

Continued Development of the Gulf of Mexico Coastal Ocean Observing System

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LONG-TERM GOALS

The overarching goal of this project is to build a robust, user-driven, sustained, operational Gulf of Mexico Coastal Ocean Observing System (GCOOS) for the benefit of the people of the United States and, in particular, those whose lives, work, and play depend upon the Gulf of Mexico. The specific goals of this project, as funding allows, are to maintain the existing GCOOS capabilities, augment the existing observations to fill gaps, and provide enhanced products and services. GCOOS capabilities include components to integrate data sets from diverse providers; assure consistency, quality, and accuracy of the data; create new products needed by users; and provide in a timely and efficient manner the data, products, and services needed by decision-makers, diverse stakeholders, and the public. Physical, meteorological, biogeochemical, and bathymetry data are major components of the data system.

OBJECTIVES

The goal will be achieved through accomplishment of six scientific or technological *objectives*:

Objective 1 is to maintain and strengthen the GCOOS Regional Association (GCOOS-RA) through continuing the activities of the board, councils, committees, task teams, and office staff to manage the development of the GCOOS and by working with regional stakeholder groups to identify their various needs and to guide the GCOOS priorities.

Objective 2 is to continue to build the observing system, GCOOS, through integration of existing observations made by different entities, provision of operation and maintenance support for existing non-federal systems that (a) monitor surface currents, harmful algal blooms, hypoxia, water level changes, estuarine water quality, and ecosystem health, (b) derive products needed by users from satellite data, and (c) add new observations to fill gaps as funding allows.

Objective 3 is to improve the Data Management and Communications (DMAC) system by enhancing and expanding the capabilities of the GCOOS Data and Products Portal; adding new data providers for Gulf open ocean, coastal, and estuarine regions and making their data interoperable; building capabilities to access legacy data; and strengthening the regional involvement with the evolution of and compliance with the data management and communication plans of IOOS.

Objective 4 is to support regional modeling capacity through providing *in situ* and remotely-sensed data to meet the needs of the modeling community in machine-to-machine formats, establishing a regional modeling task team for the Gulf of Mexico, and pursuing ecosystem modeling pilot projects to support marine resource decision-makers.

Objective 5 is to enhance the integrated outreach and education activities of the GCOOS-RA, through the activities of the GCOOS Outreach and Education Coordinator and the Outreach and Education Council, that improve information exchange between user groups and data providers, promote ocean literacy, and provide materials for the public, such as interactive ocean-themed kiosk exhibits.

Objective 6 is to obtain certification to become a member of U.S. Integrated Ocean Observing System (IOOS).

APPROACH AND WORK PLAN

1. ***Scientific/technical approach:*** Our approach consists of three activities under this project: maintain the base GCOOS-RA capabilities, contribute support to keep existing non-federal observing systems functional, and add new observing systems to fill gaps in the GCOOS.

Maintain Base Capabilities: The first activity for this work plan is to maintain the base capabilities of the GCOOS-RA that have evolved over the past 10 years. The base capabilities are to (1) maintain the GCOOS-RA so it can continue to build toward a comprehensive GCOOS; (2) continue DMAC-compliant activities to achieve interoperability with non-federal data providers—our local data nodes

(Figure 1); (3) maintain the functioning of the Data and Products Portal (Figure 2); and (4) continue activities with the outreach and education community to enhance public knowledge of the oceanic environment, their impacts on it, and its impacts on them.

