Consortium
CONCORDE
Coastal River-Dominated Ecosystems

Authors of abstract

Pat Fitzpatrick	MSU
Jessie Kastler	USM
Frank Hernandez	USM
Carla Culpepper	USM
Candace Bright	USM

But whole CONCORDE team contributed to results

Outline of talk

- Field program information
- Outreach – citizen science
- CONCORDE Meteorological Analysis (CMA) dataset
- Impact of Hurricane Patricia's remnants on ocean biology and salinity plumes
- Impact of CMA on ocean model ROMS

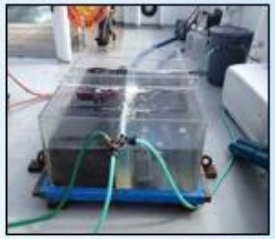
How do complex fine-scale structure and processes in coastal waters dominated by pulsed-river plumes control the exposure, impacts, and ecosystem recovery from offshore spills like the Deepwater Horizon release of 2010?

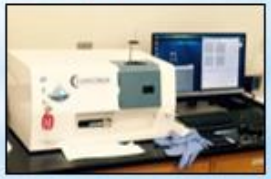
Website – www.con-corde.org

Field program information

- Four cruises (Fall 2015, Winter 2016 (Bonnet Carret spillway opening), Spring 2016, Summer 2016)
- Small boat cruises near Dauphin Island
- Measurements for
  1. Phytoplankton
  2. Chemistry constituents
  3. Ocean currents
  4. Water temperature
  5. Salinity
  6. Wind
  7. Air temperature
  8. Satellite products (Chlorophyll-a, light attenuation, CDOM, SPM)
  9. Ocean model data
  10. Concorde Meteorological Analysis (CMA)

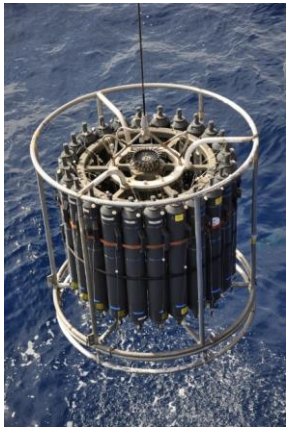
- **Objectives**
  - Relate distribution of plankton in nearshore habitats at relevant spatial and temporal scales to complex and dynamic physical forcers
  - Understand exposure risk of planktonic community during an oiling event

