

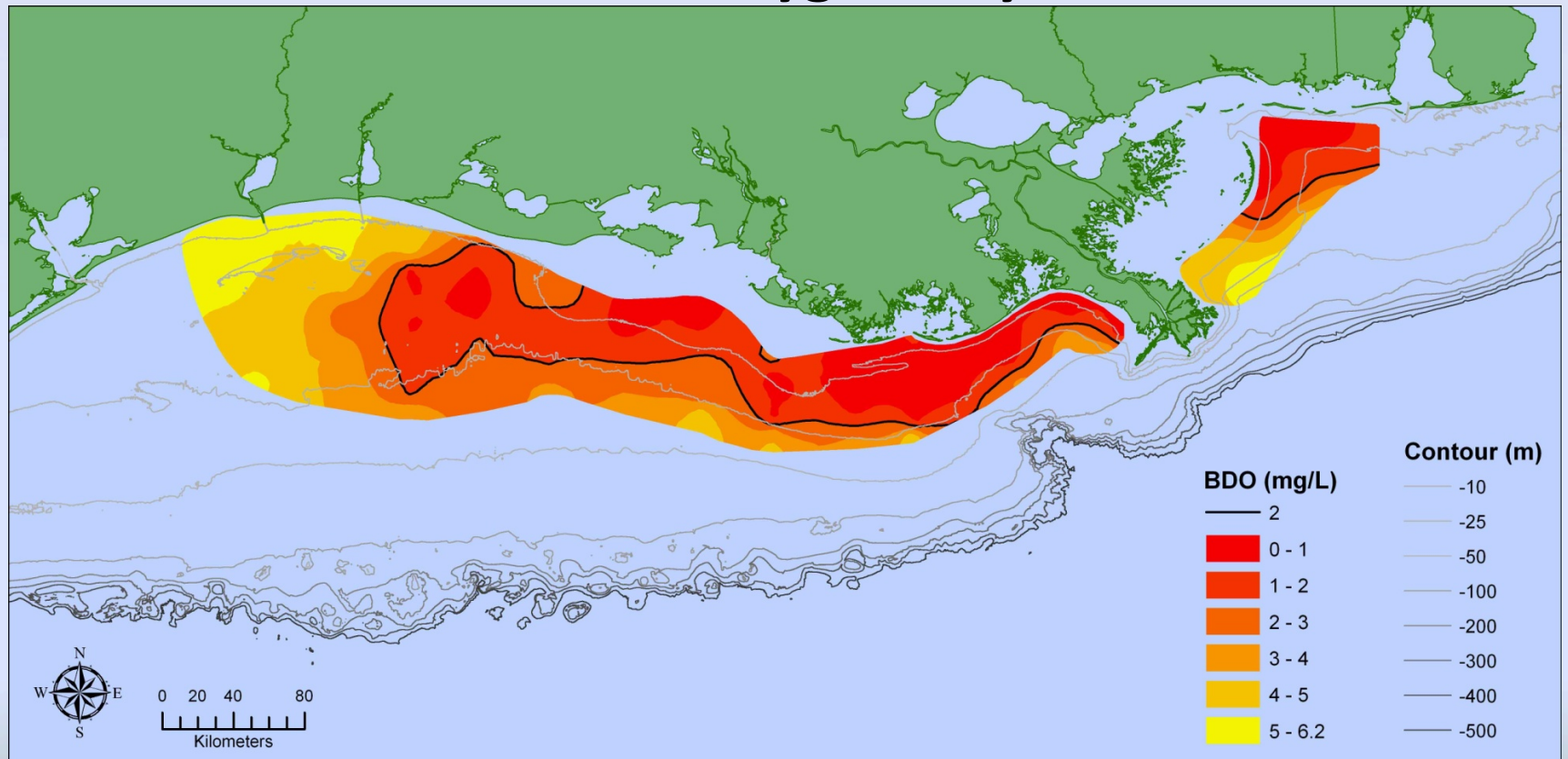
# **Documenting Hypoxia (Low Oxygen 'Dead Zones') in the Northern Gulf of Mexico**

**UNOLS RVTech Meeting  
New Orleans, Louisiana  
November 14, 2011**

**Nancy N. Rabalais**  
**[nrabalais@lumcon.edu](mailto:nrabalais@lumcon.edu)**  
**<http://www.hypoxia.net>**

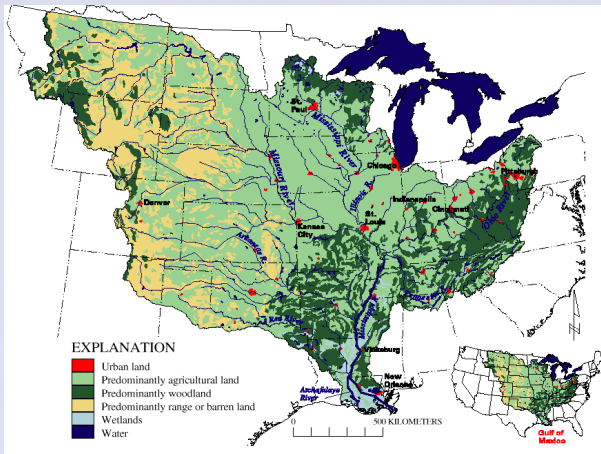
*Hypoxia,  $DO < 2 \text{ mg l}^{-1}$ , is a persistent, perennial problem on the northern Gulf of Mexico continental shelf, resulting from nutrient over-enrichment of Gulf waters from the Mississippi River watershed in a stratified coastal system.*

## **Bottom-Water Dissolved Oxygen July 18-21, 24-30, 2011**



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

# Mississippi River - Gulf of Mexico Ecosystem Continuum



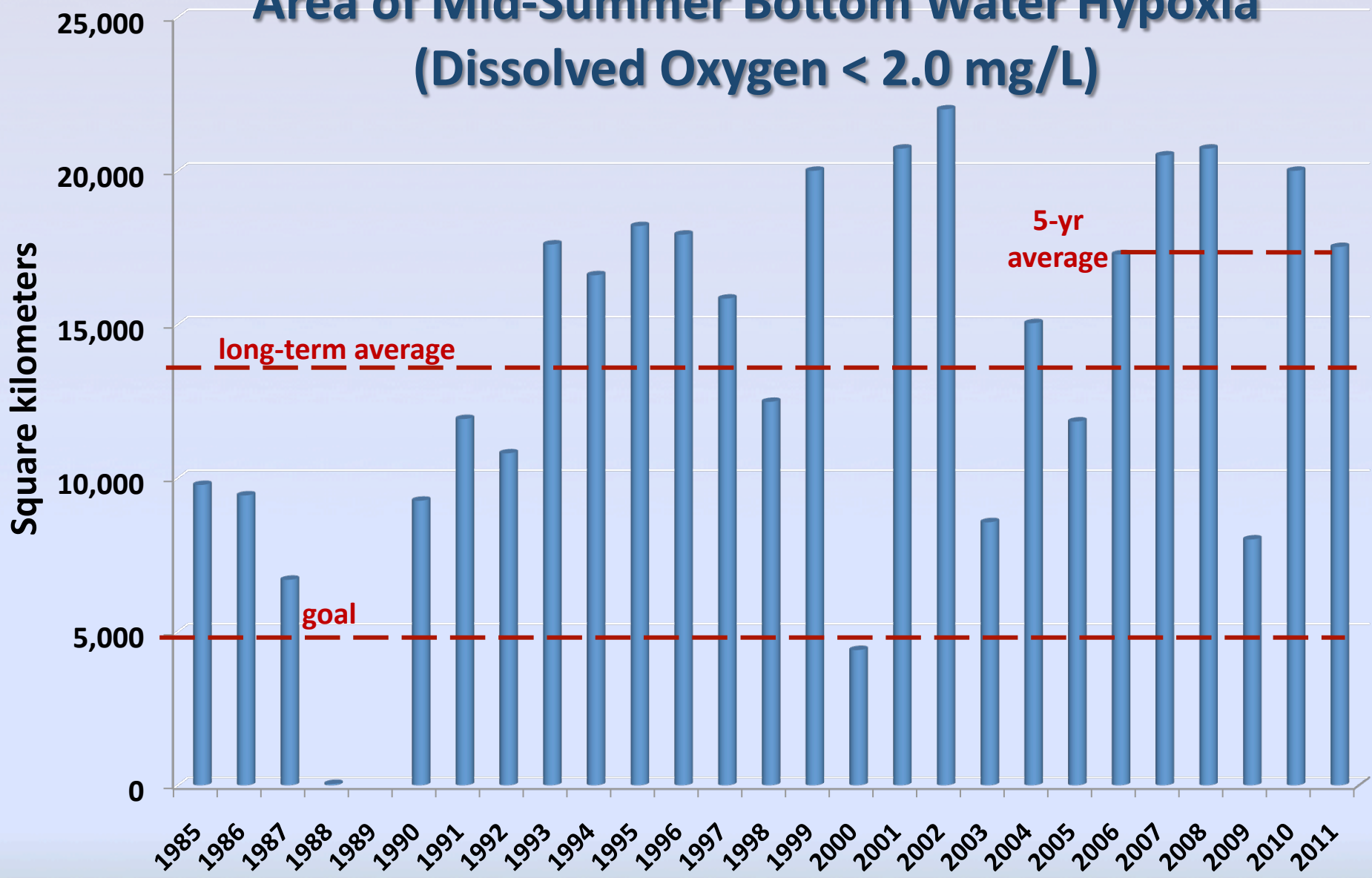
Effects are more far reaching than suspended sediment plume, esp. N & somewhat P

