

**PRELIMINARY REPORT ON TROPICAL STORM FAY FROM BERMUDA - FOR THE 37<sup>TH</sup> SESSION OF THE WMO REGIONAL ASSOCIATION IV HURRICANE COMMITTEE.****Hurricane Fay, October 11<sup>th</sup>-12<sup>th</sup>**

Bermuda Weather Service (BWS) first contacted the Bermuda Emergency Measures Organisation (EMO) on Wednesday 8<sup>th</sup> October immediately after speaking with the National Hurricane Center (NHC) in Miami regarding concern for the development of a trough of low pressure a few hundred miles to the east of the Leeward Islands. This low had not yet been identified by the NHC as a probability of formation in their 5 day outlook. The NHC then issued a probability forecast on Thursday, giving the trough a 20% probability of formation within 5 days. This information was conveyed to the public in the BWS Forecast Discussion, as well as via our regular local radio broadcasts. In addition, our public forecast synopsis was adjusted to highlight the fact that we were monitoring this possible development.

BWS then began issuing advisories on newly developed Subtropical Depression Seven at noon on Friday 10<sup>th</sup> October. This depression was located around 500 nautical miles south of the Bermuda and was expected to pass the Island around 100 nautical miles to the southeast on Sunday morning as an intensifying Tropical Storm. At this stage it was deemed a 'Potential Threat' and a 'Tropical Storm Watch' was issued.

Subtropical Depression Seven developed into Subtropical Storm Fay at 6pm on October 10<sup>th</sup> around 450 nautical miles to our south. It then gained enough tropical characteristics to be deemed a pure tropical storm (TS Fay) at 9am Saturday morning.

With the storm intensifying into a strong tropical storm, and the closest point of approach getting noticeably closer to the Island for early Sunday morning on the 12<sup>th</sup> as per regular update briefings with the NHC, BWS issued a Tropical Storm Warning at 5.30am on Saturday 11<sup>th</sup> October.

As a consequence of this warning, a press release was issued to by the EMO that day to advise the public to take the necessary precautions in advance of Tropical Storm Fay.

A further update was made at 4.30pm on Saturday, when BWS in consultation with the NHC not only issued a continuation of the Tropical Storm Warning, but also a Hurricane Watch, as there was a risk that temporary hurricane force winds could affect parts of the Island (especially exposed and elevated areas) in association with heavy thunderstorms during the early morning of Sunday as Fay made its closest approach and began to accelerate away to the east-northeast. Wording in the coincident NHC Advisory #7 included the following statement:

**“THE CENTER OF FAY IS EXPECTED TO PASS JUST TO THE SOUTHEAST OF BERMUDA EARLY SUNDAY MORNING. HOWEVER...ONLY A SLIGHT DEVIATION TO THE WEST OF THE FORECAST TRACK WOULD BRING THE CENTER AND THE CORE OF STRONGEST WINDS OVER BERMUDA.”**

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The EMO was once again advised accordingly. The Tropical Storm Warning and Hurricane Watch remained posted through Saturday night, in advance of the expected worst conditions early Sunday morning.

Wording in NHC Advisory #9 issued at 6am local time, just ahead of the worst conditions felt across the Island included:

“WIND...TROPICAL STORM CONDITIONS WILL CONTINUE OVER BERMUDA THROUGH THIS MORNING. HURRICANE CONDITIONS ARE POSSIBLE OVER BERMUDA DURING THE NEXT FEW HOURS.”

Winds generally peaked at 7-8am across the Island on the morning of the 12th, a couple of hours later than initially forecast the evening before.

In addition, Bermuda essentially sustained a direct hit from Fay, with its expected movement toward the northeast not occurring until after it had passed almost directly over the Bermuda area.

A chart of maximum wind speeds recorded at this time is detailed below, with the more elevated/exposed locations seeing the highest velocities:

Location	Maximum sustained wind	Maximum gust
<b>LF Wade International Airport (MIDAS – approx. 40ft)</b>	53.9 knots @ 1034Z	71.0 knots @ 1034Z
<b>Causeway sensor (ultrasonic – approx. 40ft)</b>	N/A	90.5 knots (instantaneous) @ 1103Z
<b>RCC Bermuda Maritime Operations Centre (290ft)</b>	84.7 knots @ 1101Z	102.2 knots @ 1101Z
<b>St David’s AWOS (50ft)</b>	68.9 knots @ 1050Z	100.3 knots @ 1110Z
<b>Fort Prospect AWOS (230ft)</b>	63.9 knots @ 1030Z	102.2 knots @ 1040Z
<b>Commissioner’s Point, Dockyard AWOS (approx. 150ft)</b>	75.7 knots @ 1020Z	106.7 knots @ 1020Z

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The extreme wind conditions began to abate around 1130Z or 8.30am local time.

