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Hurricane Storm Surge Modeling for Southern Louisiana

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ABSTRACT

Coastal Louisiana is characterized by low-lying topography and an intricate network of sounds, estuaries, bays, marshes, lakes, rivers and inlets that permit widespread inundation during hurricanes, such as that witnessed during the 2005 hurricane season with Katrina and Rita. A basin to channel scale implementation of the ADCIRC hydrodynamic model has been developed that simulates hurricane storm surge, tides and river flow in this complex region. This is accomplished by defining a domain and computational resolution appropriate for the relevant processes, specifying realistic boundary conditions, and implementing accurate, robust, and highly parallel unstructured grid numerical algorithms. The model domain incorporates the Western North Atlantic, the Gulf of Mexico and the Caribbean Sea, so that interactions between basins and the shelf are explicitly modeled, and boundary conditions for tidal and hurricane processes are specified at the open boundary, which is located in deep water. Selective refinement of the unstructured grid enables high resolution of the complex overland region for modeling localized scales of flow, while minimizing simulation time, so that the model can also be used in forecast mode. The current computational grid resolves features down to 60 meters and contains 2.17 million nodes, each with 3 degrees of freedom. ADCIRC applies a finite element-based solution to the generalized wave continuity form of the governing shallow water equations. The model algorithms must be robust and stable to accommodate the energetic flows that are generated during a hurricane, especially in the narrow inlets and channels connecting water bodies and/or floodplains. Validation of the model is achieved through hindcasts of historical hurricanes. Currently, the validated model is being used by the USACE, FEMA, and the State of Louisiana for preparing post-Katrina IPET reports, levee design, and coastal restoration studies. Other members of the Project Team: Joannes Westerink[1], Shintaro Bunya[1], Casey Dietrich[1], Rick Luettich[2], Bruce Ebersole[3], John Atkinson[4], Hans Westerink[1], Jane Smith[3], Bob Jensen[3], Andrew Cox[5], Vince Cardonne[5], Mark Powell[6] [1] Department of Civil Engineering and Geological Sciences, University of Notre Dame [2] Institute of Marine Sciences, University of North Carolina at Chapel Hill [3] U.S. Army Engineer Research and Development Center, Vicksburg [4] Ayres Associates, Fort Collins, Colorado [5] Oceanweather Inc. Cos Cob, Connecticut [6] Hurricane Research Division, National Oceanic and Atmospheric Administration

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