



Progress Report

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

Award number: # NA22NOS0120178

Period of Activity: 03/01/2023 – 08/31/2023

Submission Date: 9/20/2023

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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
<p>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.</p>	
<p>The following accomplishments detail glider deployments and other work that is underway by each IOOS Regional Association (RA) during the 2023 Hurricane Season. Accomplishments:</p> <ul style="list-style-type: none"> The SECOORA glider team is comprised of members from UGA’s Skidaway 	On-track



Institute of Oceanography (SkIO), University of South Florida (USF), and UNC-Chapel Hill.

- SECOORA purchased a new glider with funding from this award. The new glider, Unit 1091, was delivered to SkIO in May 2023. The SkIO team conducted lab checks and inspections and tested the system in the ballast tank. After passing initial checks, Unit 1091 was deployed on 8/3/23 off the coast of GA. This was the inaugural deployment and the glider remained at sea until 8/28/23 when it was picked up off the coast Wilmington, NC. Unit 1091 was recovered 3 days prior to Idalia heading back out to sea over NC after initial landfall in FL.
- USF and SkIO ordered alkaline battery packs for late summer/early fall glider deployments. SkIO has also repaired Pelagia, which had a leak that could not be repaired by Teledyne-Webb. Pelagia is a G1 glider and Teledyne-Webb is no longer supporting the repair of the G1 gliders.
- SkIO glider technicians are creating electronic versions of service reports and maintenance records for all gliders housed at SkIO. These electronic reports allow for quick reference for sensor and glider operational component service dates. These maintenance logs will help keep everyone on track for glider servicing and issue tracking.
- CARICOOS is working with NOAA-AOML, Ocean and Coastal Observing – Virgin Islands (OCOVI), and the US Navy – Naval Oceanographic Office to support glider deployments during the 2023 Hurricane Season. CARICOOS and its collaborators pilot/operate the gliders deployed in waters of the US Caribbean region through the end of the hurricane season.
 - CARICOOS, with NOAA/AOML and the US Navy, have deployed four (4) underwater gliders in the CARICOOS region: 1 glider in the Atlantic Ocean and 3 in the Caribbean Sea.
 - The CARICOOS SG678 glider had an issue with the Variable Buoyance Device (VBD). The VBC was sent to the University of Washington Applied Physics Laboratory for repair. Glider SG684 from NOAA AOML was deployed as a replacement for SG678.
 - NOAA-AOML SG665 had transmission issues and was recovered in mid-August, and glider SG630 was deployed on 8/26/23 as a replacement.
 - OCOVI deployed two (2) US Navy gliders in the waters of the US Virgin Islands in mid-August (NG278 and NG267).
- GCOOS is the glider mission planning leader for the Gulf of Mexico with collaborators from the Texas A&M Geochemical and Environmental Research Group (GERG), University of Southern Mississippi (USM), and USF.
 - GERG deployed Howdy (unit 308) on 8/16/23. This is the first of two missions that GERG will conduct this hurricane season.
 - The USM team has experienced delays in purchasing gliders for the 2023 hurricane season. USM is purchasing two Hefring Ocean Scout 200m gliders; however, the USM purchasing department shut down for the month of June and two weeks into July, causing a backup in purchasing. Expected delivery is October 2023.
 - In June, the USF glider JaiAlai (Unit 841) was prepped with an extended

<p>duration lithium primary battery pack and a 1000m buoyancy engine. The glider was ballasted with these changes and simulated in the USF test tank several times. The glider was deployed 7/18/23 approximately 143 km west of Clearwater, FL. JaiAlai progressed 140 km further offshore to the shelf break over a 10-day period. On 7/28/23 the glider lost communication with its science computer data storage and was then piloted back inshore for a pickup on 8/3/23. The glider was returned to the lab and found to have a problem with the science computer memory card. It was then repaired, tested, and re-deployed on a vessel of opportunity on 8/6/23. The second deployment of JaiAlai put it in the path of Hurricane Idalia, providing data to the IOOS GDAC and the GTS for model consumption. In addition, a second USF glider deployed under complimentary funding was traversing an across shelf transect within the path of the hurricane, similarly providing data to the GDAC and GTS.</p> <ul style="list-style-type: none"> • MARACOOS is planning one glider mission, with deployment off of VA, in September 2023. All other missions are planned for the 2024 Hurricane Glider season. The Rutgers team ordered a Slocum G3 glider from Teledyne Webb in April 2023 but the glider has not been delivered. Delivery is delayed until late 2023. 	
<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>Data from the above listed deployments have been submitted to the IOOS GDAC.</p> <p>Additional data management accomplishments:</p> <ul style="list-style-type: none"> • GCOOS Data Manager and GANDALF developer Bob Currier has developed error correction code for Seagliders that were reporting positive depth numbers and these correction codes have been put in production. This allows files to flow smoothly from the GDAC to NDBC and the GTS. • New layers for GANDALF, such as the RTOFS velocity and salinity models, have been implemented to assist teams with glider piloting. • CARICOOS continues to improve its glider data portal: https://www.caricoos.org/gliders?locale=en. 	<p>On-track</p>
<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</p>	
<p>Project team representatives from each RA participate on weekly glider calls led by Kathy Bailey, IOOS Program Office. These calls are hosted on Mondays and are bi-weekly during the non-hurricane season and weekly during hurricane season. Additional collaboration efforts are listed here:</p> <ul style="list-style-type: none"> • MARACOOS team member, Scott Glenn leads a weekly science team for IOOS model/data comparison and creates of a weekly brief for NOAA Environmental 	

