

Research Performance Progress Report Northern Gulf Institute

NA16OAR4320199

July 1, 2018 to June 30, 2019

**Cortez, Florida
NOAA Coastlines**



NGI
NORTHERN GULF INSTITUTE
a NOAA cooperative institute



DEPARTMENT OF COMMERCE RESEARCH PERFORMANCE PROGRESS REPORT (RPPR)

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AWARD INFORMATION	
1. Federal Agency: Department of Commerce / NOAA	2. Federal Award Number: NA16OAR4320199
3. Project Title: Proposal to Re-form the Northern Gulf Institute	
4. Award Period of Performance Start Date: 10/01/2016	5. Award Period of Performance End Date: 09/30/2022
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REPORTING INFORMATION	
Signature of Submitting Official: Whitley Alford	
16. Submission Date and Time Stamp: 07/29/2019	17. Reporting Period End Date: 06/30/2019
18. Reporting Frequency: <input checked="" type="radio"/> Annual <input type="radio"/> Semi-Annual <input type="radio"/> Quarterly	19. Report Type: <input checked="" type="radio"/> Not Final <input type="radio"/> Final
RECIPIENT ORGANIZATION	
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22. Recipient DUNS:075461814	23. Recipient EIN:646000819

ACCOMPLISHMENTS

24. What were the major goals and objectives of this project?

The primary research goals outlined in the strategic plan are: (1) to understand the structure, function, and services of ecosystems across land-sea, ocean-atmosphere, and coastal waters-deep sea interfaces; (2) to synthesize information across disciplines to reduce uncertainty and to forecast ecosystem responses; and (3) to develop applications that address regional management needs.

NGI's four research themes are: (1) Climate Change and Climate Variability Effects on Regional Ecosystems; (2) Coastal Hazards; (3) Ecosystem Management; and (4) Effective and Efficient Data Management Systems Supporting a Data-driven Economy.

25. What was accomplished under these goals?

Federal / state / industrial employees were trained in the latest GIS techniques and technologies and the data available from the Digital Coast repository. Development and maintenance of three geospatial web applications was continued. Updated 1:4800 surface hydrology databases were produced for several coastal regions of Mississippi.

Funding for HPC support for OAR researchers produced a system ranked the 62nd most powerful system in the world (May 2019). Early user-access was expected in mid-July 2019.

In a study focused on Biscayne Bay, sources of nutrients were identified from the previously conducted trend analyses. In discussions with the developer of BBSIM and other NOAA partners, it was determined that another hydrodynamic model should be considered for incorporation of a water quality model and that a more detailed assessment of nutrient loading from the watershed should be conducted.

In the VORTEX-SE project, one case study that the stratocumulus cloud fraction for QLCS's was 97% and 83% for supercells.

We started development of a real-time prototype HR-VAD product that is currently operational on the ARMOR radar. Wind profiles obtained from the HR-VAD have been compared with wind profiles from wind profiling systems nearby, with very good correlation between the two measurements. Initial analysis of conventional WSR-88D VAD wind profile data are being analyzed to determine changes in the low-level wind profile (e.g., 0-1 km storm-relative helicity) during the natural AET (+/- 2 hr of sunset) for potential severe storm cases, defined as such when a severe thunderstorm or tornado watch has been issued.

Hypoxia: An annual cruise was completed. Forecasting and hindcasting was conducted. Three technical working group workshops were conducted. Research outputs were presented to the Hypoxia Task Force at the annual meeting.

A dependency of the SFMR algorithm accuracy on environmental (mid-latitude vs tropical) characteristics (SST, ambient air temperature) was identified. Analysis of thousands of dropsondes showed that the relationships between upper level winds and surface winds needs updating. Preliminary analysis of NOAA aircraft data indicates the presence of meso-vortices in the eyewall of major hurricanes that could be responsible for the discrepancy in traditional comparisons of flight level and SFMR wind speed data. Additional SFMR high wind speed data was collected in several major hurricanes during the 2018 hurricane season to aid in analyzing the pitch dependency of the SFMR.

