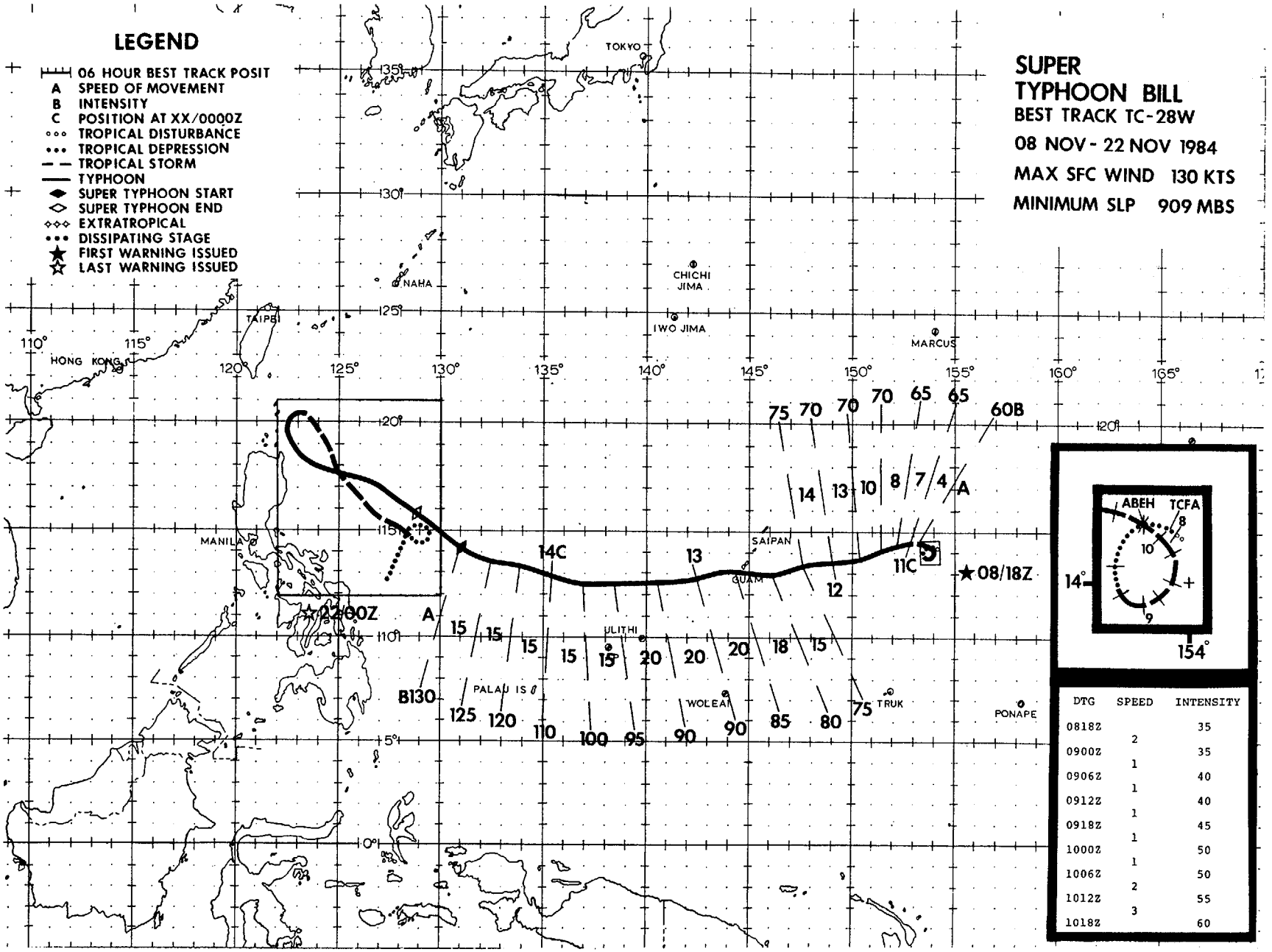
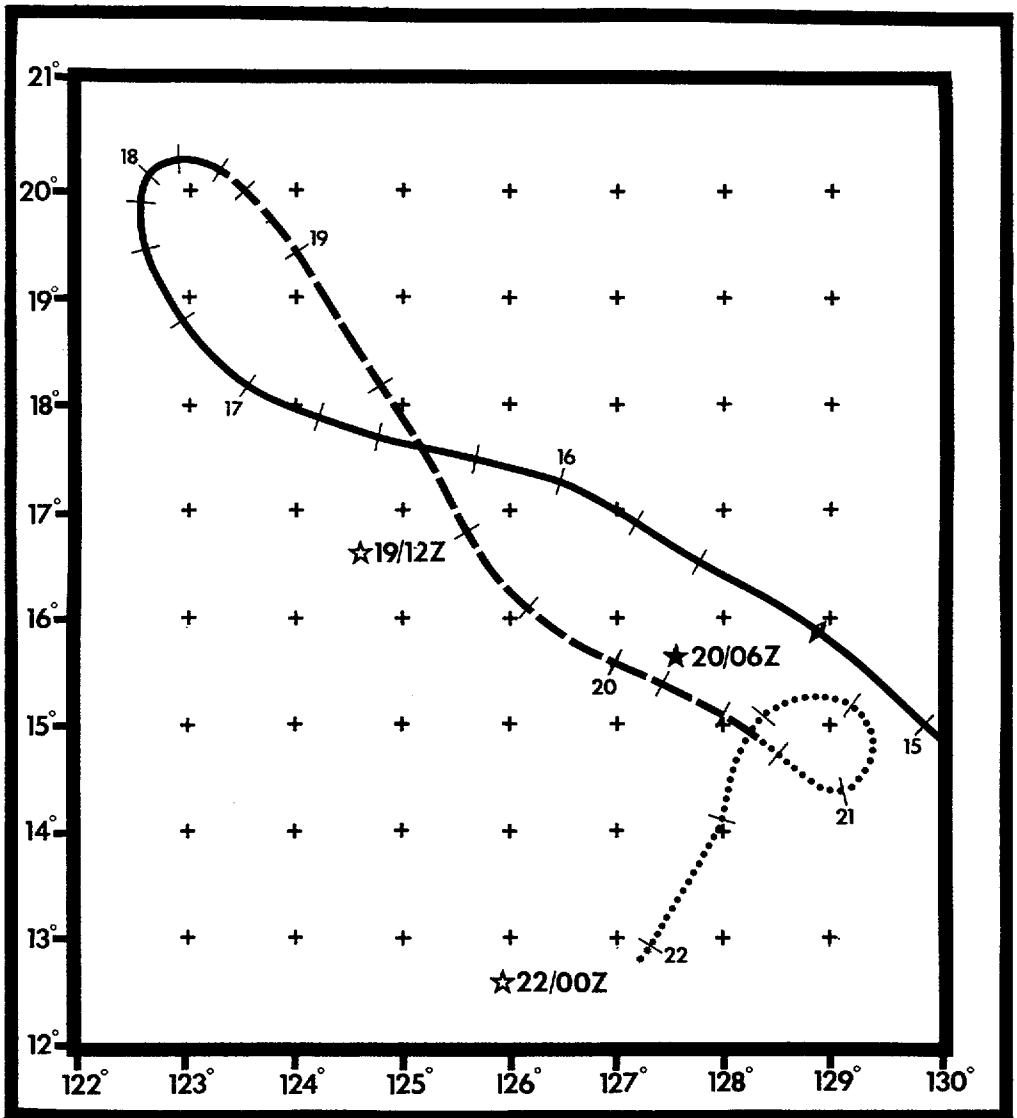

LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SUPER
TYPHOON BILL
BEST TRACK TC-28W
08 NOV - 22 NOV 1984
MAX SFC WIND 130 KTS
MINIMUM SLP 909 MBS
TOKYO
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
TAIPEI
HONG KONG
MANILA
SAIPAN
GUAM
ULITHI
WOLEAI
PALAU IS
TRUK
PONAPE
★22/00Z
★08/18Z
ABEH
TCFA
14°
154°
DTG SPEED INTENSITY
0818Z 35
2
0900Z 35
1
0906Z 40
1
0912Z 40
1
0918Z 45
1
1000Z 50
1
1006Z 50
2
1012Z 55
3
1018Z 60



DTG	SPEED	INTENSITY	DTG	SPEED	INTENSITY
1418Z		130	1812Z		65
	14			3	
1500Z		130	1818Z		60
	13			7	
1506Z		130	1900Z		55
	12			14	
1512Z		125	1906Z		50
	7			16	
1518Z		125	1912Z		50
	8			8	
1600Z		120	1918Z		45
	8			8	
1606Z		120	2000Z		45
	8			5	
1612Z		115	2006Z		40
	7			5	
1618Z		110	2012Z		40
	6			7	
1700Z		100	2018Z		30
	8			6	
1706Z		90	2100Z		30
	7			7	
1712Z		90	2106Z		30
	5			7	
1718Z		80	2112Z		25
	4			11	
1800Z		80	2118Z		25
	3			13	
1806Z		70	2200Z		25
	3				

The second and last super typhoon of the 1984 season led a rather unusual life. After forming east of Guam, it made a small cyclonic loop before heading to the west-southwest. Two days later, Bill passed just to the south of Guam by which time it had accelerated to almost 20 kt (37 km/hr). After causing some damage on the island of Guam, Bill entered the Philippine Sea and turned to the west-northwest. Although it was expected to recurve to the northeast and follow a track similar to that of Super Typhoon Vanessa, due to a complex steering environment including interaction with Typhoon Clara, Bill instead turned to the southeast before eventually dissipating east of the Philippines. Although this track is unusual, it is not uncommon for late season storms to move erratically for at least a portion of their life.

