

Preliminary Report on Florence

Overview

Tropical Storm and Hurricane Watches and Warnings were issued on Florence which passed the Island with minimal Hurricane status early on Saturday 16th September 2000. On Friday afternoon the NHC track predicted that Florence would hit the Island and was expected to strengthen to Hurricane. Fortunately the storm eventually missed Bermuda by around 60 nm. Only Tropical Storm force winds (max 38 knots with gusts to 50 kt) were recorded at the Airport. Harbour Radio recorded 43 kt gusts 56 kt). However, winds may have been somewhat stronger at the West End, closer to the storm centre.

Formation and History

Florence formed embedded in an upper level trough lying between Bermuda and the US East Coast. She was identified as Tropical Depression #10 at Noon ADT on the 11th September 2000, around 415 nm WSW of Bermuda with peak winds of 30kt gust 40kt.

The system was quickly upgraded to Tropical Storm status by 3pm, after an aircraft RECON found winds around 60 kn at 1000 ft near the centre. Florence was forecast to slowly intensify and remain slow moving, with an acceleration to the north east after 72 hours, steered by a trough moving off the US coast – and becoming a potential threat to Bermuda.

Florence was upgraded to a minimal Hurricane by 6pm on the 12th and the RECON aircraft identified a 25 nm eye. The system was still in a weak steering flow and remained virtually stationary over the next day or so. Convection gradually weakened, probably due to the storm churning up the ocean and lowering the SST's, resulting in a return to Tropical Storm status on the 13th and 14th. The guidance called for Florence to pass by Bermuda late Friday evening and, after consulting NHC, the BWS issued a Tropical Storm watch at 11:30 am on Thursday the 14th.

By early on the 15th Florence starting to move to the east, as previously predicted – although the track was rather south of east initially. Wind speeds were around 40 to 50 knots and forecast to strengthen by another 10 knots or so as it passed the Island early Saturday morning (16th), just under 60 nm to our west. The watch was accordingly upgraded to a Tropical Storm warning – with forecast winds over the Island in the range 35 to 50 kn.

Florence Intensifies and Accelerates

On the early afternoon of the 15th, it appeared from the GOES visual imagery of the storm, that Florence was accelerating and was now moving ENE at around 15-18 knots. However, the position of the centre was in some doubt, due to the dense overcast, with cloud top temperatures at around minus 70 C. At the 4.30pm conference the NHC forecaster, Lixion Avila, said he was maintaining the speed at around 12 kn. on a heading 070 degrees, with some acceleration later. Although his estimate of the speed differed from ours at BWS, due to the uncertainty caused by the CDO, we did not contest his position for advisory 19. Subsequent examination of the track would indicate that the RECON aircraft position was more accurate and that the forward speed had been well over 15 knots in the afternoon. Lixion's advisory positions for issue at 6pm had the storm passing 45 nm west of Bermuda midday Saturday 16th with maximum wind speed of 50 kn and gusts to 60 kn.

Around 5.30pm BWS received a ship report for 2000 UTC indicating 35 knots, at a position around 200 nm to the SSE of the centre of Florence. This was passed on to the NHC and the recipient (unidentified) said that this confirmed an aircraft RECON report they had just received indicating that Florence was strengthening.

Issue of Hurricane Warning causes some confusion

Just before 6.00 pm as BWS forecasters were preparing to issue the latest advisory, a call was received from Lixion Avila who said that in view of the latest aircraft report of 74 mph just SE of the centre he thought it prudent that we issue a hurricane warning. He said that NHC would issue a special Tropical Cyclone update indicating that Florence was strengthening to a Hurricane and that Bermuda was issuing a Hurricane Warning. The TC update bulletin was issued at 6.11 pm ADT but still maintained Florence at Tropical Storm intensity with aircraft reported winds at 70 mph...and a prospect of intensifying further.

We immediately received a call from RCC Bermuda (Harbour Radio) who inquired after the Hurricane Warning referred to in the TC update (that they had received over their NOAA weather wire system). They were informed that the warning was still being drafted at that time. In the event, the fax transmission of the warning was delayed, as the normal Tropical Updates for 6pm were still being transmitted. Furthermore, the transmission was taking longer than normal, as a third tropical system (TD#12) had been identified and three advisories were now being transmitted. However, besides RCC Bermuda, the other important recipients, i.e. the EMO coordinators and the media, had been informed about the warning, in advance, by telephone. They were also told the reason for the apparent disparity between the warning and the content of the advisory.

Further confusion was generated within BWS and the general public of Bermuda, as, in the event, the NHC did not increase Florence to hurricane strength until the midnight advisory, number 20. The BWS duty forecaster, Mark Guishard, queried the intensity, maintained just below hurricane strength on the intermediate 9pm ADT advisory 19A. The NHC forecaster said that his director had not wished to upgrade the storm "until a more positive hurricane signature was apparent on the satellite imagery". The NHC forecaster said that this was now becoming apparent and that he would be calling Florence a hurricane on the midnight advisory.

A short report, prepared by Mark Guishard, on the BWS operations on the night of the 15th and morning of the 16th is attached, together with a radar image at 0200 ADT.

The Final Outcome

At least now the warning had some substance. Post analysis of the track indicates that this appears to have been placed too far east on both advisories 19A and 20, resulting in the forecast CPA to Bermuda as virtually over the Island, rather than 60 nm to the NW, as was eventually confirmed by the next early morning RECON position just before 0600 UTC (3 am ADT advisory 20A). By this time GOES was into eclipse mode for several hours so it was impossible to get a good fix on the storm as it passed Bermuda. Further aircraft reports and the Barograph trace indicates the CPA at around 60 nm north west of the Island at 6 am ADT. The aircraft found maximum winds at the 850 mb level at 60 kn with central pressure up to 992 mb (up from 988 mb a few hours previously). NHC left the storm at minimal hurricane strength as the aircraft could have missed the strongest winds. Indeed Florence maintained hurricane strength and even increased (70 kn.) by advisory 23 (16/2100 UTC), before gradually weakening as she moved into the cooler waters of the north Atlantic.

Conclusions

- Initial storm track and Dvorak intensities were made difficult due to the CDO.
- The afternoon aircraft RECON data, indicating strengthening, was received too late for inclusion in the 15th September 6pm ADT bulletin.
- NHC were busy with TS Gordon in the Gulf of Mexico.

- Lixion probably did not want to risk Bermuda ending up with another “Emily” and hence preferred to err on the cautious side. (The “track of least regret”)
- We might have done better (in hindsight!) to issue the warning at the same time as the 6pm advisory on Florence alone – and then sent out the other two storm advisories which were of little interest at that time in Bermuda.
- We could have been more explicit in the warning, that the information in the warning superseded that in the advisory. We still had the statement in the warning that the latest forecasts and tropical updates would provide “detailed and up to date information” which in this case, was patently not so.
- It would have been much less confusing for everyone if the NHC had immediately upgraded Florence to a Hurricane on the 6.11 pm ADT special update. I have left a message for Lixion to call me and discuss what happened.

After reading this, I am sure that some other ideas and suggestions for improvement will come up, which we can all discuss.