# *LOWERMOST MISSISSIPPI RIVER MANAGEMENT PROGRAM (LMRMP)*

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Project Manager
NCER 2018
August 29, 2018

committed to **our coast**

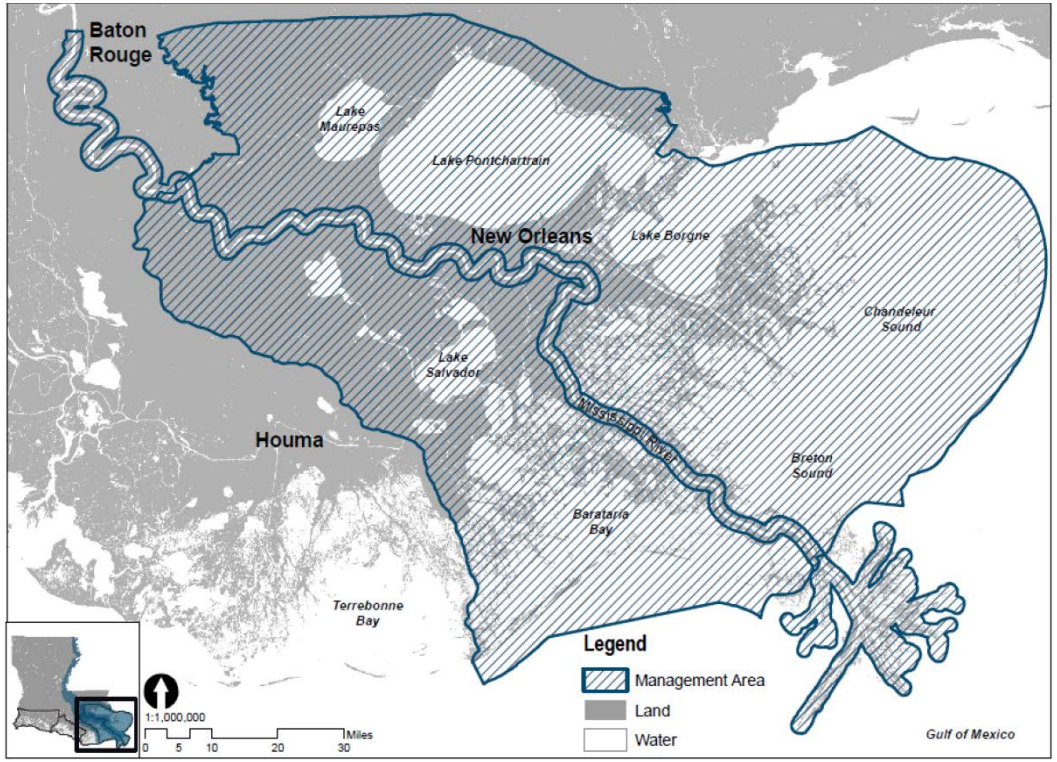
# BACKGROUND

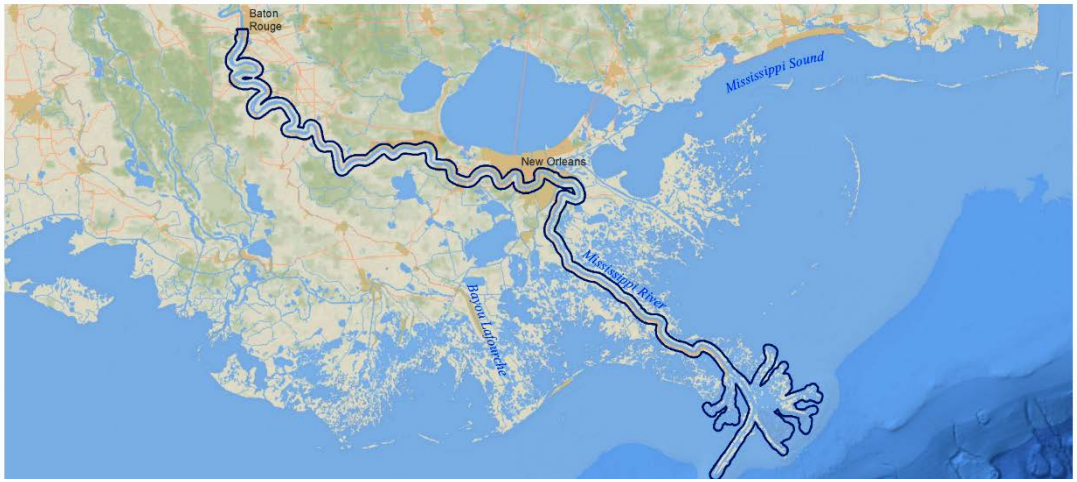
- Proposed in 2014 by State of Louisiana in 50/50 partnership with USACE
  - Approved and placed on the Initial Funded Priorities List (FPL) by the RESTORE Council in 2015 (Bucket 2)
- An amended proposal was approved by RESTORE Council in 2017
  - Removed USACE as partner in study
  - Reduced the scope of the project (removed NEPA component)
- The objective is to provide the technical information that will be needed to establish a plan to improve navigation, reduce flood risk and provide a more sustainable deltaic ecosystem in the future.
- Grant Awarded April 18, 2018 – Allocated full $9.3 million to Louisiana

# STUDY AREA

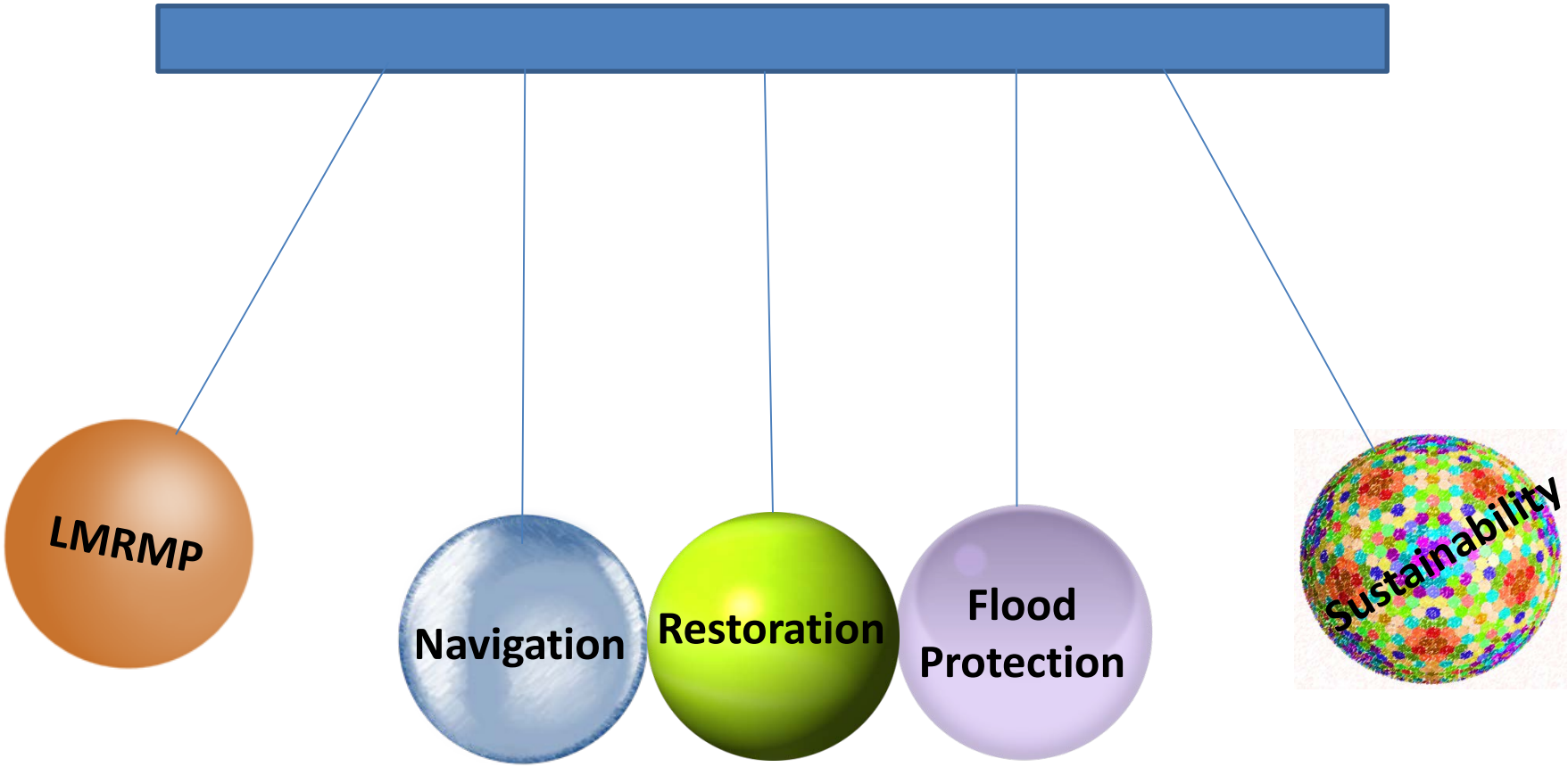
- Consistent with the Mississippi River Hydro Delta Management Study Area

- Defined as the reach from Baton Rouge to the Gulf of Mexico



The overall objective is to take a more holistic management approach for the Lower Mississippi River.

