

CDIP Wave Observations During Hurricane Matthew

James Behrens, Eric Terrill, Julianna Thomas, David Castel, Richard Seymour, Robert E. Jensen¹
Scripps Institution of Oceanography, US Army Corps of Engineers²
jb@cdip.ucsd.edu



Hurricane Matthew

- Strongest storm of the 2016 Atlantic hurricane season
- First Category 5 in the Atlantic basin since 2007

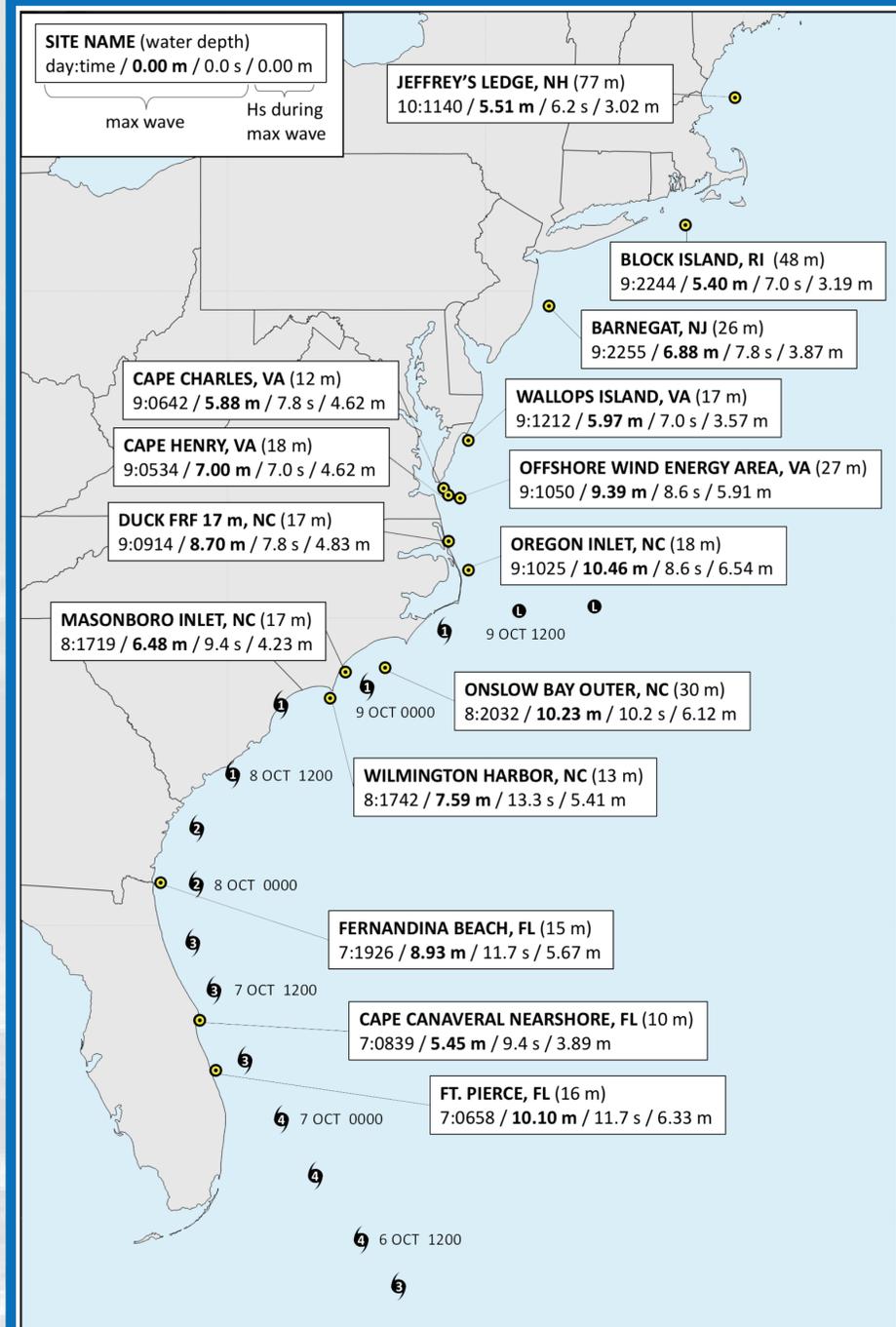


Figure 1. Wave buoy locations offshore eastern United States. Hurricane Matthew eye locations and storm intensities from NOAA's National Hurricane Center. Dates and times are UTC October 2016.

