U.S. Integrated Ocean Observing System
Advisory Committee

February, 1 2023

The Honorable Richard W. Spinrad, PhD
Undersecretary of Commerce
for Oceans and Atmosphere and
NOAA Administrator
1401 Constitution Avenue NW, Room 5128
Washington, DC 20230

Dear Dr. Spinrad,

On behalf of the Federal Advisory Committee (FAC) for the Integrated Ocean Observing System (IOOS), enclosed are recommendations that the committee formulated that align with your strategic priorities as the NOAA Administrator. These recommendations span across three priority areas and support the NOAA FY22-26 Strategic Plan: Climate Impacts at the Oceans and Coasts; Diversity, Equity, Inclusion, and Accessibility; and Fostering Growth of the New Blue Economy.

The committee supports and champions NOAA's mission, and believes it has never been more important to deliver equitable coastal services and information to the American people to support prosperity, health, and security. The U.S. IOOS Enterprise, composed of NOAA's U.S. IOOS Office, the 11 Regional Associations and their non-profit representative IOOS Association, and the Interagency Ocean Observing Committee (IOOC), which operates under the White House Office of Science and Technology Policy (OSTP), is uniquely positioned to support the Administration's priorities by bringing together ocean and coastal experts from across the federal, academic, industry, and non-profit sectors.

We hope these recommendations prove useful to you and will be adopted and implemented by NOAA. We look forward to working together with you further to implement meaningful change that drives us forward toward climate solutions, equitable service, and economic opportunity. At our next public meeting in the Summer of 2023, we are hopeful you will be able to join us to share progress on your strategic plan and discuss how we can help further support your goals. We are standing by to help, so please do not hesitate to reach out sooner if we can be of assistance.

Regards,

Scott C. Rayder
Chair for the IOOS FAC

Climate Impacts at the Oceans and Coasts

Introduction

Coastal communities face a growing number of complex climate-related impacts, and the unpredictable and intensifying nature of these events threaten ecosystems and the people and economies that rely on them. As a result, the need for reliable and timely information about how climate change impacts our coastal communities has never been greater. Over the last 20 years, the U.S. Integrated Ocean Observing System (IOOS) has built a national network of regional observing systems linked to 17 federal agencies and fostered relationships with stakeholders and partners throughout the coastal United States. This federal-regional partnership provides a unique framework for leveraging data from multiple federal, academic, state, Indigenous, local, and private partners to address national issues as they manifest at the regional and local level. To successfully navigate current and future climate-related challenges, this can only be accomplished if there are key investments in the expansion and modernization of existing observing infrastructure, regional scale modeling, technological innovation, enhanced program integration, and a deeper commitment and resultant actions to serving underrepresented communities.

While climate change is certain, its effects in coastal regions vary considerably nationwide. Coastal observations and forecasts are vital to providing communities with the information and predictions needed to prepare, plan, adapt, and respond to the impacts of climate in the coastal zone. A one-size-fits-all approach to coastal observing and coastal resilience is not sufficient to meet the complexity of communities' needs nor to meet the variable manifestations of climate change impacts region to region. The sustained IOOS presence along all of our nation's coasts is tracking these changes, and working with a range of users to provide timely and meaningful information to those who need it. Regional IOOS data and information products are being co-designed with local stakeholders in order to support decisions impacting society. There is a substantial and growing need for sustained observations and information products, for both coastal communities and all parts of society dependent on coastal regions and resources.

Because a robust coastal observing system is essential to provide timely, high-resolution forecasts and information for decision making to protect coastal ecosystems and economic health, we recommend the following steps to provide the nation with the observing capacity needed to detect and respond to the coastal climate signal:

Recommendations

Recommendation 1: NOAA should develop a national integrated coastal climate capability with IOOS as the national leader to collect-collate-synthesize continental shelf data. NOAA should designate and provide the resources to support IOOS as that leader, including appointing a full-time coastal climate program manager to manage and guide aspects of collecting, integrating and disseminating data working with NOAA's climate programs and the

IOOC agencies.

