

# TROPICAL STORM NATHAN (05W)

## I. HIGHLIGHTS

Nathan, the second tropical cyclone to form in June, crossed the Philippine island of Luzon as a disturbance, executed an abrupt track change and stalled in the South China Sea. Both the track and intensity of TD04W and Nathan were dominated by a larger monsoon circulation in the South China Sea.

## II. CHRONOLOGY OF EVENTS

- 130600Z - First mentioned on Significant Tropical Weather Advisory as an area of weak circulation with an estimated minimum sea-level pressure of 1004 mb embedded in the monsoon trough .
- 140300Z - Tropical Cyclone Formation Alert based on improved organization with increased low-level inflow and increased outflow aloft.
- 150000Z - First warning due to increased winds as the system came off Luzon and entered the warm waters of the South China Sea.
- 161200Z - Upgraded to tropical storm after system became quasi-stationary and the exposed low-level became more aligned with the deep convection; the first intensity estimate of CI 2.5 received.
- 171200Z - Peak intensity - 55 kt (28 m/sec) -based on a ship report of 50 kt (26 m/sec) winds within 55 nm (100 km) of cloud system center.
- 181200Z - Landfall along Chinese/Vietnamese border, 100 nm (185 km) east-northeast of Hanoi.
- 190000Z - Final warning - (dissipated over land)- followed rapid weakening as Nathan encountered the mountains of northern Vietnam.

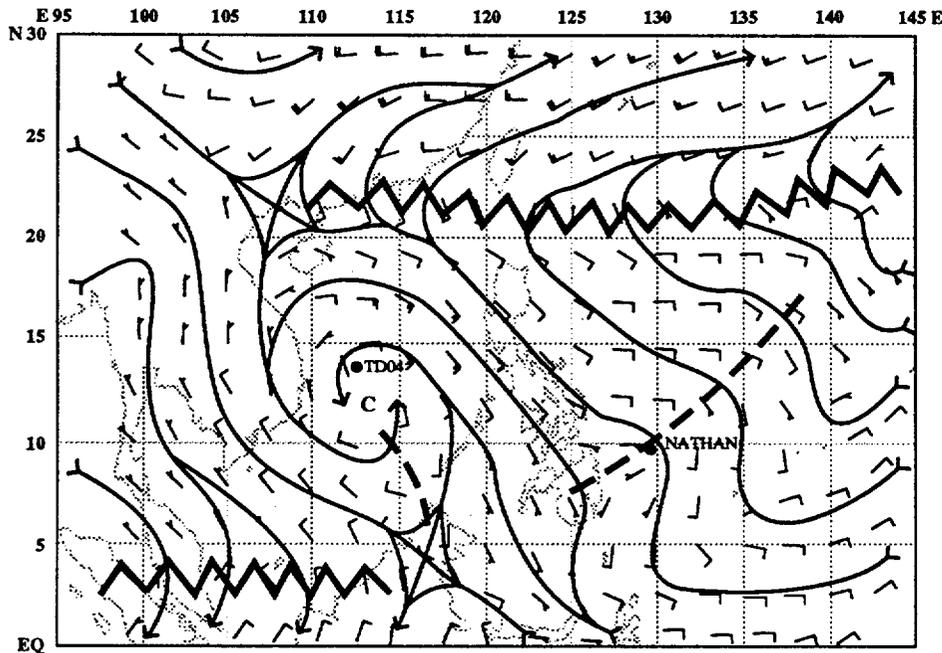


Figure 3-05-1. The 131200Z June deep layer mean analysis shows the large monsoon circulation (LMC) near 11° north latitude in the South China Sea and the subtropical ridge near 20° north latitude. Tropical Depression 04W is northwest of the center of the LMC and Nathan appears as an inverted trough east of Mindanao.

