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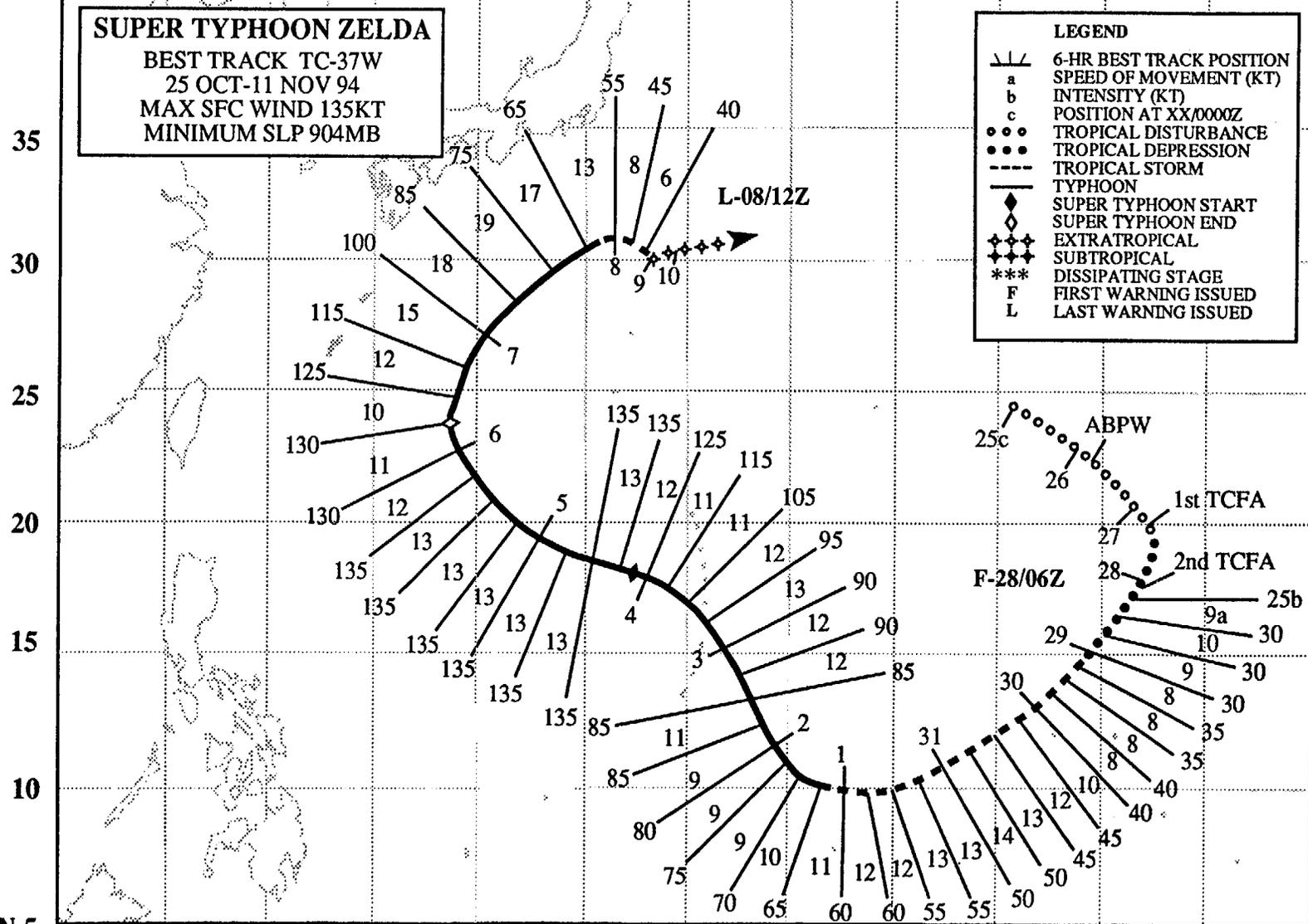
N 40

SUPER TYPHOON ZELDA
 BEST TRACK TC-37W
 25 OCT-11 NOV 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

209



N 5

SUPER TYPHOON ZELDA (37W)

I. HIGHLIGHTS

Zelda was the sixth, and final, super typhoon of 1994. During the first half of Zelda's life, it exhibited unusual motion: it moved from a subtropical latitude (25°N) southward into the deep tropics (10°N). Zelda passed to the north of Guam, and within range of Guam's NEXRAD.

