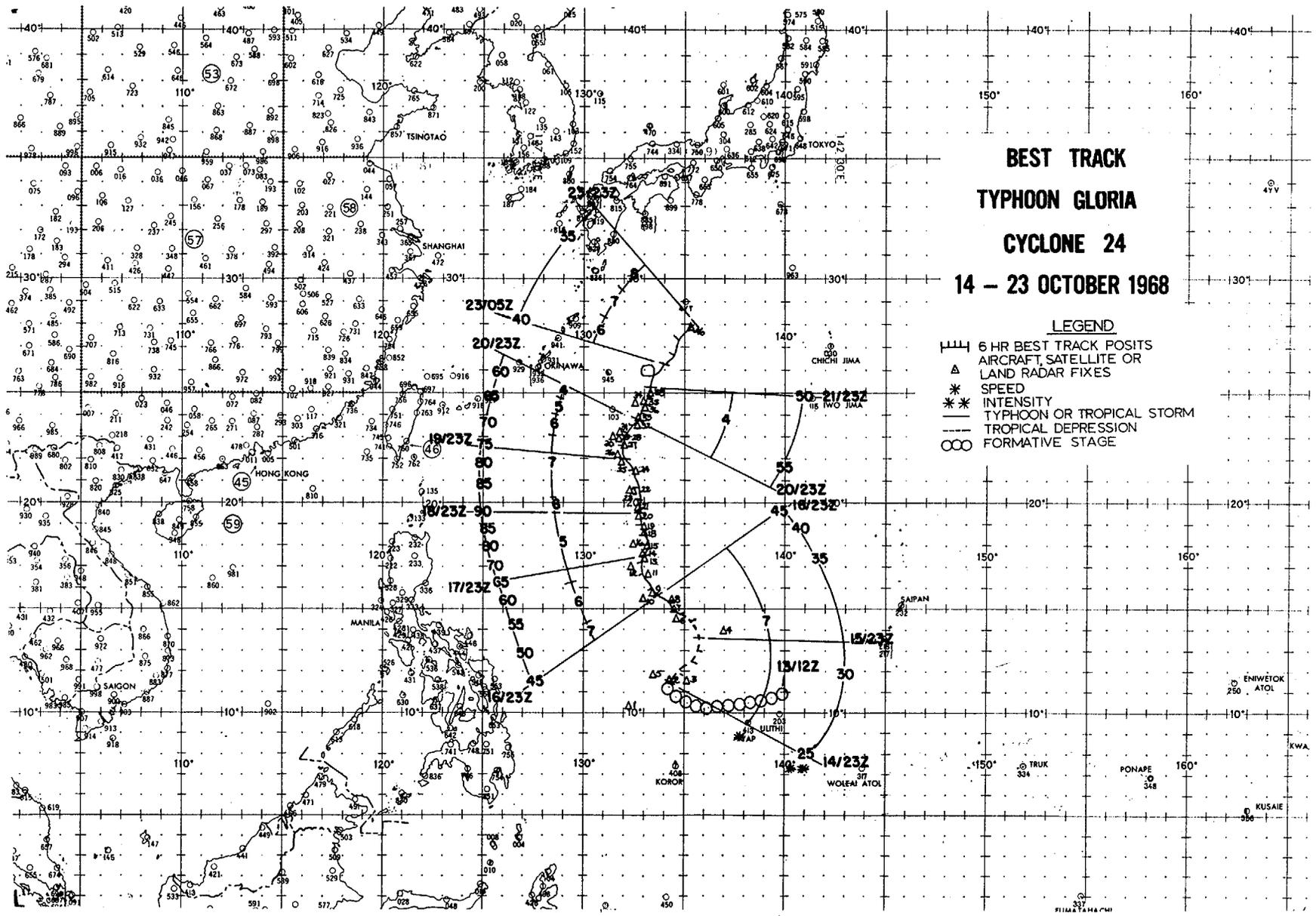
S-115



TROPICAL CYCLONE 24 - 10/14/2300Z TO 10/23/2300Z
(GLORIA)

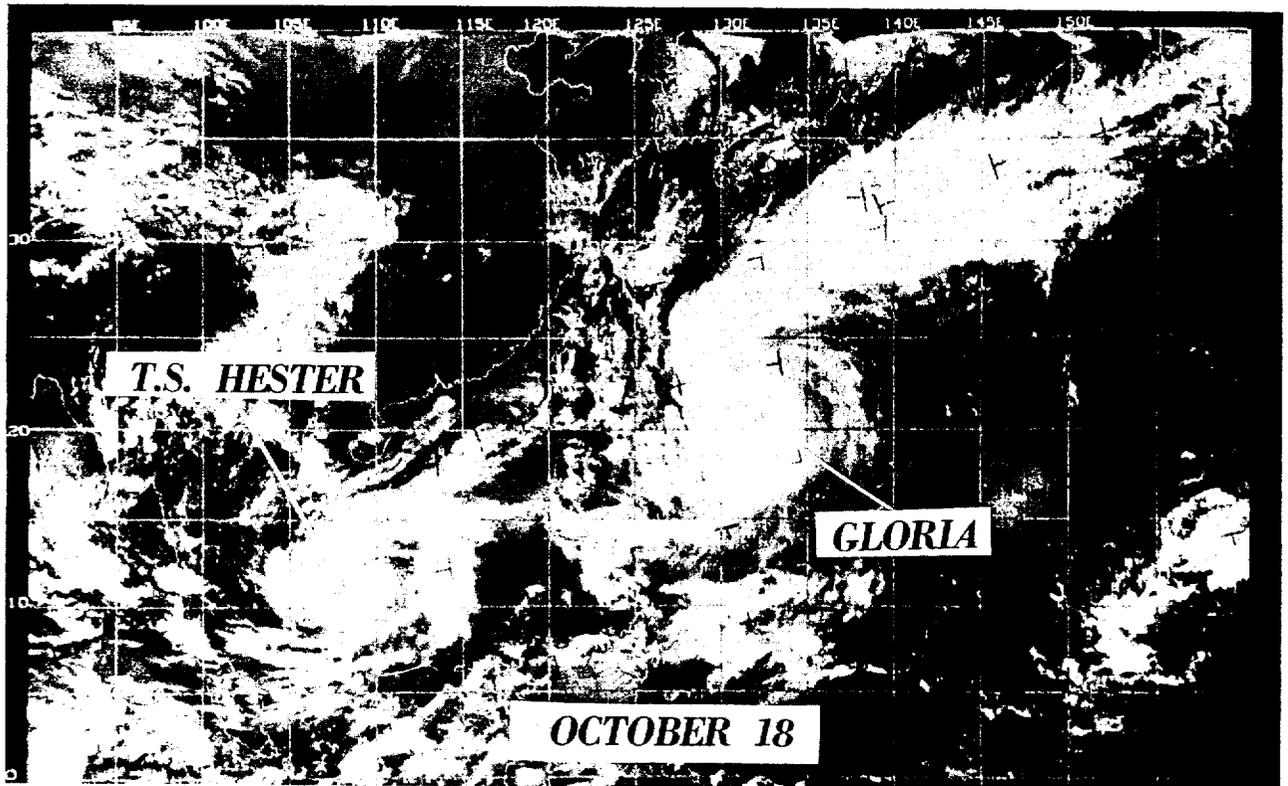
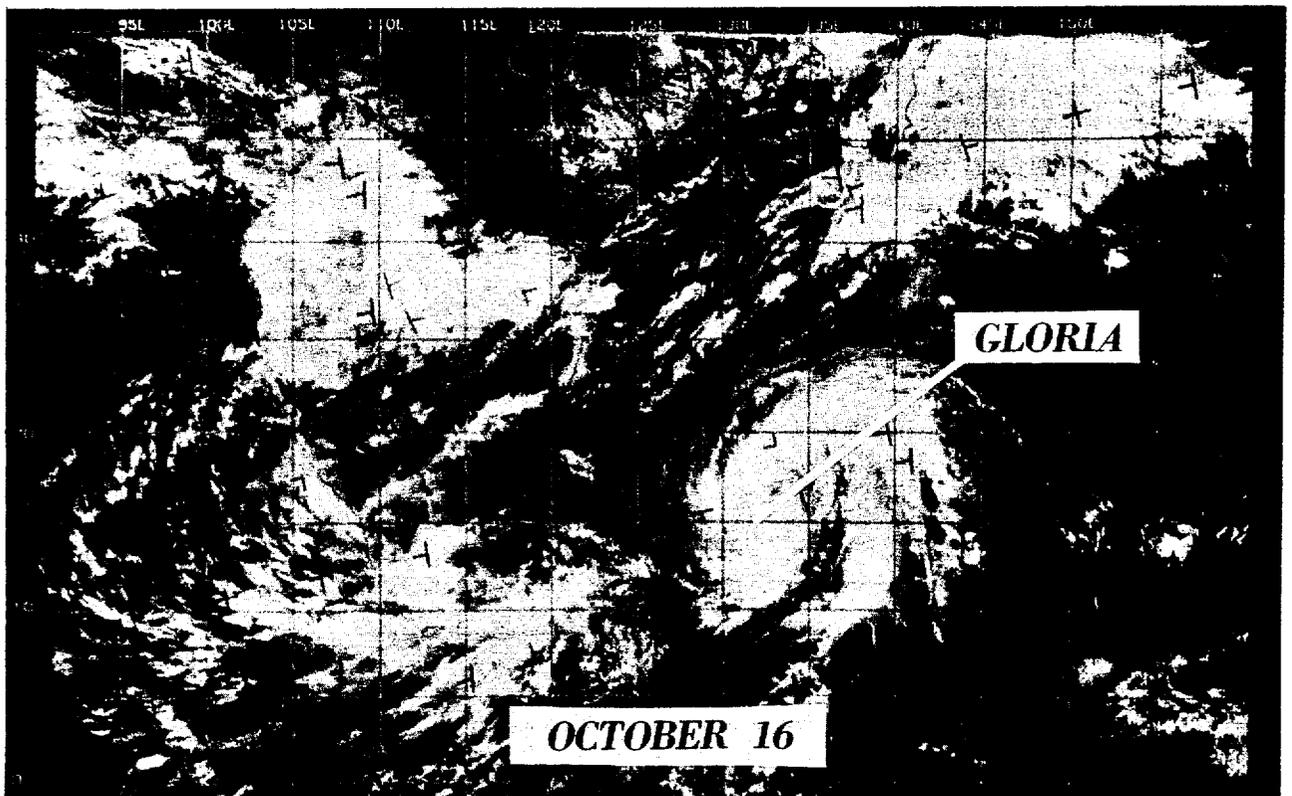
- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 37
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 13
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1236 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 942MBS AT 190300Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2716M. AT 190300Z
 - 3. MAXIMUM SURFACE WIND - 090 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 540 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 - 1. EMBEDDED VORTEX AT 131200Z
 - 2. SURFACE PRESSURE LESS THAN 1006MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - NORTHEAST
 - 2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

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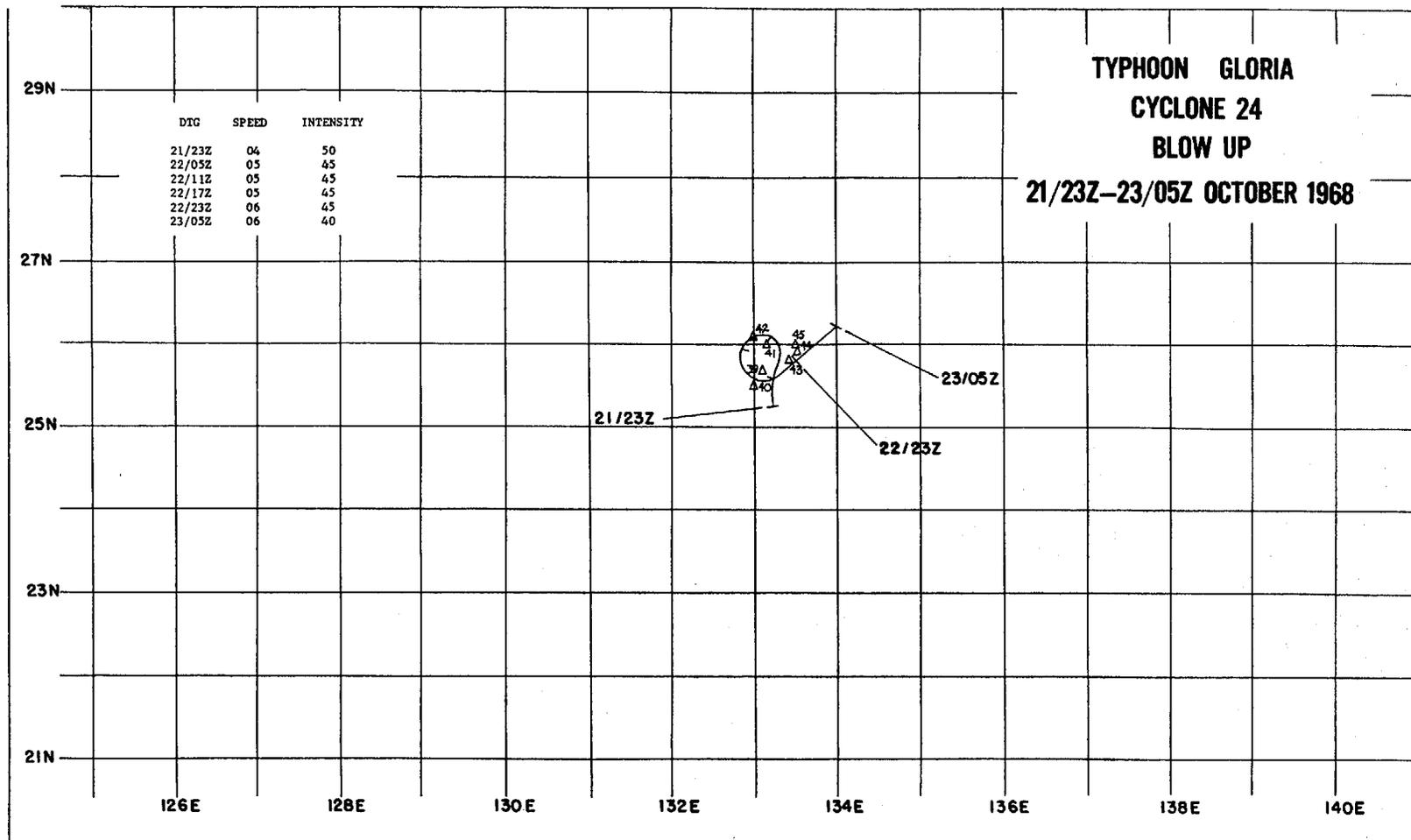


**BEST TRACK
TYPHOON GLORIA
CYCLONE 24
14 - 23 OCTOBER 1968**

- LEGEND**
- 6 HR BEST TRACK POSITS
 - ▲ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - * SPEED
 - ** INTENSITY
 - TYPHOON OR TROPICAL STORM
 - TROPICAL DEPRESSION
 - FORMATIVE STAGE



S-120



FIX NO.	TIME	POSIT	EYE FIXES CYCLONE				OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	24								
1	140230Z	10.3N 137.2E	54-P-03-20	0380M	020	020	004	---	23/22	CIRC	----	40	N.F.B.	
2	150100Z	11.7N 134.2E	54-P-03-10	0400M	027	025	001	---	26/26	----			N.F.B.	
3	150300Z	11.6N 135.1E	54-P-03-10	700MB	027	025	001	3027	12/12	----			N.F.B.	
4	150611Z	14.0N 137.0E	SLTLS	STG D	DIA	--	BNDS -							
5	150915Z	11.9N 133.4E	VW-P-----		---	---	000	---	--/--	----			N.F.B.	
6	160500Z	14.6N 134.8E	54-P-03-15	0310M	030	030	992	3011	26/--	----			N.F.B.	
7	160511Z	15.0N 134.5E	SLTLS	STG D	DIA	--	BNDS -							
8	162345Z	15.5N 134.4E	54-P-03-05	700MB	065	070	986	2978	13/10	----			--	
9	170300Z	15.8N 133.3E	54-P-03-01	700MB	065	070	980	2893	14/12	CIRC	----	10	--	
10	170606Z	15.5N 133.0E	SLTLS	STG D	DIA	--	BNDS -							
11	170845Z	16.8N 133.1E	VW-R-05-15	0320M	---	---	---	---	--/--	CIRC	----	45	F.B.	
12	171405Z	17.0N 132.3E	VW-R----15		---	---	---	---	--/--	----			--	
13	171510Z	17.3N 133.0E	VW-P-01-05	700MB	---	---	974	2865	16/13	CIRC	----	20	08	
14	172200Z	17.5N 133.0E	54-P-05-04	700MB	055	035	965	2798	16/--	CIRC	----	35	--	
15	180355Z	17.9N 133.1E	54-P-05-05	700MB	070	070	---	2758	18/10	CIRC	----	37	--	
16	180510Z	18.0N 132.5E	SLTLS	STG X	DIA	04	BNDS 4							
17	180815Z	18.5N 133.0E	VW-R-05-10	0380M	---	050	---	---	--/--	CIRC	----	80	F.B.	
18	181230Z	18.6N 133.0E	VW-P-05-05	700MB	050	---	---	2808	18/10	ELIP	NW-SE	85X50	F.B.	
19	181400Z	18.9N 133.0E	VW-R-05-10		---	---	---	---	--/--	ELIP	N-S	85X65	--	
20	182200Z	19.3N 132.8E	54-P-03-15	700MB	080	040	960	2734	17/--	ELIP	N-S	80X70	--	
21	190300Z	19.8N 132.8E	54-P-03-10	700MB	085	065	942	2716	18/13	CIRC	----	80	--	
22	190605Z	20.5N 132.5E	SLTLS	STG X	DIA	05	BNDS 3							
23	190930Z	20.5N 132.7E	VW-P-10-10	700MB	085	---	961	2754	17/11	CIRC	----	80	--	
24	191430Z	21.4N 132.6E	VW-R-05-15		---	---	---	---	--/--	CIRC	----	75	--	

FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			24		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
25	192200Z	21.9N 131.9E	54-P-07-05	700MB	075	---	964	2752	15/11	CIRC	----	50	--	
26	200000Z	22.2N 131.9E	54-P-07-05	700MB	070	070	963	2755	16/11	CIRC	----	50	--	
27	200305Z	22.5N 132.0E	54-P-07-03	700MB	080	065	965	2774	15/11	CIRC	----	50	--	
28	200505Z	23.0N 131.5E	SLTLS	STG X	DIA	05	BNDS	3						
29	200900Z	23.0N 131.8E	VW-P-05-05	700MB	075	---	960	2806	19/14	ELIP	N-S	55X45	--	
30	201215Z	23.1N 131.8E	VW-R-05-10		---	---	---	---	--/--	CIRC	----	50	--	
31	201425Z	23.1N 132.2E	VW-P-05-05	700MB	060	---	960	2791	18/12	CIRC	----	40	--	
32	202200Z	23.7N 132.6E	54-P-03-05	700MB	100	040	966	2822	18/12	----			--	
33	210200Z	23.9N 132.6E	54-P-03-10	700MB	055	040	964	2792	19/14	----			--	
34	210600Z	24.5N 132.5E	SLTLS	STG C	DIA	--	BNDS	-						
35	210925Z	24.6N 133.0E	VW-R-05-10		---	---	---	---	--/--	CIRC	----	60	--	
36	211225Z	24.4N 133.0E	VW-P-02-05	700MB	050	---	---	2880	18/11	CIRC	----	40	--	
37	211418Z	24.5N 133.0E	VW-P-02-05	700MB	---	---	---	2877	20/16	CIRC	----	40	--	
38	212200Z	25.0N 133.2E	54-P-03-10	700MB	056	050	968	2829	18/13	----			N.F.B.	
39	220330Z	25.7N 133.1E	54-P-03-10	700MB	065	065	968	2835	16/12	----			--	
40	220500Z	25.5N 133.0E	SLTLS	STG C	DIA	--	BNDS	-						
41	220855Z	26.0N 133.2E	VW-P-10-05	700MB	050	045	980	2872	16/16	----			--	
42	221401Z	26.1N 133.0E	VW-P-05-15	700MB	---	---	984	2934	17/14	----			--	
43	222220Z	25.8N 133.4E	54-P-05-15	700MB	030	020	977	2883	12/10	----			N.F.B.	
44	230310Z	25.9N 133.6E	54-P-05-05	700MB	030	035	988	2923	14/10	----			N.F.B.	
45	230555Z	26.0N 133.5E	SLTLS	STG C	DIA	--	BNDS	-						
46	232215Z	27.9N 135.3E	54-P-05-10	700MB	022	035	986	3015	11/09	----			N.F.B.	

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TROPICAL CYCLONE 24 -- 10/14/2300Z TO 10/23/2300Z
 POSITION AND FORECAST VERIFICATION DATA

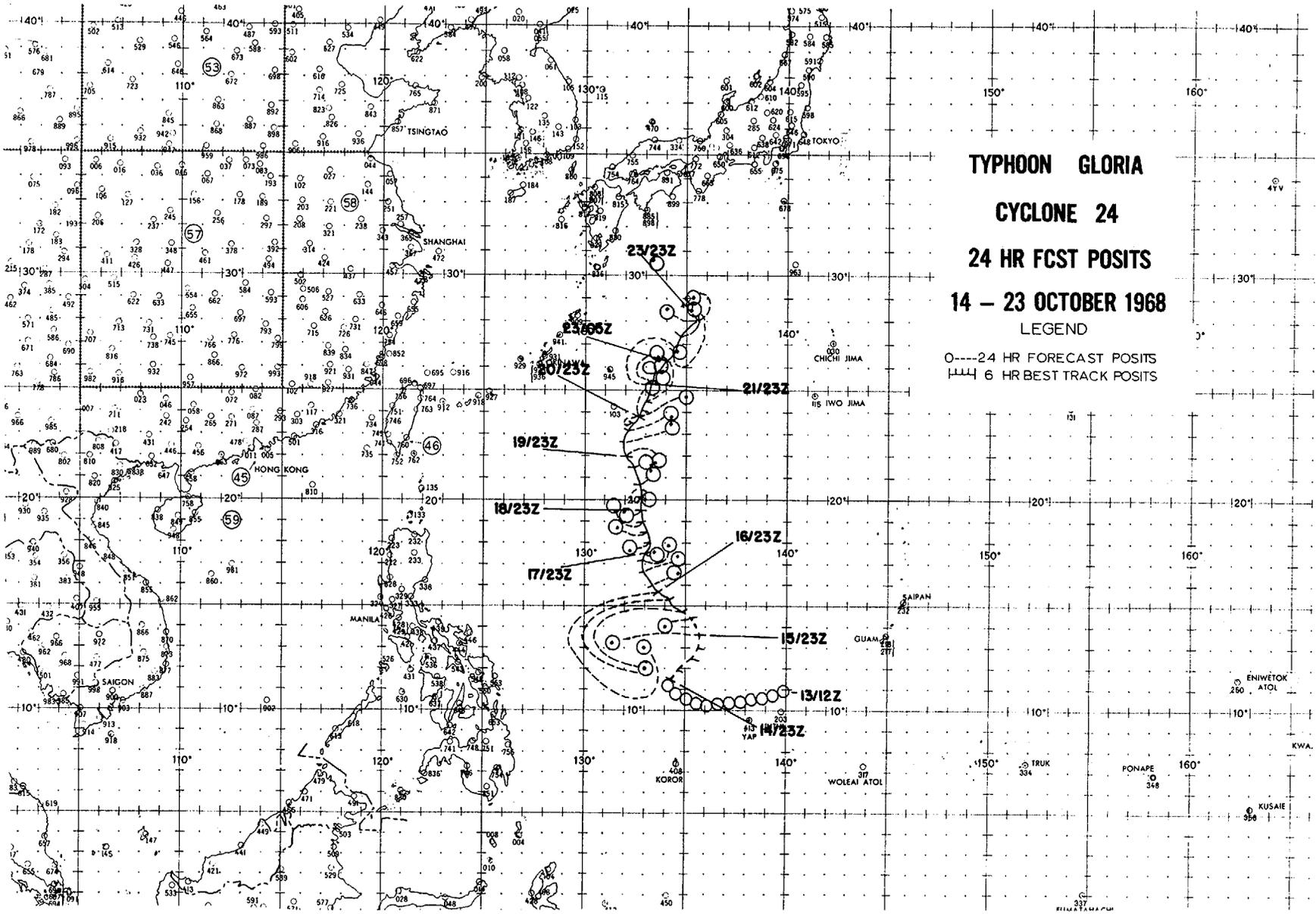
DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
161100Z	14.8N	134.8E	-----	-----	-----
161700Z	15.3N	134.2E	-----	-----	-----
162300Z	15.6N	133.6E	191-0156	-----	-----
170500Z	16.0N	133.2E	069-0096	-----	-----
171100Z	16.6N	132.9E	074-0102	-----	-----
171700Z	17.1N	132.9E	054-0078	-----	-----
172300Z	17.5N	133.0E	090-0018	-----	-----
180500Z	18.0N	133.1E	244-0048	-----	-----
181100Z	18.5N	133.0E	282-0078	-----	-----
181700Z	19.0N	132.9E	291-0078	-----	-----
182300Z	19.5N	132.8E	255-0042	108-0018	-----
190500Z	20.1N	132.8E	116-0012	244-0090	-----
191100Z	20.8N	132.6E	060-0030	306-0108	-----
191700Z	21.4N	132.4E	082-0042	263-0096	-----
192300Z	22.0N	132.0E	098-0078	207-0048	-----
200500Z	22.6N	131.9E	072-0132	079-0120	212-0090
201100Z	23.1N	132.0E	072-0132	072-0150	-----
201700Z	23.5N	132.2E	063-0168	068-0174	336-0042
202300Z	23.8N	132.5E	038-0096	064-0186	-----
210500Z	24.1N	132.8E	031-0114	056-0384	061-0240
211100Z	24.5N	133.0E	012-0114	059-0384	-----
211700Z	24.8N	133.1E	012-0090	059-0438	062-0312
212300Z	25.2N	133.2E	037-0108	051-0366	-----
220500Z	25.6N	133.2E	046-0144	044-0372	065-0738
221100Z	26.1N	133.2E	053-0126	045-0306	-----
221700Z	25.9N	132.9E	061-0096	045-0324	066-0852
222300Z	25.8N	133.5E	042-0078	050-0366	-----
230500Z	26.2N	134.0E	024-0150	051-0378	-----
231100Z	26.7N	134.4E	019-0108	052-0354	-----
231700Z	27.3N	134.8E	011-0102	050-0192	-----
232300Z	28.0N	135.4E	218-0162	058-0156	-----

AVERAGE 24 HOUR ERROR - 0095 MI.

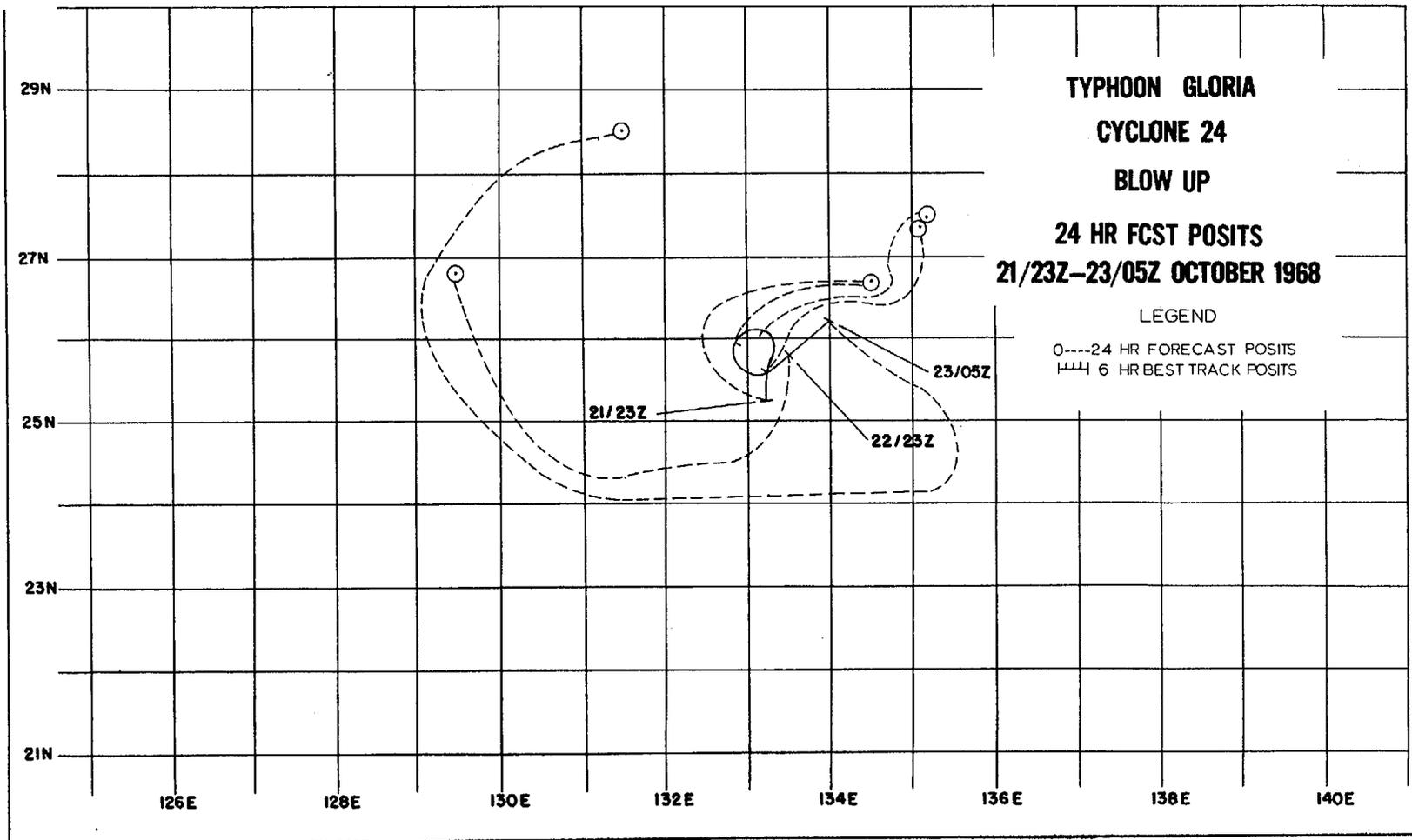
AVERAGE 48 HOUR ERROR - 0238 MI.

AVERAGE 72 HOUR ERROR - 0379 MI.

