



**Welcome to the
NASA SSC Applied Science Program
Gulf of Mexico Initiative
Strategic Planning Session
and
Panel Discussion**

GOMIAP



Workshop Agenda

- 1:00-1:10 **Check-in**
- 1:10-1:15 **Welcome (Mr. Ted Mason)**
- 1:15-1:30 **NASA Applied Science Program Overview (Dr. Teresa Fryberger)**
- 1:30-2:30 **NASA SSC Coastal Activities (Mr. Mark Glorioso)**
- NASA SSC Coastal Initiative
ROSES-08
Coastal Online Assessment and Synthesis Tool (COAST)
Completed Projects
Current Projects
DEVELOP
- 2:30-3:00 **Introduction of Coastal Strategic Plan (Mr. William Graham)**
- 3:00-3:30 **COAST Demonstration (Mr. Richard Brown)**
- 3:30-3:45 **Break**
- 3:45-4:45 **Panel Discussion: (Moderator: Mr. Mark Glorioso)**
- Best methods to develop partnerships that enhance the transition from coastal research to operations
- 4:45- 5:00 **Wrap up (Mr. Mark Glorioso)**



NASA's Contributions to the Gulf of Mexico Alliance

Mark Glorioso

Gulf of Mexico Applications Project
Stennis Space Center

GOMIAP



NASA Mission

***To pioneer the future in space exploration,
scientific discovery, and aeronautics research.***

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NASA Applied Sciences

The NASA Earth Science Applied Sciences Program *discovers and demonstrates* practical applications of NASA Earth science research and capabilities.

Our goals are to:

- Expand the benefits of NASA Earth science across a broad range of societal needs.
- Demonstrate new decision support tools for resource managers and policy makers for potential operational use.
- Provide the applications viewpoint in the design of new missions and research. Demonstrate and communicate the value of Earth science to the public and to decision, policy, and law makers.

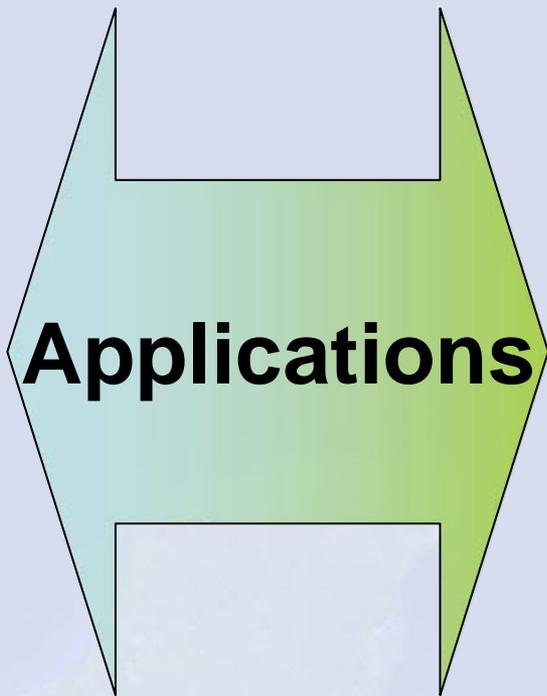


NASA Earth Science Applications

Applied Sciences will work across the “gap” and will employ all means to utilize Earth Science results, within the limits of NASA’s mission

Earth Science Results

- Technology
- Missions/
Observations
- Data and
Archives
- Research
and Analysis
- Models/
Predictions



Societal Needs

- Management
Decisions
- Policy
Decisions
- Forecasting
- Response
& Recovery

GOMAP

Gulf of Mexico Initiative

- Focus the NASA SSC applied science program on the issues facing the Gulf of Mexico and its coastal regions as identified by the Gulf of Mexico Alliance (GOMA)
- Interact and collaborate with the coastal management community and other entities to identify areas that can benefit from the utilization of NASA Earth science
- Develop a 3–5 year strategic plan that will be used to guide the deployment of NASA resources in the Gulf of Mexico



NASA ROSES-2008 A.28 Solicitation

EARTH SCIENCE FOR DECISION MAKING: GULF OF MEXICO REGION

NASA solicits proposals that develop and demonstrate innovative and practicable applications of NASA Earth science observations, models, and research to support resource management, planning, and decision making activities in the Gulf of Mexico Region.

Total Amount of Funding	\$8M total
Deadline	9/30/2008
Anticipated Number of Awards	10–25 projects
Expected Range of Award per Project	\$150K – \$400K total
Period of Performance	up to 24 months
Expected Project Start Date	circa January 1, 2009

Partner in-kind contributions strongly encouraged. However, partner funding does not count toward funding level guidelines.

ROSES Solicitations Online:

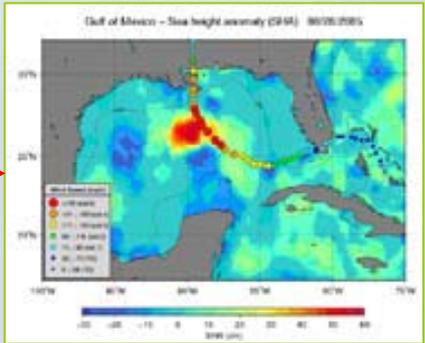
<http://nspires.nasaprs.com/external/>



Current Missions: Direct Coastal Applications

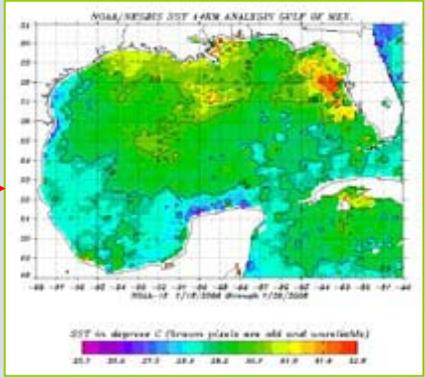
Jason-1 and Jason-2

- Ocean Surface Topography
- Sea Surface Height Anomalies
- Ocean Circulation
- Wave Heights
- Wind Speed



Terra and Aqua

- Colored Dissolved Organic Matter (MODIS)
- Chlorophyll (MODIS)
- Sea Surface Temperature (MODIS/AMSR-E)
- Ocean Surface Roughness (AMSR-E)

