Progress Report

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

Award number: #NA22NOS0120178

Period of Activity: 03/01/2025 – 08/31/2025
Submission Date: 9/29/2025

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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 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.	
The following accomplishments detail glider deployments during the 2025 Hurricane Season through 8/31/2025 and other work that is underway by each IOOS Regional Association (RA). Accomplishments:	Complete

• MARACOOS: No glider missions were conducted this reporting period. All glider missions were completed by November 2024.
• SECOORA: No glider missions were conducted this reporting period. All glider missions were completed by November 2024. The SECOORA gliders Franklin and unit_1091 were serviced and calibrated as part of this reporting cycle. The CTD for unit_1091 was returned in non-working condition for repair and swap out for a spare unit, allowing unit_1091 to conduct hurricane missions through other funding sources. Franklin's rechargeable battery had damage to 1-2 cells. A new rechargeable battery compatible with all SECOORA gliders was purchased to restore full functionality for the glider.
• CARICOOS: During the 2025 hurricane season, CARICOOS deployed six (6) underwater gliders in the US Caribbean region. Gliders SG668 and NG783 collected data near and/or during Hurricane Erin (8/15/25 - 8/19/25).
  ○ 1 glider operated by CARICOOS:
  ▪ SG678 was deployed in the Caribbean Sea on 6/24/25 and was recovered on 8/28/25 due to a pressure sensor issue.
  ○ 2 gliders operated by NOAA-AOML and CARICOOS:
  ▪ SG609 was deployed in the Caribbean Sea on 6/24/25.
  ▪ SG668 was deployed in the Atlantic Ocean on 6/25/25.
  ○ 3 gliders operated by the US NAVY and CARICOOS:
  ▪ NG665 and NG615 were deployed in the Caribbean Sea on 6/25/25.
  ▪ NG783 was deployed in the Atlantic Ocean on 6/25/25.
• GCOOS: The team conducted 3 glider missions:
  ○ University of Southern Mississippi (USM) has two Hefring Seascout gliders (Ori, with a CTD and PAM, and Nori, with just CTD).
  ▪ Nori was deployed 6/25/25 but communications were lost 7/2/25 and the glider was not recovered.
  ▪ Ori was deployed 6/10/25 and recovered 6/25/25.
  ▪ Ori was deployed again 7/29/25 and recovered 8/15/25 due to a roll issue.	

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)	
Near real-time data from the above listed deployments were submitted to the IOOS GDAC. Additional data management accomplishments: • All glider missions are also displayed on GANDALF. • SECOORA glider operators submit delayed mode glider data to the SECOORA Research Workspace within 30 days of glider recovery. These data are then made available to the IOOS GDAC. • GCOOS provided updates to the ARGO float visualization tool for GANDALF and the HYCOM streamlines tool. • CARICOOS glider data undergo quality control procedures to ensure accuracy. Data is also archived/distributed through CARICOOS THREDDS/OPeNDAP and ERDDAP servers for easy access and visualization. Additionally, the data are being used to monitor	On-track

ocean heatwaves, offering insights that can help mitigate their effects on coral nurseries and support coral reef restoration efforts.	
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 IOOS-led glider calls. 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: • A science team led by Scott Glenn meets weekly for IOOS model/data comparison and creation of a weekly brief.	
Additional Areas of Success and CHAOS collaboration	
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: • SECOORA: USF hosted a glider training course in March 2025 with the Marine Technology Society (MTS) Microcredentials program resulting in Foundational Hardware and Software certificates. • SECOORA & GCOOS: March 25, 2025, Chad Lembke (USF) served as panelist at the Synapse Summit 2025 during the 'Tech to the Rescue: Innovations in Disaster Planning, Response, and Recovery.' The talk provided focused on the IOOS / SECOORA / GCOOS Hurricane Glider Program efforts over the past several years. • GCOOS launched GANDALF 2.0 during this period. While it was not funded by this project, the benefits of GANDALF 2.0 were utilized. • USM is an active participant in the EEOOTT CHAOS group and represents GCOOS in this group.	

III. PROJECT CHALLENGES/MODIFICATIONS:

- GCOOS: Nori was deemed to be lost at sea after losing communications on 7/2/25; USM is waiting for a replacement roll motor on Ori which caused the glider to malfunction on its last mission.
- CARICOOS: SG678 is under repair to address a pressure sensor issue as of 8/28/25.

