Our Planet is Changing

We need advanced tools to understand and monitor our oceans, coasts and Great Lakes

Zdenka Willis
Director, US IOOS Program Office

Integrated, Interdependent, Indispensable
U.S. IOOS: Program Overview

WHO

- Observations
- Data Management
- Modeling and Analysis

WHAT

- Weather and climate change
- Maritime operations
- Natural hazards
- Homeland security
- Public health risks
- Healthy coastal ecosystems
- Sustain Living Marine Resources

Enhances science and improves decision making.
Observation Networks: Waves

- Nation’s wave data now accessible
  - 181 platforms in 2008; 227 in 2011
  - Wave Plan called for 296
  - New IOOS supported wave sites being deployed collaboratively with USACE/CDIP program
  - Some platforms need to be upgraded to directional wave measurements
Data Integration - Community

The value of NANOOS

NANOOS is a community of people that provides data through one place for quicker decision-making.

1. Washington Dept of Ecology
2. Oceanic Remote Chemical-optical Analyzer (ORCA)
3. USGS
5. NOAA National Data Buoy Center
6. King County
7. NOAA National Ocean Service
8. IntelliCheck Mobilisa
9. Hood Canal Dissolved Oxygen Program
Data Integration – Regional to National

IOOS Catalog

- 1444 Platforms to Rectangles
- Variables: All
- Cluster platforms
- Click the data for in-situ observations
- Click the rectangles for gridded data

Filter by Date

- Start: Aug 3, 2010
- End: Aug 2, 2010

Regions: All regions

- Search by bounding box mode
- Click a gridded data rectangle to filter platforms

Service types: All

Servers: All

Data Providers on this Server

- All

Data Providers:
- All
- Data products in overlapping rectangles
- All
- Reset

Bash button (right-click the link)
- Documentation for IOOS gridded data service
- Download all SOS Platform (XML)
- Download all IOS Rectangles (XML)

Service notice: We have found that Internet Explorer is slow to display this page, and we are investigating. Firefox, Safari and Chrome browsers work well.
U.S. IOOS®: Modeling Testbed

- 5 teams, 64 scientists/analysts
- SURA is overall lead for execution
- Began in June 2010; now in the second year
- Multi-sector engagement (federal agency, academia, industry)
- Goals:
  - Less about model than process
  - Focus is on stable infrastructure (testing environment, tools, standard obs) and transition to operations
  - Enable Modeling and Analysis subsystem

Coastal Inundation
Gulf & Atlantic Coast
Rick Leuttich, UNC-CH

Shelf Hypoxia
Gulf of Mexico
John Harding, USM

Estuarine Hypoxia
Chesapeake Bay
Carl Friedrichs, VIMS

Cyber Infrastructure
Eoin Howlett, ASA

Testbed Advisory Evaluation Group
Rich Signell, USGS
OOI – Research and Development Component

NANOOS RCOOS Enhancement Conceptual Design
- Proposed new coastal buoy
- Existing coastal buoy to be sustained
- Existing estuarine buoys* to be sustained in partnership
- Existing glider track to be sustained
- Proposed new long-range HF site
- Existing long-range (180 km range) HF site to be sustained in partnership
- Existing standard-range (50 km range) HF site to be sustained in partnership
- Proposed new port wave radars
- Shoreline assessment to be sustained in partnership

OOI Conceptual Design
- Coastal mooring
- Cabled mooring
- Deepwater column mooring
- High voltage primary node
- Medium voltage primary node
- RSN cable
- Glider track
- Glider

*Existing buoys are more numerous than symbolized
# Beach Water Quality Predictive Modeling

Data assimilation from multiple sources including:

<table>
<thead>
<tr>
<th>Field programs</th>
<th>Observing systems</th>
<th>Remote sensing / Models</th>
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<tbody>
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<td>- Bacteria density</td>
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<td>- Wave activity</td>
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**WARNING**

NO SWIMMING

Swimming may cause illness due to inadequate water quality.

For more information you may contact:

The Falmouth Beach Committee (508) 548-6623
The Falmouth Health Department (508) 548-7611

Ocean Information for a Changing World
"This model has reduced the sampling burden for our Regional staff; but the major benefit has been the Department's quicker response time for posting beach advisories and subsequent enhancement of our agency's primary mission of protecting the public health."

