



Progress Report

Project Title: Accelerate Improvements in Hurricane Intensity Forecasting Through Underwater Glider Field Campaigns

Award number: # NA22NOS0120178

Period of Activity: 09/01/2022 – 02/28/2023

Submission Date: 3/22/2023

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Co-investigators: Gerhard Kuska (MARACOOS), Travis Miles (Rutgers University), Jorge Brenner (GCOOS), Stephen Howden (GCOOS/University of Southern Mississippi), Julio Morell (CariCOOS), Patricia Chardón-Maldonado (CariCOOS), Jennifer Dorton (SECOORA), Catherine Edwards (Skidaway Institute of Oceanography, University of Georgia)

I. PROJECT GOAL:

The overall goal of this project is to conduct targeted and sustained underwater glider deployments during the 2023 and 2024 Atlantic hurricane seasons. Glider missions will collect ocean observations that optimize the representation of ocean features in ocean-atmosphere coupled models used for hurricane intensity forecasts. The glider field campaign is designed to collect data in hurricane-prone regions of the U.S. (Caribbean Sea-Tropical Atlantic Ocean, Gulf of Mexico, and the South Atlantic Bight and Mid Atlantic Bight).

Objectives from the proposal are identified in Section II Progress and Accomplishments. High-level accomplishments and any issues identified by each project team member are included for each objective. Status of each deliverable is reported as complete, on-track, or delayed. If the milestone is delayed, a justification for the delay and description of activities employed or to be employed to mitigate the delay are provided.

II. Progress and Accomplishments

Objectives	Status
Objective 1: Coordinate IOOS Regional Association (RA) and OAR Atlantic Oceanographic and Meteorological Laboratory (AOML) glider sampling to measure subsurface temperature and salinity profiles during the Atlantic hurricane season.	
Funding for the project was made available to the SECOORA in September 2022. Subaward contracts were sent from SECOORA to project subawardees with awards being executed in October and November 2022. No glider missions were flown as part of this award in 2022 since the subawards were not fully executed until the end of the 2022 Atlantic Hurricane Season. The following accomplishments detail the work that is	On-track



<p>underway by each IOOS Regional Association (RA) to prepare for the 2023 Atlantic Hurricane Season.</p> <p>Accomplishments:</p> <ul style="list-style-type: none"> • The SECOORA glider team is actively mission planning with the first glider deployments planned for July 2023. The team has ordered battery packs, science sensors have been calibrated, the glider Franklin has undergone regular pump service, and the glider Pelagia was sent back to Teledyne Webb for repairs due to a forward leak. In October 2022, SECOORA ordered a new G3 Slocum glider from Teledyne Webb. The new glider is scheduled for delivery in mid-April 2023. The new glider will replace an older, more failure prone G1 glider. • CARICOOS is working with NOAA-AOML, Ocean and Coastal Observing – Virgin Islands (OCOVI), and the US Navy – Naval Oceanographic Office, to prepare for the upcoming season. Planning activities include securing vessels, determining glider lines, and refurbishing gliders. Planning should be complete by May 2023. The team is also securing building space in the DMS/UPRM field station in Isla Magueyes, La Parguera, for glider storage and a workshop area. • GCOOS is leading the glider mission planning for the Gulf of Mexico. Regular bi-monthly meetings with the project team began in Fall 2022. Glider supplies and long-life lithium battery packs have been ordered and should be delivered by March 2023. Additionally, GCOOS and Texas A&M University (TAMU) hired a new Oceanographer, Dr. Uchenna Kwankwo, who will coordinate the Gulf Glider Group. TAMU trained one additional glider pilot and glider team operations are on track to conduct two Gulf of Mexico glider missions in 2023. Although this activity is not part of this project, Texas A&M Geochemical and Environmental Research Group (GERG) is also negotiating with Teledyne to purchase one more glider to bring the GERG fleet to 5 operational gliders, providing additional assets for use in this project. • MARACOOS is on track to conduct planned 2023 glider deployments. A Slocum G3 is on order from Teledyne Webb and should be received August 2023. The glider will be used in the 2023 glider campaign. 	
<p>Objective 2: Submit real-time ocean glider profiles to the IOOS National Glider Data Assembly Center (GDAC), where data are quality-controlled and harvested by the NWS for assimilation into the operational NOAA Real-Time Ocean Forecast System (RTOFS)</p>	
<p>No data was submitted to the GDAC in 2022 for this award as no glider missions were flown as part of this project in 2022. Each RA has the appropriate data management structure to submit data to the GDAC in 2023 to support this objective.</p> <p>Accomplishments:</p> <ul style="list-style-type: none"> • CARICOOS has tested a new base station and revised their piloting tools and automatic data quality control procedures based on recommendations from the Applied Physics Laboratory (APL) at the University of Washington. • GCOOS Co-Data Manager, Bob Currier, has finalized the Seaglider data connection that will be needed to bring the University of Southern Mississippi’s Seaglider into the GANDALF visualization system. GANDALF will be used to pilot the Gulf of Mexico gliders. 	<p>On-track</p>

Objective 3: Coordinate IOOS Regional Association (RA) and OAR Atlantic Oceanographic and Meteorological Laboratory (AOML) glider sampling strategies with the IOOS Glider Lead and the National Weather Service (NWS) National Centers for Environmental Prediction (NCEP) Environmental Modeling Center (EMC) to improve model forecast accuracy

