

# Florida Keys National Marine Sanctuary

Steering Committee Meeting

Marathon 2/20/2013

## *Water Quality Monitoring*

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Florida International University, Miami, FL



National Oceanic & Atmospheric Administration

NATIONAL MARINE SANCTUARIES



# Monitoring Water Quality in FKNMS

- Establish baseline information about FKNMS waters
- Document events, both chronic and episodic
- Assess trends or changes in WQ over time
- Explain causes in WQ changes (internal & external driver)
- Provide relevant information for resource management decisions
- Document compliance practices (regulatory)
- Educate public & stakeholders about water quality \*

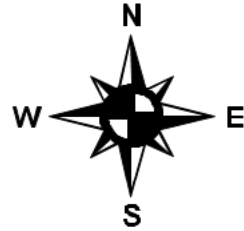


# Water Quality Monitoring Network

Southeast Environmental Research Center  
Florida International University

Funded By EPA

As of 2011

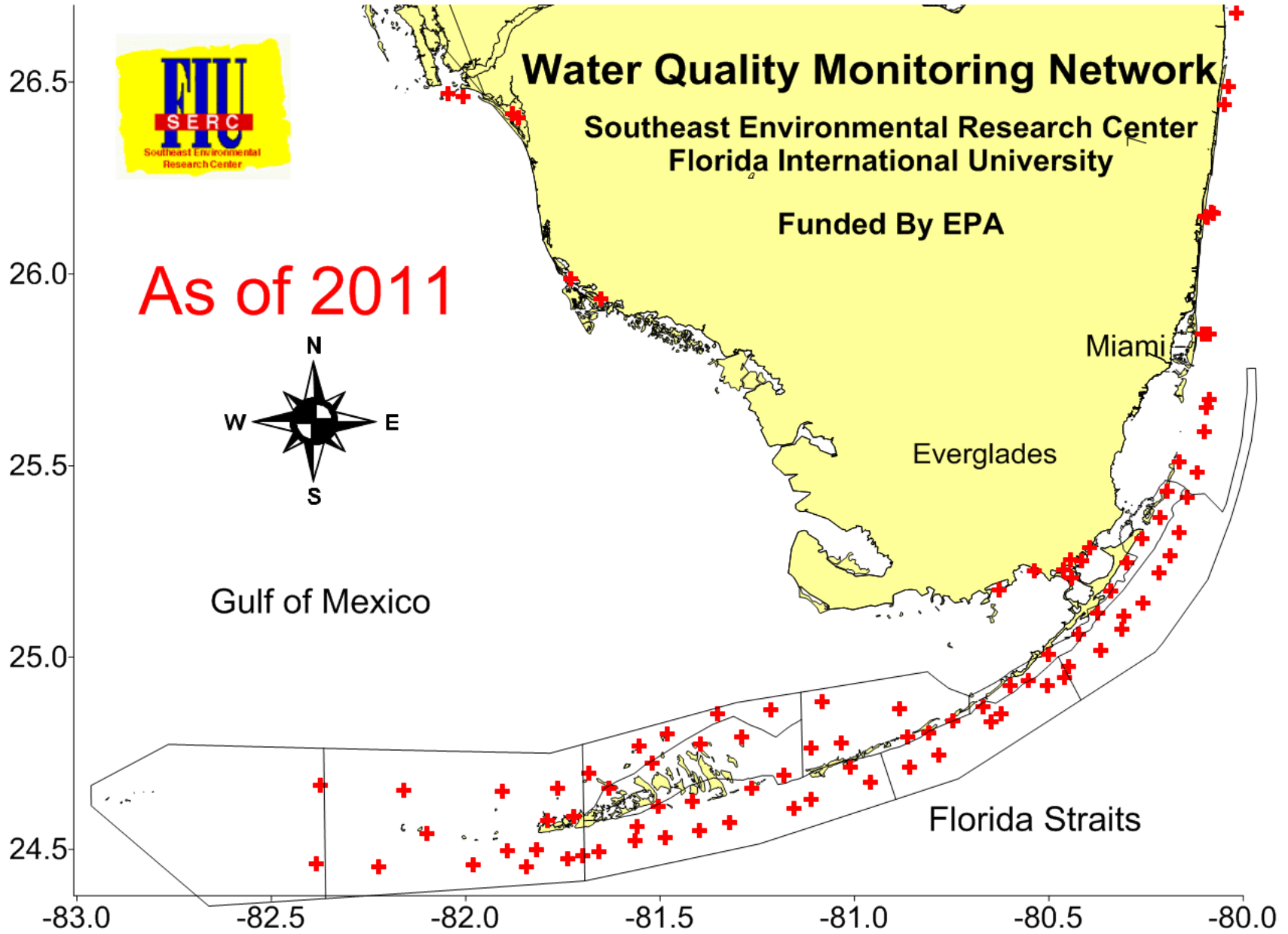


Gulf of Mexico

Miami

Everglades

Florida Straits



# *EPA developed Strategic Targets for the Water Quality Monitoring Project*

- For reef sites
- For all monitoring sites in FKNMS
  - chlorophyll  $a$  should be  $\leq 0.35 \mu\text{l}^{-1}$
  - dissolved inorganic nitrogen  $\leq 0.5 \mu\text{M}$
  - vertical attenuation coefficient  $K_d$   $\leq 0.2 \text{ m}^{-1}$
  - total phosphorus, TP  $\leq 0.25 \mu\text{M}$

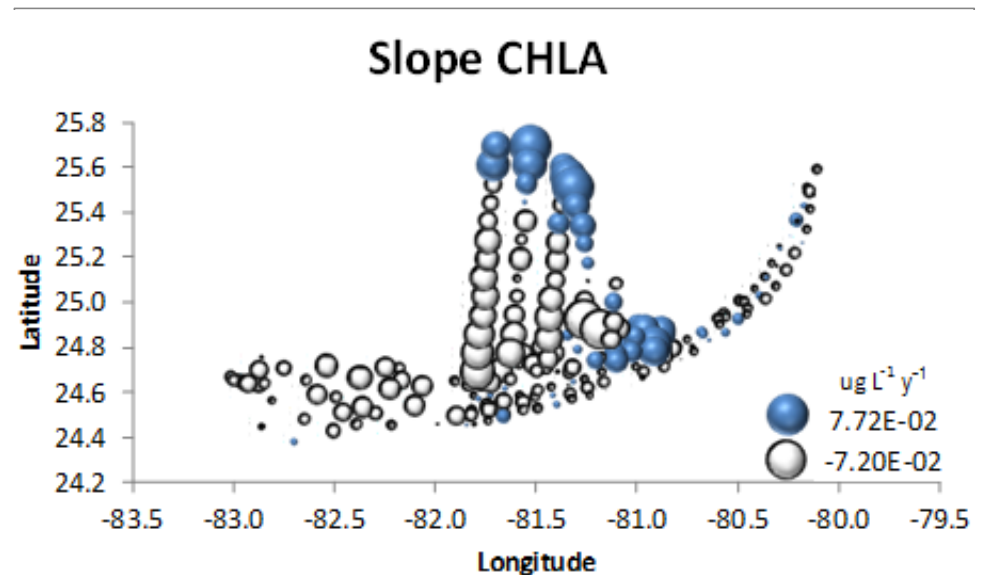
## EPA WQPP Water Quality Targets

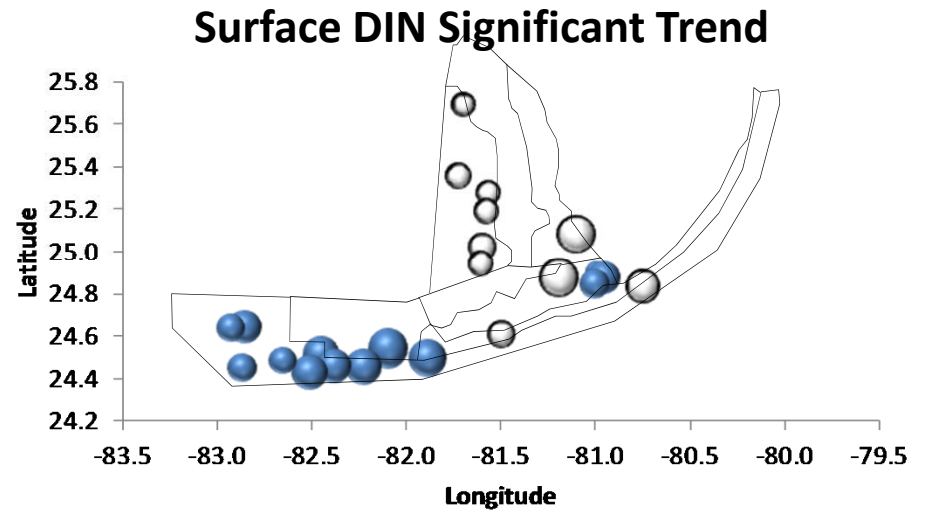
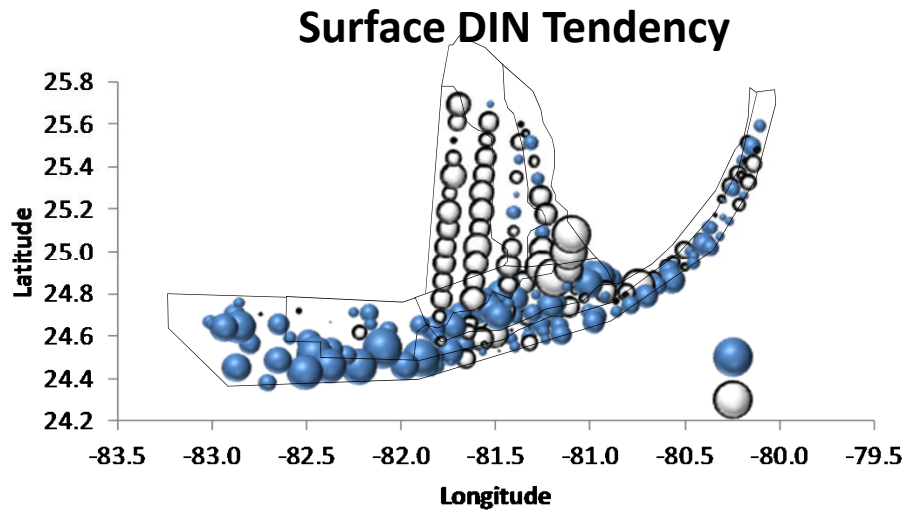
Year	Reef Stations		All Stations (except Shelf)	
	CHLA $\leq 0.35 \text{ ug l}^{-1}$	Kd $\leq 0.20 \text{ m}^{-1}$	DIN $\leq 0.75 \text{ }\mu\text{M}$ ( $\leq 0.010 \text{ ppm}$ )	TP $\leq 0.25 \text{ }\mu\text{M}$ ( $\leq 0.0077 \text{ ppm}$ )
1995-05	1,778 of 2,367 (75.1%)	1,042 of 1,597 (65.2%)	7,826 of 10,254 (76.3%)	7,810 of 10,267 (76.1%)
2006	196 of 225 (87.1%)	199 of 225 (88.4%)	432 of 990 (43.6%)	316 of 995 (31.8%)
2007	198 of 226 (87.6%)	202 of 222 (91.0%)	549 of 993 (55.3%)	635 of 972 (65.3%)
2008	177 of 228 (77.6%)	181 of 218 (83.0%)	836 of 1,000 (83.6%)	697 of 1,004 (69.4%)
2009	208 of 228 (91.2%)	189 of 219 (86.3%)	858 of 1,003 (85.5%)	869 of 1,004 (86.6%)
2010	170 of 227 (74.9%)	176 of 206 (85.4%)	843 of 1,000 (84.3%)	738 of 1,003 (73.6%)
2011	162 of 229 (70.7%)	150 of 207 (72.5%)	738 of 922 (80.0%)	844 of 923 (91.4%)

