

Data Management within SEACOOS

Southeastern Atlantic Coastal Ocean Observing System

Near Real Time Ocean Observations Online

The (tiny) big picture

Near Real-Time Ocean Observations Online: Data Management within the Southeast Atlantic Coastal Ocean Observation System (SEACOOS)

¹C. Purvis, ¹J. Cothran, ²J. Donovan, ¹M. Fletcher, ³S. Haines, ²R. Helber, ²C. Hu, ⁴E. Kearns, ²F. Muller-Karger, ²B. Murch, ⁵J. Nelson, ¹D. Porter, ³H. Seim, ²V. Subramanian, ²J. Taylor, ²R. Weisberg, ⁴E. Williams

¹University of South Carolina, ²University of South Florida, ³University of North Carolina, ⁴University of Miami, ⁵Skidaway Institute of Oceanography <http://seacoos.org>

Abstract

Even though a picture can speak a thousand words, can it meaningfully represent millions of near real-time ocean data observations from a variety of data sources? It is within the SEACOOS online observation portal that SEACOOS partners and affiliates coordinate and integrate disparate datasets into an interactive geographic information system (GIS).

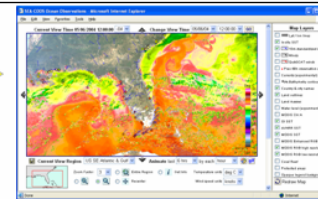
SEACOOS partners and affiliates contribute to a centralized data repository by providing both in-situ and remotely sensed data in a standard format. These data are segmented, processed, and normalized to provide a view of information ranging from near real-time in-situ and sea surface temperature data to near real-time remotely sensed products, including sea surface temperature, ocean color, and laser altimetry. The coordination of disparate datasets, namely their respective temporal and spatial resolutions, was made possible by the use of relational databases and other technologies.

Open source software solutions are well suited for the database normalization back-end tasks as well as the core GIS functions of the front-end. In addition to typical GIS mapping functionality, the online observation portal includes annotation capabilities, robust point data and raster data querying capabilities, and time-series graphing utilities. Refining the interface to meet both general and specific user needs remains an ongoing process, but the modularity of the existing tools within the portal provides an exceptional foundation on which to build.



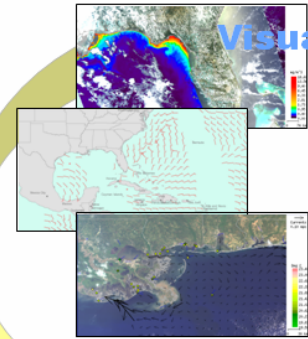
Normalization

With so many data available to describe near real-time conditions of the ocean, SEACOOS has to coordinate more than just zones and users. Many instruments report ocean condition data at different intervals, e.g. some may report every ten minutes while others may report on the hour or only several times per day. Remotely sensed images are also similarly challenging to coordinate since specific data reporting times and coverage areas may vary from day to day. As a result of these inherent temporal and spatial issues, normalization occurs at the central database in order to provide a unified collection of truly coordinated data.