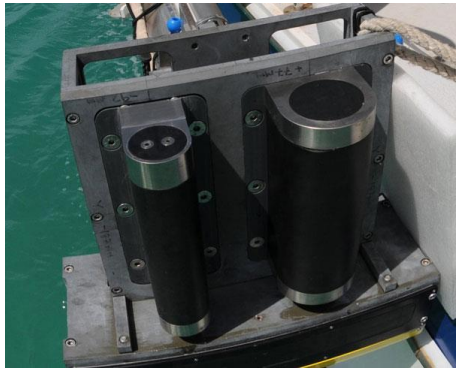


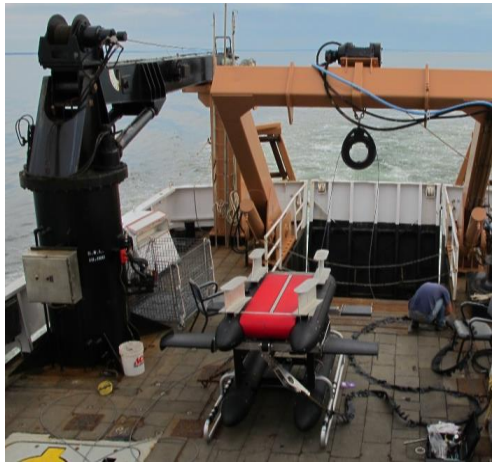


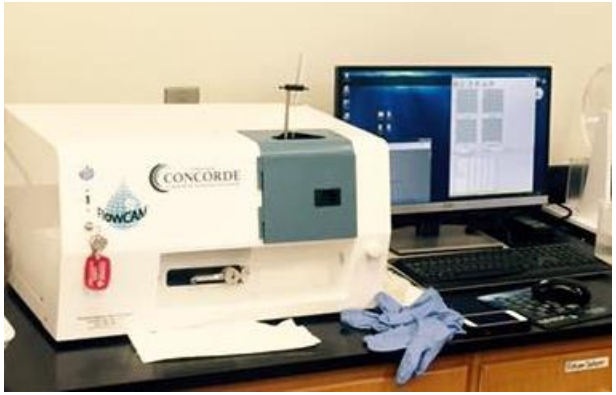
Objectives and Methodology

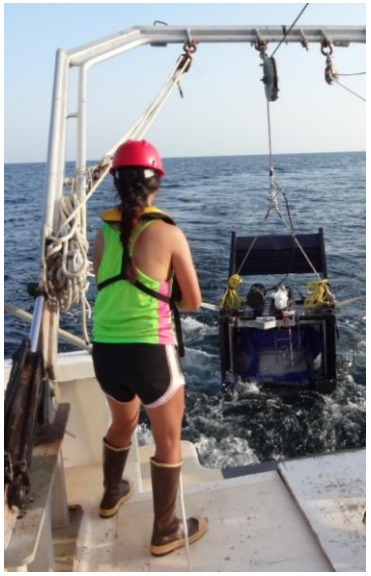
Plankton Sampling Equipment

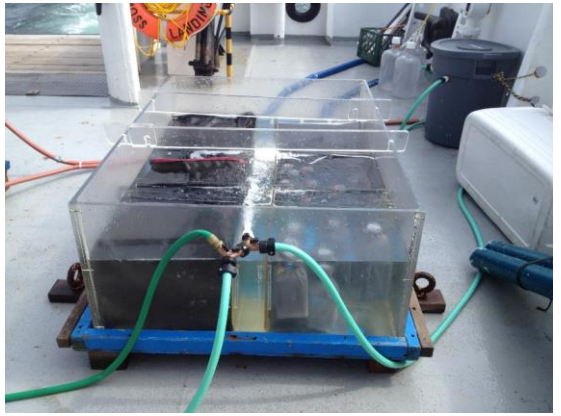




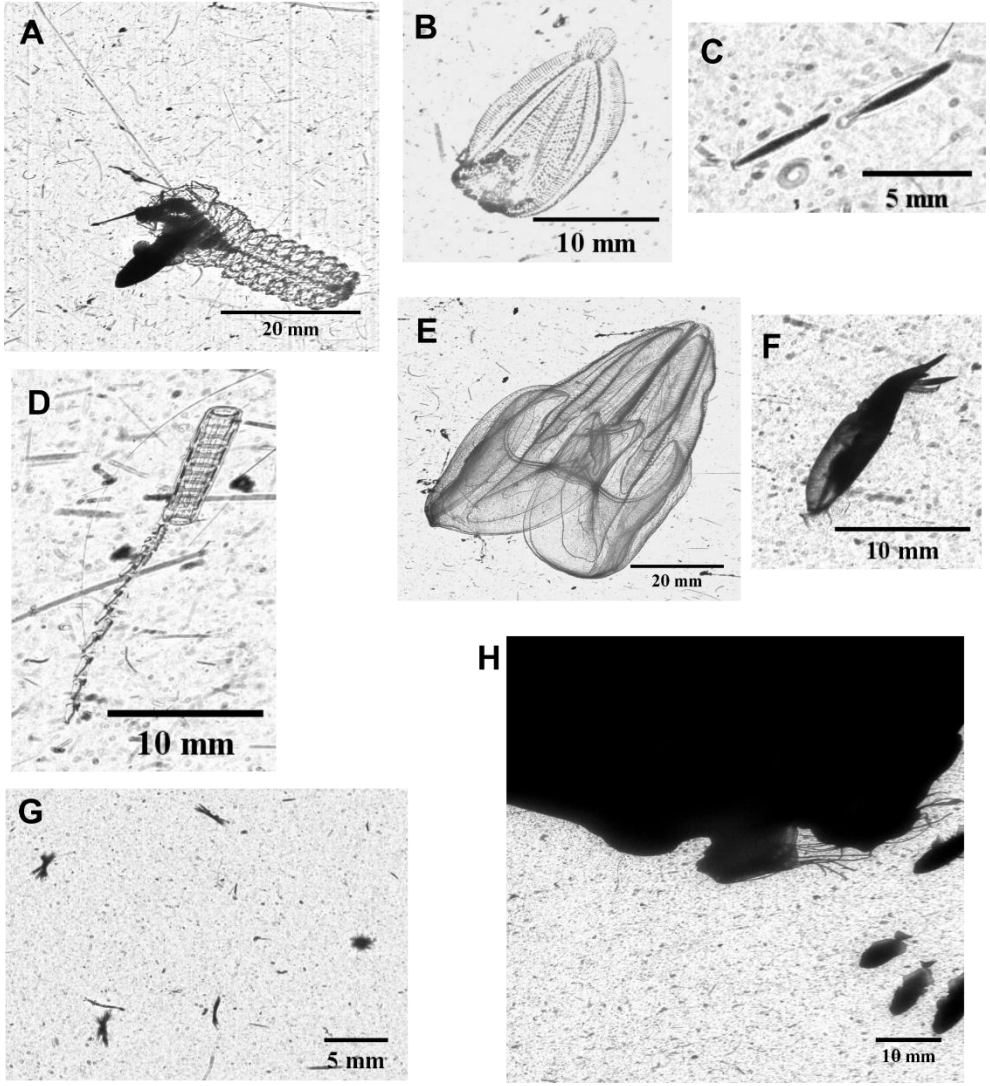








The plankton sub-project will be collecting zooplankton and ichthyoplankton samples using the MININESS and Neuston nets, image data using the DPI, acoustic backscatter data that further complements our plankton samples and DPI images. In addition, we are also using a FlowCam to identify phytoplankton and microzooplankton species.



Example images captured with the ISIIS during the Concorde fall campaign a) siphonophore preying on a larval fish b) larval flatfish c) Two round herring larvae found in dense aggregations d) Doliolid e) Lobate ctenophore (Mnemiopsis spp.) f) larval squid g) trichodesmium h) larval jacks near the bell of a large Aurelia spp. jellyfish

Zooplankton captured with the plankton nets to compare to image data

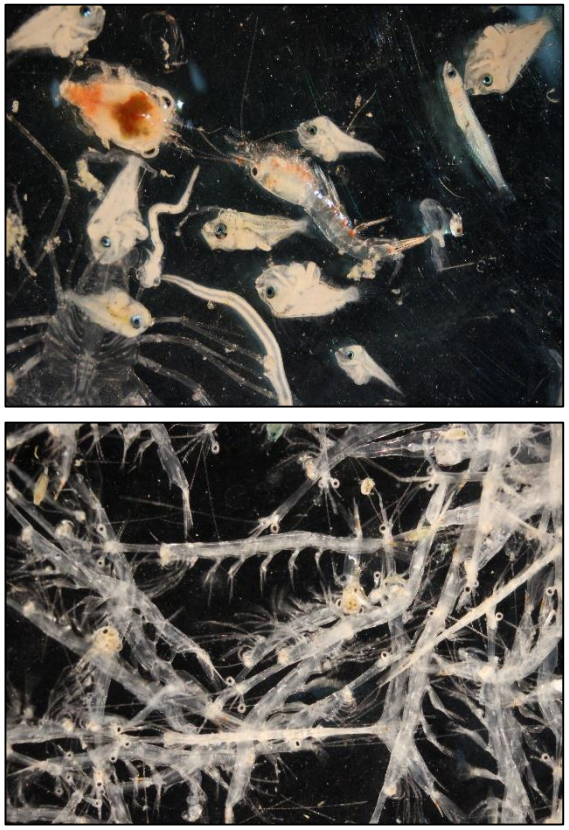


Figure 1. Images of plankton from corridor sampling region from Mobile corridor (top) on October 30th to the Eastern corridor (bottom) on October 31st. Photo credits: Hernandez lab.

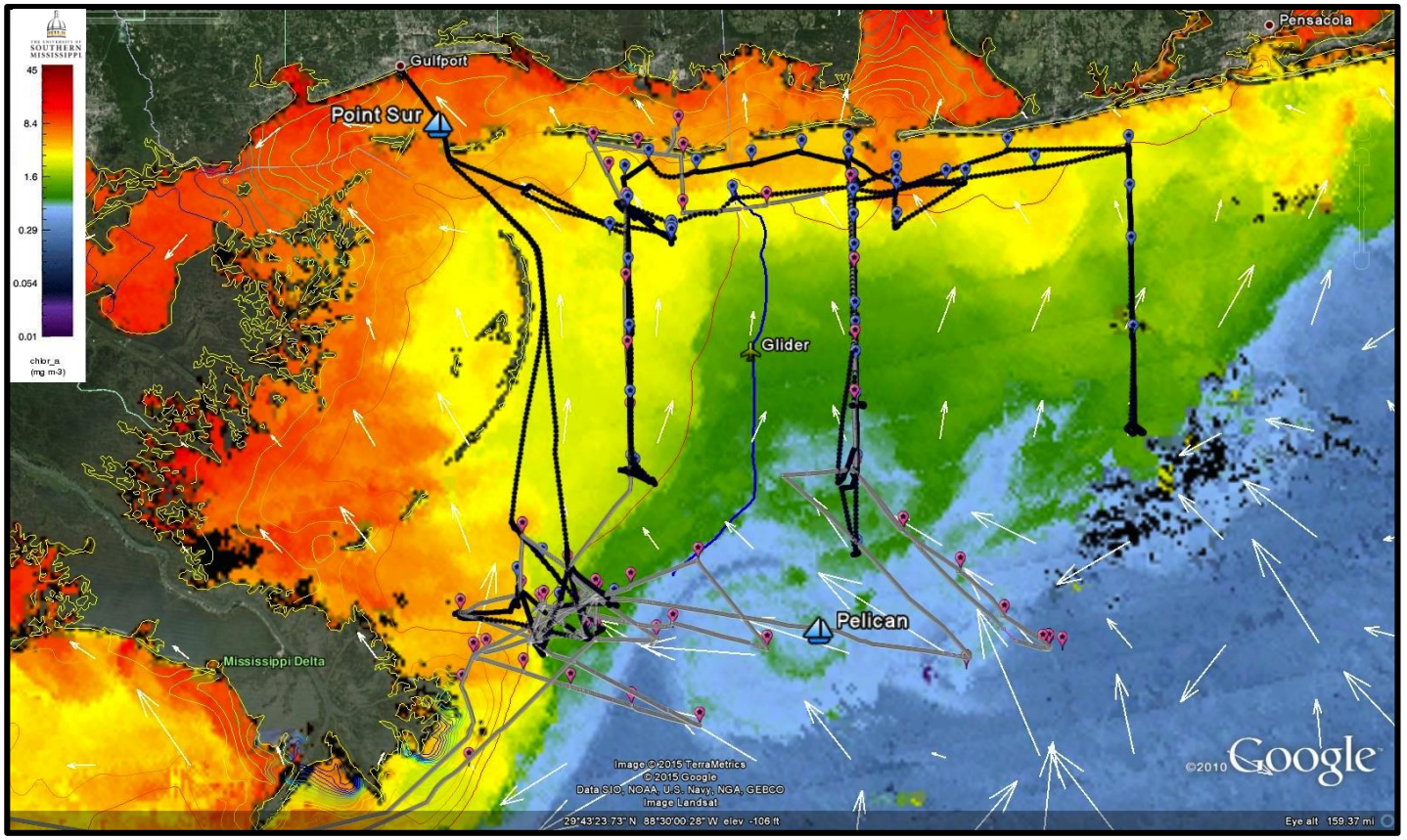
Ocean Weather Laboratory: Daily Now Cast