- Project team representatives from each RA participate on bi-weekly glider calls lead by Kathy Bailey with the IOOS Program Office. These calls are hosted on Mondays and are bi-weekly during the non-hurricane season and weekly during hurricane season.
- The IOOS Model/Data Comparison science team, led by MARACOOS co-PI Scott Glenn, accesses the growing ensemble of real time ocean forecast models – currently NOAA RTOFS (both Operational Production & Experimental Parallel runs), Navy GOFS, European CMEMS, Navy AmSeas, and SECOORA CNAPS – and compares the models to all the available glider and Argo data along the North Atlantic hurricane pathway daily. The science team includes Subject Matter Experts from each of the four IOOS regions (CARICOOS, GCOOS, SECOORA, and MARACOOS). The science team reviews the recent automated model/data comparison products and develop a compact set of conclusions. Model/Data comparison results are summarized on Thursdays and are delivered to NOAA’s Environmental Modeling Center (EMC) on Fridays for their weekly RTOFS team meeting. Results are also presented on Mondays at the IOOS Hurricane Glider meeting. Over the last year the IOOS Model/Data Comparison science team has grown the model ensemble in the automated workflow to the current six models, has identified operational RTOFS’s significant challenges of properly representing the essential ocean salinity features along the hurricane pathways, and are actively working with EMC to evaluate the anticipated improvements in the experimental RTOFS. Having the best representation of the essential ocean features in RTOFS is especially critical in 2023 since it will provide initial ocean conditions to the new hurricane forecast model HAFS when it becomes operational.
- SECOORA co-PI Catherine Edwards is coordinating with NOAA Saildrone team for Saildrone-glider coordination for the 2023 hurricane season.
- Project team members from each RA coordinate with national efforts through participation in the Underwater Gliders User Group (UG2 - <https://underwatergliders.org/>) community.

Additional Areas of Success

- Project team success stories that are not specifically part of the proposal, but which contribute to the overall IOOS and project team missions, are provided below:
- CARICOOS personnel and its partners are inviting students and volunteers to learn about glider instrumentation and train them on how to refurbish, deploy, and recover underwater gliders. This initiative promotes active, engaging, and experiential learning about advanced technology and how to turn data into practical knowledge.
 - CARICOOS designed Infographics educate and increase awareness about the instrumentation that comprises a coastal ocean observing system, its components, and the information they provide: <https://school.caricoos.org/en/instrumentation/>
 - CARICOOS provided mentorship and sponsorship to 11th and 12th grade students of the Residential Center of Educational Opportunities in Villalba, PR to conduct research

<p>projects in ocean observing instrumentation including the use of AUVs.</p> <ul style="list-style-type: none"> • The GCOOS Gulf of Mexico Glider Pilot team has coordinated with other partners, specifically CICESE in Mexico, University of Texas San Antonio, University of Louisiana – Lafayette, and AOML Saildrone Group who will now contribute their glider data from the Gulf of Mexico to the GDAC. These collaborations will increase the volume of data submitted to the GDAC in support of hurricane intensity forecasting. 	
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III. PROJECT CHALLENGES/MODIFICATIONS:

- Equipment and supply costs are increasing due to inflation and supply chain shortages. Many PIs placed orders for supplies and equipment before the end of the calendar year to secure items at 2022 costs versus 2023 costs. Multiple vendors are quoting 10%-15% price increases for 2023. Each of the RAs anticipate continued higher than normal costs for the upcoming year.

IV. PUBLICATIONS:

There are no publications for this award at this time.

V. BUDGET SUMMARY:

- Were the oldest ASAP TAS BETC accounting lines invoiced first?
 - This is Year 1 of the award. SECOORA is spending Year 1 ASAP TAS BETC lines first.
- Give details on any delays with initiating a contract/subaward. Note any issues with the previous year funds or other issues that occurred during the reporting period. Will this result with a work stoppage or cause significant problems with the partnership?
 - SECOORA has issued all subawards related to this award. All subawards have been fully executed.
- Give a brief update on project invoicing for the reporting period. Were there any delays with invoicing or payment?
 - SECOORA has not received any Year 1 invoices; however, this is not surprising since most project teams are planning for the 2023 Hurricane Season. We anticipate receiving invoices in the 2nd half of Year 1. Additionally, there is always a delay between when a subawardee conducts work and when SECOORA is given an invoice for that work. SECOORA regularly monitors invoicing frequencies with subawardees/subcontractors.
- Provide details on any property or equipment charged directly to the award having a useful life of more than one year and an acquisition cost of \$5,000 or more per unit during the period.
 - SECOORA is purchasing a new Slocum G3 Glider from Teledyne Webb. The glider will be used to measure temperature and salinity profiles at varying depths in support of this award. The total cost of the glider is \$246,712. The glider was ordered on 10/4/2022 and ½ of the purchase price was paid at that time. The balance will be paid when the glider is ready for shipment in April 2023.
- Include changes in key scientific, technical or management personnel, not included in certification.
 - No changes
- Include changes to the organizational structure such as: changes in status or partners organizations and points of contact. As a reminder, a change to the award’s Principal Investigator and a change in an award’s Key Person Specified in the Application requires NOAA approval through Grants Online. Guidance for both these Award Action Requests is available on Grants Online at http://www.corporateservices.noaa.gov/grantsonline/Documents/AAR_Assistance/Recipient_AR_Help.htm
 - No changes to organizational structure.



- Provide an update about travel completed during the reporting period.
 - No travel has been completed during this reporting period.
 - Are there any plans to initiate a new partnership (contract or subaward) during the next reporting period?
 - No
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