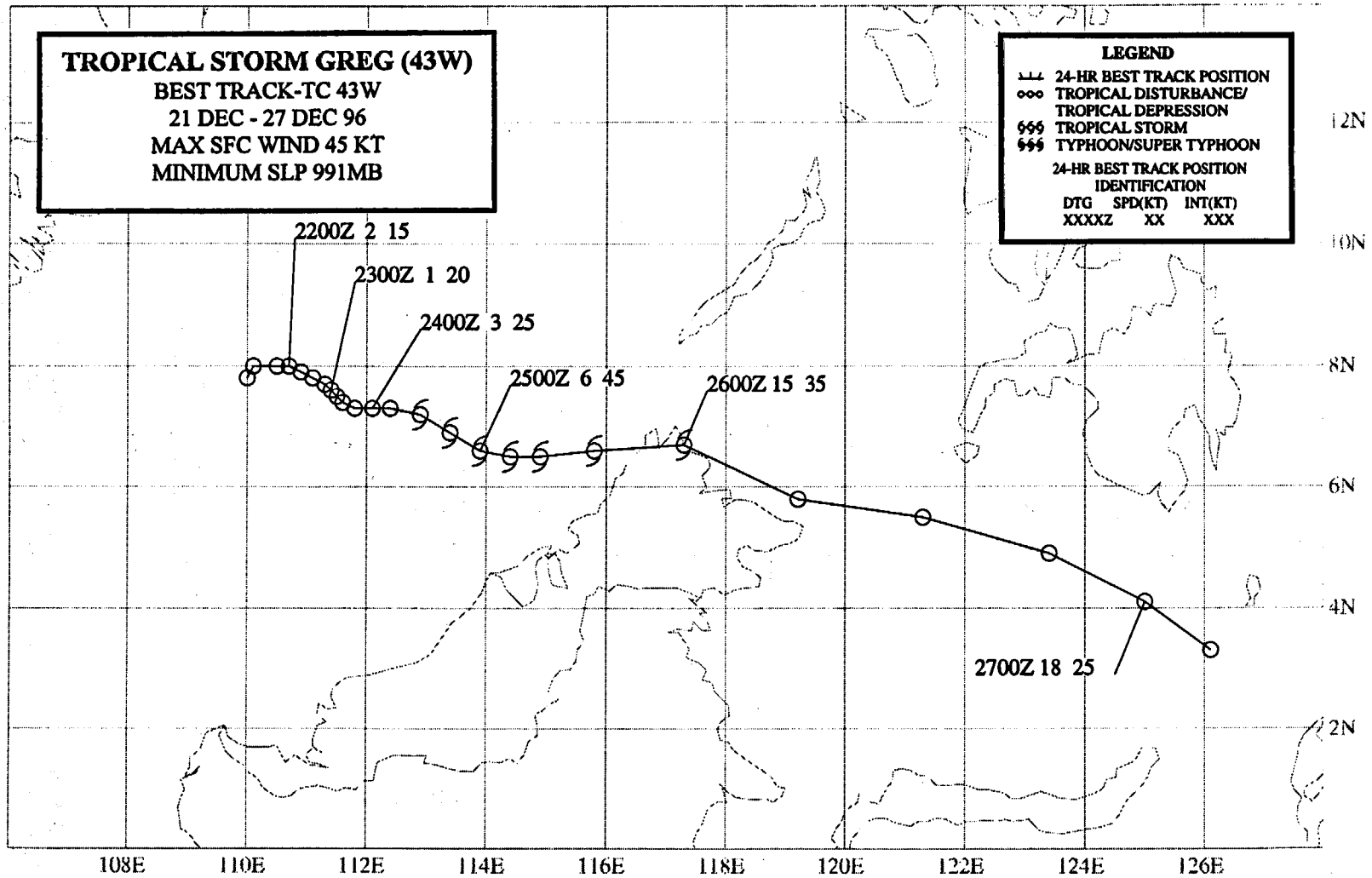
TROPICAL STORM GREG (43W)
BEST TRACK-TC 43W
21 DEC - 27 DEC 96
MAX SFC WIND 45 KT
MINIMUM SLP 991MB
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/ TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XXX
2200Z 2 15
2300Z 1 20
2400Z 3 25
2500Z 6 45
2600Z 15 35
2700Z 18 25
12N
10N
8N
6N
4N
2N
108E
110E
112E
114E
116E
118E
120E
122E
124E
126E

TROPICAL STORM GREG (43W)

I. HIGHLIGHTS

The last significant TC of 1996, Greg was one of the year's most unusual. It formed at low latitude in the South China Sea and moved toward the east-southeast. While passing over the northern tip of Borneo, Greg was responsible for the loss of many lives in the East Malaysian State of Sabah.