Circulation Models, Satellite Bio-optics, *In situ* data

Ocean Weather

http://www.usm.edu/marine/research-owx

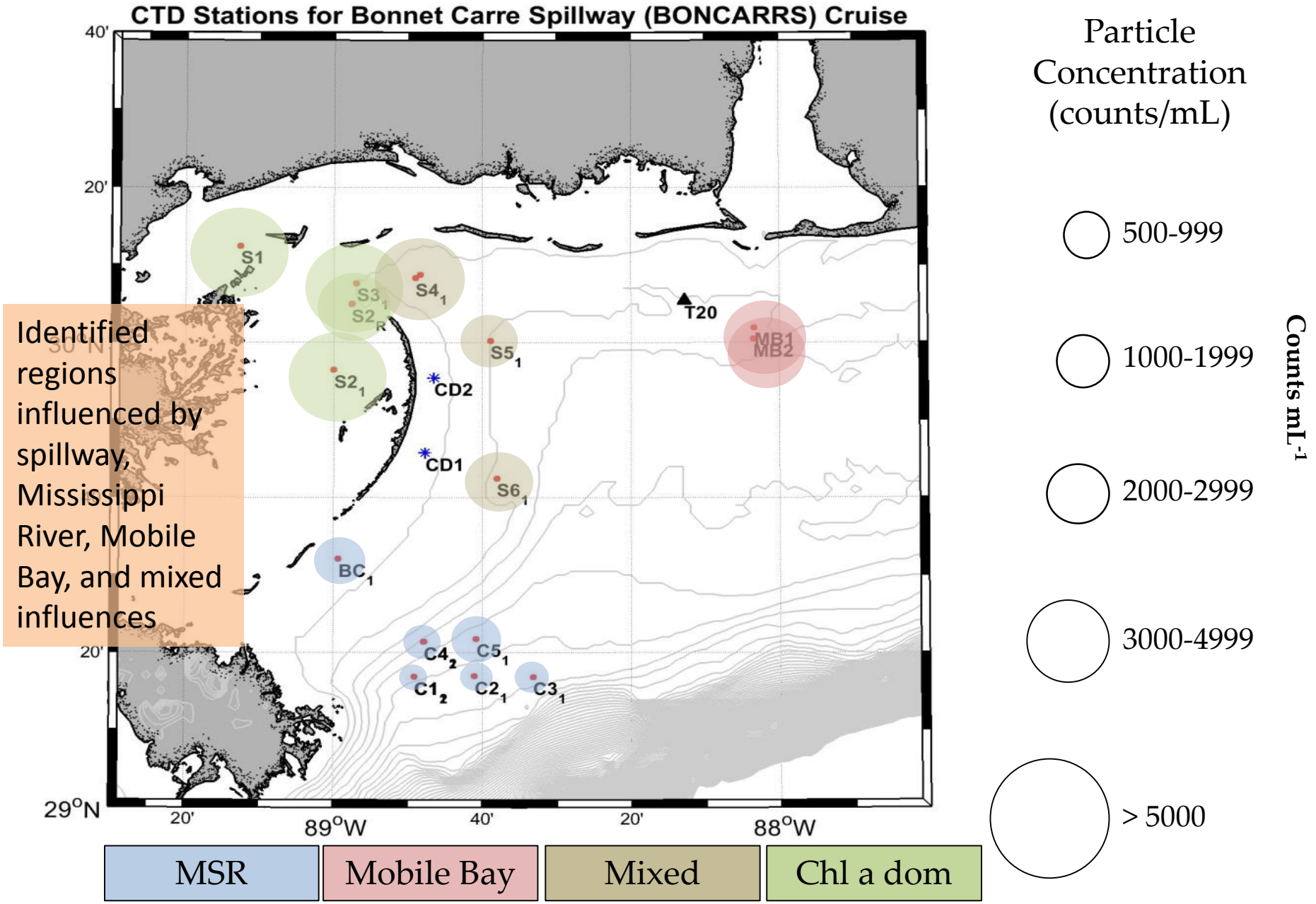
VIIRS Chlorophyll-a, NCOM Current Vectors and Surface Salinity Contours: November 1st, 2015



Fall Cruise Tracks
Point Sur
Pelican
Glider

The Ocean Weather Lab provided daily satellite and modeled ocean data to assist with strategic cruise planning, glider deployment, and sampling locations.

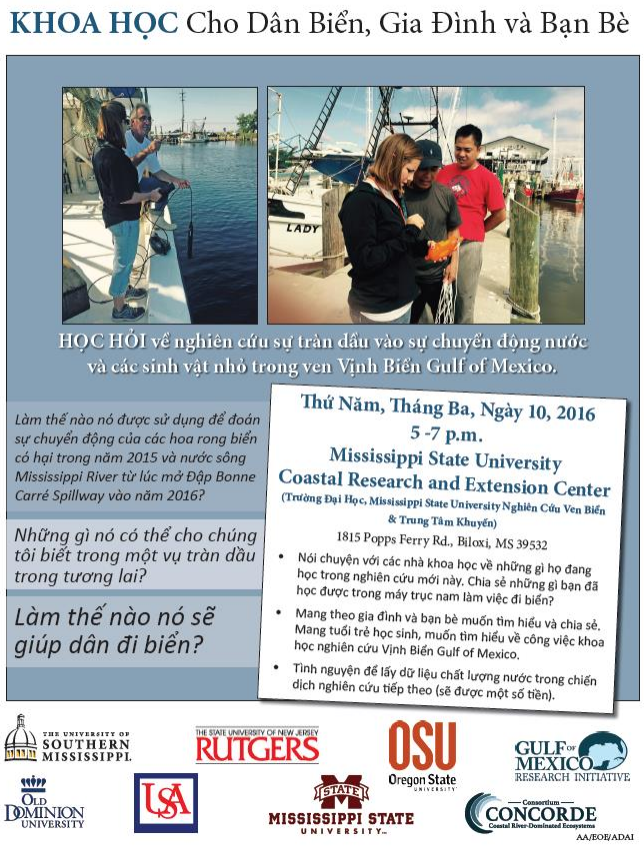
Consortium CONCORDE Coastal River-Dominated Ecosystems


CTD Stations for Bonnet Carre Spillway (BONCARRS) Cruise
Identified regions influenced by spillway, Mississippi River, Mobile Bay, and mixed influences
Particle Concentration (counts/mL)
500-999
1000-1999
2000-2999
3000-4999
> 5000
Counts mL-1
MSR
Mobile Bay
Mixed
Chl a dom
S1
S3 1
S4 1
S2 R
S2 1
S5 1
T20
MB1
MB2
CD2
CD1
S6 1
BC 1
C4 2
C5 1
C1 2
C2 1
C3 1
40'
20'
30°N
20'
29°N
20'
89°W
40'
20'
88°W

Outreach and citizen scientists

Citizen Science

- Community Recruitment
  - March 10, 2016 – Biloxi, MS
  - March 16, 2016 – Chalmette, LA
- Training
- Data Collection
- Social Science Research