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S-125

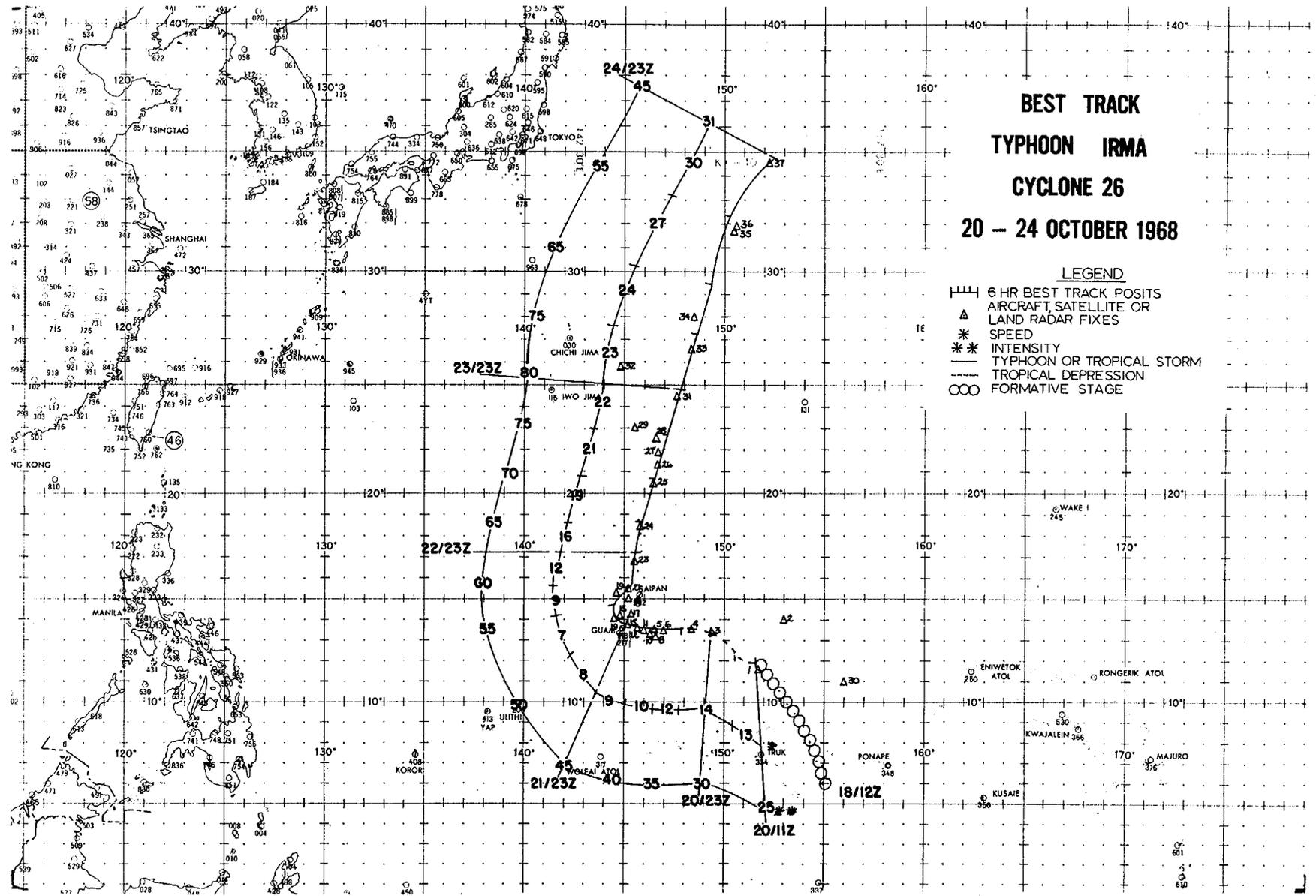


TROPICAL CYCLONE 26 - 10/20/1100Z TO 10/24/2300Z
(IRMA)

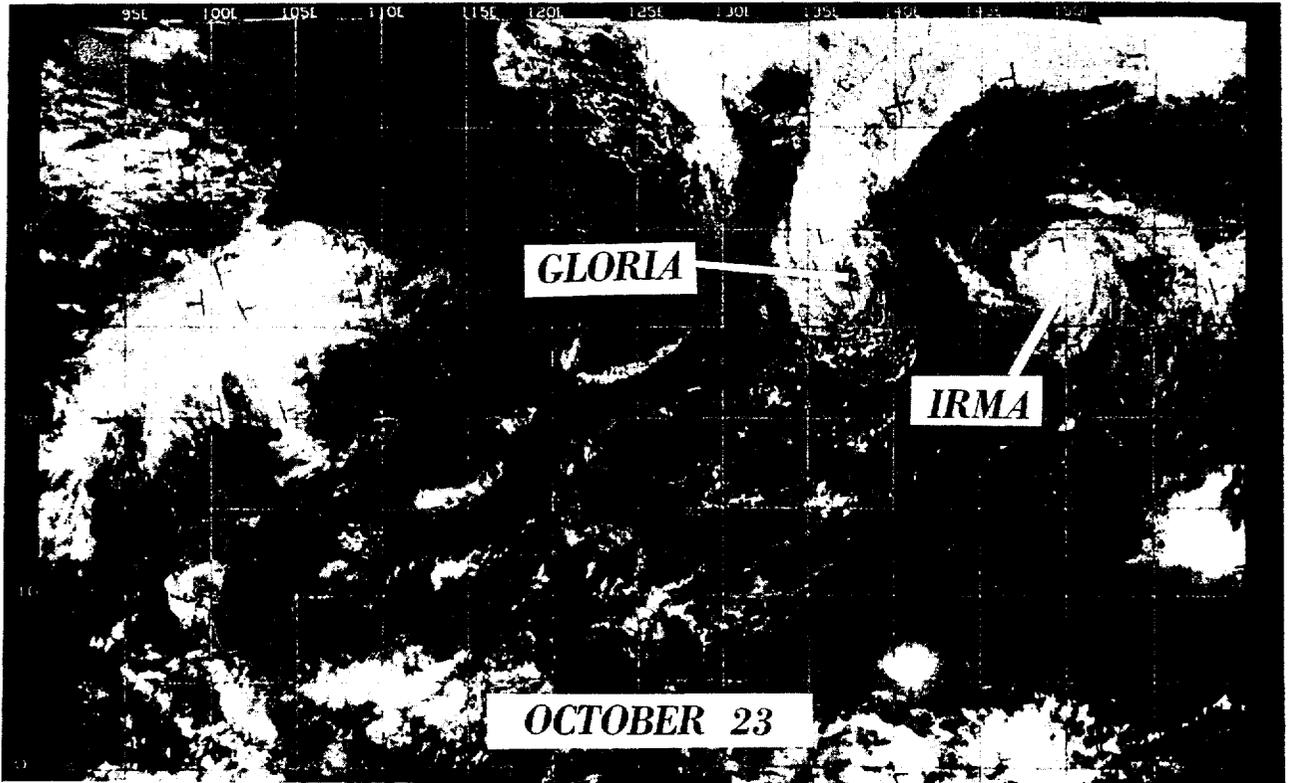
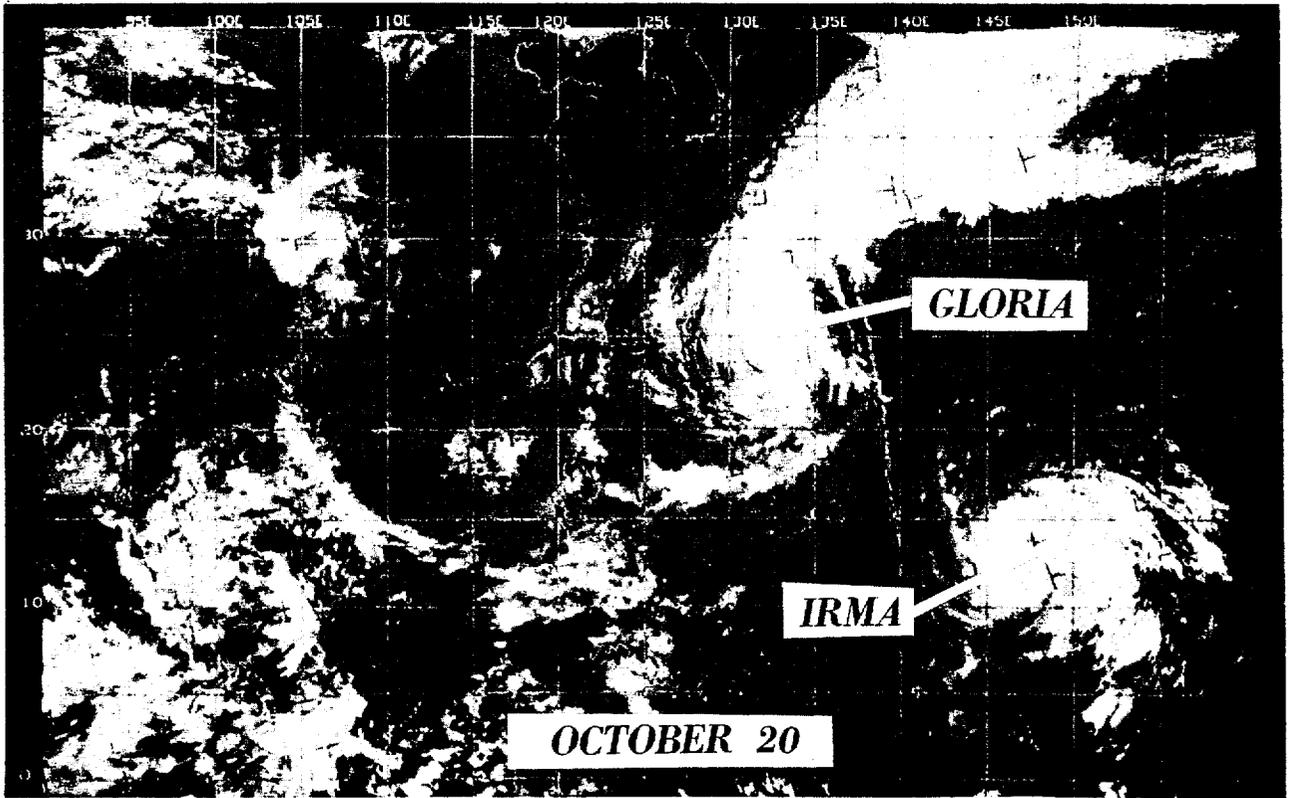
- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 19
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 04
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1764 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 946MBS AT 232200Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2700M. AT 232200Z
 - 3. MAXIMUM SURFACE WIND - 080 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 181200Z
 - 2. SURFACE PRESSURE LESS THAN 1008MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - NORTHEAST
 - 2. UPON REACHING TYPHOON INTENSITY - SOUTHWEST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

**BEST TRACK
TYPHOON IRMA
CYCLONE 26
20 – 24 OCTOBER 1968**

- LEGEND**
- ⎓ 6 HR BEST TRACK POSITS
 - △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 - * SPEED
 - ** INTENSITY
 - TYPHOON OR TROPICAL STORM
 - TROPICAL DEPRESSION
 - ○ ○ FORMATIVE STAGE



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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE				OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
				UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	FLT LVL WND								
1	190406Z	11.0N	156.0E	SLTLS	STG -	DIA 02	02	02	02						
2	200501Z	14.0N	153.0E	SLTLS	STG B	DIA --	--	--	--						
3	200815Z	11.6N	151.8E	54-P-05-05	0310M	025	015	004	---	27/27	----				N.F.B.
4	202215Z	13.3N	149.3E	54-P-10-25	0340M	025	025	998	---	24/22	----				F.B.
5	210300Z	13.6N	148.2E	54-P-05-20	0400M	020	030	996	---	24/23	----				F.B.
6	210401Z	13.5N	147.0E	SLTLS	STG X	DIA 03	03	03	---						
7	210930Z	13.5N	146.5E	VW-P-15-10	0350M	020	022	999	---	25/26	CIRC	----	13	--	
8	212030Z	14.1N	145.2E	LND RDR			---	---	---	--/--	ELIP	NE-SW	--X--	--	
9	211030Z	13.3N	146.5E	LND RDR			---	---	---	--/--	----			--	
10	211130Z	13.3N	146.3E	LND RDR			---	---	---	--/--	----			--	
11	211200Z	13.3N	146.3E	LND RDR			---	---	---	--/--	----			--	
12	211500Z	13.5N	146.0E	LND RDR			---	---	---	--/--	----			--	
13	211600Z	13.7N	145.6E	LND RDR			---	---	---	--/--	----			--	
14	212130Z	14.1N	144.9E	LND RDR			---	---	---	--/--	----			--	
15	212230Z	13.9N	144.8E	LND RDR			---	---	---	--/--	----			--	
16	212300Z	13.9N	145.2E	54-P-01-05	700MB	040	035	992	3015	14/12	----				F.B.
17	220030Z	14.1N	145.1E	LND RDR			---	---	---	--/--	----			--	
18	220300Z	14.0N	144.5E	54-P-01-03	700MB	035	040	985	2949	12/10	CIRC	----	30	--	
19	220456Z	14.0N	145.0E	SLTLS	STG X	DIA 03	03	03	---						
20	221030Z	15.0N	145.2E	LND RDR			---	---	---	--/--	----			--	
21	221230Z	15.3N	144.7E	LND RDR			---	---	---	--/--	----			--	
22	221430Z	15.3N	144.9E	LND RDR			---	---	---	--/--	----			--	
23	221557Z	15.4N	145.2E	54-P-01-04	700MB	055	---	977	2877	15/10	CIRC	----	27	05	
24	221830Z	15.9N	144.9E	LND RDR			---	---	---	--/--	----			--	

FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			26		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN							
25	222230Z	16.9N 145.4E	54-P-05-05	700MB	060	050	975	2883	16/13	CIRC	----	30	05	
26	230400Z	18.0N 145.5E	SLTLS	STG X	DIA	03	BNDS 3							
27	230400Z	18.4N 145.9E	54-P-02-02	700MB	070	080	968	2844	18/12	CIRC	----	30	--	
28	230900Z	20.4N 146.4E	VW-R-03-03	0500M	055	050	---	---	---/--	CIRC	----	50	14	
29	231155Z	21.2N 146.7E	VW-R-01-02		---	---	---	---	---/--	CIRC	----	40	15	
30	231435Z	21.9N 146.8E	VW-R-03-03		---	---	---	---	---/--	CIRC	----	30	15	
31	231522Z	22.5N 146.6E	VW-P-01-02	700MB	---	---	962	2774	19/11	CIRC	----	30	20	
32	232200Z	24.6N 147.6E	54-P-05-05	700MB	080	080	946	2700	20/12	CIRC	----	30	--	
33	240300Z	26.6N 148.4E	54-P-05-05	700MB	110	100	960	2783	21/12	CIRC	----	30	--	
34	240451Z	28.0N 148.5E	SLTLS	STG X	DIA	03	BNDS 4							
35	241510Z	31.9N 150.8E	VW-R-04-20		---	---	---	---	---/--	----			--	
36	241555Z	31.8N 150.7E	VW-P-15-02	1240M	---	070	968	2954	24/21	CIRC	----	60	F.B.	
37	242220Z	34.5N 152.3E	54-P-05-10	700MB	062	065	975	2890	17/12	----			--	

5-131

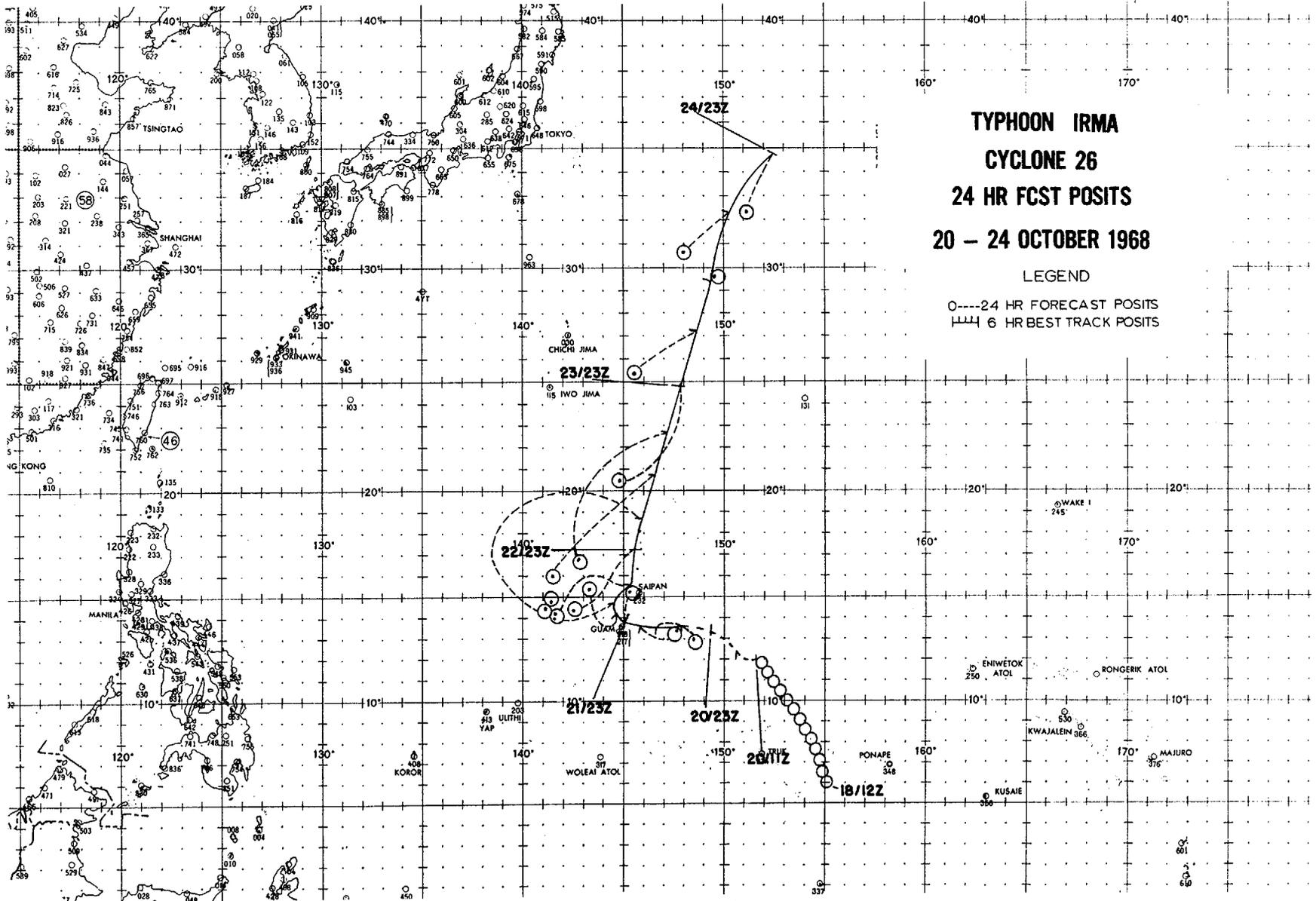
TROPICAL CYCLONE 26 -- 10/20/1100Z TO 10/24/2300Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HR. ERROR	48 HR. ERROR	72 HR. ERROR
	LAT.	LONG.	DEG. DIST.	DEG. DIST.	DEG. DIST.
211100Z	13.6N	146.7E	110-0102	-----	-----
211700Z	13.7N	145.8E	103-0102	-----	-----
212300Z	13.8N	145.0E	009-0078	-----	-----
220500Z	14.2N	144.5E	309-0090	-----	-----
221100Z	14.8N	144.7E	255-0198	-----	-----
221700Z	15.7N	145.3E	245-0222	-----	-----
222300Z	17.1N	145.5E	224-0240	-----	-----

230500Z	18.8N	145.9E	227-0378	-----	-----
231100Z	20.7N	146.5E	226-0396	-----	-----
231700Z	22.8N	147.1E	214-0426	-----	-----
232300Z	24.9N	147.8E	211-0306	214-0750	-----
240500Z	27.1N	148.6E	237-0192	218-0918	-----
241100Z	29.5N	149.3E	034-0018	217-0900	-----
241700Z	32.2N	150.3E	232-0144	212-0984	-----
242300Z	34.8N	152.5E	204-0162	215-0852	-----

AVERAGE 24 HOUR ERROR - 0203 MI.
 AVERAGE 48 HOUR ERROR - 0880 MI.
 AVERAGE 72 HOUR ERROR - ----- MI.

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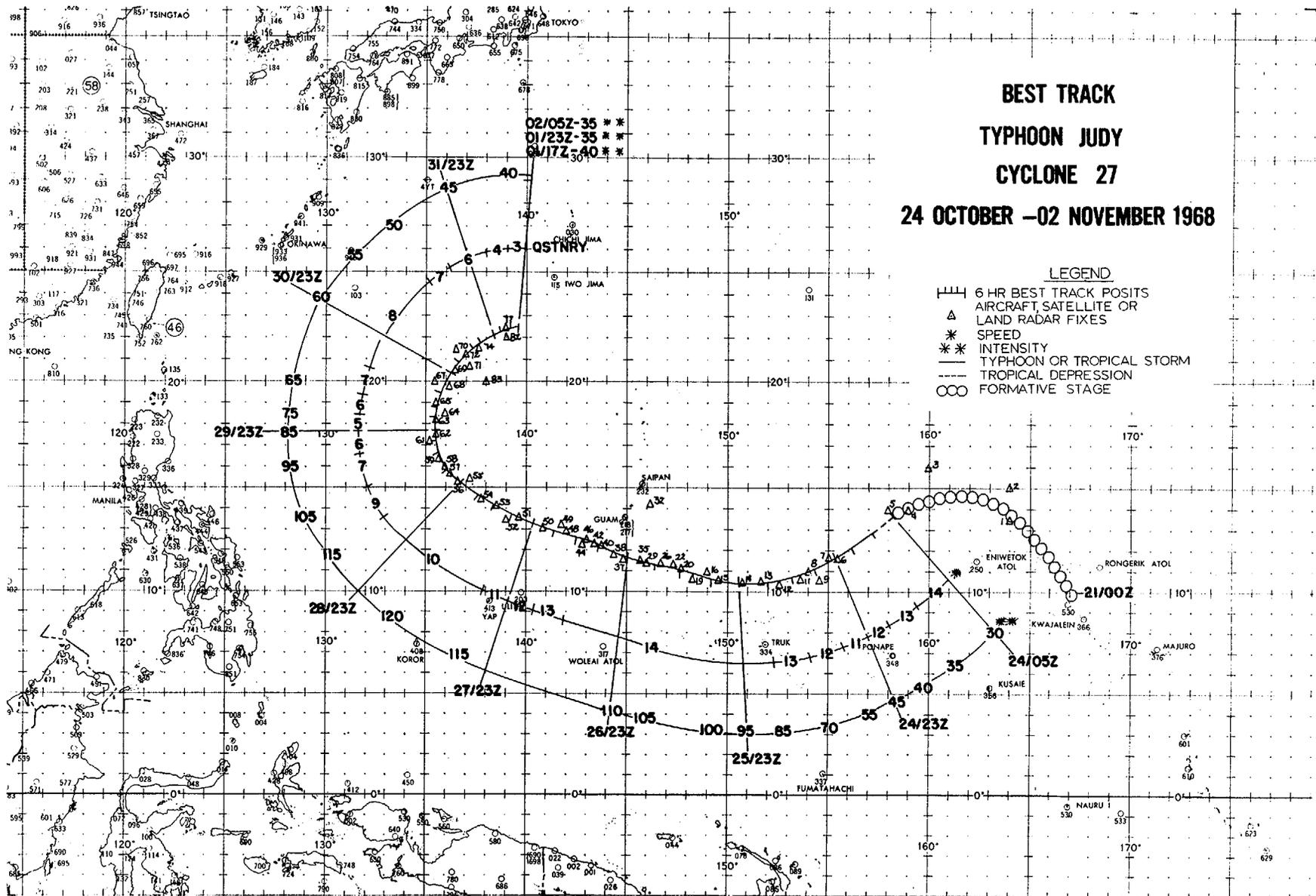
TROPICAL CYCLONE 27 - 10/24/0500Z TO 11/02/0500Z
(JUDY)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 37
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 22
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1950 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 928MBS AT 282200Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2454M. AT 282200Z
 3. MAXIMUM SURFACE WIND - 120 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - 200MB ANTICYCLONE OVER THE SURFACE CYCLONE
 - B. INITIAL SURFACE VORTEX
 1. JUNCTION VORTEX AT 210000Z
 2. SURFACE PRESSURE LESS THAN 1009MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - NORTHWEST
 2. UPON REACHING TYPHOON INTENSITY - NORTHEAST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

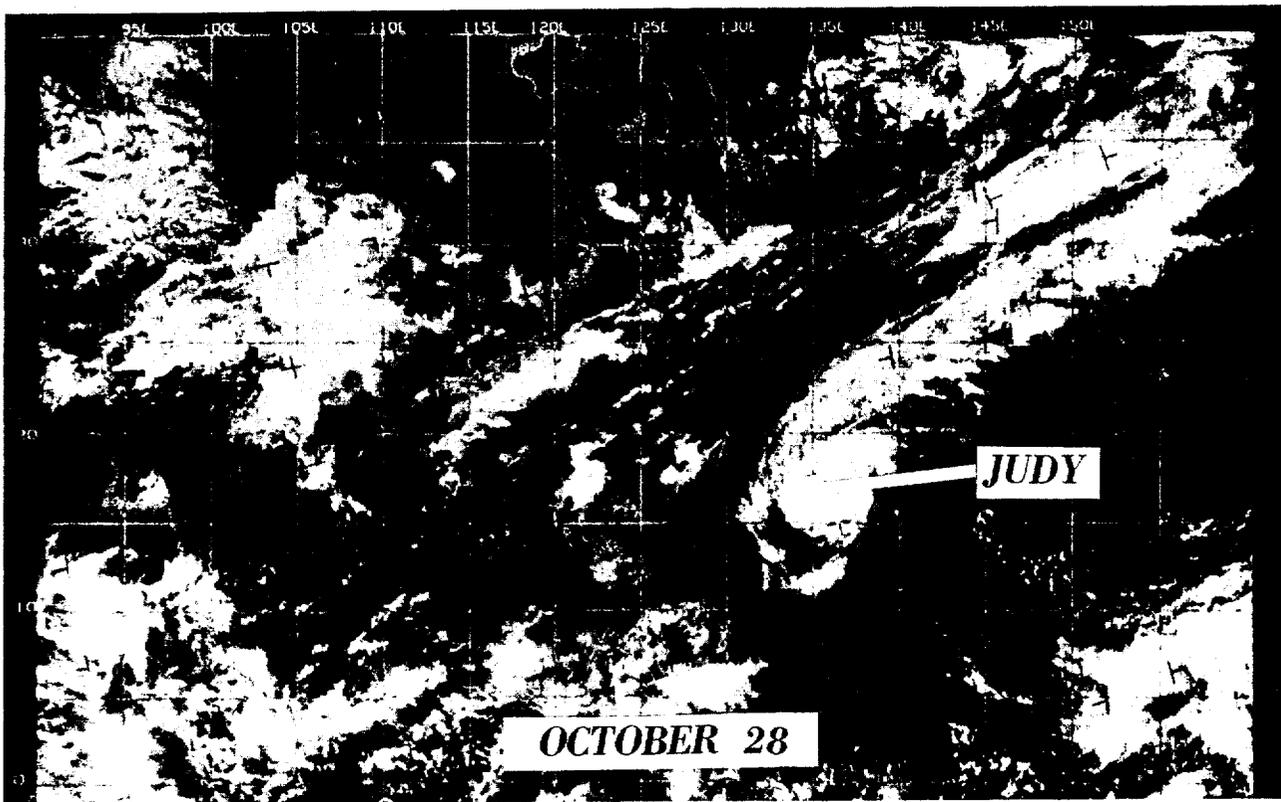
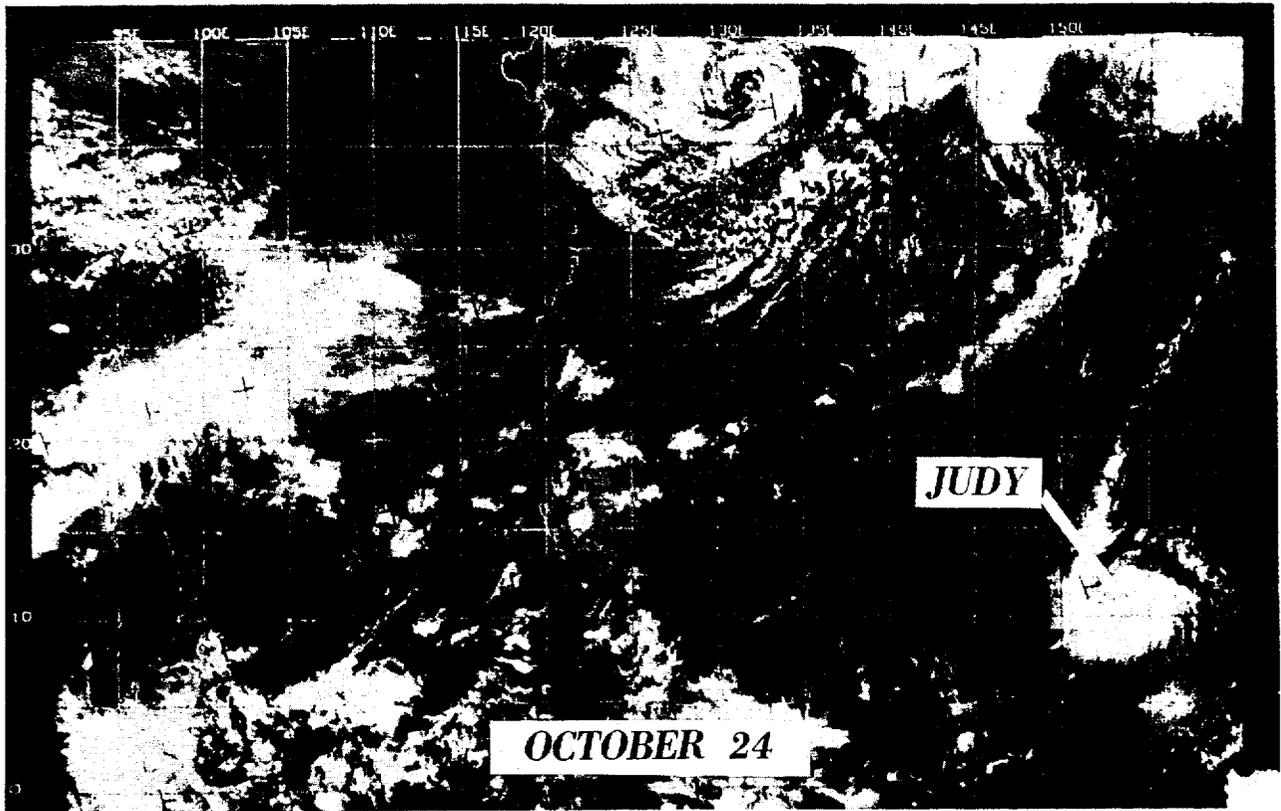
**BEST TRACK
 TYPHOON JUDY
 CYCLONE 27
 24 OCTOBER -02 NOVEMBER 1968**

LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE



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FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES		CYCLONE		OBS 27 SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	WND	FLT LVL	WND								
1	210401Z	13.5N 164.0E	SLTLS	STG B	DIA	--	BNDS -								
2	220305Z	15.0N 164.0E	SLTLS	STG B	DIA	--	BNDS -								
3	230400Z	16.0N 160.0E	SLTLS	STG X	DIA	03	BNDS 1								
4	240340Z	14.0N 159.0E	VW-P-08-05	0300M	034	030	003	3097	24/22	CIRC	----	40	--		
5	240451Z	14.0N 158.0E	SLTLS	STG X	DIA	02	BNDS 1								
6	241630Z	11.6N 155.4E	VW-P-02-03	0410M	---	050	987	3030	24/21	CIRC	----	20	--		
7	242230Z	11.6N 155.1E	54-P-10-05	700MB	072	080	978	2914	24/18	CIRC	----	30	--		
8	250350Z	11.0N 154.0E	SLTLS	STG X	DIA	03	BNDS 3								
9	250400Z	10.7N 154.6E	54-P-10-05	700MB	075	080	969	2856	19/11	ELIP	N-S	30X20	12		
10	250800Z	10.6N 154.5E	VW-R----	20	---	---	---	---	---/--	----					
11	250900Z	10.6N 153.7E	VW-P-15-05	0270M	110	100	966	---	26/22	CIRC	----	34	--		
12	251407Z	10.3N 152.6E	VW-R----	10	---	---	---	---	---/--	----					
13	251516Z	10.5N 151.8E	VW-R-05-10		---	---	---	---	---/--	ELIP	NW-SE	30X20	--		
14	252155Z	10.4N 150.8E	54-P-05-05	700MB	100	085	951	2707	18/10	CIRC	----	40	--		
15	260300Z	10.6N 149.5E	54-P-05-03	700MB	070	100	944	2609	22/12	CIRC	----	20	--		
16	260446Z	11.0N 149.0E	SLTLS	STG X	DIA	03	BNDS 3								
17	260500Z	10.8N 149.2E	54-P-05-03	700MB	090	100	942	2588	21/13	CIRC	----	20	07		
18	260710Z	11.1N 149.1E	VW-R----	15	---	---	---	---	---/--	----					
19	260852Z	10.8N 148.2E	VW-R-10-10		---	---	---	---	---/--	ELIP	NW-SE	27X20	--		
20	261040Z	11.1N 147.9E	VW-R-----		---	---	---	---	---/--	----					
21	261130Z	11.1N 147.5E	VW-R-10-10		080	---	---	---	---/--	CIRC	----	20	20		
22	261215Z	11.2N 147.3E	LND RDR		---	---	---	---	---/--	----					
23	261335Z	11.1N 147.7E	LND RDR		---	---	---	---	---/--	----					
24	261340Z	11.2N 147.1E	LND RDR		---	---	---	---	---/--	----					

5-139

FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES		CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD	
				FLT LVL	WIND	FLT LVL	WIND									
25	261345Z	11.2N 147.2E	VW-R----	10							--/--					--
26	261420Z	11.2N 146.9E	LND RDR								--/--					--
27	261450Z	11.2N 147.0E	VW-R-03-05								--/--	CIRC	----	25		10
28	261515Z	11.2N 146.8E	LND RDR								--/--					--
29	261535Z	11.2N 146.0E	LND RDR								--/--					--
30	261630Z	11.3N 146.6E	LND RDR								--/--					--
31	261755Z	11.3N 146.2E	VW-R-02-05								--/--	CIRC	----	20		--
32	261830Z	14.1N 146.1E	LND RDR								--/--					--
33	261915Z	11.5N 145.9E	LND RDR								--/--					--
34	261930Z	11.5N 145.9E	LND RDR								--/--					--
35	262045Z	11.5N 145.6E	LND RDR								--/--					--
36	262100Z	11.6N 145.7E	54-P-01-03	700MB	110	100	941	2582	20/20	CIRC	----		15			05
37	270000Z	11.8N 144.9E	54-P-01-04	700MB	130	100	943	2570	16/10	CIRC	----		20			--
38	270220Z	11.9N 144.3E	54-P-03-05	700MB	085	130	935	2518	18/10	CIRC	----		20			--
39	270230Z	11.9N 144.4E	LND RDR								--/--					--
40	270500Z	12.1N 143.9E	54-P-03-05	700MB	120	130	937	2521	16/10	CIRC	----		15			--
41	270540Z	12.0N 144.0E	SLTLS	STG X	DIA	U ₄	BNDS 4									
42	270700Z	12.2N 143.4E	LND RDR								--/--					--
43	270800Z	12.2N 143.2E	LND RDR								--/--					--
44	270900Z	12.3N 143.1E	LND RDR								--/--					--
45	270900Z	12.4N 142.9E	VW-R-05-03								--/--	CIRC	----	25		07
46	271000Z	12.4N 143.0E	LND RDR								--/--					--
47	271030Z	12.4N 142.7E	LND RDR								--/--					--
48	271351Z	13.0N 142.0E	VW-R----	15							--/--					--

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE				OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	HKNS WALL CLOUD
				UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS 27 SFC WND							
49	271415Z	13.1N	141.9E	VW-R-02-05						--/--	ELIP	NW-SE	32X26	10
50	272045Z	13.0N	140.9E	54-P-05-05	700MB	085	110	939	2562	16/10	CIRC	----	20	10
51	280300Z	13.7N	139.7E	54-P-03-03	700MB	100	100	933	2506	18/11	CIRC	----	25	10
52	280445Z	13.5N	139.0E	SLTLS	STG X	DIA 05	BNDS 4							
53	280955Z	14.1N	138.6E	VW-R-10-05						--/--	CIRC	----	35	08
54	281405Z	14.5N	137.8E	VW-R-05-05						--/--	CIRC	----	35	08
55	281950Z	15.5N	137.2E	ACFT RDR						--/--	CIRC	----	40	--
56	282200Z	15.3N	136.7E	54-P-03-02	700MB		110	928	2454	20/08	CIRC	----	30	10
57	290340Z	15.9N	136.2E	54-P-03-02	700MB		115	931	2490	18/09	ELIP	NW-SE	30X25	--
58	290540Z	16.0N	136.0E	SLTLS	STG X	DIA 05	BNDS 4							
59	290850Z	16.3N	135.7E	VW-R----10						--/--	----			--
60	290920Z	16.5N	135.7E	VW-R-05-05	0430M					--/--	CIRC	----	20	12
61	291548Z	17.1N	135.2E	VW-R-05-05						--/--	CIRC	----	27	--
62	292100Z	17.6N	135.5E	54-P-05-05	700MB	140	090	950	2640	16/12	ELIP	NW-SE	25X15	08
63	300300Z	18.1N	135.5E	54-P-02-05	700MB	065	085	951	2661	18/10	CIRC	----	20	--
64	300440Z	18.5N	136.0E	SLTLS	STG X	DIA 05	BNDS 4							
65	300925Z	19.0N	135.5E	VW-R-05-05						--/--	CIRC	----	30	F.B.
66	300955Z	19.0N	135.6E	VW-P-05-05	700MB			968	2772	23/19	CIRC	----	30	--
67	301400Z	20.0N	135.4E	VW-R-05-10						--/--	CIRC	----	35	--
68	302100Z	19.9N	136.2E	54-P-03-05	700MB	085	075	968	2874	24/12	----			--
69	310300Z	20.8N	136.5E	54-P-05-05	700MB	070	065	975	2890	20/12	CIRC	----	30	05
70	310537Z	21.5N	136.5E	SLTLS	STG X	DIA 03	BNDS 3							
71	310755Z	20.8N	137.2E	VW-R----25						--/--	----			--
72	310840Z	21.2N	137.0E	VW-R-05-05						--/--	CIRC	----	40	10

