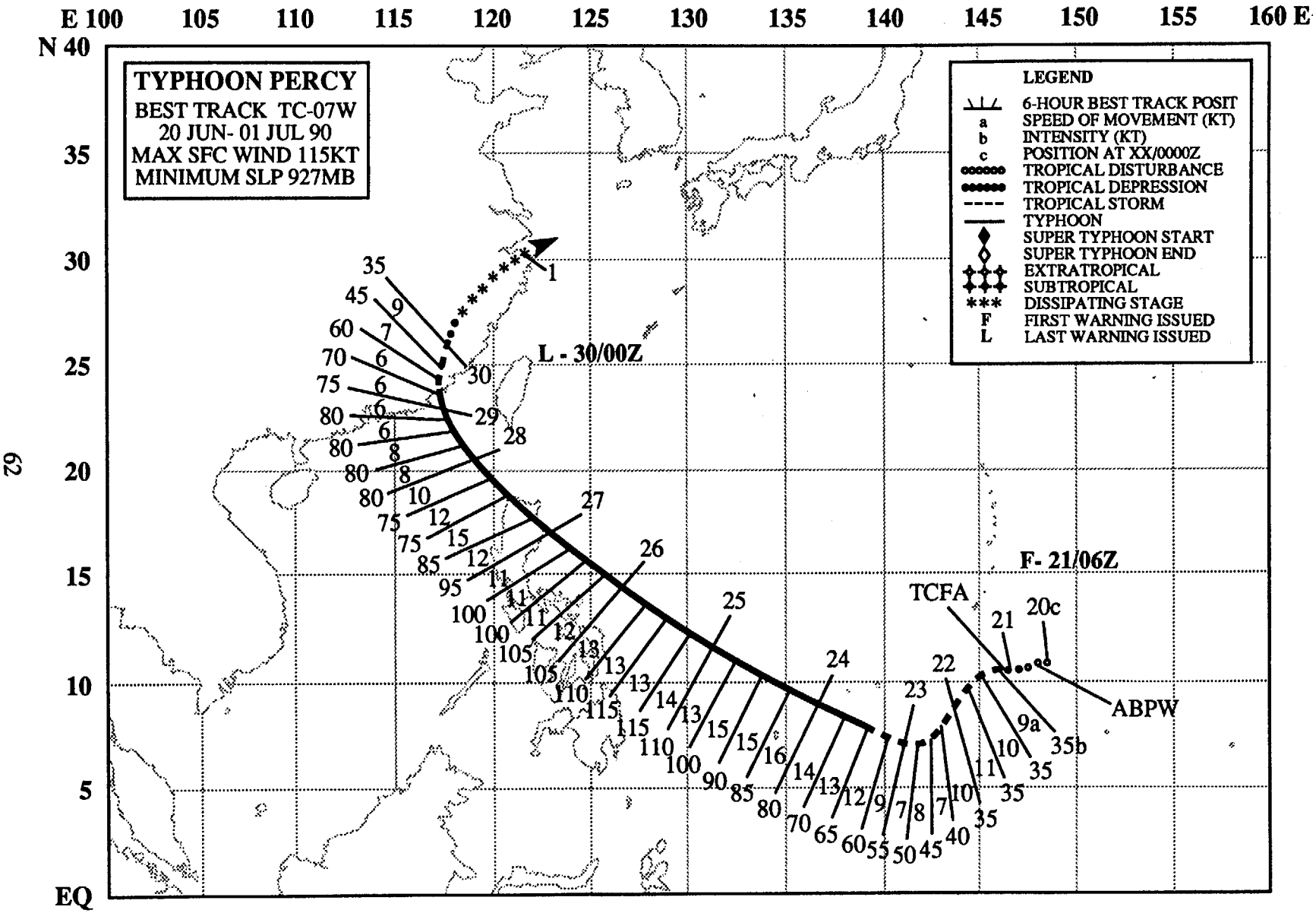
TYPHOON PERCY
BEST TRACK TC-07W
20 JUN- 01 JUL 90
MAX SFC WIND 115KT
MINIMUM SLP 927MB
LEGEND
6-HOUR BEST TRACK POSIT
SPEED OF MOVEMENT (KT)
INTENSITY (KT)
POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
L - 30/00Z
F- 21/06Z
TCFA
ABPW
E 100
105
110
115
120
125
130
135
140
145
150
155
160 E
N 40
35
30
25
20
15
10
5
EQ

TYPHOON PERCY (07W)

I. HIGHLIGHTS

Percy was the fourth and last tropical cyclone in June. After forming southeast of Guam, it executed an unusual track to the southwest for 36 hours before paralleling Ofelia's (06W) track to the west-northwest around the western periphery of the subtropical ridge. Percy damaged the western Caroline Islands and became the second typhoon within a week to batter northern Luzon before recurving over eastern China.

