

Cooperative Hypoxic Zone Monitoring Program Workshop Overview

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NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

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Outline

- **Hypoxic zone monitoring activities: past and present**
- **Products needed to manage the hypoxic zone**
- **Monitoring system requirements to support 3D time variable hypoxia models**
- **Transition to operations**

Hypoxia Task Force *Action Plan*

Coastal Goal

“Reduce the 5-year running average of the hypoxic zone areal extent to less than 5000 sq km (1928 sq mi) by the year 2015...

...(by reducing) the annual discharge of nitrogen into the Gulf. [2001 *Action Plan*]

...(by reducing) the annual discharge of nitrogen and phosphorus into the Gulf. [2008 *Action Plan*]

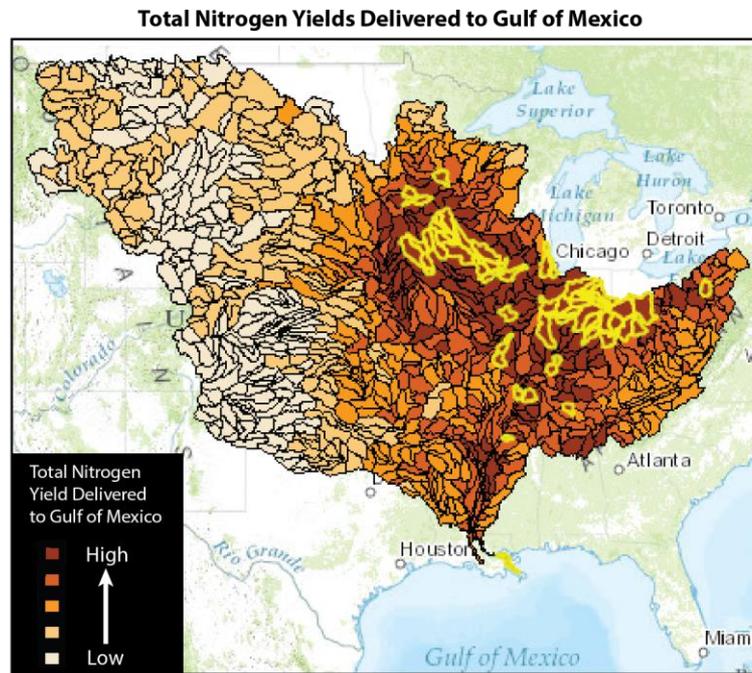


Current Coastal Goal

2015 Revised Coastal Goal:

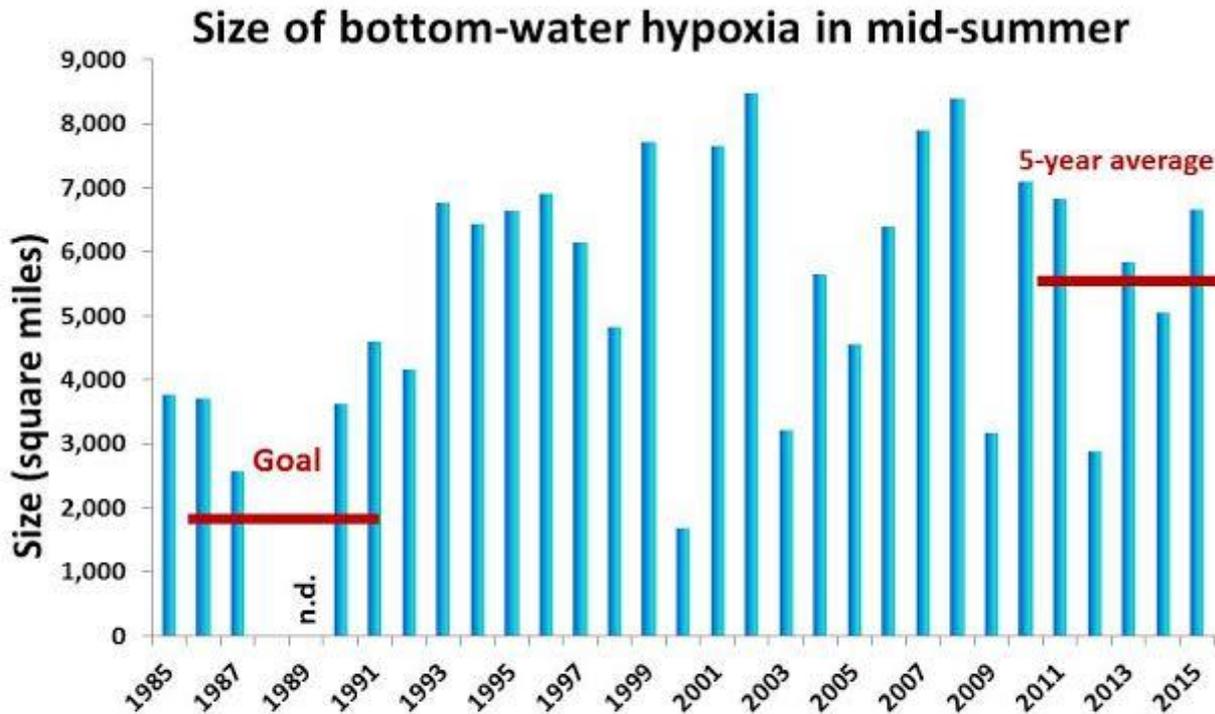
- reduce the five-year running average areal extent of the Gulf of Mexico hypoxic zone to less than **5,000 km² (1,928 mi²) by 2035**;
- an **Interim Target** of a **20% reduction** of N and P loading **by 2025** is a milestone for immediate planning and implementation actions...

