Environmental Intelligence in Support of a Resilient Nation; an ocean of possibilities

NOAA Brownbag Seminar Series

10.24.16 | Carl Gouldman, Deputy Director

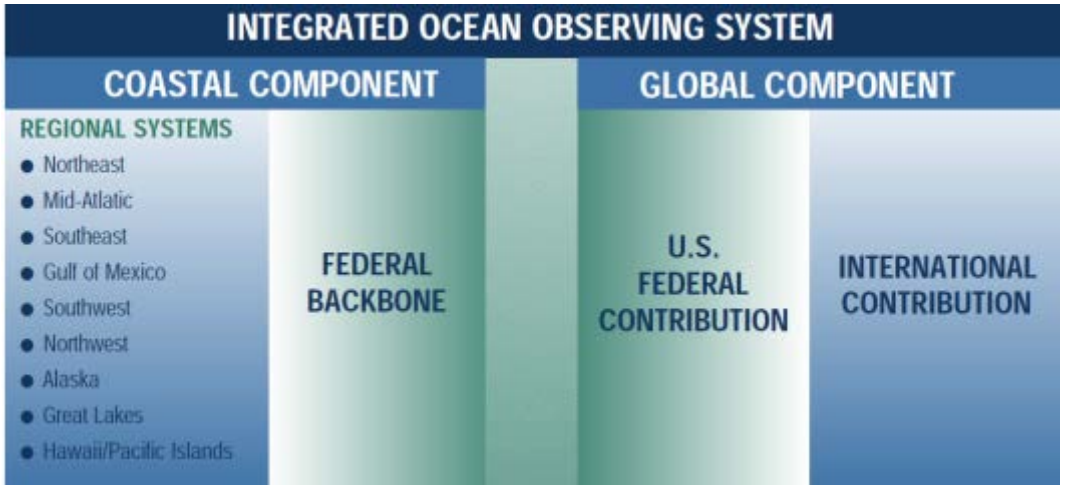
IOOS | EYES ON THE OCEAN

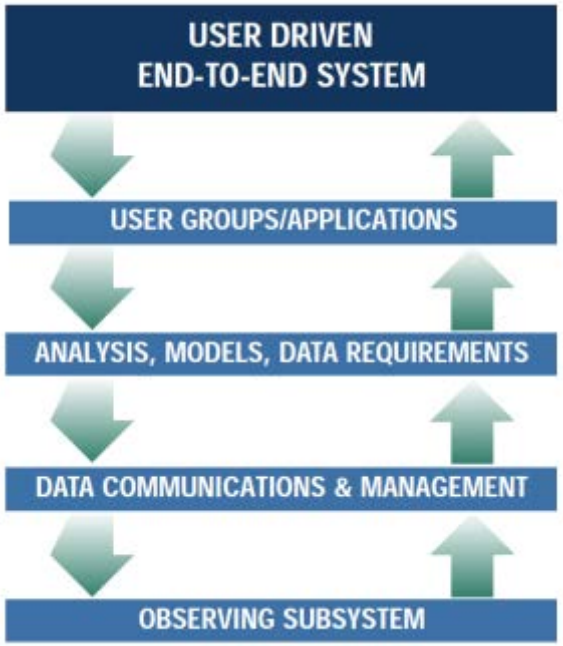
NOAA Brown Bag Outline

- IOOS Overview and Strategic Role
- Partnerships NOAA plus Regional, National, & Global
- IOOS as Coastal Intelligence support
- How to engage with IOOS?

U.S. IOOS®: Program Overview

Codified in law (P.L. No 111-11, March 2009)





- Improve predictions of climate change and weather, and their effects on coastal communities and the nation
- Improve the safety and efficiency of maritime operations
- More effectively mitigate the effects of natural hazards
- Improve national and homeland security
- Reduce public health risks
- More effectively protect and restore healthy coastal ecosystems
- Enable the sustained use of Great Lakes, ocean, and coastal resources.

Department of Commerce

DOC Strategic Goal 3 Environment

Help communities and businesses prepare for and prosper in a changing environment

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NOAA: Making Science Matter

Environmental Intelligence *(actionable information)*

Observations → Monitoring → Assessment → Modeling → Tools & Services

NOAA's long-term goals

1. Climate Adaptation and Mitigation
2. Weather-Ready Nation
3. Healthy Oceans
4. Resilient Coastal Communities and Economies

NOAA Organization

The National Oceanic and Atmospheric Administration (NOAA) is a science-based federal agency within the Department of Commerce with regulatory, operational, and information service responsibilities.

- National Ocean Service
- National Environmental Satellite, Data, & Information Service
- Oceanic & Atmospheric Research
- National Marine Fisheries Service
- National Weather Service
- Office of Marine and Aviation Operations

Advancing NOAA Partnerships (with all LOs)

Weather Ready Nation (NWS)

Modeling, Data, R&D (with WFOs, NDBC, NCEP)

Healthy Ocean (NMFS)

Ecosystems Based Mgmt/Marine Biodiversity
Marine Mammal HealthMAP

Resilient Coastal Communities and Economies (NOS)

Office of Coast Survey, Center for Operational Oceanographic Products and Services, National Geodetic Survey, National Centers for Coastal Ocean Science, Office of Response and Restoration, Office for Coastal Management, Office of National Marine Sanctuaries, & IOOS

Climate Adaptation and Mitigation (OAR)

Climate Program Office
Ocean Acidification Program
Ocean Exploration and Research
Sea Grant

NESDIS

Archive - National Centers for Environmental Information, Satellite Applications and Research
Coastwatch

OMAO

Fleet, AUVs, Operations

IOOS | EYES ON THE OCEAN

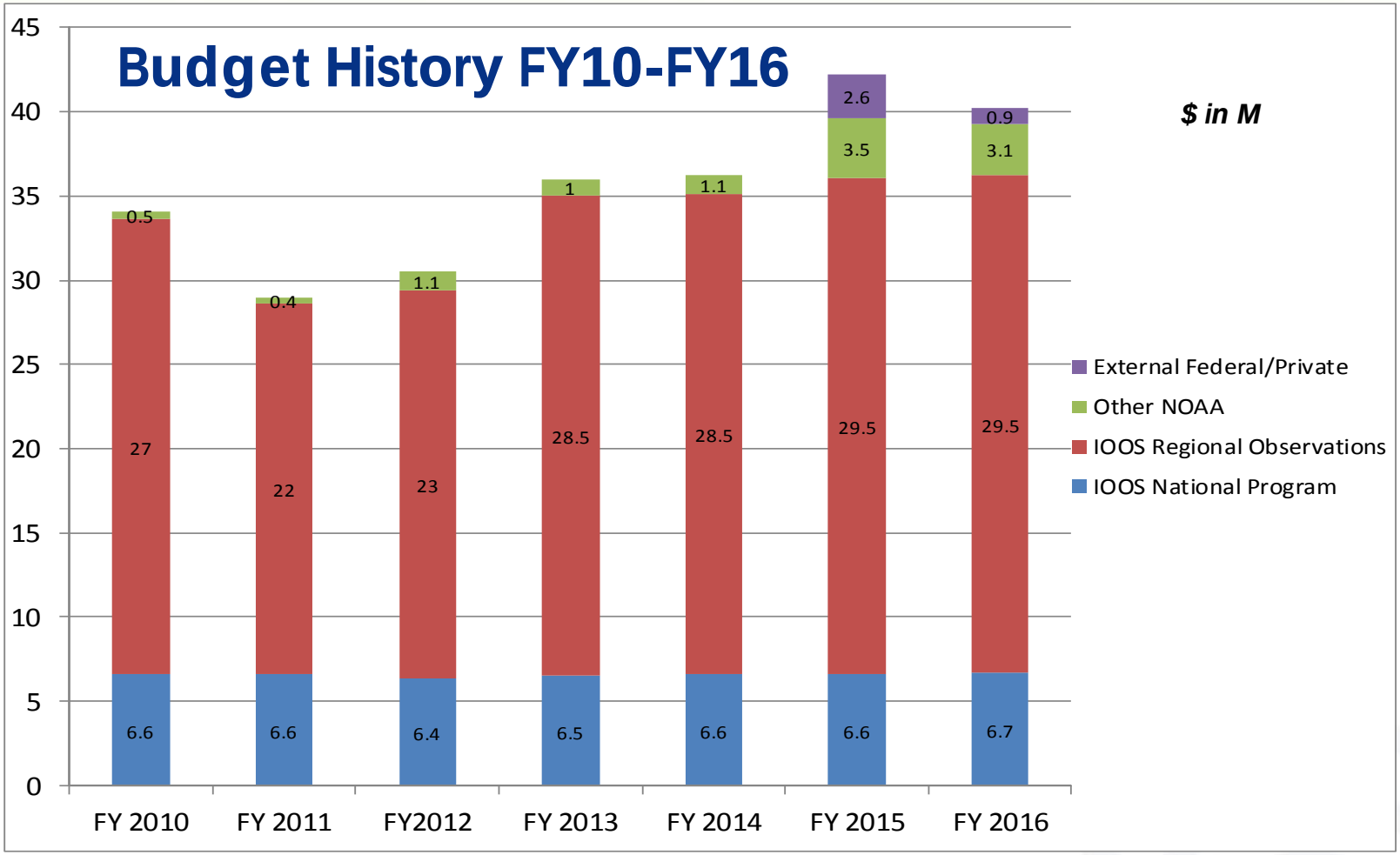
From Regional to National to Global

IOOS
Integrated Ocean Observing System

The Global Ocean Observing System
GOOS

GEO GROUP ON EARTH OBSERVATIONS

IOOS Budget and program 2016-17

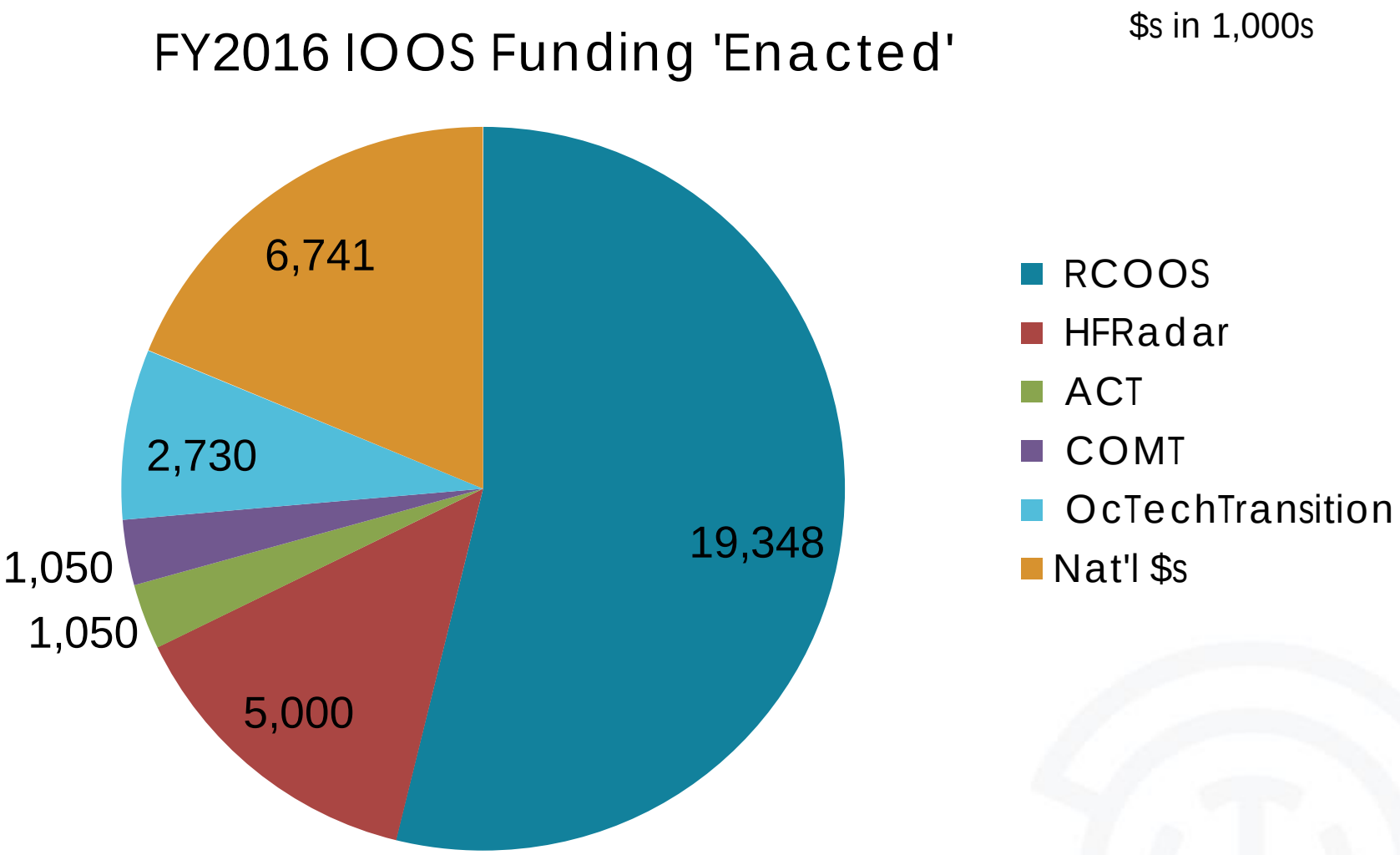


IOOS Office Primary Roles:

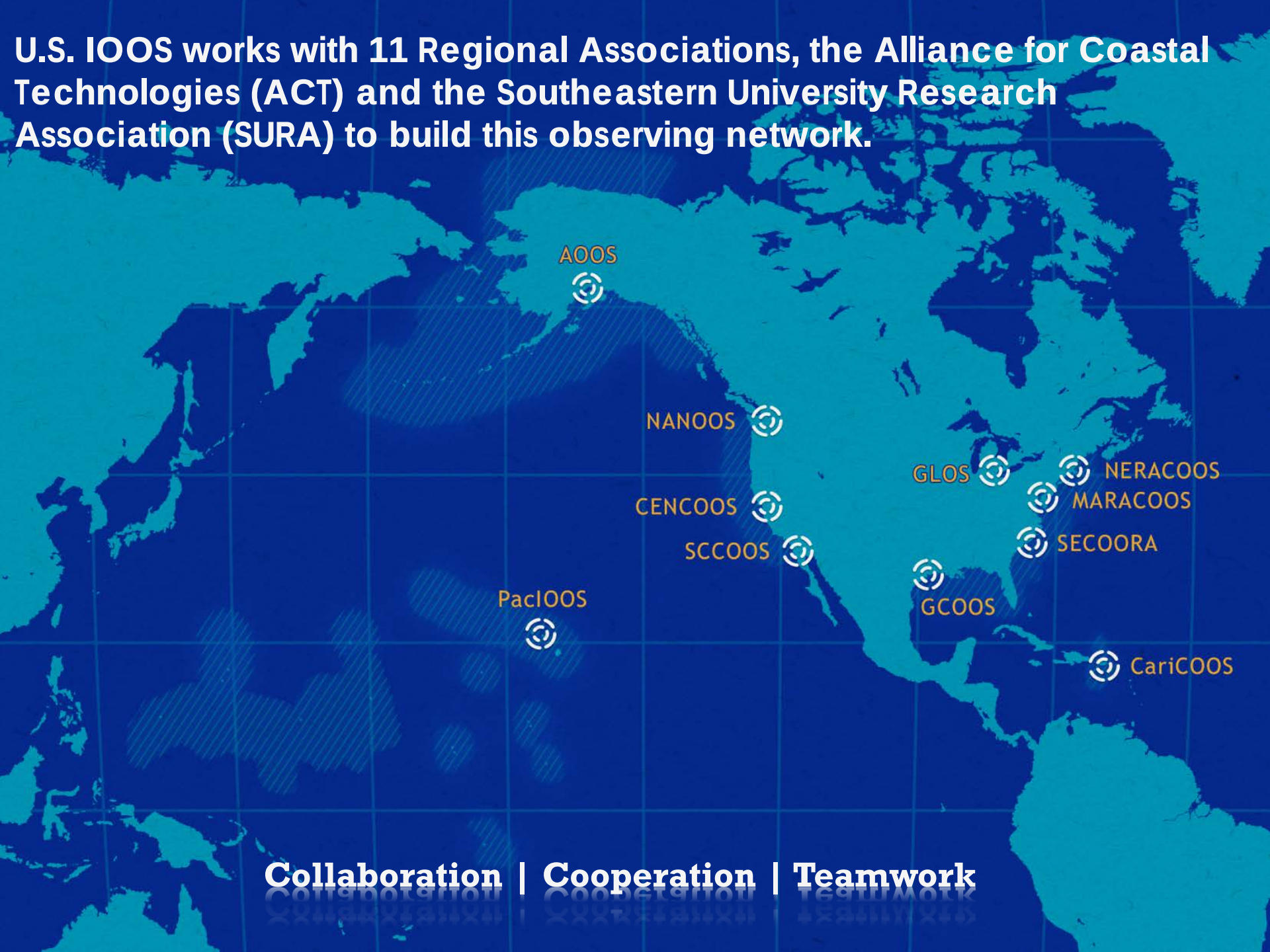
- Provide Programmatic Leadership
- Foster Operational Capability
- Champion Regional and Stakeholder Interests
- Forge Robust Partnerships

IOOS | EYES ON THE OCEAN

FY16 IOOS Funding



U.S. IOOS works with 11 Regional Associations, the Alliance for Coastal Technologies (ACT) and the Southeastern University Research Association (SURA) to build this observing network.



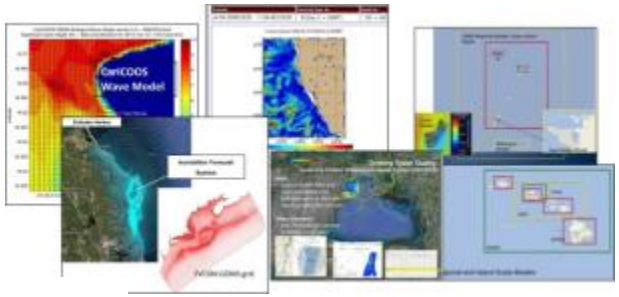
Collaboration | Cooperation | Teamwork

IOOS Regions

11 Regions

Observations

Data Access



Models

Who

- State, Local, Tribal Government
- Profit & non profit industries
- Academia

Education
Outreach

Produce | Integrate | Communicate

IOOS | EYES ON THE OCEAN

Integrated Coastal and Ocean Observation System Act of 2009 (ICOOS Act)

1. Formal recognition of IOOS Regional Associations
2. Extends **civil liability** coverage for data use
3. Establish minimum criteria for how a RICE operates
4. Adherence to data management best practices
5. Enhance delivery and quality of data and information

Credible – recognize NOAA's responsibility for ensuring data quality and assumption of liability risk

Reasonable – develop program guidelines in accordance with RA capabilities as supported by IOOS Program funding

PacIOOS
PACIFIC ISLANDS OCEAN OBSERVING SYSTEM

great lakes observing system

IOOS | EYES ON THE OCEAN

Functional Components

Alliance for Coastal Technologies (ACT)

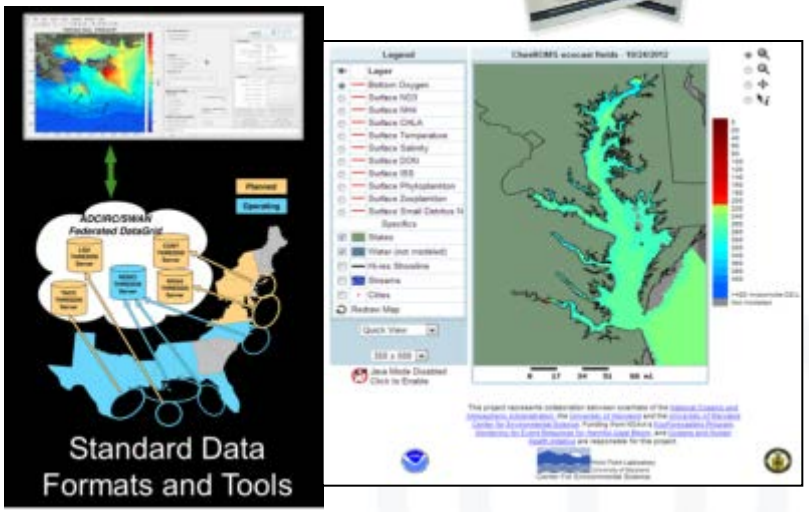
Technology Evaluations, Technical capacity building, and information clearinghouse

Nutrient Sensor Challenge

(FY2015/2016)

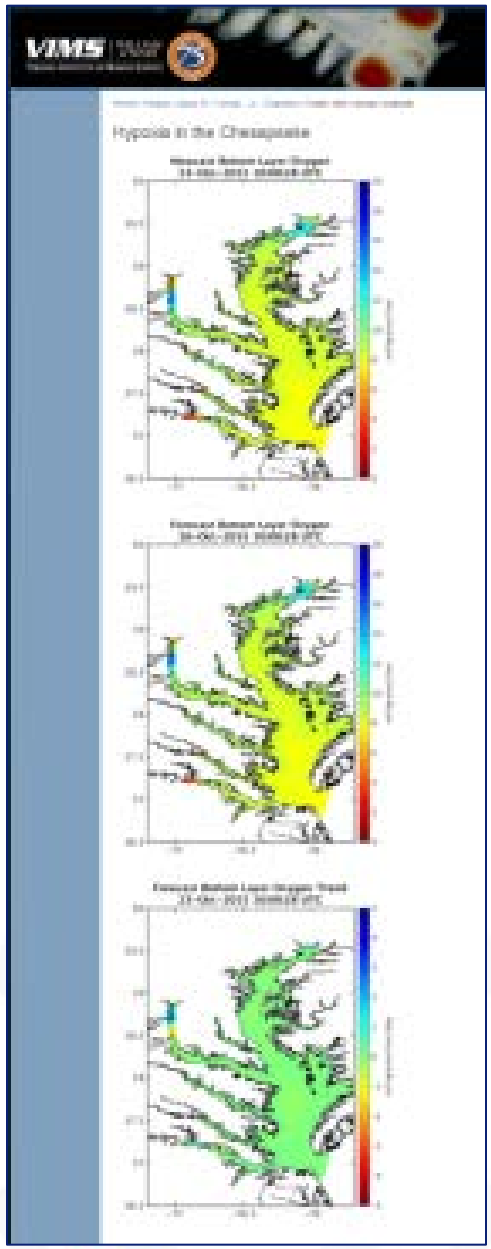
Coastal & Ocean Modeling Testbed (COMT)

Testing model skill, transition to operations, and applied science for hypoxia, inundation, and ocean forecasts

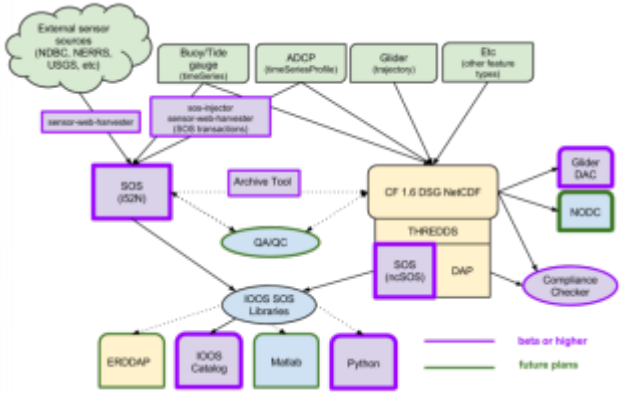


Modeling Activities

- COMT: Transition plans developed for each project (Q4)
- Coordinated development between Env. Data Server, ioos.us and COMT model viewer
- Ches. Bay Hypoxia Transition funded in FY17 President's Budget Request
- IOOS Modeling Inventory updated (~Q3)
- COMT Success stories available



Access to Data



Standards

Access on 1 page: ioos.us

2 week cache of real-time observations

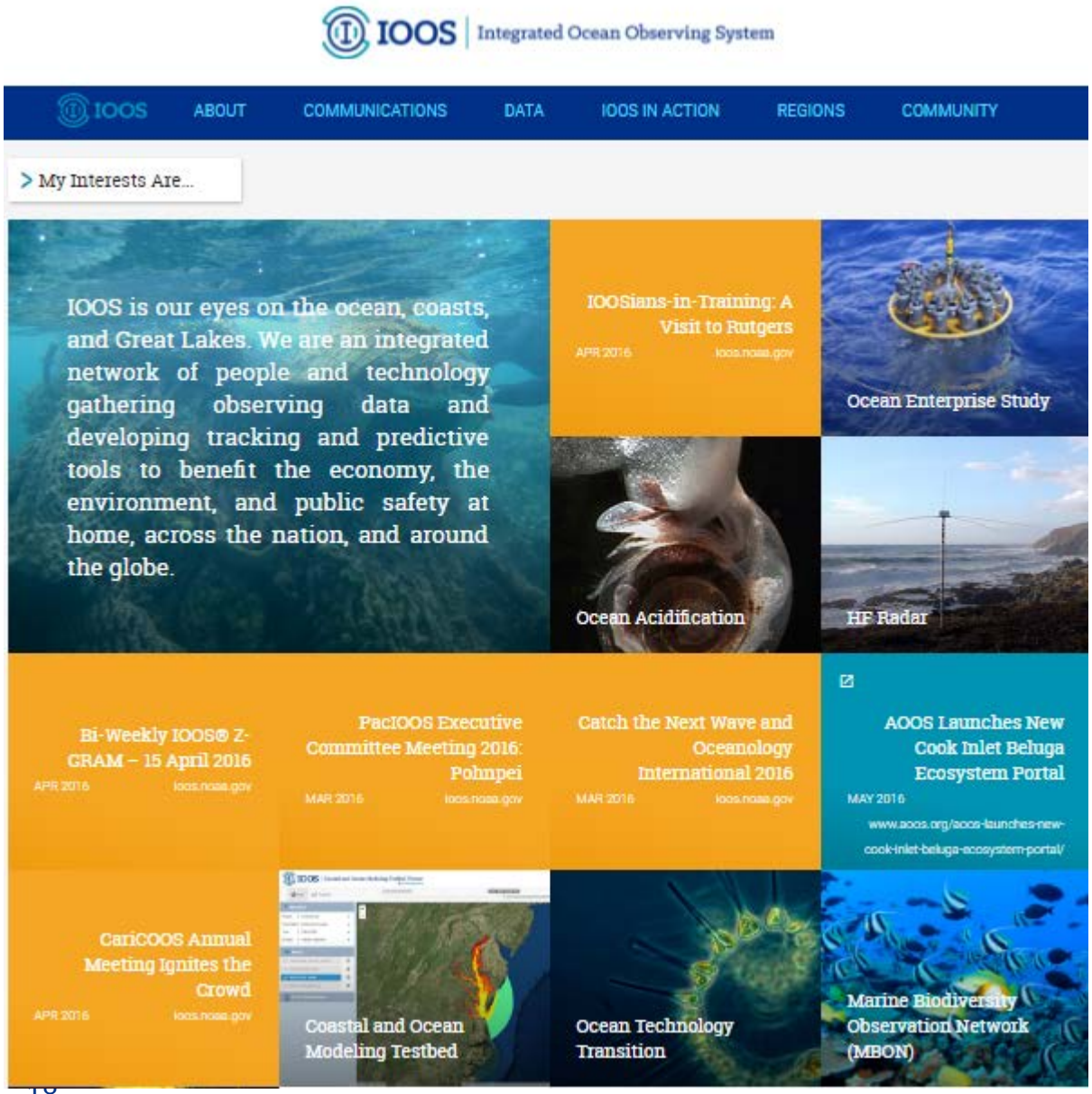
Quality Assurance

Blizzard 2016: CBOFS winds at 1/23 17:00 EST. Time-series of model output and buoy observations (1/20 - 1/23)

