

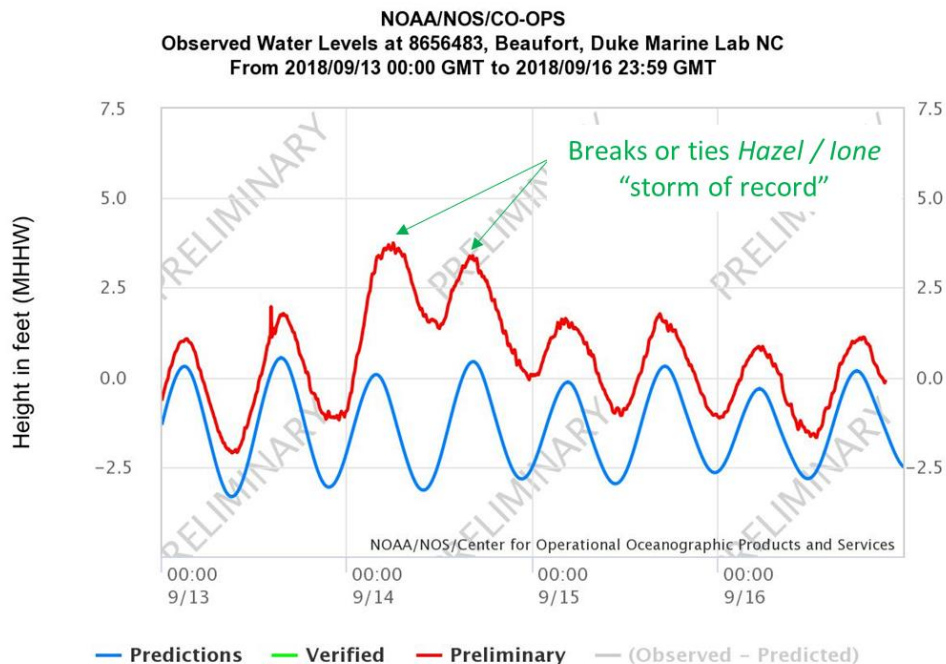


Hurricane Florence - Preliminary Assessment for Bogue Banks Oceanfront (9/16/18)

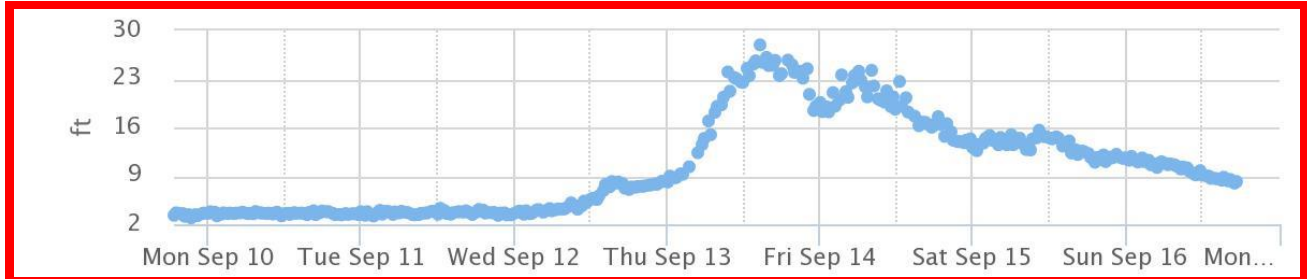
Summary Points:

- (1) Significant beach and incipient dune erosion, limited frontal dune erosion that generally starts at the Circle, Atlantic Beach and progresses westward.
Before and after photo slideshow – [CLICK HERE](#)
- (2) Florence becomes the **storm of record** (twice) for high water level at the Beaufort tide gage.
- (3) The infusion of sand via beach nourishment and subsequent development of incipient, or “baby” dunes since hurricane Floyd (1999) protected ~23 miles of homes, hotels, public accesses, and infrastructure for the storm of record. There was no flood damage to oceanfront structures, nor any breaches of the frontal dune. Structural damage was limited to walkways only.