Watersheds contributing the highest nitrogen yields to the Gulf



Gulf Hypoxic Zone Monitoring

Maximum annual areal extent of hypoxic zone – metric to assess progress toward Hypoxia Task Force Action Plan Goal



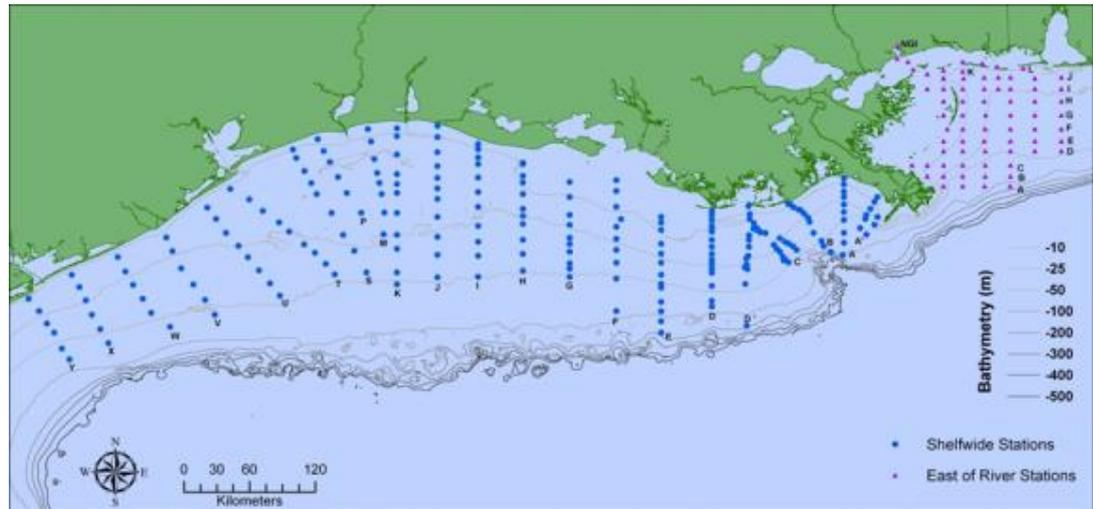
Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU
Funding sources: NOAA Center for Sponsored Coastal Ocean Research and
U.S. EPA Gulf of Mexico Program