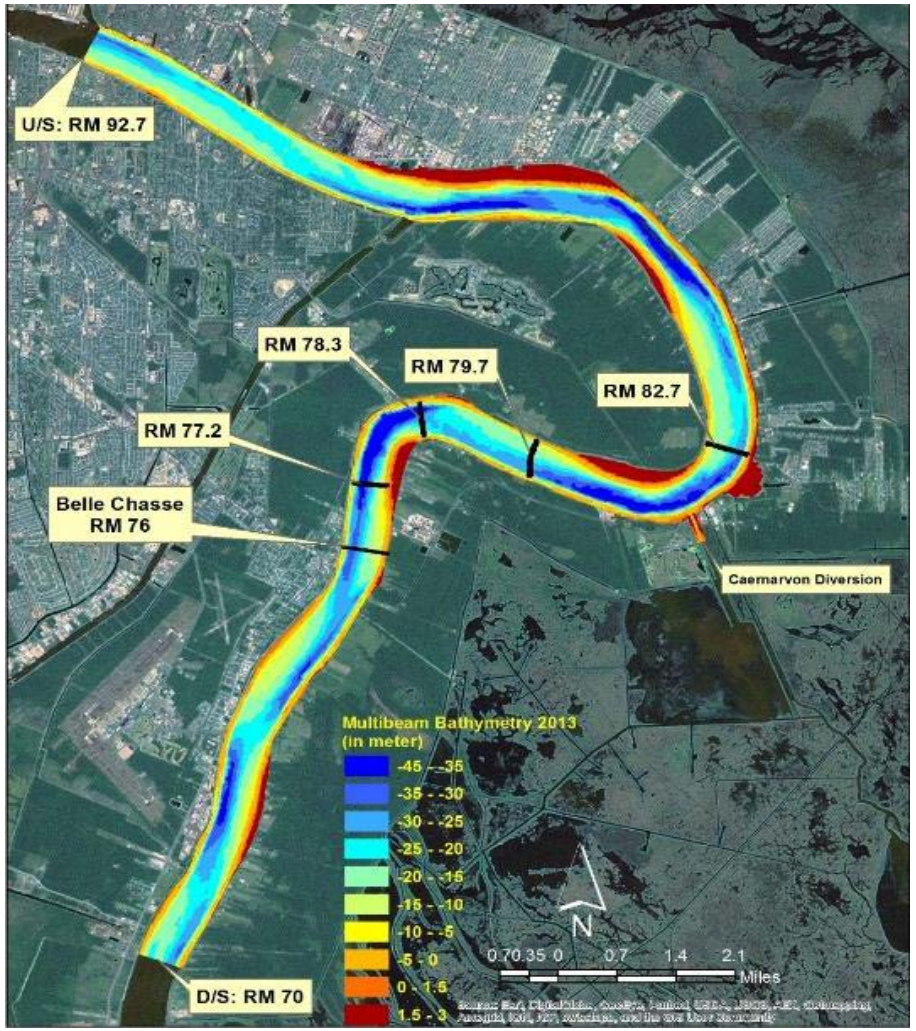


# FIVE TECHNICAL ELEMENTS

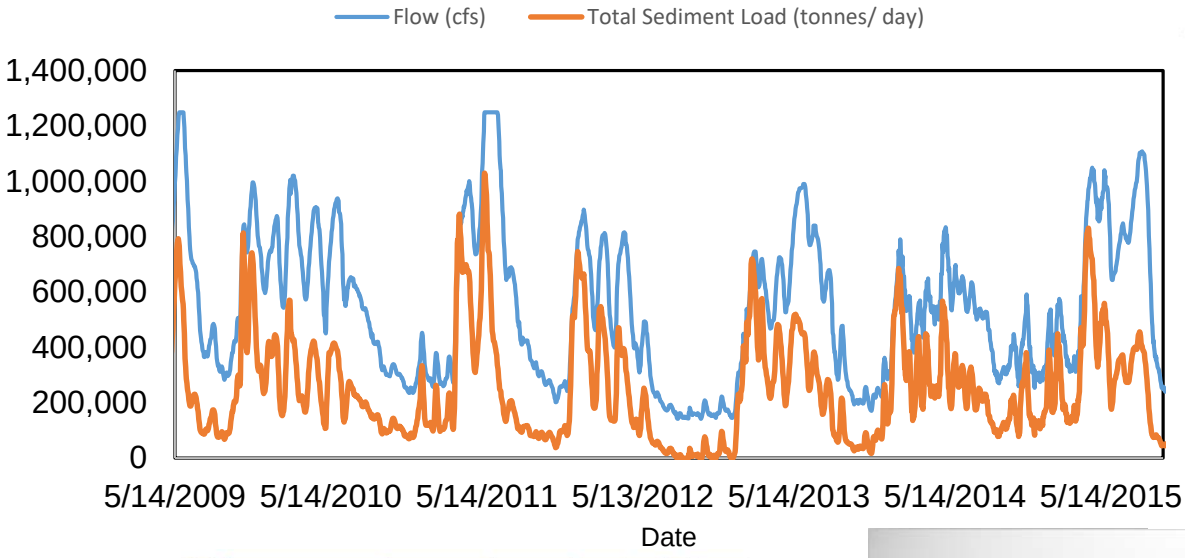
- Expanded use and development of Mississippi River Models
- Subsidence Investigations
- Impact of Storm Surge within the Mississippi River
- Geomorphology of LMR Lateral Bars
- Dredge Material Management

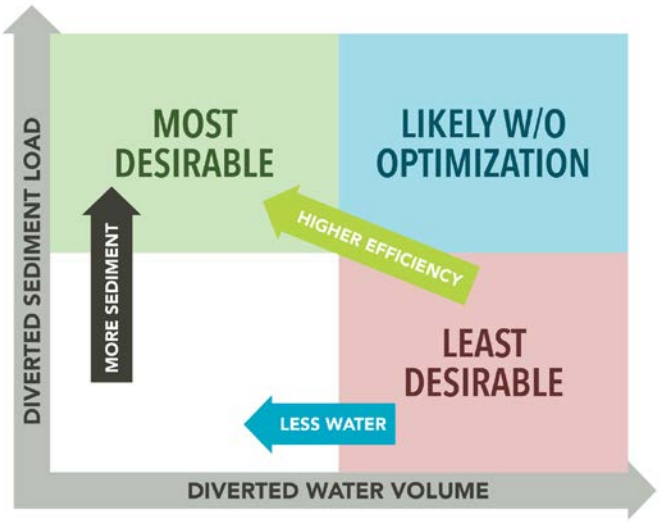
# EXTENDED APPLICATIONS OF THE MISSISSIPPI RIVER HYDRODYNAMIC MODELING TOOLS

*Utilize the modeling tools developed under MRHDM to run additional scenarios to examine a variety of possible future conditions.*

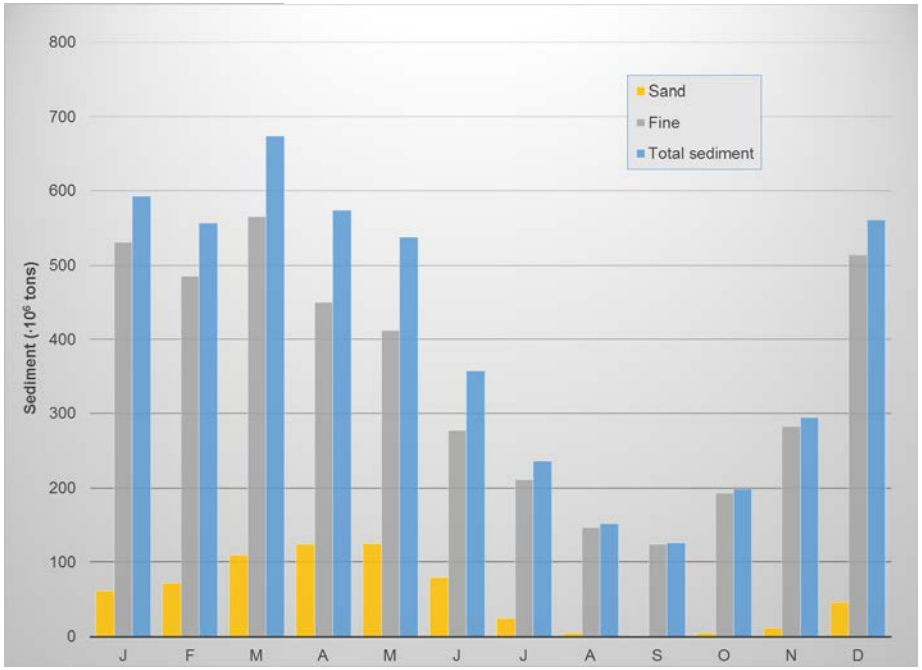


# Develop Real Time Forecasting (RTF) system for Lowermost Mississippi River water, sediment and selected nutrients







Analysis of salt wedge and sedimentation in the estuarine reach, and variability of flow through outlets

