

**TYPHOON FRANKIE (08W)**

**BEST TRACK-TC 08W**

**19 JUL - 25 JUL 96**

**MAX SFC WIND 90 KT**

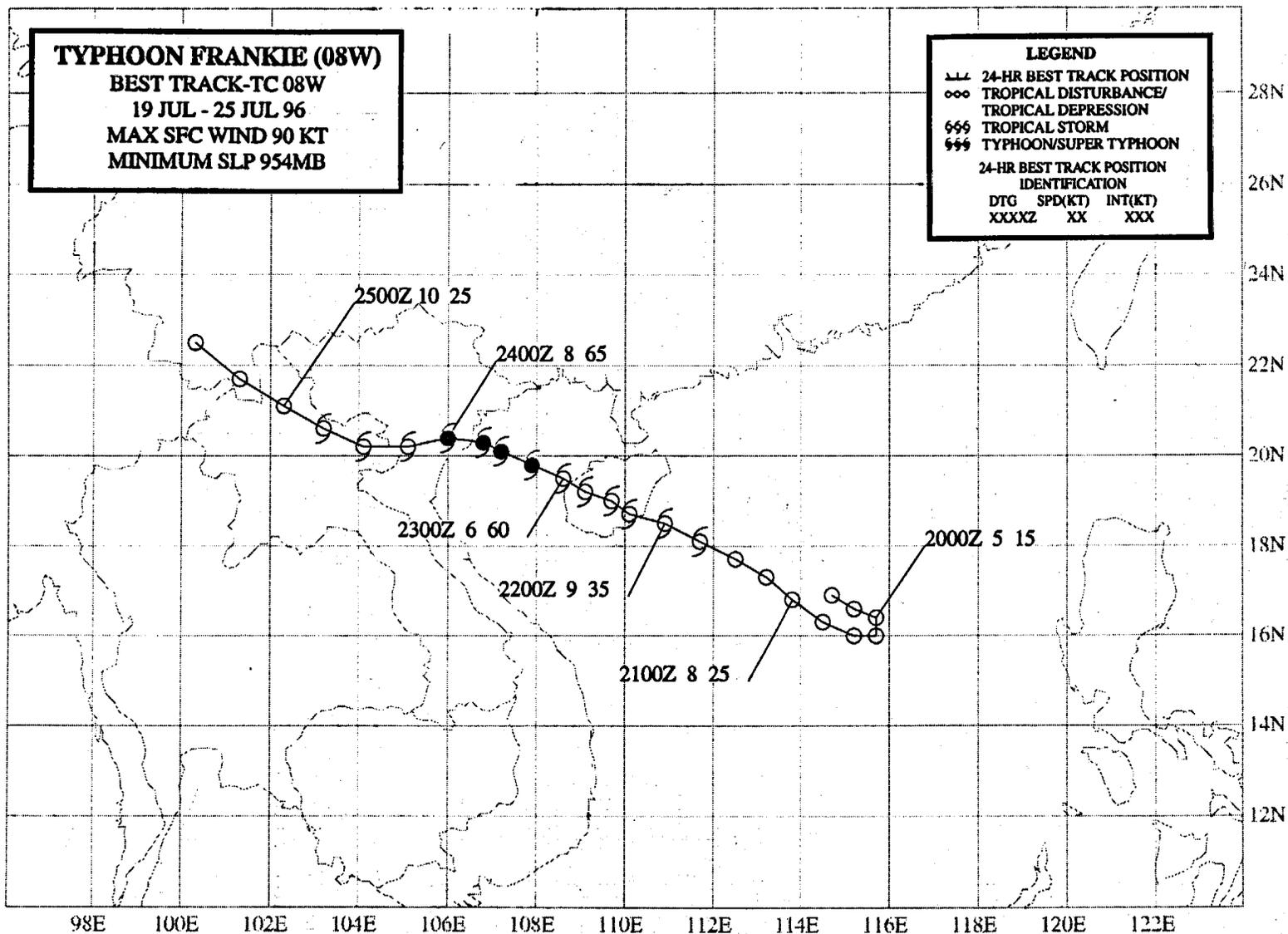
**MINIMUM SLP 954MB**

**LEGEND**

- 24-HR BEST TRACK POSITION
- TROPICAL DISTURBANCE/  
TROPICAL DEPRESSION
- ⊖ TROPICAL STORM
- ⊕ TYPHOON/SUPER TYPHOON

**24-HR BEST TRACK POSITION  
IDENTIFICATION**

DTG	SPD(KT)	INT(KT)
XXXXZ	XX	XXX



## TYPHOON FRANKIE (08W)

### I. HIGHLIGHTS

During late July, the monsoon trough became established across the northern half of the South China Sea and extended east-southeastward into Micronesia. Three TCs formed in this trough — Frankie, Gloria (09W), and Herb (10W). The westernmost of these three, Frankie originated from a monsoon depression in the South China Sea tracked to the west-northwest, and made landfall in northern Vietnam.

