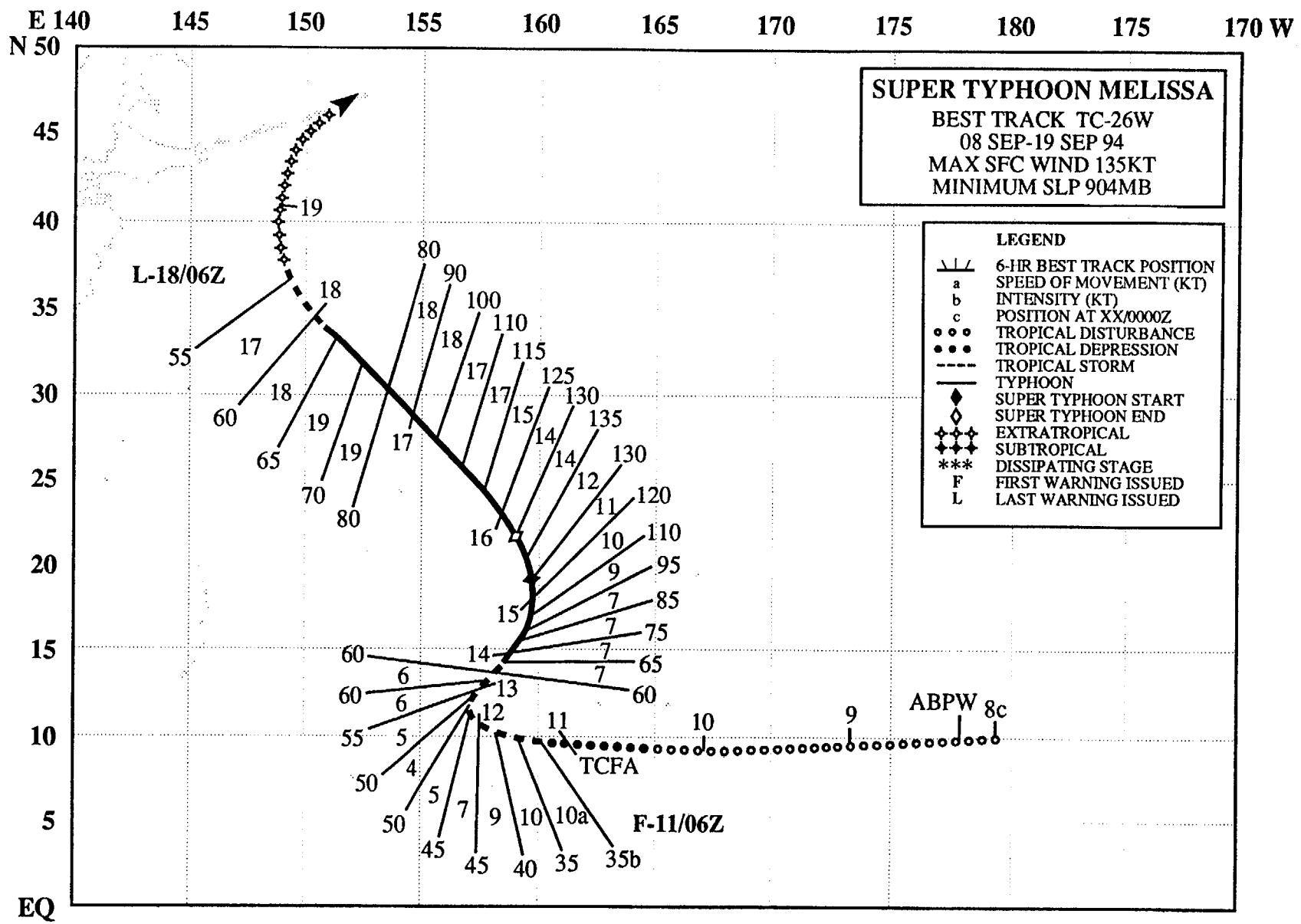
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EQ
SUPER TYPHOON MELISSA
BEST TRACK TC-26W
08 SEP-19 SEP 94
MAX SFC WIND 135KT
MINIMUM SLP 904MB
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
L-18/06Z
F-11/06Z
TCFA
ABPW 8c