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Note that NHC advisory #11 finally indicated an upgrade of Tropical Storm Fay to a weak category 1 hurricane (65 knots) at 6pm on Sunday 12<sup>th</sup> October. At this point the tropical cyclone was positioned approximately 250 nautical miles to the northeast of Bermuda. Only a day or so later, at 6pm on Monday 13<sup>th</sup>, the NHC posted their final advisory on Fay as it dissipated as a post-tropical cyclone.

A wealth of media reports and photos are available on two local news websites - <http://www.royalgazette.com/> and <http://bernews.com/>.

Considering the limited lead time available for Fay, the track and intensity forecast of this tropical storm's onset for Bermuda was generally good, with increasing confidence as it made its final approach. Noted subtleties were:

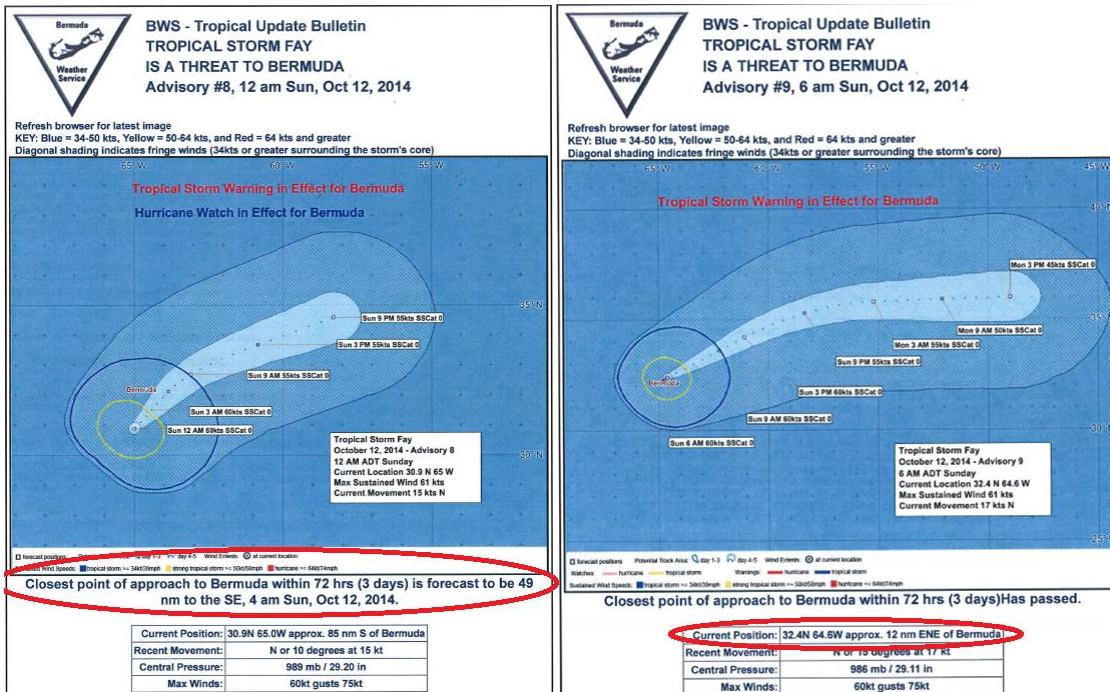
1. The caveat of a slight nudge to the west of the track during Fay's final approach would essentially give Bermuda a direct hit.
2. Winds were more excessive than expected, considering Fay's maximum sustained analysed/forecast winds of 60 knots prior, during and post Bermuda landfall.
3. Gust ratios associated with Fay were high (towards x1.6), and this is likely associated with the very active thunderstorms moving over the Island at the time.
4. There was evidence on the BWS Doppler Radar of tornadic activity (meso-vortices) moving across parts of the Island, especially towards the west end – see radar section later.