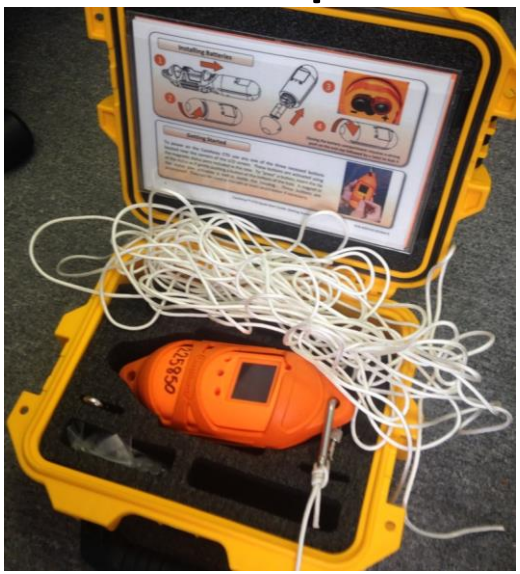


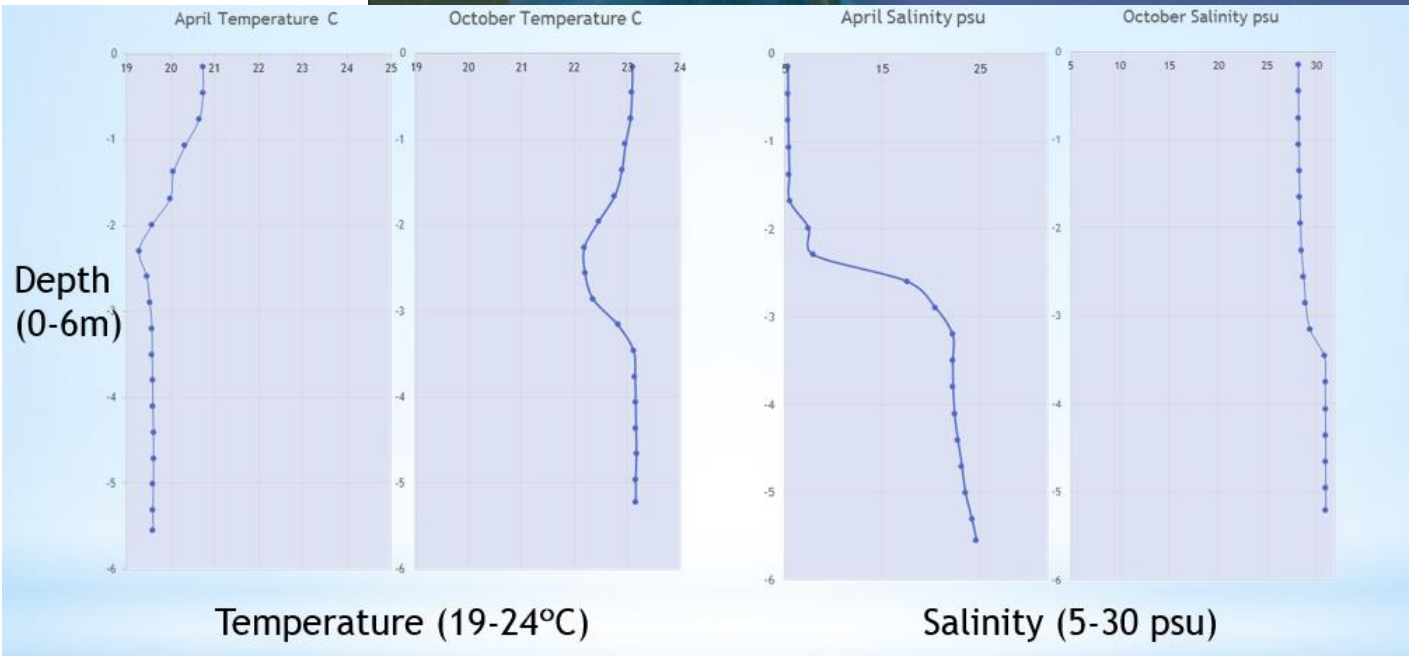
Citizen Science

- Community Recruitment
- Training
  - March 19, November 19
  - Two more in 2017
- Data Collection
- Social Science Research

- Community Recruitment
- Training
- Data Collection
  - Take Castaway to Fishermen (Ycloskey, Bay St. Louis, D'Iberville, Biloxi, Ocean Springs, Gautier)
  - Review methods & remind of limitations
- Social Science Research

Example of Castaway CTD instrument and data



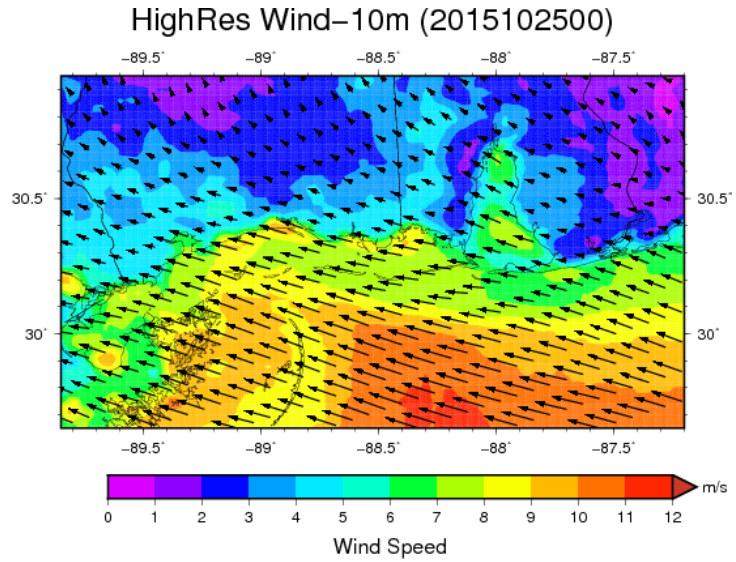


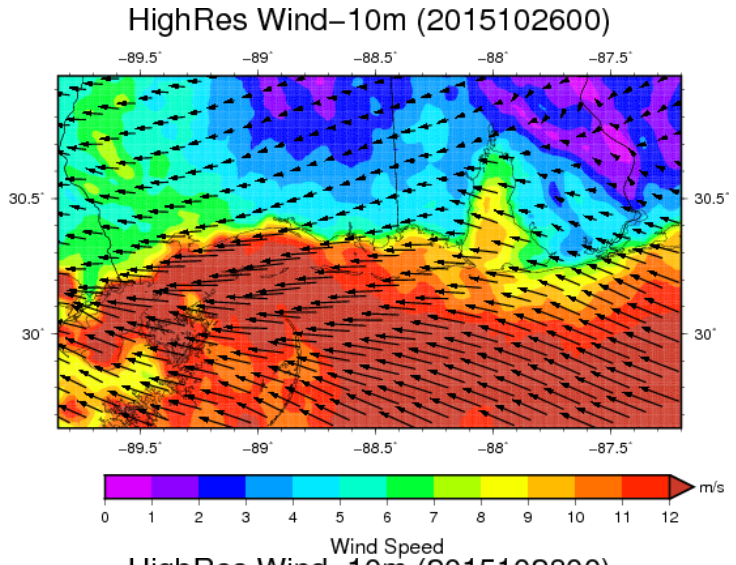
CONCORDE Meteorological Analysis (CMA)

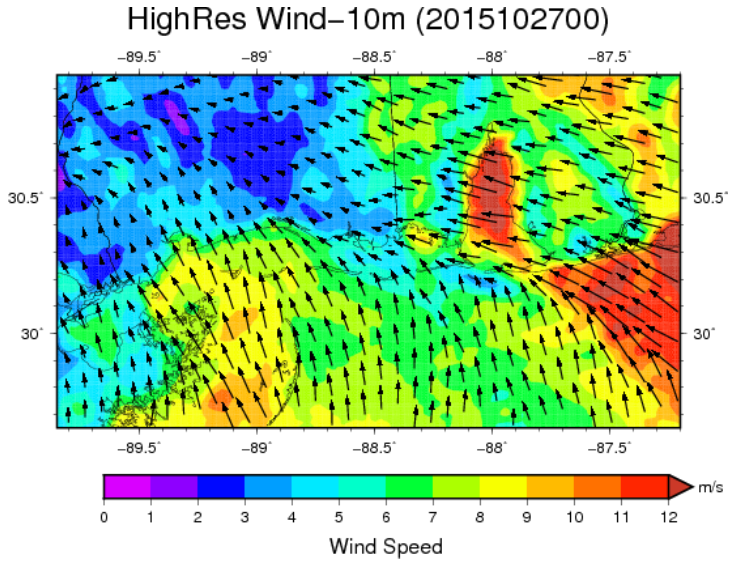
- 1-km, hourly gridded dataset in Mississippi Sound and vicinity (starting April 2015 to current)
- Temperature, wind, pressure
- 1-hr rainfall (radar –derived)
- SST from AVHRR (to capture river plumes and proper fluxes)
- Radiation fields
- Cloud cover

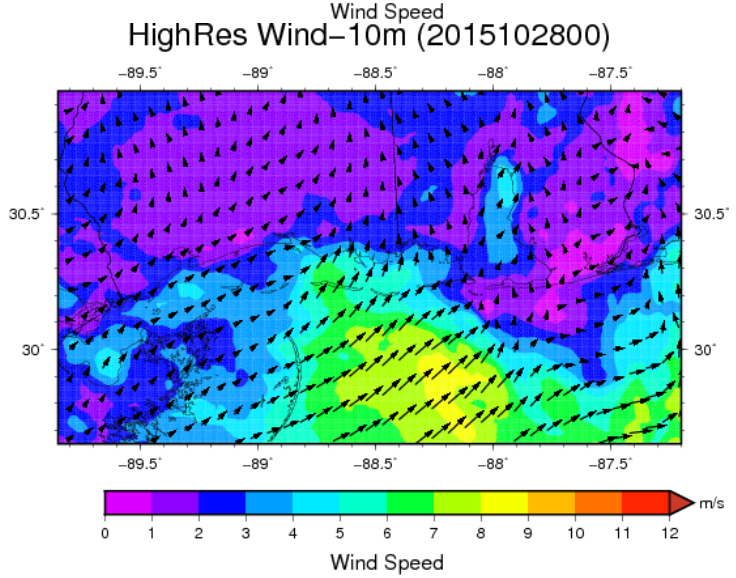
Captures diurnal processes and mesoscale patterns

Example, CMA (Hurricane Patricia's remnants)