142

SUPER TYPHOON MELISSA (26W)

I. HIGHLIGHTS

Melissa was one of the largest and most intense September typhoons to develop east of Guam in recent history. The system first appeared on 08 September near the international date line in an El Niño / Southern Oscillation (ENSO)-induced region of abnormally warm sea surface temperatures. Melissa turned abrubtly to the north as it became associated with a strong surge in the monsoonal southwesterly winds, and its subsequent track was north-oriented. It rapidly intensified, peaking at 135 kt (69 m/sec). On 15 September, a cross section of the cloud-top topography (which included the eye) was obtained by a Lidar (Light imaging and detection radar) as part of a Space Shuttle experiment. As a point of interest, meteorologists at Bracknell, England, indicated that Melissa was the "most severe tropical [cyclone]" ever developed by their operational global spectral model.

II. TRACK AND INTENSITY

Since 1991, warm sea surface temperatures associated with a prolonged ENSO event have persisted near the international date line, creating favorable conditions for eastward displacement of large-scale deep convection. On 08 September, the weakened remnants of Hurricane Kristy (11E), which developed in the eastern Pacific on 27 August, tracked westward at about 15 kt (28 km/hr) across the date line along the 10°N latitude line. This disturbance was first listed as a suspect area in the Western North Pacific on the Significant Tropical Weather Advisory at 080600Z September. On the night of 10 September, the remnants of Kristy (11E) disappeared in the eastern end of the monsoon cloud band which extended into the Marshall Islands. A low-level cyclonic circulation (most probably not the remnants of Kristy) with characteristics of a monsoon depression then grew dramatically, prompting forecasters at the JTWC to issue a Tropical Cyclone Formation Alert at 110000Z. Organization increased during the daylight hours of 11 September, and the first warning on Tropical Depression 26W was issued at 110600Z. Post analysis indicated that the winds at that time were most probably already at tropical storm intensity. Shortly afterward, cross-equatorial flow from the Southern Hemisphere began to strengthen between 150°E and 160°E. As Melissa crossed 160°E, it began to interact with a surge of deep southwesterly monsoon flow, and perhaps in response to this, it slowed and turned toward the north.

By 13 September, Melissa was moving to the northeast. It rapidly developed a deep central dense overcast (CDO) (Figure 3-26-1) and a small eye (Figure 3-26-3) as it was beginning to rapidly intensify (Holliday and Thompson, 1979). It attained typhoon intensity at 131800Z, and in 42 hours, Melissa had reached its peak intensity of 135 kt (69 m/sec). Pressures over the same period are estimated to have fallen 72 mb to a low of 904 mb. Near its peak intensity (Figure 3-26-2), astronauts in the Space Shuttle Discovery probed Melissa's eye with Lidar as part of the Lidar In-Space Technology Experiment (LITE) (Figures 3-26-4 and 3-26-5). Melissa's rapid intensification and Lidar imaging are discussed in greater detail in Section III.

As the large typhoon moved farther northward, it became less influenced by the monsoon flow to the south and more influenced by the strong ridge to the northeast. Melissa began to move to the northwest around the western periphery of the ridge, and accelerated from 10 kt (19 km/hr) on 14 September to 18 kt (33 km/hr) on 18 September (when it weakened to tropical storm intensity). Late on the morning of 19 September, Melissa passed through the axis of the sub-tropical ridge and recurved. By 20

