

TYPHOON STEVE (09W)

I. HIGHLIGHTS

Steve, with Tropical Storm Tasha (10W) and Typhoon Vernon (11W), made up the only three storm tropical cyclone outbreak to occur in the northwest Pacific this year. Steve persisted on an atypical northeastward track throughout its existence. The orientations of the monsoon trough and the subtropical ridge influenced the track of this system.

II. CHRONOLOGY OF EVENTS

- 240600Z - First mentioned on Significant Tropical Weather Advisory as an area of persistent convection with an estimated minimum sea-level pressure of 1004 mb.
- 240800Z - First Tropical Cyclone Formation Alert based on continued development of the convection.
- 250800Z - Tropical Cyclone Formation Alert reissued due to slow development.
- 251200Z - First warning based on development of persistent central convection.
- 260000Z - Upgraded to tropical storm after restriction to outflow eased.
- 270600Z - Upgraded to typhoon based on eye formation.
- 281800Z - Peak intensity - 115 kt (59 m/sec) - restricted outflow to the west, preventing further intensification.
- 011200Z - Downgraded to tropical storm because of decreased convection and increased vertical wind shear.
- 020000Z - Final warning - (extratropical) - based on the loss of central convection.

III. TRACK AND MOTION

On 19 July, several days before Steve formed, a large TUTT low appeared near the dateline and was reflected in the deep-layer mean analysis (Figure 3-09-1) as an inverted trough. By 23 July, the TUTT low became associated with the eastern extension of the Asian monsoon trough in the deep layer mean analysis (Figure 3-09-2). This synoptic-scale trough segmented the subtropical ridge into an

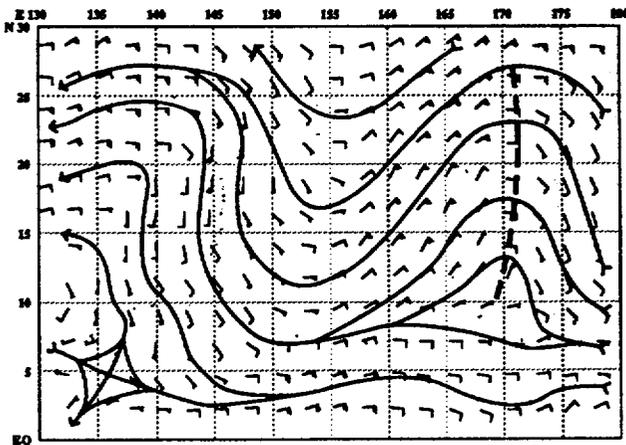


Figure 3-09-1. Deep-layer mean analysis at 190000Z July, showing the reflection of the TUTT low as an inverted trough oriented north-south along 170° East longitude.

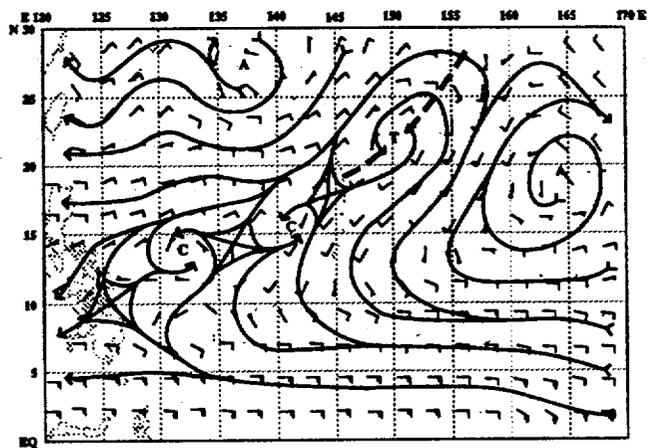


Figure 3-09-2. Deep layer mean analysis at 231200Z July indicates that the TUTT low at point T has elongated northeast-southwest and appears as an eastward extension of the Asian monsoon.

Asian cell, extending eastward from Asia, and a maritime cell, southeast of and parallel to the trough axis. Once Steve formed in the low-level monsoon trough, its basic track was to the northeast, roughly parallel to the axis of the monsoon trough. Short term speed and direction changes appeared to be related to the interaction between Steve, a midget typhoon, and the larger cyclonic circulation in the trough. Note in Figure 3-09-3 that Steve was east of a large cyclonic circulation as shown on the deep layer mean analysis for 261200Z. It was also under southwesterly mid-tropospheric flow. The track change to the north at 271200Z was related to the change in steering from southwesterly to southerly on the analysis (Figure 3-09-4). After Steve reached higher latitudes and began to weaken, it became the dominant cyclonic circulation. As the system took on extratropical characteristics and increased in size, it filled and accelerated northeastward.