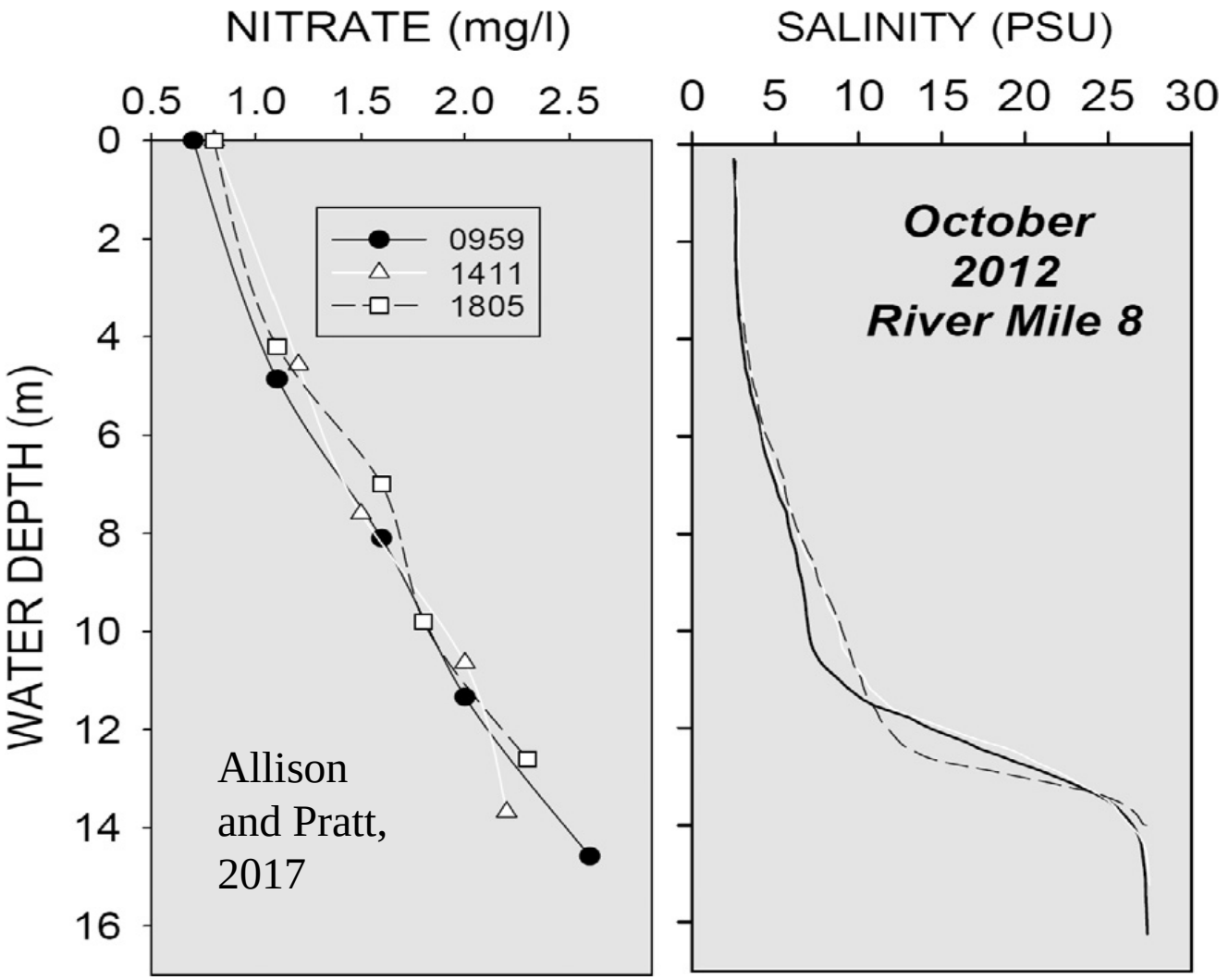
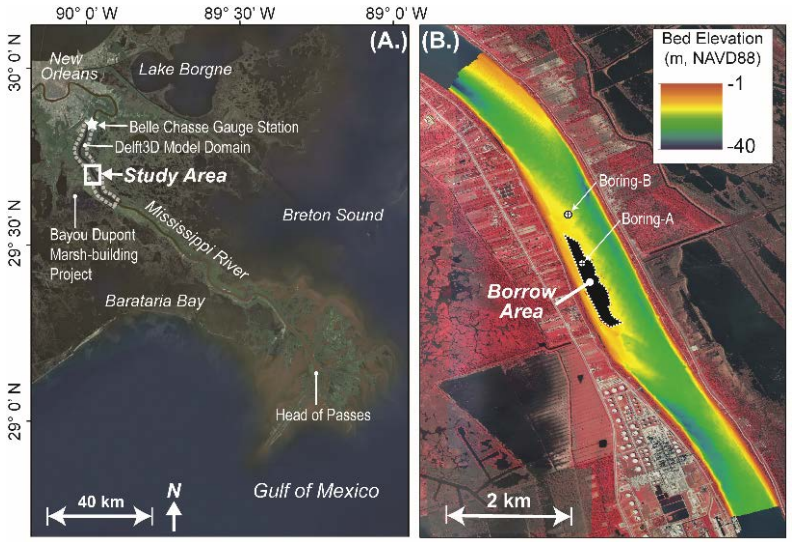
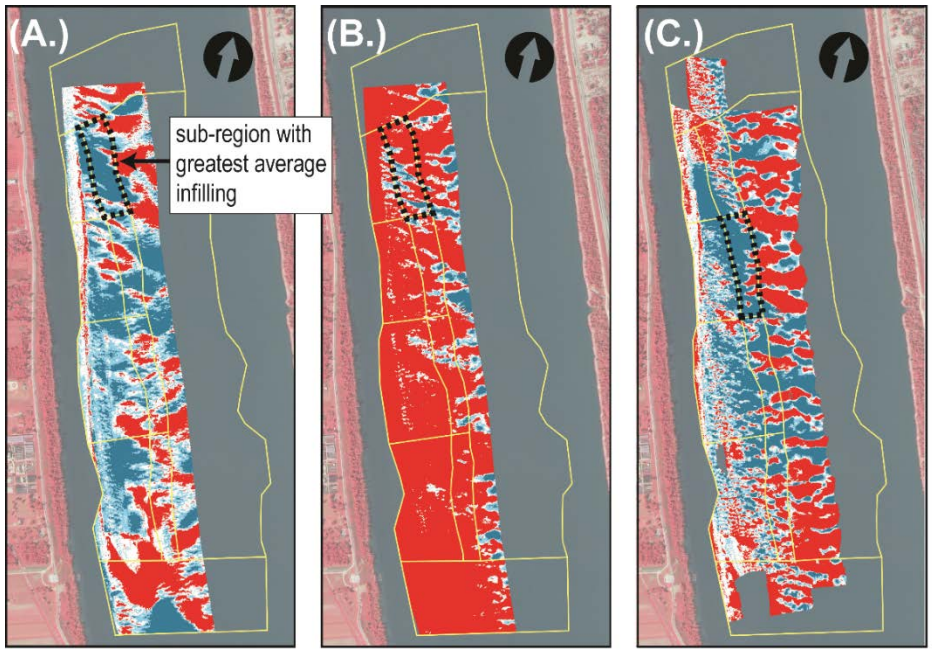



Fig. 11. Nitrate concentrations measured in Mississippi River water at low discharge through the salt wedge at a thalweg station at river mile 8 (RK 13) on September 24, 2012 at 0959, 1411, and 1811 GMT. Right panel is the salinity from CTD casts taken at the same station approximately 5–10 min prior to the beginning of the nitrate sampling for each time shown.

# Modeling analysis and optimization in support of navigation dredging operations




Map of Bayou Dupont borrow area, MSR.

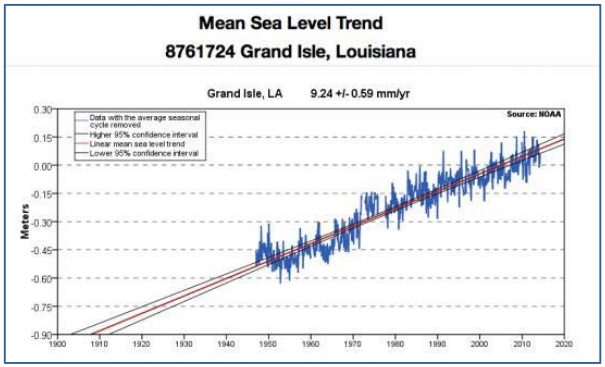


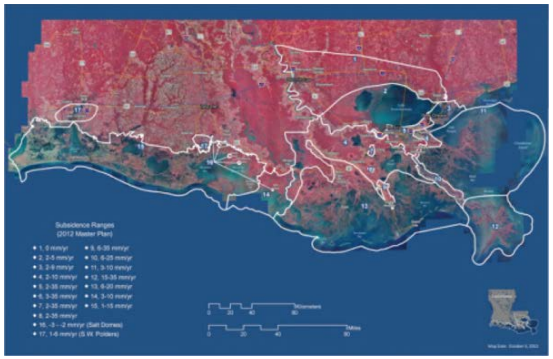

Work done by Drs. Yushi Wang and Brendan Yuill

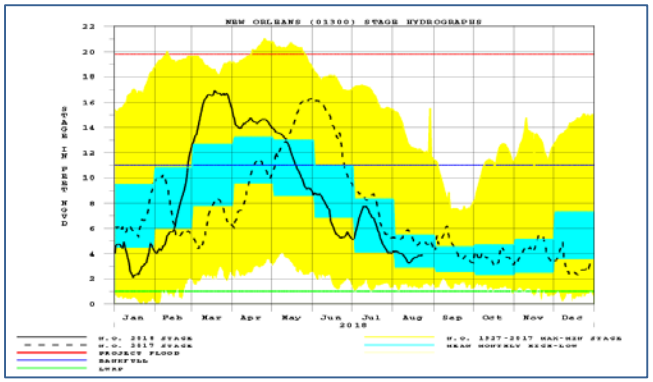
A long time series of bathymetry at this site illustrates how the channel bar responds to Multiple dredging campaigns including sediment infilling rates and patterns over a range of discharges.

