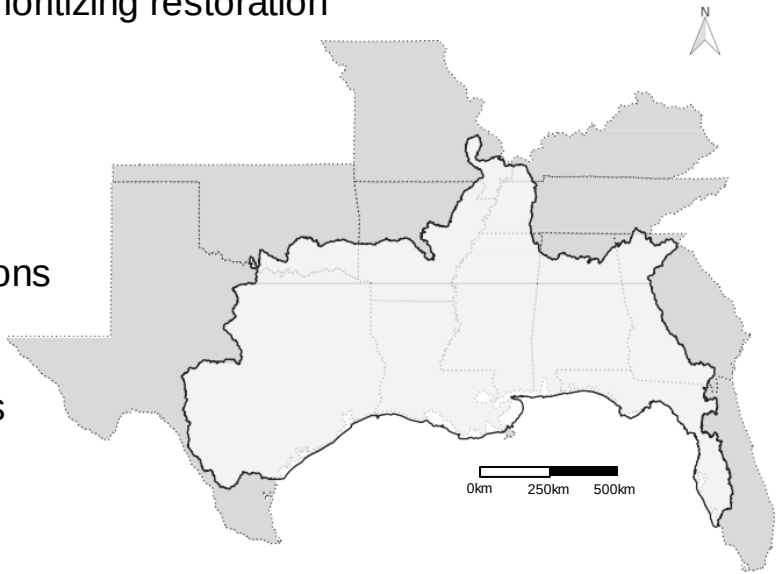
Baseline Flow & Gage Analysis and On-Line Tool Development Supporting Bay and Estuary Restoration in Gulf States

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

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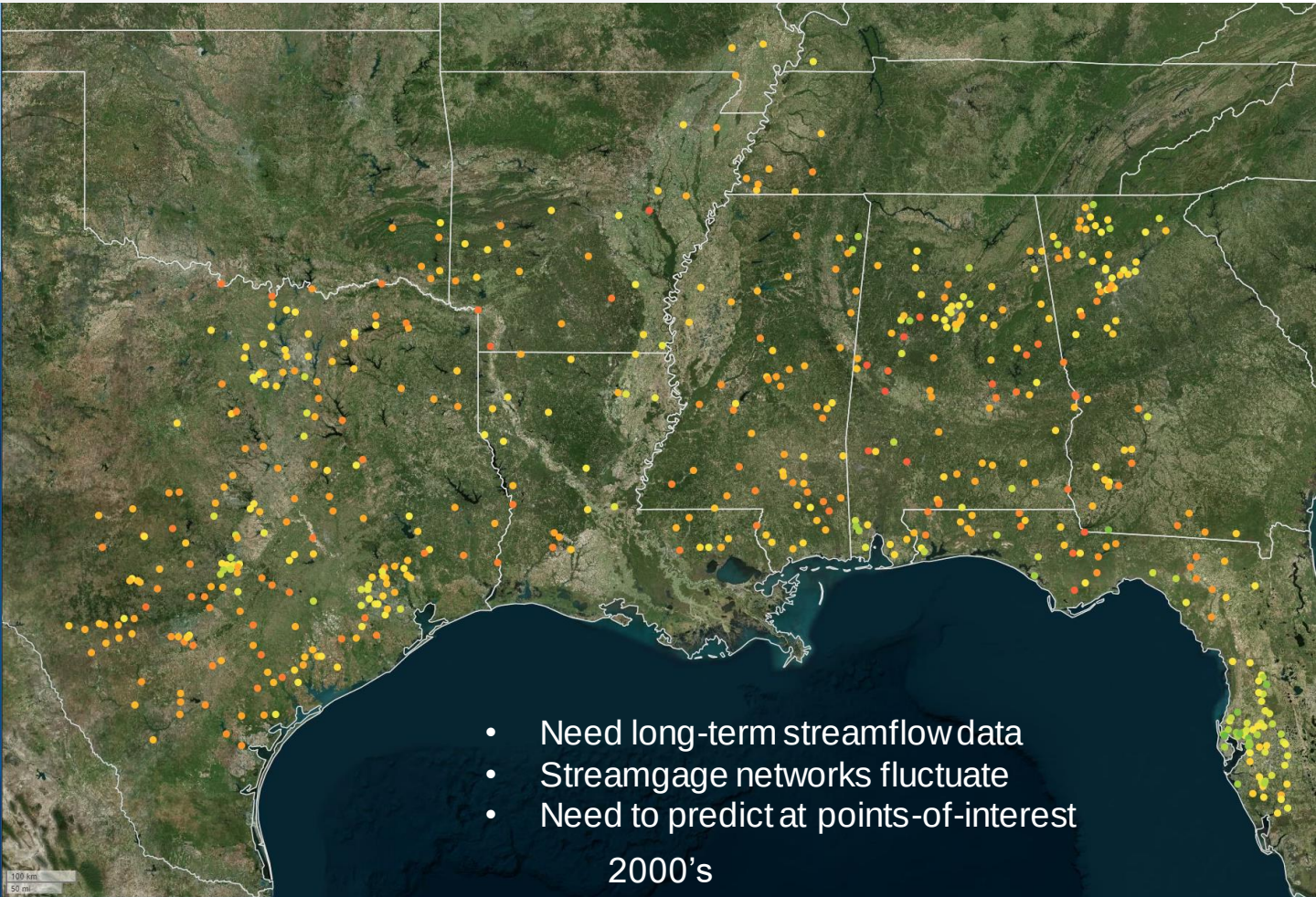
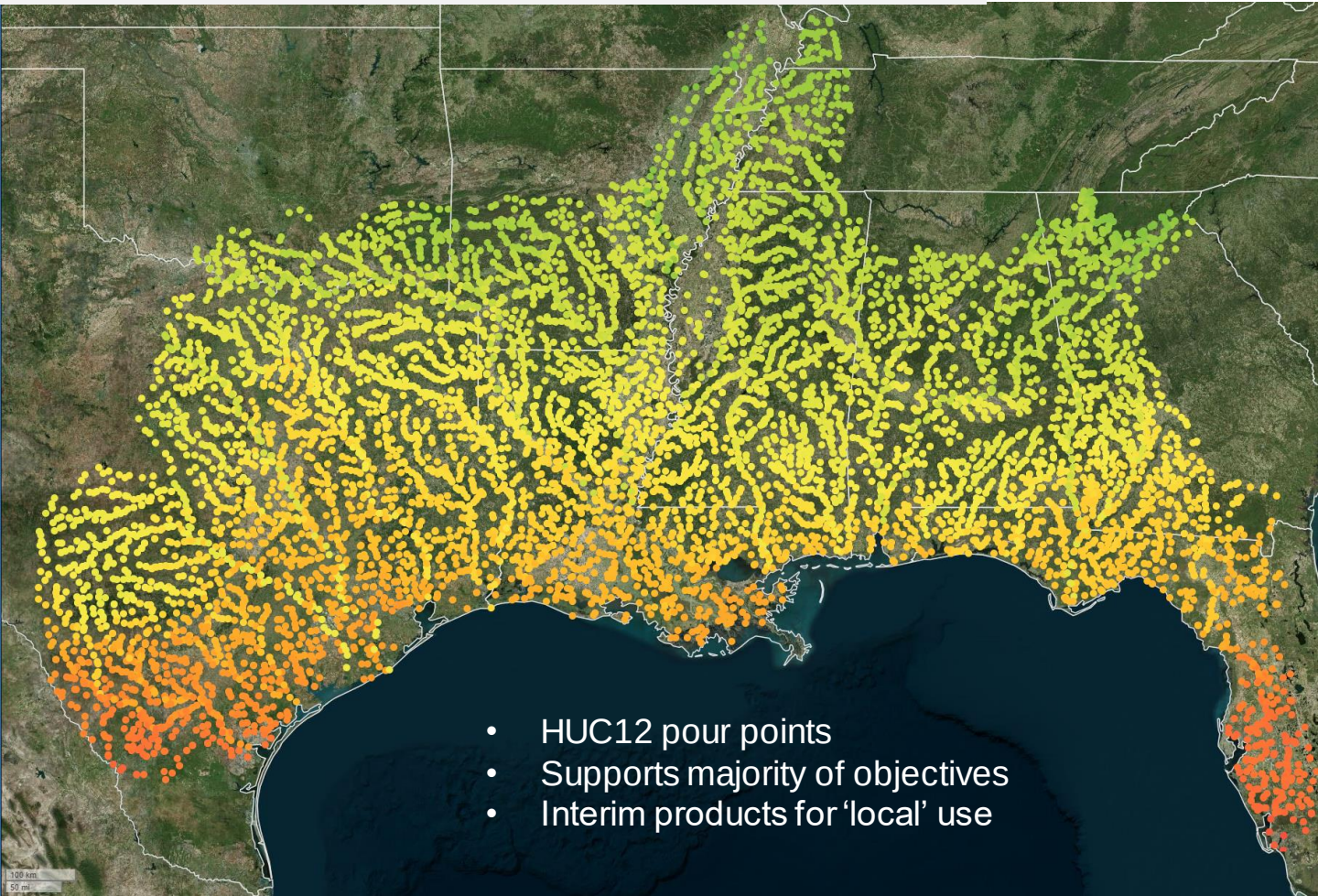
Streamgages in study area



