

Integrated Ocean Observing System (IOOS®)

Our Eyes on the Oceans, Coasts and Great Lakes

HSRP 15 April 2009

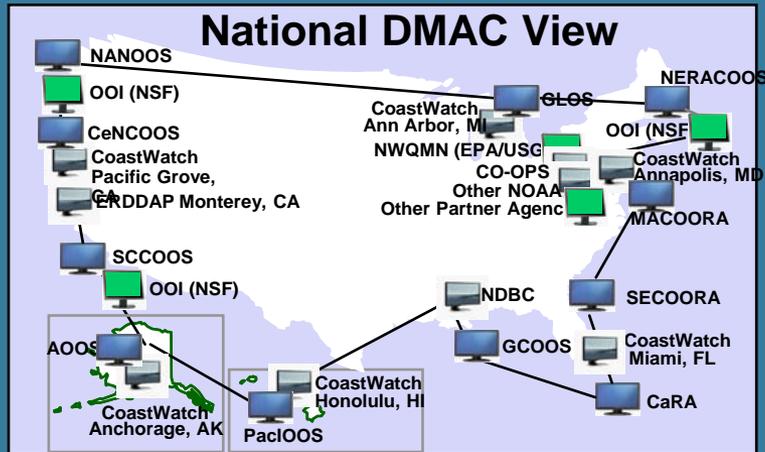
Zdenka Willis,

Director, NOAA IOOS

NOAA IOOS Program Focus

- **Data Integration & Data Management and Communications (DMAC) Implementation**
 - Limited scope IOOS implementation to modernize data infrastructure and integrate NOAA's ocean data
 - Administering US IOOS DMAC standards process; National DMAC planning
- **Regional Coastal Component**
 - Providing leadership; Managing funding and operations
- **Program Operations**
 - NOAA's Program Planning, Budgeting, & Execution System
 - Interagency and Cross-NOAA interactions

Data Management and Communications



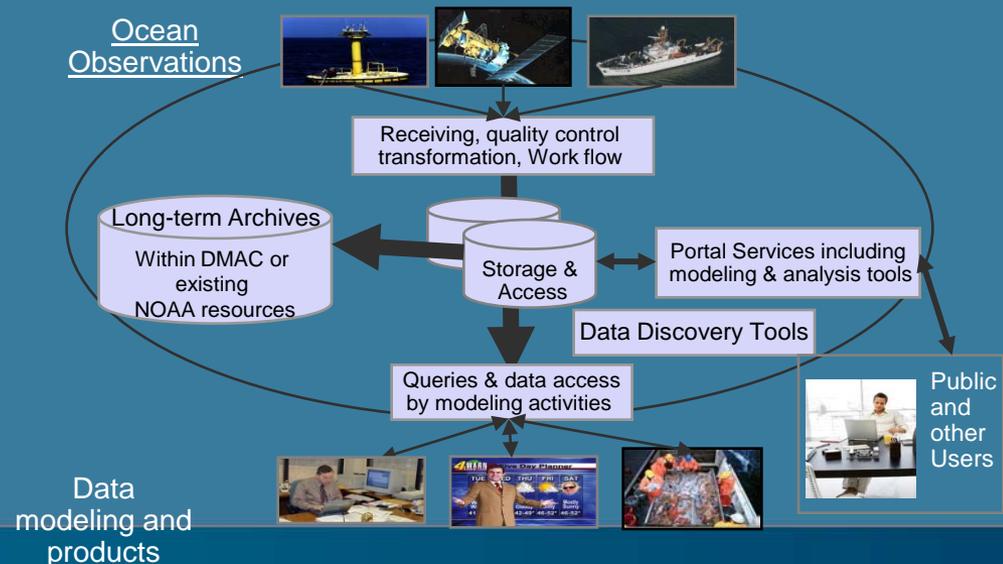
Overview

- Distributed Regional & Federal Data Assembly Centers
- Develops and manages technical design & standards
- Leverages existing Federal and Non-Federal technologies

Functionality

- Integrated data #1 request
- Standardize, integrate, and simplify delivery of data from multiple sources
- Access to broader data resources to understand impacts of climate change and improved management decisions

DMAC Functions and Interfaces



National DMAC Accomplishments

- Advancing the National IOOS DMAC Standards Process
- Acquisition planning approach
- Associated planning documents
 - *High Level Functional Requirements*
 - *Concept of Operations*
- Briefs to/feedback from NOAA leadership
- IOOS business case

