

Everglades Depth Estimation Network (EDEN) Performance-Measure Products for the Evaluation of Everglades Restoration

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Introduction

Performance measures are being developed to determine conditions that are characteristic of a healthy ecosystem for use in evaluating the restoration of the Everglades. Two potential targets of performance measures are 1) improved sheet-flow patterns for restoration of surface-water depths and duration to pre-drainage levels, and 2) the reduction of salinity fluctuations from freshwater pulses. The Everglades Depth Estimation Network (EDEN) has provided principal investigators and water-resources managers with quality-assured water levels for 300 stations for the period January 1, 1991 to the present (2012). EDEN-derived products provide tools for real-time evaluation of current conditions and restoration performance measures.

Duration Hydrographs

One product is the daily water-level duration hydrograph: a plot of water-level percentiles (based on historic daily average water level for each day of the year) against the days of a calendar year (fig. 1). A daily duration hydrograph can be used to statistically quantify the water level observed at a gaging station. In addition to the historic distribution of water level, a trace of daily water level for the current year can be plotted on the duration hydrograph. The severity and trend of dry or wet periods at a gaging station can be determined by comparison of the current daily water-level trace on the hydrograph. Figure 1B shows the daily duration hydrograph for Site 64 based on 31-years of record (1981-2011) and the measured data for 2012. One can quickly see that most of the water levels for 2012 have been between the minimum and 10th percentile for the period 1981 to 2011 and that recent (May 2012) water levels are in the 10th to 25th percentile range.

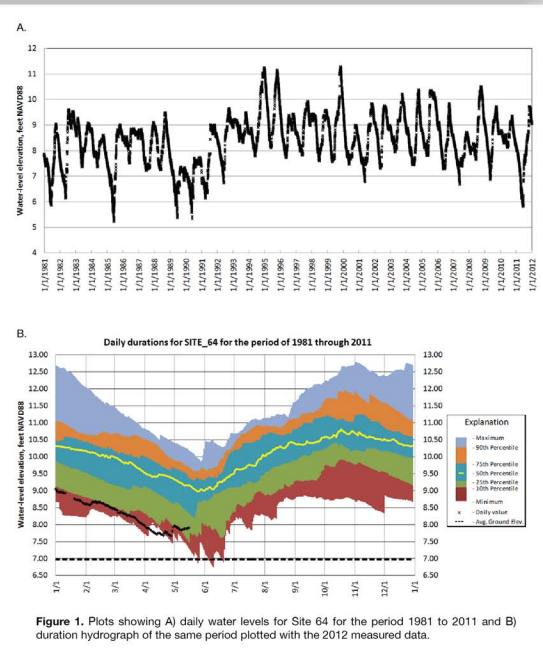


Figure 1. Plots showing A) daily water levels for Site 64 for the period 1981 to 2011 and B) duration hydrograph of the same period plotted with the 2012 measured data.

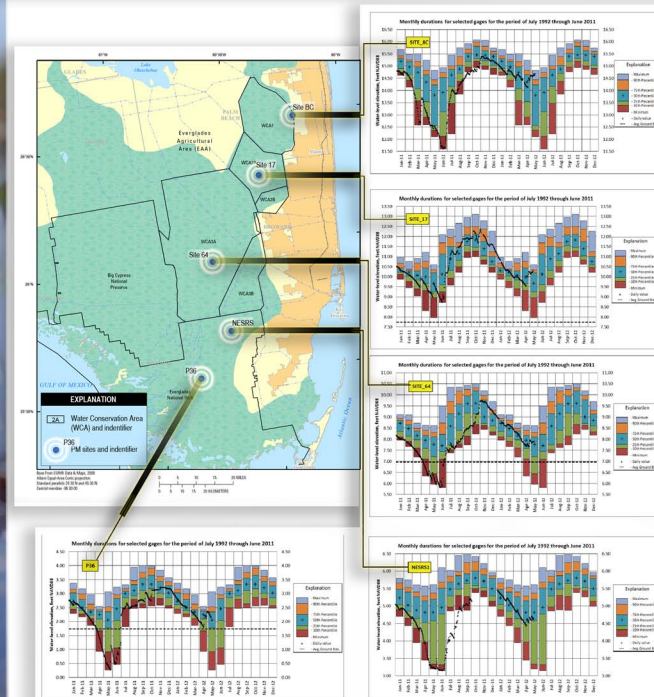


Figure 2. Real-time reporting of current conditions with respect to historical (July 1992 through June 2011) water-level distribution.