dominant wind direction



Source: N. Rabalais, LUMCON

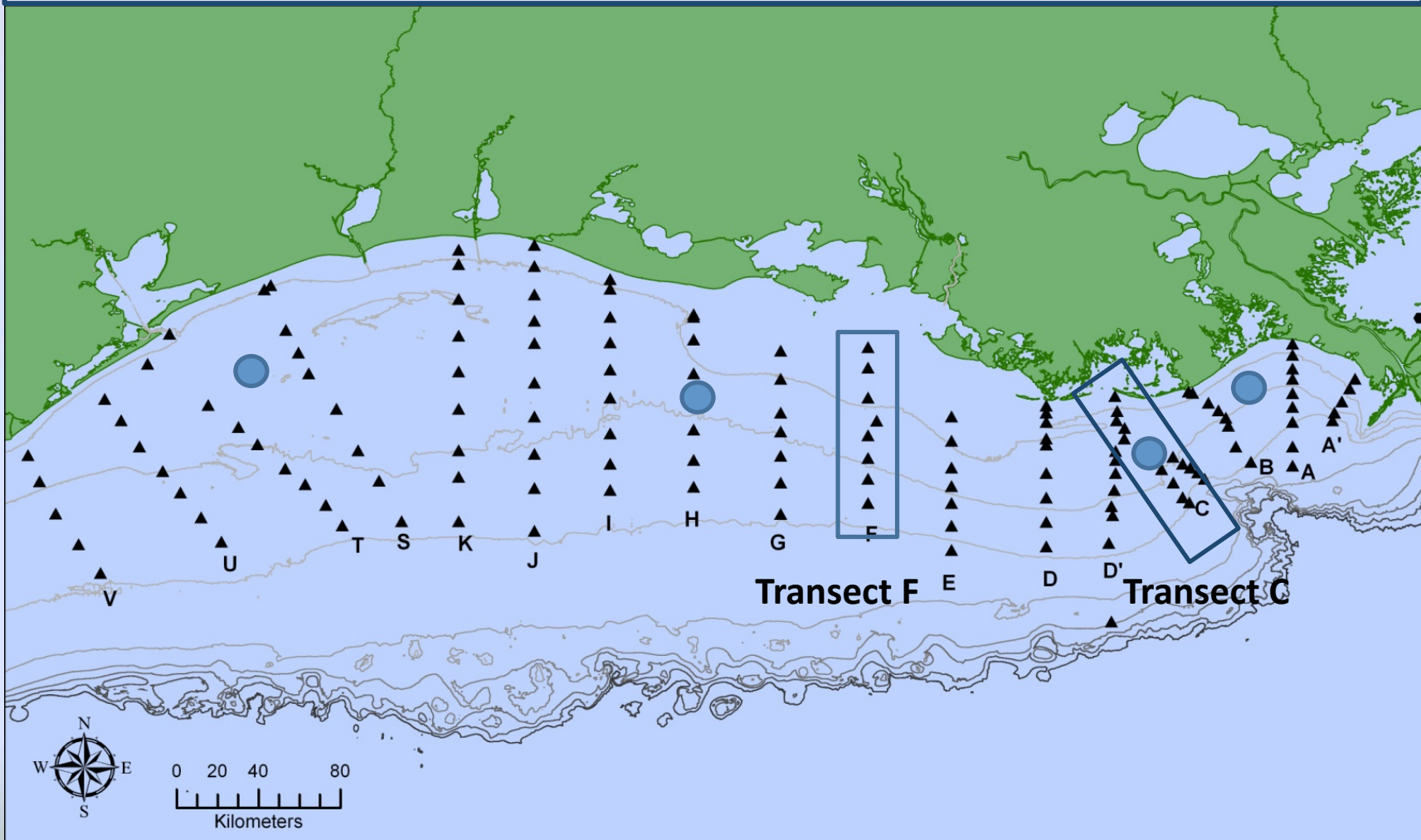
# Area of Mid-Summer Bottom Water Hypoxia (Dissolved Oxygen < 2.0 mg/L)



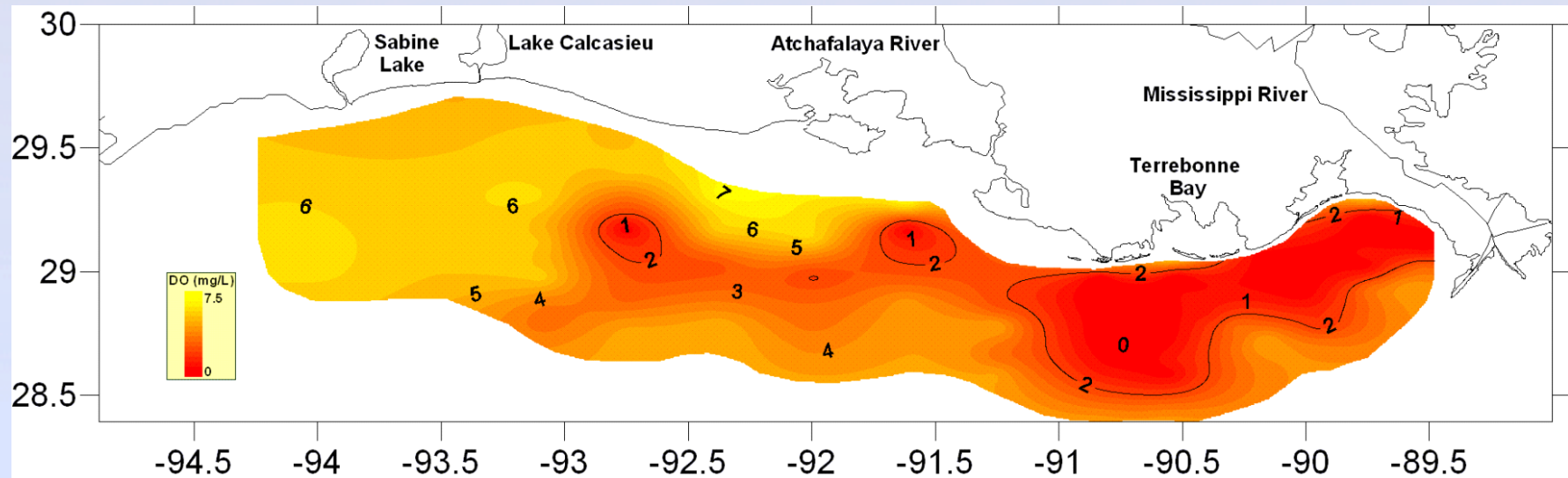
Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