High Level Requirements - ConOps

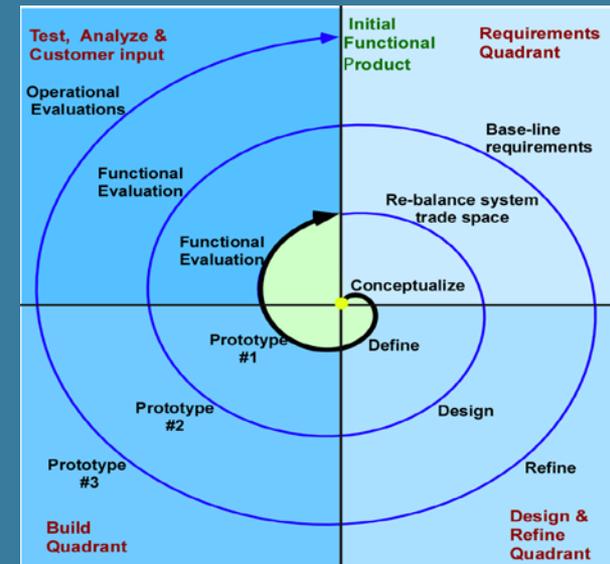
Document	High Level Functional Requirements (HLFR)	Concept of Operations (ConOps)
Description	<ul style="list-style-type: none">• Distillation of existing documents that address IOOS and its subsystems• Operational concepts per Ocean.US and industry• Addresses design principles including usage and outputs	Describes <ul style="list-style-type: none">• DMAC's purpose• Business need• Functional capabilities• Roles and responsibilities• Business impacts (e.g., change management issues)
Scope	<ul style="list-style-type: none">• IOOS-wide focus• Points out unresolved issues, such as regional roles and responsibilities• Not limited to DMAC subsystem	<ul style="list-style-type: none">• Addresses how DMAC will perform functions and services• Does not address technology or architecture

National DMAC – Next Steps (2009)

- IOOS DMAC Briefs to industry (12 March)
- Request for Information (RFI)
- Other market research (e.g. vendor meetings)
- Analysis of Acquisition Alternatives

Data Integration Framework (DIF)

- Began as pilot project (2007-2010)
 - First spiral of IOOS development
 - Evaluate benefit in 2010
- Limited scope for reduced risk
 - Implement at 3 provider and 4 customer sites
 - Start with 7 core variables
 - Currents, Temperature, Salinity, Water Level, Winds, Waves, Ocean Color (chlorophyll)
- Systems engineering documents
 - Available at <http://ioos.noaa.gov/dif/>*
 - Concept of Operations
 - Functional Requirements
 - Design

