Northern Gulf Institute 2010

NGI

NORTHERN GULF INSTITUTE

a NOAA cooperative institute

NORTHERN GULF INSTITUTE RESEARCH 2010

The Northern Gulf Institute (NGI) is a National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute, a partnership of five complementary academic institutions and NOAA addressing important national strategic research and education goals. Mississippi State University leads this collaboration, partnering with the University of Southern Mississippi, Louisiana State University, Florida State University, Alabama's Dauphin Island Sea Lab, and NOAA scientists at various laboratories and operational centers in the Northern Gulf of Mexico region.

The NOAA Cooperative Institute Science Review Panel recognized NGI for its significant efforts to address important questions related to the NOAA Strategic Goals. NGI develops, operates, and maintains an increasingly integrated research and transition program, the results of which fill priority gaps or reduce limitations in current awareness, understanding and decision support of the Gulf region. Research incorporates regional needs of the Gulf of Mexico research plan, Gulf of Mexico Governor's Action Plan II, and the Interagency Ocean Policy Task Force. NGI has been recognized as critical and well positioned to provide baseline, current, and future science and outreach needs of the region impacted by the April 20, 2010, Deepwater Horizon Incident.

VISION

NGI will be a regional leader providing integrative research and education to improve the resiliency and conservation of the Northern Gulf of Mexico.

MISSION

NGI conducts high-impact research and education programs in the Northern Gulf of Mexico region focused on integration - integration of the land-coast-ocean-atmosphere continuum; integration of research to operations; and integration of individual organizational strengths into a holistic program. The program shall measurably contribute to the recovery and future health, safety, resilience and productivity of the region, through sustained research and applications in a geospatial and ecosystem context.

RESEARCH THEMES

- Ecosystem Management
- Geospatial Data Integration and Visualization
- Coastal Hazards
- Climate Effects on Regional Ecosystems

GUIDING NGI RESEARCH

Three Councils help guide the NGI research. The NGI Council of Fellows serves as a board of director's with representation from NOAA and the 5 university partners. The NGI Executive Council provides high level strategic guidance with representatives of several line offices within NOAA. Important stakeholders are represented on the NGI Advisory Council.

The NGI Advisory Council members represent:

- NOAA National Coastal Data Development Center
- NOAA National Marine Fisheries Service
- NOAA Gulf Coast Services Center
- NOAA National Data Buoy Center
- NOAA National Weather Service LMRFC
- Coastal States Organization
- EPA Gulf of Mexico Program
- The Nature Conservancy
- Florida Sea Grant College Program
- USGS Gulf Coast & LMV
- USDA National Sedimentation Lab
- Grand Bay National Estuarine Research Reserve
- National Park Service Gulf Coast Network
- MS-AL Sea Grant Consortium
- MS Department of Marine Resources
- U.S. Army Corps of Engineers
- Louisiana Sea Grant College
- NASA Coastal Programs

IMPORTANT RESEARCH ACCOMPLISHMENTS

Important NGI research accomplishments address regional resource manager's needs with the tools and protocols transferrable to other coastal environs.

NGI Research is leading to improved understanding of:

- the life cycle and habitats of the gag grouper (*Mycteroperca microlepis*), a major commercial and game fish in the Big Bend region of Florida;

- the relationship between sediments and mercury in the Mobile Bay system including the first watershed inputs of methylmercury to Mobile Bay. The upstream or marginal areas with adjacent wetlands such as Weeks Bay and the Delta appear to be sites of net mercury methylation, leading to the hypothesis that similar areas around the Gulf of Mexico will likewise be higher in mercury levels;

- the impact of Mississippi River freshwater diversions and their increased sediment loads facilitating a scientifically controlled decision process on the use of fresh water diversions;

- inexpensive living shoreline restoration approaches that have subsequently been adopted by state government and Nature Conservancy coast line restoration efforts;

- transferable Integrated Ecosystem Assessment protocol using the NGI Ecosystem Data Assembly Center (EDAC). Working in conjunction with the NOAA National Coastal Data Development Center, the NGI data management system, Department of Defense imagery and ocean model outputs providing historic and in near real-time to researchers. EDAC provides the Navy global and Gulf of Mexico ocean model data accessed by the U. S. Coast Guard and NOAA for both research and operational search and rescue operations;

- developing prototype Integrated Ecosystem Assessments in multiple regions of the Northern Gulf with the NOAA Gulf of Mexico Regional Collaboration Team through workshops and a multi-university project;

- new storm tracking technologies including development and testing of the Weather In-Situ Deployment Optimization Method wind current tracking research balloons. NGI is also the Gulf of Mexico test bed for NOAA Unmanned Aircraft System development;

- a revised Saffir Simpson scale, based on tropical cyclone size, intensity, storm speed, and continental shelf slope/depth will help make coastal communities more resilient. The new scale accounts for all surge factors and will help coastal residents and planners better appreciate risks associated with hurricane storm surge; and

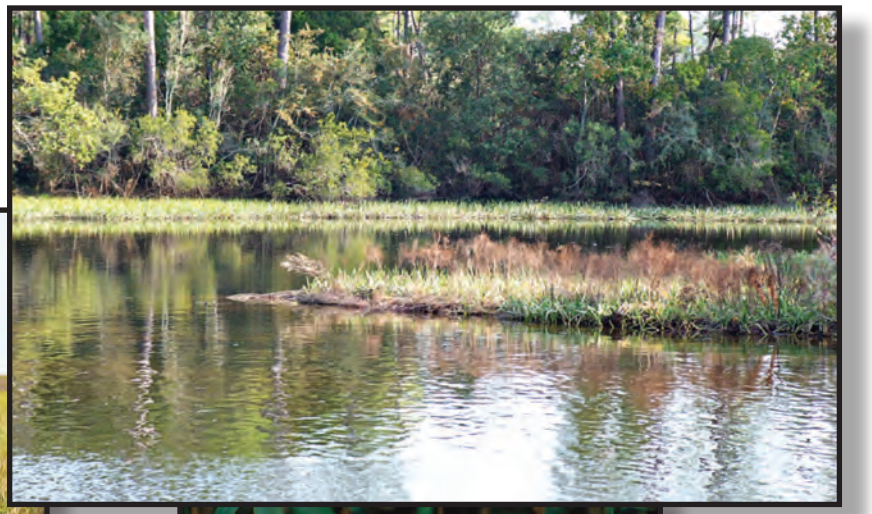
- air-sea CO_2 fluxes in the Northern Gulf of Mexico based on *in situ* observations, and spatial and temporal interpolation of remotely sensed and modeled data. Regions with low salinity impacted by outflow of the Mississippi river were found to be year-round CO_2 sinks, attributed to the large nutrient loads and resulting enhanced biological productivity;

NGI RESEARCH THEME:
ECOSYSTEM MANAGEMENT

The ecosystems in the Northern Gulf are the home to valuable fisheries, important recreational activities, and many commercial operations including fossil fuel extraction and coastal industries. The region needs more monitoring and basic information to support resource management. Fisheries ecosystem based management is a fundamental element in NOAA's Five Year Strategic Plan and a recommendation of the President's Commission on Ocean Policy as part of an overall strategy to protect, preserve, and utilize our marine resources.

Research Theme Objectives

- Monitoring and assessment of coastal marine ecosystems in the Northern Gulf
- Ecosystem-based fisheries management
- Circulation modeling and observations for ecosystem management
- Coastal ecosystem resiliency



Delta Ecosystem Forecasting System

The Delta Ecosystem Forecasting System researches the effects of different types of pulsing scenarios on coastal ecosystem dynamics. Two fundamental types of pulses that are studied within this project are: 1) pulsing of controlled river diversion structures that simulate specific frequency and duration events on ecosystem state change, and 2) proposed pulsing of river water in a basin with much longer freshwater residence time. We are developing and applying a series of linked simulation models that are used to evaluate the hypotheses that contrast how energy and nutrients are propagated up the food chain and exported under the many small and the fewer large pulsing scenarios.