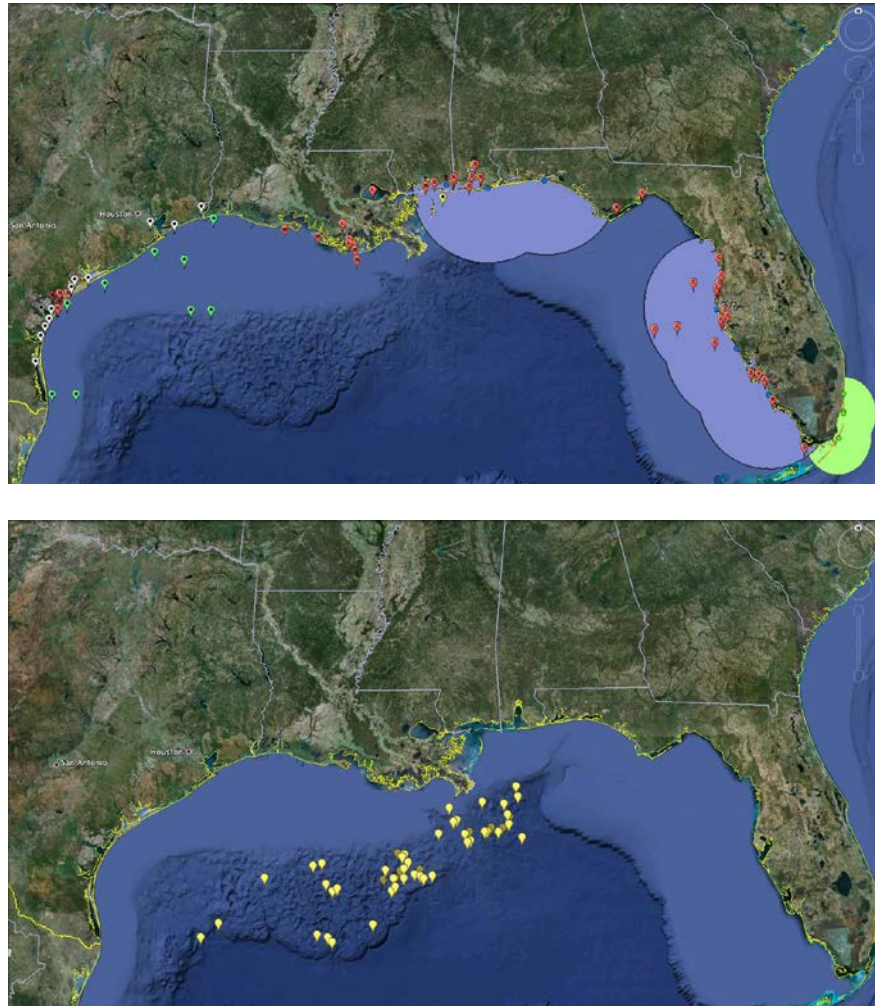


Figure 1. Existing non-federal observing assets. (upper panel) Moorings and High Frequency Radar (HFR) stations, some are being decommissioned. Upper Legend: White or gray with star = TAMU-CC TCOON; Green with star = TAMU TABS; Red with "W" = LSU WAVCIS; Red with "L" = LUMCON; Yellow with star = USM CenGOOS; Red with "D" = DISL; Red with "C" = USF COMPS; Red with "S" = Mote Marine Lab; Red with "N" = buoys supported by NOAA's water elevation projects operated by academic (many are operated by TCOON); HFR = blue sites with the blue or green offshore sampling domain shown. (lower panel) The oil and gas industry-supported ADCP stations, some are temporary.



Figure 2. (upper) Initial page of the GCOOS Data Portal showing locations of existing stations with oceanic data sets available through the GCOOS Data Portal on 26 November 2014 (<http://data.gcoos.org>). (lower) Introductory page for the GCOOS Data Products Portal (<http://gcoos.org/products/>).

Keep Existing Systems Functional: The second activity under the work plan is to (1) assist with keeping key existing non-federal observational systems functional by contributing support for operations and maintenance (O&M), (2) add enhancements to the Data Portal, and (3) initiate an ecosystem modeling pilot activity to benefit state decision-makers. Limitations in funding available have meant that several of the existing systems could not be supported. Additionally, aging equipment and a decrease in routine funding, such as from state agencies, continue to result in a number of the non-federal stations being decommissioned.

Add New Systems: Achieving a comprehensive observing system for the Gulf of Mexico—the GCOOS—requires the addition of new observing assets to fill gaps in needed observations. For years one through four of the project, no new observing systems were added because the funding level was not sufficient to install, operate, or maintain new observing assets.

2. **Key Personnel:** The key individuals on this project are identified in Table 1, together with their affiliations and roles in the project. These are the project principal investigators and co-principal investigators, including several whose tasks do not begin until actual funding is at levels sufficient to include them. Additionally, the volunteers who make up the GCOOS-RA Board of Directors (http://gcoos.tamu.edu/?page_id=261) or serve on the GCOOS committees, councils, and task teams (http://gcoos.tamu.edu/?page_id=2150) are key people that provide guidance and direction to the office staff, but the personnel vary and so are not included here.

Table 1. Key Personnel and Project Roles by GCOOS Subsystem

Key Investigator	Institution	Project Role	Base Activity Years 1, 2, 3,4	Upcoming Year = Base + Enhancements
<i>Coordinated Regional Management and Governance Subsystem</i>				
Ann E. Jochens	TAMU	Program Principal Investigator	Overall program management	Overall program management
Barbara Kirkpatrick	TAMU	Executive Director, GCOOS	Staff & Fiscal Oversight, Meetings & Travel to Maintain Regional Association	Improved Interactions with Key Stakeholder Sectors; Hold Stakeholder Workshops; Enhanced Committee Work; More Travel Interactions
<i>Data Management and Communications (DMAC) Subsystem</i>				
Matthew K. Howard	TAMU	Co-PI, GCOOS Data Manager	Maintain Basic DMAC Capability & Data Portal Maintain TABS local data node	Maintain THREDDS and raster programming capability
Felimon Gayanilo	TAMU-CC	Co-PI, GCOOS Data Portal System Architect	Programming	DMAC programming assistance for new local data nodes; modify the SOS to 52N
Sara Graves	UAH	Co-PI	<i>Not funded in Years 1-4</i>	Enhancements to GCOOS Data Module
Clint Padgett	Bowhead/ACOE	Co-PI	<i>Not funded in Years 1-4</i>	Enhancements to GCOOS Data Module
<i>Observing Subsystem</i>				
Mark Luther	USF	Co-PIs; COMPS Local Data Node	Maintain COMPS local data node on west Florida shelf	Contributions to DMAC evolution and improved data streaming
Stephan Howden	USM	Co-PI; CenGOOS Local Data Node and Stations	Maintain USM local data node; provide O&M for HFR/buoy in Central Gulf	O&M support for glider operations
Eric Milbrant	SCCF	Co-PIs; SCCF Local Data Node	Maintain the SCCF local data node in Southwest Florida	Double the data provided
Mike	DISL	Co-PI; Mobile Bay	<i>Not funded in Years 1-4</i>	Support for O&M for 3 stations in

