

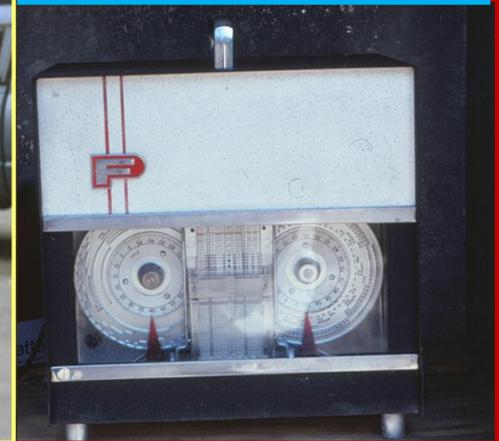
Coastal Gaging – Monitoring the Effects of Riverine and Tidal Forces

South Carolina Department of Natural Resources
Streamflow Monitoring Workshop
February 3, 2016

Presentation Outline

- General comments on USGS gaging along SC Coast
- The unsteady state of the coast
 - Teasing out coastal complexities
 - Flow, salinity, dissolved oxygen examples
- USGS gaging along the coast
 - Convergence of conditions in the 1980s
 - Demographic growth
 - Technology real-time data
 - Water availability

1980s: The Time and Place for Real-time Gaging

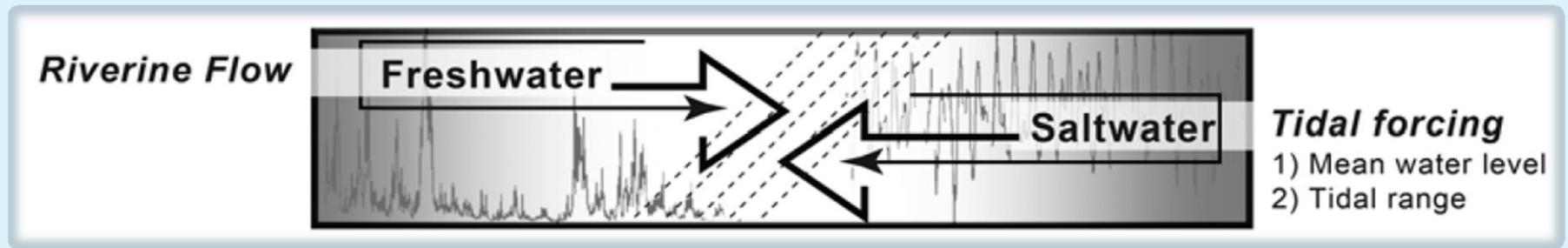


Cooper River Salinity Alert System

- Decreased flows in the Cooper River = increased salinity upstream
- Saltwater-freshwater interface will move upstream to Durham Canal
- Industries need Bushy Park Reservoir protection from salinity intrusion
- Real-time alert system established in 1985



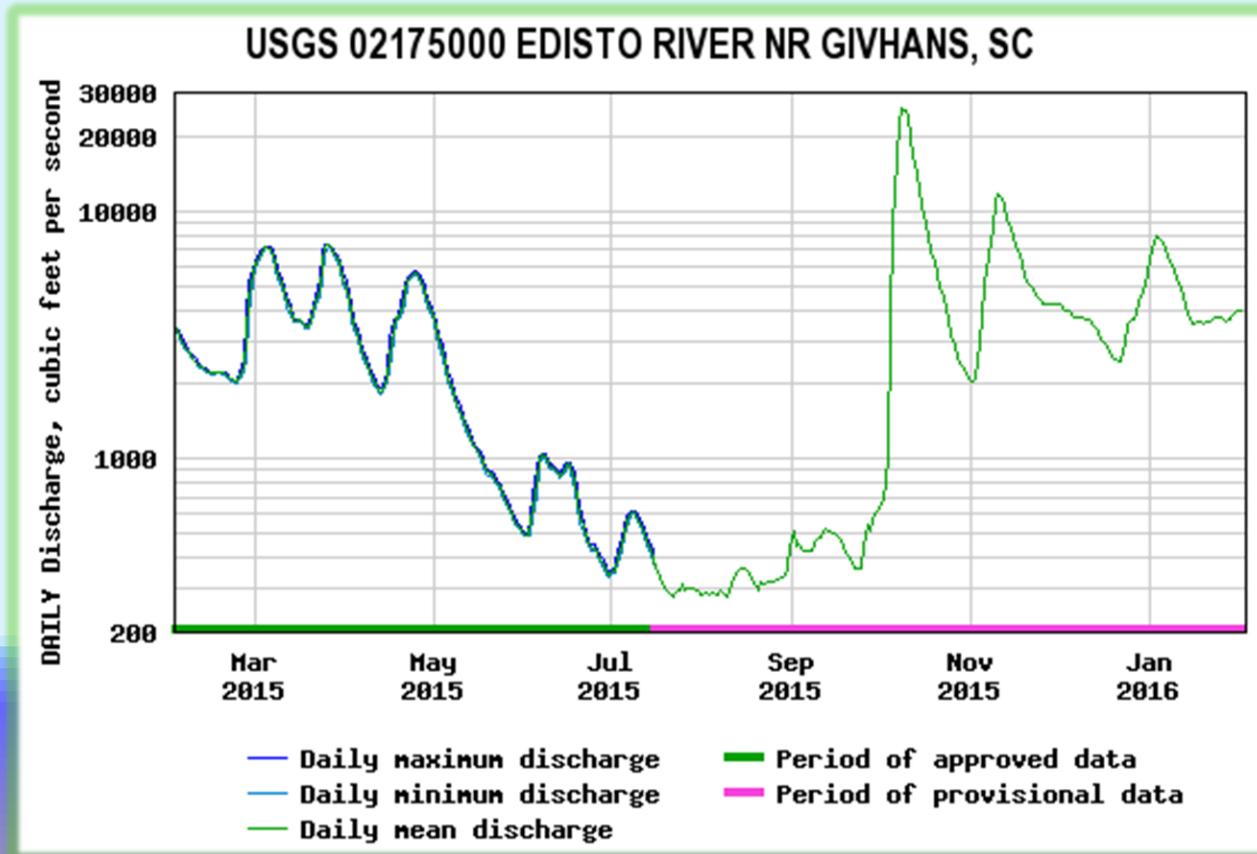
Constant Pushing and Shoving Along the Coast



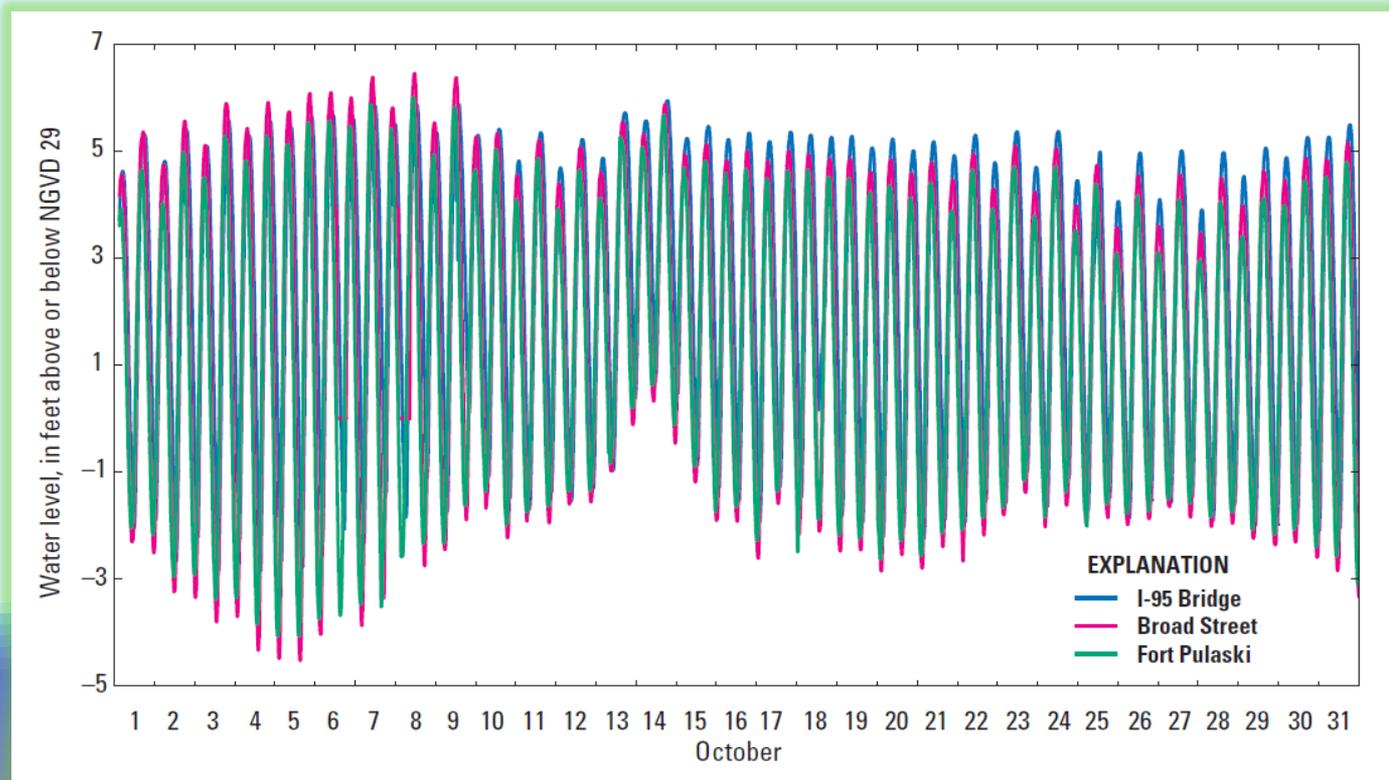
“...estuaries may never really be steady-state systems; they may be trying to reach a balance they never achieve.”