# Current Monitoring (as part of Research Programs)

Continental Shelf Hypoxia Monitoring – July, monthly or bimonthly, continuous

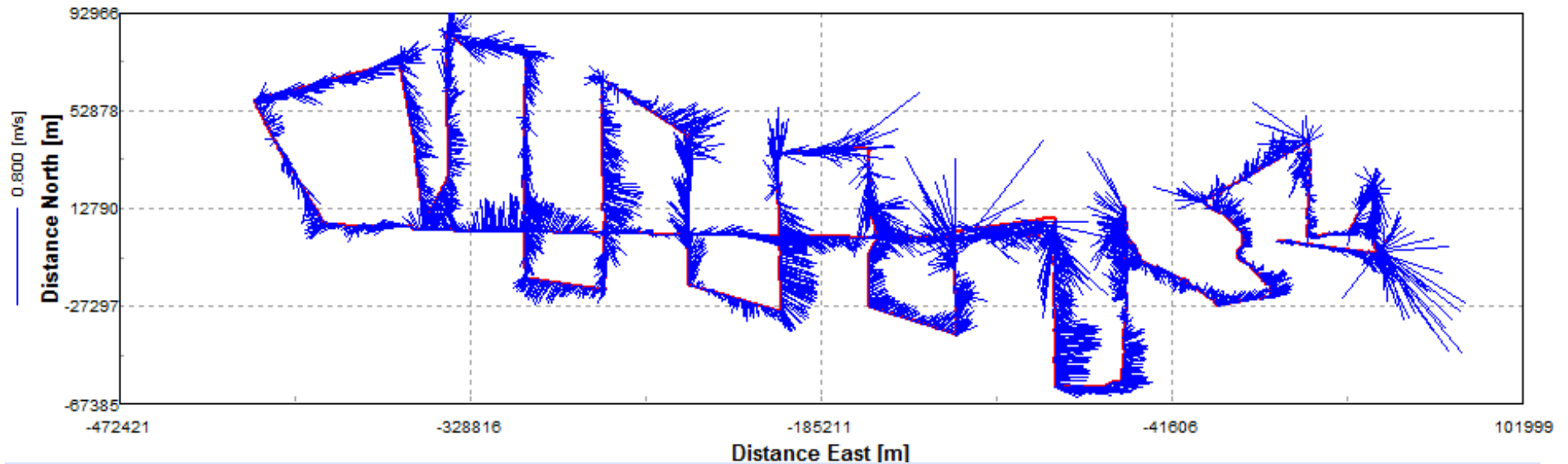


## Bottom-water Dissolved Oxygen, July 20-24, 2009



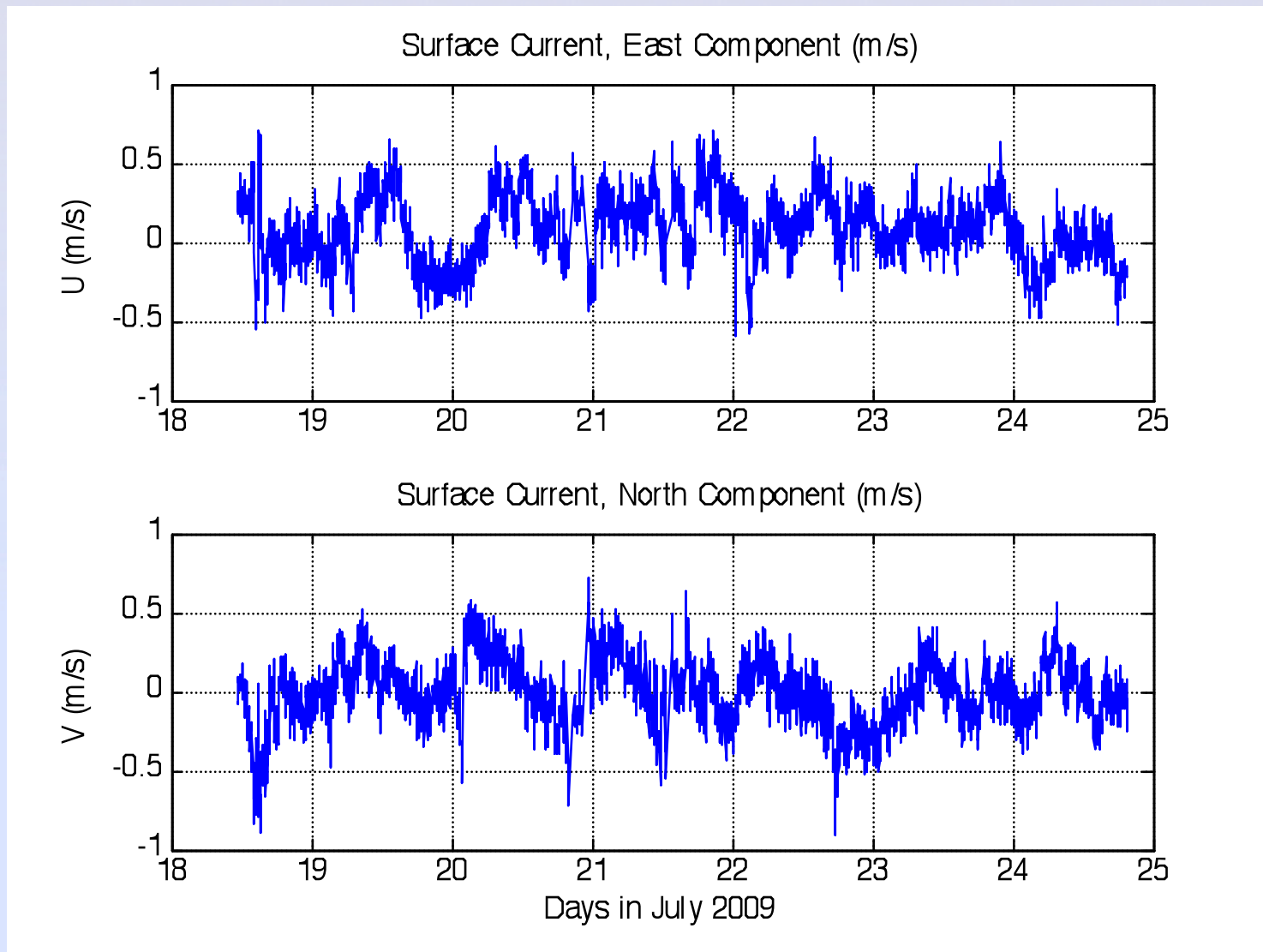
Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

# 2009 data



## Surface Velocity Vectors along the Ship Track

The direction shows where the water goes to and the length indicates the magnitude of the flow.



