Sea Bed Sediment Erodibility on the Texas-Louisiana Shelf

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Motivations

- Sediment erodibility is critical to sediment suspension, transport and deposition in estuaries and shelves.
- Few in-situ measurements of erodibility in the northern Gulf of Mexico
- Sediment oxygen demand (SOD) from sea bed
- Enhance physical and biogeochemical models
- Under what kind of condition, sediment is suspended and buried OM can be exposed.

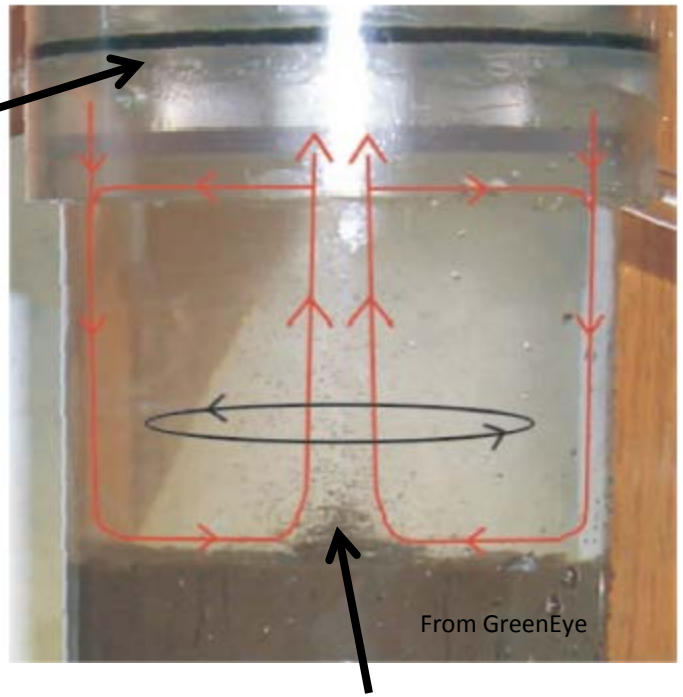
Sediment Coring and Gust Experiments

Project	P.I.	Month /Year	Research Vessel	Coring Device	Stations	Cores
NOAA NGOMEX (MCH)	DiMarco, Bianchi et al.	Aug 10, Apr 11, Aug 11, Apr 12 and Aug 12	*Pelican*	Box Corer and HYPOX	4-6 per cruise	~30 cores collected
NSF RAPID	Walsh et al.	Aug 11	*Cape Hatteras*	Multi-corer	28	56 cores
NRL & VIMS	Briggs & Friedrichs	Aug 10	*Pelican*	Multi-corer	11	22 cores