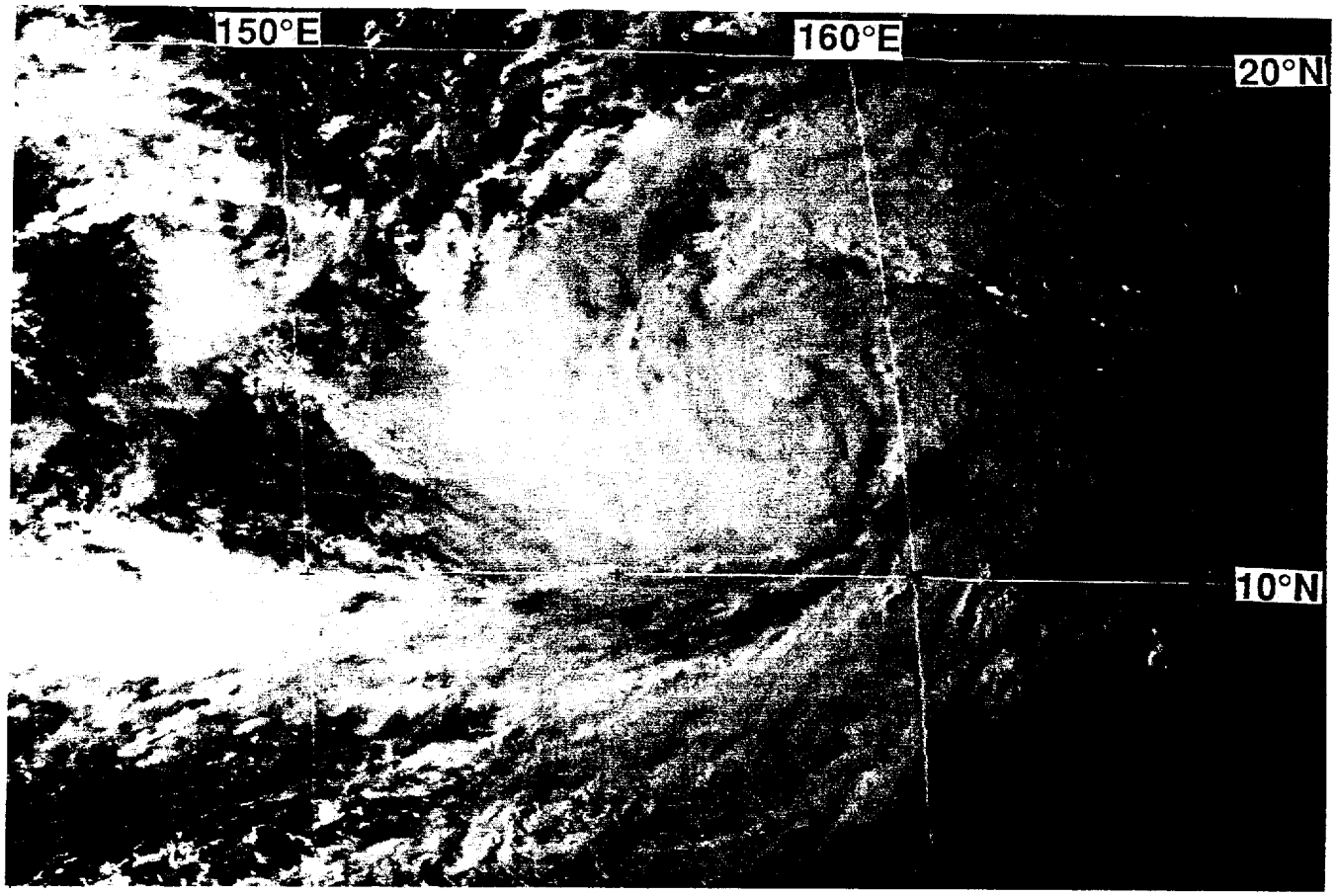

Figure 3-26-1 A very cold circular cirrus shield begins to grow near Melissa'a center (130631Z September visible GMS imagery).

September, Melissa had undergone a compound transformation (Brand and Guard, 1977) into a large extratropical low.