Access to model output

17

IOOS new website



- Dynamic, Interactive; Streamlined
- May 2016 'soft launch'

https://ioos.noaa.gov

IOOS.US

https://ioos.us/

- Entry point for access to IOOS national and Regional portals and products
- Supports discovery, visualization, and access
- Augmenting the RA capabilities with a collection of products
- Additional landing pages planned for 2016 include: HFR, ATN, COMT, and OSMC

U.S IOOS By The Numbers

17
Federal Partners
Providing a Federal Backbone for IOOS

11
Regional Associations
Observing Assets and Data Feeds

1
Alliance for Coastal Technologies
A partnership supporting sensor evaluation and verification

1
Coastal Ocean Modeling Testbed
COMT - a conduit for research models to transition to operations

1
Marine Biodiversity Observing Network
MBON integrates marine biodiversity and ecosystem data

697
National Platforms
Buoys, Water level guages, Coastal and Estuary stations at the National level

254
Regional Platforms
Buoys, Water level guages, Coastal and Estuary stations at the Regional level

9
Ocean Technology Transition Projects
OTT supports transition of marine sensors to operations

15
Animal Telemetry Projects
Providing data on animal responses to the ocean and environment

140
HF-Radar Installations
High-Frequency Radar measures speed & direction of ocean currents

41,820
Glider Days
1 Glider in the water collecting data for 1 day

8
QARTOD Manuals
Realtime Oceanographic Quality Assurance

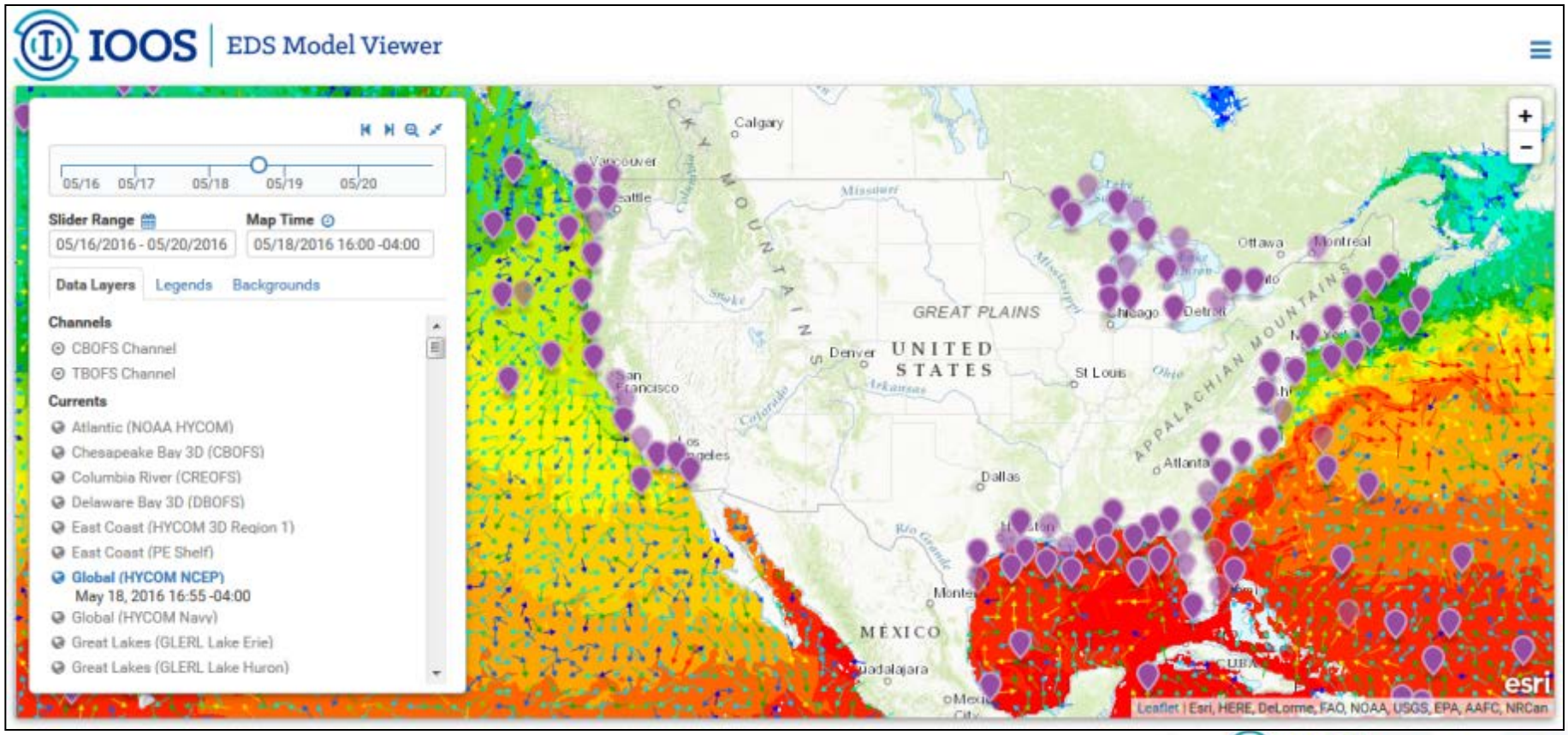
>15,000
Datasets
Oceanographic Datasets available in the IOOS Catalog

42
Servers
Top-level domains hosting data access

1
IOOS
Integrated Ocean Observing System

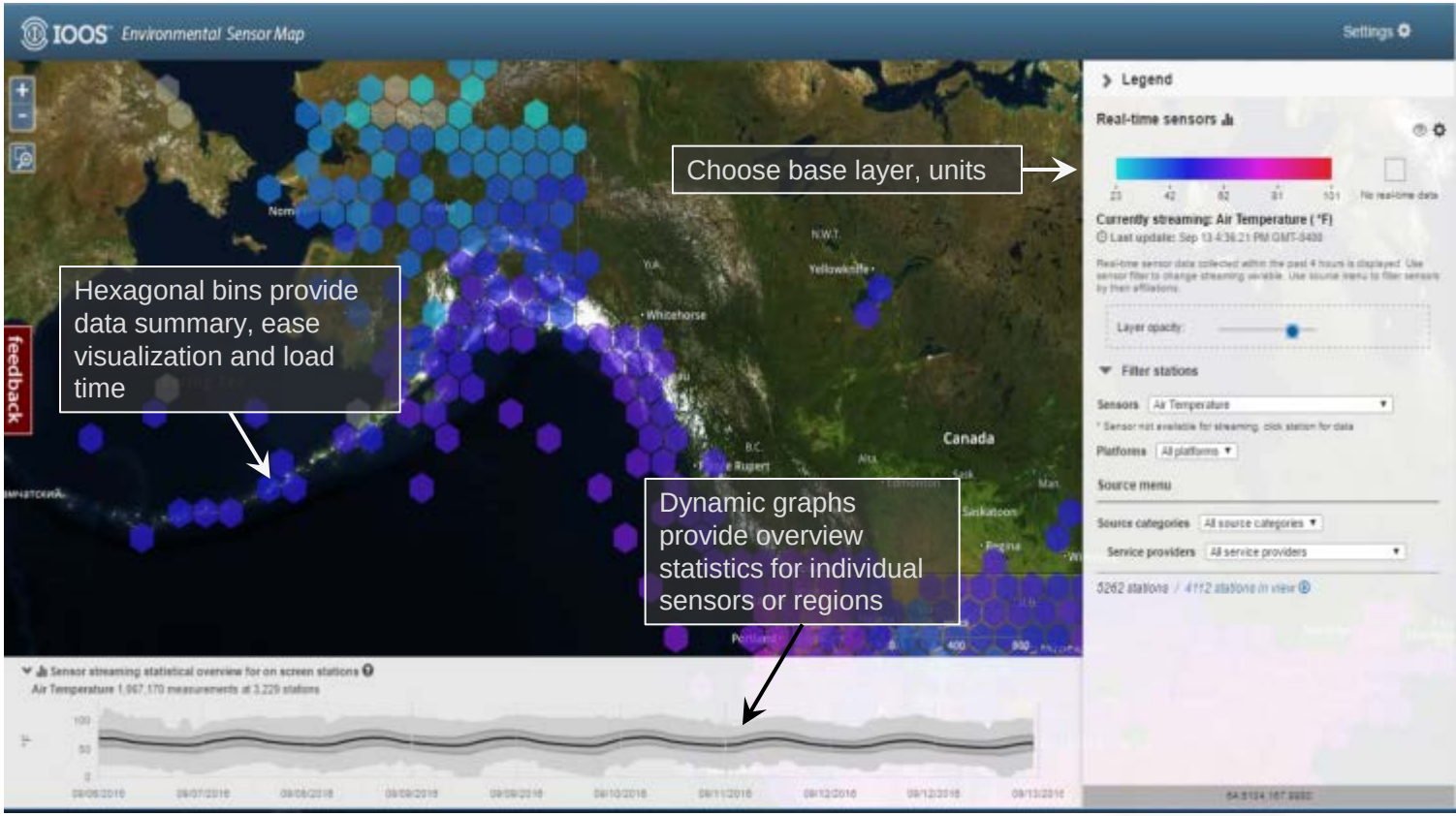
Environmental Data Server

- Requirement for publicly accessible integrated model information
- IOOS invested in a capability; provides platform for collaboration opportunities with other NOS offices
- Provides RAs a solution for hosting model output
- Demonstrates RA modeling capabilities



Environmental Sensor Map

- Integrates regional, national, and global real-time data (past 4 hours) across the IOOS enterprise – federal and nonfederal sources. (~32,000 stations, 119,515 sensors)



FY2017

- Enhanced Visualizations
- New data sets (Argo, OceanSITES, Bio Geo Chem/OA)
- Brokered API access to underlying data

sensors.ioos.us

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Marine Biodiversity Observation Network (MBON)

Interagency support:

- $15M from NASA, NOAA (IOOS and OER), and BOEM for 5 years (FY14-18)
- $2M from Shell to launch Arctic MBON

Demo projects are:

- Integrating existing monitoring
- Filling spatial, taxonomic gaps
- Monitoring "microbes to whales," "in-situ to satellites"
- Exploring technology applications
- Addressing data management
- Building MBON for the Nation
- Creating global MBON (with GEO, GOOS)
- Connecting with the Animal Telemetry Network

Credit: MBARI

Animal Telemetry Network (ATN) FY16/17 Outlook

ATN Vision: will provide *integrated data* on aquatic ecosystems from species to environment. This network will *complement* existing ocean observing assets and will *inform* ecosystem-based management, fisheries and biodiversity, marine spatial planning, ocean modeling and forecasting, and National Ocean Policy priority objectives.

FY16/17 focus:

Data Assembly Center Coordination(NC & SG)

Input:

Regional engagement

Communications/outreach planning

Interagency Accomplishments - Examples

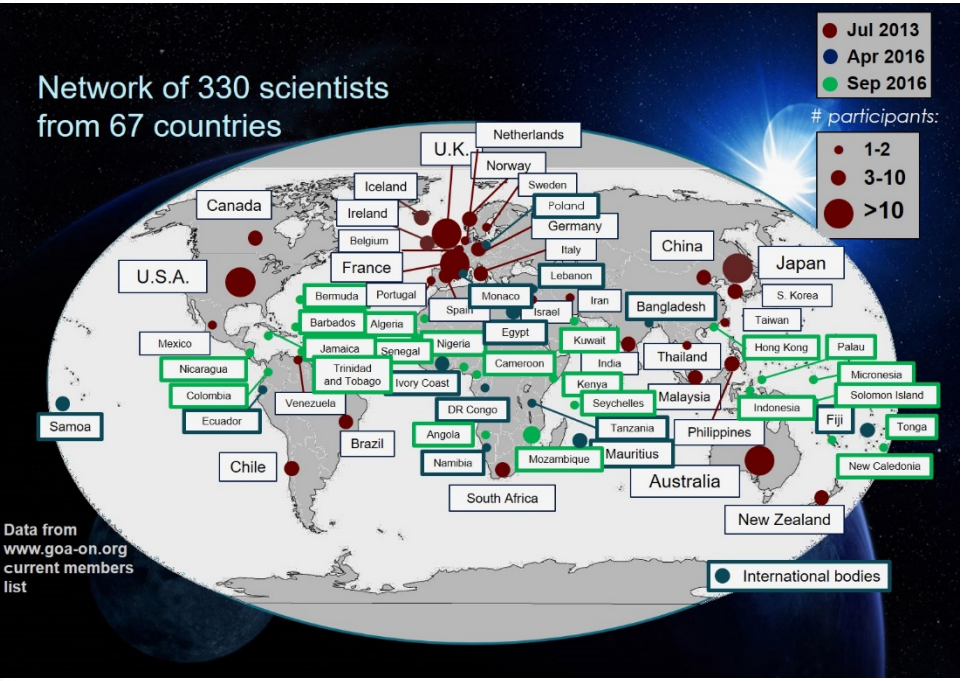
IOOC Task Teams C = complete

- Animal Telemetry Network (1=C, 1 new)
- Gliders
- Modeling
- Post-IOOS Summit 2012 Task Team (C)
- Biological integration and Observation (C)

Interagency Projects

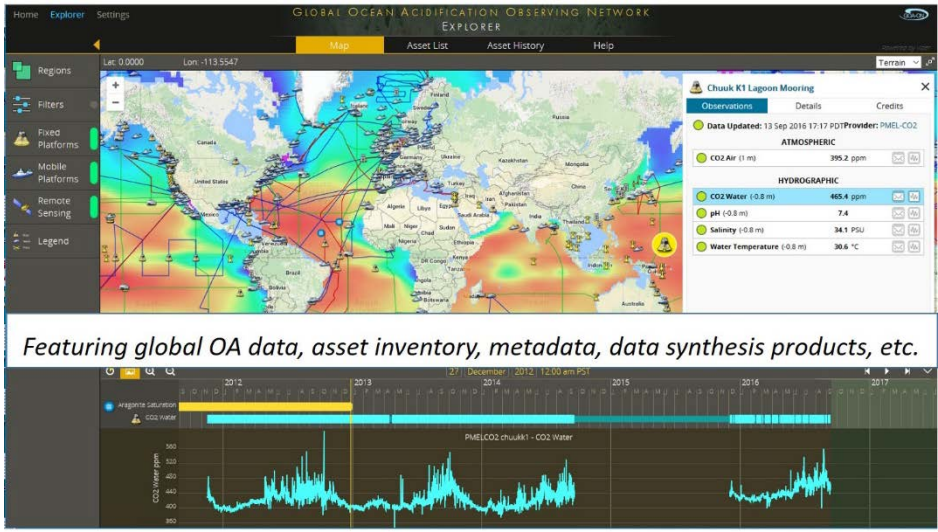
- 2014-17- Marine Mammal Health MAP (MMC, NOAA, ONR)
- 2016-18 - Marine Biodiversity Observation Network (NASA, BOEM, USGS, NOAA)
- 2014-17 - Pacific Anomalies Workshops (NASA, NSF, NOAA)
- Ocean Observations 2019 Conference (Hawaii)

Research and Innovation



GOA-ON

Global Ocean Acidification Observing Network



Featuring global OA data, asset inventory, metadata, data synthesis products, etc.

