

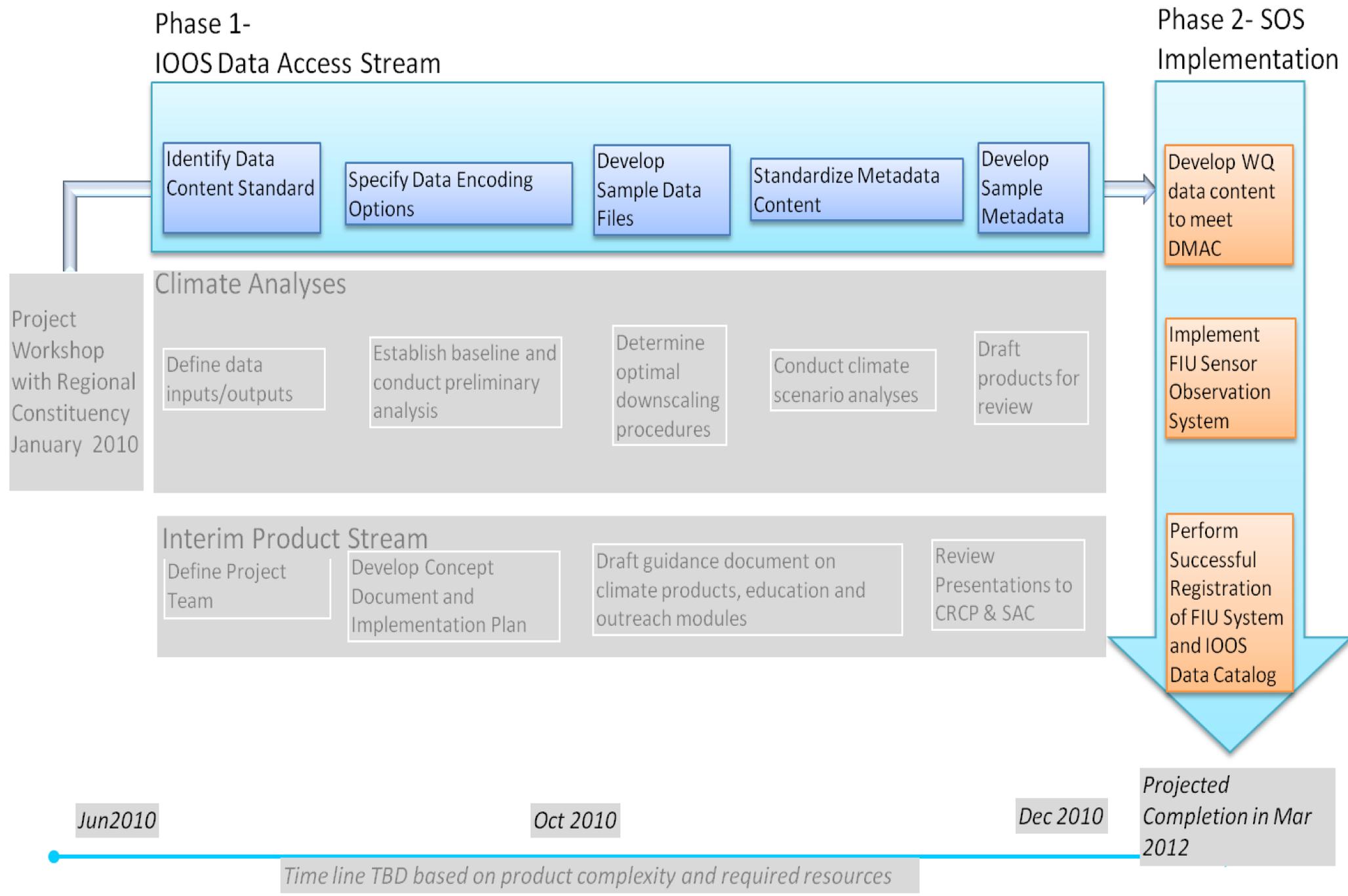
# IOOS Water Quality Activities

IOOS Regional Association  
DMAC Workshop

April 28, 2011

# IOOS IMPACT Water Quality Project

## IOOS- IMPACT Project Implementation Framework



# Development of an integrated decision support tool for beach water quality for Atlantic coastal waters

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## Where we came from individually