# Trend Analysis

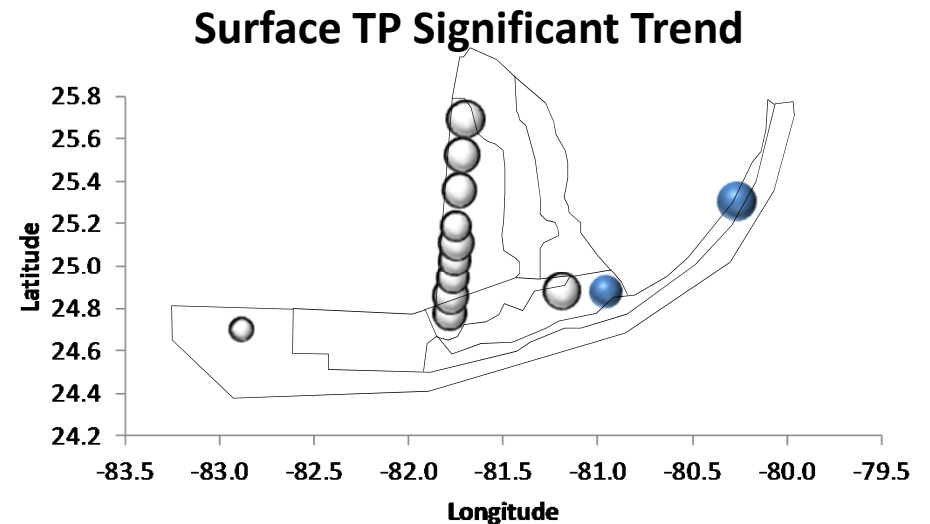
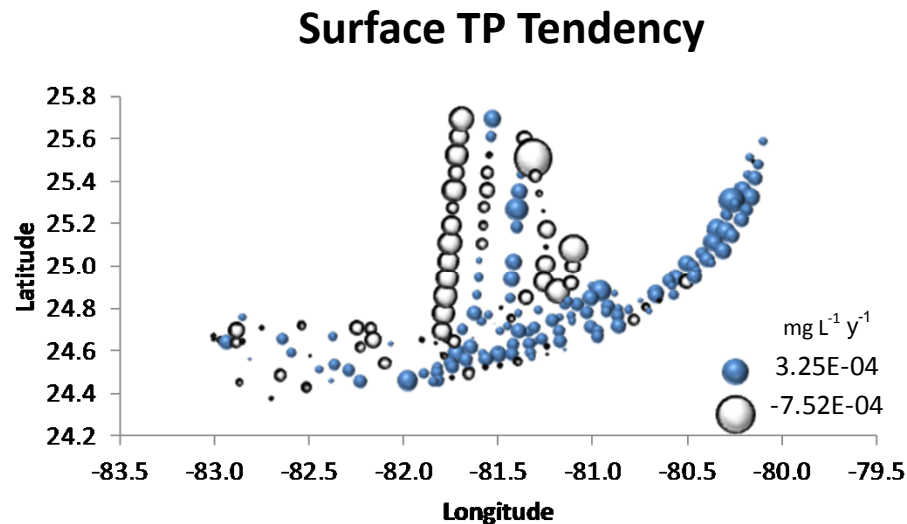
- Simplest approach
  - Slope of linear regression for each variable at each station
  - POR 1995-2011
  - Significance level set at  $p < 0.10$

Increases in Blue  
Declines in White

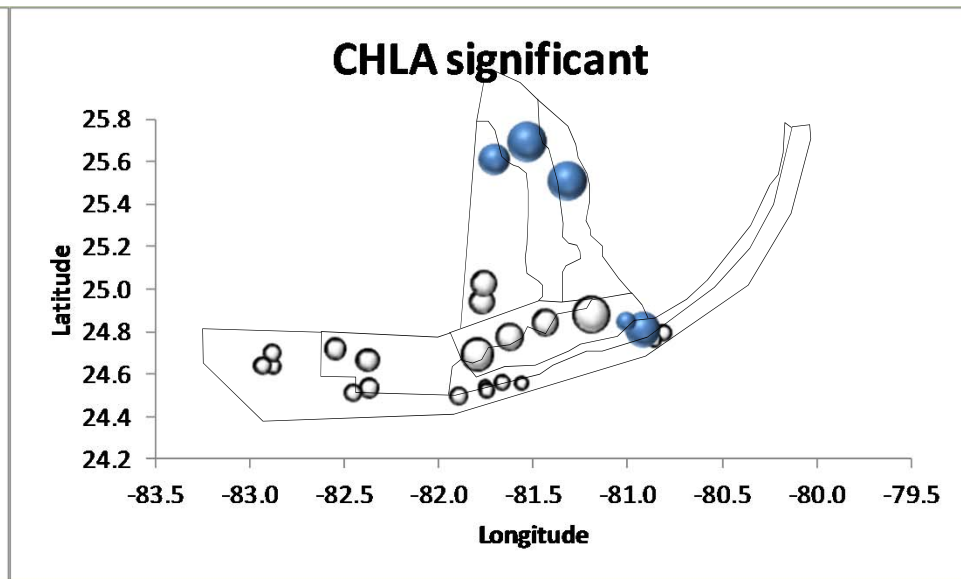
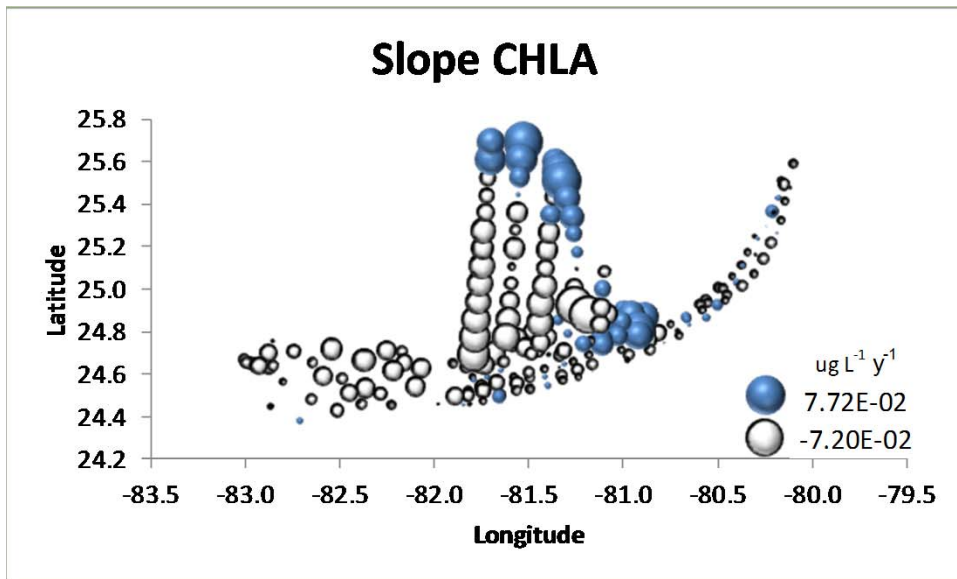