II. TRACK AND INTENSITY

The tropical disturbance that became Zelda developed at the eastern reaches of a reverse-oriented monsoon trough that was defined by a line drawn SW-NE through the centers of Teresa's (34W) remnants, Typhoon Verne (34W), and Typhoon Wilda (35W) (Figure 3-37-1a). The first mention of this disturbance on the 260600Z October Significant Tropical Weather Advisory stated, in part:

“... the low level circulation that is part of the reverse oriented monsoon trough ... has had persistent convection for over 12 hours. ... the potential for significant tropical cyclone development is fair. ...”

Based on satellite imagery that showed tightly wound low-level cloud lines to the northwest of an area of deep convection, and on synoptic reports that verified the presence of a low-level cyclonic circulation, a Tropical Cyclone Formation Alert (TCFA) was issued at 270500Z. Over the next 18 hours, the system did not show any signs of intensifying. Based on satellite imagery (e.g., see Figure 3-37-2) and on synoptic reports from Wake Island (WMO 91245), a second TCFA was issued at 280230Z. Quoting from this second TCFA:

“The tropical disturbance [pre-Zelda] is now located south-southeast of Wake Island. Wake reported sea-level pressures as low as 1006.1 mb as the system [which was moving southward] passed to the east. Satellite imagery shows an exposed low level circulation center with weak convection sheared 50 nm to the south-southwest. Minimum sea level pressure is estimated at 1004 mb.”

At 280600Z, the first warning on Tropical Depression 37W was issued as the satellite signature of the system improved. At this time, it was thought that Tropical Depression 37W was unlikely to become a tropical storm. Its history of slow development and evidence on satellite imagery of north-easterly shear on the system led JTWC forecasters to expect little further intensification. However, at 290600Z, Tropical Depression 37W was upgraded to tropical storm intensity based upon an improved satellite signature. Thereafter, Zelda continued to intensify at a slow pace, and, at 011200Z November, it was upgraded to typhoon intensity.

From the disturbance stage to the attainment of typhoon intensity, Zelda dropped equatorward from 25°N to 10°N along a very unusual “backwards C” -shaped track. This unusual motion is discussed in the next section. After becoming a typhoon (at 010600Z November), Zelda turned toward the north-northwest and continued to slowly intensify. At 030000Z November, Zelda turned toward a more westward heading, and six hours later, at 030600Z, its eye passed over the island of Anatahan (Figure 3-37-3). After passing over Anatahan with an intensity of 95 kt (50 m/sec), Zelda's rate of intensification increased. During the 120-hour period 290000Z October to 030000Z November, the intensity increased at a fairly steady rate of 10 kt per day. Then, over the 24-hour period 030600Z to 040600Z November, there was a 40 kt increase of intensity from 95 kt (49 m/sec) to 135 kt (69 m/sec). For 36 hours (040600Z to 051800Z), Zelda's intensity held steady at its peak value of 135 kt (69 m/sec) (Figure 3-37-4). Zelda reached the point of recurvature at 060600Z November, 48 hours after reaching peak intensity. (Reaching peak intensity prior to recurvature is typical for most very intense tropical cyclones that

