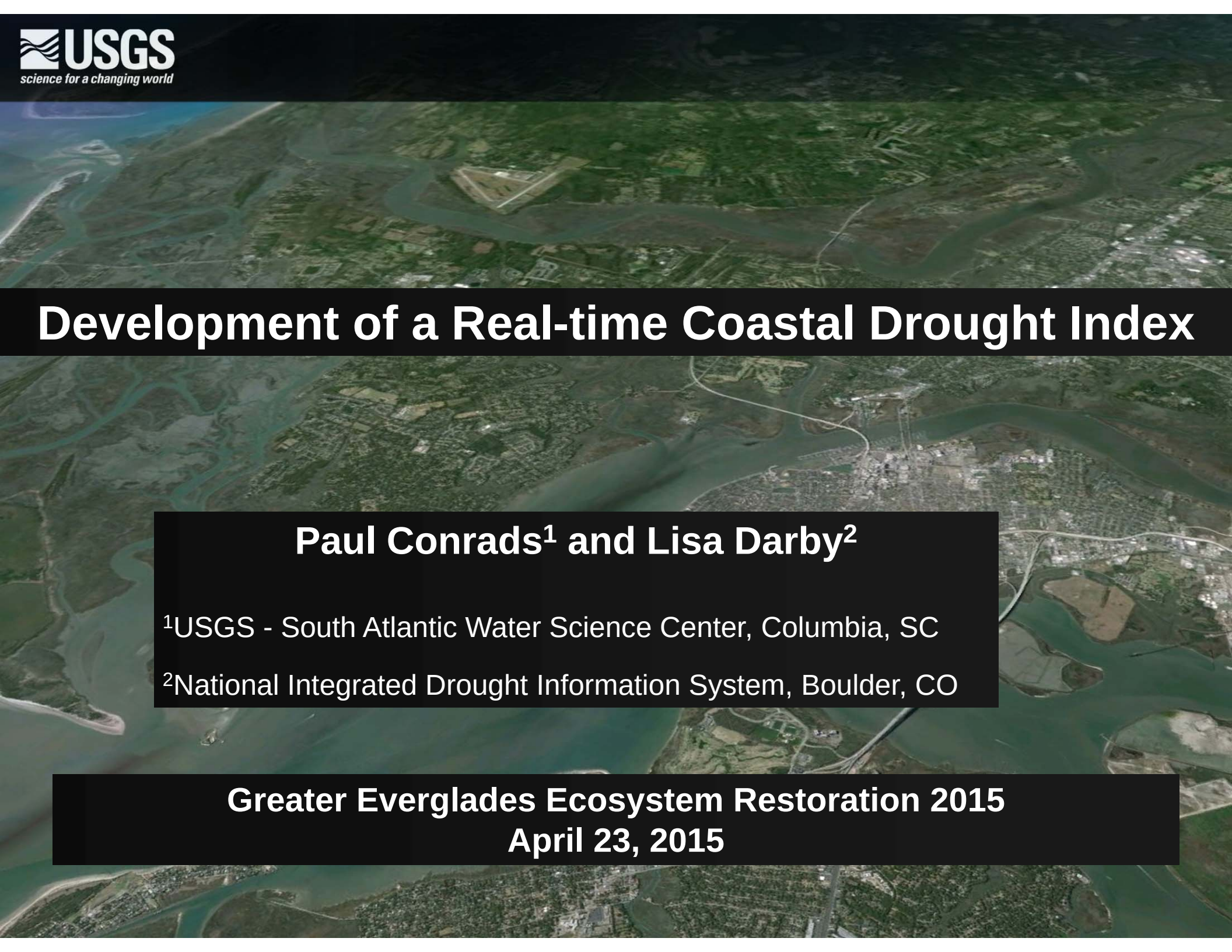


Development of a Real-time Coastal Drought Index

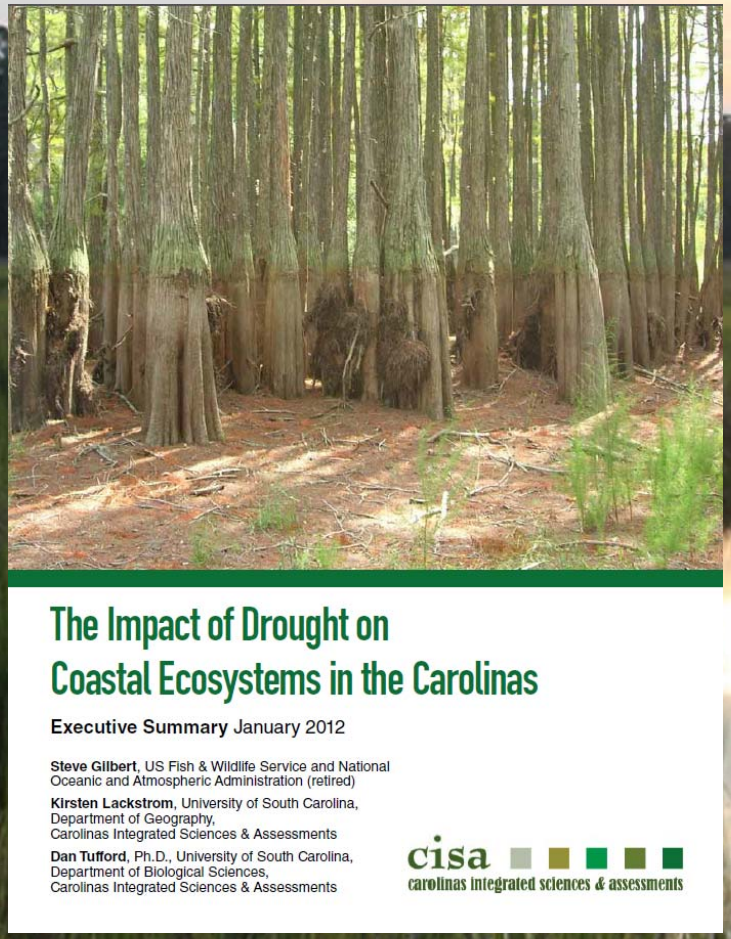
Paul Conrads[1] and Lisa Darby[2]

[1]USGS - South Atlantic Water Science Center, Columbia, SC

[2]National Integrated Drought Information System, Boulder, CO

Greater Everglades Ecosystem Restoration 2015
April 23, 2015

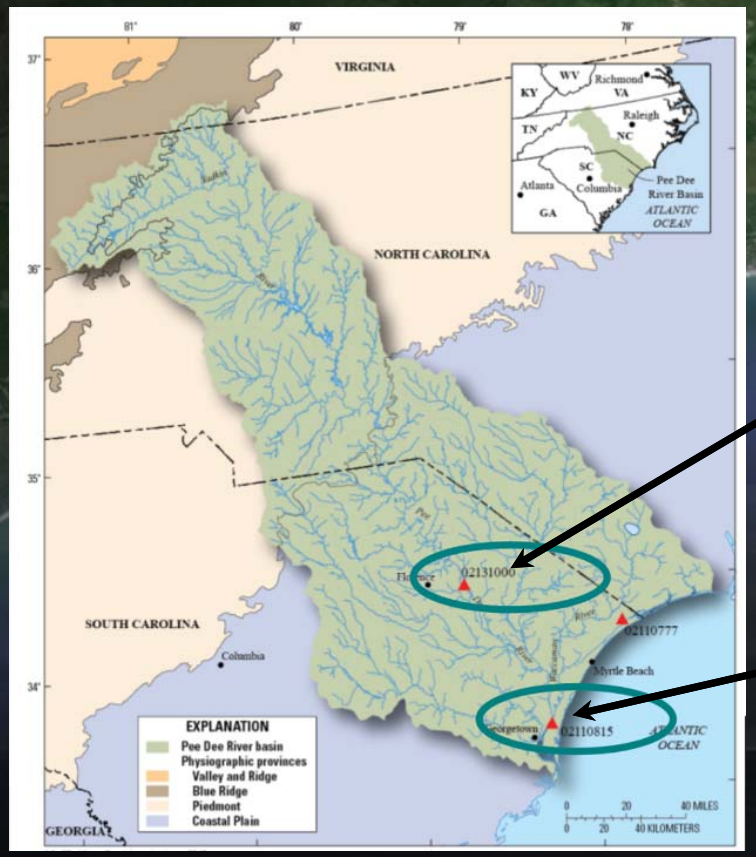
Coastal Drought



- Effects on:
  - Tidal marsh
  - Shellfisheries
  - Vibrio pathogen transport
- Largest stressor –salinity

