

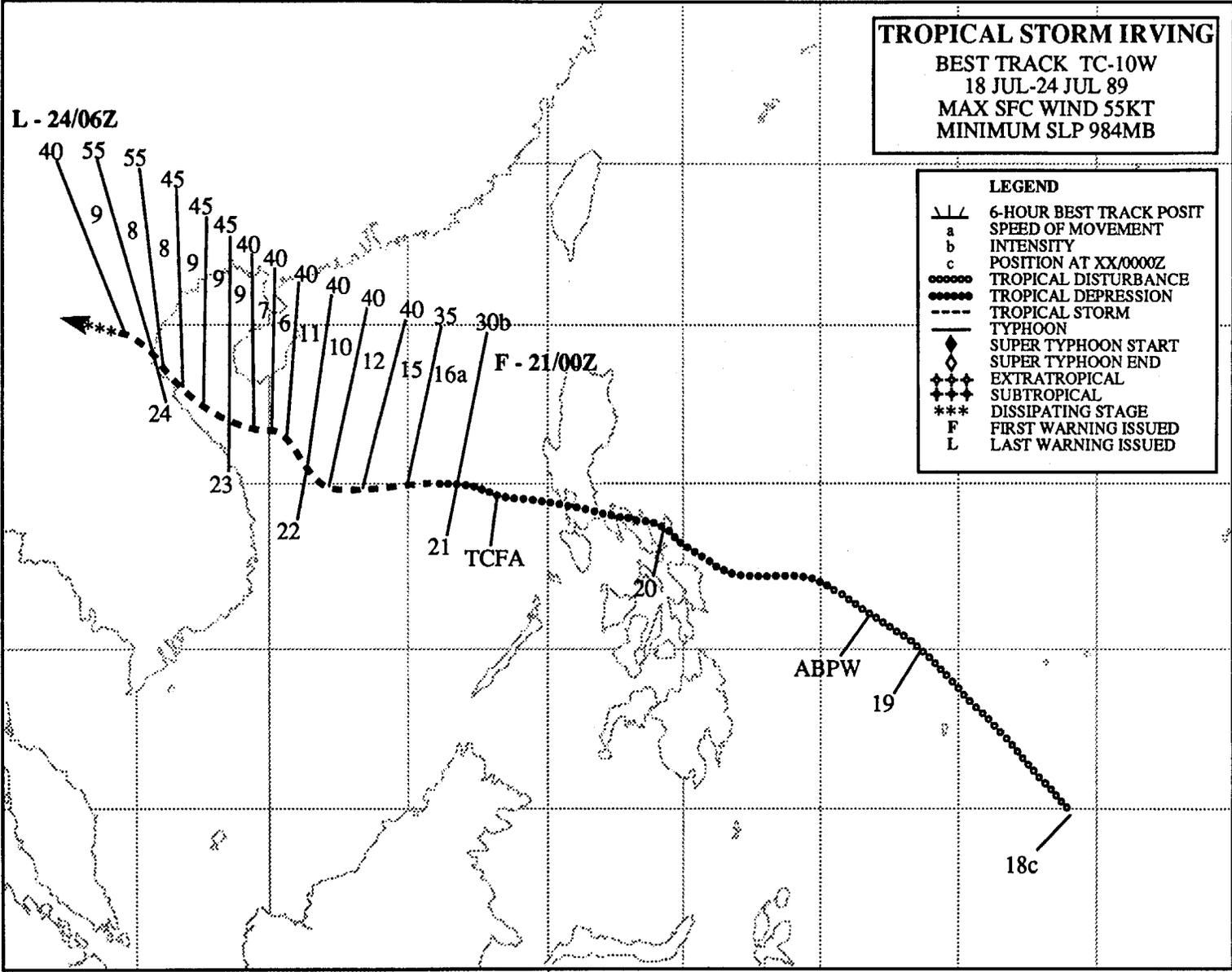
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N 30

**TROPICAL STORM IRVING**  
 BEST TRACK TC-10W  
 18 JUL-24 JUL 89  
 MAX SFC WIND 55KT  
 MINIMUM SLP 984MB

**LEGEND**

∖∖∖	6-HOUR BEST TRACK POSIT
a	SPEED OF MOVEMENT
b	INTENSITY
c	POSITION AT XX/0000Z
○○○○○	TROPICAL DISTURBANCE
●●●●●	TROPICAL DEPRESSION
-----	TROPICAL STORM
-----	TYPHOON
◆	SUPER TYPHOON START
◇	SUPER TYPHOON END
✦✦✦	EXTRATROPICAL
✦✦✦	SUBTROPICAL
***	DISSIPATING STAGE
F	FIRST WARNING ISSUED
L	LAST WARNING ISSUED



74

EQ

## TROPICAL STORM IRVING (10W)

Tropical Storm Irving was the fourth tropical cyclone of 1989 to cross the South China Sea and the last to enter the South China Sea until Typhoon Brian (27W) late in September. In August and September the tropical cyclone tracks shifted northward. Irving was short-lived and actually reached its maximum intensity as it made landfall on the coast of northern Vietnam.