Recommendation 2: NOAA should fund recapitalization and modernization of existing infrastructure and fill existing gaps in the current ocean observing network. This should include funding for the national network of moorings, profiling gliders, high frequency radar and shore stations, updating sensors, and expanding to comprehensive nationally standardized physical, chemical and biological data in order to detect change. While some progress has been made towards modernizing infrastructure, funding of existing infrastructure remains the most urgent need as collecting sustained time series is required for detecting the impacts of a shifting climate and informing adaptation and mitigation strategies.

Recommendation 3: NOAA should expand coastal observations and support regional-scale models that collectively can be used to monitor trends, detect changes, provide forecasts, and deliver tailored information products to users for improving coastal resilience. A first step is to fully fund the recently approved IOOS Regional Associations' five-year cooperative proposals, which were developed with significant regional stakeholder input.

Recommendation 4: NOAA should invest in technological innovation for new types of observing tools, sensors, and delivery mechanisms to improve coastal observations and regional scale models, reduce costs and improve the understanding, delivery, and communication of information.

Recommendation 5: NOAA should expand regional data integration services to better integrate IOOS with other coastal and global climate programs and to better provide products and services for communities. This can be achieved by supporting advanced platforms that can more rapidly communicate information, alerts and warnings to users, thereby building synergies, filling critical gaps, and developing cost-effective solutions.

Recommendation 6: NOAA should increase engagement with historically underrepresented communities that are often disproportionately affected by climate impacts and take action to co-producing observation systems and tailored products to ensure all have access to the information and tools needed to fully prepare for and respond to coastal change.

Diversity, Equity, Inclusion, and Accessibility

Introduction

Early in the current Administration, the President issued key executive orders, directives and guidance documents designed to recognize and address the reality of systemic racism within United States laws, public policies, and public and private institutions, to counter the harmful impacts of discrimination based on gender identity or sexual orientation, and to ensure that at least 40 percent of the overall benefits of investments in climate and clean energy were delivered to disadvantaged communities. In particular, the Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce (June 25, 2021) outlined the importance of the federal government providing a model for Diversity, Equity, Inclusion, and Accessibility (DEIA) for the rest of the nation.

The NOAA Administrator's Diversity and Inclusion Policy Statement (2020) recognizes the value of a workplace that integrates diversity and inclusion into standard practices. The result is more productivity, innovation and the capacity to attract and retain the necessary talent to ensure NOAA meets its mission.

We see a role for the U.S. Integrated Ocean Observing System (IOOS) and its network of 11 Regional Associations (RAs) to support the NOAA Administrator and agency in its goals. The U.S. IOOS endeavors to create, collect, and share relevant information about our ocean, coasts, and Great Lakes with and for diverse communities. Our commitment to diversity includes the recognition that our mission is best served by the leadership and contributions of people of diverse backgrounds, beliefs and culture.

Recognizing that diversity in knowledge, thought, perspective, and approach result in superior performance and effectiveness of teams, the following recommendations are provided to promote a more diverse, equitable, inclusive and accessible IOOS enterprise:

Recommendations

Recommendation 1: The IOOS Program Office, working with the IOOS Association, the RAs, the IOOC and others (e.g. NOS) should develop common DEIA vision and mission statements for the IOOS enterprise.

- The vision statement should identify the key outcomes of the DEIA work to be undertaken by the IOOS enterprise.
- The mission statement should identify key audiences with whom the IOOS enterprise will work, how the work will be conducted (e.g., principles of engagement) and the benefits they will receive as a result of this DEIA work.

Recommendation 2: NOAA should expand support for and/or develop new programs for DEIA activities within NOAA, leveraging the broader IOOS community. This could include:

- Competitive grants and funding opportunities that advance DEIA activities. These may include the development of workforce programs and programs specifically for minority

serving institutions, including leveraging STEM expertise, expanding internships and opportunities for sabbaticals and IPAs at NOAA or the IOOC agencies.

- A permanent IOOS DEIA fellowship program to work with the RAs, IOOS program office and stakeholders to identify and assess issues, identify opportunities, recommend improvements, and recommend new or expanded partnerships. We endorse the current IOOS RA's DEIA Fellow's work, including tracking and maintaining close contact throughout the Fellowship, and encourage this Fellowship to be made permanent to allow that work to continue.
- An IOOS DEIA Strategic Plan and follow on Implementation Plan for execution by the U.S. IOOS Office, developed in collaboration with the Regional Associations.