Both track and intensity forecast errors for Melissa were larger than normal. Climatological- and statistical-based aids did not anticipate the northward turn near 160°E. Although forecast fields and derived track aids from dynamic models indicated a northward turn, they lacked consistency in their forecasts. Track errors were 113 nm (209 km), 252 nm (467 km), and 421 nm (780 km) at 24-, 48-, and 72-hours respectively. The intensity errors were 15 kt (7.7 m/sec) at 24 hours, and 27 kt (14 m/sec) at 48 and 72 hours.

III. DISCUSSION

a. Rapid intensification of Melissa

From 140600Z until 150600Z, Typhoon Melissa underwent a period of rapid intensification during which its intensity increased from 85 kt (44 m/sec) to 130 kt (67 m/sec) while pressures fell an estimated 49 mb. The rapid intensification process is defined by Holliday and Thompson (1979) as an episode of intensification where pressure falls are > 1.75 mb/hr or > 42 mb/day. Table 3-26-1 shows the best-track winds, the estimated 6-hourly change in pressures, and the 6-hourly and 24-hourly rates of change of these parameters during the rapid intensification of Melissa. Unlike the increase of the eye diameters of Doug (17W) and Fred (19W) as they rapidly intensified, Melissa's eye diameter decreased during its rapid intensification.