IOOS Integrated Ocean Observing System

NOAA

Global Ocean Observing System

UNESCO

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

UK Ocean Acidification Research Programme

International Ocean Carbon Coordination Project

IAEA

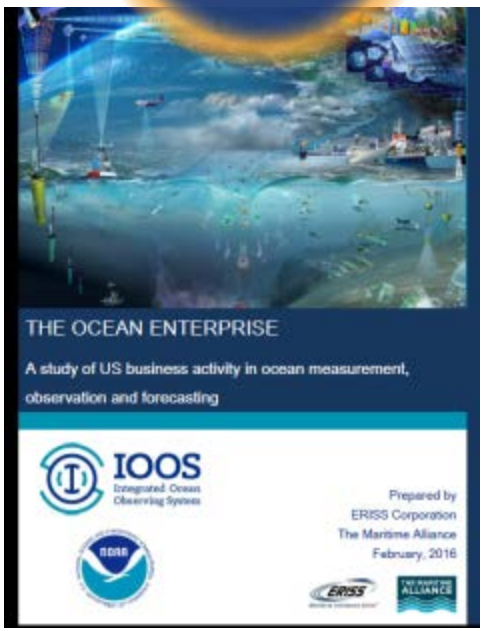
Ocean Acidification International Coordination Centre

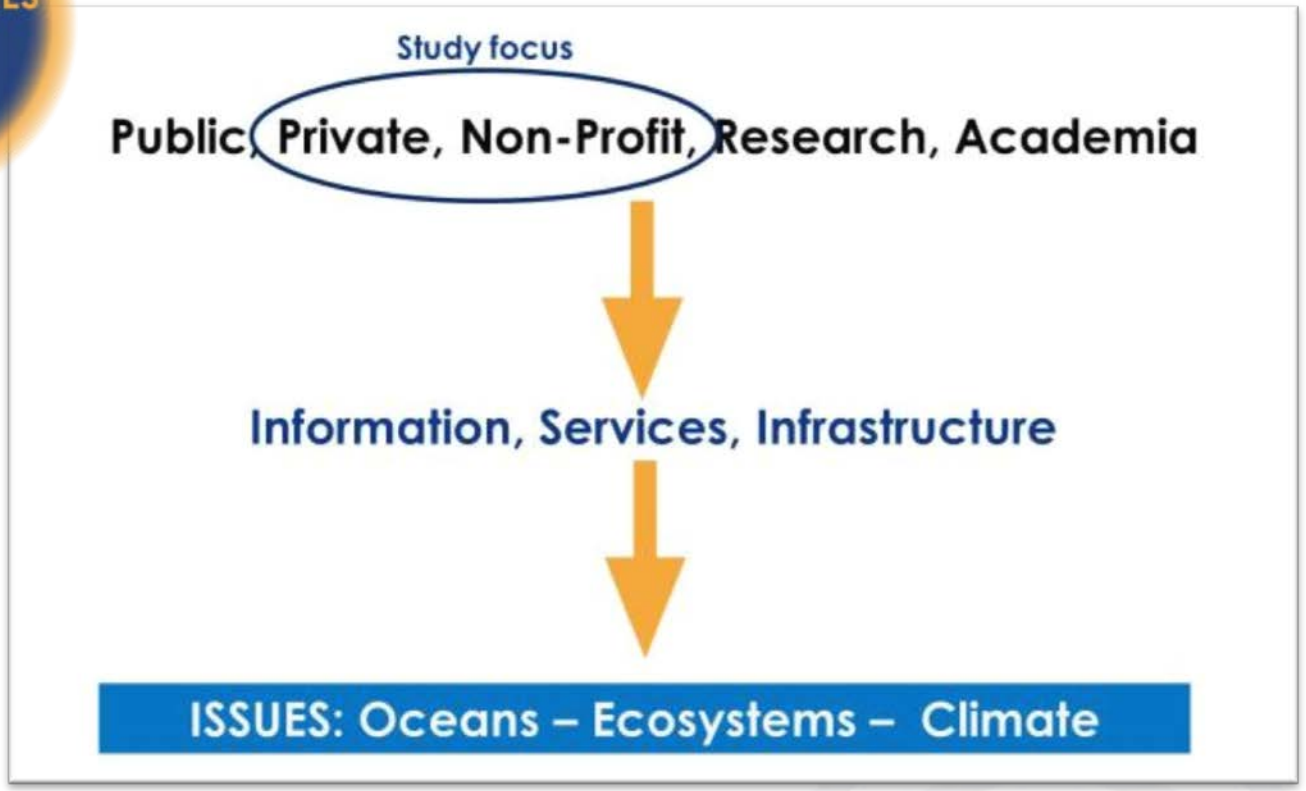
OA-ICC

BLUE PLANET Oceans and Society

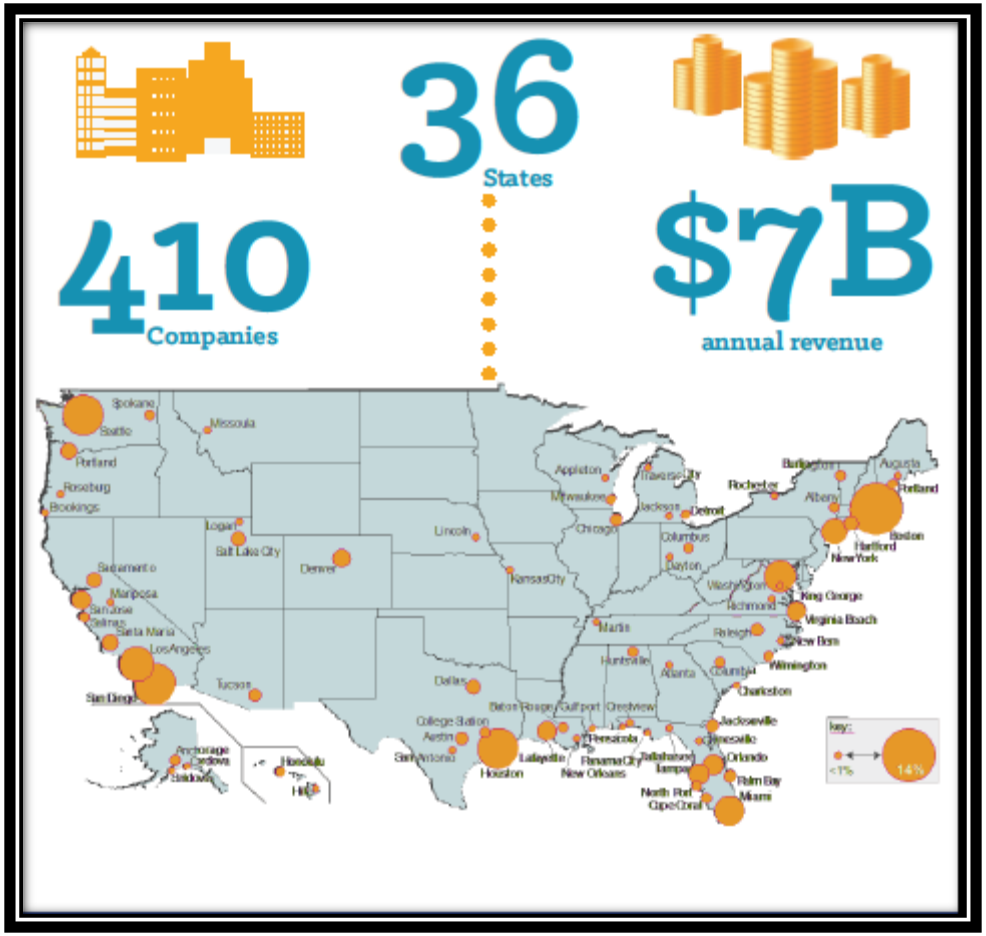
IOOS EYES ON THE OCEAN

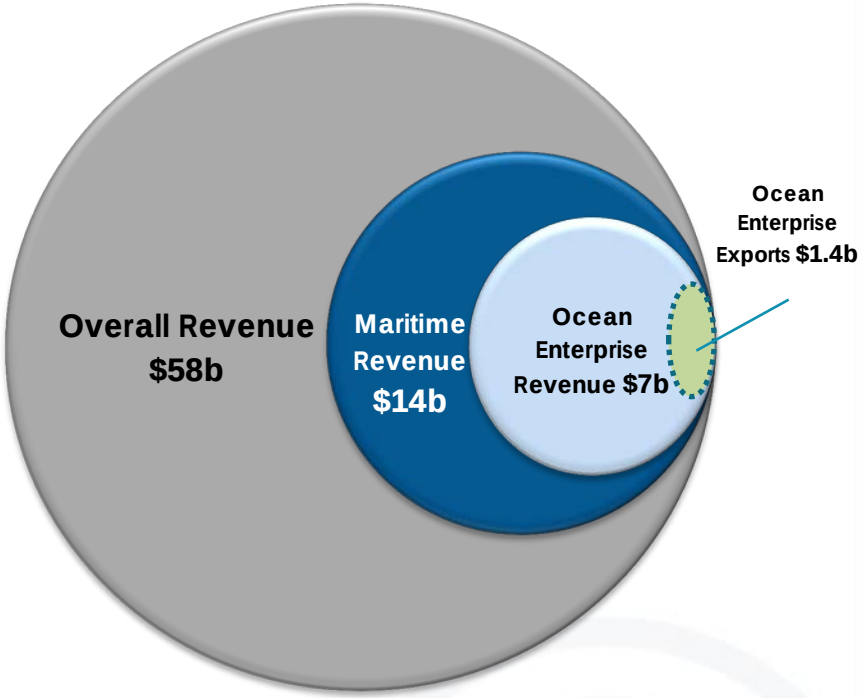
Ocean Enterprise Background





US IOOS/NOAA Ocean Enterprise Study





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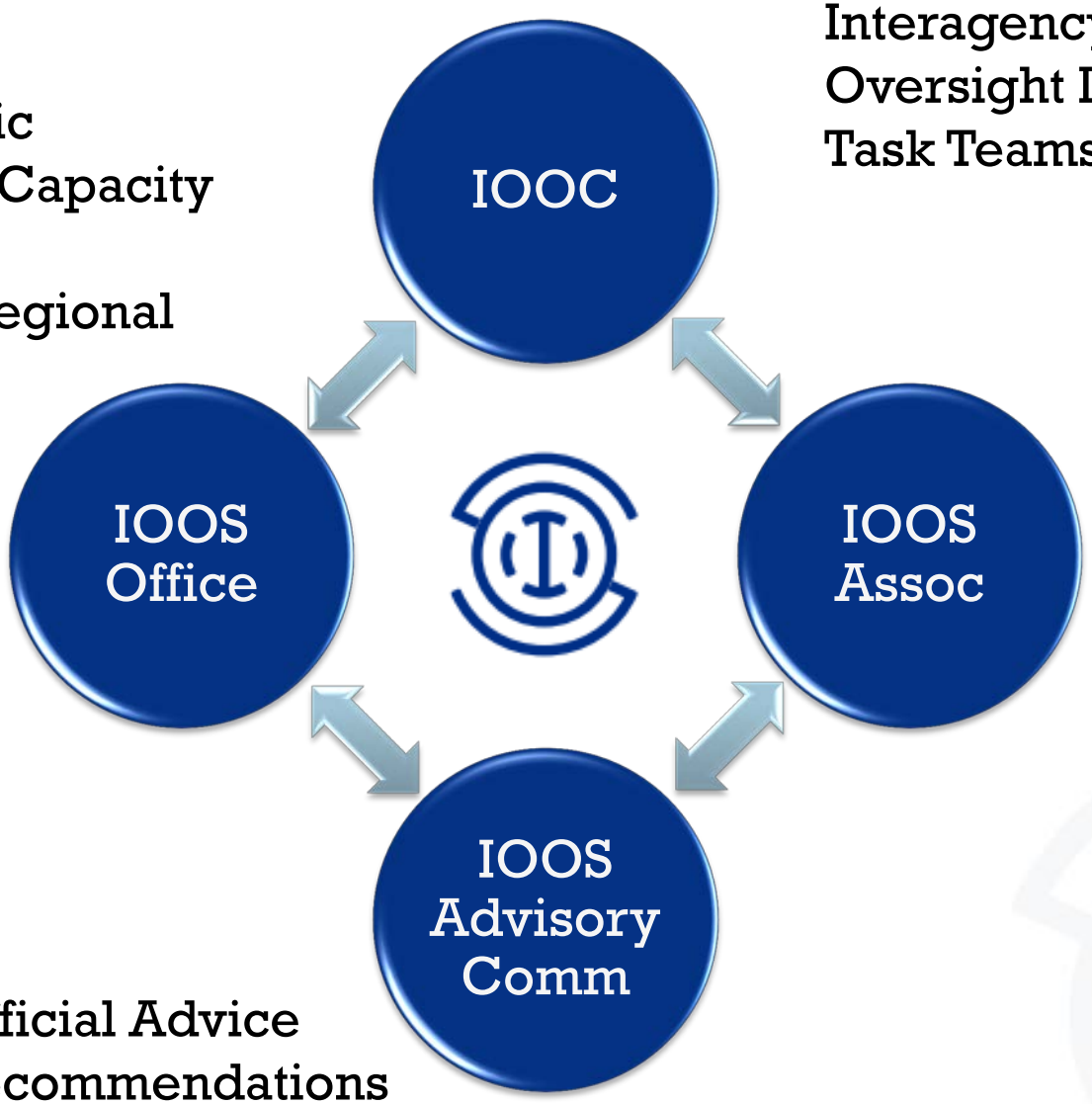
IOOS is a Team Sport