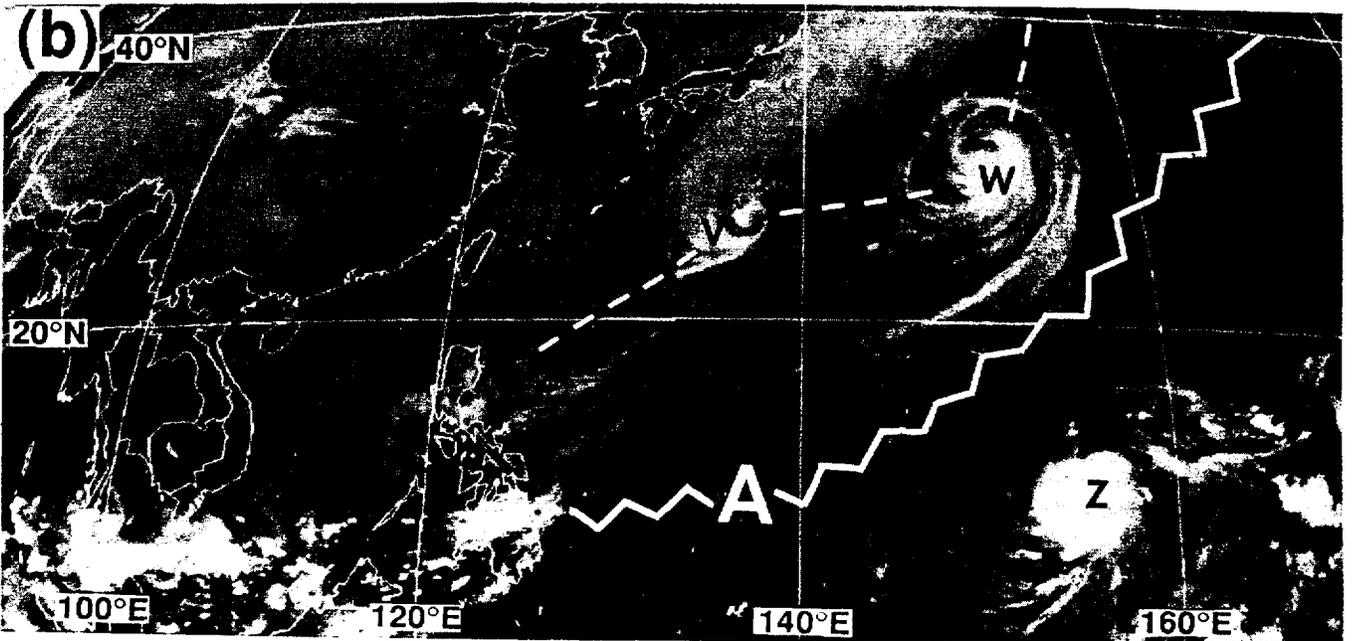
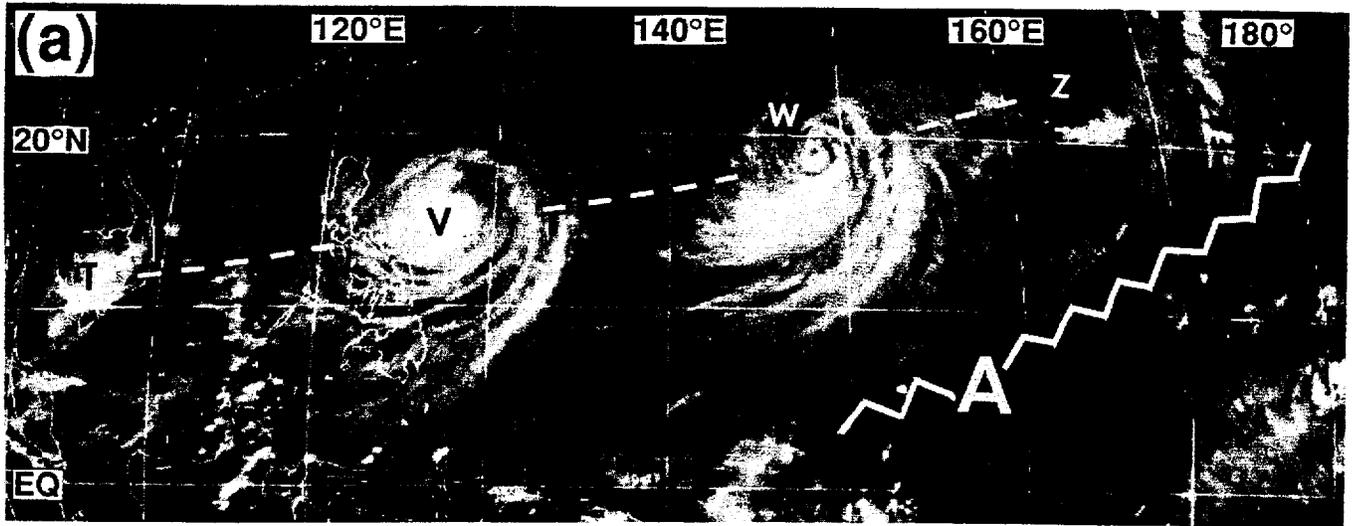