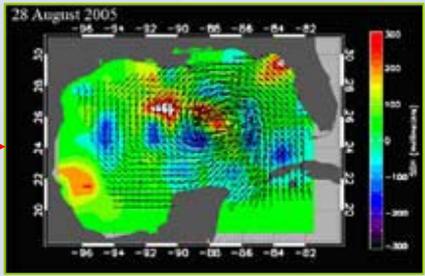


GRACE

- Ocean Circulation

QuikSCAT

- Wind Speed and Direction Over Oceans



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COAST: Coastal Online Assessment and Synthesis Tool

Purpose: Integration and visual analysis of coastal Gulf of Mexico datasets **End-User:** Coastal community

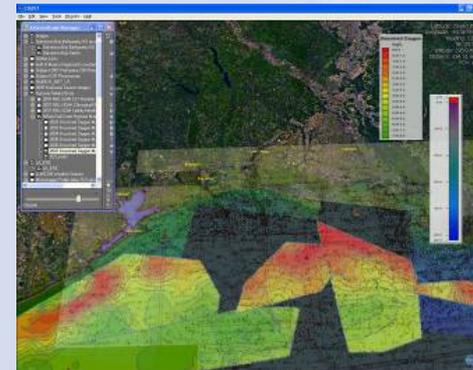
COAST integrates disparate coastal data sets from NASA and other federal and state sources.

COAST provides new data visualization and analysis capabilities.

COAST enhances the capabilities of the NASA open source 3D geobrowser, World Wind, developed at the NASA Ames Research Center.

Benefits Of An Open Source GeoBrowser ...

- *Free – core development is already paid for*
- *Extensible – install or develop functions that add value to you*
- *Worldwide developer community – new tools and support*



Why is it different?

- *Integrate your own data with other data sources and visualize the results*
- *Fuse different data types, such as spatial and spectral, for simultaneous visual analysis*
- *Visualize temporal changes in areas of interest*



preliminary
COAST 1.0.0 can be downloaded at
www.coastal.ssc.nasa.gov





Completed NASA SSC Gulf of Mexico Application Projects

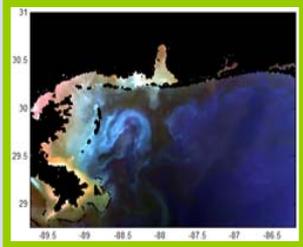
Regional Sediment Management

Purpose:
Detect suspended sediments using MODIS and VIIRS simulated data

End User:
U.S. Army Corp. of Engineers

Study Area:
Alabama, Mississippi, Louisiana

Project Leads:
Jean Ellis (NASA)
Maria Kalcic (SSAI)



Suspended Sediments Map

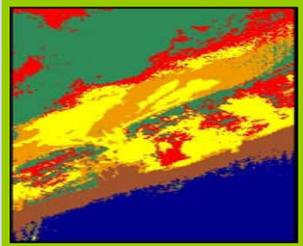
Coral Reef Early Warning System

Purpose:
Determine if NASA next generation sensors can produce key data layers for the NOAA CREWS decision support tool

End User: NOAA

Study Area:
Looe Key, FL; Kaneohe Bay, HI

Project Leads:
Callie Hall (NASA), Lee Estep (SSAI)



Benthic Classification Map

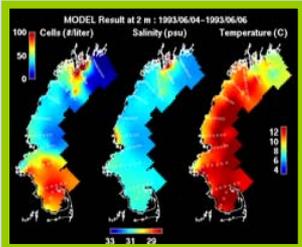
Harmful Algal Bloom

Purpose:
Identify current and future NASA data products that can be used in the NOAA HABMAPS decision support system

End User: NOAA

Study Area: Gulf of Mexico

Project Leads: Callie Hall (NASA), Lee Estep (SSAI)



HAB Forecast Map

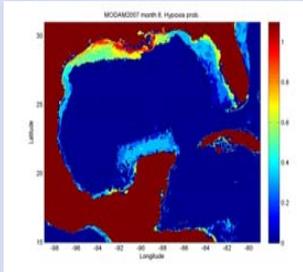
Hypoxia

Purpose:
Predict the spread of hypoxia using MODIS data and the time series product toolkit

Potential End User:
Regional Planners

Study Area: Gulf of Mexico

Project Leads:
Callie Hall (NASA), Bruce Spiering (NASA), Maria Kalcic (SSAI)



Hypoxia Probabilities Map

GO MAP



Discovery-Investigation-Implementation Project Selection Methodology

- **An independent Steering Committee was established in October 2007**
- **The Steering Committee reviewed 28 one-page Discovery project concepts in December 2007**
- **7 concepts were selected for Investigation proposal development**
- **The Steering Committee reviewed these proposals in March 2008**
- **4 projects were selected to conduct feasibility studies**
- **Steering Committee will review the results of these feasibility studies in November 2008**
- **The chosen projects will be Implemented in FY2009**

Steering Committee

NASA Stennis Applied Science Program - Gulf of Mexico Initiative

Dr. Becky Allee, NOAA Gulf Coast Services Center

Mr. David Ruple, Grand Bay National Estuarine Research Reserve

Dr. Dawn Lavoie, United States Geological Survey

Dr. James Pahl, Louisiana Department of Natural Resources

Mr. Charles Kovach, Florida Department of Environmental Protection

Dr. Larry McKinney, Harte Research Institute for Gulf of Mexico Studies

Dr. Steve Lohrenz, University of Southern Mississippi

Dr. Michael Carron, Northern Gulf Institute

Mr. Phil Bass, U.S. Environmental Protection Agency, Gulf of Mexico Program

Ms. Roberta Swann, Mobile Bay National Estuary Program

Dr. Rost Parsons, NOAA National Coastal Data Development Center

Mr. Steven Wolfe, Florida Department of Environmental Protection

Current NASA SSC Gulf of Mexico Application Projects

- Gulf of Mexico Alliance Application Pilot: Land-Use and Land-Cover (LULC) Change from 1974–2008 around Mobile Bay, AL (Dr. Jean Ellis, NASA)
- Satellite Estimation of Suspended Particulate Loads in and around Mobile Bay, AL (Dr. Jean Ellis, NASA)
- Discovery-Investigation-Implementation Projects
 - Estimating Relative Nutrient Contributions of Agriculture and Forests Using MODIS Time Series (Bruce Spiering, NASA)
 - Use of NASA Satellite Data in Monitoring Gulf Coast Forest Conditions (Duane Armstrong, NASA)
 - Coastal Marsh Monitoring for Persistent Saltwater Intrusion (Callie Hall, NASA)
 - A Standardized Remote Sensing Product for Water Clarity Estimation within Gulf of Mexico Coastal Waters (Dr. Jean Ellis and Callie Hall, NASA)

