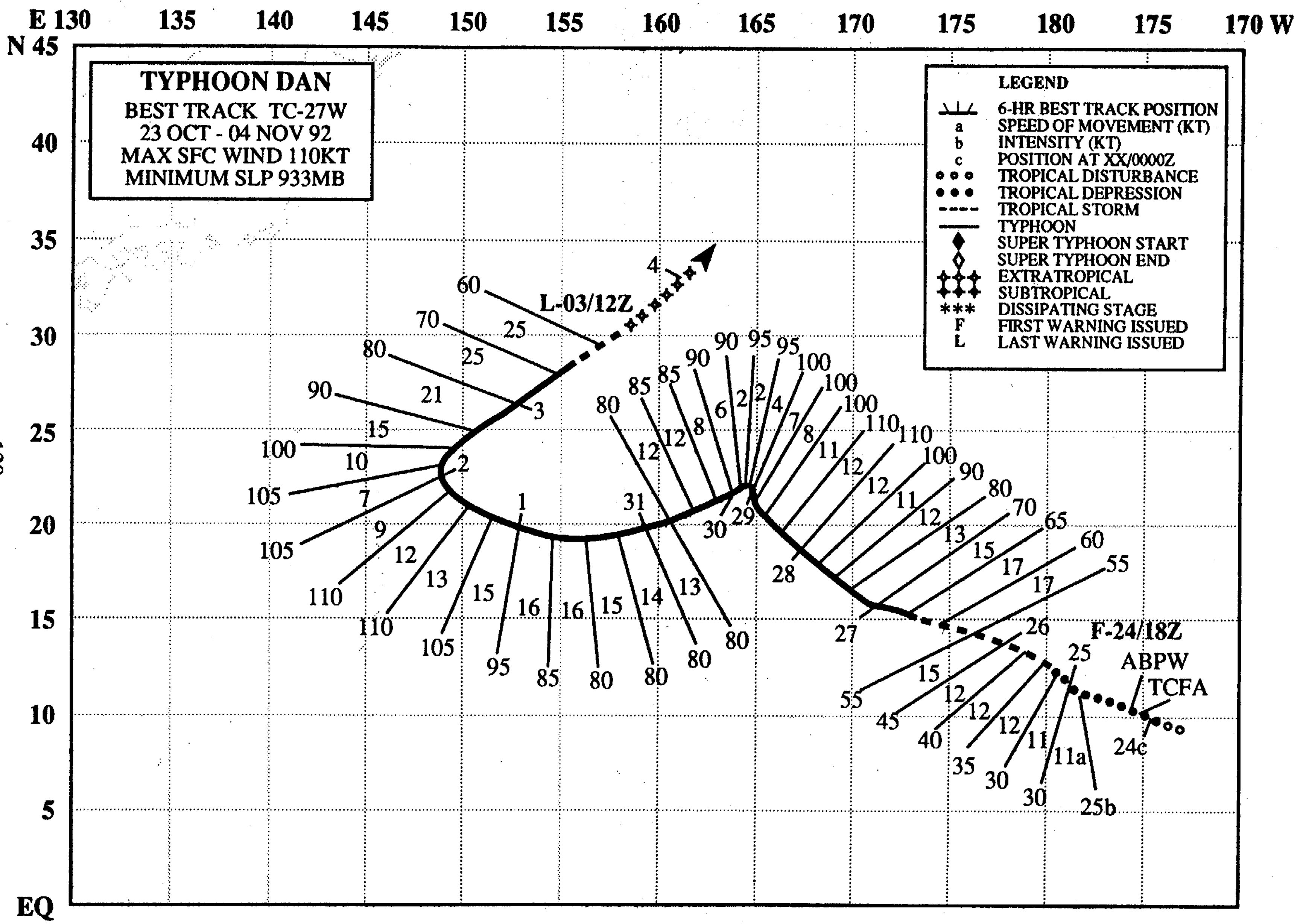

TYPHOON DAN
BEST TRACK TC-27W
23 OCT - 04 NOV 92
MAX SFC WIND 110KT
MINIMUM SLP 933MB
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
E 130
135
140
145
150
155
160
165
170
175
180
175
170 W
N 45
40
35
30
25
20
15
10
5
EQ
L-03/12Z
F-24/18Z
ABPW
TCFA

130

TYPHOON DAN (27W)

