

~~Biological Observations and Models~~

U.S. IOOS - Coasts, People, Observations, Science, and Technology

Carl Gouldman
September 8, 2020



U.S. IOOS Mission Areas

Authorizing legislation

Integrated Coastal Ocean Observing System (ICOOOS) 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

U.S. IOOS: Program Regional - National - Global

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

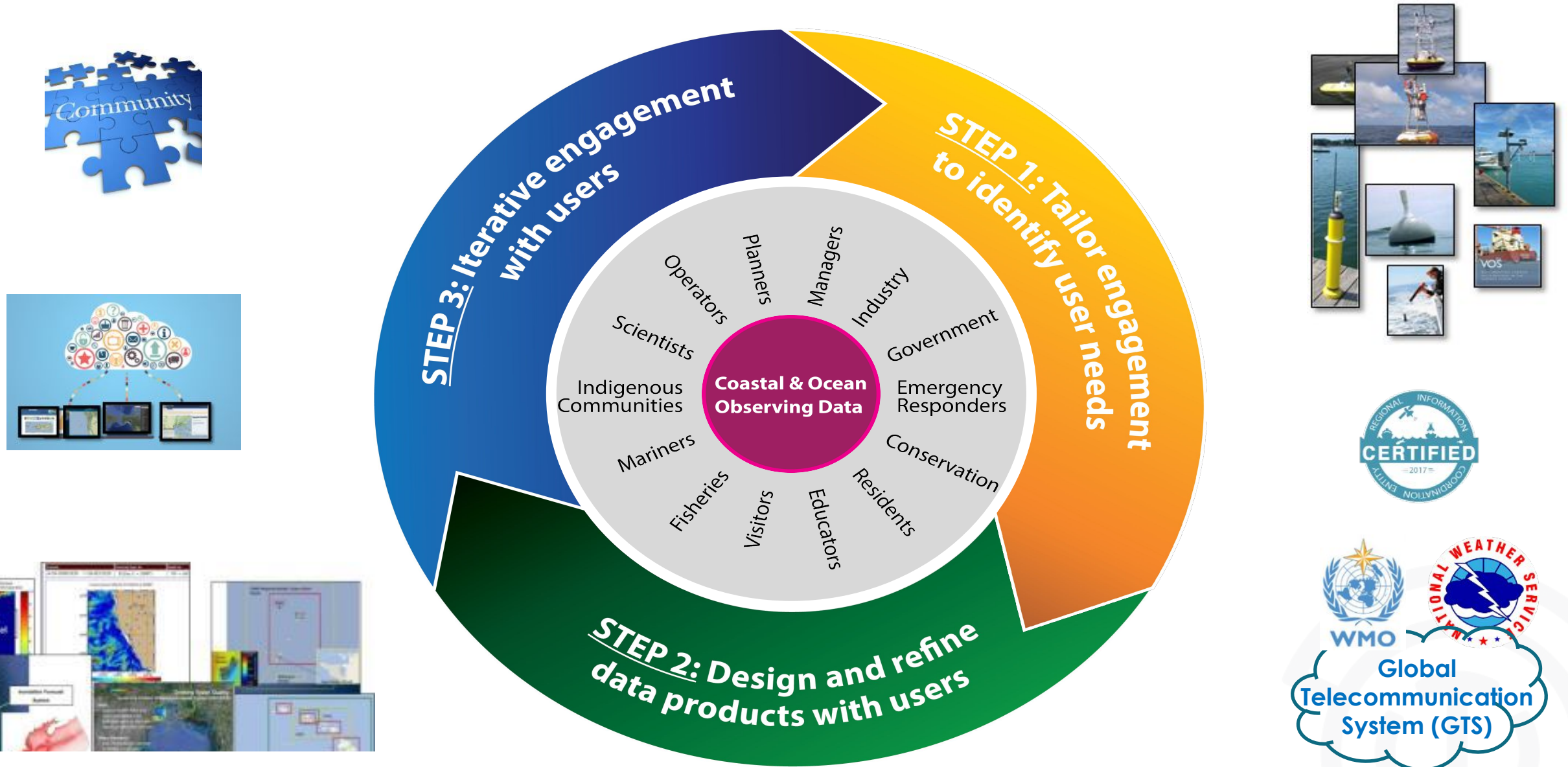


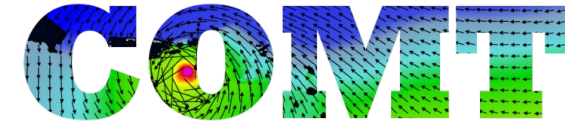
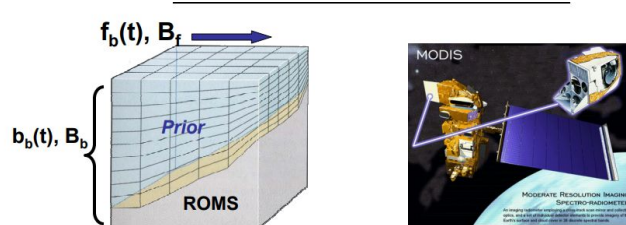
Figure: Melissa Iwamoto - OceanObs '19