**NATIONAL WATER QUALITY MONITORING COUNCIL**  
Working Together for Clean Water

National Monitoring Network for U.S. Coastal Waters and Tributaries

Three major themes

- Beach water quality
- Hypoxia and nutrient enrichment
- Harmful algal blooms

[http://acwi.gov/monitoring/network/3reg\\_wkshp.html](http://acwi.gov/monitoring/network/3reg_wkshp.html)

**Probability maps of bacterial contamination:** USEPA and CTDEP funded a study by ASA for Southport Harbor, CT to determine the location and relative contribution of bacteria sources that resulted in a beach closure for recreational activities. The project focused on elevated fecal coliform levels, which prohibited shellfishing. These model concepts are transferrable to high Enterococcus levels for beach closures. The approach used stochastic, deterministic hydrodynamic, and pollutant transport models and was used to support a bacteria TMDL. This modeling approach can be expanded to a forecast mode using real-time data including those from NERACOOS.

**Rutgers IMCS and NJDEP Rainfall Model:** A real-time application for selected coastal rainfall gages was developed for NJ. These data can be used to target beaches that may be vulnerable to contamination by bacteria during heavy rainfall events. **Wind direction and velocity also can be a predictor.**

<http://njdep.marine.rutgers.edu/>

**Beach Water Quality Assessment and Modeling Activities**

Issue: Exposure to beach swimming waters with elevated bacterial levels is a public health concern.

Goal: Develop and implement scientifically-justified decision-support tools for accurate and defensible preemptive advisory issuance decisions.

Process:

- 1.) Data integration
- 2.) Model development
- 3.) Model validation
- 4.) Operational decision-support tool

Who is doing it: A partnership involving ...

This model improved predicted results and showed transfer value to other areas such as the Chesapeake.

**REGRESSION RESULT qPCR vs. Enterolert/MF**

$$y = 13x + 14.6 \quad R^2 = .62 \quad (r = .79)$$

**qPCR used to track bacteria in NJ.** The USEPA and NJDEP determined at beaches in NJ a significant positive correlation between the QPCR and both MF and Enterolert method measurements of Enterococcus densities at all beaches.

Additional data to evaluate wet weather and tidal influences on bacterial concentrations between qPCR and membrane filtration would be useful.

<http://acwi.gov/monitoring/conference/2008/index.html>

## ABSTRACT

Successful integration of science based assessments for understanding and predicting water quality problems were explored in an Integrated Ocean Observing System (IOOS<sup>®</sup>) Regional Association, multiagency water quality workshop in January 2010. Scientists, coastal resource managers and public health officials from three IOOS<sup>®</sup> Regional Associations: the Southeast Coastal Ocean Observing Regional Association, the Mid-Atlantic Coastal Ocean Observing Regional Association, and the Northeastern Regional Association of Coastal Ocean Observing Systems discussed hypoxia, nutrient enrichment, harmful algal blooms and beach water quality in the context of implemented science based assessments. Beach water quality was identified as the top priority for collaboration between the three IOOS Regional Associations, USGS, USEPA, and NOAA for development of an integrated decision support tool.

Studies have shown that the previous day's precipitation is a predictor of whether waters are safe for swimming. The duration and intensity of rainfall are available from the Next Generation Radar system and when integrated with other available data can be used to forecast water quality conditions. Other continuous data streams include surface currents from High Frequency Radar, sea surface temperature from satellites, streamflow from coastal gaging stations, and meteorological forecasts. The integration of continuous real-time information is facilitated by the emergent IOOS and other data standards and formats that enable more efficient, routine, and effective use of these data types. The integrated decision support tools proposed through this collaboration will offer public health officials another instrument to use when deciding to post swimming advisories or to close beaches.

