Progress Report

BUILDING CAPACITY & ADVANCING THE NEXT GENERATION OF TROPICAL CYCLONE SCIENTISTS

Period of Activity: 01 October 2022 – 30 September 2023

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Budget Summary:
Total Budget: $96,666.00
Expenses: $18,889.55

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1. Project Summary

Hurricanes remain the costliest and deadliest natural disasters in the US and globally (https://www.ncdc.noaa.gov/billions/). There have been continued improvements in hurricane intensity forecasts over the past decade [*Cangialosi et al.*, 2020], however significant errors remain (~14 knots for a 72 hour forecast). New technologies have been implemented to expand ocean observing in regions where tropical cyclones undergo rapid intensity change [Miles et al., 2021]. However, many of these regions include numerous international exclusive economic zones (EEZs) such as in the eastern Caribbean, where special marine scientific research permissions are required to carry out ocean observing. Through the UN Ocean Decade Tropical Cyclone (TC) Exemplar, efforts are underway to engage a broad set of global partners to enable ocean observing and research to improve TC intensity forecasts. In this proposed project we will focus on (1) engaging early career scientists in TC research and operations and (2) developing and engaging capacity within the Caribbean region for the UN Ocean Decade TC Exemplar program.

Specific Aim 1: Supporting early career scientists This activity would support a half-year graduate stipend for Leah Hopson who is a member of an under-represented group in Dr. Travis Miles (an early career researcher) team at Rutgers. Leah will be engaged in GOMO's Coordinated Hurricane-Atmosphere Ocean Sampling field experiment and will contribute by analyzing velocity shear measurements from in situ underwater glider data and developing model experiments of hurricane upper ocean mixing. Additionally, this will allow her to travel to St. Thomas for glider deployments and engagements with students in the U.S. Virgin Islands, as well as other outreach and capacity building activities described below.

Key deliverable: *Student/ECOP/DEIA engagement and research support – directly addressing the GOMO DEIA/ECOP initiative and GOMO Strategic Plan Goal 4.*

Specific Aim 2: Supporting the Tropical Cyclone (TC) Exemplar of the UN Decade-endorsed GOOS Observing Co-Design Programme | GOMO, Rutgers, AOML, and international partners have dedicated time resources to the TC Exemplar and demonstrated significant progress in growing the program over the last year. The funds for this proposed activity would support travel to regional meetings, a co-developed technical workshop focused on capacity building and targeted engagement of regional community stakeholders, and local engagement and coordination through IOCARIBE, the University of the Virgin Islands, etc.

Key deliverable: *Ocean observing capacity building and initiation of the GOOS Observing Co-Design TC Exemplar Caribbean pilot study – directly addressing the GOMO UN Decade initiative.*

2. Scientific and Observing System Accomplishments

The Specific Aims of this project are largely in the categories of Outreach and Education, however they connect with leveraged science activities through the GOMO EEOOTT Coordinated Hurricane-Atmosphere Ocean Sampling (CHAOS) project. This included glider deployments in late summer and fall of 2023 in hurricane prone regions near the US Virgin Islands. Specifically, two University of Virgin Islands gliders were deployed (UVI_01 and UVI_02). These autonomous underwater gliders were each deployed for 33 and 23 days respectively, with 100% of real-time data made available for the Integrated Ocean Observing System (IOOS) Glider Data Assembly Center. Early career researchers, students, and staff from Rutgers University and the University of the Virgin Islands were engaged in the preparation, deployment, recovery, and analysis of data from these systems. All data were made publicly available via the GTS in real-time for ingestion into the Real Time Ocean Forecast System (RTOFS) used as the ocean initial condition for coupled hurricane forecast models. These data included essential ocean variables temperature, salinity, and density, and post deployment data analysis includes ocean velocity data.

Metrics: This work included 1 early career faculty (Travis Miles), 2 PhD students (1 from an under-represented group), and 2 early career staff members (1 at Rutgers University and 1 at the University of Virgin Islands).

A notable achievement included the first co-located upper ocean velocity measurements from a Saildrone surface vehicle and an underwater glider equipped with current profilers.

NOTE: GOMO reports activities of note, including scientific and technological achievements, and outreach and educational activities, to the NOAA leadership on a weekly,

quarterly, and annual basis. These activities will inform NOAA leadership and appear on the GOMO and other relevant websites, as well as other NOAA and non-NOAA-related publications. They also raise the visibility of the program and the individual project.

3. Outreach and Education

The primary focus of this project is 1) efforts to develop capacity and broaden participation in hurricane research and ocean observing and 2) develop regional partnerships in hurricane ocean and atmosphere research and observations.

To support Specific Aim 1: This project provided graduate student support to Leah Hopson, a second year PhD student at Rutgers University focused on hurricane research. Leah participated in a week long glider training camp at RU to learn the basic preparation, function, and capabilities of Slocum autonomous underwater gliders. This effort directly prepared her for participation in the preparation of UVI_01 and UVI_02 gliders at Rutgers University and field preparation of the systems in St. Thomas. She worked along with project staff and PIs to ballast and deploy both gliders in the US Virgin Islands for hurricane data collection during the CHAOS field campaign. Additionally, the GOMO support coincided with Leah's qualifying exams and her transition to a full PhD candidate as well as her preliminary research. Currently, Leah is focused on investigating storm stalling characteristics from the long-term IBTrACS records to determine the potential for dynamic coastal ocean responses. She is early in her PhD, and the support from OAR has been critical to helping her bridge into more specific research goals. Leah has carried out outreach activities with the Rutgers Science Bus https://sciencebus.rutgers.edu and was a 2022 – 2023 cohort member of the Rutgers Sloan STARS program https://www.csp.rutgers.edu/images/2023_Sloan_Stars_Flyer.pdf, an effort to diversify the geosciences at Rutgers and beyond.

To support Specific Aim 2: The team has begun planning for a 2024 workshop in Barbados focused on regional priorities in hurricane research and forecasting. This has included engagement by Doug Wilson, Scott Glenn, and Travis Miles through UN Ocean Decade activities including monthly GOOS Co-Design TC Exemplar meetings, the GOOS Co-Design Workshop in Paris that included conversations with WMO and other Co-Design partners, as well as activities with IOCARIBE. Specifically, Doug Wilson is working with IOCARIBE to lead implementation of the Tropical Americas and Caribbean Ocean Observing and Forecasting System (TAC-OOFS) UN Decade Project. GOOS Co-Design is a Decade Partner in this and TAC-OOFS will incorporate TC Exemplar in its activities. There is an opportunity to have a TC Exemplar modeling meeting along with a TAC-OOFS meeting in 2024. We expect Barbados planning to expand rapidly in early 2024 with the goal of a late Spring/early summer meeting.

4. Publications and Reports ***Please note the FundRef DOI for GOMO***

4.1. Publications by Principal Investigators

N/A

***** Please update your Program Manager throughout the year as papers are accepted for publication and provide 2-3 weeks advance notice prior to the date of publication. We use this information to promote GOMO to NOAA leadership and beyond.***

4.2. Other Relevant Publications

N/A

5. Data and Publication Sharing

N/A

6. Project Highlight Slides

Please ***attach*** slides using the attached template to show one important highlight from your project's progress (including relevant notes and credits) and one summary slide. The slides will be available to GOMO program managers in this Google folder also allowing PIs to make updates. *Note:* Information shared on slides may be shared with agency leadership, in interagency discussions, and occasional briefings in public settings.