IOOS Core Variables

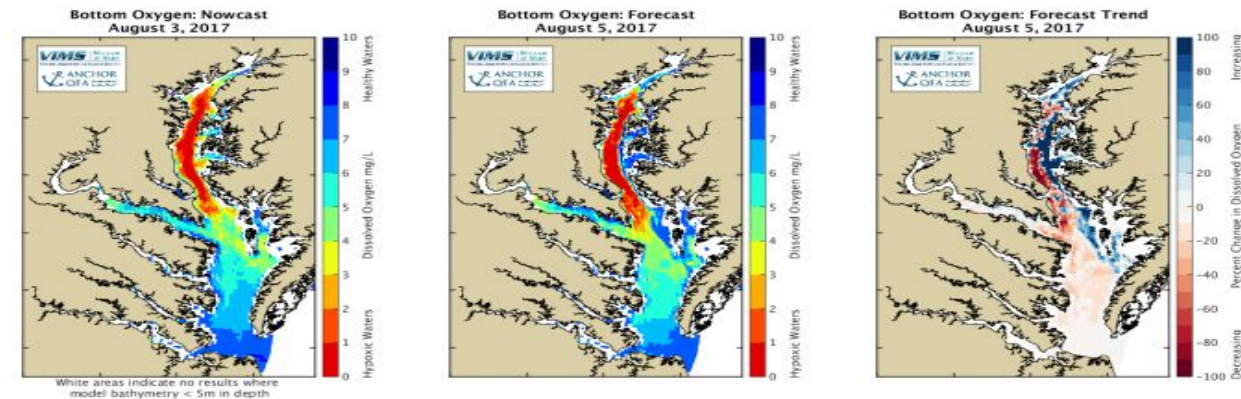
PHYSICS	BIOGEOCHEMISTRY	BIOLOGY & ECOSYSTEMS
• Bathymetry	• Acidity	• Biological vital rates
• Bottom character	• Colored dissolved organic matter	• Coral species and abundance
• Currents	• Contaminants	• Fish species/abundance
• Heat flux	• Dissolved nutrients	• Invertebrate species and abundance
• Ice distribution	• Dissolved Oxygen	• Marine mammal species/abundance
• Salinity	• Ocean color	• Microbial species/abundance/activity
• Sea level	• Optical properties	• Nekton diet
• Surface waves	• Pathogens	• Phytoplankton species/abundance
• Stream flow	• Partial pressure of CO ₂	• Sea birds species/abundance
• Temperature	• Total suspended matter	• Sea turtles species/abundance
• Wind speed and direction		• Submerged aquatic vegetation species/abundance
		• Sound
		• Zooplankton species/abundance

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

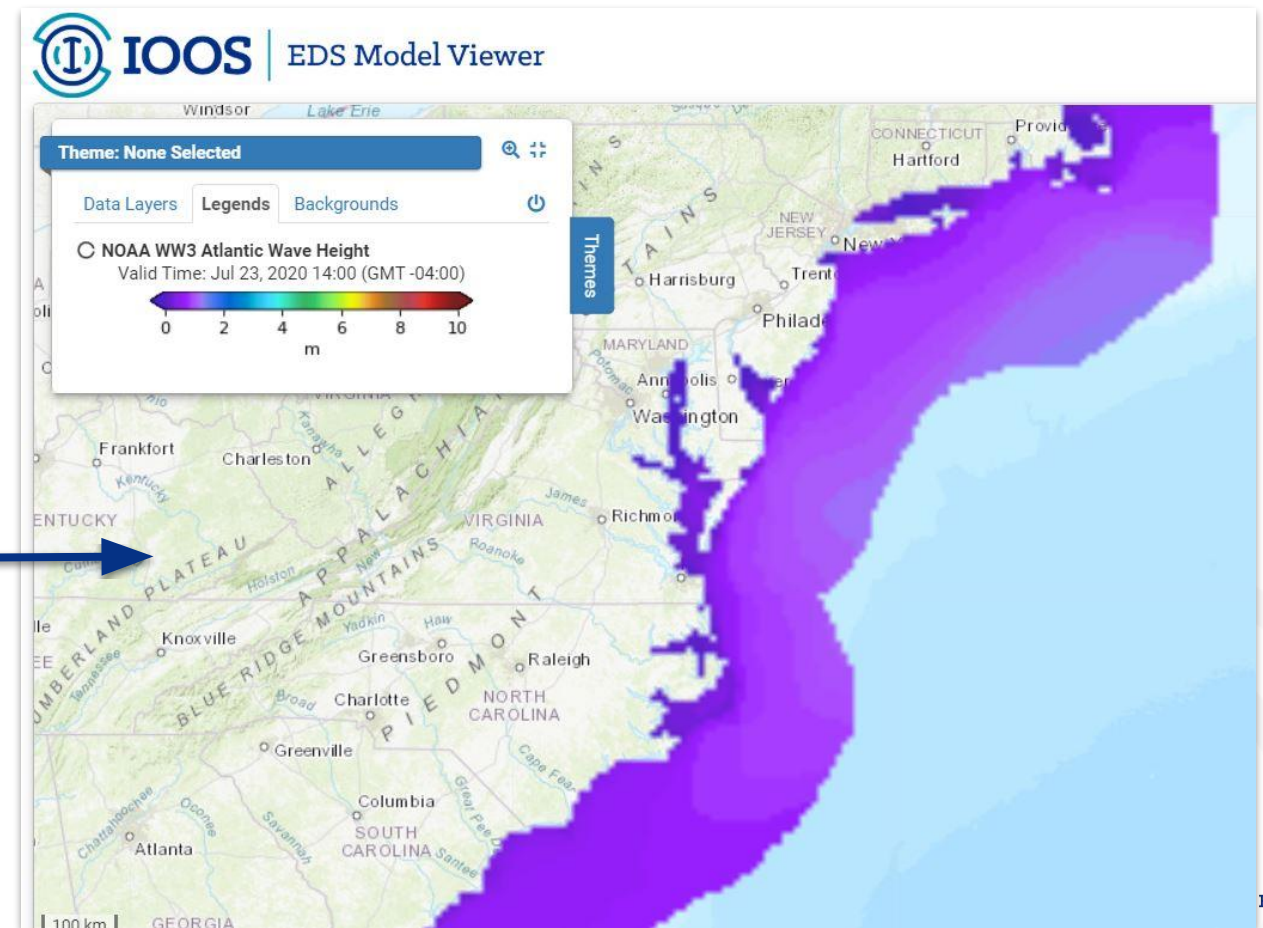
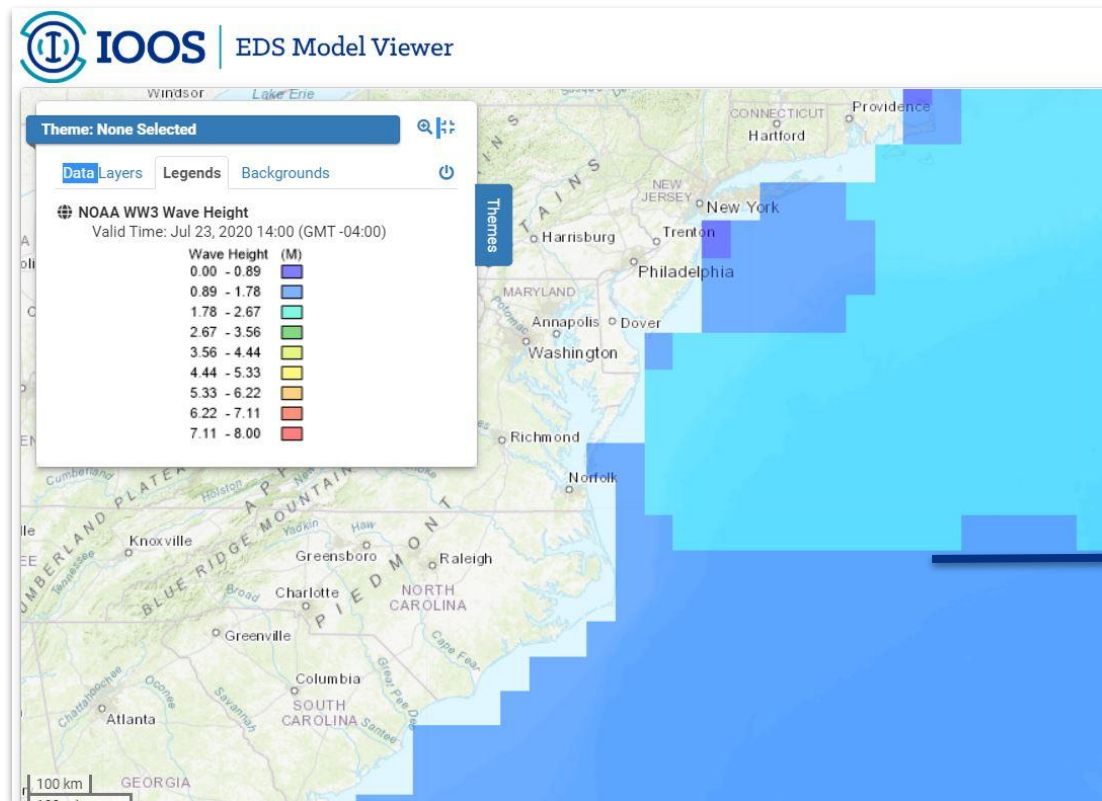