I. HIGHLIGHTS

The last significant tropical cyclone to develop in October as part of the four storm outbreak including Angela (24W), Brian (25W) and Colleen (26W), Dan became the most destructive typhoon to strike Wake Island in the past quarter-century, causing an estimated $9.0 million in damage. Just as Ekeka (01C) and Ward (21W) did earlier in 1992, Dan formed east of the international date line, marking the first time that three significant tropical cyclones crossed into the JTWC's area of responsibility from the central North Pacific during a single year. Later, Dan faked a move toward recurvature, took a west-southwesterly course, underwent an episode of reintensification, and finally, underwent a binary interaction with Typhoon Elsie (28W) before recurving sharply.

II. TRACK and INTENSITY

On 23 October, the Naval Western Oceanography Center (NWOC) initially detected the tropical disturbance that developed into Dan in the trade-wind trough 450 nm (830 km) south of Johnston Island in the central North Pacific. At 240000Z, a Tropical Cyclone Formation Alert was issued by NWOC based on an increase in convection around a well-defined low-level circulation. Because of the large field-of-view geostationary images available on the MIDDAS system, satellite analysts at Detachment 1, 633 OSS (collocated with JTWC) were able to continuously monitor the ongoing development of the tropical disturbance as it tracked toward the international date line. Based on these data, which showed that the tropical disturbance was intensifying and the close proximity of the system to JTWC's area of responsibility, JTWC forecasters, in coordination with the Central Pacific Hurricane Center, elected to issue the first warning on Tropical Depression 27W at 241800Z.

As the tropical depression moved west-northwestward, normal development brought it to tropical storm intensity shortly after crossing into the western North Pacific at 251200Z. The next day, JTWC upgraded Dan to a typhoon at 261800Z. Intensification continued, and Dan began to close in on Wake Island, where it would become the most intense tropical cyclone to affect Wake since Typhoon Sarah in September, 1967. On 28 October, at the typhoon's closest point of approach (CPA) to Wake — approximately 15 nm (28 km) to the southwest — Dan had estimated maximum sustained surface winds of 110 kt (57 m/sec). The National Weather Service Office at Wake Island recorded peak wind gusts of 90 kt (46 m/sec) in the eye wall before losing electrical power (Figure 3-27-1), and a minimum sea-level pressure of 980.8 mb (Figure 3-27-2). Later reports from Wake Island indicated that the strongest winds occurred after the CPA at 280315Z.

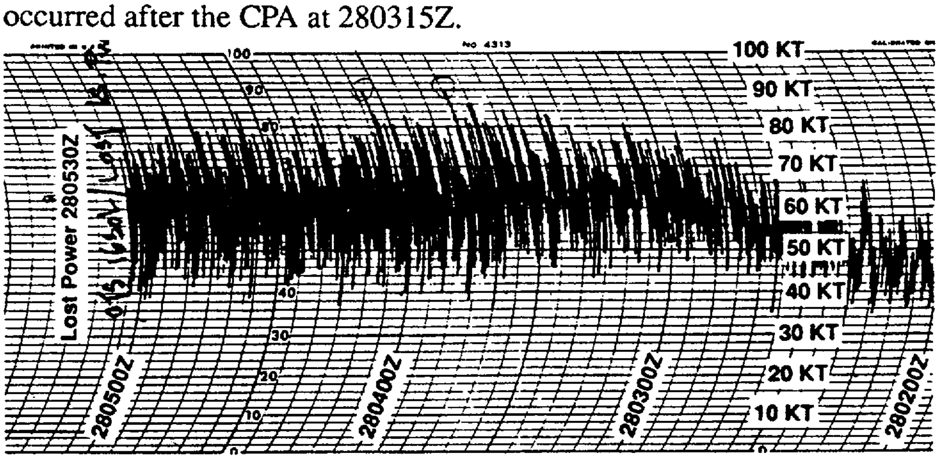

Figure 3-27-1. Wake Island's anemometer trace shows two peak wind gust to 90 kt (46 m/sec) before power was lost at 280403Z (Data courtesy of National Weather Service Office, Wake Island).