# Modeling analysis of the sustainability of the Lower River for Navigation and Restoration

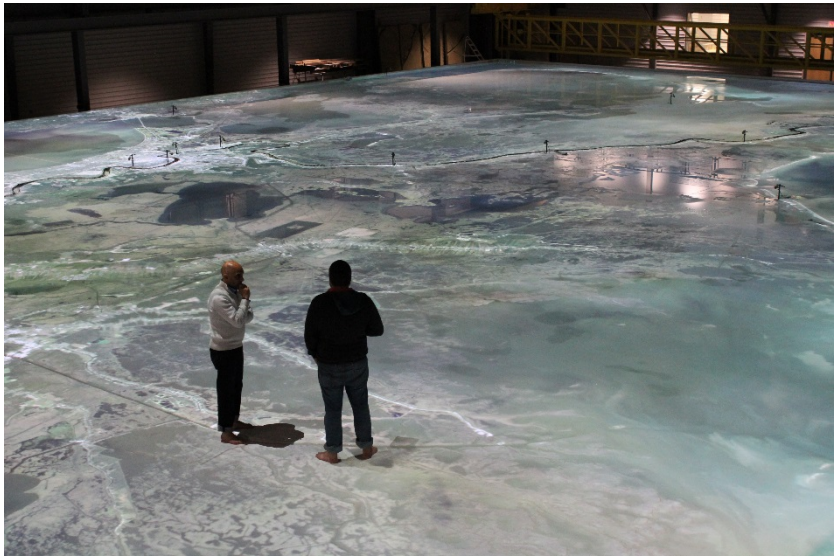
- Various temporal Eustatic sea level rise rates
- Various spatial and temporal subsidence rates
- Variations in spatial and temporal patterns of upriver water and sediment hydrographs (due to climate changes)



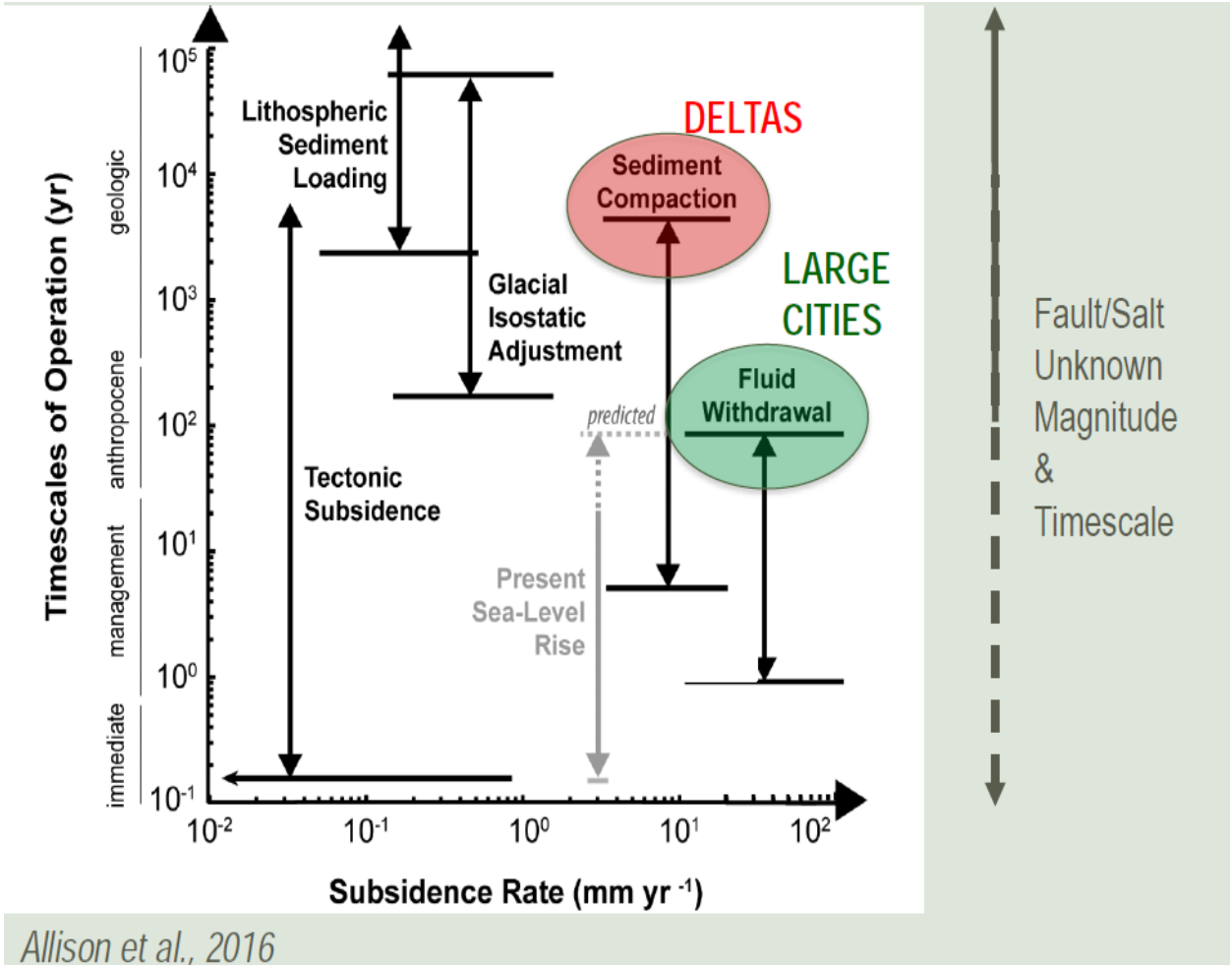


# Conduct cross calibration between selected numerical models and Small Scale Physical Model



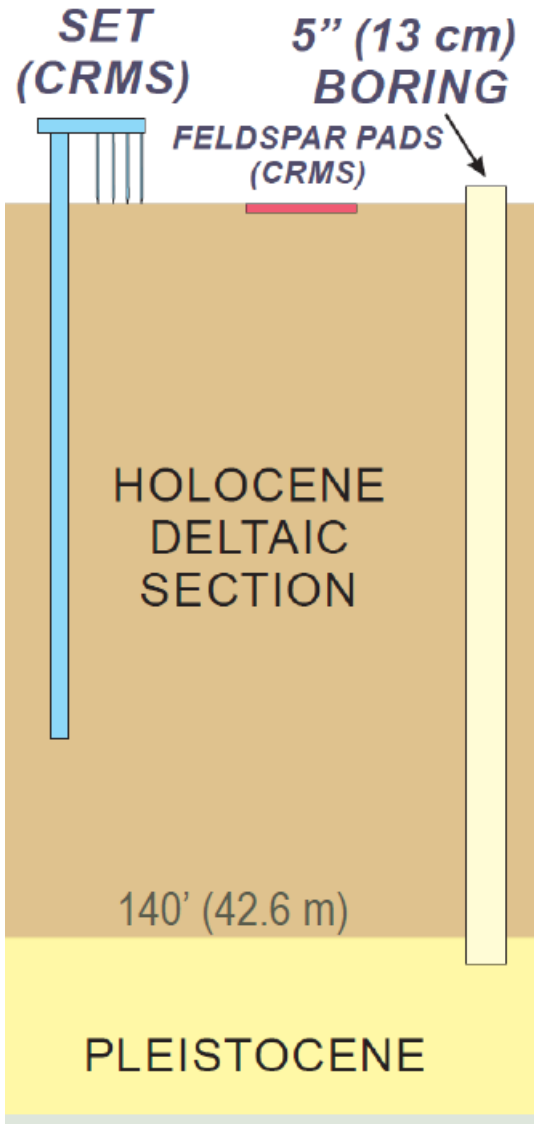
# SUBSIDENCE INVESTIGATIONS

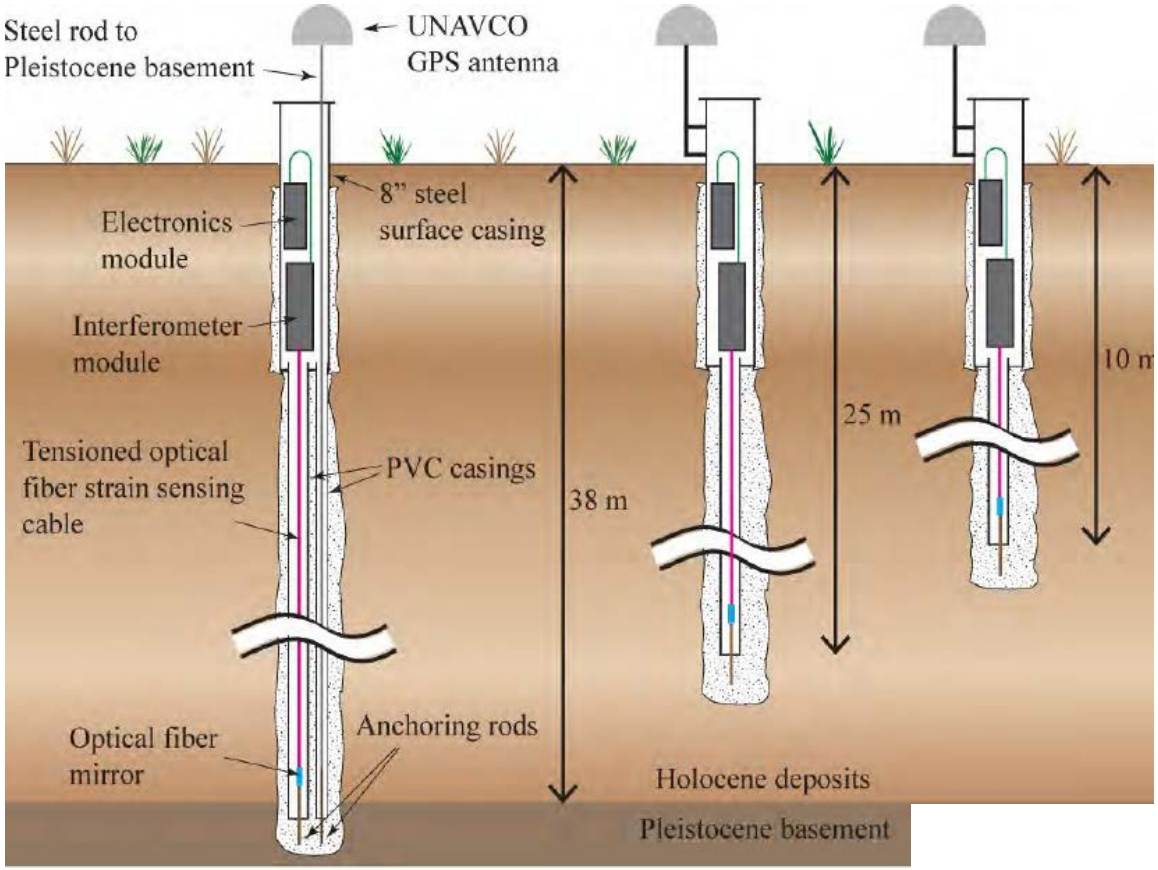
- *Develop and refine subsidence measuring techniques and methodologies.*
- *Examine the temporal and spatial variability of subsidence patterns.*