Recommendations 3: NOAA and the IOOC should develop and execute strategies in DEIA activities that will strengthen the IOOS Program, IOOC observing community, and the new blue economy. This could include:

- Conduct, assess, and publish publicly a baseline data assessment of DEIA workforce across IOOC agencies. Update the baseline assessment every two to three years to monitor areas of need and progress for follow up action as appropriate.
- Conduct an assessment of barriers to and opportunities for DEIA, including workforce development and access to funding. Assessment should include how data sources, metrics and analytical methods can be used in decision making for investments in DEIA programs.
- Develop and implement an investment strategy that could have the greatest impacts for DEIA elements with a focus on underserved communities, operational observation systems, information access, research and development and technological innovation.
- Where appropriate develop, expand, and implement partnerships with stakeholders and minority serving communities to foster technological innovation and inclusivity, including the IOOC agencies, academia, NGOs and the private sector.
- In coordination with the U.S. IOOS community, develop a plan for incorporating the new White House Council on Environmental Quality (CEQ) Indigenous Knowledge Guidance for Federal Agencies into IOOS operations.
- Explore the creation of an internship/fellowship program designed to increase agency connections with underserved communities. Such internships might be well served by including a position guarantee (e.g, service agreement equal to, or greater than time spent as an intern) within that agency or the intern's home state equivalent.

Recommendation 4: NOAA should gather knowledge and enhance access to information to increase diversity, equity, inclusivity, and accessibility in coastal ocean communities and programs. This could include:

- Incorporate principles of collaborative science by expanding stakeholder engagement and information gathering sessions with diverse and underserved groups and communities that rely on access to information and data from the ocean and exchange critical local and traditional knowledge.
- Reinforce IOOS as a key regional integrator to facilitate connections among existing networks that link communities, in order to provide information and ensure access for

communities that rely on knowledge from the ocean to guide decision making and sharing knowledge from and for the local and regional environment.
- Find and connect to a centralized repository of knowledge that includes information on best practices, technology, observing systems, and training materials for DEIA, with a focus on underserved and underrepresented communities.

Recommendation 5: NOAA should ensure coordination of DEIA activities across NOAA and the broader IOOC community. The U.S. IOOS Office could:

- Work with other NOAA Line Offices and the IOOC to ensure coordination of DEIA initiatives, to avoid duplication, provide an agency focus, and maximize investments and best practices.
- Continue to ensure that resources are available for IOOS staff to participate in NOAA diversity initiatives and to work to transfer knowledge and experience gained to Regional Association partners.
- In coordination with other entities, convene a workshop on DEIA with representation from diverse groups, including scientists and technologists from diverse fields (including social scientists and students) from academia, government, industry.

Fostering Growth of the New Blue Economy

Introduction

NOAA's strategic goal #3 is - "*ACCELERATE GROWTH IN AN INFORMATION-BASED BLUE ECONOMY - The U.S. will develop a robust blue economy — that is, the sustainable use of ocean resources for economic growth, improved livelihoods and job creation — to realize the untapped potential of America's ocean and coastal environments, contribute to equitable climate change adaptation strategies and unleash innovation."*

The growth of the New Blue Economy requires collaboration between the federal agencies, states, tribal nations, private industry, communities, and academia. IOOS plays a unique and important role as a connector to all of these stakeholders. An essential element of the New Blue Economy is that it is "information-based" – data is the lifeblood of the NBE and – how it is collected, managed, shared, and translated to support decision-making for societal benefit. The efficient collection and management of data provides a foundation for technology advances, education and workforce development, and delivers data to support critical activities and concerns in the U.S., including impacts from climate change, transportation, energy, safety, and emergency response. Data is often the foundation that successful collaborations and projects are built upon, and data and technology are common themes in the recommendations provided below.

Recommendations

Recommendation 1: NOAA should invest in technology advancement by leveraging the IOOS network of government agencies, academia, and industry.

- Technology is rapidly evolving in the ocean domain, with the creation of new sensor technology, dramatic increases in remotely-sensed data, new modeling techniques, and the use of AI/ML.
- Active engagement with the growing number of technology startups in the blue economy, and coordination of joint projects across sectors would be impactful.
- IOOS should continue to use the Ocean Technology Transition (OTT) program and explore collaboration with IOOC and NOPP on Notice of Funding Opportunity's (NOFO) related to research to operations.
- NOAA should evaluate options for a new funding model, including Other Transaction Agreements (OTAs), that allows for rapid funding and evaluation of new technologies that are agile and can move quickly to start and stop projects.