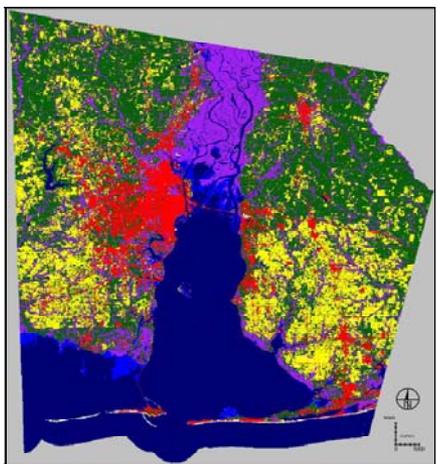
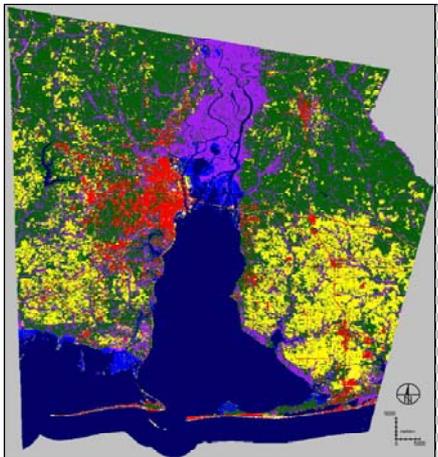
Gulf of Mexico Alliance Application Pilot: Land-Use and Land-Cover (LULC) Change from 1974–2008 around Mobile Bay, AL

Purpose: Assess LULC changes of Mobile and Baldwin counties, AL, for 1974–2008 **End-User:** Mobile Bay NEP

Class	1974		2008	
	Total Acres	Percent	Total Acres	Percent
Open water	485,302	26.4	504,431	27.2
Barren	3,504	0.2	7,954	0.4
Agriculture	272,024	14.8	284,436	15.3
Non-woody wetland	38,631	2.1	39,964	2.2
Upland forest	674,298	36.6	586,523	31.6
Woody wetland	270,618	14.7	282,213	15.2
Urban	96,688	5.3	151,644	8.2
Total	1,841,065	100.0	1,857,165	100.0

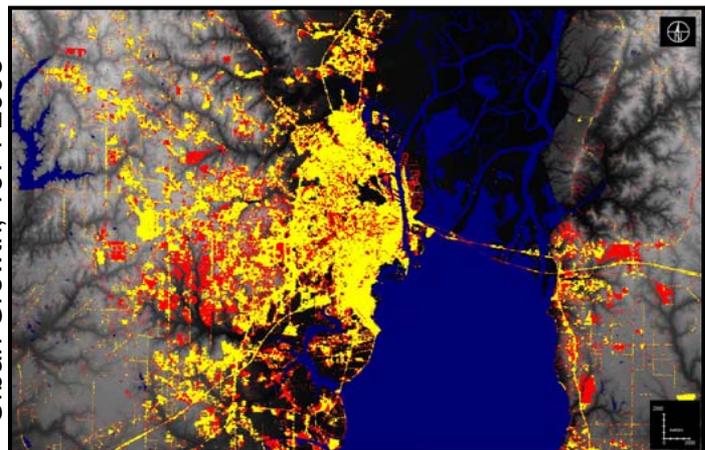
Landsat-derived LULC change statistics from 1974-2008.

Landsat-derived geospatial statistics to analyze LULC in Mobile and Baldwin counties have been calculated for nine dates between 1974–2008. Project data and data products are tailored for Mobile Bay NEP and will be available on-line [Regional Ecosystem Data Management (NOAA/NCDDC)].



(Top) Landsat MSS (11/12/1974); (Bottom) Landsat TM (3/16/08)

Urban Growth, 1974-2008



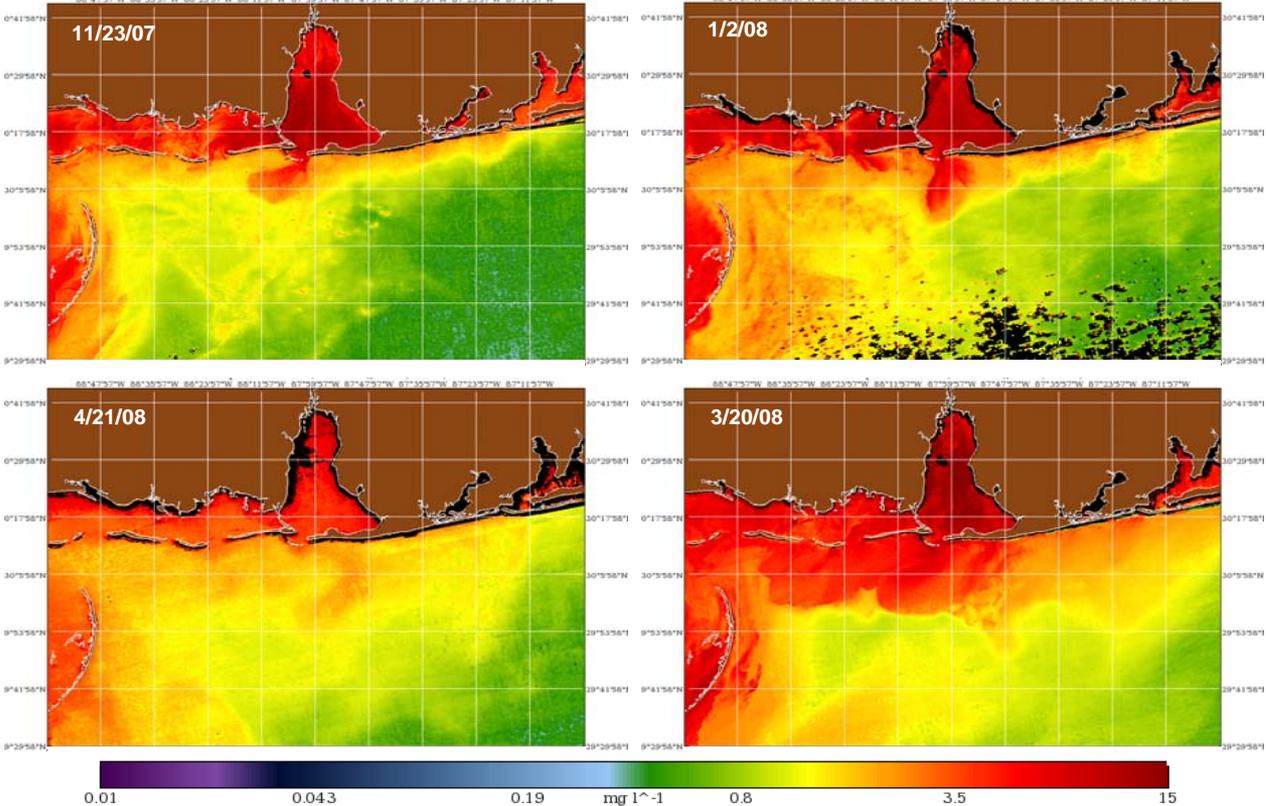
Yellow: 1974 and 2008 urban extent (Landsat MSS, 11/12/1974); Red: Urban growth from 1974 to 2008 (Landsat TM, 3/16/08); Backdrop: USGS DEM, darker grey shades indicate lower elevations