II. CHRONOLOGY OF EVENTS

200600Z - First mentioned on the Significant Tropical Weather Advisory as an area of convection that had persisted for 12 hours. A cyclonic circulation was present in the low-level wind field under weakly divergent flow aloft.

202230Z - Advisory reissued to upgrade system's potential for development from poor to fair as outflow and cloud signature improved.

210300Z - Tropical Cyclone Formation Alert due to significant increase in organized convection and improved outflow aloft during the past 24 hours.

210600Z - First warning and upgrade to tropical storm prompted by receipt of 35 kt (18m/sec) ship report.

231800Z - Upgraded to typhoon followed initial signs of eye formation within the central dense overcast and first intensity estimate of T4.0.

250600Z - Peak intensity - 115 kt (59 m/sec) - with 25 nm (46 km) diameter eye and T6.0.

291200Z - Downgraded to tropical storm resulted from weakened convective signature following cyclone's interaction with the coast of southeastern China.

300000Z - Final warning - (dissipating over land) - followed further loss of convective organization as system underwent increased vertical wind shear and loss of latent and sensible heat.

III. TRACK AND MOTION

After initially tracking westward, Percy turned and tracked southwestward for approximately 36 hours. Since the extent of the subtropical ridge and its axis along 28°N remained relatively unchanged during this period, the track change must have resulted from activity near the monsoon trough. An anticyclone had formed southeast of Typhoon Ofelia (06W) and was tracking west-northwestward in tandem with it. As Percy formed, subsidence associated with the converging outflow aloft from both Percy and Ofelia strengthened the anticyclone which resulted in northerly steering flow across Percy (Figure 3-07-1). Percy tracked around the east side of this anticyclone until approximately 221200Z. As Ofelia moved northwestward away from Percy, the anticyclone between them tracked northwestward, weakened and merged with the subtropical ridge to its north. By 231200Z it was only evident as a southwestward extension of the subtropical ridge between Ofelia and Percy (Figure 3-07-2), and by 251200Z it was no longer discernible. Percy then tracked west-northwestward around the subtropical ridge (Figure 3-07-3). After making landfall on the southeast coast of China, Percy was picked up by a mid-latitude short wave trough and finally dissipated as it recurved over eastern China.

IV. INTENSITY

Starting as a low-level circulation at the eastern end of the monsoon trough, Percy quickly developed into a tropical storm as it moved into an area of upper-level divergence. An upper-level anticyclone soon developed over the low-level circulation center. The vertically aligned system intensified into a typhoon as it obtained an outflow channel to the south. As Percy cleared the western Caroline Islands, it developed an additional outflow channel to the north and further intensified, reaching its maximum intensity of 115 kt (59 m/sec) at 250600Z (Figure 3-07-4). The typhoon

