

Modeling decadal barrier island evolution under future storms and sea level rise

Abstract: Barrier islands protect mainland coastal communities during storms. In the future, the combined effects of storms and sea level rise (SLR) threaten barrier islands with increased inundation, and loss of land and habitats for critical species. The Alabama Barrier Island Restoration Assessment (ABIRA) was a science-based, collaborative effort between the State of Alabama, the U.S. Geological Survey (USGS), and the U.S. Army Corps of Engineers (USACE) to investigate viable options for the restoration of Dauphin Island, Alabama in order to increase island sustainability and restore vital habitats for species affected by the 2010 Deepwater Horizon oil spill. A suite of numerical models was developed to provide a quantitative understanding of the physical processes governing the barrier island system. Models of alongshore sediment transport during quiescent conditions, storm-driven morphology and post-storm dune recovery were integrated to simulate decadal island evolution under scenarios of increased sea level and increased storminess (intensity and frequency). Model results showed that under high SLR and storminess, the island was unable to keep pace or recover elevation after storms and drowned in just 10 years. Model output was used to inform a habitat model used to predict resulting habitat coverage and suitability for oysters and seagrass. Together, the predictive morphological and habitat models were used to assess management actions through structured decision-making to assess their ability to meet multiple objectives for habitats, sustainability, residents, and conservation values.