

SUPER TYPHOON SALLY (23W)

I. HIGHLIGHTS

As the long-lived Orson (19W) recurved at the beginning of September, the unusual monsoon flow pattern of August (See figure 3-13-4 in Kirk's summary) gave way to a pattern more in line with climatology: the maximum cloud zone and the axis of the monsoon trough became established from the Philippines east-southeastward into Micronesia. Sally was the first of five significant TCs to develop in this new monsoon flow pattern. Forming to the southwest of Guam, Sally moved on a relatively steady west-northwest straight-moving track. It became a super typhoon while moving through the Luzon Strait, and later, though weaker, it made landfall in southwestern China where it caused extensive damage and considerable loss of life.

II. TRACK AND INTENSITY

On the first day of September, Typhoon Orson (19W) was recurving to the east of Japan, and the deep tropics of the WNP were abnormally free of deep convection. Over the next two days, as Orson (19W) recurved into the midlatitudes, amounts of deep convection in the low latitudes of the WNP began to rapidly increase as a new monsoon trough was becoming established there. On 02 September, when amounts of deep convection in the low latitudes of the WNP began to increase, a tropical disturbance quickly consolidated near the island of Guam. It was first mentioned on the 020600Z Significant Tropical Weather Advisory, which described it as follows:

"An area of convection is located near 11N 145E. Satellite imagery and synoptic data indicate a broad area of convection surrounding an inverted trough in the trade wind flow. . . ."

Early on 04 September, synoptic data showed that a low-level cyclonic circulation had formed in the monsoon trough in association with this disturbance. Cirrus outflow was well organized into an anticyclonic pattern with a center of symmetry over the LLCC. This prompted the JTWC to issue a Tropical Cyclone Formation Alert (TCFA) at 032300Z September. The MCSs comprising this disturbance were growing and collapsing at the typical 06- to 12-hour MCS time scale, creating some difficulty for the satellite analysts to accurately locate the LLCC. The uncertain knowledge of the location of the LLCC led to a second TCFA at 042300Z in order to carry the alert beyond the expiration of the first, and to give JTWC forecasters some time to gather information for the first warning (which was in preparation when the first TCFA was about to expire). As expected, the second TCFA was quickly followed by the first warning on Tropical Depression (TD) 23W, valid at 050000Z, when morning visible satellite imagery allowed for a more accurate determination of the position of the LLCC and indicated an intensity of 25 kt (13 m/sec). From this time onward (until peak), intensification proceeded at a faster than normal rate (i.e., 1.5 T numbers per day versus the normal 1 T number per day). TD 23W was upgraded to Tropical Storm Sally on the warning valid at 051800Z. The system became a typhoon at 060600Z, and a super typhoon at approximately 071600Z. The peak intensity of 140 kt (72 m/sec) occurred at 071800Z (Figure 3-23-1) as the cyclone moved through the Luzon Strait. Moving west-northwestward at nearly 20 kt (37 km/hr), the typhoon crossed the northern reaches of the South China Sea (SCS) under the steering influence of a dominant subtropical ridge. The system weakened as it moved across the SCS, but it was still potent with an intensity of approximately 100 kt (51 m/sec) when it made landfall on the Luichow peninsula in southwestern China. The typhoon crossed the Luichow peninsula and then moved along the Chinese Gulf-of-Tonkin coastline. The system went inland for good just north of China's border with Vietnam. The final warning was issued, valid at 091200Z, as the weakening TC continued its trek inland across the far north of Vietnam and southwestern China.

III. DISCUSSION

Sally's digital Dvorak (DD) numbers: a pattern begins to emerge

During 1996, the hourly time series of the DD numbers was computed and archived for all typhoons (during 1995, hourly DD numbers were computed for some selected TCs, Ward, for example). The hourly time series of Sally's DD numbers (Figure 3-23-2) shows a characteristic pattern that appears to be typical of some of the other very intense typhoons of 1996 and 1995:

- 1) the DD time series rises more rapidly than the best-track intensity (which is based primarily upon the manual application of Dvorak's techniques);
- 2) the DD time series peaks earlier than the best-track intensity;
- 3) the peak of the DD time series is approximately one-half of a T number higher than the best-track peak; and,

4) within 24 hours of the DD peak, there is a dramatic drop of the DD values of 2 or more T numbers, and then a recovery. Some or all of these behaviors are seen in the DD time series of Eve (07W), Dale (36W) and to a lesser extent Herb (10W) and Violet (26W).

