

Coastal Impacts and Processes During Hurricane Ivan

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Abstract

In September 2004, Category-3 Hurricane Ivan extensively impacted the coasts of Alabama and the Panhandle of Florida. Before and after landfall, the open-coast beaches in the impact zone were surveyed with airborne Light Detection And Ranging (lidar) in a cooperative effort between the U.S. Geological Survey, NASA, and Corps of Engineers. The data show extensive beach and dune changes as well as the opening of new inlets through barrier islands. Specifically, the average shoreline change within the impact zone was approximately 15 m of erosion. Near the location of landfall, the storm surge, which approached 3 m, completely submerged the low-lying barrier islands. Here, the system was in the inundation regime where the sea-level gradient between Gulf and back bay drove a strong landward current that transported sand across the island and into the back bay. In contrast, ten kilometers to the east in Orange Beach, Alabama, the topography was higher and the response of the system was a collision regime, resulting in dune erosion that, in places, exceeded 20 m. Locally, the vertical scour was greater than 3 m and undermined structures including several five-story condominium towers that had been built on top of dunes. In general, wave run-up was not sufficient in the Orange Beach area to overtop the dunes. Hurricane Ivan was likely the most significant coastal-change event in the southeast United States since Hurricane Hugo impacted the South Carolina coast in 1989.