### Beaches may be vulnerable to contamination when:

- rainfall intensity and duration are high;
- coastal water is moving on-shore from upwelling currents due to wind processes;
- sea surface temperature is elevated;
- turbidity is elevated from increased surface flow and turbulence due to offshore wind

**NEXRAD** data can be used to predict the direction and magnitude of storm events and increased precipitation at various scales.

**NEXRAD** can be displayed at National, regional, and local scales. Each scale can be used to track storm events.

[http://www.nws.noaa.gov/radar\\_tab.php](http://www.nws.noaa.gov/radar_tab.php)

**IOOS HF-Radar** is a valuable tool to determine the direction and magnitude of surface ocean currents. MACOORA area has HF-Radar coverage from Cape Hatteras to Cape Cod.

The direction and magnitude of surface currents may change with the wind. There is a need to determine if HF-Radar can provide beach managers with timely near shore current data.

<http://hfradar.ndbc.noaa.gov/>

**NOAA Sea Surface Temperature (SST)** from satellite imagery can be used to determine where surface temperatures are elevated in coastal waters

Considerable variability in water temperature can occur—southern beaches will be warmer sooner.

<http://www.osdpd.noaa.gov/ml/ocean/sst/>

**USGS continuous real-time discharge** data can be used to determine if rainfall events are affecting surface- water flow near coasts and causing turbid conditions.

<http://waterdata.usgs.gov/pa/nwis/rt>

**AUV glider robots** that collect 3-D data on currents and water quality along the coast have been deployed by Rutgers, Maryland, Connecticut, and Old Dominion Universities.

<http://marine.rutgers.edu/cool/auvs/>

**USGS Water Quality Watch** and other sources of continuous real-time data can be used to determine if coastal temperatures or turbidity levels are elevated.

<http://waterwatch.usgs.gov/wqwatch/>

## Where the team would like to go together

### Objectives include:

- develop an integrated decision support tool to predict beach water quality conditions;
- integrate point, spatial, and Lagrangian continuous real-time data;
- integrate data from watersheds, estuaries, and coastal areas;
- identify beaches that may be vulnerable to elevated contamination from bacteria;
- provide data for adaptive monitoring at sites that are most vulnerable.

**IOOS Testbed Team Structure**

- Testbed "Management" (Don Wright, SURA) - 25 members
- Cyber Infrastructure (Eoin Howett, ASA) - 20 members
- Estuarine Hypoxia (Chesapeake Bay, Caiti Priebe, USGS) - 21 members
- Shelf Hypoxia (Gulf of Mexico, John Harding, MSU) - 20 members
- Coastal Inundation (Gulf and East Coast, Rick Upton, UNCG) - 24 members

**IOOS Data Management and Communications Subsystem**

Observations: SOS (Sensor Observation Service), In situ observations, Gridded Model Output, Satellite and High Frequency Radar Data

Model Outputs, Decision Support Tools, Visualization Tools

DAP (Data Access Protocol) and OGC WCS (Web Coverage Services)

IOOS Web Services Layer

The subsystem is capable of delivering real-time, database-mode, in-situ and remotely-sensed physical, chemical, and biological observations. These data can be used by beach water quality models and decision support tools.

<http://testbed.sura.org/>

Efforts of the IOOS SURA Testbed and the Data Management Subsystem will provide a common cyber infrastructure for model data.

**USGS WaterAlert**

The U.S. Geological Survey WaterAlert service sends e-mail or text messages when certain parameters measured by a USGS data-collection station exceed user-definable thresholds. The development and maintenance of the WaterAlert system is supported by USGS and its data-collection partners, including numerous federal, state, and local agencies.

The **USGS WaterAlert** system is an example of a real-time notification system that determines if streamflow or a water-quality constituent (i.e. temperature or turbidity) is above or below a selected rate or concentration.

<http://water.usgs.gov/wateralert/>

**MARACOOS "Beach Basics"** links observing and data management capabilities with educational product development for improving beach safety – an issue that cross-cuts three regional themes including Maritime Safety, Water Quality, and Coastal Inundation. The E&O team is developing a series of data products including explanations of alongshore currents, waves, rip currents, weather conditions, water quality (bacteria, floatables) and swimmer safety.