duration hydrograph can be based on period of the old IOP (2002-2011) and the current condition with the new IOP is shown as it relates to the previous IOP. Figure 2 shows monthly average water-level duration curves and current conditions for five sites in the Greater Everglades. The plots show that water levels in 2011 in Water Conservation Area (WCA) 1, WCA3A, and Everglades National Park (ENP) often were between the monthly minimums and the 25th percentile of the previous IOP. For 2012, the water levels are higher. In WCA2A, water levels since July 2011 are often between the 50th and 90th percentiles. For WCA1 and ENP, water levels in 2012 generally are near the 50th percentile of the previous IOP.

Salinity Response to Water Levels

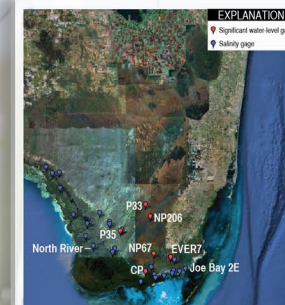


Figure 3. Map showing significant water-level stations for salinity response in Florida Bay and the salinity gages in the EDEN network.

A second product is daily duration water-level and salinity hydrographs for particular stations of concern for evaluation of performance measures. The Southern Estuaries Performance Measure for Everglades Water Levels (Comprehensive Everglades Restoration Plan, 2008) lists water-level stations that are "significant" explanatory stations for understanding the salinity response in Florida Bay (Marshall, 2004). The significant water-level stations that are in the EDEN network, and the location of the EDEN salinity sensors are shown in Figure 3.

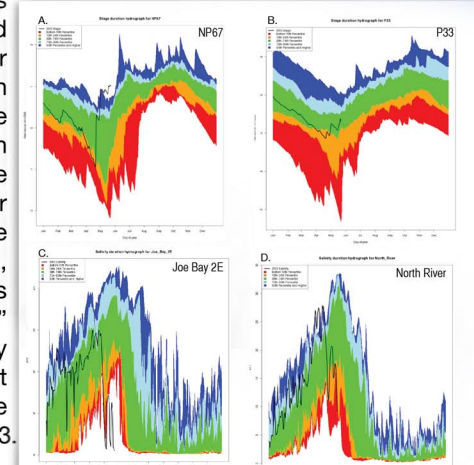


Figure 4. Water-level duration hydrographs with 2012 measured daily water levels at A) NP67 and B) P33; and salinity duration hydrographs with 2012 measured daily maximum salinity at C) Joe Bay 2E and D) North River.

The Performance Measure pairs the water level of NP67 with the salinity in Joe Bay and the water level of P33 and the salinity of the North River (fig. 3). The intent of the Performance Measure is to achieve targeted lower salinity in Joe Bay and the North River by maintaining higher water levels at NP67 and P33. Duration hydrographs of water levels and salinity clearly show the sensitivity of the salinity response to upstream water levels (fig. 4). In 2012, water levels at NP67 (fig. 4A) and P33 (fig. 4B) slowly decreased from median levels to the 10th to 25th percentile levels and salinities increased to near the 75th percentile levels at Joe Bay 2E (fig. 4C) and over 90th percentile levels at North River (fig. 4D). The salinity at both stations quickly decreased with the increase in water levels in April and May 2012.

Summary

Since 2006, the EDEN network has provided principal investigators and water-resource managers with integrated real-time data from multiple agencies, and with water-level elevation modeling and analysis. EDEN-derived products, such as the ones described in this poster, can provide real-time reporting of hydrologic conditions with respect to targeted hydrologic performance measures.

References

Comprehensive Everglades Restoration Plan (CERP), 2008, System-wide Performance Measure- Southern estuaries performance measure for Everglades water levels, 10 pp. [http://www.evergladesplan.org/pm/recover/perf_se.aspx]

Marshall III, F. E.; D. Smith; and D. Nickerson. 2004, Using Statistical Models to Simulate Salinity Variation and Other Physical Parameters in North Florida Bay. Cetacean Logic Foundation, Inc. New Smyrna Beach, Florida. 36 pp. [http://sofia.usgs.gov/publications/reports/salinity_variation/]

For more information, please visit the EDEN web at <http://sofia.usgs.gov/eden>