Keith Dyer, 1997

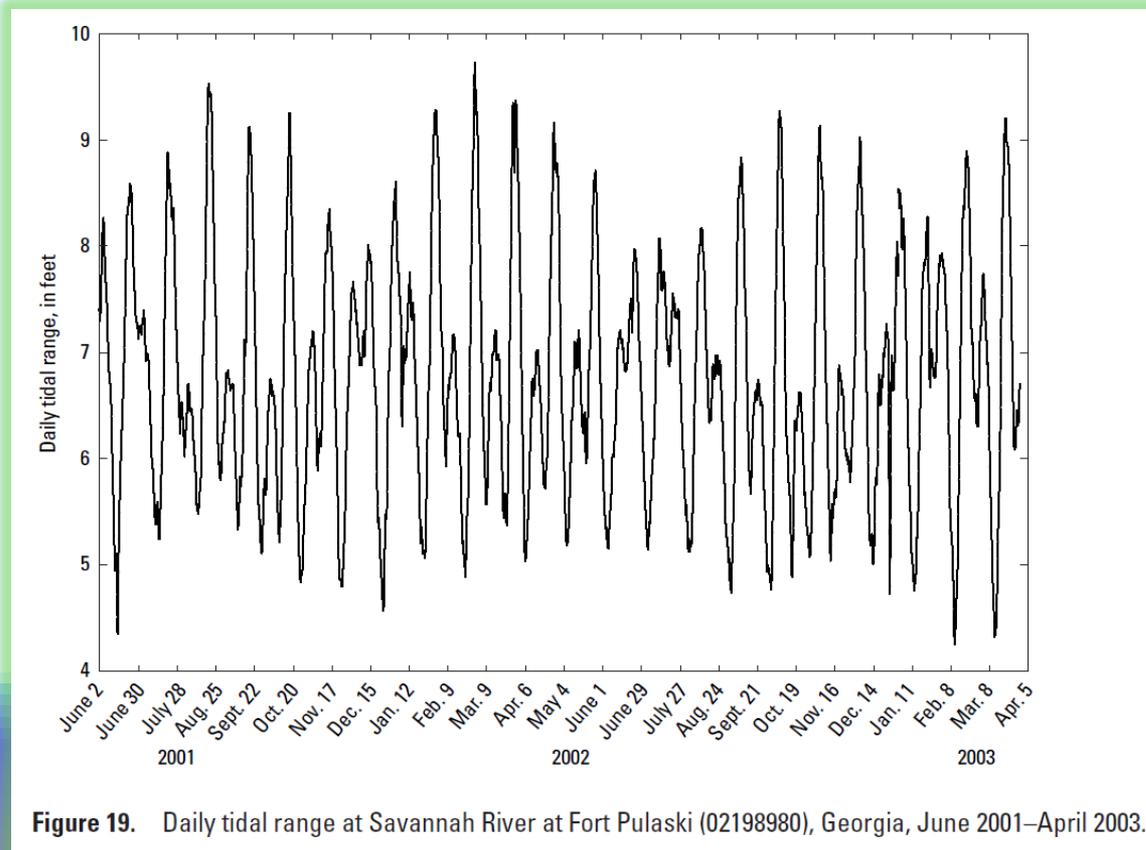
Upland Forces - Flow



Coastal Forces – Tides

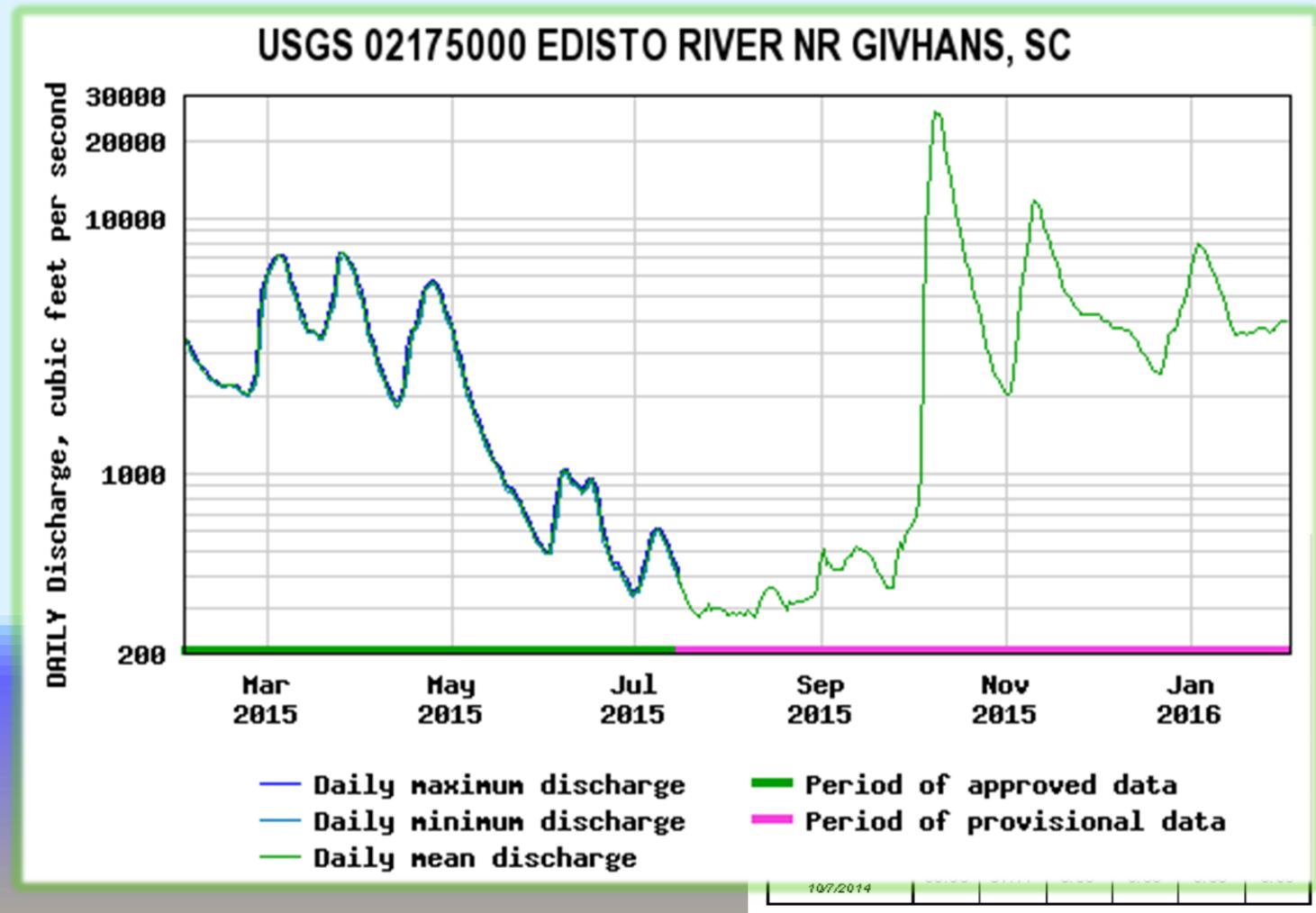


Coastal Forces – Tidal Range



Salinity – Natural Conservative Tracer

Mixing of upland flows and coastal salinity