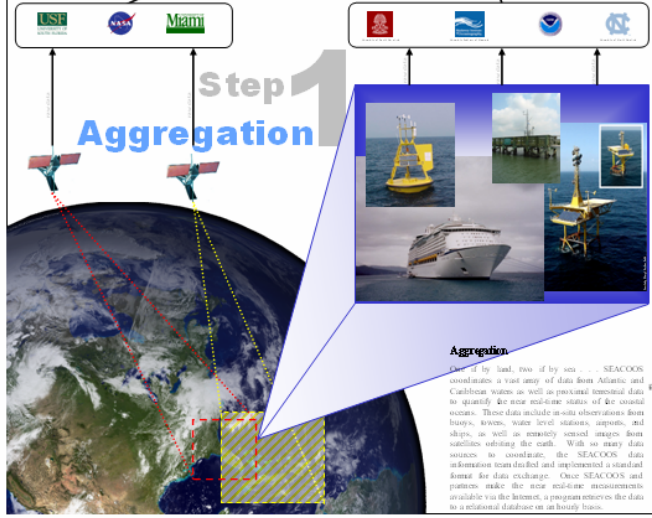
Visualization

A picture can speak a thousand words. An internet mapping application provides an interactive portal to the SEACOOS integrated data. With powerful database and file management tools as well as visualization software users can access the near real-time data in a customized fashion. The online interface allows for traditional mapping functionality such as zooming and panning, but it also provides annotation capabilities to allow the user to look at ocean condition changes over time. Ad-hoc data extraction is also available to allow the user to "drill-down" to the data and compare remotely sensed image values with in-situ measurements, for example. Time-series graphing is another tool the interface offers to examine changes in ocean conditions at specific areas over time.



Dissemination

The coordinated data have tremendous standalone value, and SEACOOS provides multiple points of entry to these data. SEACOOS maintains metadata records to allow users to access the original data source's Distributed Ocean Data System (DODS), <http://www.usdata.usc.edu/tracks60606/> servers for scientific and historical analyses. Also, with emerging data transfer technologies such as those defined by the Open GIS Consortium (OGC), <http://www.opengeps.org/> SEACOOS has already demonstrated that OGC-compliant data layers provide valuable support for other initiatives, such as the Integrated Ocean Observing System's (IOOS) Interoperability Project (<http://www.ioosopen.org/>). Customized data access and interface approaches are also being implemented in order to target a variety of specific audiences such as K-12 and higher education classrooms and scientific, fisheries, and emergency management operations.



Aggregation

Overlaid by land, two if by sea... SEACOOS coordinates a vast array of data from Atlantic and Caribbean waters as well as proximal terrestrial data to quantify the near real-time status of the coastal ocean. These data include in-situ observations from buoys, towers, water level stations, airports, and ships, as well as remotely sensed images from satellites orbiting the earth. With so many data sources to coordinate, the SEACOOS data information team drafted and implemented a standard format for data exchange. Once SEACOOS partners make the near real-time measurements available via the internet, a program retrieves the data to a relational database on an hourly basis.

Acknowledgments: SEACOOS is a collaborative regional program sponsored by the Office of Naval Research under Award No. N00014-02-1-0972 and managed by the USMC Office of the President.

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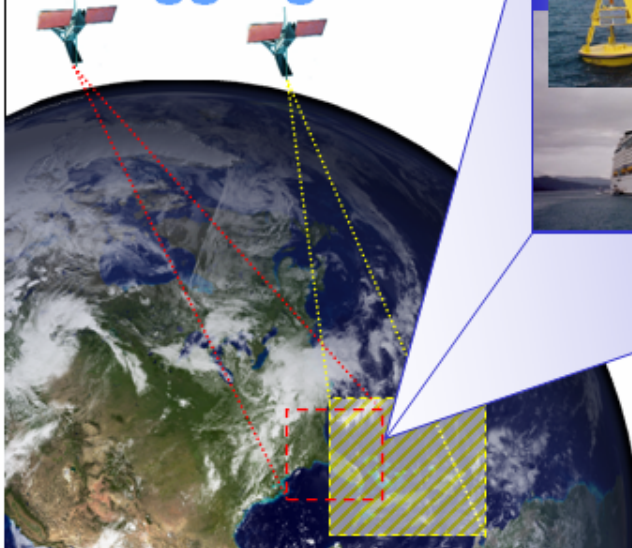
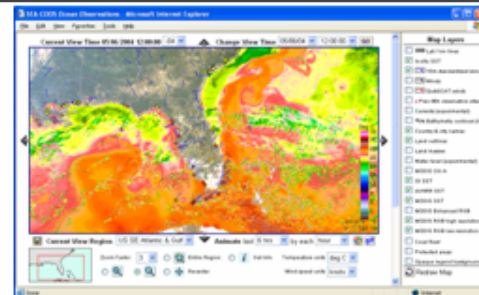
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Open source software solutions are well suited for the database normalization back-end tasks as well as the core GIS functions at the front-end. In addition to typical GIS mapping functionality, the online observation portal includes animation capabilities, robust point data and raster data querying capabilities, and time-series graphing utilities. Refining the interface to meet both general and specific user needs remains an ongoing process, but the modularity of the existing tools within the portal provides an exceptional foundation on which to build.