### **Damage reports**

Damage from what was only an hour or so of extreme winds was widespread. There were numerous felled trees as well as utility lines, and some boats were also damaged as they broke their moorings. Insurance claims are likely to have run into tens of millions of dollars (no definitive figure on this at time of writing), and some utility customers were out of power and cable for at least a few days. This was later compounded by further extensive outages meted out by Hurricane Gonzalo.

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**BWS local products - (tropical update bulletins or TUBs) as Fay made landfall:**



The two TUBs above clearly illustrate TS Fay's later than predicted move to the northeast, with a CPA of 49 nautical miles forecast Saturday midnight as per advisory #8, and then a current position of just 12 nautical miles to the east-northeast at 6am local time on the Sunday.

The lowest pressure according to the local TUBs was noted as 986mb. Local observations of pressure included the airport/BWS Meteograf recording as well as data from the NOAA tide gauge at Esso Pier"

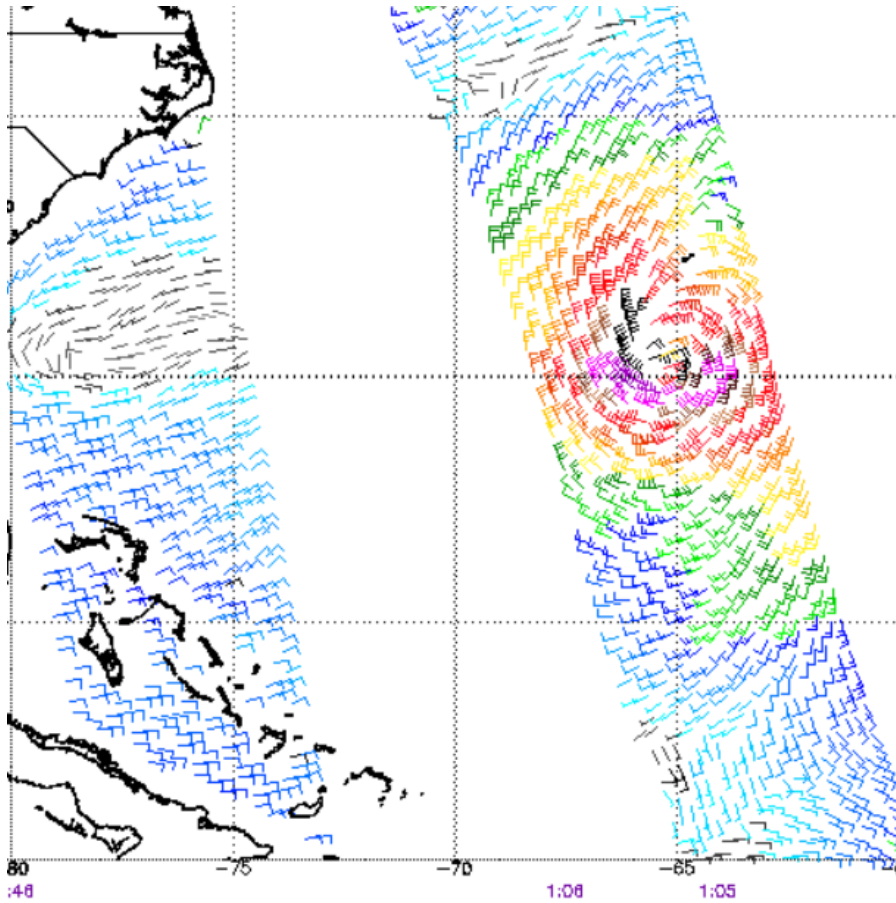
BWS Meteograf (airport) – 985.1mb (29.09inches) at 0820UTC

