

# Offshore Hydrodynamics and Geological Impacts of Hurricane Ivan along the Northeastern Gulf of Mexico

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## Abstract

In this paper we present the hydrodynamics and coastal impacts associated with Hurricane Ivan. In mid-September Hurricane Ivan entered the southern Gulf of Mexico over the Yucatan Channel as a category 5 storm (winds in excess of 155 mph). The hurricane moved generally north across the central Gulf generating waves that were between 21 m (70 ft) and 27 m (90 ft) high causing severe damage to numerous oil and gas platforms offshore. East of the mouth of the Mississippi River, an National Data Bouy Center buoy measured 16.8 m (52.5 ft) waves, the highest ever recorded during a hurricane. East of the Chandeleur Islands along southeastern Louisiana, waves approximating 7.6 m (25 ft) were recorded as Ivan veered to the north-northeast prior to landfall. Although downgraded to a category 3 hurricane at landfall east of Gulf Shores, Alabama, storm surge along the open coast in excess of 3m (10 ft) was measured and breaking waves of 3.7 m (12 ft) were modeled. Beach erosion along the Louisiana (Chandeleur Island), Alabama and northwest Florida coast was severe. Barrier islands were overwashed and breached extensively, and foredunes with pre-storm elevations of 3.5 m (12 ft) were reduced to sea level. Beach erosion approximating 50 m (~150 ft) was measured along the Florida Panhandle near Pensacola Beach. Remarkably, however, many of the barrier islands did not loose considerable amounts of sand since beach and dune sediment was transported across the island as large overwash deposits whose marginal lobes prograded the backbarrier beach over 100 m (~325 ft) into the adjacent bay. This phenomenon, referred to as conservation of barrier mass, was also measured after Hurricane Opal, a powerful hurricane that impacted the Florida Panhandle in 1995. Considerable structural damage occurred to beach homes and condominiums along the coast as well as to road, bridge and highway infrastructure connecting the mainland to the outer coast.