## III. TRACK AND MOTION

A large monsoon circulation (hereafter called LMC) in the South China Sea and the subtropical ridge along 20° north latitude set the stage for Nathan's unusual track. Initially Nathan was reflected in the deep layer mean analysis (Figure 3-05-1) as a wave in the easterlies. Farther to the west Tropical Depression 04W was a smaller shallow circulation embedded within the synoptic scale LMC. As Nathan moved northwestward and crossed southern Luzon, both the subtropical ridge and the LMC began shifting

northward (Figure 3-05-2). The curved best track reflects both Nathan's westward movement into the LMC in the South China Sea and the displacement to the north of the entire synoptic pattern. For a time, Tropical Depression 04W was expected to be drawn into Nathan; however, as Nathan sped by, Tropical Depression 04W dissipated. Nathan's abrupt track change and stall on 16 June was the result of a binary interaction with the LMC. The tropical cyclone separated from the LMC core and continued northwestward (Figure 3-05-3).

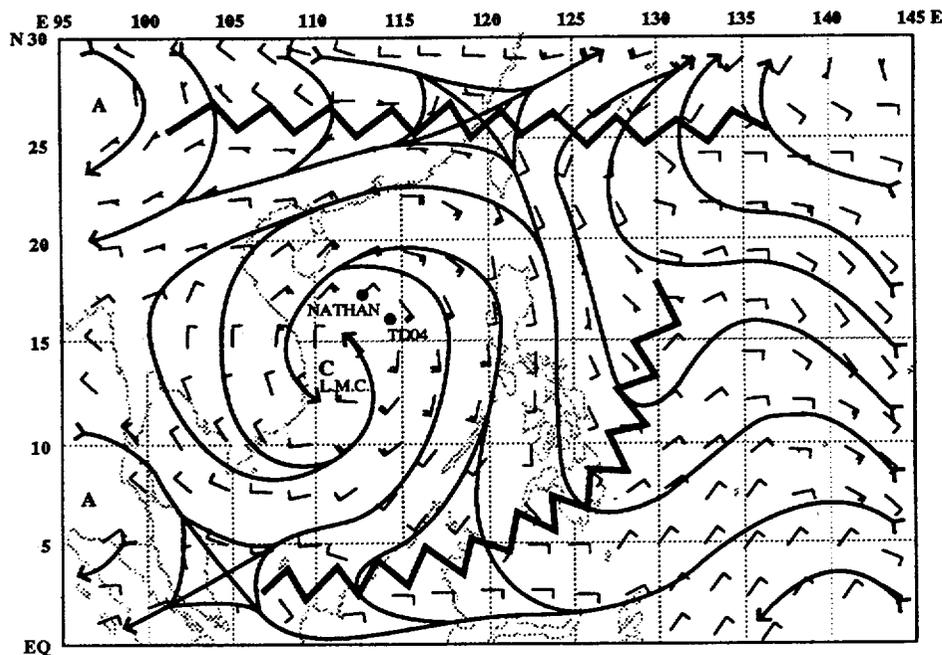


Figure 3-05-2. Both TD04W and Nathan are embedded in the flow near the center of the LMC on the 160000Z June deep layer mean analysis.