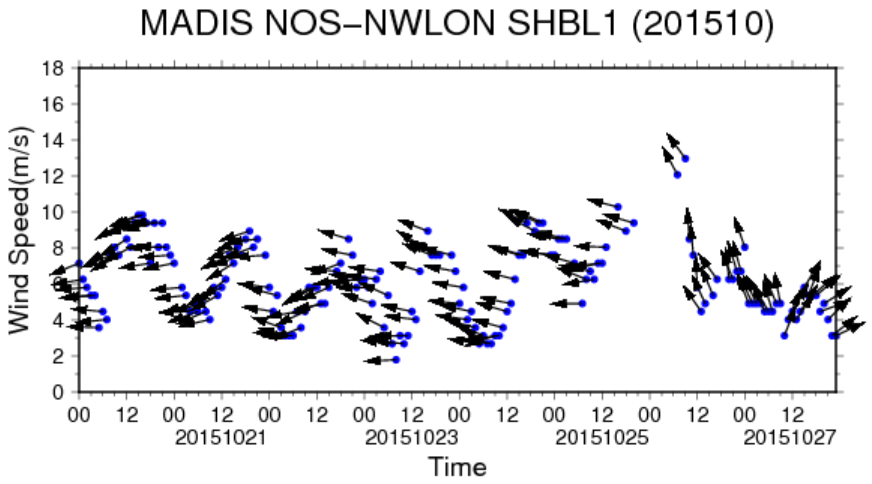


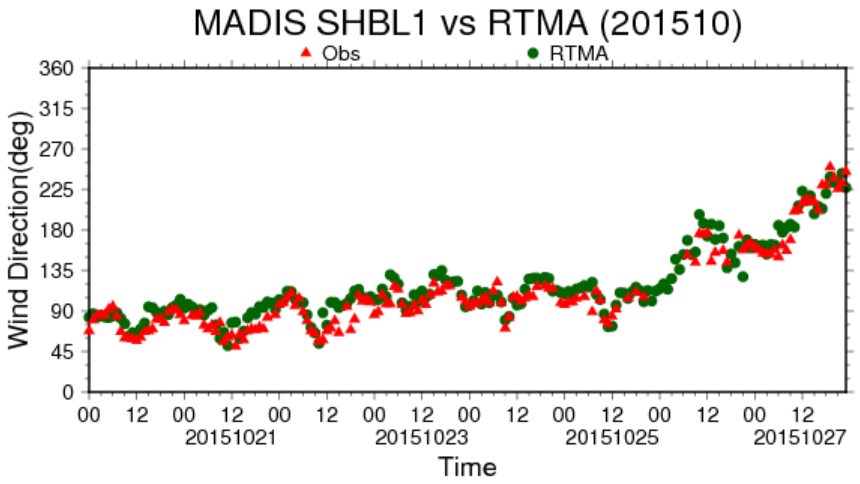


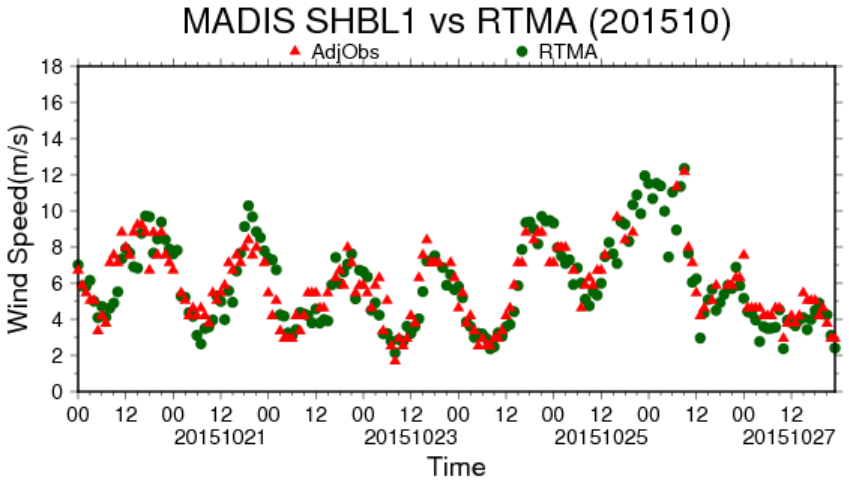




Times series of closest CMA grid point to Shell Beach buoy during Hurricane Patricia's remnants







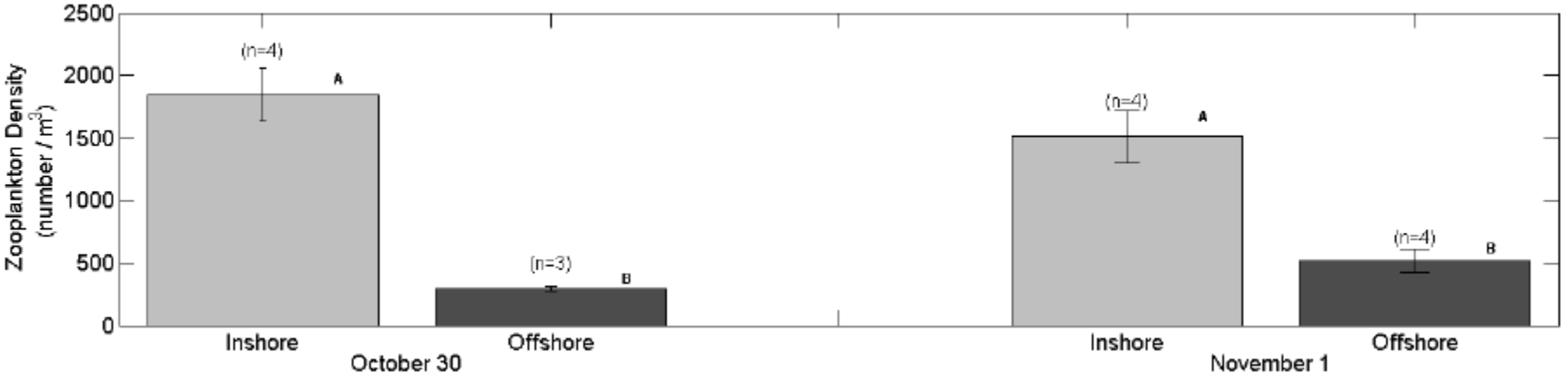
Validation shows generally low bias and errors

Wind speed (ms^{-1})							***Sample size***		
Station	May 2015		Aug 2015		Oct 2015		May n	Aug n	Oct n
	Bias	*Abs Err*	*Bias*	*Abs Err*	*Bias*	*Abs Err*			
KMSY	-1.9	1.9	-2.1	2.1	-1.7	1.7	187	157	154
BBNL1	0.6	0.8	0.0	0.7	0.0	0.5	188	115	114
D6246	1.6	1.9	0.4	1.2	0.5	1.2	164	161	150
SHBL1	-0.2	0.9	0.1	1.0	-0.7	1.2	164	155	140
NNHM6	1.1	1.2	1.2	1.3	1.1	1.2	170	118	115
KGPT	-2.2	2.2	-0.8	1.0	-2.1	2.1	171	135	130
42067	-0.6	1.3	-0.9	1.5	-0.1	1.1	46	53	13
PTBM6	0.2	1.2	-0.6	1.1	0.1	1.1	189	166	167
DPIA1	-0.1	1.0	0.7	1.5	-0.2	0.9	188	167	165

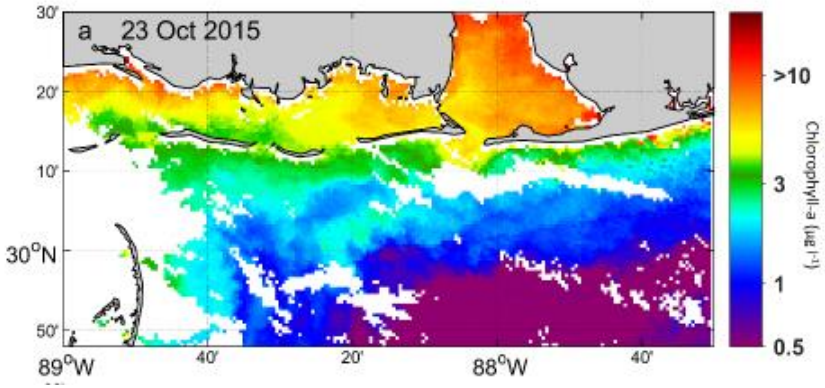
Wind direction (deg)							***Sample size***		
Station	May 2015		Aug 2015		Oct 2015		May n	Aug n	Oct n
	Bias	*Abs Err*	*Bias*	*Abs Err*	*Bias*	*Abs Err*			
KMSY	-3,7	12.0	-2.8	20.7	-3.0	18.2	185	155	151
BBNL1	20.6	24.7	15.3	32.8	23.7	32.5	188	115	114
D6246	12.5	14.0	2.4	25.6	6.2	21.3	164	161	150
SHBL1	7.1	10.7	14.7	29.3	2.6	16.3	164	155	140
NNHM6	14.8	17.9	-1.6	33.1	11.8	24.6	170	118	115
KGPT	4.4	9.1	-4.2	17.3	-0.3	14.4	169	128	127
42067	-2.7	10.4	-6.2	24.1	3.9	15.8	46	53	13
PTBM6	7.5	12.3	-8.7	22.8	6.2	14.7	189	166	167
DPIA1	4.8	12.4	8.2	21.3	9.3	14.4	188	167	165