NOAA tide gauge – 985.5mb (29.10 inches) at 0712UTC

**Satellite derived wind images –**

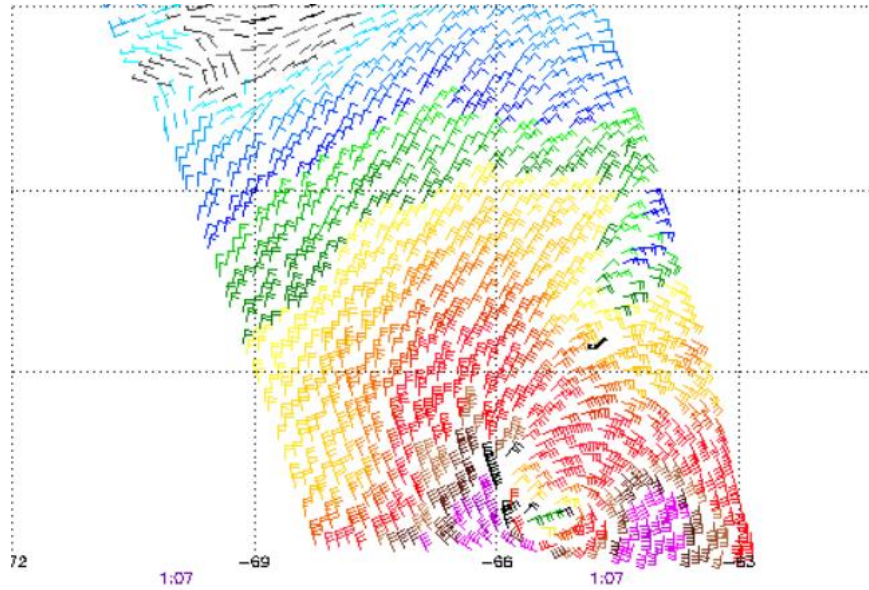
Ascat satellite overpass (50km resolution at 0105Z on the 12<sup>th</sup>) showing the circulation of TS Fay to the south of Bermuda – the pass shows strongest winds on the southern and western flank of Fay's centre:

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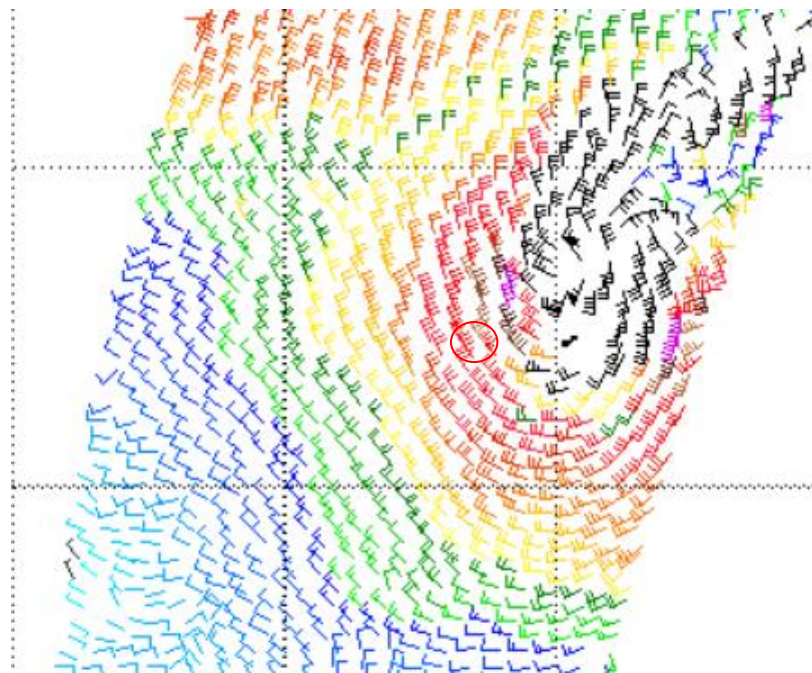


Further Ascet image (25km resolution) at 0107Z on the 12<sup>th</sup> clearly shows a core of strong winds on the western flank of Fay approaching Bermuda:

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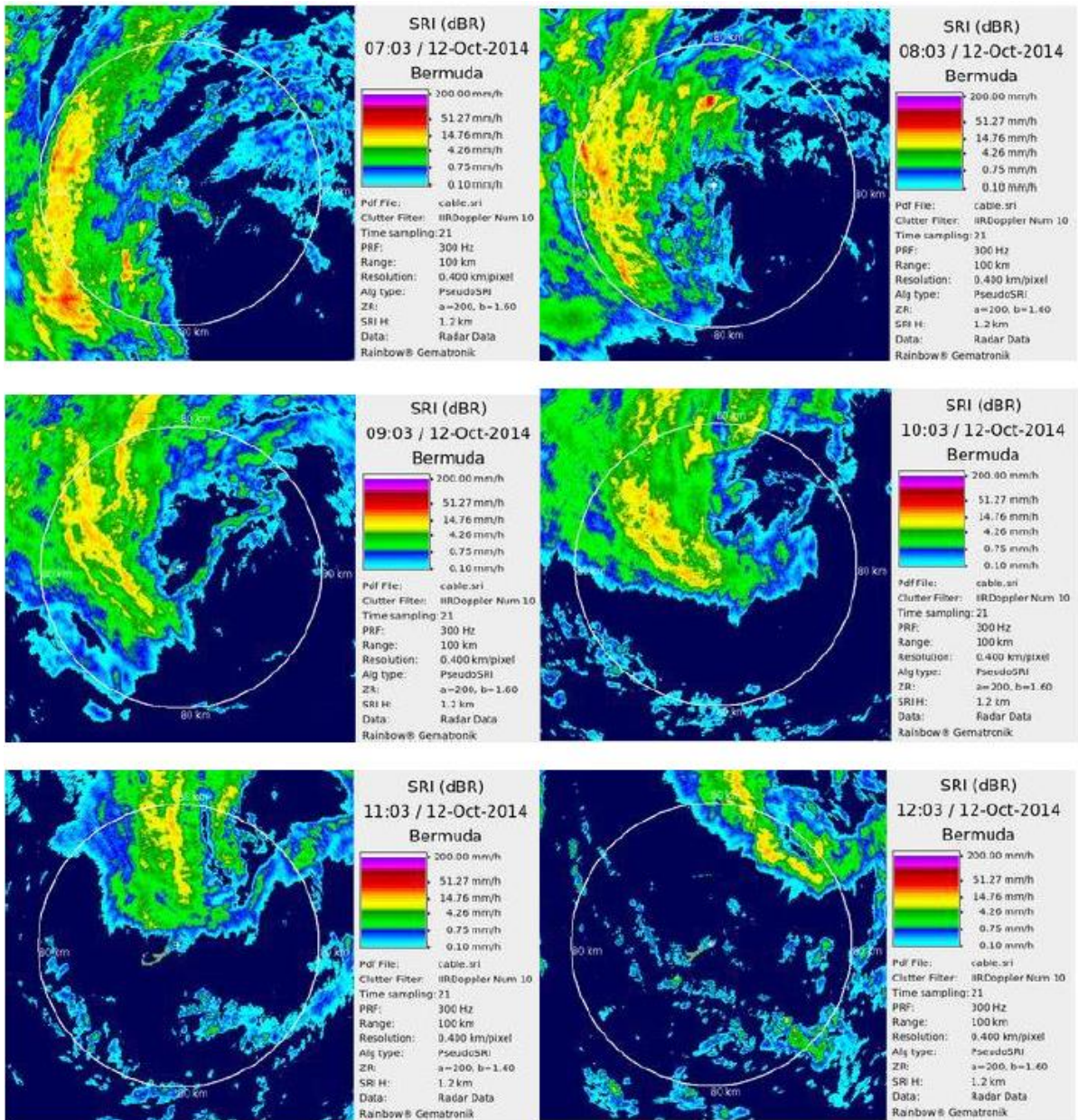
Further to this, a Windsat pass from 1102Z on the 12<sup>th</sup> shows Fay as it moved away northeast out of the Bermuda area (ringed in red):



**Radar imagery -**

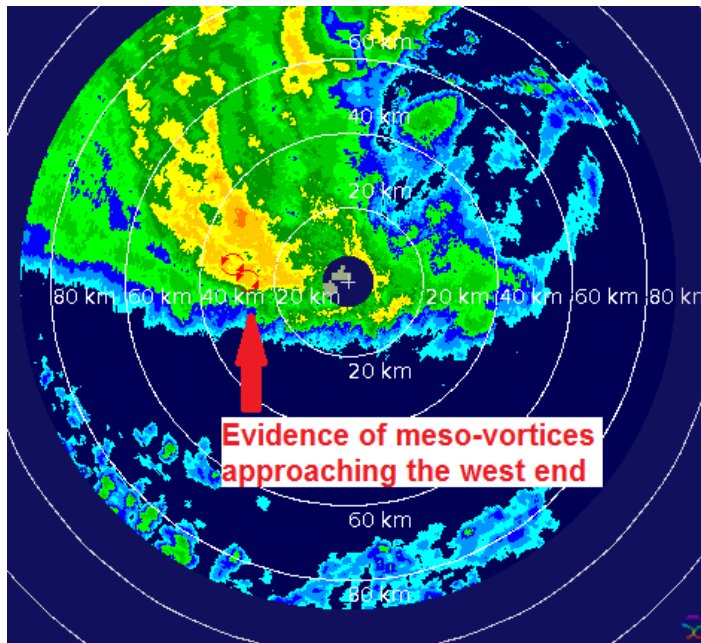
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A sequence of radar images from 0703Z through 1203Z showing the passage of the western 'eyewall type feature' as it moved over the Island (N.B.):