Super Typhoon Bill originated as an area of convection on 7 November near 14N 154E. The convection was at the trailing end of an eastward moving cold front and this may have supplied some low-level vorticity which contributed to the rapid development of the disturbance. The rapid development of the convection resulted in a TCFA at 080200Z. At the time of the TCFA, analysis of satellite imagery already indicated that 25 kt (13 m/s) surface winds were present.

The first of a total of 35 aircraft reconnaissance flights flown against Bill found the disturbance's circulation center at 080721Z but observed surface winds of only 20 kt (10 m/s). The system showed continued development during the next 12 hours, and as a result the first warning was issued at 081800Z.

From the 8th until the 10th, Bill slowly tracked in a 25 nm (46 km) wide cyclonic loop and continued to strengthen. At 0000Z on 10 November, reconnaissance aircraft reported that Bill had intensified to a 50 kt (26 m/s) tropical storm with an MSLP of 990 mb.

Bill attained typhoon strength on the 10th. The weak steering flow which had been present was replaced by easterly flow as the subtropical ridge strengthened to the north of the storm. At approximately 100600Z Bill completed its cyclonic loop and started to move to the west and then southwest on a course that would eventually bring the typhoon to the southern tip of Guam. On the 11th and 12th, Bill accelerated and gradually intensified (Figure 3-28-1). With Bill forecast to pass within 60 nm (111 km) of Guam, tropical cyclone Condition of Readiness III was set on the afternoon of 11 November. On the morning of the 12th, with Bill now

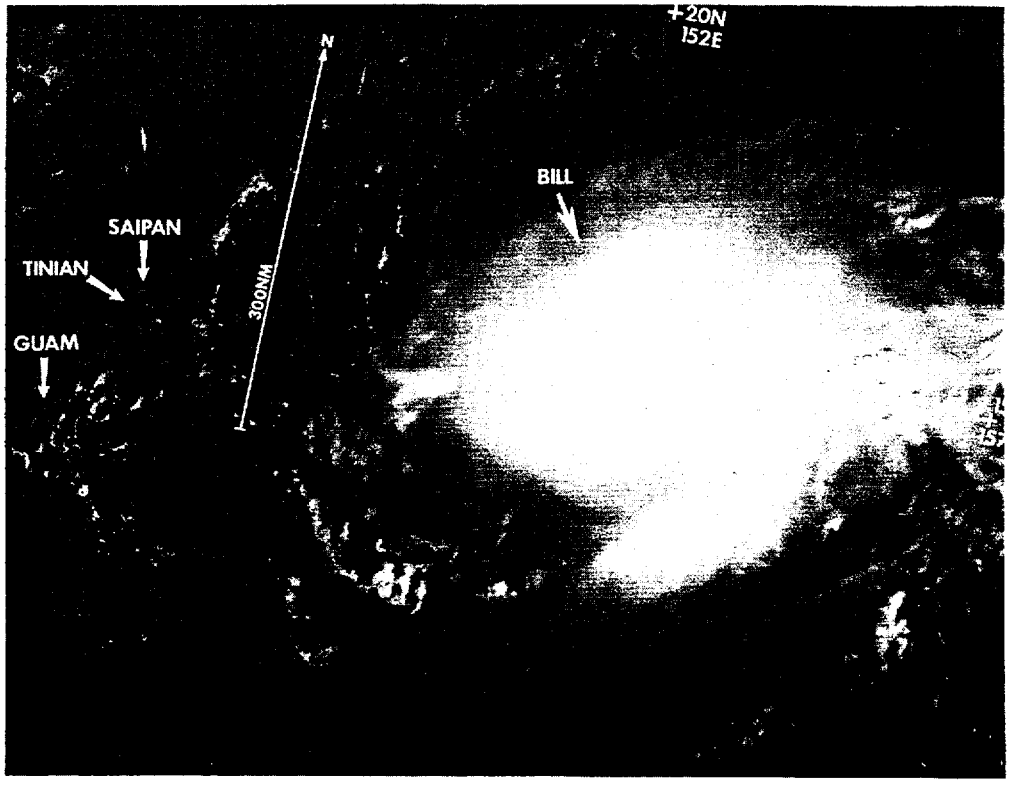


Figure 3-28-1. Bill consolidating east of Guam (1100032 November DMSP visual imagery).

forecast to pass less than 30 nm (56 km) south of the island, Condition of Readiness II was set at 112330Z.