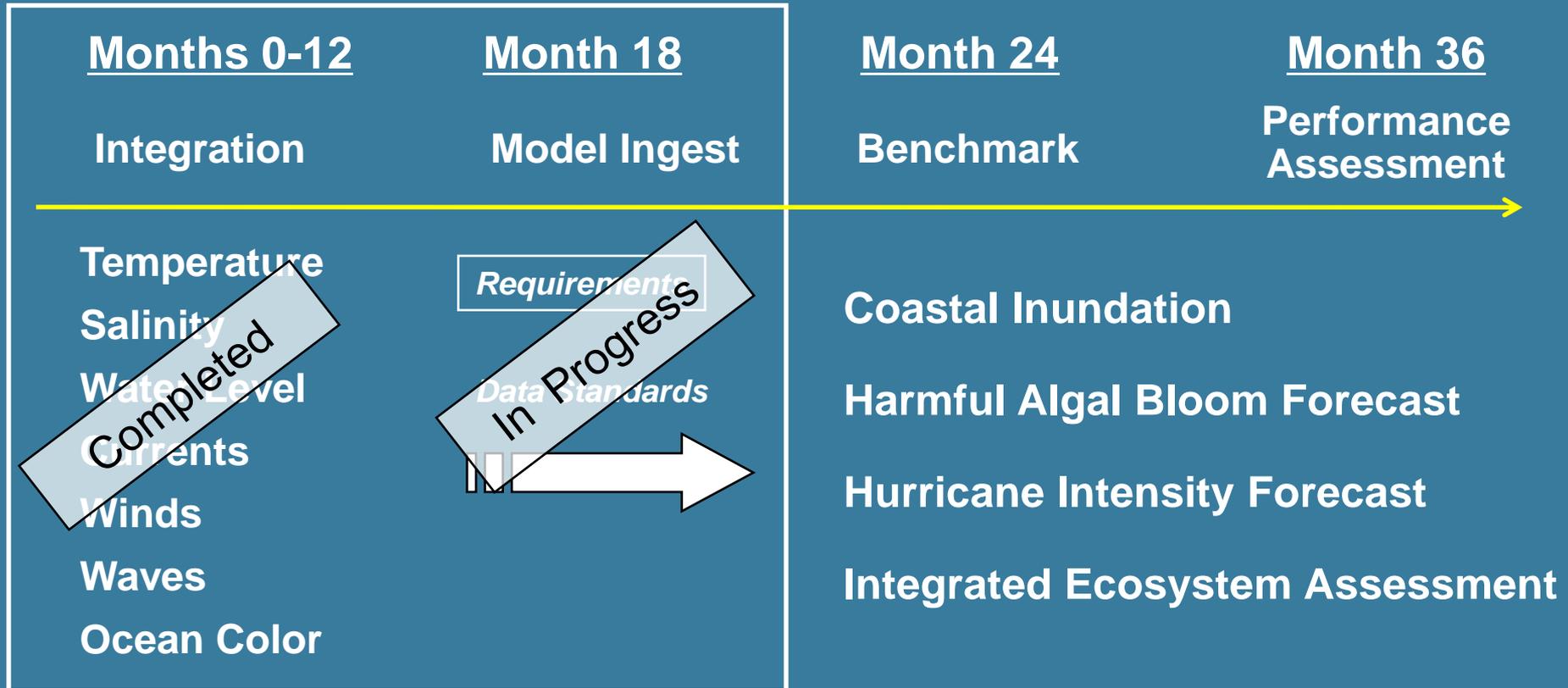


(Graphic by i3 Aerospace Technologies Pty Ltd
– used with permission)

Primary DIF Partners

- 3 NOAA data providers
- 4 NOAA customers
- 11 IOOS Regional Associations
- Integrated Products Team of representatives from all NOAA lines offices
- Industry
 - Contractor support at IOOS, NOAA, RAs
 - OGC members
 - Emerging partnerships:
 - Google as customer of IOOS data for Google Oceans
 - Amazon Web Services (NSF OOI collaboration)