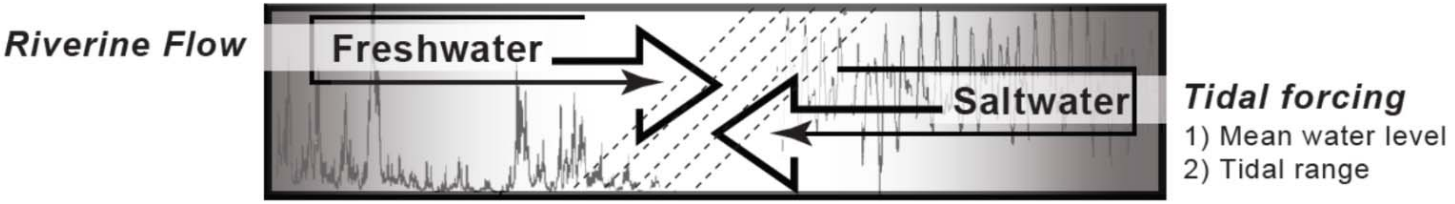
Question – Can a drought index be developed for the coast?

Can Salinity be Used as a Drought Index Variable?

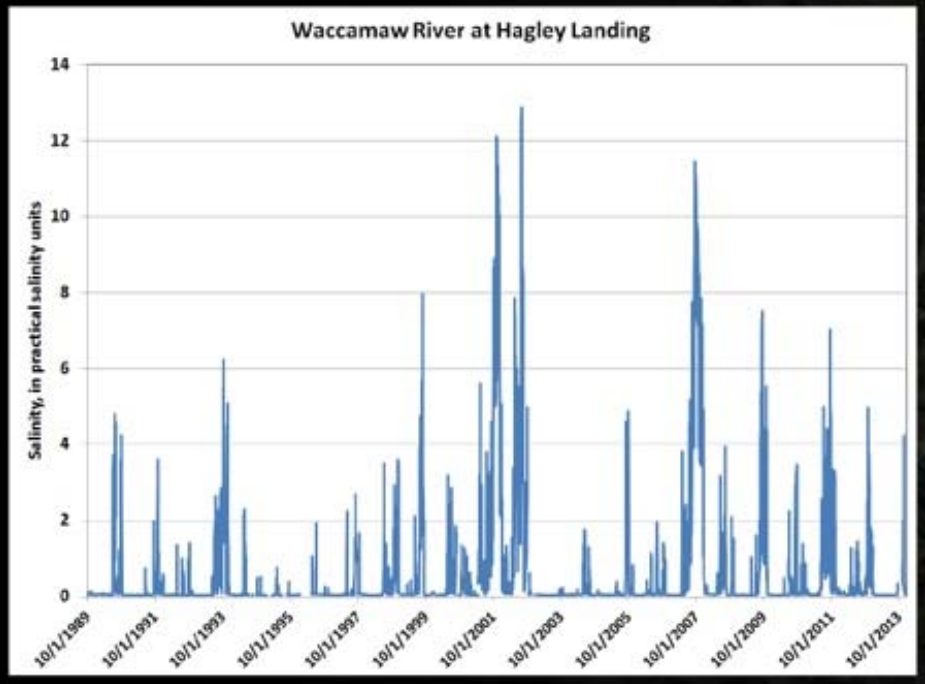


Pee Dee River

Waccamaw River

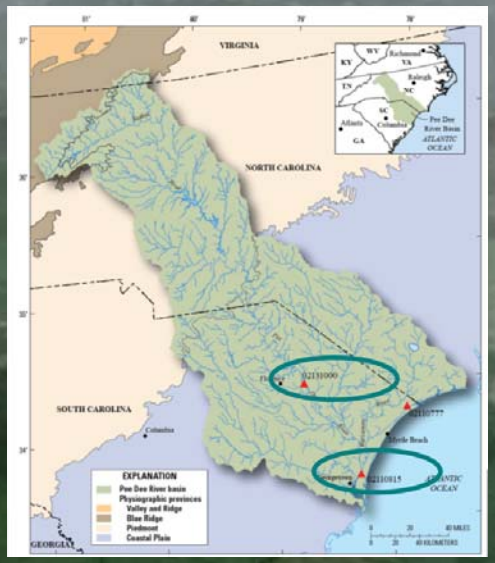


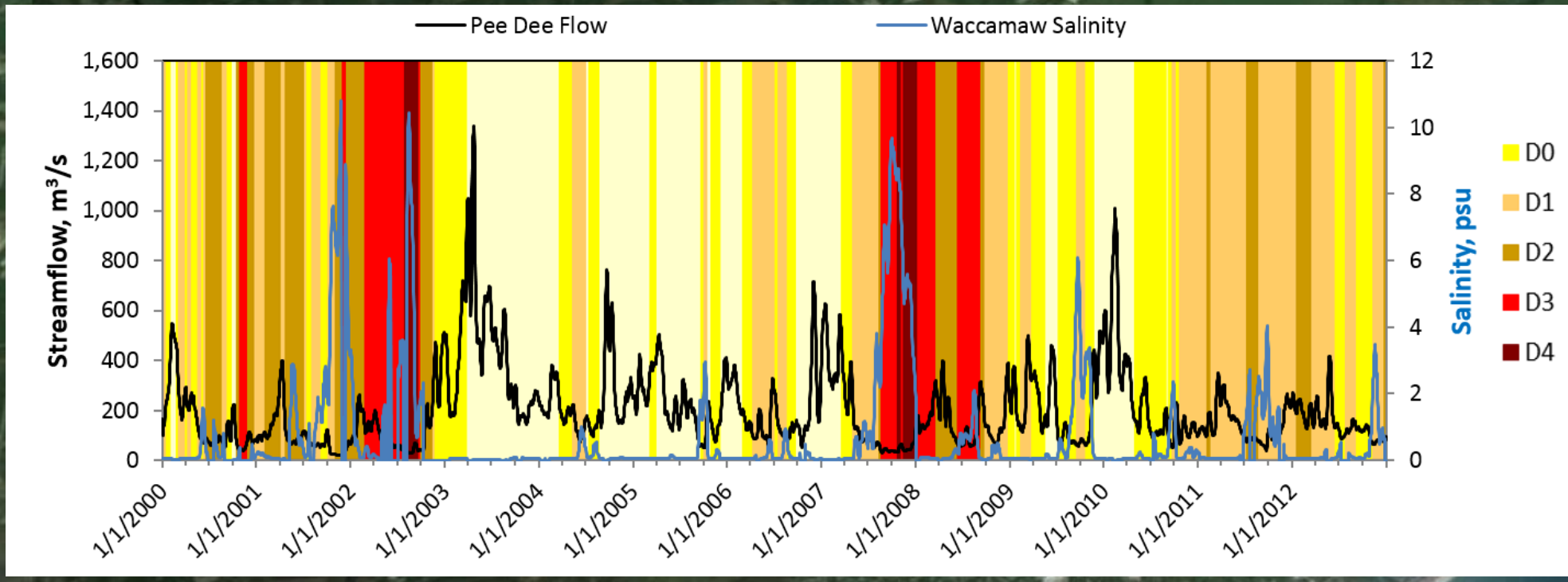
Long-term Salinity Data



Waccamaw River at Hagley Landing (02110815)
Long period of record
1989 to present
Daily mean salinity
~8,000 data point