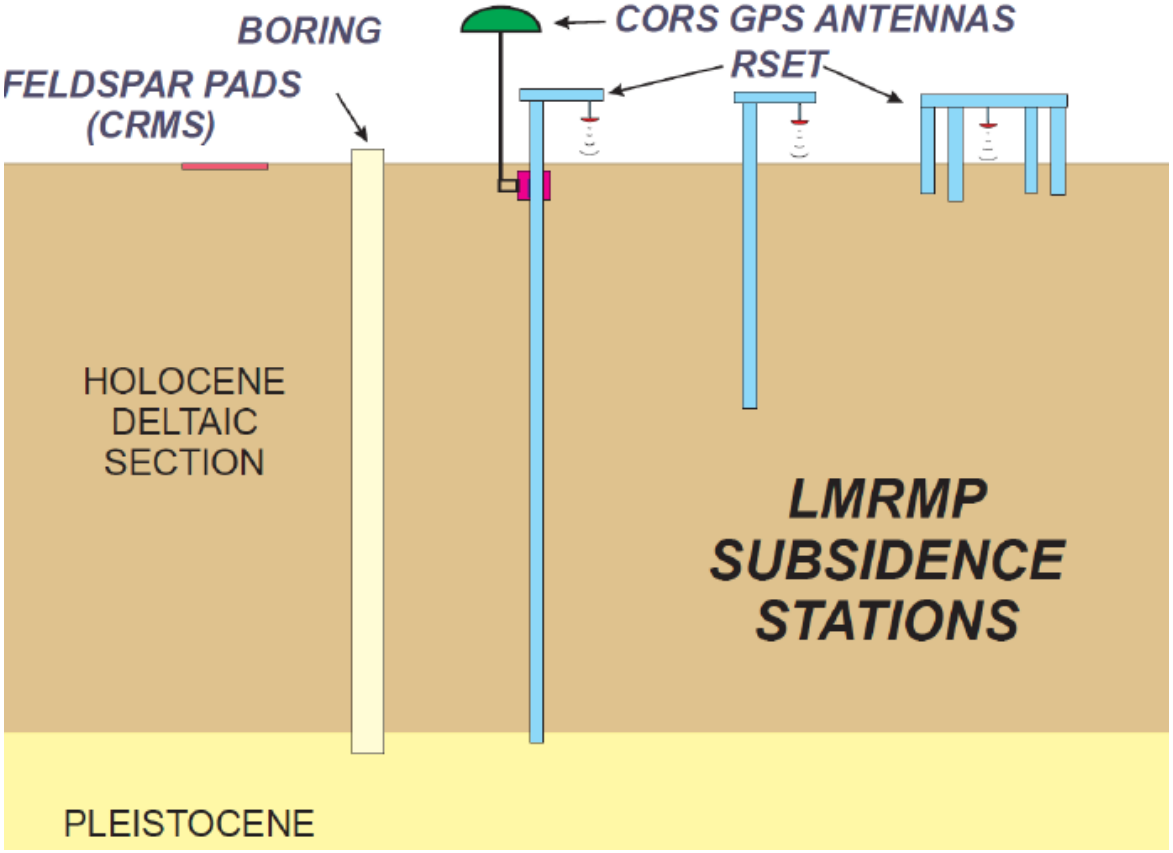

Subsidence may be the *single largest variable* in determining the sustainability of coastal communities and restoration/protection projects

# Operation, Maintenance and Data Analysis at the Myrtle Grove Subsidence Superstation



# Develop and Implement Ground-based Subsidence Observation Network Proximal to the Mississippi River Channel




- 10 to 15 stations
- Simplified (lower cost) superstation
- Laser Altimeter (continuous record)
- GPS provides referencing to InSAR

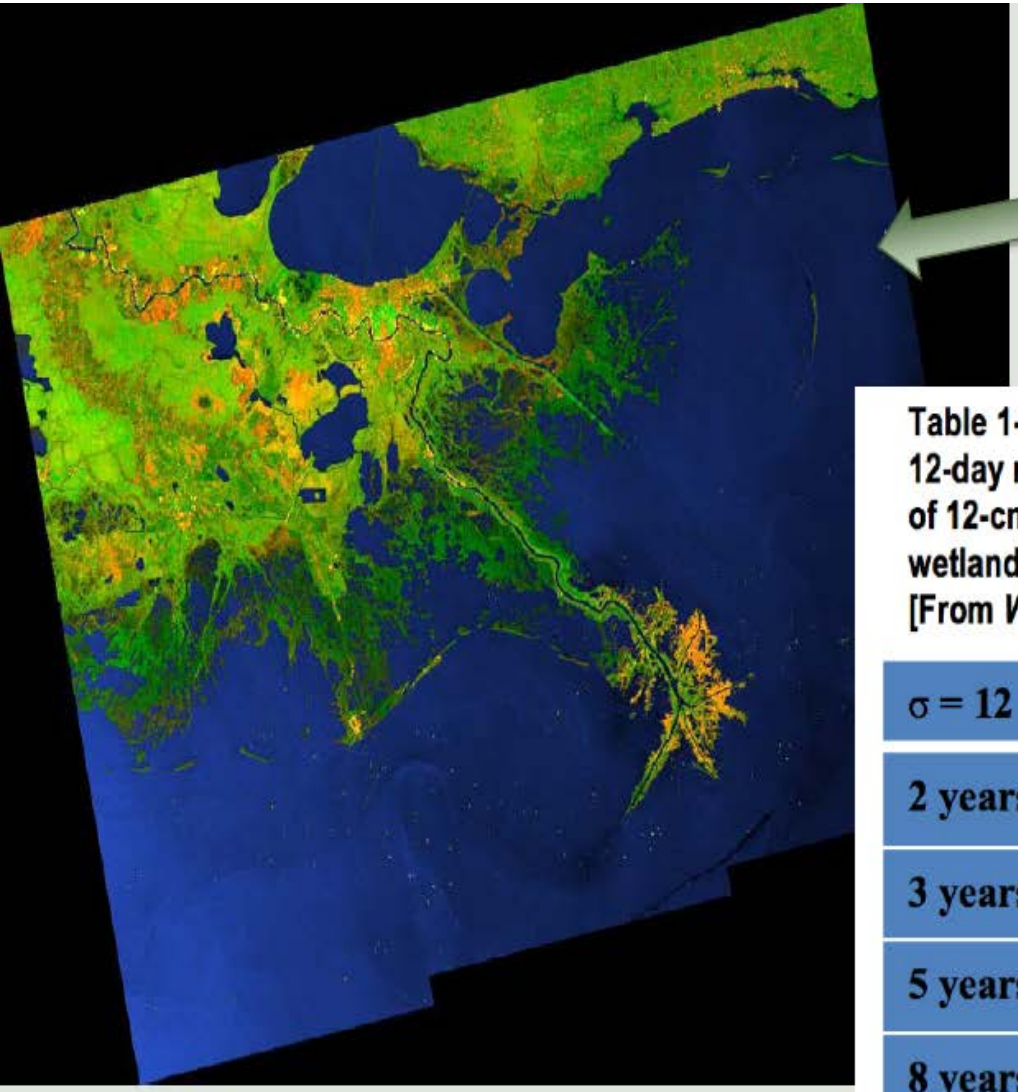
# Develop Analytical Techniques to Utilize InSAR Data from Sentinel 1 Satellite

Tulane University

COASTAL PROTECTION AND RESTORATION AUTHORITY
CPRA

NASA JPL
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

# Sentinel-1 Characteristics



Sentinel-1 swath over coastal Louisiana
12 day repeat interval since April 2016

**Table 1-1. Achievable accuracy vs. time for Sentinel-1 6-day or 12-day repeat intervals, assuming interferometric phase noise of 12-cm (e.g. tropospheric noise), i.e., similar to expected for wetland/agricultural setting in temperate/tropical climates. [From *Walters et. al., 2016*]**

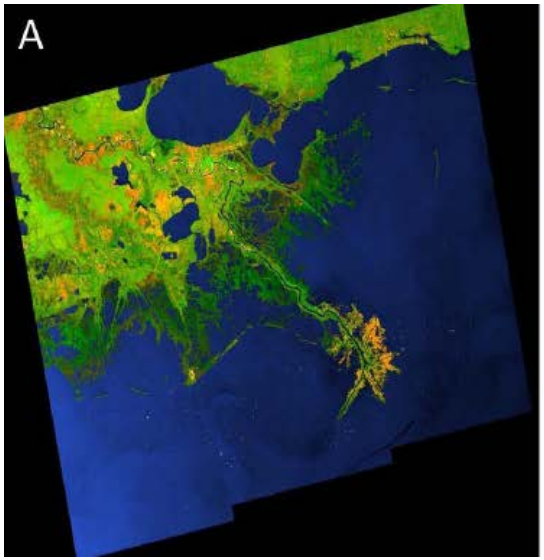
| $\sigma$ = 12 mm | 12 day (S1A) | 6 day (S1A + S1B) |
|---|---|---|
| 2 years | 2 mm/yr | 1.3 mm/yr |
| 3 years | 1 mm/yr | 0.7 mm/yr |
| 5 years | 0.5 mm/yr | 0.3 mm/yr |
| 8 years | 0.2 mm/yr | 0.17 mm/yr |