Although Guam was forecast to be in the "dangerous" semicircle of the typhoon, the strength of the flow around the ridge did have a positive effect on Guam. Bill accelerated from 15 to 20 kt (28 to 37 km/hr) as it passed Guam thereby considerably shortening the time the typhoon affected the island. This rapid forward speed may also have been a factor in the slow intensification of the system. Only a 15 kt (8 m/s) increase in intensity occurred during the 24 hour period between 111800Z and 121800Z as Bill approached Guam.

Condition of Readiness I was set on the evening of the 12th, as Bill neared Guam. Typhoon Bill passed the southern tip of the island at 121630Z at a distance of 12 nm (22 km). Figure 3-28-2 contains a plot of the data obtained by reconnaissance air-

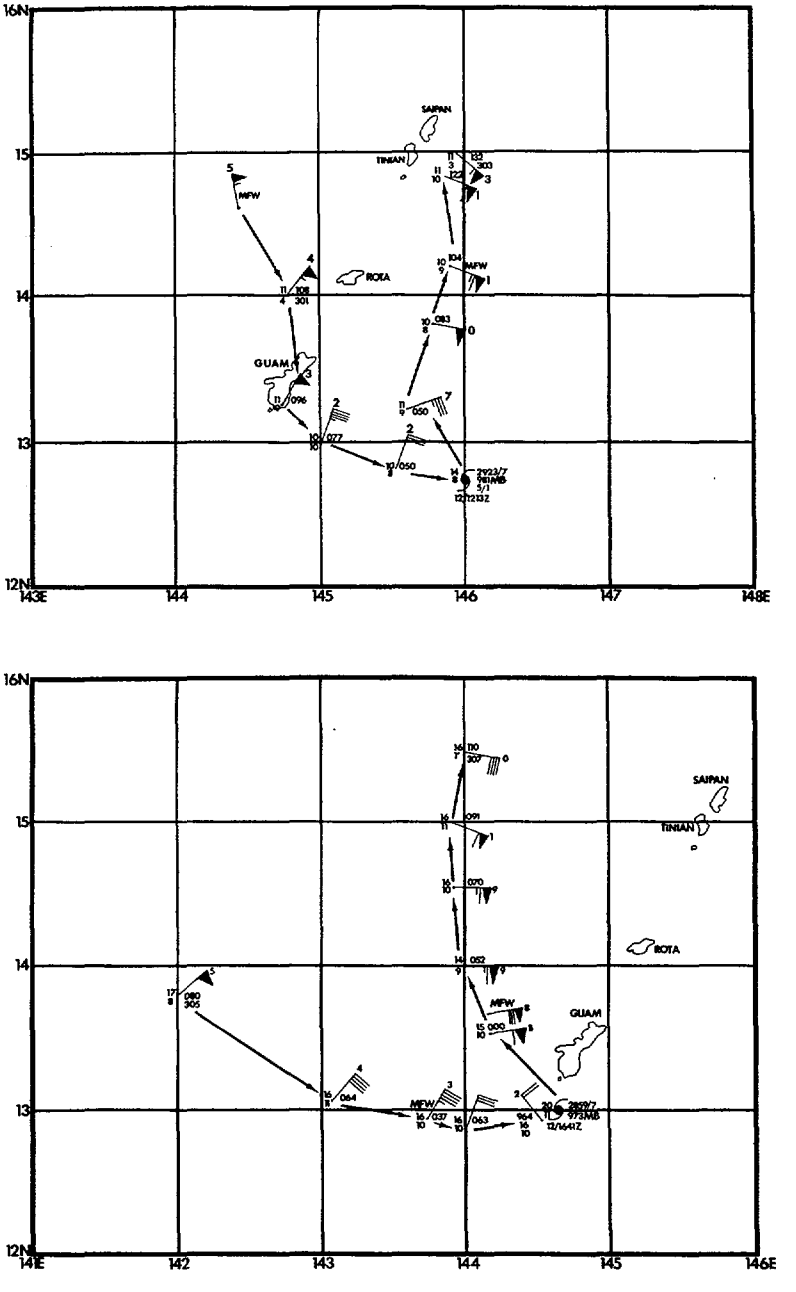


Figure 3-28-2. Plot of data obtained at the 700 mb level by aircraft reconnaissance on the two missions flown as Bill passed south of Guam.

craft during the two missions flown when Bill was at its closest point of approach to Guam. On the island itself, a maximum wind of 63 kt (32 m/s) was recorded at the National Weather Service Station (WMO 91217) at 121658Z, with a gust of 84 kt (43 m/s) recorded at Reserve Craft Beach in Apra Harbor. Typhoon Bill caused some damage on Guam, particularly to agricultural commodities. Banana trees that had been slightly damaged during the passage of Super Typhoon Vanessa were completely destroyed by Bill. Total crop damage was estimated at $7,707,911. Some minor flooding also occurred but no personnel injuries were reported. Electrical power was out in certain sections of the island for several days.