Satellite Estimation of Suspended Particulate Loads in and around Mobile Bay, AL

Purpose: Examine spatial and temporal variability of the Mobile Bay sediment plume **End User:** USACE

The variability of the Mobile Bay sediment plume, which impacts water clarity, dissolved oxygen levels, and ultimately seagrass health, will be tracked using MODIS (250 m) and in situ measurements from 10/1/07 to 9/30/08. Total suspended solids are partitioned into organic and inorganic content. Plume area will be delineated and a time-series analysis will be produced.

Total Suspended Solids (organic and inorganic particulates, mg/l)

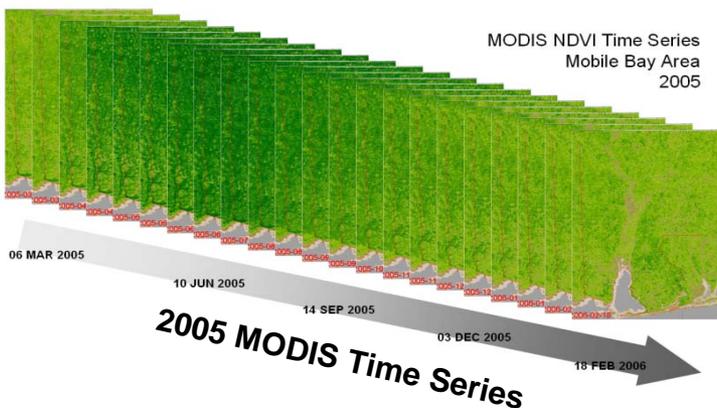


GOMIAP

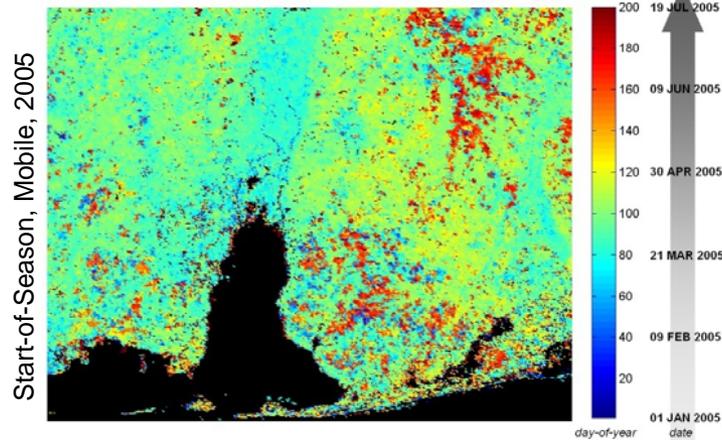
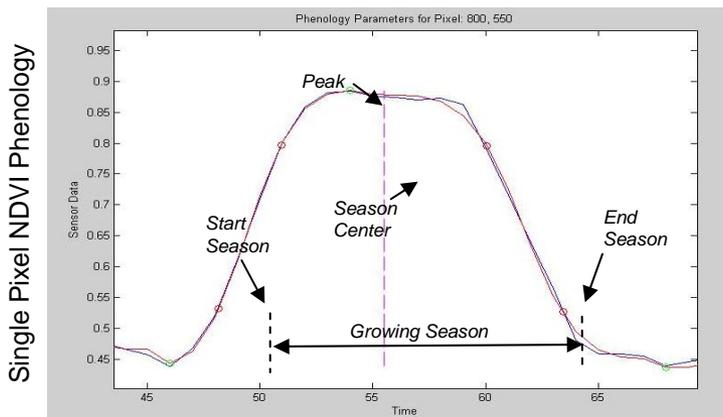
Estimating Relative Nutrient Contributions of Agriculture and Forests Using MODIS Time Series

Purpose: Demonstrate viability of nutrient source products for small to medium watersheds around Gulf of Mexico

End-User: MDEQ, potentially other state environmental agencies



Around the Gulf of Mexico, high-input crops in several regions make a significant contribution to nutrient loading of small to medium estuaries and the near-shore Gulf. In addition to crops, management of timberlands in proximity to the coasts also plays a role. Nutrient source information products can be derived from remotely sensed time series data. Conceptually, these products are intended to complement estuarine nutrient monitoring.



Use of NASA Satellite Data in Monitoring Gulf Coast Forest Conditions

Purpose: Assess potential of Gulf Coast forest monitoring products derived from NASA satellite data

End User: USDA Forest Service, USGS NWRC, and the LA-DNR

Regional monitoring of forest damage from hurricanes

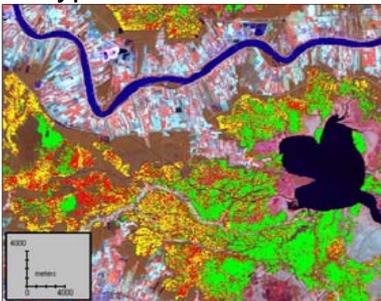
Stand-specific monitoring of baldcypress forest

Study areas – coastal Mississippi and Louisiana

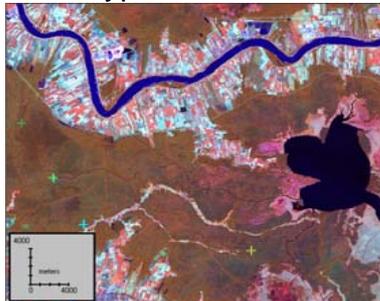
Status – developed and began to assess preliminary products

- Baldcypress stand condition products from Landsat and ASTER data
- Hurricane Katrina forest damage products from MODIS data

