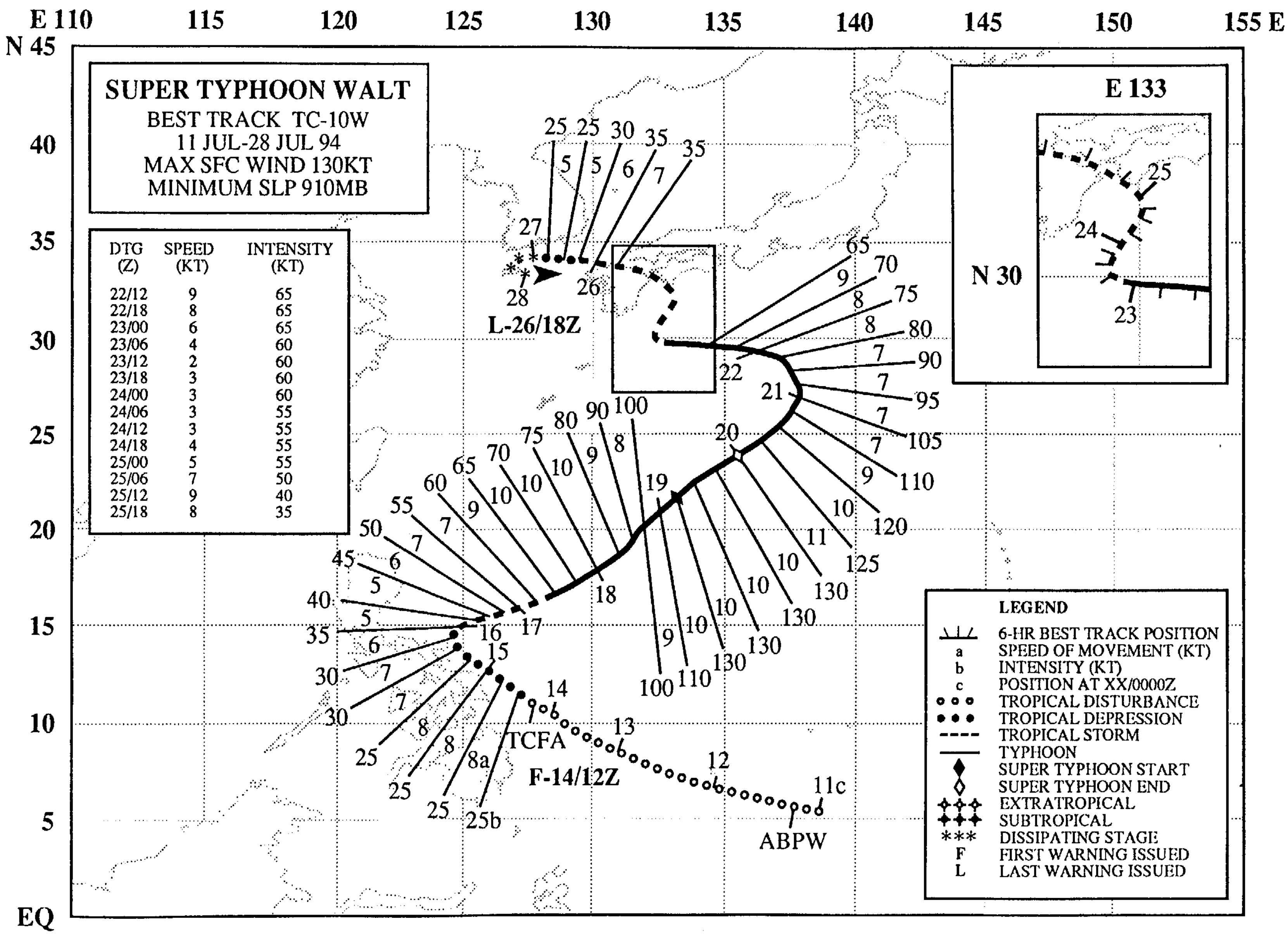

DTG (Z)	SPEED (KT)	INTENSITY (KT)
22/12	9	65
22/18	8	65
23/00	6	65
23/06	4	60
23/12	2	60
23/18	3	60
24/00	3	60
24/06	3	55
24/12	3	55
24/18	4	55
25/00	5	55
25/06	7	50
25/12	9	40
25/18	8	35

SUPER TYPHOON WALT (10W)