Data Integration Framework

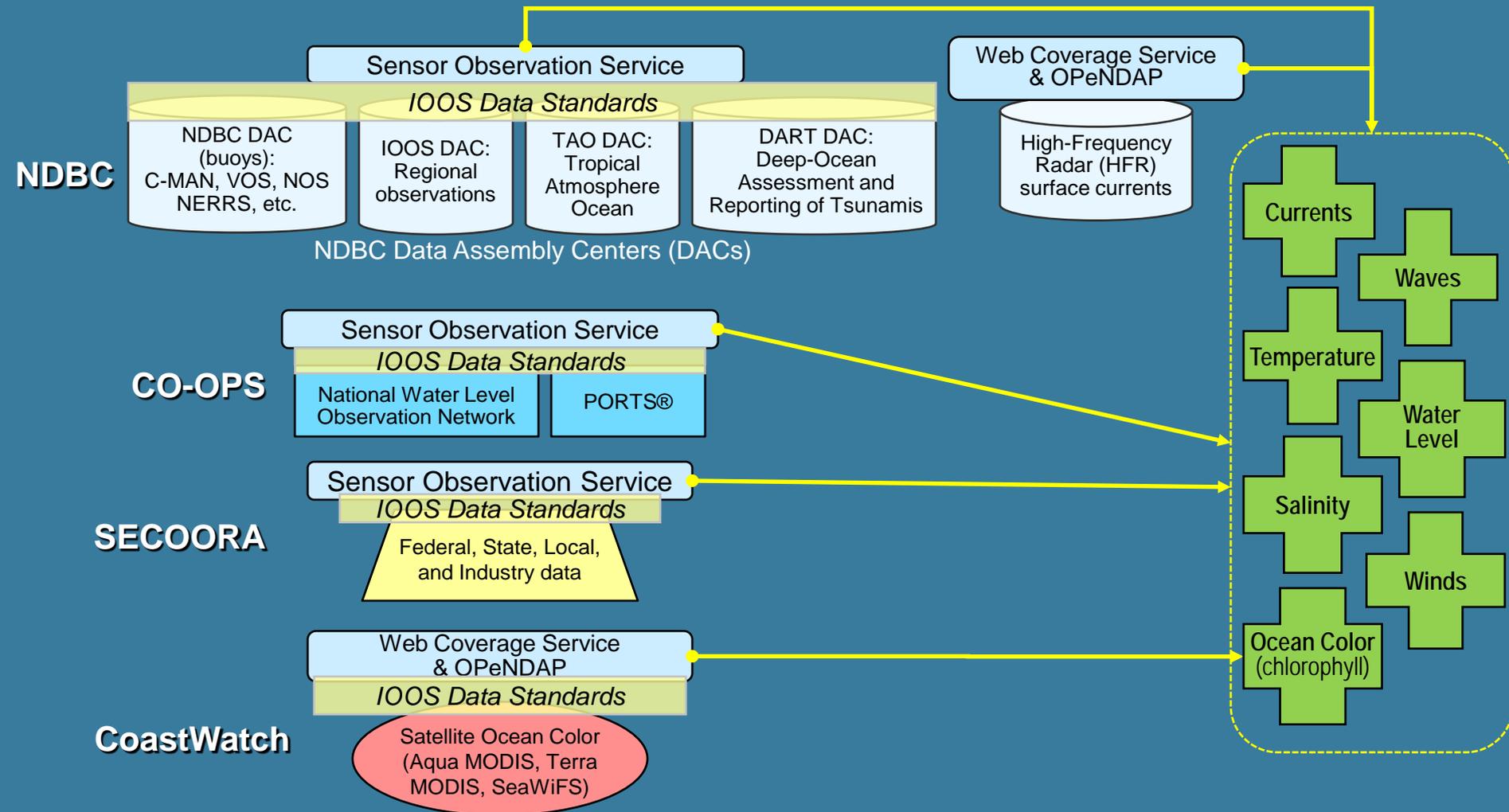


- Regional Implementation of the DIF
- Interagency/GEOSS data management collaborations
- Documents at www.ioos.noaa.gov

Integration of Data Variables

PROGRAM DATA

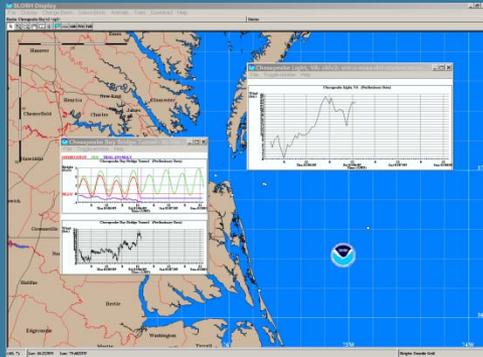
IOOS DATA



NOAA DIF Customer Projects

In 2010, will evaluate benefit of data services to several customers:

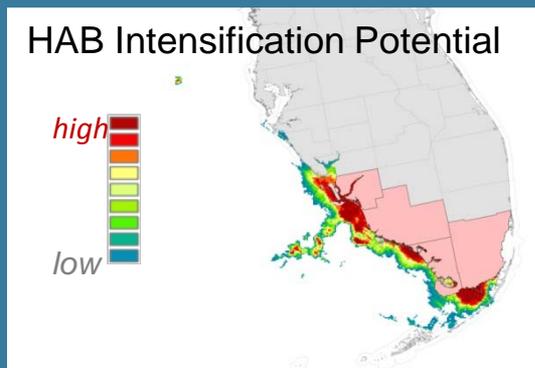
Coastal Inundation: Sea, Lake and Overland Surge from Hurricanes (SLOSH) model



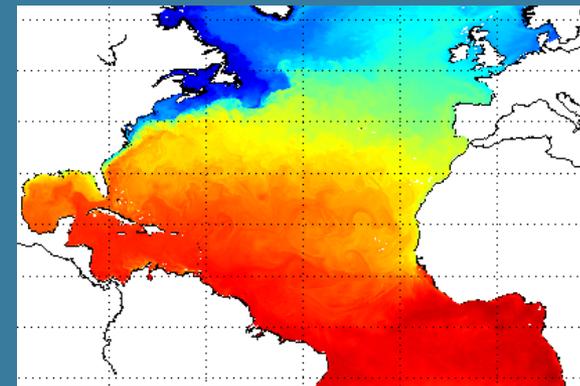
Integrated Ecosystem Assessments: Environmental Research Division Data Access Protocol (ERDDAP) application



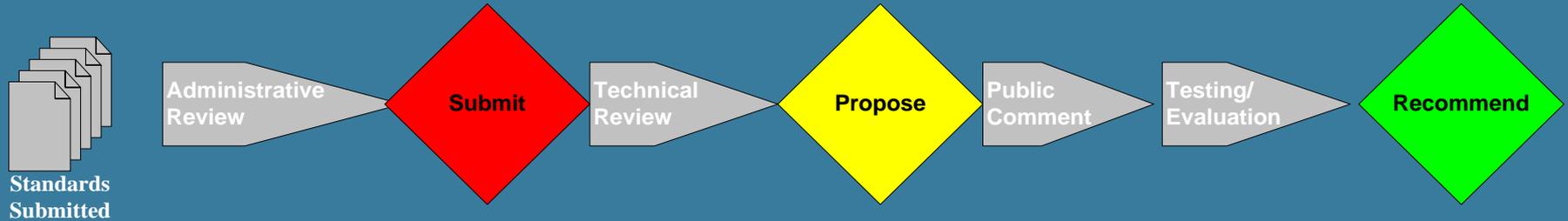
Harmful Algal Blooms: HAB Forecast System (HAB-FS)