Figure 3-37-1 (a) The disturbance that would become Zelda (labeled, Z) lies at the eastern reaches of a reverse-oriented monsoon trough (dashed white line) that stretches from the remnants of Typhoon Teresa (34W) (T) — located over southeast Asia — northeastward through Verne (33W) (V) and Wilda (35W) (W). Zig-zag line indicates induced ridging southeast of the monsoon trough (260633Z October infrared GMS imagery). (b) Typhoons Verne (33W) (labeled, V) and Wilda (35W) (W) have gained latitude while Zelda (Z) has dropped southward (302332 October GMS IR imagery).

recurve — see the discussion of peak intensity versus timing of recurvature in the Typhoon Page (03W) summary.) After passing through the point of recurvature, Zelda began to weaken rapidly. In the 48-hour period 060600Z to 080600Z there was an 85 kt decrease in intensity from 130 kt (69 m/sec) to 45 kt (23 m/sec). The final warning was issued at 081200Z as Zelda acquired extratropical characteristics. The extratropical remnant of Zelda drifted eastward and dissipated over water near 30°N 145°E, almost back to where Zelda had begun.

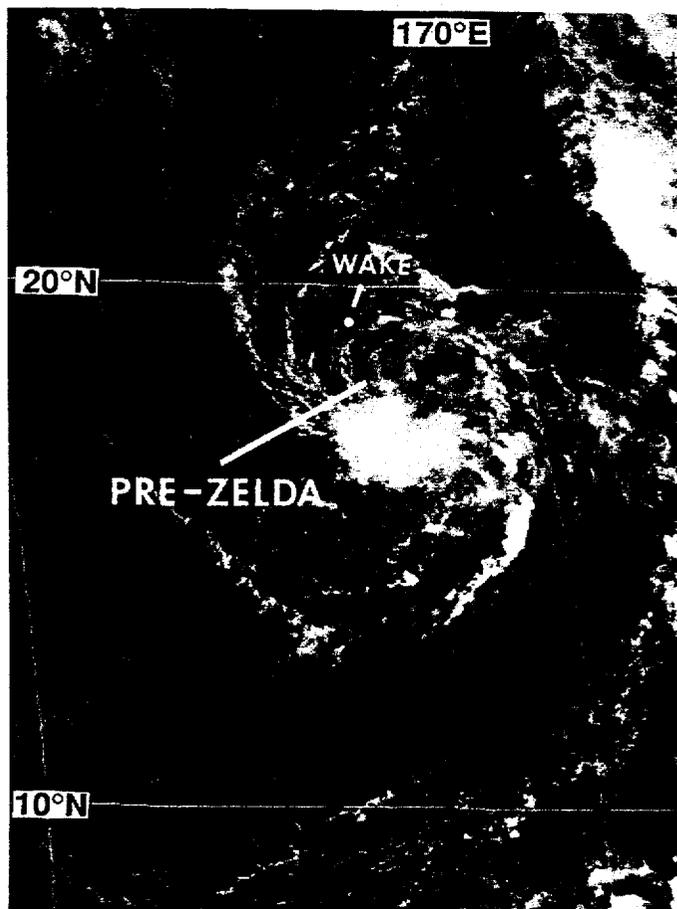


Figure 3-37-2 The exposed low-level circulation center of the tropical disturbance that would become Zelda can be seen to the north of a small area of deep convection, and is about 90 nm (165 km) south-southeast of Wake island (272331Z October visible GMS imagery).

turn to the northwest and pass near or over Guam. As the northwestward turn ensued after 010000Z, the motion became even more northward than forecast. By the 020000Z forecast, a new scenario was anticipated: numerical guidance and the official forecast now indicated that Zelda would move northwestward for 24 hours and then turn toward the west-northwest and pass near or over Saipan. However, from 021334Z to 021734Z the radar fixes indicated a north-northwestward movement. Incorporating this information, the warning at 021800Z indicated that Zelda would pass about 50 nm northeast of Saipan and then over Anatahan (a small island about 70 nm north of Saipan). At a critical time period — shortly after 021800Z — when JTWC forecasters were closely watching for evidence of Zelda's anticipated west-northwestward turn, the NEXRAD fixes (at 021832Z, 021936Z, and 022035Z) jogged to the west (see Figure 3-37-6). If interpreted as indicative of the onset of a major track change, these fixes could have been extrapolated to indicate that Zelda would pass very near or over Saipan. However, the next five radar fixes beginning at 022133Z showed northwestward motion that when extrapolated, indicated once again that Zelda would pass to the north of Saipan. Zelda passed 30 nm (55 km) to the northeast of Saipan and then directly over Anatahan.

