



Sustaining Ocean Observations to Support Hurricane Readiness in The Bahamas: A Roadmap

Introduction

Climate change is causing the increasing intensification and unpredictability of storms and hurricanes in The Bahamas and throughout the Caribbean, leaving coastal communities grappling with the worsening effects of these weather events. Improving the accuracy of hurricane forecasting in The Bahamas could improve the allocation of disaster preparedness and response resources and the issuance of effective evacuation orders. Today, the performance of existing ocean forecast models for The Bahamas region is limited by large gaps in subsurface oceanographic observations, particularly in coastal and shelf areas where climate change exerts the greatest impacts on communities. Nearshore oceanographic processes confer a significant amount of uncertainty to the current models and predictive tools that are used to forecast hurricane characteristics. For example, rapid intensification prior to landfall, as happened with [Hurricane Dorian](#) in 2019, due to the heat content of shelf waters can be the difference between a category 2 and a category 5 hurricane which require very different responses.

Improving hurricane forecasting in the region therefore relies on improving *in situ* data collection in nearshore areas and feeding those data into forecast models through data assimilation methodologies. However, traditional methods of collecting data are expensive and have limited potential for expanding nearshore data collection in a meaningful way. Fishing vessels represent a huge opportunity to illuminate nearshore oceanographic processes at a fraction of the cost of traditional methodologies. Building on work by the Fishing Vessel Ocean Observing Network ([FVON](#)) to maximize the value of data collected by fishing vessels globally, EDF and partners have worked in The Bahamas since 2023 to build partnerships with fishermen to engage in ocean data collection as part of their normal ocean-going activities. This work has resulted in increased data collection around The Bahamas since early 2024 that has been furnished to hurricane forecasters at the Atlantic Oceanographic and Meteorological Laboratory (AOML) in the United States, the main source of hurricane forecasts in the Caribbean.

To continue to provide *in situ* ocean data to hurricane forecasters and ensure that Bahamian communities have access to accurate and timely warnings of hurricane impacts, this work must be sustained with support from Bahamian stakeholders who stand to benefit from the data as well as regional and international long-term funding sources. Drawing from the outcomes of a workshop co-hosted by EDF and University of The Bahamas in Nassau, in September 2025, this roadmap outlines a plan for achieving this goal.

Data Collection and Data Pipeline

Since December 2024, 10 vessels have been outfitted with sensors, including commercial fishing vessels, mailboats, and sport fishing vessels. These vessels cover a broad geographic range within The Bahamas archipelago, from Grand Bahama in the northwest to Crooked Island in the southeast (Figure 1). Project fishermen have recorded >4,600 temperature profiles to date (Figure 2). Project data are fed into the Global Telecommunications System (GTS) where they are available to be ingested into operational ocean models used to inform hurricane intensity and track predictions. Data are currently available within The Bahamas to the Bahamas



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Department of Meteorology, Bahamas National Geographic Information Systems (BNGIS), Bahamas Department of Environmental Protection and Planning (DEPP), and University of The

