FORECASTING THE IMPACTS OF LAKE OPERATIONS ON THE ESTUARINE HYDRODYNAMICS AND POLLUTANT TRANSPORT

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Water quality in an estuary is directly influenced by physical forcings (e.g. freshwater discharge and wind forcings) which modify water quality by altering the fluxes and concentrations of different chemical constituents and changing residence times. Motivated by the current urgency for improved water quality-related coastal hazard predictions, we have developed and verified a system that forecasts the main physical parameters that affect the estuarine circulation and pollutant pathways (water levels, water temperature, salinity, and the 3D velocity field). The forecasting system can be adapted to forecast hazards such as flooding and erosion during extreme storms, the evolution of algal blooms, eutrophication, estuarine heat waves, and hypoxia.

The current version of the system is being applied and tested in the Caloosahatchee River Estuary (CRE) and the St Lucie Estuary (SLE). These estuaries are located on the west and east coasts of the Florida peninsula, respectively. They are connected to Lake Okeechobee through a series of dams and canals. Freshwater discharges from Lake Okeechobee into the CRE are frequent and highly regulated. However, direct discharges from the lake into SLE are less frequent and occur when lake water elevations are extreme. Both estuaries have been affected by water quality issues for decades. They have different tidal regimes and morphologies. Therefore, hydrodynamics and pollutant transport pathways differ for each.

In this study, we describe the development of the forecasting system, and we analyze the influence of freshwater discharges from Lake Okeechobee on salinity, water temperature patterns, and the overall circulation in the estuaries. This allows us to determine the spatio-temporal variations in residence times and pollutant transport in the estuaries. Initial results indicate that freshwater discharge plays a significant (first-order) role in the residence times of the estuaries and that accurate forecasts of freshwater discharge are necessary.

PRESENTER BIO: Dr. Olabarrieta is an Associate Professor at the Civil and Coastal Engineering Department of the University of Florida. Dr. Olabarrieta has worked for more than 25 years on modeling coastal hazards, including coastal erosion and flooding, tsunamis, meteotsunamis, and water quality hazards. Her research goal is to improve the capabilities of modeling and forecasting coastal hazards.