Application of the Coupled ARCIRC+SWAN Model to Hurricane Ike on the Texas Gulf Coast

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The geometrically complex system of narrow inlets, back bays, rivers, coastal ridges, and intricate topology that comprises the Texas Gulf Coast requires a high resolution, unstructured mesh in order to accurately depict the propagation of tropical storm driven surge and waves. The adjacent shelf, with a width of over 200 km at some points, makes the area particularly susceptible to highly localized water level and current gradients that are associated with tropical storm induced flooding. With many population centers lying on bays that are hydraulically connected to the Gulf, the need for a highly accurate surge and waves model is apparent.

In this study, the tightly coupled ADCIRC+SWAN hydrodynamic and wave models are applied to Hurricane Ike. Hurricane Ike was a strong category 2 hurricane that made landfall on the Texas Gulf coast on September 13, 2008 creating significant storm surge and inland flooding. The study applies the tx2008 computational grid consisting of over 3.3 million computational nodes resolving coastal features as small as 50 meters. The grid domain stretches from the Texas coastal flood plain to the Atlantic Ocean incorporating the entire Gulf of Mexico and Caribbean Sea.

The coupled ADCIRC+SWAN model results will be validated using extensive surge and wave data collected by NOAA, USGS, US Army Corps of Engineers, and other federal and local authorities.

This study also investigates the origin of the previously undocumented forerunner surge which inundated the Texas Coast with up to 2.5 meters of water 15

hours prior to landfall, while the center of the storm was off the continental shelf. The slowly developing forerunner efficiently pushed water into estuarine systems, including the heart of Houston more than 80 km inland, and propagated as a large shelf wave past Corpus Cristi more than 300 km away from the track of the storm.