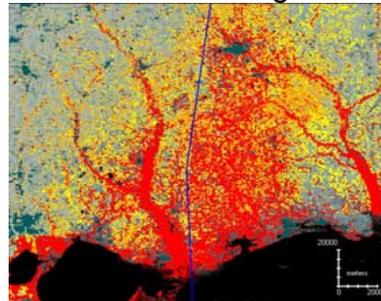
Landsat
Cypress Classification



Reference
Cypress Points



MODIS-Based
Forest Damage



NLCD
% Tree Canopy Cover



Coastal Marsh Monitoring for Persistent Saltwater Intrusion

Purpose: Assess the feasibility of using NASA satellite data to monitor persistent saltwater intrusion in coastal marshes

End User: USGS National Wetlands Research Center and Louisiana Department of Natural Resources

Approach: Use time series of vegetation indices to identify stressed vegetation (NDVI), moisture indices to determine if persistent flooding is cause of stress (NDMI, NDWI), and CDOM absorption to determine flood water salinity (a_g – salinity relationship)

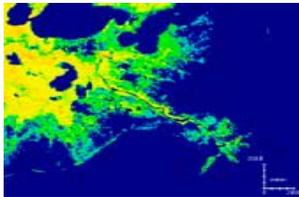
- **Sensors:** MODIS, Landsat, Hyperion, ALI, ASTER
- **Tools:** Time Series Product Tool (TSPT)

Study Area: Sabine-Calcasieu River Basin (Louisiana)

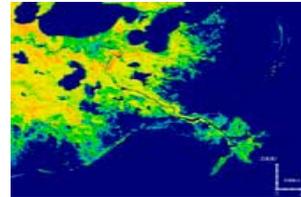
Decision Support: Coast-Wide Reference Monitoring System (CRMS) created by Louisiana Coastal Wetlands Conservation & Restoration Task Force

- Determine effectiveness of Breaux Act restoration projects by providing reference sites for which no paired reference areas exist
- Ensure strategic coastal plan for Louisiana is effective in re-creating sustainable coastal ecosystem

Selected Accomplishments: Analyzed NDVI, NDMI, NDWI time series (2004–2006) of study area; isolated storm surge events and time-shifts in output indices and implemented user-defined region-of-interest selection with TSPT; validated satellite data products with extensive in situ data from CRMS monitoring sites; preliminary generation of additional indicators based on multiple time series variables.



Cumulative NDVI Integral 2004

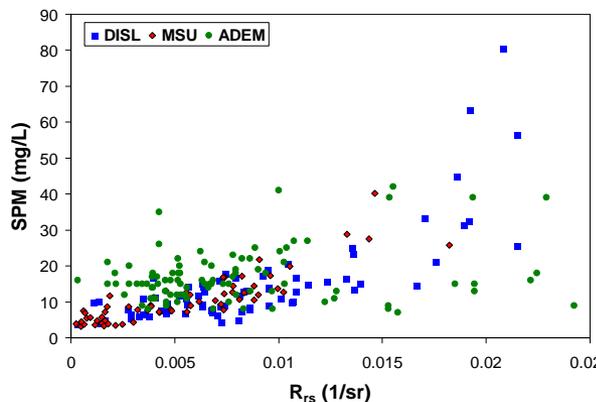
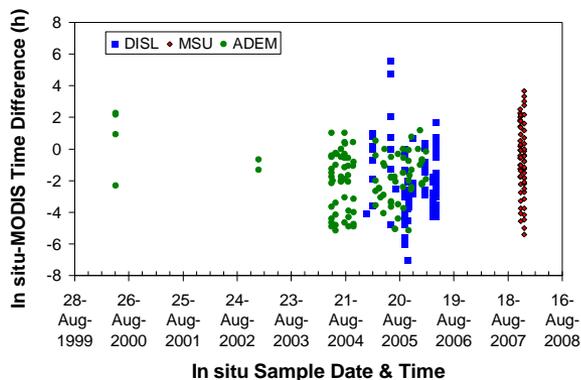


Cumulative NDVI Integral 2006

A Standardized Remote Sensing Product for Water Clarity Estimation within Gulf of Mexico Coastal Waters

Purpose: Develop a standard remote sensing data product for total suspended sediment

End User: Gulf of Mexico Alliance Nutrients and Water Quality Priority Issue Team

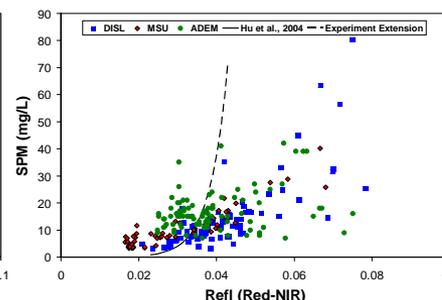
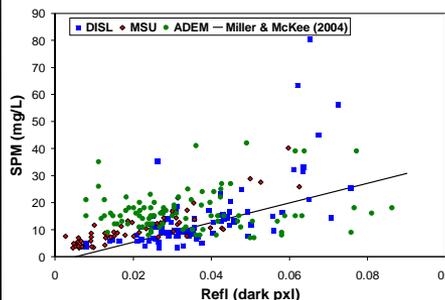


Obtained and atmospherically corrected MODIS data that was temporally and spatially concurrent to the in situ measurements. Mobile Bay data shown here.

In situ data from 2002 to 2007: Total suspended sediment (TSS) suspended particulate matter (SPM) Secchi disk depths.

Data courtesy of:
 MSU, DISL-MSU-NASA, and Alabama Department of Environmental Management (ADEM). Additional data (not shown) has been provided by University of South Mississippi (USM) and Louisiana Department of Environmental Quality (LDEQ).
Additional data are welcome!

Tested the correspondence between published algorithms and our data. Mobile Bay data are shown here.



DEVELOP

DEVELOP is a student-run, student-led scholarship program that conducts research projects relevant to community concerns to demonstrate the benefits of NASA Applied Sciences capabilities.

Projects are conducted in 10- to 20-week terms and are presented at high-level forums to target community leaders and policy makers as well as industry and federal agency partners.

The goal is to establish ongoing local activity that continues to benefit the community and foster human capital development.

More information on the program can be found at:

<http://develop.larc.nasa.gov/index.html>



Assessing Hurricane Forest Damage

The New Course

- Implement the NASA Coastal Initiative 3–5 year strategic plan
- Win ROSES proposals
- Continue to build partnership

"The pessimist complains about the wind; the optimist expects it to change; the realist adjusts the sails."