I. HIGHLIGHTS

The first tropical cyclone of 1994 in the western North Pacific to become a super typhoon, Walt was the larger and more intense of three named tropical cyclones which, for several days, were located along the axis of a reverse-oriented monsoon trough (Figure 3-10-1 and Figure 3-10-2). Typical of tropical cyclones embedded in a reverse-oriented monsoon trough, Walt exhibited unusual motion: eastward motion at low latitudes followed by a turn to the north. After reaching its peak intensity of 130 kt (67 m/sec), Walt slowly decayed as it made a gradual turn from a northward to a westward track. Before dissipating in the Korea Strait, its remnant cloud system brought much needed rain to some drought-stricken portions of South Korea.

II. TRACK AND INTENSITY

During early July, the axis of the monsoon trough extended across much of Micronesia at rather low latitudes (5°-7°N). Most of the deep convection associated with this monsoon trough was located south of 10°N. By 11 July, a persistent cloud cluster had consolidated near Palau. The first mention of this

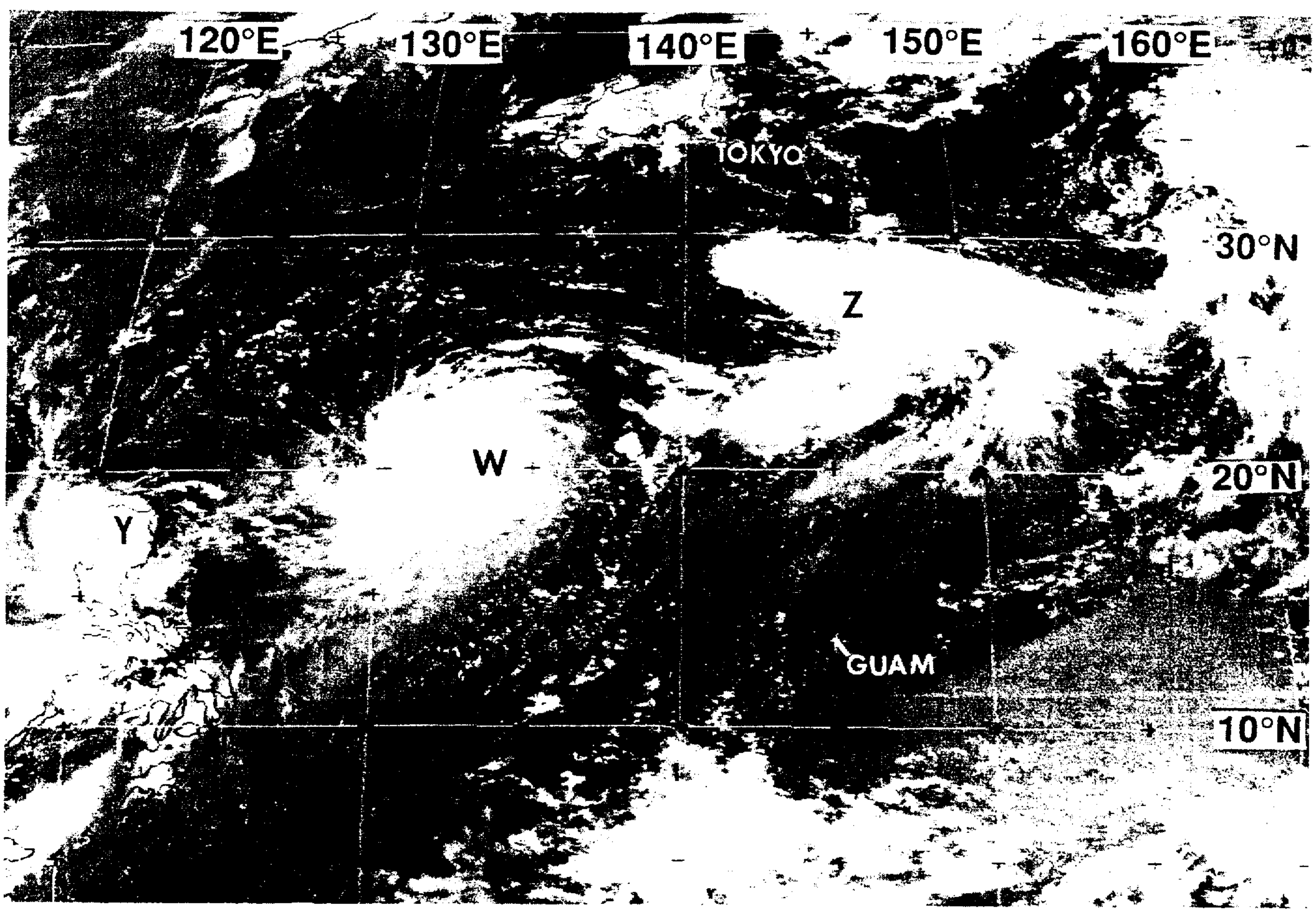

Figure 3-10-1 Yunya (11W), Walt , Zeke (12W), and a subtropical disturbance are aligned SW-NE along the axis of a reverse-oriented monsoon trough (190031Z July visible GMS imagery).

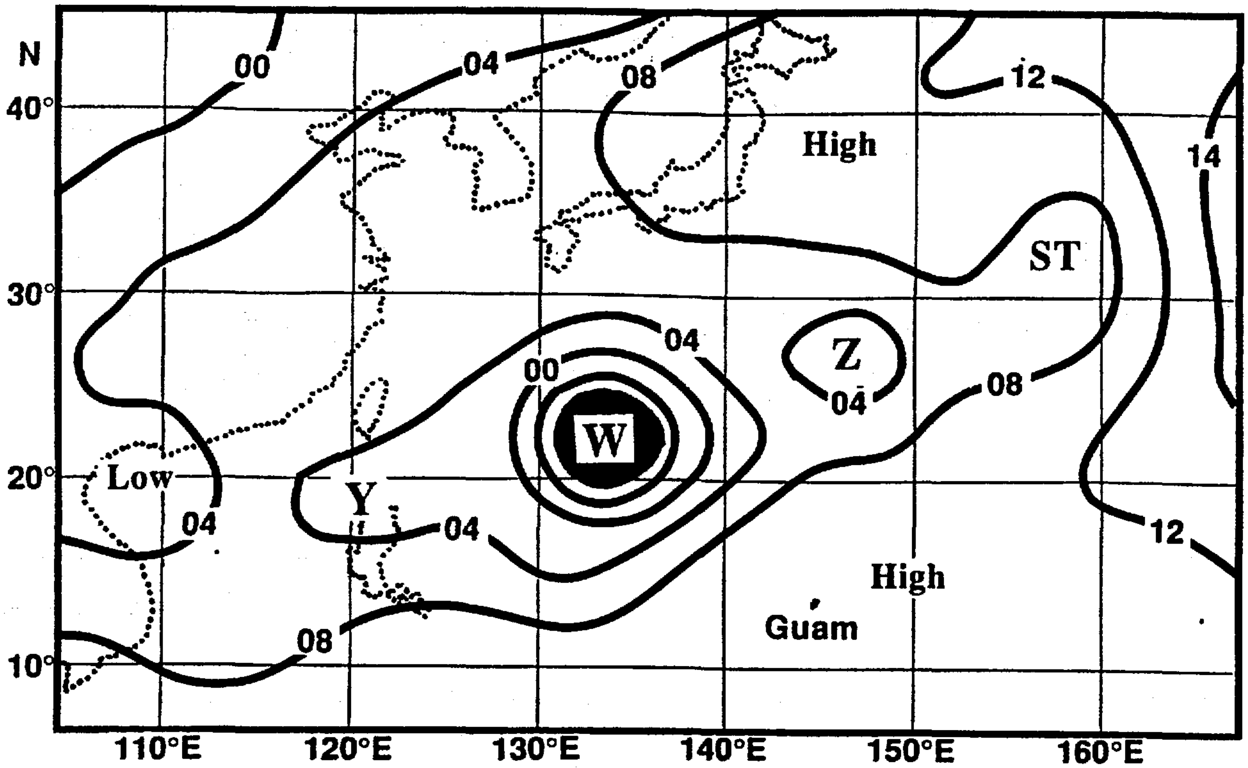

Figure 3-10-2 As in Figure 3-10-1, except sea-level pressure analysis at 190000Z July.

cloud cluster as a suspect tropical disturbance appeared on the 110600Z July Significant Tropical Weather Advisory. During the next few days, this tropical disturbance moved slowly northwestward. At 140800Z, the organization of the deep convection had further improved, and a Tropical Cyclone Formation Alert was issued. The first warning was issued soon thereafter at 141200Z.