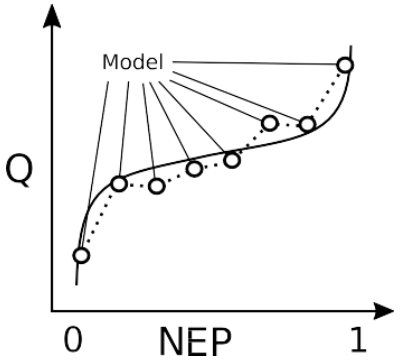
Prediction points



Estimating flow-duration curves

Traditional method:

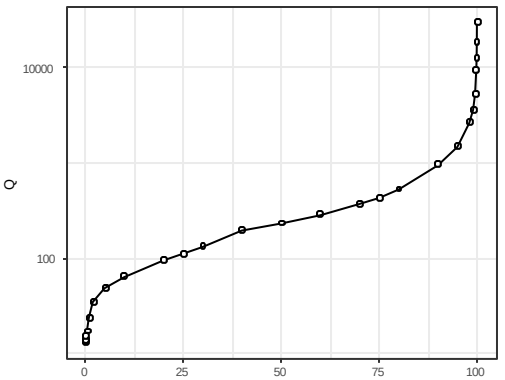
- Choose arbitrary number of quantiles
- Estimate using separate models.
- Leads to physically inconsistent FDCs.



What if we predicted each quantile simultaneously?

New method:

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



Worland, SC, Steinschneider, S, Asquith, WA, Knight RR, and Wieczorek, M. 2019. Prediction and inference of flow-duration curves using multi-output neural networks. *Water Resources Research, accepted.*