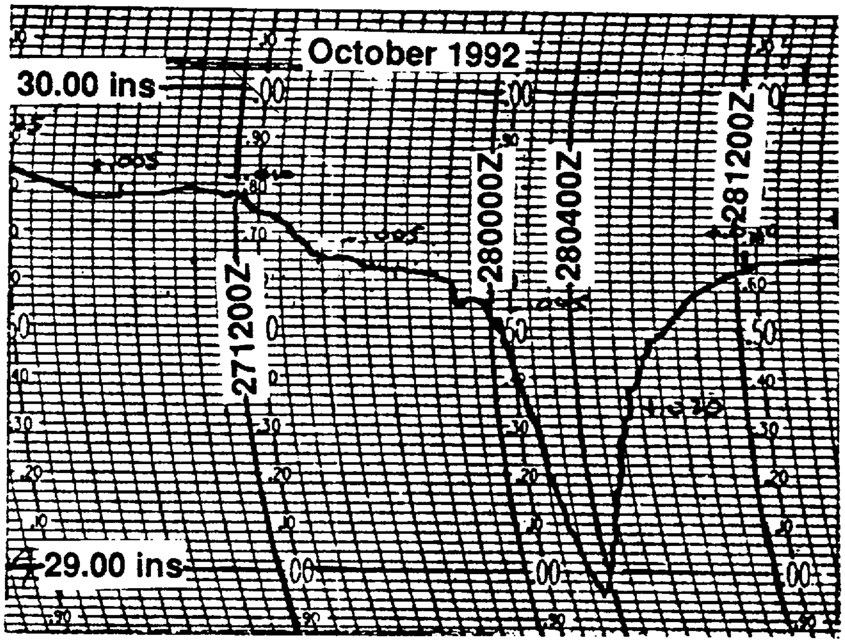

Figure 3-27-2. Microbarograph record for the period 27 through 28 October at Wake Island showing a minimum pressure of 28.95 inches (980.8 mb), at 280315Z, at Typhoon Dan's closest point of approach (Data courtesy of the National Weather Service Office, Wake Island).

On 29 October, one day after hammering Wake Island, the typhoon made a northward motion towards recurvature, stalled, and then made an abrupt track change to the west-southwest in response to the subtropical ridge strengthening after the passage of a mid-latitude trough to the north. At the same time, Dan weakened as upper-level westerlies increased aloft. As a consequence, the typhoon's eye disappeared from the satellite imagery and the typhoon's intensity dropped to 80 kt (41 m/sec). On 31 October, binary interaction commenced with Typhoon Elsie (28W), which was located to the southwest near the Mariana Islands (Figure 3-27-3). At one point, the two cyclones closed to within 630 nm (1170 km) of each other. The upper-level shear diminished during the binary interaction event, allowing Typhoon Dan to intensify again to a peak of 110 kt (57 m/sec) at 011200Z November. Twelve hours later, Dan recurved sharply and accelerated northeastward when an approaching mid-latitude trough moving eastward from Japan created a large break in the subtropical ridge. The final warning was issued by JTWC at 031200Z, when satellite imagery indicated the system was rapidly transitioning into an extratropical cyclone.

III. FORECAST PERFORMANCE

For JTWC, the overall mean track forecast errors were 130, 245 and 330 nm (240, 455 and 610 km) for 24, 48 and 72 hours, respectively. Although these values were larger than the long term mean, JTWC's extended outlooks for track were 30% and 60% better at 48 and 72 hours, respectively, than CLIPER. JTWC's track forecasting performance is summarized graphically in Figure 3-27-4. The four areas of concern were: the approach to Wake Island, possible recurvature after passing Wake, the effects of binary interaction with Typhoon Elsie (28W), and recurvature revisited. JTWC addressed these challenges by shifting to a northwest forecast track on 26 October, and indicated in its 260600Z Prognostic Reasoning message that the tropical cyclone would "pass near Wake Island within the next 36 to 60 hours at a peak intensity of close to 105 knots." The track and intensity forecasts made on the 26 October proved to be accurate, allowing Wake Island to make sufficient preparations two days prior to the onset of destructive winds. After Dan passed Wake Island, the forecast aids gave conflicting guidance. The climatological and statistical aids hinted at recurvature, while the numerical models and dynamic forecast aids indicated a sharp westward turn was going to occur (Figure 3-27-5). JTWC adopted a "stairstep" forecast, but at 291200Z changed its track scenario to a west-southwest track, when the track change occurred. The effects of binary interaction with Elsie (28W) on Typhoon Dan were also over-estimated by the JTWC. It was believed that the interaction would keep Dan on a nearly westward course and preclude short-term recurvature, thus the sharpness of recurvature caught the forecasters by surprise.