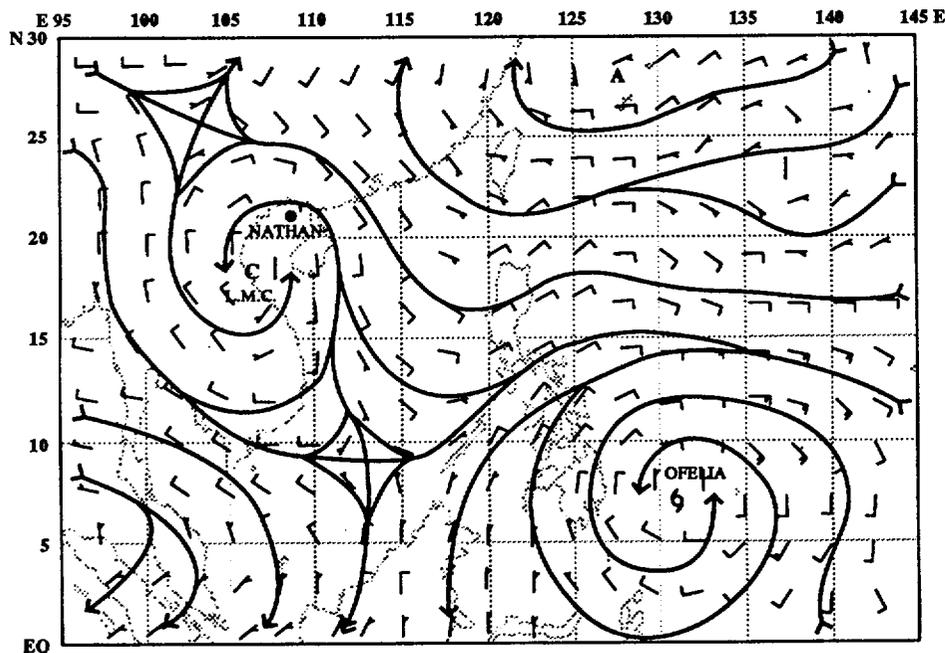


Figure 3-05-3. The 181200Z June deep layer mean analysis shows Nathan north-northeast of the center of the LMC.

#### IV. INTENSITY

Nathan slowly consolidated from multiple low-level circulations in an area of poorly organized convection. Convection continued to increase in amount and organization as the system approached the Philippine Islands (Figure 3-05-4). Nevertheless, passage across Luzon, rapid motion toward the LMC in the South China Sea and strong vertical wind shear all kept Nathan below tropical storm intensity. Intensification finally occurred when Nathan entered the core of the LMC on 16 June. The shear-type cloud pattern with its exposed low-level circulation center gave way to a central dense overcast, and

