Measuring dune, beach, and nearshore response to an extreme event: Atlantic City, New Jersey

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Extreme storm events can wreak havoc on the shoreline, infrastructure, and important coastal habitats. Hurricane Sandy (October 29, 2012) provided a clear example of the impact from an extreme event on the New Jersey coastal zone. Open-coast shoreline changes and beach and dune volume losses were substantial with over 14 million cubic yards of sand moved out of the beach/dune system (not including changes that occurred in the nearshore zone, seaward of the beach face). Observations during the passage of extreme events are limited, and few governmental agencies have the capability and tools to collect event-driven data on storm hydrodynamics, flooding, erosion, and geomorphological change. Further, coastal communities such as Atlantic City rely on storm damage reduction projects comprised of engineered dunes and wide beaches to protect oceanfront infrastructure, businesses, and homes. Extreme storms can greatly modify the exposed beaches and dunes, but damage reduction projects are often perceived as failures by the general public who do not understand the mechanisms of change associated with such storms. Nearshore changes in the area from the beach face to the seaward limit of the surfzone are often not measured due to the limited accessibility and difficulty associated with data collection in this area.

This study will engage in the rapid deployment of instruments and shoreline surveys to collect hydrodynamic (wave spectra, current, water level, sediment transport) and morphological (dune, beach, and nearshore survey) datasets associated with a barred profile under extreme event conditions (northeast storm or hurricane) in Atlantic City, a high-recreational use urban beach. The goal of the proposed project is to quantify the mechanisms of change that modify the dune, beach, and nearshore region as associated with the passage of an extreme storm (from onset through post-storm recovery).

The information gained from measuring the changes to the beach, dune, and nearshore during an extreme event will provide shoreline managers insight on how the engineered beach and dune performed under specific hydrodynamic conditions and may help with planning post-storm mitigation and continued resiliency efforts. The collected data will identify whether changes are episodic or linear during a storm event and, if deposition occurs, identify when and where it occurs on the profile. This is important to the understanding of how the beach, dune, and nearshore reacts to wave impacts and can be used to further refine coastal storm and wave overtopping models, or for generating warnings for potential beach flooding. With the threat that extreme storms can cause billions of dollars of damage to coastal properties and infrastructure, the benefit of this study is an improved understanding of the physical processes during such events leading to improved models of erosion, flooding, and shoreline recovery.