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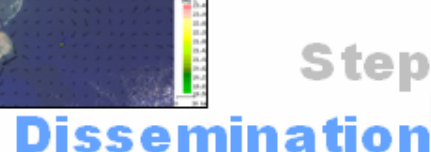
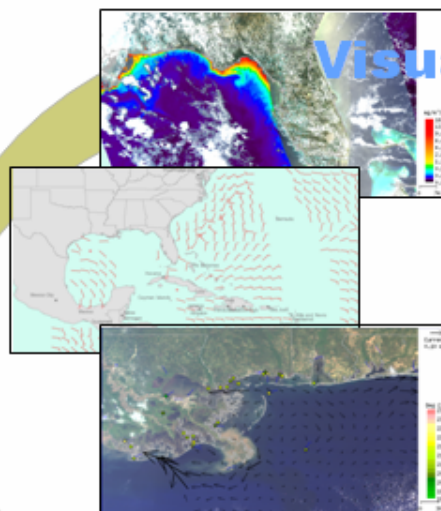
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The nuts & bolts

- Data is aggregated and stored
- Data is normalized
- Data is visualized
- Data is disseminated

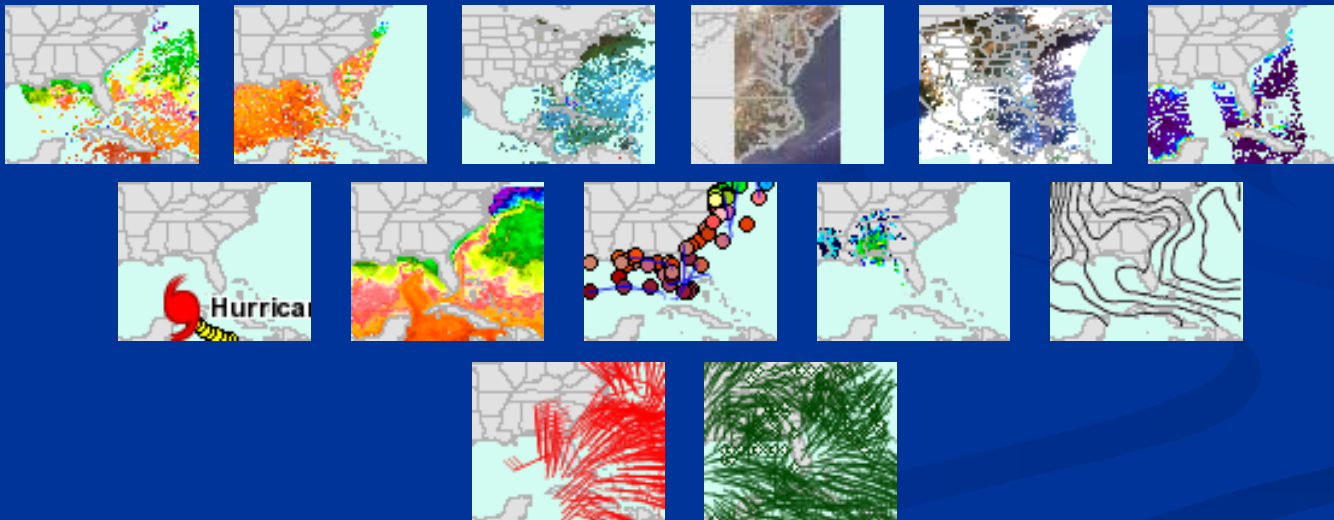
Let's work sdrawkcab

4. Data is disseminated
3. Data is visualized
2. Data is normalized
1. Data is aggregated and stored

Dissemination

- OPeNDAP (DODS) data access
- OGC-friendly: WMS, WFS
- pick a layer, any layer

http://nautilus.baruch.sc.edu/seacoos_misc/show_sea_coos_obs_time_ranges.php



Dissemination : example 1

■ NC OneMap Viewer

[http://gisdata.usgs.net/
website/NC_OneMap/
viewer.asp](http://gisdata.usgs.net/website/NC_OneMap/viewer.asp)