Wave Observations

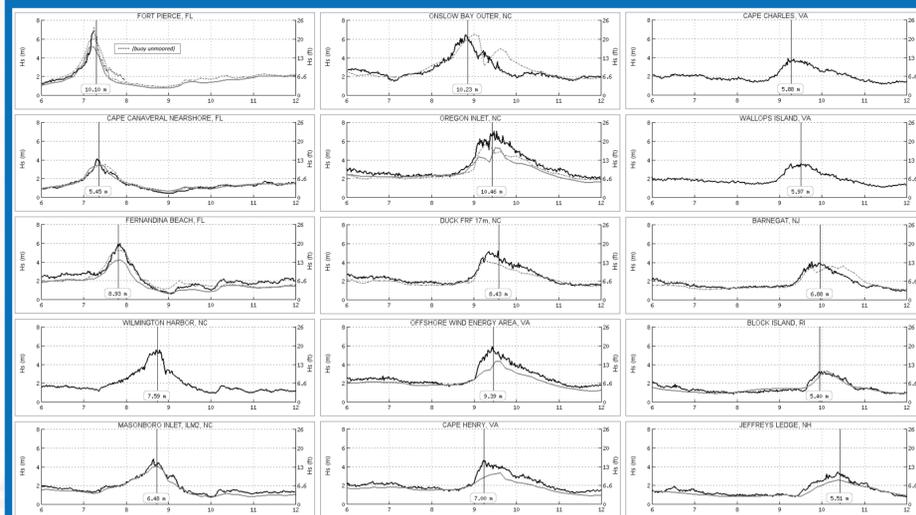


Figure 2. Significant wave height (Hs) measured by CDIP wave buoys October 6-11, 2016 (all times UTC). For each buoy, Hmax arrival time and amplitude are indicated. Where available, NOAA's operational WWS and NWPS predictions are shown. Buoys are displayed in order from south to north.

Table 1.

Maximum recorded wave heights during October 2016 Hurricane Matthew event (listed from south to north).

Station name	UTC (DD-HH)	Hmax (m)	Tmax (s)	Hs (m)	Tp (s)	Dp (deg)	Delay (hr)	Hmax / Hs	Depth (m)
Fort Pierce, FL	07-06	10.10	11.7	6.33	11.76	069	1.19	1.60	16
Cape Canaveral Nearshore, FL	07-08	5.45	9.4	3.89	14.29	119	1.03	1.40	10
Fernandina Beach, FL	07-19	8.93	11.7	5.67	13.33	123	-1.36	1.57	15
Wilmington Harbor, NC	08-17	7.59	13.3	5.41	12.50	182	0.49	1.40	13
Masonboro Inlet, NC	08-17	6.48	9.4	4.23	10.53	134	1.58	1.53	17
Onslow Bay Outer, NC	08-20	10.23	10.2	6.12	9.88	158	0.84	1.67	30
Oregon Inlet, NC	09-10	10.46	8.6	6.54	9.09	355	-2.86	1.60	18
Duck FRF 17 m, NC	09-09	8.70	7.8	4.83	9.09	033	-4.72	1.80	17
Offshore Wind Energy Area, VA	09-10	9.39	8.6	5.91	8.33	028	0.21	1.59	27
Cape Henry, VA	09-05	7.00	7.0	4.62	7.14	044	0.09	1.52	18
Cape Charles, VA	09-06	5.88	7.8	3.64	10.53	104	1.49	1.62	12
Wallops Island, VA	09-12	5.97	7.0	3.57	11.76	139	-0.07	1.67	17
Barneгат, NJ	09-22	6.88	7.8	3.87	7.14	019	4.64	1.78	26
Block Island, RI	09-22	5.40	7.0	3.19	6.25	035	-1.46	1.69	48
Jeffrey's Ledge, NH	10-11	5.51	6.2	3.02	9.09	064	2.26	1.82	77