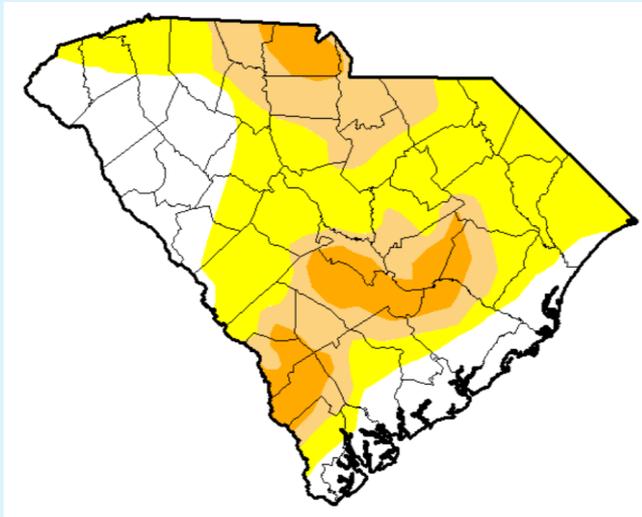


Salinity – Natural Conservative Tracer

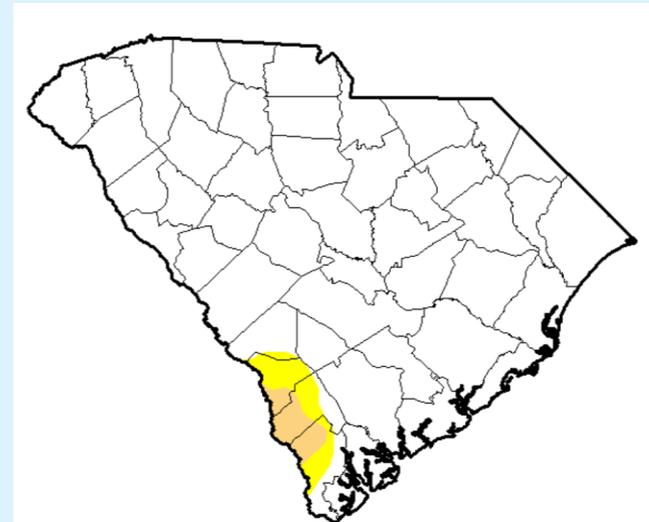
Drought maps before and after October flood

September 29, 2015

October 6, 2015



Intensity

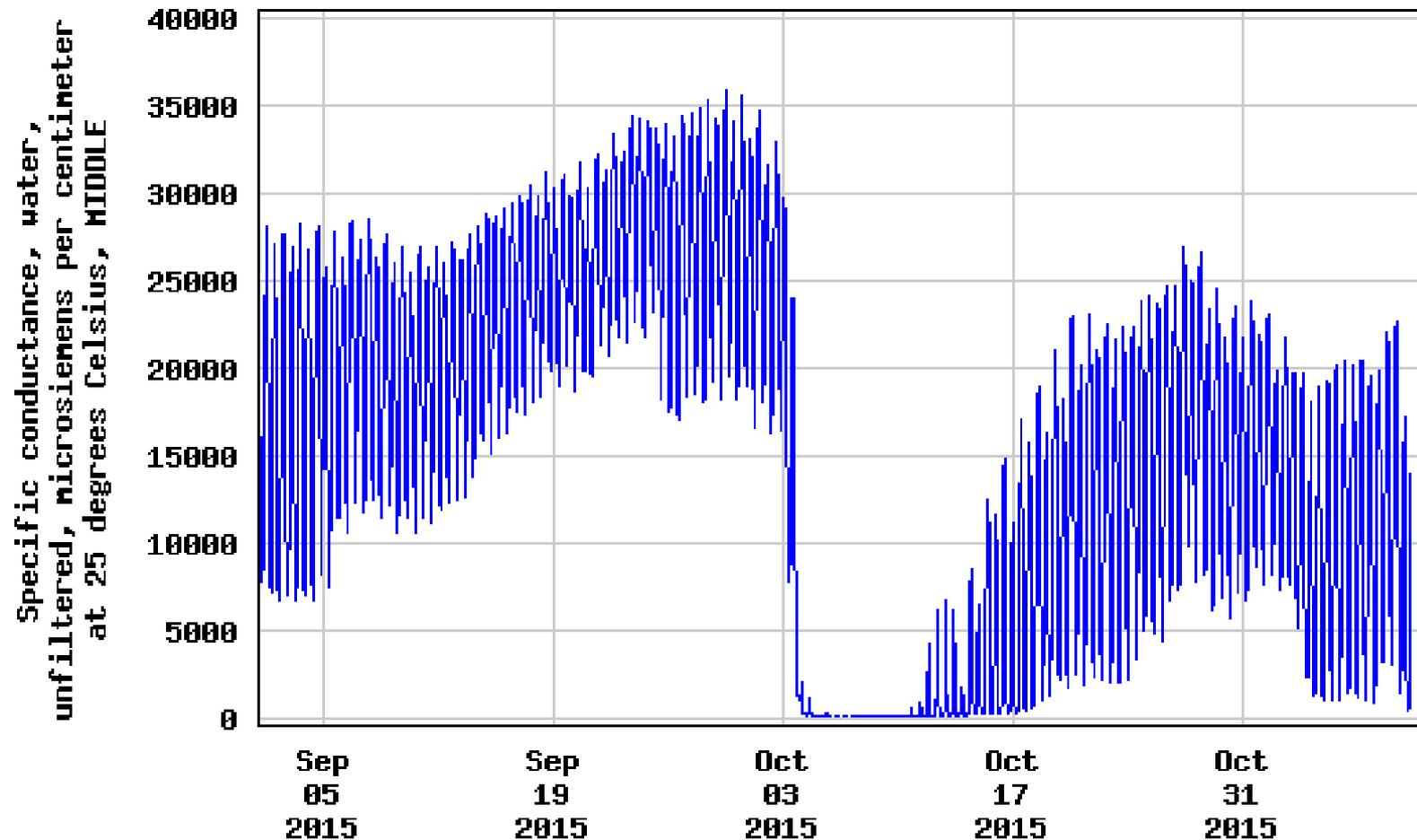


Drought Conditions (Percent Area)