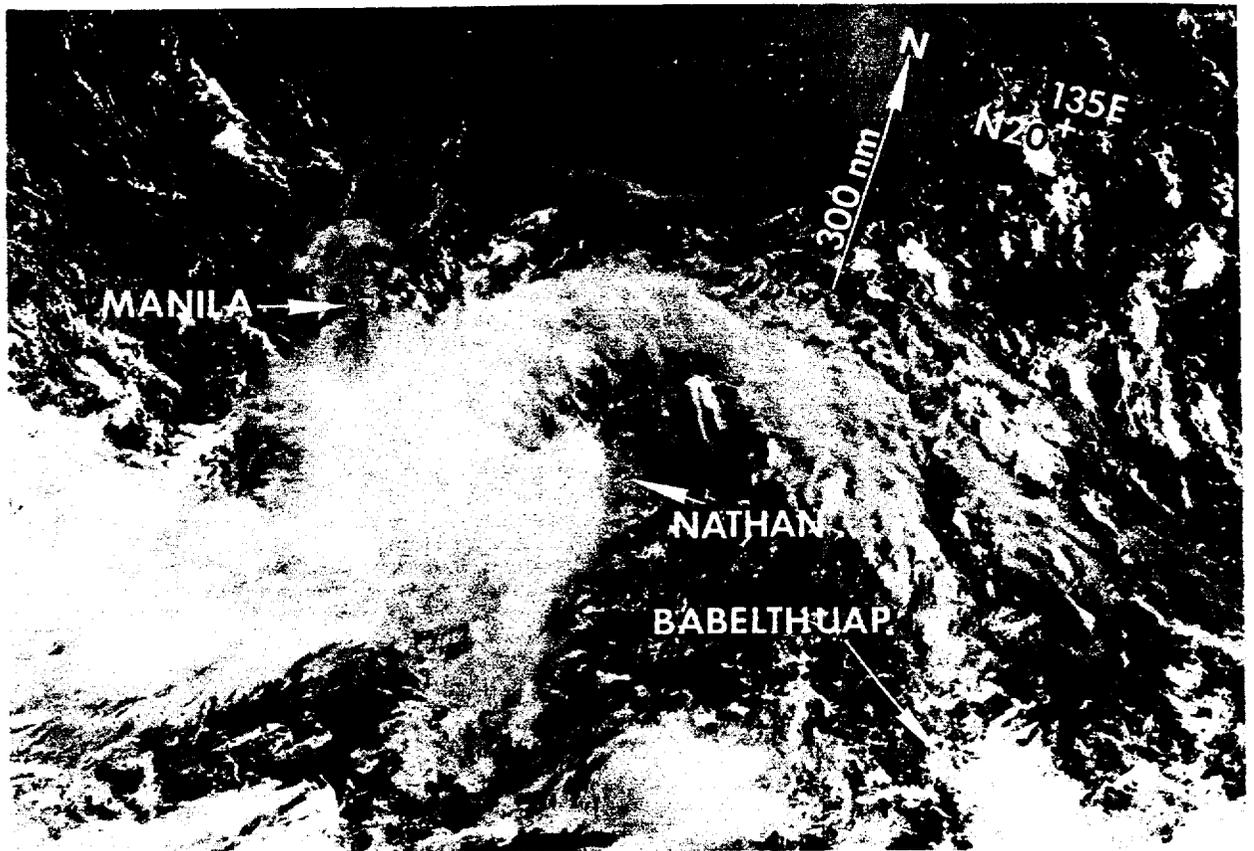


Figure 3-05-4. Nathan consolidates as it approaches the Philippine Islands (140049Z June DMSP visual imagery).

Nathan intensified into a tropical storm (Figure 3-05-5). Slow intensification continued until the tropical cyclone began interacting with land. Nathan weakened and dissipated rapidly after crossing Hainan Dao and making landfall on the coast of Vietnam on 18 June.

#### V. FORECASTING PERFORMANCE

Plots of JTWC's forecasts on the best track are presented in Figure 3-05-6. JTWC had a difficult time with this tropical cyclone in the South China Sea. Nathan's interaction with the center of the LMC and the northward shift of the entire synoptic pattern became apparent only after the fact. OTCM had a better handle on the overall northwestward track (Figure 3-05-7), but it did not reflect the interaction with the core of the LMC, as can be seen by the OTCM guidance to the south on 15 June.

#### VI. IMPACT

In Hong Kong, according to the "Monthly Weather Summary June 1990" published by the Royal Observatory, 13 people were killed, 5 were missing and 15 injured as a result of Nathan. Minor mudslides were reported throughout the area and scaffoldings collapsed in Kowloon. The cargo ship "Tien Fu" sank in the South China Sea on the night of 16 June with the loss of the captain and three of its crew. Along China's southern coast, torrential rain associated with Nathan caused 10 deaths and flooded 5,000 hectares of farmland in eastern Guangdong. In Zhanjiang, 100,000 hectares of paddy fields were destroyed. Two men were reported missing in Macao after being swept overboard from a dredger on 17 June.