On the short term, intensity forecasts were average, however, the failure of track scenario and Dan's reintensification after passing Wake Island had a definite impact on the intensity outlooks. Starting on 281200Z and for two-and-one-half days, the 72-hour intensity forecasts errors ranged from 30 to 80 kt (20 to 41 m/sec) too low, resulting in the largest intensity errors of 1992.

IV. IMPACT

Although the eye did not pass directly over Wake Island, Typhoon Dan devastated the tiny island which was still recovering from a near-miss by Typhoon Sybil (18W). Damage was officially estimated to be $9.0 million. High surf surged over the surrounding coral reef, inundating most of the permanent structures. All residents sought safety in concrete shelters. For the rest of Dan's life, it threatened only maritime interests. There were no reports of any loss of life.

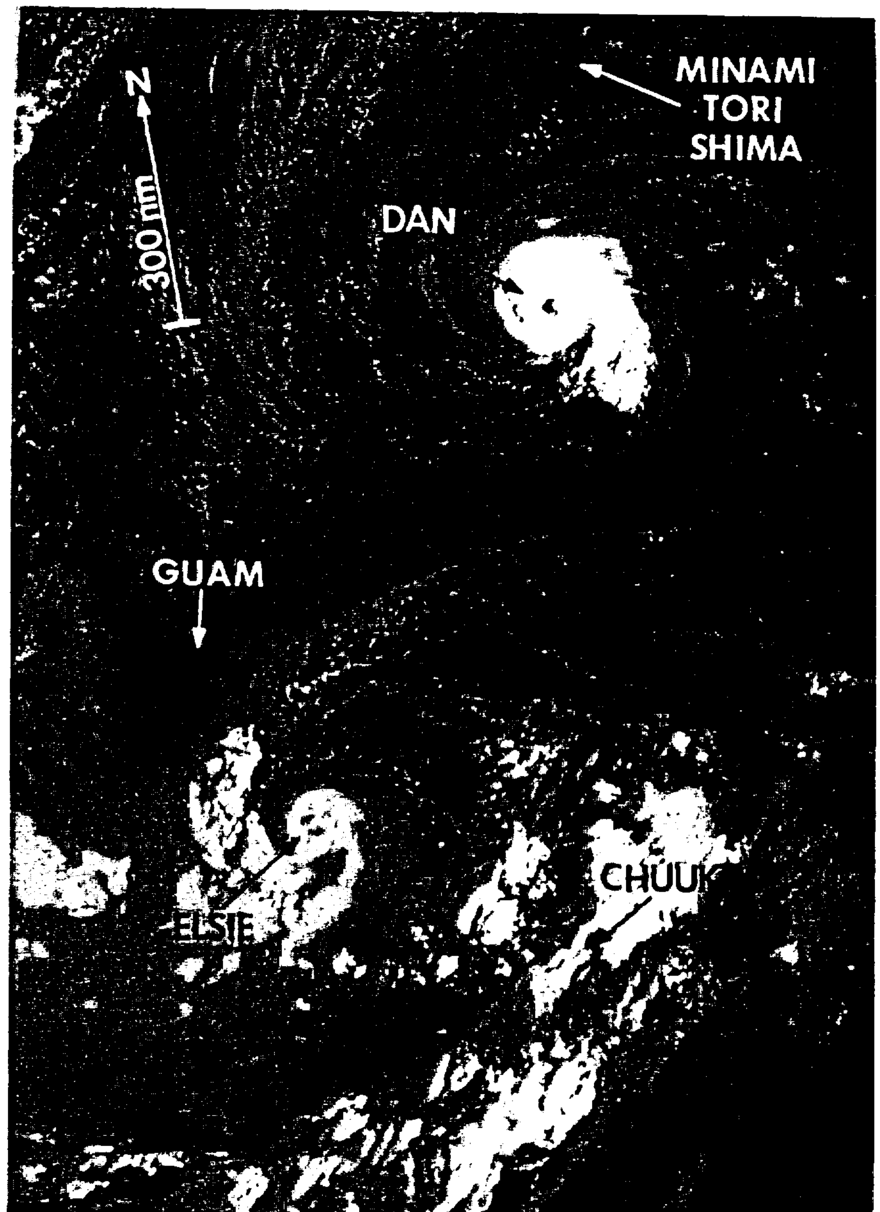

Figure 3-27-3. Near its second peak intensity, Typhoon Dan is involved in a binary interaction with Typhoon Elsie (28W), which is visible to the southwest (312258Z October DMSP visual imagery).