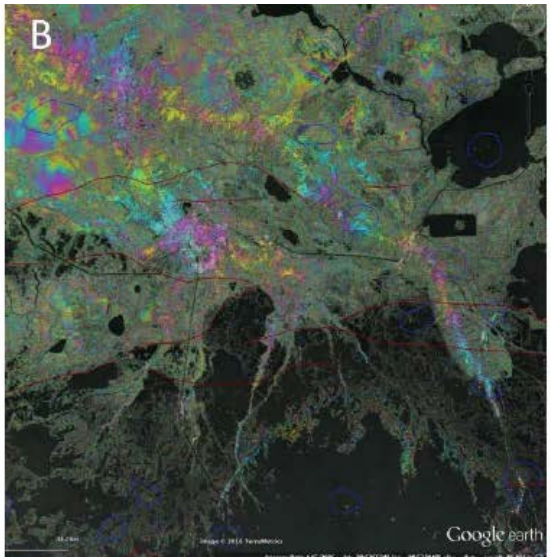
# Sentinel-1 InSAR from April 2016

VV/HV Mode Image

12-day Interferograms of the Terrebonne Bay Region

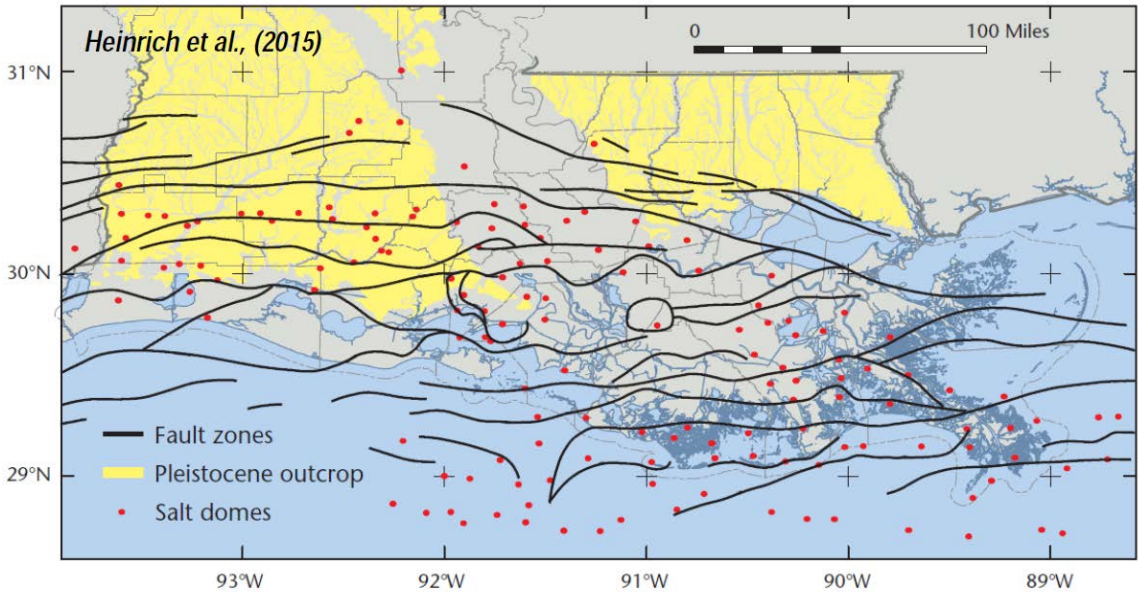
12-day Interferograms of the MRD birdfoot




# Geologic Hazards Expert Panel

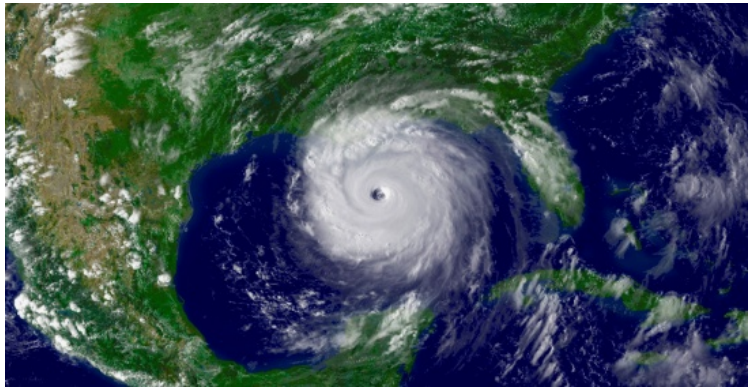
- Identify critical scientific uncertainties and issues
- Suggest targeted research to help resolve/inform the scientific uncertainties and issues
- Provide guidance on geologic hazard related issues
- Provide input and guidance on data collection/monitoring and adaptive management plans
- Review scientific model outputs




# Impact of Storm Surge within the Mississippi River utilizing C-STORM MS

- ✓ Build a State of Louisiana/USACE cooperative and collaborative coastal and river hazard assessment capability that will inform multiple efforts for increasing community resilience while restoring the ecosystem.
- ✓ Special focus on the interaction of storm surge and riverine flows and how alterations to the Mississippi River may alter flood risk.

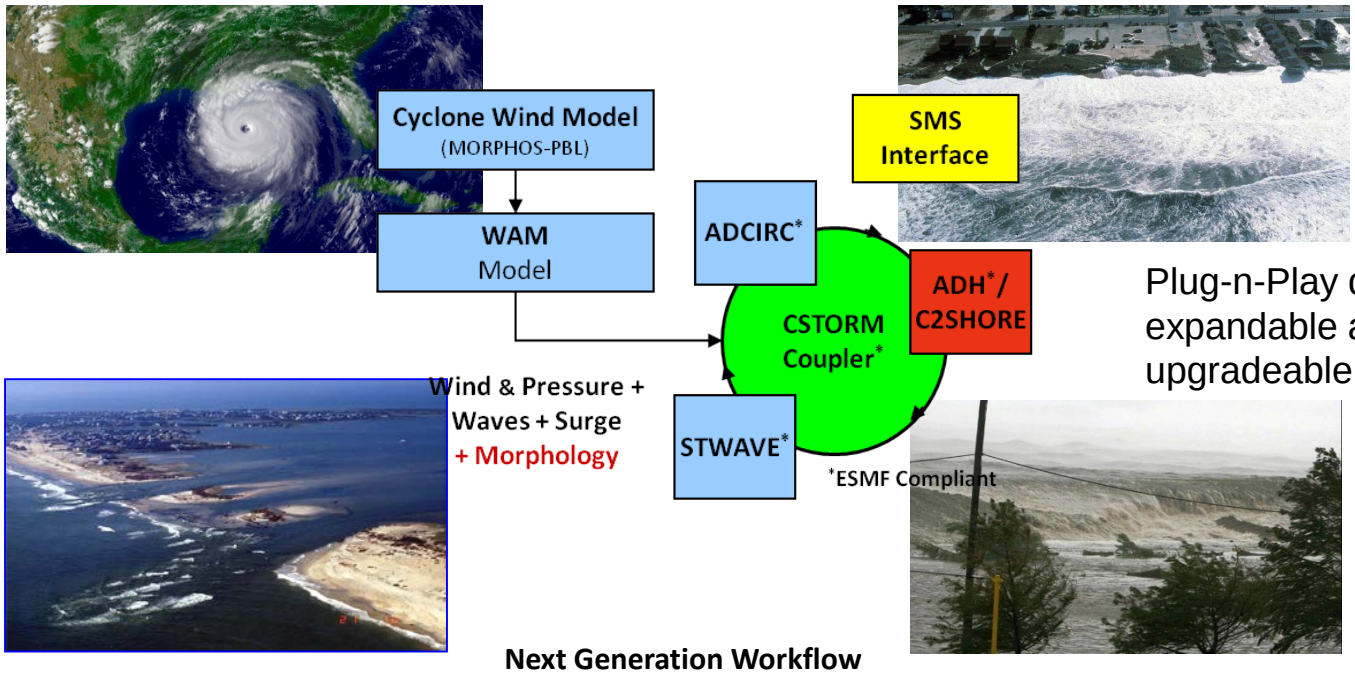
South Louisiana communities face risk from coastal storm surge and waves as well as from riverine and precipitation event flooding. Restoration activities can have system wide impacts on flood risk that must be evaluated as part of a comprehensive restoration plan.



# ERDC's Coastal Storm Modeling System

Application of high-resolution, highly skilled numerical models in a tightly integrated modeling system with user friendly interfaces

