



NOAA's Response to the June 2021 IOOS Advisory Committee Recommendations

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IOOS Advisory Committee Spring Meeting



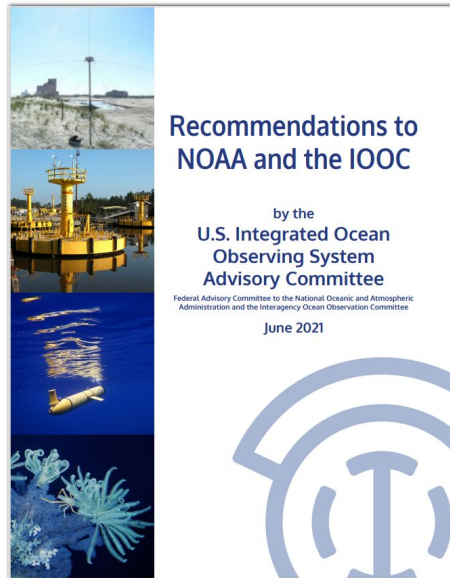
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Link to full report:

https://cdn.ioos.noaa.gov/media/2022/05/NOAA-Response-to-IOOS-AC-Recommendations_April-2022_with-letter.pdf

Background



In June 2021, the U.S. IOOS Advisory Committee submitted a report on their recommendations to NOAA and the IOOC

Three Priority Areas:

1. Vision and Strategy for the Future
2. Creating and Sustaining Strategic Partnerships
3. Requirements Management and Infrastructure Investments for Success and Growth

April 2022 Response to IOOS AC Recommendations

- NOAA concurs or concurs with intent for all 21 recommendations



As a bit of background for those who aren't familiar, in June 2021, the US IOOS Advisory Committee submitted a report on their recommendations to NOAA and the IOOC.

These recommendations covered three priority areas:

1. Vision and Strategy for the Future
2. Creating and Sustaining Strategic Partnerships
3. Requirements Management and Infrastructure Investments for Success and Growth

Hopefully you've all had a chance to read NOAA's full response to these recommendations that we distributed ahead of this meeting.

- Overall, NOAA concurs or concurs with intent for all 21 recommendations

Rather than go one by one through the recommendations with you, we wanted to highlight some of the steps we have taken to address the recommendations in the three priority areas.

Priority Area #1: Vision and Strategy for the Future

Maintain and increase IOOS observing infrastructure

FY17-21 "Fill the Gaps" funding from Congress

- \$11.6M - Gliders
- \$9.6M - HFR
- \$8.1M - Streamlined observation access

Infrastructure Investment and Jobs Act (IIJA)



Advance technology, data tools, and data aggregation

Ocean Technology Transition (OTT) Program

NOAA Water Initiative Service Delivery Framework

Tech conferences, trade shows, competitions

DMAC: Annual Meeting, NOFO

Regional Ocean Partnerships

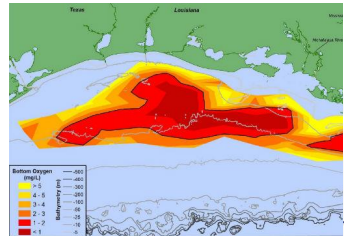
Advance linkages and integration of regional and global models

NOAA Modeling Board

- "Expanding Operational Ocean Forecasting and Prediction" Working Group

Coastal and Ocean Modeling Testbed program

Changes to marine Joint Effort for Data assimilation Integration (JEDI) infrastructure within the Unified Forecast System



Each of these gray boxes reflects a theme pulled from the recommendations for this priority area - these themes encompass anywhere from 1-4 recommendations

- See sections below to see which recommendations are encompassed in each theme
- The sections below also give more information for each of the examples provided in these slides, however more thorough responses will be found in the full response to recommendations document.

Maintain and increase IOOS observing infrastructure:

Rec 1.1.1 Maintain and increase IOOS observing infrastructure and measurements and ensure they capture the coastal climate signal and its impact through sustained observations and models.