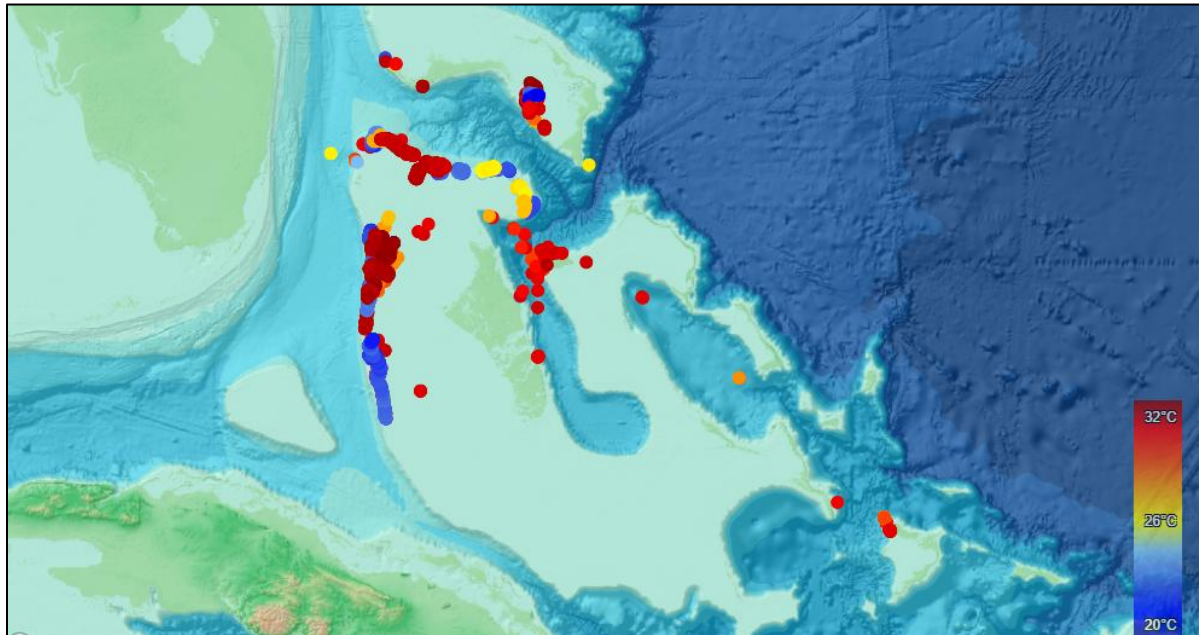


Figure 1: Map of project data collection to date showing distribution of depth profiles.

Bahamas (UB) via [ERDDAP](#). Through this data pipeline, project data are accessible to hurricane forecasters and these Bahamian institutions. Unfortunately, the data are not currently available to all potential data users in The Bahamas.

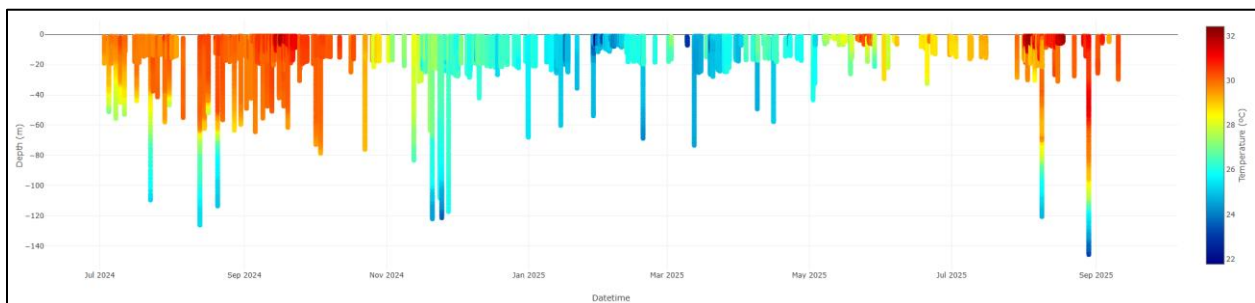


Figure 2: Curtain plot of project data over time showing overall extent of warm water at depth throughout the year

Sources of Demand for Project Data

The Bahamas Government

The Department of Meteorology is the primary user of project data within The Bahamas. Data are currently being used as auxiliary information to NOAA hurricane forecasts to support the issuance of warnings and alerts from the Department. Other potential users include the Department of Marine Resources to aid in stock assessment and fishery management, and the Office of the Prime Minister to support the development of Ocean Thermal Energy Conversion (OTEC) infrastructure.

Other Bahamian Stakeholders



Some project fishermen currently use project data to better understand the distribution of target species such as snapper, grouper, lobster, and conch. While not currently available to other Bahamian stakeholders, conservation organizations including the Bahamas Agriculture and Marine Science Institute and the Cape Eleuthera Institute are interested in accessing project data to support coral reef restoration and protected area management.