As Super Typhoon Gordon (08W) was about to make landfall on the coast of China and Tropical Storm Hope (09W) was reaching peak intensity, the disturbance that would eventually develop into Irving formed on 18 July in the monsoon trough near the southwestern Caroline Islands. The disturbance moved slowly northwestward across the Philippine Sea. Synoptic data at 190000Z July indicated a surface circulation, and the disturbance was

considered a suspect area on that day's Significant Tropical Weather Advisory.

The disturbance crossed the Philippine Sea from southeast of Palau to over the Philippine Islands in three days. The lowest observed minimum sea-level pressure was 1004 mb. Once in the South China Sea, the disturbance became better organized and JTWC issued a Tropical Cyclone Formation Alert at 202000Z. The first warning on Tropical Depression 10W was issued four hours later. The depression was upgraded to tropical storm intensity at 210600Z.

The tropical easterly jet was weakly established across the Southeast Asia; still, the vertical wind shear over the South China Sea due to the northerly flow aloft was sufficient to prevent Tropical Storm Irving (Figure 3-10-1)

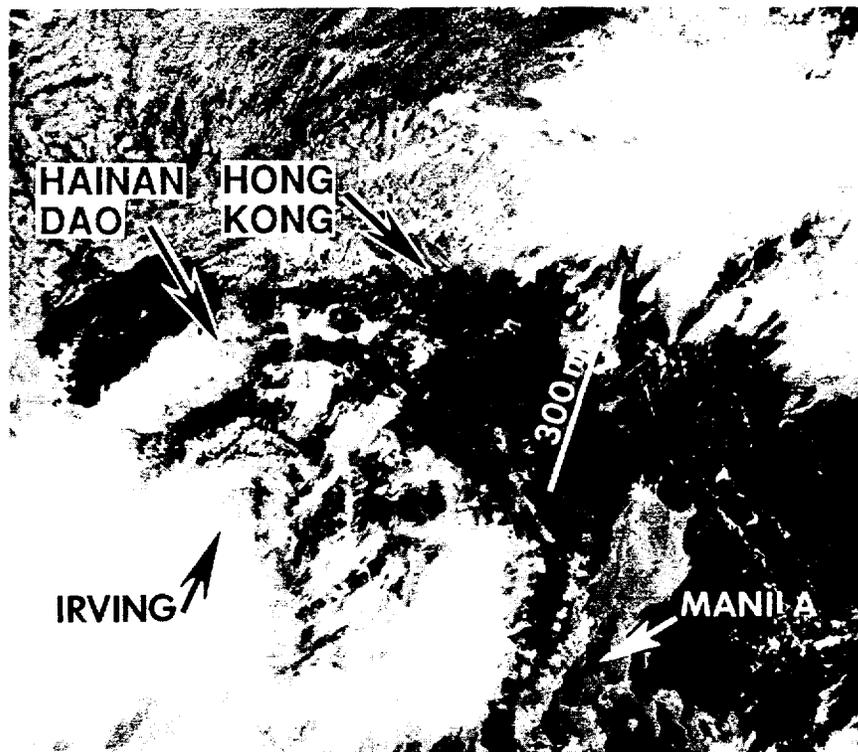


Figure 3-10-1. Vertical wind shear is responsible for the separation between the low-level circulation center and the bright cloud tops to the southwest. The area of cloudiness at the top right of the picture is the remnants of Tropical Storm Hope (09W) over eastern China (NOAA visual imagery 220533Z July).

from reaching typhoon intensity. Throughout Irving's lifetime, the upper-level cloud circulation center was located southwest of the low-level center. As a result, the nighttime infrared satellite fixes of the upper-level cloud features were displaced to the southwest of the low-level circulation center. This tilt to the system also resulted in differences between the radar and corresponding satellite fixes.

Based on satellite imagery, Irving was downgraded to a tropical depression on the 230600Z warning. However, a reanalysis of the imagery indicated Irving actually continued to intensify as it entered the warm waters of the

Gulf of Tonkin. In addition, the Gulf of Tonkin is a natural region of forced low-level convergence due to the surrounding topography. The 240000Z warning upgraded the system again to tropical storm intensity. Irving was downgraded for a second time to a tropical depression on the final warning when it moved into northern Vietnam at 240600Z.

The remnants of Irving moved across the mountains and dissipated over Laos. News reports estimated that at least 102 people died and another 488 were injured in Vietnam. In addition, more than 80,000 houses and 160,000 acres of crops were destroyed.