SUPER TYPHOON GINGER (24W)

I. HIGHLIGHTS

The seventh of eleven Tropical Cyclones (TCs) to attain super typhoon intensity in the western North Pacific (WNP) during 1997, Ginger formed at low latitudes in the Marshall Islands. It was one of ten TCs that formed east of 160E and south of 20N; within the "El Niño" box in Figure 3-3a. Ginger moved on a north-oriented track through the eastern portion of the western North Pacific basin. As it neared its peak intensity, the typhoon possessed an extensive system of primary and peripheral rainbands. When it reached 30N, it accelerated within the mid-latitude westerlies where it transitioned into a vigorous extratropical low. Ginger was one of the many 1997 TCs that formed at the eastern end of the monsoon trough near the international dateline (IDL) and evolved into a large solitary TC's (i.e., much of the WNP basin, with the exception of the single typhoon, was unusually free of deep convection).

II. TRACK AND INTENSITY

During the first two weeks of September 1997, two TCs, STY Oliwa (02C) and TY David (21W), formed near the IDL, moved across the basin as large solitary typhoons, and recurved near Japan. On 21 September, as David was recurving east of Japan, the tropical disturbance that was to become Ginger had consolidated at low latitude near the IDL. On 22 September, this tropical disturbance became better organized, as evidenced by a low-level cyclonic circulation that was well-defined by synoptic data. Deep convection associated with the low-level circulation became organized into curved bands; and animated water vapor imagery indicated the presence of anticyclonic flow at upper levels over the low-level center. This disturbance was first mentioned on the Significant Tropical Weather Advisory (ABPW) valid at 0000Z on 22 September. A Tropical Cyclone Formation Alert (TCFA) was issued at 0530Z on the 22nd, when satellite data indicated continued improvement in the system's organization and the presence of factors deemed favorable for TC formation (e.g., the water vapor derived winds showed strong upper-level divergence over the system). Based on satellite derived intensity estimates of 25 kt (13 m/sec), the first warning on Tropical Depression

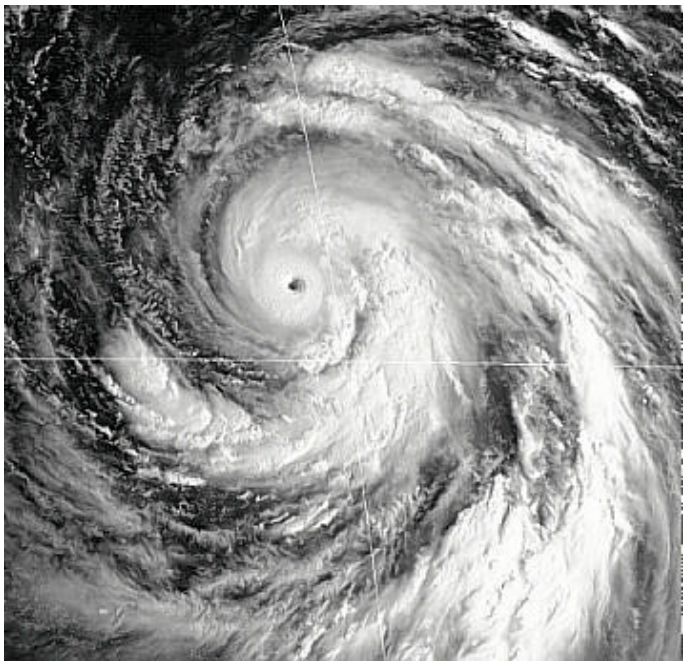


Figure 3-24-1 Ginger nears its peak intensity of 145 kt (75 m/sec). Extensive banding features accompanied this TC (262132Z September visible GMS imagery).

(TD) 24W was issued valid at 1800Z on 22 September. For 36 hours, TD 24W moved northwest and slowly intensified. Based on satellite intensity estimates, it was upgraded to Tropical Storm Ginger (24W) on the warning valid at 0600Z on 24 September. Ginger began to track in a more northerly direction. Intensifying at a normal climatological rate, it became a typhoon at 1200Z on the 25th. At this point Ginger began a period of explosive deepening (see Discussion Section) and in the 24-hour period from the 26th at 0000Z to the 27th at 0000Z, the intensity jumped from 75 kt (39 m/sec) to 145 kt (75 m/sec).

As it neared its peak intensity, Ginger's structure provided spectacular views via visible satellite imagery (e.g., Figure 3-24-1). It had a small well-defined eye embedded in a smooth symmetrical Central Dense Overcast (CDO), which in turn was surrounded by an extensive pattern of primary and peripheral cloud bands. The unusually cloud free structure of the large-scale environment served to highlight Ginger in the imagery (Figure 3-24-2).

