

Report on 2001 Hurricane Season in Bermuda

Operational Aspects

(submitted to WMO for inclusion in the RAIV/HC-XXIV 2002 Doc 4.2)

Bermuda was affected by several Tropical Cyclones during the 2001 season. The most notable of these, in all aspects, was Karen. Six other TC's, Dean, Erin, Gabrielle, Humberto, Michelle and Olga also passed close to the Island, although with minimal damage.

TC Dean had the courtesy to diminish to a minimal tropical disturbance to our southwest on the 23rd August. The remnants appeared to pass by the Island late on the 24th, giving a few thundery squalls, before regenerating to a Tropical Storm again, several hundred miles to our north, on the 27th.

TC Erin brushed by 90 nm. to the east of Bermuda on the evening of the 9th September. At that time Erin was a major Hurricane with estimated core winds up to 105 kn. Fortunately, only tropical storm force winds affected the Island, with little structural damage, no injuries or loss of life reported. There was some coastal erosion, due to large battering waves. Had Erin tracked only a degree or so further west, it would have been a different story.

From a forecast perspective, there was sufficient notice for the public and emergency managers to take necessary precautions against such a major storm, with watches and warnings being issued, upgraded and downgraded in a timely and logical manner, within constraints of forecast accuracy.

TC Humberto passed 130 nm. to our west on the evening of 23rd of September, strengthening to a Cat II Hurricane, at that time. Apart from some coastal swell there was little effect on Bermuda and no watches or warnings were issued.

TC Gabrielle passed around 170 nm. to the northwest of Bermuda on the 17th September. Tropical Storm watches and warnings were posted for the Island. Minimal tropical storm winds affected the Island with no significant damage.

TC Karen initially formed as a low pressure disturbance on an old cold front, to the southeast of Bermuda on Wednesday, the 10th October. NWP models predicted the low to deepen and pass just west of the Island on the night of the 11th. The BWS issued a gale warning early on Wednesday morning.

Subsequently, the forecast track and timing of the system proved reasonably accurate, but the low deepened much more than expected and the gale warning was upgraded to a storm warning (48 kn. or more) at 2pm local time on the Thursday. The north easterly winds in Bermuda continued to increase, reaching minimal Hurricane force overnight.

Winds decreased to around gale force, from the south, by the afternoon of the 12th as the disturbance moved away to the northwest. The NHC began issuing advisories on sub-tropical storm #1 (later to become Hurricane Karen) at 5pm EDT.

There was considerable damage to vegetation and power supplies, with around 22,000 of the 30,000 power subscribers without electricity by the morning of the 12th. All schools and government offices, and many private concerns remained closed that day. There was also considerable damage and disruption to the marine community, including the two cruise ships that were in port. Since the storm evolved rapidly, wave induced coastal erosion and damage to marine structures was quite minor.

Fortunately there was no loss of life and only a few reported injuries. Initial reports from the insurance community assessed the overall damage as being considerably less than with Hurricane Emily, the last TC to affect Bermuda, significantly, in 1987.

There was considerable public outcry that the populace had not been sufficiently warned. It was apparent that the average Bermudian, and, indeed, emergency managers, paid much less attention to the gale and storm warnings, than they normally do to TC warnings.

Realistically, there is no denying that the extremely rapid development of the system, in close proximity to the Island, combined with the lack of the high-profile publicity that tropical systems enjoy – i.e. watches, warnings, advisories and tracking maps, resulted in real deficiencies in “getting the message across”. This was despite several live radio interviews during the afternoon of the 11th, and television coverage of the expected storm early that evening.

Furthermore, the 55-65 kn. winds actually encountered, together with the significantly high gusts recorded, some in excess of 90 kn., were considerably more, in terms of damaging impact, than the forecast sustained winds of 40 to 50 kn.

The opposite was the case with TC Michelle, which affected Bermuda on the 6/7th November and had been forecast approaching the Island for several days ahead. After conferring with NHC, the BWS issued a Hurricane Watch on the evening of the 4th. Michelle was subsequently forecast to go extra-tropical and merge with a cold front, as it passed south of Bermuda. However, it was agreed with NHC that to avoid any further public confusion, the TC watch/warning system would be retained. Accordingly, the watch was changed to a Tropical Storm warning on the afternoon of the 5th. In the event, maximum sustained wind speed at the airport was 33 kn. with gusts to 49 kn. Gusts of 49 kn. were recorded at Harbour Radio (300 ft ASL). The anemograph trace for the Cable and Wireless site – (275 ft ASL, including a 150 ft tower) revealed a 5 minute period around 1015 UTC on the 7th, with sustained winds around 53 kn. and gusts to 58 kn. Little damage was reported. Most trees and branches that were susceptible to damaging power lines had disappeared during the previous storm. Similarly, all boats with weak moorings had been eliminated, or were safely out of the water. Predictably, the public's reaction was “much ado about nothing”. However, most people agreed this was much better than being caught out.

At the time of writing, 2nd December, TC Olga is still in existence, to our southwest, as a Tropical Storm, expected to dissipate in the next day or so.