Flow, Salinity, and Drought Index

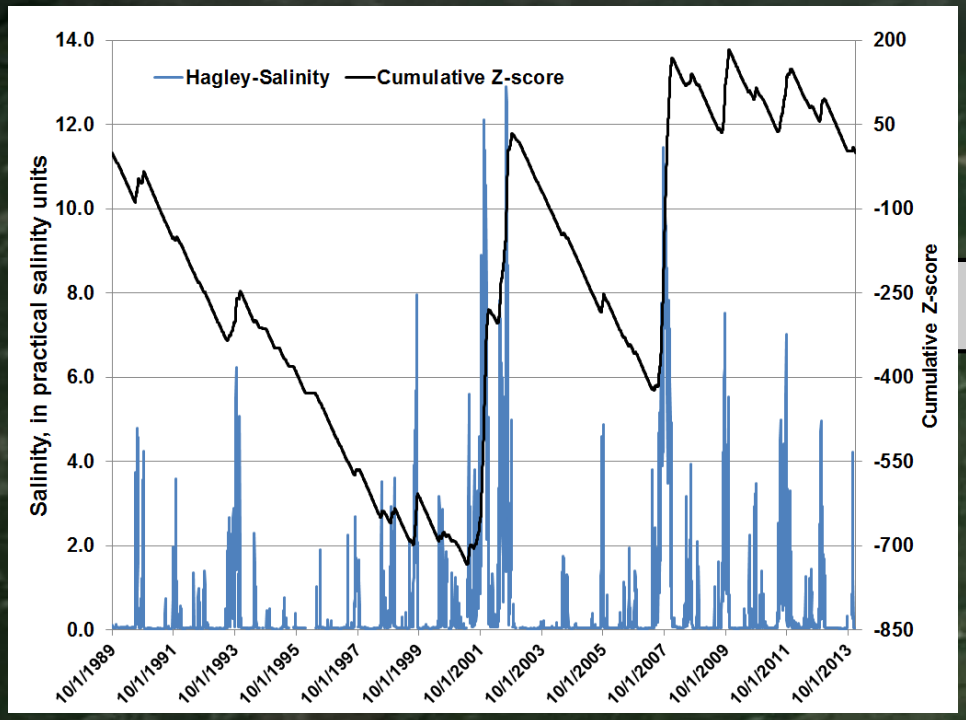


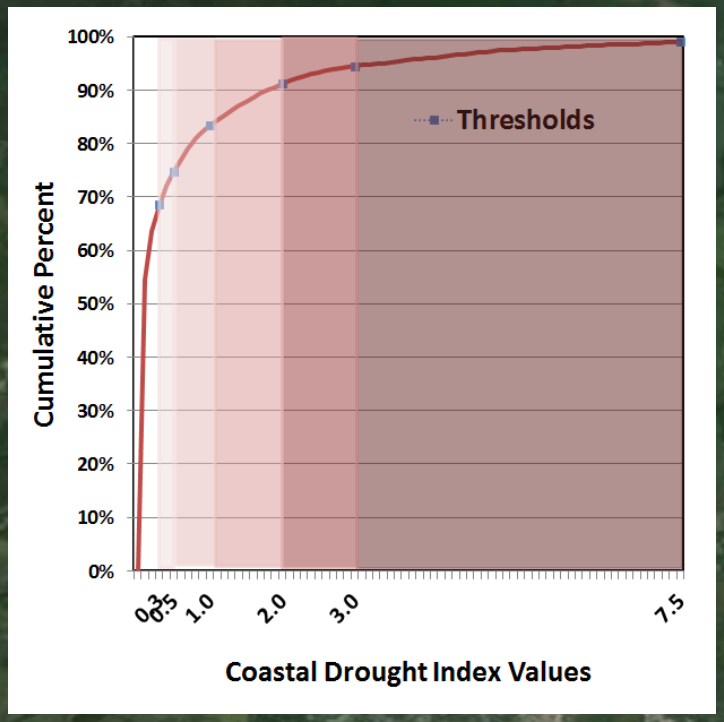


Index Development Approach

1. Signal process salinity times series to extract drought information,
2. Create “coastal drought” salinity time-series,
3. Compute frequency distribution, and
4. Use frequency distribution to set drought thresholds

Index Development Approach





- Computed frequency distribution of CDI values
- Pick threshold values from distribution

Issues to Address

- Concern for “wet” conditions
- Time scales between the CDI and ecological response variables

Standardized Precipitation Index (SPI)

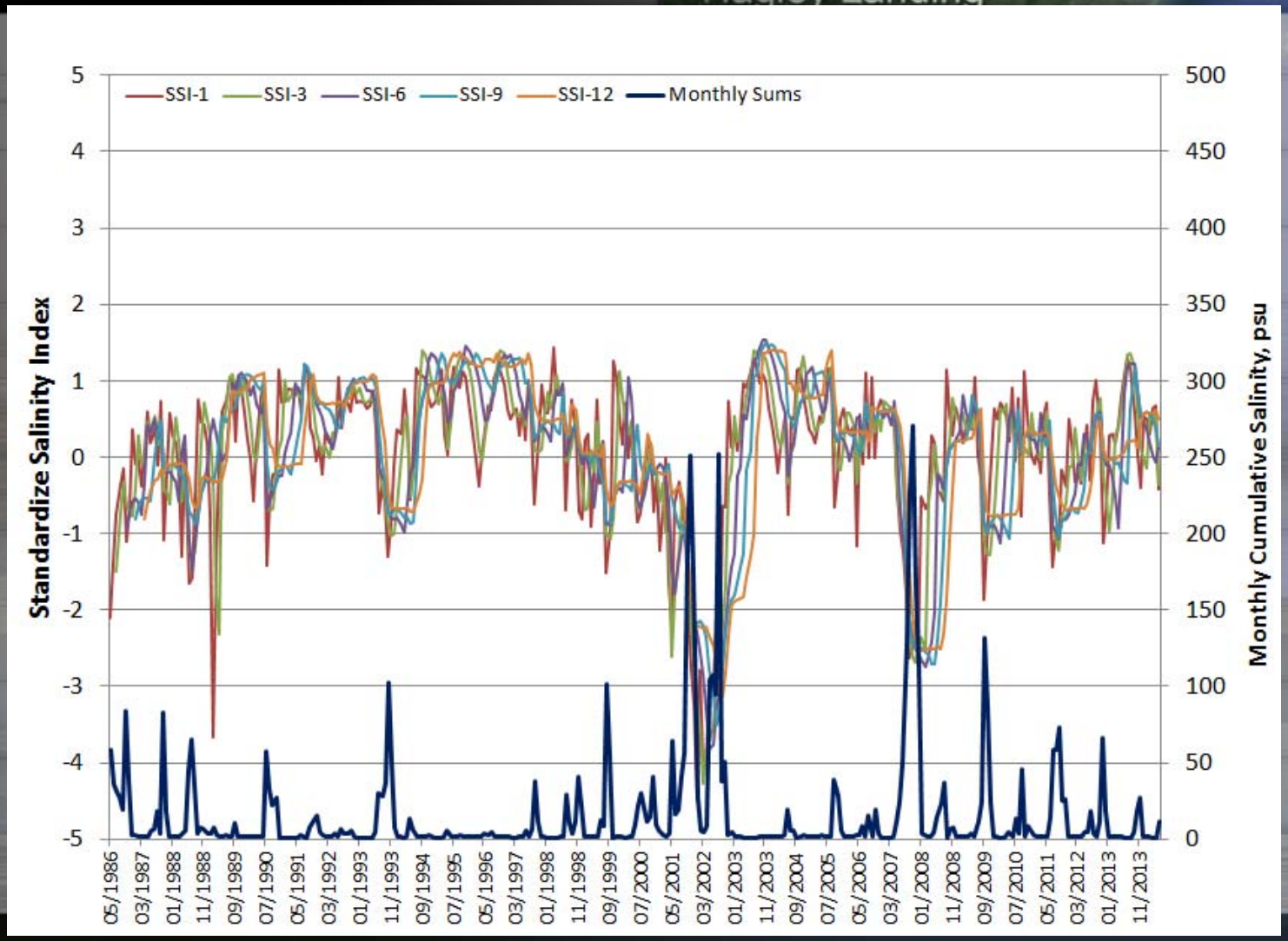
- Similarity of SPI and cumulative Z-scores
- Normalize precipitation with probability distribution
- Index values are standard deviation from the median
- Index for dry and wet conditions
- SPIs comparable for different locations