Regional and International Organizations

The Caribbean is a region of broad continental shelves, where traditional methods of ocean observing often cannot operate effectively. This makes data collected in The Bahamas especially valuable for the Global Ocean Observing System (GOOS), which is backed by United Nations Educational, Scientific and Cultural Organization (UNESCO); World Meteorological Organization (WMO); United Nations Environment Programme (UNEP); and International Science Council (ISC) and managed by UNESCO's Intergovernmental Oceanographic Commission (IOC, with regional component IOCARIBE focused on the Caribbean). GOOS provides critical data to policymakers, scientists, and communities worldwide to improve ocean and climate models, support early warning systems, and inform adaptation and resilience planning. Other international organizations, such as the National Oceanographic and Atmospheric Administration (NOAA), apply ocean data across a wide spectrum of uses, including weather forecasts, fisheries assessments, and climate monitoring. But due to recent political shifts, NOAA faces constrained funding, making data from historically under-observed regions such as The Bahamas more important than ever.

Private Sector

The blue economy is expanding rapidly in The Bahamas as the country seeks to diversify away from imports—particularly in the face of tariff pressures—and develop sustainable national energy sources. Renewable energy resource assessments, including those conducted for ocean thermal energy conversion (OTEC) floating photovoltaics, offshore wind, wave energy, and ocean current/tidal energy require accurate data to design and operate projects. Tourism, one of the largest industries in The Bahamas, depends on healthy marine ecosystems and robust risk management, linking ocean data to the insurance sector, which underwrites tourism infrastructure and coastal assets. Meanwhile, the shipping industry benefits from data that support safer and more efficient routing, and the sport fishing sector relies on real-time information to enhance both productivity and safety.

CoastPredict and the Global Coast Experiment

The Global Coast Experiment reflects strong international demand for high-quality ocean data from the Caribbean. CoastPredict and IOCARIBE are the leading implementers of the 5-year, \$90 million initiative to build coastal observing systems in areas with limited existing data coverage but high exposure to climate risks—especially as ocean conditions change. Based on a survey of existing pilot sites, CoastPredict identified the Caribbean as a priority region. The Caribbean's wide and shallow shelves create challenges for other observing platforms such as satellites and buoys, leaving major data gaps in nearshore areas that matter most for coastal populations, fishers, and sectors like tourism that make up the backbone of the Caribbean economy. At the same time, tropical cyclones have devastating social and economic impacts in the region, making accurate and actionable ocean data a cornerstone of resilience. By filling gaps, Caribbean data can improve global climate models, hurricane forecasting, and ocean-based risk assessments used by coastal communities, fishers, and policymakers worldwide.

Within this framework, The Bahamas is positioned as a leader with comparatively strong data pathways and governance structures that altogether can serve as a foundation and example for



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scaling fishing vessel observing networks across the wider Caribbean. The FVON-Bahamas pilot also importantly addresses local and national priorities that align with CoastPredict's objectives for the Caribbean region: improved early warning systems, marine spatial planning, fisheries resilience, blue economy development, and conservation of marine ecosystems.

In partnership with CoastPredict and IOCARIBE, The Bahamas not only contributes vital data to global systems but also gains access to shared science, technology, expertise, and international resources. These collaborations open pathways for training and capacity building, provide access to the latest observing tools and methodologies, and strengthen the voice of The Bahamas in international forums. International partners like FVON, CoastPredict, and CoastPredict can also help identify viable funding pathways for long-term sustainability by connecting the pilot to international resources and communicating the value of successful regional collaboration. By engaging in these partnerships, The Bahamas enhances its own ability to prepare for and respond to climate risks while shaping broader regional and global strategies for ocean resilience.

