COASTRR: COASTAL STORM RAPID RESPONSE MEASUREMENTS OF HURRICANE HARVEY IMPACT AND RECOVERY ON TWO TEXAS BARRIER ISLANDS

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INTRODUCTION

The COAstal STorm Rapid Response (COASTRR) system has been implemented to measure hydrodynamic, morphodynamic, and sedimentary processes occurring along coastlines during storm impact and subsequent recovery. Relatively few measurements are available to evaluate the physical processes shaping coastal systems during extreme storm events, nor to assess post-storm system recovery (e.g. Sherwood et al., 2014). Prior to landfall of Hurricane Harvey, instruments to collect high-resolution in-situ hydrodynamic measurements across two different barrier island transects on the upper Texas Gulf Coast were deployed before and recovered after the storm. Hurricane Harvey struck the central Texas Gulf Coast as a Category 4 storm on August 25, 2017 causing severe infrastructure damage and erosion near its landfall location but generating mostly accretional features at the two field sites on Hog Island and Follets Island, respectively, which were located more than 160 miles northeast of Harvey's landfall location.

METHODS

The idea of the COASTRR system is to provide the capability for detailed measurements of nearshore and across-island storm surge and wave hydrodynamic forcing conditions during storm impact, as well as pre- and post-storm topographic and bathymetric elevation data. Site-specific Rapid Response Units (RRUs), each containing a pressure transducer (PT) and a tilt current meter (TCM), are designed to record water level fluctuations, wave heights, current velocities, and wave orbital velocities during storm impact (Anarde and Figlus, 2017). Figure 1 shows a schematic and photo of the setup.

Digital elevation models (DEMs) for the selected project sites were created from multiple unmanned aerial system (UAS) flights and real-time kinematic GPS surveys on the ground before and immediately after storm impact. UAS images were converted to DEMs using standard photogrammetric structure-from-motion algorithms. Complementary surface sediment samples, as well as push- and vibra-cores of the storm deposits and affected barrier areas were collected to facilitate linking the measured storm hydrodynamics with morphodynamic and sedimentary processes.

RESULTS

Comparison of pre- and post-storm DEMs indicate that at Hog Island an inactive cut between open ocean and bay waters was inundated and overwash deposits were forced through the cut into the back-barrier area. RRU measurements indicate <1 m of storm surge inundation across the cut with approximately 0.5 m of sediment accretion in the backshore. Storm deposits include sets of thin lamina of quartz sand overlain by mineral-rich sand. At Follets Island, even further northeast of the landfall location, dune collision and re-grading of the beach profile were the primary storm impacts observed, in addition to erosion of the recently restored dune from heavy rainfall.

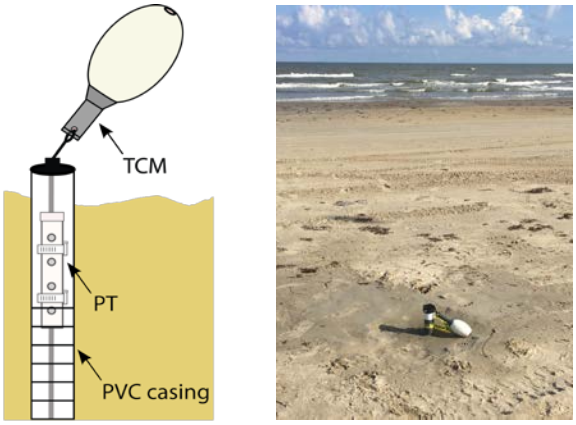

Figure 1 – RRU consisting of a TCM and PT mounted on top of and inside (respectively) a slotted-PVC well casing. Left: Schematic drawing of setup. Right: Photo of installed RRU on the beach at Follets Island, Texas.

ONGOING AND FUTURE WORK

The analysis of spectral wave information and current velocity across the barrier islands measured by the RRUs will be at the forefront of the ongoing investigation. In addition, the post-storm subaerial morphodynamic development and recovery processes of both study sites will continue to be evaluated via UAS flights, substrate coring, and sediment analysis.

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