After Ginger peaked on 27 September, it moved slowly north-northwestward and arrived at its point of recurvature 36 hours later at 1200Z on 28 September with an intensity of 110 kt (57 m/sec). Typically, weak typhoons peak at or near their point of recurvature, while more intense typhoons, like Ginger, experience a delay between reaching peak intensity and arriving at their point of recurvature (JTWC 1994).

After recurving, Ginger began a slow acceleration into the midlatitudes. Finally, the intensity fell below typhoon force at 1800Z on the 30th, and the system made a smooth transition into a vigorous extratropical low. The final warning was issued, valid at 0600Z on 30 September, when a complete extratropical transition was expected within six hours.

III. DISCUSSION

a. Ginger's Digital Dvorak (DD) time series

Ginger was one of several typhoons during 1997 for which a time series of hourly DD-numbers (Figure 3-24-3) was recorded. Ginger's DD-numbers are in overall agreement with the best-track intensity; although there are two notable exceptions. First, the drop of the DD-numbers below the values of the best track intensities as Ginger was weakening, is an intrinsic feature of Dvorak analysis for a TC weakening over water. The decrease of the Current Intensity (CI) is delayed, by about one day behind a falling computed Data T (DT) number. In general this results in the CI remaining one T-number higher than the DT for steadily weakening systems. The second discrepancy is harder to explain, and carries both operational and research implications with it. The best-track intensity values are all lower than their corresponding DD-numbers as Ginger intensified. The rate of intensification during the 24-hr period from 0000Z on 26 September to 0000Z on September, as shown by Digital Dvorak (50 mb for an average of 2.1 mb/hr), is quite different from that computed from the best track (74 mb for an average of 3.1 mb/hr). The former rate of intensification qualifies as a case of explosive deepening (defined as meeting or exceeding a drop of minimum sea-level pressure of at least 2.5 mb/hr for 12 hours (Dunnavan 1981)). The latter rate of deepening is not so extreme, but qualifies as a case of rapid deepening (defined as a drop of minimum sea-level pressure of at least 1.75 mb/hr, or 42 mb/24 hrs (Holliday and Thompson 1979).

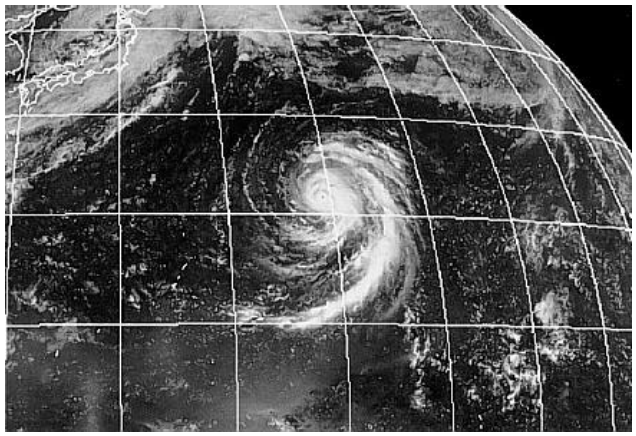


Figure 3-24-2 Ginger and its extensive pattern of primary and peripheral cloud bands are isolated in an otherwise relatively cloud free tropics (270033Z September visible GMS imagery).

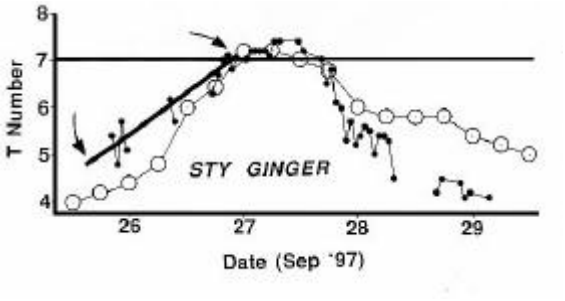


Figure 3-24-3 A time series of Ginger's hourly DD-numbers (small black dots) compared with the best-track intensity (open circles). Note that as Ginger was intensifying the best-track intensity rises faster than the value of the DD-numbers (indicated by the thick black line).