-William A. Ward



Questions?

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Panel Questions

- Discuss a successful collaboration that resulted in adding an operational product.
 - What are the criteria for adding an operational product? (Local/State/Fed)
 - How long does it really take to transition research to operations?
- What are the barriers that the research and operational partner need to consider when transitioning a research application project?
- Internal to your organization, what is the long-term view of regionalization and how does it affect partnerships?
- What are the major barriers to implementing Remote Sensing prototype products for state and local agencies?
- How important is it at the federal, state, and local perspective to link climate change and climate variability to projects proposed for the GOM?
- Discuss the best methods to publicize successes in partnership relationships and applications.



Unedited Backup slides follow

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Missions In Development: Direct Coastal Applications

- **Aquarius**
 - Sea Surface Salinity
 - Surface Roughness
- **NPP (VIIRS)**
 - Algal Blooms
 - Surface Temperature
 - Colored Dissolved Organic Matter
 - Suspended Matter



Decadal Survey Missions: Direct Coastal Applications

- **SMAP** (Soil Moisture Active Passive)
 - Algal Blooms
 - Waterborne Infectious Disease
 - Surface Water and Ocean Topography
- **SWOT** (Surface Water/Ocean Topography)
 - Ocean Circulation
 - Algal Blooms
 - Waterborne Infectious Disease
 - Surface Water and Ocean Topography
- **GEO-CAPE** (Geostationary Coastal and Air Pollution Events)
 - Coastal Water Quality
 - Algal Blooms
 - Waterborne Infectious Disease
- **ACE** (Aerosol/Cloud/Ecosystem)
 - Algal Blooms
 - Waterborne Infectious Disease
- **PATH** (Precipitation and All-weather Temperature and Humidity)
 - Algal Blooms
 - Waterborne Infectious Disease
- **GRACE II**
 - Ocean Circulation
 - Sea Surface Height

← 2010-13

2013-16

2016-20

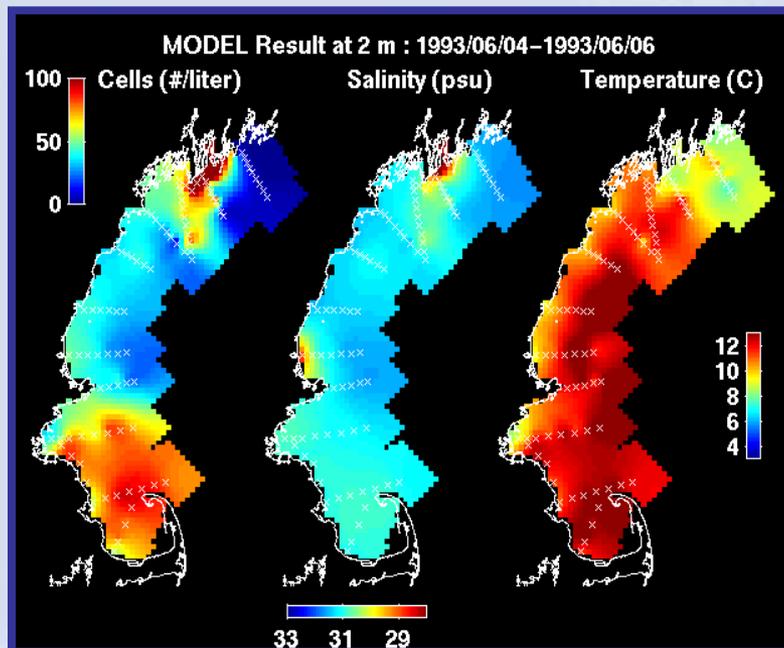
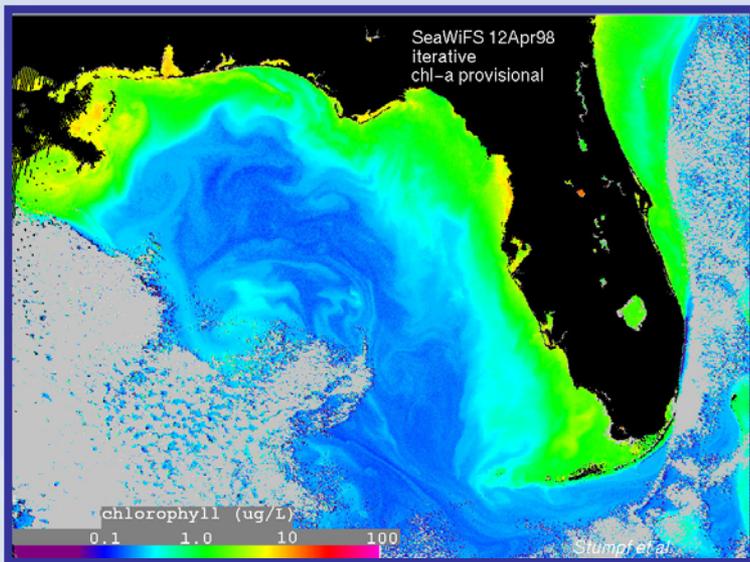
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Coastal Management Predicting Algal Blooms



Current Capacity:

Respond to bloom detection with bio-physical models using satellite data and in situ sampling to forecast trajectories and impacts



