Hydrodynamic Modeling Efforts of the U.S. Geological Survey in Support of Everglades Restoration

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The U.S. Geological Survey (USGS) has developed two hydrodynamic models for the southern Everglades to better understand and predict hydrologic conditions, including the mixing of salt and freshwater within the coastal mangrove fringe. The Southern Inland and Coastal Systems (SICS) model, which was developed first, encompasses the Taylor Slough area and northeastern Florida Bay with 305-m grid resolution. The second model, referred to as the Tides and Inflows in the Mangroves of the Everglades (TIME) model, is coarser in resolution (500 m), but covers a much larger area than SICS, including Shark and Taylor Sloughs, the Gulf of Mexico, and northern Florida Bay (see Schaffranek and Riscassi, these proceedings). Although TIME encompasses the SICS model domain, the SICS model will continue to be used to provide detailed simulations for the Taylor Slough area. Both models use the Flow and Transport in a Linked Overland/Aquifer Density Dependent System (FTLOADDS) computer program to simulate coupled surface water/groundwater flow and solute transport. Subsequently, output from both models is similar and consists of flows, stages, and salinities in the wetlands and underlying aquifer system. SICS and TIME simulations have focused primarily on the period from 1996 through 2002 and use sub-hourly timesteps to capture hydrodynamic responses to high frequency stresses, such as tides. This 7-year period was selected because it encompasses the 5-year data set used for Florida Bay studies (1996-2000), and because it correlates with the focused data collection effort of the USGS and other agencies in the southern Everglades. Model input and output data are available from the USGS SOFIA website.

The original motivation for SICS and TIME was to synthesize highly varied Everglades hydrologic and hydrochemical data, assess optimal data collection locations to resolve uncertainties, and evaluate dominant hydrologic processes. However, because SICS and TIME are unique in their ability to represent the complex hydrodynamic conditions, new applications are continuously evolving. For example, as part of the Florida Bay/Florida Keys Feasibility Study (FBFKFS), the USGS is providing simulated estimates of freshwater flows to Florida Bay modelers (see Wang and others, these proceedings). In addition, a link was established between SICS and the South Florida Water Management Model (SFWMM), which allows for accurate prediction of freshwater flows to Florida Bay under restoration conditions. Another application is the use of SICS model-derived salinities in conjunction with the ATLSS models (Across Tropic Level System Simulation) to assess restoration effects on fish populations (see Swain and Cline, these proceedings). Future applications with SICS and TIME will include the capability to simulate water quality and the use of optimization schemes to improve management strategies.

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