Initially, Walt (as a tropical depression) moved northwestward towards Luzon. Then it slowed and turned towards the northeast at a relatively low latitude (15°N), and intensified. Concurrent with Walt's low-latitude turn toward the northeast, a long band of deep convective cloud clusters (which included Walt's cloud system) acquired a SW-NE (i.e., reverse) orientation, and extended from 15°N in the South China Sea to 30°N near the international date line. This cloud band signaled the onset of the year's first of three episodes of reverse orientation of the monsoon trough.

As Walt moved northeastward, it continued to intensify. By 190600Z its intensity peaked at the 130 kt (67 m/sec) super typhoon threshold (Figure 3-10-3). This peak intensity remained until 200000Z, when it began to slowly weaken. At 210000Z, Walt turned towards the west. Dropping below typhoon intensity shortly after 230000Z, Walt then tracked northward for two days. A westward turn at 250000Z led Walt to landfall at 250600Z on the southwestern end of the Japanese island of Shikoku. The estimated intensity at landfall was 50 kt (26 m/sec). Walt dissipated over water south of Korea after crossing southern Japan. The final warning was issued at 261800Z.

III. DISCUSSION

a. Unusual motion

The track of Super Typhoon Walt was north-oriented (JMA 1976). Tropical cyclones which move

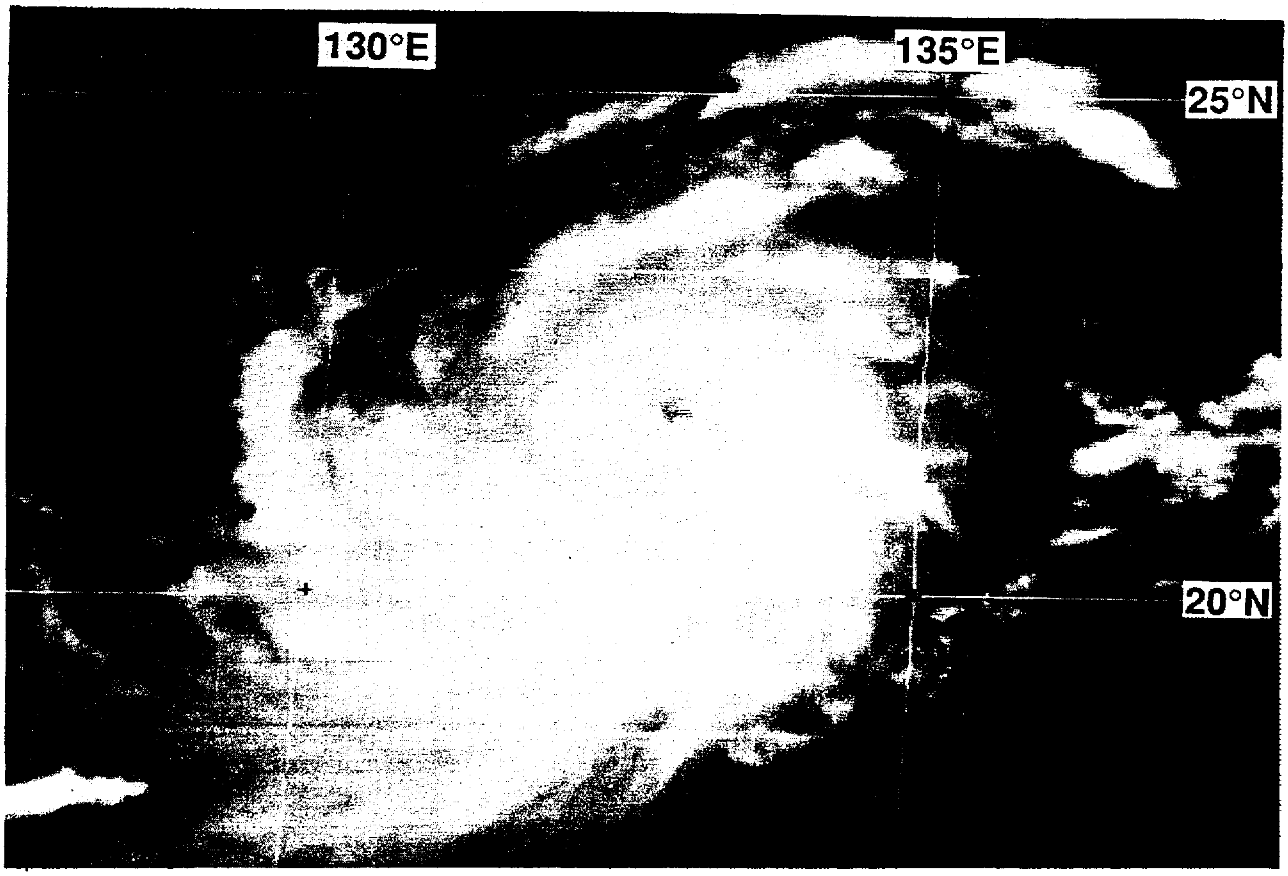

Figure 3-10-3 Walt at peak intensity (190600Z July visible GMS imagery).