Key Investigator	Institution	Project Role	Base Activity Years 1, 2, 3,4	Upcoming Year = Base + Enhancements
Dardeau		Stations		Mobile Bay
Lei Hu	DISL	Co-PI; Mobile Bay Local Data Node	Maintain local data node at Mobile Bay	Maintain local data node at Mobile Bay
Kyeong Park	DISL	Co-PI; New Provider	<i>Not funded in Years 1-4</i>	Telemetry for existing buoy; O&M for new data provider
Chunyan Li	LSU	Co-PI; WAVCIS Stations & Local Data Node	Maintain WAVCIS local data node in eastern Louisiana; O&M to keep at least one WAVCIS station operational	O&M to keep additional WAVCIS stations operational
Lisa Campbell	TAMU	Co-PI; HAB Local Data Node	<i>Not funded in Years 1-3;</i> Maintain data node in Year 4	Maintain data node – phytoplankton/HABs at Port Aransas, Texas
Kevin Speer	FSU	Co-PI; New Provider	New data provider; Big Bend area off Florida	O&M to keep Big Bend FL - Tower N7
Kellie Dixon	MOTE	Co-PI; HAB Stations & Local Data Node	Maintain Mote local data node & O&M to keep 2 HAB buoys operational	O&M for additional Mote HAB obs
Robert Currier	MOTE	Co-PI; New Provider	<i>Not funded in Years 1-2;</i> Improve beach water quality data stream in Year 3	GCOOS employee as of Nov 6, 2014
J. Scott Duff & Gary Jeffress; Larry Lloyd	TAMU-CC	Co-PI; TCOON Water level Local Data Node; Engagement for Integrated Water Quality Network	Maintain TCOON local data node with server enhancement (Texas water level network)	O&M for TCOON stations enabling expansion of water level network outside of Texas; Enhancement of the nearshore Integrated Water Quality Network project for TX, LA, MS and AL
Nancy Rabalais	LUMCON	Co-PI; LUMCOM Stations and Local Data Node	Maintain LUMCON Local Data Node's environmental monitoring stations off Louisiana	O&M for existing DO observations in out years; Add DO sensor east of Mississippi River Delta
James E. Ivey	FL FWRI	Co-PI; New Provider	<i>Not funded in Years 1-4</i>	New data provider; O&M to retain biochemical, HAB stations on West FL Shelf
Jan van Smirren	Fugro-Geos	Co-PI; New Provider	<i>Not funded in Years 1-4</i>	HFR station: Phase 1 - pilot in TX
Modeling and Analysis Subsystem				
Paul A. Montagna	TAMU-CC	Co-PI; Ecosystem modeling task	Ecosystem model: tools for decision-makers	
Frank Muller-Karger; Chuanmin Hu	USF	Co-PI; Ocean Color RS provider	Maintain IMaRS local data node: one satellite product	Enhanced satellite products provided
Robert Leben	CCAR at CU	Co-PI; SSH RS provider	New satellite provider: sea surface height product	Improved product availability
Nan Walker	LSU	Co-PI; SST RS provider	Maintain ESL local data node: one satellite product	Additional satellite products provided
Outreach and Education Subsystem				
Chris Simoniello	TAMU	Co-PI, GCOOS Outreach and Education Manager	O/E Coordinator work	Outreach and Education Coordination; O/E for additional interactive kiosks (2-3); EOC project support

ACOE=U.S. Army Corps of Engineers; Bowhead=Bowhead Science and Technology LLC; CBI=Conrad Blutcher Institute; CCAR=Colorado Center for Astrodynamics Research, University of Colorado; DISL=Dauphin Island Sea Laboratory; FSU=Florida State University; Fugro=Fugro-GEOS, Inc.; FWRI=Florida Fish & Wildlife Research Inst.; HRI=Harte Research Institute; LSU=Louisiana State University; LUMCON=Louisiana Universities Marine Consortium; MOTE=Mote Marine Laboratory; SCCF=Sanibel-Captiva Conservation Foundation; TAMU=Texas A&M University; TAMU-CC=Texas A&M Univ.-Corpus Christi; UAH=University of Alabama-Huntsville; USF=University of South Florida; USM=University of Southern Mississippi

3. **Work Plan for Upcoming Year:** The work plan for the upcoming year includes six tasks. The office staff will organize and hold meetings of the GCOOS-RA governing bodies and stakeholder

workshops. The project team will operate their local data nodes and provide data and products to the GCOOS data system. The project team and other members of the GCOOS-RA will engage with stakeholder sectors to ascertain needs. The office staff will entrain additional non-federal local data nodes into the GCOOS data system as well as enhance the capabilities and products of the Data and Product Portal. The office staff and other GCOOS-RA members will continue working with the outreach and education community to put information into the hands of those who need it. The GCOOS-RA will apply for certification as an IOOS Regional Association. Additionally, plans for year 5 include the addition of new assets to the systems of the principal investigators, again, only if funding is sufficient.