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Trophic Linkages and Biomass Production in Estuarine Ecosystems

Evidence suggests that the migration of juvenile fishes offshore represents a significant export of energy from estuaries. Although this link has rarely been quantified, biogeochemical cycling may be affected in Northern Gulf of Mexico estuaries through energy translocation via biomass export by estuarine dependent fishes, and this pathway may be important in the top-down control of energy subsidies to coastal ecosystems. The central tenet of our proposal is that wetlands and adjacent waters associated with deltas are pulse-regulated ecosystems. Different spatial and temporal scales and the pattern of pulsed freshwater inputs are critical parameters controlling nutrient cycling, productivity, residence time and export, and trophic structure.

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Watershed Modeling Improvements to Enhance Coastal Ecosystems

The goal of this project is improved watershed-wide decision support for resource management agencies. Improved hydrologic and water quality data collection, analysis, and simulation tools are demonstrated on selected catchments of the Mobile River and Weeks Bay watersheds. The following interconnected processes are evaluated in this study: rainfall-runoff generation; sediment yield; phosphorus transport; stream bank erosion; best management practices; and habitat response.

Contact: William McAnally at mcanally@gri.msstate.edu

Monitoring and Assessment of Coastal and Marine Ecosystems in the Northern Gulf

The overall goal of this project has been to document the seasonal variability of critical water quality parameters in key coastal regions to provide a clearer understanding of the impacts of the Lower Pearl River estuary and the Bay of Saint Louis on the western Mississippi Sound and further offshore into the Mississipp Bight. Data collected as part of this NGI effort, as well as historical data from the region, have been assembled in a database and are available to researchers and environmental managers to aid in decision-making.

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Quantifying Ecosystem Services of Different Coastal Habitat Types

This project develops quantitative tools for measuring ecosystem services of different aquatic habitat types in the coastal Gulf of Mexico ecosystem. Ecosystem services related to habitat quality include nutrient recycling, amelioration of anthropogenic stressors, and the promotion of biological production. This project quantifies changes in secondary production and the transfer of secondary production from two important types of coastal habitat (emergent saltmarsh and oyster reefs) to the larger coastal ecosystem in response to both habitat restoration and degradation. Deliverables from this project are data on the habitat quality-production relationship for these two key habitat types, modeling tools for measuring and predicting fishery response to habitat change, and an assessment of habitat quality based on collected data and model analysis projected onto GIS map layers.

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Development of Prototype Integrated Ecosystem Assessments in the Northern Gulf of Mexico

The goal of this work is to begin the process of generating an Integrated Ecosystem Assessment (IEA) for the Gulf of Mexico and to identify a way forward to complete that IEA. The specific objectives are to: identify and summarize IEA Drivers and Pressures for three representative systems in the Northern Gulf of Mexico; identify the similarities and differences in Drivers and Pressures among the three systems; and formulate an approach to complete the full 5-step IEA process for the Gulf of Mexico.

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From Physics to Fish: Modeling the Effect of Pulsed River Diversion on Fish Distribution

Our project combines hydrodynamics, water quality, and individual-based fish models into a single integrated "physics to fish" model, and examines how changes in salinity, temperature, and water quality resulting from diversions affect several key fish species. The individual-based fish model is being developed to simulate the movements of thousands of individuals in the same 3-dimensional spatial grid as used by the hydrodynamics model. We examine both the short- and long-term influences of different diversion release scenarios on fish distributions and environmental conditions experienced by exposed fish.

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Riverine and Estuarine Carbon Export to the Coastal Ocean, Northern Gulf of Mexico

This project studies carbon export dynamics and transformations in the river and the bay, addressing three hypotheses: (1) The Barataria Bay is a net sink for atmospheric CO_2 on an annual basis, but may be a seasonal source of CO_2 during some months; (2) The Mississippi River is a net source of atmospheric CO_2 on an annual basis, with seasonal highs and lows that are related to fluctuations in temperature and turbidity; (3) The bay and the river each export about the same amount of labile organic carbon to the coastal ocean.

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Food Webs Without Borders: A Case for Ecosystem-based Management in the Northern Gulf of Mexico

The importance of food web interactions at the interface among terrestrial, aquatic and marine ecosystems is poorly understood within coastal areas of Northern Gulf of Mexico. Among the issues which require detailed examination is the quantification of the strength of food web linkages among these ecosystems. Another issue is the determination of the productivity of estuaries in the region and the fate of the extraordinary primary production that characterizes these ecosystems. The project was designed to assess the importance of: 1) energetic and nutrient subsidies from vegetated habitats in the Mobile Bay Delta and surrounding terrestrial habitats to the productivity of the base of the Mobile Bay food web and 2) migratory fishes and crustaceans in supporting the growth of higher order consumers living in the oligohaline reaches of this system.

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NGI and National Coastal Data Development Center

Hyperspectral Imagery Support to the Gulf of Mexico Alliance Habitat Project for Grand Bay National Estuarine Research Reserve
The Northern Gulf Institute, the Environmental Cooperative Science Center and Grand Bay National Estuarine Research Reserve partnered to conduct a flyover and collect hyperspectral data for the entire Grand Bay NERR. This imagery is one of the largest continuous coverage hyperspectral datasets along the Gulf of Mexico and the only dataset that completely covers a National Estuarine Research Reserve.

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Monitoring and Assessment of Coastal and Marine Ecosystems in the Northern Gulf

Ongoing anthropogenic impacts are exacerbating effects of eutrophication worldwide, including in the Northern Gulf of Mexico and along the Mississippi coast. Macrobenthic communities offer effective indicators of biotic integrity, but their use for distinguishing anthropogenic stress from natural stress is tricky because estuarine organisms are eurytolerant. Conventional benthic indices are based largely on taxonomic information and are not equally sensitive to all types of stressors, equally applicable across all habitats, or directly linked to ecosystem function. Effective coastal management calls for benthic indicators that respond to specific stressors, apply across different habitats, and reflect ecosystem function. Organic enrichment followed by hypoxia engenders depauperate macrofaunal communities consisting mostly of small short-lived opportunistic organisms. Thus, macrobenthic process indicators that integrate body-size descriptors should also reflect effects of eutrophication. The overarching purpose of the macrofaunal indicator component of this project is to elucidate how macrobenthic function may be impaired by hypoxia in the Mississippi Bight region.

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Assessment of Ecosystem Services of Selected Coastal Habitat Types: Towards a Model-based Toolset for Management Planning

This project builds on previously developed quantitative models for estimating the ecosystem services of two important coastal habitat types (oyster reef and salt marsh). The objectives of this project are to take the existing model for the Pascagoula river and apply it to another estuarine system and species to test for mode generality. This project will provide both data and tools for ecosystem-based management decision making.

Contact: Richard Fulford at richard.fulford@usm.edu

Contrasting High and Low Relief Fishery Habitats of the Northeastern Gulf: Habitat Delineation, Food Web Components and Spatial Demographics

This project will bridge gaps in knowledge between inshore and offshore fisheries, explicitly habitat and biological interactions. Objectives include: 1) examining temporal and spatial patterns in fish community structure, abundance and demographics in an area of high and low relief hard bottom habitat and making inter-habitat comparisons of these parameters; 2) delineating and quantifying hard bottom habitats using side scan sonar; 3) collecting geo-referenced habitat video and still images for ground-truthing side scan data; 4) characterizing diets, predator-prey interactions, resource overlap and habitat-associated differences in diet of the reef fish communities within and across depths and habitats; and comparing those findings with those from low relief sites, and 5) comparing growth and condition of fishes between high- and low-relief habitat types, and examining the effect of the scale of a species' movements (or site fidelity) on these parameters.