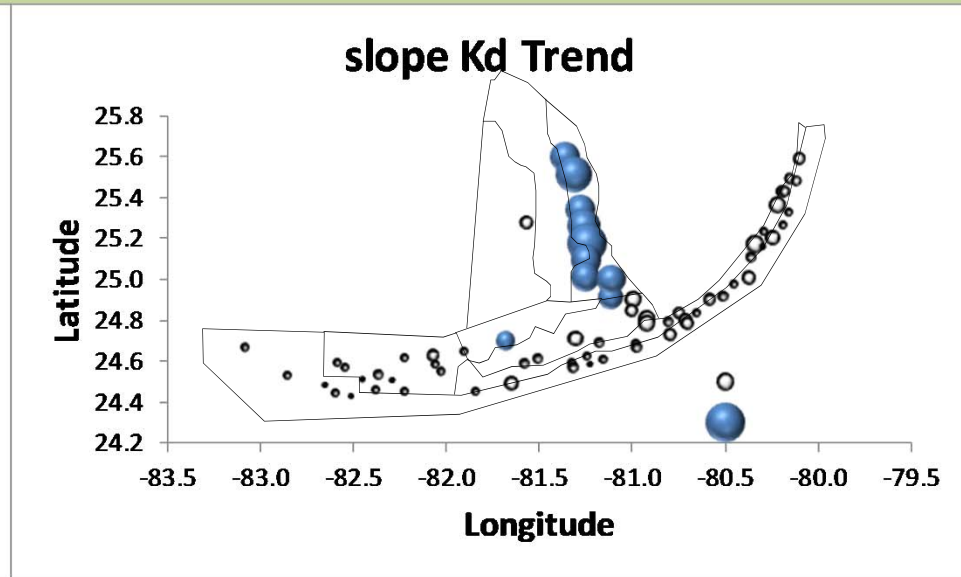
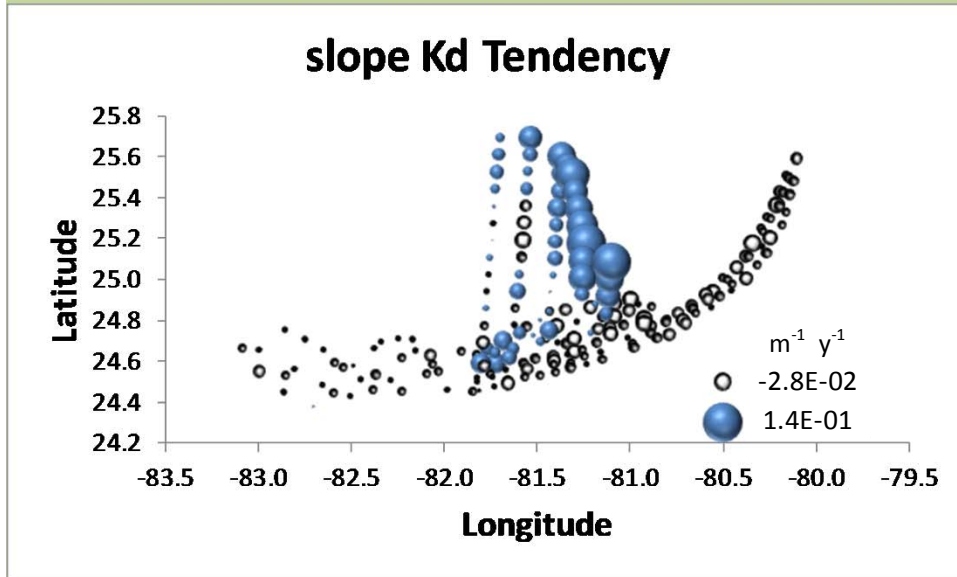
***DIN increased in Tortugas and Marquesas..a couple of Sluiceways stations increased!!***



***TP has not changed a lot. It declined along west Shelf..a couple of stations increased!!***

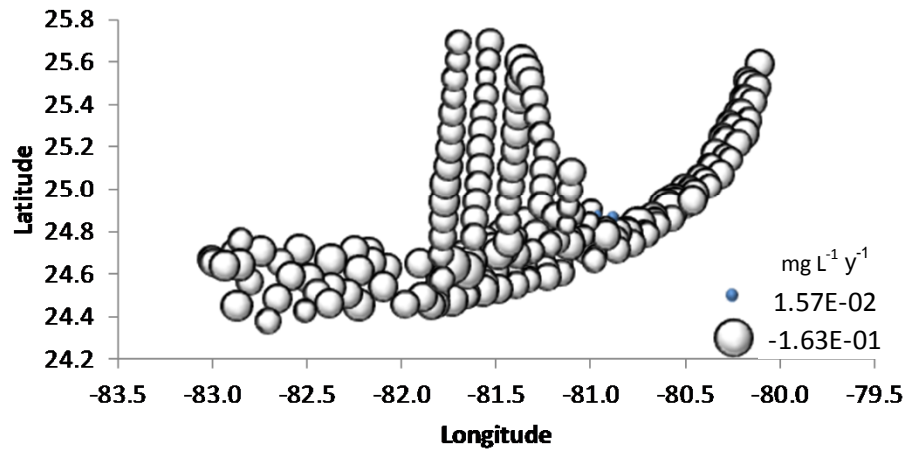


***CHLa tends increase along northeast Shelf and Sluiceways***  
***CHLa trend increases along northeast Shelf & Sluiceways and declines in Backcountry***  
***Kd increased in eastern Shelf and stayed practically the same in Sanctuary***