UTC: Universal Coordinated Time day and hour of Hmax arrival, October 2016
Hmax: Amplitude (trough-to-crest) of largest recorded individual wave
Tmax: Period of Hmax wave
Hs: Significant wave height at time of Hmax arrival
Tp: Peak period corresponding to the measured Hs
Dp: Peak direction corresponding to the measured Hs (meteorological convention)
Delay: Time elapsed between Hs max and Hmax; Delay > 0 means Hmax occurred after Hs max
Hmax / Hs: Ratio of Hmax to Hs during the time interval of Hmax arrival
Depth: Water depth at buoy station

Hindcast Comparison

Hs values from NOAA's Operational Wave Watch III output vs. Hs values computed from the station buoy data record centered within 30 minutes following each hindcast.

Mean slope was computed by least squares linear regression for each storm-centered quadrant (i.e. quadrant 1 is NE of the storm eye, increasing clockwise), for storm eye locations within 8 degrees of arc (~900 km) of each station.

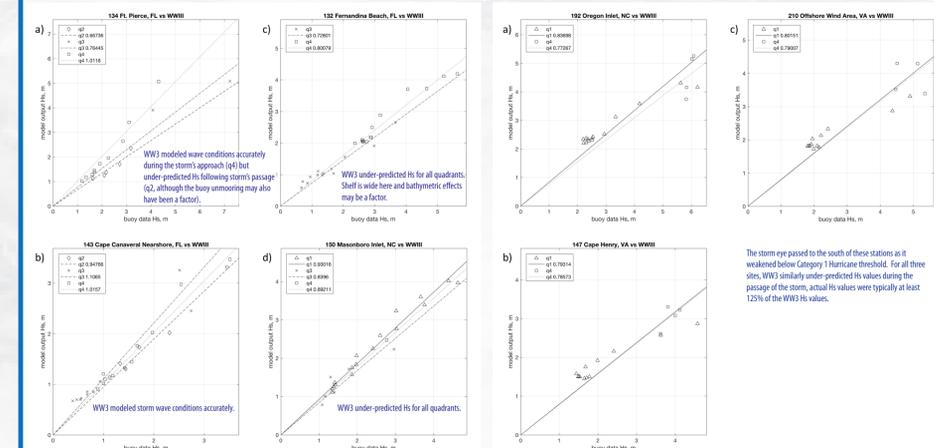


Figure 3. Scatter plots of Hs values from WaveWatch III hindcast vs. buoy data analysis for stations south of Cape Hatteras, separated by quadrant of station location relative to hurricane eye location. Mean slope for each quadrant is indicated.

Figure 4. Scatter plots of Hs values from WaveWatch III hindcast vs. buoy data analysis for stations north of Cape Hatteras, separated by quadrant of station location relative to hurricane eye location. Mean slope for each quadrant is indicated.

Coastal Data Information Program (CDIP)

- CDIP is a wave monitoring network along United States coastlines.
- Established 1975
- Primary funding comes from the U.S. Army Corps of Engineers (USACE).
- Several sites analyzed here are cost shared with the U.S. Navy and National Oceanic Atmospheric Administration's U.S. Integrated Ocean Observing System (NOAA IOOS), and the US Navy.
- Datawell Waverider moored directional wave buoys are the wave sensors.
- Sensitive to wave motion period range 2 sec < T < 30 sec
- Waveriders report their continuous wave observations in 27 minute segments.
- Data telemetry is via Iridium.
- Data quality control is applied prior to dissemination to NOAA/NDBC/NWS.
- These data streams are converted into a variety of standardized data products by CDIP at the Scripps Institution of Oceanography, University of California, San Diego, and are available in near-real time.
- At present, CDIP's network consists of ~70 buoys.