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Integrated Research for the Northeast Gulf of Mexico Big Bend Region

The project is an integrated study of the marine ecosystem of the northern West Florida Shelf, including the Big Bend Region (BBR), using an interdisciplinary observational, experimental, and modeling approach. The objectives of the research are: to understand the physical processes responsible for distributing water within the BBR, including cross-shelf transport of riverine-influenced seawater, transport of biological material, and the natural and anthropogenic variability of the system; to understand the nutrient cycling, resource connectivity, and trophic interactions between BBR river-dominated coastal areas, nearshore seagrass habitats, estuaries and offshore reef fish communities; and to study the processes supporting regional productivity of a number of reef fish species important to both commercial and recreational fisheries, using gag grouper (*Mycteroperca microlepis*), as a primary model.

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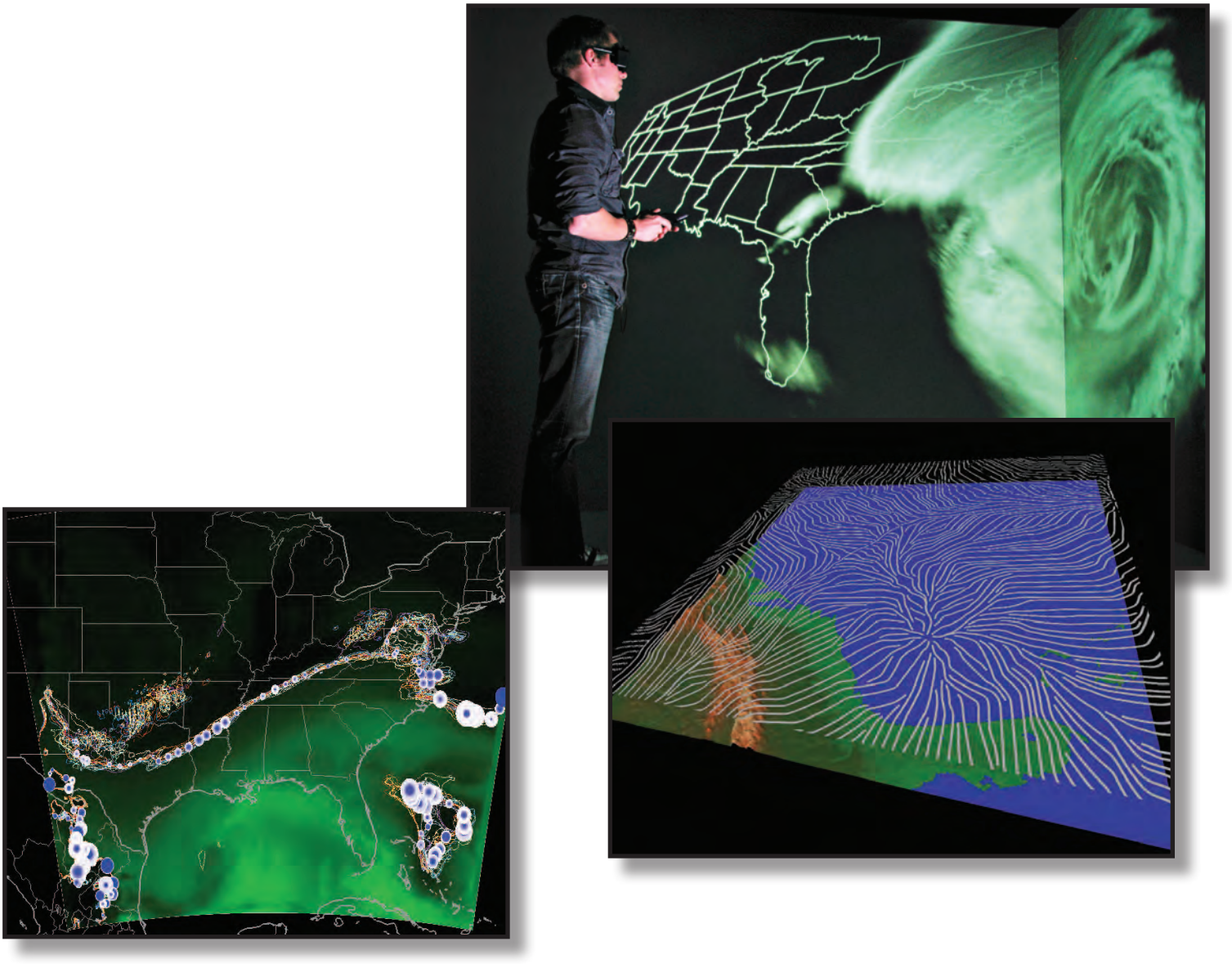
NGI RESEARCH THEME:

GEOSPATIAL DATA INTEGRATION AND VISUALIZATION IN ENVIRONMENTAL SCIENCE

The ability to assess the distribution of features in the coastal environment has improved dramatically over recent decades. Many organizations are involved in collecting data to measure the primary properties of coastal zones using a variety of methods ranging from remote sensing to *in situ* sensors and sampling. There is a wealth of accumulated information about coastal zones in various databases, files, spreadsheets. Sharing generated datasets, information, and results between geographically distributed organizations often proves to be challenging. Further, use of higher resolution data has been limited because of the computational intensity required.

Research Theme Objectives

- Geospatial assessment and strategic planning
- Semantics-driven framework for understanding coastal/ocean data
- Visualization technologies
- Improvements to coastal mapping methodologies



Spatial Technology and High Performance Computing for Improving Prediction of Surface Water Quality

The goal of this project is to develop and demonstrate the use of advanced spatial technology and high performance computing capabilities in the prediction of surface water quality. The use of advanced spatial data analysis and high performing computing capabilities for development of input for surface water quality models, enhancing model performance, and demonstrating and displaying model results will be investigated. Modern models of surface water quality typically consider not only in-stream hydraulic and kinetic processes and the influence of point sources, but the influence of landscape features. As such, much of the data required to drive these integrated models is geospatial in nature and model estimations are often directly impacted by the availability and accuracy of those geospatial data. In addition, the application of an integrated model approach is typically computationally intensive. However, recent advances in high performance computing can be used to aid in the development and application of modeling systems and the interpretation of model predictions. Through more accurate modeling, effective policy decisions can be made or developed by the responsible agencies.

Contact: William McAnally at mcanally@gri.msstate.edu

Visualization Techniques for Improving Public Understanding of Catastrophic Events

One of the greatest challenges to an appropriate public response to emergencies is accurate and easily understood information. The general populace can readily become so overloaded with information that individuals will either not realize the magnitude of the crisis and thus not prepare or respond adequately, or overreact and evacuate when such is not warranted. As modeling and forecasting improve, one important facet of public awareness that has not been sufficiently addressed is visualization of the data in such a way that the information is easily understood, and provides an accurate spatial depiction of the threat. This project focuses on developing new 2D and 3D visualization tools which produce visualization products that can be made publicly available, are easily interpreted by the non-technical public, and can be viewed on personal computers or used in television coverage. The initial efforts focus in two areas: storm surge and hurricane intensity/direction.

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An Information Semantic Approach for Resource and Knowledge Discovery in an Integrated Ocean Observing System

The goal of this project is to develop an IOOS compliant pilot that uses semantic web technologies and web services to enable resource and knowledge discovery among private and public data sets within the Northern Gulf of Mexico. This project uses a scientific approach that utilizes an open source and standards-based approach for developing the middleware necessary for facilitating data sharing from the disparate and heterogeneous data providers of the region. The project is expected to provide IOOS with more timely predictions of natural hazards and their impacts; to sustain, protect, and restore healthy marine and estuarine ecosystems; and to sustain, protect, and restore marine resources.