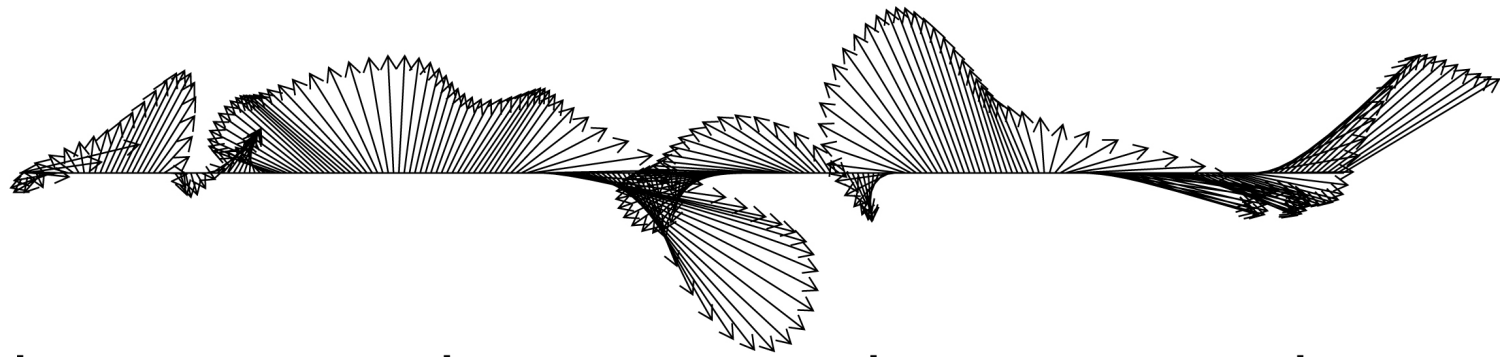
**2009**

The most striking feature is that the east flow has a relatively strong positive mean value. The mean north velocity is an order of magnitude smaller, even though the two velocity components have similar maximum values.



July 2008

10 m/s

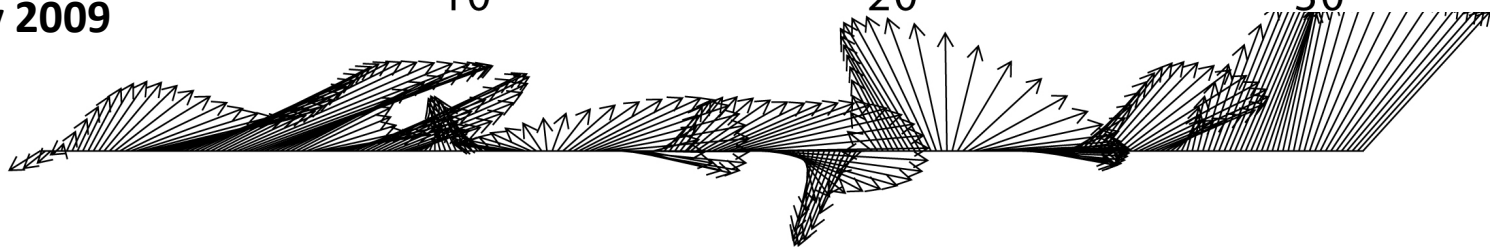


July 2009

10

20

30

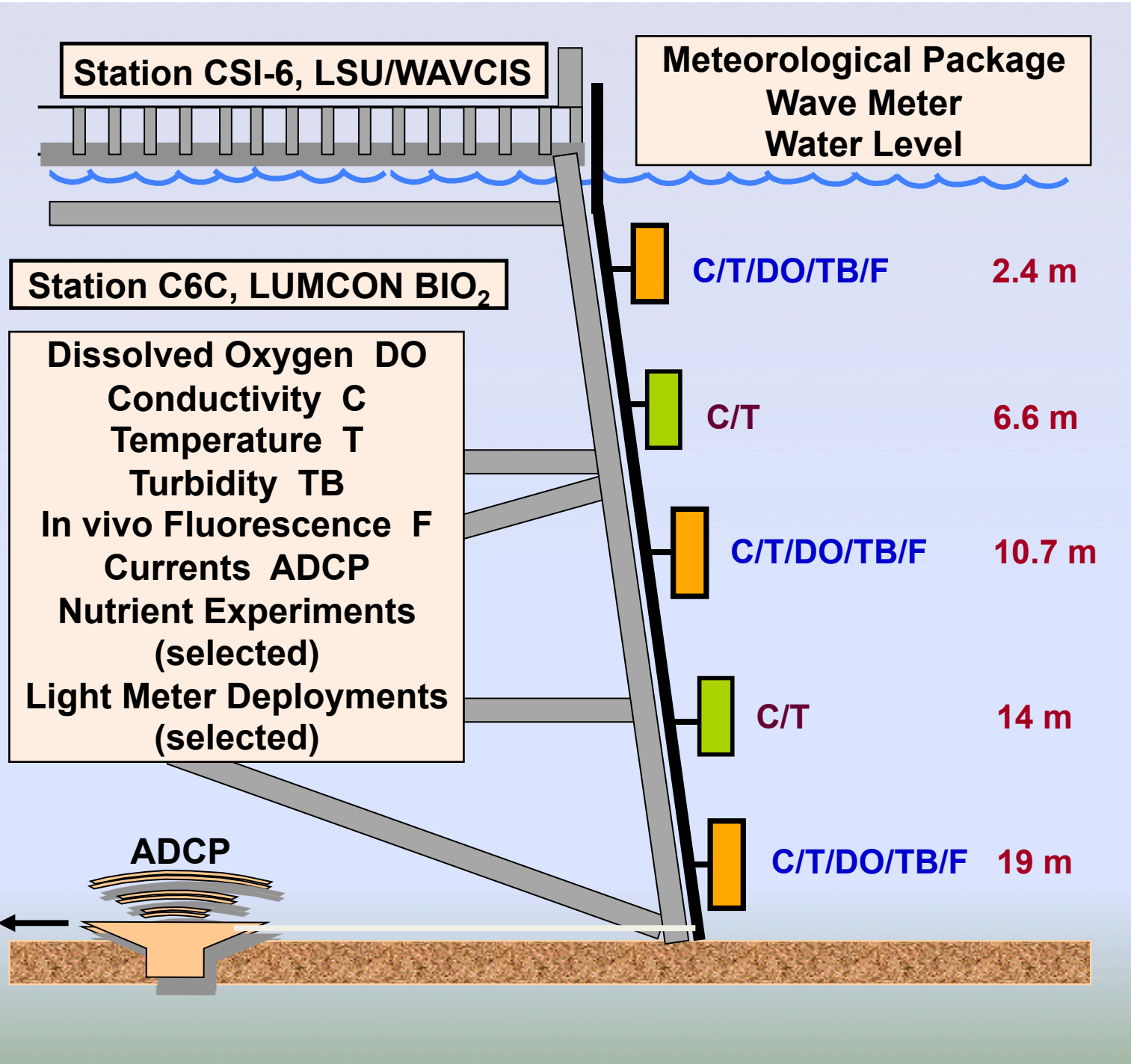


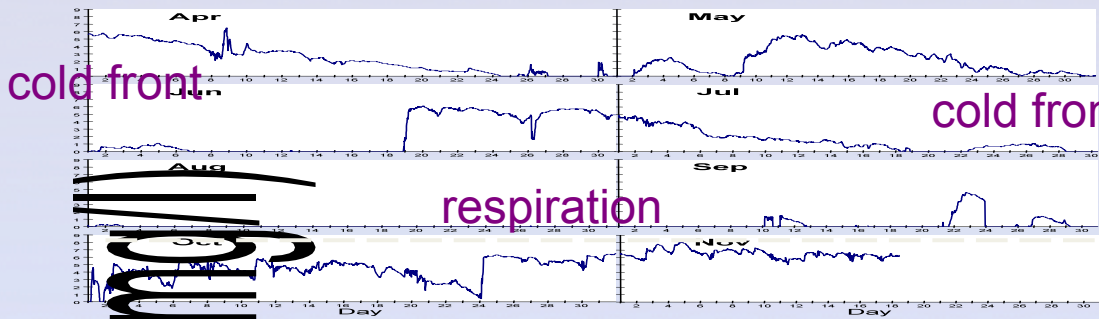
10

20

30

Day





Dissolved Oxygen (mg l<sup>-1</sup>)