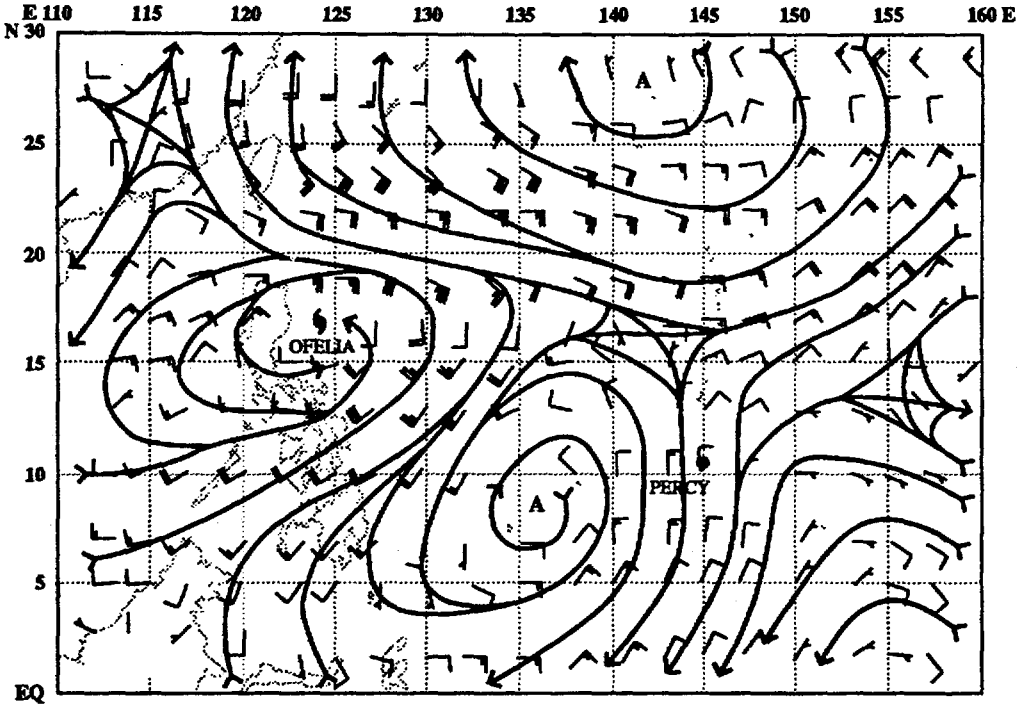

Figure 3-07-1. The 211200Z June deep layer mean analysis shows Percy embedded in northerly flow with a anticyclone to its west. Ofelia's (06W) circulation is located to the northwest of the anticyclone.

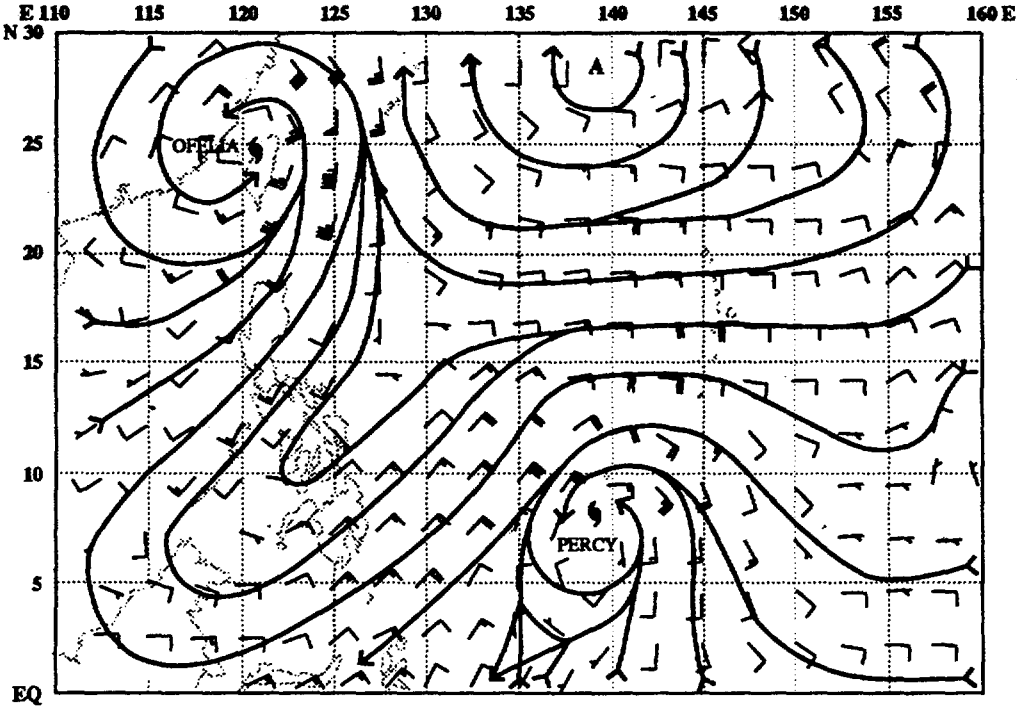

Figure 3-07-2. The 231200Z June deep layer mean analysis indicates the ridge between Ofelia (06W) and Percy has weakened and become a southwestward extension of the subtropical ridge.

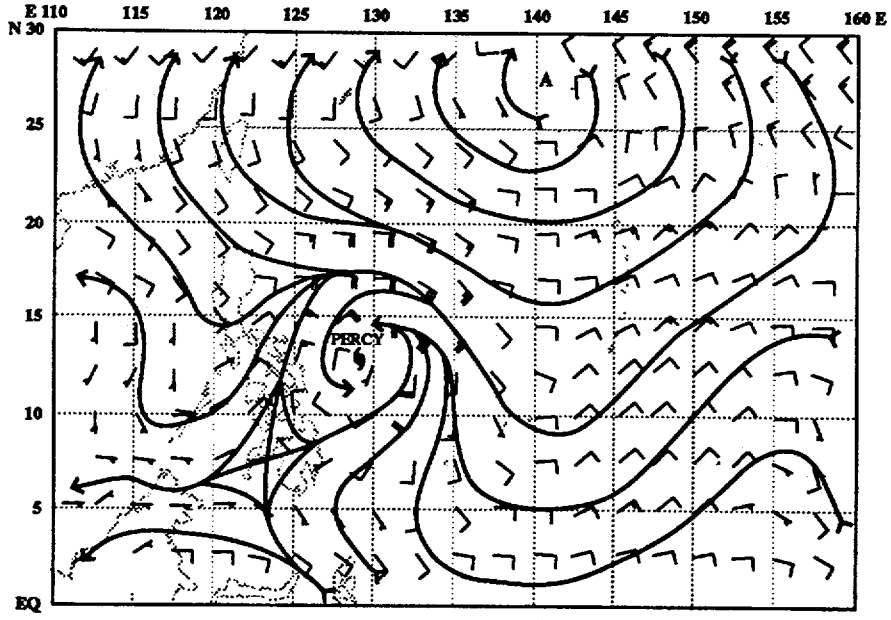

Figure 3-07-3. The 251200Z June deep layer mean analysis shows Percy embedded in the flow around the western end of the subtropical ridge.