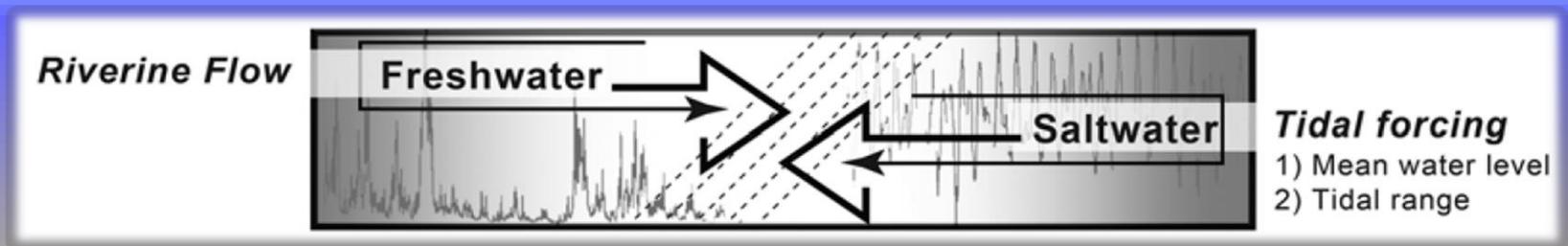
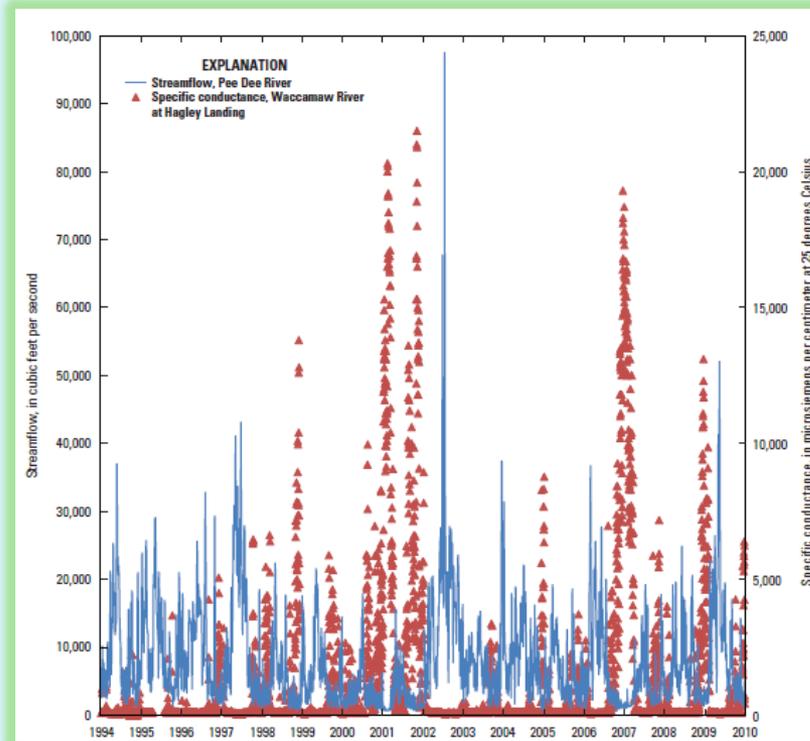
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	95.93	4.07	1.72	0.00	0.00	0.00
Last Week <i>9/29/2015</i>	26.80	73.20	31.76	10.91	0.00	0.00
3 Months Ago <i>7/7/2015</i>	33.06	66.94	38.43	0.00	0.00	0.00
Start of Calendar Year <i>12/02/2014</i>	96.63	3.37	0.00	0.00	0.00	0.00
Start of Water Year <i>9/29/2015</i>	26.80	73.20	31.76	10.91	0.00	0.00
One Year Ago <i>10/7/2014</i>	68.83	31.17	0.00	0.00	0.00	0.00

Salinity – Natural Conservative Tracer

USGS 021720869 ASHLEY RIVER NEAR NORTH CHARLESTON, SC

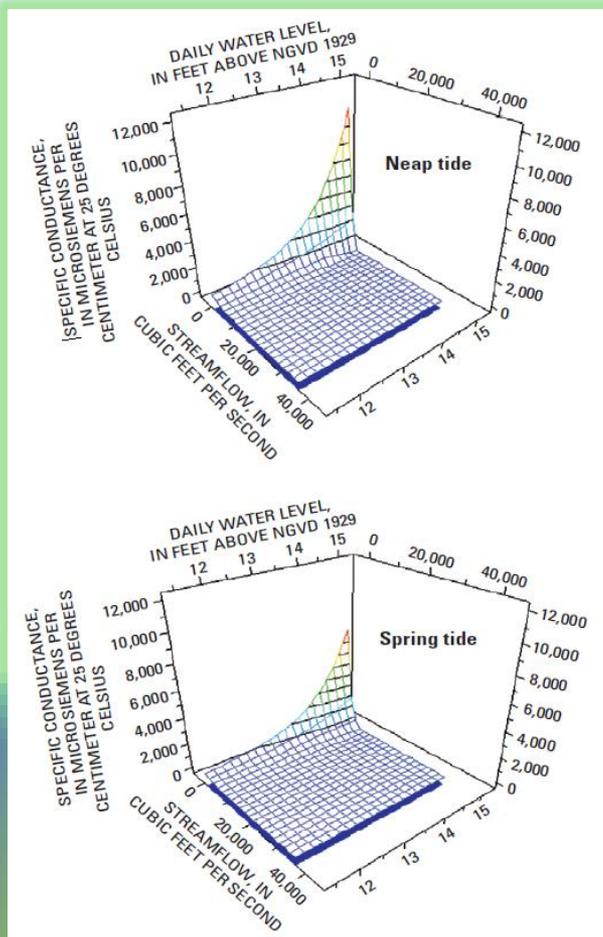


Convergence of Conditions

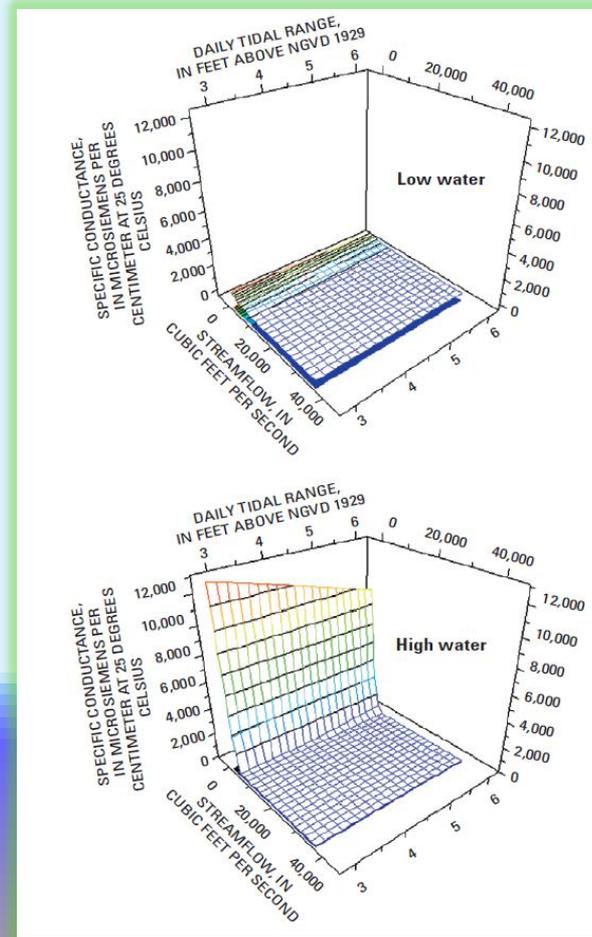


Interaction of Flow, Tidal Range, and Water Level

Spring Tides or Neap Tides?