# Dissolved Oxygen (mg l<sup>-1</sup>)

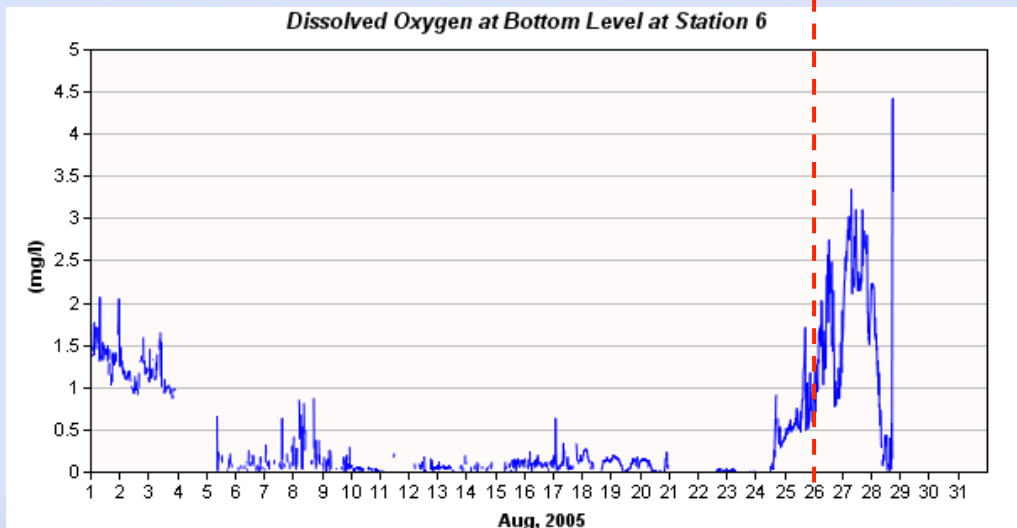
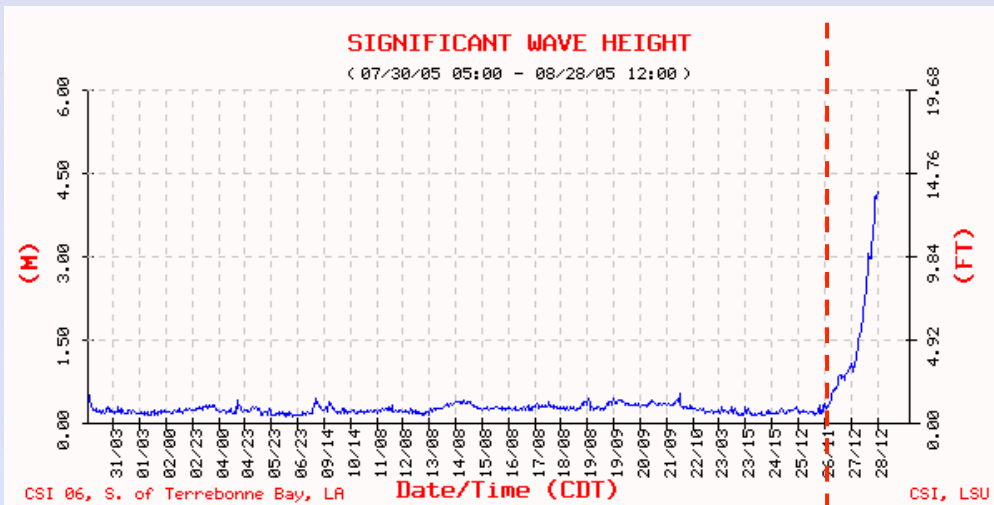
tropical storm

respiration

deep water intrusion

cold fronts

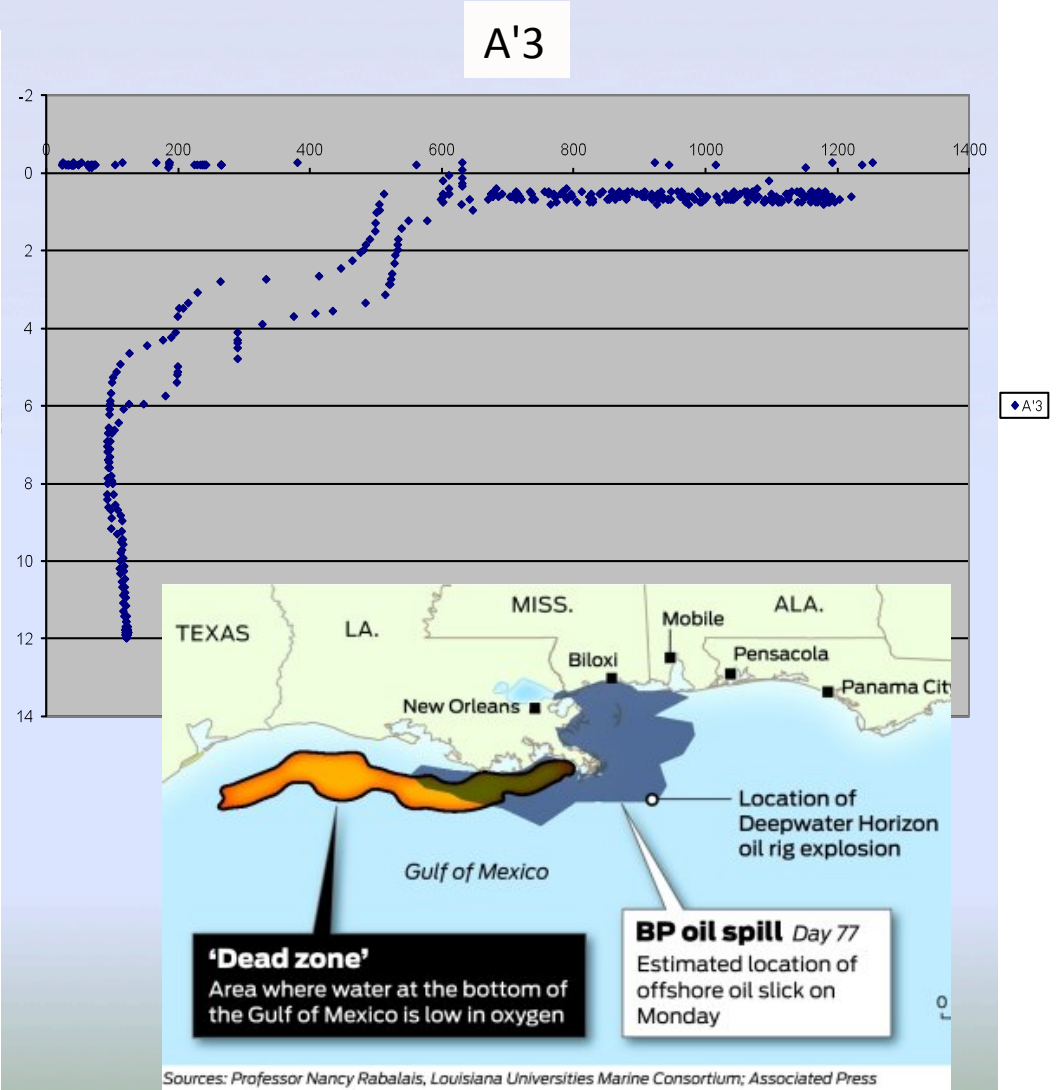
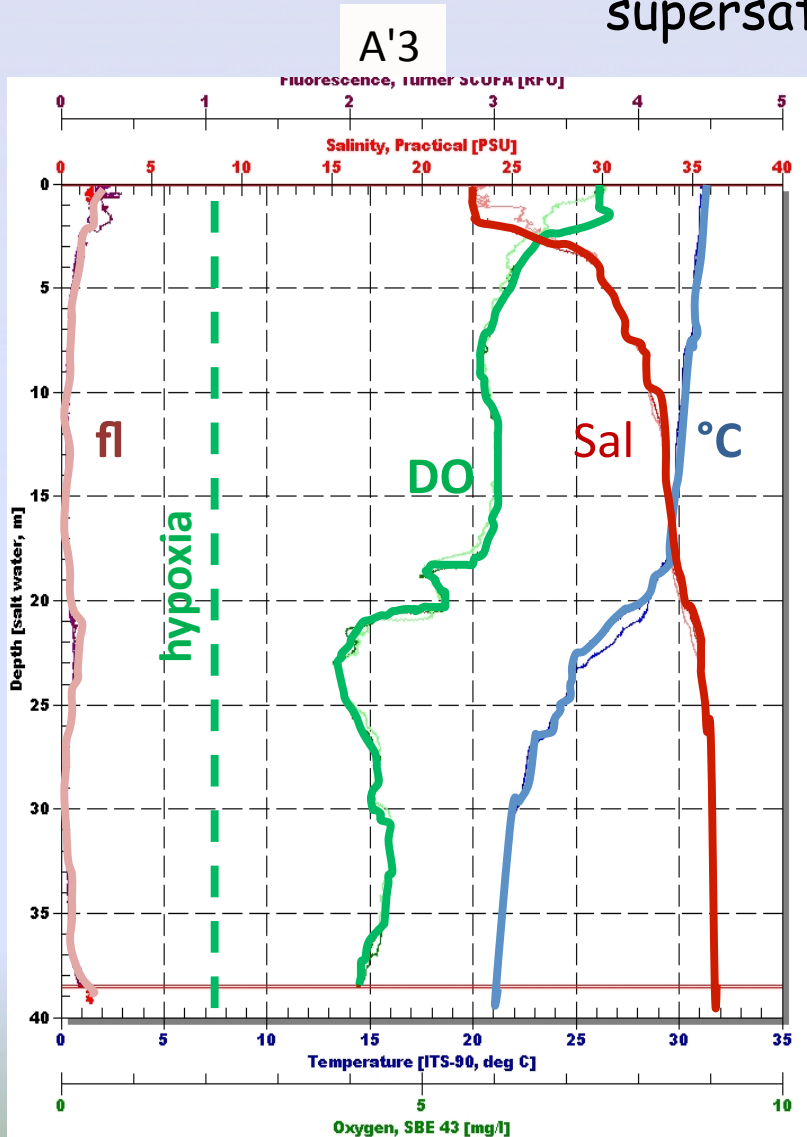
resp