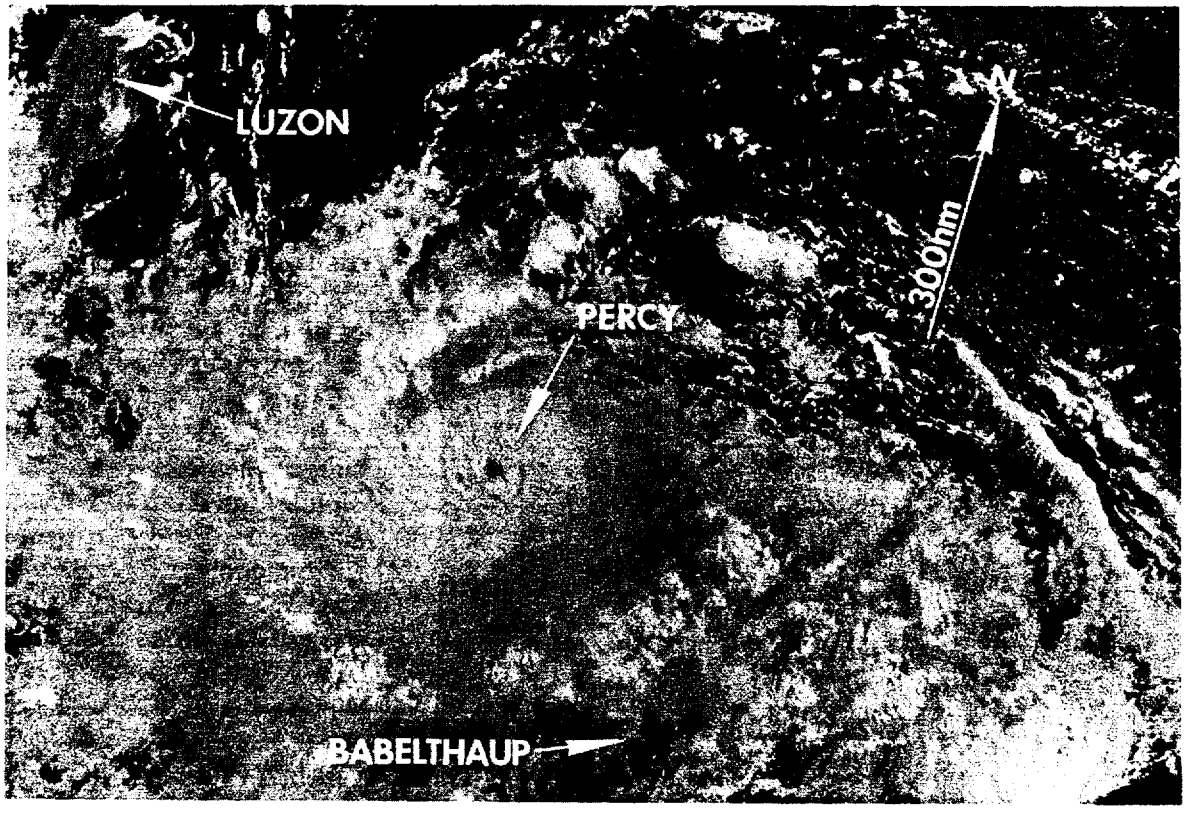

Figure 3-07-4. Typhoon Percy just prior to reaching maximum intensity. Northern Luzon is visible at the top left of the image (250021Z June DMSP visual imagery).

weakened initially due to increasing vertical wind shear from the northeast, and later, from land interactions with northern Luzon (Figure 3-07-5). After moving into the South China Sea and reintensifying slightly, Percy's eye wall (Figure 3-07-6) assumed a polygonal structure (Lewis and Hawkins, 1982). Further weakening resulted from additional vertical wind shear and passage over China.