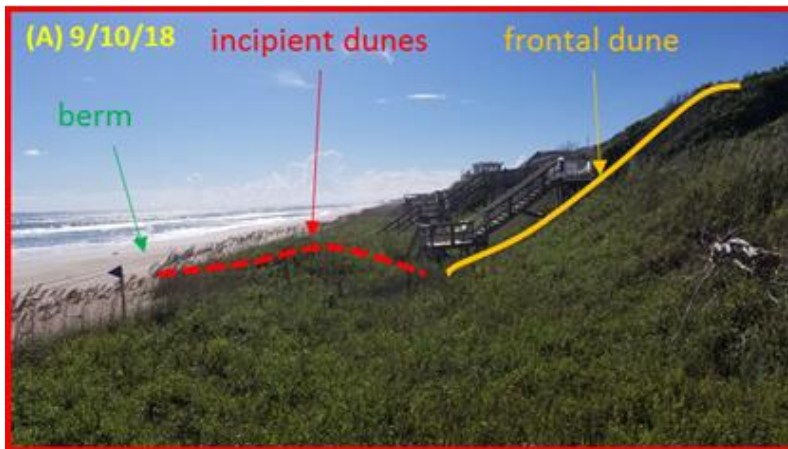
Storm of Record (2) – NOAA's National Ocean Service top ten highest water levels at 110 of their longest-term tide gage stations is provided at https://tidesandcurrents.noaa.gov/est/Top10_form_ft.pdf. The highest water level ever recorded at the Beaufort, NC gage (8656483) was 3.39 feet relative to MHHW – achieved exactly twice during Hazel (1954) and Ione (1955). Florence exceeded this benchmark the first time early Friday morning (9/14/18 @ 5:54 GMT) with a 3.75 feet MHHW reading, and proceeded to tie the Hazel/Ione record the subsequent high tide later that afternoon (3.39 feet MHHW @ 16:12 GMT). This resulted in an unprecedented “one-two” punch to Carteret County.



Offshore Waves and Storm Surge – The nearest wave buoy is located roughly 40 miles due south of Beaufort Inlet ([LEJ3](#)) and recorded a wave height of 28 feet on Thursday afternoon (9/13/18) as *Florence* approached Bogue Banks (image below). The maximum wave height for the last hurricane significantly impacting Bogue Banks was 25 feet (*Irene* 2011).



Storm surge is the wall of water being pushed by a hurricane in the northeast quadrant, while storm tide includes the additive or subtractive impacts of the tide. The magnitude of storm surge is predicated on numerous factors such as; storm intensity, forward speed, angle of approach, and slope of the continental shelf. The storm surge plus wave action drives peak erosion during hurricanes - at the present it is unclear what the actual storm surge and/or storm tide was for Bogue Banks.



Beach Erosion – The incipient dune field is generally a result of pioneer vegetation along the beach berm initiating dune growth and/or as an offshoot of various sand fencing and dune planting activities that have been coordinated through the local municipalities, home owner groups, and individuals; and importantly acts as a line of defense to the large foredune that fronts most of Bogue Banks and often exceeds an elevation of 20 feet. The berm is the “flat part” of the beach. **Florence significantly impacted the berm and incipient dune field, and only in very isolated areas impacted the foredune** (see preceding page – Memorial Park, Pine Knoll Shores)

Photos

[All Pre Storm Photos](#)

[All Post Storm Photos](#)

[Select Before and After Slideshow](#)

Surveying, Volume, and Beach Nourishment – Later this week, *Geodynamics, LLC* will mobilize and begin surveying 122 transects along Bogue Banks (spaced roughly 1,000 feet apart), which is part of one of the most comprehensive, annually surveyed [beach monitoring](#) networks in the U.S. The last survey was conducted in the Spring of 2018 prior to the hurricane season and will serve as our pre-storm survey.

The County/Bogue Banks predominantly takes a volumetric approach to ascertain beach health. 2018 marks the nineteenth anniversary of hurricane *Floyd* and since 1999; Bogue Banks has gained roughly 9.6 million cubic yards (cy) of sand, which is mostly attributed to the many beach nourishment projects that have been constructed along the island beginning in 2001. A total of approximately 14.5 million cy of sand have been placed directly on Bogue Banks as a result of beach nourishment, meaning 4.9 million cy have since eroded off the beach (14.5 million cy placed on the beach minus 9.6 million cy remaining). If we average the volume loss (-4.9 million cy) across the entire 128,393 feet (24.3 miles) of Bogue Banks oceanfront, the island has lost sand at a rate of -2.0 cy per linear foot per year (cy/ft/yr) since 1999 (a 19-year window). In addition to gaining a better understanding of how much sand was lost/eroded during *Florence*, we will be able to place this event in a greater long term context and begin planning for future beach nourishments projects immediately.

The infusion of sand via beach nourishment and subsequent development of incipient, or “baby” unquestionably protected ~23 miles of homes, hotels, public access, and infrastructure for a storm of record. There was no flood damage to oceanfront structures, nor any breaches of the frontal dune. Any physical damage was limited to walkways only. Compared to *Floyd* (1999), which was not a storm of record nor arguably as much of a “direct hit” as *Florence*, the beaches performed very well with the added sand borne from beach nourishment (see image below).