- The Coastal and Ocean Modeling Testbed is a partnership of federal and non-federal partners including a cloud 'sandbox'
- COMT works to accelerate transition of coastal and ocean modeling research to operational ocean products and services.
- Coastal coupling community of practice.



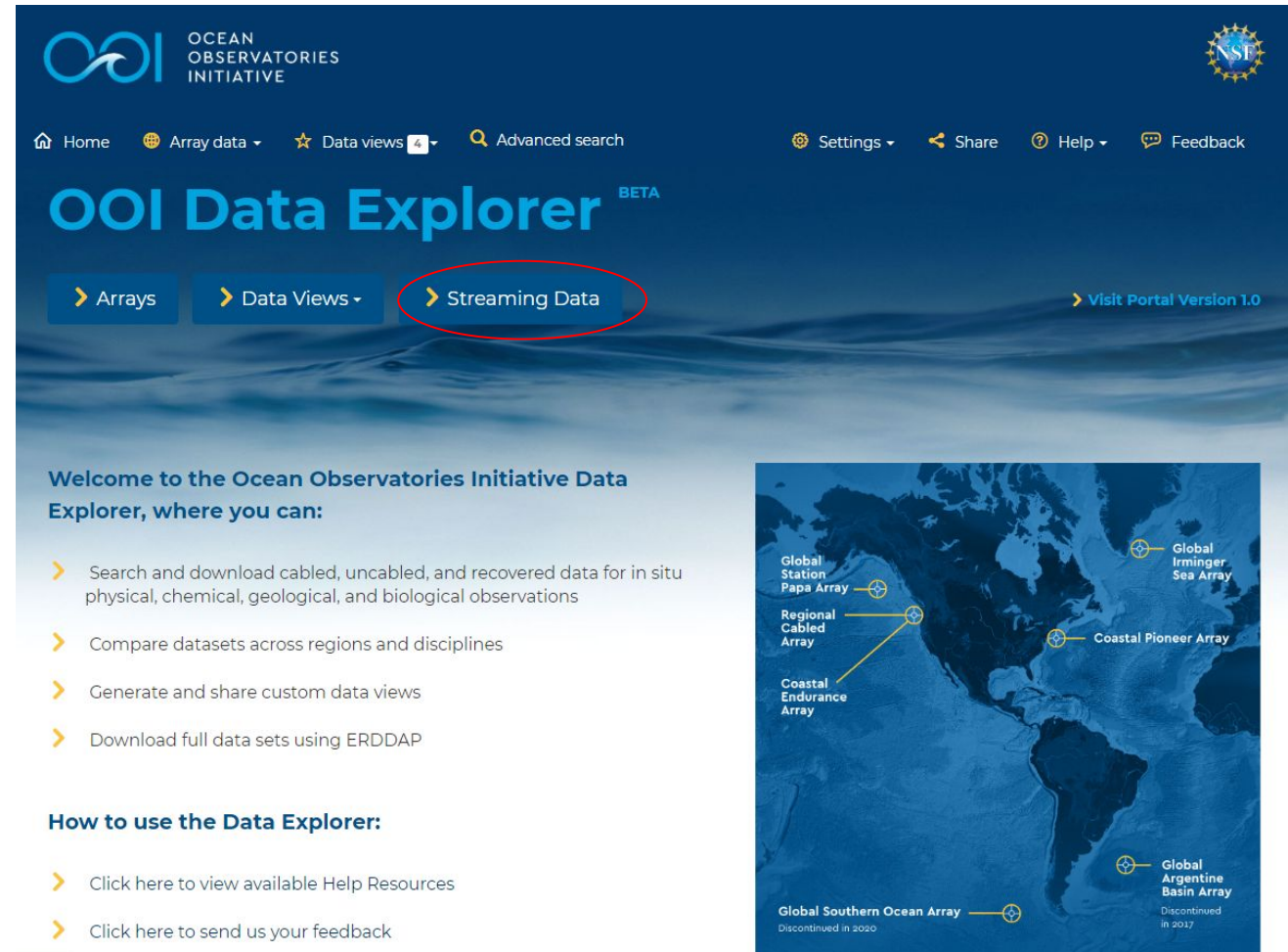
IOOS Model Viewer

- 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

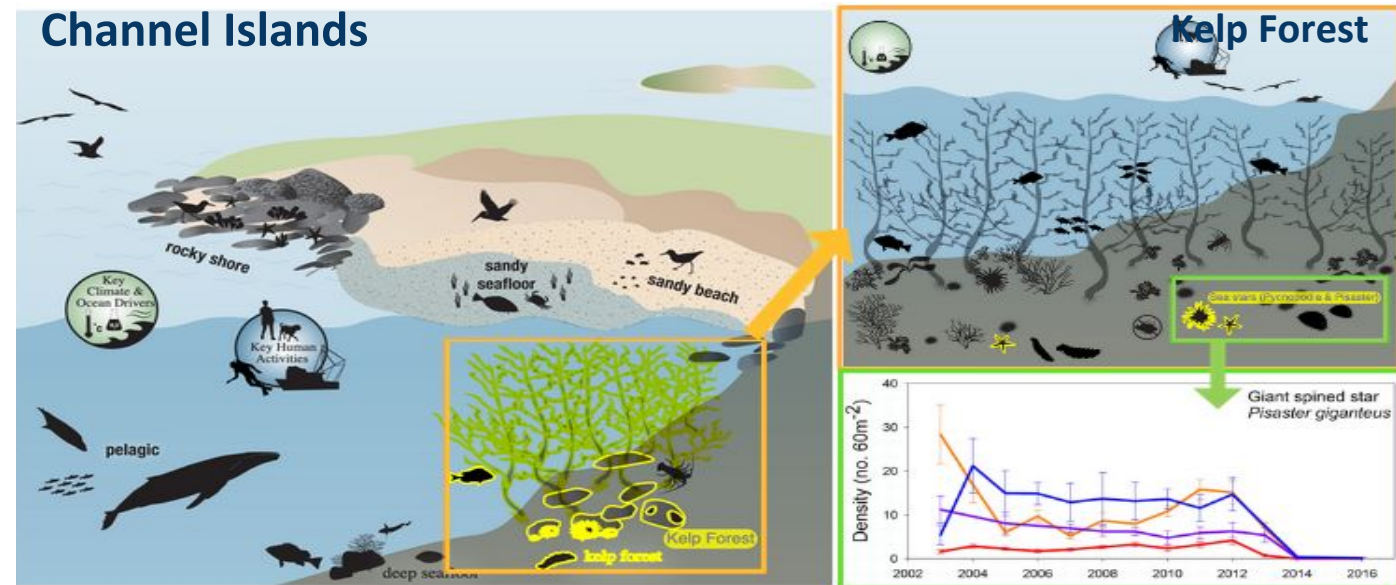
- Working towards RA ERDDAPs as primary data source
- Sensor Map updates - large release coming Oct 2020 <https://sensors.ioos.us/>
- Links to Ocean Observatories Initiative (OOI) portal development
 - “Platforms and sensor systems (to) measure physical, chemical, geological and biological properties and processes from the seafloor to the air-sea interface. “
<https://ooi-data-explorer.axds.co/>



Beta version -
<https://ooi-data-explorer.axds.co/>

Ecosystem Trends and Biodiversity

- <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/>
- 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

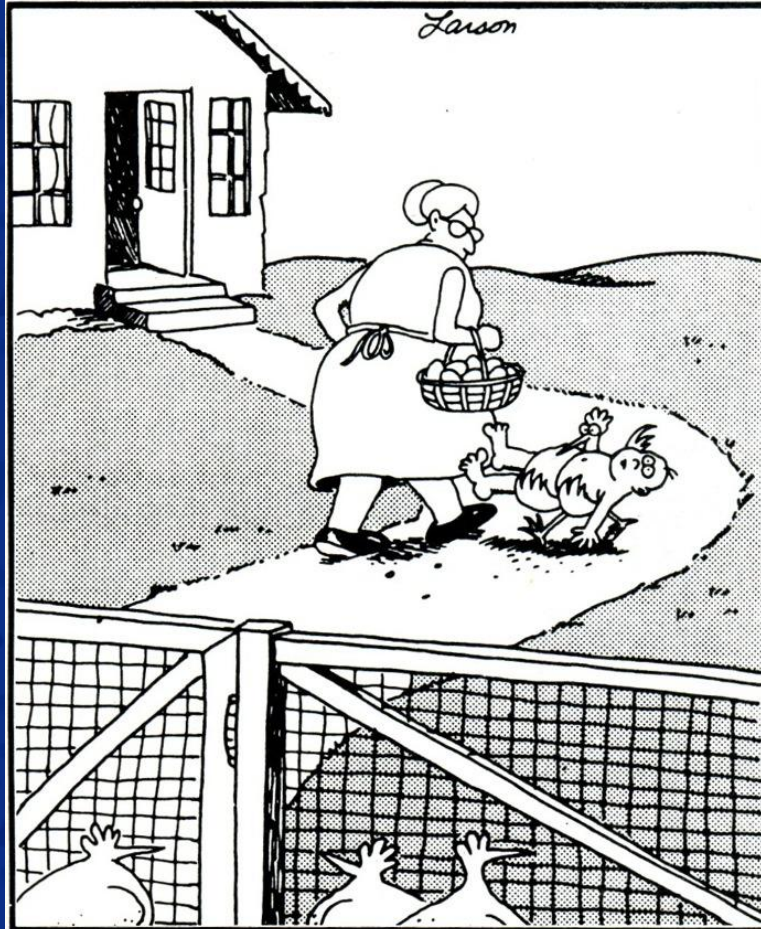


Regional → National → Global



Support for technology & research

Questions?



Carl.Gouldman@noaa.gov

NOAA S&T Focus Areas - 6 Strategies (one still 'Draft')

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.