### II. TRACK AND INTENSITY

During June and the first half of July, the monsoon trough was either very weak or absent from the tropics of the WNP. Easterly winds prevailed, and TC formation occurred at relatively high latitude (20°N) in association with disturbances in the TUTT. During the latter half of July, the first major penetration of the monsoon trough into Micronesia occurred. Inevitably, the monsoon cloud band consolidated into discrete areas of deep convection (in this case, three of them). The westernmost of the three areas of deep convection along the monsoon trough became a monsoon depression in the South China Sea (see the discussion section). It was first mentioned on the 180600Z July Significant Tropical Weather Advisory. A small well-defined LLCC (Figure 3-08-1) embedded within this monsoon depression became Frankie. A Tropical Cyclone Formation Alert was issued valid at 201100Z when deep convection continued to consolidate around the LLCC shown in Figure 3-08-1. Rapid development of a CDO pattern type with well-defined peripheral low-level cloud lines (Figure 3-08-2) prompted the JTWC to issue the first warning on Tropical Depression (TD) 08W, valid at 210000Z. During the early morning of 22 July, TD 08W formed a large CCC (Figure 3-08-3) prompting its upgrade to Tropical Storm Frankie on the warning valid at

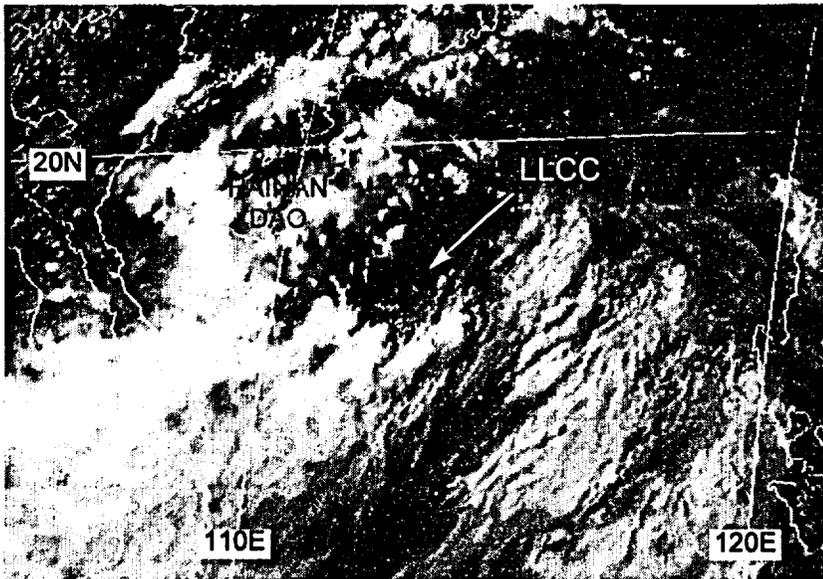


Figure 3-08-1 A small well-defined LLCC is present near the center of a monsoon depression. This LLCC became Frankie (210731Z July visible GMS imagery).

211800Z. After becoming a tropical storm, Frankie passed over the island of Hainan and continued to intensify. After clearing the west coast of Hainan, Frankie developed a ragged eye (Figure 3-08-4). Over the Gulf of Tonkin, the eye became better defined and Frankie was upgraded to a typhoon on the warning valid at 230600Z. The intensity peaked at 90 kt (46 m/sec) at 231200Z, and remained at that intensity until it crossed the coast of northern Vietnam at approximately 232200Z July. Thereafter, the system weakened, and the final warning was issued, valid at 240600Z.