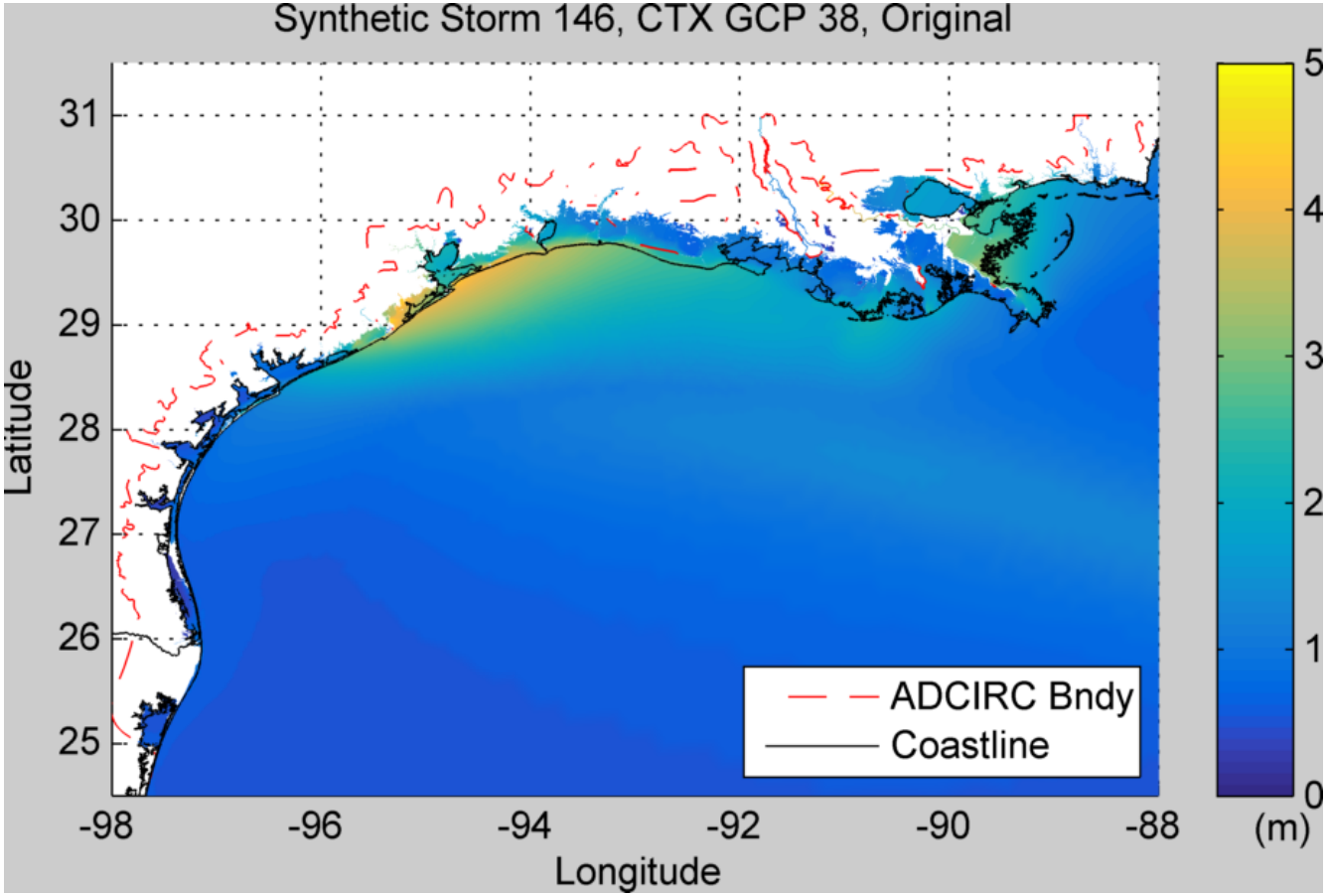
Readily relocatable and flexible forcing features.




Plug-n-Play design for expandable and upgradeable system.

Provides for a robust, standardized approach to modeling coupling. Used for establishing the risk of coastal communities to future occurrences of storm events.

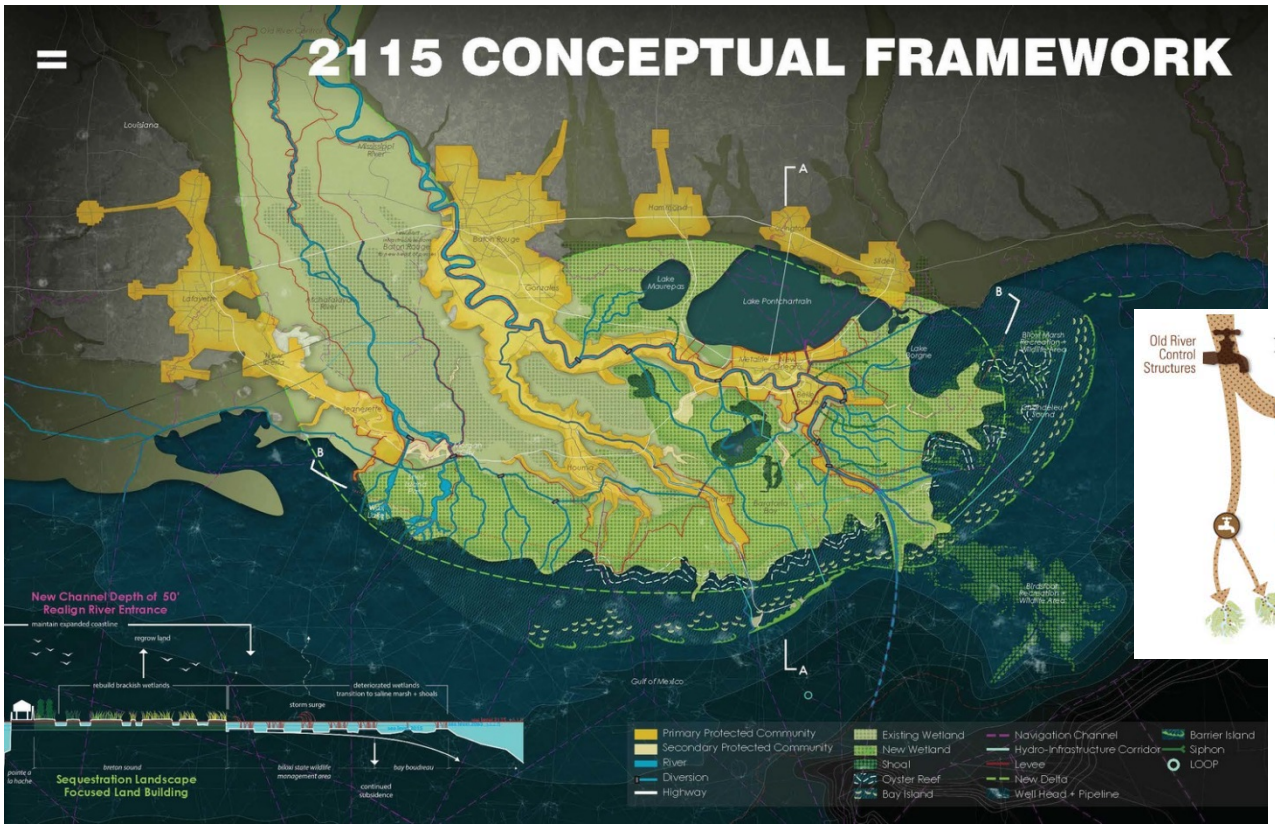
# Example Max Surge Results



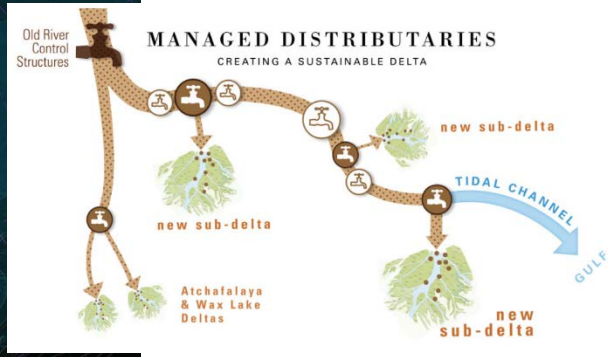

Surge and wave results will be obtained for all simulations and available for statistical and other analyses

# MISSISSIPPI RIVER ALTERATIONS

Changing Course was a design competition to reimagine a more sustainable Lower Mississippi River Delta. The coastal hazard assessment system will be applied to quantify storm surge propagation up the river associated with different Mississippi River channel configurations under various river stages and how that influences risk for communities.

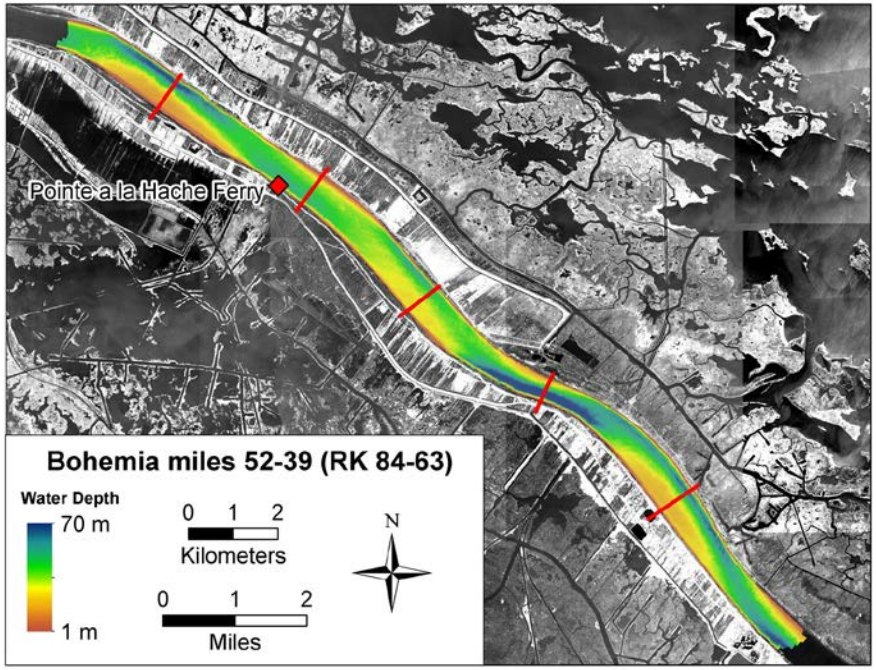






# GEOMORPHOLOGY OF LMR LATERAL BARS

- Update and refine LCA Hydro Geomorphology Study
- Seismic survey of Wills Point, Alliance, and Myrtle Grove lateral bars
- Tracer Sand Observation Study of Sediment Transport at Wills Point, Alliance and Myrtle Grover lateral bars
- Sediment Cores at select lateral bar locations
- Observational Data collection of Bennet Carre Spillway Operation



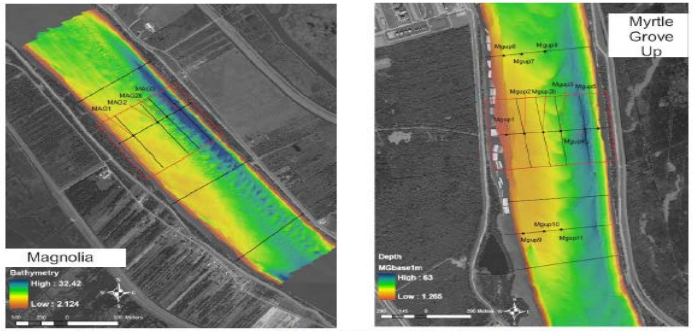




*Figure 7a. Sampling stations and ADCP transects utilized in 2008-2010 at Magnolia (left) and Myrtle Grove Up (right). Limits of the bedload grid areas are shown in red.*