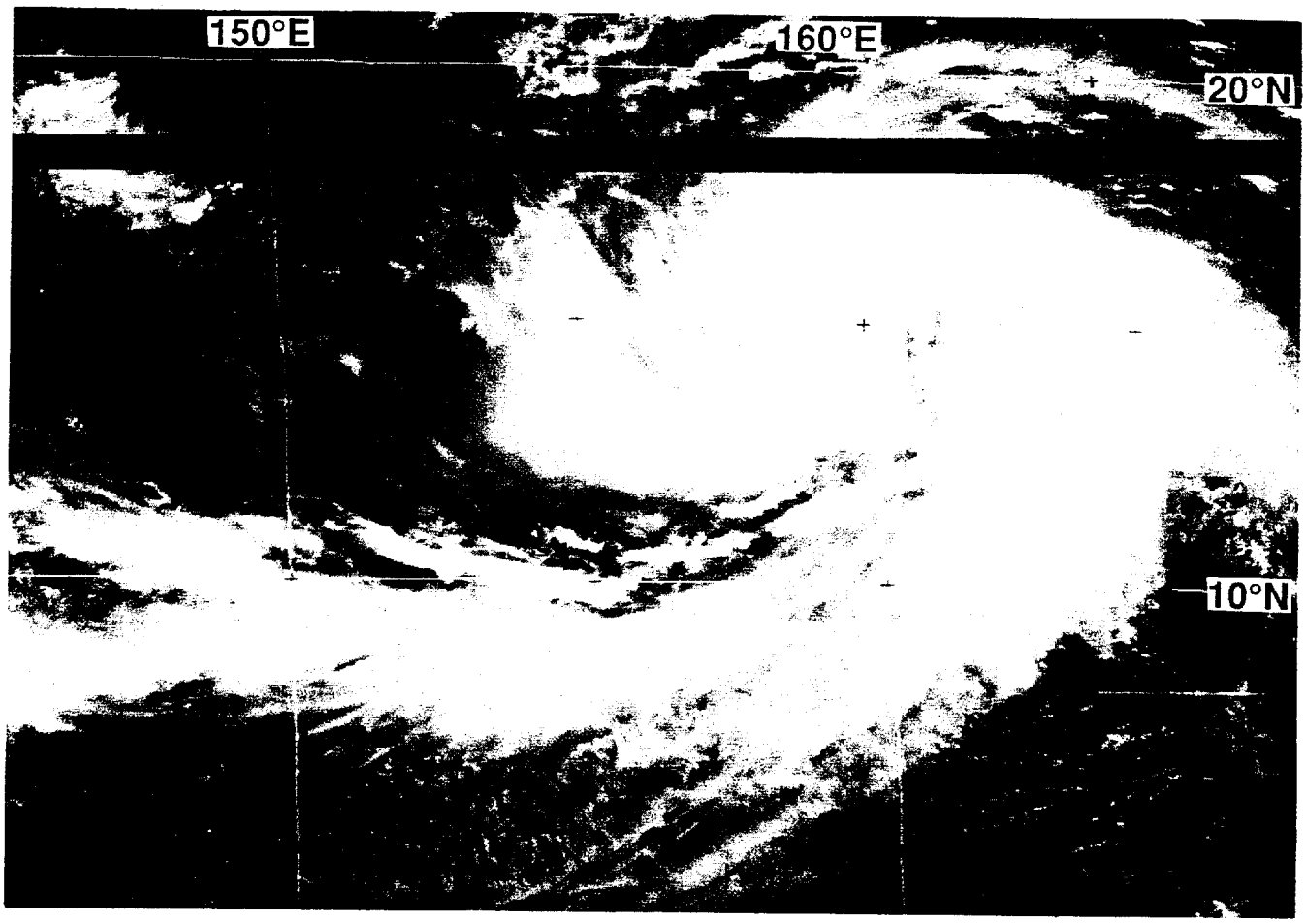

Figure 3-26-2 A small eye has formed (132331Z September visible GMS imagery).

b. Melissa imaged by Lidar

As Melissa was near maximum intensity, LITE on the Space Shuttle Discovery observed the typhoon with Lidar (Figures 3-26-4 and 3-26-5). Melissa's intensity at the time was 130 kt (67 m/sec) (Figure 3-26-3). The Lidar image shows the eye of the super typhoon, surrounded by a deck of cirrus near 15-17 km (8-9 nm) altitude. The inner edge of the wall cloud is visible, sloping inward from the top where the eye diameter is 45 km (25 nm) to the bottom where the eye diameter is 30 km (16 nm). Some scatterers (most probably thin cirrus) also appear over the eye itself. The data and its interpretation was provided by Mr. Charles Trepte, Aerosol Research Branch, NASA Langley Research Center.

IV. IMPACT

As large and intense as Super Typhoon Melissa was, it spent its life over open ocean, missing the many Mariana Islands and the Japanese island of Minami-Tori-Shima. The typhoon's large circulation covered nearly 1 million square miles of the Pacific.