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Advanced Data Assimilation Experiments for GOES-R Series Applications

This project is helping to develop protocols for data to be provided by the Geostationary Operational Environmental Satellite-R Series (GOES-R) which will be launched in 2015. The findings of the dependence of precipitation forecast accuracy on model's initial condition point to the need of assimilating operationally time-continuous GOES-R data to better capture important features in the dynamic fields. The goal is to improve mesoscale precipitation forecast through data assimilation and therefore increase predictions to more than 9 hours.

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The Mississippi Digital Earth Model

The Mississippi Digital Earth Model is composed of seven framework layers as defined by the Federal Geographic Data Community's National Spatial Data Infrastructure. The Geospatial Education and Outreach project portion was developed in response to the limited availability of geospatial data needed by first responders immediately following Hurricane Katrina of August 29, 2005. An assessment was conducted of the educational needs of Mississippi's local governments, especially the localities in the southern portions of the state most susceptible to the effects of hurricanes. A series of intensive two-, three- and five-day workshops were compiled that would provide a strong foundation in the fundamentals and applications of GIS. Courses offered range from basic concepts of GIS to advanced, enterprise database management systems. Technical assistance is provided to local governments following classroom preparation as a means to increase the success rate of implementation of GIS in the work place.

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Spatial Variation and Temporal Trend of Water Quality in the Northern Gulf of Mexico

This project conducts ground truth observations and standardized algorithms to produce and evaluate the spatial and temporal variations of water quality parameters in the Northern Gulf of Mexico. Tasks under this project include: 1) conducting ground truth measurements in key water-quality parameters in the water column; 2) refining/developing remote sensing tools that can be applied to satellite images for derivation of water clarity in Gulf waters; and 3) acquiring and processing MODIS and/or MERIS images to derive time series of the spatial distributions of water clarity. These products provide a basis for future prediction of ecosystem health in a changing environment and a valuable clue if the significant population drop in New Orleans after Hurricane Katrina caused any changes in the surrounding ecosystem.

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Visual Analytics for Assessment and Interpretation of Simulated River Flooding

The specific goals of this project are the development of visual analytic tools to enable scientists and forecasters to better interpret and distribute hydrologic information. The resulting product will be useful in the research community as an interpretation tool for river level and flood data, but would also serve as a useful platform for hydrologic forecasters within the National Weather Service to more quickly and accurately determine areas at risk for flooding. Another potential use is communicating with the emergency management community to better visualize areas to be impacted by flooding and support making decisions on evacuations.

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Data Management in Support of NOAA's Integrated Ecosystem Assessment through the NGI Ecosystem Data Assembly Center

NOAA is developing and expanding the concept and techniques of Regional Ecosystem Data Management to support ecosystem observations and ecosystems approaches to management. The EDAC will expand on current capabilities and move into integration with REDM. Data discovery, required data transformations and direct integration into Intergrated Ecosystem Assesment models and tools will drive technological development. In addition the technical capacity of the EDAC will be enhanced to support broader use with the NGI as a whole. Additionally historical and near-real time ecosystem data cataloging into the EDAC have been introduced. The resulting data management systems will enhance the REDM effort and expand the capability of EDAC to gather ecosystem data.

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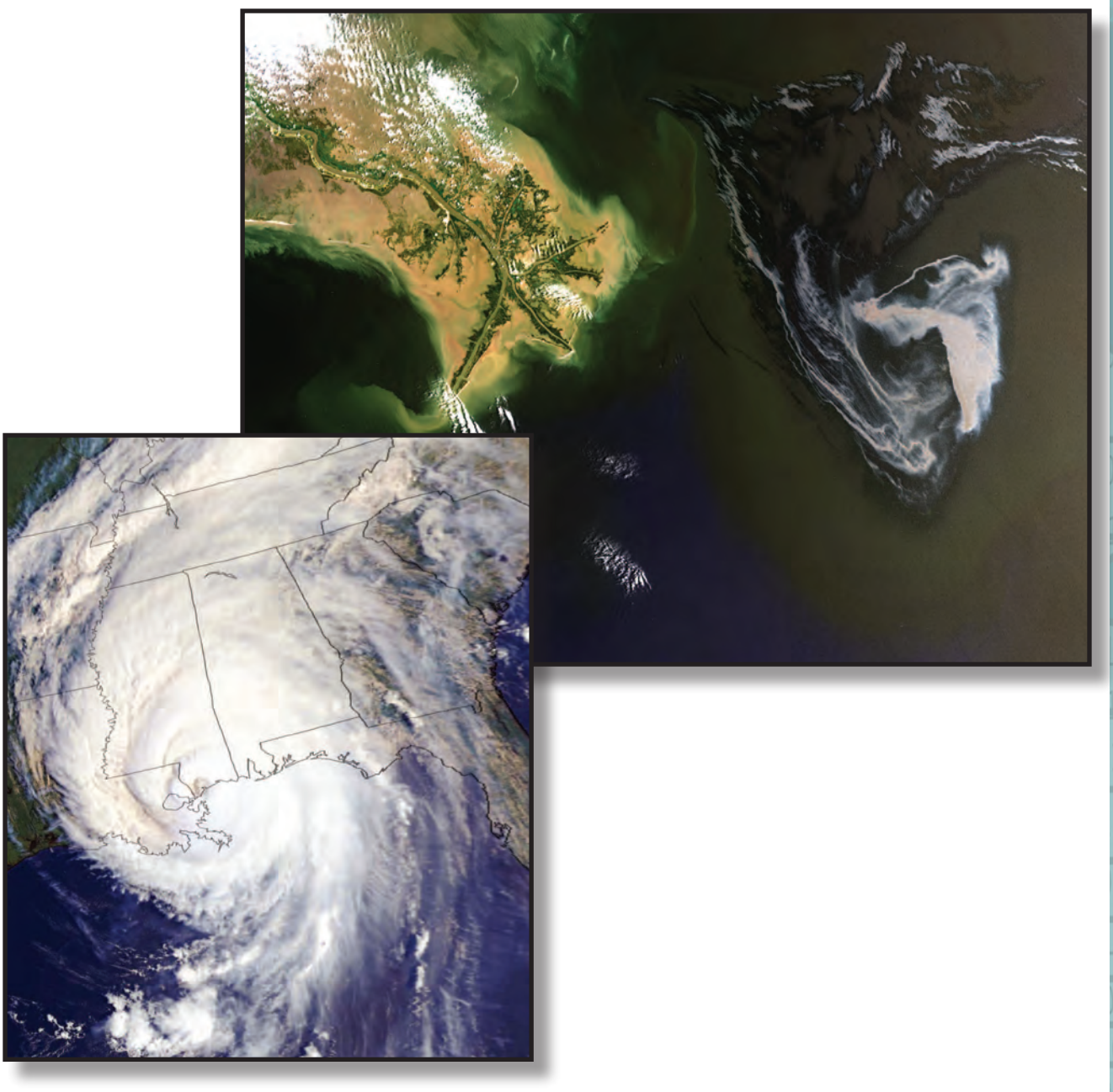
NGI RESEARCH THEME:
COASTAL HAZARDS AND RESILIENCY

Improving understanding of several significant coastal hazards is more crucial now than ever before. Coastal populations have grown exponentially over the past 30 years. In addition, the Gulf of Mexico is one of the most economically critical ecosystems in the Nation. Coastal hazards and public health and safety are major concerns to agencies responsible for the public good of coastal regions. Weather and ocean phenomena considered in the context of anthropogenic factors pose considerable resource sustainability, financial and safety threats to the Gulf coast region.