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND								
73	311125Z	21.3N	137.3E	VW-P-05-10	700MB	---	---	980	2966	19/10	CIRC	----	40	--
74	311405Z	21.7N	137.6E	VW-R-05-10	2900M	060	---	---	---	--/--	CIRC	----	38	10
75	312100Z	21.6N	138.0E	54-P-05-05	700MB	060	040	976	2893	20/14	----			--
76	010200Z	21.9N	138.1E	54-P-05-05	700MB	040	055	980	2929	20/14	CIRC	----	30	--
77	010435Z	22.5N	139.0E	SLTLS	STG D	DIA	--	BNDS	-					
78	010830Z	22.4N	139.1E	VW-R-05-05		---	030	---	---	--/--	CIRC	----	12	--
79	011405Z	22.2N	139.4E	VW-P-05-05	0310M	---	025	988	---	27/25	CIRC	----	15	--
80	012200Z	22.4N	139.6E	54-P-03-05	700MB	030	035	990	3015	16/14	----			--
81	020300Z	22.1N	139.5E	54-P-03-05	700MB	020	035	994	3051	16/14	----			--
82	020530Z	22.0N	139.0E	SLTLS	STG C	DIA	--	BNDS	-					
83	030430Z	20.0N	138.0E	SLTLS	STG C	DIA	--	BNDS	-					

TROPICAL CYCLONE 27 -- 10/24/0500Z TO 11/02/0500Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
241100Z	12.9N	157.1E	-----	-----	-----
241700Z	12.1N	156.1E	-----	-----	-----
242300Z	11.5N	155.3E	-----	-----	-----
250500Z	10.9N	154.4E	005-0396	-----	-----
251100Z	10.5N	153.2E	011-0486	-----	-----
251700Z	10.3N	152.0E	214-0084	-----	-----
252300Z	10.4N	150.5E	024-0228	-----	-----
260500Z	10.7N	149.2E	090-0318	-----	-----
261100Z	11.0N	147.8E	083-0096	-----	-----
261700Z	11.3N	146.4E	026-0108	-----	-----
262300Z	11.7N	145.0E	134-0054	039-0516	-----
270500Z	12.2N	143.7E	084-0054	091-0540	-----
271100Z	12.6N	142.5E	067-0054	072-0270	-----
271700Z	13.0N	141.3E	057-0084	051-0324	-----
272300Z	13.4N	140.3E	040-0084	104-0138	-----
280500Z	13.8N	139.3E	013-0054	064-0132	092-0708
281100Z	14.2N	138.5E	013-0054	053-0132	-----
281700Z	14.6N	137.5E	021-0150	047-0156	056-0540
282300Z	15.2N	136.7E	076-0072	047-0156	-----
290500Z	15.9N	136.0E	053-0096	051-0132	069-0192
291100Z	16.6N	135.6E	064-0036	064-0102	-----
291700Z	17.2N	135.5E	303-0042	033-0198	036-0174
292300Z	17.8N	135.4E	303-0042	094-0084	-----
300500Z	18.2N	135.5E	278-0042	049-0132	056-0114
301100Z	18.8N	135.6E	259-0030	021-0048	-----
301700Z	19.5N	135.8E	263-0090	304-0090	025-0216
302300Z	20.3N	136.2E	232-0036	284-0096	-----
310500Z	20.9N	136.7E	345-0024	260-0126	038-0186
311100Z	21.4N	137.3E	000-0084	251-0126	-----
311700Z	21.7N	137.8E	005-0138	269-0210	323-0180
312300Z	22.0N	138.4E	360-0048	291-0096	-----
010500Z	22.2N	138.8E	022-0144	018-0198	299-0180
011100Z	22.3N	139.2E	008-0096	027-0300	-----
011700Z	22.3N	139.5E	016-0126	028-0360	300-0246

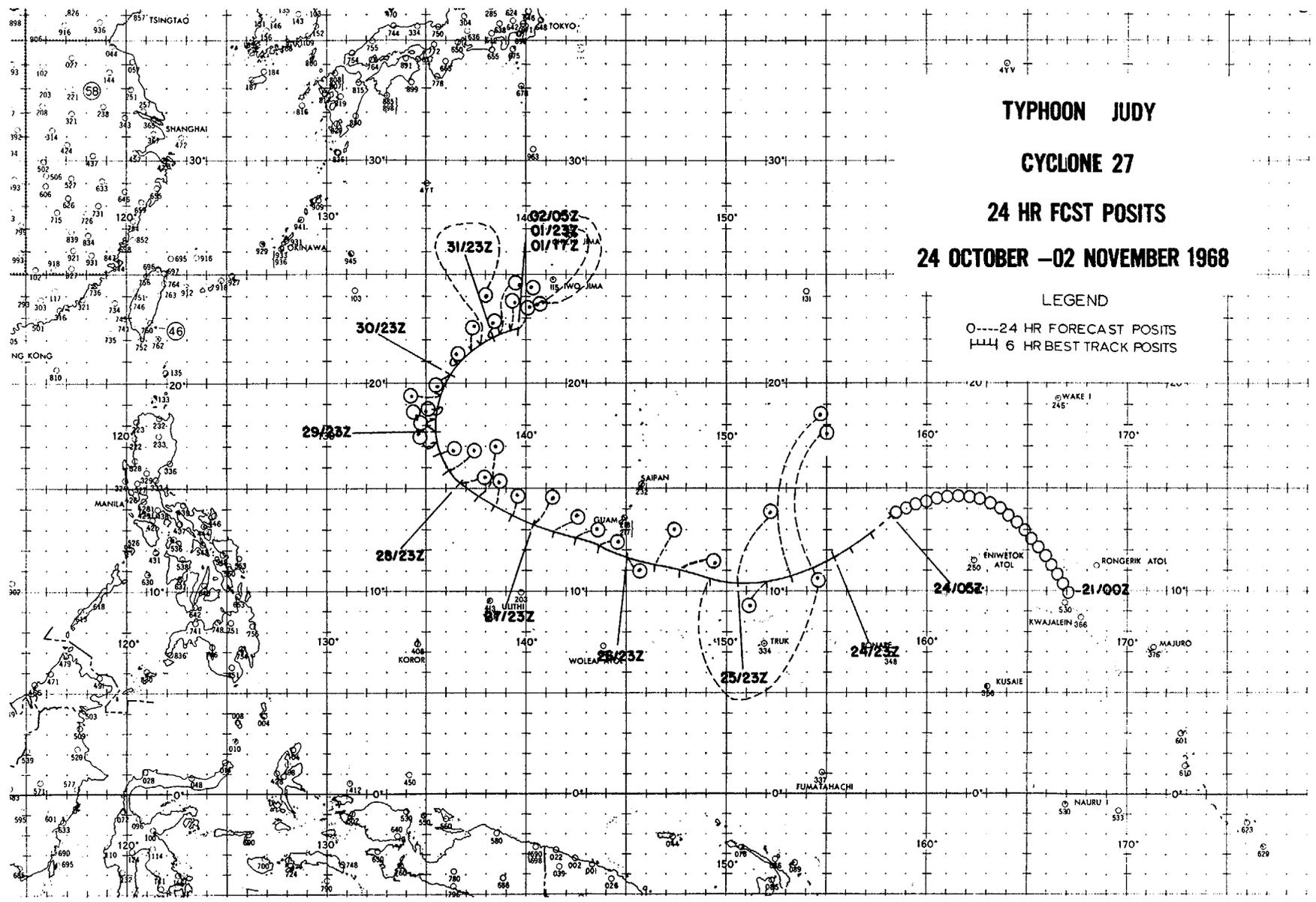
TROPICAL CYCLONE 27 -- 10/24/0500Z TO 11/02/0500Z
 POSITION AND FORECAST VERIFICATION DATA (CONT)

DTG	STORM POSITION		24 HR. ERROR		48 HR. ERROR		72 HR. ERROR	
	LAT.	LONG.	DEG.	DIST.	DEG.	DIST.	DEG.	DIST.
012300Z	22.3N	139.5E	022	0078	030	0204	-----	
020500Z	22.3N	139.5E	029	0102	041	0498	040	0540

AVERAGE 24 HOUR ERROR - 0110 MI.
 AVERAGE 48 HOUR ERROR - 0208 MI.
 AVERAGE 72 HOUR ERROR - 0297 MI.

TYPHOON JUDY
CYCLONE 27
24 HR FCST POSITS
24 OCTOBER -02 NOVEMBER 1968

LEGEND
 ○----24 HR FORECAST POSITS
 ———6 HR BEST TRACK POSITS

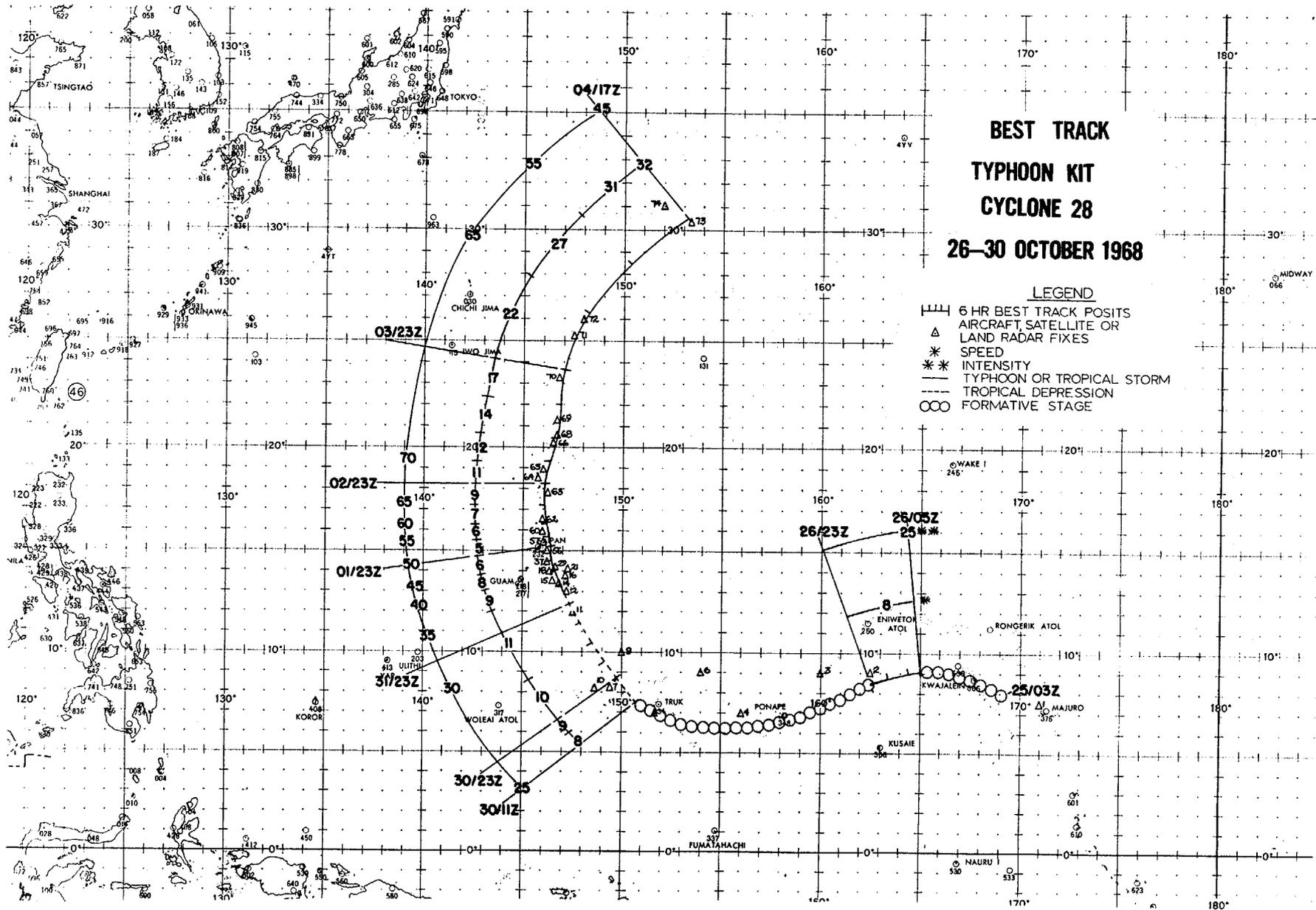


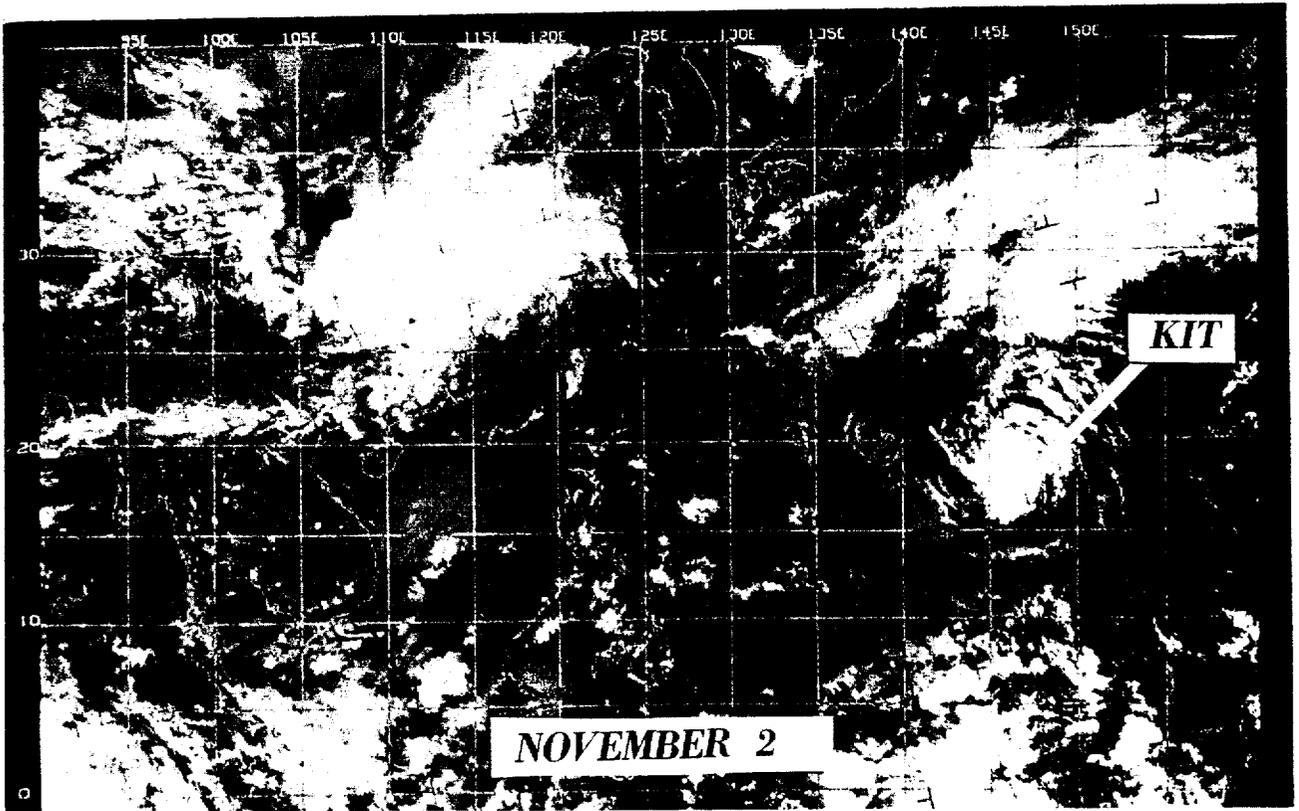
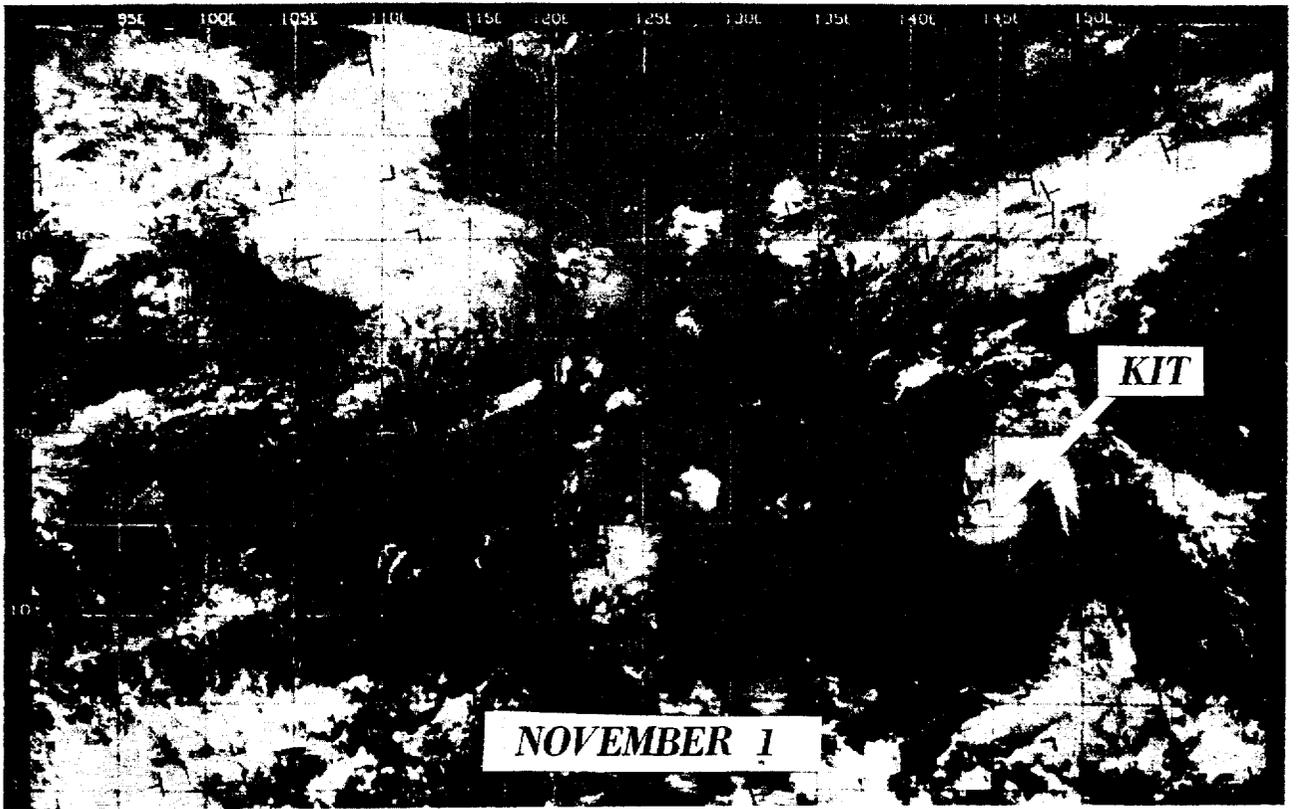
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TROPICAL CYCLONE 28 - 10/26/0500Z TO 11/04/1700Z
(KIT)

- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 26
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 08
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1716 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 959MBS AT 032100Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2743M. AT 032100Z
 - 3. MAXIMUM SURFACE WIND - 070 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 250300Z
 - 2. SURFACE PRESSURE LESS THAN 1008MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - NORTHWEST
 - 2. UPON REACHING TYPHOON INTENSITY - SOUTHWEST
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE				OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS	
				UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND							WALL CLOUD	
1	250350Z	07.5N	171.0E	SLTLS	STG B	DIA	--	BNDS -							
2	260251Z	09.0N	162.5E	SLTLS	STG C	DIA	--	BNDS -							
3	270345Z	09.0N	160.0E	SLTLS	STG A	DIA	--	BNDS -							
4	290343Z	07.0N	156.0E	SLTLS	STG B	DIA	--	BNDS -							
5	300135Z	07.0N	151.7E	54-P-05-10	0400M	025	020	002	---	25/24	----				--
6	300436Z	09.0N	154.0E	SLTLS	STG B	DIA	--	BNDS -							
7	310142Z	08.1N	149.2E	54-P-03-10	0380M	022	025	004	---	24/24	CIRC	----	40		--
8	310300Z	08.1N	149.1E	54-P-03-10	0370M	020	025	004	---	25/24	----				--
9	310533Z	10.0N	150.0E	SLTLS	STG C	DIA	--	BNDS -							
10	310930Z	08.1N	147.6E	VW-P-05-10	0450M	---	020	005	---	25/23	----				--
11	312320Z	12.3N	147.5E	54-P-03-10	0450M	060	060	992	---	26/24	CIRC	----	20		--
12	010315Z	13.0N	147.1E	54-P-03-01	700MB	040	040	988	3027	12/08	CIRC	----	20		--
13	010432Z	13.0N	147.5E	SLTLS	STG C	DIA	--	BNDS -							
14	010530Z	13.4N	146.9E	LND RDR		---	---	---	---	--/--	----				--
15	010550Z	13.6N	146.5E	VW-R-02-02	0490M	028	025	---	---	--/--	CIRC	----	15		08
16	010900Z	13.8N	146.7E	LND RDR		---	---	---	---	--/--	----				--
17	010900Z	13.9N	147.1E	VW-R-03-15	0450M	---	---	---	---	--/--	----				F.B.
18	010930Z	14.0N	147.2E	VW-R-----		---	---	---	---	--/--	----				--
19	010945Z	13.8N	146.7E	LND RDR		---	---	---	---	--/--	----				--
20	010945Z	13.9N	146.7E	LND RDR		---	---	---	---	--/--	----				--
21	011000Z	13.9N	146.7E	LND RDR		---	---	---	---	--/--	----				--
22	011000Z	13.9N	147.2E	LND RDR		---	---	---	---	--/--	----				--
23	011000Z	14.1N	147.2E	VW-R-----		---	---	---	---	--/--	----				--
24	011030Z	14.2N	147.2E	VW-R-----		---	---	---	---	--/--	----				--

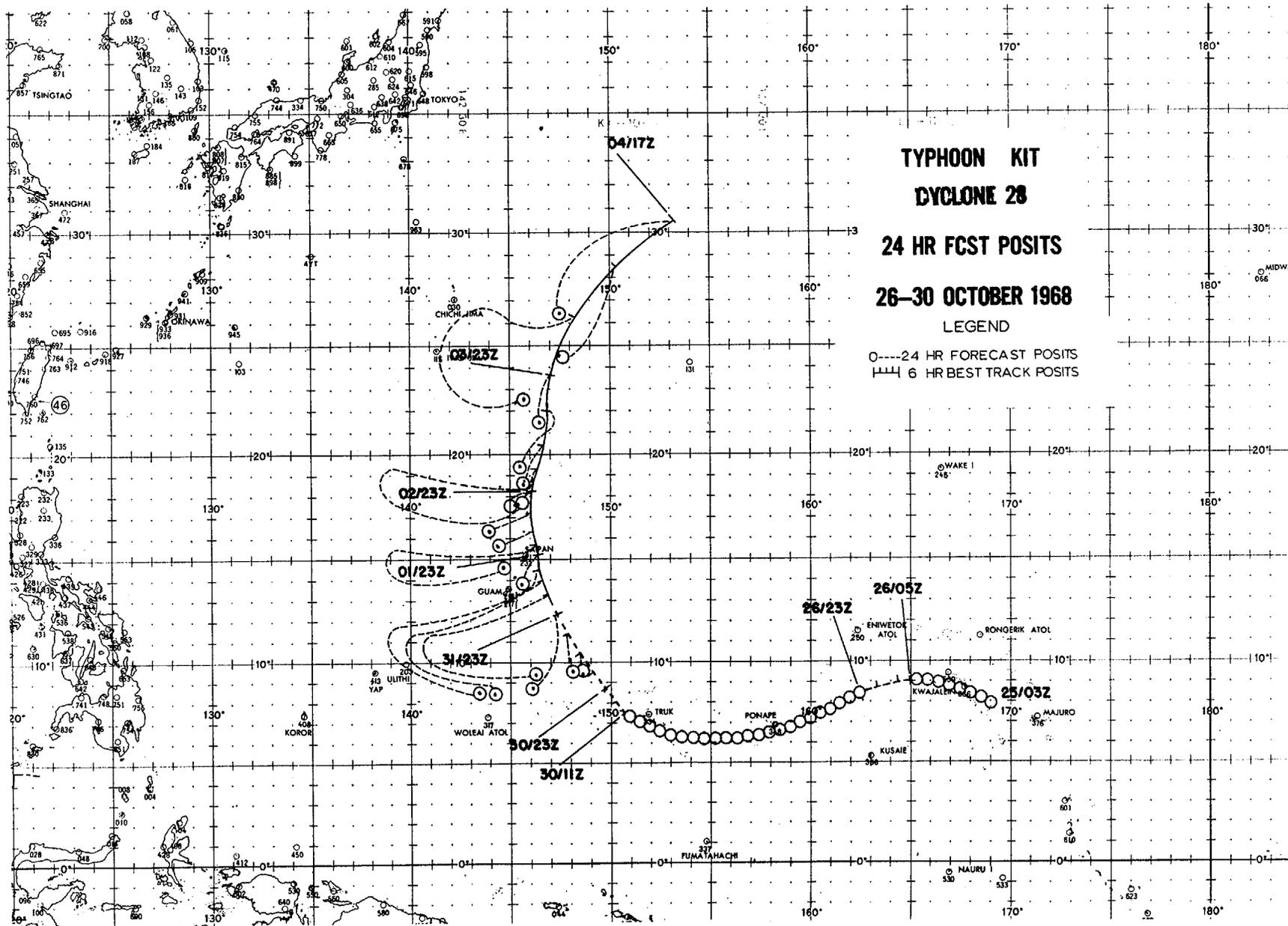
FIX NO.	TIME	POSIT		UNIT- METHOD -ACCY	EYE FIXES FLT LVL	CYCLONE FLT WND	28 OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
73	041710Z	30.3N	153.3E	VW-P-02-03	700MB	---	050	976	2909	17/12	ELIP	NE-SW	25x15	F.B.
74	050429Z	31.0N	152.0E	SLTLS	STG C	DIA --	BNDS -							

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TROPICAL CYCLONE 28 -- 10/26/0500Z TO 11/04/1700Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
010500Z	13.2N	146.9E	189-0240	-----	-----
011100Z	14.0N	146.6E	203-0360	-----	-----
011700Z	14.6N	146.3E	205-0402	-----	-----
012300Z	15.1N	146.3E	207-0078	-----	-----
020500Z	15.6N	146.2E	236-0090	-----	-----
021100Z	16.2N	146.1E	252-0090	-----	-----
021700Z	17.1N	146.0E	245-0126	-----	-----
022300Z	18.1N	146.0E	231-0042	223-0288	-----
030500Z	19.2N	146.2E	206-0096	229-0198	-----
031100Z	20.4N	146.7E	206-0126	226-0264	-----
031700Z	22.0N	146.8E	208-0168	222-0324	-----
032300Z	23.8N	147.1E	193-0138	208-0288	-----
040500Z	26.2N	148.1E	210-0246	203-0420	215-0492
041100Z	28.4N	150.2E	215-0264	207-0528	-----
041700Z	30.3N	153.2E	233-0378	220-0690	223-0852

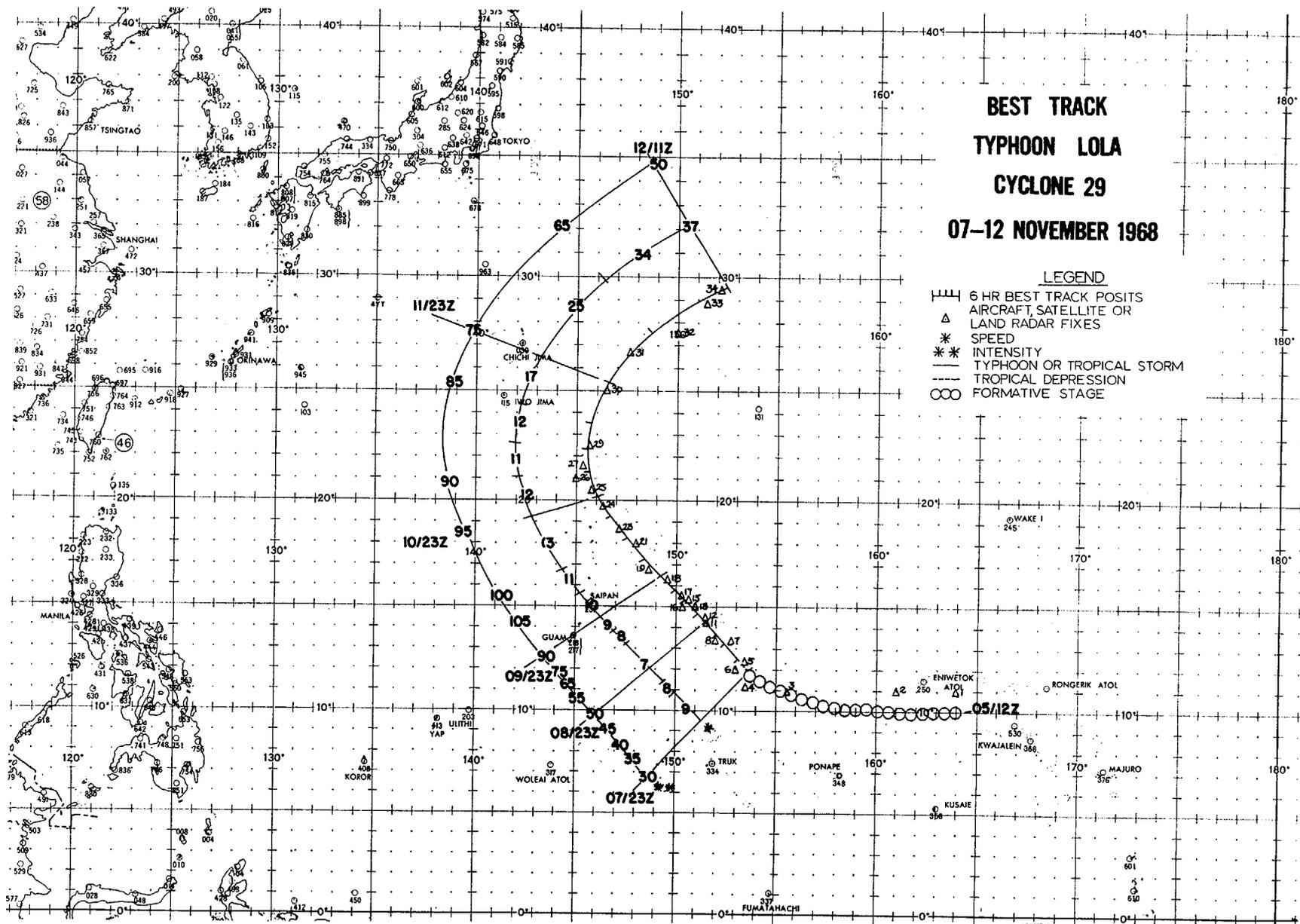
AVERAGE 24 HOUR ERROR - 0189 MI.
 AVERAGE 48 HOUR ERROR - 0375 MI.
 AVERAGE 72 HOUR ERROR - 0672 MI.