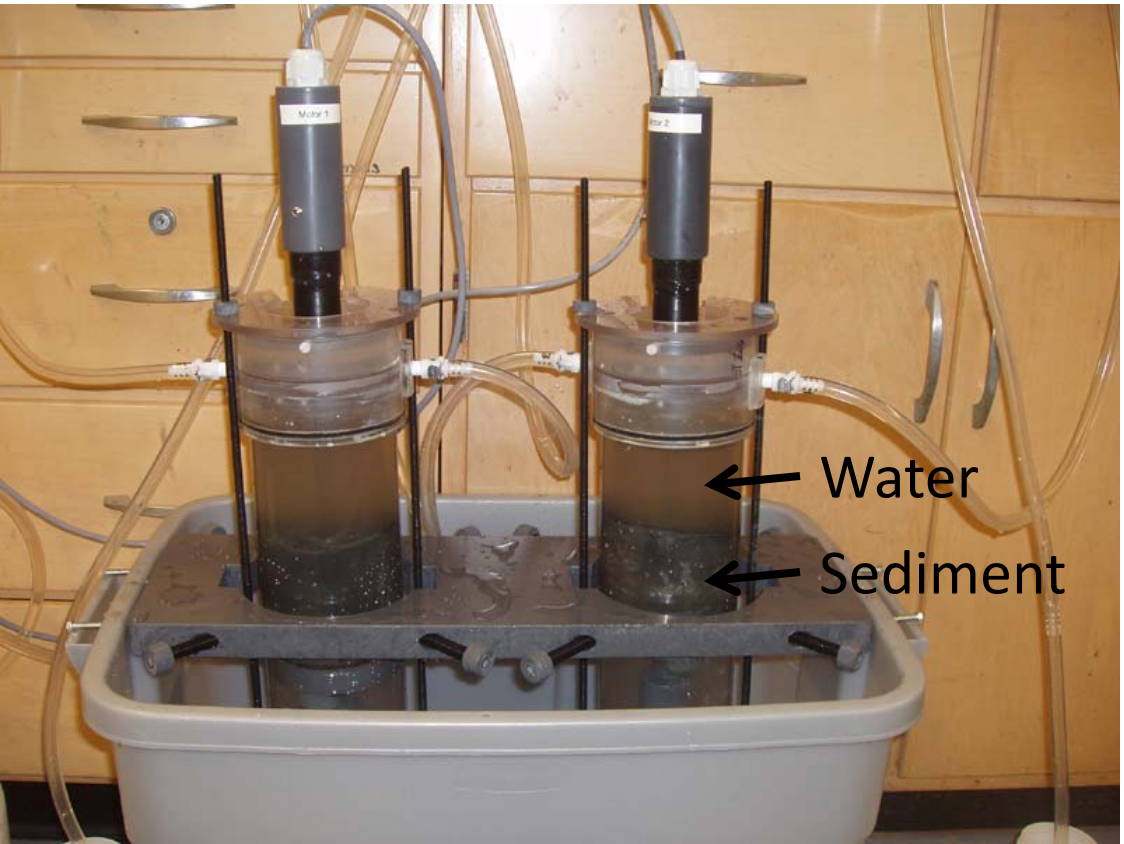
Dual-core Gust erosion microcosm system

Gust System – Sediment Suspension

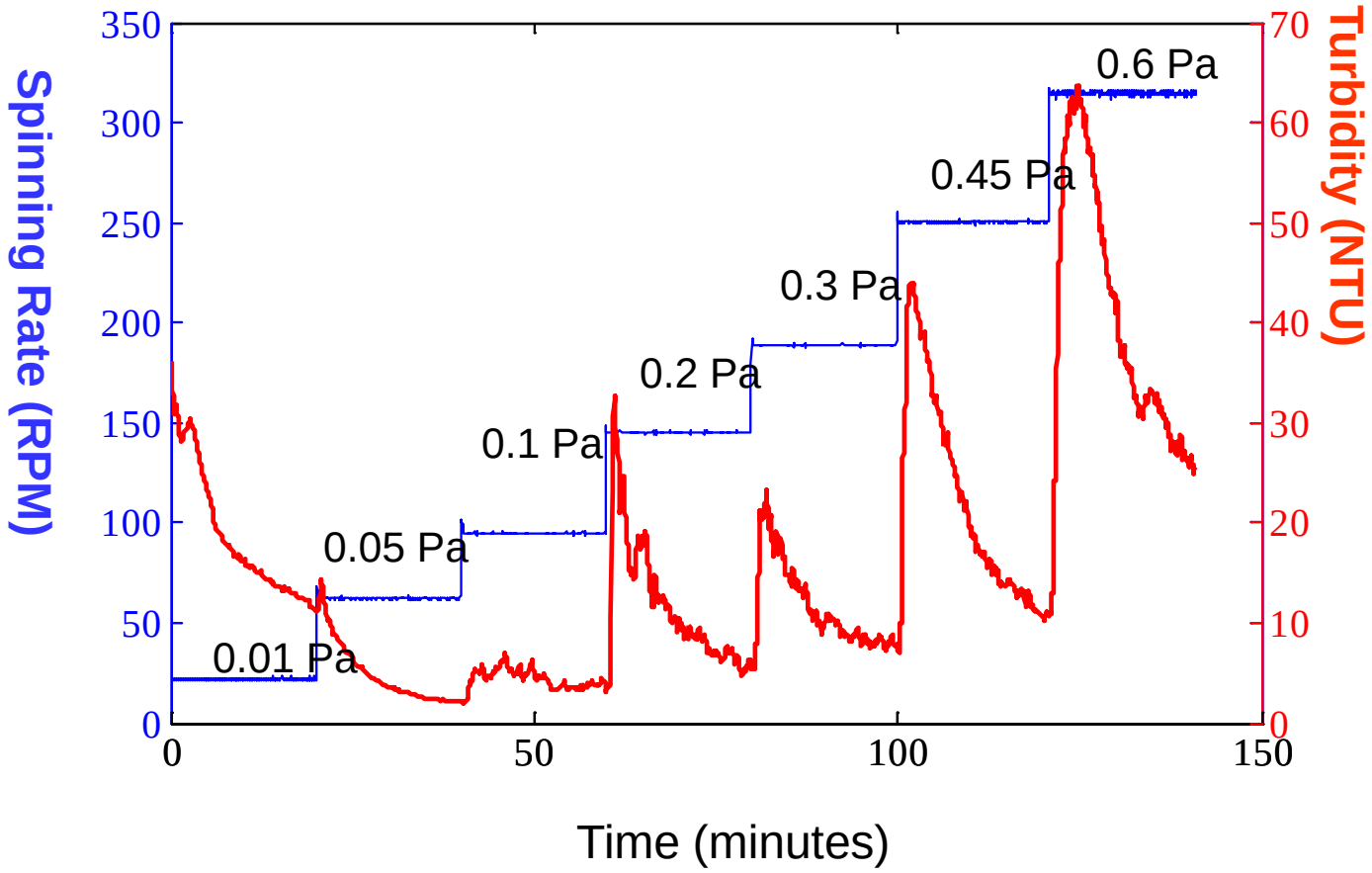
Magnetic-coupling spinning disk to apply shear stress