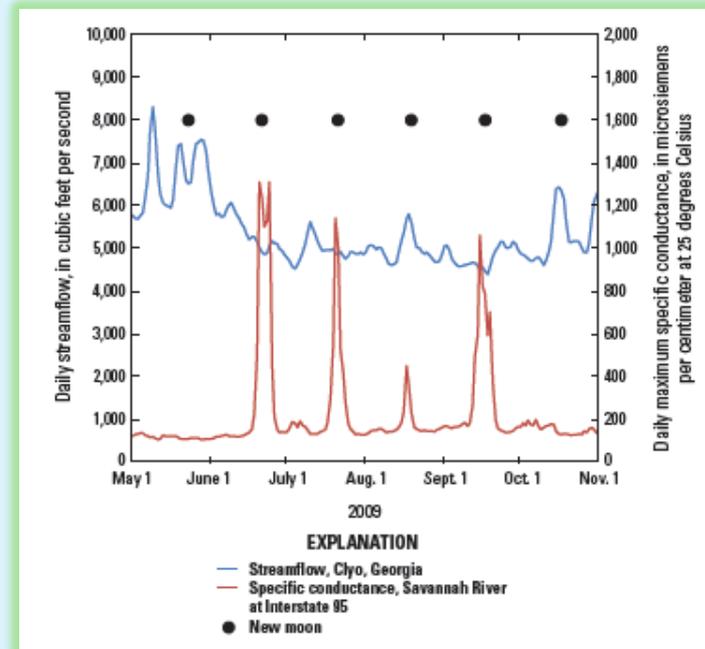
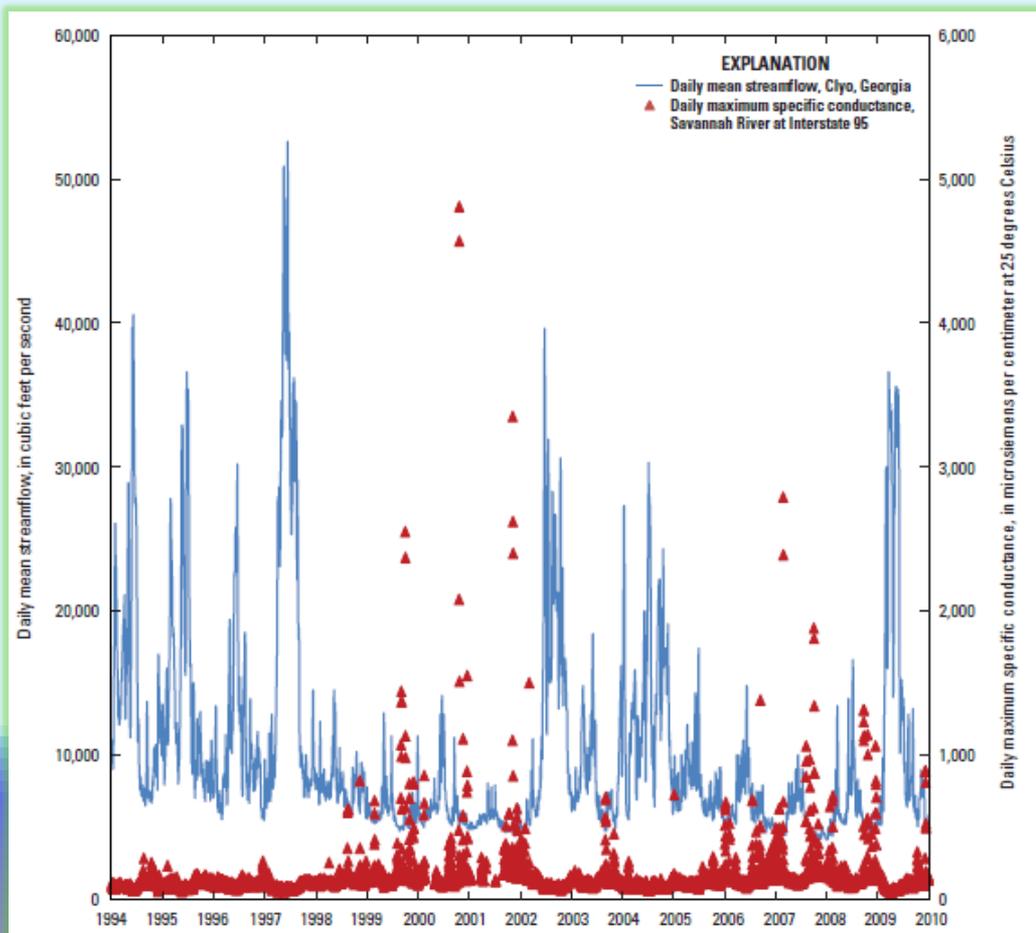


High or Low Water Level ?

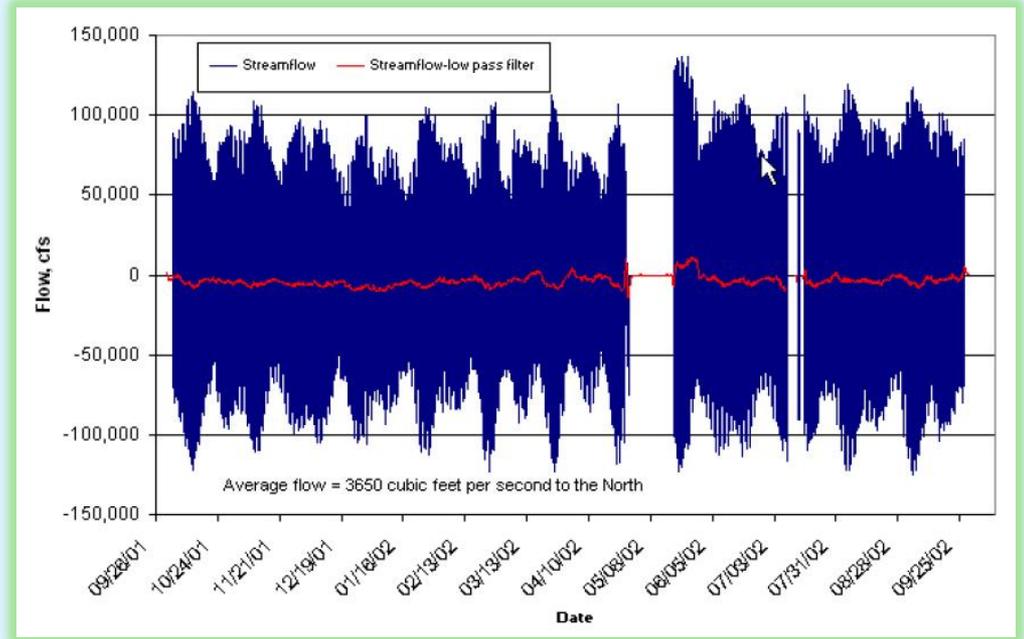
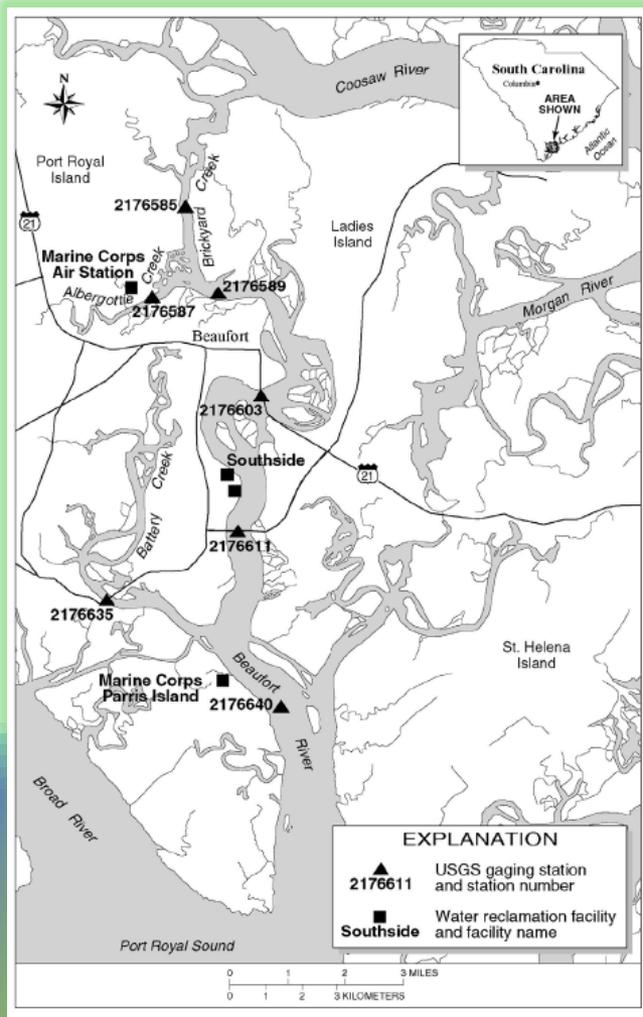