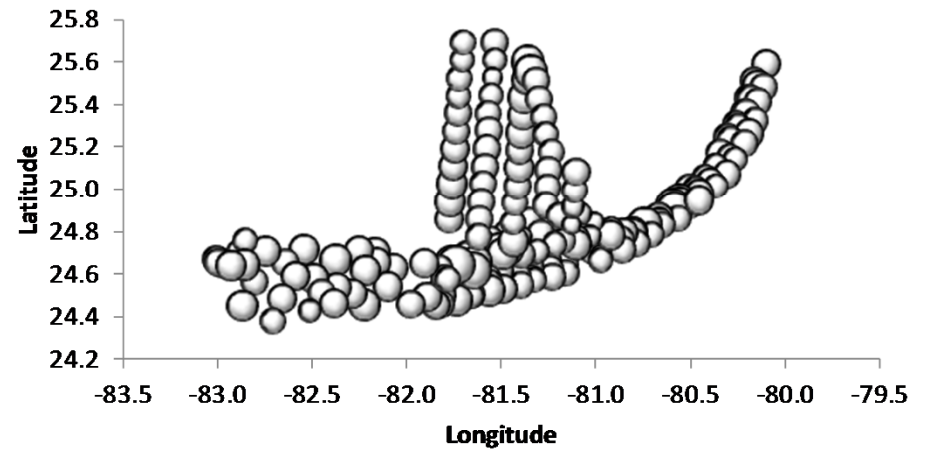




### Surface TOC Tendency

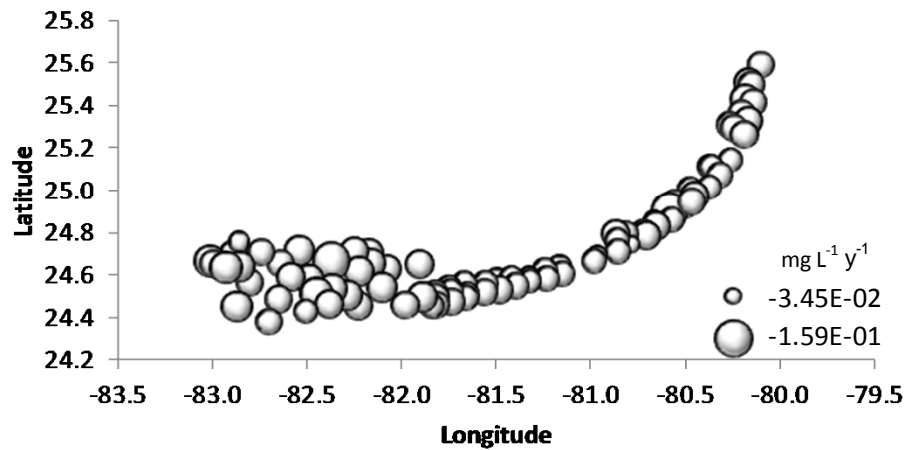


### Surface TOC Significant Trend

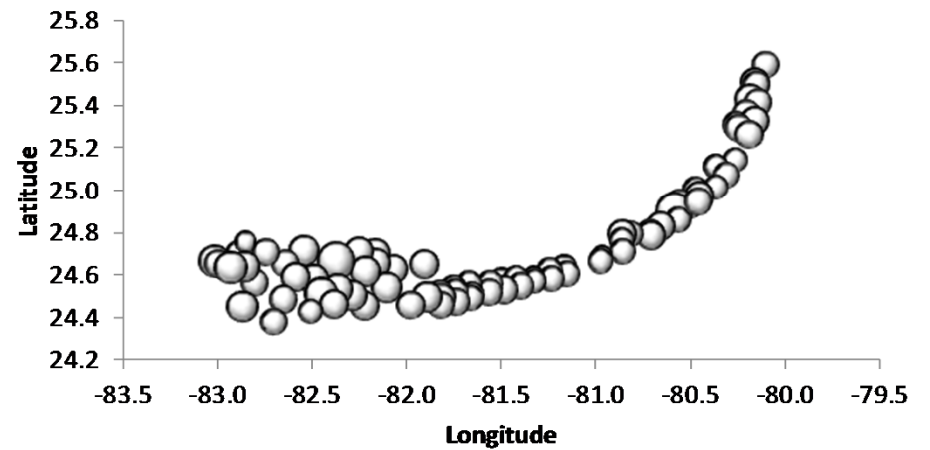


***TOC has consistently declined region wide in both, surface and bottom samples***

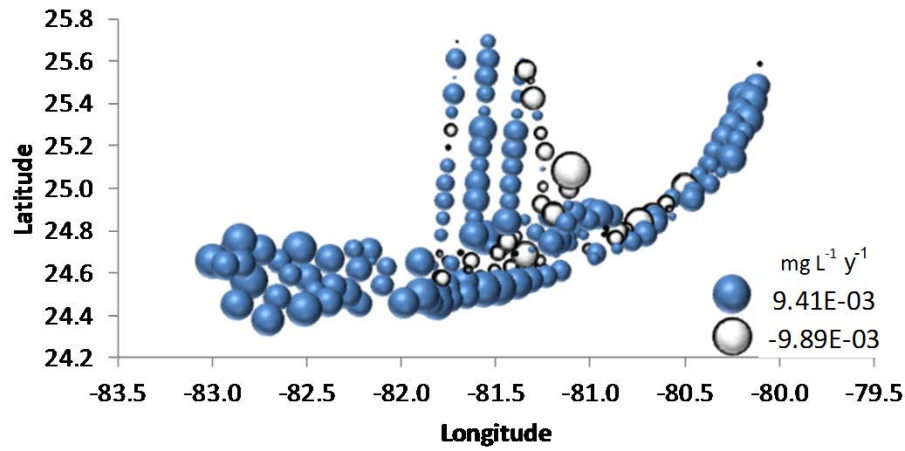
### Bottom TOC Tendency



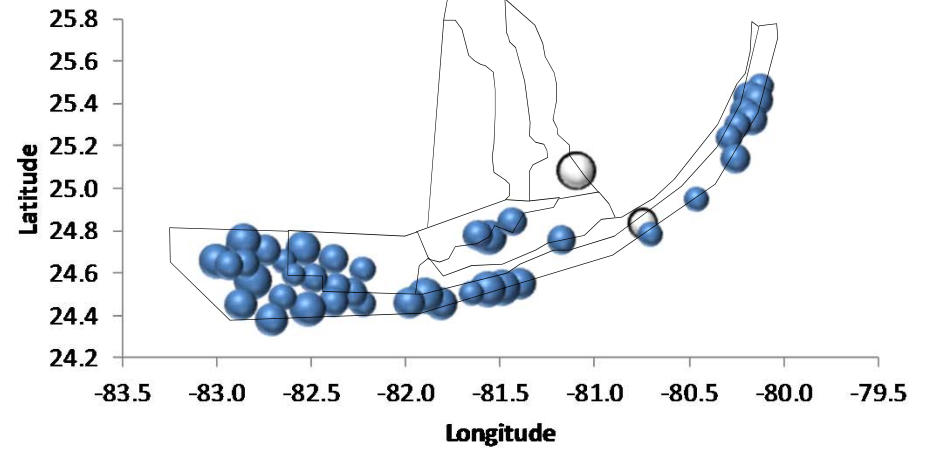
### Bottom TOC Significant Trend



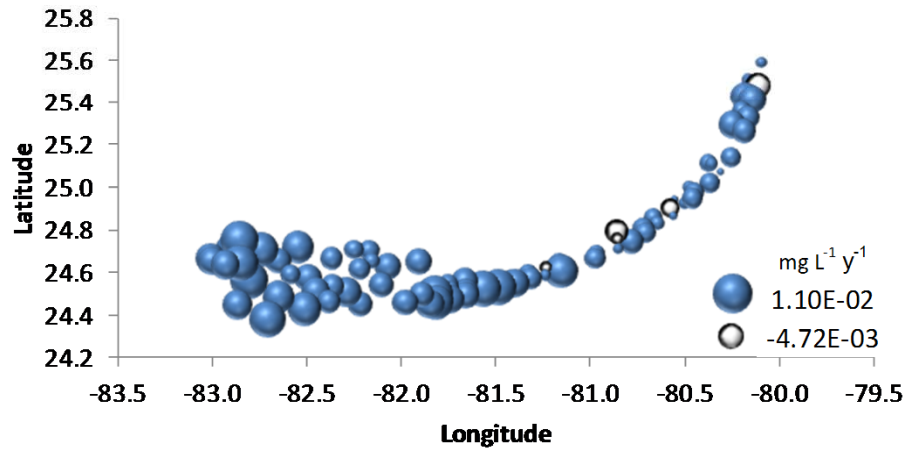
### Surface TN Tendency



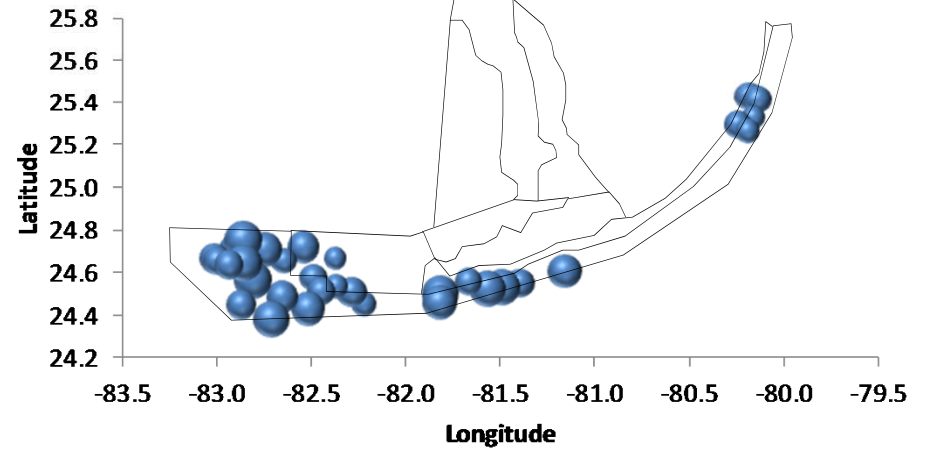
### Surface TN Significant Trend



### Bottom TN Tendency

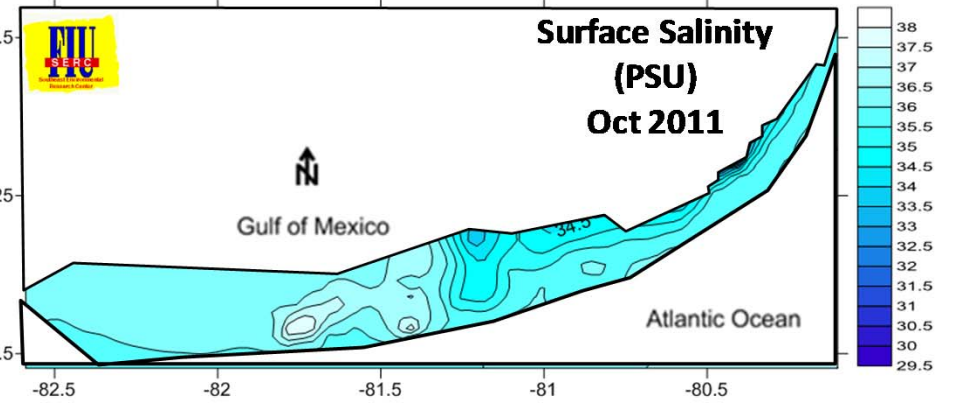
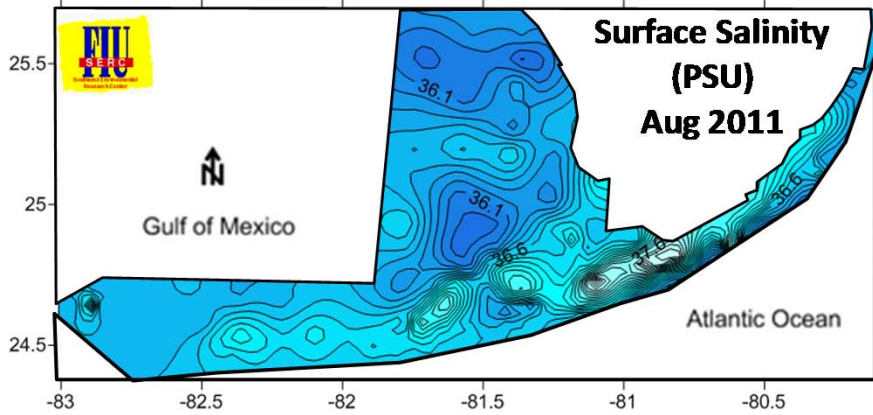
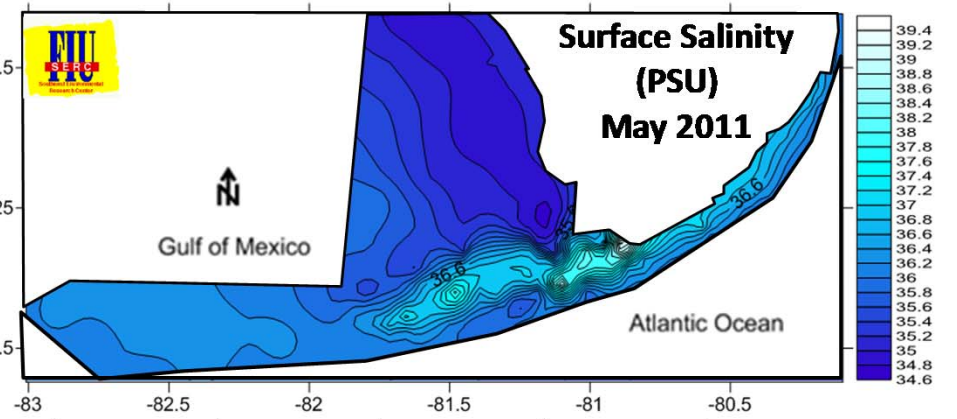
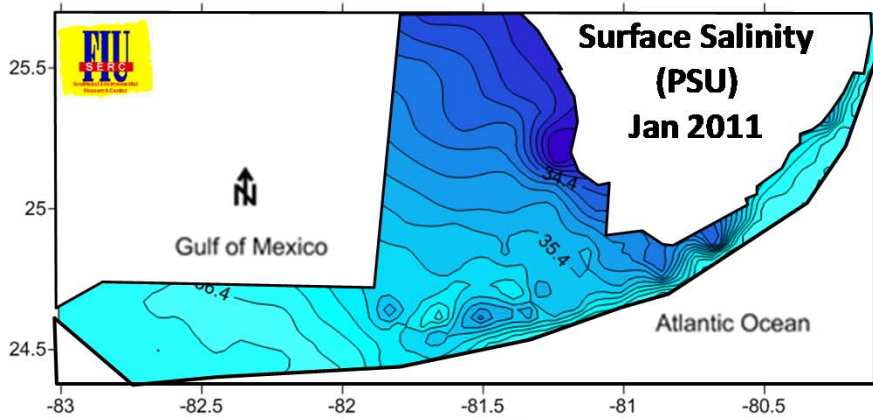


