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EFFECTS OF WINDS AND STORM SURGE ON SALINITY VARIATIONS IN APALACHICOLA BAY DURING HURRICANE DENNIS

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Apalachicola Bay is a barrier island estuarine system located in the Florida Panhandle (Figure 1). The long axis of the bay is approximately in the east–west direction. The bay is connected to the Gulf of Mexico through five inlets. At both ends of the bay along the long estuarine axis lie two inlets, Indian Pass and West Pass at the western end and East Pass and Lanark Reef at the eastern end. Due to the long wind fetch along the bay axis and the location of the major inlets at the eastern and western ends of the bay, dynamic surface winds from the east and west directions play a significant role in the salinity variations within the bay. Most of the freshwater discharged into the bay flows from Apalachicola River. The southward river discharge is approximately perpendicular to the east–west bay axis. The major tidal constituents in the bay are diurnal and semidiurnal components, which cause periodic changes of water level and salinity in the bay.

Strong winds and storm surges in the events of hurricanes often cause substantial changes in estuarine circulations and transport processes. In order to evaluate the magnitudes of the hurricane impacts on estuarine environments and ecosystems, a 3D hydrodynamic model is applied to investigate salinity changes during hurricanes. A case study for Hurricane Dennis in 2005 (Figure 1) has shown that the previously calibrated model reasonably reproduces the changes of water levels and salinity in the bay in responses to the winds, storm surges, and river floods during the hurricane event (Figures 2, 3).

Analysis of modeling results indicates that winds caused strong mixing in the bay. Storm surge mainly entered the bay though the large opening in East Bay. Several model simulations are conducted for different hurricanes with different tracks and winds, which are produced from a large scale storm surge model (ADCIRC) covering the Gulf of Mexico and part of the Atlantic Ocean. Results will be used to investigate the responses of estuarine salinity responses to different hurricane conditions. Because salinity is an important factor for oyster mortality and growth, the study will be very helpful for biologists to study hurricane impacts on the estuarine ecosystem in Apalachicola bay.

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Figure 1 Hurricane Dennis landed in NW Florida coast in July, 2005.

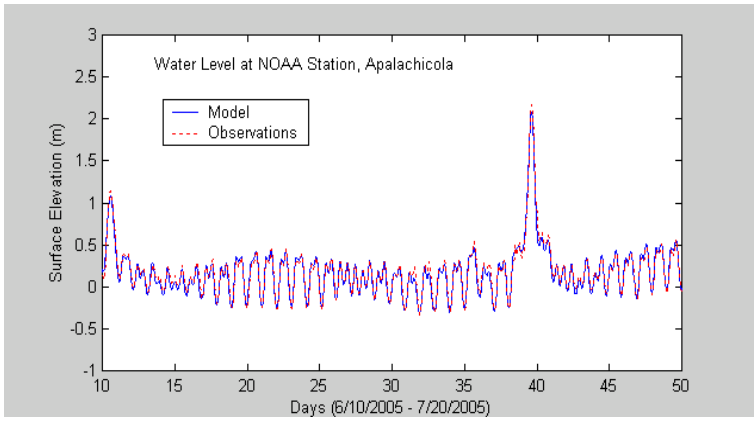

Figure 2 Comparison between model predicted and observed water levels.

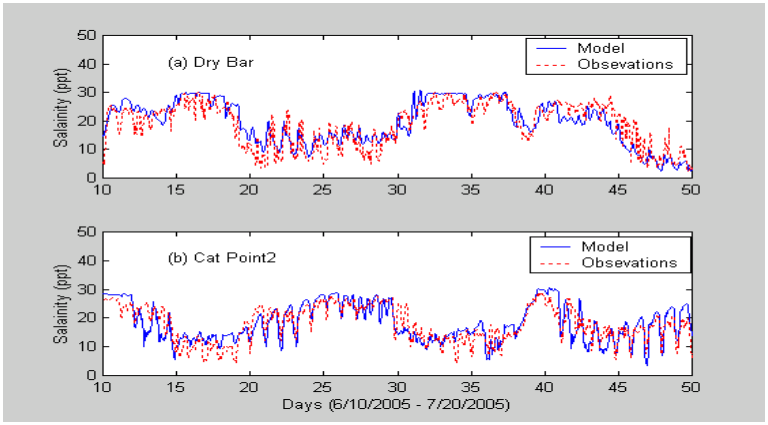

Figure 3 Comparison between model predicted and observed salinity.