The six-hour time step of the best track (Figure 3-37-6) and its subjective smoothing can not accommodate the short-term track changes indicated by the radar.

III. DISCUSSION

a. Unusual motion

The full trace of Zelda's motion — from its early stages as a tropical disturbance near 25°N 160°E, to its dissipation near 30°N 145°E — forms one of the oddest shaped tracks of 1994. Particularly unusual was the early portion of Zelda's track wherein the system moved southward on a "backwards C" - shaped track. One hypothesis for this unusual motion is that Zelda was carried southward in the flow around an anticyclone which had formed to the southeast of typhoons Wilda (35W) and Verne (33W) (Figure 3-37-1a,b and Figure 3-37-5).

b. NEXRAD's view of Zelda

Beginning at 020740Z November and continuing through 031432Z, forecasters at Andersen Air Force Base, Guam, were able to provide to the JTWC hourly fixes on the center of Zelda's large eye (Figures 3-37-6 and 3-37-7). The high frequency (approximately hourly) of accurate fixes obtained from the NEXRAD for Zelda were very useful overall, but illustrated that the short-term track changes that are resolvable with the NEXRAD must be interpreted with caution. For several forecasts prior to 020000Z, numerical guidance and the official forecast indicated that Zelda, which was then moving westward, would

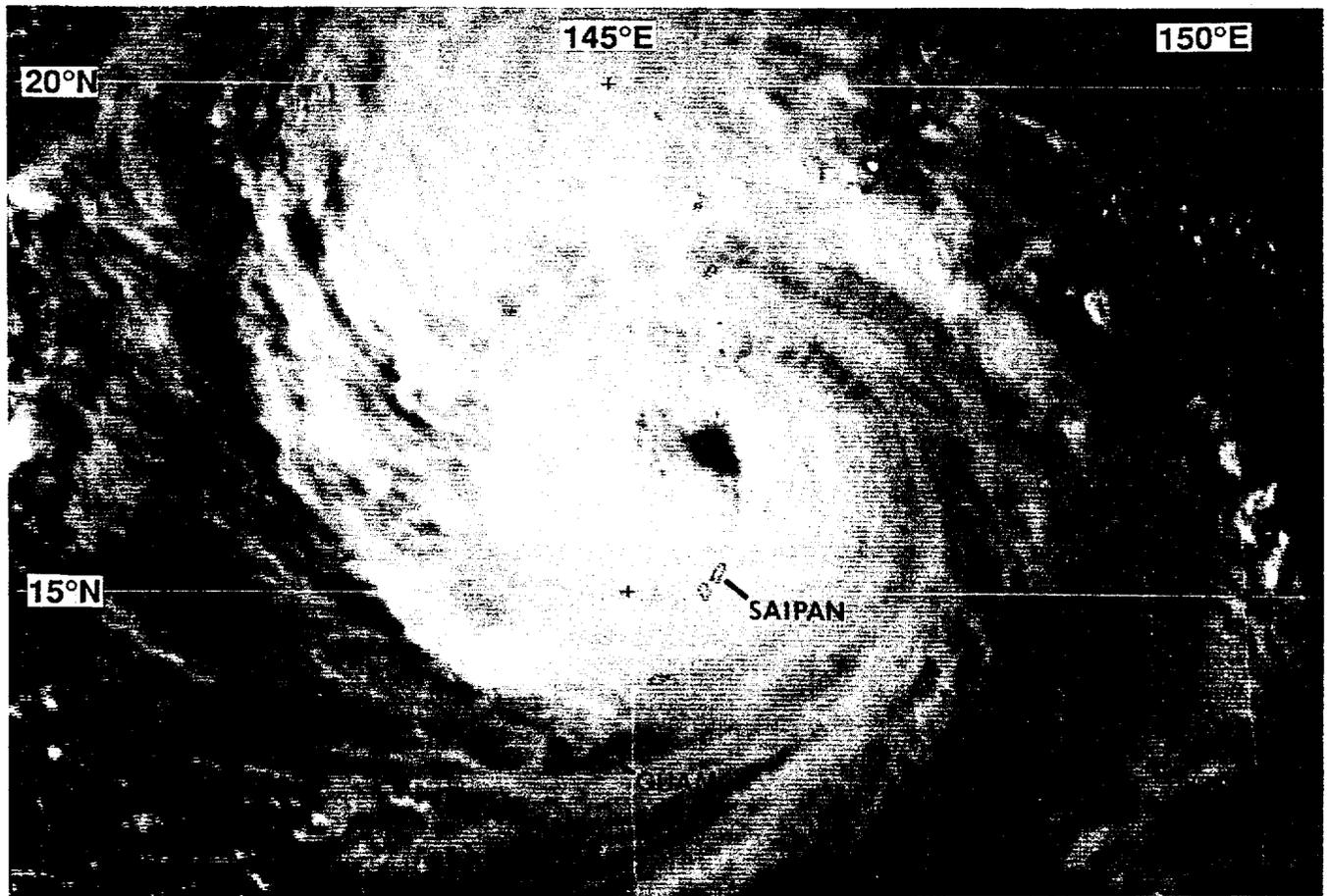


Figure 3-37-3 The island of Anatahan lies within Zelda's eye at the time of this satellite image (030631Z November visible GMS imagery).

IV. IMPACT

Of all the tropical cyclones that affected the Mariana island chain during 1994, Zelda had the most impact. High wind damaged homes in Saipan and Tinian. Hardest hit was the island of Anatahan — the northernmost inhabited island of the Commonwealth of the Northern Mariana Islands. The large eye of Zelda passed over Anatahan where the homes and crops of the 39 residents were devastated. All 39 residents were evacuated by the U.S. Navy and transferred to Saipan. Fortunately, no reports of serious injuries or deaths were received.