The Roadmap

To achieve our goal of sustaining ocean data collection at scale in The Bahamas to support hurricane readiness of coastal communities far into the future, EDF will engage in 5 broad 'actions' over the next 15 months:

Action 1 is to measure and communicate the impact of FVON data in The Bahamas and among other Caribbean nations and regional stakeholders such as NOAA to raise awareness, curry support, and align political actors. Through this work we will continue to generate and communicate quantitative evidence of the value of ocean data and build the economic case for sustained data collection.

Action 2 is to establish Bahamian project leadership and build in-country oceanography and meteorology capacity. Developing Bahamian ownership of the project will ensure that project activities can accurately respond to changing circumstances in the future and creates buy-in to project success.

Action 3 is to work with IOCARIBE, WMO, and CoastPredict to identify and pursue funding and partnership opportunities that further FVON networks in The Bahamas and across the Caribbean. The primary target is the GlobalCoast Experiment projects administered by CoastPredict, which offers a potential route to sustained funding for ocean observations throughout the Caribbean.

Action 4 is to identify and engage all public/private data users and develop pathways for investment in data collection in country. By identifying and aggregating private sector demand for ocean data, we aim to build the long-term incentives for investment in ocean data collection in the region.

Action 5 is to build new FVON networks in other Caribbean nations in collaboration with IOCARIBE and CoastPredict and promote knowledge exchanges in the region with The Bahamas positioned as a regional leader. By scaling networks of fishermen engaged in data collection throughout the region in collaboration with other Caribbean nations and institutions, we will build an enabling environment for the long-term collection and use of *in situ* ocean data throughout the Caribbean.



These actions are described in more detail below.

Action 1: Measure and communicate the impact of FVON data in The Bahamas and among other Caribbean nations and regional stakeholders such as NOAA to raise awareness, curry support, and align political actors.

1.1 Continue working with AOML to quantify the impact of FVON data for hurricane forecasting via [OSSEs](#), data denial experiments, etc. Use FVON best practices (from Moana Project, eMOLT, and other regional networks) as protocols for these experiments.

- Ensure that experiments are rigorous and avoid overpromising and ensure that results are presented first by NOAA and the European Centre for Medium-Range Weather Forecasts (ECMWF).
- Quantify the value of FVON data to better response and preparedness: evacuation planning, routing, and resource allocation.
- Continue partnering with The Bahamas Department of Meteorology who are working on making warnings more effective through social science.

1.2 Develop diverse communications products: videos, blogs, newspaper articles, scientific manuscripts, TV and radio.

- Tailor products for different audiences: The Bahamas, the wider Caribbean, the United States, and international stakeholders.
- Use compelling, short-form options and analytics for social media channels. Younger audiences prefer platforms such as Instagram, TikTok, and YouTube.
- Combine communications products with word of mouth and education, which is more powerful for certain audiences and regions.
- Make sure to communicate clear value to fishers, who are key to data collection. Also communicate that the data is anonymized.
- Develop a 2-3 minute video showcasing the project and shorter clips for social media platforms.
- Write 1-2 blogs on the project for the [EDFish](#) platform.
- Continue engaging Bahamian media contacts to provide updates and generate interest.

1.3 Conduct a cost-benefit analysis of investment in a national ocean observing system.

- While there is currently no national ocean observing system, workshop participants expressed a strong desire to build one. Most pointed to lack of resources and costly technologies as the main barrier to achieving this. but AI modeling is a growing field and provides significant opportunity to increase the benefits of ocean observing.
- Costs of establishing a national ocean observing system include equipment, installation, and data management costs.
- Establishing a national ocean observing system accrues benefits to: hurricane early warning systems, coral monitoring and restoration, sustainable fisheries management, aquaculture and food security (especially with increasing independence from international imports, price instability from tariffs), renewable energy (offshore wind, wave/tidal energy; job opportunities and technical advancement), carbon credits (mangroves, seagrasses), coastal erosion monitoring (Ministry of Works), ecosystem-based management, and safety at sea.
- In addition, fishers pay for [ROFFS](#) models (water temperature, clarity, bait, etc.) and would benefit from subsurface temperature models (especially during tournaments).