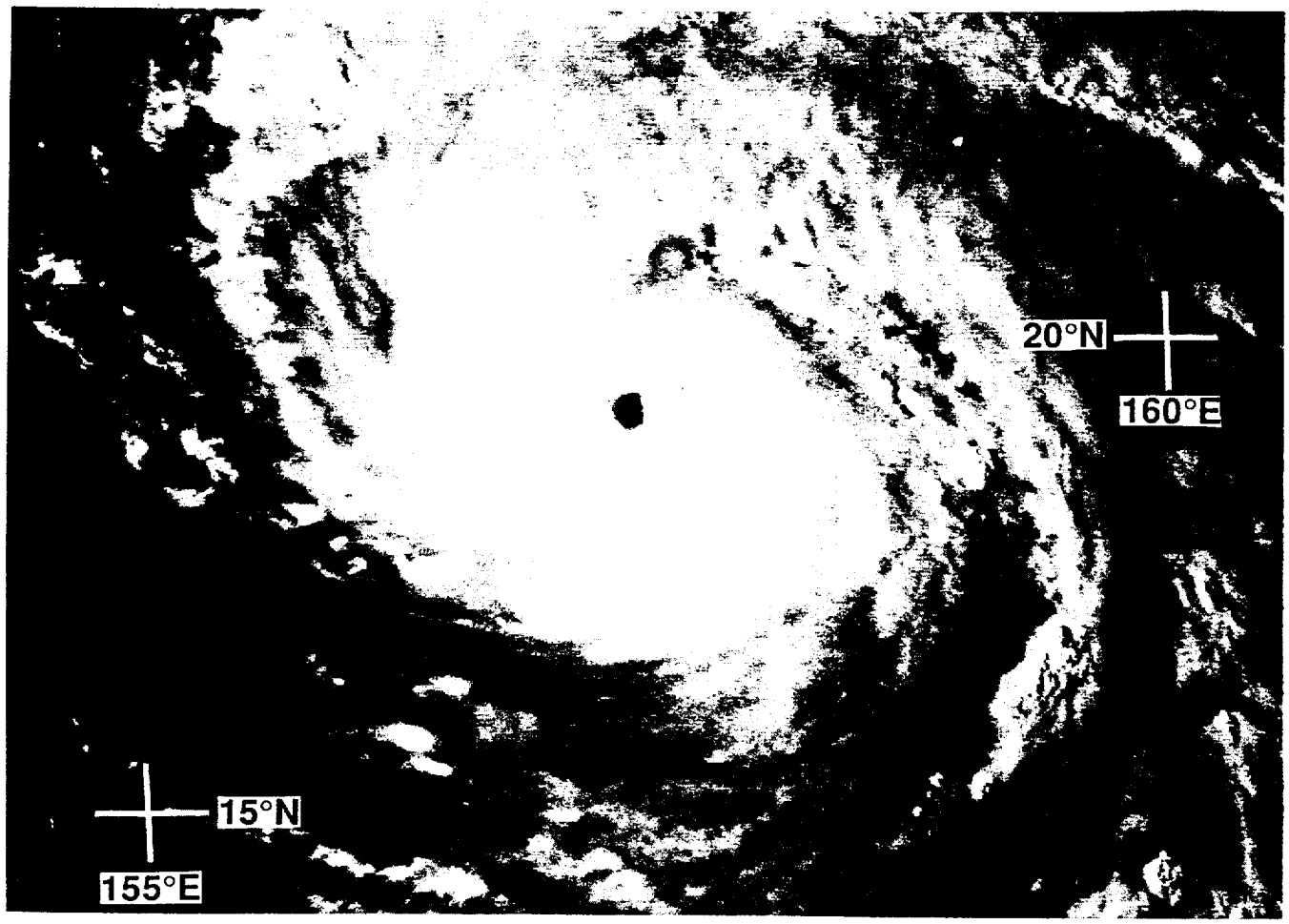

Figure 3-26-3 Melissa near peak intensity (150537Z September visible GMS imagery). Melissa was probed by a Lidar aboard the Space Shuttle Discovery at this time.

Date/Time (Z)	Wind Range (kt)	Pressure Rng (mb)	RateDP (mb)	
			1-hr	24-hr
13/12-13/18	60-65	980-976	-0.67	
13/18-14/00	65-75	976-968	-0.75	
14/00-14/06	75-85	968-959	-1.50	
14/06-14/12	85-95	959-949	-1.67	-31
14/12-14/18	95-110	949-933	-2.67	-43
14/18-15/00	110-120	933-922	-1.83	-46
15/00-15/06	120-130	922-910	-2.00	-49
15/06-15/12	130-135	910-904	-1.00	-45
15/12-15/18	135-130	904-910	1.00	23

Table 3-26-1 Pressure changes and rates of change for each six-hour warning period during the intensification of Super Typhoon Melissa, beginning at 131200Z and ending at 151800Z.