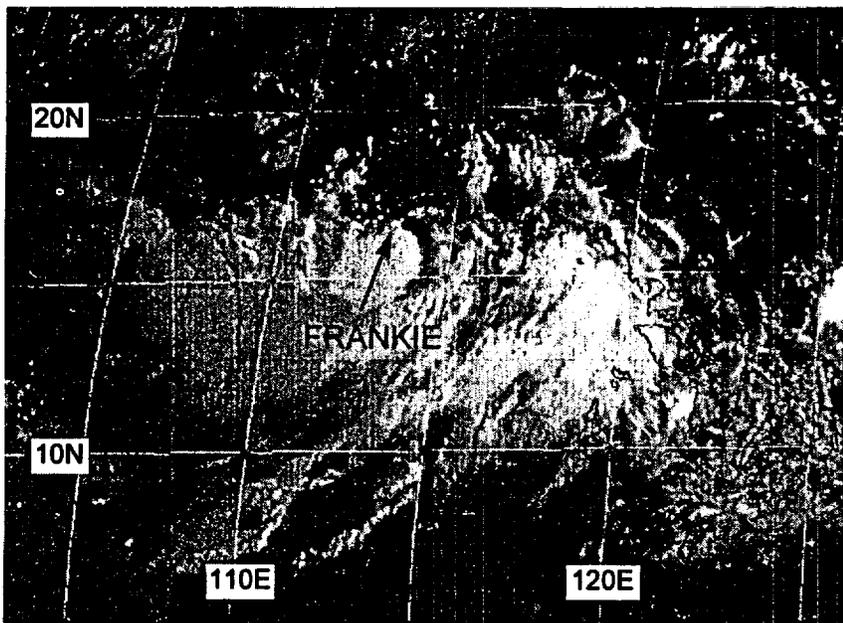


Figure 3-08-2 Deep convection becomes established over the LLCC shown in Figure 3-08-1 (202331Z July visible GMS imagery).

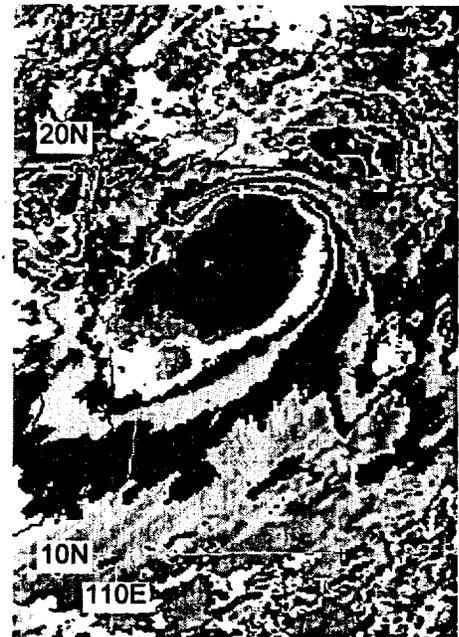


Figure 3-08-3 A large CCC erupts over the LLCC of Frankie. Coldest cloud-top temperature was  $-97^{\circ}\text{C}$  (indicated by the arrow) (212224Z July enhanced infrared GMS imagery).

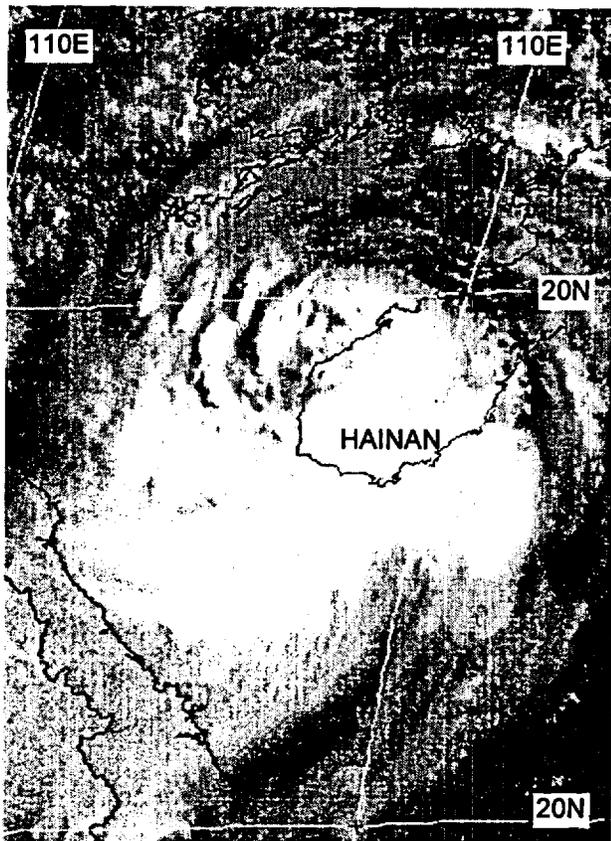


Figure 3-08-4 Frankie acquires a ragged eye as it clears the coast of Hainan island (230031Z July visible GMS imagery).