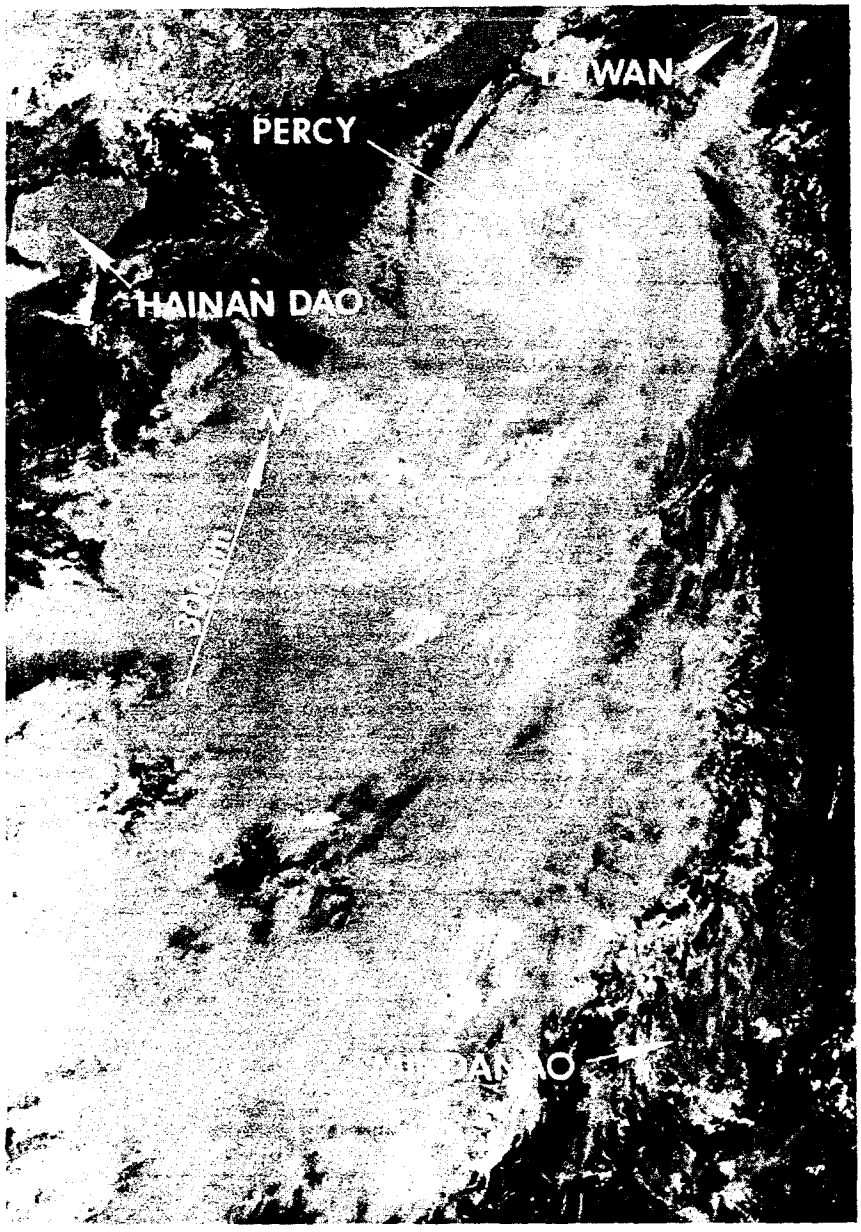

Figure 3-07-5. A ragged, cloud-filled eye reformed after the typhoon collided with northern Luzon. Percy is one day before making landfall in southeastern China. Taiwan is at top right and Hainan Dao at top left (280100Z June DMSP enhanced infrared imagery).

V. FORECASTING PERFORMANCE

Of particular interest was the southwestward portion of Percy's track. Initially, JTWC thought the dynamic high pressure system between Ofelia (06W) and Percy was too weak to influence Percy's track. Forecasters favored persistence and climatology for a west-northwestward track. Forecasters assumed that any departure from this track would be short lived as a result of interactions with a vorticity center associated with a mass of convection to the southeast of Percy. A binary interaction (Figure 3-07-7), when added to the translation of the overall system, would cause a net displacement of Percy to the southwest. This would only last until the two vortices merged. In contrast, OTCM guidance (Figure 3-07-8), which agreed with the deep layer mean, suggested a track south of west which turned out to be accurate. Later, as Percy approached Luzon, another forecast problem arose. The NOGAPS prognostic series indicated that the subtropical ridge would weaken and allow Percy to recurve east of Taiwan. As a result, JTWC and a number of the objective aids forecast recurvature at that longitude. However, the subtropical ridge