Hurricane Intensity: Real-Time Ocean Forecast System (RTOFS-Atlantic)



IOOS[®] DMAC Standards Process



- **Web-based, collaborative tools, 2 cycles/year**
- **Review process for adopting/adapting existing standards for IOOS realm**

Current Status: 12 standards submitted to date

- 3 are at Recommended level
- 4 are at Proposed level
- 4 are tabled awaiting updates
- 1 is tabled awaiting more discussion

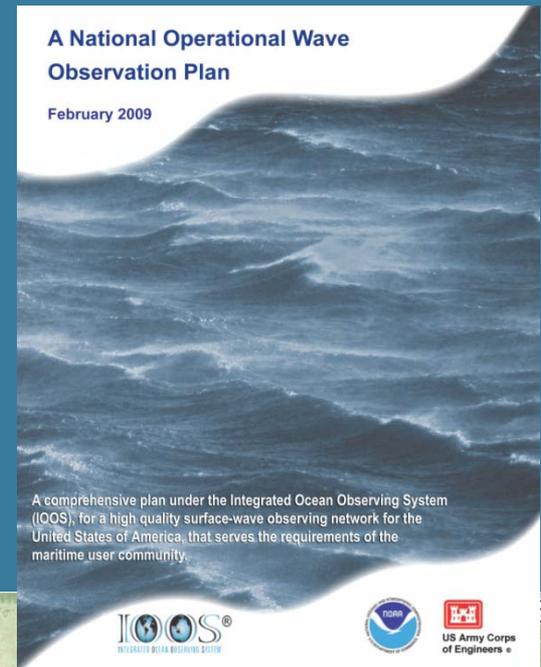
Wave and Current

Waves

- National Waves Plan
- Incorporation into PORTS

Currents

- 100 HFR on net
- Going live with USGC
- Frequency
- Data Management



Regional Coastal Component

IOOS Regional Associations

A network of 11 regional coastal ocean observing systems that meet national and regional needs for local ocean observations, data management, and modeling

- Regions meet National missions through...
 - Expanded observations and modeling capacity
 - Connections to users and stakeholders
 - Implementation of national data standards
 - Products transitioned to other regions and to NOAA operations



1. Alaska Ocean Observing Systems (AOOS)
2. Caribbean Regional Association (CaRA)
3. Central and Northern California Coastal Ocean Observing System (CeNCOOS)
4. Gulf Coastal Ocean Observing System (GCOOS)
5. Great Lakes Observing System (GLOS)
6. Mid-Atlantic Coastal Ocean Observing System Regional Association (MACOORA)
7. Northwest Association of Networked Ocean Observing Systems (NANOOS)
8. Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS)
9. Pacific Islands Ocean Observing System (PacIOOS)
10. Southern California Coastal Ocean Observing System (SCCOOS)
11. Southeast Coastal Ocean Observing System Regional Association (SECOORA)
12. Alliance for Coastal Technology

IOOS Regions Supporting IOOS Missions

Transportation/ Homeland Security

- Surface current data from >100 High Frequency Radar stations
- Improved tools for port pilots and ships entering major harbors
- High-resolution coastal mapping (funded by CA and Pacific NW) to NOAA standards
- Oil spill trajectory tracking (Cosco Busan)
- Delivering models of nearshore waves

Ecosystems and Oceans Human Health

- Larval Sampling
- Harmful Algal Bloom monitoring: 4 RAs
- IEA data collection and support: 4 RAs
- Benthic habitat and species mapping (NEBO)
- Extension of CalCOFI transects
- Fisheries stock information and products support recreational and commercial fishing: 4 RAs
- Aquaculture: Data/products for shellfish growers (northwest); abalone (CA); lobster (northeast)

Climate

- Coastal observations to monitor *local* impacts of global climate change
- Observations and data support state/CZM climate change adaptation plans:
 - LiDAR collection for hi-res topography
 - State Sea Level Rise plans (2 RAs)
 - Lead PI for 5-year NSF climate project
- Coastal Inundation modeling projects (4)

Natural Hazards/Weather Prediction

- SE Marine Weather Portal – **single** site for marine weather data
- Providing data and products to WFOs:
 - New York City; Philadelphia; Boston; Wakefield, VA; Newport & Wilmington, NC; Honolulu, HI; and San Juan, PR
- Water Quality projects: 4 RAs

