Hurricane Irene Observations at the Field Research Facility

The eye of Hurricane Irene passed approximately 8km west of the Field Research Facility (FRF) on 27 August 2100UTC (Figure 1). Meteorological and oceanographic instruments remained operational throughout the storm in both the ocean and sound environments at the FRF (Figure 2). The extensive complement of data (e.g. winds, waves, currents, water level, runup, morphology) gathered from the northeast quadrant of a category 1 hurricane is quite rare and may provide unprecedented insight into storm processes as well as critical model validation data. A very preliminary analysis of these data reveals a few interesting highlights from the event.

Storm surge and runup: Maximum observed storm surge (including astronomical tides) on the ocean side was 0.92m, NAVD88 (Figure 2; panel 5) but the water level reached an elevation of 4.26m, NAVD88 due to 3.34m of wave-driven runup. The maximum observed storm surge on the sound side, interestingly, more than doubled what was measured on the ocean at 1.90m (NAVD88) and is the highest water level measured in the sound at the FRF since observations began in 1979 (Figure 2; panel 6).

Winds: The maximum wind gust measured from the end of the pier was 37.6m/s (75kts). Maximum sustained wind speed, both adjusted to +10m MSL, was 32.6m/s on the ocean and 23.0m/s on the sound (Figure 2; panel 4).

Waves: Significant wave height, measured roughly 16km offshore, peaked at 7.1m. Significant wave heights exceeded 3m (15s period) for 18hr at our wave buoy located 3km seaward of the pier (Figure 2; panels 1-3).

Currents: Observations from the cross-shore array showed a peak current velocity of 3m/s (6kts) at the most shallow sensor, located roughly 50m from the beach at a depth of 2m, approximately 1hr before the maximum wind.

Seabed changes: The elevation of the seabed in the inner surf zone, located approximately 50m from shore, lowered 30cm in 30hr. Seabed elevation recovered to pre-storm levels and accreted an additional 5cm just 12hr after the passing of the hurricane eye (i.e. complete recovery prior to the end of the storm).

Morphology: Beach change was relatively nominal along a 5km reach of shoreline measured by CLARIS at the beginning and end of the storm. A noteworthy exception occurred at a small, hotspot region, less than 600m alongshore, where the dune retreated approximately 5m. Figure 3 illustrates this change where the white point cloud shows the topography prior to the storm and the red point cloud shows the beach and dune topography just after the storm passed.

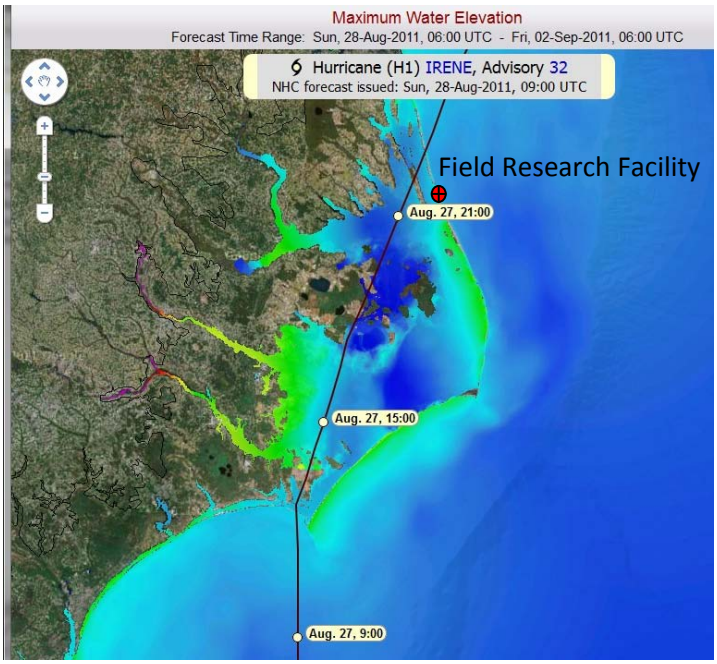

Figure 1: Track of Hurricane Irene through North Carolina, 27-28 August 2011.