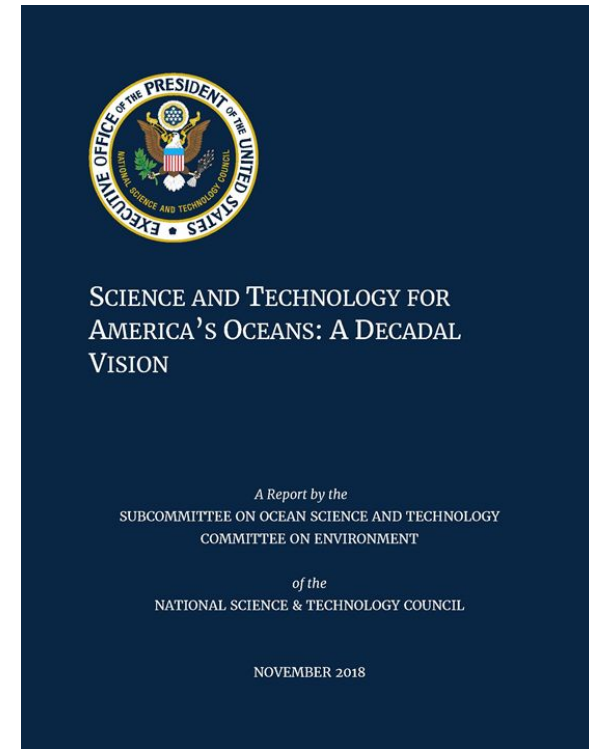
<https://nrc.noaa.gov/NOAA-Science-Technology-Focus-Areas>