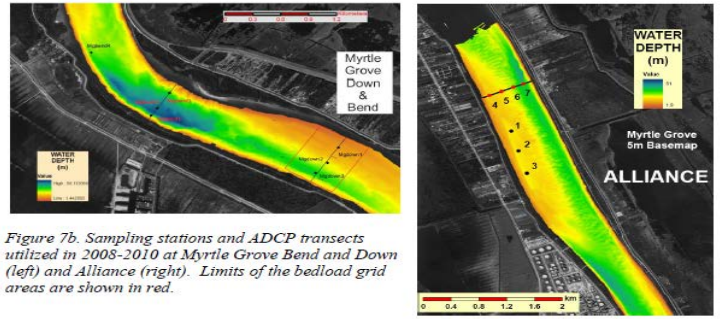
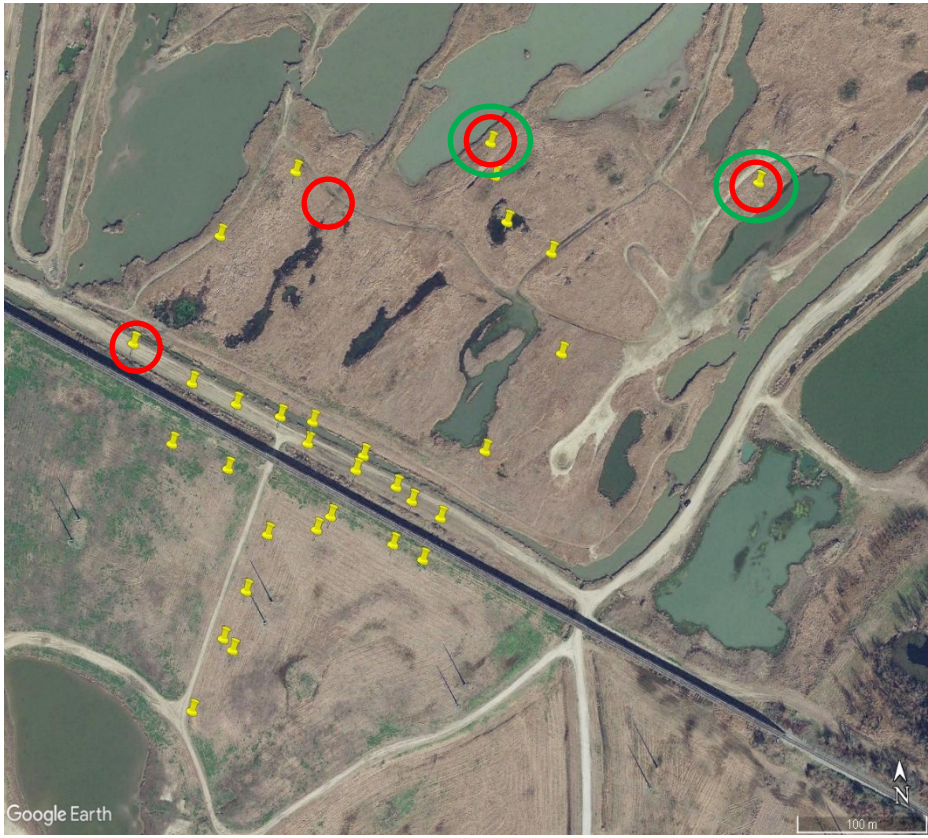



*Figure 7b. Sampling stations and ADCP transects utilized in 2008-2010 at Myrtle Grove Bend and Down (left) and Alliance (right). Limits of the bedload grid areas are shown in red.*

# Tracer Sand Studies

Tracer sand observational study of sediment transport at 3 LMR lateral bars (Wills Point, Alliance, and Myrtle Grove)

Observational Data collection of Bonnet Carre Spillway Operation

# DREDGED MATERIAL MANAGEMENT

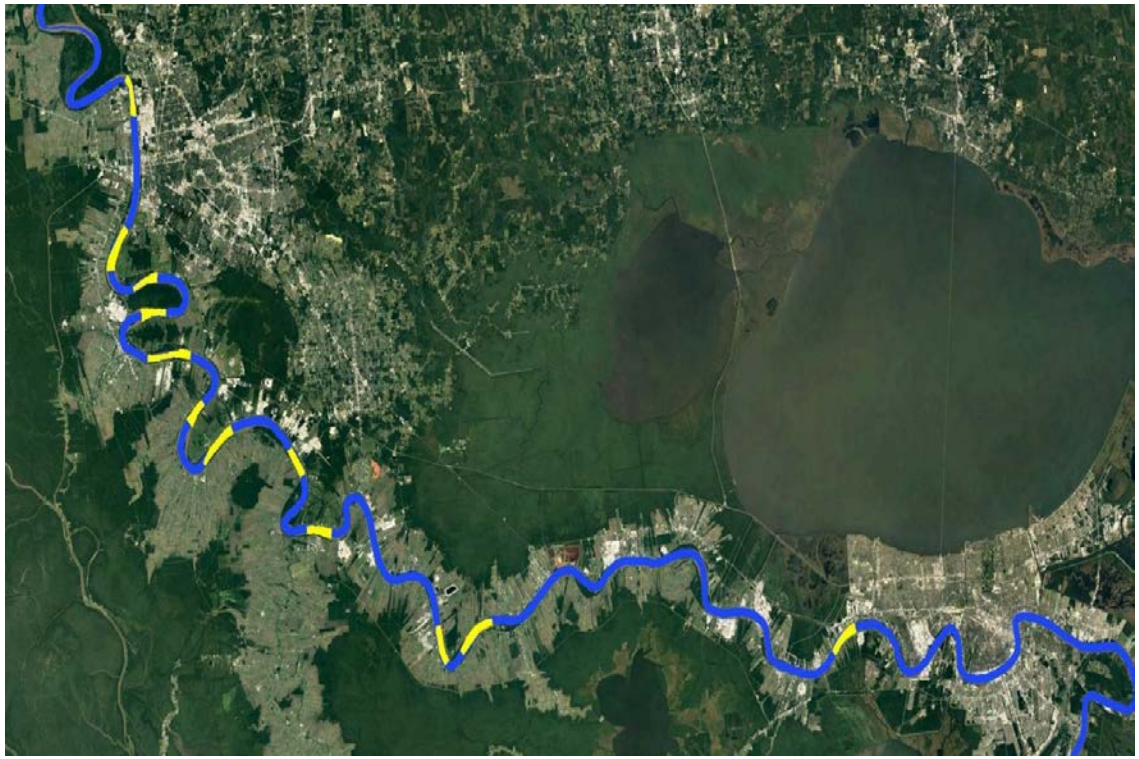
Synthesis and analysis of LMR Deep Draft Navigation dredging activities

Tracer sand observational study of dredged sediment in the deep draft navigation "crossings" from RM 230-220

Economic analysis of current and alternative dredging strategies

- *Understand how maintenance dredging impacts restoration activities.*
- *Identify and optimize existing dredging practices and operations*

# Mississippi River Deep Draft Crossings



| | |
|---|---|
| **Baton Rouge Front** | **Mile 233-229** |
| **Redeye** | **Mile 225-223** |
| **Sardine Point** | **Mile 220-218** |
| **Medora** | **Mile 213-211** |
| **Granada** | **Mile 205-203** |
| **Bayou Goula** | **Mile 199-197** |
| **Alhambra** | **Mile 192-189** |
| **Philadelphia** | **Mile 184-182** |
| **Smoke Bend** | **Mile 176-174** |
| **Rich Bend** | **Mile 159-157** |
| **Belmont** | **Mile 155-152** |
| **Fairview** | **Mile 117-115** |

# CPRA Project Contacts

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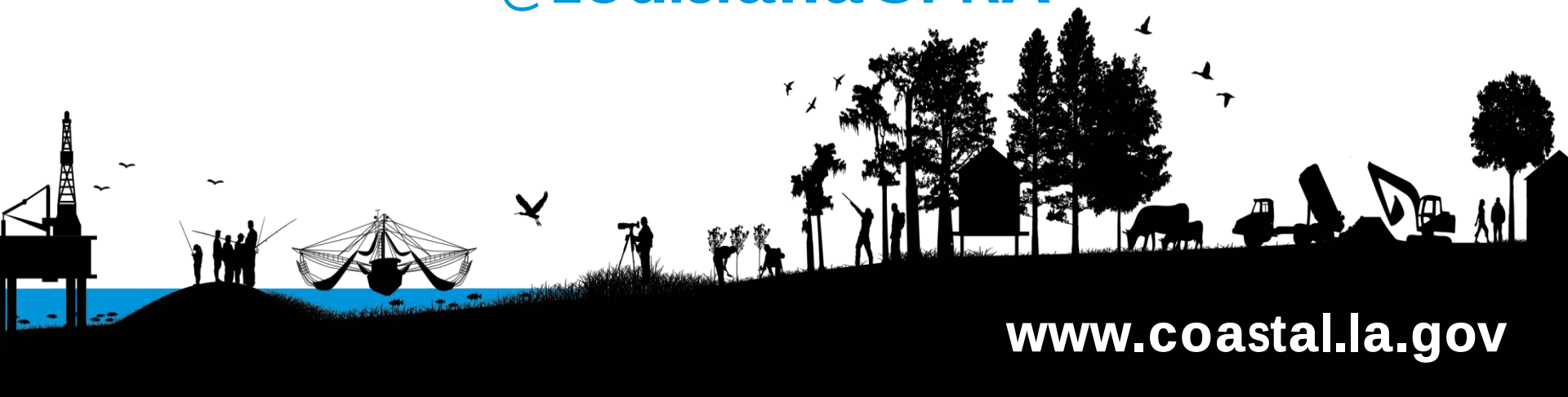

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