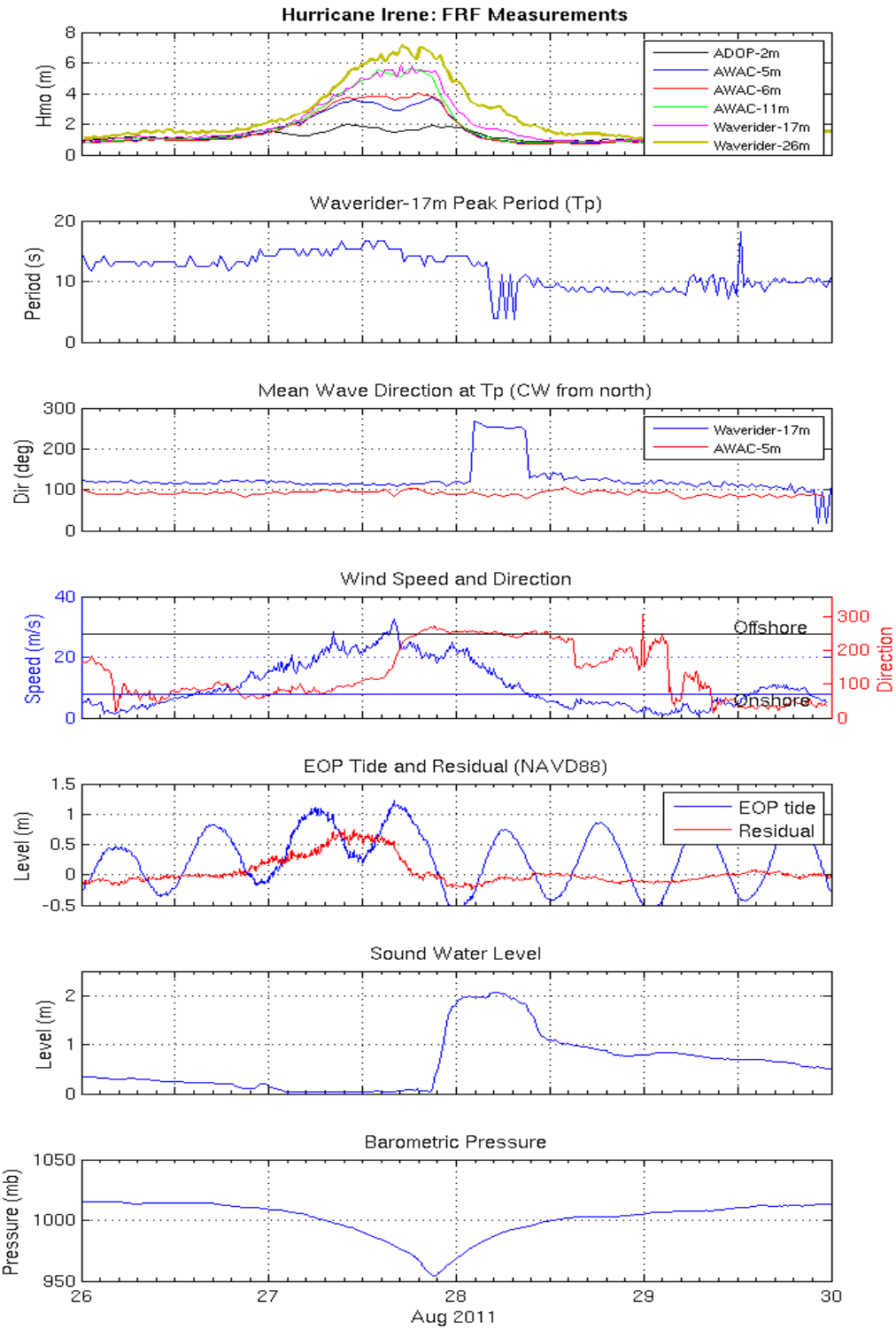

Figure 2: Oceanographic and meteorological observations at the Field Research Facility during Hurricane Irene, 27-28 August 2011.

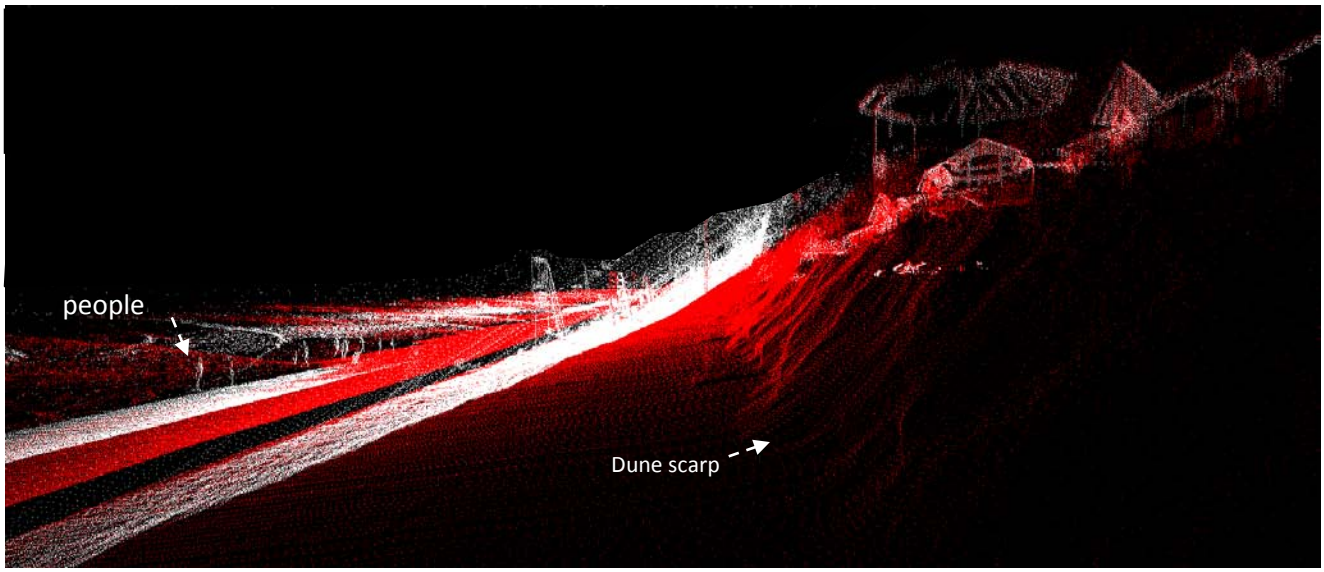

Figure 3: LiDAR topographic point cloud collected by CLARIS before the storm peak (white) and at the end of the storm (red). View oriented in profile looking south with the dune scarp (5m retreat) on the right and the lower foreshore on the left.