

Interrelation of Everglades Hydrology and Florida Bay Dynamics to Ecosystem Processes and Restoration in South Florida: Regional Simulation of Inundation Patterns in the South Florida Everglades

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The ability to quantify changes in water-surface elevations and hence water depths in the southern Everglades, throughout space and time, is fundamental to evaluating both the historical and current hydrologic behavior of the ecosystem and the success of restoration efforts. The low topographic relief yields very small water-surface gradients that produce large fluctuations in the spatial extent of inundation making the ecosystem highly sensitive to regulatory controls. A time series of daily water depths has been generated for the region of the southern Everglades encompassing the Taylor Slough and C-111 wetlands to analyze changes in seasonal inundation patterns and hydroperiods and to evaluate and correlate the response of wetland water levels to local precipitation and regulated structure flows. The time series can be used to validate the performance of flow models guiding restoration efforts and to investigate how wetland sheet flows have been affected by anthropogenic influences.

A land-surface elevation grid was interpolated from topographic data collected by the U.S. Geological Survey (USGS), National Mapping Division, using differential global positioning system technology. Water-level data, from 1995 to present, obtained from the South Florida Water Management District (SFWMD), the National Park Service (NPS) Everglades National Park, and from within the USGS are used to interpolate daily water-surface elevation grids. The water-surface elevations are then subtracted from the topographic surface to produce daily grids of computed water depths. Structure releases and precipitation data were obtained from the NPS, SFWMD, and USGS to aid in the analyses.

Water-depth accuracy is directly correlated to the spatial distribution of hydrologic monitoring stations and to the spatial resolution and accuracy of the topographic data. The spatial resolution of the topographic data is 400 meters and the stated vertical accuracy is 15 cm; however, tests against elevation values published by the National Geodetic Survey for 17 benchmark monuments resulted in an Root Mean Square Error of 4.1 cm. To estimate water-depth accuracy, computed depths were subtracted from depths measured in the wetlands adjacent to the C-111 canal and in Taylor Slough in 1997 and 1999. The standard

deviation of the differences between measured and computed water depths was found to be 12 cm.

The simulated time series of regional inundation patterns is used to compare historical and current water depths and hydroperiods in order to isolate temporal changes, particularly as these may have been affected by anthropogenic influences such as the management of control structure releases and the re-engineering of canals. Further analysis is focused on quantifying the response of water-depth to precipitation and control structure releases. Several time series and sample water-depth maps are available at the Tides and Inflows in the Mangroves of the Everglades (TIME) website (<http://time.er.usgs.gov>).

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