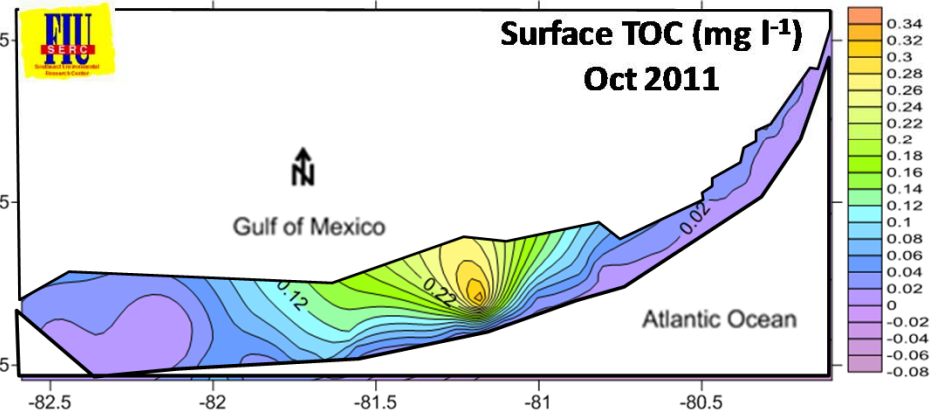
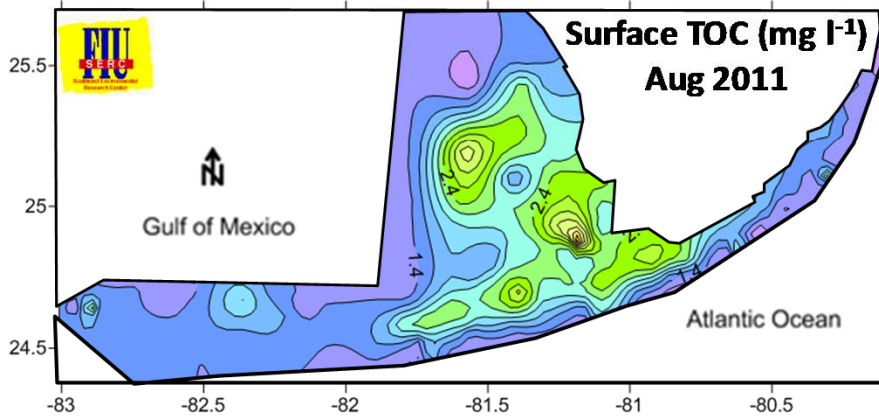
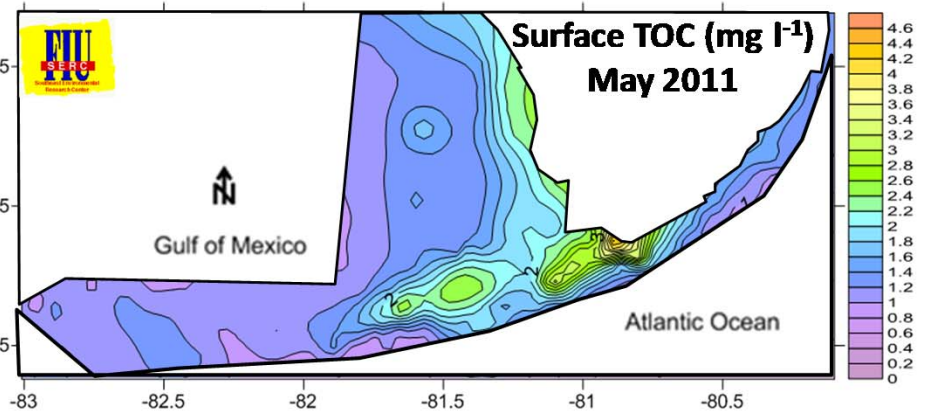
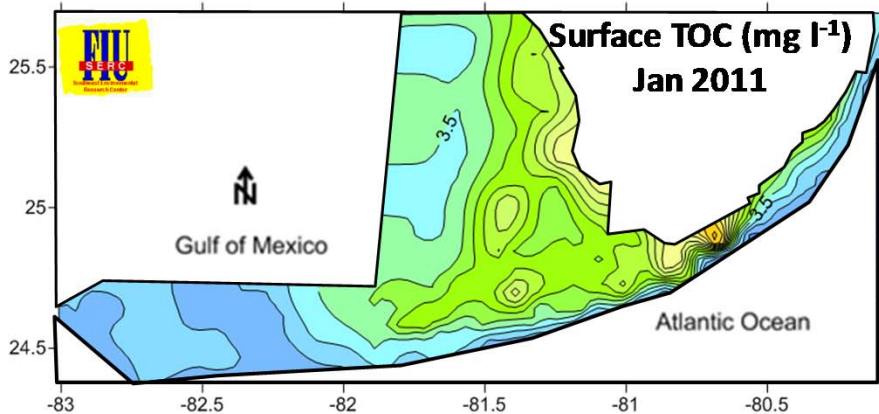
### Bottom TN Significant Trend

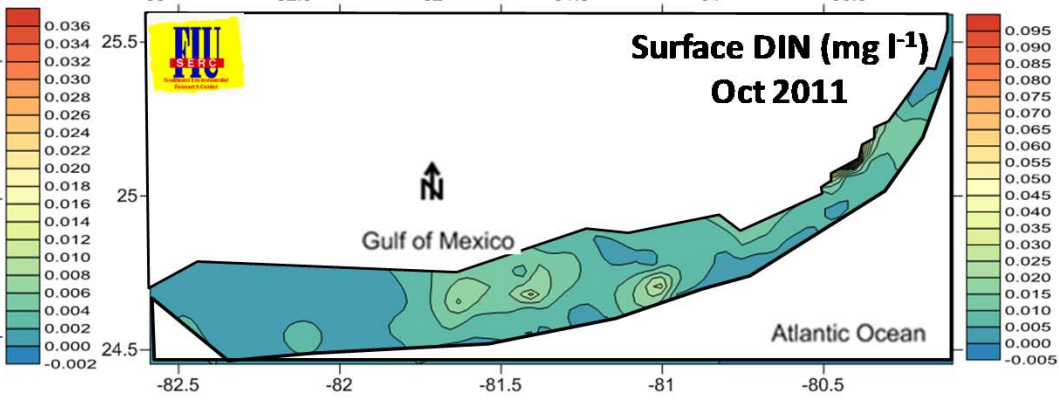
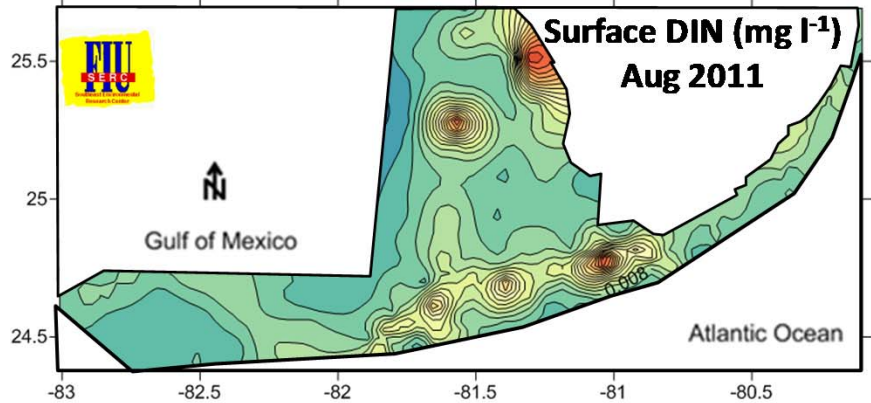
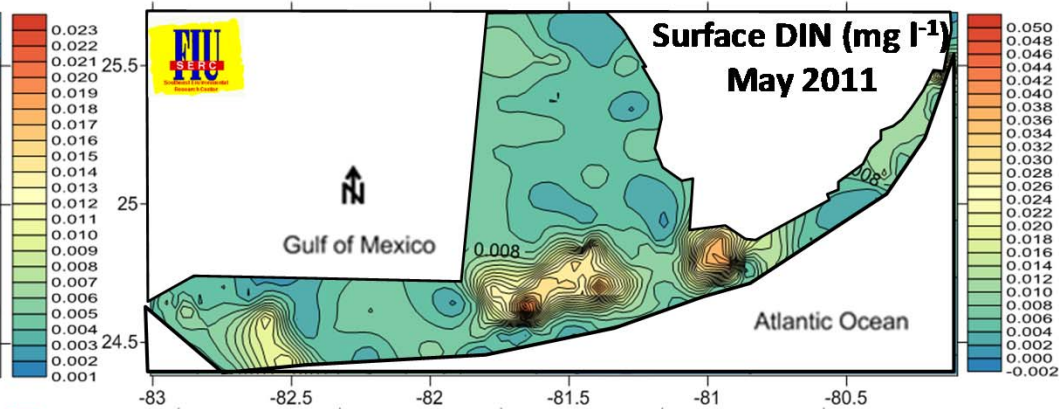
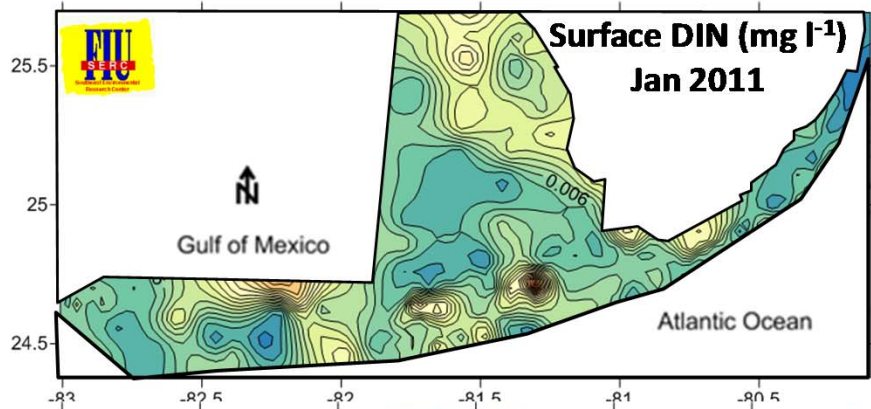