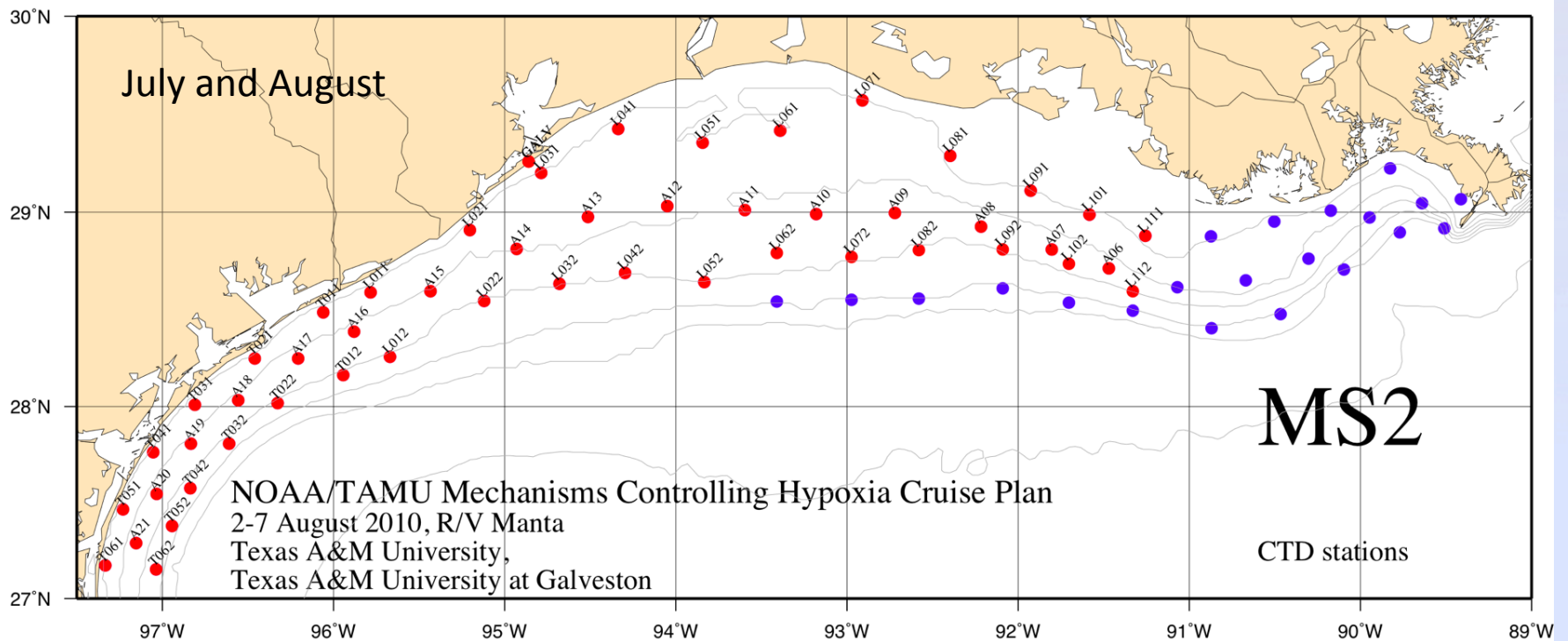


Hurricane Katrina

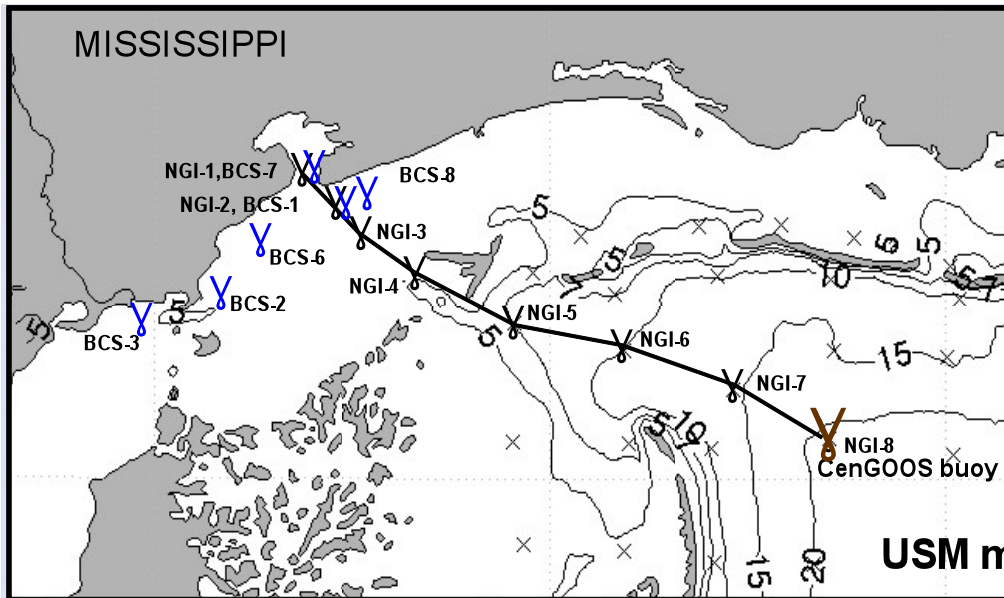
Fluorescence data from July 2010 indicated high oil presence at many stations directly to the west of the Mississippi River delta; yet dissolved oxygen levels at the same depths were typical for summer and often supersaturated in DO.