Action 2: Establish Bahamian project leadership and build in-country oceanographic and meteorological capacity. Dr Brandon Bethel of University of The Bahamas has agreed to lead the project going forward. Office of the Prime Minister, the Department of Meteorology, BNGIS, and DEPP are involved for policy development and establishing links between agencies, but for expertise and level of interest, longevity, and insulation from political pressure, Dr Bethel is the natural leader. UB should manage the data and data analyses and the rest of the project team will support Dr. Bethel as needed.

2.1 Provide support for capacity building courses and trainings and academic tracks in oceanography and meteorology. There is a need to bring in more PhD students and scientists to contribute to making data actionable.

- Build research and technical capacity across multiple government programs, not just academia, for managing data.

2.2 Assess spatial-temporal data gaps along with the need and ability to fill those gaps with FVON in following years and adjust project coverage.

- FVON must expand south to provide better coverage across The Bahamas.
- Based on the proposed target use cases of ocean data, The Bahamas must supplement data collection with research into models that support coral monitoring, renewable energy, aquaculture, and carbon storage. This will also require collecting more parameters beyond temperature and depth, like salinity which is important for many oceanographic physical and biogeochemical processes.

2.3 Develop a national data portal that integrates FVON data with other ocean data collected by gliders, buoys, numerical models, and other systems in the region and that provides easy access to Bahamian users. This portal should be a real-time, accessible public portal with anonymized fisher data using confidential WMO IDs modeled after GOOS and NOAA portals. Currently, DEPP is housing the data and can share it with government agencies who request to use it but there are barriers to access for researchers and the private sector.

- Main challenges to overcome include:
 - Infrastructure and knowledge needs: computers and qualified data managers.
 - Proper management of sensitive fisher data and trust between government and fishers.
 - Bridging gaps between multiple actors. Data is currently siloed between agencies across the islands.
 - Need for formal data sharing agreements and digitization for open access.
 - Need for funding for graduate programs and training, plus modeling workshops at UB.
 - Need to understand how to engage more fishers including sport fishermen and younger commercial fishermen.

2.4 Work with government agencies to streamline availability of the data to Bahamian stakeholders and ensure more flexible use of all ocean data in The Bahamas. Position the Office of the Prime Minister as the project government lead to align different agencies and integrate research and development.

- Need to adopt best practices used by FVON and [OceanOPS](#) for data management and visualizations.
- Need to work with fishers to develop trust, communicate valuable impacts, and ensure confidentiality.



Action 3: Work with IOCARIBE, WMO, and CoastPredict to identify and pursue funding and partnership opportunities that further FVON networks in The Bahamas and across the Caribbean.

3.1 Continue positioning University of The Bahamas as a key project partner of CoastPredict

- Coordinate with CoastPredict and position Dr. Bethel and UB as key local partners. Help as needed with CoastPredict site proposal.
- Provide support for computing capacity, training, and workshops. Support UB modeling and assimilation work for disaster management and renewable energy development.
- Through communications materials, show that The Bahamas has capacity and success through local leadership. Develop examples of value derived from the data.
- Leverage existing relationships with FVON and IOCARIBE to bring international awareness and funding to The Bahamas.
- Build partnerships with other countries participating in the Global Coast Experiment (Barbados, Colombia, Dominican Republic, Grenada, Mexico, Trinidad and Tobago) as well as other Caribbean countries interested in / with capacity to build out observing systems. Barbados and Jamaica already reached out to share resources and expertise. There are robust meteorology programs across the region to connect with.

3.2 Communicate value of AOML data analysis and other communications products at IOCARIBE, WMO, IOC, GOOS meetings, and scientific conferences such as [GCFI](#).

- Dr. Bethel can represent the project and present at these venues as the project lead.

3.3 Conduct modeling impact studies of FVON data, e.g. OSE and OSSEs of RTOFS and future high resolution regional models.