<p>Modeling Center scientists. SECOORA team members also participate on these weekly meetings.</p> <ul style="list-style-type: none"> • SECOORA co-PI Catherine Edwards is coordinating with the NOAA-AOML Saildrone team for Saildrone-glider coordination for the 2023 hurricane season. This coordination will include a paired Saildrone/SECOORA glider mission and a Saildrone/Navy glider mission. • USM, part of the GCOOS team, has been collaborating with the US Navy to deploy 3 gliders in the Gulf of Mexico. On behalf of NOAA AOML, USM launched 1 Seaglider (SG635) into the Gulf of Mexico. The SG635 mission is to transit through the Gulf of Mexico and eventually exit the Gulf through the Florida Straits and be recovered in Miami. • Project team members from each RA coordinate with national efforts through participation in the Underwater Gliders User Group (UG2 - https://underwatergliders.org/) community. 	
<p>Additional Areas of Success and CHAOS collaboration</p>	
<p>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:</p> <ul style="list-style-type: none"> • USM is an active participant and represents GCOOS in the EEOOTT CHAOS group. Dr. Howden and Mr. Martin have both served as coordination leads for a week each in August and presented ocean conditions during the calls. • CARICOOS personnel have made presentations to the following schools and state agencies, highlighting the importance of underwater glider data for improving tropical cyclone intensity forecasts. <ul style="list-style-type: none"> ○ Interagency Board for Beach Management of Puerto Rico ○ Puerto Rico State Agency for Emergency and Disaster Management ○ Students from the Escuela Montessori Alejandro Tapia y Rivera in La Parguera, Lajas, Puerto Rico ○ Students from the Residential Center of Educational Opportunities of Villalba, Puerto Rico ○ Students from the Inter-American University of Puerto Rico and island public schools participating in the summer internship OCEANOS subsidized by the NASA Science Activation Program ○ Girl’s Scout of Caribe • Bob Currier, GCOOS Data Manager, will present <i>Cutting the Gordian Knot: Standardizing Uncrewed Systems Data Formats</i> at the Oceans2023 conference in Biloxi, MS. His talk is scheduled for 9/27 in the session, Ocean Data Visualization and Information Management 2. • GCOOS has provided updates of glider deployments in its monthly eNewsletter. A glider-focused release was published in August: https://gcoos.org/uncrewed-systems-idalia/. • The USF College of Marine Science published a news story on 8/11/23 highlighting the value of glider observations: https://www.usf.edu/marine-science/news/2023/deep-diving-glid-capture-key-ocean-data-for-hurricane-forecasting.aspx 	

III. PROJECT CHALLENGES/MODIFICATIONS:

- Glider equipment and supplies are having longer than normal delivery schedules. For example, the SECOORA glider (Unit 1091) was delivered in May 2023, approximately 6-8 weeks behind schedule. MARACOOS ordered a Slocum G3 from Teledyne Webb in April 2023 and the original delivery date was August 2023. This date has now been pushed back to October/November 2023 timeframe.
- G1 gliders are no longer being serviced by Teledyne-Webb.

IV. PUBLICATIONS:

There are no publications during this report period.

V. BUDGET SUMMARY:

- Were the oldest ASAP TAS BETC accounting lines invoiced first?
 - This is Year 1 of the award. SECOORA and subawardees are 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 and 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 is receiving Year 1 invoices. Note that SECOORA receives quarterly invoices from subawardees; therefore, there is 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.
- 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 purchased a new Slocum G3 Glider from Teledyne Webb. The glider is used to measure temperature and salinity profiles at varying depths in support of this award. The total cost of the glider is \$246,712 and the glider has been paid for in full and delivered in May 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.
 - No changes to organizational structure.
- Provide an update about travel completed during the reporting period.
 - SECOORA, the Lead PI for this award, does not have any funds for SECOORA personnel travel. Subawardees (i.e., other RA glider team members) are using travel funds to cover roundtrip travel to glider deployment/recovery locations.
- Are there any plans to initiate a new partnership (contract or subaward) during the next reporting period?
 - No