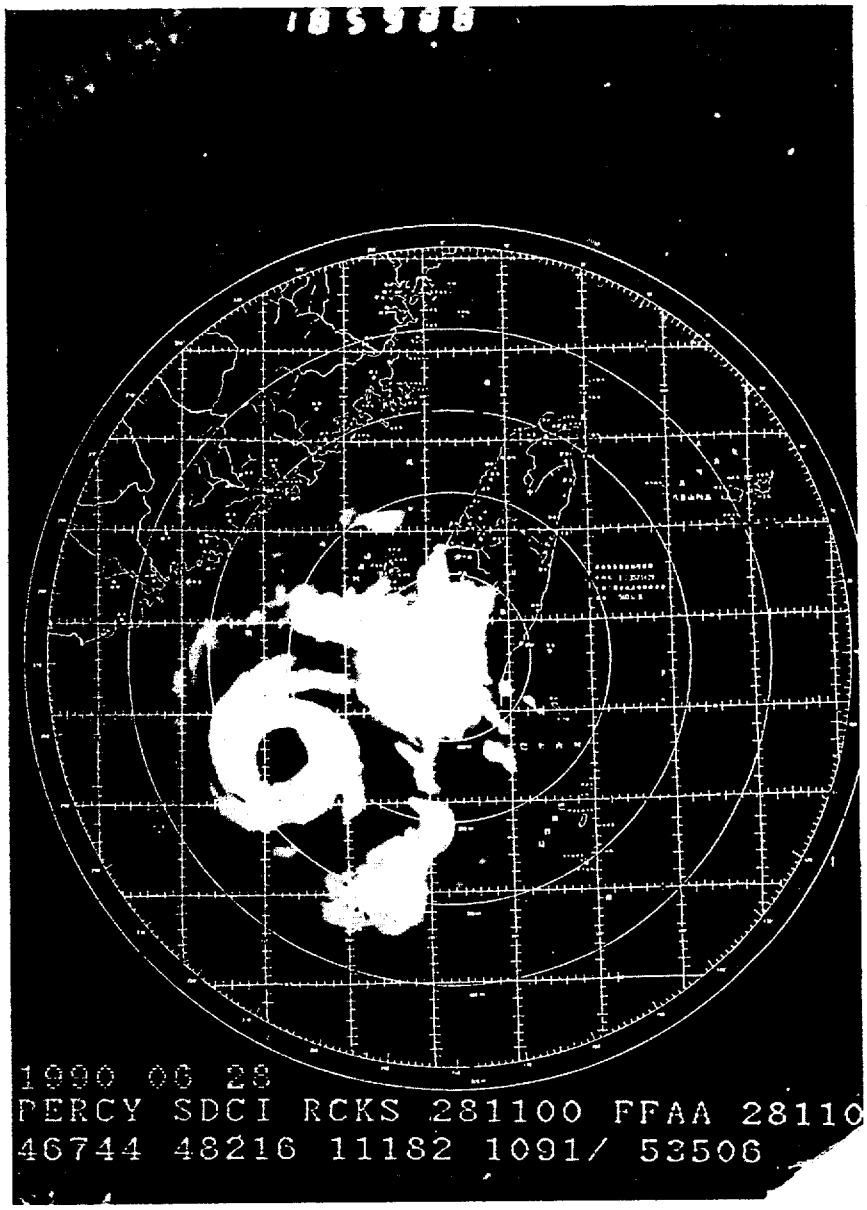

Figure 3-07-6. The polygonal structure of Percy's eye wall at 281100Z June as viewed by the zohsiung (WMO 46744) radar (photograph courtesy of the Central Weather Bureau, Taipei, Taiwan).