- UB students, with support from international training opportunities and knowledge exchange can conduct these studies.

3.4 Work with individual Caribbean nations to further FVON networks in the region through funding opportunities such as UNESCO country grants or philanthropic grants.

- Take advantage of IOCARIBE meetings, conferences, and networking as opportunities to build relationships with other countries. Highlight the cost-sharing benefits of regional collaboration.

3.5 Continue conversations with CoastPredict leadership and country focal points around the value of FVON to the Caribbean focal area.

- Dr. Bethel, FVON steering committee members, Geoffrey Greene, and leads of other key Bahamian agencies should have these conversations.

3.6 Identify a pipeline of funding opportunities and support applications from Bahamian project leads, prioritizing opportunities that can support the near-term and medium-term project needs, with a vision of long-term support.

- Bahamian leads identify project needs with support from IOCARIBE regional leadership and FVON capacity building and coordination.
- FVON and IOCARIBE support pursuing funds from development banks, country grants, philanthropy, and opportunities like the GlobalCoast Experiment.



3.7 Leverage FVON assets such as expertise and support in data management, sensor best practices, technological innovation, data product development, use cases, communications, fundraising to effectively engage funding opportunities. These assets are available through FVON membership.

- Dr Bethel and Geoffrey Green agree to join the FVON member committee.

Action 4: Identify and engage all public/private data users and develop pathways for investment in data collection in country. A dedicated agency or department within the government should manage and share the data, making sure it's accessible, financially viable, and multi-use. R&D is essential to ensuring value and financial sustainability. Determine what data is provided for free and to whom. Repackaging public data for specific purposes is typically how revenue is generated.

4.1 Identify private sector demand for Bahamian in situ data including:

- Energy sector: renewable wind/wave/tidal/ocean current/solar energy, ocean thermal
- Defense (RBDF, but no robust analytics department)
- Tourism & commercial entities (Atlantis, Baha Mar): corporate social responsibility (CSR) requires demonstrating that they are supporting environmental and social issues, sustainability departments/spokespeople, annual sustainability reports, joint workshops
- Insurance: required installations for risk assessments
- Fisheries: FADs, potential for big tournaments
- Policy: conservation (DEPP), food security (SDGs)

4.2 Identify demand for Bahamian in situ data from U.S. government sources and other governments.

- Temperature data supports regional disaster preparedness and monitoring through collaborations with met agencies.
- Acoustic/subsurface data could also support the US Navy, Drug Enforcement Agency (DEA) monitoring unauthorized vessels, and UK disaster response services in the region.

4.3 Develop mechanisms for transfer of monetized value of data to The Bahamas

- Requirements for commercial and research permits.
- Funding could flow through UB eventually. Government funding is typically routed via the treasury department.

Action 5: Build new FVON networks in other Caribbean nations in collaboration with IOCARIBE and CoastPredict and promote knowledge exchanges in the region with The Bahamas positioned as a regional leader.

5.1 Continue to identify opportunities to develop FVON networks in the region and engage through the global ocean observing community

- The regional appetite is strong (Antigua, Barbados, Grenada, Jamaica, Mexico), as demonstrated during the last Hurricane Committee meeting.
- FVON steering committee members can engage via IOC and POGO connections.
- Dr. Bethel and the government of The Bahamas can engage through regional WMO offices, international departments, [CARICOM](#) networks, the Caribbean fishing network (CNFO).
- UB can engage with regional and international research institutions.
- Project fishermen can spread benefits via word of mouth and at tournaments.



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5.2 Position Bahamian project leads as leaders of cost-effective and robust ocean observing in the Caribbean and key contributors to knowledge exchanges with other Caribbean nations.

5.3 Establish a base in The Bahamas in service of the broader region with a long-term vision of a Caribbean Oceanography Institute that offers R&D, training, sensor manufacturing, etc.

- Develop the concept gradually beginning with small workshops and infrastructure, gaining momentum/value/funding, scaling over 5-10 years.