Suspended Sediment



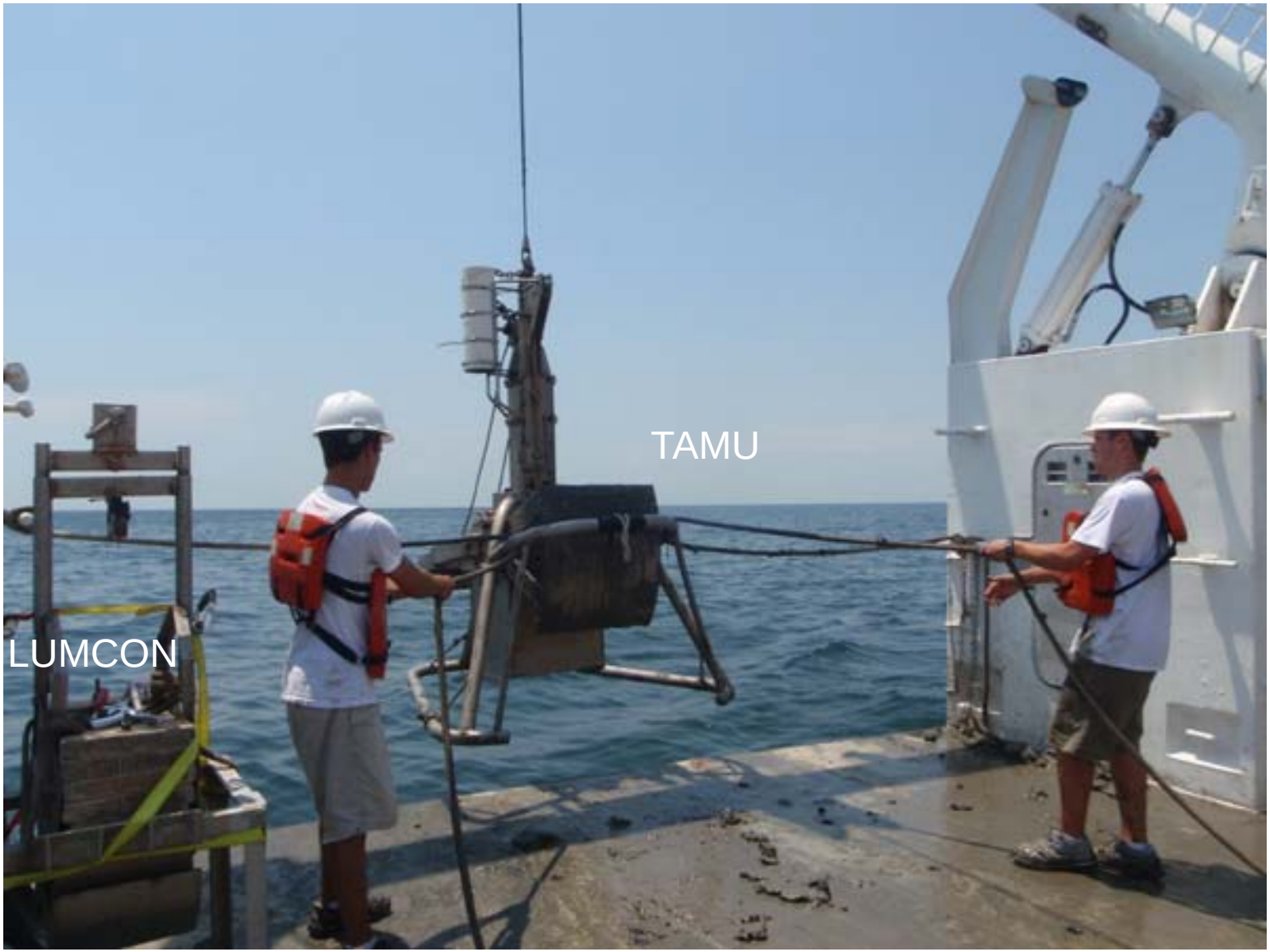
Gust Sediment Experiment



Each experiment takes about 3+ hours for suspension and 2 hours for filtration.

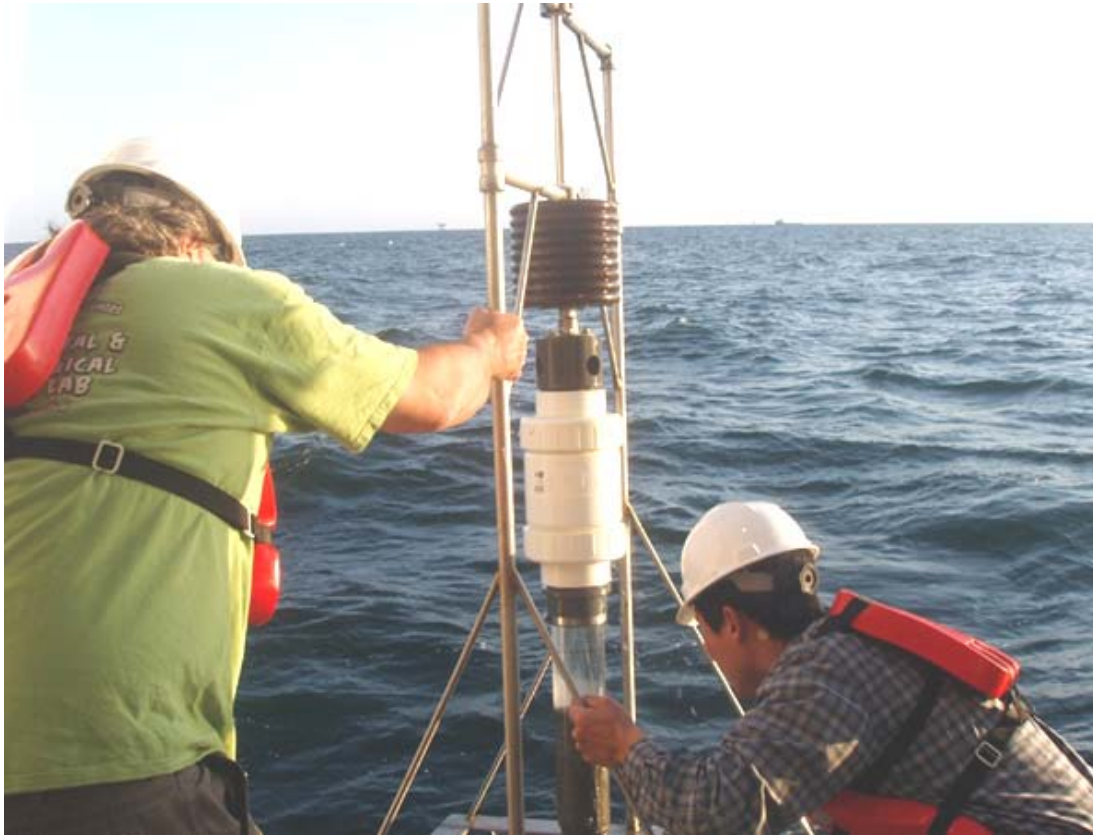
Follow methods of Sanford and Maa (2001) as well as Dickhudt et al. (2009).