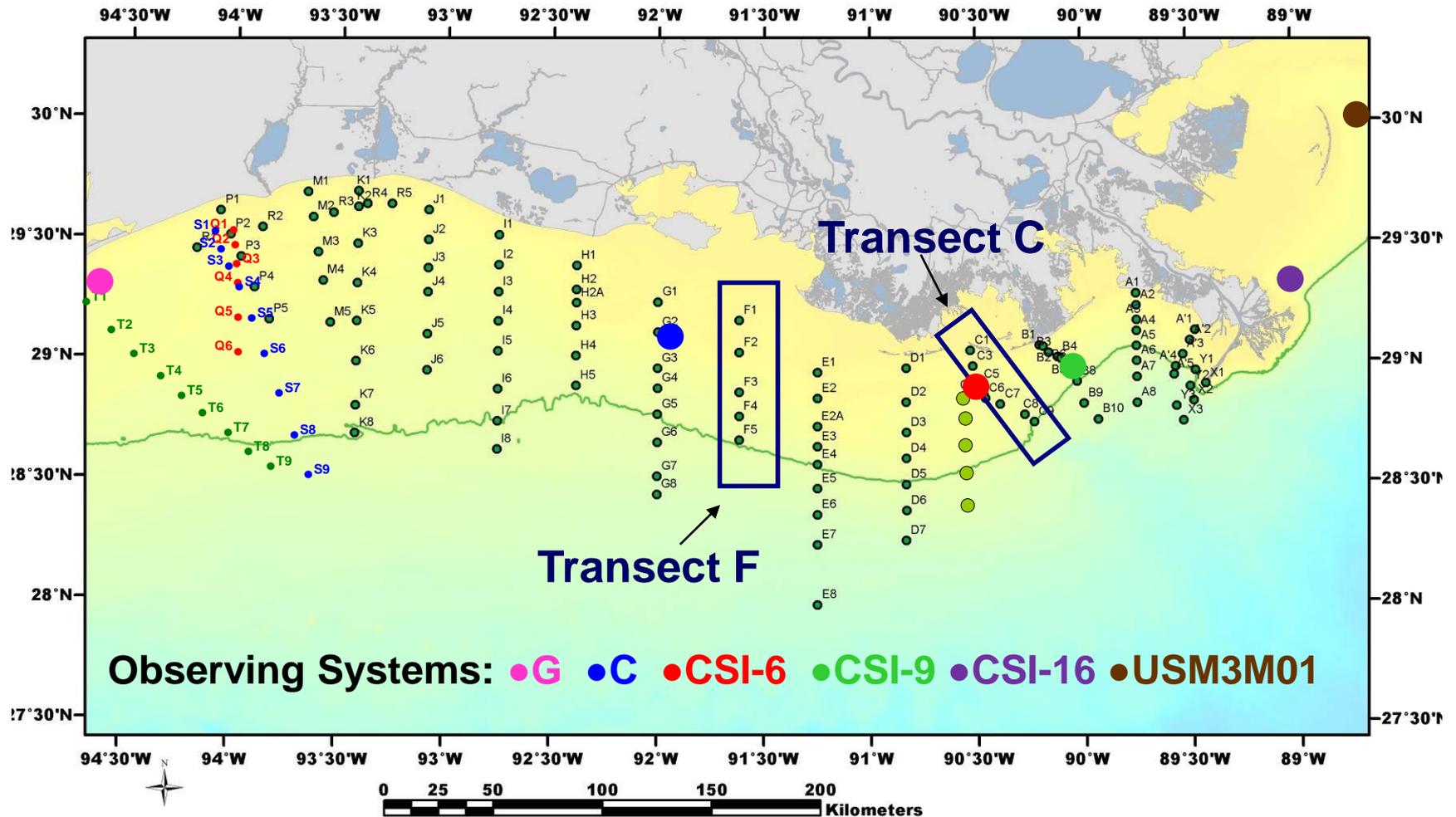
Gulf Hypoxic Zone Monitoring Implementation Plan (2009, revised 2012)

Core System Requirements

- **Increase frequency of shelf-wide surveys**
- **Expand spatial boundaries**
- **Maintain Transects C & F**
- **Deployment of gliders**
- **Maintain current observation systems and ensure all are outfitted with dissolved oxygen sensors**
- **Create a portal to maximize accessibility to, and exchange of, hypoxia data**
- **Dissemination of relevant data and findings to management community**