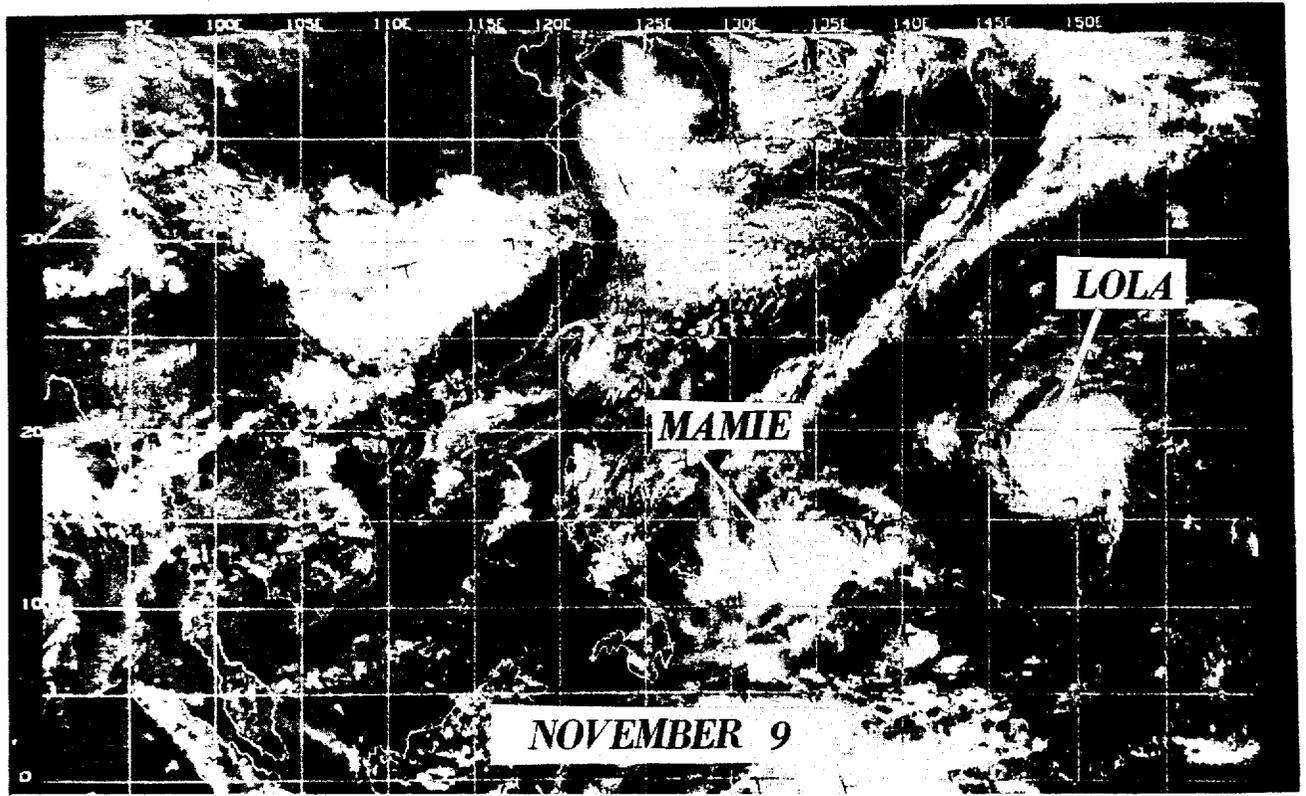
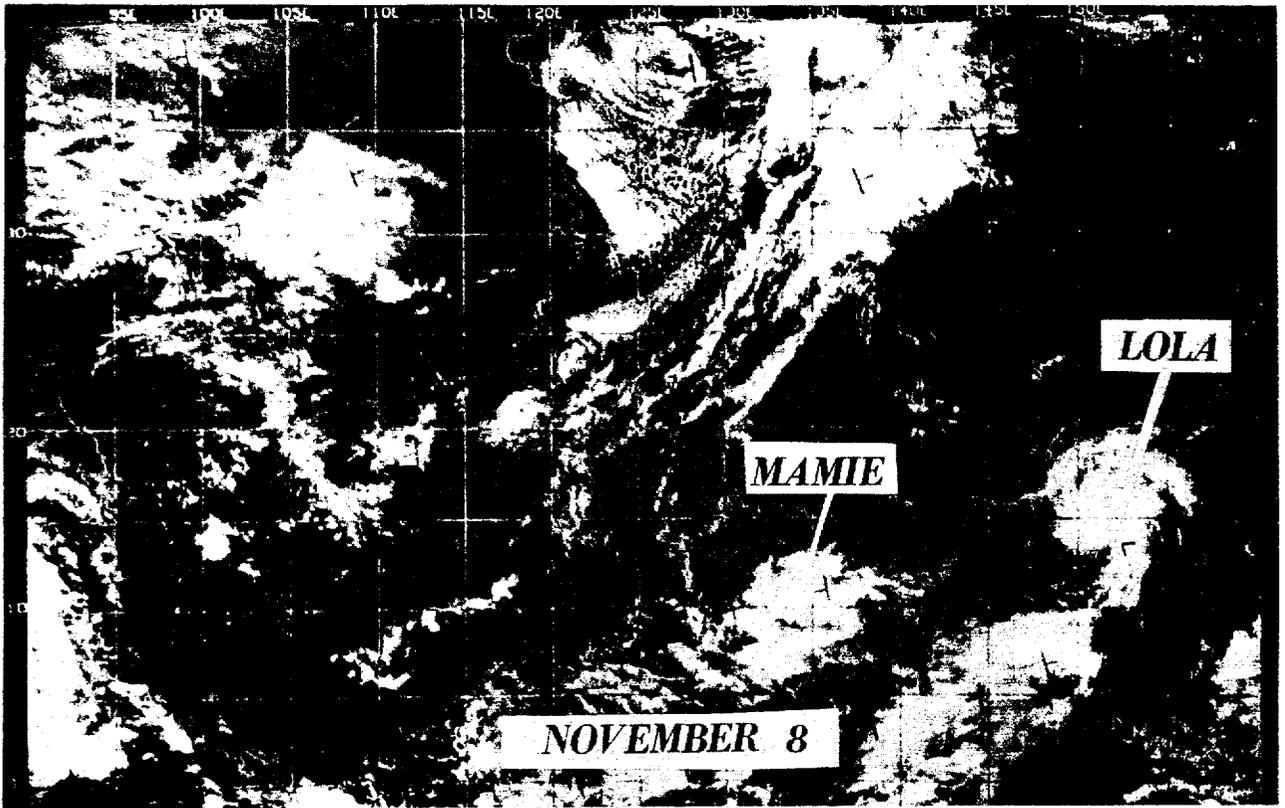


TROPICAL CYCLONE 29 - 11/07/2300Z TO 11/12/1100Z
(LOLA)

- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 19
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 10
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1386 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 938MBS AT 100300Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2547M. AT 100300Z
 - 3. MAXIMUM SURFACE WIND - 105 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - 200MB ANTICYCLONE OVER THE SURFACE CYCLONE
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 051200Z
 - 2. SURFACE PRESSURE LESS THAN 1008MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - EAST
 - 2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC
- III. FINAL DISPOSITION - BECAME EXTRATROPICAL

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FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		29		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
1	050420Z	11.0N 164.0E	SLTLS	STG B	DIA	--	BNDS	-						
2	060320Z	11.0N 161.0E	SLTLS	STG B	DIA	--	BNDS	-						
3	070415Z	11.0N 155.5E	SLTLS	STG X	DIA	02	BNDS	1						
4	080105Z	12.1N 153.4E	54-P-07-01	0400M	048	050	998	3094	24/22	CIRC	----	10	F.B.	
5	080300Z	12.3N 153.4E	54-P-10-01	0450M	025	045	997	3057	24/23	CIRC	----	10	07	
6	080510Z	12.0N 153.0E	SLTLS	STG C	DIA	--	BNDS	-						
7	080920Z	13.3N 152.9E	VW-R-15-05	0500M	---	---	---	---	---/---	CIRC	----	12	--	
8	081030Z	13.3N 152.0E	VW-R-----		---	---	---	---	---/---	----			--	
9	081200Z	13.3N 152.4E	VW-R-10-05	0450M	---	030	---	---	---/---	CIRC	----	30	--	
10	081406Z	13.4N 152.2E	VW-R-10-05	0450M	---	---	---	---	---/---	CIRC	----	30	15	
11	082100Z	14.2N 151.7E	54-P-10-01	700MB	035	045	981	2917	18/11	CIRC	----	10	--	
12	090300Z	14.5N 151.5E	54-P-10-01	700MB	070	065	968	2822	18/11	CIRC	----	15	--	
13	090410Z	15.0N 151.0E	SLTLS	STG X	DIA	03	BNDS	3						
14	090740Z	15.0N 151.0E	ACFT RDR		---	---	---	---	---/---	----			--	
15	090920Z	15.2N 150.6E	VW-R-40-05		---	---	---	---	---/---	CIRC	----	10	16	
16	091400Z	15.0N 150.2E	VW-R----01		---	---	---	---	---/---	----			--	
17	091450Z	15.8N 150.2E	VW-R-03-05		---	---	---	---	---/---	CIRC	----	10	20	
18	092100Z	16.2N 149.7E	54-P-03-03	700MB	080	085	951	2673	20/13	CIRC	----	12	--	
19	100300Z	16.9N 148.8E	54-P-10-10	700MB	075	080	938	2547	19/12	CIRC	----	15	--	
20	100505Z	17.0N 148.5E	SLTLS	STG X	DIA	04	BNDS	3						
21	100823Z	18.0N 148.0E	VW-R----15		---	---	---	---	---/---	----			--	
22	100845Z	17.9N 148.1E	VW-R-10-03		---	---	---	---	---/---	CIRC	----	12	--	
23	101403Z	18.8N 147.1E	VW-R-03-05		---	---	---	---	---/---	CIRC	----	15	--	
24	102100Z	19.9N 146.3E	54-P-03-02	700MB	088	100	948	2655	24/18	CIRC	----	08	--	

FIX NO.	TIME	POSIT		EYE FIXES CYCLONE				OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WIND	OBS SFC WIND								
25	110300Z	20.7N	145.7E	54-P-10-02	700MB	080	090	950	2661	20/14	CIRC	----	08	--	
26	110409Z	21.0N	145.0E	SLTLS	STG X	DIA 03	BNDS 3								
27	110750Z	21.8N	145.2E	VW-R-15		---	---	---	---	---/---	----			--	
28	110835Z	21.8N	145.4E	VW-R-05-05		---	035	---	---	---/---	CONC		38-15	--	
29	111405Z	22.5N	145.8E	VW-R-05-05		---	---	---	---	---/---	CIRC	----	28	15	
30	112110Z	25.0N	146.5E	54-P-04-03	700MB	115	100	951	2676	19/10	ELIP	NE-SW	40X30	12	
31	120245Z	26.8N	147.6E	54-P-07-05	700MB	110	115	955	2728	20/10	ELIP	NW-SE	40X30	10	
32	120505Z	27.5N	150.0E	SLTLS	STG X	DIA 04	BNDS 2								
33	120900Z	28.9N	151.4E	VW-R-01-05		---	---	---	---	---/---	ELIP	NW-SE	50X20	--	
34	121040Z	29.4N	152.1E	VW-P-01-02	700MB	---	---	---	2960	23/12	ELIP	NW-SE	45X20	--	

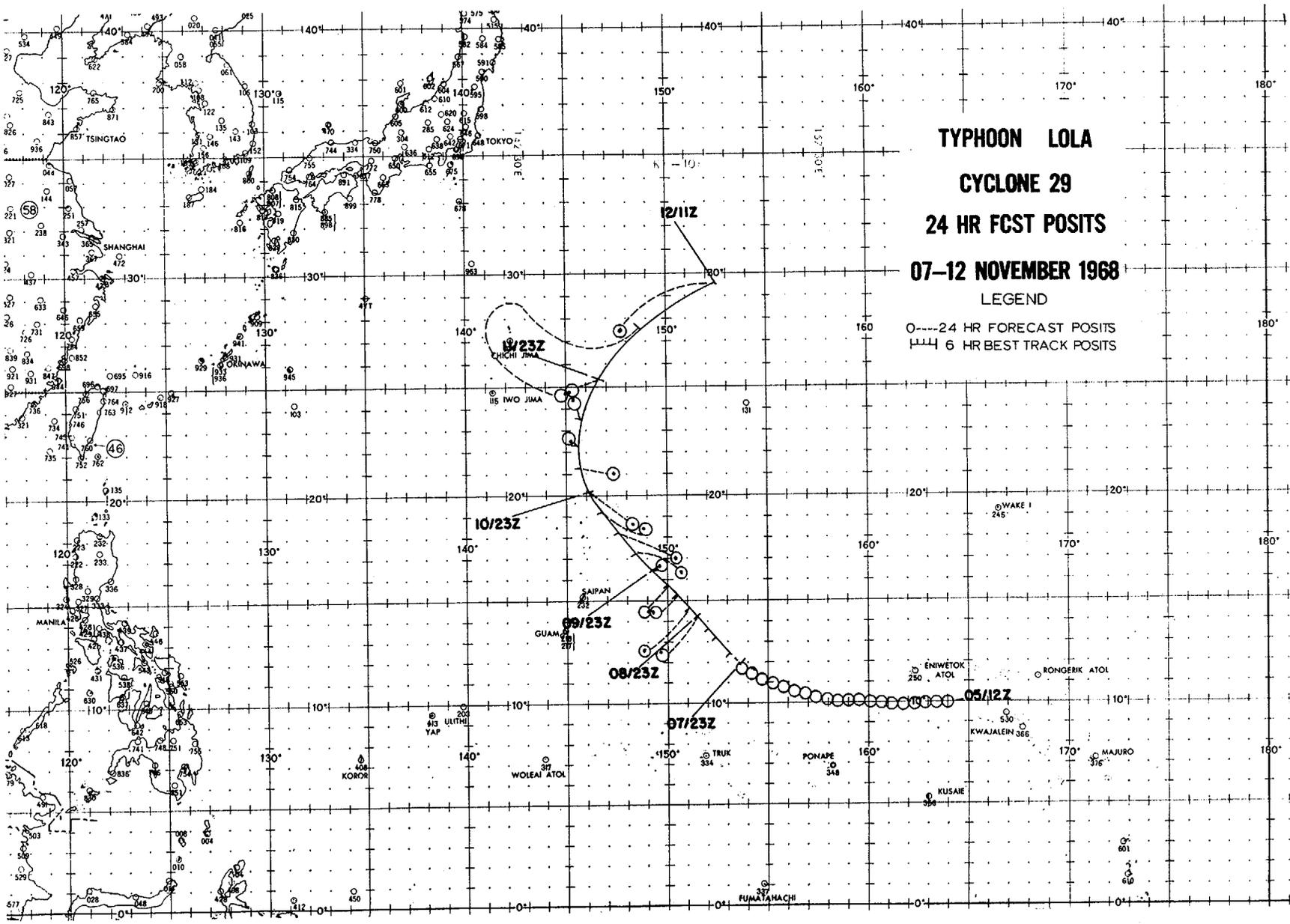
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TROPICAL CYCLONE 29 -- 11/07/2300Z TO 11/12/1100Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HR. ERROR		48 HR. ERROR		72 HR. ERROR	
	LAT.	LONG.	DEG.	DIST.	DEG.	DIST.	DEG.	DIST.
080500Z	12.6N	153.0E	-----		-----		-----	
081100Z	13.2N	152.5E	-----		-----		-----	
081700Z	13.7N	152.0E	-----		-----		-----	
082300Z	14.3N	151.6E	226-0150		-----		-----	
090500Z	14.8N	151.1E	224-0180		-----		-----	
091100Z	15.3N	150.5E	234-0078		-----		-----	
091700Z	15.9N	150.0E	210-0096		-----		-----	
092300Z	16.5N	149.3E	090-0018		-----		-----	
100500Z	17.2N	148.6E	113-0132		220-0330		-----	
101100Z	18.2N	147.8E	116-0156		208-0222		-----	
101700Z	19.2N	146.8E	112-0120		190-0250		-----	
102300Z	20.1N	146.0E	121-0144		120-0190		-----	
110500Z	21.2N	145.5E	097-0090		122-0342		210-0540	
111100Z	22.2N	145.5E	303-0018		128-0342		-----	
111700Z	23.5N	145.8E	336-0054		140-0240		199-0528	
112300Z	25.3N	146.6E	249-0078		165-0264		-----	
120500Z	27.6N	148.7E	230-0258		199-0150		164-0402	
121100Z	29.5N	152.3E	242-0264		246-0270		-----	

AVERAGE 24 HOUR ERROR - 0122 MI.
 AVERAGE 48 HOUR ERROR - 0262 MI.
 AVERAGE 72 HOUR ERROR - 0490 MI.

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TROPICAL CYCLONE 30 - 11/09/0500Z TO 11/23/2300Z
(MAMIE)

- I. DATA
 - A. STATISTICS
 - 1. NUMBER OF WARNINGS ISSUED - 52
 - 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 09
 - 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2154 MI
 - B. CHARACTERISTICS AS A TYPHOON
 - 1. MINIMUM OBSERVED SLP - 972MBS AT 180815Z
 - 2. MINIMUM OBSERVED 700MB HEIGHT - 2866M. AT 210845Z
 - 3. MAXIMUM SURFACE WIND - 065 KTS (FROM BEST TRACK)
 - 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - LOW LEVEL SURGE INTO CYCLONIC CIRCULATION FROM THE SOUTH WITH SUBSEQUENT DIVERGENCE AT 200MB LEVEL
 - B. INITIAL SURFACE VORTEX
 - 1. JUNCTION VORTEX AT 070600Z
 - 2. SURFACE PRESSURE LESS THAN 1006MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 - 1. INITIAL - EAST
 - 2. UPON REACHING TYPHOON INTENSITY - SOUTHEAST
- III. FINAL DISPOSITION - DISSIPATED OVER LAND

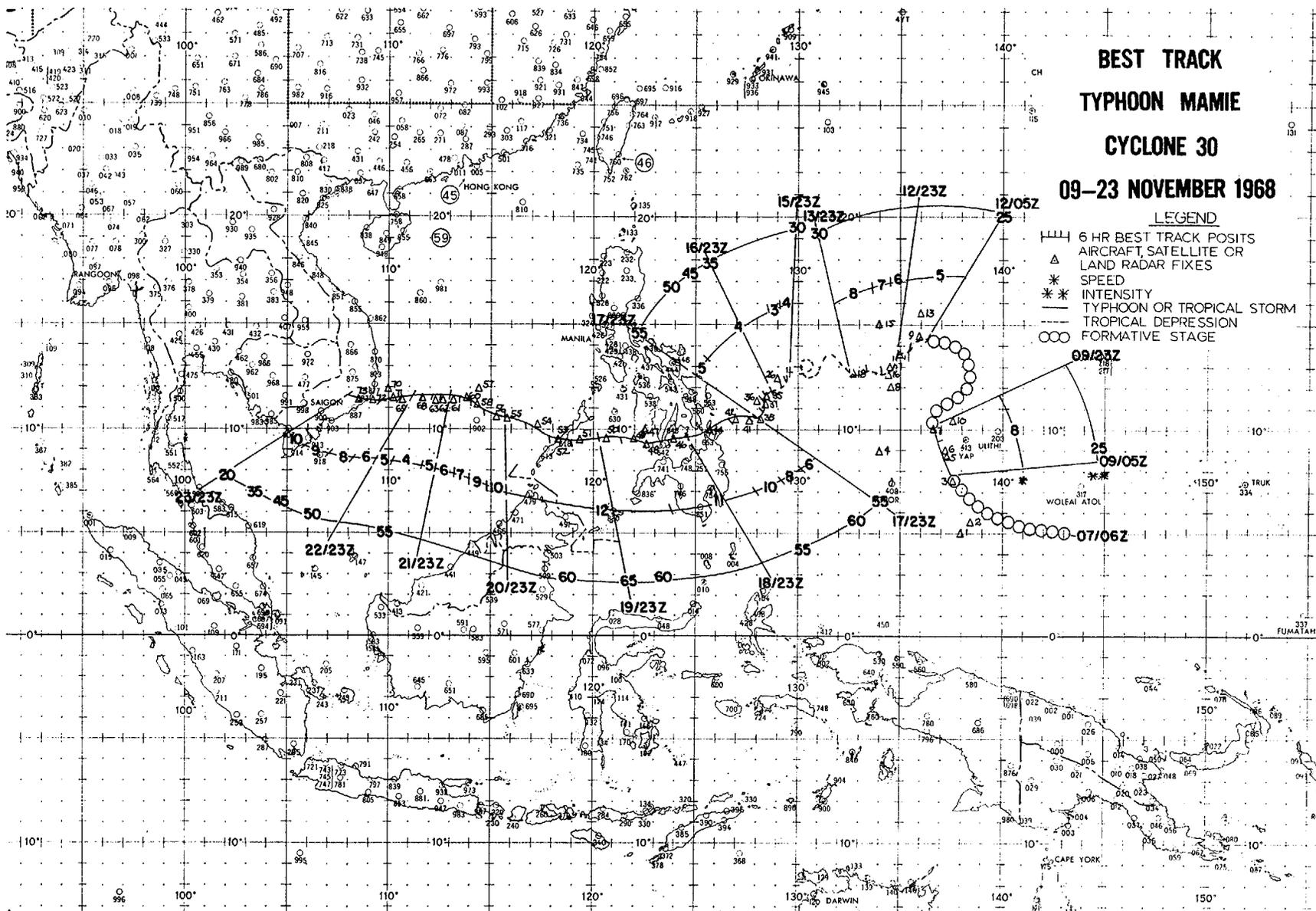
BEST TRACK TYPHOON MAMIE CYCLONE 30

09-23 NOVEMBER 1968

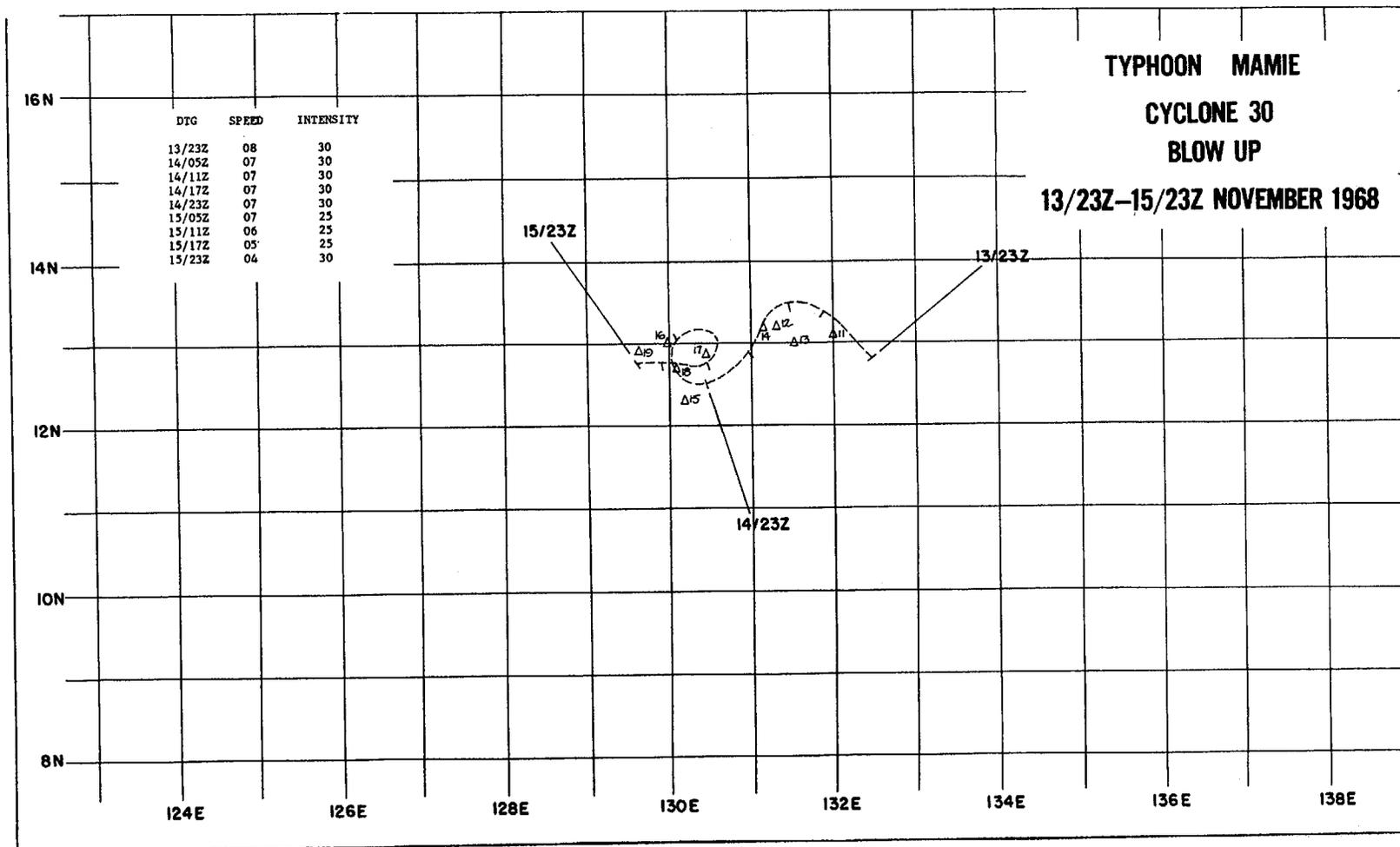
LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE

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5-166

FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND								
1	060515Z	05.0N 138.0E	SLTLS	STG A	DIA	--	BNDS -						
2	080510Z	05.5N 138.5E	SLTLS	STG C	DIA	--	BNDS -						
3	090240Z	07.6N 137.5E	54-P-03-10	0470M	025	025	003	---	26/26	----		--	
4	090605Z	09.0N 134.0E	SLTLS	STG C	DIA	--	BNDS -						
5	091240Z	08.9N 137.2E	VW-P-10-10	0360M	---	025	006	---	24/23	----		--	
6	091440Z	09.0N 137.1E	VW-P-05-10	0450M	---	025	006	---	24/22	----		--	
7	092225Z	10.0N 136.7E	54-P-05-15	0480M	018	015	003	---	25/24	----		--	
8	100505Z	12.0N 134.5E	SLTLS	STG A	DIA	--	BNDS -						
9	101240Z	14.5N 136.0E	ACFT RDR		---	---	---	---	--/--	----		--	
10	110108Z	11.4N 137.6E	54-P-02-20		025	025	002	---	27/26	----		--	
11	110600Z	13.5N 135.0E	SLTLS	STG A	DIA	--	BNDS -						
12	120005Z	14.2N 136.7E	VW-P-02-10	0330M	---	030	001	---	21/19	CIRC	----	10	--
13	120505Z	15.5N 136.0E	SLTLS	STG C	DIA	--	BNDS -						
14	130130Z	13.3N 134.6E	54-P-02-15	700MB	036	040	006	3139	12/--	----		N.F.B.	
15	130555Z	15.0N 134.0E	SLTLS	STG C	DIA	--	BNDS -						
16	130820Z	12.7N 134.5E	VW-P-03-10	0310M	025	025	001	---	27/24	----		--	
17	131410Z	13.0N 134.4E	VW-P-03-10	700MB	---	---	002	3150	17/13	CIRC	----	20	F.B.
18	132205Z	12.8N 132.8E	54-P-03-02	700MB	040	035	994	3063	16/11	----			F.B.
19	140245Z	13.1N 132.0E	54-P-03-03	700MB	040	045	997	3085	14/11	----			--
20	140650Z	13.5N 130.5E	SLTLS	STG X	DIA	03	BNDS 2						
21	140900Z	13.2N 131.3E	VW-R----05		---	---	---	---	--/--	----			--
22	140928Z	13.0N 131.5E	VW-P-02-05	0450M	---	025	996	---	26/24	CIRC	----	40	--
23	141405Z	13.2N 131.2E	VW-P-02-10	0450M	---	---	998	---	24/--	----			F.B.
24	142145Z	12.3N 130.2E	54-P-05-10	700MB	030	025	996	3072	13/12	----			F.B.

FIX NO.	TIME	POSIT		EYE FIXES CYCLONE				OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN-TATION	EYE DIA	THKNS WALL CLOUD
				UNIT-METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND							
25	150230Z	13.0N	130.0E	54-P-10-03	700MB	035	035	000	3100	13/12	----		--	
26	150530Z	12.5N	129.0E	SLTLS	STG X	DIA	03	BNDS 1						
27	150900Z	12.8N	130.4E	VW-P-10-03	0450M	---	022	000	---	25/24	----		--	
28	151405Z	12.7N	130.1E	VW-P-03-03	700MB	---	---	001	3170	11/12	CIRC	----	20	--
29	152220Z	12.9N	129.7E	54-P-03-03	700MB	015	035	---	3082	11/10	----			N.F.B.
30	160245Z	12.6N	129.8E	54-P-07-02	700MB	035	035	979	2923	12/11	CIRC	----	15	N.F.B.
31	160646Z	13.0N	129.0E	SLTLS	STG X	DIA	03	BNDS 1						
32	160810Z	12.2N	130.1E	54-P-05-03	700MB	035	035	992	3039	15/12	CIRC	----	25	--
33	161530Z	12.1N	129.3E	VW-P-05-05		---	030	992	---	25/21	----			F.B.
34	162000Z	12.2N	129.3E	VW-P-07-05	0360M	---	030	994	---	26/23	ELIP	NW-SE	99X80	--
35	170230Z	11.8N	128.5E	54-P-05-04	700MB	045	070	983	2978	18/11	----			--
36	170545Z	11.5N	128.0E	SLTLS	STG X	DIA	03	BNDS 2						
37	170834Z	11.2N	128.4E	54-P-05-04	700MB	040	055	985	2951	15/10	ELIP	N-S	20X10	--
38	171600Z	10.7N	128.1E	VW-R-05-10		----	---	---	---	--/--	CIRC	----	50	--
39	171730Z	10.8N	128.3E	VW-P-05-05		----	---	---	---	--/--	----			--
40	172005Z	10.6N	128.3E	VW-R-05-10		----	---	---	---	--/--	CIRC	----	40	--
41	180246Z	10.4N	127.6E	54-P-08-03	700MB	074	055	976	2899	18/12	CIRC	----	30	--
42	180640Z	10.5N	127.0E	SLTLS	STG X	DIA	02	BNDS 2						
43	180815Z	10.8N	127.0E	54-P-05-02	700MB	075	080	972	2874	20/12	CIRC	----	30	10
44	181528Z	10.0N	125.8E	VW-R-05-05		----	---	---	---	--/--	CIRC	----	24	--
45	182002Z	10.0N	125.4E	VW-R-02-05		----	---	---	---	--/--	CIRC	----	24	--
46	190300Z	09.6N	124.0E	54-P-03-03	500MB	050	065	---	---	52/58	CIRC	----	15	--
47	190540Z	10.0N	122.5E	SLTLS	STG X	DIA	03	BNDS 2						
48	190820Z	09.2N	122.7E	54-P-05-10	500MB	060	050	---	---	56/56	CIRC	----	05	--

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FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		30		MIN 700MB HGT	FLT LVL TT/TU	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP							
49	191508Z	09.6N 122.0E	VW-R-01-10		---	---	---	---	---	---/---	CIRC	----	40	--
50	192100Z	09.7N 120.6E	VW-R-02-10		---	---	---	---	---	---/---	CIRC	----	35	--
51	200300Z	09.6N 119.4E	54-P-02-07	500MB	050	070	972	---	06/05	CIRC	----	10	--	
52	200635Z	09.0N 118.0E	SLTLS	STG X	DIA 04	BNDS 2								
53	200830Z	09.6N 118.2E	54-P-02-10	500MB	050	050	---	---	55/54	----				--
54	201510Z	10.1N 117.2E	VW-R-01-05	1410M	038	---	---	---	---	---/---	CIRC	----	40	--
55	202020Z	10.6N 115.9E	VW-R-01-05	700MB	---	---	---	---	---	---/---	CIRC	----	40	--
56	210215Z	10.7N 115.2E	54-P-03-05	700MB	080	085	976	2880	16/10	CIRC	----	30	--	
57	210731Z	12.0N 114.5E	SLTLS	STG X	DIA 05	BNDS 3								
58	210845Z	11.1N 114.4E	54-P-03-03	700MB	080	110	974	2866	16/08	CIRC	----	15	--	
59	211330Z	11.2N 114.3E	VW-R-01-10		---	---	---	---	---	---/---	----			--
60	211500Z	11.6N 113.9E	VW-R-01-10		---	---	---	---	---	---/---	CIRC	----	30	--
61	212000Z	11.5N 113.2E	VW-R-01-10		---	---	---	---	---	---/---	CIRC	----	30	--
62	220310Z	11.4N 112.7E	VW-R-05-03		---	---	---	---	---	---/---	CIRC	----	12	09
63	220545Z	11.4N 112.2E	VW-R-05-05		---	---	---	---	---	---/---	CIRC	----	12	09
64	220630Z	11.0N 112.0E	SLTLS	STG X	DIA 04	BNDS 3								
65	220808Z	11.4N 112.1E	VW-R-05-05		---	---	---	---	---	---/---	CIRC	----	12	--
66	221420Z	11.4N 112.1E	VW-R-01-10		---	---	---	---	---	---/---	----			--
67	221500Z	11.4N 112.0E	VW-R-02-10		---	---	---	---	---	---/---	CIRC	----	30	--
68	222000Z	11.5N 111.7E	VW-R-01-15		---	---	---	---	---	---/---	CIRC	----	30	--
69	230315Z	11.4N 110.8E	VW-R-05-05		---	045	---	---	---	---/---	CIRC	----	30	--
70	230725Z	12.0N 110.0E	SLTLS	STG X	DIA 04	BNDS 4								
71	230800Z	11.6N 110.3E	VW-R-05-05		---	035	---	---	---	---/---	CIRC	----	30	10
72	231450Z	11.4N 109.2E	VW-R-02-02		---	---	---	---	---	---/---	CIRC	----	22	09

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	EYE FIXES CYCLONE		30		OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	WNO	OBS SFC	WNO							
73	232000Z	11.5N 108.4E	VW-R-02-03			---	---	---	---	--/--	CIRC	----	25	--

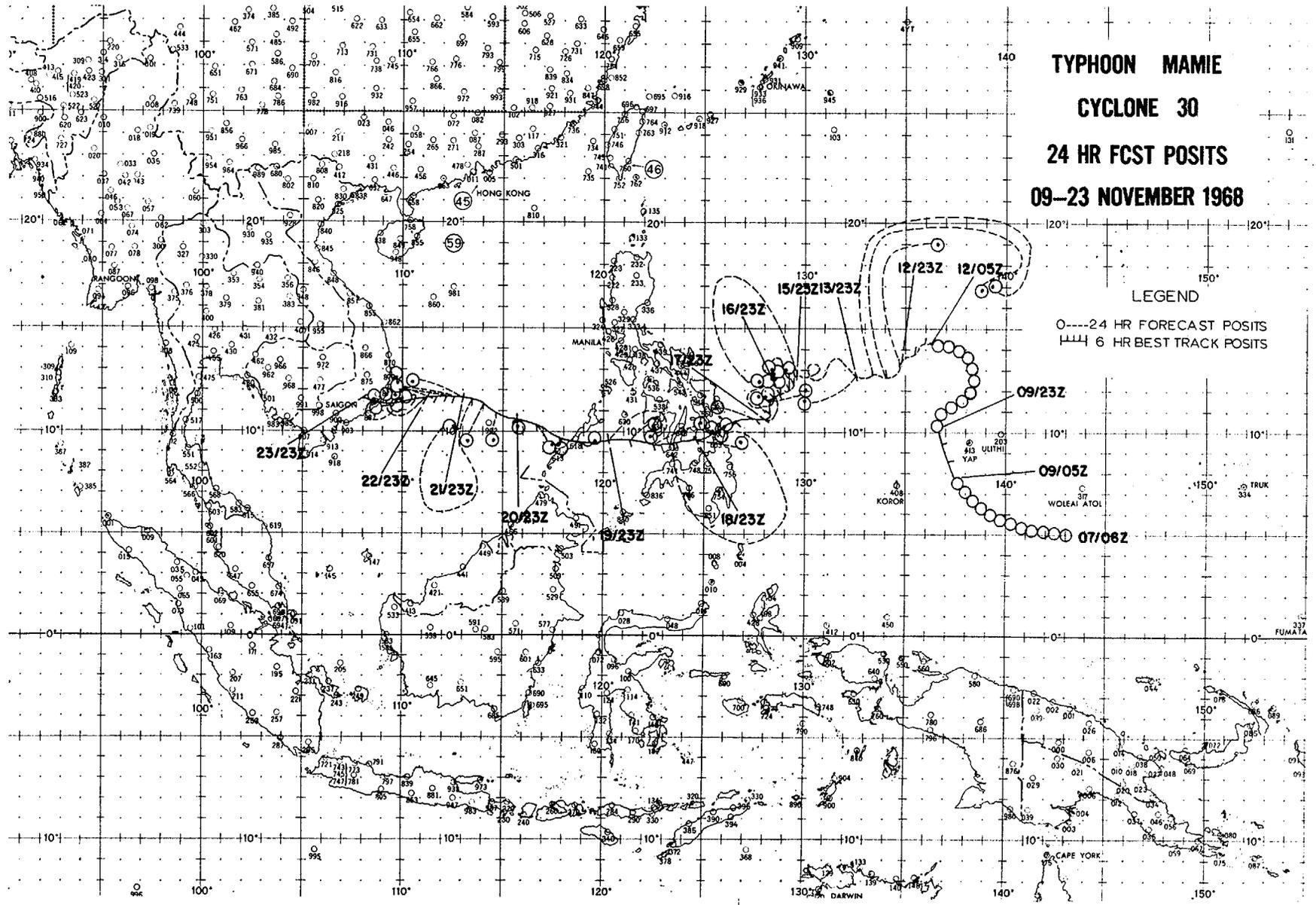
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TROPICAL CYCLONE 30 -- 11/09/0500Z TO 11/23/2300Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HR. ERROR		48 HR. ERROR		72 HR. ERROR	
	LAT.	LONG.	DEG.	DIST.	DEG.	DIST.	DEG.	DIST.
162300Z	11.9N	128.7E	344	0042	-----	-----	-----	-----
170500Z	11.7N	128.4E	000	0066	-----	-----	-----	-----
171100Z	11.2N	128.3E	064	0102	-----	-----	-----	-----
171700Z	10.8N	128.3E	338	0060	-----	-----	-----	-----
172300Z	10.5N	128.0E	000	0078	-----	-----	-----	-----
180500Z	10.7N	127.4E	284	0096	-----	-----	-----	-----
181100Z	10.5N	126.5E	234	0030	-----	-----	-----	-----
181700Z	10.0N	125.6E	270	0006	-----	-----	-----	-----
182300Z	09.8N	124.5E	097	0138	-----	-----	-----	-----
190500Z	09.4N	123.5E	074	0120	327	0096	-----	-----
191100Z	09.4N	122.3E	069	0156	050	0054	-----	-----
191700Z	09.7N	121.3E	071	0066	072	0054	-----	-----
192300Z	09.7N	120.1E	085	0120	097	0282	-----	-----
200500Z	09.5N	118.9E	090	0036	086	0252	015	0072
201100Z	09.8N	117.8E	180	0018	084	0300	-----	-----
201700Z	10.3N	116.7E	134	0066	094	0144	102	0084
202300Z	10.7N	115.7E	170	0036	104	0192	-----	-----
210500Z	11.0N	114.8E	185	0078	154	0096	101	0354
211100Z	11.3N	114.0E	203	0108	193	0108	-----	-----
211700Z	11.4N	113.5E	215	0090	187	0108	116	0156
212300Z	11.5N	113.0E	288	0150	226	0090	-----	-----
220500Z	11.5N	112.6E	285	0156	232	0174	206	0126
221100Z	11.5N	112.1E	280	0132	241	0216	-----	-----
221700Z	11.6N	111.7E	296	0120	256	0162	234	0210
222300Z	11.6N	111.2E	278	0114	284	0288	-----	-----
230500Z	11.5N	110.6E	281	0030	280	0282	251	0294
231100Z	11.4N	109.8E	265	0060	278	0240	-----	-----
231700Z	11.4N	108.8E	090	0054	286	0186	288	0168

AVERAGE 24 HOUR ERROR - 0083 MI.
 AVERAGE 48 HOUR ERROR - 0174 MI.
 AVERAGE 72 HOUR ERROR - 0183 MI.