TAMU and LUMCON box corers

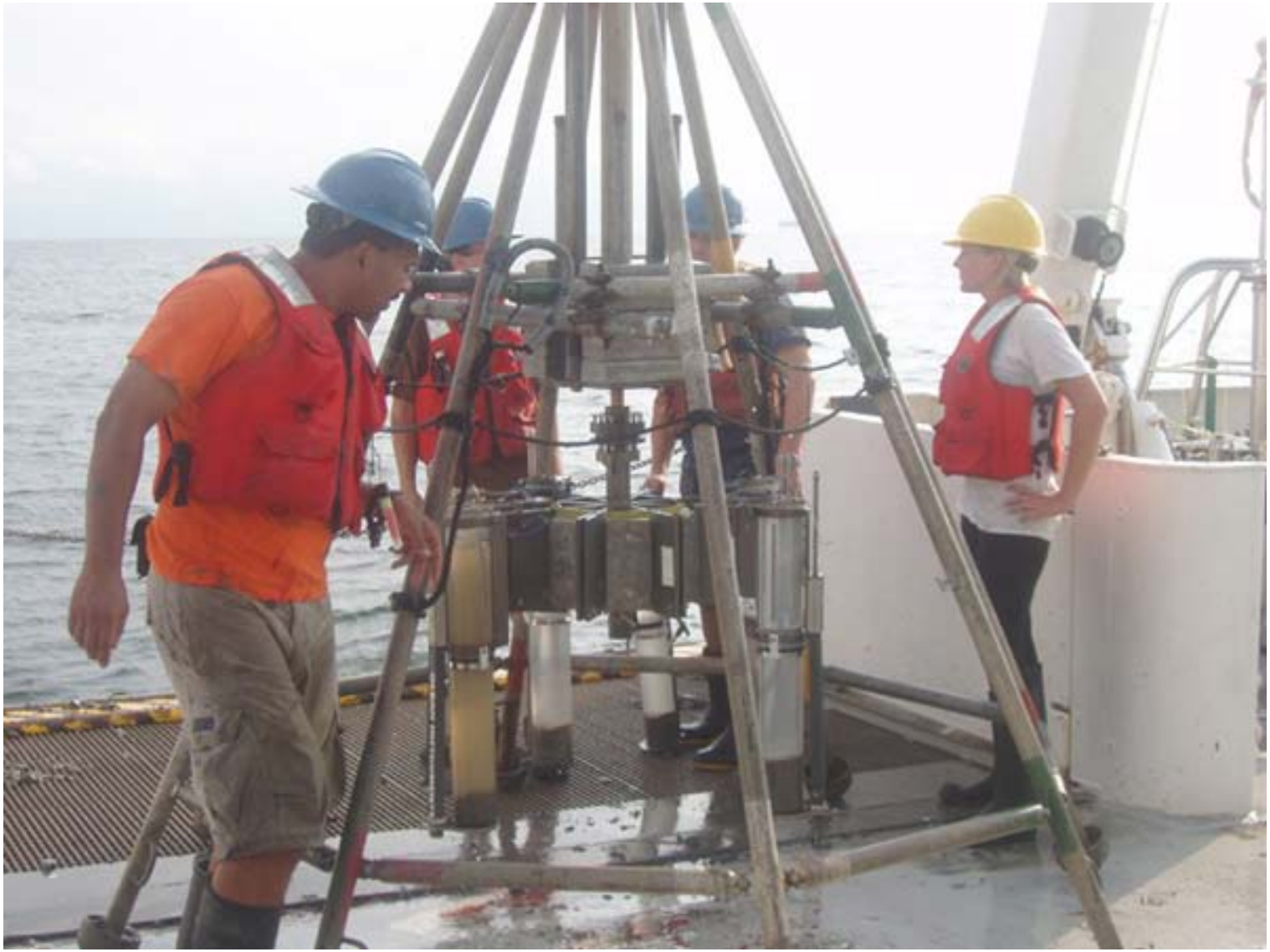


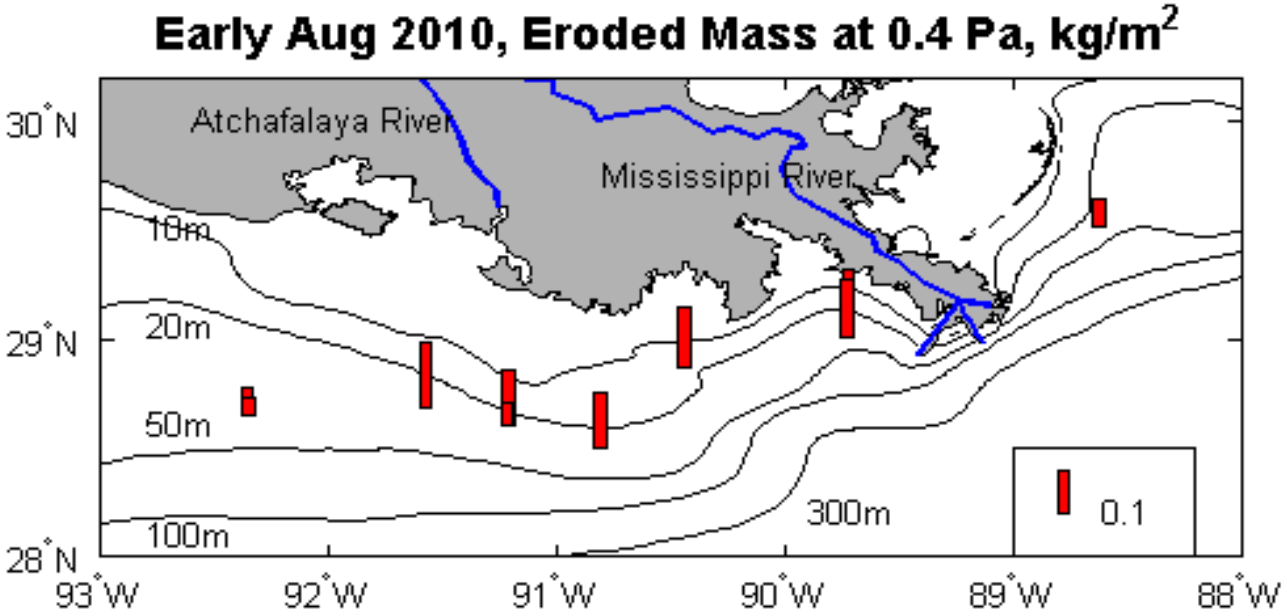
HYPOX Corer on R/V Pelican

- Based on the design of Dr. Wayne Gardner.
- A new HYPOX corer was made at Texas A&M University.
- It was equipped with adjustable penetration depth pins and weighting disks (0-150 lbs).

