Baseline Flow & Gage Analysis and On-Line Tool Development Supporting Bay and Estuary Restoration in Gulf States

A comprehensive assessment of streamflow alteration and development of decision-support framework to facilitate restoration
Project Objectives / Tasks

- Which streams are most altered?
- Where are there gaps in streamgaging network?
- How has streamflow delivery to the Gulf changed through time?
- Assist resource managers in prioritizing restoration

- Predictions at ungagged locations
- Trends in streamflow
- Quantify flow alteration
- Streamgaging network analysis
- Online mapping application
Streamgages in study area

- Need long-term streamflow data
- Streamgage networks fluctuate
- Need to predict at points-of-interest

2000’s
Prediction points

- HUC12 pour points
- Supports majority of objectives
- Interim products for ‘local’ use
Estimating flow-duration curves

Traditional method:
- Choose arbitrary number of quantiles
- Estimate using separate models.
- Leads to physically inconsistent FDCs.

What if we predicted each quantile simultaneously?

New method:
- Multioutput neural networks
- Simultaneous quantile prediction
- Greater likelihood of physically consistent FDCs

Developing streamflow time series

Nearby streamgage acts as a donor

Ungaged point-of-interest

Prediction points

- HUC12 pour points
- Supports majority of objectives
- Interim products for ‘local’ use
Trend results stratified by season

Starting year of trend period

Percentile of flow duration within each season
Suwannee River at White Springs, FL 0 Trends for POR 1950-2015

Site no. 12, HDI=16

Calculation for Withlacoochee River near Holder, FL 1950-2015:

255/365 = .70

Withlacoochee River near Holder, FL 255 Significant Trends for POR 1950-2015

Site no. 10, HDI=25

Data are provisional and subject to revision until they have been thoroughly reviewed and received final approval.
Streamflow Alteration – Trends Disturbance Index

- 0 - .22: Least Disturbed
- .23 - .44: Low to Moderate Disturbance
- .45 - .66: Moderate to High Disturbance
- .67 – 1.0: Most Disturbed

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Network Analysis using Model Divergence

- Analysis of prediction error will be used to identify gaging needs
- Warmer colors → areas that need more streamgaging (under-represented)
- Use network analysis to guide streamgage placement in phase 2
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Example Web Mapper

ICE - LOWER MISSISSIPPI GULF STATES

- Visualize information for area
- Identify / compare sites
- Basin / flow characteristics
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Example Web Mapper
Filter and visualize sites based on similar characteristics
Identify sites that may have similar flow regimes
Data Visualization Tool

Prediction at unaged locations

Trends in Streamflow

Hydrologic Alteration

Streamgage Network Analysis

Data Visualization Tool
RESTORE - Streamflow alteration assessments to support bay and estuary restoration in the Gulf States

Summary

Human alteration of waterways has impacted the minimum and maximum streamflows in more than 86% of monitored streams nationally and may be the primary cause for ecological impairment in river and stream ecosystems. Restoration of freshwater inflows can positively affect shellfish, fisheries, habitat, and water quality in streams, rivers, and estuaries. Increasingly, state and local decision-makers and federal agencies are turning their attention to the restoration of flows as part of a holistic approach to restoring water quality and habitat and to protecting and replenishing living coastal and marine resources and the livelihoods that depend on them. Personnel in the Lower Mississippi-Gulf Water Science Center have been working to quantify and map streamflow alteration to support streamflow and estuary restoration along the Gulf Coast.

Child Items (11)

- Basin characteristics for sites used in RESTORE Streamflow alteration assessments
- Estimated quantities for the four points of 9,203 level-12 hydrologic unit codes in the southeastern United States, 1950--2009
- Geospatial data supporting assessments of streamflow alteration to support bay and estuary restoration in the Gulf States
- Heuristically-determined geospatial boundary of streams and rivers draining to the Gulf of Mexico in the south-central and southeastern United States, July 2018
- Presentations
- Solar radiation for National Hydrography Dataset, version 2 catchments in the southeastern United States, 1950 - 2010
- Streamflow characteristics for sites used in RESTORE Streamflow alteration assessments
- Summary of basin characteristics for National Hydrography Dataset, version 2 catchments in the southeastern United States, 1950 - 2010
- Summary of streamflow statistics for USGS streamgages in the southeastern United States: 1950 - 2010
- Trend analysis results for sites used in RESTORE Streamflow alteration assessments