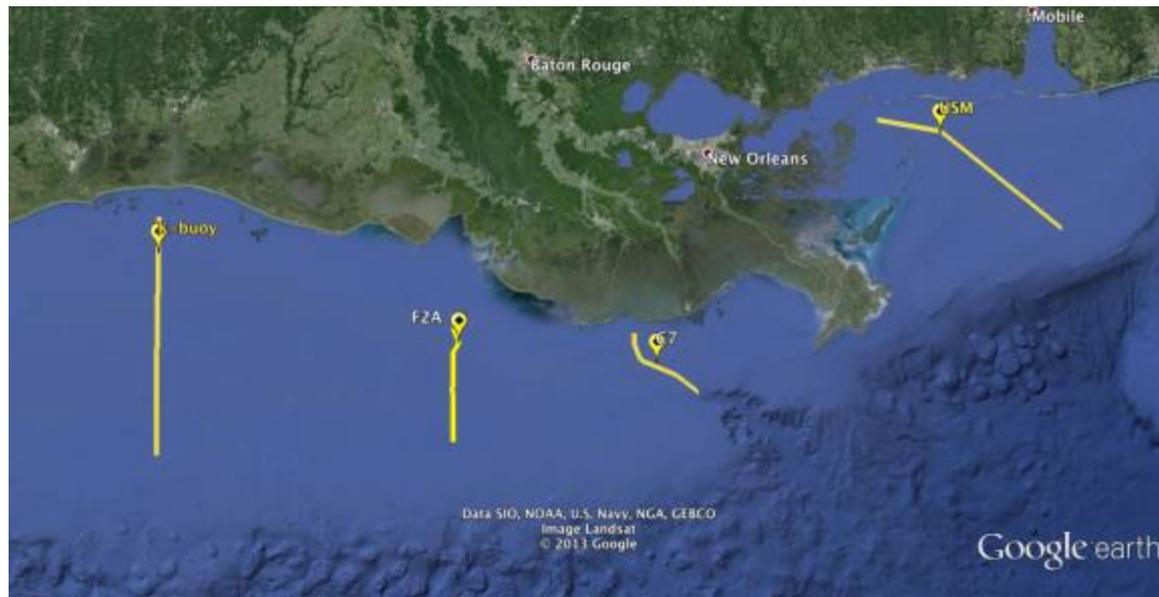
Hypoxic Zone Monitoring Activities



Glider Implementation Plan for Hypoxia Monitoring in the Gulf of Mexico

**White paper from NOAA/NGI
Gulf Hypoxia Glider
Application Meeting,
April 2013 at Stennis**

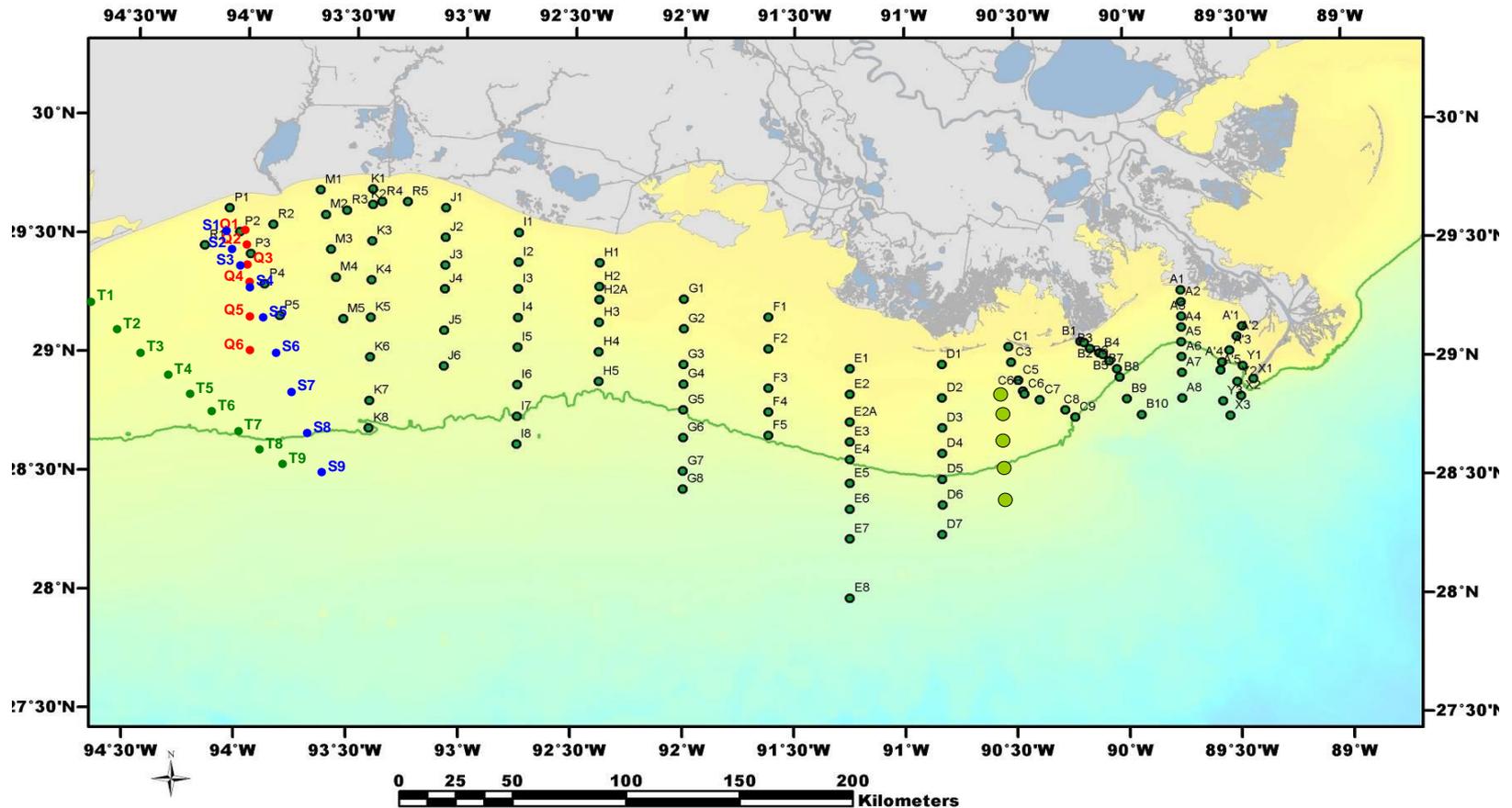
- **Tier 1: 4 transects
with observing systems**



- **Tier 2: add a transect to west, increase sampling frequency, and add “sawtooth” surveys**
- **Tier 3: add sensors to determine hypoxia effects on living marine resources**

Today

- One shelfwide survey (July) - failed in 2016



Monitoring Requirements are driven by Management Products

Product 1

Management Need: Measure progress towards the Coastal Goal Metric of the Hypoxia Task Force Action Plan

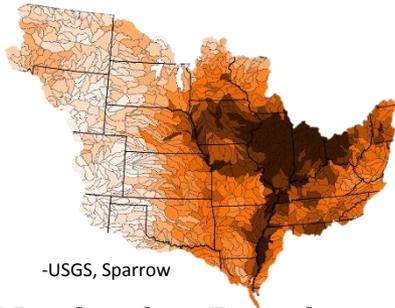


-Lumcon

Monitoring Requirement: Mid-summer Shelfwide Ship Survey

Product 2

Management Need: Evaluate the overall nutrient reduction required to reduce the hypoxic zone

