COASTAL RESILIENCE CENTER
A U.S. Department of Homeland Security Center of Excellence

Modeling the Combined Coastal and Inland Hazards From High-Impact Hurricanes

Isaac Ginis, University of Rhode Island (URI), Graduate School of Oceanography (GSO)

Other Participants/Partners: Tetsu Hara, David Ullman, Pam Rubinoff and Austin Becker, University of Rhode Island; Jason Fleming, Seahorse Coastal Consulting; Peter Stempel, Pennsylvania State University; Avichal Mehra, Andre van der Westhuysen, and Ali Abdulali, NOAA National Centers for Environmental Prediction/Environmental Modeling Center; and Saeed Moghimi, NOAA National Ocean Service.

SHORT DESCRIPTION

This project advances the modeling capabilities of the real-time ADCIRC Prediction System for predicting hazards and potential impacts from tropical and extratropical cyclones on critical infrastructure and communities in the United States. The primary focus is on improving wind, coastal ocean circulation, wave, and hydrological modeling of combined multiple hazard impacts, including coastal flooding due to storm surge and inland flooding due to rainfall.

ABSTRACT

The primary goal of this project is to develop and transition to operations new and improved modeling capabilities for the real-time ADCIRC Prediction System (APS). In Year 1-6, we developed an ADCIRC mesh with very high resolution in the Southern New England region and demonstrated its utility in simulating storm surge and riverine flooding for selected historical and synthetic tropical and extratropical storms. In Year 6, we further modified the ADCIRC mesh in the upland areas around the major rivers in the region to enhance the model's capability to interface with observations and forecasts of river discharge to better simulate the flooding resulting from the combination of wind/wave-driven surge and high river discharge. The APS is currently based on the coupled ADCIRC-SWAN framework. In Year 6, in collaboration with NOAA scientists, we implemented on the RENCI computer cluster a flexible coupling application for ADCIRC with the WAVEWATCH III (WW3) wave model based on the NOAA Environmental Modeling System (NEMS), ADCIRC-WW3-NEMS (Moghimi et al. 2020), recently developed at NOAA. This was the first successful implementation of the ADCIRC-WW3-NWM-NEMS coupled framework

outside the NOAA high-performance computing machines. In Year 7, the ADCIRC-WW3-NEMS modeling system development and evaluation will continue, and it will be transitioned to the real-time APS.

In Year 1-6, we have also been developing a new modeling system for predicting surface wind during hurricane landfall based on the URI Hurricane Boundary Layer (HBL) Model. In Year 6, the model has been validated with simulations of Hurricanes Florence, Irma and Michael. The HBL source code is currently being evaluated for implementation into the APS in collaboration with the Fleming project. In Year 7, the HBL model will be integrated into the ADCIRC-WW3-ATM.

In Year 1-6, we developed, tested, and refined a novel approach to collecting storm consequence data and coupling it with ADCIRC high-resolution storm model outputs in partnership with the Becker project. In Year 6, in collaboration with Rhode Island (RI) Emergency Management Agency (RIEMA), we created a prototype of the Coastal Hazard Analysis, Modeling, and Prediction System (CHAMP) (richamp.org) for Emergency Management and Response that can be used in Emergency Operations Centers. This RI-CHAMP system will be transitioned to operational status for the Statewide Emergency Operations Center (EOC) in Year 7.