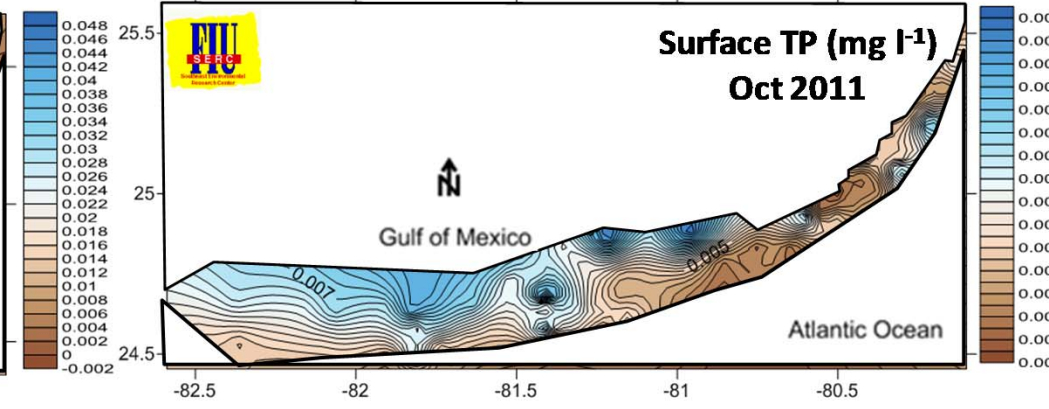
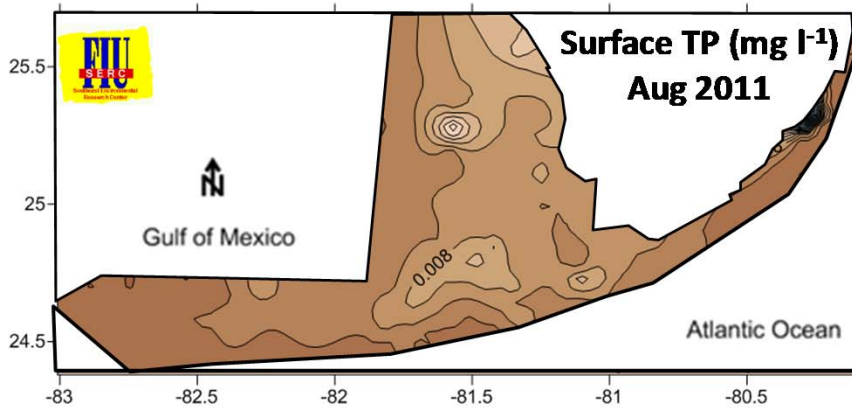
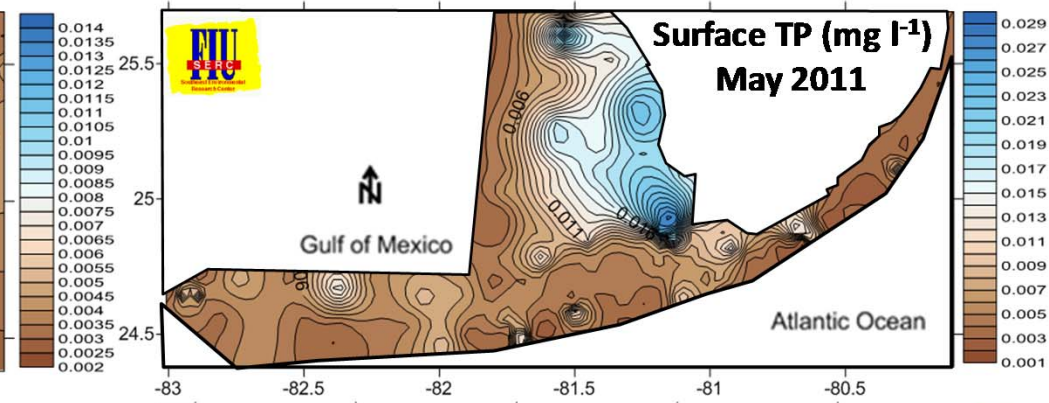
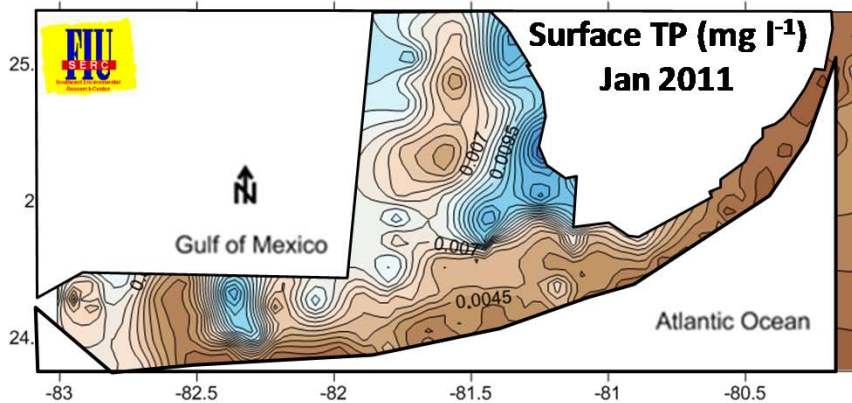
***TN has increased, especially in Tortugas and Lower and Upper Keys...!!!!***

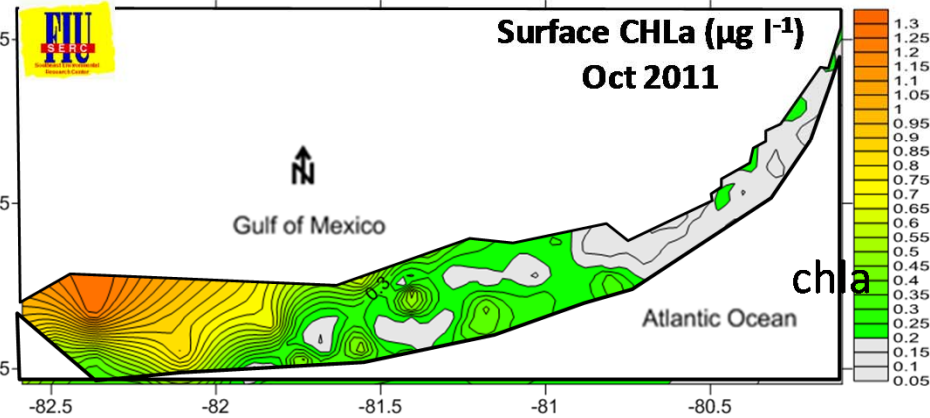
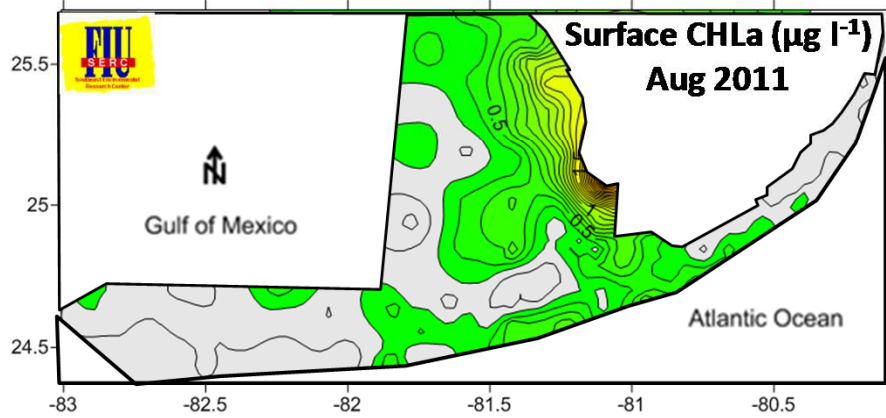
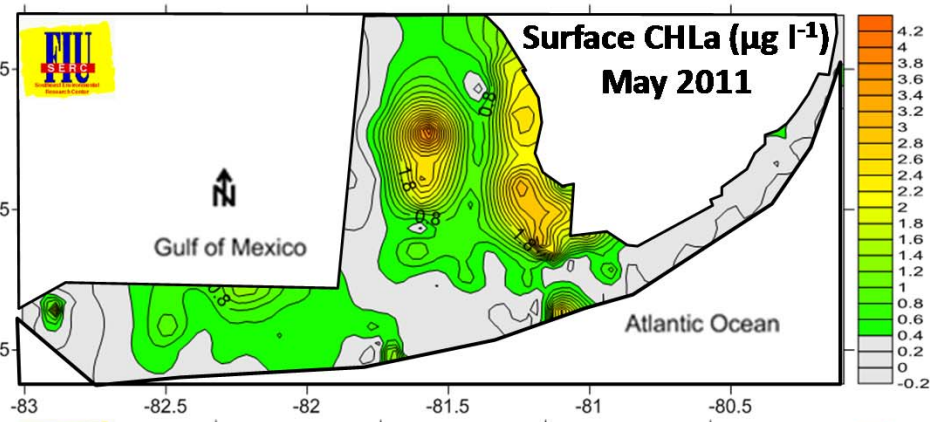
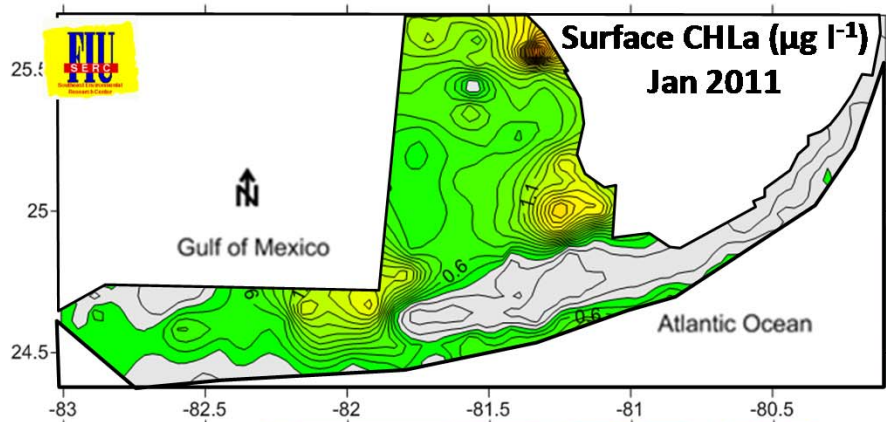
2011