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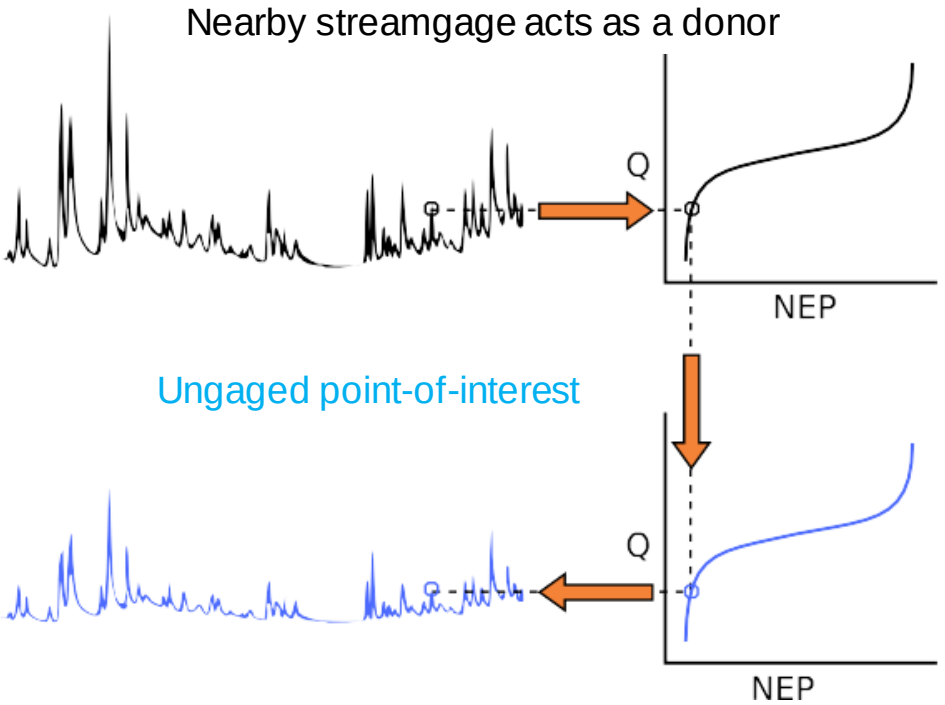
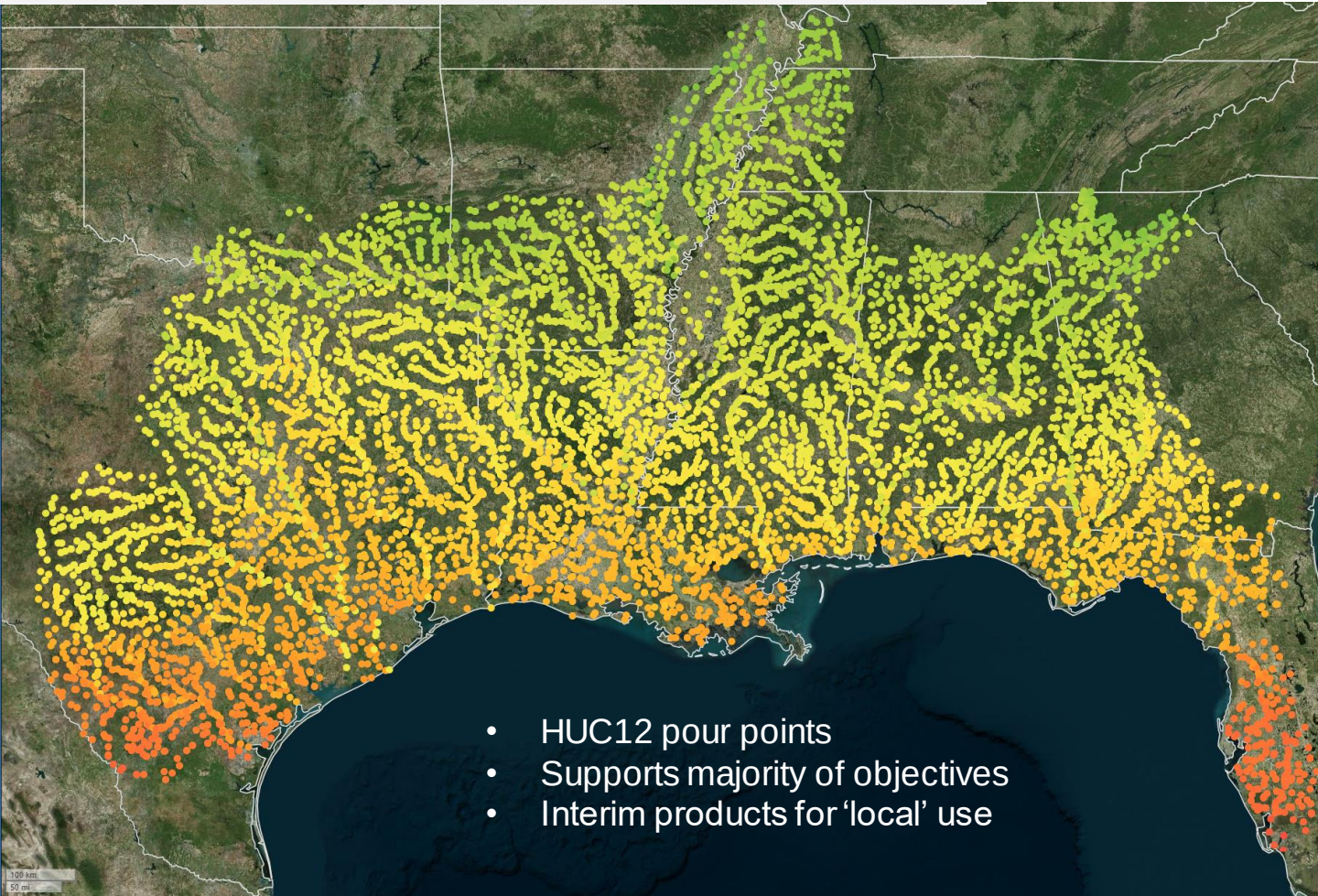
Developing streamflow time series