Benefits of computing a *Standardize Salinity Index*

- Compute for multiple time periods
  - 1-month, 3-month, 6-months, etc.
  - Difference time periods used for different drought response variable
- Index for fresher and saltier conditions
- Real-time computation of SSI
- Challenges
  - Limited number of long-term sites
  - Missing record – estimating data gaps

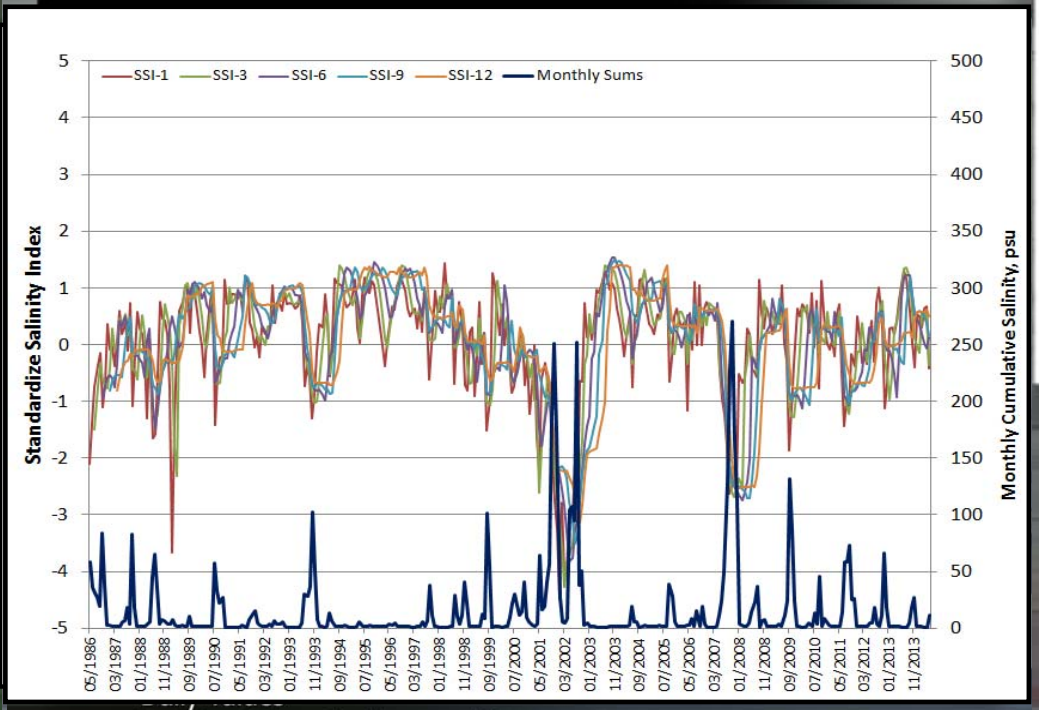
Monthly values

Negative SSIs – saltier conditions
Positive SSIs- fresher conditions

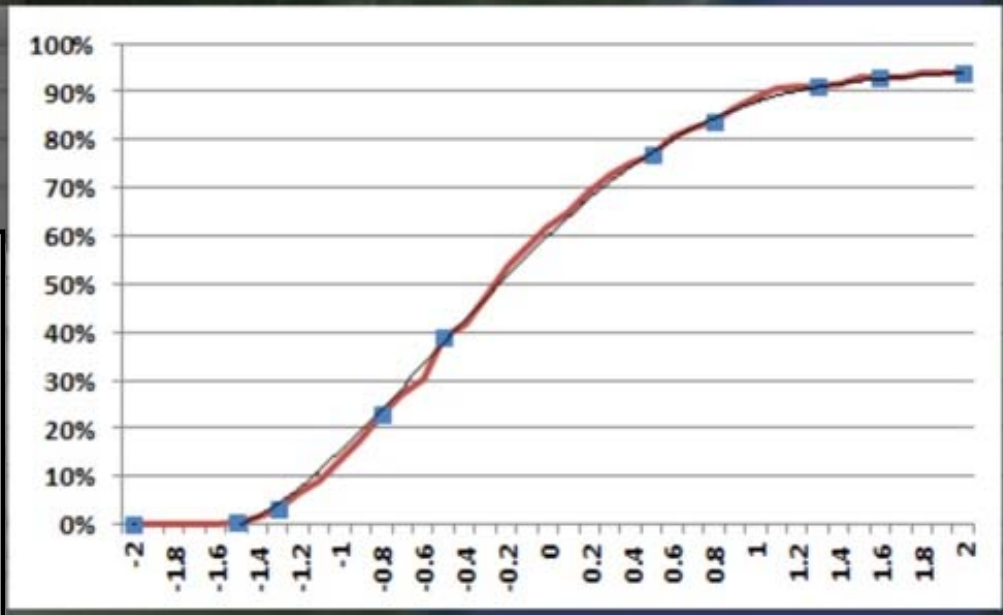