The discrepancy between the DD-numbers and best track intensities during intensification is not uncommon. However, in the case of Ginger, one can see that the resulting rate of deepening is quite different depending on whether the best-track or the DD-numbers are used to compute it. The results of research into TC intensification processes may be very different depending upon which method is used. DD-numbers are still experimental, and methods for incorporating them into operational practice are being explored. Reasons for the disagreement between the DD-numbers and the best-track intensities must be determined before any modifications are made to the current methods of estimating TC intensity utilizing satellite imagery.

b. Large and solitary

Ginger was one of many TCs of the 1997 season that formed at the eastern end of the monsoon trough near the IDL and became large solitary typhoons (Figure 3-24-2 and Figure 3-24-4). The persistent reduction of deep convection throughout much of Micronesia and within the low latitudes of the WNP basin became more pronounced during the latter half of 1997. The low-level monsoon westerlies and their associated deep convection moved eastward to the IDL (and beyond) in association with large-scale climatic anomalies related to El Niño. Other large and solitary typhoons during 1997 included TY David (21W), STY Oliwa (02C), STY Ivan (27W), STY Joan (28W), STY Keith (29W), and STY Paka (05C).

c. Concentric eye wall clouds

Ginger was yet another example of an intense WNP typhoon acquiring concentric eye wall clouds that are easily seen on conventional visible and infrared imagery, and are especially well-defined on microwave imagery (Figure 3-24-5). Microwave imagery is particularly well-suited to observe concentric eye wall clouds, and to document their evolution. (Paka's eye-wall replacement cycle was exceptionally well documented on microwave imagery; see the Paka

(05C) summary). The rapid fall of Ginger's DD-numbers (Figure 3-24-3) within 24 hours of its peak was a manifestation of its acquisition of concentric wall clouds. There is a tendency for the most intense typhoons (e.g., STY Dale (36W), in 1996, and STY Paka (05C)) to develop concentric eye wall clouds within 24 hours of their first or only peak.

IV. IMPACT

Ginger remained at sea for its entire life, and no reports of damage or injury were received at JTWC.

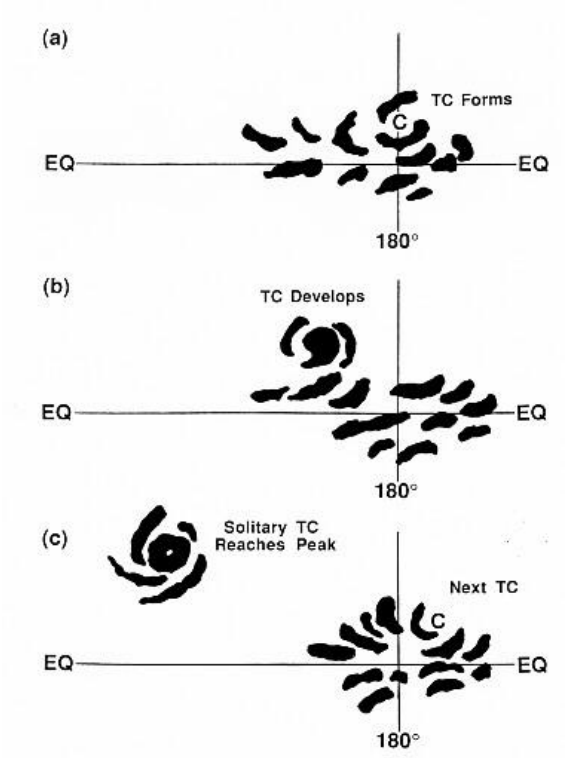


Figure 3-24-4 A graphic illustration of the process whereby a large solitary TC forms in an eastward displaced monsoon system, and then tracks northwestward, intensifies, and becomes isolated in a relatively cloud-free environment. This process was typical of most of the very intense TCs that occurred during the latter half of 1997