Collection, routine data quality control, dissemination, and archival of 6198 ship days of underway meteorological and oceanographic data from 32 research vessels. Notable is the increase of over 1100 days of data received and processed by the SAMOS DAC in FY18 as compared to FY17. For the NOAA fleet, we received and processed SAMOS data for 89% of the days NOAA vessels were

Attach a separate document if more space is needed for #6-10, or #24-50.

ACCOMPLISHMENTS (cont'd)

26. What opportunities for training and professional development has the project provided?

NGI researchers and partners continued to provide timely updates to local stakeholders concerning topics and conditions of the region. Concept and topic specific releases, classes and multi-disciplinary workshops for further professional development were provided to both the public and private sectors. Several team members attended programming workshops, seminars on leadership, ARC GIS classes, and took online courses at affiliated universities. Students associated with the NGI attended; AGU, AMS, AAPG, HPC2, US Hydro, software training for GNSS work, and the NOAA Geospatial Summit. Additionally, NGI personnel (including students) received instruction on operation of the UAS and ASVs and their associated data collection systems. Additionally, many opportunities were made available to undergraduate, graduate and postdoctoral scholars, which often resulted in opening and expanding their career development pathways. Students were able to continue their training for participation in the various NOAA field programs. As well as contributing to or authoring publications and attending conferences to present their findings. NGI teams have also participated in training activities and attended conferences to enhance their knowledge on the operation of HPC systems as well as advocate potential research activities that may be conducted by NOAA on the newly installed system. This includes training on software, hardware integration and programming for use in better management of High-Performance Computing assets used to support the NOAA mission.

The NGI has provided further resources for educators, researchers and the public to obtain professional training to stay up to date with or in some cases learn or gain exposure to advanced geospatial technologies. This includes training and education for both proprietary and open-source geospatial software platforms. Allowing for enhancements to workforce development and spatial data dissemination. Funding also provided analyses results to meteorologists as well as local and regional emergency managers in the field seeking to improve warning dissemination to vulnerable populations.

Several new techniques have been integrated with the NOAA Hurricane Research Division and the National Hurricane Center. Both organizations can now use the new techniques to gain further insight into the characteristics and enhancement of various tropical cyclone products. These new techniques being integrated with the Hurricane Forecast Improvement Project (HFIP) and will be utilized to improve hurricane and tropical system intensity and track forecasts.

Additional professional development and outreach opportunities have been undertaken to expose not only professionals but students and the general public to NOAA mission specific science and STEM/STEAM related research and findings of active and often locally relevant projects. These events include participation by NGI scientists in educational summer camps, and engaging K-12 students in ocean and atmospheric coursework. Workforce and professional development mean nothing without interaction with students and future scientists. NGI also takes a great interest in forging community STEM/STEAM engagement events, with active demonstrations, displays and activities for students and members of the public which include: NASA Infinity Center Homeschool Mondays, Stennis "Take your kids to work day", Mississippi Science Teachers Association Annual Meeting, GOMA (Gulf of Mexico Alliance) All Hands Meeting, Gulfport Highschool Theatre (Theatrical Production on Climate), Harrison County School District (Visiting Faculty lectures, displays and activities), Lynn Meadows Discovery Center (Children's Museum displays and activities), SC19 (Super Computing Conference to discuss NOAA use of new HPC systems), Celebrate the Gulf (Marine Science Festival), Mississippi Aquarium-Gulfport, and Starkville Oktibbeha County School District (Visiting Faculty lectures, displays and activities).

27. How were the results disseminated to communities of interest?

Results of the sponsored operations and research have been disseminated through several channels including publication in peer reviewed journals and proceedings as well as through both public and project specific specialized meetings, conferences and workshops. As a result, both the public and other local stakeholders have been given a better understanding of their associated environments.