Bill entered the Philippine Sea late on the 12th moving west at 20 kt (37 km/hr) and intensifying. In the 24 hour period between 131200Z and 141200Z, the MSLP dropped 54 mb to 912 mb and the wind speed increased from 95 kt (49 m/s) to 125 kt (64 m/s) (Figure 3-28-3). The pressure continued to drop for another 12 hours, with aircraft reconnaissance at 142234Z reporting an MSLP of 909 mb. This was the lowest pressure reported in Bill. Bill attained super typhoon strength at approximately 141800Z which it then maintained for 12 hours.

Bill turned to the west-northwest early on the 14th and by 141800Z had turned to the northwest. It now appeared that Bill was starting to move around the western end

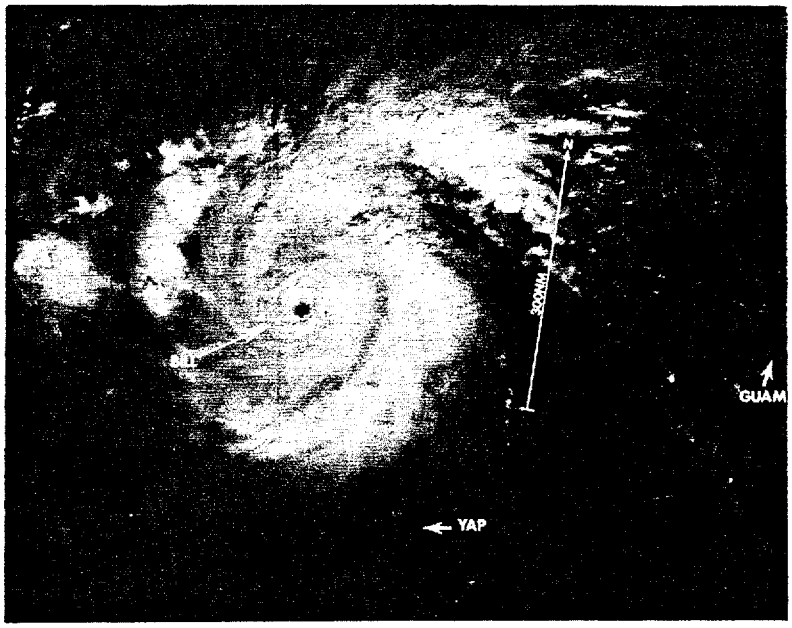


Figure 3-28-3. Typhoon Bill as it appeared on satellite imagery while undergoing rapid intensification (140044Z November DMSP visual imagery)

of the subtropical ridge. What was initially expected to be a simple recurvature scenario would soon become a complex interaction between Bill, the approaching Typhoon Clara (now developing near Truk (WMO 91334)), the mid-latitude westerlies, and the northeast monsoon. These factors would eventually cause Bill to weaken, double back on its present track and eventually dissipate.

Bill slowed down as it moved to the northwest and by 151800Z was moving at 7 kt (13 km/hr) down from the 15 kt (28 km/hr) movement of twenty-four hours earlier. This was due to the passage of a mid-latitude trough to the north which weakened the subtropical ridge. Bill now began to weaken as it encountered strong upper-level westerlies which disrupted its outflow and sheared the convection to the northeast (Figure 3-28-4). This marked the start of a weakening trend which would continue until dissipation.

At 1200Z on the 15th, the subtropical ridge reintensified temporarily forcing Bill back on a west-northwest course which it maintained until late on the 16th. On the 17th, Bill started to track to the northwest as the ridge weakened once again. It now appeared that recurvature was finally going to occur. At 180000Z Bill turned again, this time to the northeast but unfortunately this was not to be the start of the long awaited recurvature.

At this time, three factors were involved in the steering of Bill: Typhoon Clara had become the dominant circulation in the Philippine Sea (Figure 3-28-5), the flow around the subtropical ridge was waning, and the northeast monsoon was gaining strength. The subtropical ridge was the first loser in this tug-of-war as Clara's large low-level circulation started to draw a weakening Bill to the southeast. Figure 3-28-6 shows the rapidly weakening Bill with little convection remaining as it moved towards Clara.