These specific characteristic behaviors of the DD time series are closely tied to the evolution of the character of the eye. As TCs approach their peak intensity, their eyes are usually small and well defined. Why the DD numbers rise more quickly and peak earlier and higher than the best track has not been determined. The dramatic fall of the DD time series following the peak can usually be linked to the formation of concentric wall clouds. The DD numbers recover from the dramatic fall after the inner wall cloud collapses and a new larger eye is established.

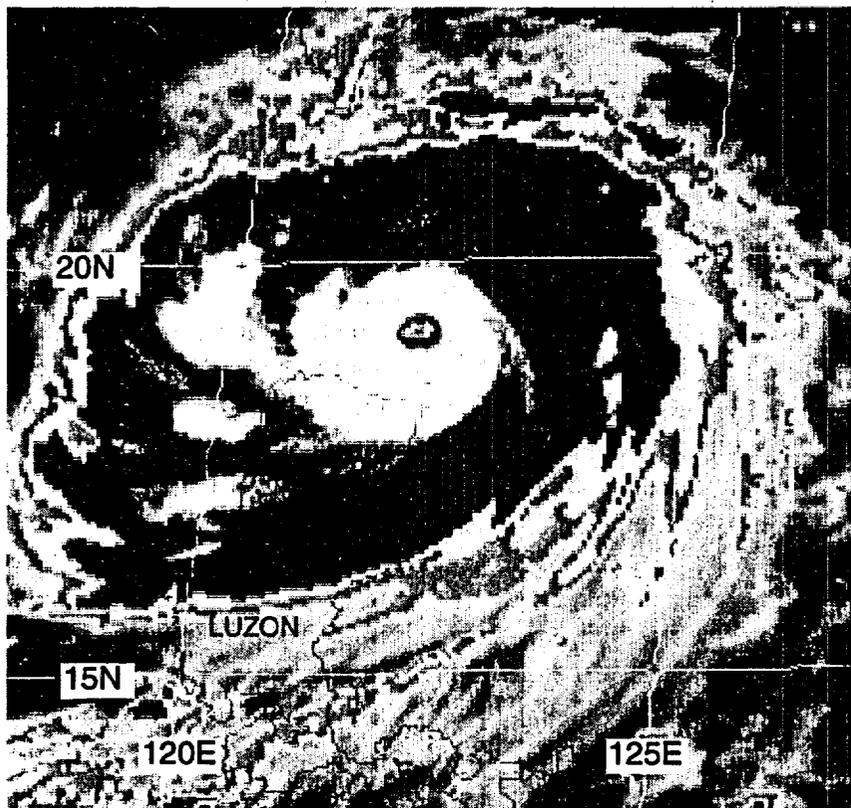


Figure 3-23-1 Sally shortly before reaching its peak intensity of 140 kt (72 m/sec) (071631Z September enhanced infrared GSM imagery). Enhancement curve is "MB".

IV. IMPACT

Sally was catastrophic in southern China. At least 114 people were reported killed with another 110 missing. The city of Zhanjiang on the east coast of the Luichow peninsula was one of the hardest hit. Here, 79 people were reported killed. Almost all trees in this city and its suburbs were reported to have been uprooted by high winds. Economic losses were described as the worst since 1954. Combined losses in the cities of Zhanjiang and Maoming were estimated at US \$1.5 billion.

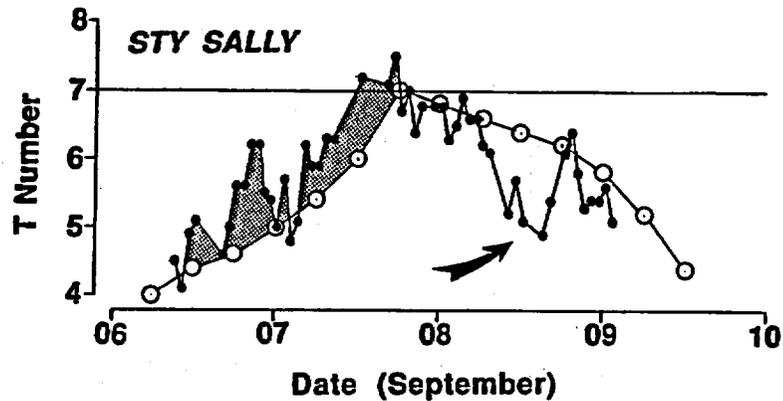


Figure 3-23-2 The time series of Sally's hourly DD numbers (small black dots connected by thin solid line). For comparison, the final best track intensity at six-hour intervals (converted to a T number) is superimposed (open circles connected by thin solid line). Shaded regions indicate that the DD number is higher than the best-track intensity. The arrow points to the relative minimum in the DD time series which occurred approximately 24 hours after the peak in the DD numbers.