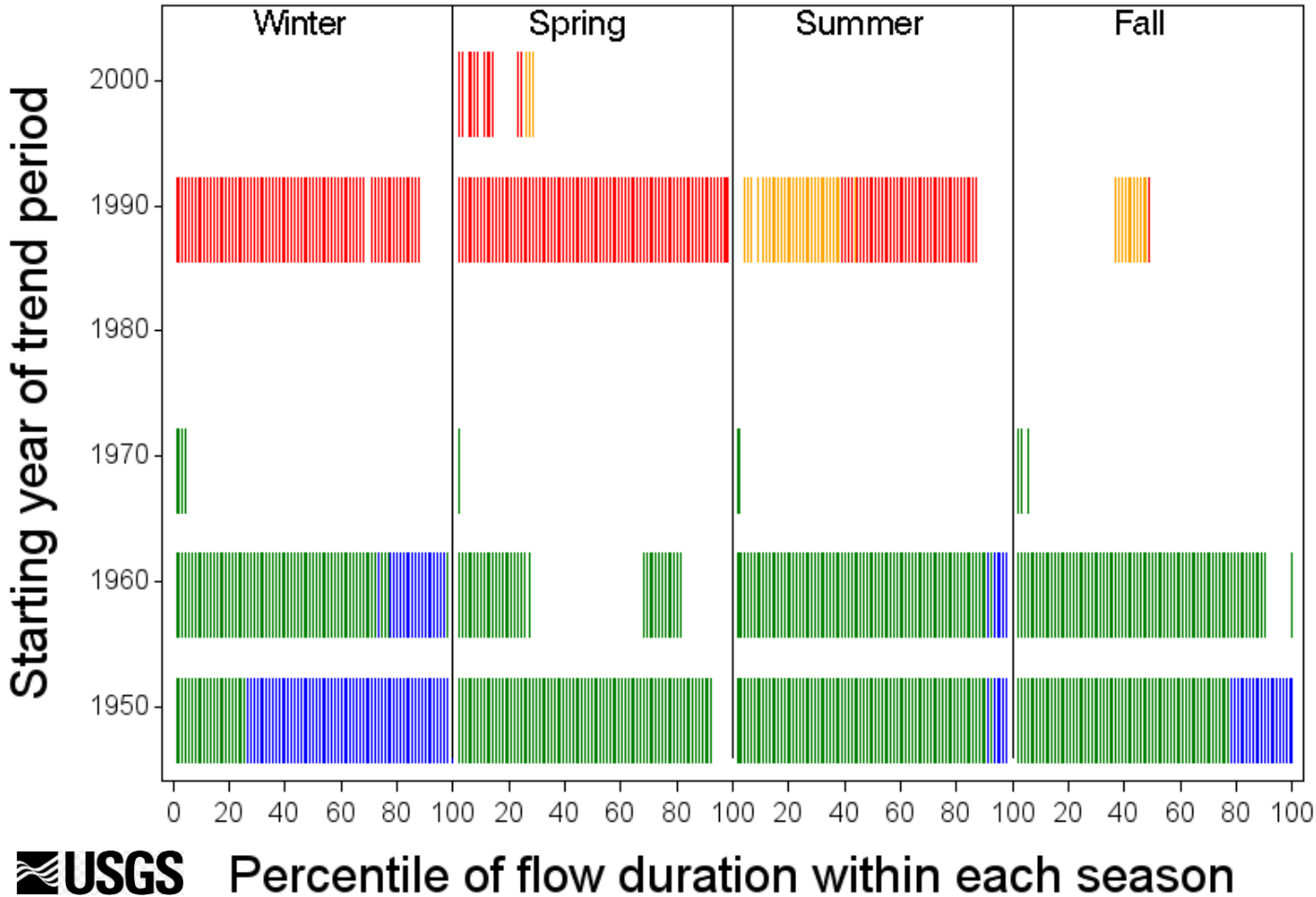


Worland, SC, Steinschneider, S, Asquith, WA, Farmer, WH, and Knight RR. 2019. Copula theory as a generalized framework for flow-duration curve based streamflow estimates in ungaged catchments. *Water Resources Research, bureau approved.*

Prediction points



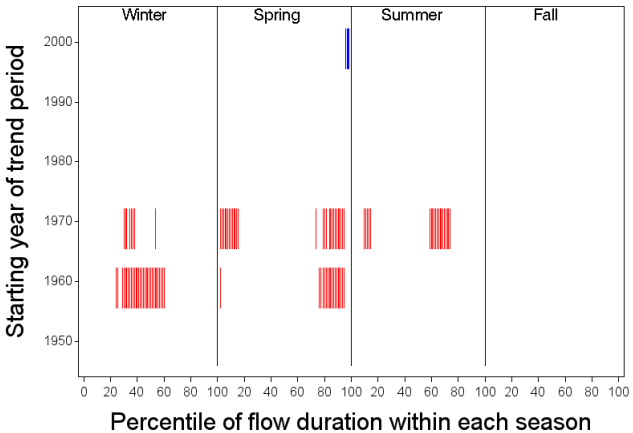
Trend results stratified by season



Streamflow Alteration – Trends Disturbance Index

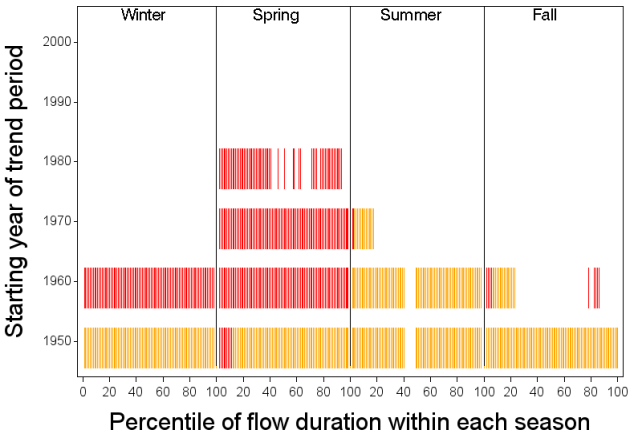
Suwannee River at White Springs, FL
0 Trends for POR 1950-2015

Site no. 12, HDI=16



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

Site no. 10, HDI=25



Reference Site

Calculation for Withlacoochee River near Holder, FL 1950-2015:
255/365 = .70

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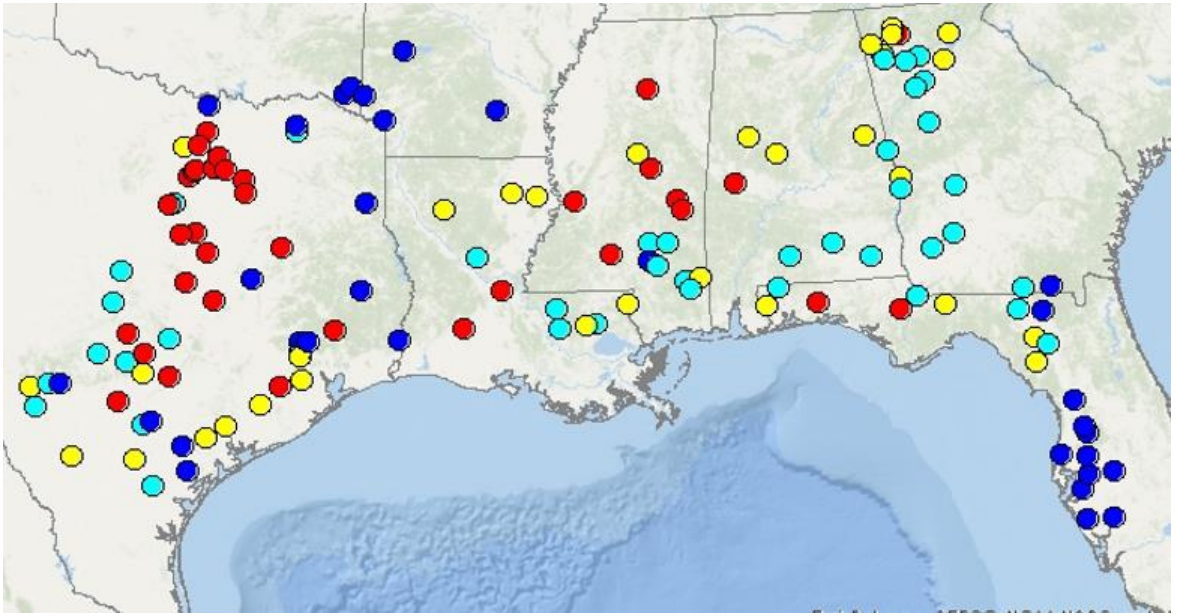
Data are provisional and subject to revision until they have been thoroughly reviewed and received final approval.