IOOS & Ocean Science and Technology: Decades in the Future

- 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

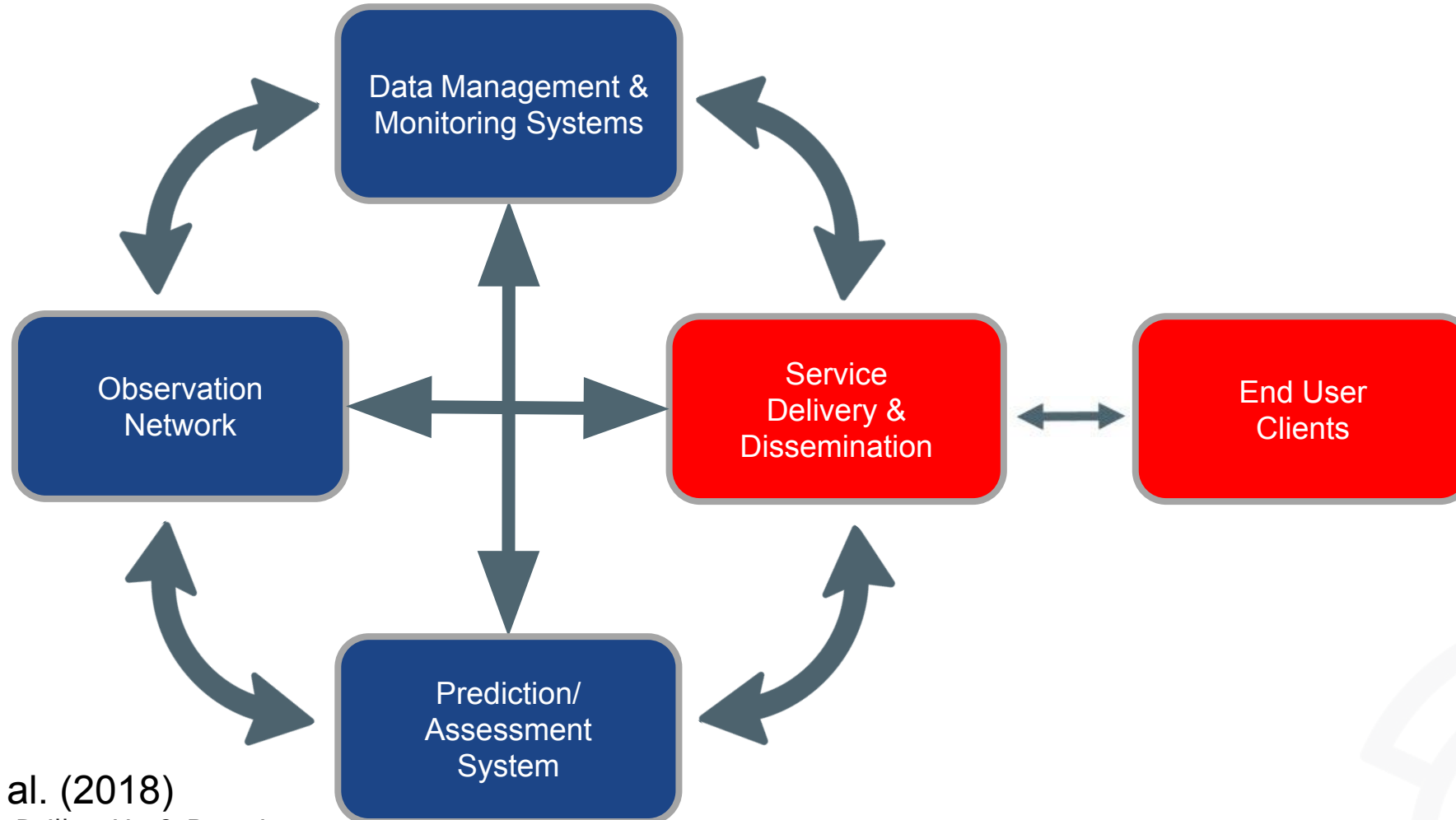


**2021
2030** United Nations Decade
of Ocean Science
for Sustainable Development



Back Up Slides

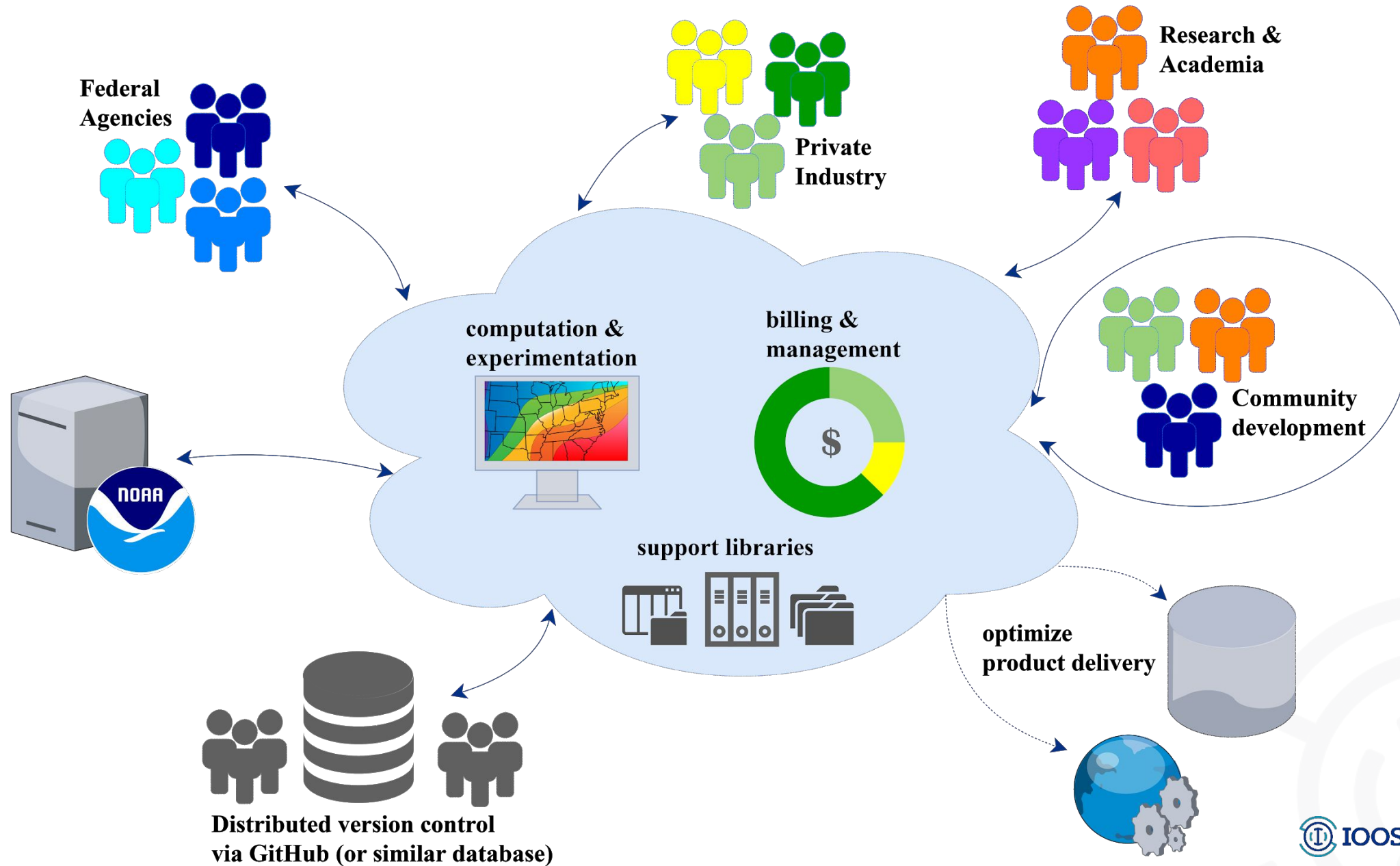
Elements of an Operational Oceanography System



Credit: Schiller et al. (2018)

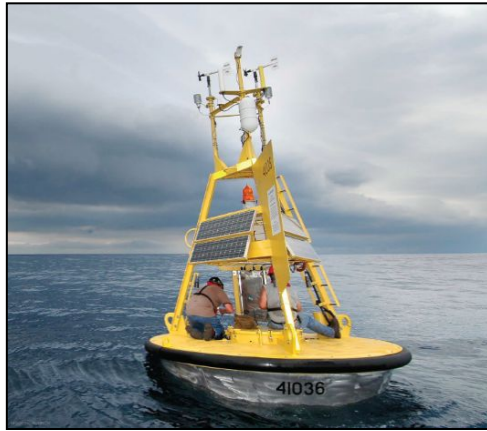
Schiller, A., Mourre, B., Drillet, Y., & Brassington, G. (2018). An Overview of Operational Oceanography. *New Frontiers In Operational Oceanography*.

An IOOS cloud-based model development sandbox



IOOS Observing Assets

Coastal Moorings



Shore Stations



HF Radar



Sub-surface Gliders



Wave Buoys



Animal Telemetry,
Marine Biodiversity



Ocean Technology Transition Program

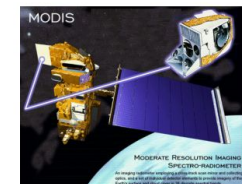
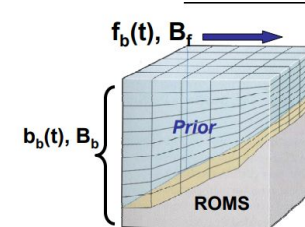
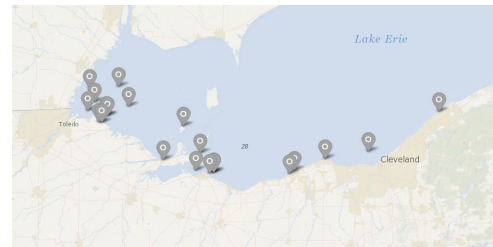
Mission

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.