on such tracks follow long generally northward paths from their genesis location into the mid-latitudes. A north-oriented track may feature large meanders and abrupt turns to the left or right. The speed of forward motion is often slower than average. Many north-oriented tracks feature eastward motion at low latitudes, and some even have an eastward component of motion for their entire track. Most north-oriented motion occurs during July through September (Lander 1995a).

The pattern of the large-scale low-level monsoon circulation of the western North Pacific has been shown to be a discriminator of tropical cyclone track type (Harr and Elsberry 1991; Lander 1995a). One pattern in particular, the reverse-oriented monsoon trough, has been shown by Lander (1995a) to be almost exclusively associated with north-oriented motion.

In its simplest description, the large-scale low-level circulation of summer over the western North Pacific can be described in terms of low-latitude southwesterlies, a monsoon trough and a subtropical ridge (Figure 3-10-4a). The axis of the summer monsoon trough of the western North Pacific usually emerges from East Asia at about 20° N to 25°N, and extends southeastward to a terminus southeast of Guam (13°N ; 145°E) (Sadler et al. 1987). Most of the tropical cyclones which develop in the western North Pacific form in the monsoon trough. When the axis of the monsoon trough is in its normal orientation (NW-SE), tropical cyclones tend to move northwestward on tracks close to those expected from climatology. As an episodic event, the axis of the monsoon trough becomes displaced to the north of its usual location and takes on a SW-NE (i.e., reverse) orientation (see Figure 3-10-4b). When the monsoon trough acquires a reverse orientation, tropical cyclones along it tend to move on north-oriented tracks, as was the case with Walt.