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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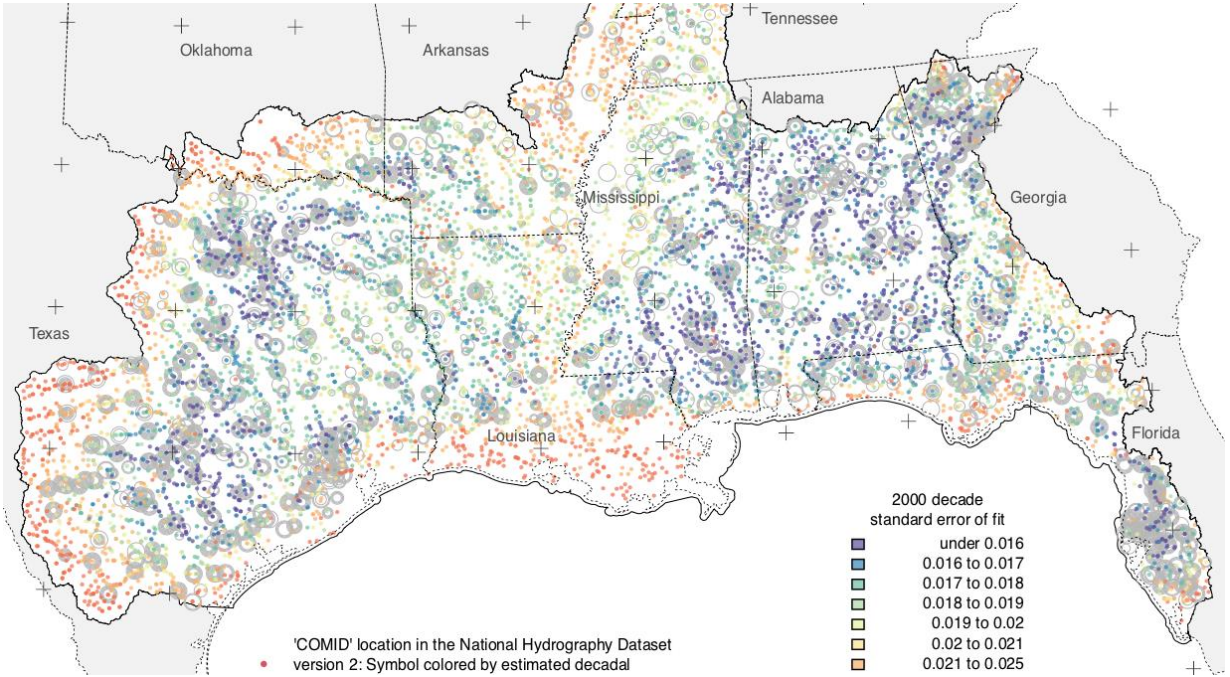
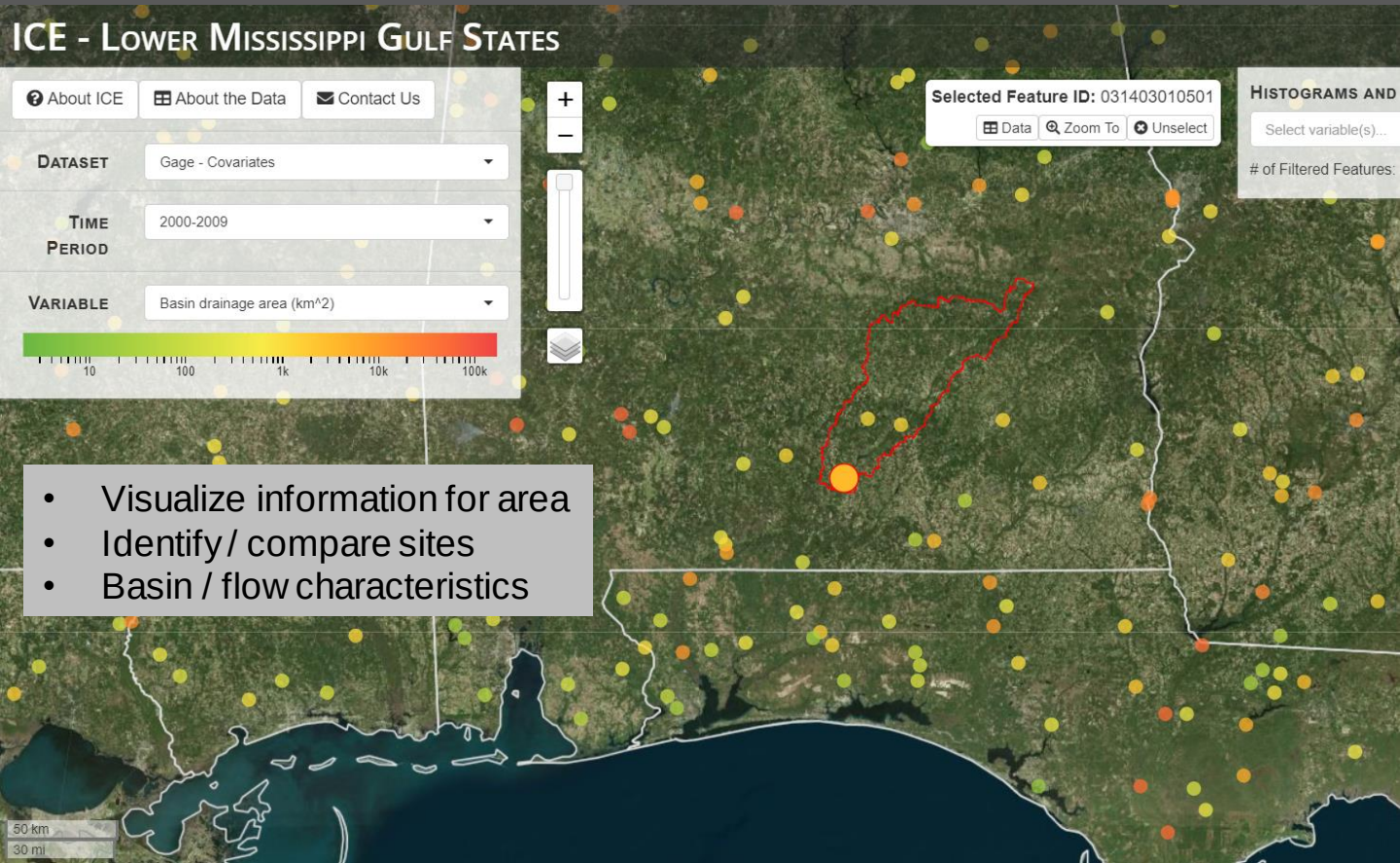
Network Analysis using Model Divergence