- Increased resources in recent years have been critical for maintaining and growing IOOS observing infrastructure.
- "Fill the Gaps" funding from Congress in FY17–21 invested \$11.6M in glider observations, \$9.6M in high-frequency radar (HFR) observations, and \$8.1M in streamlined access to observations.
 - Glider missions increased from ~50 to over 100 missions
 - 15 gliders procured across the 11 RAs for missions related to HABs, fisheries, hurricane intensity forecast improvements,

- ecosystem monitoring and water quality
 - Funds supported the IOOS National Glider Data Assembly Center, which has become the operational conduit for getting nonfederal glider data into NOAA for operational assimilation by the NOAA Real-time Ocean Forecast System (RTOFS)
- 30 new HFRs, major repairs to a further 31 HFRs, support for operations and maintenance of 63+ HFR stations
- IJA is bringing critical resources to enhance and improve ocean, coastal, and Great Lakes observing infrastructure.
 - IJA provides a singular opportunity.
 - These investments allow NOAA to increase support for key programs, activities, and partnerships that expand delivery of strong science, service, and stewardship to address improved and enhanced coastal, ocean, and Great Lakes observing systems.

Advance technology, data tools, and data aggregation:

Rec 1.2.1 Ensure use of 11 federally certified regional data centers to implement advanced data tools and further data aggregation

Rec 1.2.2 Identify ways that NOAA can use technological innovations to address the needs of coastal and oceanographic communities and stakeholders, including for outreach and education purposes.

- OTT Program: sponsors the transition of marine observing technologies to an operational mode
 - Currently supports 8 projects at an annual expenditure of \$2.75M
 - Covers topics such as HABs, hypoxia, ocean acidification, animal borne sensors, and physical ocean observations
- Service Delivery Framework: mission to “continuously build a network of trusted experts who engage internally and externally with partners to inform NOAA’s product and service development to be useful, usable, and used.”
 - This involves substantial engagement to:
 - Coordinate and integrate NOAA contributions to understand needs and communicate with product and service developers
 - Prioritize investments in product lines, e.g., science (observations and data), services (technical assistance, engagement, training), and stewardship (resource management, place-based)
 - Develop new, and refine existing, products and services informed by user needs
 - Transmit and translate actionable information for decision-makers across multiple sectors
- Conferences, trade shows, competitions:
 - Regional workshops (e.g., Technology Development and Transition -

- power and persistence of uncrewed vehicle systems, carbon dioxide removal technologies, artificial intelligence and cloud system development, automatic omics' (eDNA) samplers, etc.)
- DOE “Powering the Blue Economy: Ocean Observing Prize” - challenges innovators to integrate marine renewable energy with ocean observation platforms, ultimately revolutionizing our ability to collect the data needed to understand, map, and monitor the ocean and to realize the full potential of the Blue Economy
- IOOS sponsors technology conferences and trade shows such as the Marine Technology Society Oceans Conference, Oceanology International, Oceans in Action, BlueTechWeek, etc.
- DMAC:
 - Annual DMAC meeting - brings together RA and community members to communicate and discuss advancements and innovations in the coastal oceans and Great Lakes (next meeting scheduled for June 2022)
 - NOFO regarding Topic Area 2 of the FY21 Implementation of the U.S. IOOS funding announcement (Advancing the National DMAC System Architecture) resulted in funding for two projects:
 - Passive Acoustic Monitoring Access Network: Advancing Data Management and Cyberinfrastructure Solutions for a Big Data Problem (awarded to the University of Colorado)
 - Reaching for the Cloud: Architecting a Cloud-Native Service-Based Ecosystem for DMAC (awarded to RPS)
- Regional Ocean Partnerships:
 - From FY19–21, Congress appropriated a total of \$5.5M for ROPs, or their equivalent, to enhance their capacity for sharing and integration of Federal and non-Federal data to support regional coastal, ocean and Great Lakes management priorities.
 - In the Explanatory Statement for NOAA’s FY20 and FY21 appropriation to support “Regional Data Portals”, Congress directed the IOOS Office and the Office for Coastal Management to coordinate implementation of these funds given that the RAs have strong regional relationships and capacity for data sharing and could serve this role effectively in regions without an established regional ocean partnership.
 - In the five regions where established ROPs do not exist (Great Lakes, Caribbean, Southeast, Pacific, and Alaska), IOOS RAs have been serving as the equivalent to enhance sharing and integration of federal and non-federal data.

Advance linkages and integration of regional and global models:

Rec 1.1.2 Advance linkages between regional near-shore and global ocean models and enhance

integration with NOAA's Unified Forecast System (UFS).