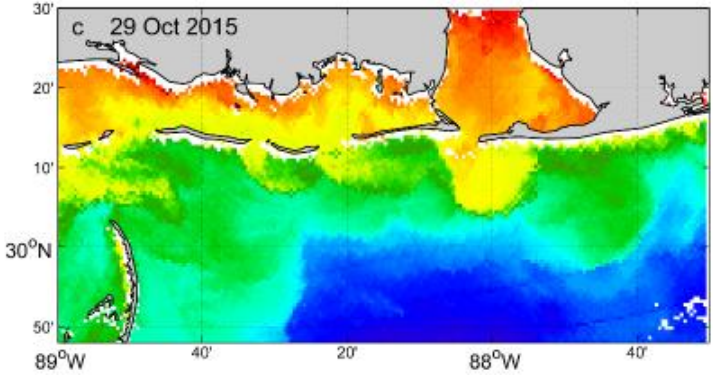
Impact of Patricia’s remnants

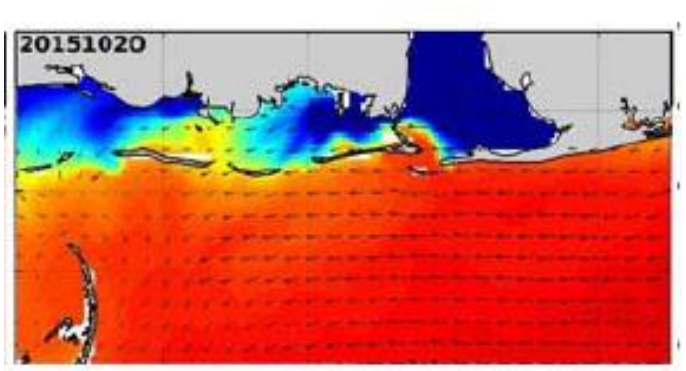
Zooplankton density after Patricia - Inshore versus offshore

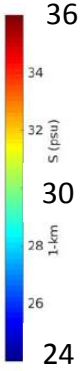


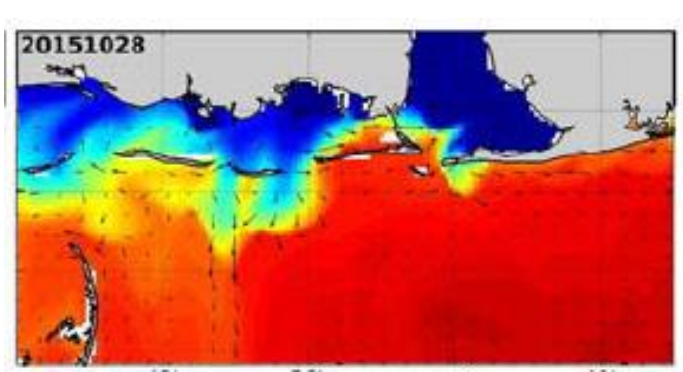
Chlorophyll-a (top) and salinity (bottom) before and after Patricia