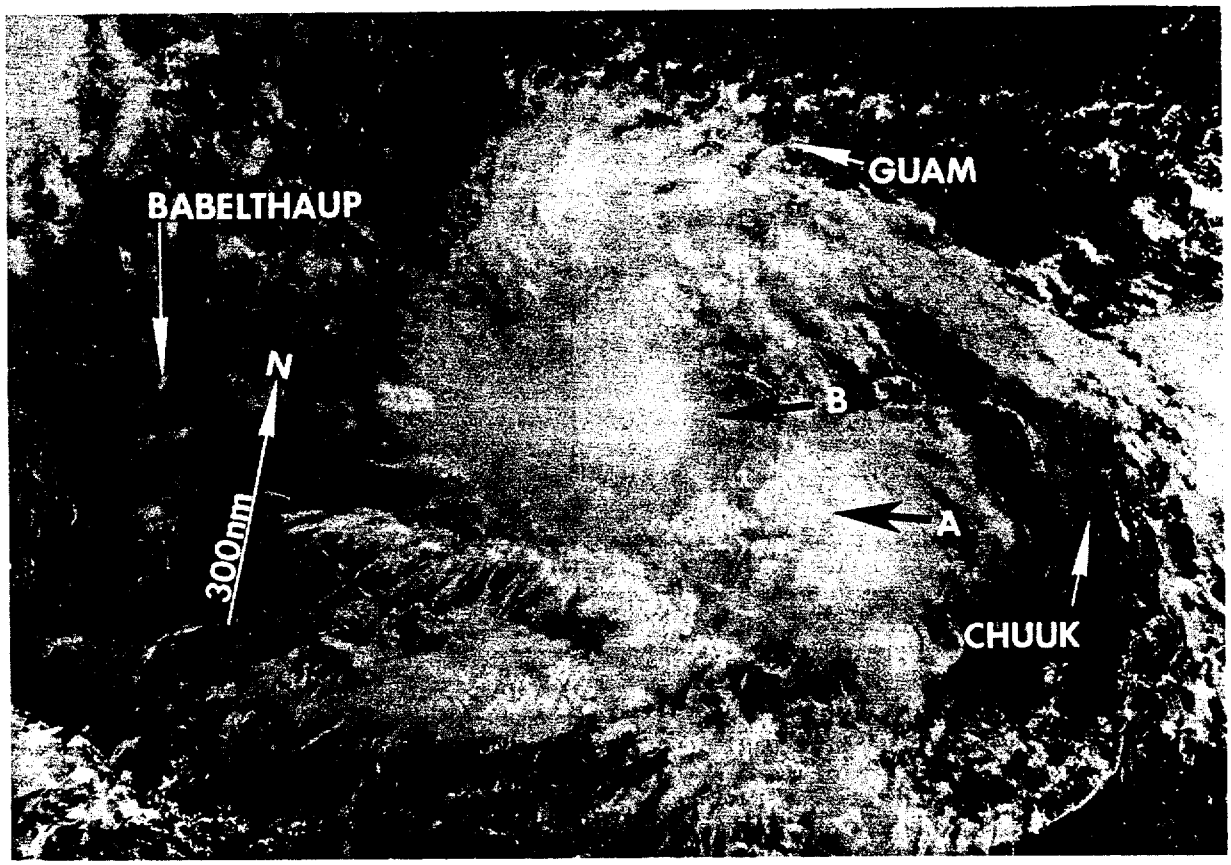

Figure 3-07-7. The vorticity associated with the convective mass (at point A) may have joined with the vorticity associated with the low-level circulation center (at point B), to interact as a binary pair. Babelthaup in the Palau Islands can be seen to the west of Percy's cloudiness (212343Z June DMSP visual imagery).

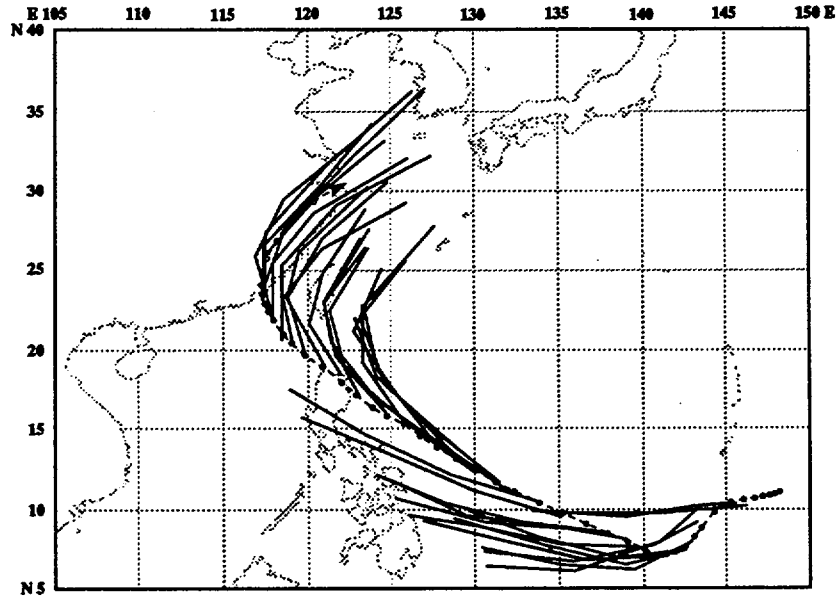

Figure 3-07-8. OTCM guidance and the JTWC forecasts compared to the final best track near the start of the unusual southwesterly motion.

did not weaken and Percy tracked further west before recurving. All the JTWC forecasts are plotted on the best track in Figure 3-07-9.