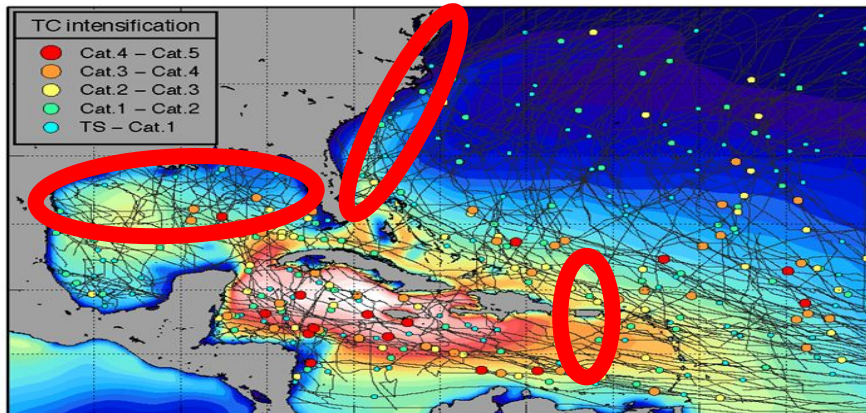


Priority Focal Areas:

- HABs
- Animal Borne Sensors
- Ocean Acidification
- Physical Ocean Observations



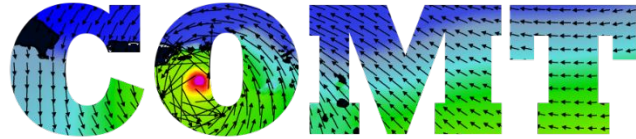
Underwater Gliders (AUVs)



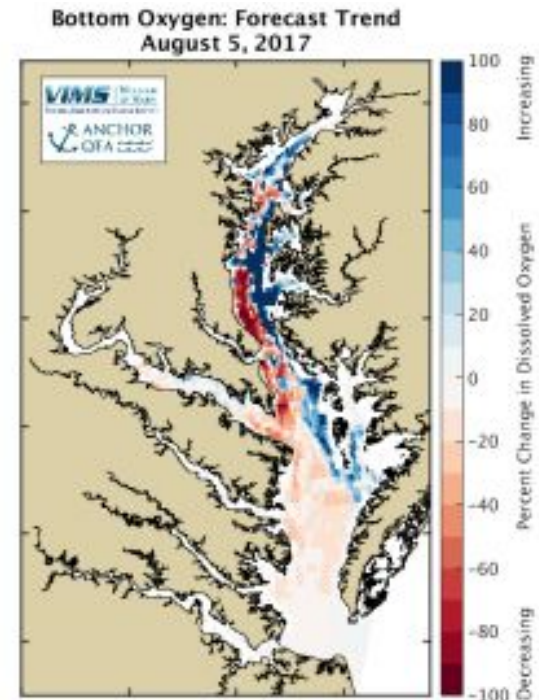
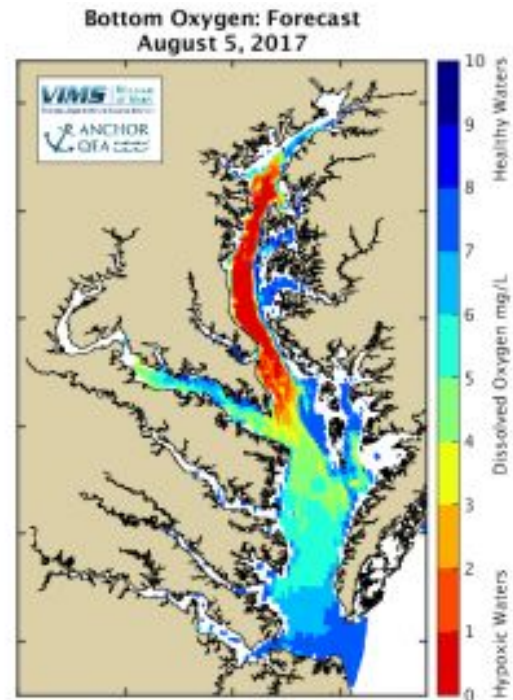
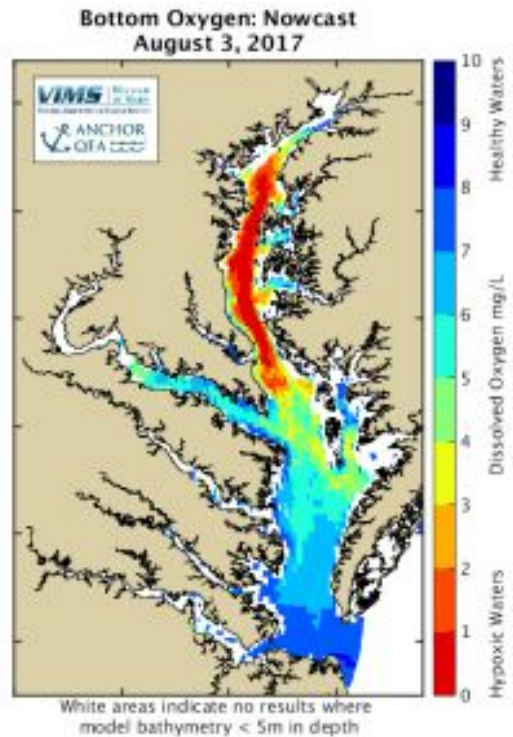
Applications Include:

- 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

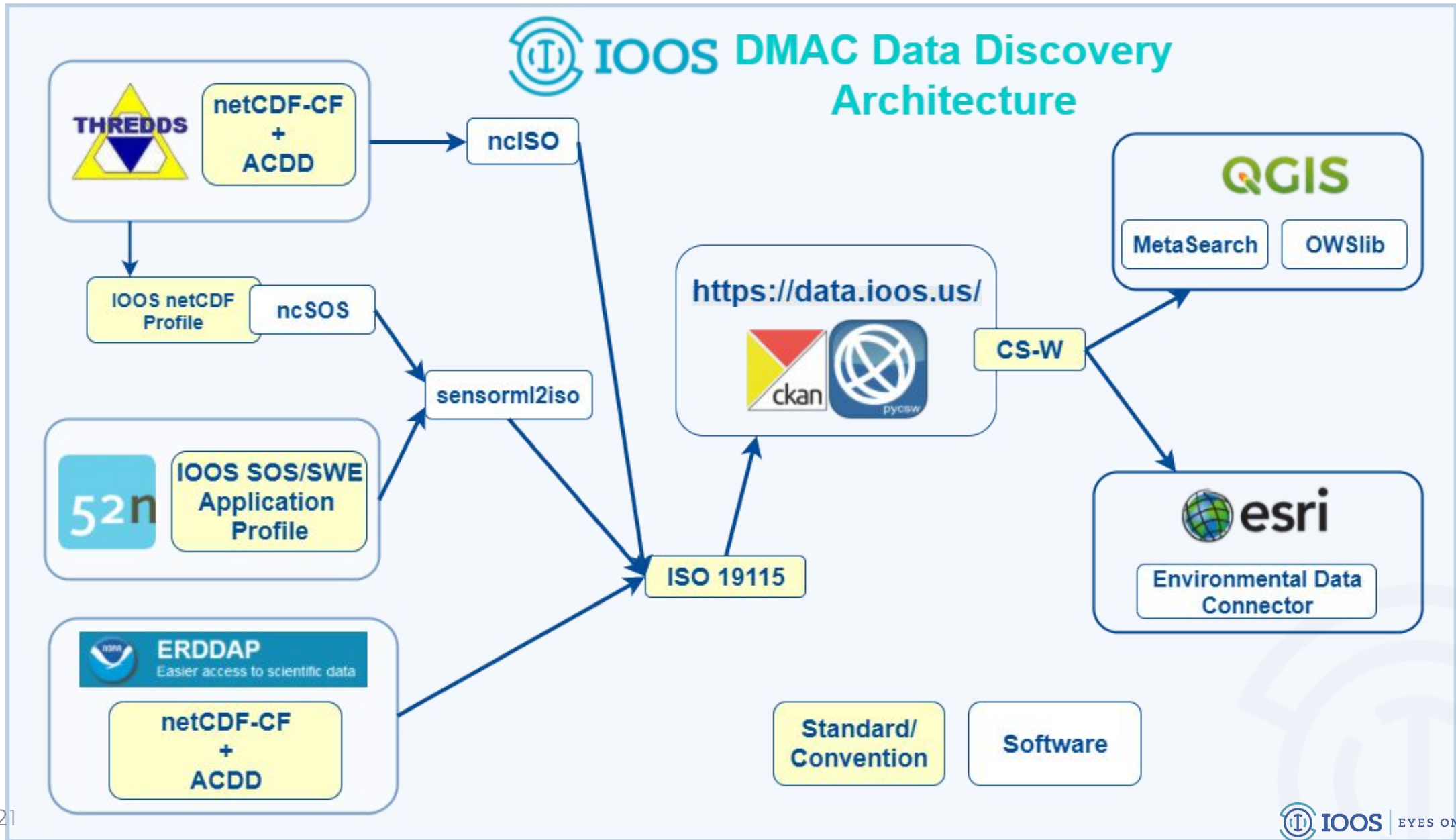
Coastal and Ocean Modeling Testbed



- 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.



IOOS Data Mgmt and Cyberinfrastructure (DMAC) Data Discovery



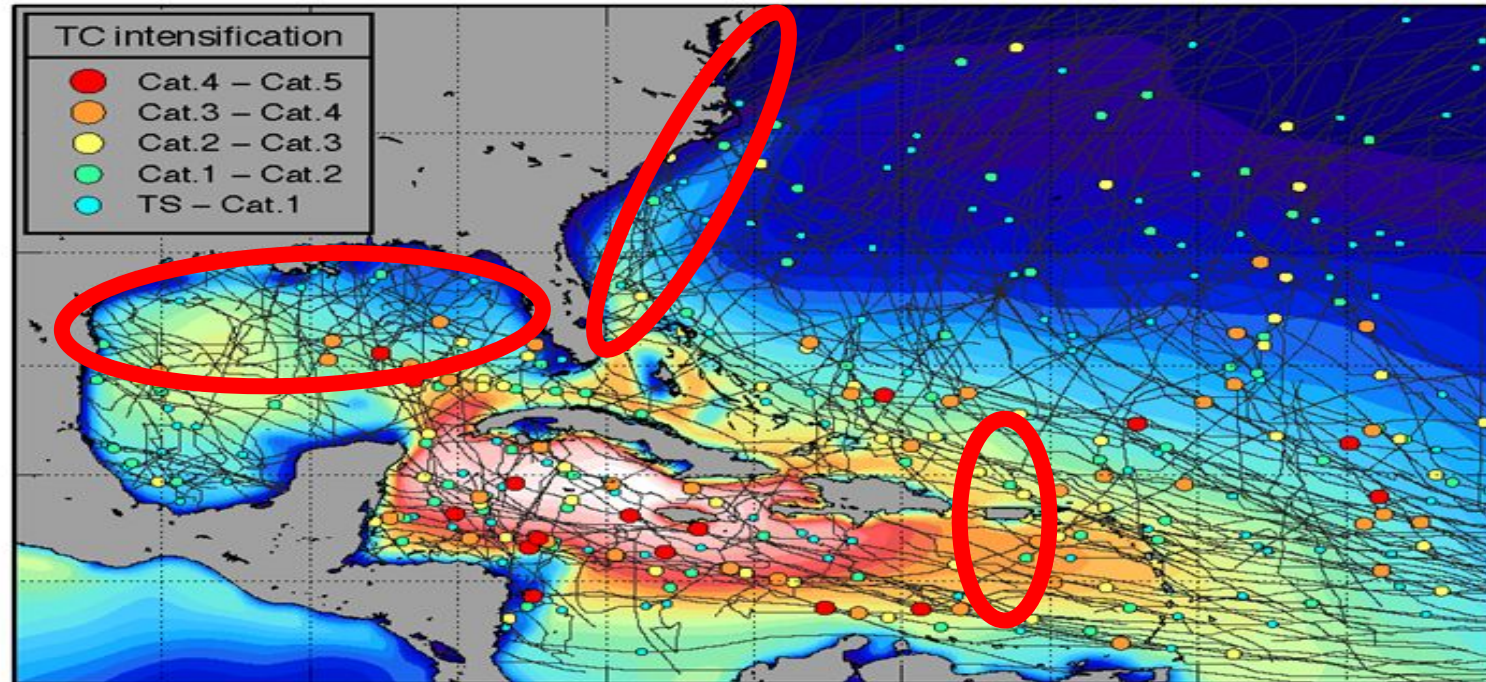
Underwater Gliders: Hurricane Intensity

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.



Partners include:
AOML, NAVY, USM,
Shell, IOOS Regional Associations



Weather Research and Forecasting Innovation Act 2017 & 2019

PUBLIC LAW 115-25—APR. 18, 2017
Title III / Sec. 301(a)(2)

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

Jan, Feb, and March for 2018-2020