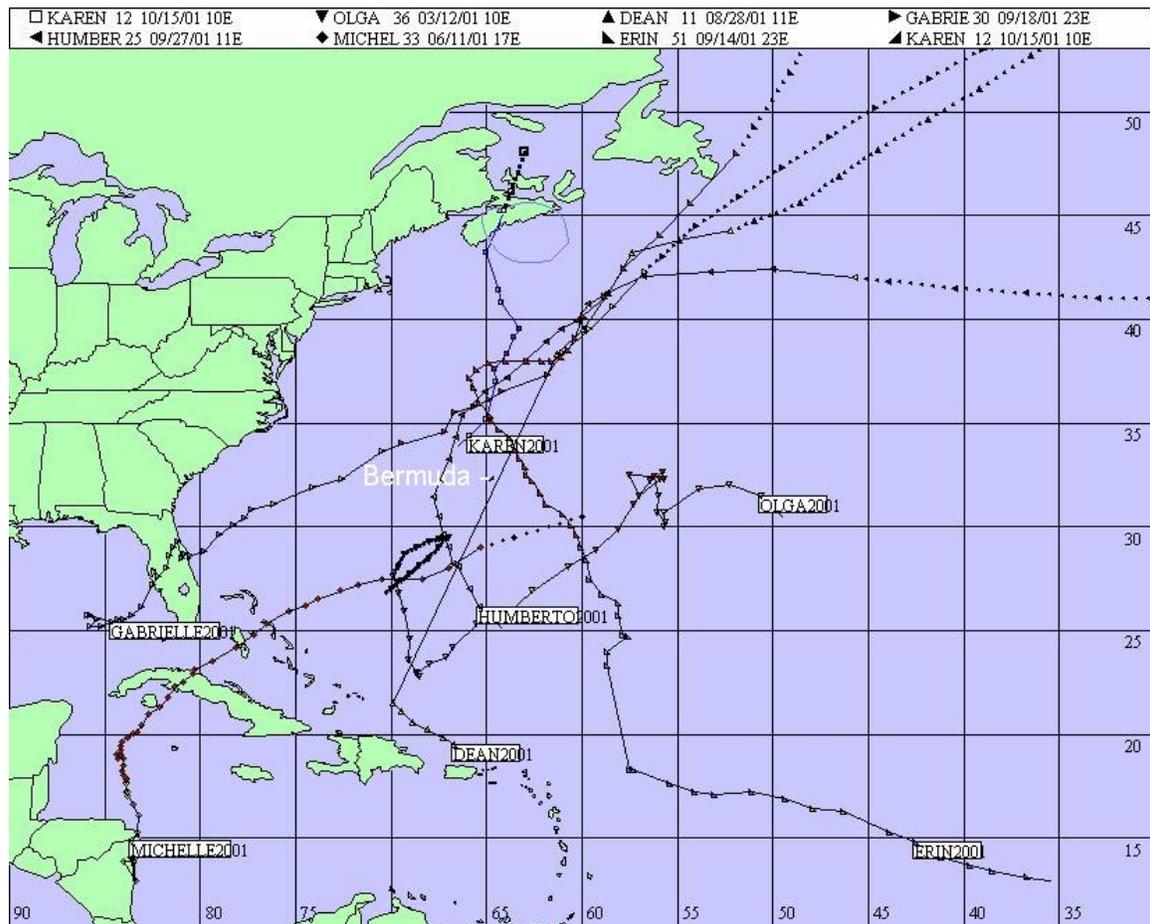
Olga was the second sub-tropical low development of the season, with the NHC issuing advisories from the afternoon of the 24th. Although the low centre was nearly 800 nm. east of Bermuda, the system covered a large area, and strong north to north easterly

gradient winds were already affecting the Island at that time. The BWS issued a gale warning, which later validated, with several days of 30-40 kn. winds being recorded at North Rock (on Bermuda's northern fringing reef). From the 25th to 28th November, Hurricane Olga was nearly stationary, several hundred miles to the east of Bermuda. It was, however, agreed with the NHC that we maintained our warning at non-tropical status (i.e Gale), unless the TC threatened the Island more directly. Olga eventually began moving towards the southwest, passing around 320 nm. to the southeast of the Island on the 29th.

Again there was minimal damage, although there were large swells, of the order 15-22 ft. One notable casualty was the World International 14 Yacht regatta, with most races being cancelled due to the high winds.

A more detailed presentation on TC Karen and the impact on Bermuda, will be circulated at the RAIV HC meeting.

Fig.1. Chart of TC's affecting Bermuda in the 2001 season (courtesy Hurrevac)



Item for discussion under Agenda Item 6

In terms of possible improvements in the operational plan, the RAIVHC need to review the policy concerning the issue of NHC advisories on sub-tropical systems, in order to achieve consistency.

The mechanism for transition of these systems into the full tropical stage is not fully understood and, despite the science, if there is risk to life involved, we should take the pragmatic approach, and issue tropical style advisories, and even, watches and warnings, since this is what the public and emergency managers would prefer.

Meanwhile, it is understood that the Bermuda Emergency Measures Organisation will also be reviewing its procedures laid down for reaction to our local non-tropical storm warnings, whether winter or summer.

Minor matters, to be clarified with the NHC

The BWS issue local marine warnings, i.e. small craft, gale and storm, for the Island, and the surrounding Marine Area. This area is designated as extending 25 nm. around Bermuda, for marine forecast purposes. Accordingly, we would prefer, to avoid confusion, that Bermuda's TC warnings also cover this area. We understand that some other Caribbean Islands might have much larger, designated marine areas and such a practice would be misleading in those cases. However, Bermuda is a small Island and the designated marine area is also relatively small.

The only observational data disseminated internationally from Bermuda, are those for the airport. Unfortunately the airport anemometers are poorly exposed to winds from the north east through north west, such that winds over the open sea and exposed areas are invariably, considerably higher. We wish to point this out, since, under these circumstances, the TXKF wind data will likely be at variance with the analysed gradient. Indicated gusts from these directions are usually representative of sustained winds over the adjacent sea and exposed areas. We aim to include the data from North Rock on our web site (www.weather.bm) by next season.

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3rd December 2001