The Influence of Riverine Discharges on Total Water Level Predictions During Tropical and Extratropical Storms

Kendra Dresback[1], Brian Blanton[2], Sam Bush[1], Randall Kolar[1],

[1]School of Civil Engineering and Environmental Science, University of Oklahoma, USA

[2] Renaissance Computing Institute, University of North Carolina at Chapel Hill, USA

In order to produce a holistic representation of coastal flooding, one needs to capture the dominant physical processes within the modeling system in order to generate estimates of the "total water level" in coastal regions. From previous research done as part of DHS and NOAA projects, a real-time forecast system was developed to obtain a total water level product. This real-time system brings together rainfall, wind, waves, tides and surge through coupled hydrologic, hydrodynamic, wave models and precipitation estimations. The resulting modeling system, called the ADCIRC Surge Guidance System-Scalable, Terrestrial, Ocean, Riverine, Meteorological (abbreviated ASGS-STORM), has been shown to have notable skill when applied to the target Tar and Neuse river basins in North Carolina (Dresback et al., 2013). Within this coupled model system, a hydrologic model and precipitation estimates compute the upland flooding associated with the rainfall associated with tropical or extratropical storms. The discharges from the hydrologic model are then used as upstream boundary conditions for the hydrodynamic model. The influence of the riverine discharges on water levels within the hydrodynamic model varies, depending on the type of tropical or extratropical storm. For example, Hurricane Floyd did not have a significant storm surge associated with its landfall; however, the rainfall and riverine flooding produced from the storm has been associated with the 500-year flood levels for the area. This study will examine the influence of the riverine discharges on the flooding estimates produced via the hydrodynamic model through high-water marks and gauges, as well as flooding extents, within the riverine and coastal areas. Specifically, we will contrast results with and without the hydrologic model coupling for Hurricanes Irene, Isabel and Floyd in the North Carolina area, along with an extratropical storm.