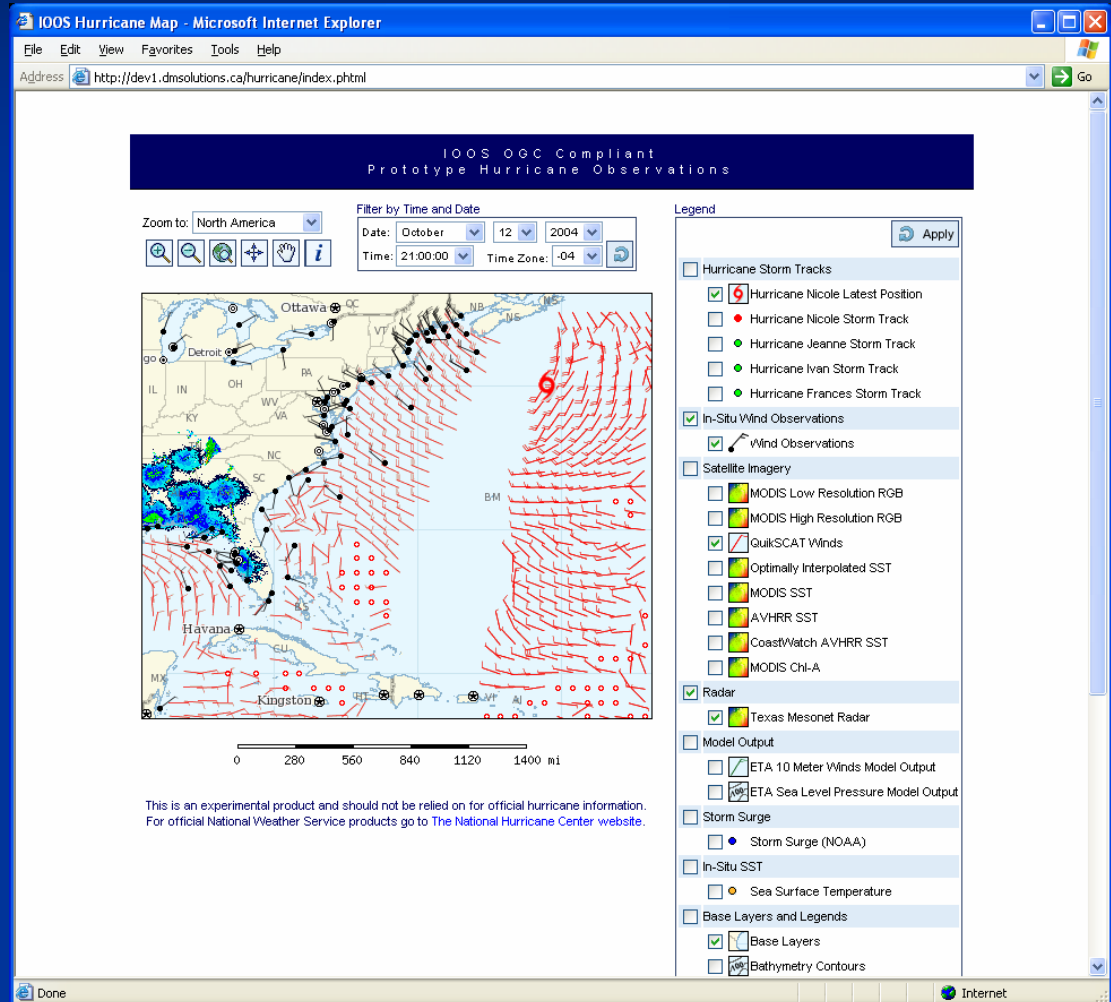
U.S. Department of the Interior || U.S. Geological Survey || EROS Data Center
URL: http://gisdata.usgs.net/website/NC_OneMap/ || Maintainer: webmapping@usgs.gov || Modified: June 28, 2004