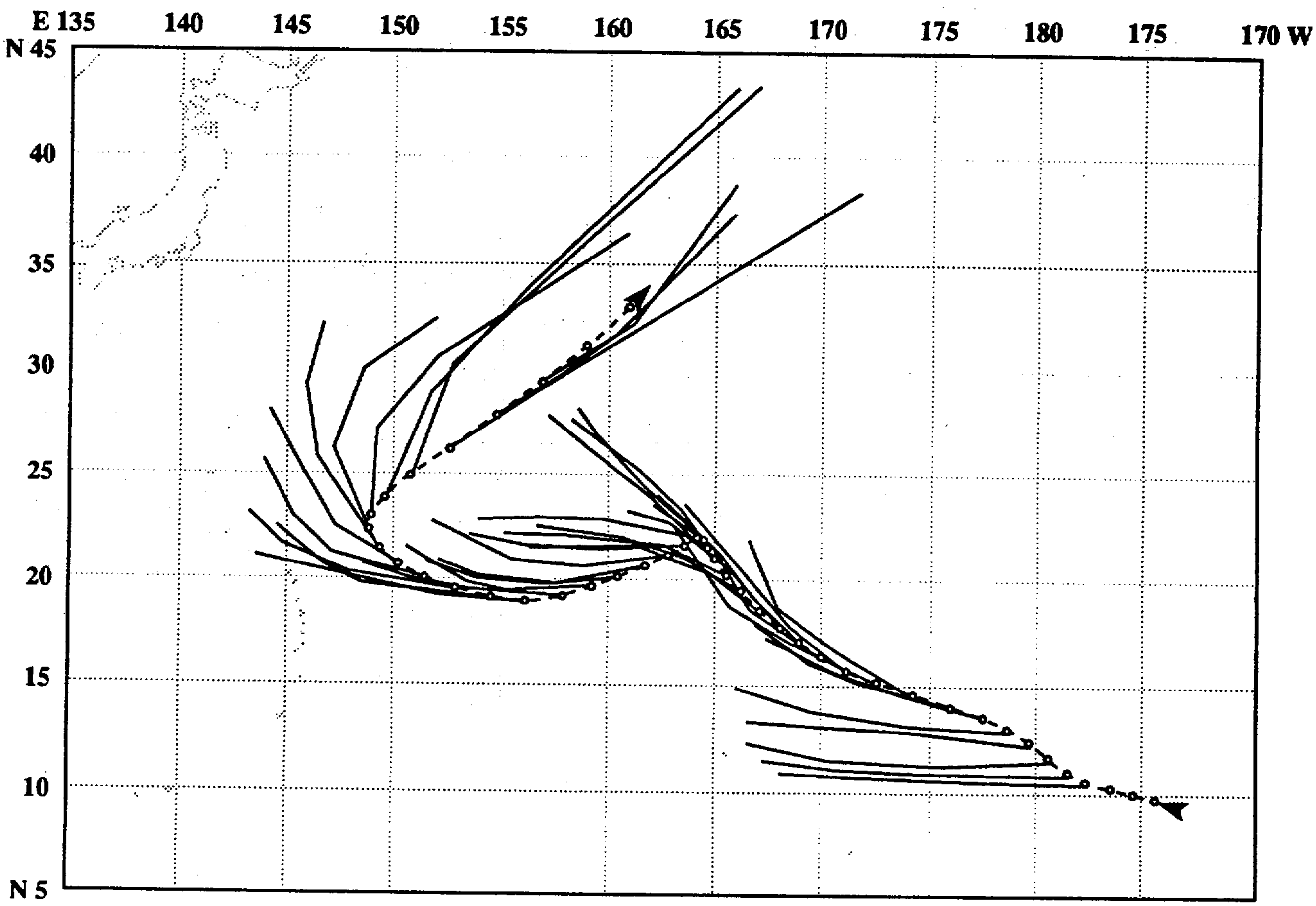

Figure 3-27-4. JTWC forecasts for Dan relative to the official best track.