II. TRACK AND INTENSITY

During the second half of December, twin low-latitude monsoon troughs became established between approximately 100°E and 170°E. A band of strong low-level westerly winds persisted between the two trough axes. A total of five TCs — two in the Northern Hemisphere (Fern (42W) and Greg) and three in the Southern Hemisphere (Ophelia (11S), Phil (12P), and Fergus (13P)) — formed within these monsoon troughs (Figure 3-43-1).

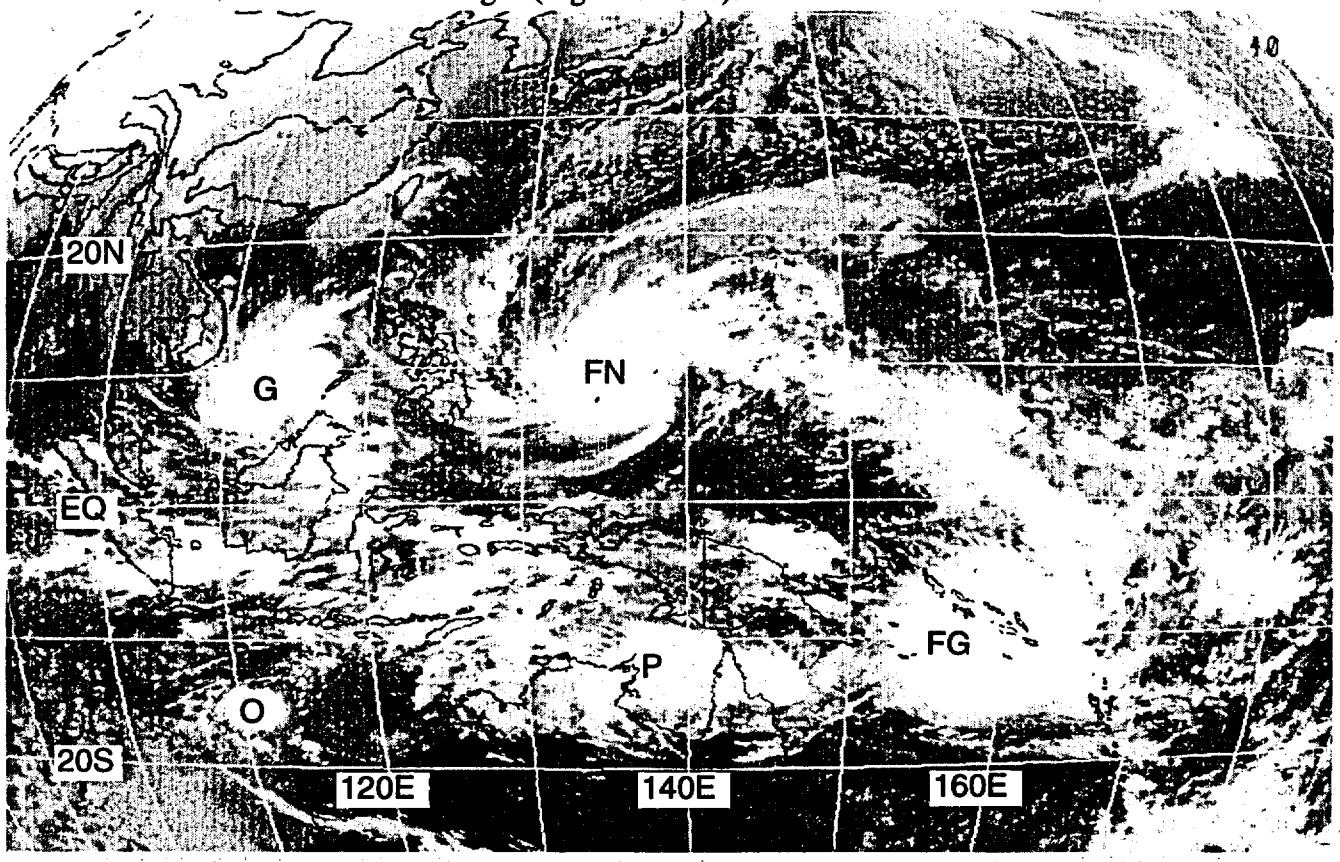

Figure 3-43-1 Five TCs — Greg (G), Fern (FN), Ophelia (O), Phil (P), and Fergus (FG) — lie within twin monsoon troughs (242330Z December infrared GMS imagery).

The tropical disturbance which became Greg was first mentioned on the 210600Z Significant Tropical Weather Advisory when an area of persistent deep convection was observed in the low latitudes of the South China Sea. On 23 December, this area of deep convection began to show signs of becoming better organized. Remarks on the 232100Z Significant Tropical Weather Advisory included:

"[An] area of convection . . . remains near 7N 112E. Animated infrared satellite imagery indicates that the convective organization associated with this system has improved over the past 12 hours in response to an equatorial westerly wind burst. Gradient-level [westerly and southwesterly] winds reported [by stations in East Malaysia are near 30 kt (15 m/sec).] . . ."

