U.S. IOOS Mission Areas

**Authorizing legislation**
Integrated Coastal Ocean Observing System (ICOOS) Act (P.L. No 111-11, March 2009)

**Mission Areas**
- Predicting Weather & Climate Variability
- Safe and Efficient Transportation and Commerce
- Preparedness and Risk Reduction for Coastal Communities
- Healthy Ecosystems and Water Quality

Supporting Decisions Every Day
Partnership effort that leverages dispersed national investments to deliver ocean, coastal and Great Lakes data relevant to decision-makers.

Global Component
- US contribution to Global Ocean Observing System (GOOS)
- 1 of 15 Regional Alliances of GOOS

National Component
- 17 Federal agencies

Regional Component
- 11 Regional Associations
  - Stakeholder driven
  - Academia, state/local/tribal government, private industry

Stakeholder Driven, Science Based, Policy Neutral
IOOS meets societal needs through stakeholder engagement

STEP 1: Tailor engagement to identify user needs

STEP 2: Design and refine data products with users

STEP 3: Iterative engagement with users

Coastal & Ocean Observing Data

Indigenous Communities

Mariners

Fisheries

Scientists

Planners

Operators

Managers

Industry

Government

Emergency Responders

Residents

Conservation

Figure: Melissa Iwamoto - OceanObs '19
<table>
<thead>
<tr>
<th>PHYSICS</th>
<th>BIOGEOCHEMISTRY</th>
<th>BIOLOGY &amp; ECOSYSTEMS</th>
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</thead>
<tbody>
<tr>
<td>Bathymetry</td>
<td>Acidity</td>
<td>Biological vital rates</td>
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<td>Bottom character</td>
<td>Colored dissolved organic matter</td>
<td>Coral species and abundance</td>
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<tr>
<td>Currents</td>
<td>Contaminants</td>
<td>Fish species/abundance</td>
</tr>
<tr>
<td>Heat flux</td>
<td>Dissolved nutrients</td>
<td>Invertebrate species and abundance</td>
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<tr>
<td>Ice distribution</td>
<td>Dissolved Oxygen</td>
<td>Marine mammal species/abundance</td>
</tr>
<tr>
<td>Salinity</td>
<td>Ocean color</td>
<td>Microbial species/abundance/activity</td>
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<tr>
<td>Sea level</td>
<td>Optical properties</td>
<td>Nekton diet</td>
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<td>Surface waves</td>
<td>Pathogens</td>
<td>Phytoplankton species/abundance</td>
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<td>Stream flow</td>
<td>Partial pressure of CO2</td>
<td>Sea birds species/abundance</td>
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<tr>
<td>Temperature</td>
<td>Total suspended matter</td>
<td>Sea turtles species/abundance</td>
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<td>Wind speed and direction</td>
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<td>Submerged aquatic vegetation species/abundance</td>
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<td>Sound</td>
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<td></td>
<td>Zooplankton species/abundance</td>
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Ocean Technology Transition (OTT)

- The IOOS Ocean Technology Transition Program sponsors the transition of emerging marine observing technologies to operational mode.

- **Priority Focal Areas:**
  - HABs
  - Animal Borne Sensors
  - Ocean Acidification
  - Physical Ocean Observations

- The Coastal and Ocean Modeling Testbed is a partnership of federal and non-federal partners including a cloud ‘sandbox’

- COMT works to accelerate transition of coastal and ocean modeling research to operational ocean products and services.

- Coastal coupling community of practice.
IOOS Model Viewer

- IOOS Environmental Data Server Model Viewer - https://eds.ioos.us/
- Continued updates to visualization - improving how layers draw
- Added dissolved oxygen (CBOFS, ROMS), and NOAA Great Lakes ice
IOOS Sensor Map and NSF-funded Colleagues

- Working towards RA ERDDAPs as primary data source

- Sensor Map updates - large release coming Oct 2020 [https://sensors.ioos.us/](https://sensors.ioos.us/)

- Links to Ocean Observatories Initiative (OOI) portal development
  - “Platforms and sensor systems (to) measure physical, chemical, geological and biological properties and processes from the seafloor to the air-sea interface.” [https://ooi-data-explorer.axds.co/](https://ooi-data-explorer.axds.co/)

Beta version - [https://ooi-data-explorer.axds.co/](https://ooi-data-explorer.axds.co/)
Ecosystem Trends and Biodiversity

- [https://marinebon.org/](https://marinebon.org/)
- Open source, cloud-based tools to ensure Sanctuary condition reports and infographics and IEA Ecosystem Status Reports are online, interactive, up to date
- Soft launch Spring 2020: [https://marinebon.org/sanctuaries/](https://marinebon.org/sanctuaries/)

- Channel Islands well advanced; Monterey Bay, Florida Keys, Olympic Coast in progress; in discussion with Stellwagen/Northeast IEA
- NOS, NMFS discussing strategic approach, pooled resources for product expansion
How we do it

Building Communities

Strong Partnerships

Regional → National → Global

Support for technology & research
Questions?