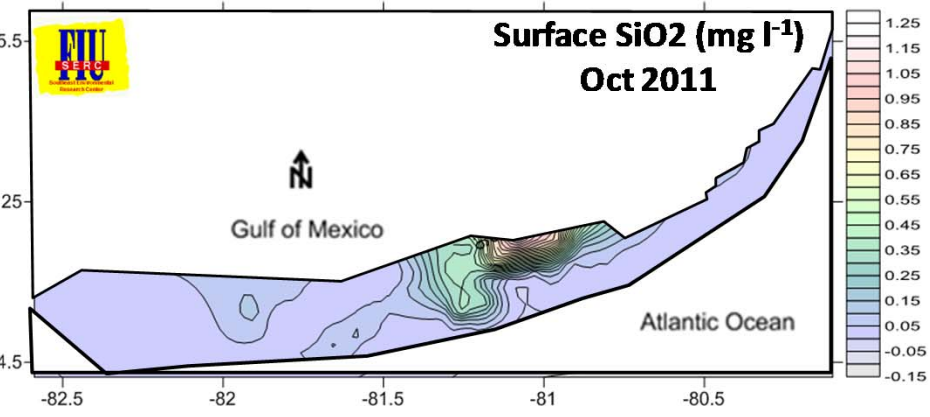
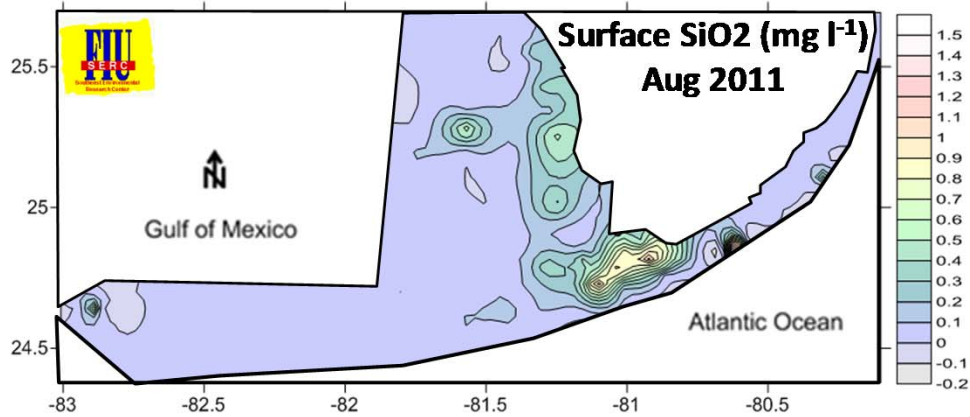
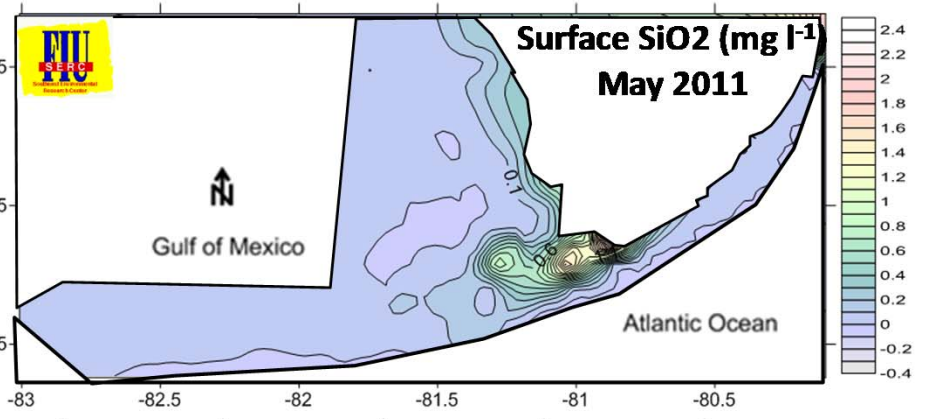
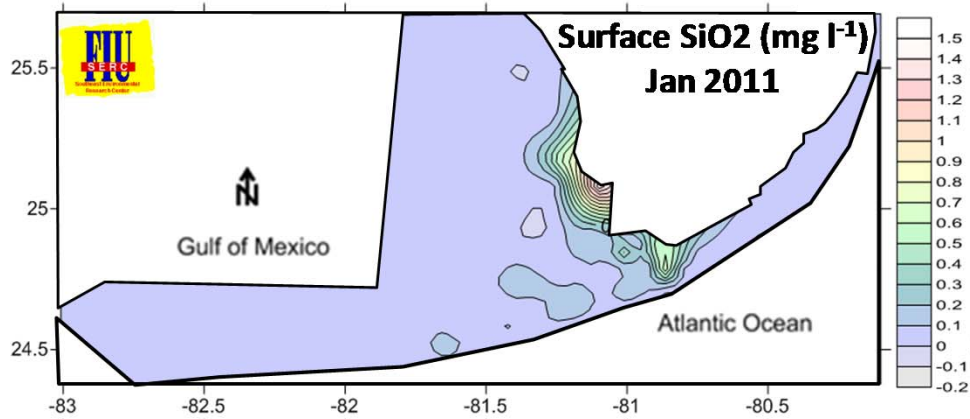


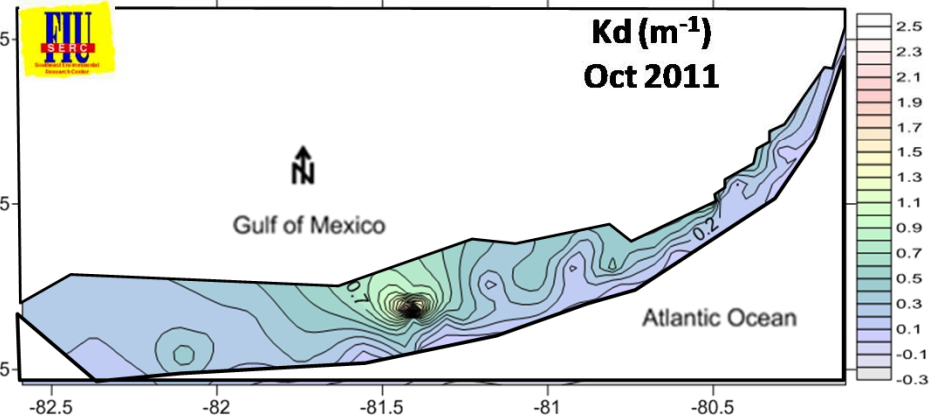
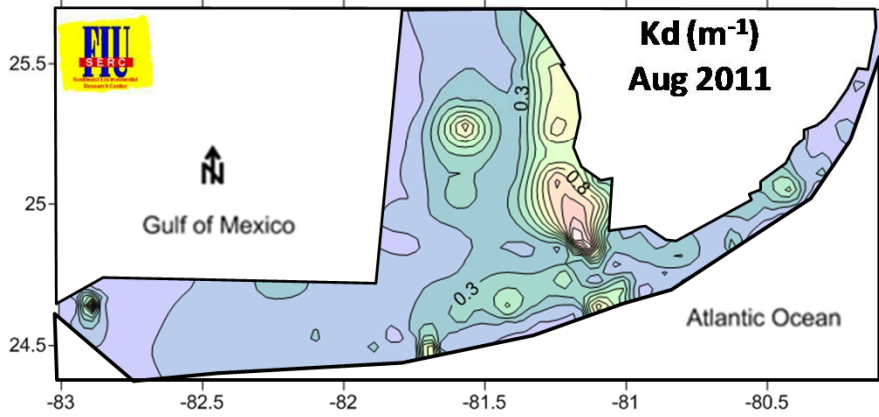
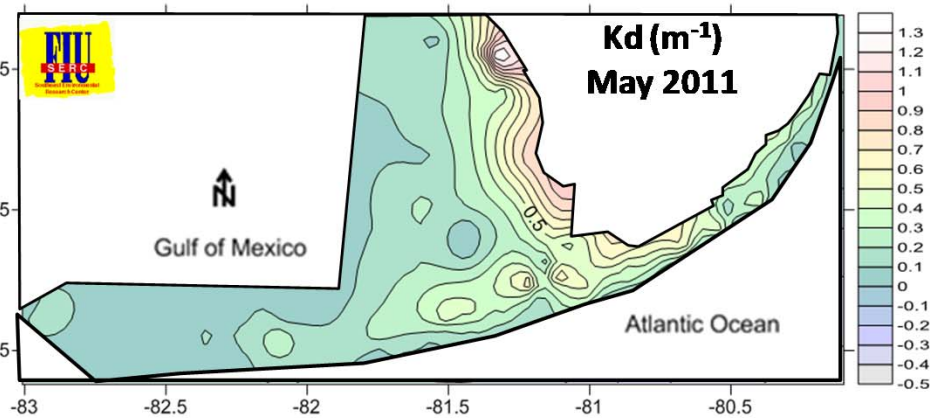
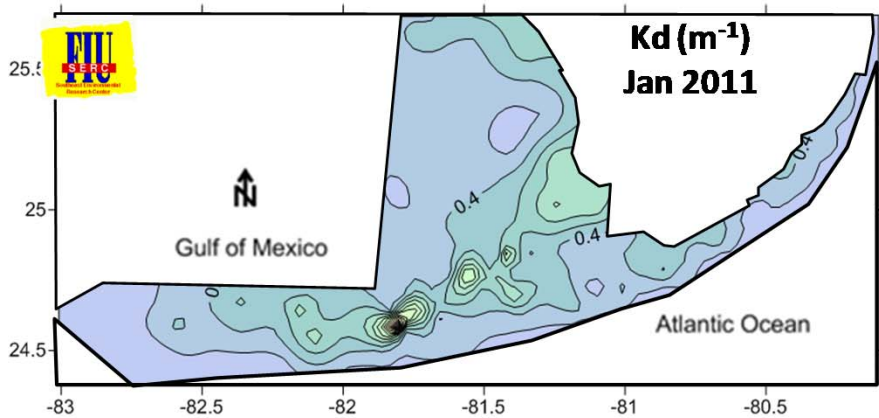