VI. IMPACT

Percy seriously affected several islands in the western Carolines. The first of these was Sorol, an atoll located 150 nm (280 km) southeast of Yap. As the tropical storm passed 40 nm (75 km) to the south of Sorol, the second largest island in the lagoon, Pegelmol, was almost cut in half and another island lost one third of its area due to wave action. Taro patches, coconut trees and other vital crops were essentially wiped out and will take take years to replace. After reaching typhoon intensity, Percy passed 55 nm (100 km) south-southwest of Yap, which received sustained winds of 35-45 kt (18-23 m/sec) with gusts to 55 kt (28 m/sec). In addition, Yap suffered extensive flooding along its eastern shore. Most roads were blocked by water and later by debris and flooding from the unusually high tide. Nugulu, 60 nm (110 km) to the south-southwest of Yap, took the brunt of the typhoon. Maximum gusts estimated at 70 kt (35 m/sec) totally destroyed all crops. Seven homes were completely demolished; others lost their roofs. Fortunately there were no fatalities. Palau was not as lucky; one child's death was attributed to the typhoon as Percy passed 125 nm (230 km) to the north-northeast of Koror. Power, radio and TV were knocked out as winds ripped off tin roofs and snapped power poles. Broken limbs took out power lines. Once past the Caroline islands, Percy became the second storm in less then a week to devastate northern Luzon. The resulting landslides and floods left at least 8 people dead and 31,206 homeless, adding to the misery left behind by Ofelia (06W).

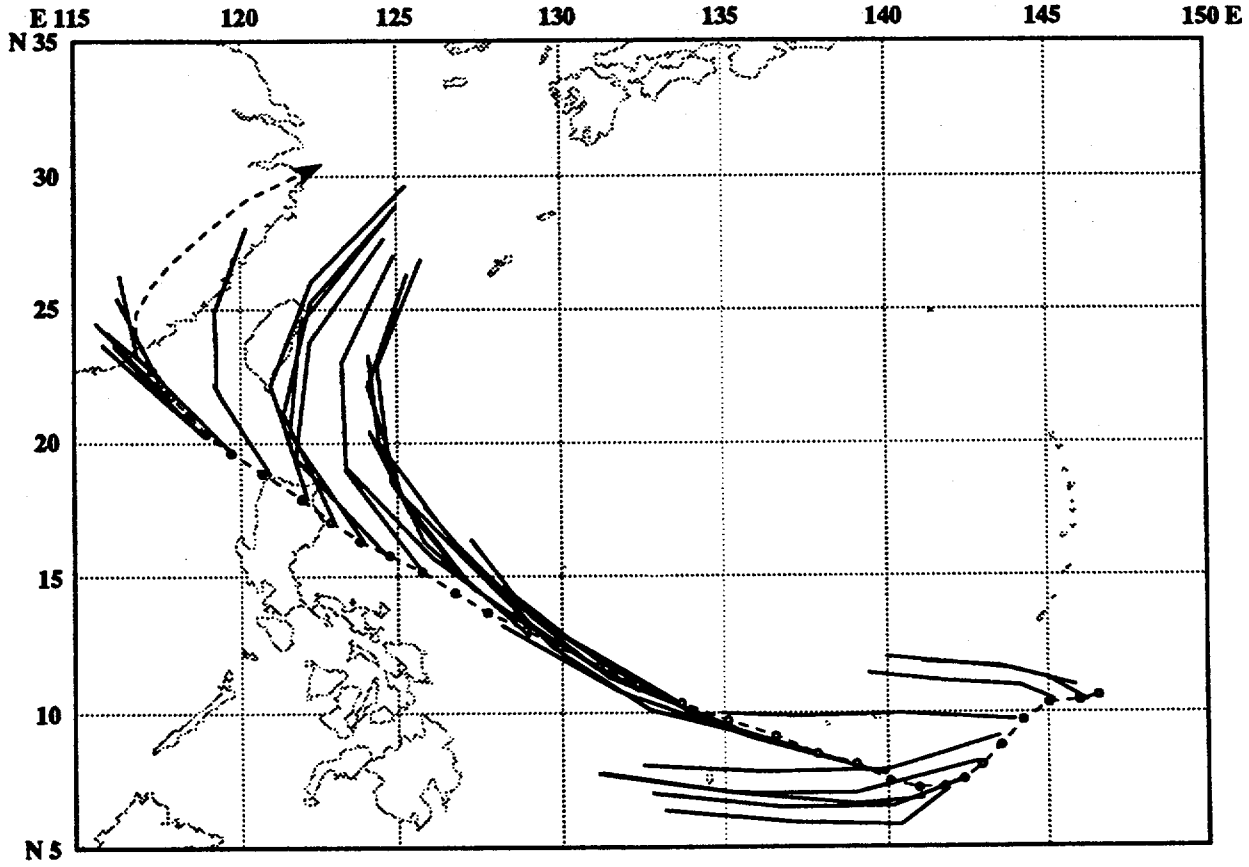

Figure 3-07-9. A plot of all the JTWC forecasts (solid lines) with the best track (dashed lines).