- The NOAA Modeling Board was established in FY21 to unify production of world-leading, fully coupled, Earth System models for research, operations, and applications
 - In FY22, NOAA established a new working group under the NOAA Modeling Board called "Expanding Operational Ocean Forecasting and Prediction" which will be responsible for achieving a clear framework for cross-NOAA and external modeling community coordination and integration with respect to the operational ocean observation value chain and to define needs/requirements and a path for research to operational needs
- Coastal and Ocean Modeling Testbed program: five three-year projects were funded in FY21 with a focus on transitioning models from research to operations
 - These projects include improving data assimilation, coupling of 3D ocean models to the National Water Model, and improvements to the NOS Global Extratropical Surge and Tide Operational Forecast System model
- Changes to marine JEDI infrastructure within the UFS
 - Funded projects to advance atmosphere/ocean coupled modeling and ocean data assimilation in UFS and JEDI frameworks in support of UFS-based Hurricane Analysis Forecast System and UFS-based coastal applications

Priority Area #1: Vision and Strategy for the Future

Economic valuation of observing systems

Ocean Enterprise Studies

Benefits of Ocean Observing Catalog (BOOC)

IOOS Association - Prototype economic valuation study of observing systems within the IOOS regions

Broader NOAA initiatives:

- Global Ocean Monitoring and Observing/Ocean Acidification Program valuation study
- Bureau of Economic Analysis: Marine Economy Satellite Account statistics
- Office of Performance, Risk & Social Science: GeoXO Study



Enhance the future workforce

IOOS Association DEIA fellow and IOOS RAs

Review fellowship applications and host interns (e.g., Hollings Scholarship and EPP/MSI)

Other engagements: DMAC Code Sprint, Google Summer of Code

Distribution of "The Ocean Is Our Home" (published by EuroGOOS)

Economic valuation of observing systems:

Rec 1.1.3 Continue to undertake economic valuation processes of observing systems to better quantify benefits and enhance messaging for sustained observations

- Ocean Enterprise Studies: Two released → a baseline study in 2015, and a 2015–2020 update released in December 2021, with plans to update every 5 years
 - These studies include survey results and trend information to better understand how the U.S. Ocean Enterprise business cluster of providers of ocean observing technology and intermediaries creating value added information services have responded to opportunities to support a growing and changing Blue Economy
- BOOC: (collab with the Center for the Blue Economy at the Middlebury Institute of International Studies at Monterey)
 - provide a GIS-based central repository of case studies, papers, and reports describing the societal and economic benefits derived from ocean observations, with input by various stakeholders from around the world.
- IOOS Association prototype economic valuation study of observing systems within the IOOS regions
 - collab with the Center for the Blue Economy at the Middlebury Institute of International Studies at Monterey

- Broader NOAA initiatives:
 - GOMO and OAP co-funded a valuation study by Hauke Kite-Powell, which was completed this past winter. This report will be made public once the results have been reviewed by the NOAA sponsor programs
 - Bureau of Economic Analysis: in June 2021 released the first official Marine Economy Satellite Account statistics from 2014–2019
 - NOAA’s Office of Performance, Risk & Social Science: In 2021 initiated study of the potential benefits to society of NOAA’s next generation geostationary satellite program (GeoXO)
 - More than 150 discrete benefits have been identified, with applications ranging from electric power production, aviation, hurricane response, wildfires, human exposure to poor air quality, HABs, and agriculture
 - GeoXO will also provide new types of observations, which are likely to lead to discoveries and new applications
 - The GeoXO working group completed a report detailing these findings as part of the mission planning efforts and studies for producing monetized benefits estimates are underway

Enhance the future workforce:

Rec 1.2.3 Leverage diverse STEM expertise to enhance future workforce.