Map: -75.47, 33.31 -- Image: 662, 428 -- ScaleFactor: 0.013629629629634

Dissemination : example 2

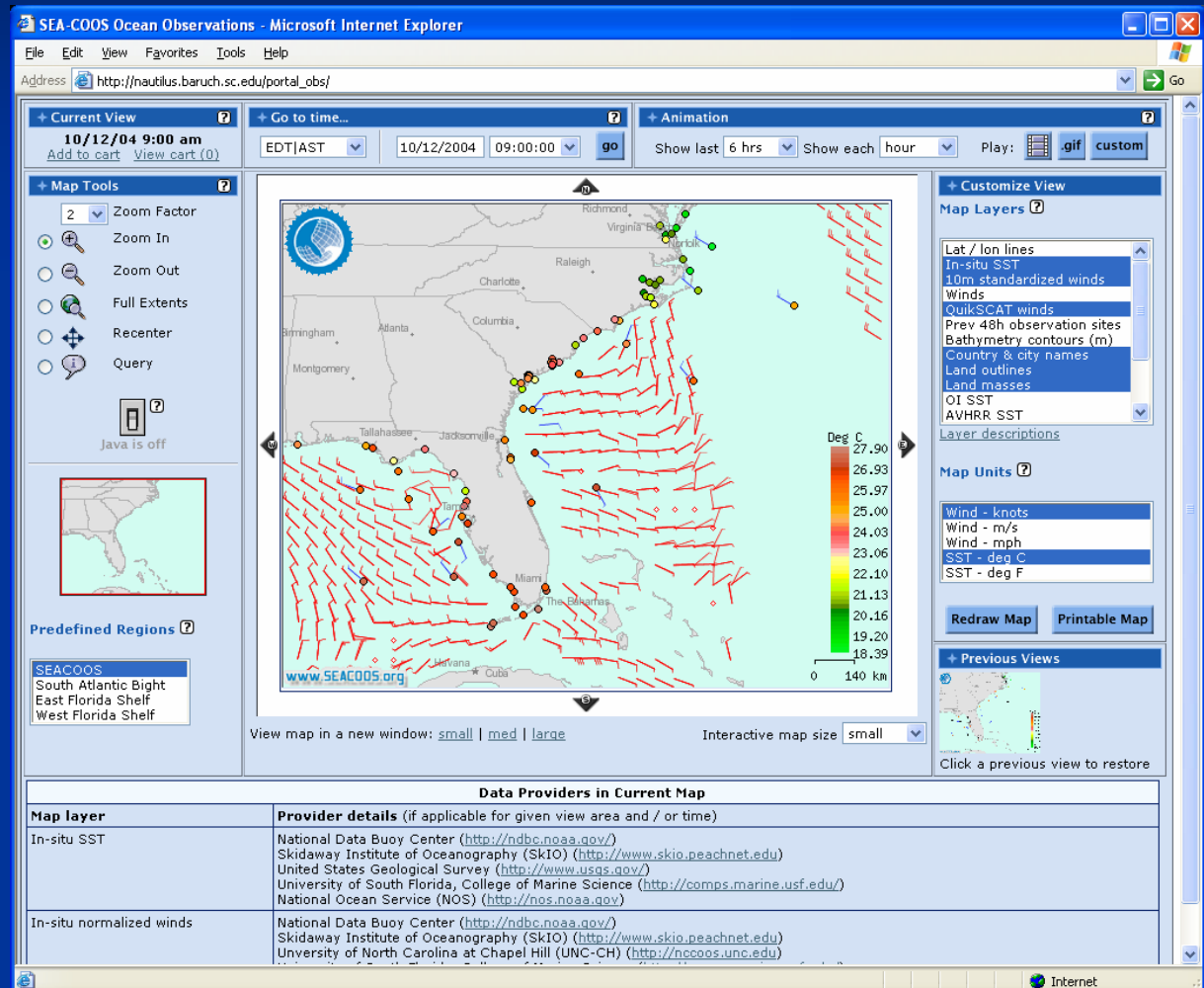
■ Integrated Ocean Observing System hurricane demo