- 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

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

Example Web Mapper



- Visualize information for area
- Identify / compare sites
- Basin / flow characteristics

Baseline Flow & Gage Analysis and On-Line Tool Development
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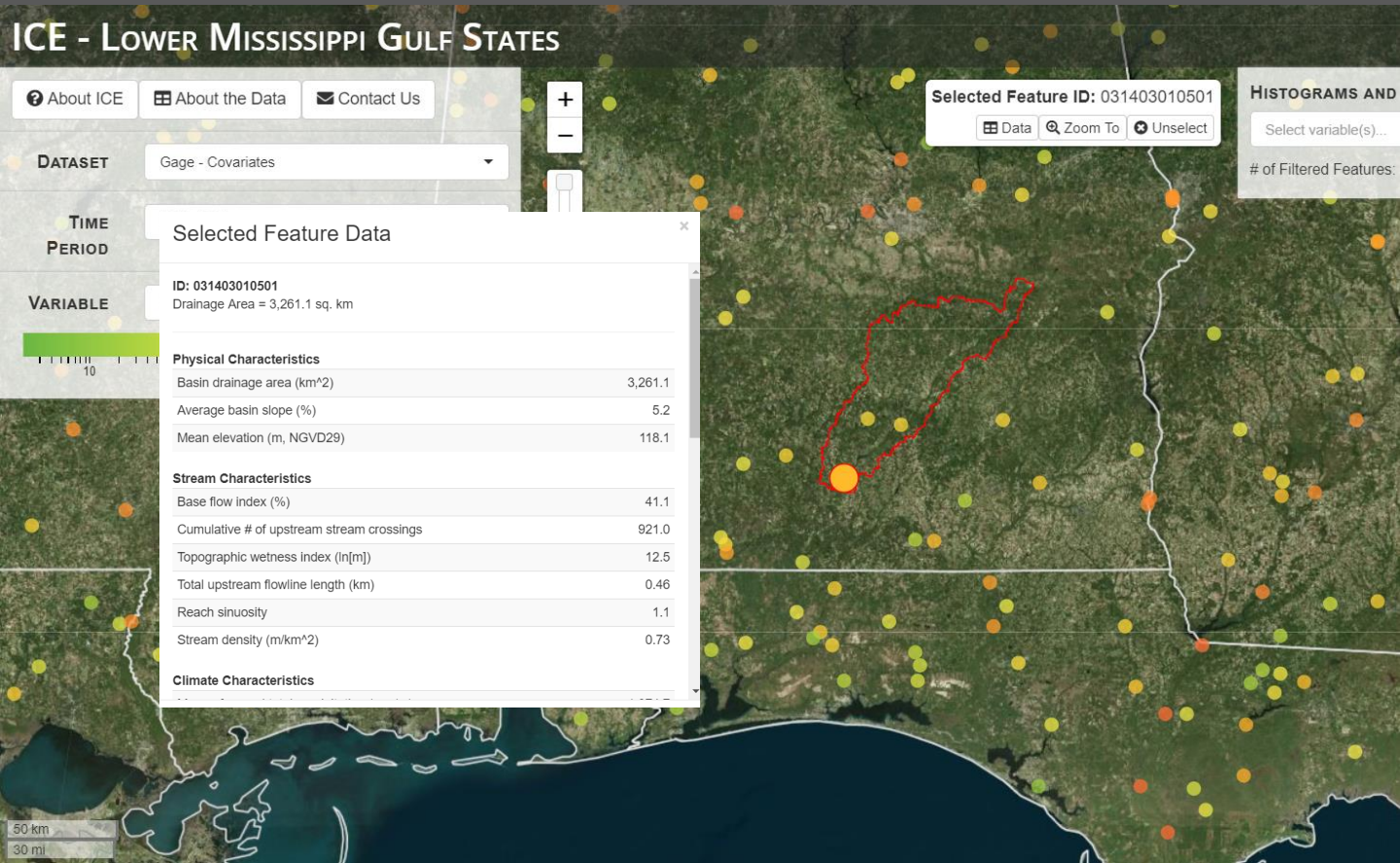