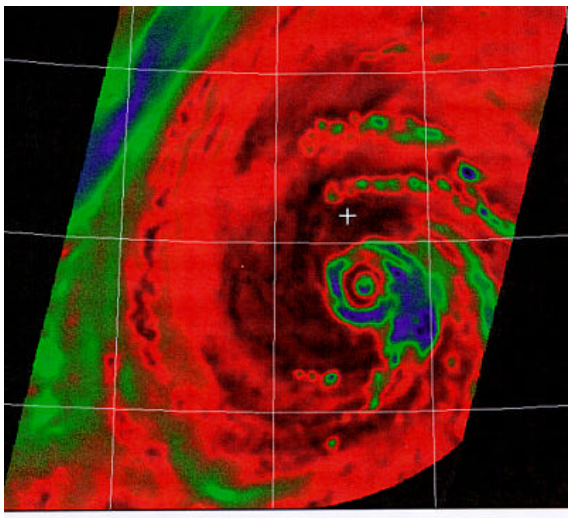
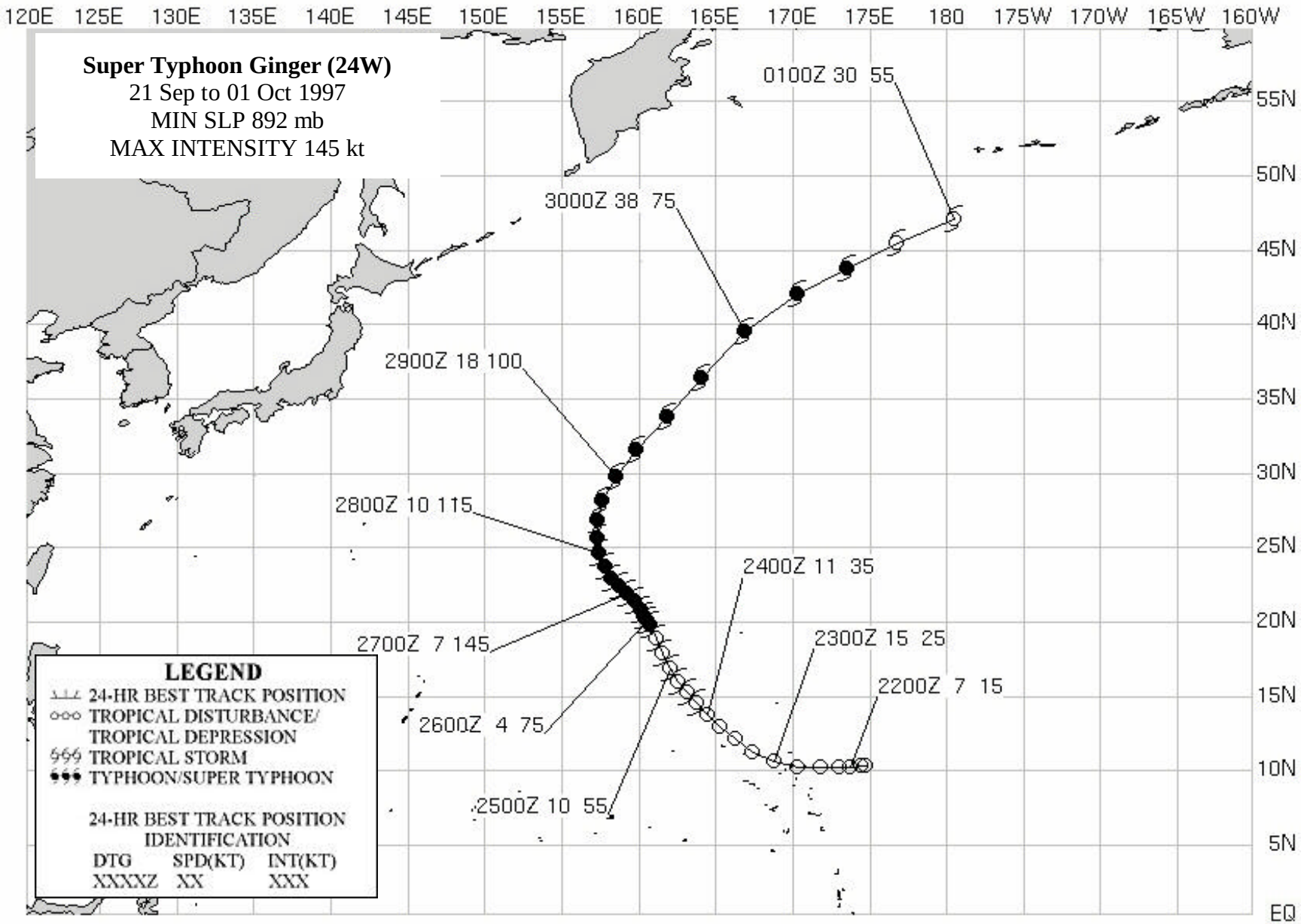


Figure 3-24-5 Microwave imagery clearly reveals the acquisition of concentric eye wall clouds by Ginger within 24 hours of reaching its peak intensity (272132Z September horizontally polarized 85 GHz microwave DMSP imagery).


Super Typhoon Ginger (24W)
21 Sep to 01 Oct 1997
MIN SLP 892 mb
MAX INTENSITY 145 kt
120E 125E 130E 135E 140E 145E 150E 155E 160E 165E 170E 175E 180 175W 170W 165W 160W
55N 50N 45N 40N 35N 30N 25N 20N 15N 10N 5N EQ
0100Z 30 55
3000Z 38 75
2900Z 18 100
2800Z 10 115
2400Z 11 35
2300Z 15 25
2200Z 7 15
2700Z 7 145
2600Z 4 75
2500Z 10 55
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/ TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XXX