Rabalais et al. unpubl. data



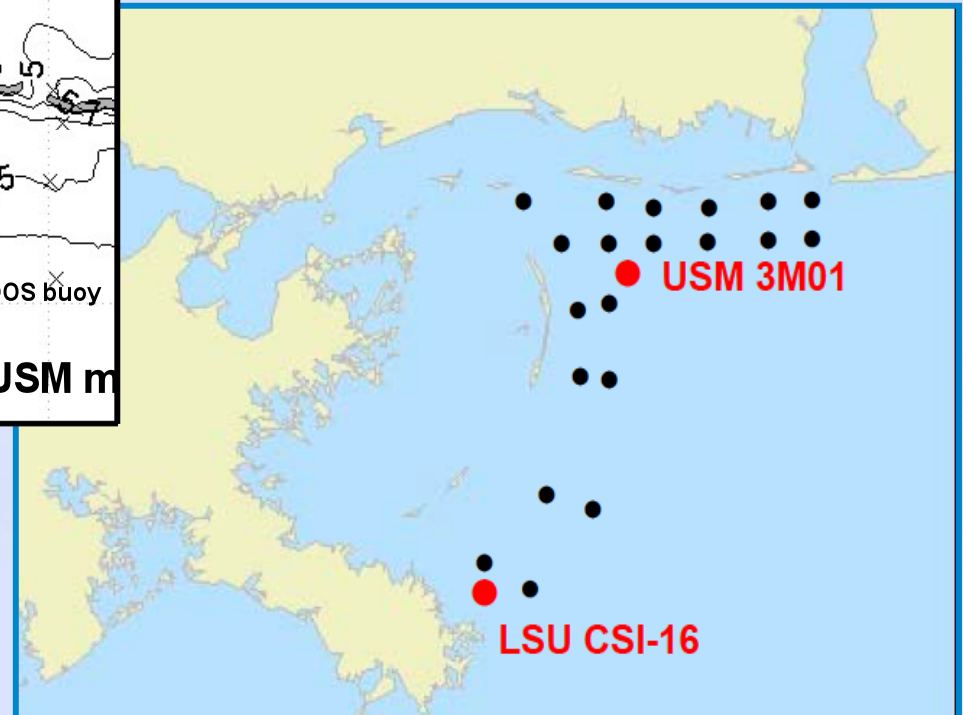


Station plan for 2-7 August 2010 hypoxic area survey on R/V *Manta*. Red dots designate CTD stations. Blue dots represent stations not sampled due to potential presence of oil from Deepwater Horizon spill. Stations labeled with 'L' indicate cross shelf lines where undulated towed vehicle will be deployed. "A" stations are CTD-only stations between cross-shelf lines. Map provided by S. F. DiMarco, TAMU.



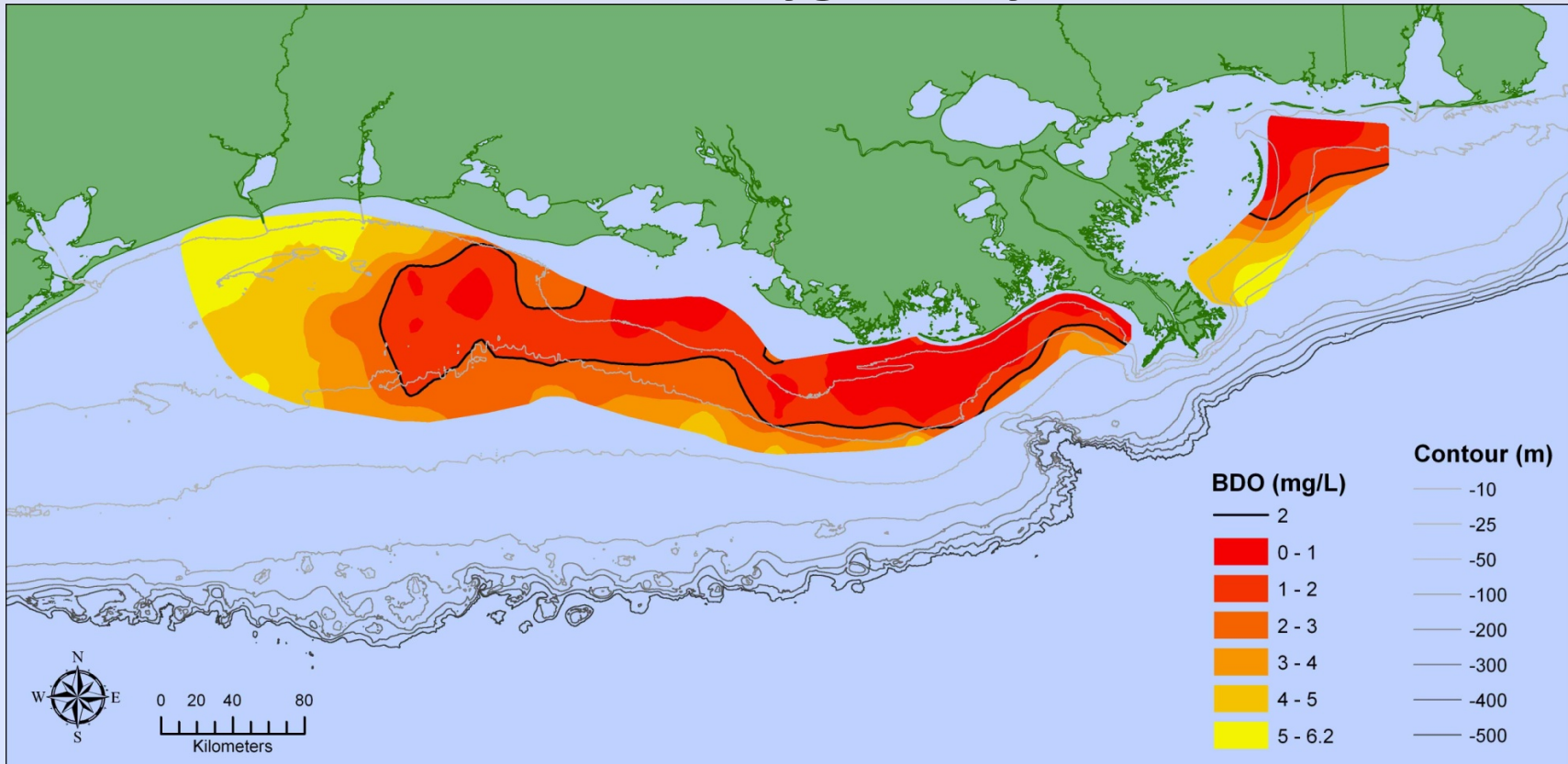
Blue dots = Bonnet Carré Spillway (BCS) stations  
 Black dots = Northern Gulf Institute (NGI) stations  
 From Gundersen et al., USM

Monthly sampling sites (USM) to monitor hypoxia in the Mississippi Sound/Bight, showing the Northern Gulf Institute (NGI) transect line (●), the Bonnet Carré Spillway (BCS) stations (●), and S.P. Milroy's 2010 high-resolution hypoxia stations (◆) currently sampled at monthly intervals by the Department of Marine Science, USM.