- IOOS Association DEIA Fellow: Hired in January 2022 to help amplify regional work and identify opportunities to improve IOOS’ ability to serve and engage underserved communities
- IOOS personnel serve as application reviewers and internship hosts for the Hollings Scholarship Program and EPP/MSI
 - The RAs also host summer undergraduate interns, some through the Hollings and EPP/MSI programs (e.g., SECOORA), and some through their own summer programs (e.g., CARICOOS).
- Other engagements:
 - DMAC Code Sprint: Funding for an undergraduate and a recent graduate to attend the 2019 and 2022 DMAC Code Sprints
 - Google Summer of Code: Support and mentor new or beginning open source programmers from around the world, using innovative tools and code to tackle urgent coastal ocean and Great Lakes issues
 - In 2021, IOOS hosted 2 undergraduates and 1 Ph.D. student
- Copies of the children’s book “The Ocean Is Our Home” by Dina Eparkhina and Karri Lehtonen (published by the European Global Ocean Observing System) were printed for distribution to six local elementary schools
 - This book describes the ocean’s ecosystem and economic services, and the importance of ocean data and information to maintain and advance those services.

Priority Area #2: Creating and Sustaining Strategic Partnerships



Overarching Themes:

Rec 2.1 Maintain/Build on existing partnership model

Rec 2.2 Use partnerships to accelerate innovation and inclusivity

- IOOS' success is built on partnership across public and private sectors and is based upon the regional and national cooperation identified in the Integrated Coastal and Ocean Observing System Act of 2009.

NOAA and Interagency Partnerships:

Rec 2.3.1 Analyze NOAA initiatives with established partnership models to ensure alignment with IOOS effort

Rec 2.3.4 Collaborate with NOAA Big Data Project, and other relevant entities, regarding IOOS contributions to ecological forecasting and regional ocean forecasting efforts.

Rec 2.3.3 Pursue leveraged support from other agencies and private sources through the National Ocean Partnership Program (NOPP).

- The IOOS Office strives to work with partners across NOAA and interagency in order to maintain alignment with ongoing initiatives.
- This is by no means a comprehensive list of NOAA and Interagency partners, we are constantly looking for new collaborations to advance IOOS goals and missions and leverage resources.

Private Industry Partnerships:

Rec 2.3.2 Expand engagement with private industries and other entities to rapidly establish partnerships to augment aging ocean observing infrastructure.

- Stakeholder engagement and partnerships are fundamental to the success of the IOOS Enterprise.
- OTT: an ongoing, multi-year effort to transition prototype ocean, coastal, and Great Lakes observing, product development, and data management technologies to sustained operations in a stepped, parallel, and scalable process
 - Includes stakeholder engagement from industry, government, academia, and others invested in the monitoring and assessment of the nation's ocean and coastal regions
- New Blue Economy: NOAA is engaged in dialogue with many private industry partnerships regarding how to share requirements
- The IOOS Office actively works with IOOS RAs and Ocean Enterprise businesses (e.g., SOFAR, Saildrone, etc.) to tackle aging infrastructure among other things
- NOAA has entered into a MOU with BOEM
 - Goal: advancing wind energy responsibly while protecting biodiversity and promoting cooperative ocean use
 - MOU provides an unprecedented opportunity to advance offshore wind and characterization of ocean regions, providing a win-win for addressing climate change and increasing ocean observing capacity to further assess ocean environments
 - The IOOS Office will leverage the wind energy MOU with BOEM to maximize the benefits of wind energy platforms and minimize the wind energy interference to the IOOS HFR network
 - The IOOS Office will also leverage wind energy platforms to increase ocean observations in those regions

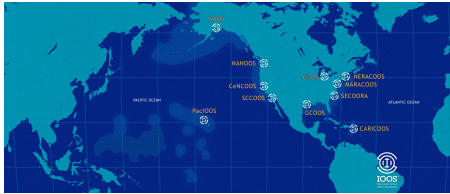
Partnerships with BIPOC (Black, indigenous, people of color) and Underserved and Underrepresented Communities:

Rec 2.3.5 Expand the participation at all levels of BIPOC and underserved and underrepresented communities, including co-production of knowledge and incorporation of local and traditional Indigenous knowledge.