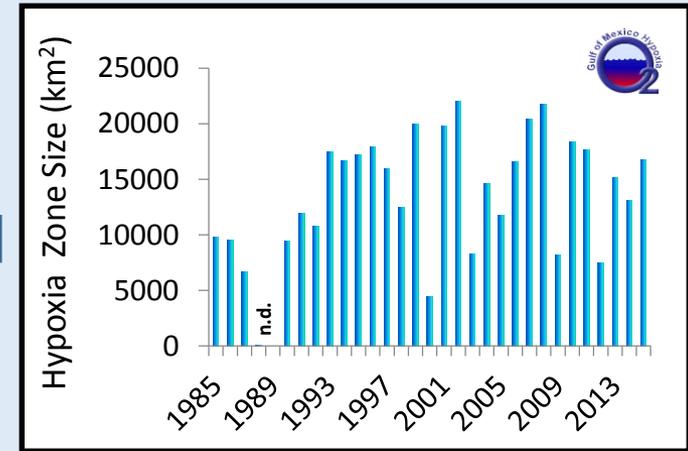


-USGS, Sparrow

Monitoring Requirement: River Nutrient Loading and Discharge Data

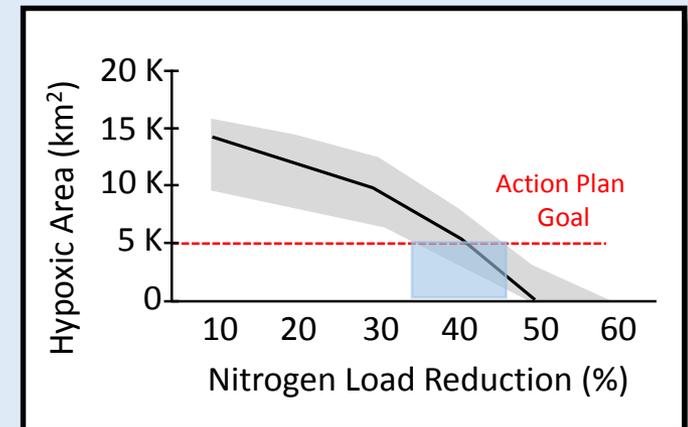
Model Integration / Validation

HTF Goal Metric



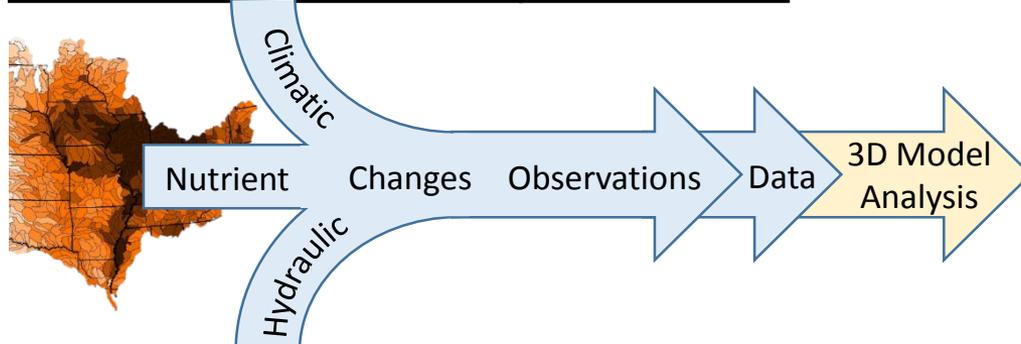
-Nancy Rabalais, Eugene Turner

HTF Guidance on Nutrient Reduction



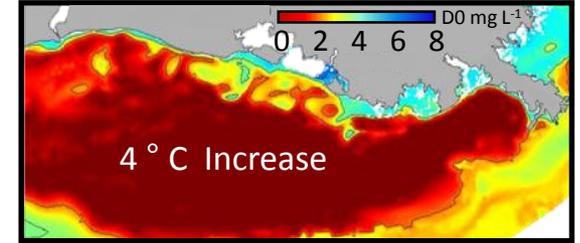
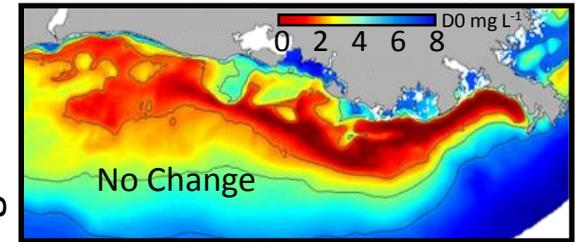
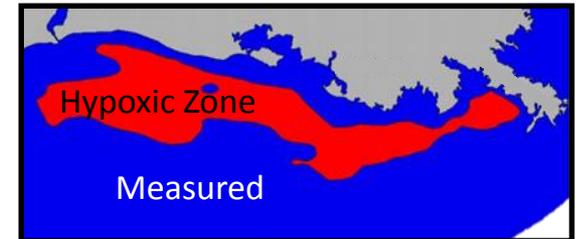
Monitoring Requirements are driven by Management Products

Management Need: Evaluate strategic management questions related to nutrient reductions including timing, input location, nutrient type, and impacts of climate change