Set Your Clocks

Savannah River



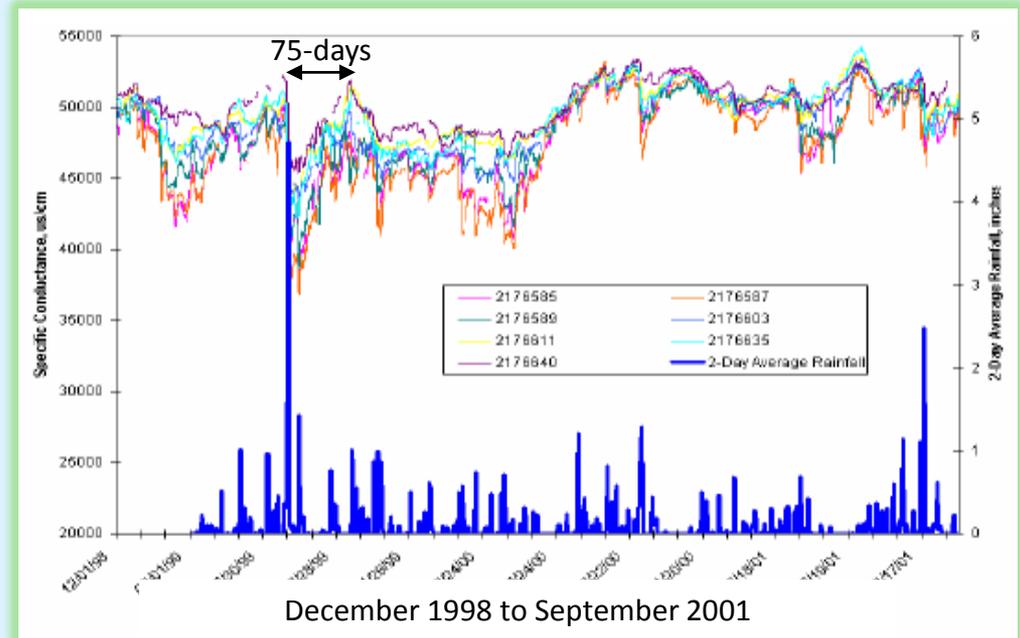
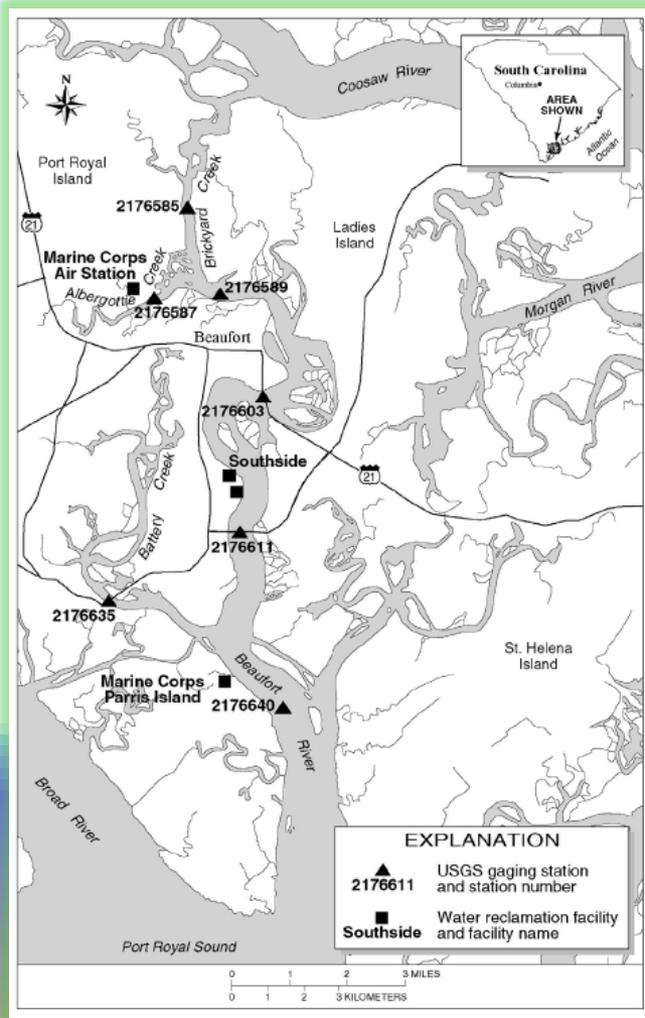
Beaufort River



Hourly and Filtered Flows

Conrads et al., 2003

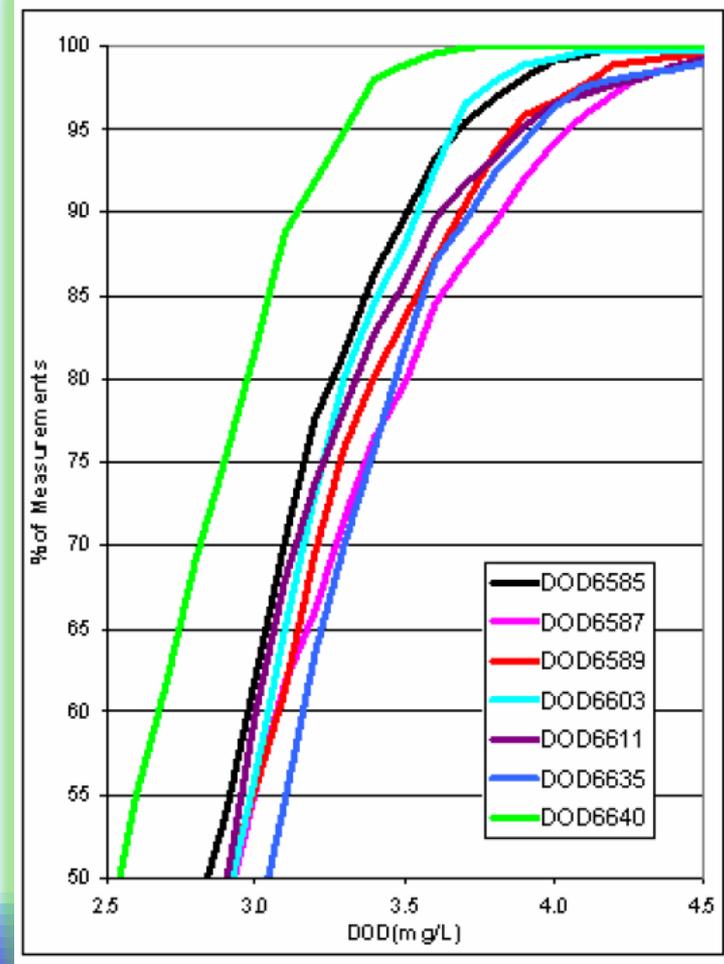
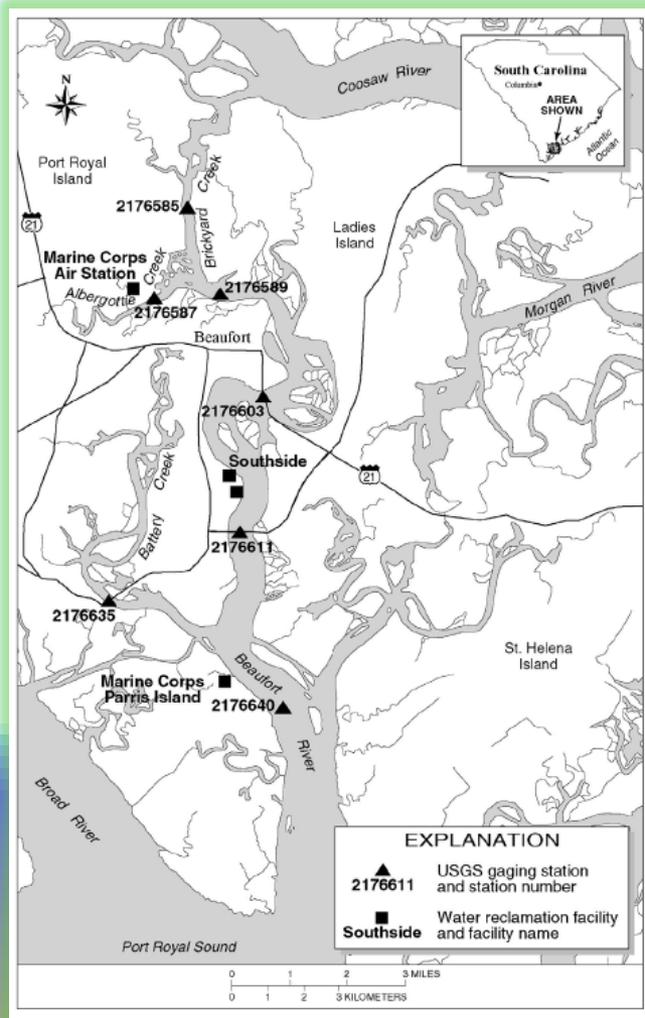
Beaufort River