JTWC issued a TCFA at 240400Z as visible and microwave satellite imagery indicated that convective organization was improving, and water-vapor imagery supported upper-level divergence over the system. The first warning on Tropical Depression (TD) 43W soon followed, valid at 240600Z. TD 43W was upgraded to Tropical Storm Greg on the warning valid at 250000Z. In postanalysis, however, reanalysis of satellite data determined that Greg most probably became a tropical storm at 241200Z. Continuing to move on a very unusual east-southeastward track, Greg reached a peak intensity of 45 kt (23 m/sec) at 250000Z (Figure 3-43-2) and maintained this intensity until making landfall on the northern tip of Borneo. The final warning was issued, valid at 270600Z, when most of the deep convection associated with the system collapsed as Greg dissipated south of the Philippines.

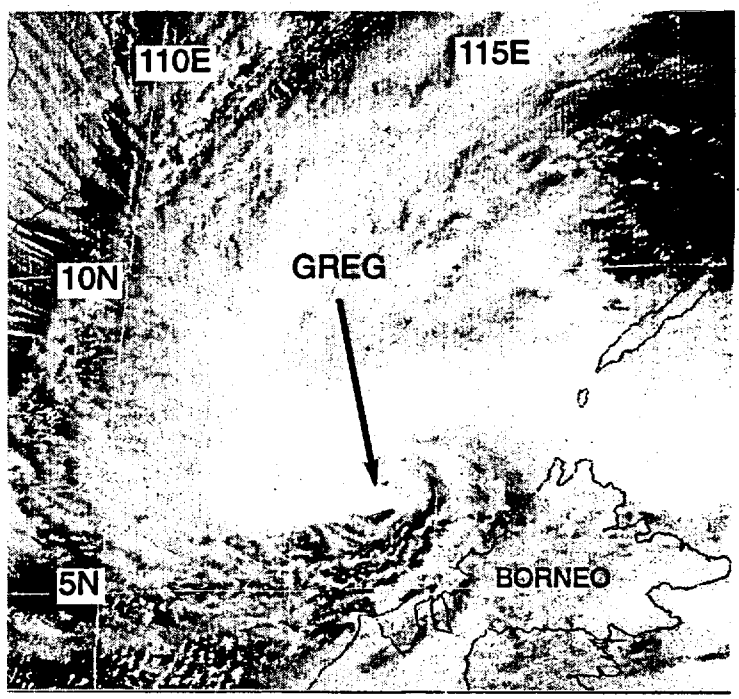

Figure 3-43-2 Greg at peak intensity of 45 kt (23 m/sec) bears down on the northwest coast of Borneo (250231Z December visible GMS imagery).