Now with "negative" drought values

Transform SSI values into Drought Declarations



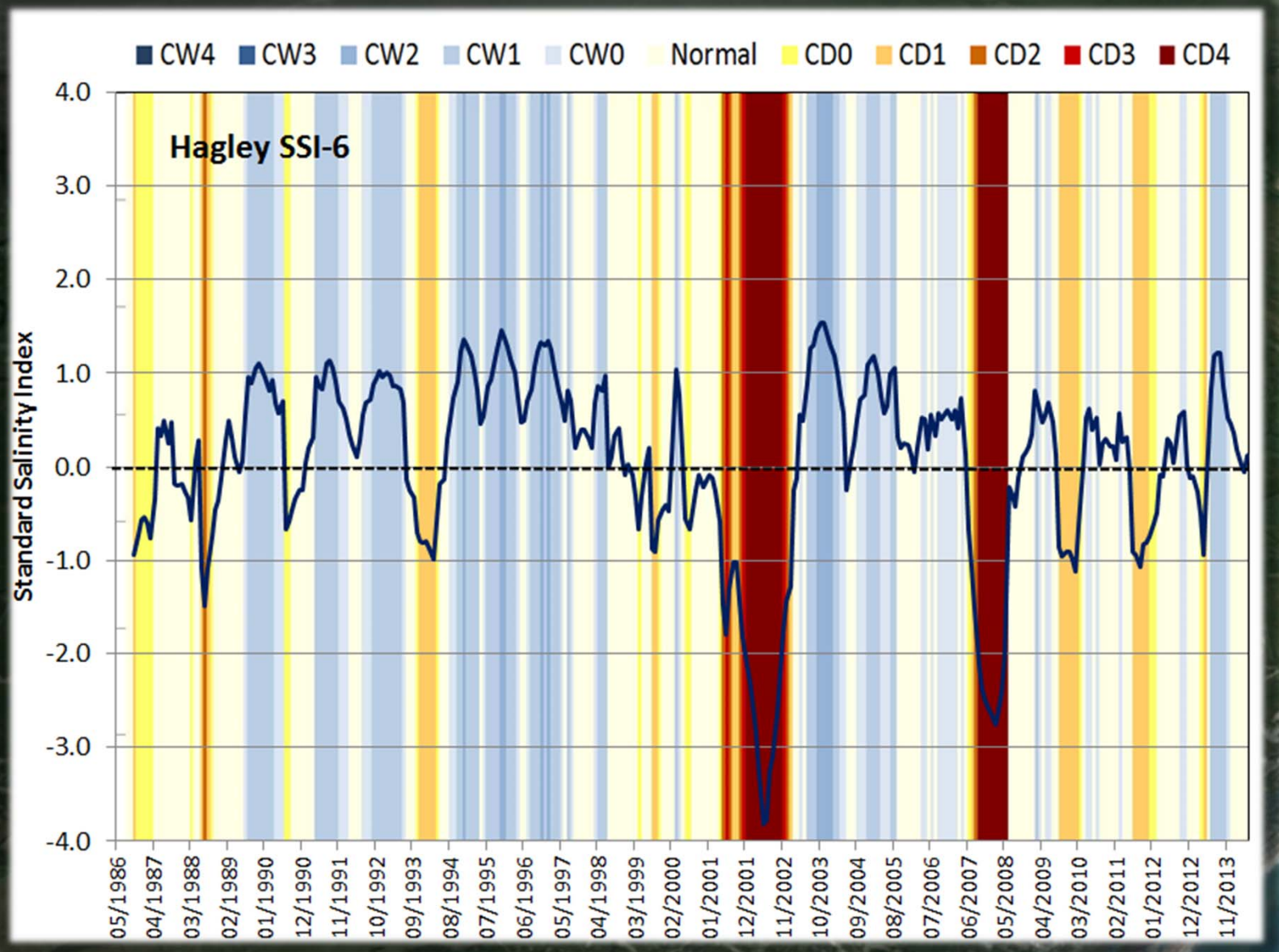
Positive SSIs – fresher conditions
Negative SSIs – saltier conditions



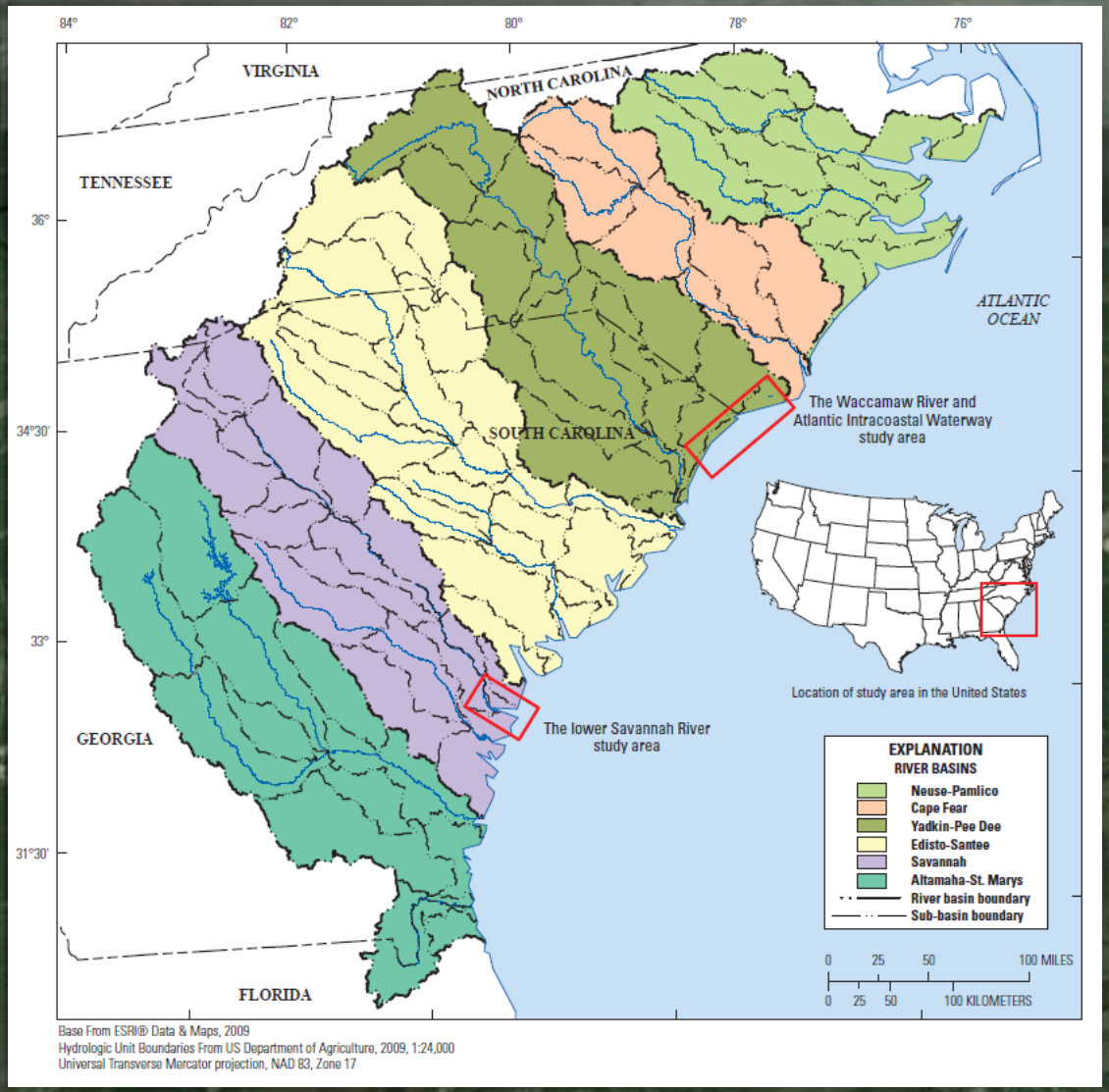
Declaration	Decsription	CDI Threshold
W4	Exceptional wet	2
W3	Extreme Wet	1.6
W2	Severe Wet	1.3
W1	Moderate Wet	0.8
W0	Abnormally Wet	0.5
N0	Normal	0
D0	Abnormally Dry	-0.5
D1	Moderate Drought	-0.8
D2	Severe Drought	-1.3
D3	Extreme Drought	-1.6
D4	Exceptional Drought	-2