Research Theme Objectives

- Forecasting and valuing catastrophic natural events to coastal communities
- Assessment of localized hypoxia in shelf waters
- Address issues of oceans and public health
- Economic assessment of coastal hazards



Restoring Estuarine Landscapes in Alabama Coastal Waters Through the Creation of Oyster Reefs

We hypothesized that the creation of a complex "biogenic breakwater" would facilitate the maintenance and expansion of other biogenic habitats; and result in fisheries enhancement. We initially saw positive results due to the placement of the experimental breakwater complexes in reducing shoreline erosion and live vegetation retreat; however, shoreline protection was not consistent and by the end of the study period there were no differences between control and reefs sites at Point aux Pins. The same trend was not seen at Alabama Port and may be due to the differences in wave climate between the two sites. We initially saw positive results in oyster recruitment and survival on both the seeded reefs at Point aux Pins and the non-seeded reefs at Alabama Port; however, these positive gains in oyster density did not continue through the duration of monitoring period. Finally, we saw positive results of elevated species richness and densities in large fish due to the presence of the breakwater complexes. We believe the initial positive results of many of our target variable were short lived due to the reduced capacity of the breakwater reefs after the active 2008 hurricane season which flattened and spread the reef complexes; thus, a sturdier design needs to be implemented for future oyster reef breakwaters to ensure little reef movement.

Contact: Kenneth Heck at kheck@disl.org

Public Health and Stressors

Changing hydrologic regimes and nutrient loadings in coastal waters may impact ecosystem restoration and public health. Large rivers like the Mississippi can have a significant impact on biological processes in the coastal zone and shifts in nutrients within estuaries may promote growth of potentially toxic algal species. Our research focus is on planktonic community structure and function, measuring particulate organic matter composition, microbial respiration and algal growth rates, and harmful algal blooms and increased waterborne pathogens such as *Vibrio* sp. bacteria along transects in two Louisiana estuaries, Barataria Bay and Breton Sound. These estuaries are targeted for restoration by increased inputs of Mississippi River water, and our research will help test effectiveness of the river restoration strategy.

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Developing a Foundation for Analysis of Natural and Human-Induced Disturbances to Coastal Economies

This project involved a series of individual research tasks, which, although independent of one another, are unified around a common theme of coastal economics. Areas include: non-market valuation of MS Barrier-island restoration; non-market valuation of Louisiana wetland restoration; hurricane evacuation behavior; MS River Basin land-use analysis; Northern Gulf Coast migration patterns analysis; Assessment of economic recovery of seafood processors and dealers, marinas, commercial harvesters, and bait dealers in coastal Mississippi; Port of New Orleans economic impact analysis; Northern Gulf coast business resiliency analysis; Post-Katrina retail sector shifts analysis; economic impact analysis of public agencies within coastal communities as a result of coastal hazards; and analysis of impact of information released by independent media sources concerning coastal hazards on attendance levels at publicly-funded federal, state and local recreational facilities.

Contact: Daniel Petrolia at drp95@msstate.edu

Assessing the Impact of Ordinances, Outreach and Enforcement on the Resiliency of Gulf Coastal Watersheds

The goal of this research is to test the hypothesis that the most ecologically resilient watersheds are those with well-defined ordinances and regulations that include established enforcement and are supplemented with active and effective NGO (non-governmental organization) involvement. The development of a GIS database to map and analyze relationships between watershed regulation and water quality by compiling regulatory codes, ordinances, enforcement actions, and NGO outreach efforts for coastal watersheds establishes a spatial methodology for analyzing coastal watersheds. Coupling the spatial data with local stakeholder data, collected via focus groups and questionnaires, establishes a holistic methodology for assessing the resiliency of Gulf Coastal watersheds. Conclusions from the study watersheds relating to ecology, governance, NGO activity, and community resilience will test the assumption that water quality, sound management, and involved communities lead to resilient systems. The study will establish a methodology in which the effectiveness of regulatory action and NGO outreach on water quality and community resiliency can be assessed, while simultaneously improving the data available to other NGI researchers. It is expected that results from this effort can serve as input for policy recommendations at state, county, and municipal levels.

Contact: Jason Walker at jwalker@lalc.msstate.edu

Improving Hurricane Intensity and Landfall Estimation with Refined Modeling

The storm surge of Hurricane Katrina is unprecedented in the U.S. for its elevation, area coverage, and levee breaches in New Orleans. This research seeks to address Mississippi and Louisiana storm surge issues using the finite element model ADCIRC. This research facilitates answers to the sensitivity of the storm surge in Mississippi to wind profiles of major hurricanes, as well as to eye size. An additional issue involves the impact of the Louisiana wetlands and the Mississippi River. It is widely believed that wetland erosion has increased

storm surge vulnerability in southeast Louisiana. Grids will be created based on historical wetland data, and new ADCIRC runs examine the impact of wetland loss in the last 65 years. Specifically, we are investigating: 1) a hurricane moving over the less-eroded marsh of Louisiana in 1970 and 1940; 2) a weaker hurricane due to more marshland; and 3) a simulation without the Mississippi River levee system.

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Microbial Source Tracking and its Application to the Northern Gulf of Mexico

The objective of this study is to determine if statistically valid correlations could be shown between enterococcal counts of water samples from creek and coastal sites and the presence of four molecular, library-independent markers that specify human and/or sewage pollution. Samples were tested for the presence of enterococci, fecal coliforms and the presence of genetic markers for *Methanobrevibacter smithii*, Bacteroides, *Bacteroides thetaiotaomicron*, and Fecalibacterium. The presence of each individual human/sewage markers was not statistically dependent upon the presence of any other. Of the logistic regressions performed for all the organisms and sites, there were only 7 significant correlations. Human specific Bacteroides had a significant relationship for collection sites and enterococci counts. *B thetaiotaomicron* had a significant relationship for collection sites and fecal coliforms. Fecalibacterium had no site specific correlations but was positively correlated to enterococci counts and had a strong qualitative correlation to fecal coliform counts.

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Interaction Between Off-shore Circulation and Nearshore Processes During Extreme Weather Events

The major goal of the research is to study the interaction between the near-shore and off-shore processes during extreme weather events by using numerical modeling. The model is based on the Princeton Ocean Model and takes into account the recently suggested approaches to describing wave-currents interaction and the land-sea boundary motion. The advanced numerical model capable of simultaneous reproduction of coastal dynamics and near-shore processes in the Northern Gulf of Mexico is developed. The short-term objective of the proposed research is to analyze the effects of moving sea-land boundary and current-wave interaction on storm surges in the near-shore region. The long-term objective is to advance the understanding of the dynamical links between coastal circulation and near-shore processes during extreme weather conditions to improve modeling and monitoring of the coastal circulation. More precisely, to develop special algorithms that will allow us to predict water level variations and water quality, debris and pollutant transports, to estimate effects of coastal restoration activities on sediment transport and to assess other environmental and economical impact of severe weather events.

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Satellite and in situ Optical Assessment of Algal Bloom Events in the Northern Gulf of Mexico

This project examines the feasibility of detection of diagnostic optical patterns that allow identification and characterization of harmful algal bloom events. The primary goal is to refine and evaluate optical and satellite-based approaches to detect and monitor bloom events of harmful algal species in Gulf of Mexico waters. Our objectives can be organized into three major efforts including: 1) development of a capability for glider-based optical assessments of algal bloom events in the Northern Gulf of Mexico; 2) evaluate capabilities for rapid, high resolution above water hyperspectral radiometry as a means for mapping of algal bloom phenomena and other optically distinct features in complex coastal waters; and 3) relate satellite observations to *in situ* discrete analyses of phytoplankton taxa and environmental variables at selected sites. It is anticipated that this three-pronged approach will yield a predictive capability for environmental conditions conducive to bloom development in turbid waters.