Specific Conductance and Rainfall

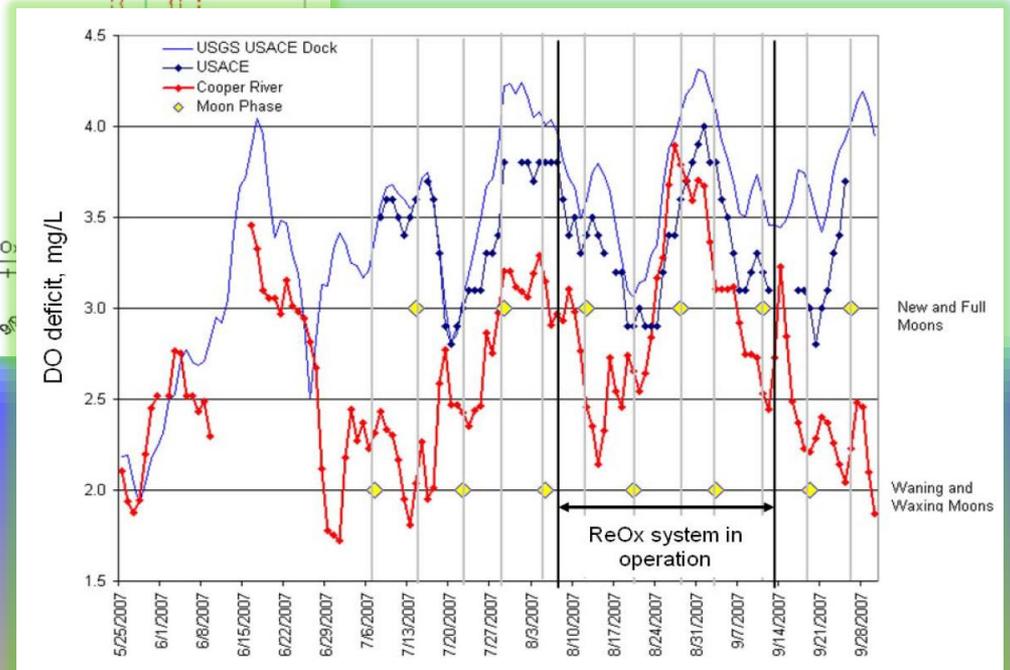
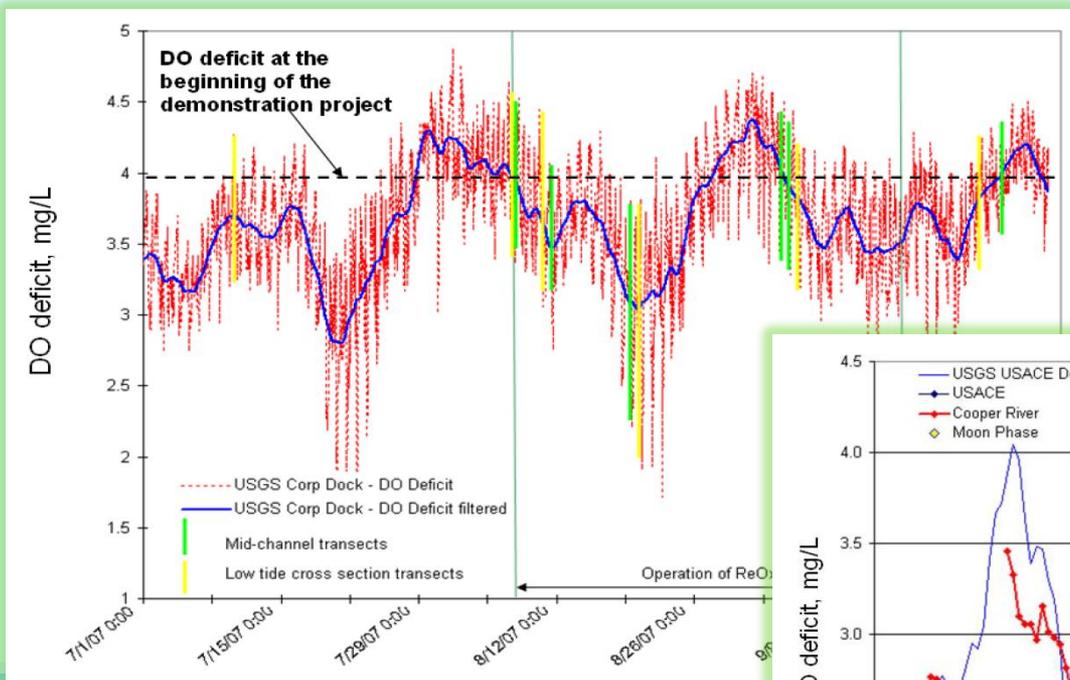
Conrads et al., 2003

Beaufort River



Frequency Distribution of Dissolved Oxygen Deficit

Savannah Harbor: Re-oxygenation Demonstration Project

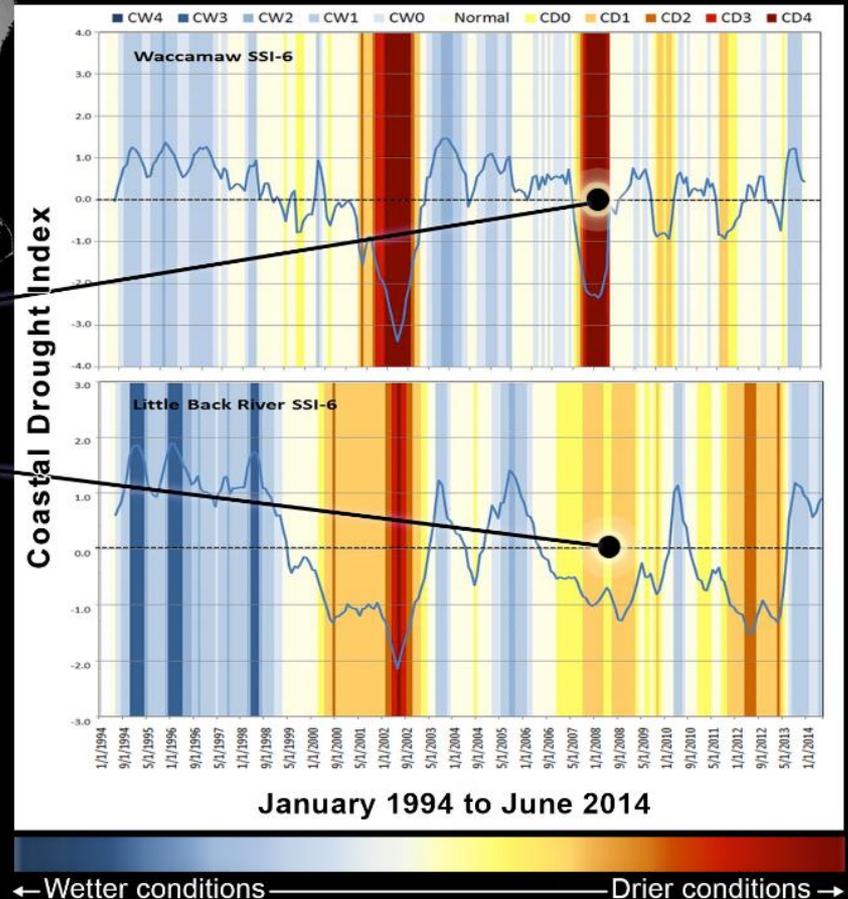
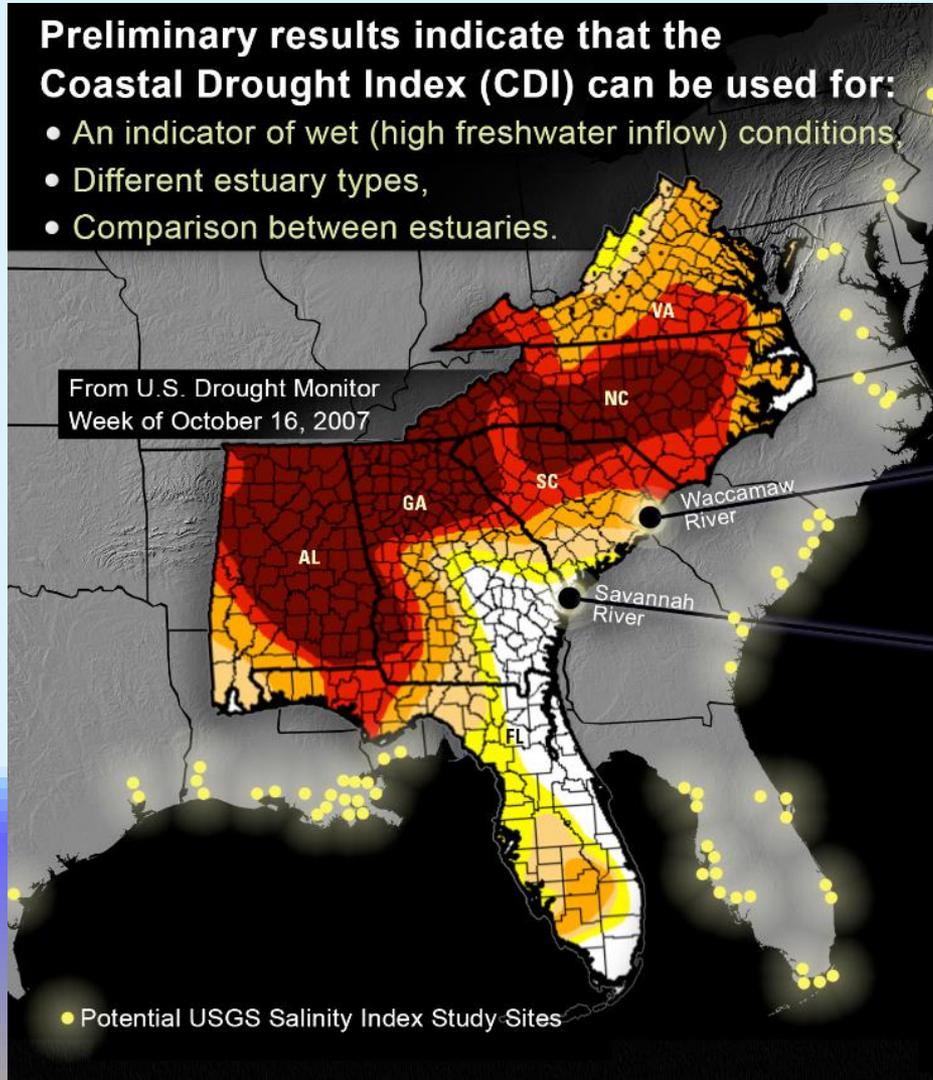