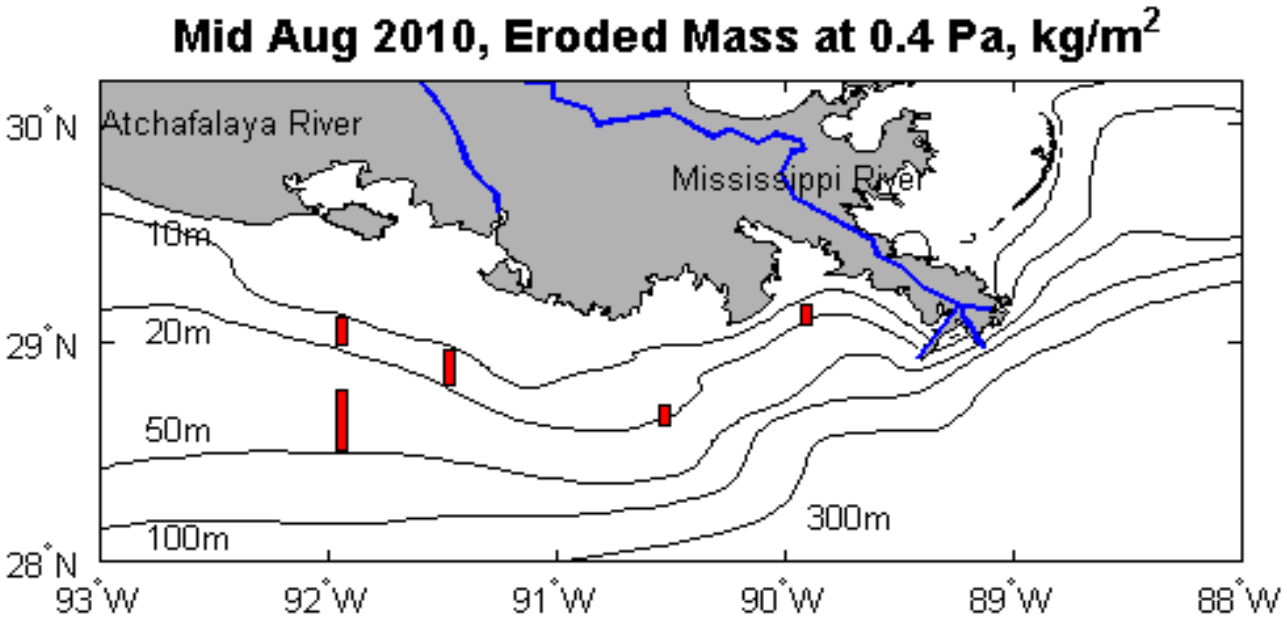


Multi-Corer on R/V Cape Hatteras

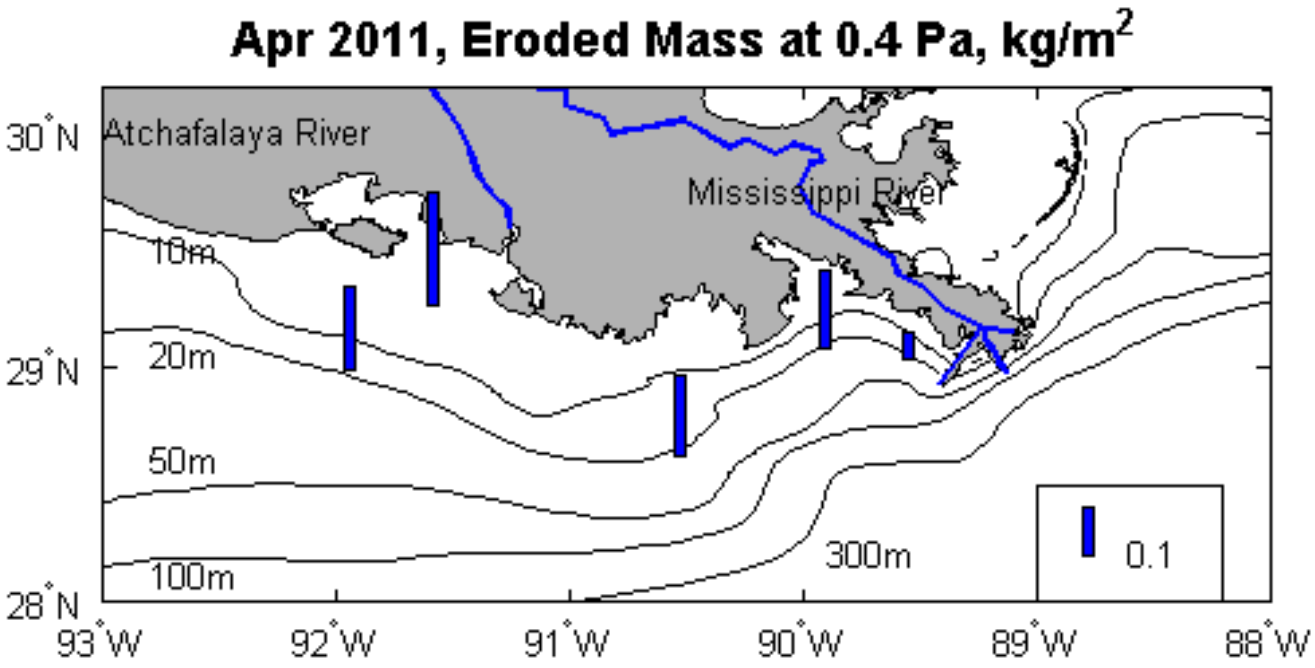




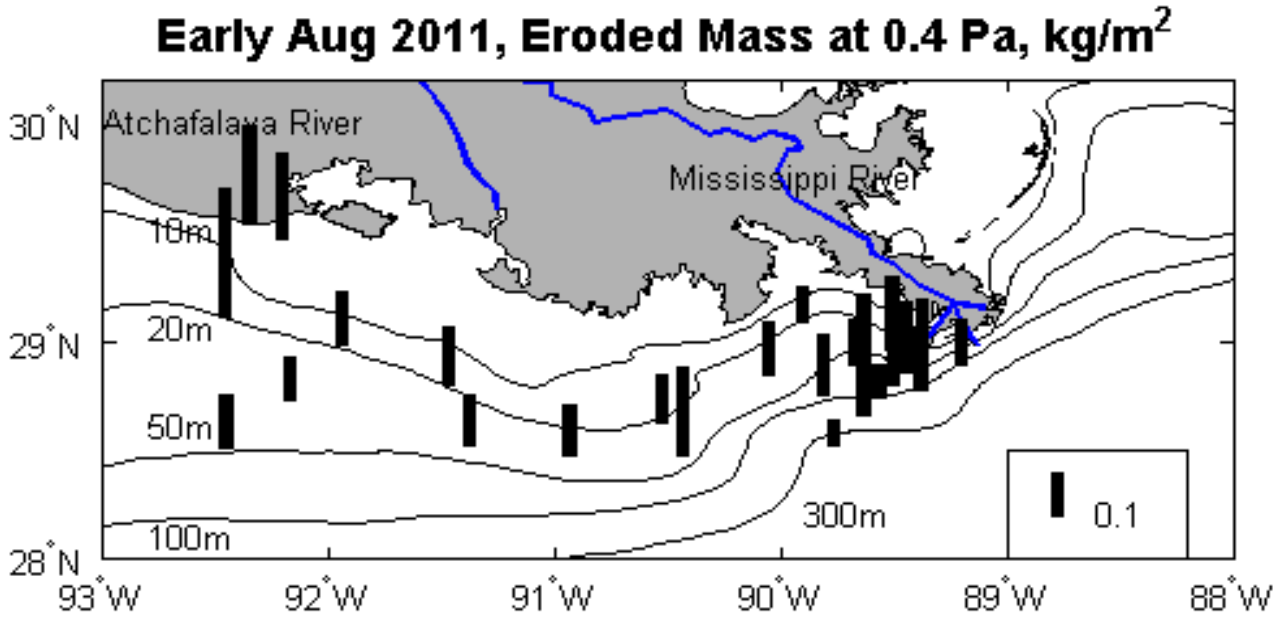
Briggs, Multi-Corer