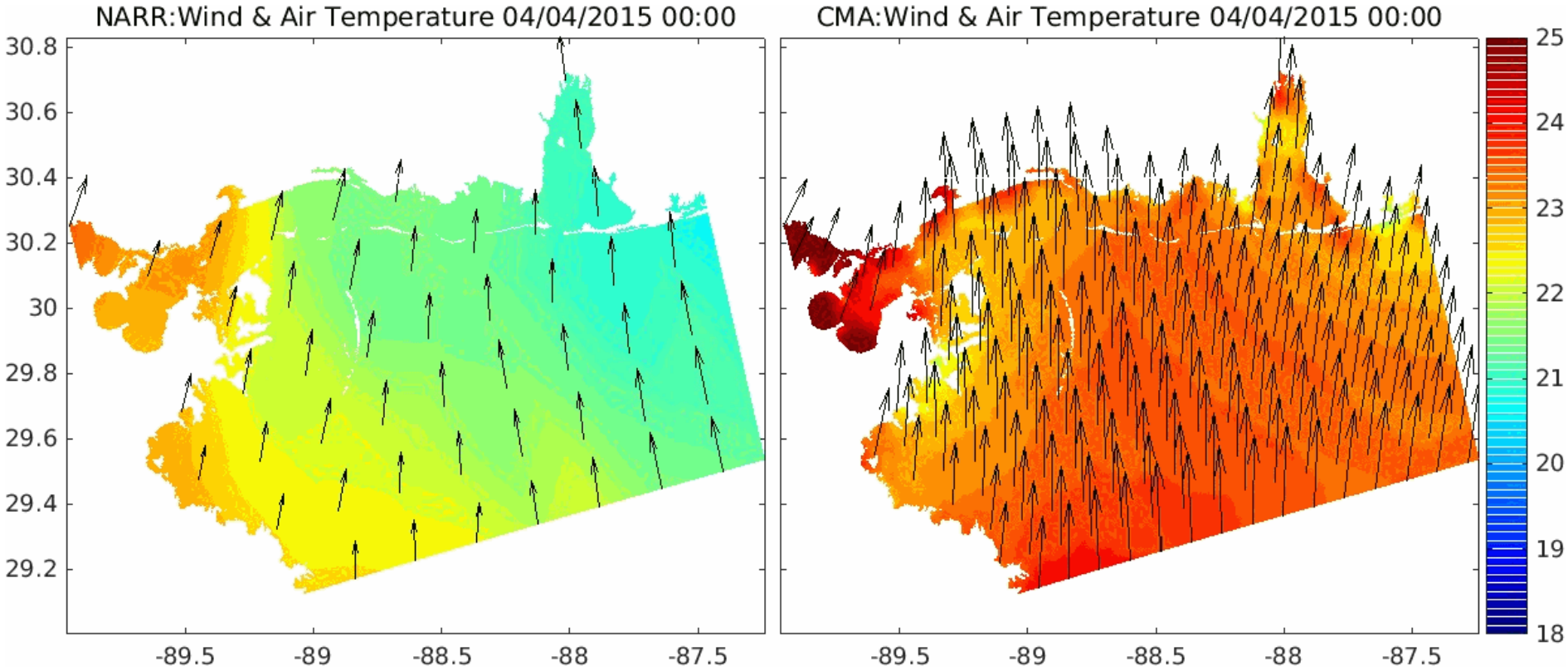




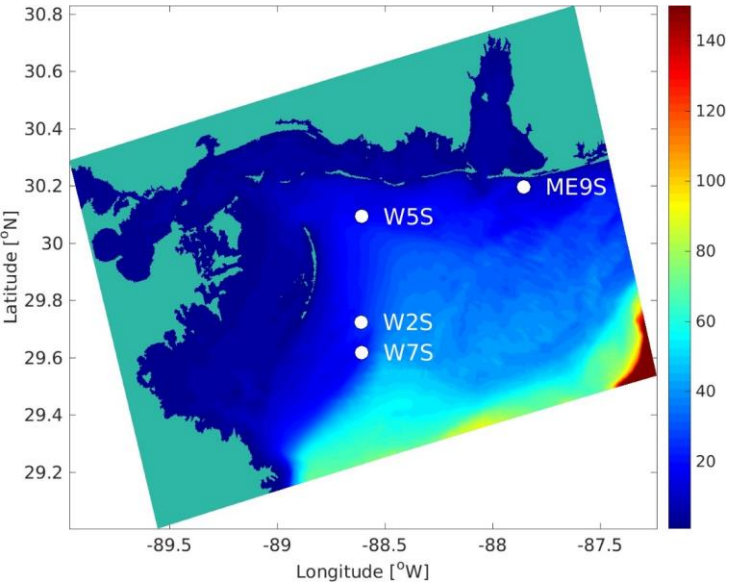


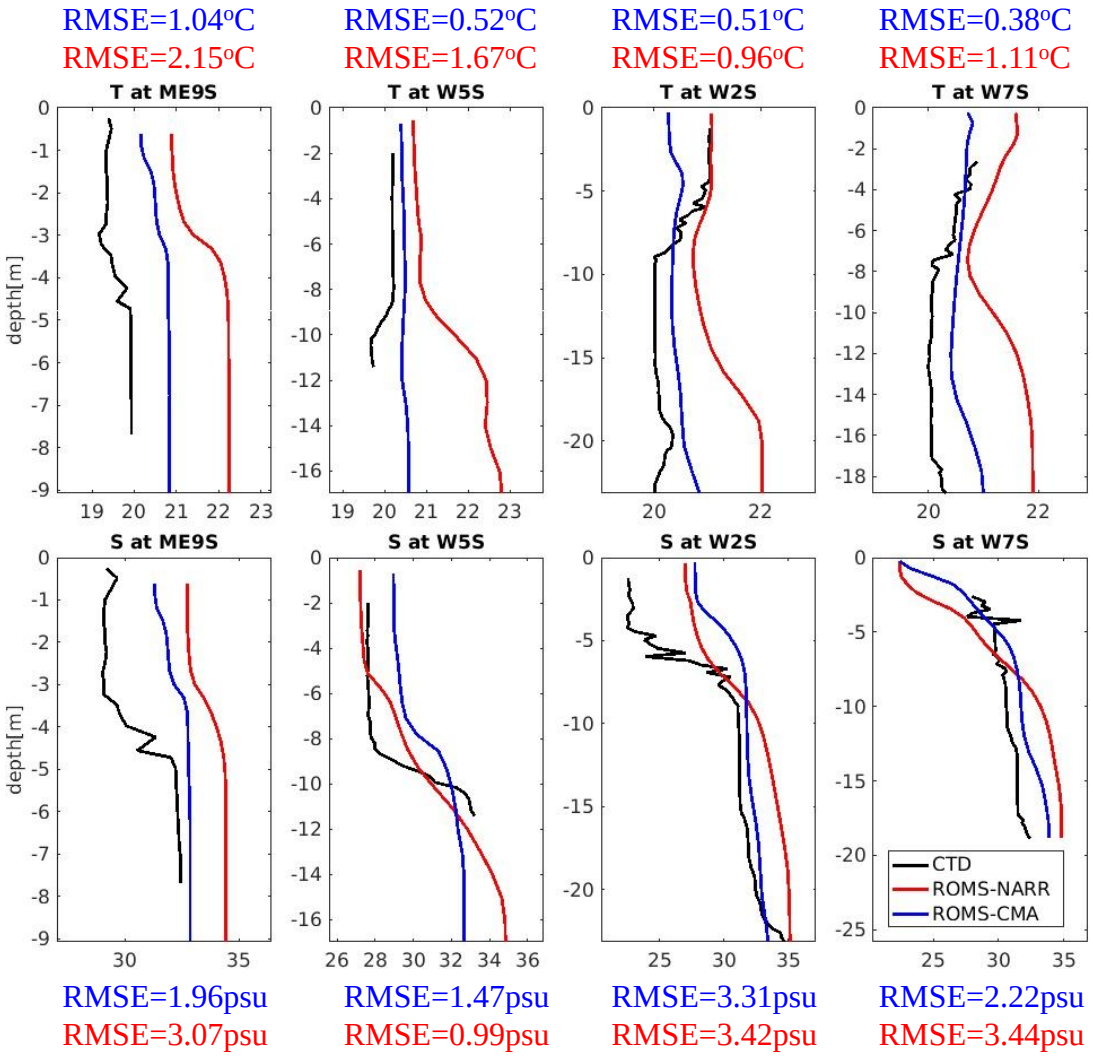
CMA impact on ocean model ROMS

NARR (30 km, time interpolated) vs CMA (1 km, reanalysis)



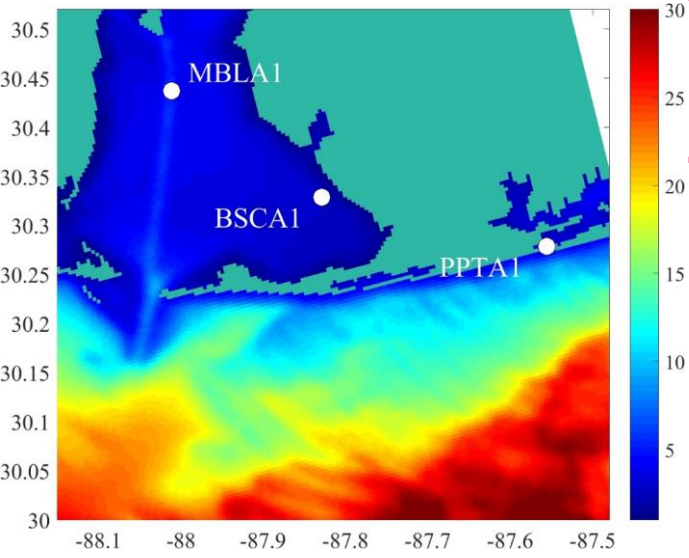
Ocean model results
CTD profiles from CONCORDE spring cruise in 2016