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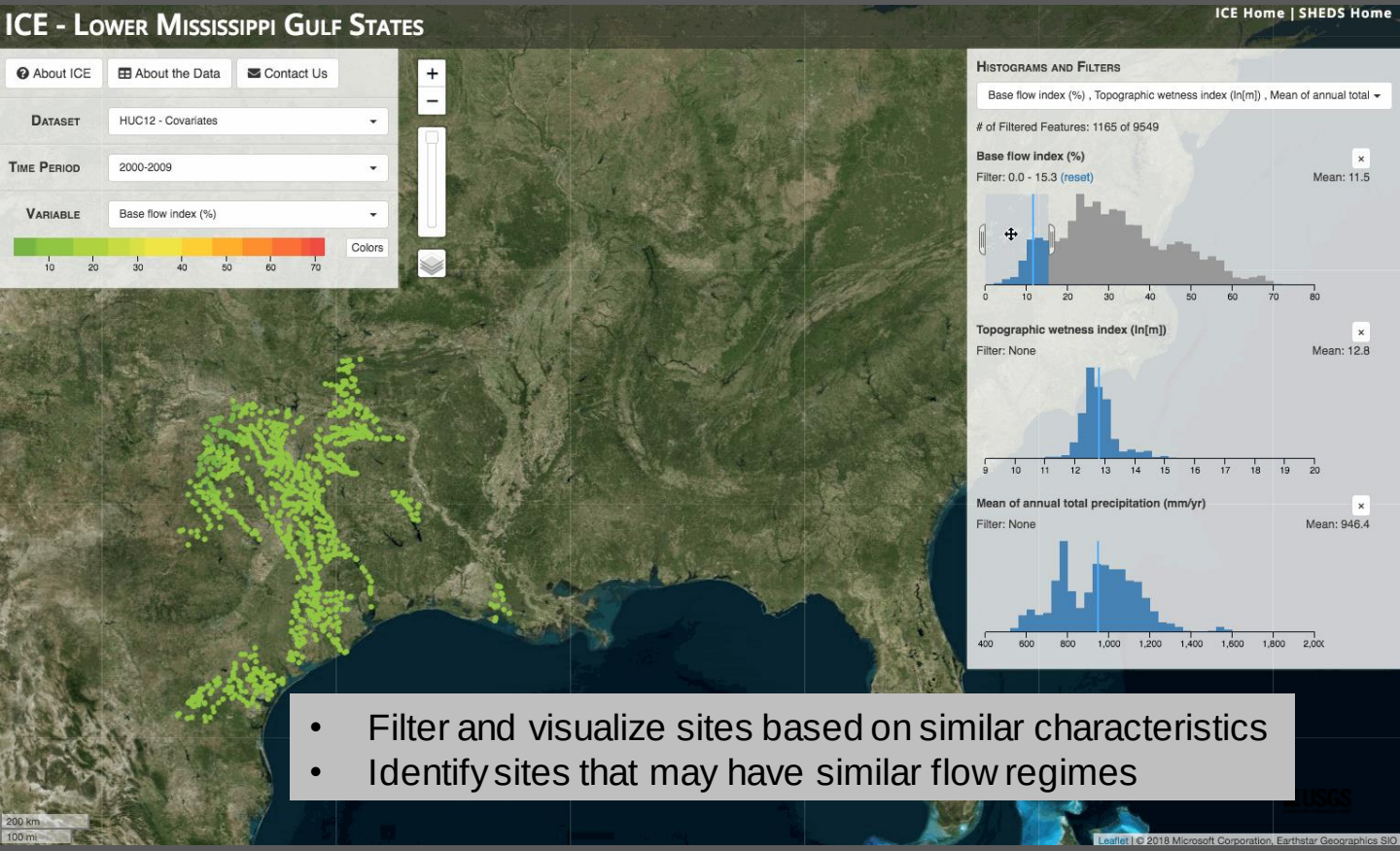
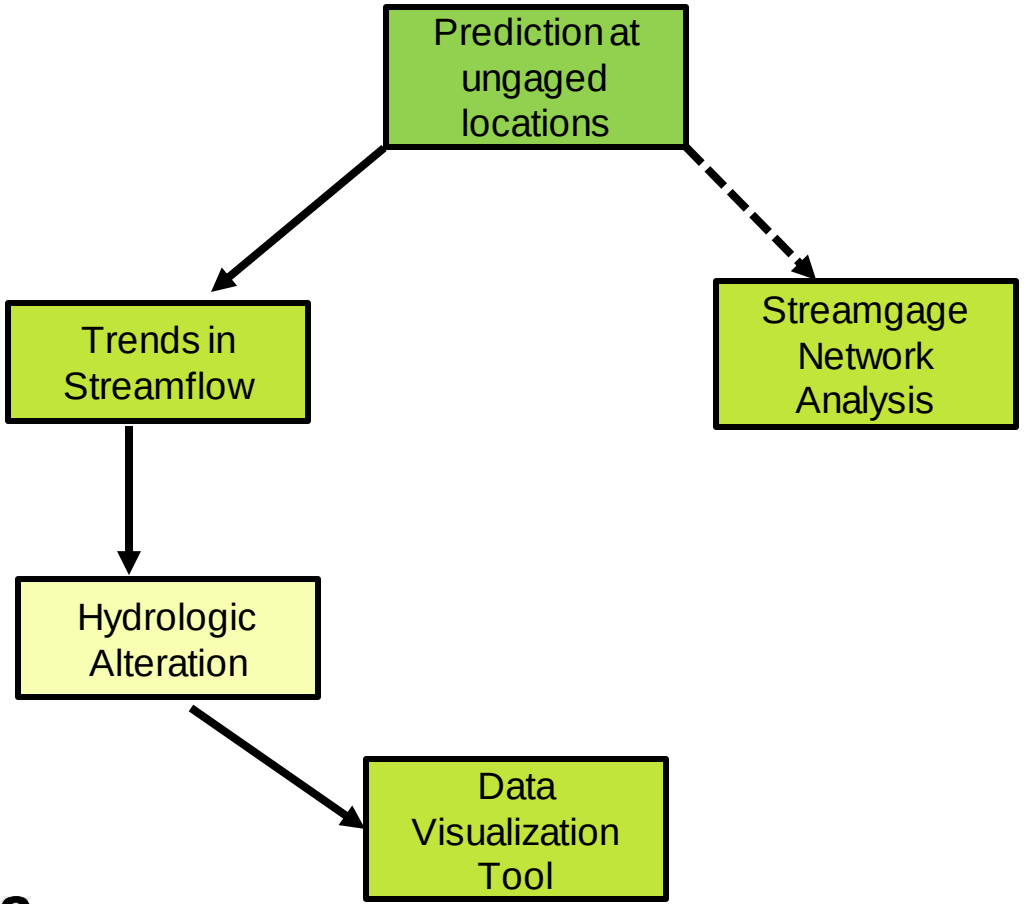
Supporting Bay and Estuary Restoration in Gulf States

Example Web Mapper



- Filter and visualize sites based on similar characteristics
- Identify sites that may have similar flow regimes


Prediction at ungaged locations
Trends in Streamflow
Streamgage Network Analysis
Hydrologic Alteration
Data Visualization Tool

USGS

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

View

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 quantiles for the pour 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
- Observed and modeled daily streamflow values for 74 U.S. Geological Survey streamgage locations in the Trinity and Mobile-Tombigbee River basins in the southeast United States: 2000--2009
- 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