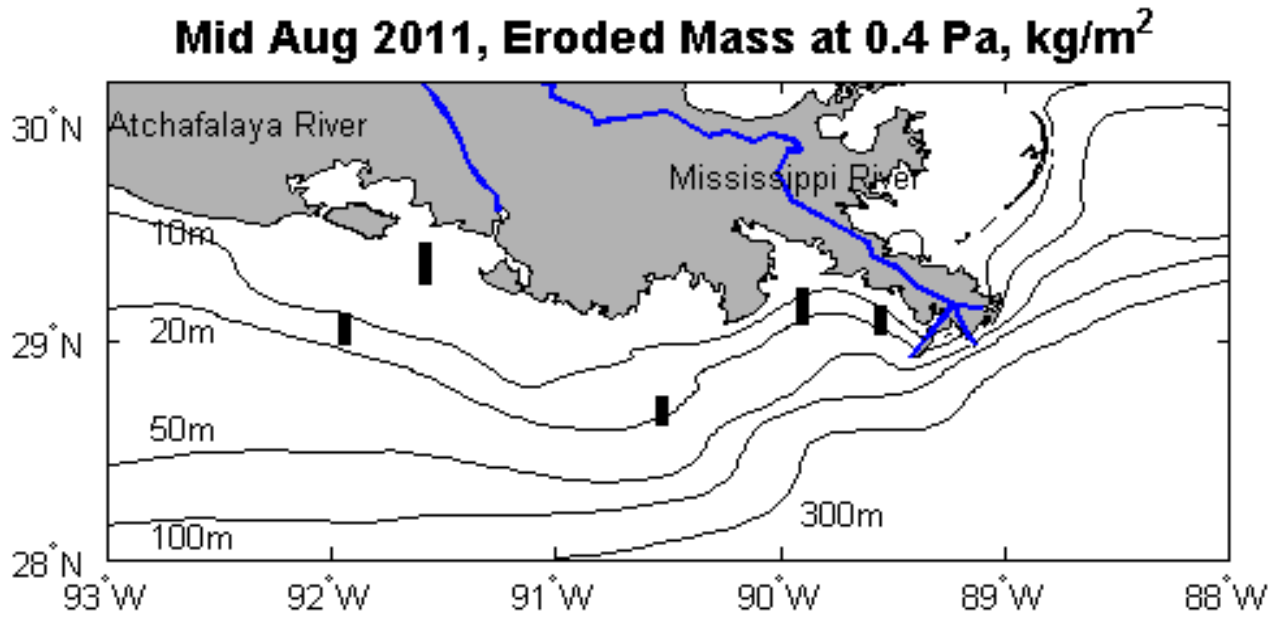
NOAA, Box Corer


Apr 2011, Eroded Mass at 0.4 Pa, kg/m2
Atchafalaya River
Mississippi River
10m
20m
50m
100m
300m
0.1
30˚N
29˚N
28˚N
93˚W
92˚W
91˚W
90˚W
89˚W
88˚W