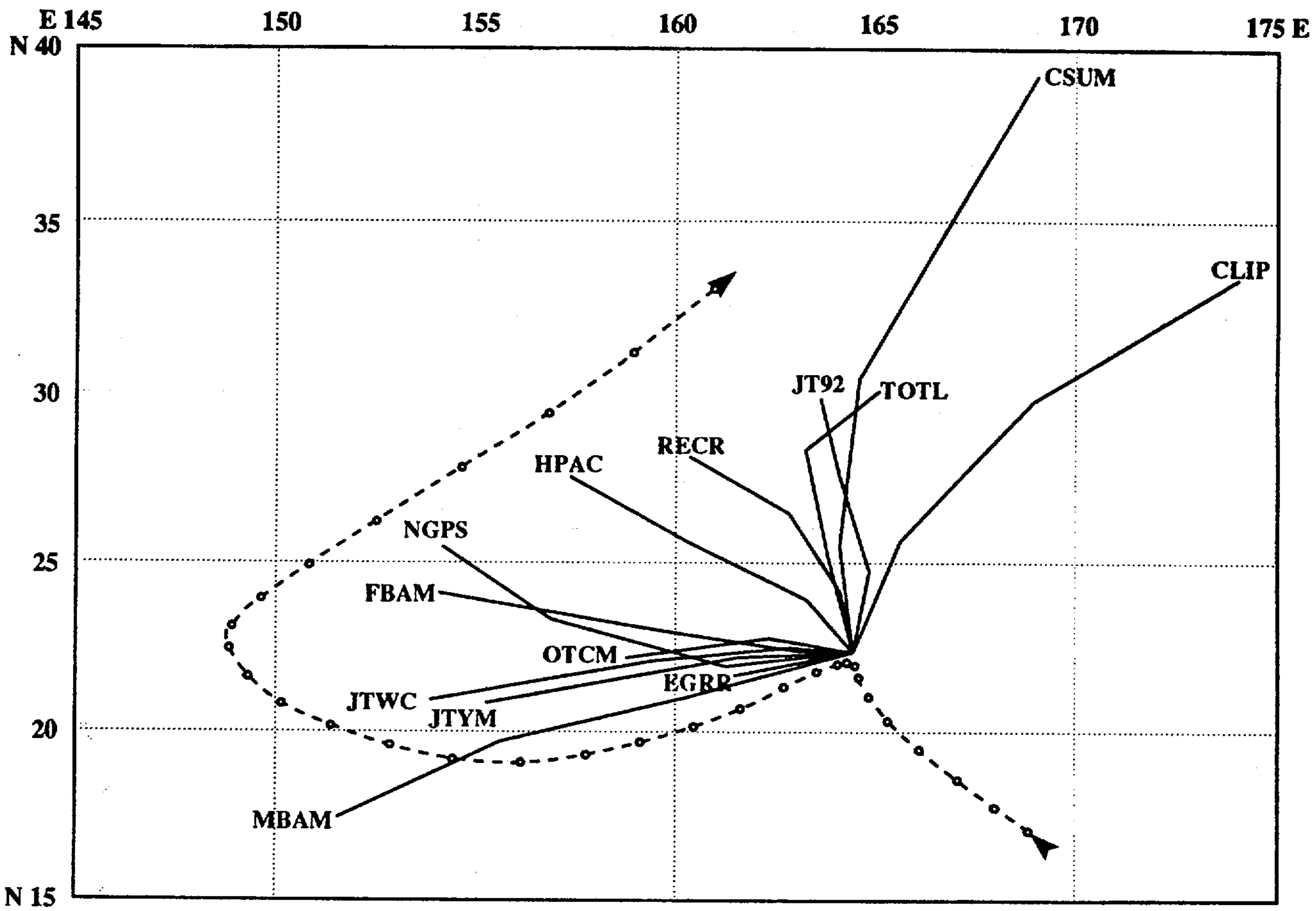

Figure 3-27-5. Forecast aids at 291200Z October for the major track change. Shown are the climatological/statistical forecast aids HPAC, CLIP, TOTL, RECR, JT92 and CSUM along with the dynamic aids OTCM, FBAM, MBAM, JTYM and the numerical models, NGPS and EGGR.