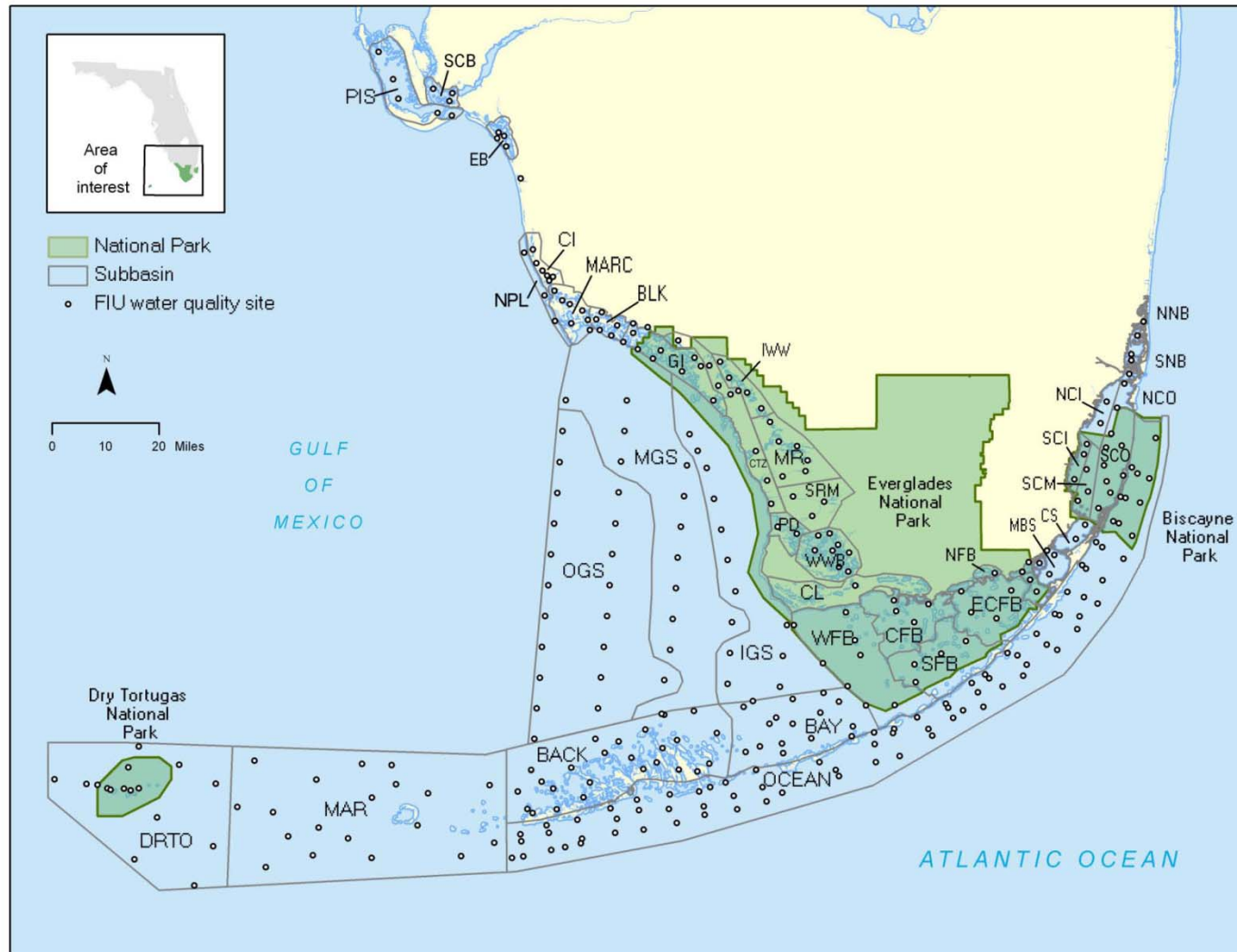






Recent achievements....

# Biogeochemical Segmentation of South Florida Coastal and Estuarine Waters



Developed with data generated from **monitoring** WQ since 1991

**Adopted by EPA and FDEP** with minor changes for derivation of Numeric Nutrient Criteria

# More work needs to be done with coupling monitoring with remote sensing technologies and coastal ocean observation systems

NOAA-IMPACT  
(Integrated Marine  
Protected Area  
Climate Tools)  
project is  
“ingesting” fixed-  
site data into IOOS  
and attempting to  
couple with remote  
sensing  
information.

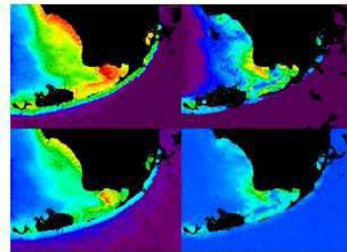
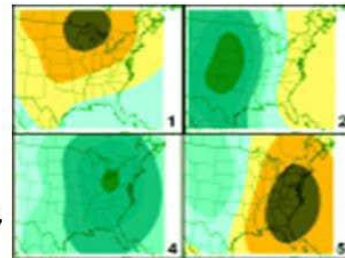
**NEW** Proposal in  
preparation for  
NASA-ROSES



Global Pattern  
(Climate and Circulation)

Regional  
Local

Weather Types  
(pressure, temperature,  
winds, clouds, etc.)



Precipitation/runoff, re-suspension,  
upwelling, transport, etc.

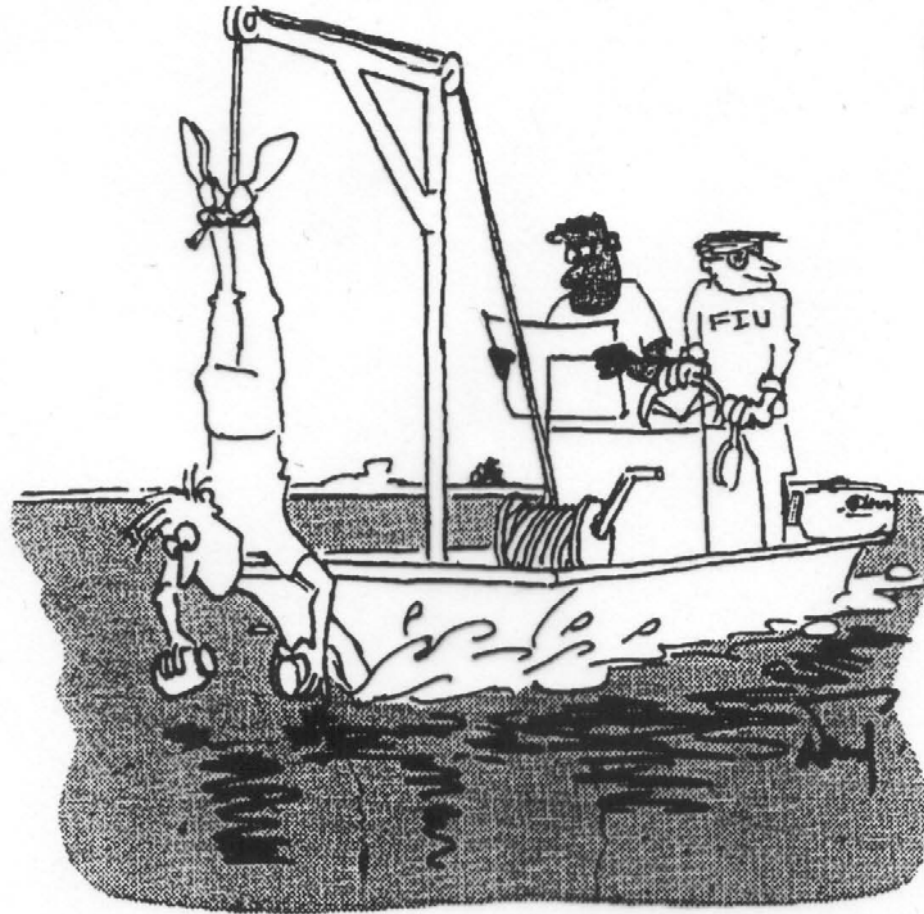
Water Response  
(temperature, algal blooms, light  
attenuation, turbidity, salinity, etc.)

Benthic-pelagic coupling,  
trophodynamics, etc.

Climate Impacts  
(habitat alteration, water quality  
degradation, fish mortality, etc.)



**Can you get sexy science from a routine  
water quality monitoring program?**



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Thanks !!!....

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**ADDITIONAL**



# Trend Analysis with Cusum charts