WORK COMPLETED

In Year 4 of the project, the planned work was largely completed, except that funding was not adequate to cover all enhancement or new tasks. In particular, additional observing assets and data management enhancements were not funded and related tasks were not undertaken. The work completed under the six task areas are:

- *Task 1: The office staff will organize and hold meetings of the GCOOS-RA governing bodies and stakeholder workshops.* Shown in Table 2 are the 5 meetings and 1 workshop that were held during the reporting period (http://gcoos.tamu.edu/?page_id=391). Personnel Changes: Ann Jochens retired as Executive Director of the GCOOS-RA, and Dr. Barb Kirkpatrick was hired for the position. Dr. Sharon Walker, PI for Education and Outreach, Institution for Marine Mammal Studies, retired, and Dr. Chris Simoniello became the lead PI for Outreach and Education. Dr. Simoniello continues as the Outreach and Education Coordinator.

Table 2. GCOOS-RA Meetings and Workshops from 1 December 2013 through 30 November 2014.

Description	Location	Date
Education and Outreach Council	Pensacola, FL	12-13 November 2013
Modeling task team	Conference call	4 December 2013
Modelling task team	Houston, TX	10 February 2014
Integrated Tracking of Aquatic Animals in the Gulf of Mexico (iTAG) workshop	St Petersburg, FL	29-30 May 2014
Non-governmental (NGO) workshop	Houston, TX	10-11 June 2014
18 th GCOOS-RA Board of Directors Meeting	Tallahassee, FL	17-19 March 2014
9 th Annual GCOOS Members Meeting	Tallahassee, FL	17-18 March 2014
19 th GCOOS-RA Board of Directors Meeting	Houston, TX	11-12 September 2014
HF radar Needs in the Gulf of Mexico	Webinar	27 October 2014

- *Task 2: The project team will operate their local data nodes and provide data and products to the GCOOS data system.* Figure 3 shows the locations of the observing assets that were partially supported by this project.
- *Task 3: The project team and other members of the GCOOS-RA will engage with stakeholder sectors to ascertain needs.* The GCOOS-RA website added a ‘press room’ section where media can sign up for media releases and/or the e-newsletter. A media specialist was hired as a consultant to assist the staff in media releases. The first release was a call for HF radar in the Gulf and was published 27 October 2014 in conjunction with the HF radar webinar.

The Board and Staff continued to develop the 10-year Build-Out Plan for the GCOOS (Figure 3). The 2nd version was approved by the Board in June and was posted to the website (<http://gcoos.tamu.edu/BuildOut/BuildOutPlan-V2.pdf>). A significant section on ecosystem monitoring was added to version 2.

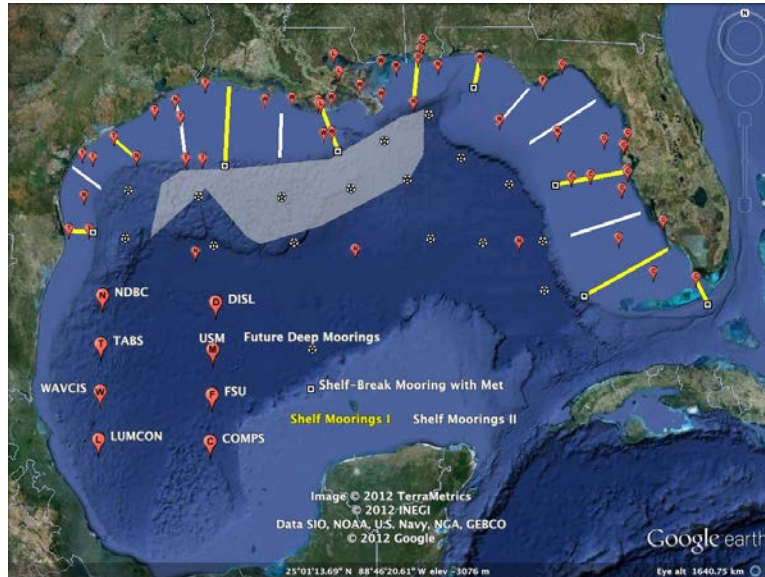


Figure 3. Existing mooring locations (red symbol with letter) with planned locations of additional moorings in the 10-year GCOOS Build-Out Plan when funding allows. Partial support was provided to the existing assets except for NDBC buoys, which are supported through NOAA. In addition the GCOOS-RA supported water elevation stations along the Texas coast through TCOON, a harmful algal bloom station off Sarasota, FL (Mote Marine Lab), and FL water quality stations of the SCCF.