Sampling sites for monitoring transects east of the Mississippi River when possible (USM). [See also Continental Shelf Hypoxia and NGI monthly transect]. The University of Southern Mississippi's observing system, "USM 3M01", and LSU WAVCIS observing system, "CSI-16", are shown in red. Neither are equipped with oxygen capabilities, but CSI-16 is amenable, e.g. two off Terrebonne Bay and Caminada Pass..

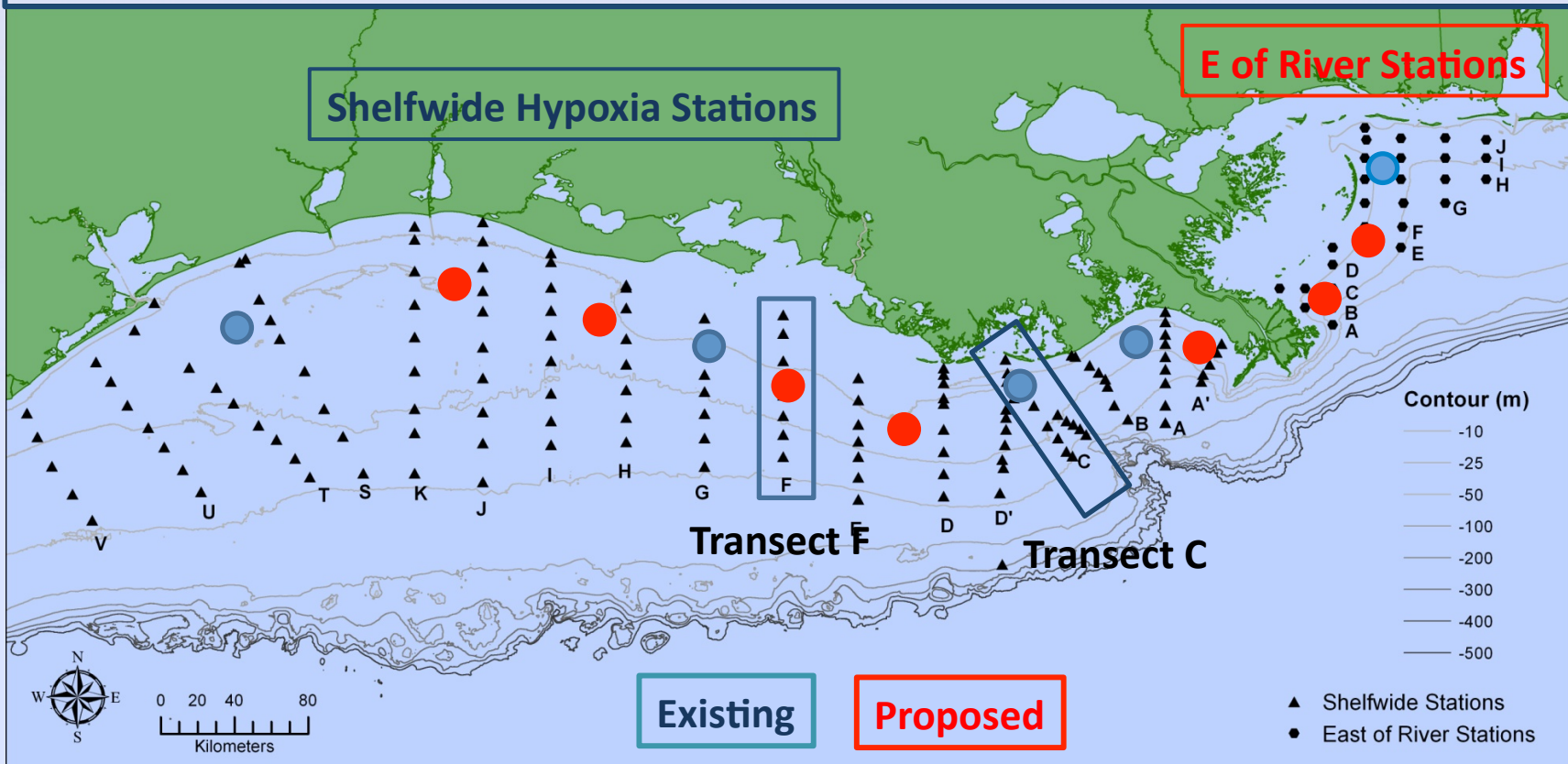
# Bottom-Water Dissolved Oxygen July 18-21, 24-30, 2011

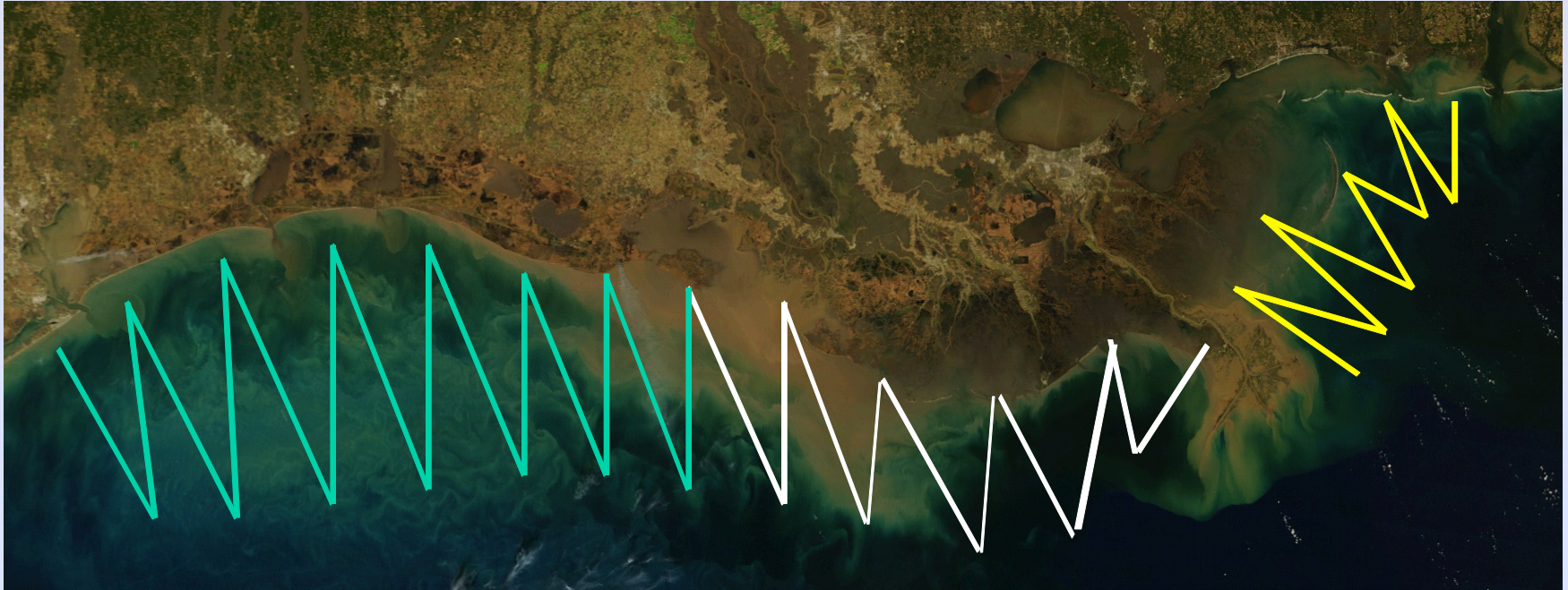


Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research



# Continental Shelf Hypoxia Monitoring – seasonal, monthly or bimonthly, continuous





Potential glider paths for determination of dissolved oxygen distribution across the area most likely affected in mid-summer. Gliders can be continuous from June through September and be operated from several ports and with contingency among the glider operations for sharing of equipment and ship operations for recovery and deployment.

# “Thanks” to all participants and funding agencies