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Five Key Focus Areas - intended to expand NOAA’s application of these focus areas:

- Unmanned Systems
- Artificial Intelligence
- ‘Omics
- Cloud Services
- Data

One Draft Strategy:
- Citizen Science

Will guide transformational advances in the quality and efficiency of NOAA's science, products, and services.

https://nrc.noaa.gov/NOAA-Science-Technology-Focus-Areas
• White House (OSTP) Science and Technology for America’s Oceans: A Decadal Vision

• UN Decade of Ocean Science for Sustainable Development

• Supporting and implementing OceanObs’19 recommendations and preparing for OceanObs’29

• IOOS Grand Challenges & Actions including Essential Ocean Variables and Communities of Practice development
Back Up Slides
Elements of an Operational Oceanography System

Credit: Schiller et al. (2018)
An IOOS cloud-based model development sandbox

Federal Agencies

Research & Academia

Private Industry

Community development

computation & experimentation

billing & management

support libraries

optimize product delivery

Distributed version control via GitHub (or similar database)
IOOS Observing Assets

- Coastal Moorings
- Shore Stations
- HF Radar
- Sub-surface Gliders
- Wave Buoys
- Animal Telemetry, Marine Biodiversity

Photo credits: Rutgers/CODAR/Dan Costa/PacIOOS/K. Millikan
Mission

The IOOS Ocean Technology Transition Program sponsors the transition of emerging marine observing technologies, for which there is an existing operational requirement and a demonstrated commitment to integration and use by the ocean observing community, to operational mode.

Priority Focal Areas:
- HABs
- Animal Borne Sensors
- Ocean Acidification
- Physical Ocean Observations

https://ioos.noaa.gov/project/ocean-technology-transition/
Underwater Gliders (AUVs)

Applications Include:

- Improving hurricane intensity forecasts
- Ecosystem dynamics monitoring
- MBARI dye tracking experiment
- Test performance of acoustic receivers and other sensors
- Fish stock mapping of Red Grouper and others
- Glider speed testing in the Gulf Stream
- Harmful Algal Bloom (HAB) mapping
- Listening to tagged fish, whale acoustics
- Sustained and targeted ocean observations for improving tropical cyclone intensity and hurricane seasonal forecasts
- Upper ocean monitoring of U.S. Caribbean/Atlantic Economic Exclusion Zone (EEZ)
- Sampling around Station ALOHA and other long term stations
- Hydrographic mapping
- Ocean acidification sampling
- Climate monitoring
Coastal and Ocean Modeling Testbed

• The Coastal and Ocean Modeling Testbed, COMT, is a partnership of federal and non-federal partners

• COMT works to accelerate transition of coastal and ocean modeling research to operational ocean products and services.
Underwater Gliders: Hurricane Intensity

Helping to improve Hurricane Intensity forecasts

- Throughout hurricane season, IOOS and its partners deploy Hurricane Glider survey lines in the Atlantic, Gulf of Mexico and Caribbean Oceans.
- These gliders collect data that help researchers and forecasters improve hurricane intensity forecasts.
- This partnership continues this year and is on track to deploy and operate 9 NOAA and 2 US Navy gliders in the Caribbean Sea and tropical Atlantic to provide high-quality ocean data used for weather forecasts.
INTEGRATION OF OCEAN AND COASTAL DATA FROM THE INTEGRATED OCEAN OBSERVING SYSTEM.—In National Weather Service Regions where the Director of the National Weather Service determines that ocean and coastal data would improve forecasts, the Director, in consultation with the Assistant Administrator for Oceanic and Atmospheric Research and the Assistant Administrator of the National Ocean Service, shall—

(A) integrate additional coastal and ocean observations, and other data and research, from the Integrated Ocean Observing System (IOOS) into regional weather forecasts to improve weather forecasts and forecasting decision support systems; and

(B) support the development of real-time data sharing products and forecast products in collaboration with the regional associations of such system, including contributions from the private sector, academia, and research institutions to ensure timely and accurate use of ocean and coastal data in regional forecasts.

(C) support increasing use of autonomous, mobile surface, sub-surface, and submarine vehicle ocean and fresh water sensor systems and the infrastructure necessary to share and analyze these data in real-time and feed them into predictive early warning systems.  (C was added with NIDIS reauth. Act S2200 in 115th Cong.)

Also see ICOOS Act of 2009
https://cdn.ioos.noaa.gov/media/2017/12/Public_LawNo111-11HR-146_-PassedSigned_033009.pdf

Senate ICOOS Act Reauthorization Bill S. 914
https://www.congress.gov/116/bills/s914/BILLS-116s914is.pdf
Observations Ingested into GTS