- *Task 4: The office staff will entrain additional non-federal local data nodes into the GCOOS data system as well as enhance the Data-Product Portal's capabilities and products. The GCOOS-RA Data Portal enhancements continue in accordance with IOOS DMAC projects (<http://data.gcoos.org/index.php>). The installation of 52N SOS was fully operational in June 2014, with periodic changes. It is now harvested by EMMA on a regular basis. The GCOOS Products page (<http://gcoos.org/products/>) was enhanced through the addition of tabs on New/Highlight, Outreach and Education, Glider, and Oil & Gas topics. Included are: glider tracking capabilities, both subsurface and wave gliders, sea level rise scenarios, and hurricane tracker.*
- *Task 5: The office staff and other GCOOS-RA members will continue working with the outreach and education community to put information into the hands of those who need it. The GCOOS-RA Eco Hero Game was installed at the Sanibel Captiva Conservation Foundation visitor's center (Sanibel, FL). In addition, the game source information was given to colleagues from the National Marine Aquarium in Plymouth, UK, for adaptation to their local flora and fauna.*
- *Task 6: If funding allows, add new assets to the systems of the principal investigators. Funding was not sufficient to add new assets in Year 4.*

RESULTS

Results of the project through 30 November 2014 are:

*Maintain Base Capabilities: **DONE within funding limitations***

- Maintain the GCOOS-RA so it can continue to build toward a comprehensive GCOOS
 - 2 workshops
 - 2 conference call meetings
 - 3 meetings
 - 1 webinar
 - See Table 2
- Continue DMAC-compliant activities to achieve interoperability with non-federal data providers—our local data nodes
 - See Figure 3 for local data nodes partially funded by this project, enabling them to continue with interoperability activities as they provide their DMAC-compliant data.
- Maintain the functioning of the Data and Products Portal
 - See Figure 1 (products and data web sites).
- Continue activities with the outreach and education community to enhance public knowledge of the oceanic environment, their impacts on it, and its impacts on them.
 - continued enhancements to the Products page.

*Keep Existing Systems Functional: **DONE within funding limitations***

- Assist with keeping key existing non-federal observational systems functional by contributing support for operations and maintenance (O&M)
 - 9 local data nodes on the Gulf shelves were partially supported (USF-COMPS, Mote Marine Lab, DISL, FSU-Tower N7; USM-CenGOOS & HFR; LSU-WAVCIS; LUMCON; TABS; and TCOON); IOOS support is not sufficient for operation and maintenance of these aging assets, which were purchased under other projects, although it does help.
 - 1 local data node in the rivers to estuaries was partially supported (SCCF)
 - partial support for year 4 for HAB station (Campbell – TX HAB station)
 - Limitations in funding available meant that several of existing systems could not be supported or telemetered (Dardeau – Mobile Bay Estuary Monitoring; Park–AL station)
- Add enhancements to the Data Portal
 - Limitations in funding available have meant that the enhancements from Graves of UAH and Padgett for Bowhead/USACE could not be supported. These projects are in jeopardy of not moving forward because they will take several years to complete and have not yet started.
- Initiate an ecosystem modeling pilot activity to benefit state decision-makers
 - Project is moving into its final stages.

*Add New Systems: **Insufficient funding to add new systems***

Achieving a comprehensive observing system for the Gulf of Mexico—the GCOOS—requires the addition of new observing assets to fill gaps in needed observations. No new observing systems were added because the funding level was not sufficient to install, operate, or maintain new observing assets.

Limitations in funding available meant that several of the planned new systems or upgrades to

existing system could not be supported (see Table 1; Chunyan & Rabalais – upgrades to WAVCIS and LUMCON moorings for hypoxia monitoring; Park – adding telemetry to achieve real-time data deliver for an existing shelf station off AL; van Smirren – addition of an HFR pilot off Galveston). These projects are in jeopardy of not moving forward because they will take several years to complete and have not yet started.

The beach quality project has moved forward because the initial work planned for years 1 and 2 with the GCOOS Data Portal was able to be completed under a separate project. For year 4, the Kirkpatrick-Currier Beach Quality Monitoring network is funded at low levels to maintain the local data node.

IMPACT AND APPLICATIONS

National Security

The project has resulted in the rapid availability of non-federal data sets for use by the U.S. Coast Guard in its Search and Rescue operations. Two High Frequency Radar systems, which can reduce the search area, are installed and operational—MS-AL-FL panhandle area (Stephan Howden of USM under this project) and Tampa Bay to Naples, FL (Robert Weisberg of USF through the HFR project of the Southeast Coastal Ocean Observing Regional Association)—and data from both are available through the GCOOS Data and Products Portal. The footprints of the two systems are shown in Figure 5 in blue. The building of the High Frequency Radar network, which will consist of 48 (52 to Miami) HFR systems, will result in better outcomes for many SAR events (Figure 4). Additionally, when the High Frequency Radar network is built, it may provide data that can be used to track ships. Currently, funding levels are insufficient to add HFR stations.