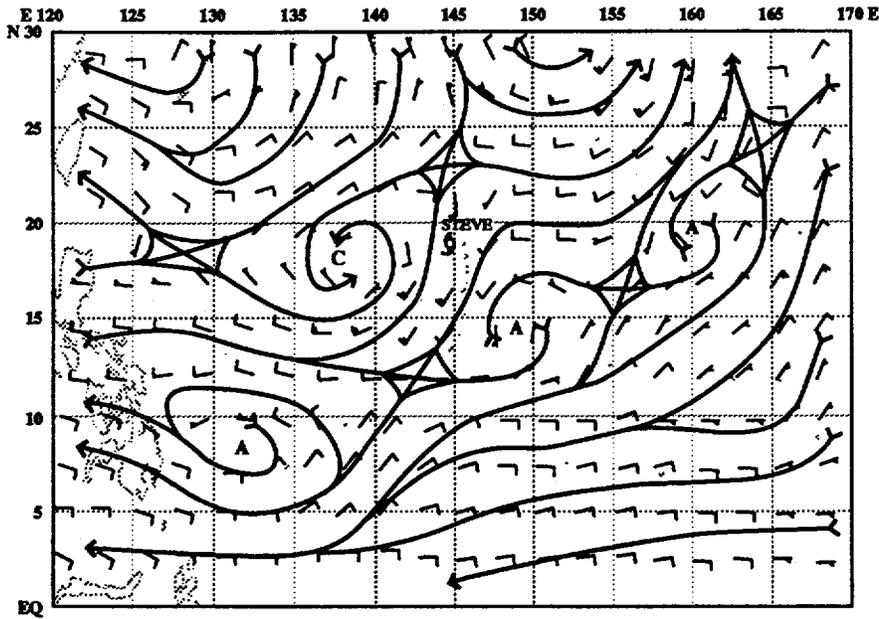


Figure 3-09-3. Deep layer mean analysis at 261200Z July depicts Steve east of a larger cyclonic circulation in the monsoon trough, embedded in southwesterly flow.

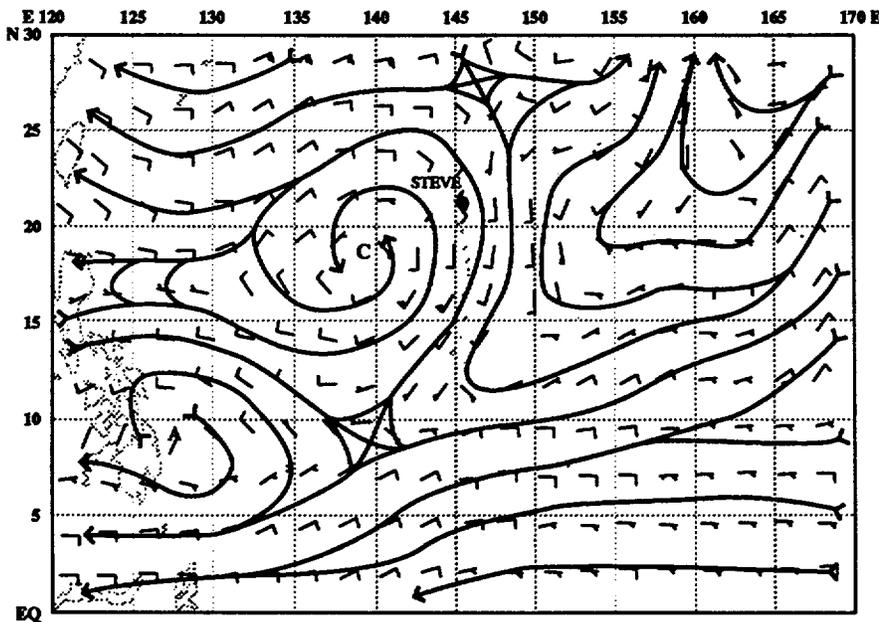


Figure 3-09-4. Deep layer mean analysis at 271200Z July shows Steve embedded in southerly flow.