Programmatic
Operational Capacity
Partnerships
Champion Regional



Interagency
Oversight IOOS
Task Teams

Congress
OMB
Sponsor Events
RA Coordination

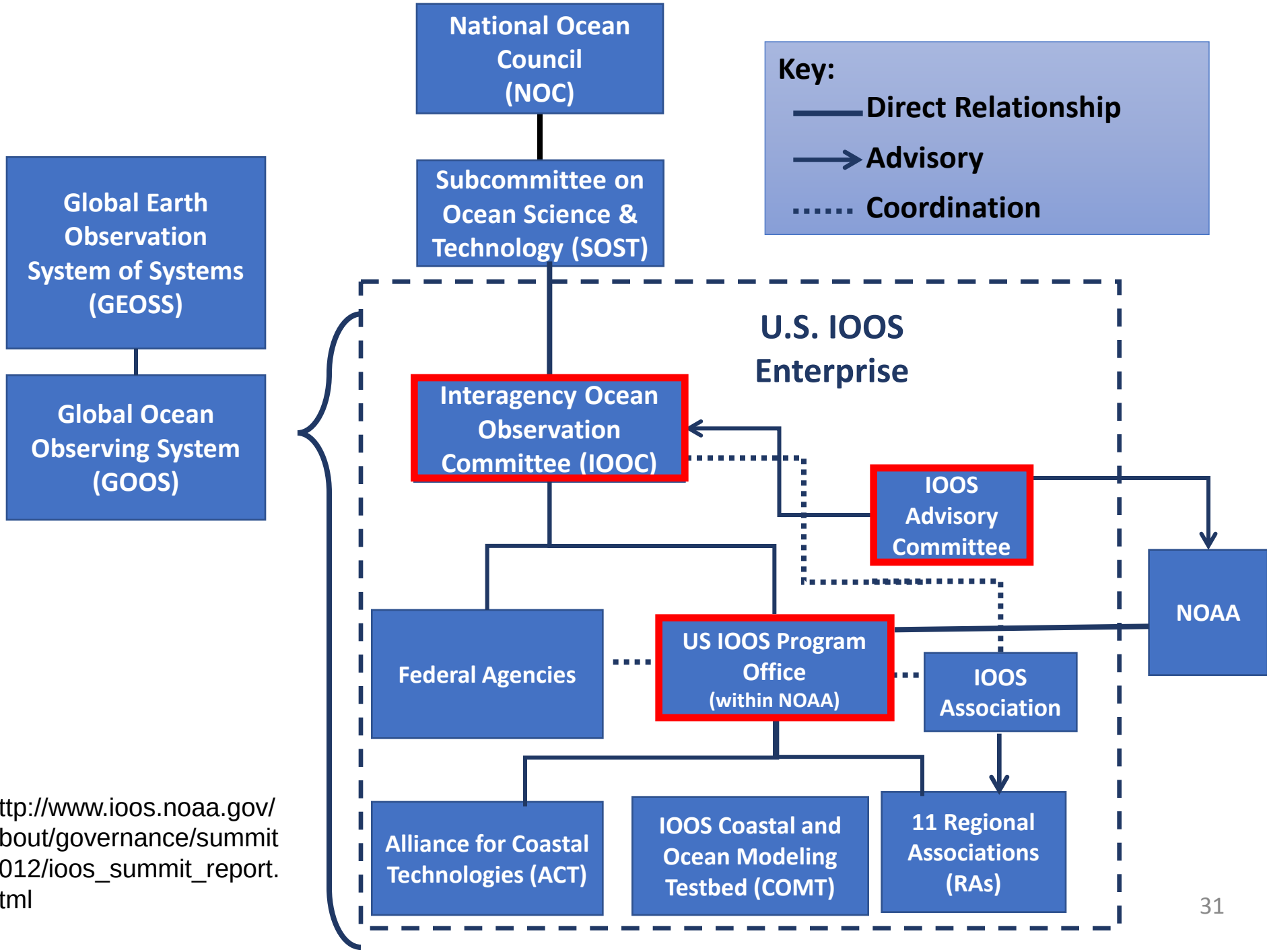
Official Advice
Recommendations

Questions

https://noaa.ioos.gov

https://www.facebook.com/usioosgov

@usioosgov

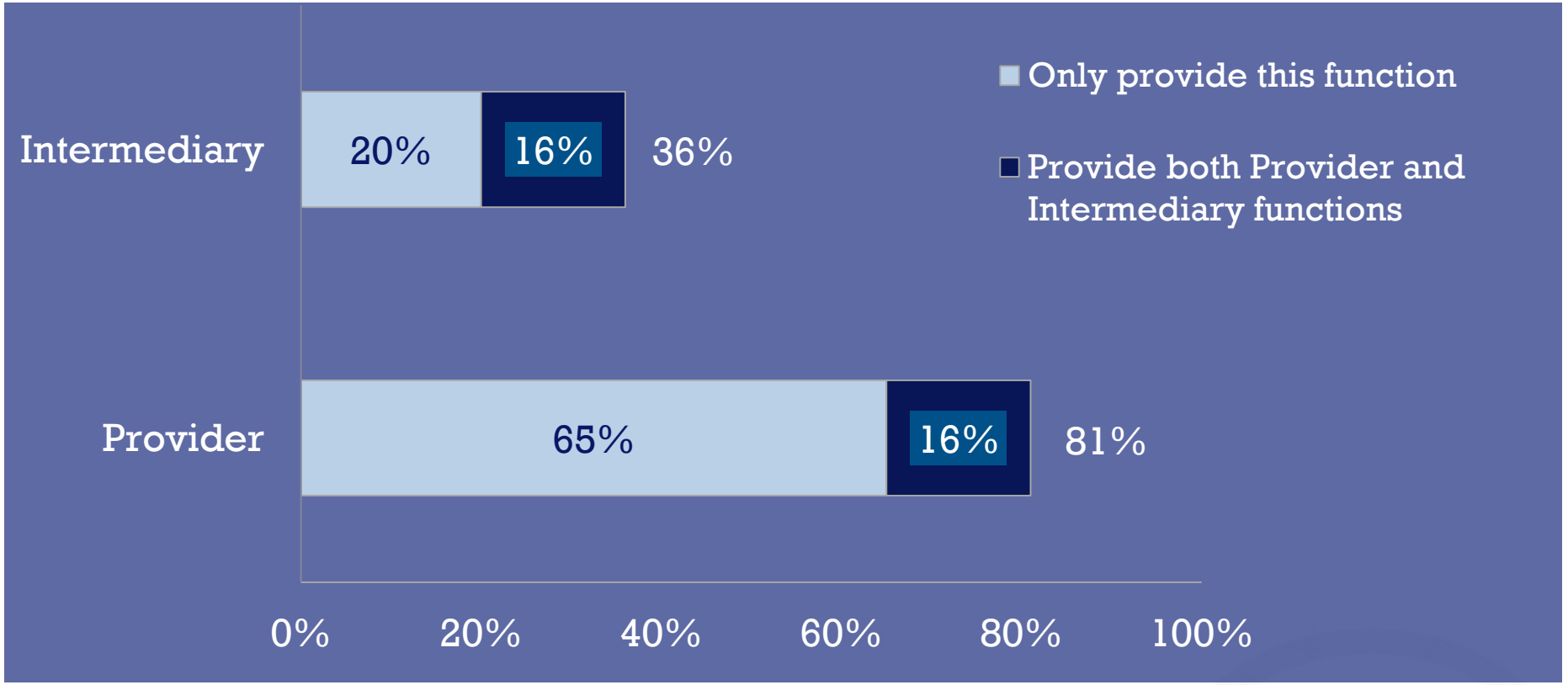


http://www.ioos.noaa.gov/about/governance/summit2012/ioos_summit_report.html

IOOS New Logo

- **Collaborative effort:** IOOS Office, Interagency Ocean Observation Committee (IOOC), Regional Associations,
- **Streamlined, integrated design** reflects IOOS's renewed focus on the user experience.
- Light and dark blue stand for the **coasts and deep water.**
- Integration represents **a signal moving out** in stages—local-national-global.
- There's **more to discover** every time you see it—just like there is with IOOS.

Ocean Enterprise Study 2015: Functions



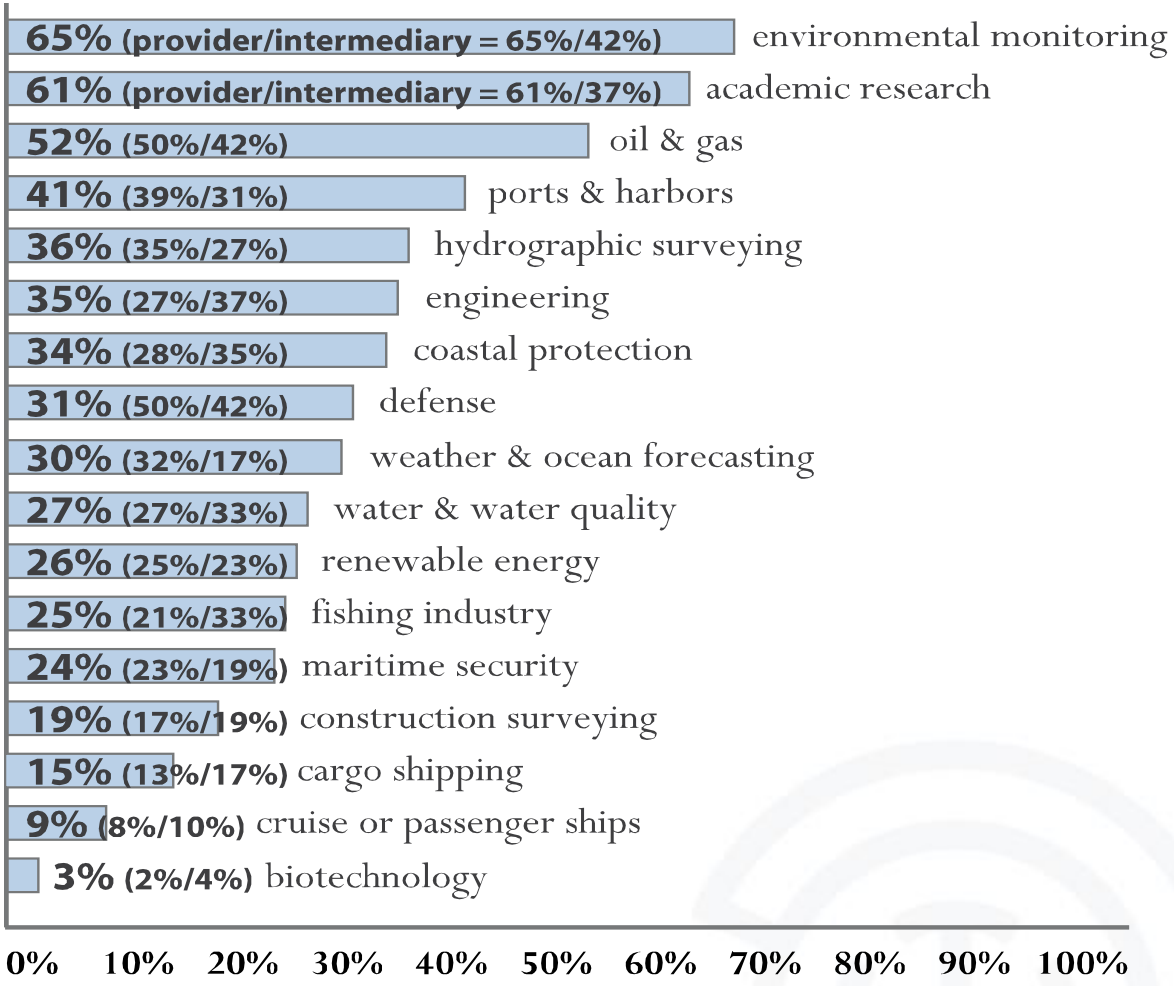
81 % of the companies we surveyed were providers