IV. PUBLICATIONS:

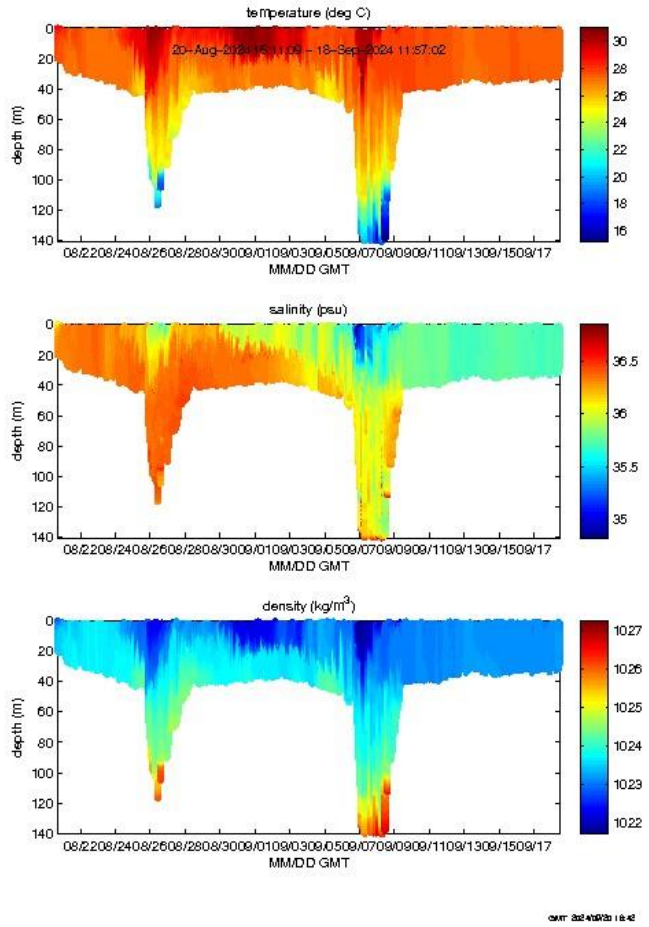
- Shi, J., C. Hu, J. Cannizzaro, B. Barnes, Y. Zhang, C. Lembke, and M. Le Henaff, (2025)" Intensification of Hurricane Idalia by a River Plume in the Eastern Gulf of Mexico" Environmental Research Letters, 20, 024050, DOI 10.1088/1748-9326/adad8a

V. BUDGET SUMMARY:

- Were the oldest ASAP TAS BETC accounting lines invoiced first?
  - Yes
- 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?

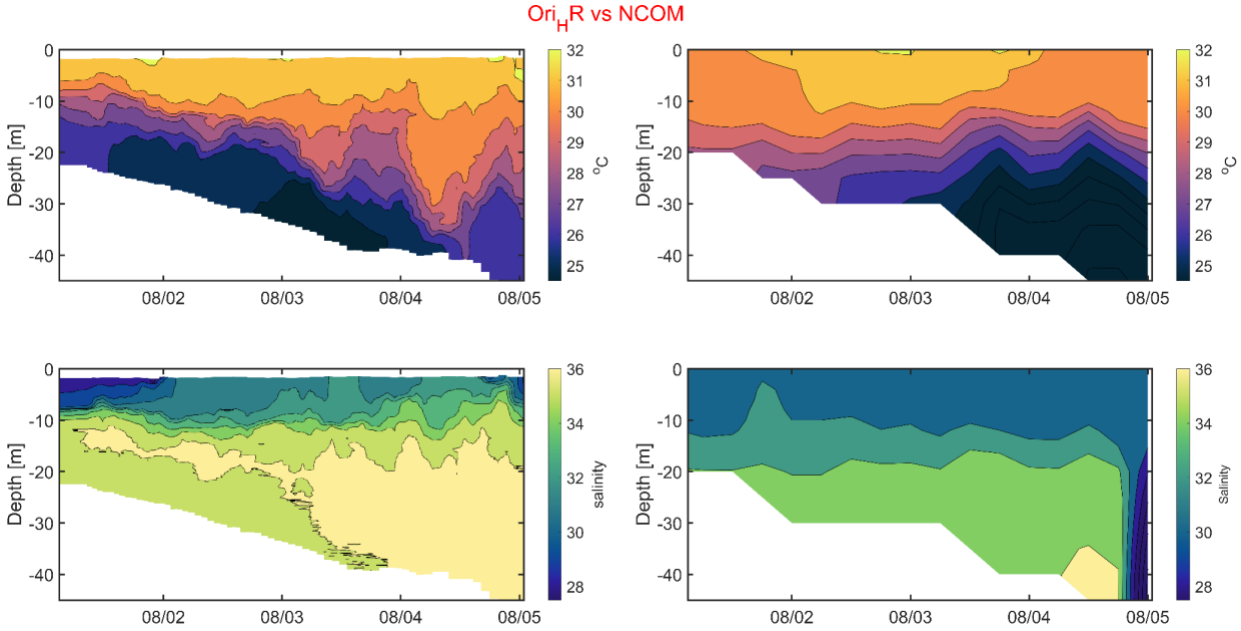
    - SECOORA has issued all subawards related to this award and all subawards have been fully executed.
- Give a brief update on project invoicing for the reporting period. Were there any delays with invoicing or payment?
    - SECOORA is receiving invoices from all project team members for this award. 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. CARICOOS has already submitted a final invoice for this award.
- 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.
    - No equipment was purchased during this reporting period.
- 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

Appendix A



Temperature (upper, deg C), salinity (middle), and density (lower, kg/m3) from unit_1091 mission August-September 2024 in two round-trip cross shelf sections from the 20m isobath to the upper slope and back. Temperatures less than 20° C indicate water that has been upwelled onto the outer shelf and upper slope by frontal eddies that move northward along the edge of the Gulf Stream, bringing cool and nutrient-rich water into the photic zone.

Appendix B



CTD data for Temperature (top, left graph) and Salinity (bottom, left graph) for the Hefring Oceanscout Ori mission, operated by USM. The Ori temperature and salinity data is compared to the Navy Coastal Ocean Model temperature (top, right graph) and salinity (bottom, right graph) for the same ROI.