Recommendation 2: NOAA should review and evaluate the current Data Management & Cyberinfrastructure (DMAC) structure to meet the exponential growth in data being created from sensors, models, analysis, and AI.

- The accomplishments of IOOS and the RAs in the area of data management have been remarkable, and are made possible through community effort and promotion of data standards and use of open-source technologies. As the volume of data increases and

demands on the system increase, it is important that the system continues to scale to meet these demands.
- The review should evaluate a number of areas, including security, redundancy, technology components, scalability, hybrid-centralization, and Cloud-readiness.

Recommendation 3: NOAA should review and evaluate the data buy agreements currently in place for the ocean domain.

- NOAA has entered into agreements to purchase data, especially in the weather and satellite enterprise, and current technologies are expanding beyond the air-sea interface. Future opportunities for the data-purchase model in the ocean domain should be evaluated further.
- Potential data buys could include hydrographic surveys, platforms such as Saildrone and Wave Gliders should be evaluated
- It would be valuable to learn about successes and challenges from the weather enterprise such as GPSRO and the NWS National Mesonet Program.
- NOAA should consider increased coordination of data buys across offices and define "best practices for data buys" in order to ascertain if they can be used to support the IOOS, NOS, and NOAA missions, and if so, ensure equitable agreements between federal and private entities in these agreements across the agency.

Recommendation 4: IOOS should evaluate its role in coordination of data collection and data management for the Offshore Wind sector.

- The growth of offshore wind is transformational for the U.S in terms of its climate and energy strategies, and is also a tremendous opportunity to leverage these projects as ocean observing assets and to expand ocean observing capabilities in the U.S. EEZ. Data collected during planning, permitting, and operations includes extensive site characterization (geological, geophysical and archeological seafloor and subsurface data, metocean observations) and baseline environmental data (marine species, habitats, baseline monitoring for fish, avian, and marine mammal species).
- NOAA/IOOS should coordinate with BOEM to frame a data sharing agreement between the offshore wind developers and government, leveraging IOOS's experience and data infrastructure to manage disparate data required by regulatory processes. There are a number of data sharing agreements that could be considered as templates for such an agreement, including the IOOS data sharing agreement with Orsted[1] and the MOU between NOAA and BOEM[2].
- IOOS should also consider partnerships and work closely with regional entities such as the Regional Wildlife Science Collaborative (https://rwsc.org/) and Responsible Offshore Science Alliance (https://www.rosascience.org/).

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[1] *NOAA signs data-share agreement with offshore wind energy company* (2021 March 29). (https://www.noaa.gov/media-release/noaa-signs-data-share-agreement-with-offshore-wind-energy-company)

[2] *NOAA and BOEM announce interagency collaboration to advance offshore wind energy* (12 January 2022). (https://www.noaa.gov/news-release/noaa-and-boem-announce-interagency-collaboration-to-advance-offshore-wind-energy)

- There is a need for a data backbone to support these types of regional efforts and IOOS should consider expanding its data infrastructure to include more ecosystem and marine life data.
- NOAA should promote coordination of oceanographic data collection on offshore structures, supported by and in partnership with the offshore wind industry. IOOS and its RAs are ideally positioned to advise on what types and where these measurements are most valuable, and can provide guidance and standards on instrument configuration and data management for integration of sensors on offshore wind structures.

Recommendation 5: NOAA should promote IOOS to support STEM education in ocean sciences

- IOOS is uniquely positioned to be the leader in providing data and content for our next generation of STEM students, and become a platform to support student and citizen science.
- NOAA should promote IOOS tools and data for use in high school and college courses – consider an IOOS Education lead position to coordinate with NOAA Office of Education, National Sea Grant and the RAs, and actively engage with institutions.
- NOAA should support programs that provide simple tools (e.g., XLS, Python notebooks) that can be used to leverage IOOS data and teach relevant technical skills and support workforce development.
- Using a number of channels including partnerships and co-branding, IOOS should engage universities with ocean science/engineering and data science programs to develop internships and co-ops with government, academic, and business entities performing data science with NOAA/IOOS ocean data.