36% were Intermediaries

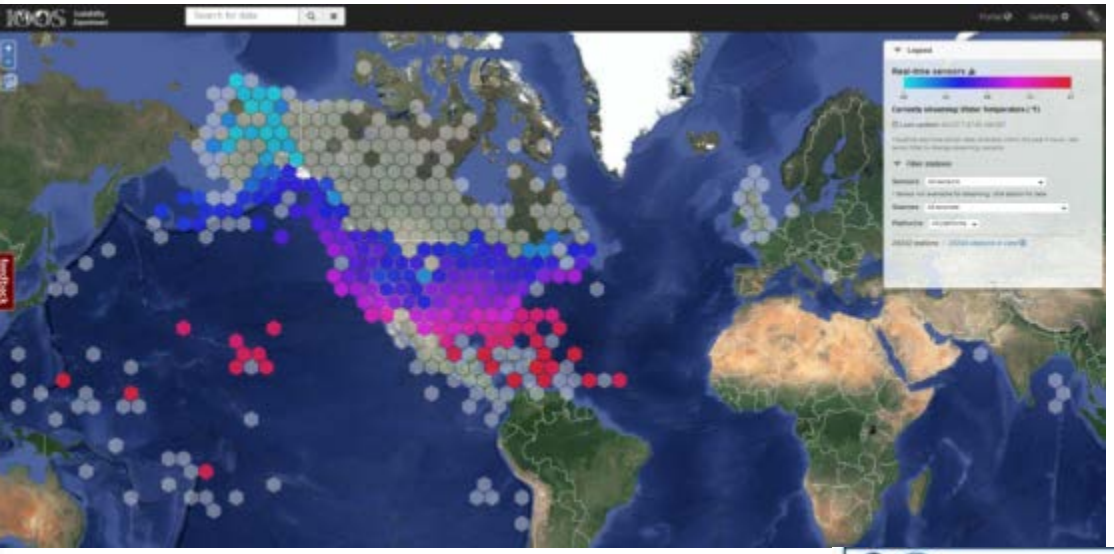
Market Sectors

Represents 'overall' activities of firms

Shows provider, intermediary split



Data Mgmt: DMAC – Environmental Sensors & Models



- 2 week cache of ALL known, available real-time observations
- AOOS & Axiom
- Release June 2016

- THREDDS, WMS access to all model output
- ASA for Coast Guard / IOOS
- Pre Release now

Blizzard 2016: CBOFS winds at 1/23 17:00 EST. Time-series of model output and buoy observations (1/20 - 1/23)

NOAA's Resilience Framework

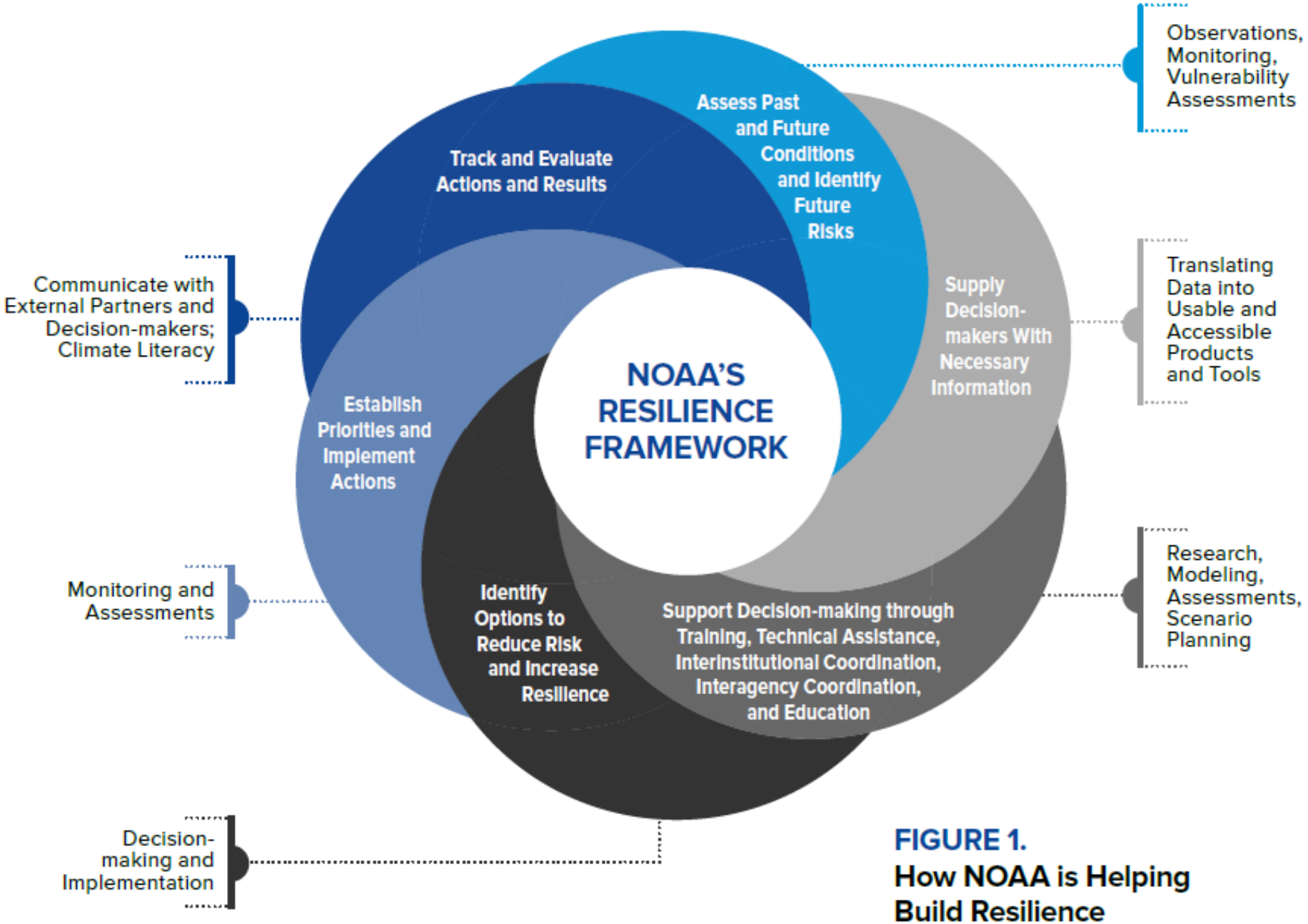


FIGURE 1.
How NOAA is Helping Build Resilience

Oct 2016 Staffing and Leadership Update

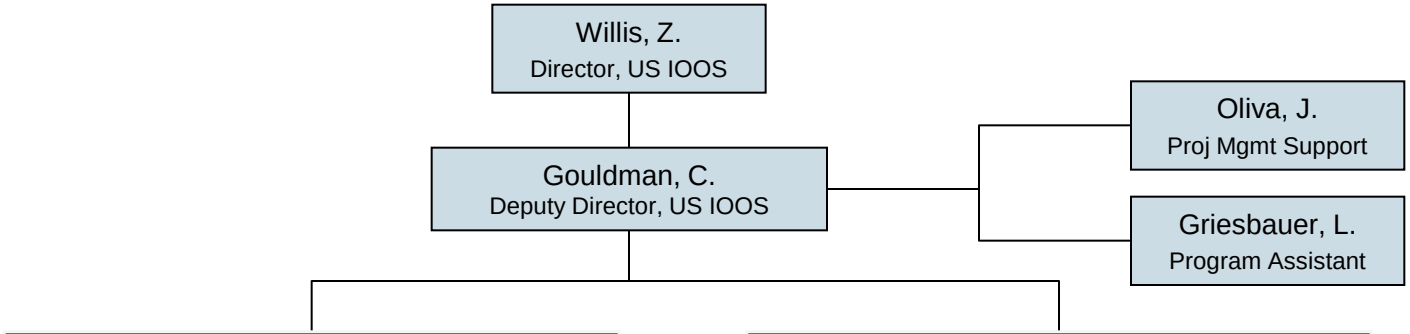
- IOOS Office Changes:
- New Director in FY2017
- Derrick Snowden & Terence Lynch (A) - as Division Chiefs

NEW in last year

- Bill Woodward: Animal Telemetry Network Coordinator*
- Kate Culpepper: Communications Specialist
- LCDR Eric Johnson: NOAA Corps in Ops Division
- Jennifer Bosch: Ops Division
- Micah Wengren: New 'data scientist' starts May 2016
- Tiffany Vance: New 'data scientist' starts June 2016
- Debra Esty – Grants / Contracts business support
- New Env. Compliance Coordinator – by end of CY16

* BOEM funded position

U.S. Integrated Ocean Observing System Program



Operations Division	
Snowden, D. Division Chief/DMAC Systems Architect	
Bailey, K. Physical Scientist/Products Specialist	Baltes, B. Modeling Testbed Proj. Lead
Bosch, J. Oceanographer	Canonico-Hyde, G. MBON Project Manager
Harlan, J. HF Radar Proj Manager	Johnson, E. (CDR) Project and Actions Officer/ Regional PoC
Moustahfid, H. Biology/Ecosystem Proj Manager	Ragsdale, R. DMAC Architecture Support
Vance, T. Physical Scientist/Data Manager	Wengren, M. Physical Scientist/Data Manager
	Woodward, B. ATN Network Coordinator

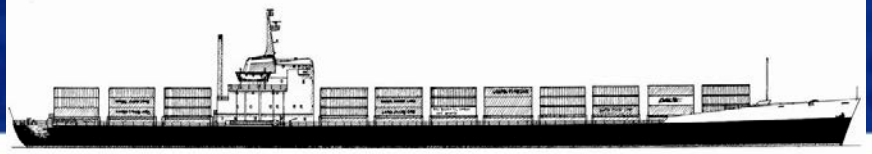
Regions, Budget & Policy Division	
Lynch, T. Acting Division Chief	
Snowden, J. Physical Scientist	Culpepper, K. Communications Specialist
Davila, C. Business Manager	Easter, D. Regional Point of Contact
Evans, R. Grants Specialist	Ketcham, T. Info Mgmt Support
Kromer, V. Reception/Office Manager	Rhoades, J Regional Point of Contact
Esty, D. Management and Program Analyst	

As of 9/22/16

HF Radar FY17 Outlook

- Refinement of O&M costs
- **At your local WFO**
- Significant Wave Height
- Tsunami detection – partner with NWS
- Global HF Radar – GEO/GOOS
- Archiving continues every month
- QARTOD manual underway

Without



The U.S. public wouldn't have:

24% of wine

99% of shoes

97% of clothes

Almost all personal electronics

90% of

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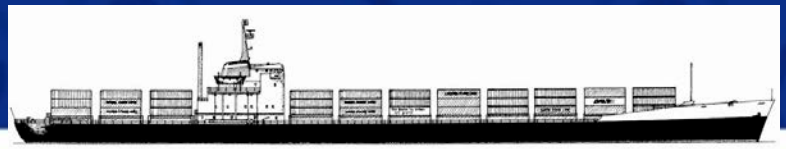
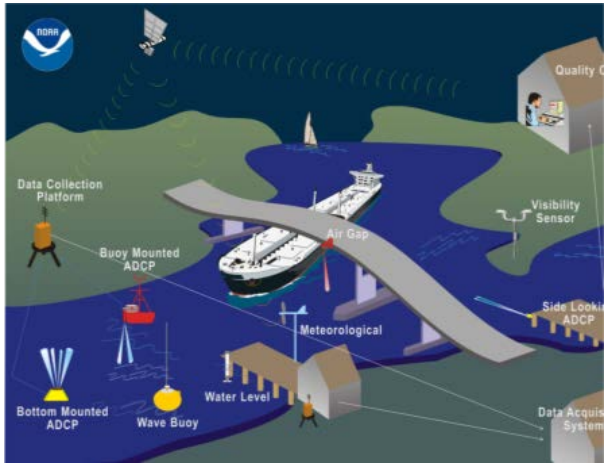
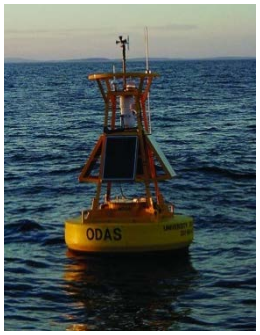
We couldn't move



Without: Ocean Observations and Forecasts





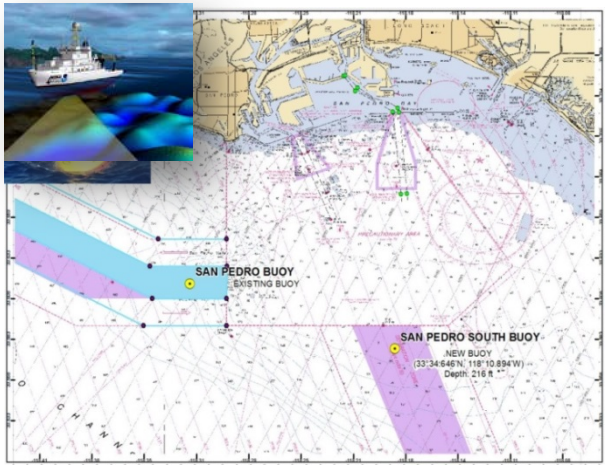
Wind and Wave Forecast - NERACOOS F01 - Penobscot Bay

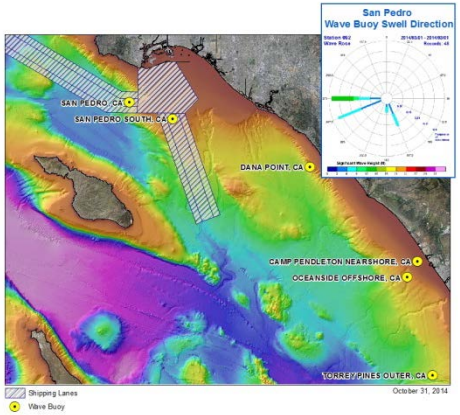
NERACOOS

Select station:

Date	Monday				Tuesday				Wednesday				Thursday			
HOUR	1:00 PM	4:00 PM	7:00 PM	10:00 PM	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM
WIND FORECAST																	
WIND SPEED (MPH)	18	17	20	22	20	19	19	17	14	14	17	17	14	NA	NA	NA	NA
WIND DIRECTION	WNW	WNW	WNW	WNW	WNW	W	W	W	W	W	W	WNW	W	NA	NA	NA	NA
WAVE FORECAST																	
WAVE HEIGHT (feet)	2.6	2.5	3.0	3.5	3.2	2.7	2.3	2.2	2.0	1.8	1.6	1.7	1.9	1.6	1.1	NA	NA
WAVE PERIOD (seconds)	3.3	3.2	3.5	3.9	3.9	3.7	3.4	3.3	3.2	3.1	3.1	3.0	3.2	3.7	4.0	NA	NA
PRIMARY DIRECTION	WNW	WNW	W	W	W	W	W	W	W	W	W	W	WSW	WSW	SW	NA	NA