USGS

Coastal Drought Declarations

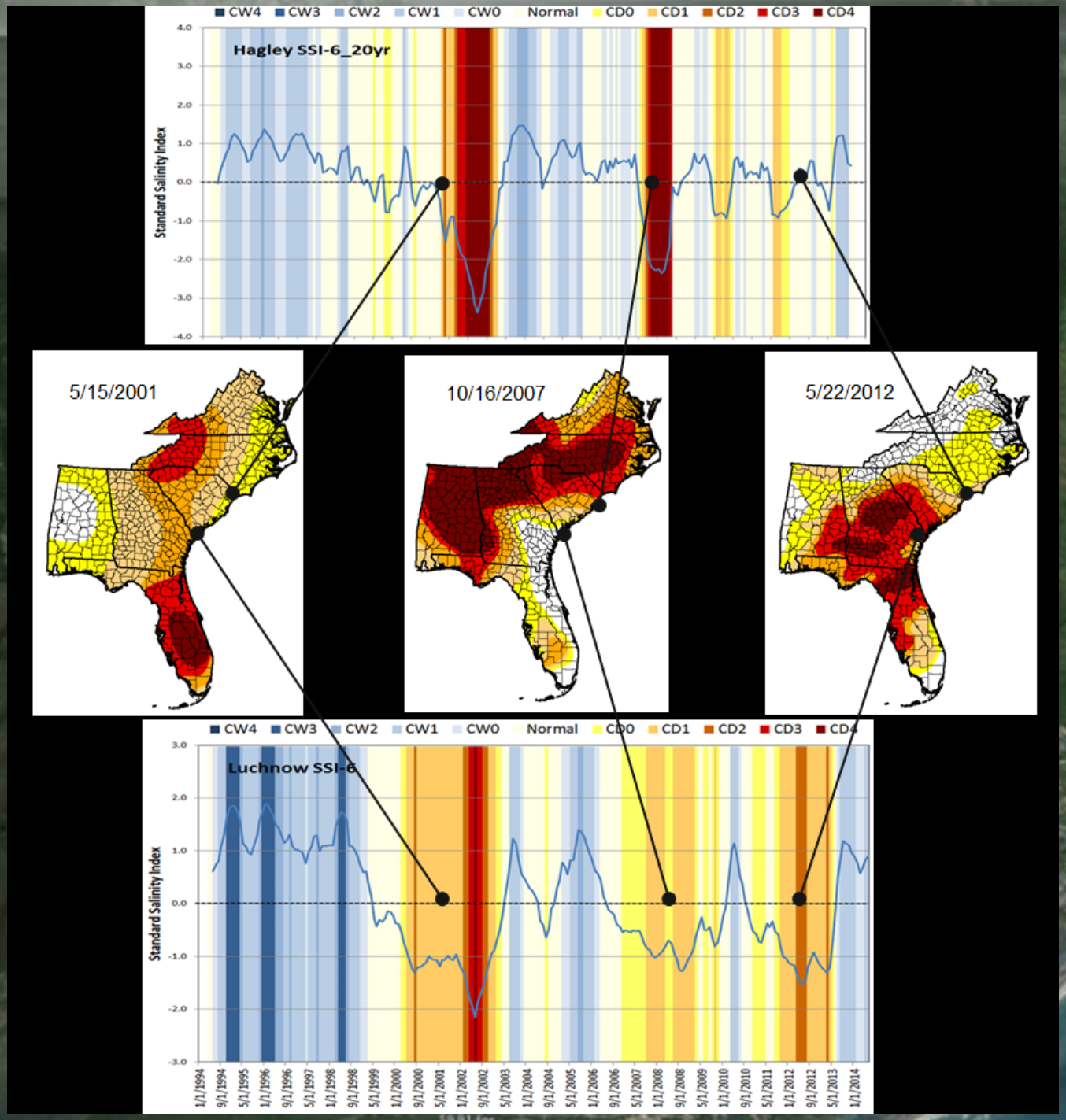


Regional Comparison

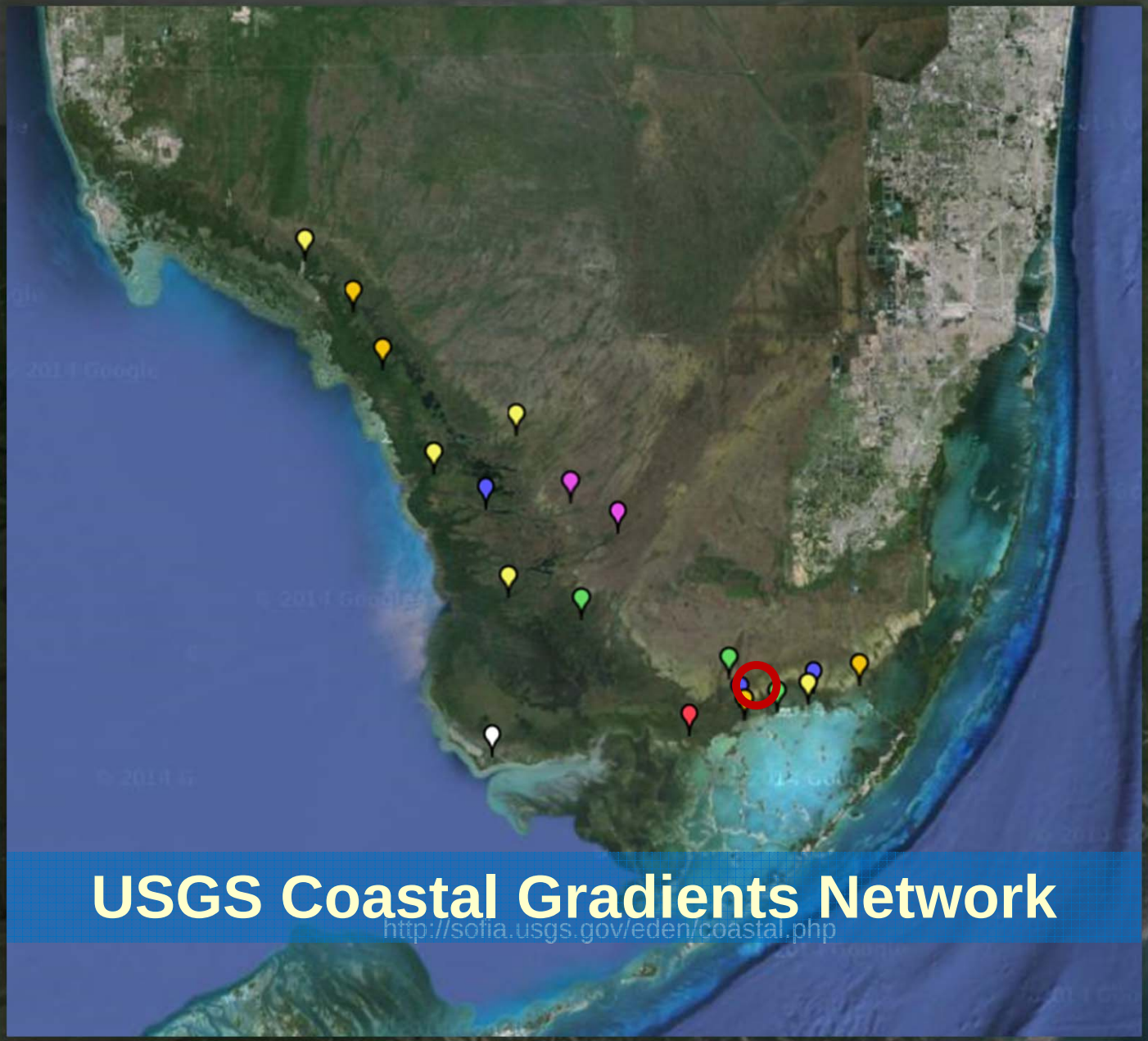


Is the CDI a site specific index or can it be used to regional comparisons?