David E. Tilson, PE, Chief, Bureau of Water, South Carolina Department of Health and Environmental Control (SCDHEC)
Funding Distribution

- ONR: 23.80%
- NSF: 21.79%
- NOAA: 14.21%
- Industry: 5.91%
- NOPP: 5.72%
- EPA: 0.39%
- USDA: 0.37%
- DHS: 16.66%
- State Governments: 0.79%
- Foundations: 2.14%
- DOE: 3.36%
- Foreign Governments: 3.80%

1997 - 2008 Total Grants $76,717,845
Observing Networks: HF Radar

Stakeholders
• > 30 institutions operate HF Radars
• Used by >40 government/private entities
• Partnership with Industry: US-based CODAR Ocean Sensor

Who Depends on it
• USCG Search and Rescue
• Water quality; Criminal forensics
• Commercial marine navigation
• Offshore energy; Harmful algal blooms
• Marine fisheries
• Emerging - Maritime Domain Awareness
• Emerging – Tsunamis

Decreases search area by 66% in 96 hours

IOOS – White
DHS – Green
DoD – Yellow
NJ DEP - Red

Mid Atlantic
M. J Murdock Trust: seeks to enrich the quality of life in the Pacific Northwest by providing grants and enrichment programs to non-profit organizations that seek to strengthen the region's educational, spiritual, and cultural base in creative and sustainable ways.

A tool that enables the Nation to track, predict, manage and adapt to changes in our marine environment and delivers critical information to decision makers to...
Global Component: Global Ocean Observing System for Climate

Total in situ networks 61%

- **Surface measurements** from volunteer ships (VOSclim)
  - 87% of total
  - 200 ships in pilot project

- **Global drifting surface buoy array**
  - 100% of total
  - 5° resolution array: 1250 floats

- **Tide gauge network** (GCOS subset of GLOSS core network)
  - 59% of total
  - 170 real-time reporting gauges

- **XBT sub-surface temperature section network**
  - 81% of total
  - 51 lines occupied

- **Profiling float network** (Argo)
  - 100% of total
  - 3° resolution array: 3000 floats

- **Repeat hydrography and carbon inventory**
  - 62% of total
  - Full ocean survey in 10 years

Reference time series 48%
- 56 sites

Global reference mooring network 34%
- 29 moorings planned

Global tropical moored buoy network 73%
- 119 moorings planned

continuous satellite measurements of sea surface temperature, height, winds, and colour
Integration
Interdependent
Indispensable
Responding to Crisis: Deepwater Horizon

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

HFR validation of SABGOM Forecast with satellite detected oil slicks

Web Portal

HFR data informed NOAA trajectory forecasts

Briefing Blog
Responding to Crisis: Japan Tsunami Warning

- International buoy program
- Tsunami wave at DART Station 21418 located 470n mi northeast of Tokyo.
- Largest peak 1.8M
Responding to Crisis: Japan Tsunami Response

CeNCOOS:
- Recorded the tsunami passage with U.S. IOOS sensors
- Five-fold increase in web traffic

NANOOS:
- Featured “Tsunami Evacuation Zones for the Oregon Coast” application
- NANOOS Visualization System provided easy access to current and water height data
- Four-fold increase in web traffic

PacIOOS:
- Provided the only real-time water level and turbidity measurements for Waikiki
- Ten-fold increase in web traffic
Using Social Media to reach out in new ways

Types of Information:

a) Initial info including link to tsunami portal;

b) graphs of water level for various locations;

c) synthesis information

Facebook:

= Posts

= Tsunami event
Responding to Crisis: Hurricane Irene

Around-the-clock data and other information before, during and after hurricanes

- **CaRa:**
  - 4 buoys provided real-time observations

- **SECOORA:**
  - Buoys used to initialized models/verified forecasts.
  - Forecast system used by Coast Guard, North Carolina Division of Emergency Management, National Hurricane Center, USACE, and multiple National Weather Service Forecast Offices

- **MARACOOS:**
  - Surface currents by the High Frequency Radar
  - Delivered forecasts to New Jersey Board of Public Utilities, Connecticut governors office, and Delaware River Basin Commission
  - Underwater glider collected data

- **NERACOOS:**
  - Buoys critical to the National Weather Service
  - Local television stations in Connecticut reported conditions from the NERACOOS buoy
  - Northeast Coastal Ocean Forecast System (NeCOFS) provided to the National Weather Service
U.S. IOOS® : Challenge

• Leveraging resources yields positive results.
• Multi-sector approach is a hallmark of IOOS but adds complexity
• As we are now interdependent both from a fiscal, science and operational perspectives, loss of any 1 funding stream means significant risk to the entire enterprise
• So what is needed?
  – Unified portrayal of what Ocean Observing is critical
  – Coordinated message
  – Continued mutual engagement