Economic Development

Integration of existing and new observing elements into a unified ocean observing system will provide easy access to data, products, and services needed by users in their desired formats. Impacts of this system will enable the private sector to more easily generate new product lines. It will employ workers at technically skilled levels, such as for equipment manufacture, deployment, operation and maintenance, and data processing and analysis. For example, the project is providing O&M support to keep operational the observing system that measures surface currents over the shelf in the Mississippi-Alabama-Florida panhandle region. This system was used to track movement of oil at the surface from the BP *Deepwater Horizon* oil spill in 2010. The GCOOS will provide information that can be used to promote tourism by providing up-to-date information on beach, boating, and similar conditions; and, through the integration and linkage of people and resources, provide society the capability to better predict and mitigate against coastal hazards (e.g., track pollutants from industrial spills or enhance planning response for storm surge and coastal inundation), manage commercially important marine resources (e.g., wind energy, fisheries), and facilitate safe and efficient marine transportation.

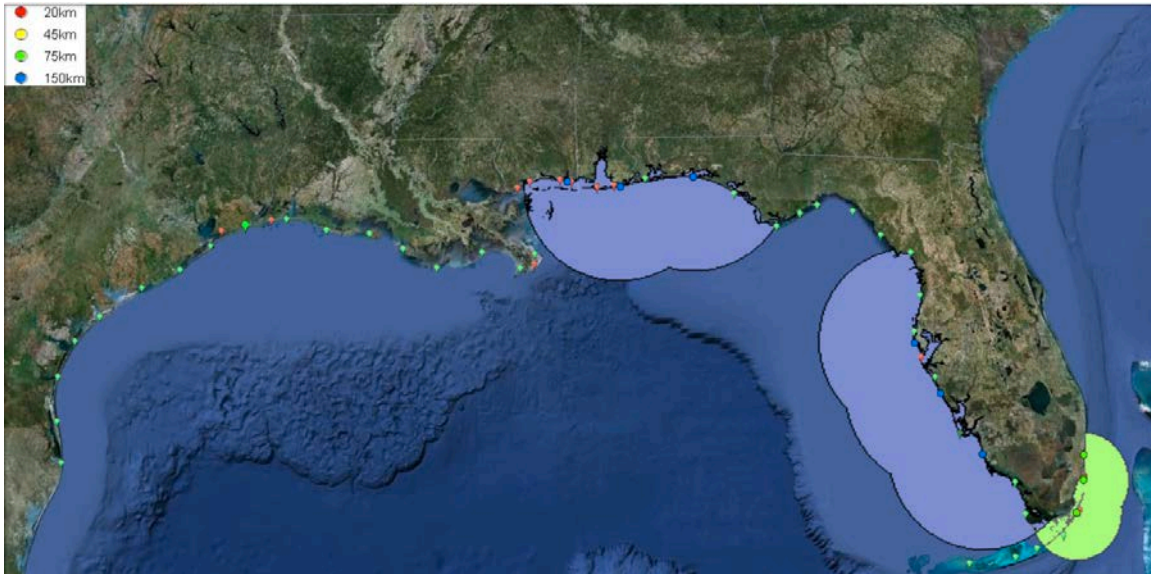


Figure 4. Planned HFR Network. The footprints of the 3 existing systems are shown in blue and green over the shelf.

Quality of Life

The potential future impact of the project is that the GCOOS itself will be built, and this will provide data and information that can be used to assess quality of life issues related to the marine environment. Through integration of the multi-disciplinary data and information obtained from diverse sources, monitoring to preserve and restore healthy marine ecosystems will advance (e.g., monitor and suggest how to mitigate low oxygen conditions on the shelf and in the coastal estuaries – Figure 5) and protecting human health will be benefited (e.g., improve prediction of water quality including harmful algal blooms – Figure 6). Improved capabilities to detect and predict climate variability will result from long time series of data that will allow better decisions on actions to adapt to, mitigate, or prevent the consequences. The sharing of the data, models, and products via the internet is for the common benefit of the public and all participants, including industry, NGOs, academia, and federal, state, regional, and local government agencies.