Contact: Steven Lohrenz at steven.lohrenz@usm.edu

Air Monitoring and Analysis at Grand Bay National Estuarine Research Reserve

Mercury levels in seafood pose a significant human health risk in the Northern Gulf of Mexico. While some mercury sources are local and easily identified, much of the mercury entering the Gulf of Mexico may originate in other parts of the country or world, and enters the system through wet and dry deposition from the atmosphere. Using dry deposition mercury analyzers, gas analyzers (Carbon monoxide, Sulfur dioxide, Ozone, and Nitrogen Oxides), and meteorological data, it should be possible to use atmospheric modeling to identify sources of air-borne mercury deposited in the Gulf of Mexico region. Data is processed and analyzed at NOAA's Air Resources Laboratory. The station at the Grand Bay National Estuarine Research Reserve is one in a network of sites used to generate atmospheric models.

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Optimizing the Use of Lightning Data in Severe Storm Warning Assessment

The project uses total lightning, model-derived, and radar data to develop algorithms and/or guidelines as to whether a particular storm is likely to require a warning. Our overriding goal is to develop guidance products that will best use total lightning data in assessing severe storm scenarios. These products ultimately could be used by the National Weather Service to issue improved warnings, leading to fewer injuries, fatalities, and loss of property.

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Developing an Understanding of Research and Operational Needs in the Gulf Region for the NOAA Unmanned Aircraft Systems Project

This project conducts research and analysis of the capabilities of various Unmanned Aircraft Systems and their suitability for achieving selected test bed mission requirements by developing multiple operations and logistical support models including cost comparisons and full consideration of the environmental conditions of operations that achieve science data acquisition objectives in various regions. The unique challenges of UAS operations in the Arctic and Gulf of Mexico are specifically addressed.

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NOAA Coastal Storms Program – Advanced Circulation Model / Storm Surge Grid Cataloging Project

Through NOAA's Coastal Storms Program, an online catalog of unstructured grids used in hydrodynamic modeling projects has been proposed to document existing and future models in the Gulf of Mexico. This unstructured grid catalog is intended to provide modelers, coastal managers, and funding agencies with a mechanism of sharing grids and information about projects to help identify modeling gaps and redundancies. This project consists of hosting workshops and producing an assessment of the feasibility of developing a prototype catalog of unstructured grids used in storm surge models. This project supports NOAA's continued development of the prototype catalog through participation in the implementation workshop and on the project team which is reviewing status and recommendations, establishing roles and responsibilities and developing the long-term maintenance plan.

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Balloon and Payload Acquisition for Weather In-Situ Deployment Optimization Method Activities during the 2009 Hurricane Season

Weather In-Situ Deployment Optimization Method (WISDOM) is one of the approaches NOAA is taking to improve hurricane predictions. During the past few years, an increasing number of hurricanes have impacted the southern coast of the United States with devastating results. Some experts have forecast that this trend will continue in the years ahead. A component to more accurate, longer-range forecasts is a set of measurements taken in the hurricane environment over a significant portion of its lifetime. The challenge will be to develop systems capable of obtaining these important measurements in an economical manner without placing NOAA personnel at increased risk. The instrumented balloons and the WISDOM system operation by NGI is one of the approaches for obtaining this data.

Contact: Michael Carron at mcarron@ngi.msstate.edu

Development of a Northern Gulf of Mexico Operational Forecast System

The NOAA National Ocean Service's Physical Oceanographic Real-Time Systems along the northern coast of the Gulf of Mexico will provide real-time oceanographic data to promote safe and efficient navigation. A global or basin-scale model will provide boundary conditions to a proposed Northern Gulf of Mexico Shelf domain model. This will cover the continental shelf from the shoreline seaward to approximately the 200 m isobath and from the southern tip of Texas to between Pensacola and Choctawhatchee Bays, Florida.

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Developing a Tool for Cost Effective Best Management Practices and Resilient Communities

This project develops a decision support tool that enables the construction industry to design and build more resilient and sustainable communities through the inclusion of best management practices in new commercial and residential construction. Specific tasks include: complete production of a spreadsheet based application that will include screens for site characterization, hydrographs, and best management practice cost and effectiveness; linkage of a spatial package with the spreadsheet; and outreach to educate interested parties about the status and functions of the application.

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Sediment and Mercury Path Fate Modeling

Sediments are the main repository of mercury in the coastal Gulf of Mexico as well as the site of transformation of inorganic mercury to methylmercury, the more toxic form that is bioaccumulated through food webs. Resuspended sediments are a major transport vector for total mercury and methylmercury. The redistribution of mercury-containing sediments is a critical determinant of where in the coastal environment mercury will become a problem. Our ultimate goal is to provide a suite of methods to predict the path and fate of sediment and mercury in the Gulf coastal region from entry point to fish stocks.

Contact: William McAnally at wmcanally@gri.msstate.edu

Toward an Understanding of Gulf Coast Resident Preferences and Perceptions on Risk and Restoration

The behavior of coastal residents and the economic choices they make profoundly affects coastal land management and the consequences of weather events such as hurricanes and climate change. Economic decisions about risk are fundamentally driven by risk preferences and by risk perceptions. However, many coastal decisions such as buying coastal property, investing in storm protection, or supporting public projects such as coastal restoration and invasive species management, which have long-term consequences, also involve a significant time dimension as well. With regard to public projects such as coastal restoration or invasive species management, the economic benefits of management options are not well-understood, and at the same time, the costs are significant. Policy support and behavior may be closely linked to the issue of climate change. Thus, although one may support restoration in general, given the added perceived risks from climate change, perhaps with drastic consequences, one may view restoration as pointless in the face of overwhelming opposition.

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Understanding Coastal Resiliency from Hurricane Impacts Using Integrated Modeling and Observations

The long term goal of this study is to improve our understanding of coastal resiliency from hurricane impacts using integrated numerical modeling, *in-situ* observations and remote sensing techniques. The specific objectives of this project are to 1) Develop a comprehensive dataset of vegetation, soil and salinity characteristics before and after high energy disturbances in Breton Sound and Wax Lake Delta based on *in-situ* monitoring; 2) Compile geospatial data and analyze wetland changes in Breton Sound and Wax Lake Delta based on satellite imagery and modeling; 3) Improve the wind forcing input for storm surge and wave models; 4) Extend the NOAA ocean wave prediction model to coastal regions with wetlands; 5) Develop and test a coupled wave, surge and sediment transport modeling system for coastal regions using the Breton Sound and Wax Lake Delta as a natural "laboratory"; 6) Conduct numerical simulations to test hypotheses of coastal resiliency.

Contact: Q. Jim Chen at qchen@lsu.edu

Validation and Verification of a Canine Fecal Source Identification

The work aims to validate quantitative source tracking assays to allow transition to NGI and beyond. The quantitative component (versus plus/minus) is important because quantitative assays allow calculation of relative loads. The ultimate goal is to transition field results into outreach and management actions to achieve a reduction in fecal loads. Remediation actions for fecal contamination from gulls can be undertaken once the contamination is properly identified.