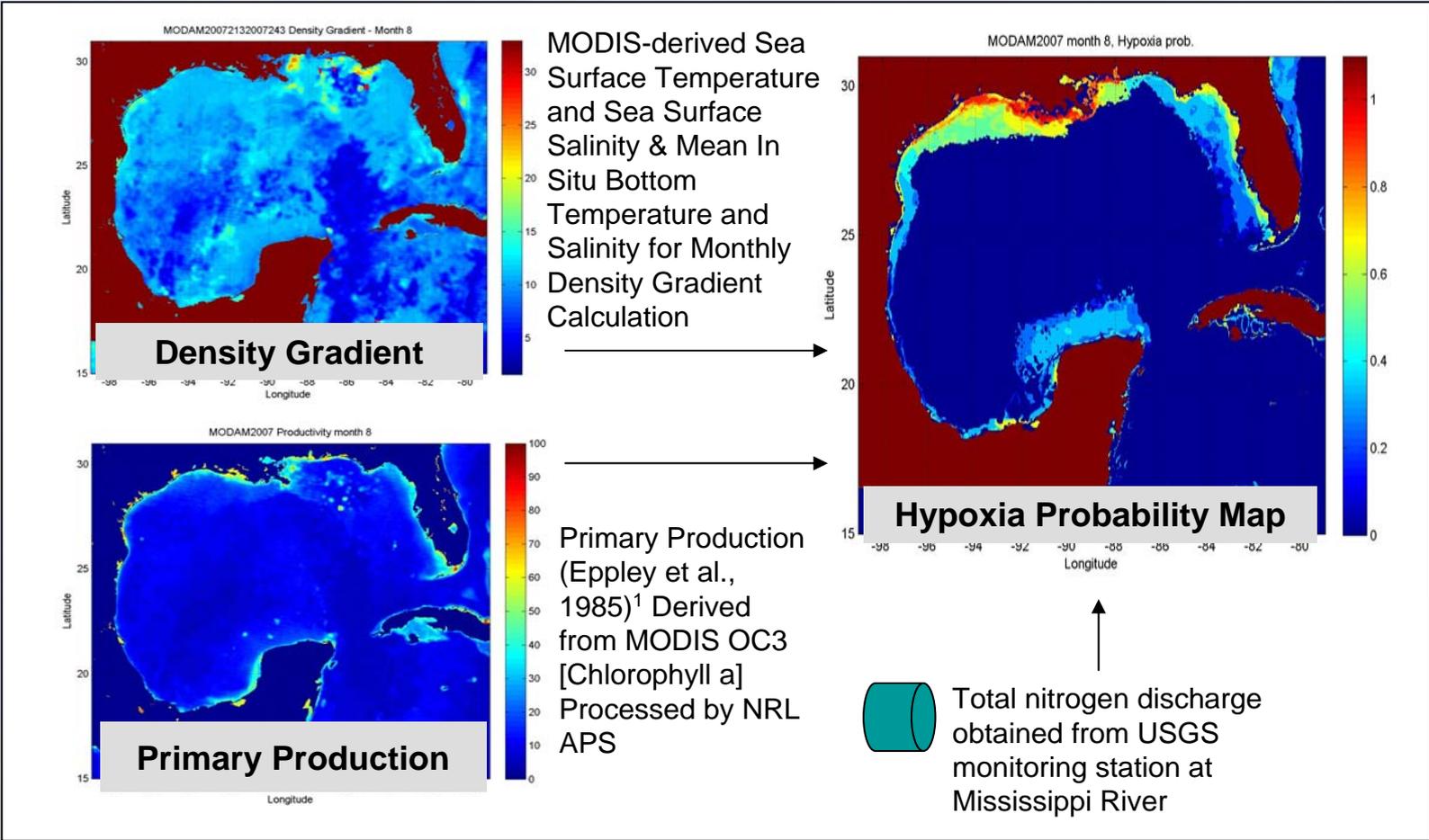
Future Capacity:

Prediction of bloom onset

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Hypoxia Probability Map

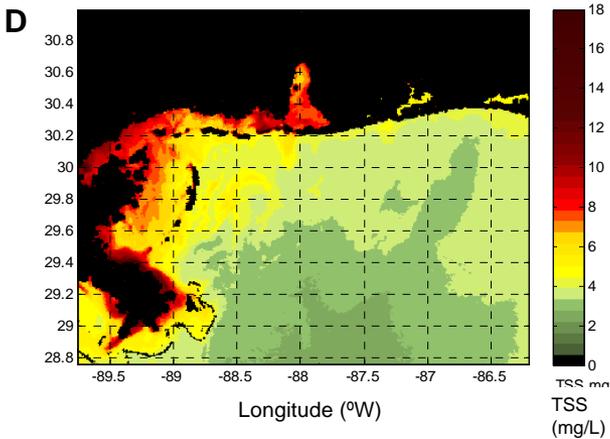
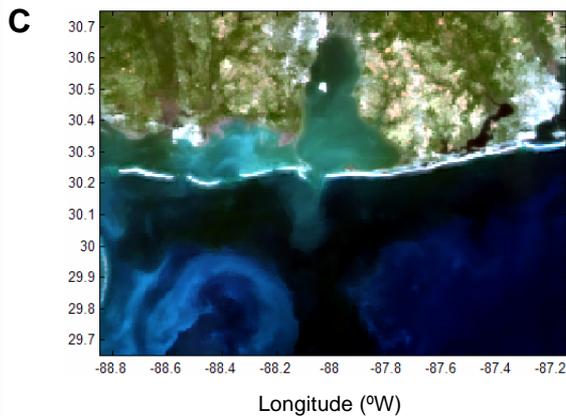
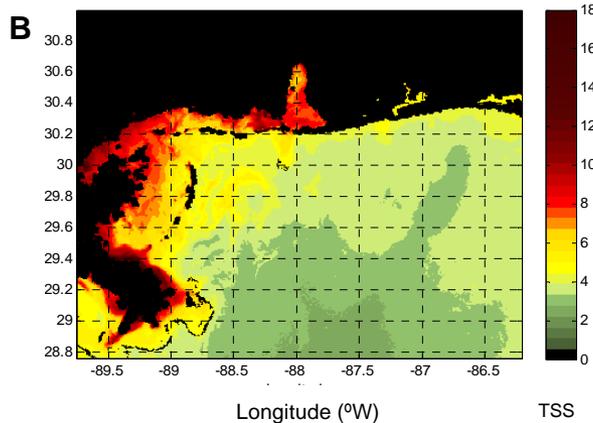
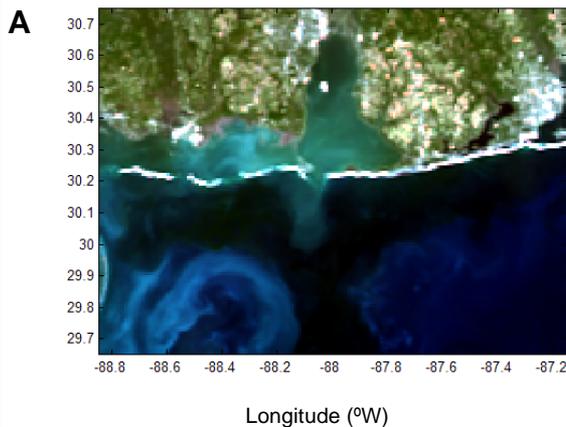


¹Eppley, R.W., E. Stewart, M.R. Abbott, and U. Heyman. 1985. Estimating ocean primary production from satellite chlorophyll. Introduction to regional differences and statistics for the southern California Bight. *Journal of Plankton Research* 7:57-70.