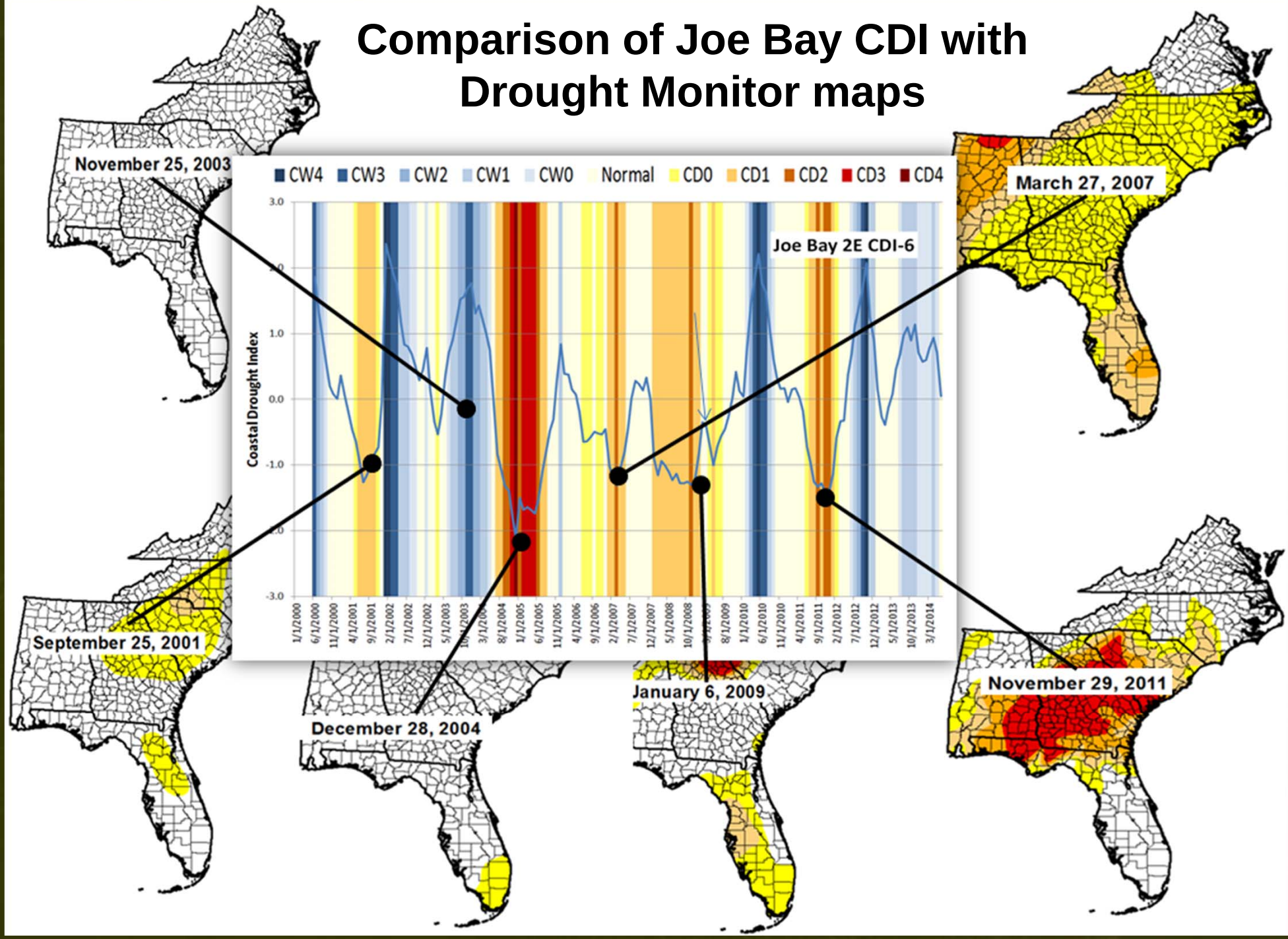
Comparison with Drought Monitor Maps



Florida Bay Application

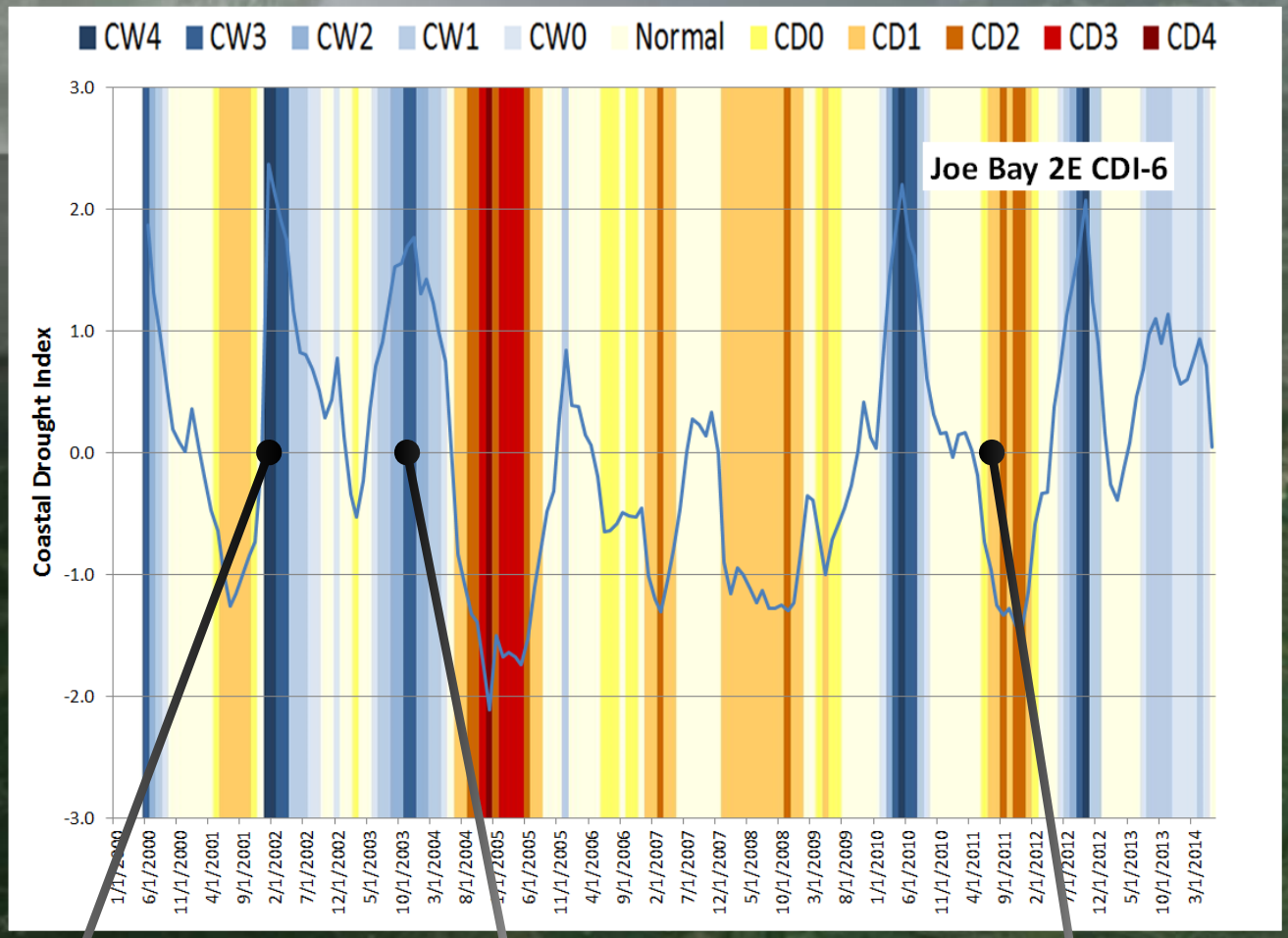


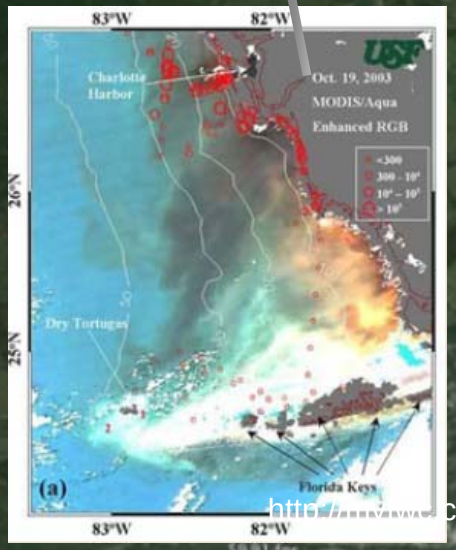
Comparison of Joe Bay CDI with Drought Monitor maps