III. DISCUSSION

a. *On the importance of microwave imagery*

During the night of 24 December, as Greg (then TD 43W) was moving east-southeastward toward the northern tip of Borneo, a DMSP satellite passed over the system at 241452Z. Microwave imagery from this pass (Figure 3-43-3) indicated that a well-organized curved band of deep convection accompanied the LLCC. DMSP passes outside of the range of the Guam ground station are received several hours time-late at the JTWC via the MISTIC system. This imagery was used in postanalysis to upgrade Greg to a tropical storm earlier than indicated on the warnings. Though received late, the microwave imagery was nevertheless used to help support the real-time upgrade of Greg to a tropical storm at 250000Z.

b. *Greg's unusual east-southeastward motion*

Greg's east-southeastward motion from near 8°N 110°E to near 3°N 126°E was very unusual. TCs which form within (or move into) the South China Sea late in the year are often blocked from moving west by well-established northeasterly monsoon flow. Such TCs often remain quasi-stationary or move southwestward and dissipate. Greg formed in the SCS when an unusual large-scale wind pattern dominated the region: a belt of low-level westerly winds existed in equatorial latitudes between twin monsoon troughs (i.e., one north, the other south of the equator). With the Northeast Monsoon blocking its motion to the west, it is hypothesized that the strong westerly winds to the south of Greg provided the flow asymmetry responsible for its eastward motion. This factor, plus the existence of the large circulation of Fern (42W) to Greg's northeast were cited on prognostic reasoning messages as possible sources of the east-southeastward movement of Greg.

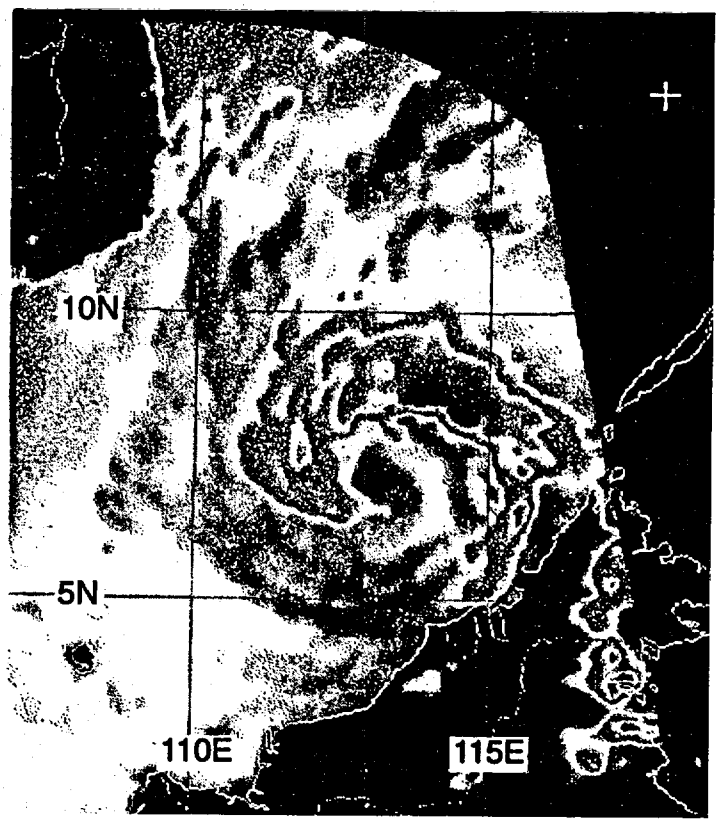

Figure 3-43-3 A well-defined spiral band of deep convection, wrapping almost one complete turn from tip to tail around Greg's LLCC, helped to support the postanalysis upgrade of the timing of tropical storm intensity (241452Z December horizontally polarized 85 GHz SSM/I DMSP imagery).

IV. IMPACT

Greg was responsible for loss of life and extensive damage to property in the East Malaysian State of Sabah (located on the northwest coast of Borneo). At least 124 lives were reported lost with another 100 reported missing primarily due to flooding from torrential rains. In Kota Kinabalu, the capital of the State of Sabah, high wind scattered billboards and other debris, and broke windows in the 30-story government building.