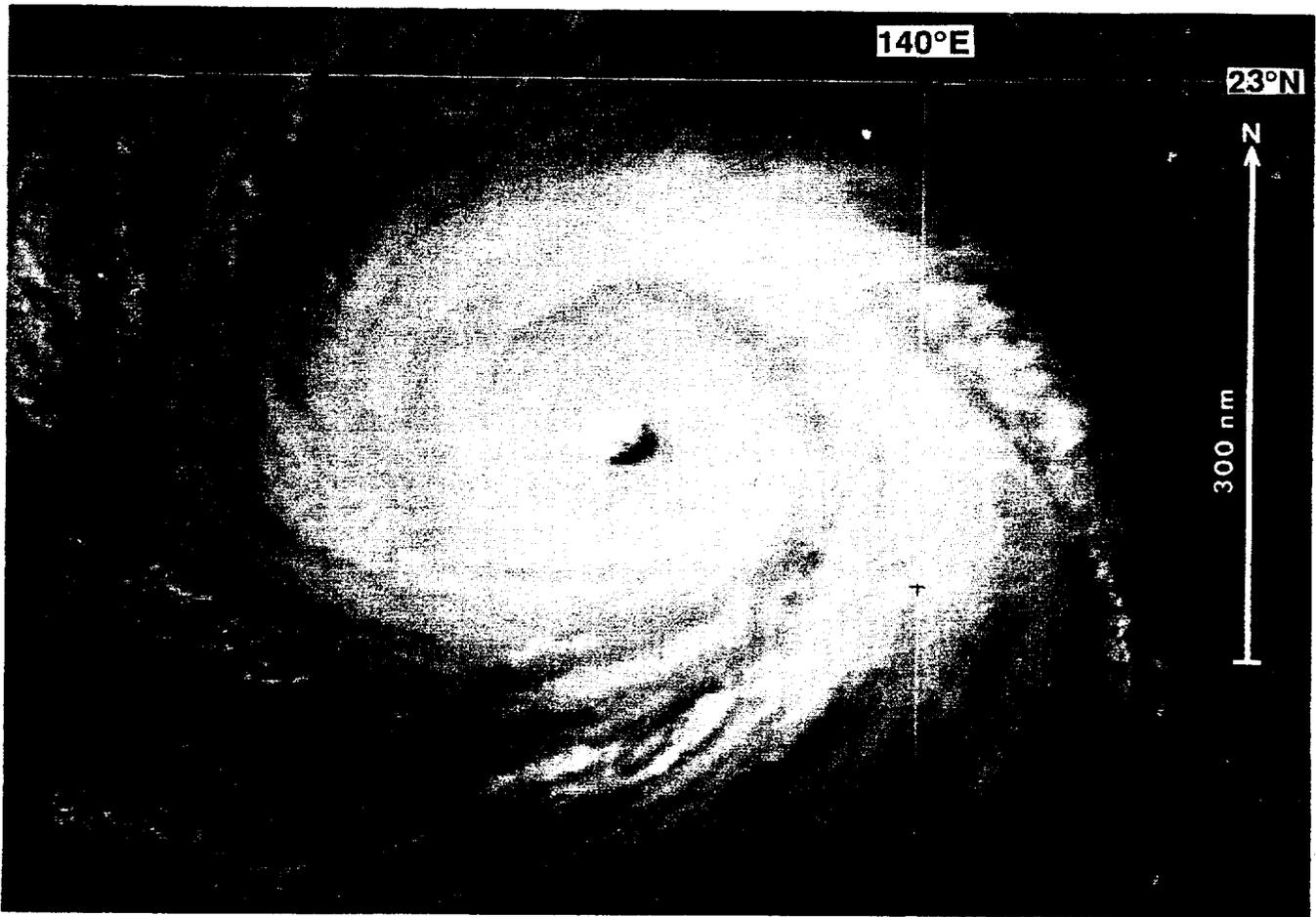


Figure 3-37-4 Super Typhoon Zelda at its peak intensity of 135 kt (69 m/sec) (042331Z November visible GMS imagery).



Figure 3-37-5 Schematic illustration of environmental factors possibly contributing to Zelda's unusual southward motion. Typhoons Verne (33W) (labeled, V) and Wilda (35W) (W) lie along the axis of a reverse oriented monsoon trough, whose axis is moving northward along with these two typhoons. A ridge (zig-zag line) has been induced in the lower and middle troposphere to the southeast of the monsoon trough, and Zelda (Z) has been steered southward around the anticyclonic circulation (labeled, A) along this ridge. The tracks of the tropical cyclones are indicated. Open circle = tropical storm intensity, filled circle = typhoon intensity. Black shaded regions are silhouettes of the deep convection.