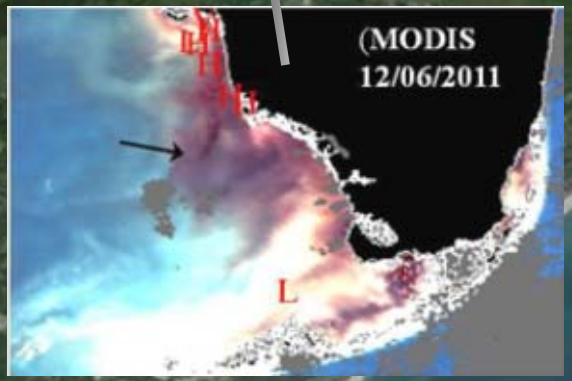


Dark water events in Southern Florida

Size of the 2011 event much smaller than the one 10 years earlier







http://...com/research/redtide/monitoring/historical-events/dark-water/

USGS

Summary

- CDI can be used for drought and wet conditions
- Not a site specific CDI
- May be able to use different periods of salinity record
- Can be used to regional comparison
- The multiple CDI-interval can tie it to various drought response variables
- Based on established SPI computation that readily understood and used in the drought community


Questions?
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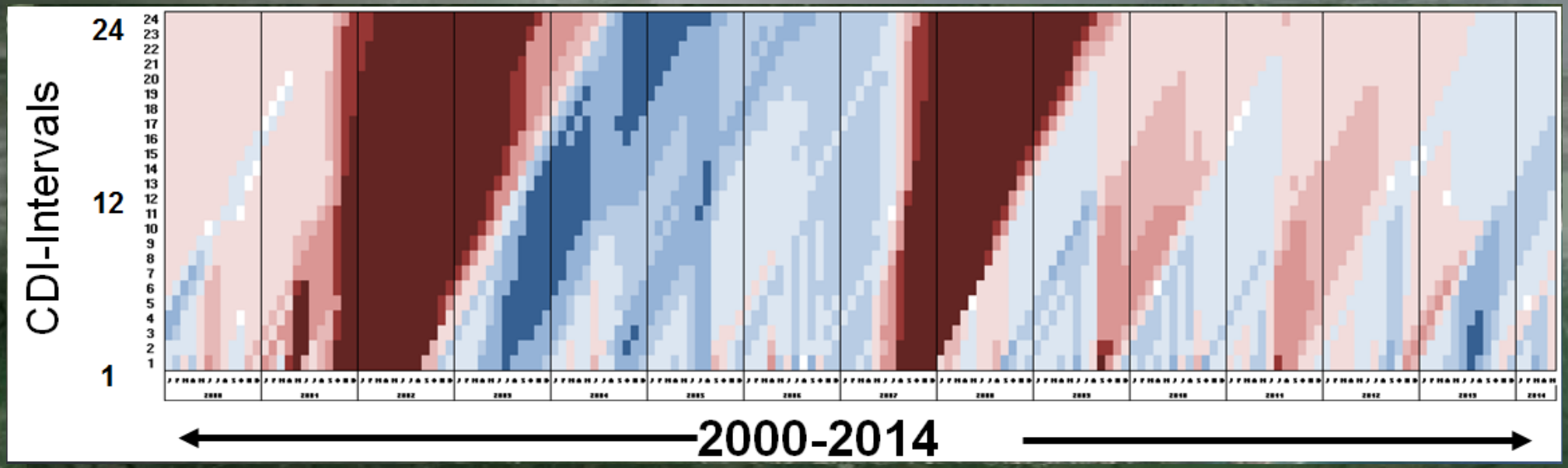
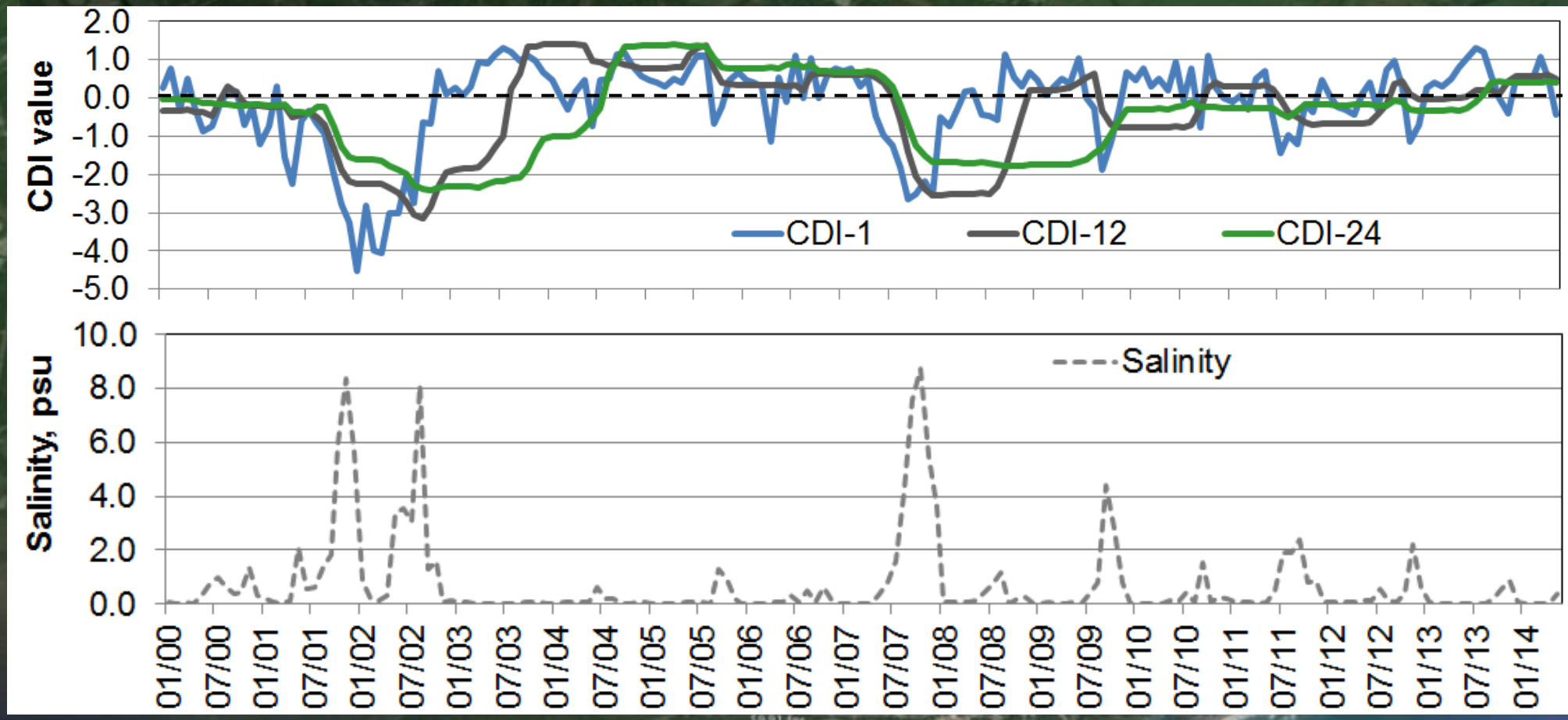
803.750.6140


CDI-Intervals
24
12
1
2000-2014


CDI value
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
CDI-1
CDI-12
CDI-24
Salinity, psu
10.0
8.0
6.0
4.0
2.0
0.0
Salinity
01/00
07/00
01/01
07/01
01/02
07/02
01/03
07/03
01/04
07/04
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