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Mobile Bay Sediment Plume Mapping Using MODIS and VIIRS

Purpose: Identify the Mobile Bay sediment plume using MODIS and simulated VIIRS data



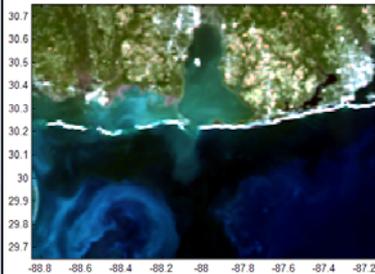
MODIS images (A&B, 1000m, 9 Nov 2007) are calibrated and validated using in situ data collected in collaboration with Mississippi State University and Dauphin Island Sea Lab. VIIRS simulations (C&D, 750m, 9 Nov 2007) are based on MODIS data.

Chalky, white colored waters in A&C indicate higher total suspended sediments (TSS). Higher TSS is evidenced by darker red shades in B&D. TSS concentrations in excess of 8 mg/L are found inside Mobile Bay.

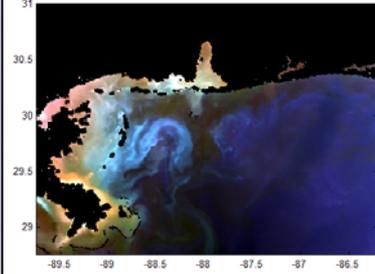
This project demonstrates VIIRS may be used to detect TSS in coastal waters.

RSM Project Plan

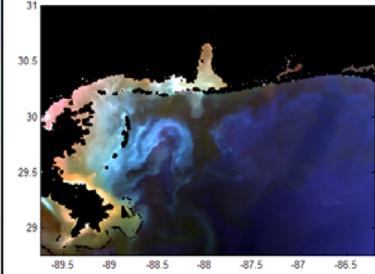
1. Obtain MODIS images



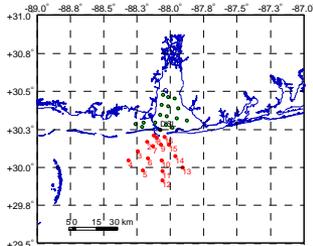
2. Enhance MODIS to detect TSS concentrations



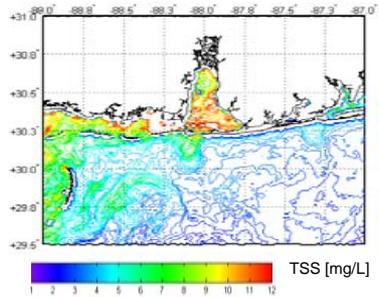
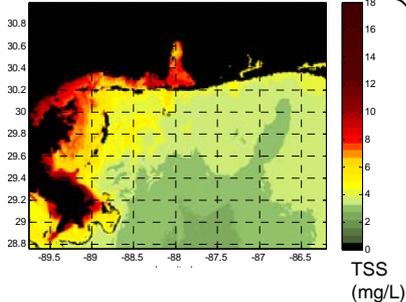
3. Simulate VIIRS using MODIS



4. Calibrate and validate MODIS with in situ data



5. Determine TSS concentrations



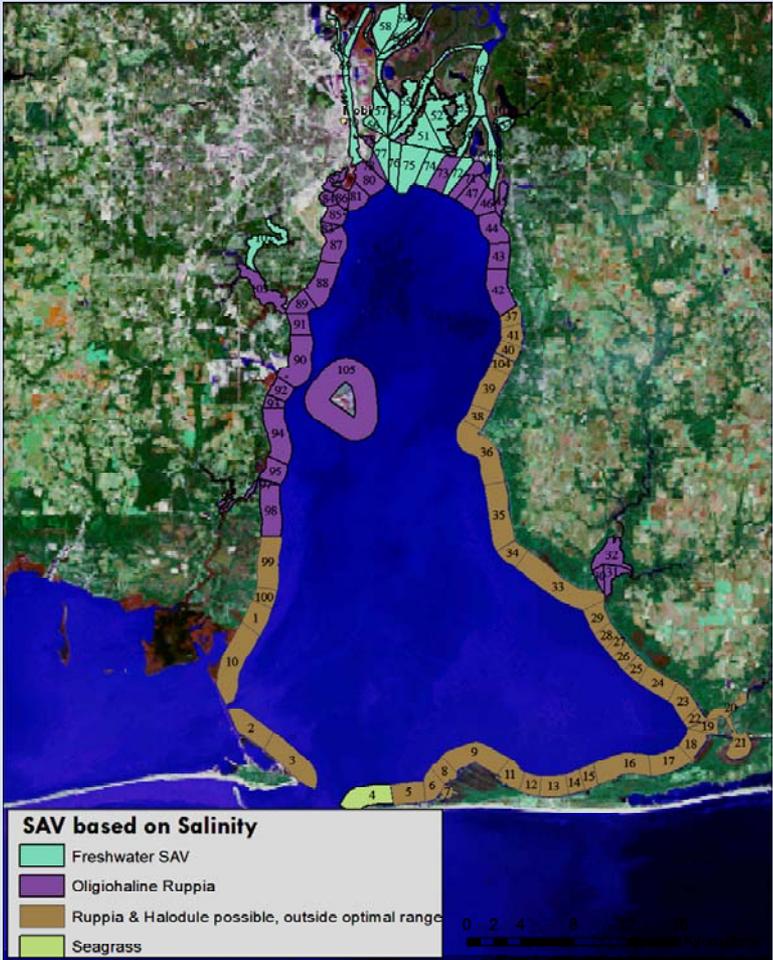
Coastal Marsh Monitoring for Persistent Saltwater Intrusion

Callie Hall (NASA), Maria Kalcic and Lee Estep (SSAI), Greg Steyer and John Burras (USGS)

Next Steps

- 1) Perform land-cover change analysis using all acquired datasets and indices to determine best indicators of persistent flooding
- 2) Produce time series of flooded areas using best set of indicators
- 3) Perform additional salinity studies using ALI and other datasets to improve model estimates for different dates before and after Hurricane Rita
- 4) Investigate additional modeling approaches to salinity inversion
- 5) Produce time series of salinity gradient over the study area for either monthly or seasonal averages
- 6) Merge salinity time series with flooding time series to produce time series maps for determination of persistent saltwater intrusion
- 7) Meet with USGS CRMS representatives in Baton Rouge in late July/early August to discuss investigation results and preliminary products

Gulf of Mexico Regional Collaborative (GOMRC) Restoration Prioritization Toolset Demo: SAV Prioritization and Salinity Classification



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