Bill continued to track to the southeast and weaken under the combined influence of Typhoon Clara and the westerlies. Aircraft reconnaissance at 191130Z confirmed this weakening trend. The MSLP had risen to 997 mb and the maximum observed 700 mb flight

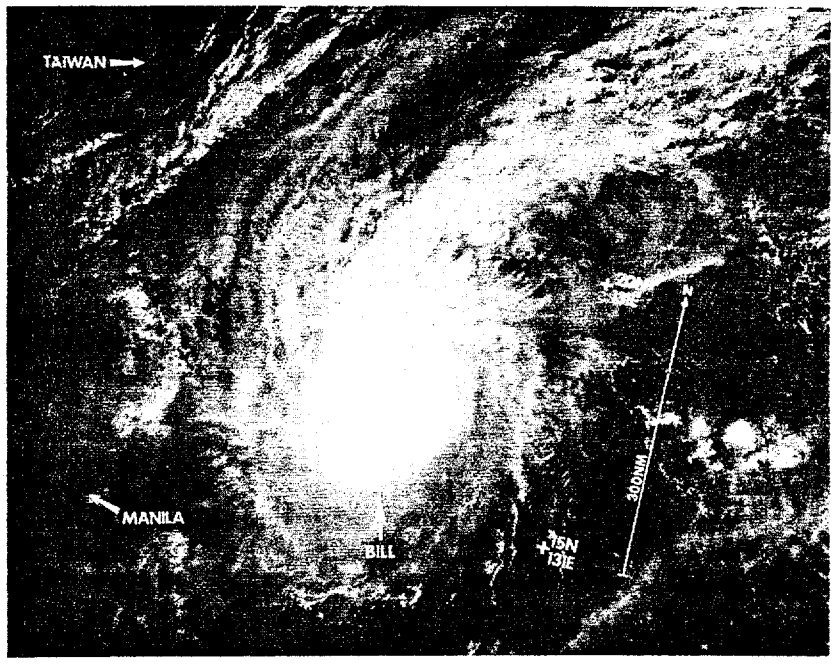


Figure 3-28-4. Bill east of Luzon as it encountered the upper-level westerlies and began to weaken. Note the cloud covered eye and the cirrus streaming to the northeast (160145Z November DMSP visual imagery).

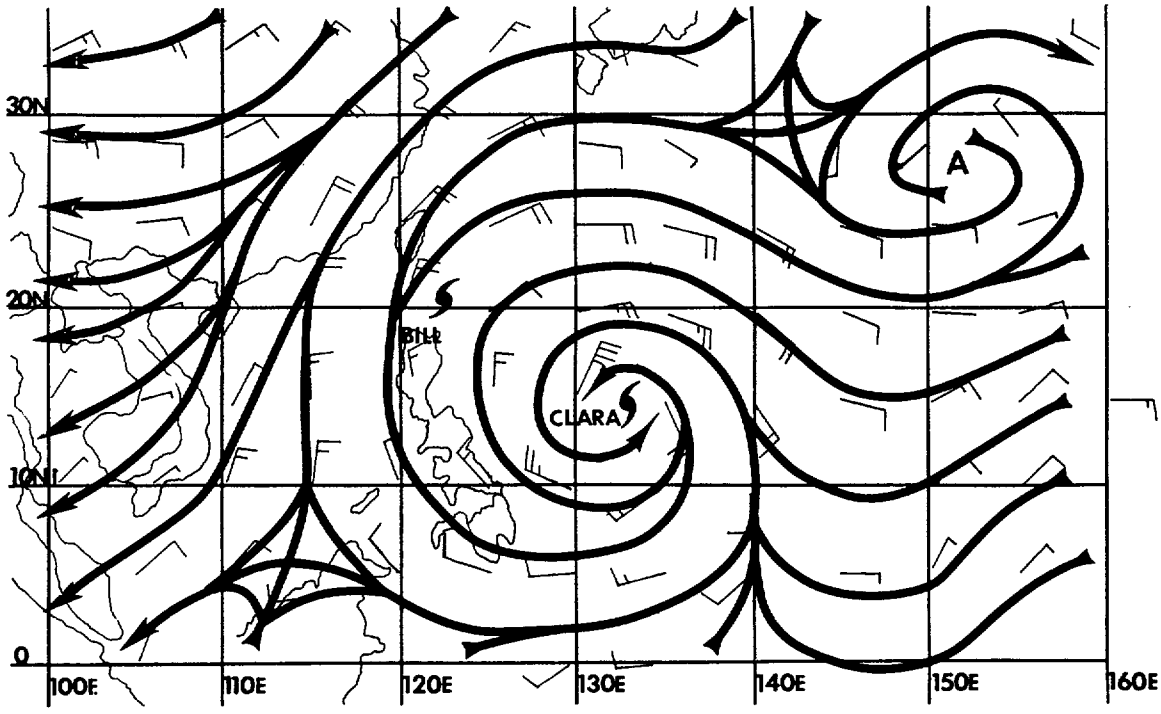


Figure 3-28-5. The 181200Z 925 mb NVA analysis showing the dominance of Typhoon Clara in the Philippine Sea. Bill which supported 65 kt (33 m/s) winds at this time was a small circulation compared to Clara and the northeast monsoon.