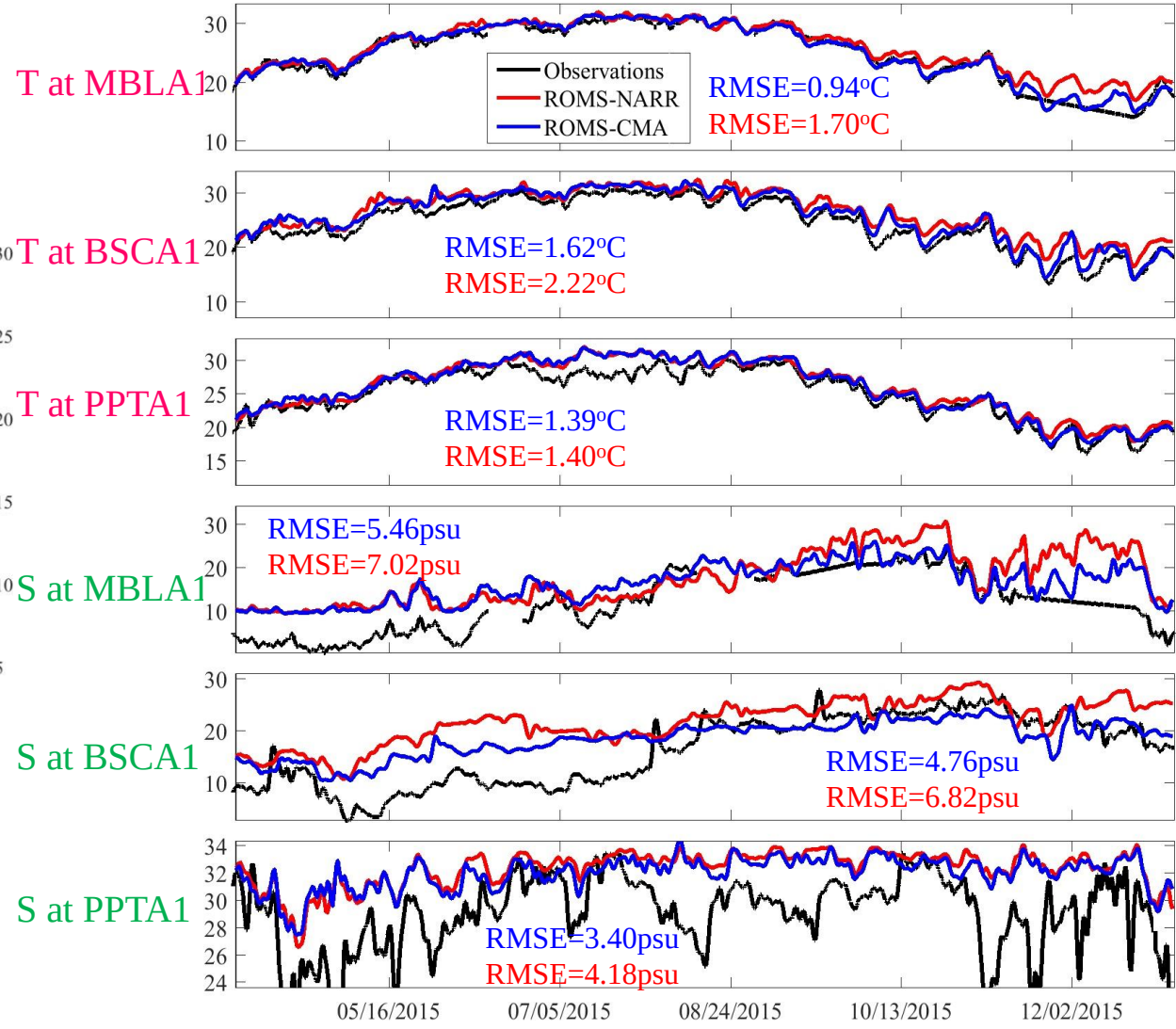




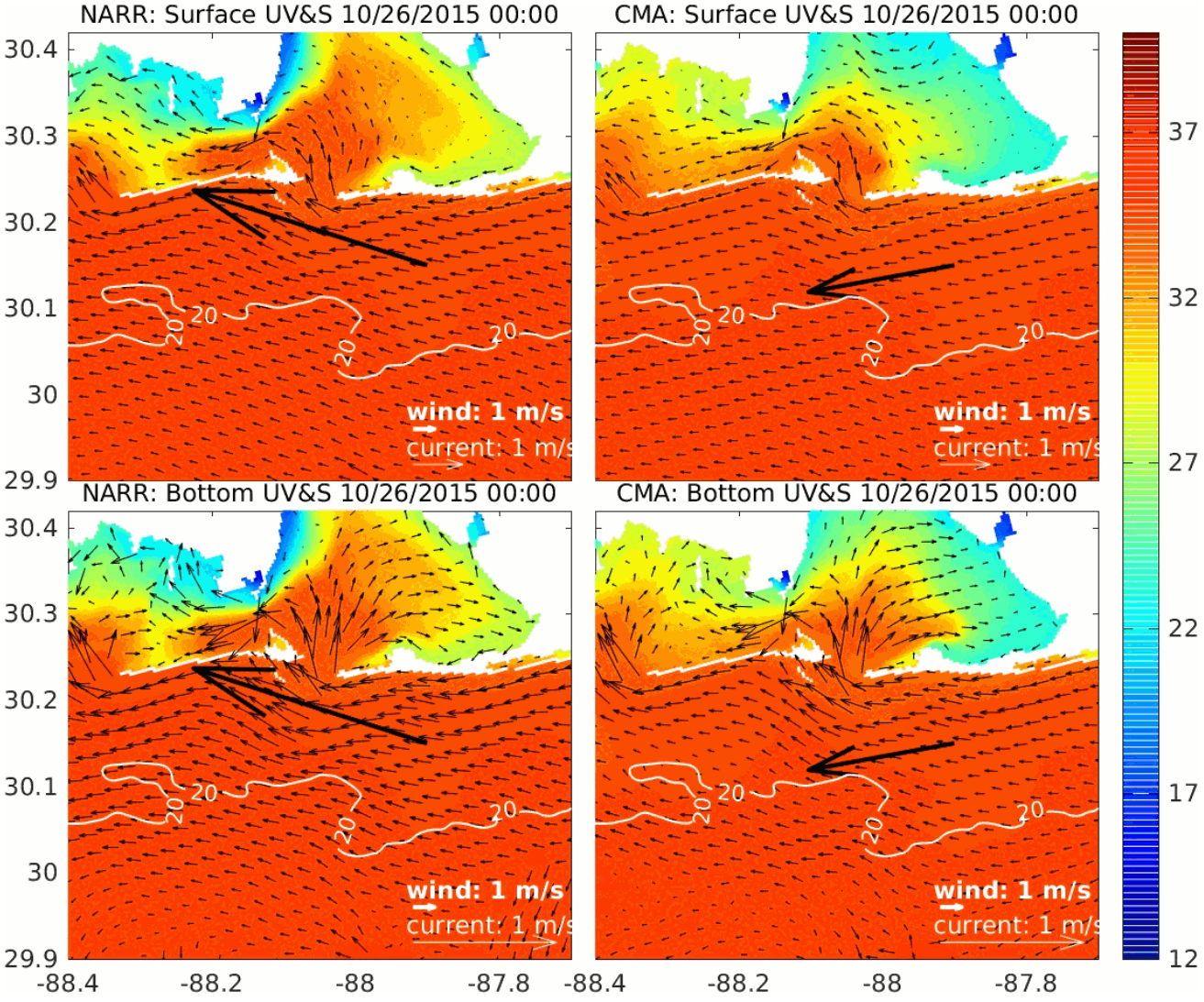
Results

Model results vs NDBC buoys in 2015

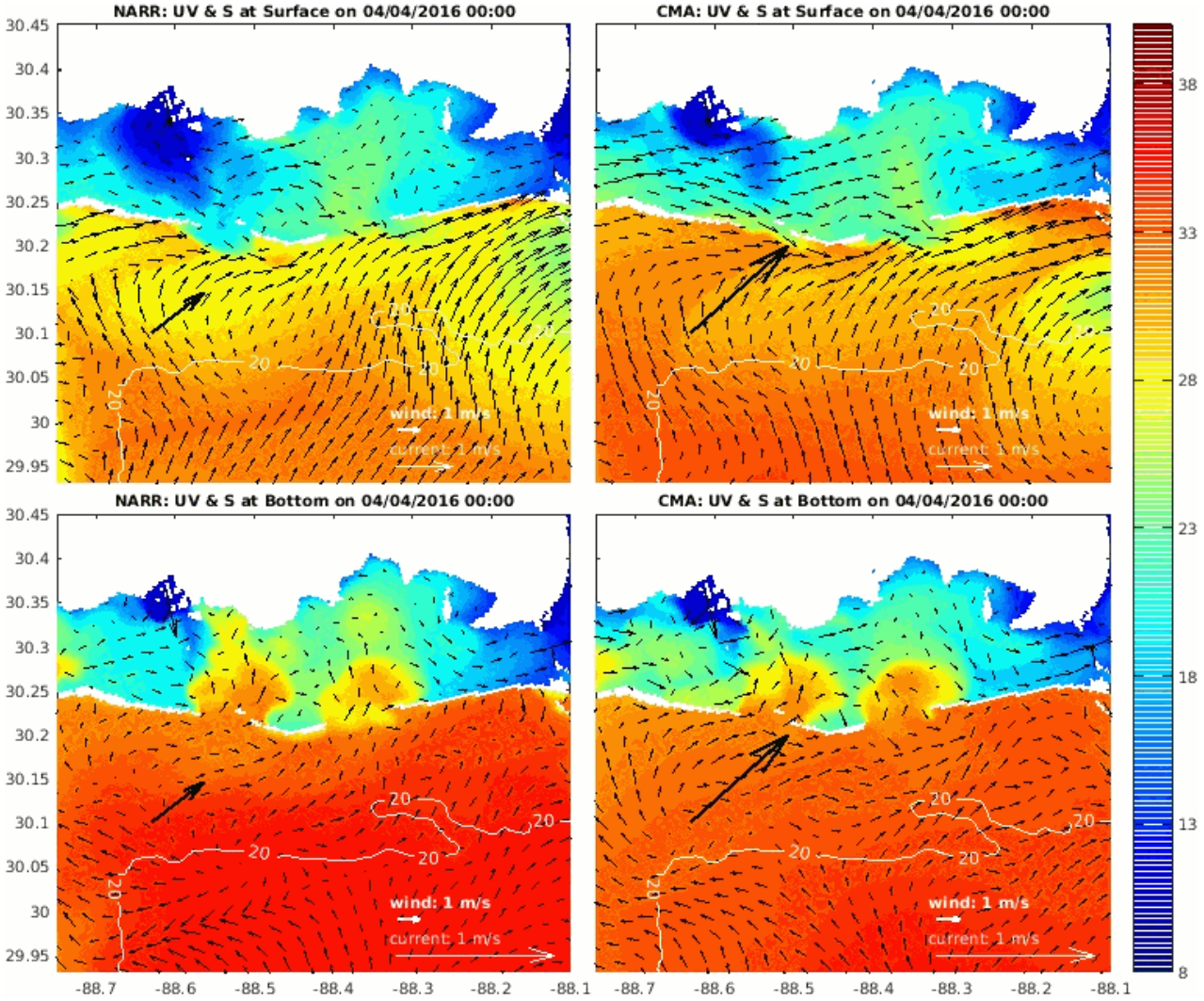




- Post remnants of tropical storm Patricia (10/27/2015), the wind direction rotated suddenly, and the fresh water rushed out of the Main Pass. The plume is stronger if the model is driven by high resolution CMA forcing.



- In the beginning of April 2016, the wind direction rotated in a clockwise direction. Model driven by CMA shows higher mixing rate.



Summary

1) Model-observation comparisons suggest that the model performance is improved by high resolution CMA forcing.
2) The freshwater plume coming out of the Mobile Bay post Hurricane Patricia is stronger when the model is driven by CMA forcing. The model driven by CMA forcing displays a higher mixing rate compared with the model results derived from NARR forcing.

This research was made possible by a grant from The Gulf of Mexico Research Initiative (GoMRI).

Data are publicly available through the Gulf of Mexico Research Initiative Information & Data Cooperative (GRIIDC) at https://data.gulfresearchinitiative.org