Photo credit Texas Parks and Wildlife

Map »

Spatial Services

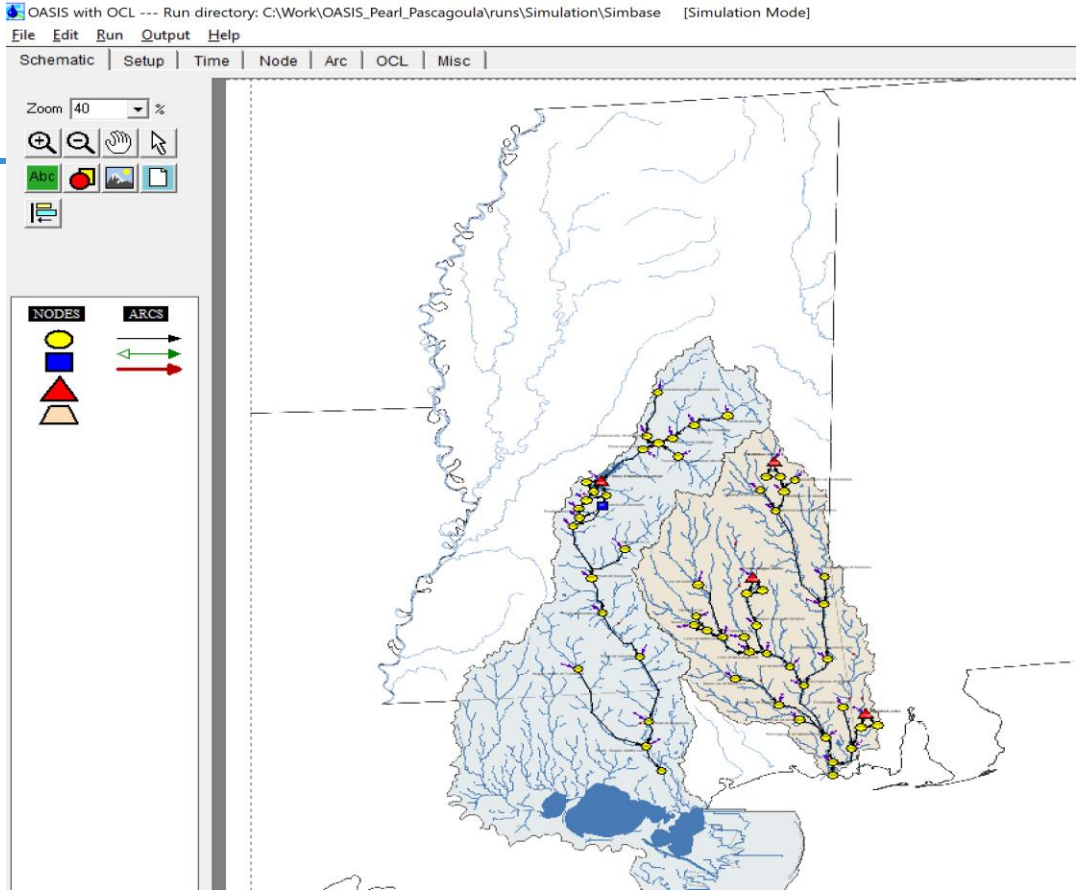
ScienceBase WMS : https://www.sciencebase.gov/catal

Communities

- USGS Lower Mississippi-Gulf Water Science Center

Provenance

Data source : Input directly



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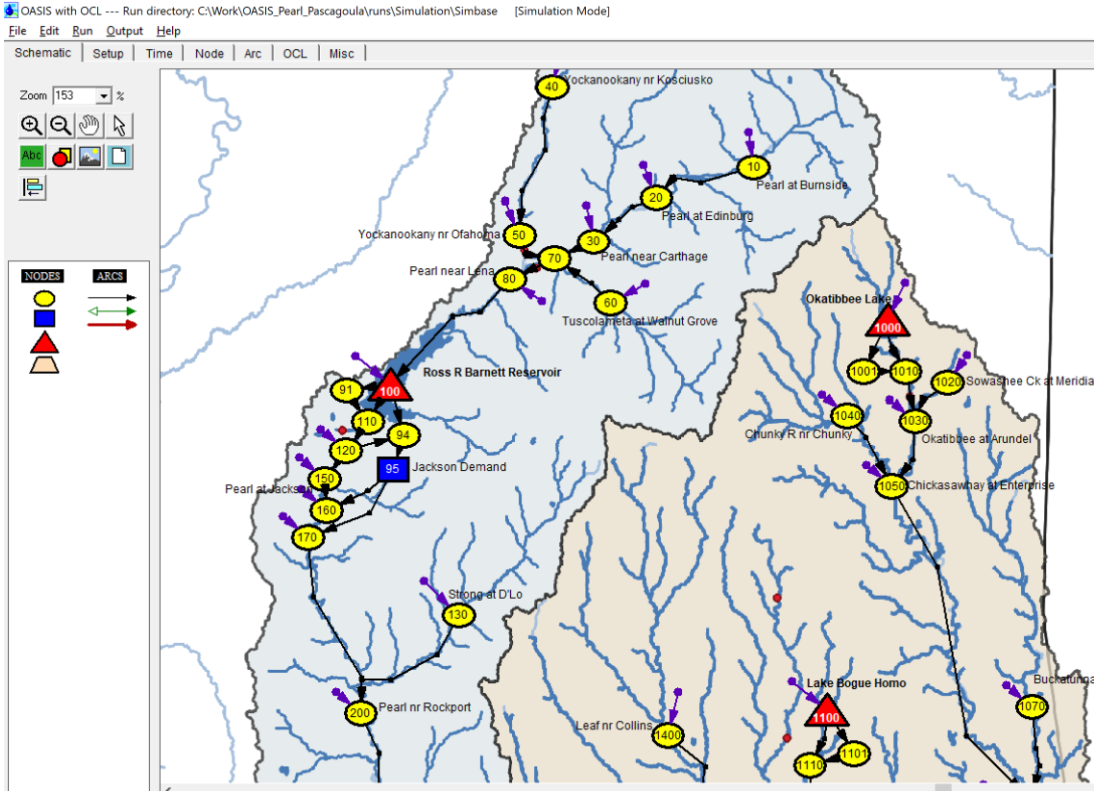
USGS science for a changing world



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