← Sensor Validation and Verification Services →

Regional Observations

- Fixed Platforms

Buoys, ADCP, Tide Gages, Weather Stations

- Moving Platforms

Floats, Drifters, Gliders, Ships

- Images / 2D GIS

LIDAR, Webcams, Marine Ecosystems

- Remote Sensing

Satellite - Cloud, Temperature, Altimetry, Winds

- Models

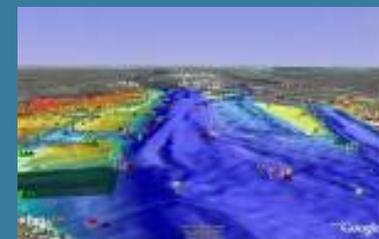
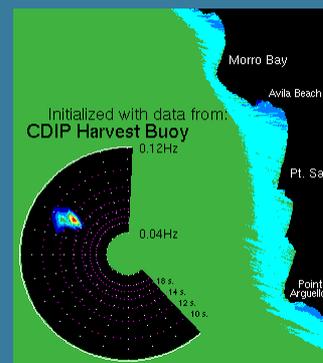
Atmospheric, Ocean, Wave

- Raster / Vector

Bathymetry

- Other

Acoustic, Climate, Local Knowledge



Regional Data Assembly Center Elements

Identify **Instrument/Platform**

Identify the data provider

Determine number/resolution required

Which **Variables** will be measured

How often will the data be collected

How will the **Metadata** be captured

How will the data be received

How will the data be distributed

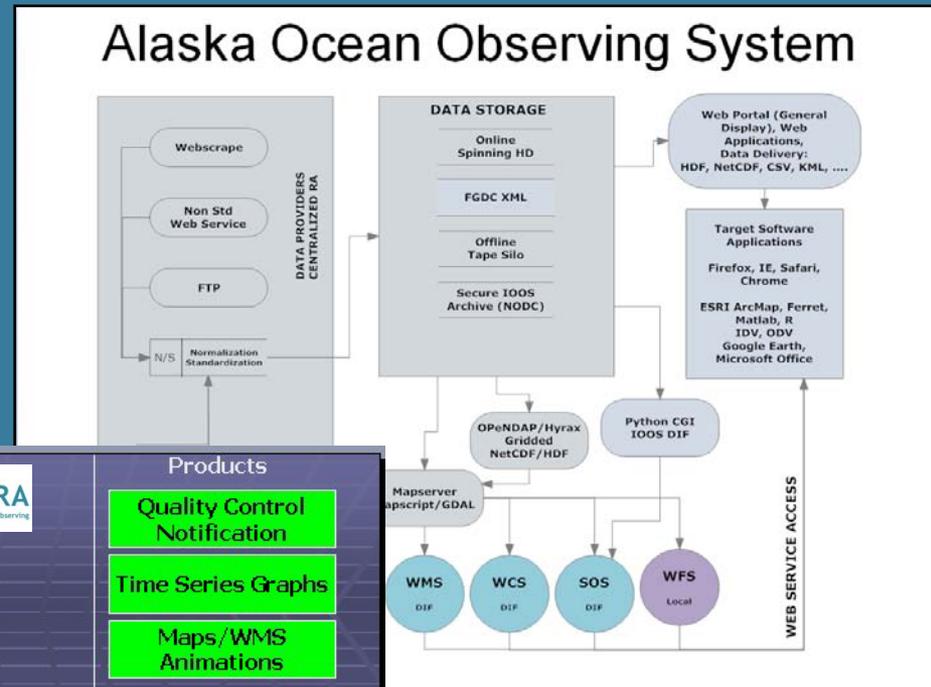
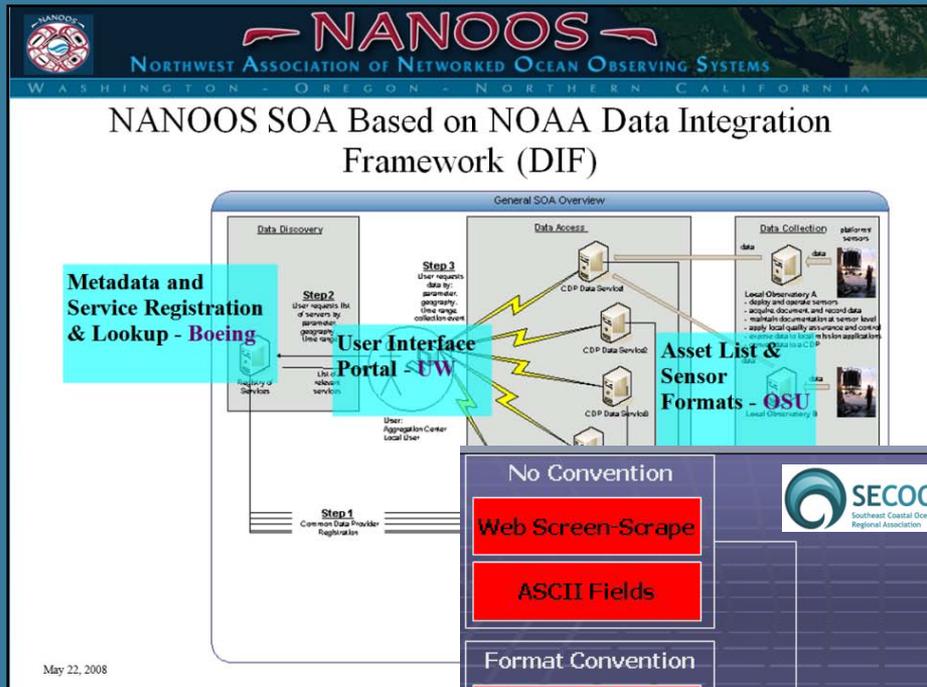
What format will the data be transmitted