<http://openioos.org>



Visualization : example 1

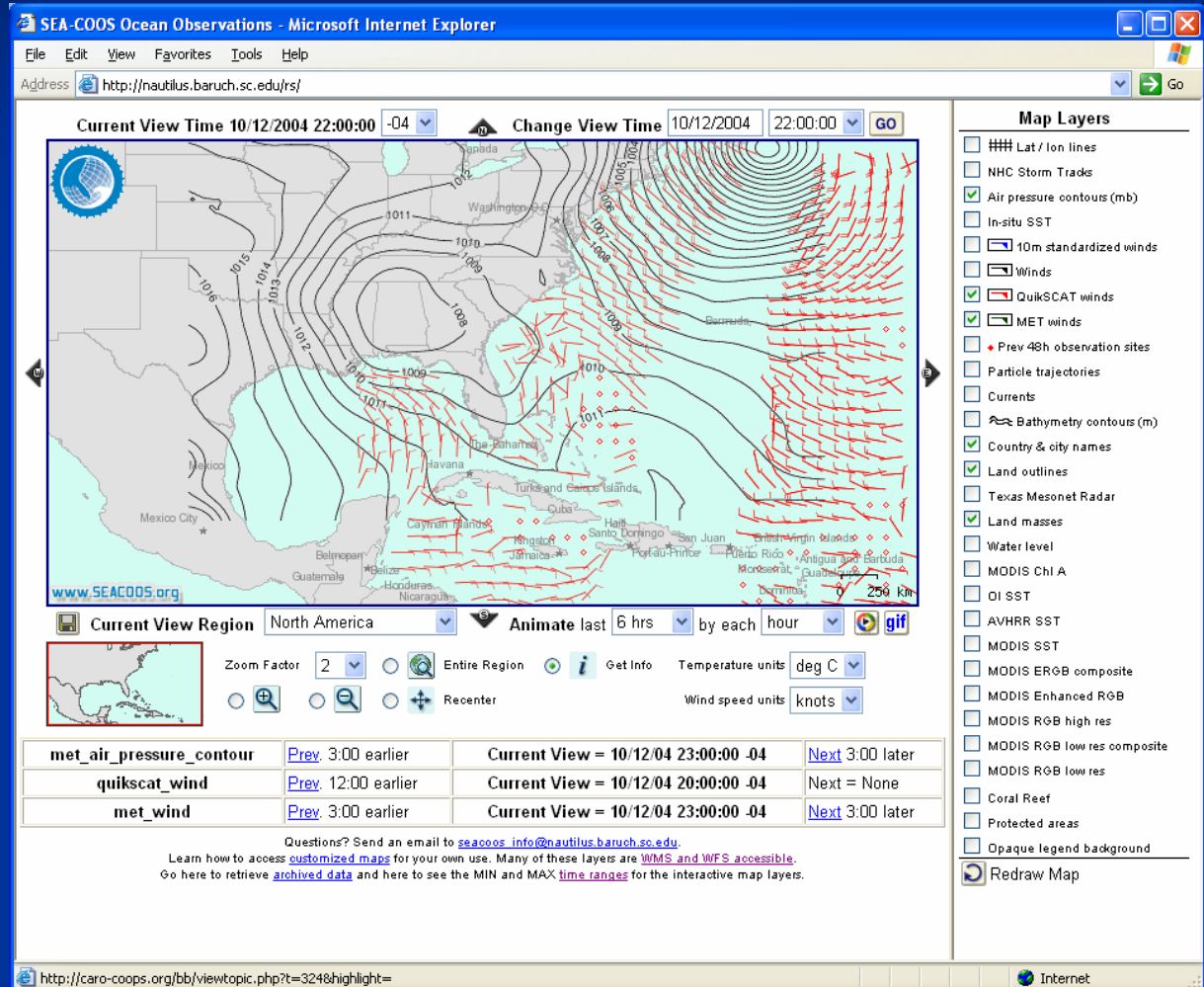
■ [Production site](http://www.seacoos.org)
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Data Management within SEACOOS