Monitoring Requirement: Cruises, Gliders, Moorings

Strategic Guidance on Nutrient Reductions and Scenario Forecast



Longitude

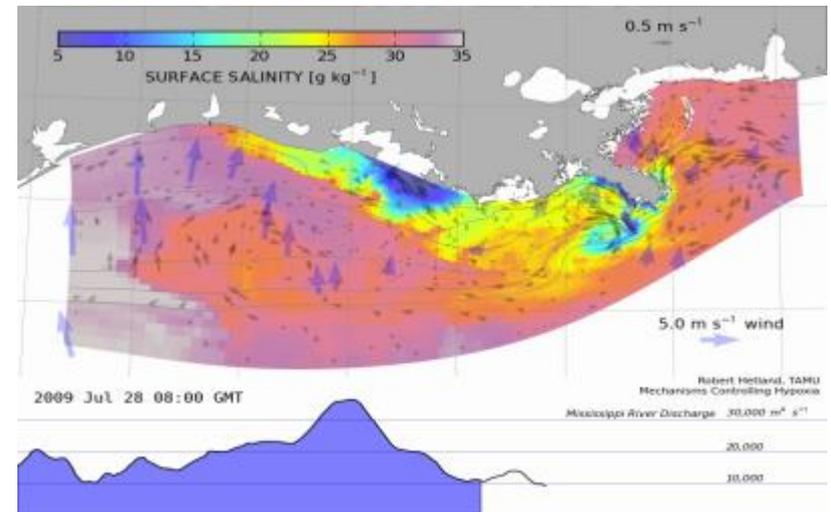
Latitude

Product 5

Monitoring system requirements needed to support 3D time variable hypoxia models

Deterministic 3D time variable models:

- **Justic (LSU): 3-D coupled hydrodynamic (FVCOM-LATEX) water quality model**
- **Hetland (TAMU): 3D dynamically coupled (ROMS hydrodynamic model)**
- **Fennel (Dalhousie): 3D dynamically coupled (biogeochemical model)**
- **Ko/Lehrter (NRL/EPA): EPA-COMGEM 3D hydrodynamic biogeochemical model**



Visualization of hydrodynamic model showing sea surface salinity in relationship to Mississippi River discharge in 2009. Source: S. DiMarco, Texas A&M

Ship Surveys

Monitoring Activity	Annual Amount
HYPOXIC ZONE MID-SUMMER AREAL EXTENT	
Mid-summer annual cruise	\$111K + ship time
MONITORING DATA TO SUPPORT VALIDATION OF 3-D TIME VARIABLE HYPOXIA MODELS	
Mid-summer (July) ship survey in Mississippi Bight	\$50K
Monthly (Apr-Oct) surveys in Mississippi Bight	\$300K
Monthly Transects C and F	\$480K
SEAMAP	\$190K

Moored Observing Systems

Monitoring Activity	Annual Amount
MONITORING DATA TO SUPPORT VALIDATION OF 3-D TIME VARIABLE HYPOXIA MODELS	
Four Sites West of Delta: CSI-6, C, CSI-9, G Two Sites East of Delta: USM 3M01, CSI-16	<u>Average cost per site per year:</u> First Year: \$175K After First Year: \$125K

Gliders

Monitoring Activity	Annual Amount
MONITORING DATA TO SUPPORT VALIDATION OF 3-D TIME VARIABLE HYPOXIA MODELS	
Tier 1 of Glider Implementation Plan (4 transects; cover June through Aug)	<p><u>First year</u></p> <p>\$960K (purchase 8 gliders) + \$180K for cruise deployments</p> <p><u>After First Year:</u></p> <p>\$180K for cruise deployments</p>

Transition to Operations

- **Mid-summer ship survey**: NOAA NCCOS support for FY17
- **Empirical models for scenario forecasts**: NOAA NCCOS funding study to develop transition-to-operations plan
- **Deterministic models**: NOAA IOOS & NCCOS developing transition-to-operations plan
- **Data management and dissemination**: GCOOS and NCEI
- **Nutrient loading measurements**: USGS, LSU, USACE
- **SEAMAP**: NOAA NMFS

Questions



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