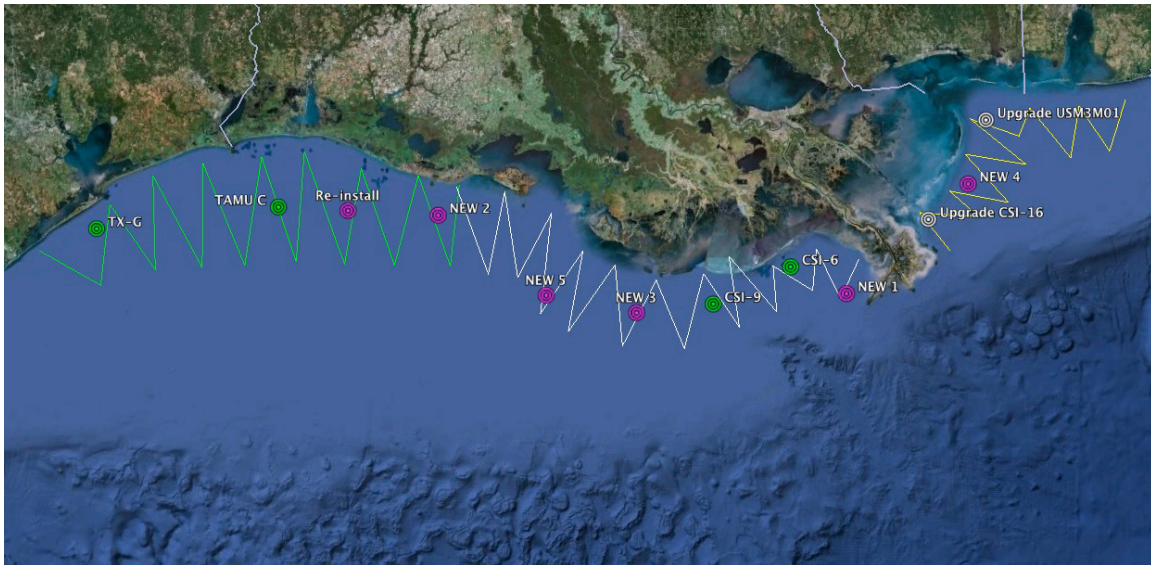


Figure 5. Hypoxia monitoring plan for the Gulf shelf; additional plans are under development for the estuaries and nearshore environment with the Gulf of Mexico Alliance Water Quality and Nutrient Reduction Priority Issue Teams.

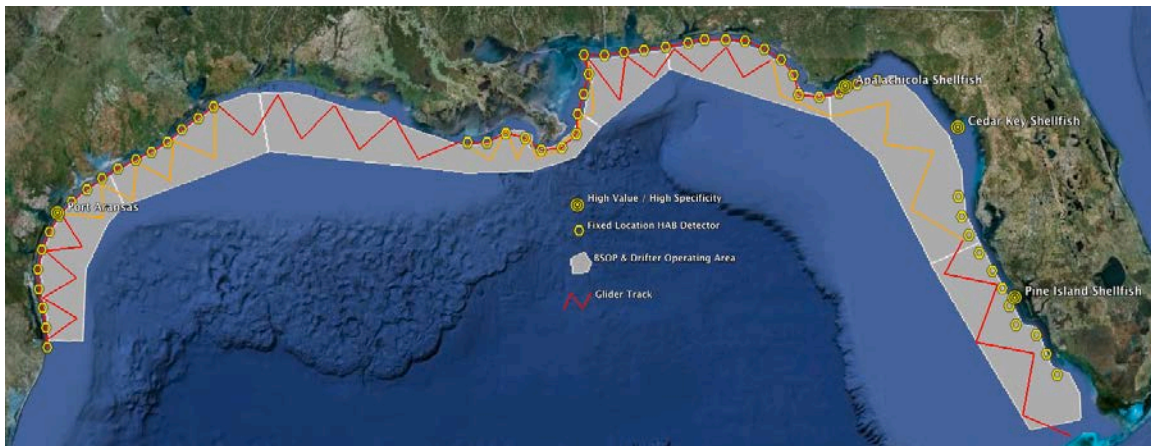


Figure 6. Harmful Algal Bloom Integrated Observing System (HABIOS), a HABs monitoring plan under development with the Gulf of Mexico Alliance Water Quality Priority Issue Team.

Science Education and Communication

Through the outreach and education activities of this project, more information will be available to the public, in forms suitable for diverse intellectual abilities, to help them make informed decisions regarding a broad range of interactions with the coastal ocean environment—from recreational activities to emergency responses.

TRANSITIONS

National Security

High frequency radar data are used by the U.S. Coast Guard to narrow the search radius during Search and Rescue operations (Figure 5). Non-federal data sets have been made available for immediate ingestion into weather forecast models and use in planning emergency response actions.

Economic Development

Web-based access to a wide range of data and information has been made available to recreational boaters, including sports fishermen and tourists, to improve planning for leisure time; over time this enhances the tourism industry.

Quality of Life

Efforts are underway to improve water quality monitoring and to integrate data sets for more effective decision-making by local, state, and federal agencies. The focus currently is on issues of hypoxia, excessive nutrient loading and eutrophication, harmful algal blooms, and beach conditions (Figures 5 and 6).