### III. DISCUSSION

#### a. *The transformation of a monsoon depression into a typhoon*

Frankie originated from a monsoon depression — a common genesis pathway for TCs in the WNP (see Appendix A for a detailed description of monsoon depressions in the WNP). An unresolved question remains concerning the transition of a monsoon depression into a conventional TC: does the monsoon depression become the conventional TC, or does a conventional TC form within the circulation of the monsoon depression? In Frankie's case, it can be argued that the conventional TC (Frankie) formed within the preexisting circulation of the monsoon depression. The well-defined exposed LLCC (Figure 3-08-1) that became the focus of Frankie's deep convection was surrounded by an area of gales (Figure 3-08-5) before the core winds increased. When persistent deep convection appeared in the core of the monsoon depression, it quickly became a CDO-type conventional TC. Soon after the formation of Frankie's CDO, the peripheral cloudiness in the monsoon depression was suppressed and the areal extent and amount of

deep convection in the system became much smaller. TCs in the WNP that develop from monsoon depressions tend to be large, and Frankie's small size is somewhat unusual. Perhaps the geomorphology of the Gulf of Tonkin contributed to the evolution of this monsoon depression into a small TC. Many TCs which move into the Gulf of Tonkin become smaller.

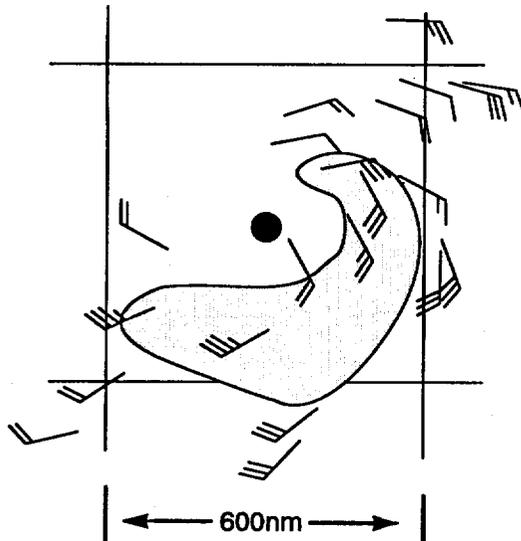


Figure 3-08-5 An area of gales existed in the monsoon depression before deep convection grew in its center (black dot) and the system became a conventional tropical cyclone. Wind reports are a center-relative composite of ship observations at 201200Z, 210000Z and 211200Z July.

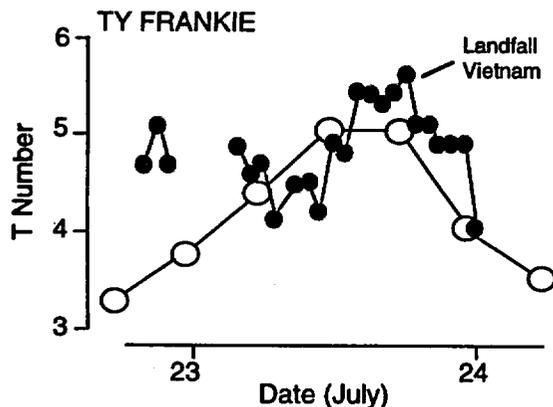


Figure 3-08-6 A time series of Frankie's intensity as it crossed the Gulf of Tonkin and made landfall in Vietnam. The hourly DD time series is indicated by black dots, and the six-hourly best-track intensity (converted to a T number) is indicated by the open circles.

#### b. Frankie's intensity time series

Upon entering the Gulf of Tonkin, Frankie acquired an eye and intensified from 50 kt (26 m/sec) to 90 kt (46 m/sec) in a period of 24 hours (Figure 3-08-6). The equivalent pressure drop of 33 mb in 24 hours was below the criteria for rapid deepening, defined as a decrease of 42 mb in 24 hours (Holliday and Thompson, 1979). The intensity increase did, however, qualify as "fast" in terms of its rise of more than 1.5 Dvorak T numbers in 24 hours. Dvorak classifies the rate of intensification of a TC as "slow", "normal", or "fast" if the 24-hour rise in its T-number estimate is 0.5, 1.0, and 1.5 respectively. Another aspect of Frankie's intensification over the Gulf of Tonkin concerns the timing of its peak. The best track indicates it reached its peak intensity approximately eight hours prior to landfall, while the DD numbers (Figure 3-08-6) continued to rise until the western eye-wall cloud made landfall. The discussion of the behavior of the time series of the DD numbers for Frankie, and for some of the other typhoons of 1996, is intended to highlight certain aspects of the DD time series that may prove to have important research and/or warning implications. Differences between the DD numbers and the best-track intensity are expected, and substantial disagreements are curiosities that lack ground-truth verification.

#### IV. IMPACT

Frankie caused extensive property damage and loss of life in the northern provinces of Vietnam. There were 104 people reported dead or missing, and 466 were reported injured. Total economic losses were estimated at over US \$200 million.