Coastal Drought

Preliminary results indicate that the Coastal Drought Index (CDI) can be used for:

- An indicator of wet (high freshwater inflow) conditions.
- Different estuary types,
- Comparison between estuaries.

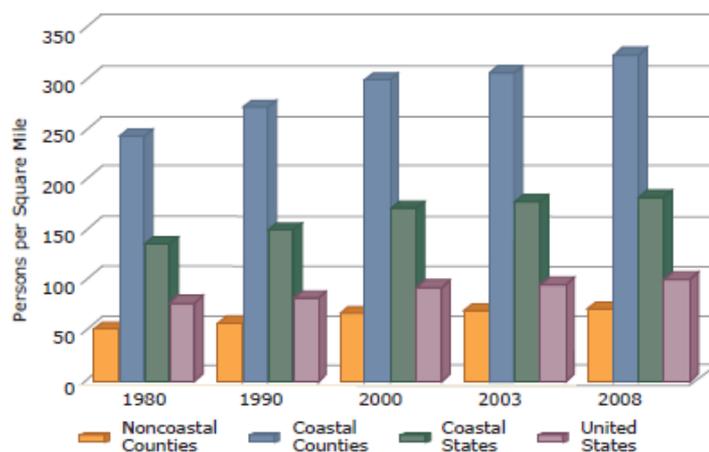
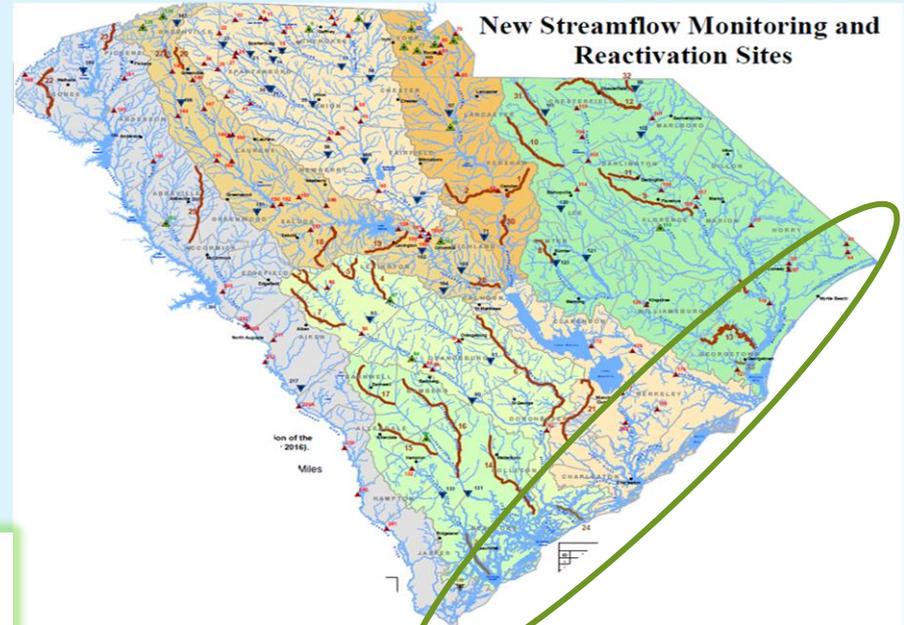
From U.S. Drought Monitor
Week of October 16, 2007



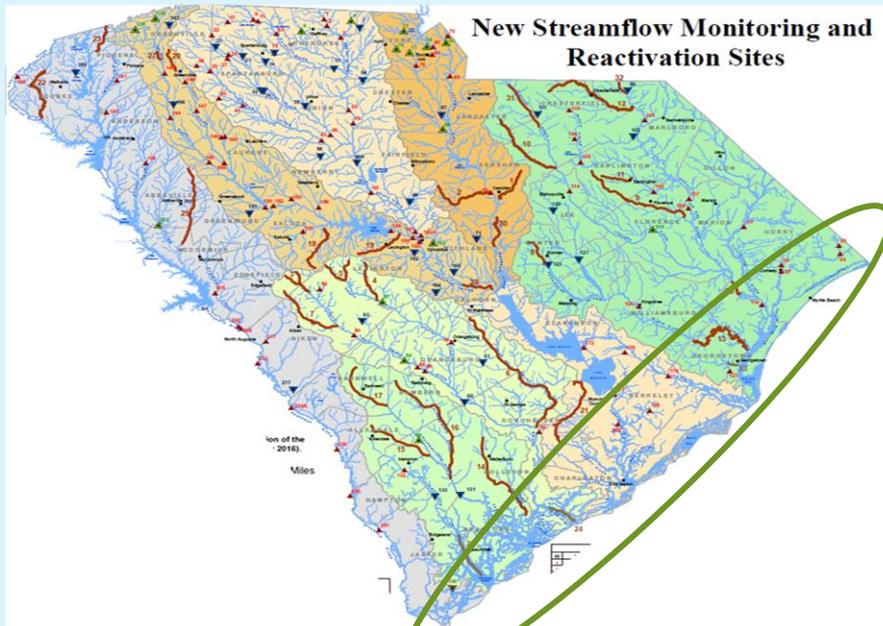
USGS Gaging along SC Coast

- Convergence of conditions in the 1980s

- Demographic growth
- Water availability Issues
- Technology real-time data



History of USGS along SC Coast



1980s

- Charleston – salinity alert
- Grand Strand – freshwater availability

1990s

- Grand Strand – DO TMDL
- Charleston – start of 10+ year DO TMDL development

2000s

- Beaufort – DO TMDL
- Savannah Harbor Deepening

2010s

- Charleston Harbor Deepening
- Savannah Harbor Deepening
- Climate Change

Concluding thoughts

- Over the last 30 years, the USGS coastal network has played an important data and information role in major water-resources decisions along the coast.
- The network has been centered around urban centers. Few gages along undeveloped stretches of the coast.
- Data used by many to address various issues
- Difficult to anticipate how data will be used in the future

Questions?

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