ACCOMPLISHMENTS (cont'd)

28. What do you plan to do during the next reporting period to accomplish the goals and objectives?

The NGI and its associated researchers intend to continue to provide high-quality work and dissemination of research findings. NGI will also continue to develop and implement a more comprehensive watershed assessment for the Gulf of Mexico, to include the continued development of a land use GIS database, further hydrologic and biologic assessments, and continually enhanced water quality, oceanographical and meteorological assessments that will be used in future modeling and assessment of the regions conditions.

PRODUCTS

29. Publications, conference papers, and presentations

There were 70 Associated publications generated by this project cycle. These are listed in detail in the attached MS Excel Document and have been submitted to the NOAA Institutional Repository.

PRODUCTS (cont'd)

30. Technologies or techniques

Nothing to Report

31. Inventions, patent applications, and/or licenses

Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

PRODUCTS (cont'd)

32. Other products

In addition to publications generated by the associated research, the NGI Education & Outreach team produces a quarterly newsletter of current events, notices and relevant research based upon requested researcher submissions, to the NGI Website as both a Newsletter and as Blog posts. These can be viewed at <http://www.ngi.msstate.edu/portal/> and <http://www.ngi.msstate.edu/portal-blog/> respectively.

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

33. What individuals have worked on this project?

Robert Moorhead- Director NGI
Steve Ashby- Associate Director NGI
Jonathan Harris- Outreach Coordinator
Brandy Akers- Program Administrator (July 2018 - May 2019)
Whitley Alford- Program Administrator (June 2019)

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS (cont'd)

34. Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Whitley Alford has replaced Brandy Akers as the NGI Program Administrator.

35. What other organizations have been involved as partners?

Besides NOAA, LA office of Coastal Protection and Restoration, MS Department of Marine Resources, MS Department of Environmental Quality, RESTORE Council, Gulf of Mexico Research Initiative (GoMRI), GRIIDC, the NOAA RESTORE Science Program, the National Academies of Science Gulf Research Program, and Florida A&M University

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS (cont'd)

36. Have other collaborators or contacts been involved?

Nothing to Report

IMPACT

37. What was the impact on the development of the principal discipline(s) of the project?

Additional information about processes associated with associated regions of study was developed. These finding were made available as recommendations to local stakeholders and resource managers and used to influence additional studies to be conducted in the future. On the matter of the "Gulf Dead Zone", The Hypoxia Task Force was informed about the extent of the hypoxia zone in 2018. Interactions with stakeholders in the watershed of the MS River were increased. The hypoxia zone east of the MS River was highlighted in several presentations and was highlighted again for those who did not know of its existence.

IMPACT (cont'd)

38. What was the impact on other disciplines?

An increased understanding on the impacts and influences of independent interactions among separate scientific disciplines.

39. What was the impact on the development of human resources?

These projects provide the opportunity to train the next generation of experts in their respective fields, including training graduate students in NOAA-relevant disciplines, which is often augmented by personal mentoring by NOAA scientists from associated line offices. These interactions will provide good candidates for the future NOAA mission workforce. They have provided hands on experience to dozens of undergraduate and graduate students. The results of these projects may lead to increases in human resources by number and skill as understanding of the associated environment is enhanced and improved. Additionally, the graduate students involved have refined their research skills and have become familiar with the peer review publication process.

IMPACT (cont'd)

40. What was the impact on teaching and educational experiences?

The NGI through its associated Education & Outreach offices and personnel have been able to provide significant opportunities to local and regional educators and students alike through design and implementation of science curriculum alongside the various state departments of education as well as through individual teachers and through support of students.

The NGI Education and Outreach Program connects universities to NOAA and 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. Together we develop communication and significant long-term messaging campaigns to address identified priority issues and to disseminate content and reports of research accomplishments through a multi-media approach including listserv emails, Twitter, Facebook, and continual updates to the institution's website with NGI audience relevant news. Content includes recent information about research activities.