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TYPHOON MAMIE
CYCLONE 30
24 HR FCST POSITS
09-23 NOVEMBER 1968

LEGEND
○-----24 HR FORECAST POSITS
—— 6 HR BEST TRACK POSITS

TROPICAL CYCLONE 31 - 11/18/1100Z TO 11/27/2300Z
(NINA)

- I. DATA
 - A. STATISTICS
 1. NUMBER OF WARNINGS ISSUED - 39
 2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 13
 3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 2316 MI
 - B. CHARACTERISTICS AS A TYPHOON
 1. MINIMUM OBSERVED SLP - 959MBS AT 260820Z
 2. MINIMUM OBSERVED 700MB HEIGHT - 2755M. AT 260820Z
 3. MAXIMUM SURFACE WIND - 070 KTS (FROM BEST TRACK)
 4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 360 MI
- II. DEVELOPMENT
 - A. INITIAL IMPETUS - FRACTURE OF A POLAR TROUGH AND AN EASTERLY WAVE
 - B. INITIAL SURFACE VORTEX
 1. JUNCTION VORTEX AT 160600Z
 2. SURFACE PRESSURE LESS THAN 1006MB
 - C. 200MB FLOW ABOVE SURFACE VORTEX
 1. INITIAL - SOUTH
 2. UPON REACHING TYPHOON INTENSITY - SOUTHEAST
- III. FINAL DISPOSITION - DISSIPATED OVER WATER

BEST TRACK

TYPHOON NINA

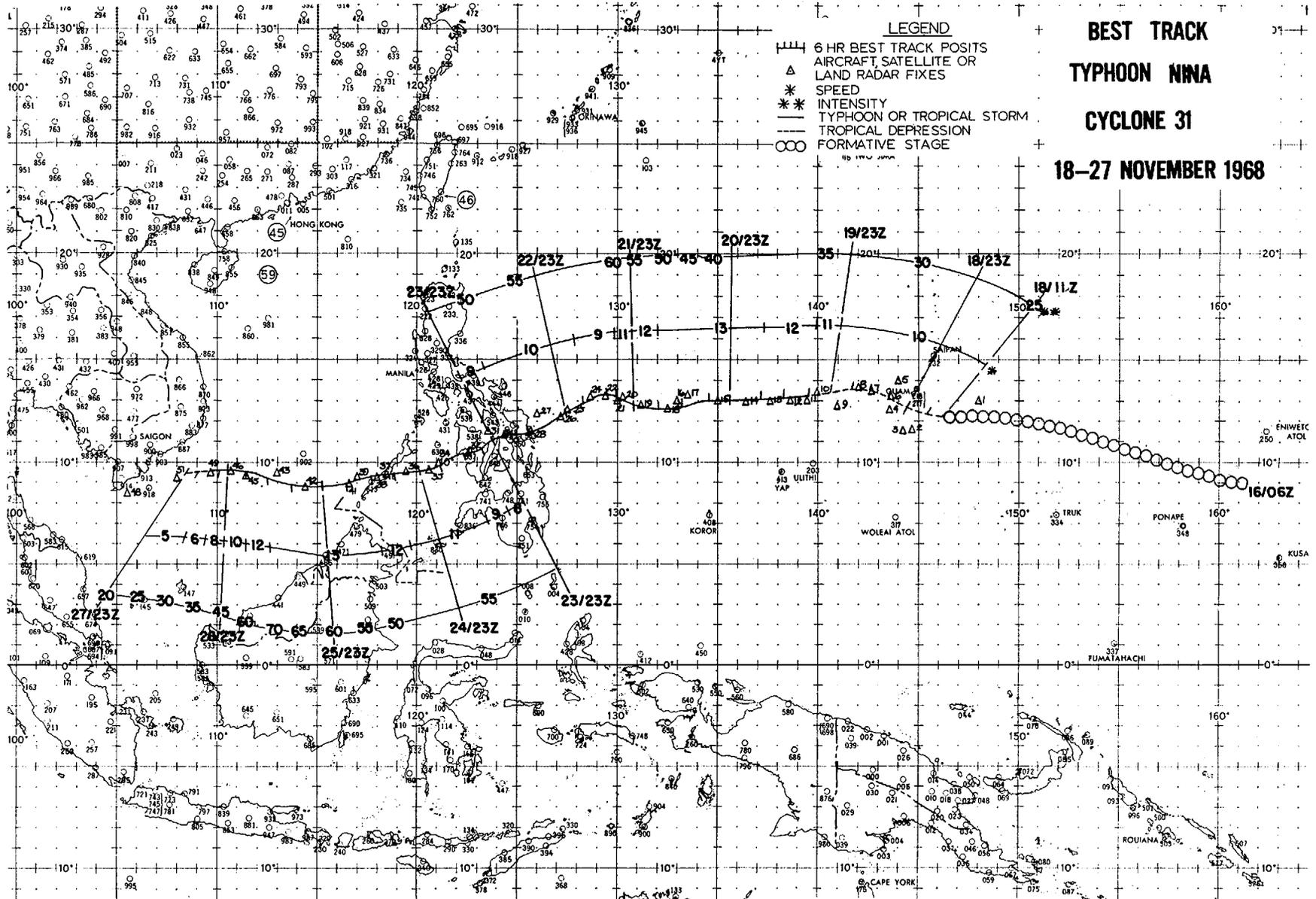
CYCLONE 31

18-27 NOVEMBER 1968

LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE

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FIX NO.	TIME	POSIT	UNIT METHOD -ACCY	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTA- TION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	LVL WND	FLY WND								
1	180445Z	13.0N 148.0E	SLTLS	STG X	DIA	05	BND5 2							
2	182130Z	11.6N 144.8E	VW-P-05-10	0450M	020	015	004	---	25/24	----			N.F.B.	
3	190200Z	11.5N 144.3E	VW-P-03-10	0450M	---	020	003	---	26/25	----			N.F.B.	
4	190345Z	12.6N 143.7E	LND RDR		---	---	---	---	---/--	----			--	
5	190540Z	14.0N 144.0E	SLTLS	STG X	DIA	05	BND5 2							
6	190550Z	13.1N 143.7E	LND RDR		---	---	---	---	---/--	----			--	
7	190930Z	13.6N 142.8E	54-P-03-08	700MB	028	---	995	3054	10/--	----			N.F.B.	
8	191400Z	13.8N 142.0E	54-P-03-02	700MB	040	---	000	3054	12/11	CIRC	----	10	07	
9	192130Z	12.9N 141.0E	54-P-03-15	700MB	030	030	001	3060	11/10	----			F.B.	
10	200300Z	13.5N 140.0E	54-P-03-10	700MB	050	035	994	3030	15/12	----			F.B.	
11	200439Z	13.0N 139.5E	SLTLS	STG C	DIA	--	BND5 -							
12	200843Z	13.0N 138.8E	VW-P-05-03		---	025	993	3080	26/26	CIRC	----	10	F.B.	
13	201538Z	13.0N 137.6E	VW-P-03-03	700MB	---	---	990	3071	15/13	CIRC	----	10	F.B.	
14	202100Z	13.0N 136.3E	54-P-03-05	700MB	040	040	992	3027	15/11	CIRC	----	40	F.B.	
15	210300Z	13.0N 135.0E	54-P-05-03	700MB	060	060	984	2972	18/10	CIRC	----	40	F.B.	
16	210535Z	13.0N 133.0E	SLTLS	STG X	DIA	05	BND5 3							
17	210912Z	13.1N 133.4E	VW-R-03-10		---	---	---	---	---/--	----			F.B.	
18	211400Z	12.6N 132.5E	VW-P-05-05	700MB	---	---	985	2944	17/10	----			F.B.	
19	212230Z	12.9N 131.1E	54-P-03-10	700MB	048	065	972	2856	14/09	CIRC	----	20	F.B.	
20	220245Z	13.1N 130.2E	54-P-05-05	700MB	050	060	969	2826	16/10	CIRC	----	25	--	
21	220630Z	13.0N 130.0E	SLTLS	STG X	DIA	04	BND5 3							
22	220927Z	13.3N 129.4E	VW-R----15		---	---	---	---	---/--	----			--	
23	220950Z	13.2N 129.4E	VW-P-05-05	700MB	---	---	970	---	14/08	ELIP	NW-SE	30X20	--	
24	221401Z	13.1N 128.7E	VW-R-03-10		---	---	---	---	---/--	CIRC	----	30	--	

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FIX NO.	TIME	POSIT		EYE FIXES CYCLONE			31		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
				UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WNO	OBS MIN SLP						
25	222100Z	12.6N	127.5E	54-P-03-10	700MB	055	---	973	2862	14/08	CIRC	----	50	--
26	230225Z	12.1N	127.1E	54-P-10-05	700MB	075	065	975	2859	14/10	CIRC	----	40	07
27	230530Z	12.5N	126.0E	SLTLS	STG X	DIA 05	BND5 4							
28	230930Z	11.7N	125.8E	VW-R-05-10		---	---	---	---	--/--	ELIP	N-S	39X30	--
29	231401Z	11.3N	125.3E	VW-R-05-10		---	---	---	---	--/--	CIRC	----	27	--
30	232056Z	11.3N	124.3E	54-P-05-04	500MB	060	---	---	---	00/54	ELIP	NW-SE	30X25	15
31	240300Z	10.6N	123.5E	54-P-05-10	500MB	060	---	---	---	03/52	CIRC	----	30	--
32	240625Z	10.5N	122.5E	SLTLS	STG X	DIA 05	BND5 3							
33	240840Z	10.5N	122.6E	54-P-03-03	500MB	050	---	---	---	02/52	CIRC	----	30	--
34	241700Z	10.0N	121.1E	VW-R-02-05	700MB	---	---	---	---	--/--	CIRC	----	40	--
35	242100Z	09.8N	120.5E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	20	--
36	250300Z	09.7N	119.5E	54-P-05-02	700MB	080	060	977	2914	17/--	CIRC	----	30	10
37	250720Z	09.5N	118.5E	SLTLS	STG X	DIA 04	BND5 2							
38	250900Z	09.2N	118.0E	54-P-05-03	500MB	090	---	---	---	51/54	ELIP	NW-SE	20X15	17
39	251530Z	09.2N	117.0E	VW-R-05-10		---	---	---	---	--/--	----			--
40	251615Z	09.0N	116.7E	VW-P-03-05	700MB	---	---	976	2965	18/10	CIRC	----	30	--
41	251930Z	09.0N	116.0E	VW-R-03-10		---	---	---	---	--/--	CIRC	----	25	15
42	260300Z	08.9N	114.4E	54-P-05-05	700MB	085	090	970	2816	20/12	CIRC	----	25	--
43	260620Z	09.5N	113.0E	SLTLS	STG X	DIA 03	BND5 3							
44	260820Z	09.3N	112.8E	54-P-05-05	700MB	095	120	959	2755	20/10	CIRC	----	25	F.B.
45	261530Z	09.2N	111.3E	VW-R-02-05		---	---	---	---	--/--	CIRC	----	30	N.F.B.
46	262130Z	09.7N	110.8E	VW-P-06-10	700MB	---	---	---	3047	18/10	----			N.F.B.
47	270315Z	09.6N	110.2E	54-P-05-02	700MB	070	075	990	3042	15/08	CIRC	----	10	N.F.B.
48	270714Z	08.5N	105.5E	SLTLS	STG C	DIA --	BND5 -							

FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND								
49	270900Z	09.5N 109.8E	54-P-03-02	700MB	035	035	993	3048	14/12	CIRC	----	10	N.F.B.
50	271500Z	09.4N 109.5E	VW-P-05-01	0460M	---	025	002	---	25/22	----			F.B.
51	272000Z	09.1N 108.0E	VW-P-05-02	0440M	---	030	002	3087	23/21	----			F.B.

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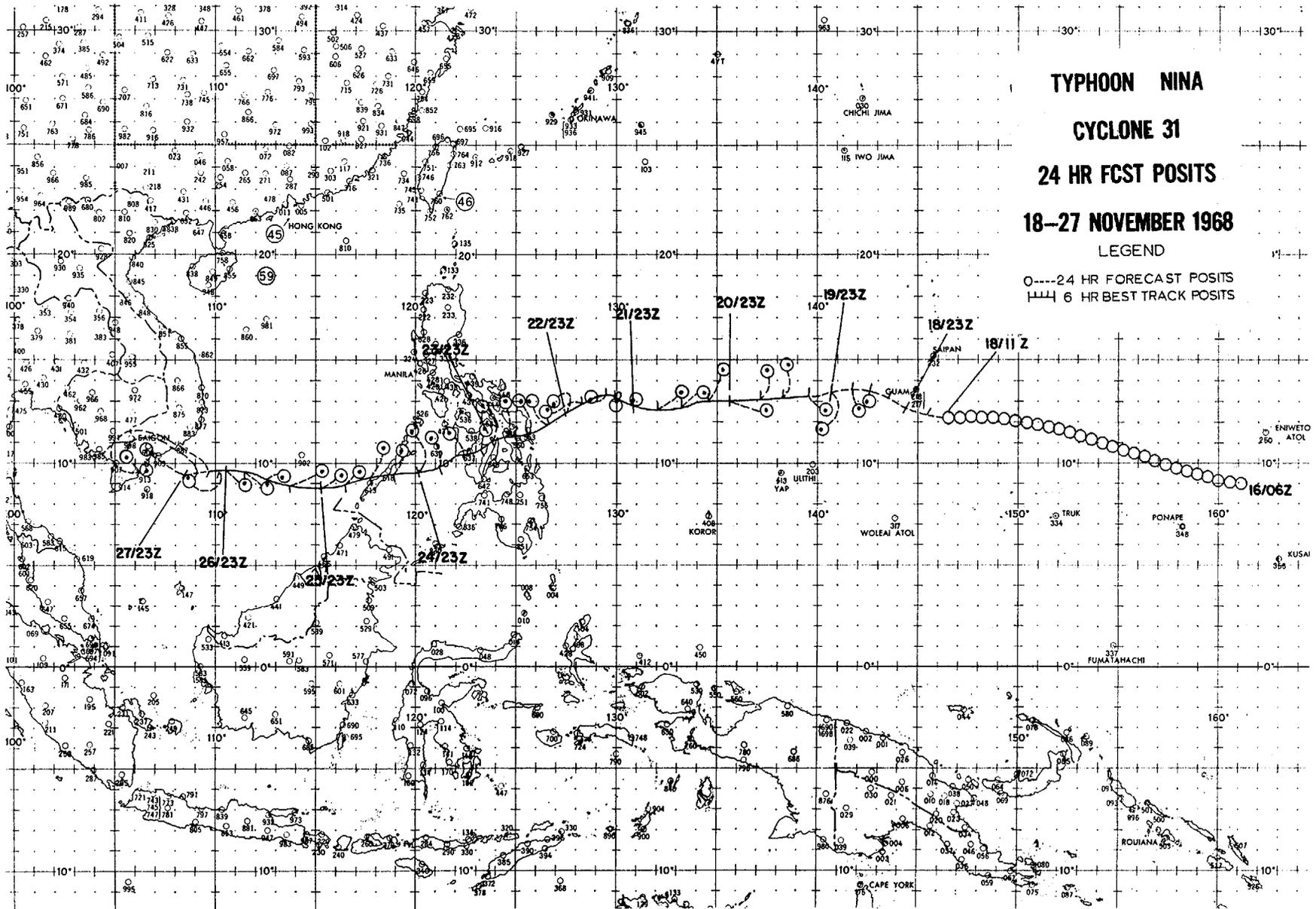
TROPICAL CYCLONE 31 -- 11/18/1100Z TO 11/27/2300Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
200500Z	13.2N	139.6E	130-0054	-----	-----
201100Z	13.1N	138.3E	007-0108	-----	-----
201700Z	13.0N	137.1E	008-0090	-----	-----
202300Z	13.0N	135.8E	104-0090	-----	-----
210500Z	13.0N	134.5E	022-0096	-----	-----
211100Z	12.8N	133.2E	066-0072	-----	-----
211700Z	12.6N	132.0E	060-0066	-----	-----
212300Z	12.9N	130.9E	000-0006	-----	-----
220500Z	13.1N	130.0E	180-0006	018-0096	-----
221100Z	13.2N	129.6E	264-0108	087-0090	-----
221700Z	12.9N	128.3E	264-0102	085-0060	-----
222300Z	12.4N	127.4E	321-0036	320-0042	-----
230500Z	11.8N	126.5E	333-0078	326-0084	354-0174
231100Z	11.5N	125.6E	348-0090	308-0144	-----
231700Z	11.4N	124.7E	356-0096	300-0150	046-0114
232300Z	11.0N	123.9E	342-0114	337-0120	-----
240500Z	10.6N	123.2E	010-0072	329-0162	326-0168
241100Z	10.4N	122.2E	340-0066	340-0162	-----
241700Z	09.9N	121.1E	355-0072	004-0186	316-0228
242300Z	09.7N	120.1E	356-0108	358-0192	-----

250500Z	09.5N	118.9E	011-0066	029-0150	341-0222
251100Z	09.2N	117.8E	014-0102	360-0138	-----
251700Z	09.0N	116.5E	036-0048	006-0132	020-0252
252300Z	08.9N	115.2E	067-0054	011-0156	-----
260500Z	08.9N	113.9E	057-0084	035-0168	042-0222
261100Z	09.2N	112.6E	090-0030	044-0162	-----
261700Z	09.5N	111.5E	099-0174	082-0084	034-0126
262300Z	09.6N	110.6E	140-0042	094-0084	-----
270500Z	09.5N	110.1E	256-0072	058-0096	054-0162

AVERAGE 24 HOUR ERROR - 0075 MI.
 AVERAGE 48 HOUR ERROR - 0126 MI.
 AVERAGE 72 HOUR ERROR - 0185 MI.

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TROPICAL CYCLONE 32 - 11/21/2300Z TO 11/29/1700Z
(ORA)

I. DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 33
2. NUMBER OF WARNINGS WITH TYPHOON INTENSITY - 23
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1884 MI

B. CHARACTERISTICS AS A TYPHOON

1. MINIMUM OBSERVED SLP - 931MBS AT 250300Z
2. MINIMUM OBSERVED 700MB HEIGHT - 2481M. AT 250300Z
3. MAXIMUM SURFACE WIND - 120 KTS (FROM BEST TRACK)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 420 MI

II. DEVELOPMENT

A. INITIAL IMPETUS - DEVELOPMENT OF DIVERGENCE AT 200MB LEVEL OVER SURFACE CYCLONIC CIRCULATION

B. INITIAL SURFACE VORTEX

1. JUNCTION VORTEX AT 181800Z
2. SURFACE PRESSURE LESS THAN 1006MB

C. 200MB FLOW ABOVE SURFACE VORTEX

1. INITIAL - EAST
2. UPON REACHING TYPHOON INTENSITY - ANTICYCLONIC

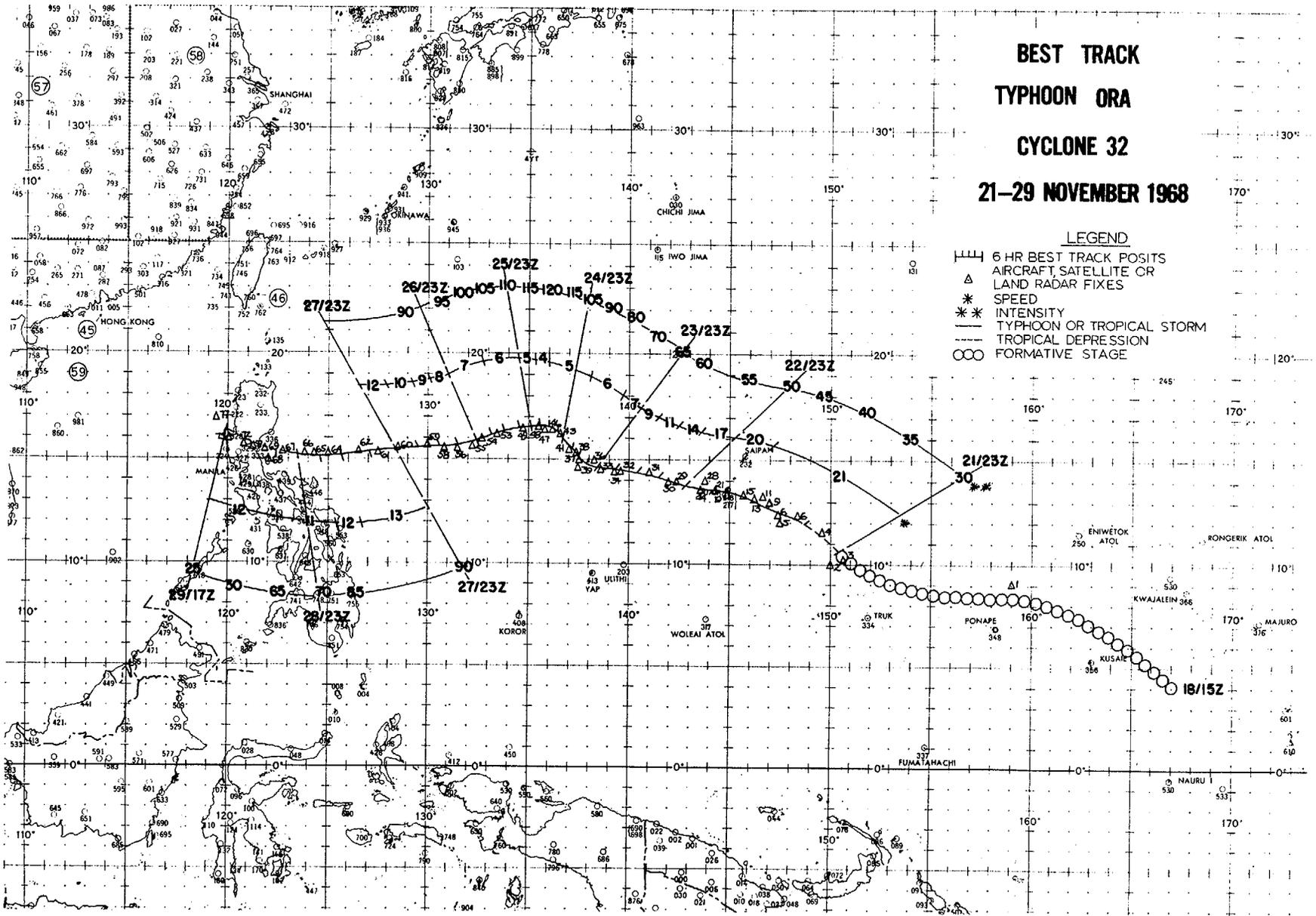
III. FINAL DISPOSITION - DISSIPATED OVER WATER

**BEST TRACK
TYPHOON ORA
CYCLONE 32
21-29 NOVEMBER 1968**

LEGEND

- 6 HR BEST TRACK POSITS
- △ AIRCRAFT, SATELLITE OR LAND RADAR FIXES
- * SPEED
- ** INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ○ ○ FORMATIVE STAGE

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FIX NO.	TIME	POSIT	UNIT-METHOD-ACCY	EYE FIXES		CYCLONE		OBS ³² SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
				FLT LVL	LVL WND	FLT LVL	LVL WND								
1	200439Z	09.0N 159.0E	SLTLS	STG B	DIA	--	BNDS -								
2	210535Z	10.0N 150.0E	SLTLS	STG A	DIA	--	BNDS -								
3	212100Z	10.2N 150.7E	54-P-07-10	700MB	065	055	001	3063	11/10	CIRC	----	30	05		
4	220320Z	11.5N 149.6E	54-P-05-10	700MB	045	035	995	3066	12/10	----				--	
5	220435Z	12.0N 147.5E	SL TLS	STG X	DIA	05	BNDS 2								
6	220715Z	12.3N 148.3E	VW-R-----			---	---	---	---/--	----					--
7	220815Z	12.4N 148.1E	VW-P-05-10	0450M	---	035	995	---	25/24	CIRC	----	12		--	
8	220915Z	12.4N 147.4E	VW-R-----			---	---	---	---/--	----					--
9	221015Z	13.0N 147.0E	VW-R----10			---	---	---	---/--	----					--
10	221045Z	13.0N 146.9E	LND RDR			---	---	---	---/--	----					--
11	221115Z	13.2N 146.6E	VW-R----10			---	---	---	---/--	----					--
12	221210Z	13.2N 146.3E	VW-P-05-05	700MB	---	---	996	3050	14/11	CIRC	----	05		--	
13	221220Z	13.1N 146.2E	LND RDR			---	---	---	---/--	----					--
14	221320Z	13.3N 146.2E	LND RDR			---	---	---	---/--	----					--
15	221415Z	13.4N 145.7E	LND RDR			---	---	---	---/--	----					--
16	221438Z	13.4N 145.6E	LND RDR			---	---	---	---/--	CIRC	----	30		--	
17	221515Z	13.5N 145.3E	LND RDR			---	---	---	---/--	----					--
18	221525Z	13.3N 145.2E	VW-R-03-02			---	---	---	---/--	CIRC	----	08		--	
19	221630Z	13.4N 144.9E	VW-R-----			---	---	---	---/--	----					--
20	221730Z	13.5N 144.6E	VW-R-----			---	---	---	---/--	----					--
21	221825Z	13.6N 144.3E	LND RDR			---	---	---	---/--	----					--
22	221850Z	13.6N 144.1E	LND RDR			---	---	---	---/--	----					--
23	221930Z	13.6N 144.0E	LND RDR			---	---	---	---/--	----					--
24	222000Z	13.7N 143.7E	LND RDR			---	---	---	---/--	----					--

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FIX NO.	TIME	POSIT	EYE UNIT-		FIXES METHUD		CYCLONE FLT		OBS 32 SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FURM	ORIENTIATION	EYE DIA	THKNS WALL CLOUD
			METHUD	-ACCY	FLT LVL	WIND										
25	222030Z	13.7N 143.7E	LND	RDR												
26	222105Z	13.8N 143.6E	LND	RDR												
27	222205Z	13.8N 143.3E	LND	RDR												N.F.B.
28	230040Z	14.0N 143.9E	LND	RDR												
29	230100Z	14.0N 142.4E	54-P-02-02		700MB	078	070	978	2917	18/12	CIRC	----	20		10	
30	230300Z	14.0N 142.0E	54-P-02-02		700MB	070	070	975	2905	20/12	CIRC	----	20		10	
31	230530Z	14.5N 141.0E	SLTLS		STG X	DIA	04	BNDS 4								
32	230910Z	14.3N 140.8E	VW-P-05-05		700MB			977	2882	16/08	CIRC	----	15		--	
33	231400Z	14.5N 139.7E	VW-P-05-05		700MB	055		964	2829	20/10	CIRC	----	15		--	
34	231705Z	14.4N 139.3E	VW-R-05-05								CIRC	----	15		--	
35	232100Z	14.6N 138.7E	54-P-03-03		700MB	085	055	962	2746	20/12	CIRC	----	20		--	
36	240255Z	15.0N 138.1E	54-P-03-01		700MB	095	080	940	2585	22/12	CIRC	----	10		--	
37	240625Z	15.0N 137.5E	SLTLS		STG X	DIA	04	BNDS 3								
38	241030Z	15.2N 137.4E	VW-R----	05												
39	241055Z	14.8N 137.5E	VW-R-05-02								CONC		35-06		12	
40	241430Z	15.3N 137.2E	VW-R-01-02				035				CONC		35-11		07	
41	242100Z	15.5N 137.0E	54-P-05-03		700MB	090		943	2634	20/10	CONC		30-10		10	
42	242106Z	15.7N 137.0E	ACFT RDR		8000M											
43	250300Z	16.2N 136.6E	54-P-03-03		700MB	100	100	931	2481	21/12	CIRC	----	30		10	
44	250525Z	16.5N 136.5E	SLTLS		STG X	DIA	04	BNDS 4								
45	250800Z	16.3N 136.7E	VW-R----	10	0460M											
46	250845Z	16.5N 136.1E	VW-R-01-02		0460M						ELIP	NW-SE	14X09		--	
47	251400Z	16.5N 135.9E	VW-R-02-01		700MB						CIRC	----	14		04	
48	252115Z	16.6N 135.4E	54-P-03-05		700MB	105	085	937	2554	17/10	CIRC	----	30		10	

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FIX NO.	TIME	POSIT	EYE FIXES CYCLONE			32		MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIENTATION	EYE DIA	THKNS WALL CLOUD
			UNIT-METHOD-ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP						
49	260300Z	16.5N 134.9E	54-P-03-03	700MB	100	085	940	2585	18/10	CIRC	----	40	10
50	260620Z	17.0N 134.5E	SLTLS	STG X	DIA	05	BNDS 4						
51	260830Z	16.2N 134.3E	VW-R----	15		---	---	---	---/---	----			--
52	260900Z	16.2N 134.2E	VW-R-10-10			---	---	---	---/---	----			--
53	261421Z	16.1N 133.3E	VW-P-10-05	700MB	---	---	968	2804	20/10	CIRC	----	40	--
54	262100Z	16.0N 132.7E	54-P-04-10	700MB	080	090	954	2694	18/10	CIRC	----	40	05
55	270230Z	15.8N 132.1E	54-P-02-05	700MB	080	100	961	2743	16/10	CIRC	----	30	05
56	270524Z	15.5N 131.5E	SLTLS	STG X	DIA	04	BNDS 3						
57	270750Z	15.8N 113.2E	ACFT RDR			---	---	---	---/---	----			--
58	270900Z	15.5N 130.9E	VW-R-02-02			---	---	---	---/---	CIRC	----	30	--
59	271400Z	15.9N 130.0E	VW-R-02-02			---	---	---	---/---	CIRC	----	12	--
60	272230Z	15.6N 128.5E	54-P-03-10	500MB	065	---	966	2812	---/56	ELIP	NW-SE	40X15	--
61	280245Z	15.4N 127.4E	54-P-03-10	700MB	060	060	957	2704	16/12	CIRC	----	25	--
62	280614Z	15.5N 126.5E	SLTLS	STG X	DIA	04	BNDS 4						
63	280815Z	15.2N 126.4E	54-P-03-05	700MB	080	090	949	2624	17/11	CIRC	----	20	--
64	281504Z	15.3N 125.0E	VW-R-05-03	0420M	---	---	---	---	---/---	CIRC	----	20	--
65	281805Z	15.2N 124.2E	VW-R-----	0420M	---	---	---	---	---/---	----			--
66	282027Z	15.2N 123.9E	VW-R-03-02	0440M	---	---	---	---	---/---	CIRC	----	10	--
67	290300Z	15.3N 122.8E	54-P-05-03	500MB	080	---	955	2707	04/52	CIRC	----	20	10
68	290709Z	15.0N 122.0E	SLTLS	STG X	DIA	03	BNDS 3						
69	290815Z	15.6N 121.9E	54-P-03-05	500MB	070	095	---	2701	16/--	CIRC	----	15	05
70	291000Z	15.7N 121.6E	LND RDR			---	---	---	---/---	----			--
71	291120Z	15.8N 121.2E	LND RDR			---	---	---	---/---	----			--
72	291210Z	15.9N 120.9E	LND RDR			---	---	---	---/---	----			--

FIX NO.	TIME	POSIT	EYE FIXES		CYCLONE		OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TO	EYE FORM	ORIEN- TATION	EYE DIA	THKNS WALL CLOUD
			UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	32								
73	291240Z	15.8N 121.0E	LND RDR							--/--				--
74	291500Z	16.0N 120.6E	VW-R-03-02							--/--	CIRC		10	--
75	291630Z	16.0N 120.0E	LND RDR							--/--				--
76	291745Z	16.4N 120.0E	VW-R-----							--/--				--
77	292055Z	17.0N 119.4E	VW-P-02-15	700MB				009	3130	09/08				--