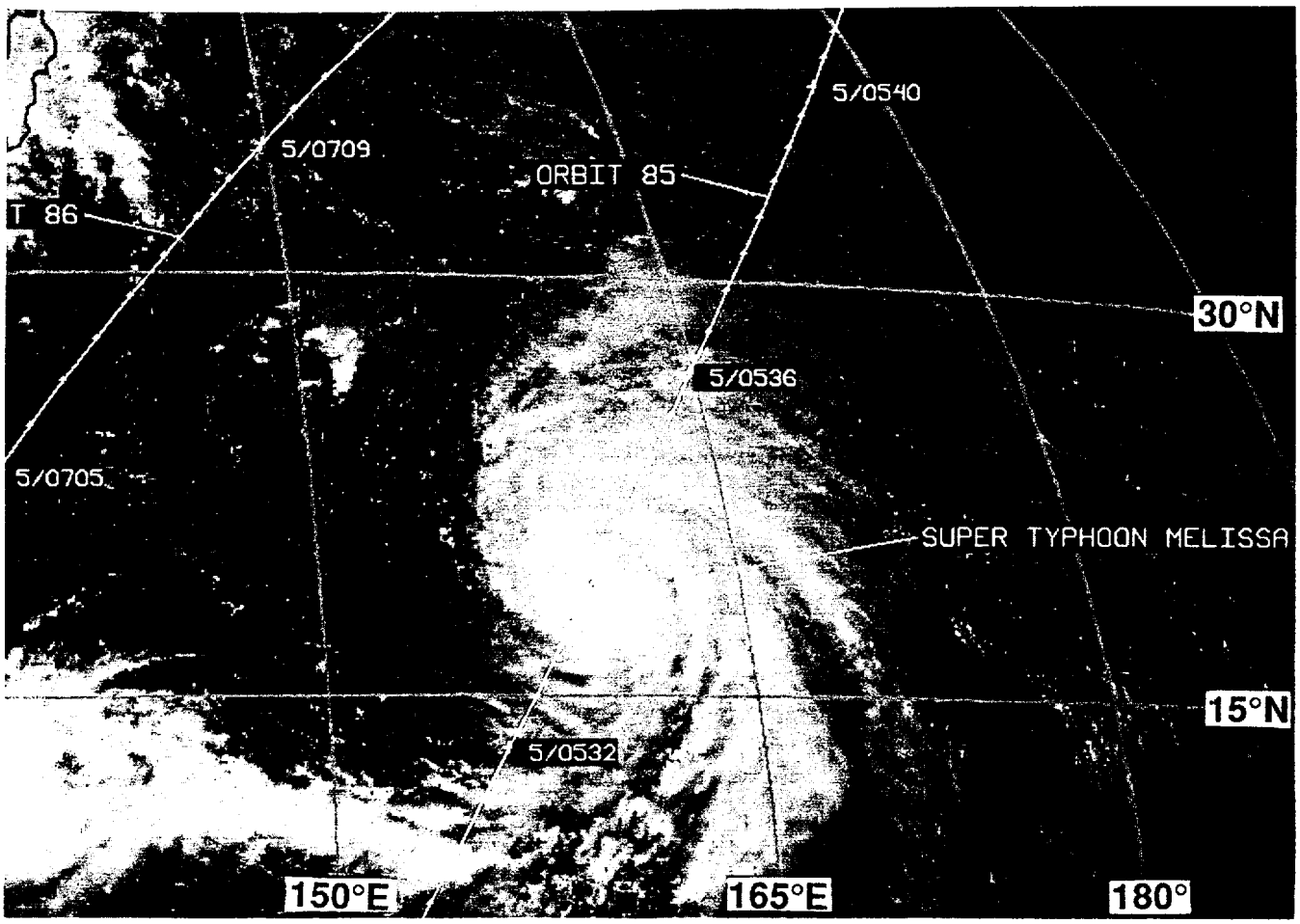

Figure 3-26-4 During orbit number 85, the Space Shuttle Discovery passes directly over Melissa.