Education and outreach is something NGI has taken seriously since its inception. We are constantly developing coastal, marine and atmospheric science courses, curriculum and fieldwork for regional and even national educators to use as supplemental material for their classroom.

Some Projects NGI is involved in include:

Professional Development for teachers including continuing education opportunities for teachers and industry professionals in conjunction with the MSU Geosciences Program. Additionally, NGI develops "Travelling Trunk Shows". Generally speaking, these trunks include Art and Science based curriculum designed to support state educational requirements. We typically include the "science, literature and arts behind the scenes" that includes targeted classwork and lessons of discovery for, specifically in our case, oceanography, marine and fisheries science, and weather. These trunks provide STEAM focused interaction with large numbers of schoolchildren, their parents, teachers and administrators.

We have also developed a "Scientists Get Involved" program that includes science, engineering and mathematics faculty from departments spanning all NGI partner institutions, giving visiting, timely, guest lectures in classrooms of local schools, children's museums, public events and festivals all along the Gulf Coast.

All this we undertake in addition to outreach opportunities provided by displays and presentations made while travelling to state and national science teaching association meetings, as well as national industry specific conferences including most earth and atmospheric sciences conferences, high performance computing conferences, and those that involve UAS and AUV technologies.

The NGI Education and Outreach Program continues to be positioned to provide high-impact, curriculum-based support to both the public and educators throughout our region. We look forward to working to provide a better future to our communities through

41. What was the impact on physical, institutional, and information resources that form infrastructure?

Nothing to Report

IMPACT (cont'd)

42. What was the impact on technology transfer?

Nothing to Report

43. What was the impact on society beyond science and technology?

Because of these projects there has been an increase in public understanding of the environment including watershed and associated downstream impacts on water quality, marine habitat environment and climate of the region.

IMPACT (cont'd)

44. What percentage of the award's budget was spent in foreign country(ies)?

0 , null

CHANGES/PROBLEMS

45. Changes in approach and reasons for change

There have been no significant changes reported

CHANGES/PROBLEMS (cont'd)

46. Actual or anticipated problems or delays and actions or plans to resolve them

Please see the attached list of all projects that were extended beyond their originally scheduled project end date, address reasons for the delays and plans to resolve them.

47. Changes that had a significant impact on expenditures

Nothing to Report

CHANGES/PROBLEMS (cont'd)

48. Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to Report

49. Change of primary performance site location from that originally proposed

Nothing to Report

PROJECT OUTCOMES

50. What were the outcomes of the award?

Numerous presentations and publications improved hazardous weather warnings to the general public, state, local, and professional entities. Increased understanding of physical (e.g., wind, stress, waves, and cyclonic characteristics), chemical (e.g. salinity), and biological (fish dynamics and phytoplankton distribution) processes in the Gulf of Mexico lead to improved simulations and forecasting related to water quality patterns (e.g., salinity and oxygenation) and currents. Coastal resiliency to impacts of sea level rise was enhanced with the ongoing development of a geospatial based decision support tool.

DEMOGRAPHIC INFORMATION FOR SIGNIFICANT CONTRIBUTORS (VOLUNTARY)

Gender:

- Male
- Female
- Do not wish to provide

Ethnicity:

- Hispanic or Latina/o Not
- Hispanic or Latina/o Do not
- wish to provide

Race:

- American Indian or Alaska Native Asian
- Black or African American
- Native Hawaiian or other Pacific Islander
- White
- Do not wish to provide

Disability Status:

- Yes
 - Deaf or serious difficulty hearing
 - Blind or serious difficulty seeing even when wearing glasses
 - Serious difficulty walking or climbing stairs
 - Other serious disability related to a physical, mental, or emotional condition
- No
- Do not wish to provide

Attach a separate document if more space is needed for #6-10, or #24-50.