5-186

TROPICAL CYCLONE 32 -- 11/21/2300Z TO 11/29/1700Z
 POSITION AND FORECAST VERIFICATION DATA

DTG	STORM LAT.	POSITION LONG.	24 HR. ERROR DEG. DIST.	48 HR. ERROR DEG. DIST.	72 HR. ERROR DEG. DIST.
220500Z	12.0N	148.8E	-----	-----	-----
221100Z	12.9N	146.8E	-----	-----	-----
221700Z	13.4N	144.8E	-----	-----	-----
222300Z	13.8N	142.9E	131-0180	-----	-----
230500Z	14.1N	141.5E	122-0174	-----	-----
231100Z	14.3N	140.3E	209-0084	-----	-----
231700Z	14.5N	139.3E	215-0072	-----	-----
232300Z	14.6N	138.5E	252-0150	-----	-----
240500Z	14.8N	137.9E	262-0120	146-0138	-----
241100Z	15.1N	137.4E	247-0102	232-0198	-----
241700Z	15.5N	137.1E	251-0162	232-0192	-----
242300Z	15.9N	136.8E	238-0168	247-0348	-----
250500Z	16.3N	136.4E	235-0150	245-0288	207-0210
251100Z	16.5N	136.0E	184-0102	243-0282	-----
251700Z	16.5N	135.6E	128-0102	246-0330	237-0354
252300Z	16.5N	135.1E	116-0048	242-0318	-----
260500Z	16.4N	134.5E	030-0060	242-0282	246-0378
261100Z	16.2N	133.9E	009-0084	218-0126	-----
261700Z	16.1N	133.1E	025-0084	149-0102	248-0414
262300Z	15.9N	132.4E	042-0060	088-0120	-----
270500Z	15.7N	131.6E	090-0012	041-0150	245-0348
271100Z	15.7N	130.7E	186-0066	035-0138	-----
271700Z	15.7N	129.5E	180-0084	052-0162	141-0114
272300Z	15.5N	128.3E	131-0072	067-0150	-----
280500Z	15.2N	127.0E	113-0102	111-0078	061-0252
281100Z	15.1N	125.7E	147-0096	174-0132	-----
281700Z	15.1N	124.6E	107-0156	175-0156	068-0300
282300Z	15.2N	123.5E	144-0150	137-0174	-----
290500Z	15.4N	122.4E	165-0144	134-0210	152-0150

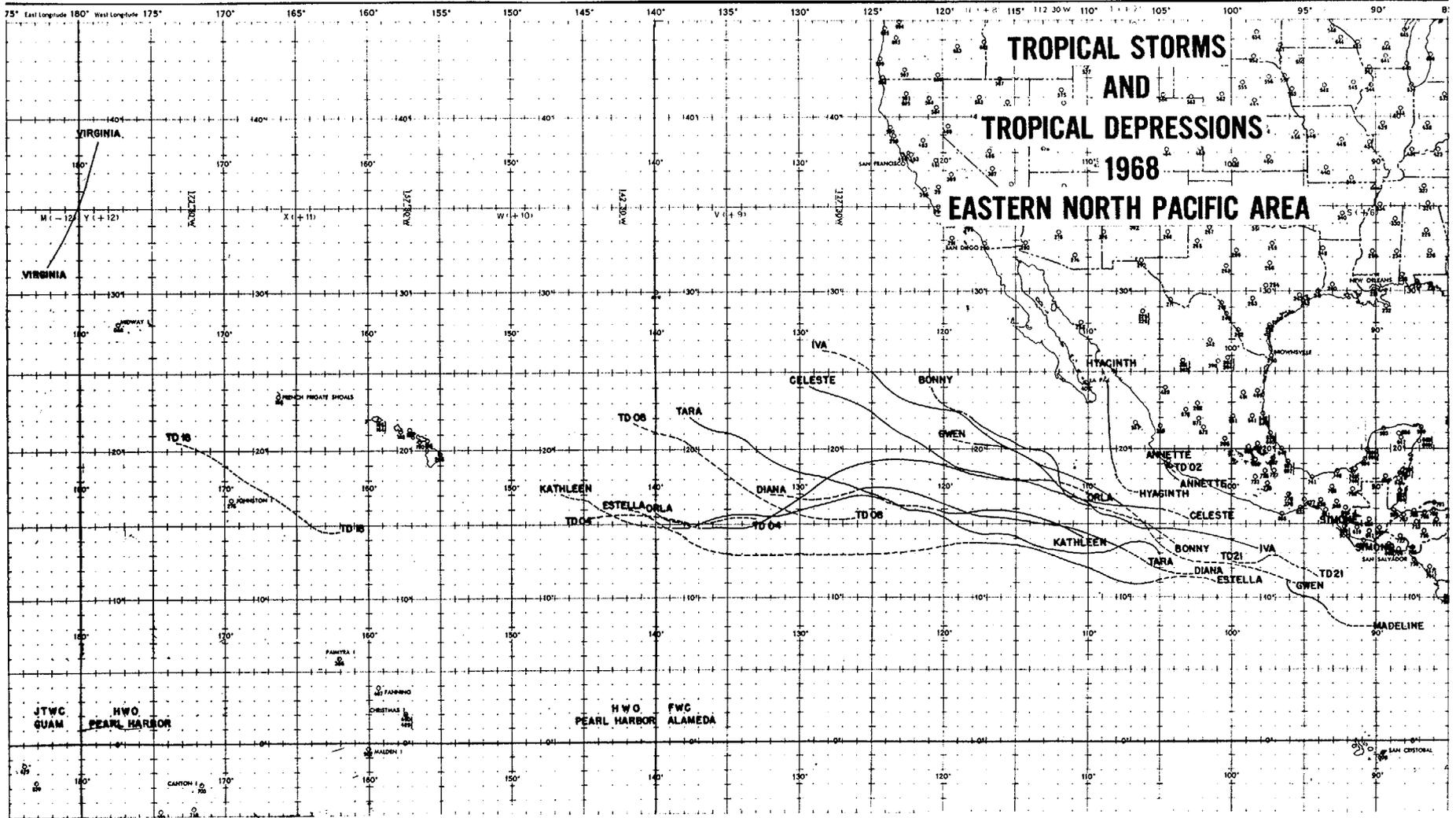
AVERAGE 24 HOUR ERROR - 0107 MI.
 AVERAGE 48 HOUR ERROR - 0194 MI.
 AVERAGE 72 HOUR ERROR - 0280 MI.

ANNEX

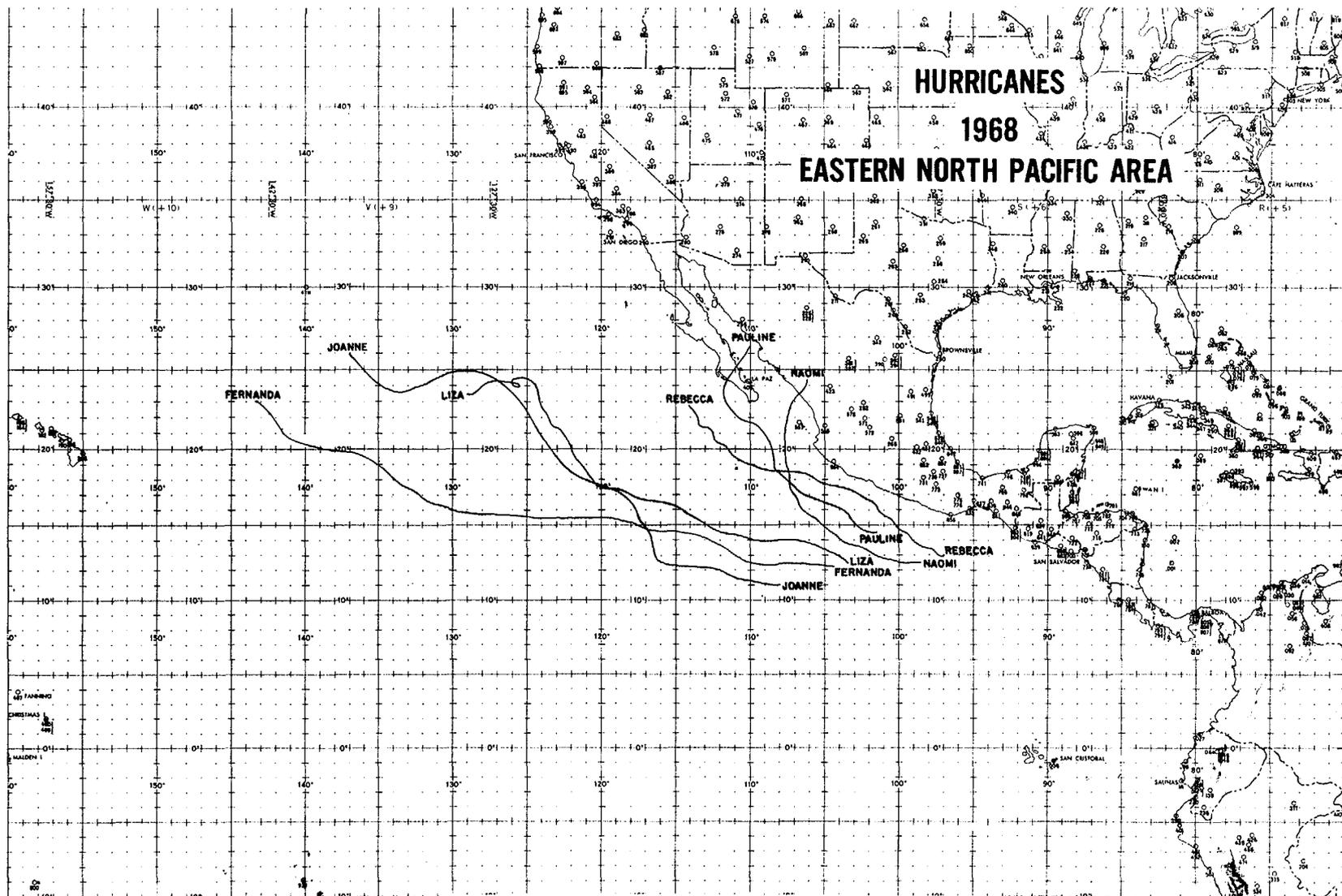
A

SUMMARY OF TROPICAL CYCLONES
IN THE
EASTERN NORTH PACIFIC OCEAN
(180 DEGREES TO NORTH AMERICAN COAST)
FOR
1968

AN-1



HURRICANES 1968 EASTERN NORTH PACIFIC AREA



AN-2

Fleet Weather Central, Alameda issued a record total of 501 Tropical Warnings on 6 hurricanes, 13 tropical storms and 5 tropical depressions. Additional warnings on systems which originated in Fleet Weather Central, Alameda's area were issued by Fleet Weather Central, Pearl Harbor after these systems were passed to Pearl Harbor at 140° West.

The following seven year summary covering Fleet Weather Central Alameda/Fleet Weather Central, Pearl Harbor areas is presented for comparison:

	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
Total Number of Warnings*	122	80	60	244	342	474	531
Calendar Days of Warnings*	35	26	21	73	70	119	126
Tropical Depressions*				2	6	2	6
Tropical Storms	6	5	4	9	6	12	13
Hurricanes	2	4	2	1	7	6	6
Total Tropical Cyclones*	8	9	6	12	19	20	25

*Tropical Depression information not available 1962-1964

Land strikes were recorded on two hurricanes. NAOMI struck Central Mexico and PAULINE crossed Baja, California. No damage reports were received by Fleet Weather Central Alameda concerning these two land strikes.

Forecasting tools used included twice daily readouts of the Fleet Numerical Weather Central's "HATRACK" steering program and a locally devised method using "RADFO" wind data. No definitive study of verification of these systems is available as yet.

The warning system in the Eastern North Pacific suffers considerably, due to lack of data. APT readouts continue to be the primary source of location data and thus creates a deficiency in intensity information. Satellite versus Recon data for the six hurricanes of 1968 is shown below:

<u>HURRICANE</u>	<u>SATELLITE FIX</u>	<u>RECON FIX</u>
FERNANDA	19	0
JOANNE	8	0

<u>HURRICANE</u>	<u>SATELLITE FIX</u>	<u>RECON FIX</u>
LISA	7	3
NAOMI	6	1
PAULINE	9	1
REBECCA	$\frac{13}{62}$	$\frac{0}{5}$
TOTAL		

TROPICAL CYCLONES FOR THE 1968 SEASON

ORIGINATED BY FLEET WEATHER CENTRAL, ALAMEDA

<u>CYCLONE</u>	<u>PERIOD</u>
01 TROPICAL STORM "ANNETTE"	20 JUN - 21 JUN 1968
02 TROPICAL DEPRESSION 02	21 JUN - 22 JUN 1968
03 TROPICAL STORM "BONNY"	4 JUL - 9 JUL 1968
04 TROPICAL DEPRESSION 04	12 JUL - 14 JUL 1968
05 TROPICAL STORM "CELESTE"	15 JUL - 21 JUL 1968
06 TROPICAL STORM "DIANA"	21 JUL - 26 JUL 1968
07 TROPICAL STORM "ESTELLE"	23 JUL - 01 AUG 1968
08 TROPICAL DEPRESSION 08	30 JUL - 01 AUG 1968
09 HURRICANE "FERNANDA"	04 AUG - 15 AUG 1968
10 TROPICAL STORM "GWEN"	05 AUG - 10 AUG 1968
11 TROPICAL STORM "HYACINTH"	16 AUG - 19 AUG 1968
12 HURRICANE "JOANNE"	21 AUG - 28 AUG 1968
13 TROPICAL STORM "IVA"	21 AUG - 27 AUG 1968
14 TROPICAL STORM "KATHLEEN"	25 AUG - 03 SEP 1968
15 HURRICANE "LISA"	28 AUG - 07 SEP 1968

	<u>CYCLONE</u>	<u>PERIOD</u>
16	TROPICAL STORM "MADELINE"	28 AUG - 31 AUG 1968
17	HURRICANE "NAOMI"	08 SEP - 13 SEP 1968
18	TROPICAL STORM "ORLA"	23 SEP - 01 OCT 1968
19	HURRICANE "PAULINE"	28 SEP - 03 OCT 1968
20	HURRICANE "REBECCA"	04 OCT - 12 OCT 1968
21	TROPICAL DEPRESSION 21	11 OCT - 15 OCT 1968
22	TROPICAL DEPRESSION 22	15 OCT - 17 OCT 1968
23	TROPICAL STORM "SIMONE"	18 OCT - 19 OCT 1968
24	TROPICAL STORM "TARA" ORIGINATED BY HWO, PEARL HARBOR, HAWAII	20 OCT - 28 OCT 1968
18	T.D. 18*	30 AUG - 01 SEP 1968

*WESPAC LISTING

TROPICAL STORMS 1968
POSITION DATA

TROPICAL STORM ANNETTE
20 JUN - 21 JUN

DTG	LAT	LONG	DTG	LAT	LONG
202100Z	18.0N	103.8W	210600Z	18.9N	104.4W
210000Z	18.4N	104.1W	211200Z	19.5N	104.6W

TROPICAL STORM BONNY
4 JUL - 9 JUL

DTG	LAT	LONG	DTG	LAT	LONG
040600Z	13.9N	104.0W	070600Z	20.5N	114.5W
041200Z	14.8N	105.3W	071200Z	20.8N	115.4W
041800Z	15.3N	106.9W	071800Z	21.0N	116.3W
050000Z	15.9N	108.5W	080000Z	21.2N	116.8W
050600Z	16.2N	109.5W	080600Z	21.5N	117.3W
051200Z	16.5N	110.3W	081200Z	21.8N	117.7W
051800Z	16.6N	110.9W	081800Z	22.2N	118.2W
060000Z	16.9N	111.5W	090000Z	22.5N	119.0W
0610600Z	17.4N	111.8W	090600Z	22.9N	119.8W
061200Z	18.5N	111.8W	091200Z	23.3N	120.3W
061800Z	19.6N	112.6W	091800Z	23.9N	120.7W
070000Z	20.1N	113.5W			

TROPICAL STORM CELESTE
15 JUL - 21 JUL

DTG	LAT	LONG	DTG	LAT	LONG
150000Z	15.7N	103.3W	181200Z	18.2N	116.1W
150600Z	15.8N	103.8W	181800Z	18.3N	117.1W
151200Z	15.9N	104.1W	190000Z	18.6N	118.2W
151800Z	16.0N	104.6W	190600Z	19.0N	119.2W
160000Z	16.1N	105.2W	191200Z	19.6N	120.2W
160600Z	16.1N	106.2W	191800Z	20.1N	121.1W
161200W	16.2N	107.2W	200000Z	20.6N	122.1W
161800Z	16.3N	108.3W	200600Z	21.1N	123.1W
170000Z	16.4N	109.4W	201200Z	21.7N	124.1W
170600Z	16.7N	110.5W	201800Z	22.3N	125.0W
171200Z	17.1N	111.7W	210000Z	22.8N	126.0W
171800Z	17.5N	112.8W	210600Z	23.2N	127.1W
180000Z	17.8N	113.9W	211200Z	23.6N	128.2W
180600Z	18.0N	115.0W	211800Z	24.0N	129.5W

TROPICAL STORM DIANA
21 JUL - 26 JUL

DTG	LAT	LONG	DTG	LAT	LONG
210000Z	11.5N	103.0W	240000Z	15.8N	118.5W
210600Z	11.8N	104.5W	240600Z	16.1N	119.6W
211200Z	12.4N	105.9W	241200Z	16.6N	120.5W
211800Z	13.2N	107.2W	241800Z	17.0N	121.5W
220000Z	13.8N	108.6W	250000Z	17.2N	122.5W
220600Z	14.2N	110.0W	250600Z	17.4N	123.5W
221200Z	14.7N	111.4W	251200Z	17.5N	124.5W
221800Z	15.1N	112.9W	251800Z	17.2N	126.2W
230000Z	15.2N	113.8W	260000Z	16.9N	128.0W
230600Z	15.4N	114.9W	260600Z	16.8N	129.3W
231200Z	15.5N	116.1W	261200Z	16.9N	130.6W
231800Z	15.6N	117.3W	261800Z	17.0N	132.0W

TROPICAL STORM ESTELLE
23 JUL - 01 AUG

DTG	LAT	LONG	DTG	LAT	LONG
230000Z	11.0N	100.0W	271800Z	13.4N	121.0W
230600Z	11.2N	101.2W	280000Z	13.3N	122.4W
231200Z	11.4N	102.2W	280600Z	13.2N	123.8W
231800Z	11.5N	103.3W	281200Z	13.1N	125.3W
240000Z	11.4N	104.4W	281800Z	13.0N	126.8W
240600Z	11.2N	105.3W	290000Z	13.0N	128.4W
241200Z	11.0N	106.3W	290600Z	13.0N	129.8W
241800Z	11.1N	107.3W	291200Z	13.0N	131.2W
250000Z	11.3N	108.3W	291800Z	13.0N	132.8W
250600Z	11.7N	109.3W	300000Z	13.0N	134.2W
251200Z	12.1N	110.1W	300600Z	13.1N	135.3W
251800Z	12.5N	110.9W	301200Z	13.3N	136.3W
260000Z	12.9N	111.8W	301800Z	13.7N	137.2W
260600Z	13.2N	112.9W	310000Z	14.1N	138.0W
261200Z	13.5N	114.2W	310600Z	14.6N	138.8W
261800Z	13.7N	115.5W	311200Z	15.0N	139.6W
270000Z	13.9N	116.9W	311800Z	15.5N	140.5W
270600Z	13.9N	118.3W	*010000Z	15.7N	141.8W
271200Z	13.6N	119.7W			

*FWC, PEARL HARBOR AREA

TROPICAL STORM GWEN
05 AUG - 10 AUG

DTG	LAT	LONG	DTG	LAT	LONG
051800Z	11.0N	96.0W	080600Z	17.1N	108.8W
060000Z	11.5N	97.0W	081200Z	17.8N	110.2W
060600Z	12.0N	98.2W	081800Z	18.3N	111.5W
061200Z	12.2N	100.0W	090000Z	19.0N	113.0W
061800Z	12.5N	101.8W	090600Z	19.5N	114.3W
070000Z	12.7N	103.0W	091200Z	20.0N	115.5W
070600Z	13.2N	104.4W	091800Z	20.2N	116.9W
071200Z	14.3N	105.5W	100000Z	20.4N	118.0W
071800Z	15.3N	106.5W	100600Z	20.6N	119.2W
080000Z	16.3N	107.5W			

TROPICAL STORM HYACINTH
16 AUG - 19 AUG

DTG	LAT	LONG	DTG	LAT	LONG
160000Z	17.0N	106.0W	171800Z	20.2N	108.4W
160600Z	17.1N	106.5W	180000Z	21.2N	108.5W
161200Z	17.3N	107.1W	180600Z	21.9N	108.5W
161800Z	17.5N	107.5W	181200Z	22.6N	108.5W
170000Z	18.0N	107.8W	181800Z	23.5N	108.5W
170600Z	18.5N	108.0W	190000Z	24.3N	108.7W
171200Z	19.3N	108.3W	190600Z	25.1N	109.0W

TROPICAL STORM IVA
21 AUG - 27 AUG

DTG	LAT	LONG	DTG	LAT	LONG
211800Z	13.5N	98.5W	241200Z	19.3N	113.9W
220000Z	13.9N	99.9W	241800Z	20.0N	115.5W
220600Z	14.1N	101.1W	250000Z	20.8N	116.8W
221200Z	14.6N	102.3W	250600Z	21.5N	117.8W
221800Z	14.7N	103.9W	251200Z	22.4N	118.9W
230000Z	14.7N	105.2W	251800Z	22.7N	120.7W
230600Z	15.0N	106.7W	260000Z	23.3N	122.5W
231200Z	15.8N	108.4W	260600Z	24.0N	124.0W
231800Z	16.5N	109.9W	261200Z	25.0N	125.2W
240000Z	17.1N	111.4W	261800Z	25.9N	126.7W
240600Z	18.3N	112.5W	270000Z	26.1N	128.4W

TROPICAL STORM KATHLEEN
25 AUG - 03 SEP

DTG	LAT	LONG	DTG	LAT	LONG
251800Z	14.2N	110.2W	300600Z	16.2N	129.4W
260000Z	14.7N	111.3W	301200Z	15.8N	130.6W
260600Z	15.1N	112.4W	301800Z	15.4N	132.0W
261200Z	15.5N	113.5W	310000Z	15.4N	133.3W
261800Z	15.9N	114.5W	310600Z	15.4N	134.6W
270000Z	16.0N	115.8W	311200Z	15.2N	135.6W
270600Z	15.8N	117.4W	311800Z	15.0N	136.5W
271200Z	15.8N	118.5W	010000Z	15.0N	137.1W
271800Z	15.9N	119.4W	010600Z	14.9N	138.0W
280000Z	16.1N	120.3W	011200Z	14.8N	138.9W
280600Z	16.3N	121.2W	*011800Z	14.8N	139.9W
281200Z	16.4N	122.0W	*020000Z	14.9N	140.8W
281800Z	16.4N	122.9W	*020600Z	15.1N	141.8W
290000Z	16.5N	123.8W	*021200Z	15.5N	142.8W
290600Z	16.7N	124.8W	*021800Z	16.0N	143.7W
291200Z	17.0N	125.9W	*030000Z	16.4N	144.7W
291800Z	16.9N	127.0W	*030600Z	16.7N	145.7W
300000Z	16.6N	127.9W	*031200Z	17.0N	146.7W

TROPICAL STORM MADELINE
28 AUG - 31 AUG

DTG	LAT	LONG	DTG	LAT	LONG
281800Z	08.0N	090.5W	300600Z	09.6N	094.0W
290000Z	08.0N	091.5W	301200Z	09.8N	094.5W
290600Z	08.1N	092.4W	301800Z	10.0N	095.0W
291200Z	08.3N	092.8W	310000Z	10.3N	095.5W
291800Z	08.7N	093.2W	310600Z	10.6N	096.0W
300000Z	09.2N	093.5W	311200Z	10.8N	096.4W

*FWC, PEARL HARBOR AREA

TROPICAL STORM ORLA
23 SEP - 01 OCT

DTG	LAT	LONG	DTG	LAT	LONG
230000Z	17.0N	109.5W	270600Z	18.8N	126.2W
230600Z	17.3N	110.5W	271200Z	18.4N	127.1W
231200Z	17.6N	111.3W	271800Z	18.0N	128.0W
231800Z	17.9N	112.4W	280000Z	17.6N	128.8W
240000Z	18.0N	113.2W	280600Z	17.1N	129.5W
240600Z	18.0N	114.0W	281200Z	16.7N	130.2W
241200Z	18.0N	114.8W	281800Z	16.4N	130.7W
241800Z	18.1N	116.0W	290000Z	15.9N	131.3W
250000Z	18.4N	117.4W	290600Z	15.5N	132.0W
250600Z	18.7N	118.5W	291200Z	15.0N	133.2W
251200Z	18.9N	119.5W	291800Z	14.9N	134.3W
251800Z	19.3N	120.8W	300000Z	14.9N	135.5W
260000Z	19.4N	121.9W	300600Z	14.9N	136.6W
260600Z	19.4N	122.8W	301200Z	15.0N	137.5W
261200Z	19.5N	123.7W	301800Z	15.1N	138.4W
261800Z	19.3N	124.7W	010000Z	15.3N	139.0W
270000Z	19.0N	125.5W	010600Z	15.5N	139.7W

TROPICAL STORM SIMONE
18 OCT - 19 OCT

DTG	LAT	LONG	DTG	LAT	LONG
181800Z	13.5N	091.5W	190600Z	14.3N	092.2W
190000Z	13.8N	091.8W	191200Z	14.7N	092.6W

TROPICAL STORM TARA
20 OCT - 28 OCT

DTG	LAT	LONG	DTG	LAT	LONG
201800Z	13.0N	105.0W	241800Z	15.9N	122.0W
210000Z	13.8N	105.6W	250000Z	16.2N	123.0W
210600Z	14.0N	106.4W	250600Z	16.6N	123.9W
211200Z	13.4N	107.7W	251200Z	16.8N	124.7W
211800Z	13.0N	108.8W	251800Z	17.0N	125.5W
220000Z	13.0N	110.0W	260000Z	17.5N	126.5W
220600Z	13.0N	111.5W	260600Z	17.9N	127.4W
221200Z	13.3N	112.8W	261200Z	18.1N	128.3W
221800Z	13.9N	114.0W	261800Z	18.2N	129.4W
230000Z	14.3N	115.0W	270000Z	18.8N	130.6W
230600Z	14.5N	116.0W	270600Z	19.2N	131.8W
231200Z	14.5N	116.9W	271200Z	20.0N	133.0W
231800Z	14.8N	118.0W	271800Z	20.8N	134.0W
240000Z	15.3N	119.0W	280000Z	21.0N	135.4W
240600Z	15.6N	120.0W	280600Z	21.5N	136.6W
241200Z	15.7N	121.0W	281200Z	22.0N	137.5W

TROPICAL STORM VIRGINIA
25 AUG - 26 AUG

DTG	LAT	LONG	DTG	LAT	LONG
**260000Z	36.1N	179.7W	**260600Z	38.8N	178.8W

**PREVIOUS POSITIONS IN JTWC, GUAM AREA

TROPICAL DEPRESSIONS 1968
POSITION DATA

TROPICAL DEPRESSION ZERO TWO
21 JUN - 22 JUN

DTG	LAT	LONG	DTG	LAT	LONG
211800Z	18.5N	104.0W	220600Z	19.2N	104.8W
220000Z	19.0N	104.7W			

TROPICAL DEPRESSION ZERO FOUR
12 JUL - 14 JUL

DTG	LAT	LONG	DTG	LAT	LONG
122100Z	15.4N	133.0W	140000Z	15.4N	139.4W
130000Z	15.4N	133.8W	140600Z	15.5N	140.6W
130600Z	15.3N	135.3W	*141200Z	15.5N	142.0W
131200Z	15.0N	136.8W	*141800Z	15.5N	144.2W
131800Z	15.2N	138.2W			

TROPICAL DEPRESSION ZERO EIGHT
30 JUL - 01 AUG

DTG	LAT	LONG	DTG	LAT	LONG
300000Z	15.4N	126.0W	311200Z	18.9N	135.8W
300600Z	15.4N	127.8W	311800Z	20.0N	137.1W
301200Z	15.7N	129.5W	010000Z	20.6N	138.5W
301800Z	16.2N	131.2W	010600Z	21.0N	139.8W
310000Z	16.8N	132.9W	*011200Z	21.7N	141.2W
310600Z	17.8N	134.3W			

TROPICAL DEPRESSION TWO ONE
11 OCT - 15 OCT

DTG	LAT	LONG	DTG	LAT	LONG
111800Z	11.5N	94.0W	131800Z	12.5N	96.3W
120000Z	11.6N	94.3W	140000Z	12.6N	96.6W
120600Z	11.8N	94.6W	140600Z	12.7N	96.9W
121200Z	11.9N	94.8W	141200Z	12.8N	97.5W
121800Z	12.0N	95.0W	141800Z	12.5N	98.0W
130000Z	12.1N	95.3W	150000Z	12.4N	98.5W
130600Z	12.2N	95.6W	150600Z	12.4N	99.0W
131200Z	12.3N	95.9W	151200Z	12.4N	99.4W

*FWC, PEARL HARBOR AREA

TROPICAL DEPRESSION TWO TWO
15 OCT - 17 OCT

DTG	LAT	LONG	DTG	LAT	LONG
151800Z	12.5N	93.5W	170000Z	14.8N	96.9W
160000Z	13.0N	94.4W	170600Z	15.0N	97.7W
160600Z	13.6N	94.9W	171200Z	15.0N	98.4W
161200Z	14.1N	95.4W	171800Z	15.2N	99.3W
161800Z	14.5N	96.2W			

TROPICAL DEPRESSION ONE EIGHT*
29 AUG - 01 SEPT

DTG	LAT	LONG	DTG	LAT	LONG
300000Z	14.5N	162.0W	310600Z	18.6N	169.4W
300600Z	14.7N	163.2W	311200Z	19.4N	170.7W
301200Z	15.3N	164.4W	311800Z	20.0N	171.9W
301800Z	16.6N	166.0W	010000Z	20.7N	173.3W
310000Z	17.7N	167.8W			

*WESPAC LISTING

INDIVIDUAL HURRICANE TRACKS
FOR 1968
IN THE EASTERN NORTH PACIFIC OCEAN

NOTE: Due to a lack of reconnaissance data, accurate intensities could not be determined and thus are not included with the hurricane best tracks.

HURRICANE FERNANDA

041800Z TO 150000Z AUG 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED:

FWC ALAMEDA	- 35
FWC PEARL	- 7
TOTAL	- 42

2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 7

3. TOTAL DISTANCE TRAVELED DURING TROPICAL
WARNING PERIOD - 2340 MILES

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - UNKNOWN
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 70 KT (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 400 MI.