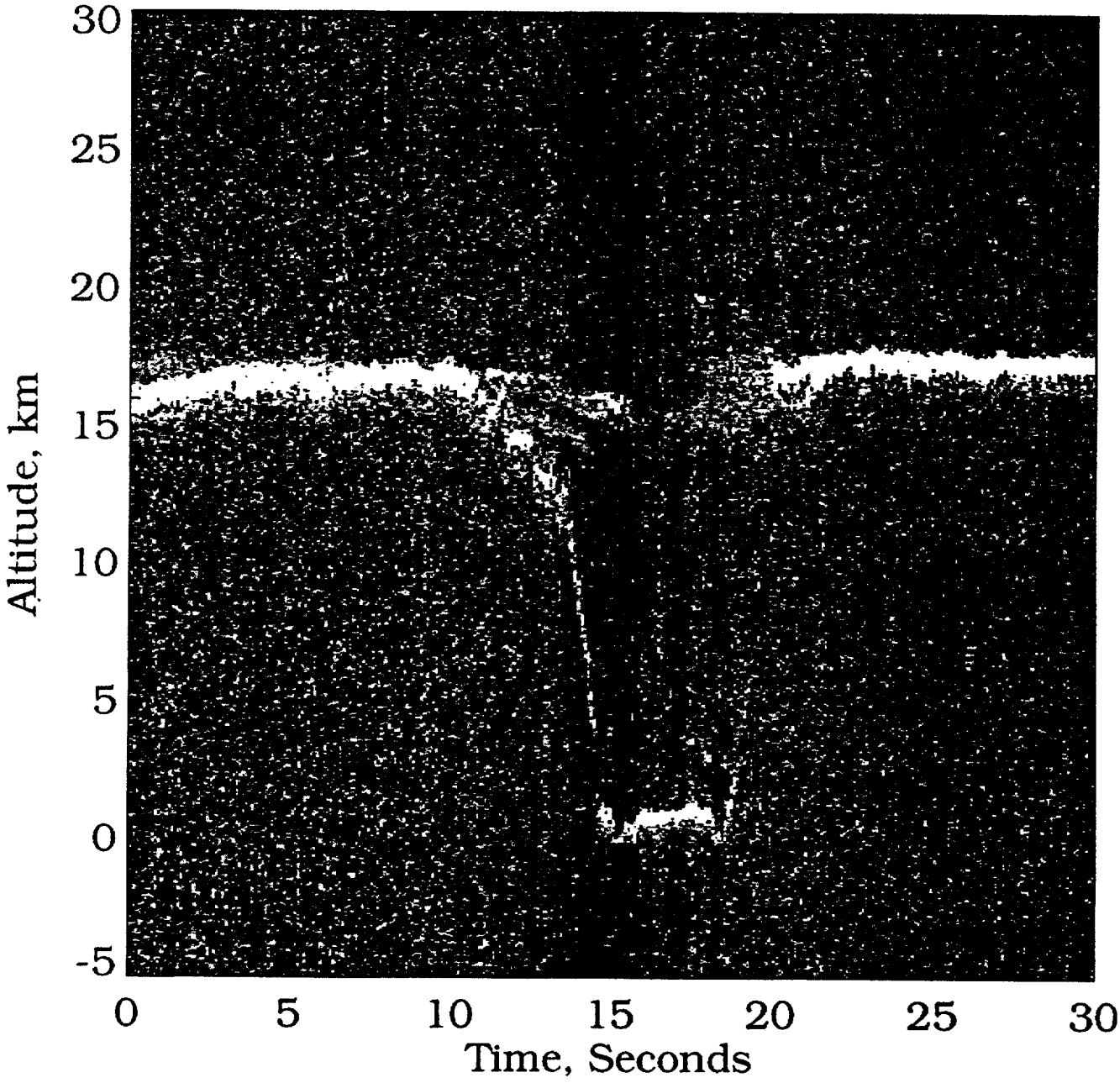

Figure 3-26-5 An altitude-time plot of the 532 nanometer LITE data raw signal distribution showing a cross-section of Melissa's eye at 150357Z September.