level wind was 28 kt (14 m/s). (Since the mission was flown at night, no surface wind data were available.) Based on the aircraft reconnaissance data and the lack of convection and organization on satellite imagery, Bill was downgraded to a tropical depression and finaled at 191200Z. As it turned out, this was premature. Early on the 20th, with Clara completing recurvature along 132E and accelerating to the northeast, its influence on Bill weakened and Bill began to regenerate some convection. Visible imagery indicated that a low-level circulation center was present. Aircraft reconnaissance a short time later, flying in the daylight at the 1500 ft (457 m) level at 200205Z reported that Bill was still moving to the southeast and now had an MSLP of 999 mb. The aircraft also reported, that a well-defined low-level circulation with 40 to 55 kt (20 to 28 m/s) winds was present! The strongest winds were located in the western semicircle of the storm and were being enhanced by the northeast monsoon. As a result Bill was returned to warning status as a tropical storm at 200600Z (Figure 3-28-7).

Although the aircraft wind data suggests that Bill intensified between 191200Z and 200600Z, this is not considered likely. Due to the weak mid-level winds reported on the 191130Z fix mission, JTWC had the impression that Bill was rapidly dissipating. In fact Bill still possessed a well-defined surface

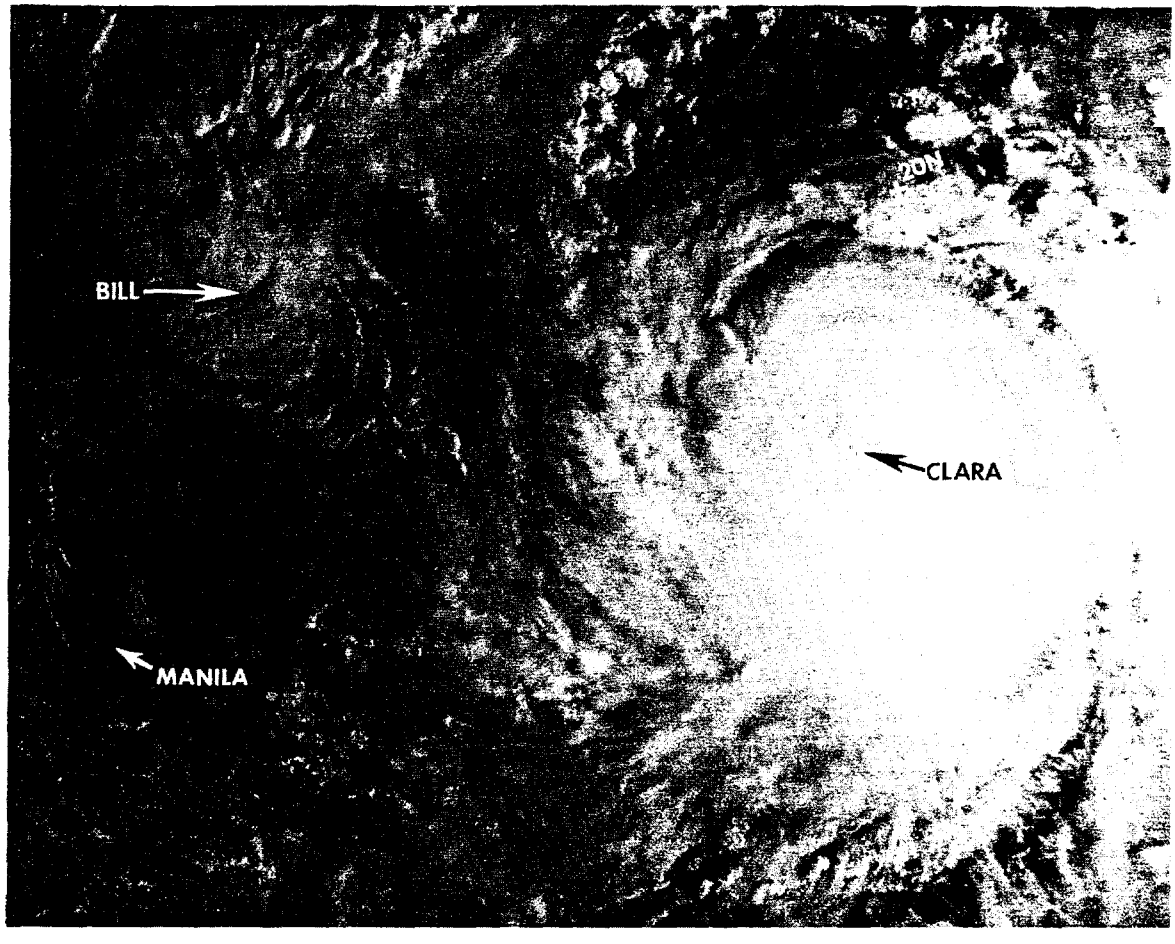


Figure 3-28-6. A weakened Bill as it heads southeast under the influence of Clara's inflow (1822582 November NOAA visual imagery).

circulation which was weakening at a much slower rate that the mid-level circulation. If the 191130Z fix mission had been able to observe surface winds it would probably have reported that 50 kt (26 m/s) surface winds were still associated with Bill.