II DEVELOPMENT

A. INITIAL IMPETUS - ITCZ

B. INITIAL SURFACE VORTEX

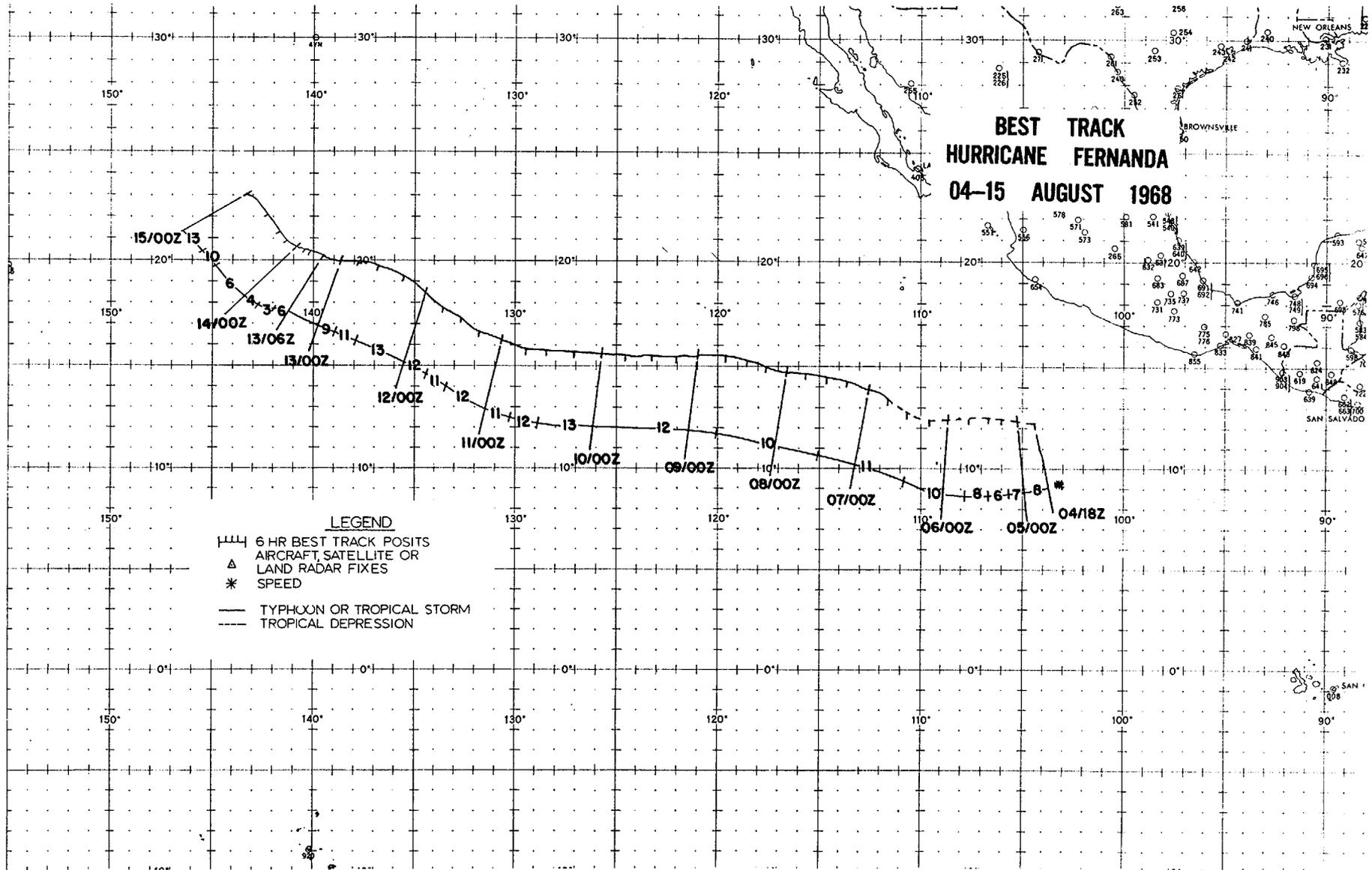
1. 041800Z
2. SURFACE PRESSURE LESS THAN 1008MB

C. TIME STORM REACHED HURRICANE INTENSITY - 091200Z

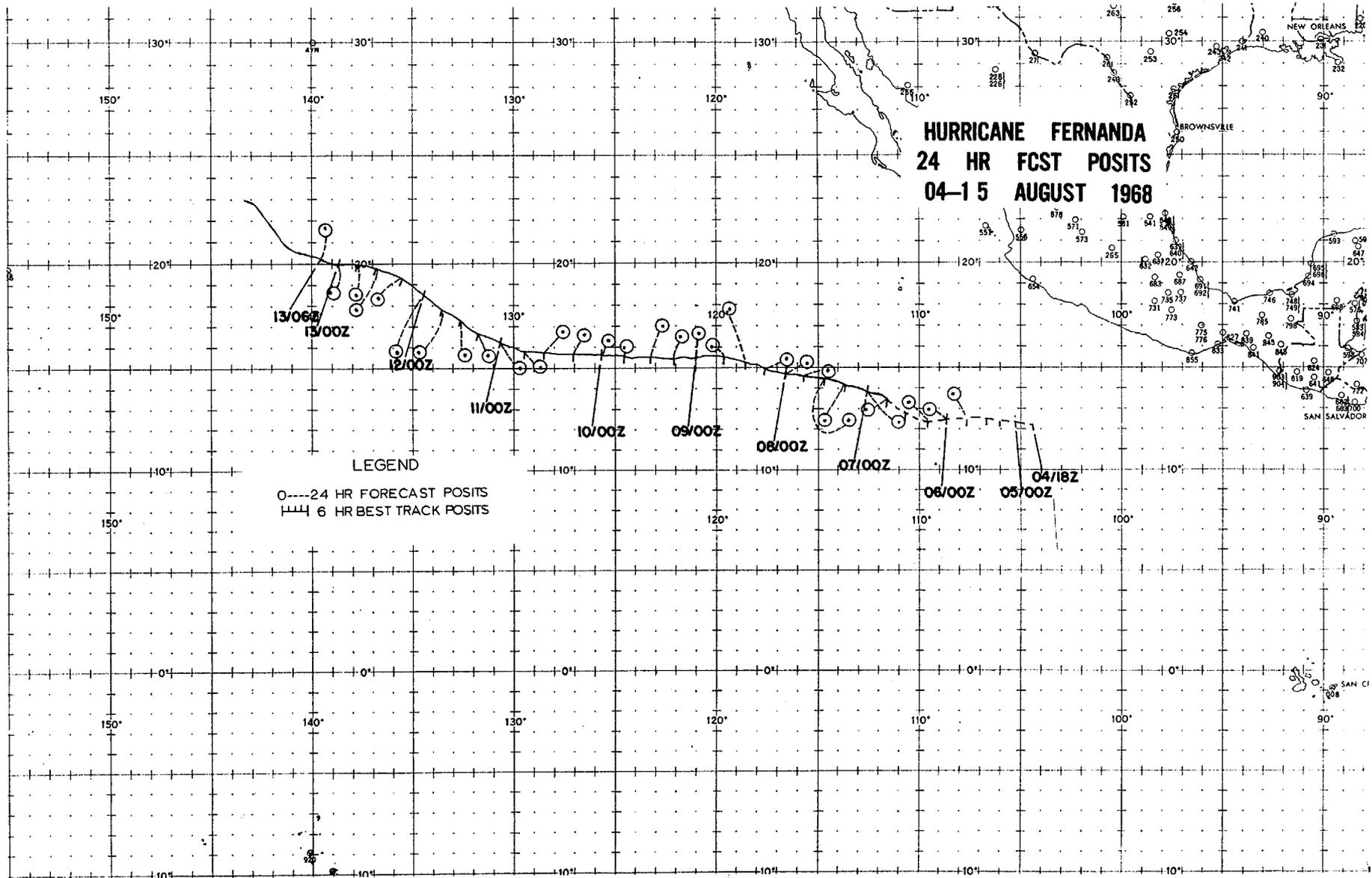
III FINAL DISPOSITION

A. DISSIPATED OVER WATER

AN-18



6T-19



POSITION FROM BEST TRACK AND VERIFICATION DATA

STORM POSIT	24 HR ERROR			48 HR ERROR		72 HR ERROR
<u>TIME</u>	<u>LAT</u>	<u>LONG</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>
041800Z	12.1N	104.3W	-	-	-	-
050000Z	12.2N	105.1W	-	-	-	-
050600Z	12.3N	105.9W	-	-	-	-
051200Z	12.4N	106.6W	-	-	-	-
051800Z	12.4N	107.5W	325/96	-	-	-
060000Z	12.3N	108.5W	300/69	-	-	-
060600Z	12.5N	109.6W	304/65	-	-	-
061200Z	12.8N	110.7W	298/53	-	-	-
061800Z	13.4N	111.6W	147/62	-	-	-
070000Z	13.9N	112.5W	159/90	-	-	-
070600Z	14.2N	113.6W	210/117	-	-	-
071200Z	14.4N	114.6W	150/131	-	-	-
071800Z	14.5N	115.7W	071/58	-	-	-
080000Z	14.7N	116.7W	073/78	-	-	-
080600Z	15.0N	117.7W	074/87	-	-	-
081200Z	15.3N	118.7W	332/142	-	-	-
081800Z	15.4N	119.7W	325/44	074/111	-	-
090000Z	15.4N	120.9W	070/60	072/152	-	-
090600Z	15.4N	122.0W	009/79	063/200	-	-
091200Z	15.4N	123.1W	017/100	010/202	-	-
091800Z	15.4N	124.5W	360/18	360/96	065/189	-
100000Z	15.5N	125.7W	031/58	031/116	067/249	-
100600Z	15.7N	127.0W	045/66	031/191	-	-
101200Z	15.8N	128.4W	048/82	038/191	061/348	-
101800Z	15.9N	129.5W	131/81	062/69	-	-
110000Z	16.2N	130.7W	135/103	061/101	-	-
110600Z	16.6N	131.9W	151/76	069/105	042/228	-
111200Z	17.2N	132.8W	163/106	082/92	045/216	-
111800Z	17.8N	133.7W	205/136	156/180	-	-
120000Z	18.4N	134.7W	203/174	162/215	115/102	-
120600Z	19.2N	135.6W	233/82	175/216	131/120	-
121200Z	19.8N	136.8W	210/72	174/261	136/138	-
121800Z	20.0N	137.8W	182/90	201/276	-	-
130000Z	20.0N	138.7W	200/78	204/281	167/305	-
130600Z	20.1N	139.5W	357/97	267/105	177/273	-

PASSED TO FWC PEARL HARBOR

24 HOUR FORECAST ERROR = 85.5
 48 HOUR FORECAST ERROR = 166.3
 72 HOUR FORECAST ERROR = 216.8

(CONT'D)

POSITION FROM BEST TRACK AND VERIFICATION DATA (CONT.)

STORM POSIT			24 HR ERROR	48 HR ERROR	72 HR ERROR
<u>TIME</u>	<u>LAT</u>	<u>LONG</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>
131200Z	20.3N	140.1W	-	-	-
131800Z	20.4N	140.4W	-	-	-
140000Z	20.6N	140.8W	-	-	-
140600Z	20.9N	141.2W	-	-	-
141200Z	21.2N	141.6W	267/263	-	-
141800Z	22.1N	142.3W	255/226	-	-
150000Z	23.0N	143.2W	246/275	-	-

24 HOUR FORECAST ERROR = 255.0

(PEARL HARBOR)

HURRICANE JOANNE

211800Z TO 281800Z AUG 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 30
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 11
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 3850 MI

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 1002.4 (PERIPHERAL SHIP)
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 65 KTS (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION: 360 MI

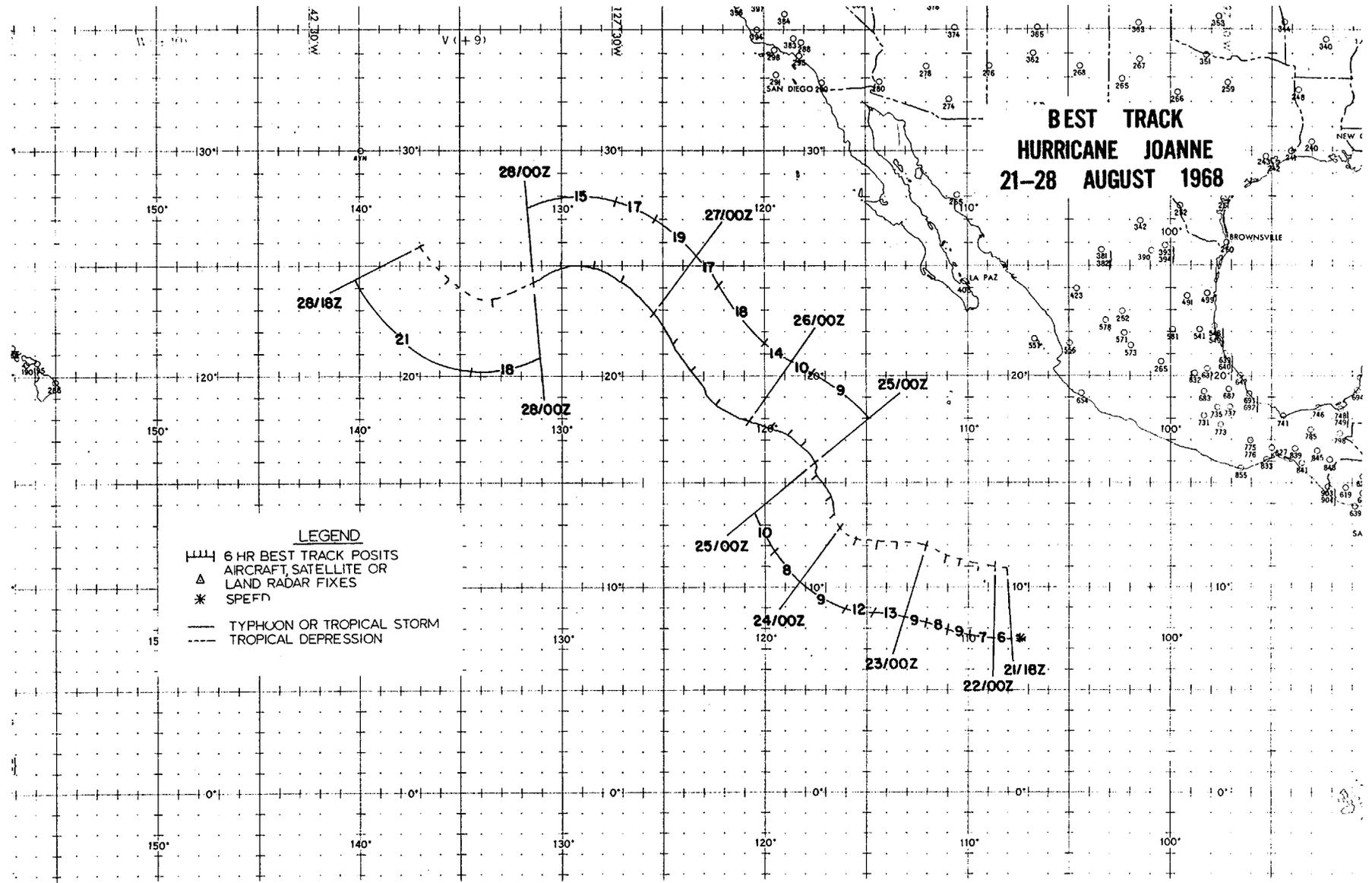
II DEVELOPMENT

- A. INITIAL IMPETUS - ITCZ (TROPICAL CYCLONE #12)
- B. INITIAL SURFACE VORTEX: 211800Z (ESSA VI)
- C. TIME STORM REACHED HURRICANE INTENSITY: 240600Z

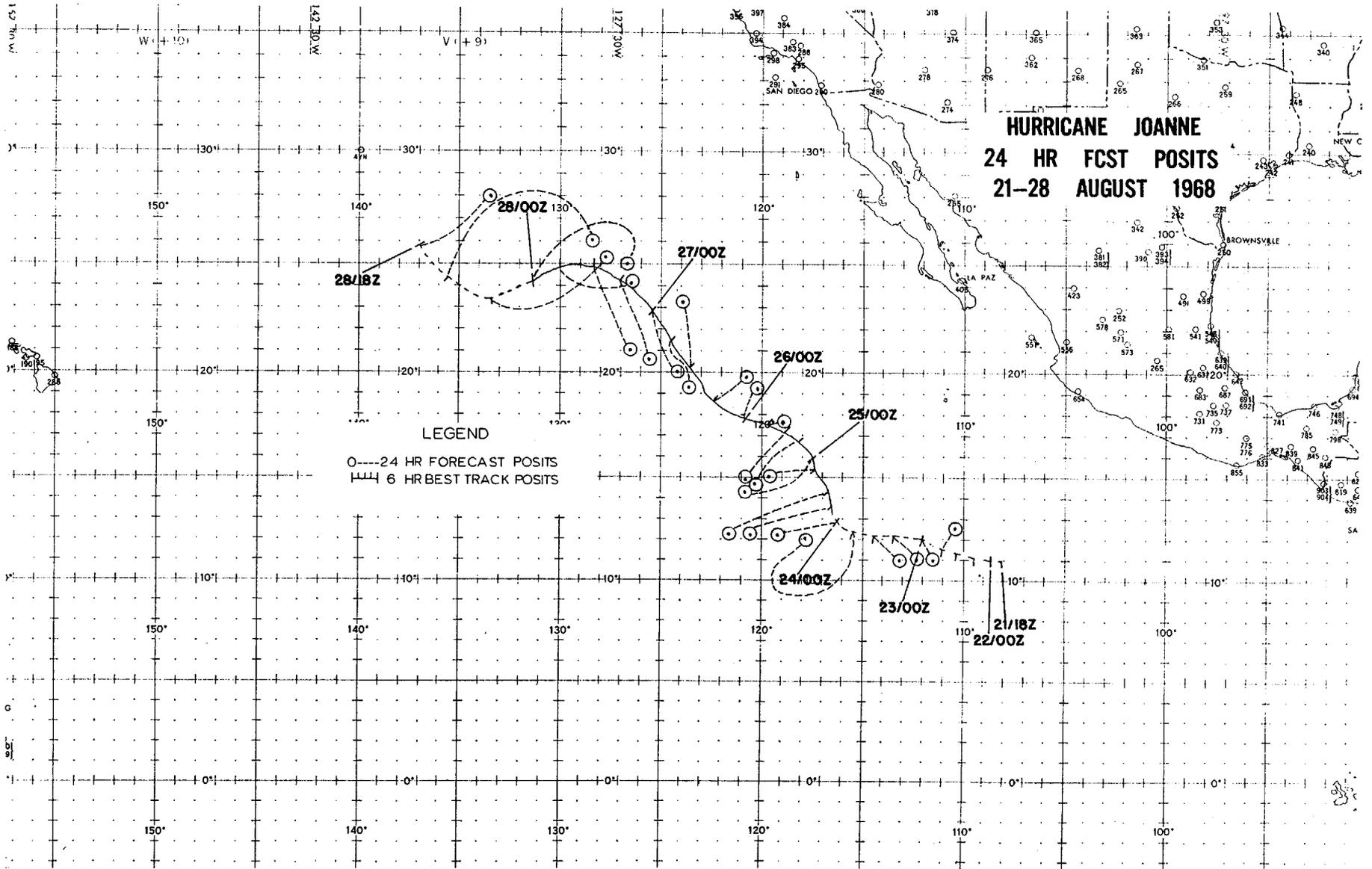
III FINAL DISPOSITION

- A. DISSIPATED OVER WATER

AN-24



AN-25



POSITION FROM BEST TRACK AND VERIFICATION DATA

TIME	STORM POSIT		24 HR ERROR	48 HR ERROR	72 HR ERROR
	LAT	LONG	DEG/DIST	DEG/DIST	DEG/DIST
211800Z	11.0N	108.0W	-	-	-
220000Z	11.0N	108.7W	-	-	-
220600Z	11.1N	109.4W	-	-	-
221200Z	11.2N	110.2W	-	-	-
221800Z	11.6N	111.0W	030/60	-	-
230000Z	12.0N	112.0W	155/66	-	-
230600Z	12.1N	113.2W	140/90	-	-
231200Z	12.1N	114.4W	130/108	-	-
231800Z	12.3N	115.4W	270/150	-	-
240000Z	12.9N	116.1W	255/185	-	-
240600Z	13.6N	116.5W	250/240	-	-
241200Z	14.3N	116.8W	245/310	-	-
241800Z	15.2N	117.2W	265/160	-	-
250000Z	16.0N	117.5W	245/220	-	-
250600Z	16.8N	118.1W	225/175	-	-
251200Z	17.1N	118.9W	215/160	-	-
251800Z	17.5N	119.8W	080/45	-	-
260000Z	18.0N	120.9W	035/75	-	-
260600Z	18.8N	122.4W	060/120	220/185	-
261200Z	20.1N	123.7W	175/190	175/245	-
261800Z	21.5N	124.5W	155/140	110/220	-
270000Z	23.0N	125.4W	155/195	105/170	-
270600Z	24.2N	127.0W	155/240	105/240	-
271200Z	25.0N	128.3W	155/265	-	165/480
271800Z	25.0N	130.0W	105/230	135/280	-
280000Z	24.3N	131.4W	080/280	115/300	085/380
280600Z	23.6N	133.4W	075/350	105/270	-
281200Z	24.5N	135.5W	065/360	095/365	-
281800Z	26.0N	137.0W	060/240	085/440	-

24 HOUR FORECAST ERROR = 186 MI
 48 HOUR FORECAST ERROR = 272 MI
 72 HOUR FORECAST ERROR = 430 MI

HURRICANE LISA

281800Z AUG TO 070000Z SEP 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 38
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 22
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1932 MI.

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 998.0MB
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 75 KTS (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 340 MI.

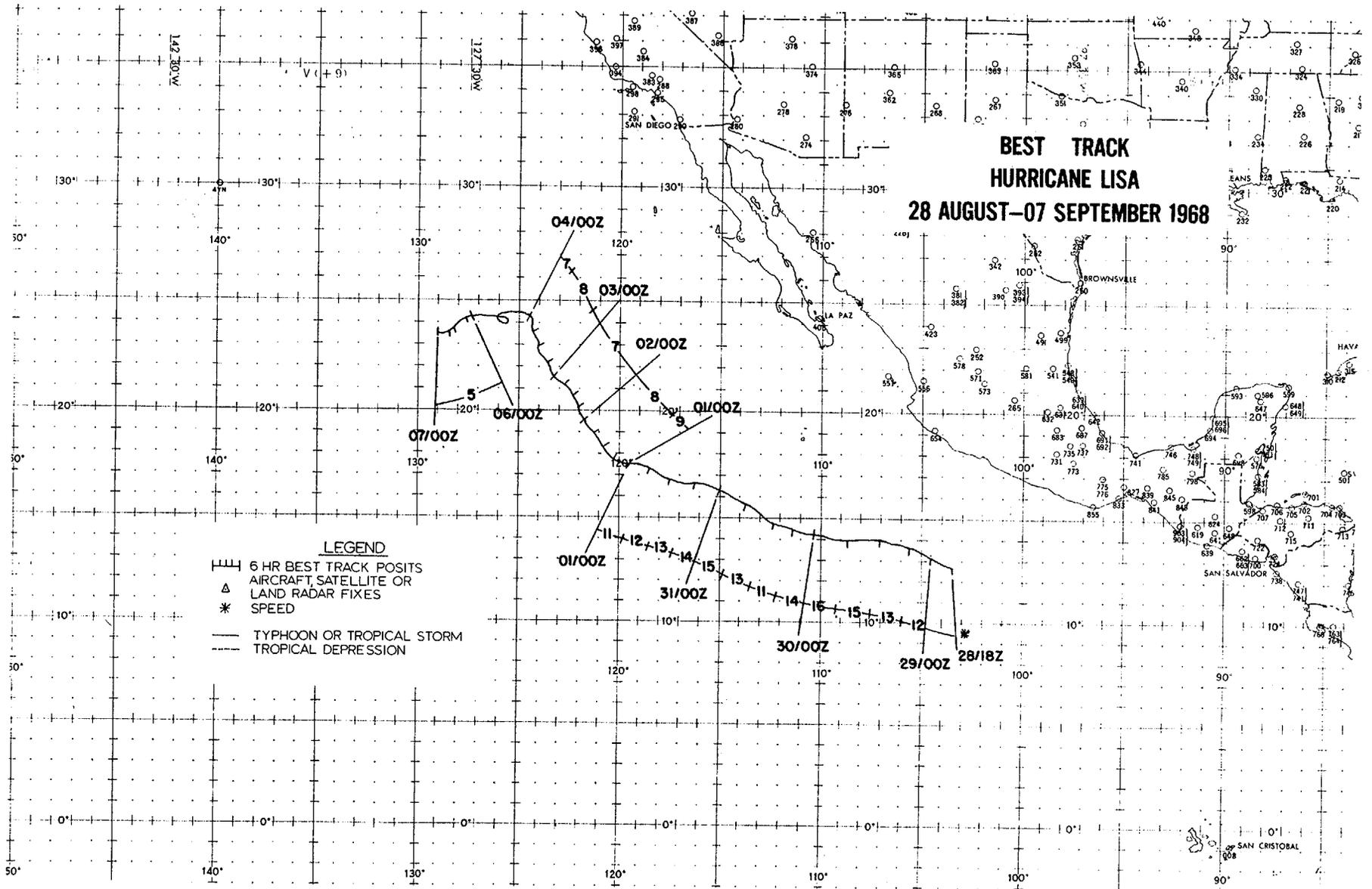
II DEVELOPMENT

- A. INITIAL IMPETUS - ITCZ (TROPICAL CYCLONE #15)
- B. INITIAL SURFACE VORTEX: 281800Z (ESSA VI)
- C. TIME STORM REACHED HURRICANE INTENSITY: 291800Z

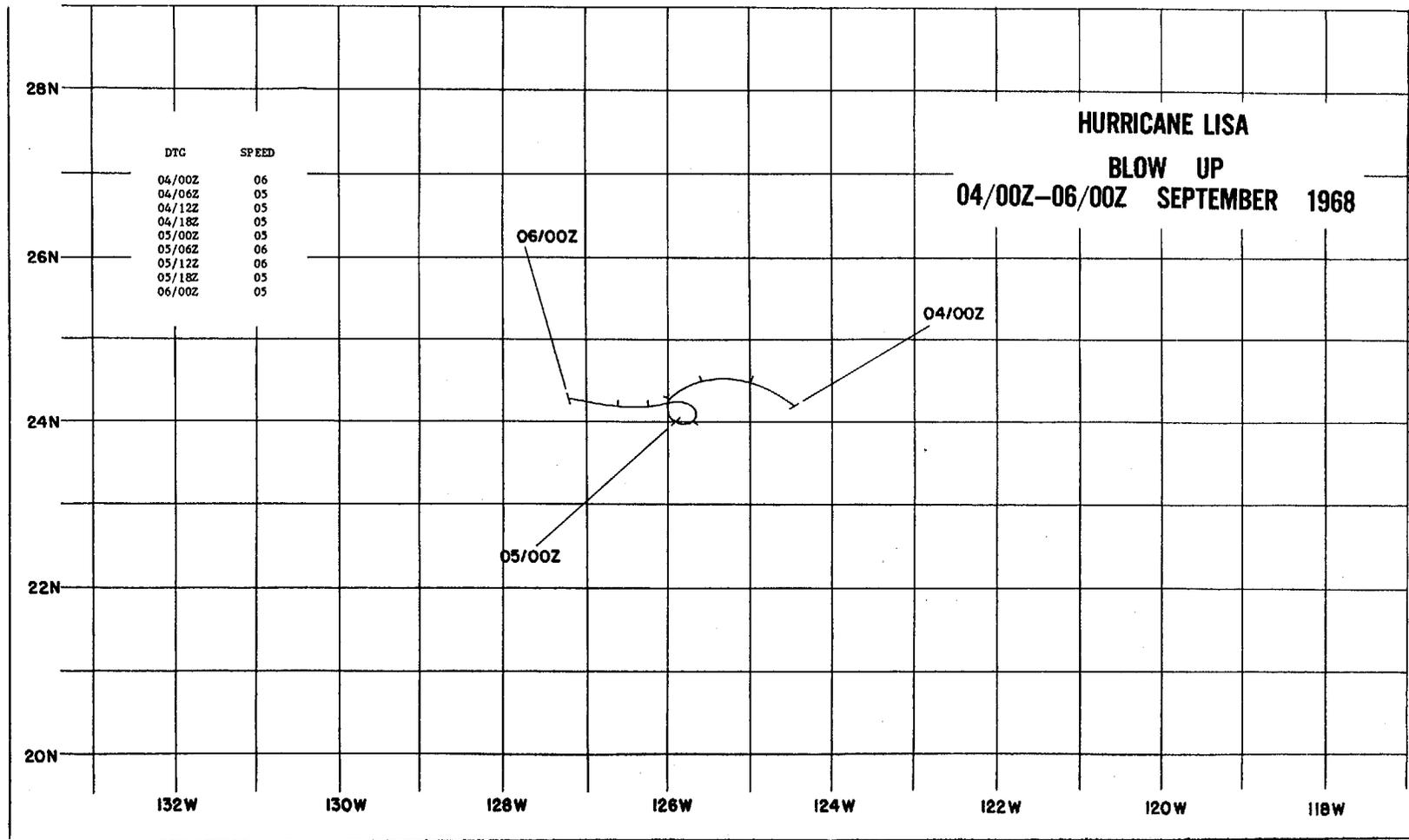
III FINAL DISPOSITION

- A. DISSIPATED OVER WATER

AN-28

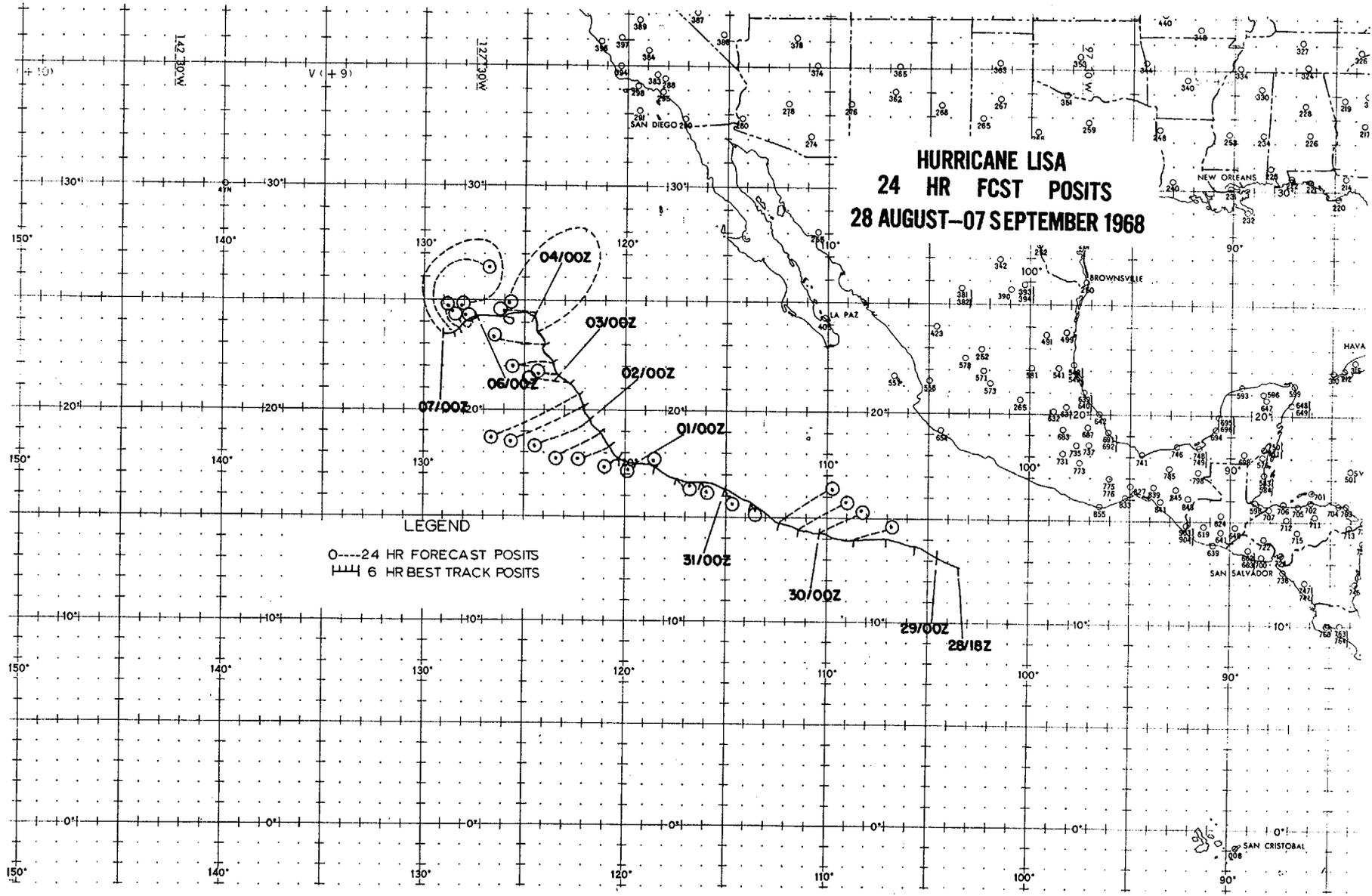


AN-29

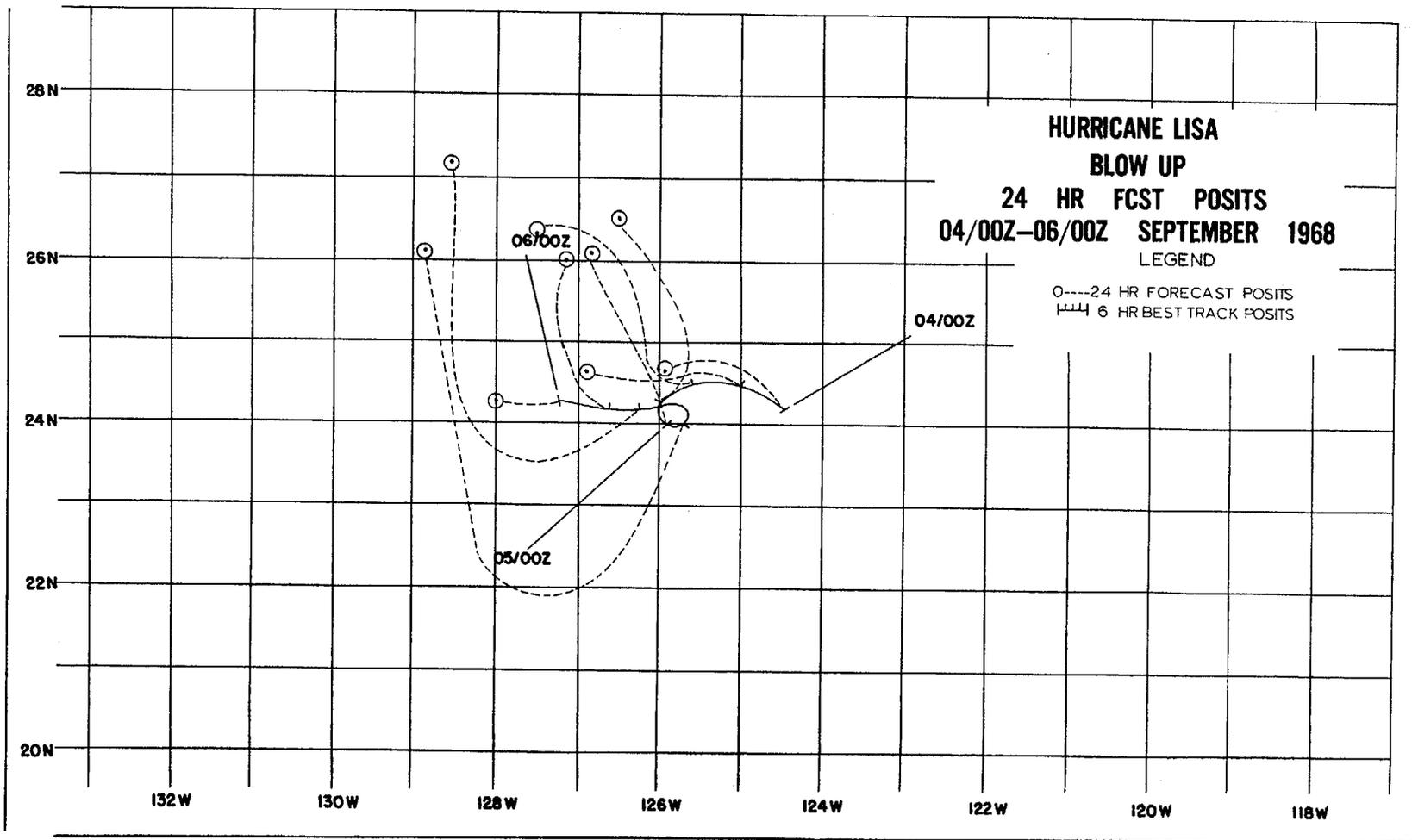


14-4-2013-34

AN-30



AN-31



POSITIONS FROM BEST TRACK AND VERIFICATION DATA

STORM POSIT			24 HR ERROR	48 HR ERROR	72 HR ERROR
<u>TIME</u>	<u>LAT</u>	<u>LONG</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>
281800Z	12.5N	103.5W	-	-	-
290000Z	13.1N	104.5W	-	-	-
290600Z	13.7N	105.6W	-	-	-
291200Z	14.0N	107.0W	-	-	-
291800Z	14.0N	108.8W	071/118	-	-
300000Z	14.1N	110.3W	063/149	-	-
300600Z	14.4N	111.3W	060/156	-	-
301200Z	14.9N	112.3W	064/178	-	-
301800Z	15.7N	113.8W	090/30	076/207	-
310000Z	16.3N	115.0W	159/47	075/210	-
310600Z	16.7N	116.2W	155/42	073/210	-
311200Z	16.9N	117.4W	118/42	073/275	-
311800Z	17.1N	118.6W	333/28	171/38	-
010000Z	17.4N	119.7W	218/15	108/18	068/288
010600Z	17.8N	120.4W	225/51	203/15	-
011200Z	18.3N	120.9W	244/78	270/19	067/285
011800Z	19.0N	121.4W	240/132	234/156	-
020000Z	19.6N	121.7W	243/187	230/223	255/139
020600Z	20.1N	122.0W	245/242	232/288	-
021200Z	20.6N	122.4W	244/285	245/285	259/204
021800Z	21.1N	122.8W	277/114	249/396	-
030000Z	21.5N	123.3W	276/72	247/383	224/450
030600Z	22.1N	123.7W	266/108	247/494	-
031200Z	23.0N	124.0W	254/157	243/498	244/498
031800Z	23.8N	124.2W	299/114	254/258	-
040000Z	24.2N	124.5W	288/86	251/245	245/630
040600Z	24.5N	125.0W	277/114	252/274	-
041200Z	24.5N	125.6W	310/154	256/297	248/687
041800Z	24.3N	126.0W	347/133	304/326	-
050000Z	24.0N	125.9W	338/144	326/263	266/390
050600Z	24.0N	125.7W	307/218	278/316	-
051200Z	24.2N	126.2W	324/235	289/360	266/498
051800Z	24.2N	126.6W	340/125	324/307	-
060000Z	24.3N	127.2W	272/49	342/272	320/427
060600Z	24.1N	127.7W	293/51	310/300	-
061200Z	23.9N	128.1W	312/64	340/381	285/514
061800Z	23.7N	128.5W	031/176	357/253	-
070000Z	23.5N	129.0W	042/84	325/88	341/424

24 HR FORECAST ERROR = 117 MI
 48 HR FORECAST ERROR = 255 MI
 72 HR FORECAST ERROR = 418 MI

HURRICANE NAOMI

081800Z TO 130600Z SEP 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 19
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 5
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1100 MILES

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 992.5
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 75 KTS (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 540 MI.