Contact: Kelly Goodwin at kelly.goodwin@noaa.gov

Forecasting Episodic Changes in Hurricane Intensity and Structure Over the Gulf of Mexico

The primary goal of this project is to provide greater insight into forecasting time-sensitive trends of rapid formation, changing intensity, and changing wind field area (or size) of hurricanes over the Gulf Mexico in the interest of reducing the uncertainty in the risk posed to Gulf Coast residents and infrastructure. The focus is to identify key features or processes present in the ambient atmosphere and in the Gulf of Mexico that led to critical episodic changes in the intensity and structure of Gulf hurricanes, particularly with three recent hurricanes: Humberto, Gustav, and Ike. A new recognition technique of cloud and precipitation patterns from satellite and radar data is proposed to assist in the identification of forming or intensifying hurricanes. The findings of analytical and numerical modeling approaches may yield insight into causes of the episodic changes experienced with hurricanes, and therefore provide improved guidance for forecasting similar, future events.

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NGI RESEARCH THEME:
CLIMATE CHANGE EFFECTS ON ECOSYSTEMS

NOAA's interest in the nation focusing targeted climate services at all scales will require unprecedented levels of coordination between all agencies. Within the U.S. extensive climate-related changes have already been documented. NGI will help promote research to address the impacts to the region from climate change.

Research Theme Objectives

- Impact of regional climate variability on watersheds and coastal activity
- Explore the impacts of event-scale forcing linked with climate variability
- Examine climate change impacts to fisheries ecosystems

Investigating Material Exchange Between the Marsh and Channel Along an Estuarine Gradient

The wetland boundary between terrestrial and coastal ocean environments is a dynamic and highly productive zone, but its role in biogeochemical cycling and ocean productivity is not well understood. Material exchange with marshes and groundwater are two key sources for carbon to the coastal ocean. Diversions have been built along the Mississippi River corridor south of New Orleans which deliver freshwater, sediments, and nutrients to Barataria and Breton Sound estuaries. The effectiveness of these diversions as marsh sustenance tools are not clear, but biogeochemical processing occurring within estuaries as a result of fluvial discharge through these diversions may impact how deltaic marshes contribute to the coastal ocean nutrient budgets. Inundation frequency and duration of marsh water levels will have a strong impact on the net retention or release of C, N and P occurring within estuaries as a result of fluvial discharge through these diversions may impact how deltaic marshes contribute to the coastal ocean nutrient budgets. Recent studies have shown that extended low water or dry periods in a marsh can lead to a net export of nutrients as well as loss of carbon. Rapid wetland loss due to rising sea levels combined with landscape-scale hydrologic alterations indicate these buried carbon repositories may be vulnerable to remineralization processes and ultimately contribute to ocean-atmosphere carbon pools.

Contact: Jaye Cable at jcable@lsu.edu

Trophic Support of Fishery Production in Salt Marshes related to Tidal Inundation Patterns

Coastal salt marshes have been designated as Essential Fish Habitat for many fishery species with little understanding of the processes involved in the support of fishery production and how this support varies over geographic scales. Geographic variability in estuarine hydroperiod and marsh inundation patterns can be substantial. The relative contribution of marsh surface production and other sources to the trophic support of fishery species is therefore likely to vary among regions with differing tidal regimes and thus access to the vegetated marsh surface. Examination of trophic pathways through stable isotope analysis can help to clarify the importance of marsh productivity and geographic variations in the direct contribution of the marsh surface to fishery production. The project will clarify the mechanistic links and processes underpinning the value of marsh habitats in general, and refine the EFH designation by determining regional variations in marsh value related to flooding patterns. It will also provide insights into likely future changes in marsh functioning due to changes in the marsh landscape associated with climate change, sea level rise, subsidence, and anthropogenic coastal modifications.

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Climate-related Ichthyofaunal Shifts in the Northern Gulf of Mexico: Implications for Estuarine Ecology and Nearshore Fisheries

Multiple species of snappers (*Lutjanidae*) and parrotfishes (*Scaridae*) were either added to the local ichthyofauna, or have become notably more abundant over the last 3+ decades. A key next step is to determine how these "new" tropical/subtropical species are interacting with endemic species. That is, what are the consequences, if any, for estuarine ecology and regional fishery production? To predict the ultimate consequences of these climate-related changes, we must explore basic questions regarding species interactions and food-web ecology. Our goal is to provide researchers and managers with information that will be required for implementing ecosystem-based conservation measures in the Northern Gulf of Mexico as regional/global climate continues to evolve.

Contact: Kenneth Heck at kheck@disl.org

Identifying Linkages Between Zooplankton Dynamics, Fishery Resources and Climate Change in the Northern Gulf of Mexico

This project brings together regional plankton and fisheries expertise along with new technologies and methodologies to expand a unique database by incorporating data on the hitherto neglected invertebrate zooplankton component of Southeast Area Monitoring and Assessment Program (SEAMAP) plankton samples and to improve the SEAMAP plankton sampling program. SEAMAP is a state/federal program designed to collect, manage and disseminate fishery-independent data and has been funded since 1983. Surveys of shrimp, groundfish, plankton, and reef fish are conducted in the Gulf of Mexico. The combined efforts will result in the application of new imaging technologies to analyze and archive SEAMAP plankton samples; improvement in taxonomic resolution of invertebrate zooplankton in those samples; and integration of new (to SEAMAP) methodologies for underway zooplankton sampling and the enumeration of gelatinous zooplankton. Digitization of zooplankton using Zooscan technology will enable SEAMAP to exploit the enormous potential information remaining in the samples. We anticipate that our examination of decapod crustacean larvae will result in identification of specimens to lower taxonomic levels than had been previously achievable. These efforts will culminate in a more extensive and inclusive plankton database that will become the foundation not only for our investigations into zooplankton dynamics but for complementary studies of ecosystem function and assessments requiring long-term databases.

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SUPPLEMENTAL RESEARCH IN RESPONSE TO THE DEEPWATER HORIZON DISASTER

Since the disasterous explosion and release of millions of gallons of oil from the Deepwater Horizon drilling rig on April 20, 2010, NGI has called upon its leadership to identify the research needs, match those needs to the NGI assets, and identify gaps in research needed to address the short- and long-term impacts. NGI researchers immediately began increasing data collection and capture of information relevant to assessing the impacts to the ecosystems and restoration of the Gulf's coastal and marine communities. Early in the response process, national and industry leaders recognized NGI for its successful collaborations and for leading research across the Northern Gulf region. Several ongoing projects were modified to include oil impacts and new grant sources addressed immediate short-term research needs. NGI existing collaborations are relevant to conservation of the region's vital natural resources and will support national and regional long-term goals.

Data Sampling and Modeling of Contaminant Dispersant

The oil and other contaminants from the Deepwater Horizon spill have a fundamental impact on the less-visible portions of the delicate chemical and biological ecosystem of the Gulf of Mexico. Biological and chemical impacts are critical elements that need to be addressed at the micro level. JSU researchers supported by NGI are constructing, validating, and deploying a pair of adaptive, mobile robotic sampler platforms for in-water capture and return of oil spill chemical, microbial and particulate matter for analysis. These sampler platforms will be located within selected Alabama and coastal waters.

Contact: Gordon W. Skelton at gskelton@c-did.com

Impacts of the Deep Water Horizon Oil Spill on Ecosystem Structure and Function in Alabama's Marine Waters

Researchers from NGI partner Dauphin Island Sea lab are addressing seven areas that will evaluate the initial (acute) impacts of the Deepwater Horizon Oil Spill. These tasks include: 1. documenting the impacts of oil intrusion on economically and ecologically important fishes in Alabama's Nearshore and Coastal waters; 2. documenting the impacts of oil intrusion on Keystone Sentinels in Mobile Bay waters; 3. documenting the impacts of oil intrusion on the health of critical nursery habitats and habitat utilization patterns of the young of economically important fishes; 4. evaluating the impacts of oil, methane and dispersant on pelagic food web structure and organic matter cycling along the Alabama coast; 5.evaluating the extent to which sedimentary biogeochemical cycles, and specifically the nitrogen cycle that have been changed by inundation of Coastal waters by oil; 6. quantifying the effects of oil on the microbial community structure and processes in Alabama Coastal waters; and 7. evaluating the potential for along-estuary transport of oil-derived substances in surface and subsurface waters of the ship channel of the Mobile Bay estuary.

