

CHAPTER 1

OPERATIONAL PROCEDURES

A. GENERAL

Services provided by the Joint Typhoon Warning Center (JTWC) include forecasts of tropical cyclone formation, intensity, direction and speed of movement and area extent of damaging winds. The primary products of JTWC providing these services are the Tropical Cyclone Formation Alert issued when formation of a tropical cyclone is suspect, and tropical cyclone warnings issued in 1971 at 0000Z plus every six hours whenever significant tropical cyclones were observed in the JTWC area.

FLEWEACEN Guam provides computer and meteorological/oceanographic synoptic scale analysis support for JTWC.

Communications services for JTWC are provided by the Nimitz Hill Message Center of NAVCOMMSTA Guam.

Before October 1971 warnings for typhoons were transmitted using FLASH precedence to forces afloat, a continuation of a policy authorized in late 1970 by CINCPACFLT. After October a new procedure was initiated whereby typhoon warnings and warnings for specifically designated tropical storms were given special handling in the communications system at NAVCOMMSTA Guam. This procedure terminated the requirement for the regular use of FLASH precedence on typhoon warnings.

B. ANALYSES AND DATA SOURCES

1. FWC ANALYSES:

a. Surface polar stereographic projection analysis, Northern Hemisphere, Western Pacific area; 0000Z, 0600Z, 1200Z, and 1800Z.

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

c. Surface mercator projection analysis, Northern and Southern Hemisphere, Western Pacific and Indian Ocean area; 0600Z and 1800Z.

d. Sea surface temperature charts; daily.

2. JTWC ANALYSES:

a. Gradient level (3,000 feet) streamline analysis and nephanalysis of satellite-observed significant cloudiness; 0000Z and 1200Z.

b. 700 MB, 500 MB, and 200 MB mercator projection contour analysis; 0000Z and 1200Z.

c. Reconnaissance data. Observations from weather reconnaissance aircraft are plotted on large scale sectional charts.

d. Time cross sections of selected tropical stations.

e. Time sections of surface reports for selected tropical stations.

f. Additional and more frequent analyses similar to those above during periods of tropical cyclone activity.

3. SATELLITE DATA:

Satellite data played a major role in the early detection of tropical cyclones in 1971. This aspect, as well as applications of satellite data to tropical cyclone tracking, is discussed in Chapter 2, Reconnaissance.

4. RADAR:

Land radar reports, when available, were used for tracking tropical cyclones during the 1971 typhoon season. Once a storm moved within range of a land radar site, reports were usually received hourly.

The 1970 Annual Typhoon Report (FWC/JTWC) describes the WESTPAC radar network and use of radar during 1971 is treated in Chapter 2, Reconnaissance.

5. COMPUTER PRODUCTS:

During 1971 the FWC computer was equipped with a varian plotter. After local development of software the varian plotter was used to eliminate a significant portion of the hand plotting effort. Varian charts are plotted routinely at synoptic times for the surface and the 700 and 500 MB levels. Additionally, a chart which approximates the 200 MB level is also plotted. This chart uses rawinsonde data at 200 MBs and composites aireps above 33,000 feet and within six hours of the 0000Z and 1200Z synoptic times. Additional data is added to these charts; data which is not available in the proper format for varian use. These include pibal gradient level winds, low cloud movement, and missing or late synoptic reports necessary for a detailed gradient level streamline analyses.

In addition, the standard array of synoptic scale computer analyses and prognostic charts are provided.

JTWC relies heavily on the computer center for objective typhoon forecasts and for statistical post analysis.

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. Intensity Changes of Tropical Storms and Typhoons of the Western North Pacific Ocean (Brand and Gaya, 1971) NAVWEARSCHFAC Tech Paper No. 5-71.

c. Climatological 24-Hour Typhoon Movement (McCabe, J. T., 1961).

d. Western Pacific Typhoon Tracks, 1950-1959 (FWC/JTWC).

e. Far East Climate Atlas (1st Weather Wing, February 1963).

f. Annual Typhoon Reports, 1959-1969 (FWC/JTWC).

g. A Climatology of Tropical Cyclones and Disturbances of the Western Pacific with a Suggested Theory for Their Genesis/Maintenance (Gray, Wm., 1970) NAVWEARSCHFAC Tech Paper No. 19-70.

h. The Typhoon Analog computer program (TYFOON).

2. PERSISTENCE:

Extrapolation of storm movement using 12 hour mean speed and direction was the most reliable objective method for 24 hour forecasts.

3. OBJECTIVE TECHNIQUES:

During 1970 the following individual objective forecasting methods were employed:

- a. ARAKAWA - surface pressure grid model.
- b. HATRACK - based on 700 MB SR prognosis.
- c. HATRACK - based on 500 MB SR prognosis.
- d. TYRACK - based on program-selected best steering level from Pearl tropical fields.
- e. TYFOON - analog weighted mean track.

(See Chapter 3 for technique evaluation.)

D. FORECASTING PROCEDURES:

1. TRACK FORECASTING: An initial track based on persistence blended subjectively with climatology is developed for a 3 to 4 day period. This initial track is subjectively modified by use of the following:

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

- b. Objective techniques are considered, weight is given to techniques according to recent past performance.

- c. Twenty-four hour height-change analyses are evaluated for forecast track/speed changes (Hoover, 1957).

- d. The prospects of recurvature must be evaluated for all westward moving storms. The basic tools for this evaluation are accurate continuity on mid-latitude troughs and numerical progs to indicate changes in amplitude or movement. Relative position and strength of the subtropical ridge and northward beta force are also important considerations.

- e. Finally, a check is made against climatology to ascertain the likelihood of the forecast. If the forecast track is climatologically unusual a reappraisal of the forecast rationale is made and adjustments are made if warranted.

2. INTENSITY FORECASTING: Intensity forecasts are made by using a linear extrapolation of past intensification subjectively tempered with climatology as a first guess.

This first guess is modified considering availability of upper tropospheric evacuation, 850-700 MB temperatures, sea surface temperatures, and possible terrain. All these considerations are predictions along the forecast track and are additionally dependent on the accuracy of the forecast positions.

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. Amended or corrected warnings are given the same number as the warnings they modify. Forecast positions are issued at 0000Z plus every six hours as follows:

Tropical Depressions	12 hr and 24 hr
Typhoons and Tropical Storms	12, 24, and 48 hr (72 hr at 00Z and 12Z only)

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

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of results from 1971 is presented in Chapter 4.

F. PROGNOSTIC REASONING MESSAGE:

Whenever warnings are being issued, an amplifying message is issued at 00Z and 12Z. This prognostic reasoning message is intended to provide meteorological units with technical and non-technical reasoning appropriate to the behavior of current storms and the logic of the latest JTWC forecasts.

G. TROPICAL WEATHER SUMMARY:

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

H. TROPICAL CYCLONE FORMATION ALERT:

Alerts are issued when the formation of a tropical cyclone

is considered possible or probable. Alerts are typically used to cover a suspect area before reconnaissance can be conducted and additionally to cover an existing tropical depression of low or unknown development potential. These messages are issued at any time and are valid for up to 24 hours unless cancelled, superseded or extended.

REFERENCE:

Hoover, E. W., Devices for Forecasting Movement of Hurricanes, Manuscript of the U. S. Weather Bureau, Jan. 1957.