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

Integrating ADCIRC Prediction System Tools to Support Hazus Damage Assessments and Planning

Evaluating Mitigation Alternatives using Ecosystem Design for Surge/Wave Attenuation

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SHORT DESCRIPTION

We will build on previous research integrating ADCIRC Prediction System results with Hazus flood exposure and damage modeling techniques to evaluate the impact of natural hazards to improve planning. The final phase of this effort considers ecosystem design as a mitigation alternative, yielding new information about the value of mangrove ecosystems and further illustrating the decision-support capability of the improved Hazus estimates using ADCIRC input. Collaborative ecosystem design strategies support mitigation alternatives by defining the value of coastal greenbelts in reducing storm surge and wave effects.

ABSTRACT

Communities need clear guidance to identify and prioritize vulnerable infrastructure and populations that may be threatened and/or protected to optimize pre-disaster planning and rapid response efforts. Accurate estimates of how natural coastal greenbelt ecosystems can protect communities will support both long-range planning and crucial land use and redevelopment decisions during initial stages of recovery. High-resolution visualization and quantification of flood exposure and associated damage within an innovative communication platform integrates and leverages community-specific data and fine-scale modeling of flood exposure to facilitate innovative design and planning approaches. Within the context of a communication platform, decision-makers are provided with typically unavailable, high-resolution, actionable, community-specific information about avoiding

loss and rebuilding for maximum future risk reduction.

Year 7 will build on our Year 6 effort titled “Integrating CERA-Planning Software to support DHS Modeling and Planning Efforts for more Resilient Communities”. In the Year 6 effort, we investigated how programming skills developed within CERA-Planning as a tool of the ADCIRC Prediction System can be integrated into Hazus flood exposure and damage modeling techniques that have been developed to evaluate the impact of natural hazards to improve planning. We demonstrated during the 2020 Hurricane Season the value of ADCIRC predictions of storm surge during real-time forecasting of Hurricanes Laura and Delta (southwest Louisiana) in describing flood exposure and consequence using Hazus.

For the Year 7 effort, we will consider ecosystem design as a mitigation alternative to derive new information about the protective value of mangrove ecosystems and further illustrate the decision-support capability of the improved Hazus estimates using ADCIRC input. The development of ecosystem designs in establishing coastal greenbelts as a mitigation alternative will be in collaboration with other members of the CRC, including Dan Cox of OSU and John Van de Lindt of CSU. They will characterize the ecosystem features of coastal wetland ecosystems, providing expertise on the anticipated storm surge and wave effect reduction functions that may be anticipated through various ecosystem design mitigation strategies.

- This team effort within CRC uses tools connecting ADCIRC and Hazus to quantify surge reduction estimates of ecosystem designs using mangrove-dominated coastal landscapes (greenbelts).
- SWAN and/or XBeach will be used to quantify wave reduction. Hazus coastal flood model economic loss results will be correlated with mangrove forest structure input to provide functions showing loss reduction as a result of designing mangrove forest greenbelts.
- Further, FEMA’s Flood Assessment Structure Tool (FAST) will be used for a smaller case study to determine the impacts of mangrove forest characteristics on individual structure damage, which will be used to translate Hazus census block results to an individual consumer level.
- The collaboration with Cox and Van de Lindt is planned for Mexico Beach, FL, impacted by 2018 Hurricane Michael, depending on consultation with other CRC collaborators and stakeholders.

There are three specific strategies that will focus the efforts during YR7 to develop ecosystem designs to complement previous efforts to integrate ADCIRC Prediction System into Hazus flood exposure and damage modeling techniques to improve mitigation planning.

Ecosystem Design Strategy 1: Develop functions to describe how the structure of root systems (prop root and pneumatophore systems) can be defined with basal area estimates of mangrove forest structure to predict impacts of these greenbelts on surge and wave reduction.

Ecosystem Design Strategy 2: Estimate how different landscape designs in mangrove ecosystem structure (using tree density, distribution, and growth) will reduce surge and wave exposure to coastal regions during a storm event.

Ecosystem Design Strategy 3: Use surge and wave damage cost reduction estimates using Hazus and higher resolution tools (e.g., FAST) to describe the economic mitigation value of mangrove ecosystem designs as coastal greenbelts.