Visualization : example 2

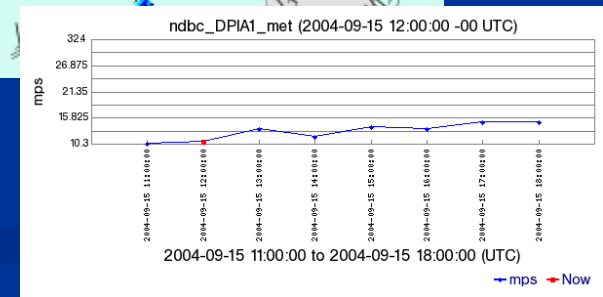
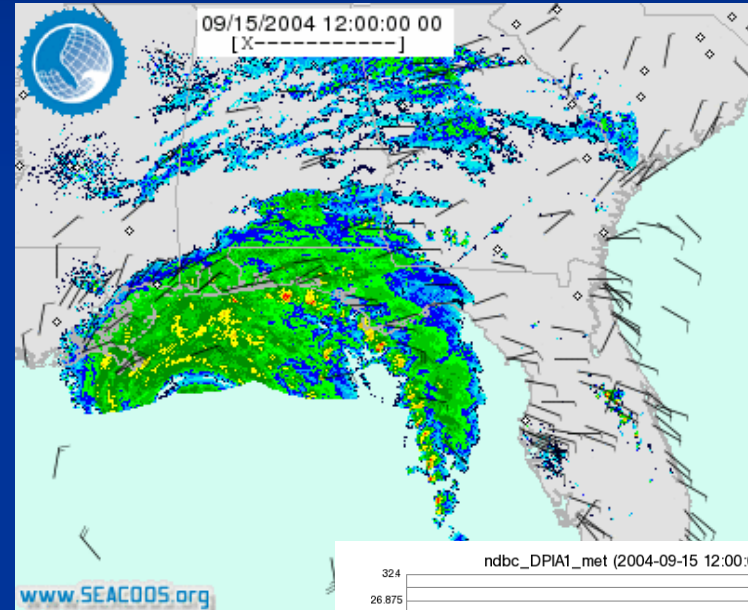
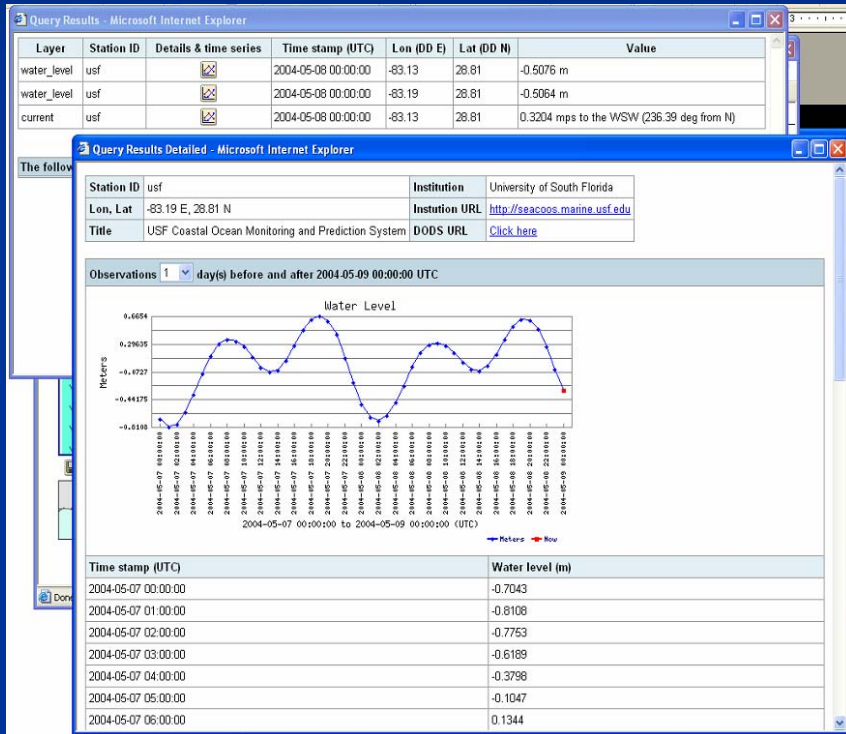
- [Development site](http://nautilus.baruch.sc.edu/rs)
- [Model dev site](http://nautilus.baruch.sc.edu/model_rs)
- Main engines
 - PHP
 - PHP-MapScript
 - Perl
 - MapServer