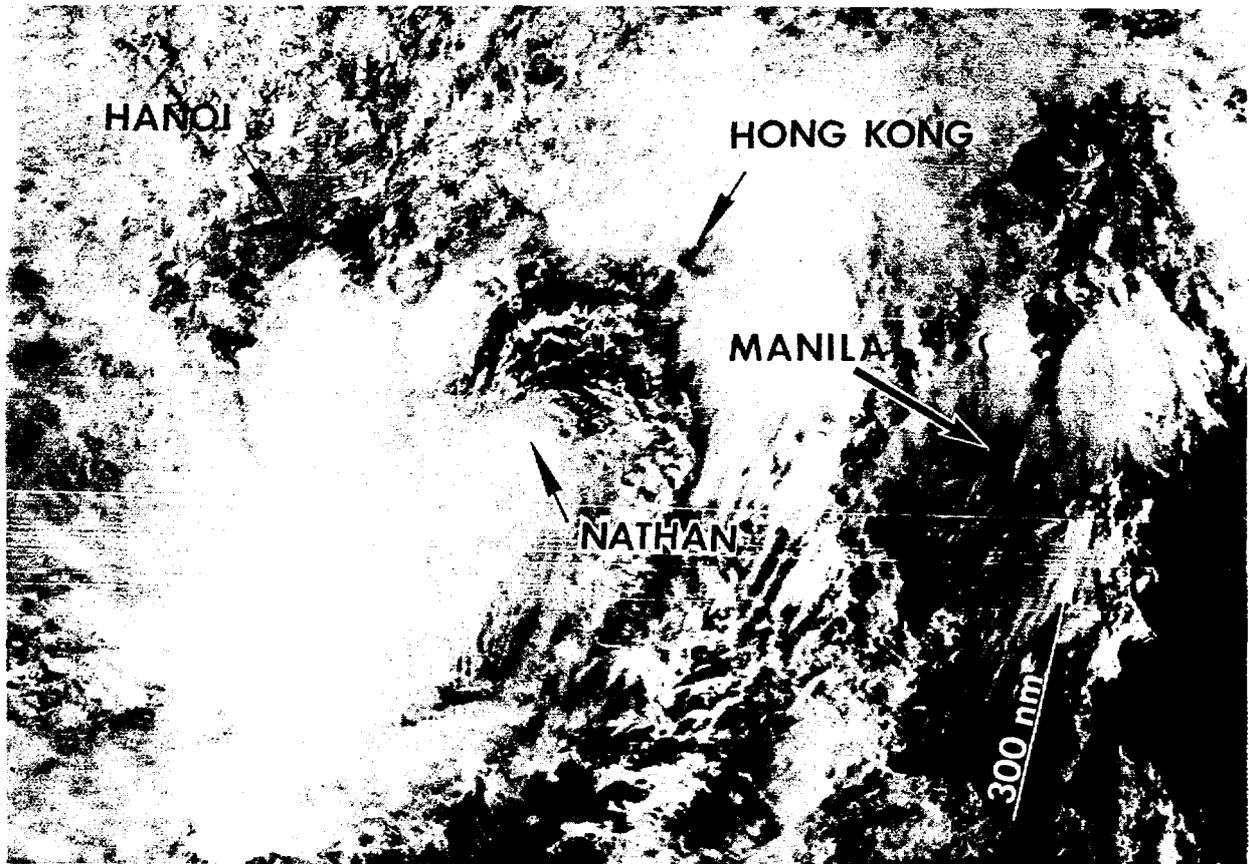


Figure 3-05-5. Tropical Storm Nathan with a ragged central dense overcast churns towards Hainan Dao (170128Z June DMSP visual imagery).