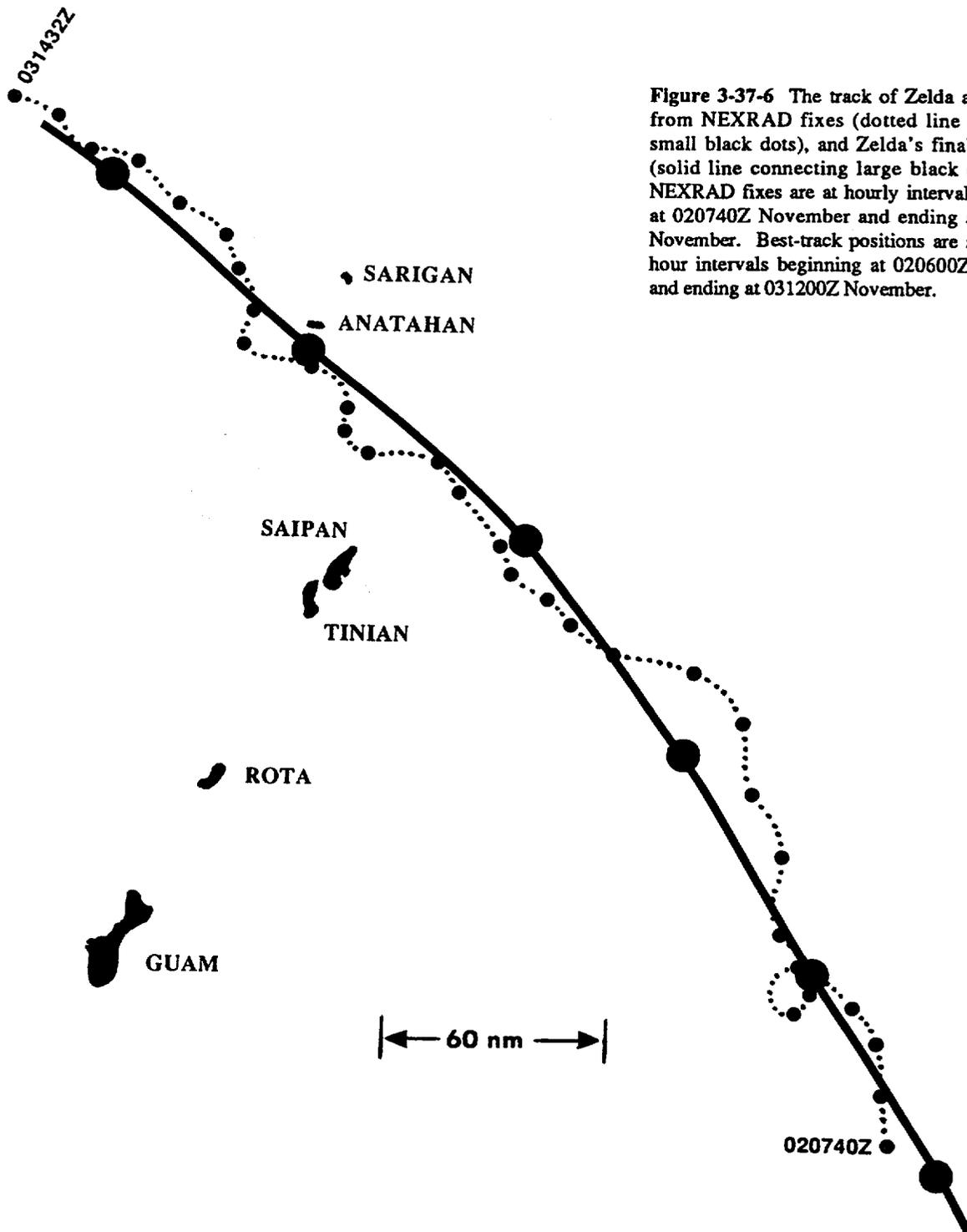


Figure 3-37-6 The track of Zelda as estimated from NEXRAD fixes (dotted line connecting small black dots), and Zelda's final best track (solid line connecting large black dots). The NEXRAD fixes are at hourly intervals beginning at 020740Z November and ending at 031432Z