What **Services** are required

What information will be archived and where

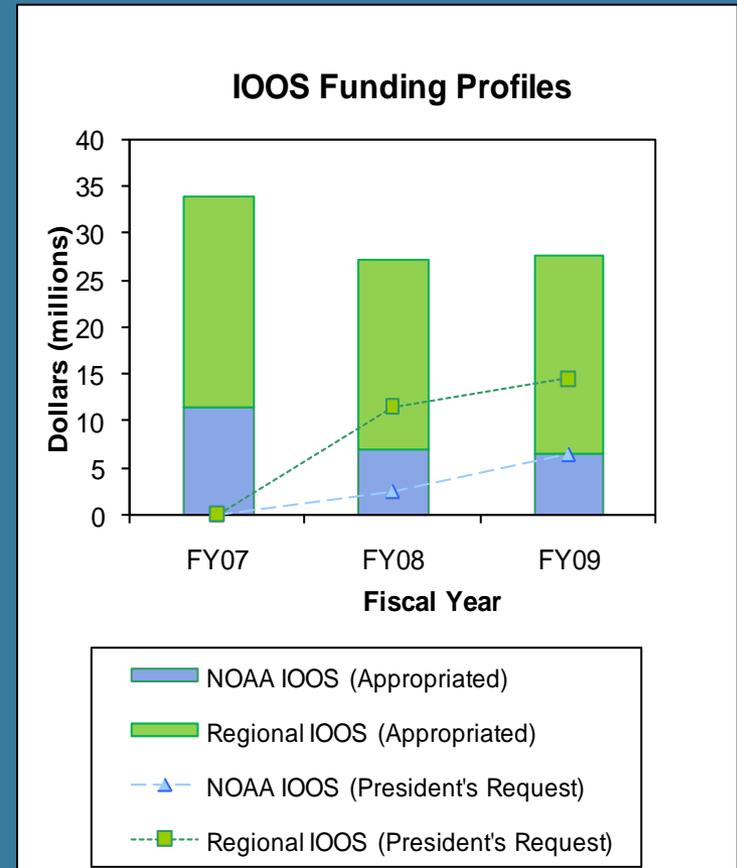


Emerging Regional Architecture



IOOS Regional Funding

- **FY07: \$22.4M to Regional IOOS; \$11.5M to NOAA IOOS**
- **FY08: \$20.4M Regional IOOS; \$6.8M NOAA IOOS**
- **FY09: \$21M Regional IOOS; \$6.5M NOAA IOOS**
- **FY10: Limited geographic FFO; sensor verification and validation**
- **FY11: Competitive process based on Regional business model**



Interagency Interactions

- **NOAA leadership in IWGOO yielded successful IOOS-related partnerships:**
 - **National Water Quality Monitoring Network (NOAA, EPA, & USGS)**
 - **Census of Marine Life: Sharing data standards with Ocean Biogeographic Information System (NOAA, USGS)**
 - **Ocean Observatories Initiative (NOAA, NSF)**
 - **Integrated Ocean and Coastal Mapping (NOAA, USGS)**
 - **Marine Protected Areas FAC, statement on IOOS (NOAA, DOI)**
 - **GEOSS: NOAA participation on two US-GEO Working Groups**

Legislation

- **PASSED!!!!**
- **Elements of the legislation**
 - **Governance: Council; Committee; Office; Advisory Panel**
 - **RA – Regional Information Coordinating Entities**
 - **Certification/Contracts**
 - **Liability**
 - **Reports: Independent Cost Estimate**
- **NOAA IOOS reviewing with lawyers and agency interpretation; then will need to send to IWGOO for discussion**

Communication Efforts

- US IOOS website
- Branding IOOS
- Out reach material
- Pod Cast
- Ocean Hall video

IOOS® in Action: Enhancing Lives of American Citizens

Improving Safety, Economy, and Environment

Overview: Emergency managers making evacuation decisions amid an approaching storm, farmers deciding what crops to plant, and coastal communities concerned about sea level rise all need the same thing - reliable and timely access to multiple data sources about emerging threats to enable wise choices in an uncertain world. The Integrated Ocean Observing System (IOOS) is a federal-regional partnership working to provide new tools and forecasts to improve safety, enhance the economy, and protect our environment.