Visualization fun : graphs & animations

■ Ad-hoc time-series graphs

■ Ad-hoc animations



Normalization

- Reporting time varies
 - In-situ data
 - E.g. daily, hourly, half-hourly, every 10 minutes
 - Remotely-sensed data
 - E.g. twice daily
- Reporting area varies
 - Remotely-sensed data passes
- Round-the-clock updating is resource intensive
 - Balance the server load

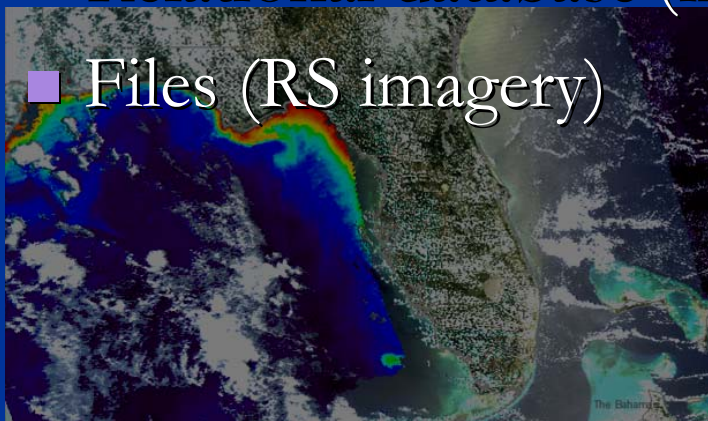


Data aggregation & storage

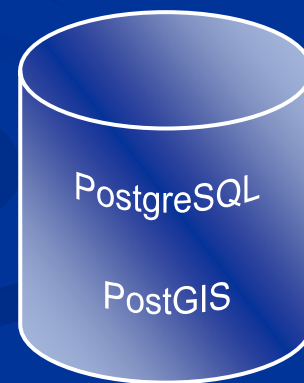
- Aggregation format flavors
 - netCDF (in situ and remotely-sensed data)
 - PNG (RS imagery)
- Storage
 - Relational database (in situ, model output, some RS)



- Files (RS imagery)



- Technology
 - Perl
 - PostgreSQL & PostGIS



Magic 8 ball

- Track the audience
 - Monitor layer hits and areas of high interest
 - Map it!
- Foster communication
 - Intranet + Internet

A friend in the business

- Production site: <http://seacoos.org>
- Development site: <http://nautilus.baruch.sc.edu/rs>
- Very active listserv dealing with mainly remote-sensing issues: remotesensing@caro-coops.org
 - [mailto: majordomo@caro-coops.org](mailto:majordomo@caro-coops.org)
 - message text: subscribe remotesensing
- Who am I?
 - Charlton Purvis, University of South Carolina, SEACOOS
 - cpurvis@sc.edu
 - Happy to help and share.