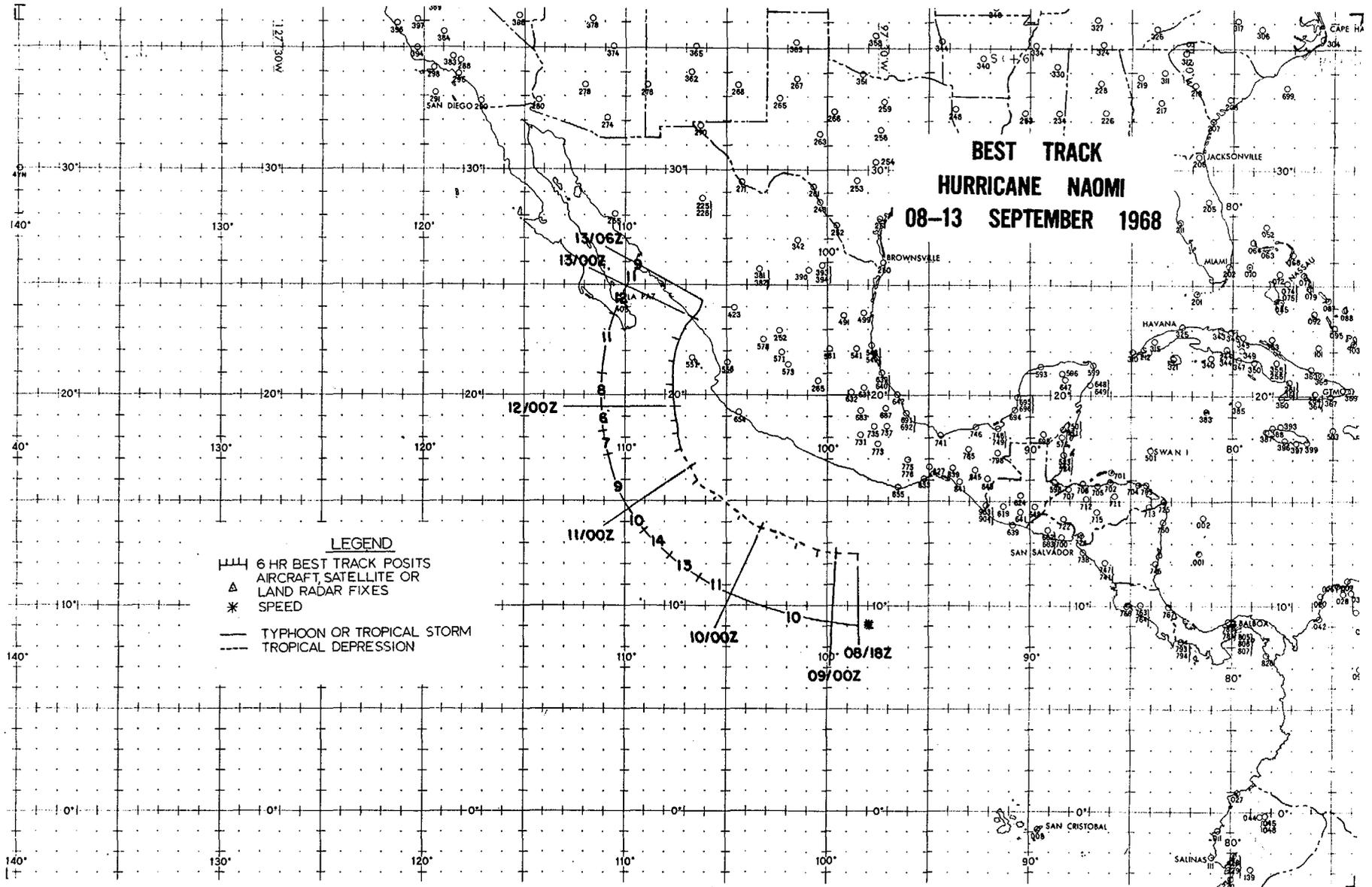
II DEVELOPMENT

- A. INITIAL IMPETUS - ITCZ (TROPICAL CYCLONE #17)
- B. INITIAL SURFACE VORTEX: 081800Z (ESSA VI)
- C. TIME STORM REACHED HURRICANE INTENSITY: 120000Z

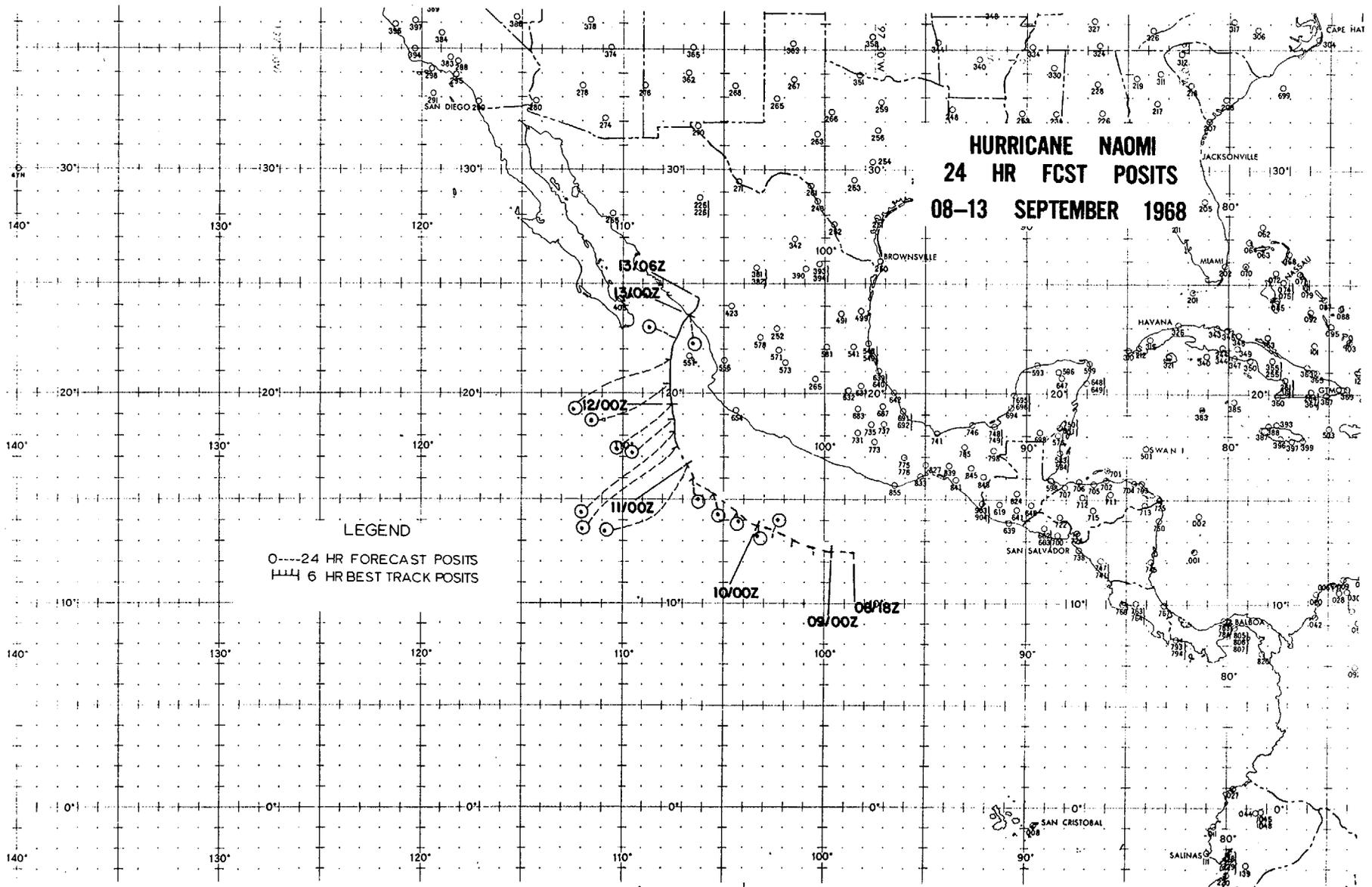
III FINAL DISPOSITION

- A. DISSIPATED OVER LAND

AN-34



AN-35



POSITIONS FROM BEST TRACK AND VERIFICATION DATA

STORM POSIT		24 HR ERROR	48 HR ERROR	72 HR ERROR	
<u>TIME</u>	<u>LAT</u>	<u>LONG</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>	<u>DEG/DIST</u>
081800Z	12.5N	98.5W	-	-	-
090000Z	12.5N	99.5W	-	-	-
090600Z	12.7N	100.5W	-	-	-
091200Z	13.0N	101.5W	-	-	-
091800Z	13.5N	102.4W	015/30	-	-
100000Z	13.8N	103.2W	010/35	-	-
100600Z	14.4N	104.3W	160/25	-	-
101200Z	15.2N	105.5W	165/50	-	-
101800Z	16.0N	106.5W	160/65	-	-
110000Z	16.7N	106.9W	230/315	-	-
110600Z	17.4N	107.2W	230/370	-	-
111200Z	18.2N	107.4W	230/365	-	-
111800Z	18.9N	107.6W	225/155	-	-
120000Z	19.7N	107.7W	215/165	-	-
120600Z	20.5N	107.7W	240/255	-	-
121200Z	21.5N	107.6W	245/325	-	-
121800Z	22.7N	107.3W	285/85	-	-
130000Z	23.7N	106.7W	175/85	-	-
130600Z	24.5N	106.1W	-	150/580	-

24 HR FORECAST ERROR = 166 MI
 48 HR FORECAST ERROR = 580 MI

HURRICANE PAULINE

280000Z SEP TO 030000Z OCT 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 21
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 6
3. TOTAL DISTANCE TRAVELED DURING TROPICAL WARNING PERIOD - 1080 MILES

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - NOT OBSERVED
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WIND - 70 KTS (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION - 300 MI

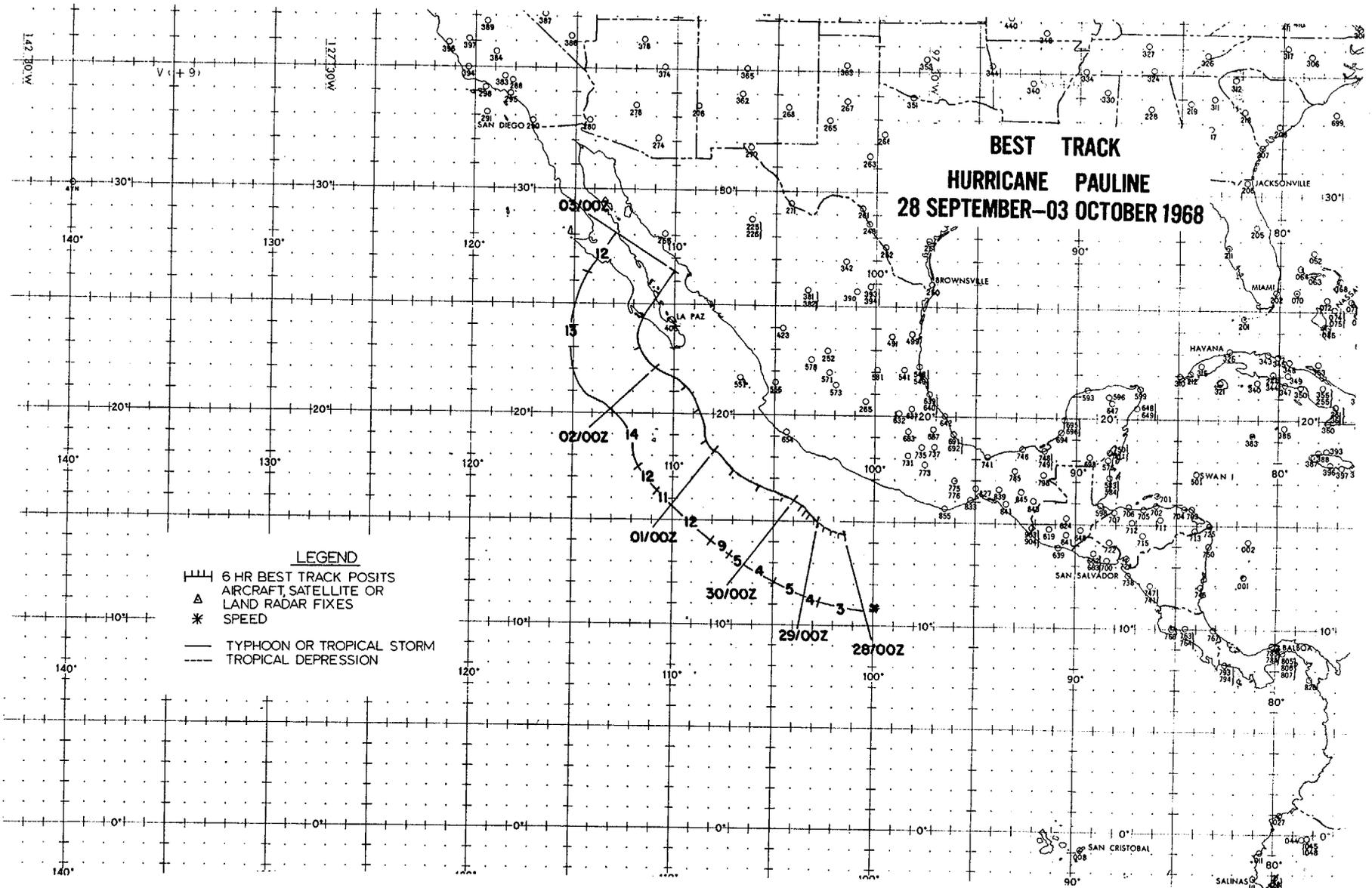
II DEVELOPMENT

- A. INITIAL IMPETUS - ITCZ (TROPICAL CYCLONE #19)
- B. INITIAL SURFACE VORTEX: 280000Z
- C. TIME STORM REACHED HURRICANE INTENSITY: 010600Z

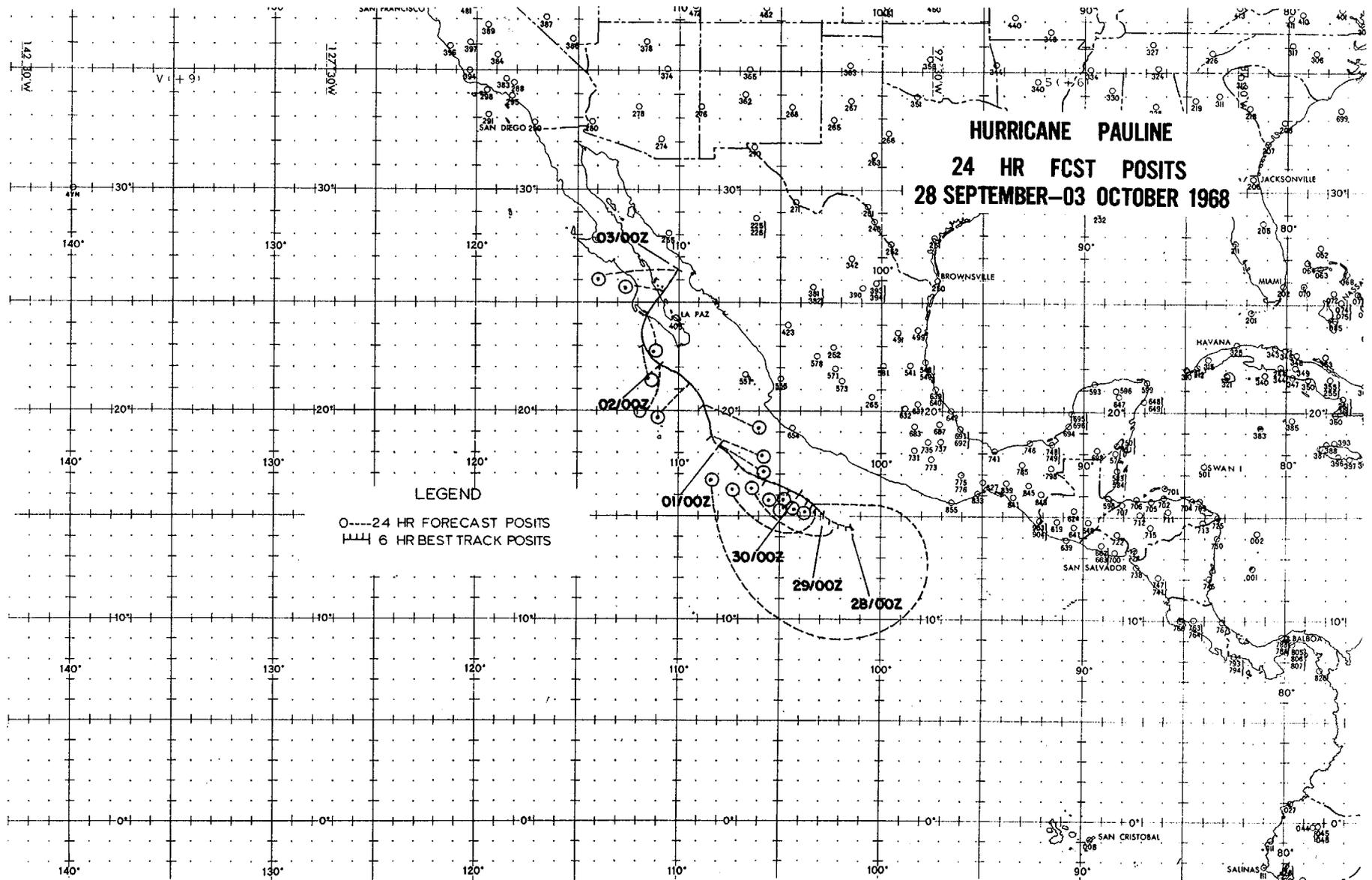
III FINAL DISPOSITION

- A. DISSIPATED OVER WATER

AN-38



AN-39



POSITIONS FROM BEST TRACK AND VERIFICATION DATA

TIME	STORM POSIT		24 HR ERROR	48 HR ERROR	72 HR ERROR
	LAT	LONG	DEG/DIST	DEG/DIST	DEG/DIST
280000Z	14.5N	101.5W	-	-	-
280600Z	14.5N	101.8W	-	-	-
281200Z	14.6N	102.1W	-	-	-
281800Z	14.7N	102.4W	-	-	-
290000Z	14.9N	102.8W	275/210	-	-
290600Z	15.1N	103.1W	285/260	-	-
291200Z	15.5N	103.4W	285/300	-	-
291800Z	15.7N	103.6W	205/35	-	-
300000Z	16.0N	104.0W	215/40	-	-
300600Z	16.3N	104.7W	195/50	-	-
301200Z	16.8N	105.8W	165/60	-	-
301800Z	17.3N	107.0W	125/160	-	-
010000Z	18.1N	107.9W	120/140	-	-
010600Z	18.8N	108.4W	110/170	150/180	-
011200Z	20.1N	108.8W	125/205	160/230	-
011800Z	21.3N	109.5W	220/135	150/350	-
020000Z	22.0N	111.0W	200/120	140/320	-
020600Z	23.0N	111.8W	165/90	125/360	-
021200Z	24.7N	111.5W	175/130	140/395	165/470
021800Z	25.7N	110.7W	265/130	230/350	-
030000Z	26.5N	110.0W	265/240	230/420	175/470

24 HR FORECAST ERROR = 145 MI
 48 HR FORECAST ERROR = 325 MI
 72 HR FORECAST ERROR = 470 MI

HURRICANE REBECCA

041800Z TO 120600Z OCT 1968

I DATA

A. STATISTICS

1. NUMBER OF WARNINGS ISSUED - 31
2. NUMBER OF WARNINGS WITH HURRICANE INTENSITY - 6
3. TOTAL DISTANCE TRAVELED TROPICAL WARNING PERIOD - 1200 MI

B. CHARACTERISTICS

1. MINIMUM OBSERVED SLP - 1006.5MB (PERIPHERAL SHIP)
2. MINIMUM OBSERVED 700 MB HEIGHT - NOT OBSERVED
3. MAXIMUM SURFACE WINDS - 100 KT (EST.)
4. MAXIMUM RADIUS OF SURFACE CIRCULATION\$- 290 MI

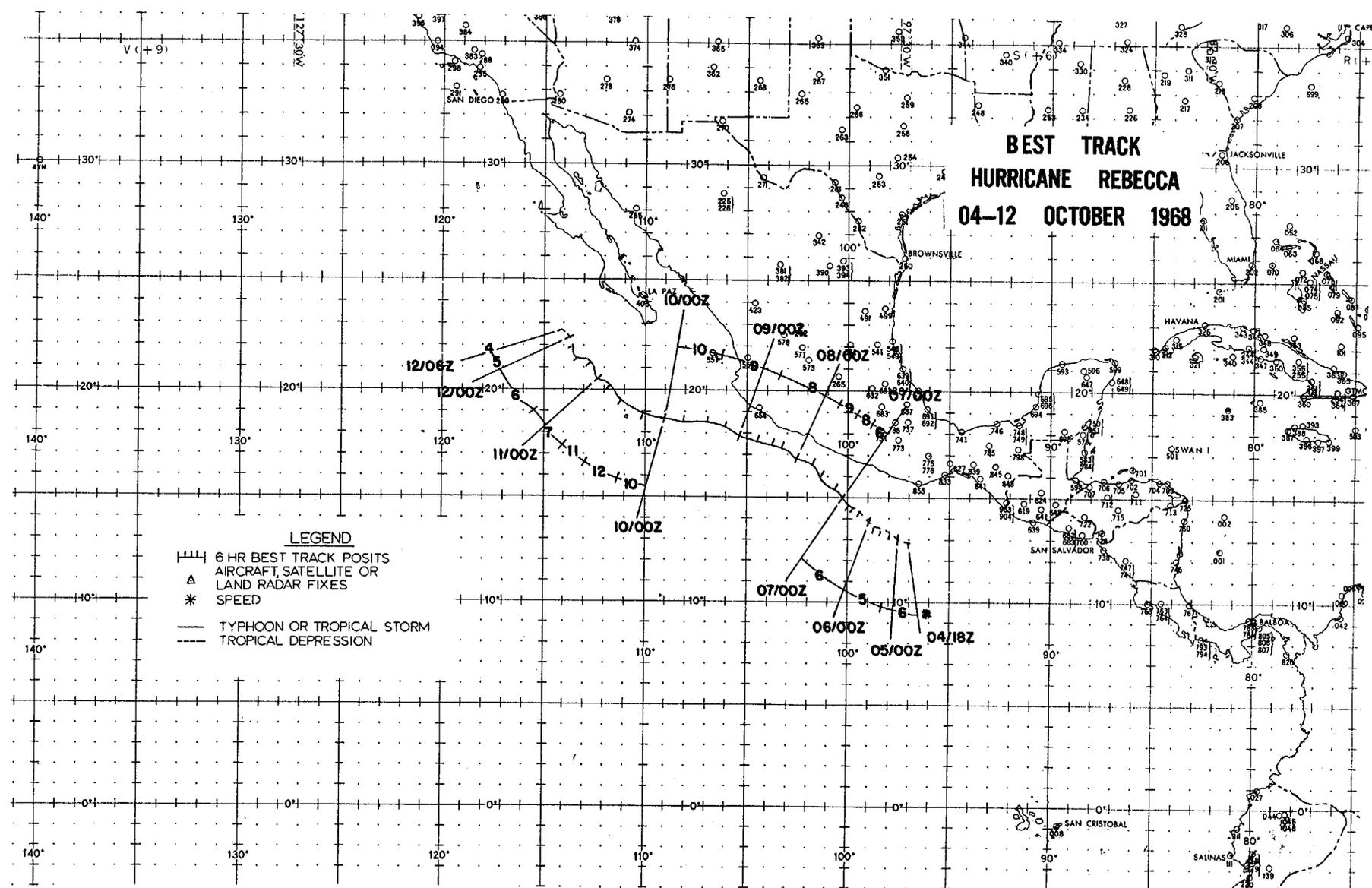
II DEVELOPMENT

- A. INITIAL IMPETUS - ITCZ (TROPICAL CYCLONE #20)
- B. INITIAL SURFACE VORTEX: 041800Z
- C. TIME STORM REACHED HURRICANE INTENSITY - 081800Z OCT 68

III FINAL DISPOSITION

- A. DISSIPATED OVER WATER

BEST TRACK HURRICANE REBECCA 04-12 OCTOBER 1968



LEGEND

 6 HR BEST TRACK POSITS
 AIRCRAFT, SATELLITE OR LAND RADAR FIXES
 SPEED
 TYPHOON OR TROPICAL STORM
 TROPICAL DEPRESSION

AN-42

POSITIONS FROM BEST TRACK AND VERIFICATION DATA

TIME	STORM POSIT		24 HR ERROR	48 HR ERROR	72 HR ERROR
	LAT	LONG	DEG/DIST	DEG/DIST	DEG/DIST
041800Z	13.0N	97.0W	-	-	-
050000Z	13.0N	97.5W	-	-	-
050600Z	13.2N	97.9W	-	-	-
051200Z	13.4N	98.3W	-	-	-
051800Z	13.6N	98.7W	295/240	-	-
060000Z	13.9N	99.0W	255/170	-	-
060600Z	14.2N	99.3W	255/260	-	-
061200Z	14.4N	96.6W	220/96	-	-
061800Z	14.7N	100.0W	195/200	-	-
070000Z	15.0N	100.3W	320/20	-	-
070600Z	15.3N	100.7W	310/20	-	-
071200Z	15.9N	101.3W	0/0	-	-
071800Z	16.5N	101.9W	115/75	-	-
080000Z	16.9N	102.5W	130/60	-	-
080600Z	17.2N	103.1W	115/70	-	-
081200Z	17.4N	103.8W	110/85	-	-
081800Z	17.7N	104.6W	095/95	-	-
090000Z	17.9N	105.3W	055/95	095/120	-
090600Z	18.1N	106.0W	055/110	095/210	-
091200Z	18.3N	107.0W	050/150	095/175	-
091800Z	18.5N	108.1W	300/15	085/220	-
100000Z	18.7N	109.0W	080/50	075/320	090/255
100600Z	19.0N	110.0W	315/55	075/350	-
101200Z	19.5N	111.1W	065/35	090/330	090/330
101800Z	20.2N	111.8W	115/90	125/60	-
110000Z	20.7N	112.3W	210/40	115/70	-
110600Z	21.2N	112.8W	245/90	265/110	-
111200Z	21.4N	113.2W	240/100	205/40	-
111800Z	22.0N	113.5W	335/230	180/80	-
120000Z	22.4N	113.8W	015/275	255/170	205/80
120600Z	22.8N	114.0W	030/380	260/275	-

24 HR FORECAST ERROR = 119 MI
 48 HR FORECAST ERROR = 169 MI
 72 HR FORECAST ERROR = 222 MI

APPENDIX A

ABBREVIATIONS AND DEFINITIONS

1. Words and phrases that appear frequently in this report are abbreviated as follows:

ANAL	Analysis
APT	Automatic Picture Transmission
ATS	Applications Technology Satellite
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Force
CINCPACFLT	Commander in Chief, Pacific Fleet
CIRC	Circulation
CPA	Closest Point of Approach
DEG.	Degree(s)
DTG	Date-Time Group
ESSA	Environmental Science Services Administration
FNWC	Fleet Numerical Weather Central, Monterey, California
FWC/JTWC	Fleet Weather Central/Joint Typhoon Warning Center, Guam
ITCZ or ITC	Intertropical Convergence Zone
JHWC	Joint Hurricane Warning Center, Hawaii
KT(S)	Knots(s)
MAX	Maximum
MB(S)	Millibar(s)
MIN	Minimum
MI or N.M.	Nautical Miles
MOD	Modification
NEDN	Naval Environmental Data Network
NESC	National Environmental Satellite Center, Suitland, Maryland
POSIT(S)	Position(s)
PROG	Prognosis
RECON	Reconnaissance
SLP	Sea Level Pressure
T.	Typhoon
T. D.	Tropical Depression
T. S.	Tropical Storm
VW1	Airborne Early Warning Squadron ONE
54WRS	54th Weather Reconnaissance Squadron

2. The following items define and clarify certain words and phrases that appear in the Eye Fix Summaries in Chapter V. Several definitions in this section have special meanings with regard to the machine prepared Eye Fix Summaries and may not necessarily have the same meaning as used elsewhere in the report.

a. FIX NO. - this number corresponds to the number of the fix plotted on the "Best Track Chart".

b. TIME - the date-time of the fix.

c. POSIT - the latitude and longitude of the fix.

d. UNIT - METHOD - ACCY:

(1) UNIT - the unit that made the fix if made by a reconnaissance squadron; 54-54WRS, VW-VW1.

(2) METHOD - the method used to make the fix; P - penetration, R - radar (these two refer to fixes by reconnaissance squadrons), LND RDR - land radar, SHP RDR - ship radar, SLTIS - satellite cloud picture location.

(3) ACCY - center determination and estimated navigational accuracy of the fix (in nautical miles).

e. FLT LVL - altitude of aircraft at time of fix in whole meters above mean sea level or given as a constant pressure surface; or, stage (STG) of development for a satellite location.

f. FLT LVL WND - maximum observed flight level wind speed in knots; or, diameter (DIA) in whole degrees of latitude for a satellite location.

g. OBS SFC WND - maximum observed surface wind speed in knots; or, number of bands (BNDS) for a satellite location.

h. OBS MIN SLP - minimum observed sea level pressure in whole millibars (reported on penetration fixes only).

i. MIN 700MB HGT - minimum observed 700MB level height in whole meters.

j. FLT LVL TT/TD - flight level temperature (TT) and dewpoint (TD) at fix location.

k. EYE FORM - description of cloud eye; CIRC - circular, ELIP - elliptical.

1. ORIENTATION - direction of orientation of an elliptical eye to an eight point compass.

m. EYE DIA - eye diameter or major/minor axes of an elliptical eye, in N.M.

n. THKNS WALL CLOUD - thickness of wall cloud in N.M. if observed. F.B. (feeder bands) or N.F.B. (no feeder bands) may be entered if wall cloud thickness not observed.

3. The following definitions are given to clarify usage in this report:

a. VORTICES:

(1) Cold vortex - a closed cyclonic circulation identified as having originated as a cold core system removed from the ITCZ or any easterly wave.

(2) Embedded vortex - a closed cyclonic circulation along an easterly wave and separated from the ITCZ.

(3) Junction vortex - a closed cyclonic circulation at the junction of an easterly wave and the ITCZ.

b. RECONNAISSANCE FLIGHTS:

(1) Synoptic track - a set reconnaissance pattern between specified coordinates scheduled to gather and report meteorological data.

(2) Investigative flight - weather reconnaissance of an area containing a suspected circulation.

(3) Fix mission - aircraft reconnaissance scheduled to fix the center position of and gather peripheral data about a known tropical cyclone.

c. FIX - the determination of the position of a tropical cyclone at a precise time, generally by reconnaissance aircraft penetration of the center or by airborne, land, or ship radar. In the case of a

reconnaissance aircraft penetration the actual fix may be based on any of the following: visual observation of the cloud pattern and sea surface, radar, surface pressure, surface or flight level winds, constant pressure height or temperature.

d. The term "tropical cyclone" has two definitions as used herein depending on usage:

(1) "Tropical cyclone" may be used to describe a suspected cyclonic circulation which appears to be capable of intensification.

(2) "Tropical cyclone" may be used in the general sense e.g., "Typhoon Agnes was the most intense tropical cyclone of 1968", or "tropical cyclones most frequently develop during August and September".

e. TROPICAL DEPRESSION (T.D) - as used by JTWC this is a numbered tropical cyclone in which the maximum sustained surface wind speed is 33 knots or less and whose winds are expected to increase to 34 knots or more within 48 hours.

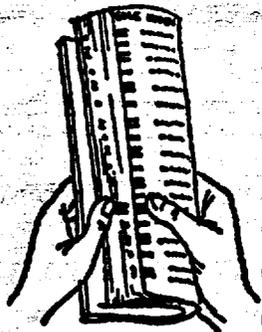
f. TROPICAL STORM (T.S.) - a named tropical cyclone in which the maximum sustained surface wind speed is greater than 33 knots but less than 64 knots.

g. TYPHOON/HURRICANE - a named tropical cyclone in which the maximum sustained surface wind speeds are 64 knots or greater. West of 180 degrees longitude these are called typhoons, east to 180 degrees they are called hurricanes. All references to typhoons apply equally to hurricanes.

h. Recurvature - that point at which a tropical cyclone ceases movement to the west of north and commences moving east of north.

EDGE INDEX

HOW TO USE THE EDGE INDEX



Bend the book nearly double and hold it in your right hand as shown.

Locate the listing you want in the Edge Index.

Match up the 1 or 2 line symbol next to the listing you have selected with the corresponding 1 or 2 dot symbol on the page edge.

OPEN THERE.

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CHAPTER II *Reconnaissance*

CHAPTER III *JTWC Studies*

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CHAPTER V *Individual Typhoons
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APPENDIX A *Abbreviations and Definitions*