Integrated ocean information is now available in near real time, as well as retrospectively. Easier and better access to this information is improving our ability to understand and predict coastal events - such as storms, wave heights, and sea level change. Such knowledge is needed for everything from tidal development planning. For example, earlier and more accurate forecasts mean a store manager can make more informed decisions about whether to ship hurricane supplies or beach towels to his shop for a coming season.

Climate Change: IOOS data help managers predict their resources and the health of essential fish habitats and so on they can take action to protect our environment. Photo: NOAA

Predicting Severe Weather: Compatible, easily accessible data from multiple sources are increasing understanding of how oceans drive storms to arrive earlier, more accurate weather predictions so people can get to safety before disaster strikes. For example, Northeast fishermen use IOOS® weather and water data to make informed decisions about when it is safe to head to sea, while Puerto Rico's Department of Natural Resources relies on IOOS derived shoreline maps to plan for and respond to storm surge, flash floods, and sea level rise.

Forecast Integrated: Forecasters are using IOOS data to make more accurate forecasts of coastal conditions. For example, hourly sea surface temperatures, sea level, and wave heights are used to predict coastal conditions. Photo: NOAA

U.S. Department of Commerce
The National Oceanic & Atmospheric Administration
Integrated Ocean Observing System (IOOS) Program

http://ioos.noaa.gov

Linking IOOS® to the Ocean Observatories Initiative (OOI)

Understanding our Oceans, Coasts and Great Lakes

Overview: Our planet is constantly changing and the connections between these changes and our oceans, coasts and Great Lakes are complex and not fully understood. Unlocking the secrets of our waters requires advanced tools to understand and monitor our marine and Great Lakes environments and improve decision making. But how is this accomplished?

What is IOOS? The Integrated Ocean Observing System (IOOS) is a federal, regional and private sector partnership providing new tools and forecasts to improve safety, the economy, and our environment. IOOS is integrating a number of existing and planned independent open ocean, coastal, and Great Lakes observing efforts to form a "system of systems". This means coordinated data for modeling and advanced products providing access to real time forecasts of ocean conditions. IOOS incorporates various tools - such as buoys, satellites, ships, underwater robots, and high frequency radar stations - to collect ocean observations and

What is OOI? The Ocean Observatories Initiative (OOI) will construct a networked infrastructure of sensor systems to measure physical, chemical, geological and biological variables in the ocean. Supported by the National Science Foundation's Division of Ocean Science, OOI is driven by needs of

OOI will include global moorings, coastal observatories on the Pacific Northwest IOOS data from anywhere in the world. IOOS turn the raw data into useful information. The goal is to arm decision makers with the knowledge they need to respond to management and policy related problems across the nation.

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Linking IOOS® to the National System of Marine Protected Areas (MPAs)

Protection and Restoration of Ocean Resources

Overview: Our oceans, coasts and Great Lakes are natural ecosystems that sustain aquatic species, habitats, and natural processes - until the natural balance is changed through impacts and contaminants, both natural and man-made. As a result of these impacts, aquatic ecosystems can experience habitat degradation, species loss and declines in fish stocks, and decline in overall ecosystem health. Several tools and management methods can be used to begin to restore and protect aquatic ecosystems. When these tools and methods are used in cooperation with each other, restoration and protection efforts can be more effective.

What is IOOS? The Integrated Ocean Observing System (IOOS) is a federal, regional, and private sector partnership providing new tools and forecasts to improve safety, the economy, and our environment. IOOS is an integrating effort coordinated between 17 federal agencies and 11 regions.

What are MPAs? MPAs are places in the ocean where resources are protected by laws or regulations. Examples include national marine sanctuaries, national wildlife refuges, and state reserves and fishery management areas. Nearly all MPAs in the U.S. are multiple use, allowing such activities as commercial and recreational fishing, boating, and diving. In 2006, the National Oceanic and Atmospheric Administration (NOAA) began implementing a national system of marine protected areas. The MPA system

This pamphlet represents the numerous species being protected by Marine Protected Areas. While some aim to protect and restore whole ecosystems, they also can be designated to protect one single species or an area that has high cultural significance. Photo: Florida Keys National Marine Sanctuary

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Questions?



“Providing information needed to improve safety, enhance our economy and protect our environment”

<http://ioos.noaa.gov>