Science Education and Communication

Materials and lesson plans are being developed to provide educators with new tools and information to educate their classes in the marine ecosystem. Plans also include the expansion of the locations with the GCOOS interactive learning kiosks installed; the targeted locations are for informal educational settings such as aquariums and museums. <See "Educators at <http://gcoos.org>>

RELATED PROJECTS

The Gulf of Mexico Coastal Ocean Observing System (GCOOS) was formed in 2000 as one of the regional coastal ocean observing systems under the U.S. Integrated Ocean Observing System (IOOS). GCOOS is developing as a sustained ocean observing system that provides data, information, and products on marine and estuarine systems to a wide range of users. A Regional Association, the GCOOS-RA, was established by a Memorandum of Agreement (MoA) in January 2005. The organizational structure was in place by April 2006. Much progress has been made toward the development of the GCOOS. However, as revealed by the BP *Deepwater Horizon* oil spill, which is a vivid example of the need for a robust ocean observing system in the Gulf of Mexico, much remains to be done to bring this observing system to maturity.

Projects that have supported GCOOS development to date are in four main areas: Regional Association Governance and Management, Data Management, Observations, and Modeling. All areas include components of Outreach and Education in them, and all are represented on the GCOOS web site at <http://gcoos.org>. The foundational projects for each of these areas were:

Regional Association Governance and Management: Projects that developed the GCOOS Regional Association, its structure, and priorities, as well as provided staff and travel support for the GCOOS-RA efforts.

1. Maintenance and Enhancement of the Gulf of Mexico Coastal Ocean Observing System-Regional Association. Awarded \$1,199,943 by NOAA, Cooperative Agreement NA08NOS4730289, 1 May 2008 through 30 April 2012. Principal Investigators: A.E. Jochens and W.D. Nowlin, Jr.
2. Development of the Gulf of Mexico Coastal Ocean Observing System (GCOOS) and its Regional Association (GCOOS-RA): Phase II. Awarded \$1,100,688 by NOAA, Cooperative Agreement NA05NOS4731167, 1 June 2005 through 31 May 2008. Principal Investigator: W.D. Nowlin, Jr. A.E. Jochens was a named key person on this project and was the Regional Coordinator for GCOOS-RA.
3. Workplan to Increase Nonfederal Participation in the GOMA Monitoring Network Workshop. Awarded \$11,000 by EPA, Grant Number MX-00D09813, 1 January 2013 through 31 December 2013. Principal Investigator: A.E. Jochens.

Data Management: Projects that support common data management and regional interoperability.

4. Maintenance and Enhancement of the GCOOS Data Portal; Building toward a Regional Operations Center. Awarded \$1,700,000 by NOAA, Cooperative Agreement NA08NOS4730411, 1 January 2009 through 30 June 2013. Principal Investigators: A.E. Jochens, M.K. Howard, F. Gayanilo, S.H. Walker, and C. Simoniello.
5. Integration of and Regional Enhancement to the GCOOS: Development of a Data Portal. Awarded \$500,000 by NOAA, Cooperative Agreement NA07NOS4730217, 1 January 2008 through 30 April 2010. Principal Investigators: A.E. Jochens and M.K. Howard.
6. GCOOS Services to the Gulf of Mexico Research Initiative (GoMRI): Awarded \$315,250 for the first three years of the contract period 1 June 2011 through 31 May 2016. Years 4 and 5 will be priced when the scope of work to be carried out in those years is decided. Principal Investigators: M.K. Howard and A.E. Jochens. A proposal to GoMRI for \$226,957 for years 2015-2016. We have not heard the results as of 30-November-2014.
7. Incorporation of Hypoxia and Nutrient Datasets into the GCOOS Data Portal: Principal Investigator: M.K. Howard. Awarded \$75K for calendar years 2014-2015 by the Gulf of Mexico Alliance.
8. National Marine Sanctuaries as Sentinel Sites for a Demonstration Marine Biodiversity Observation Network (MBON). MBON was awarded to the University of South Florida through funding opportunity NOAA-NOS-IOOS-2014-2003803. GCOOS is a subcontractor to University of South Florida and was awarded \$250,392 for a five year period starting 1-August-2014. Principal Investigator: M.K. Howard.

Note: #6 below also has elements of Data Management.

Observations: Projects that support entrainment of non-federal local data nodes into the GCOOS and that promote data interoperability using IOOS standards and protocols.

9. Standardization of Local Data Network Nodes in the Gulf of Mexico. Awarded \$744,038 by NOAA, Cooperative Agreement NA07NOS4730199, 1 January 2008 through 31 December 2011. Principal Investigators: A.E. Jochens and M.K. Howard.

Note: #3 and 4 above also have elements of entraining non-federal data nodes into GCOOS.

Modeling: Projects that support regional modeling and analysis capacity building and the development of the Model Resource Center of the Data and Products Portal.

10. GOMEX 3-D Operational Ocean Forecast System Pilot Project. Subcontract with Portland State University for \$200,000 for the period 11 March 2010 through 10 September 2011. Principal Investigators: M.K. Howard, A.E. Jochens, and S.F. DiMarco.
11. SURF contract for \$28,921 for the period 1 June 2010 through 31 December 2011. Principal Investigator: M.K. Howard