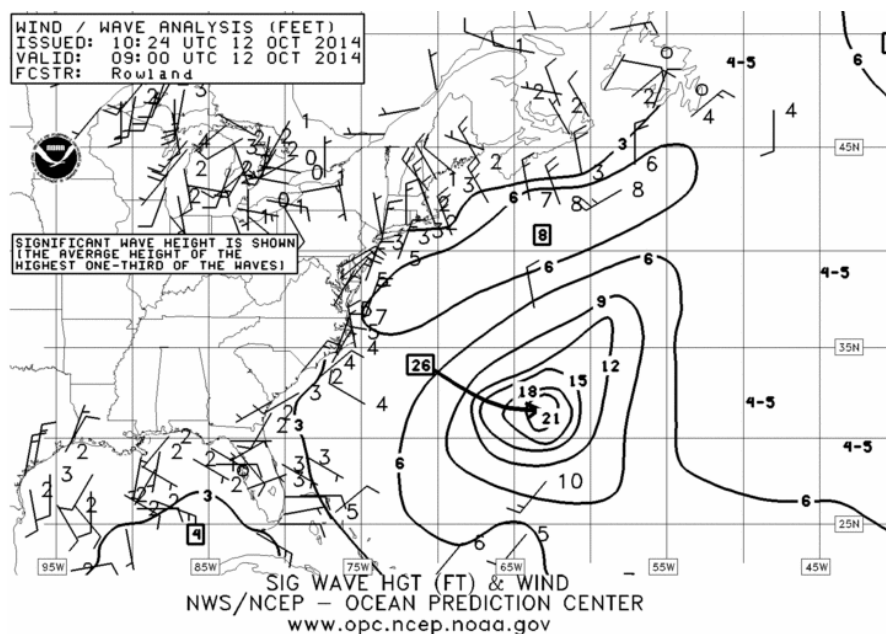


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There was evidence of meso-vortices moving across Bermuda in concert with the deep convection:



**Seas** – The 09Z OPC analysis on Sunday 12<sup>th</sup> October indicated seas in excess of 20ft around the Bermuda area:

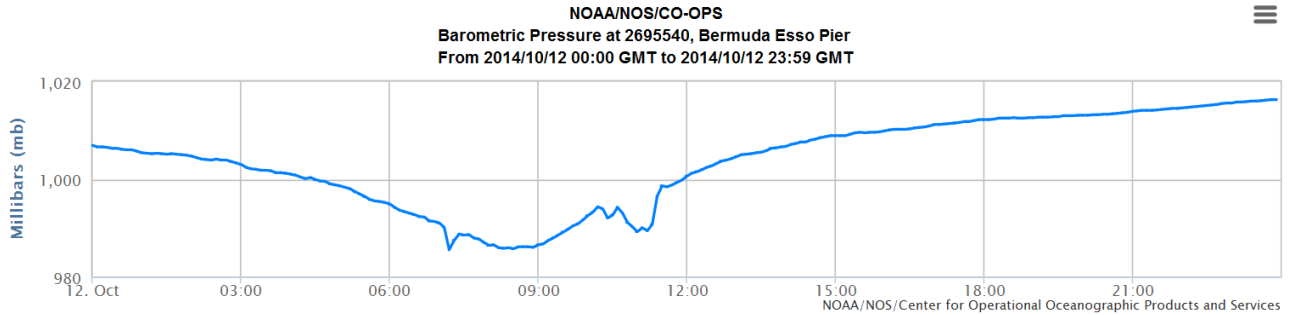




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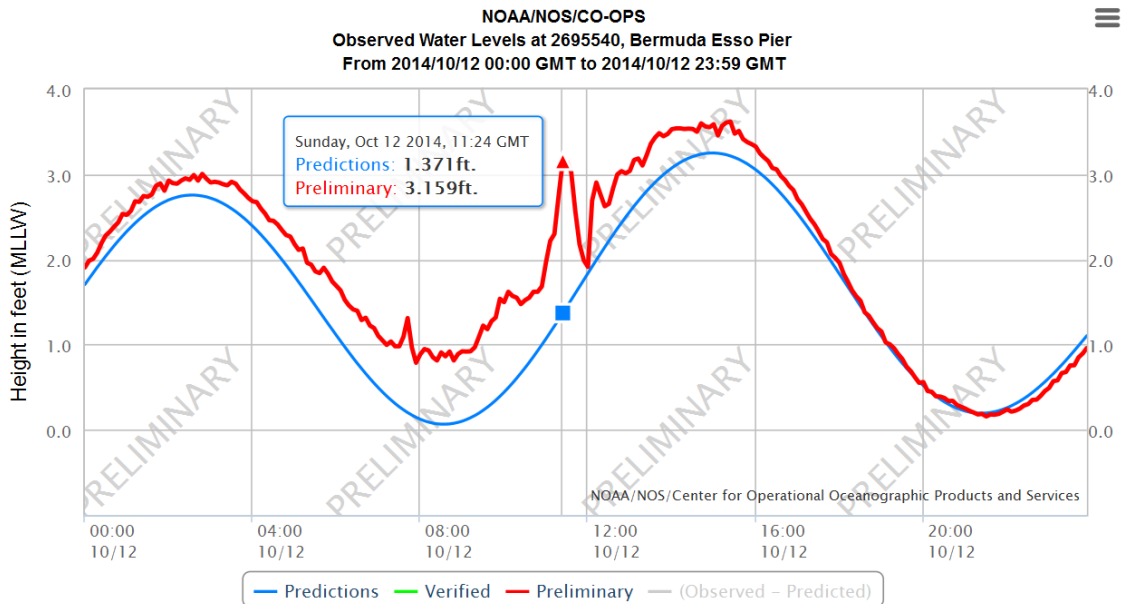
**Pressure - NOAA Tide Gauge at Esso Pier, St George's**

Barometer trace falling to 985.5mb/29.10inches at 0712Z:



**Tidal data from Esso Pier –**

Data suggests a maximum storm surge/tide approaching 2ft at 1124Zm around the time of mid-tide:



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The Hurricane Watch was ended with the 05:30am forecast update on Sunday 12<sup>th</sup> October, with the Tropical Storm Warning remaining in place until midday, when it was superseded by a Small Craft Warning for strong winds (20kt or more) and rough seas (9ft or more).

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**Reclassification by the National Hurricane Center –**

As is customary, the NHC specialists also compile a report on significant Tropical Cyclones. With regards to Fay, the NHC engaged in protracted communications with BWS, especially with respect to recorded wind velocities across the island, as well as the extensive data that the airport's S-Band Doppler radar provided during the event. The main reason for this was due to the borderline hurricane status of strong Tropical Storm Fay, and whether, with extensive research of event data, the storm could be reclassified as a weak category 1 hurricane. Note that in advance of the Fay's impact, the NHC were providing intensity forecasts via satellite derived intensity estimates (Dvorak method, Microwave imagery etc.), limited surface observations such as ocean buoys (NDBC buoy 41049, 300nm south of Bermuda), and Hurricane Hunter aircraft reconnaissance data. In effect, despite this wealth of data, the intensity forecast was a well educated estimate, but a shift of only a few knots in intensity would mean a strong 60 knots tropical storm becoming a weak 65-70 knot category 1 hurricane.

So after extensive post-analysis of all the data available, the NHC on Wednesday 3<sup>rd</sup> December were in a position to reclassify the intensity of Fay as it passed the Bermuda area. Their findings indicated that Fay was indeed already a hurricane as it brushed the southeast of the Island area during the early morning of the 12<sup>th</sup> October. It was technically a landfall with sustained winds of 70 knots. Finally, it is worth noting that Fay was the first 'hurricane landfall' for Bermuda since Hurricane Emily in September 1987.

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Report published by:

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Bermuda Weather Service  
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