NOAA, HYPOX

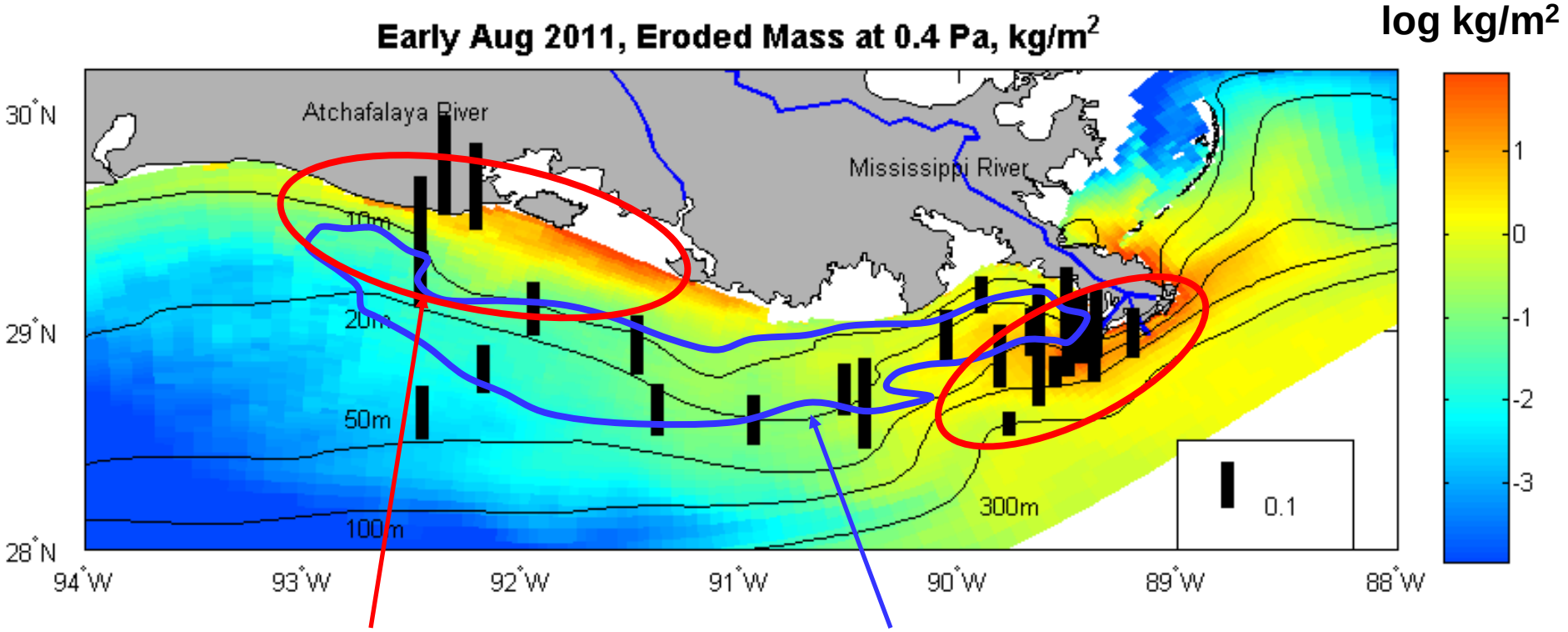


NSF,
Multi-Corer



NOAA,
HYPOX +
Box Corer

Comparison with modeled sediment accumulation

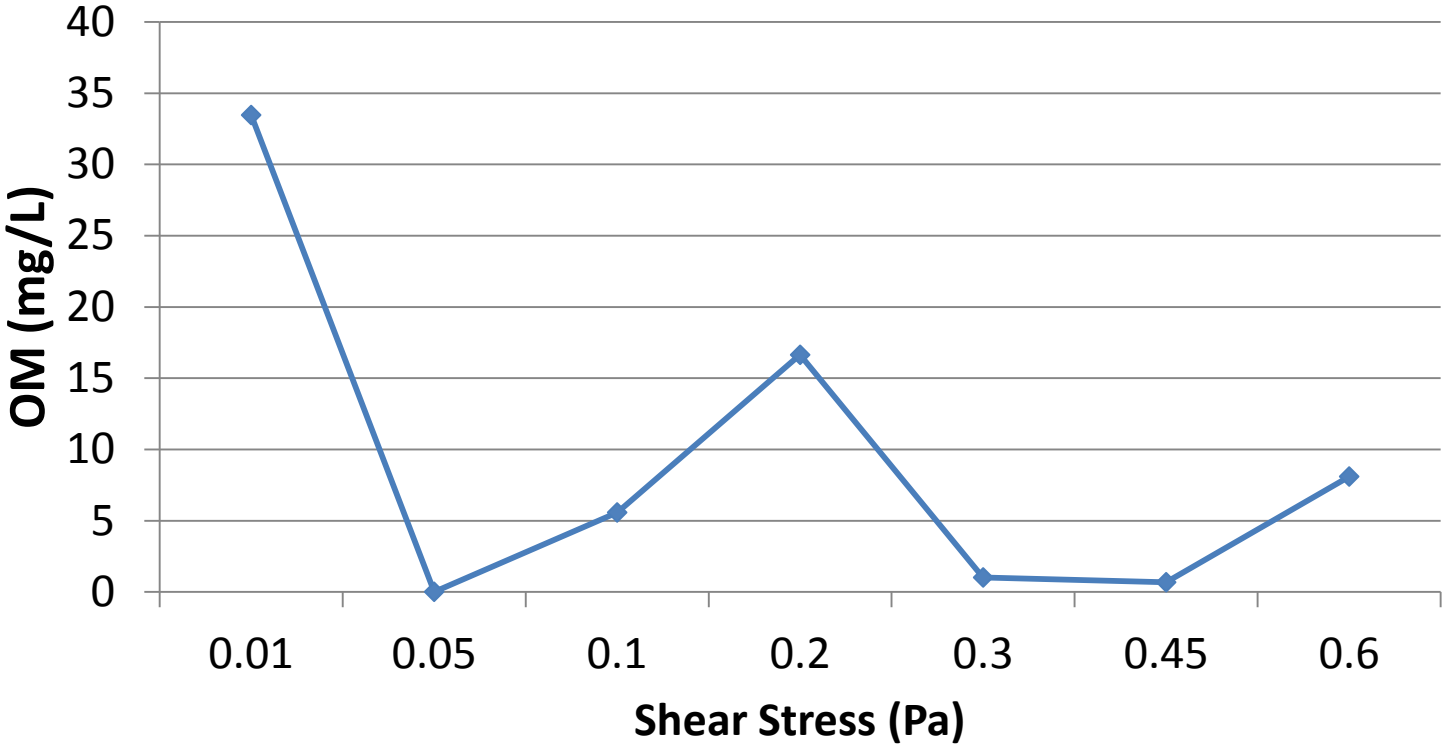


High erodibility on fresh muds

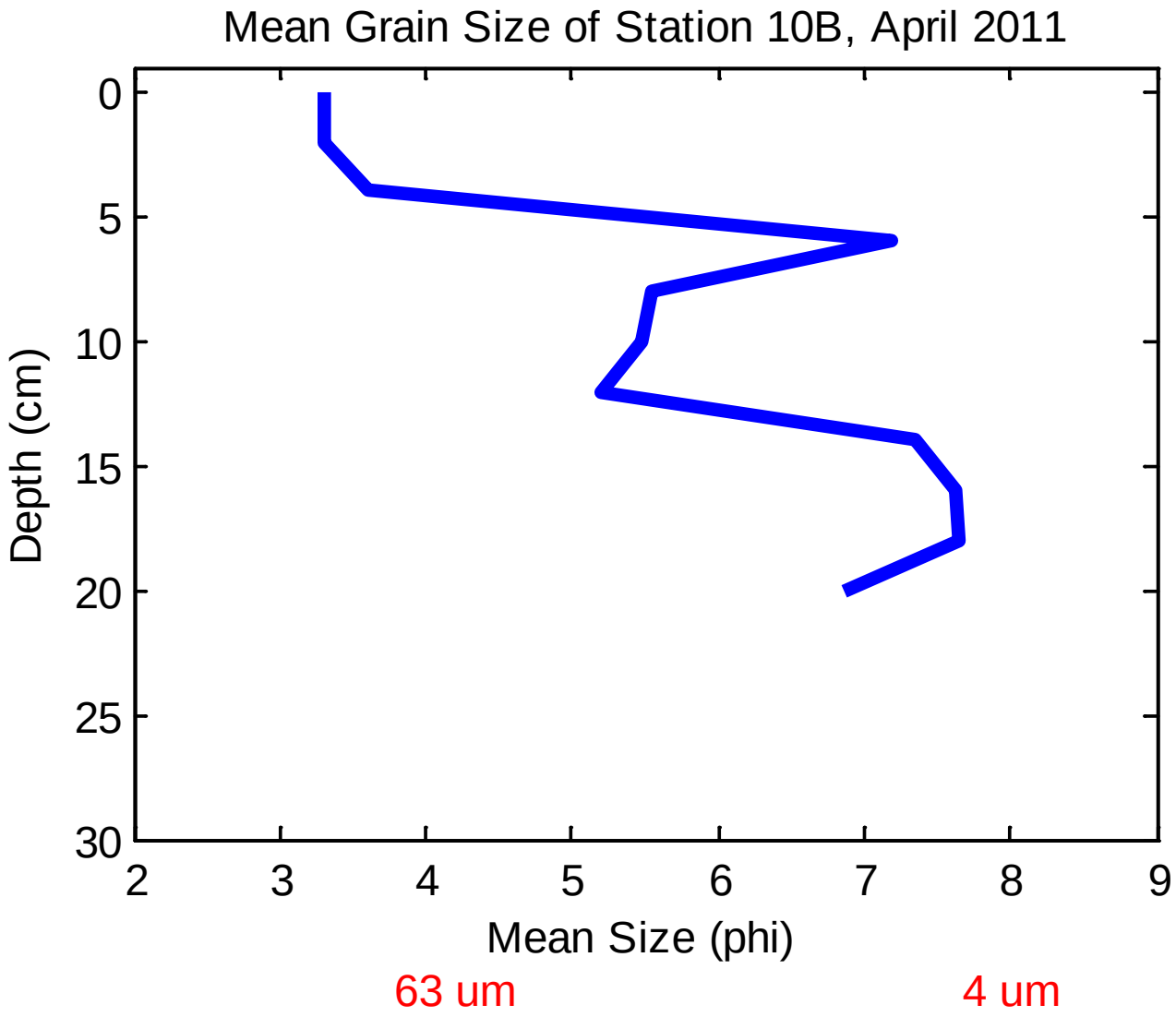
Hypoxic water in 1993

Color base map from Xu et al. (2011)

OM Concentration at Station 10B
April 2011



Organic matter may represent about 30% of suspended mass at some shear stress levels



Sand-mud laminations

Preliminary Findings

- Sediment under the hypoxic water in the northern Gulf of Mexico is relatively consolidated; 'fresh' muds next to the Mississippi Delta and Atchafalaya Bay mouth are more mobile.
- Windy condition, fair-weather and flood all impacts erodibility; sediment in windy April seems to be mobile.
- Significant suspension tends to occur when shear stress reaches high values of 0.45 to 0.6 Pa.
- High OM concentration is found along the sediment-water interface (fluff layer)

Ongoing and Future Work

- Laser grain size
- Organic matter content
- Oxygen profile in HYPOX cores
  - May provide more complete water column oxygen profile
- Cruises in April and August 2012

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References

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