IV. INTENSITY

The area of convection that eventually became Typhoon Steve formed in the monsoon trough and moved under strong upper-level divergence. Once the convection consolidated, the system (Figure 3-09-5) developed rapidly but remained relatively small -- its deep convection was confined to within 90 nm (165 km) of the center. With no restriction to its outflow, Steve quickly developed an eye and reached typhoon intensity. The typhoon intensified to 115 kt (59 m/sec) and remained at peak intensity



Figure 3-09-5. Steve intensifies as it tracks northward (280811Z July DMSP visual imagery).

for 24 hours until upper-level outflow from Tropical Storm Vernon (11W) to the southwest began to restrict Steve's outflow to the west (Figure 3-09-6). Steve weakened slowly as its deep convection gradually decreased. Its circulation expanded in size and retained storm-force winds as an extratropical system.

V. FORECAST PERFORMANCE

Steve's atypical track produced a difficult forecasting situation. The synoptic features that influenced the track, the monsoon trough and subtropical ridge, were themselves difficult to forecast. To further complicate matters, Steve was one of three tropical cyclones active in the Northwest Pacific at the same time. JTWC's track forecasts were based on Steve's location relative to the subtropical ridge to the northwest. Steve's northeastward movement put the JTWC forecasts significantly left of the actual track (Figure 3-09-7). Dynamical, statistical and climatological objective aids all predicted initial northwestward motion for Steve. The 72-hour forecast errors for Steve averaged 556 nm (1030 km).

VI. IMPACT

No information was received.

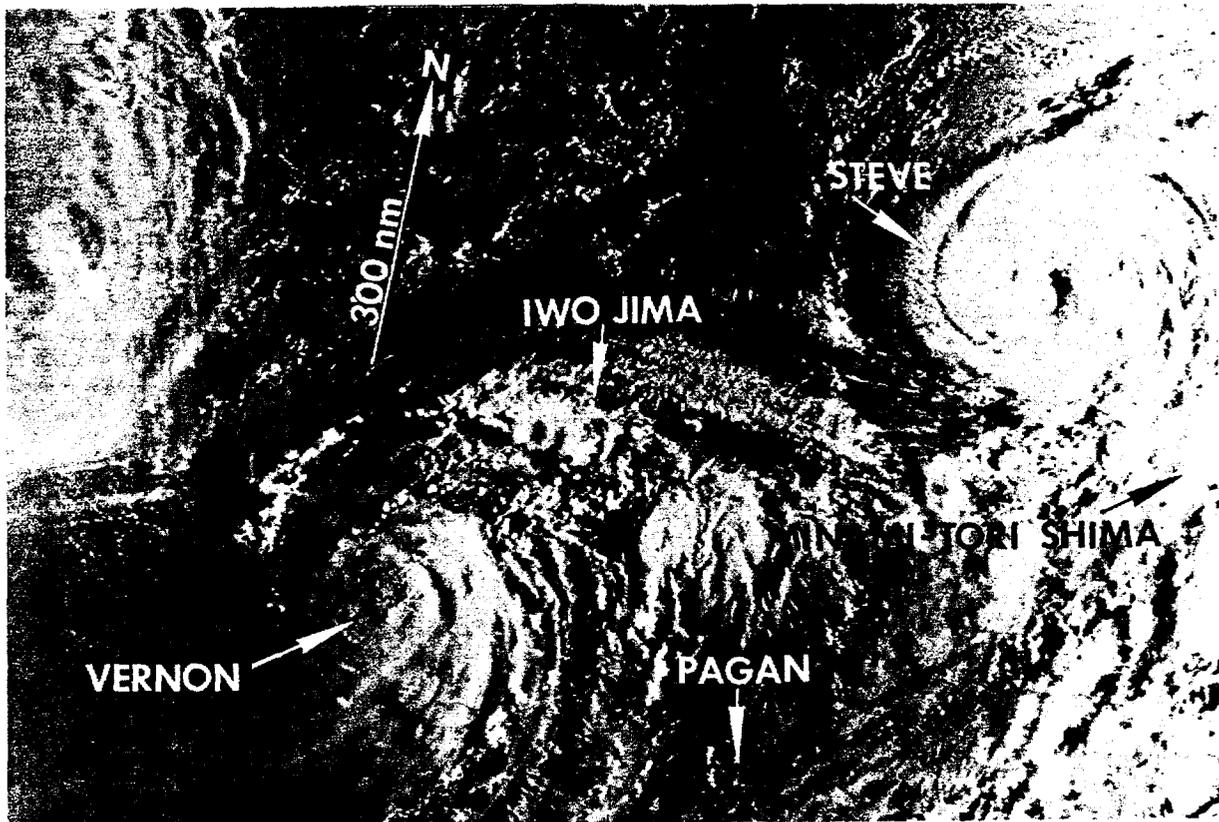


Figure 3-09-6. As Steve weakens, Tropical Storm Vernon (11W) intensifies to the southwest (302028Z July DMSP visual imagery).