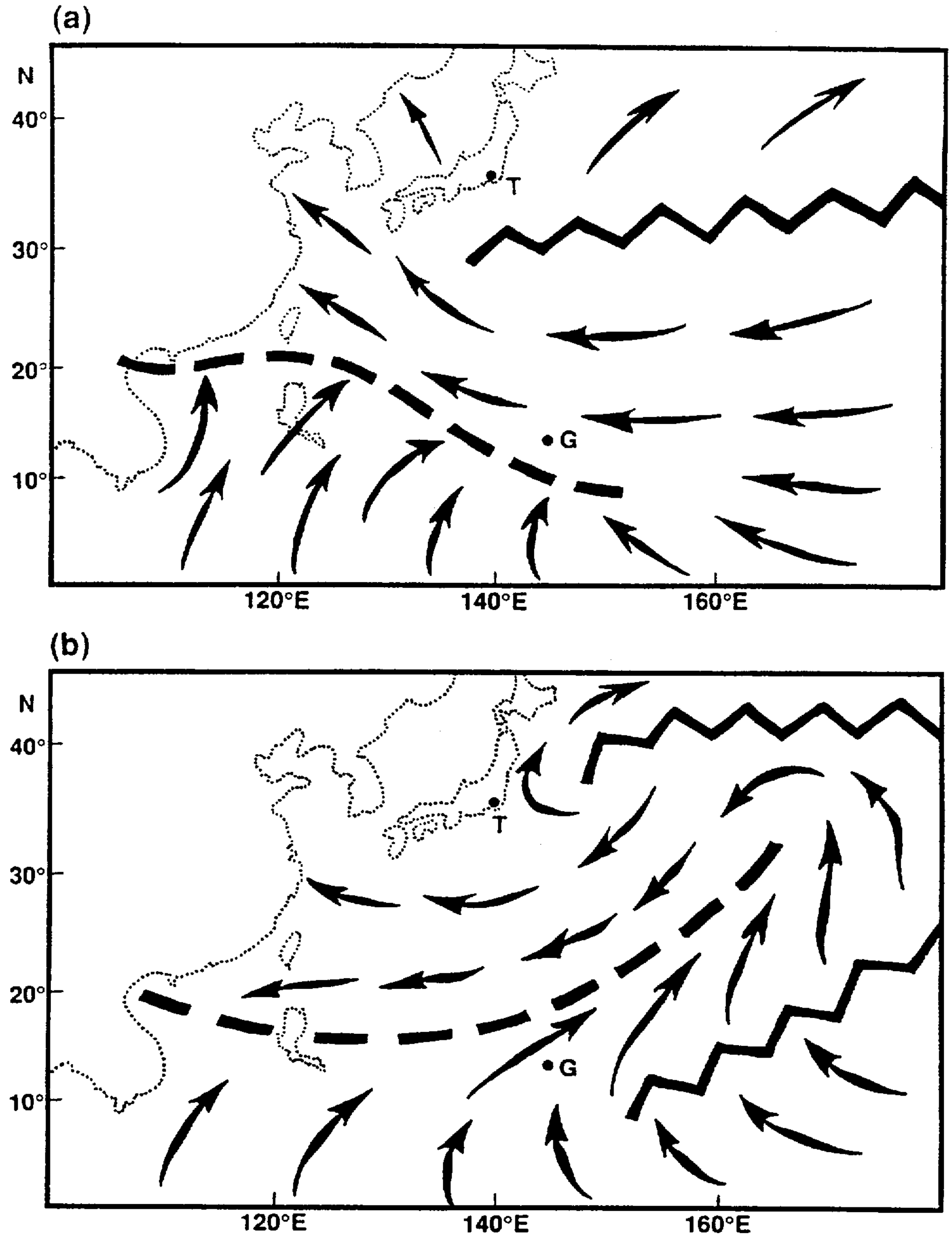

Figure 3-10-4 The low-level circulation of summer in the tropics of the western North Pacific: (a) the long-term average; and (b) a schematic illustration of the low-level circulation associated with a reverse-oriented monsoon trough. Bold zig-zag lines indicate ridge axes, and bold dashed line indicates the axis of the monsoon trough. Arrows indicate wind direction. The location of Guam (G) and Tokyo (T) are indicated.

b. Decay over warm water

After reaching super typhoon intensity over the warm waters of the Philippine Sea, Walt gradually weakened while moving slowly northward towards southern Japan. Although it was over warm sea surface temperatures, Walt weakened from 130 kt (67 m/sec) at 200000Z to 50 kt (26 m/sec) by 250600Z (the time of landfall in southern Japan) without any signs of appreciable vertical shear. By 280600Z Walt had completely dissipated.

c. Forecast performance

Overall, the official forecasts for Walt were good. The track forecast extracted from the NOGAPS model (the objective aid, "NGPS", received at the JTWC) and the forecast low-level wind fields made by the NOGAPS model had two periods of difficulty during the lifetime of Walt. The biggest problem with the numerical guidance provided by the Navy's NOGAPS model (e.g., wind and height fields, and the track aid "NGPS") was in the prediction of the size of Walt in relation to the prediction of the sizes of two other tropical cyclones, Yunya (11W) and Zeke (12W), that accompanied Walt along the axis of the monsoon trough. Early in Walt's life, the NOGAPS model was greatly over-forecasting the size and intensity of the pre-Zeke tropical disturbance that was located to the east of Walt. At the same time, the size and intensity of Walt were under-forecast by NOGAPS. As a result, the model output showed Walt dissipating and being swept eastward into the exaggerated circulation of Zeke (12W).

A few days later, the NOGAPS forecasts radically changed. They began to over-forecast the size of Walt, causing the model-predicted track of the smaller Zeke (12W) to be affected (i.e., to undergo a binary interaction with Walt that moved it too far to the north and west). Walt did eventually become a large and very intense typhoon, so the NOGAPS forecasts which called for Walt to grow extremely large verified reasonably well; however, this relatively minor error had significant consequences on the track forecasts of Zeke (12W) (see Zeke's summary).

IV. IMPACT

No reports of fatalities or significant damage were received. As a weak tropical storm passing over southern Japan, peak recorded wind gusts were near 35 kt (17 m/sec). Rainfall in southern portions of the Korean Peninsula caused by Walt helped to alleviate ongoing severe drought conditions.