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A Comprehensive Assessment of Oil Distribution, Transport, Fate, and Impacts on Ecosystems and the Deepwater Horizon Oil Release

NGI partner USM is developing a strategy to: 1) characterize the distribution and transport of the oil in coastal waters on the Northern Gulf of Mexico, 2) characterize the chemical form and evolution of oil and dispersant and potential contribution to coastal hypoxia, 3) assess the impacts of oil and dispersant on the coastal and offshore habitat, food webs, and living marine resources and 4) assess the impacts of the oil spill on public health and welfare.

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Impact of DwH Oil Spill on the Louisiana Coastal Environments

Continuing the NGI partnership, LSU researchers are continuing the focus on the coastal environments of Louisiana. For those areas not yet affected by oil, baseline data specific to the impending impact of the oil is being collected. For regions that have already been impacted, researchers are investigating seven components: 1.Barataria estuary water quality; 2.nutrient dynamics and primary productivity in the Breton Sound estuary as impacted by the Gulf of Mexico oil spill; 3. plankton monitoring of the Barataria and Breton Sound transects; 4. oil spill effects on ecosystem respiration for the two Louisiana estuaries; 5. examining the biological uptake of highly carcinogenic polycyclic aromatic Hydrocarbon- Benzo(a)pyrene from crude oil polluted environments in the Gulf of Mexico; 6. impacts of the Deepwater Horizon Oil Spill on *Vibrios* in the Gulf of Mexico; and 7. modeling the effects of pulsed river diversion on oil transport and fish distribution.

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Impact of Crude Oil on Coastal and Ocean Environments of the West Florida Shelf and Big Bend Region from the Shoreline to the Continental Shelf Edge

This project encompasses an integrated, rapid-response study of the impact of oil on coastal and ocean marine ecosystems of the northeastern Gulf of Mexico. NGI partner FSU researchers are improving upon the models of physical parameters that influence the distribution and persistence of oil; examining the effects of oil deposition on biogeochemistry and the direct and indirect consequences to coastal habitats and marine food webs that support fishery production; and determining the ecological effects needed to inform rapid bioremediation.

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Monitoring of Natural Resources in the Pontchartrain Basin Following the Deepwater Horizon Oil Spill: Processes, Habitats, and Fisheries

UNO researchers working through the NGI are investigating the dynamics of the estuaries and transport processes influencing the distribution of oil through the coastal ecosystem, and changes to the coastal environment. The monitoring work builds on existing monitoring programs addressing important ecosystem processes and functions by identifying oil related changes and statuses. Process surveys are including measurements of flows and particulate transport along bay-Gulf gradients, and bathymetric and shoreline surveys of areas where dredging and placement of sand has occurred. Researchers are analyzing water samples, together with tissue samples, vegetation and sediment for oil and residue.

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NIUST Deepwater Horizon Oil Spill Multi-Task Research

The National Institute for Undersea Science and Technology is supported through NGI and is conducting research to: examine microbially mediated oxygen consumption in waters of the Northern Gulf of Mexico to quantify the impact of nutrients, oxygen and carbon substrate concentrations on these microbially mediated processes; modify the Station Service Device to become a versatile platform for detecting, monitoring and mapping oil plumes; improve understanding of the processes governing the fate of oil droplets in the deep plumes, including the advection and mixing of materials, we will map the size and three-dimensional distribution of oil droplets and hydrates throughout the water column using a quantitative camera system augmented by sensors for methane, CDOM and PAH levels; characterize the impact of oil spill contamination on the physiological responses and overall health of seagrass systems in the Northern Gulf of Mexico, integrating a combination of molecular biomarker, genetic and chemical biomarker analyses.

Contact: Ray Highsmith at ray@olemiss.edu

Integrated Assessment of Oil Spill by Mississippi State University

NGI university lead MSU is conducting research in four areas: (1) Hurricane Effects on the Deepwater Horizon Incident. Due to the complexity and variety of oil spill models, as well as to account for model uncertainty, we plan to run an ensemble of oil spill models providing results to six tropical cyclone scenarios using several modeling approaches; (2) Fate and Transport of Oil and Dispersants in Northern Gulf of Mexico Estuaries applying predictive tools to estimate the physical distribution, dispersion and dilution of contaminants under the action of currents and storms in coastal estuaries and incorporate fundamental scientific research from other tasks into predictive tools to aid in estimating impacts and remedial strategies protective of human and ecological health; (3) Impact of the Deepwater Horizon Incident on Natural Systems to assess early responses of intertidal habitats to oil/dispersant contamination and assess the interaction between oil/dispersant system and soil/sediment microbial assemblages; and (4) Technology and Data Integration for Deepwater Horizon Incident Recovery Management provides a Coastal and Marine Spatial Planning toolkit for displaying results useful in recovery management and a foundation for future research through a platform and mechanism for integration of scientific project results.

Contact: Bill McAnally at mcanally@gri.msstate.edu

Gulf of Mexico Research and Resource Support Tools

Harte Research Institute is working toward its mission to support and advance the long-term sustainable use and conservation of the Gulf of Mexico. One key goal is to maintain and grow GulfBase, the HRI research and resource database on Gulf of Mexico information and data. HRI led the Biodiversity of the Gulf of Mexico Project, working with 140 authors and taxonomists at 80 institutions in 15 countries to compile all 15,419 species known from the Gulf. This resulted in a book published in 2009 by Texas A&M University Press and the subsequent conversion of the information (species list, biology, habitat, depth, range, distribution, references) into a database. That database is now ready to be placed into GulfBase along with analytical tools to allow researchers to sort and search the data, as well as compare various habitats and regions. The BP Deepwater Horizon blowout and oil spill has prompted the need for this information and database to be made available to the Gulf of Mexico research community for current and on-going research, and this project will help make this happen before 2010 is concluded. The primary goal of this research project is the final development of the Biodiversity of the Gulf of Mexico (BioGoMx) database and placement on GulfBase.org with analytical tools. In addition, GulfBase, HRI's highly used and very successful resource of information on the Gulf of Mexico will begin a remake and update to make it more user friendly and functional to Gulf researchers and managers.

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EDUCATION AND OUTREACH

The NGI Education and Outreach team develops comprehensive integrated programs to communicate NGI research and to facilitate the transition of NGI research to NOAA operational centers. The program bridges universities to NOAA with student participation in NGI research, career forums, internships, and student employment. NGI works closely with the educational programs at the Gulf of Mexico Alliance, the various Gulf of Mexico Sea Grant programs and the NOAA Gulf of Mexico Regional Collaboration Team to develop a long-term communication and messaging campaign to address identified priority issues.

The NGI Program Office's strategic location at the Stennis Space Center, MS, facilitates close interactions with several NOAA activities and key regional stakeholder groups. NGI has enhanced the opportunities for broadening its geographic focus area through collaboration with the Harte Research Institute at Texas A&M University in Corpus Christi. With the recent groundbreaking for the Mississippi State University Science and Technology Center at Stennis Space Center which will house NGI and NOAA activities, NGI has the foundation and the building blocks to maintain and grow its role in Northern Gulf of Mexico environmental research and education.

NGI AWARDS BY FISCAL YEAR

** Includes $4,460,300 (2009) and $4,495,500 (2010) for the Mississippi State University Science & Technology Center, which will house the Northern Gulf Institute Program Office and other oganizations.*

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