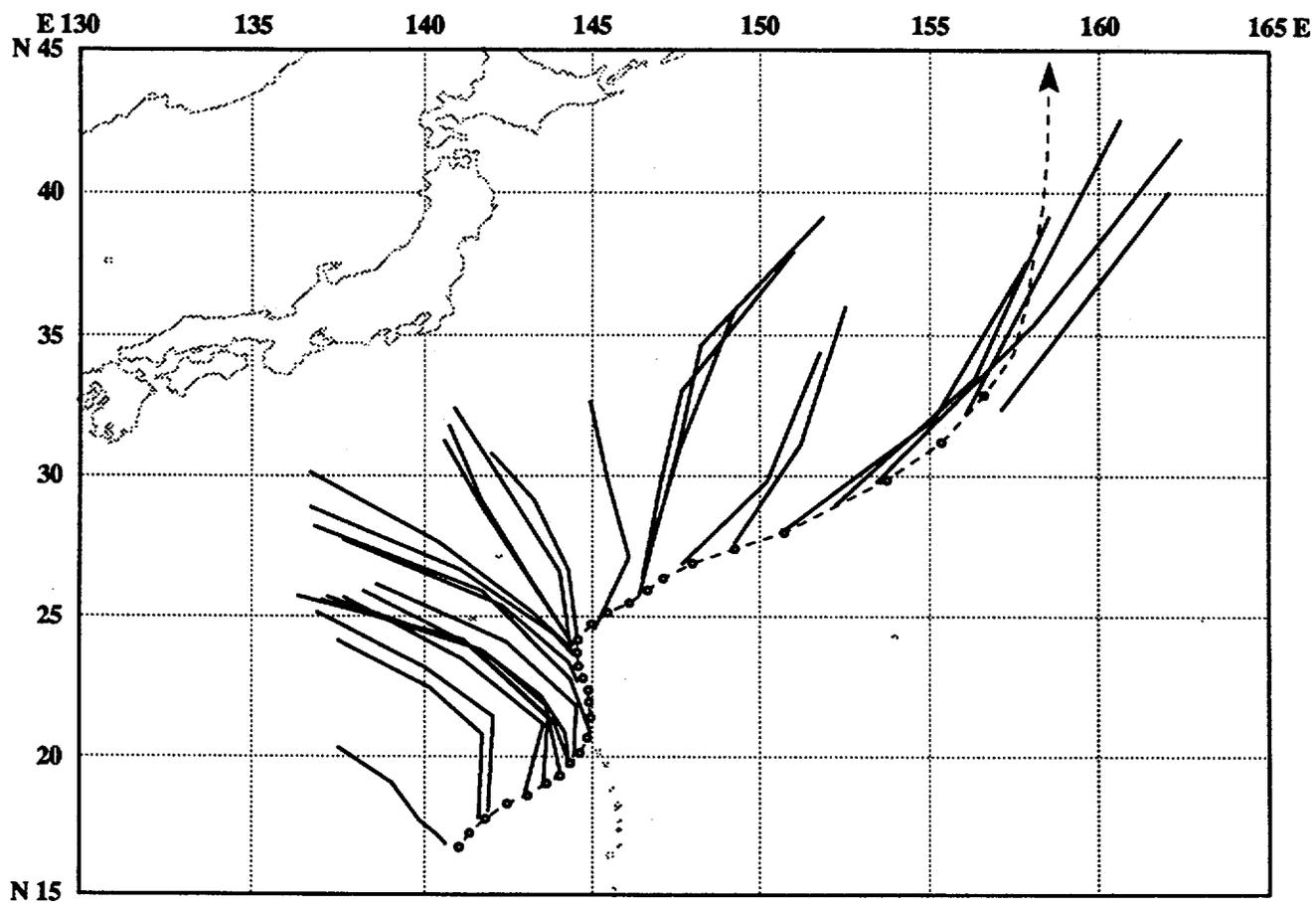


Figure 3-09-7. Summary of JTWC forecasts (solid lines) for Steve is superimposed on the best track (dashed line).