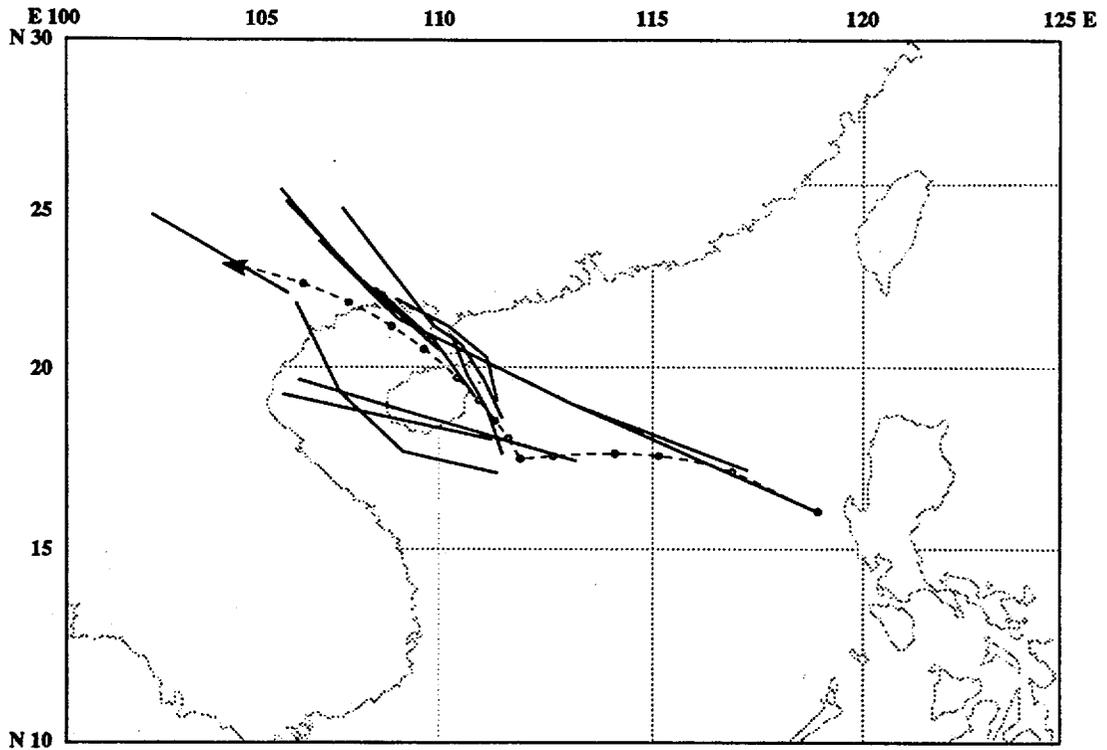


Figure 3-05-6. JTWC forecasts (solid lines) for Nathan are superimposed on the final best track (dashed line). The abrupt track change and stall in the South China Sea were difficult to forecast.

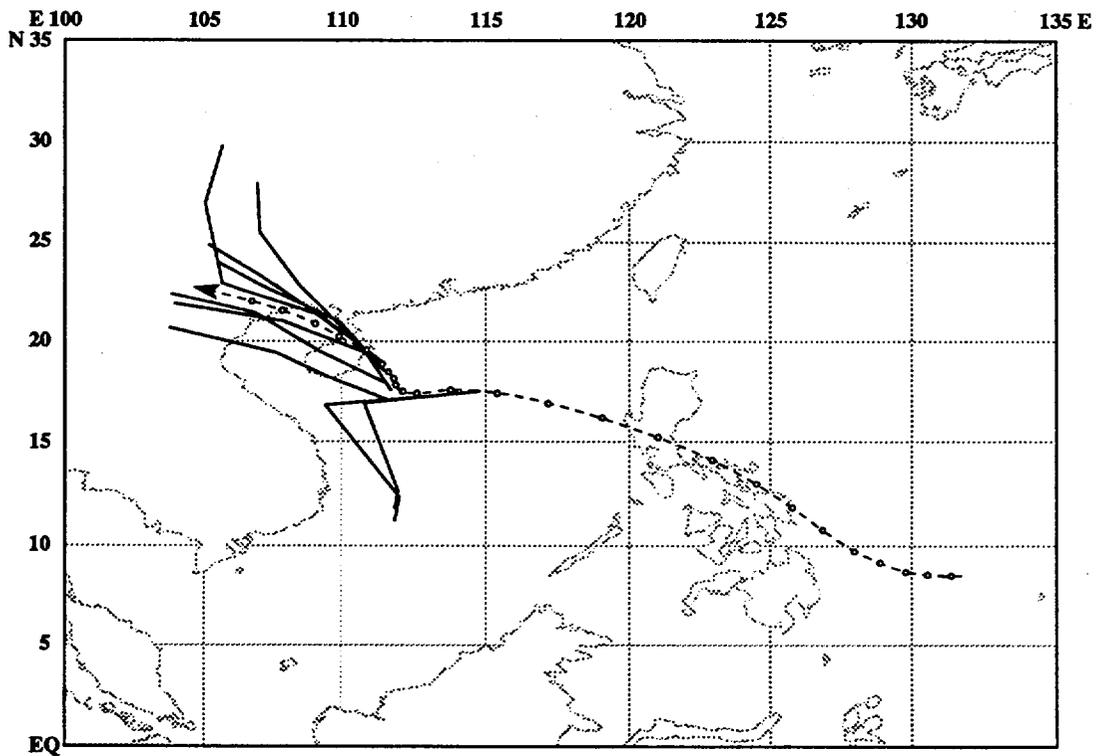


Figure 3-05-7. When Nathan interacted with the core of the LMC, OTCM guidance had difficulties, as indicated by the two solid lines that abruptly turn southward on 15 June.