- Expanding the participation at all levels of BIPOC and underserved and underrepresented communities provides valuable knowledge and expertise that increases the effectiveness of the IOOS Enterprise.
- IOOS Association DEIA Fellow: connecting with RAs to help them develop plans to establish and grow DEIA efforts within their regions, including:
 - Working with indigenous communities to incorporate their knowledge into data portals
 - Hosting workshops with stakeholder communities to facilitate interpretation of data and products and obtain essential feedback
- Columbia River Inter-Tribal Fish Commission: took over the Oregon State University coastal ocean observations and modeling on an operational basis
 - This effort involves three tribes and includes the accompanying

- fieldwork

Priority Area #3: Requirements Management and Infrastructure Investments for Success and Growth



Assessing and Tracking Requirements

Assessing Requirements:

- RA gap analysis
- Leverage across programs and matrixing requirements:
 - Weather Water Climate Board
 - NOAA Modeling Board
 - NOAA Climate, Ecosystems, and Fisheries Initiative
 - Connections to Weather Enterprise
 - Office of National Marine Sanctuaries condition reports
 - HAB forecasting and observing with National Centers for Coastal Ocean Science

Tracking Requirements:

- Community Unfunded Requirements List: informs annual planning process, tracks recapitalization priorities

Infrastructure Investments

Regional infrastructure investments through Operations, Research, and Facilities funding

Infrastructure Investment and Jobs Act (IIJA) - \$150M allocated for “improved and enhanced coastal, ocean, and Great Lakes observing systems” and includes \$50M of PAC funding



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Assessing and Tracking Requirements:

Rec 3.1.1 The U.S. IOOS Office should adopt a requirements management system that begins with higher-level objectives (e.g. “IOOS observations will lead to a XX% improvement in hurricane intensity forecasts over the next X years”).

Rec 3.1.3 U.S. IOOS Office should develop an annual investment strategy based on a traceable requirements management process.

Rec 3.2.1 IOOS Office should create an unfunded requirements list based on a gap analysis.

Rec 3.2.4 IOOS should, where possible without a federal budget cross-cut, assess requirements in the context of the total federal investments

- Assessing Requirements:
 - IOOS is working with the RAs to create a repeatable cycle to identify gaps in each region
 - The IOOS Office focuses on leveraging across programs and matrixing requirements through platforms such as:
 - the NOAA Climate, Ecosystems, and Fisheries Initiative
 - connections to the Weather Enterprise
 - contributions to the Office of National Marine Sanctuaries conditions reports
 - partnerships with the National Centers for Coastal Ocean Science on HABs

- the NOAA Weather Water Climate Board, and the NOAA Modeling Board.
- Tracking Requirements:
 - Based upon recommendations of the IOOS Advisory Committee, the IOOS Office has developed a Community Unfunded Requirements List (CURL) to catalog gaps and needs of the system.
 - This detailed and comprehensive spreadsheet organized by region allows the office to maintain a current and periodically updated information source and tool to help prioritize resource investments and budget requests for the future.
 - Informs the annual planning process
 - Tracks recapitalization priorities

Infrastructure Investments:

Rec 3.2.2 IOOS Enterprise should develop an Observing System Recapitalization Plan to include maintenance, operations, sustainability, and modernization of the observing system.

Rec 3.2.3 NOAA should set up PAC budget lines for IOOS, for infrastructure refreshes and equipment servicing as part of a larger plan to fully fund present and future known and emerging infrastructure needs.

- Investments in regional infrastructure are managed through Operations, Research, and Facilities (ORF) funding
- Infrastructure Investment and Jobs Act (IIJA) allocated resources to IOOS to help meet recapitalization needs.
 - \$150M allocated for “improved and enhanced coastal, ocean, and Great Lakes observing systems” and includes \$50M of PAC funding
 - Initial spend plans were established by NOAA for the first 2 of 5 years, with the intent to revisit plans for years 3, 4, and 5 on an annual basis.

(Recs not explicitly mentioned in this presentation, but addressed in the response document):

Rec 3.1.2 NOAA Leadership should develop a coherent description of the many ocean observing programs within its Line Offices, including associated budgets in a cross-Line Office roll-up.

Rec 3.1.4 NOAA Leadership should position IOOS as the oceanographic operational integrator at NOAA.



If you haven't already, I encourage you to read NOAA's response to the June 2021 IOOS Advisory Committee recommendations, as it covers much more detail than I have provided in this presentation.

I also want to note that although we have highlighted many ways in which IOOS has already begun addressing these recommendations, we acknowledge that there is always more work to be done as we strive to continually advance and grow the IOOS Enterprise.

I want to thank the Advisory Committee for helping us with this task and providing thoughtful recommendations - we appreciate your support and guidance in helping IOOS be the best it can be.