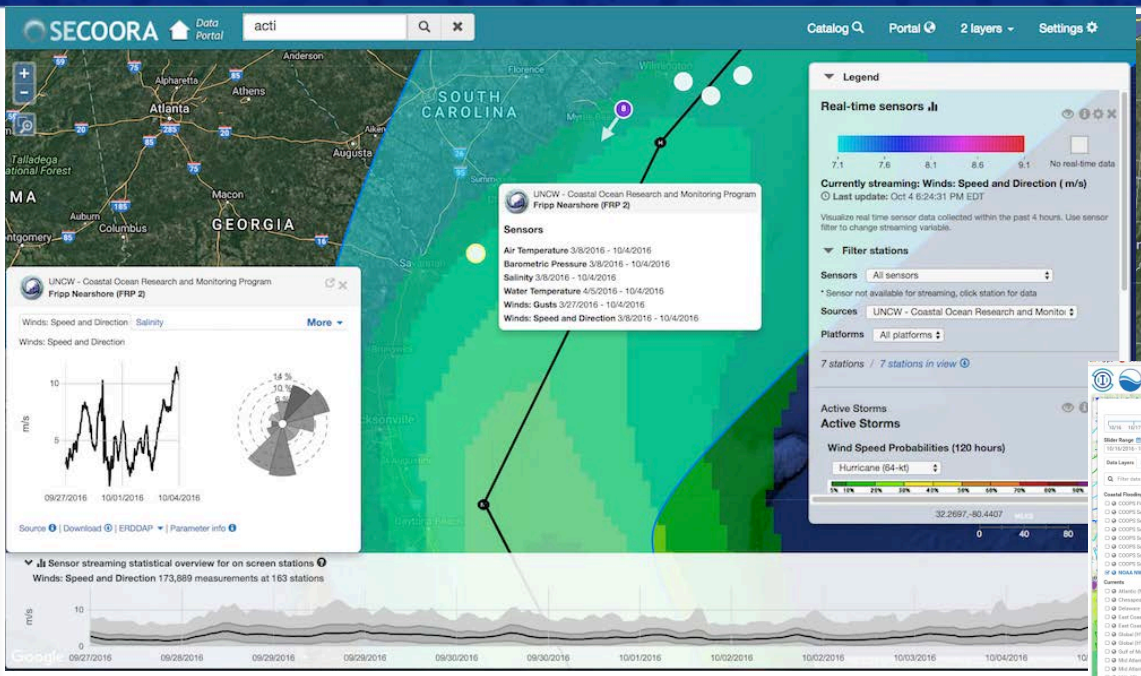
NOAA's PORTS® - 24 systems

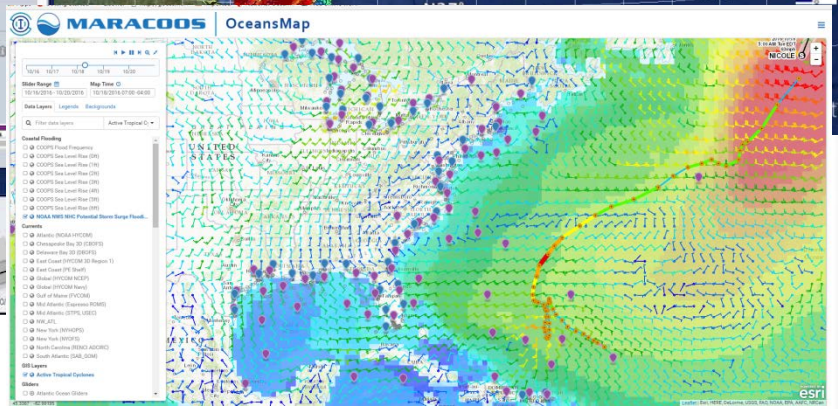


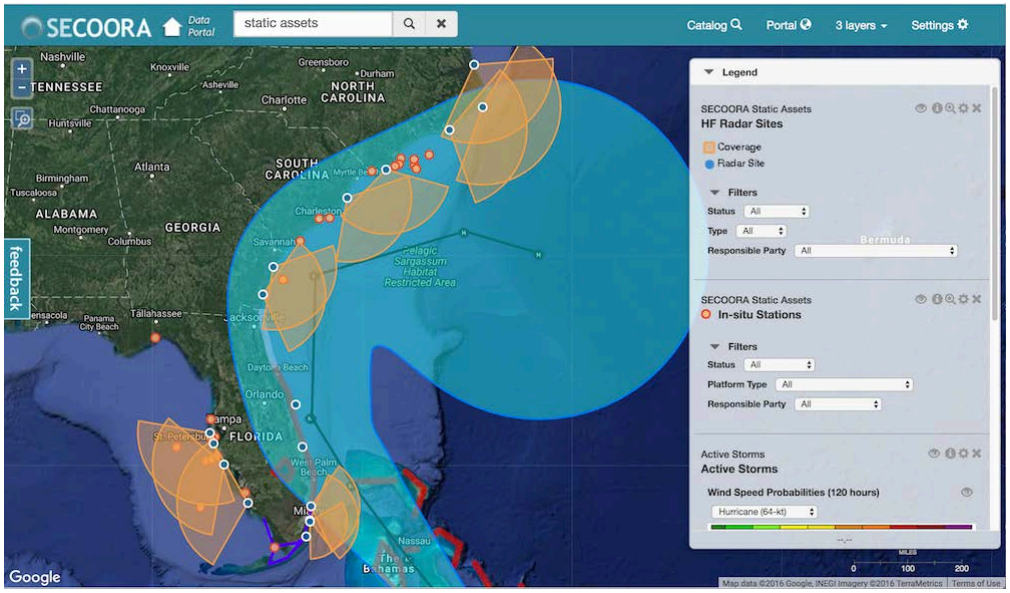


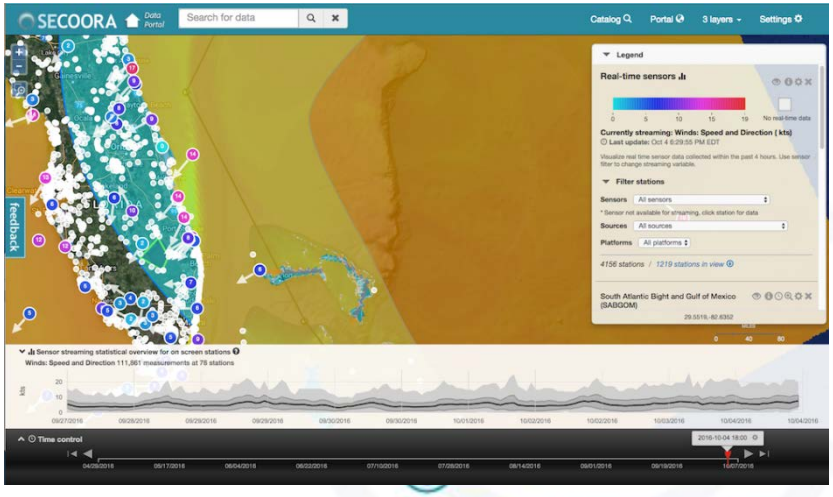
IOOS | EYES ON THE OCEAN

Public Good: Supporting Hurricane Response







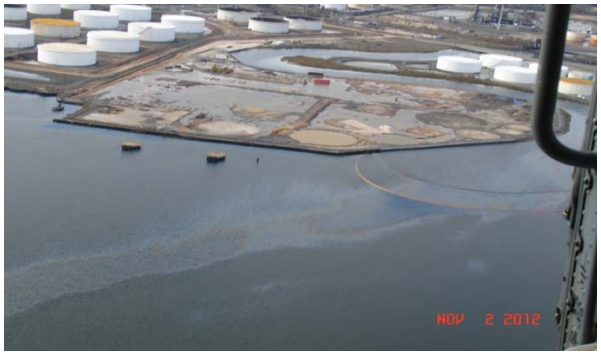


Post Storm: Response, Recovery, Long-term Planning

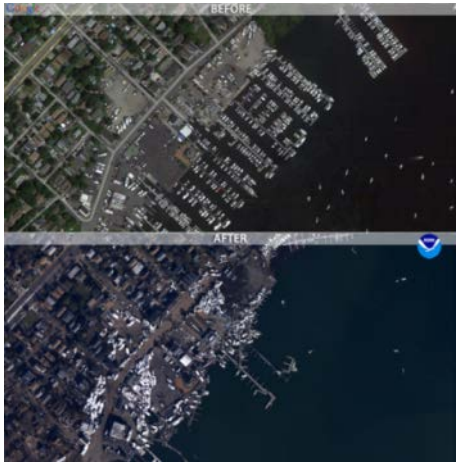
Navigation Response Team

Shoreline Imagery

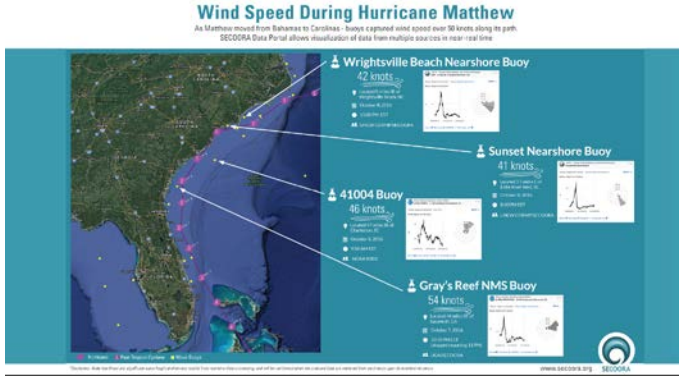
Oil Spill Response

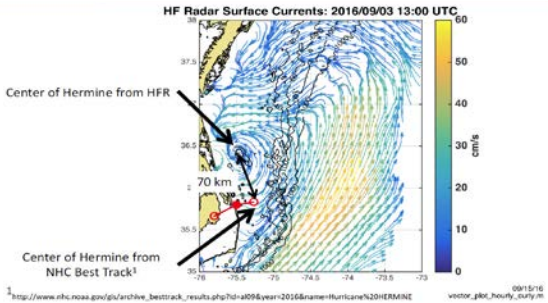


Marine Debris



Analysis of the Storm





Promoting Resilience

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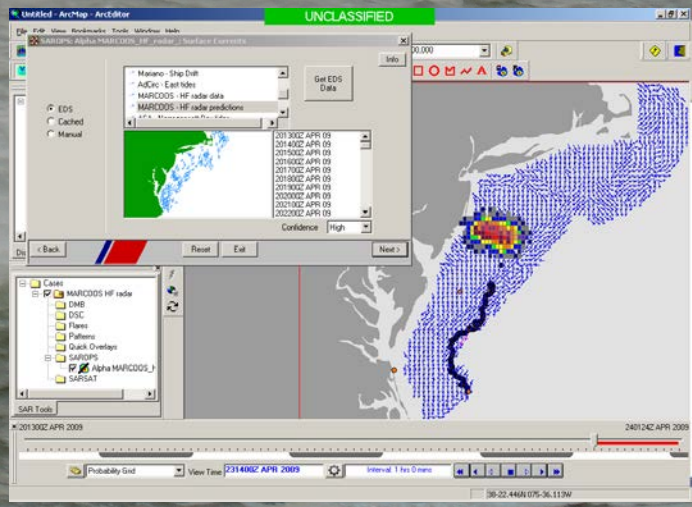
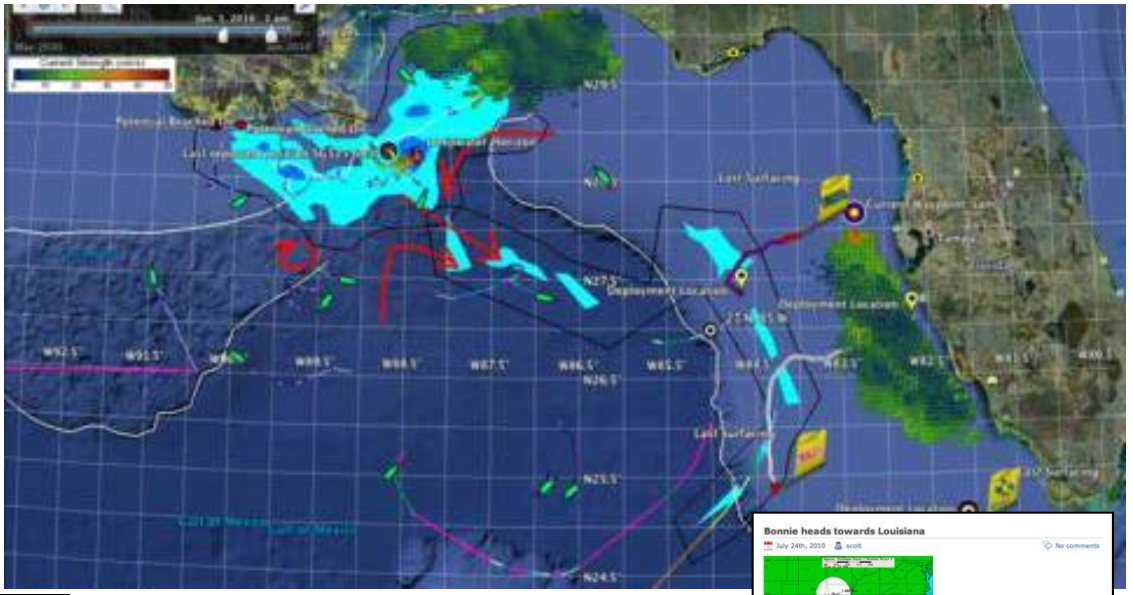
Saving Lives – supporting the US Coast Guard – Search and Rescue