November. Best-track positions are shown at 6-hour intervals beginning at 020600Z November and ending at 031200Z November.

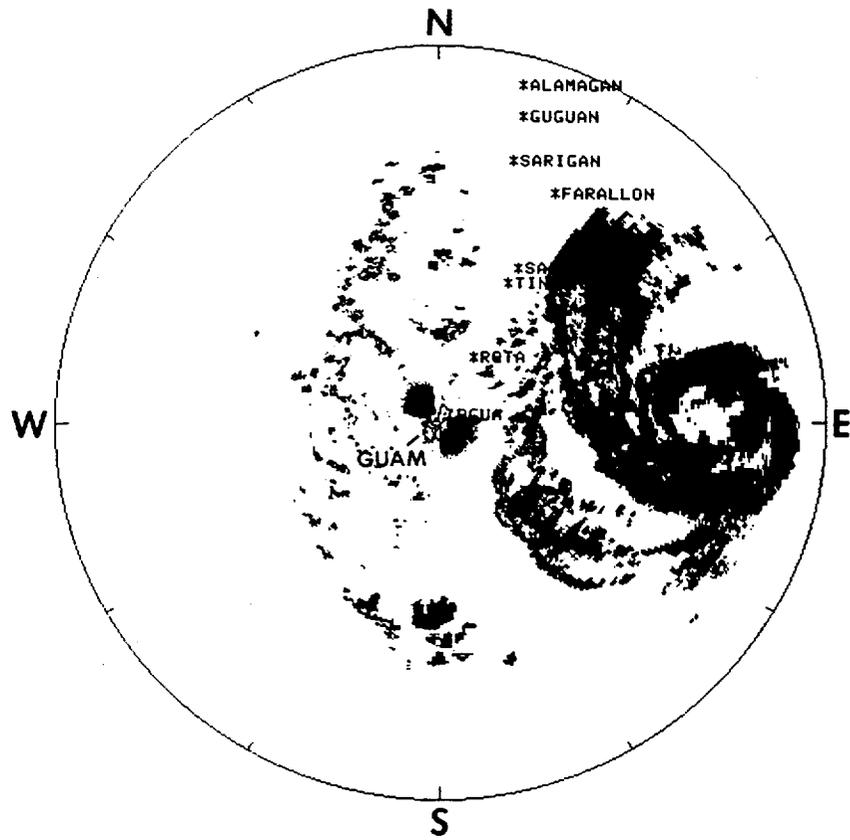


Figure 3-37-7 Zelda's relatively large eye is centered about 170 nm (315 km) to the east of Guam (021415Z November NEXRAD base reflectivity product).