As it turned out, the increase in convection was temporary. As Clara moved further away, its effect lessened and Bill slowed, doing a small cyclonic loop on the 21st. Bill was now under the influence of the northeast monsoon which pushed the low-level circulation to the southwest. By the 22nd the low-level circulation became embedded in the northeast monsoon, and Bill was no longer identifiable as a significant tropical cyclone. The final warning was issued at 220000Z. Although the low-level circulation dissipated in the Philippine Sea, residual convection brought locally heavy rains to the central Philippines early on the 23rd of November.

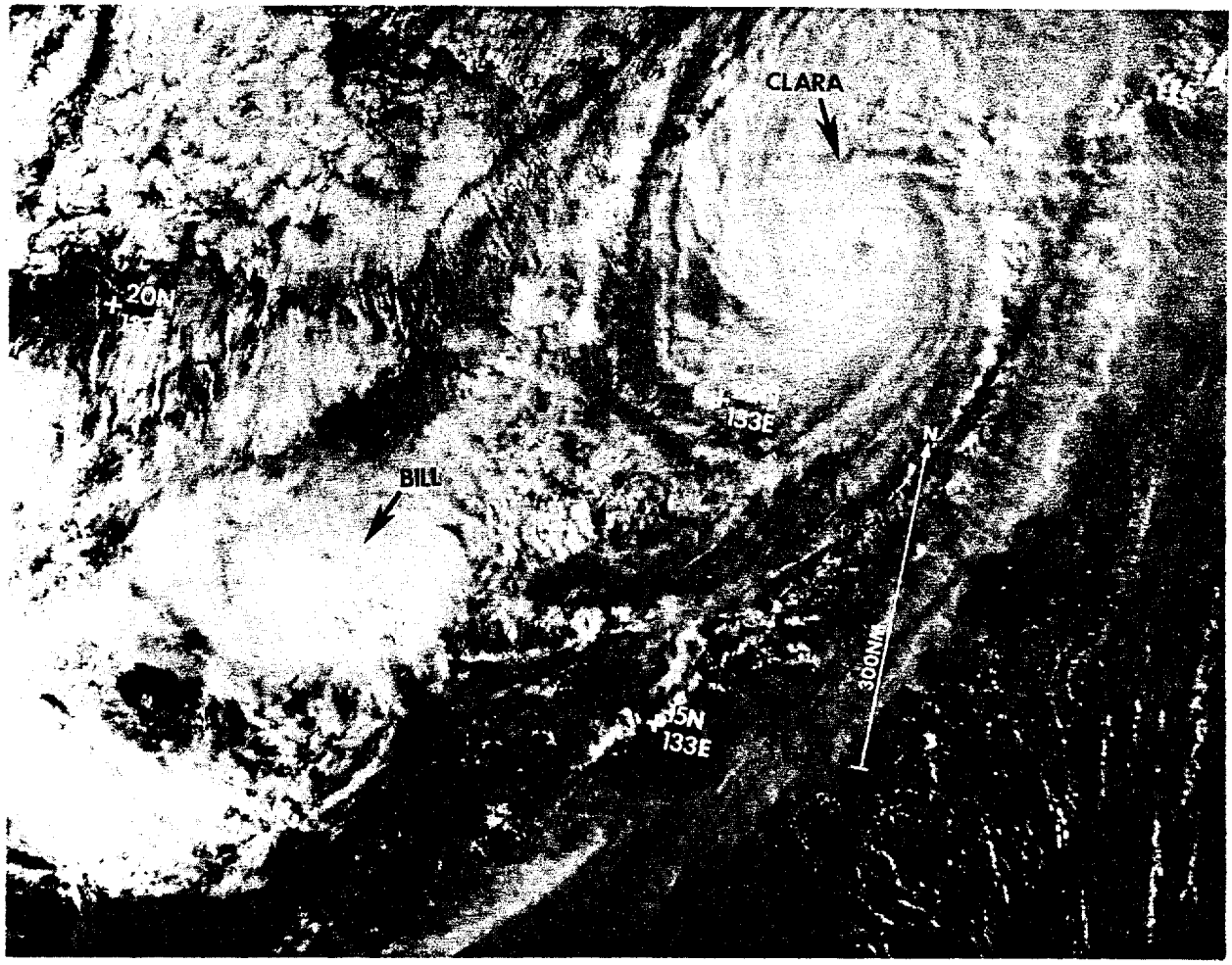


Figure 3-28-7. Typhoon Clara accelerating to the northeast and beginning extratropical transition. Bill now has more convection than 24 hours earlier, but this convective flare-up was temporary (2007002 November NOAA visual imagery).