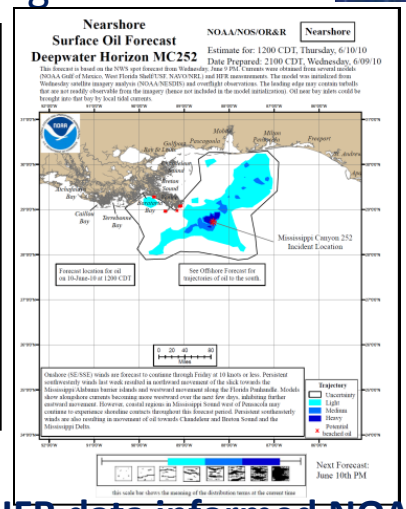
Public Good: US IOOS Regional Response to DHW

U.S. IOOS partnership demonstrated ability to:

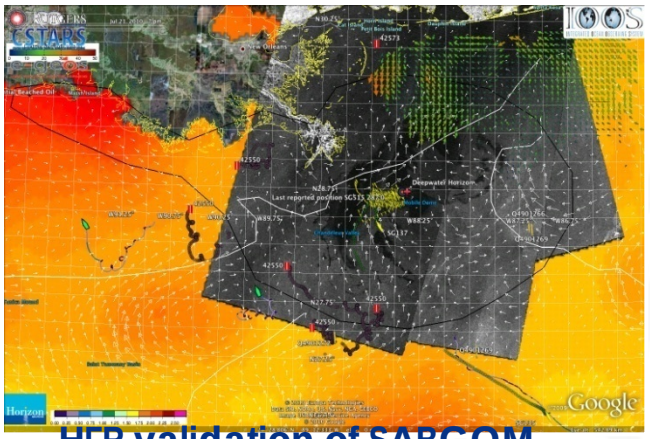
- Quickly deploy technologies: Gliders and HF radar, saving resources/improving safety
- Models/Imagery ingested into NOAA/Navy models
- Data assimilation improved spill response decision-making and public understanding



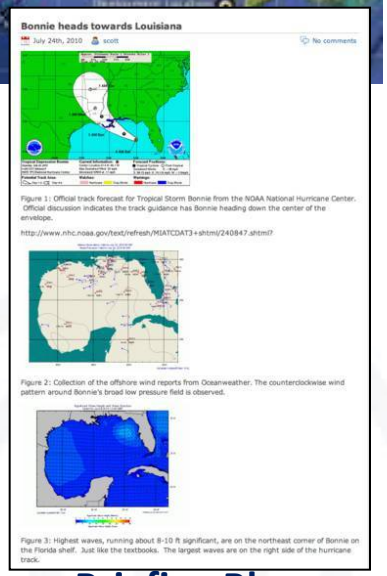
Web Portal



HFR data informed NOAA trajectory forecasts



HFR validation of SABGOM Forecast with satellite detected oil slicks



Briefing Blog

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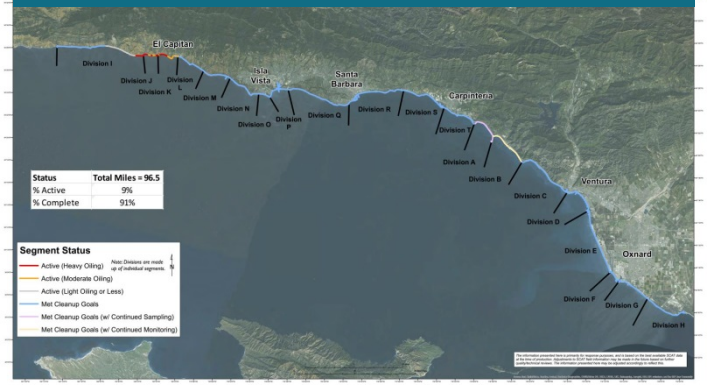
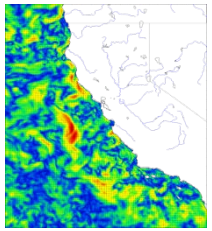
Public Good - Refugio State Beach Oil Spill – May 2015

NOAA lead for response mission

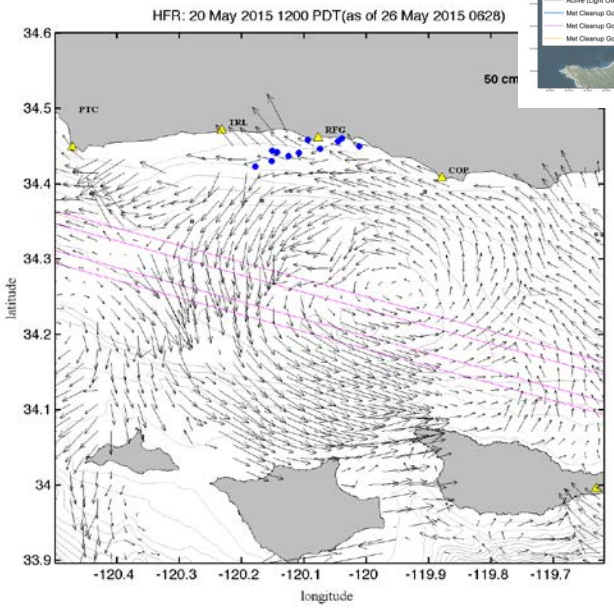


Gliders

HR Radar



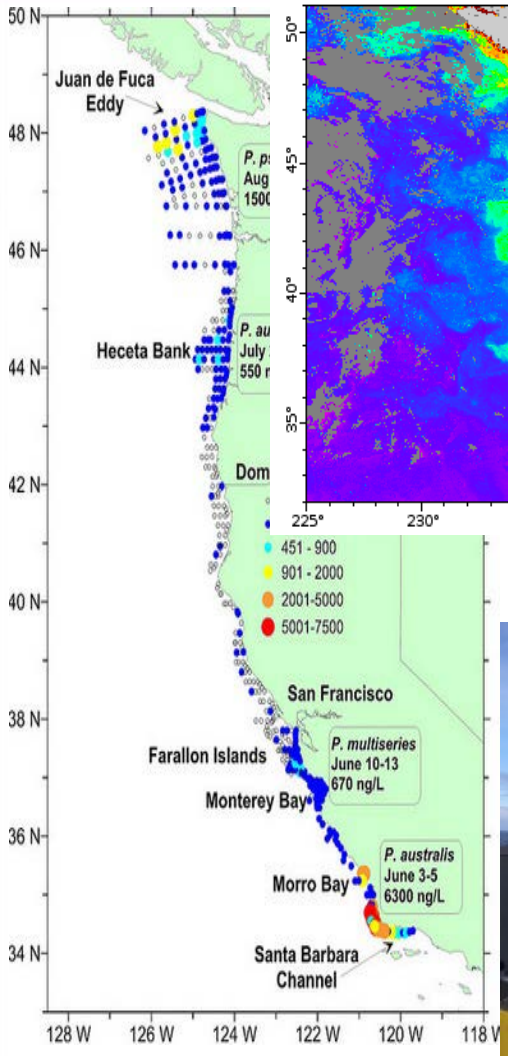
Modeling



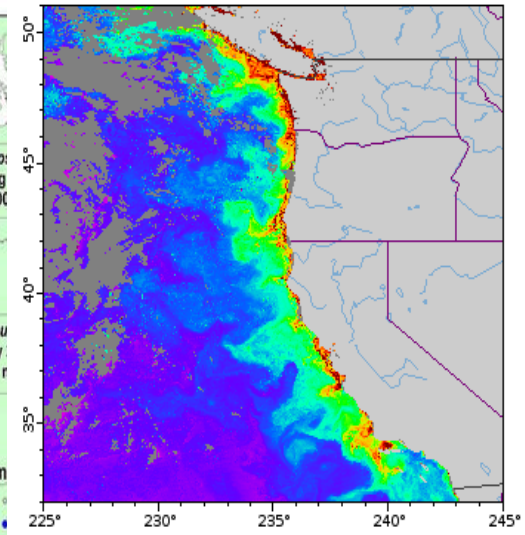
IOOS Regional Assets support national mission: supporting gliders, surface currents from HF radar, and regional models

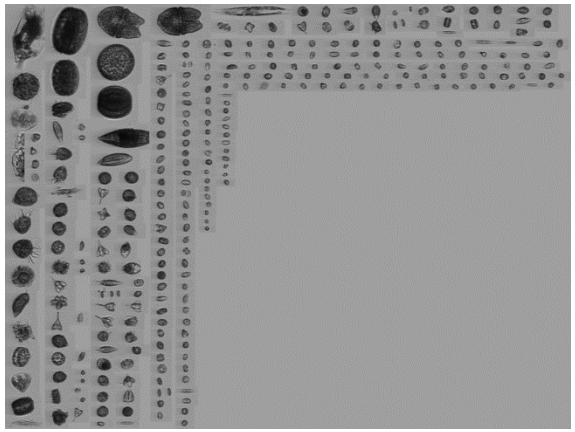
IOOS EYES ON THE OCEAN

Public Good: Ocean Observing and Public Health

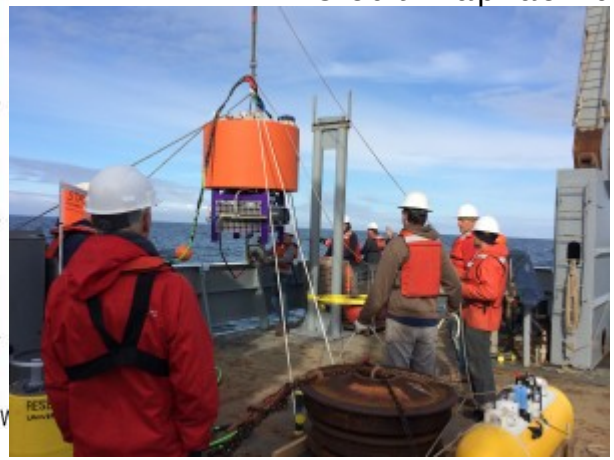


Harmful Algal Bloom Monitoring



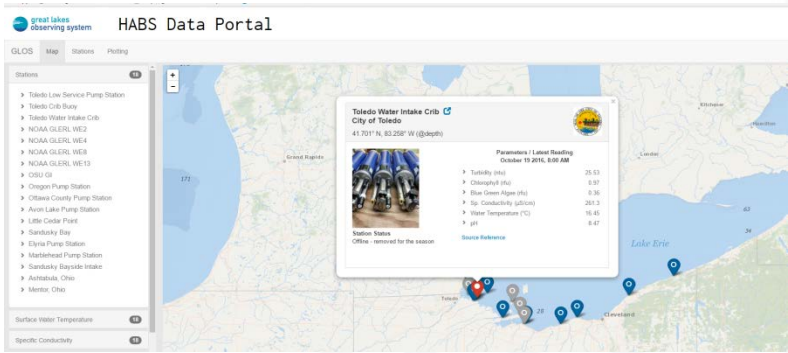


Output imagery from the IFCB, October 11 SF Bay Deployment.
Credit: Raphael Kudela



Deployment of PNW ESP, May 2016. Credit: Stephanie Moore

- Improved forecasts to mitigate and respond to human health hazards, caused by harmful algal blooms and pathogens :
  - Improved reporting of real-time meteorological and oceanographic conditions;
  - Improving reporting of water quality parameters; and
  - Creating better trajectory models.



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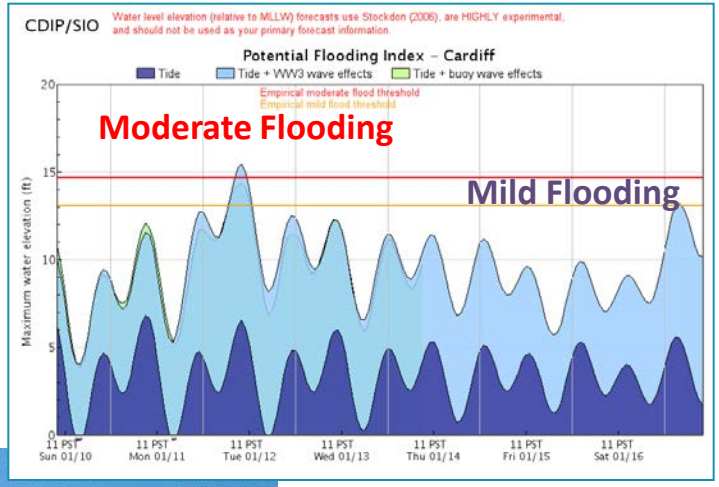
Public Good - Coastal Hazards: Flooding

Hwy 1- Moderate Flooding

Parking Lot- Mild Flooding



Wave height, wave period and tidal inputs aid in forecasting local flooding events.

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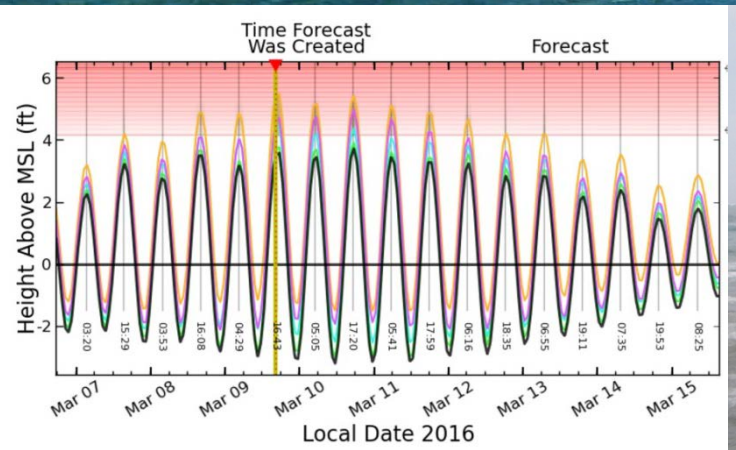
Pacific Islands Ocean Observing System
Wave-Run Up Models Forecast Possible Wave Inundation

Photo Credit: Karl Fellenius



Economy: Ocean Observation and Tourism

Healthy Coral Reef

Dead Coral Reef