INTEGRATION OF ENVIRONMENTAL INFORMATION SYSTEMS

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A major challenge of the “information age”-- to share and integrate environmental information from multiple sources.

What is required -- Interoperability

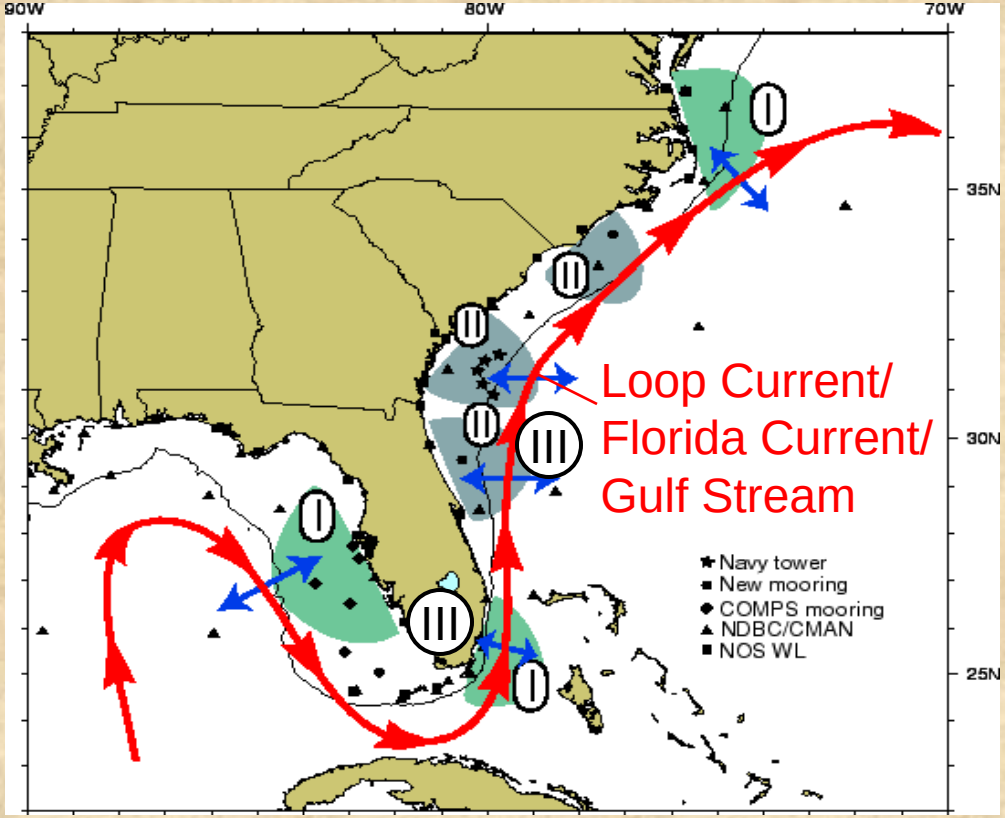
•increases utility of distributed databases
•creates efficiencies in data generation and use
•makes it possible to apply a broader spectrum of environmental information to any given problem.

But
•difficult and time consuming
•must deal with differences in measurements, data, and data management.

Coastal ocean observing systems have addressed interoperability– examples is the Southeast Atlantic Coastal Ocean Observing System (SEACOOS).

SEACOOS: a southeast regional system

SEACOOS was initiated in 2002 with ONR funding to develop a coastal ocean information system for FL, GA, SC and NC



Nick Shay, RSMAS

Goal:
To increase the quantity and quality of environmental information from the coastal ocean of the SE U.S. and facilitate its use in a range of societal, scientific, and educational applications.

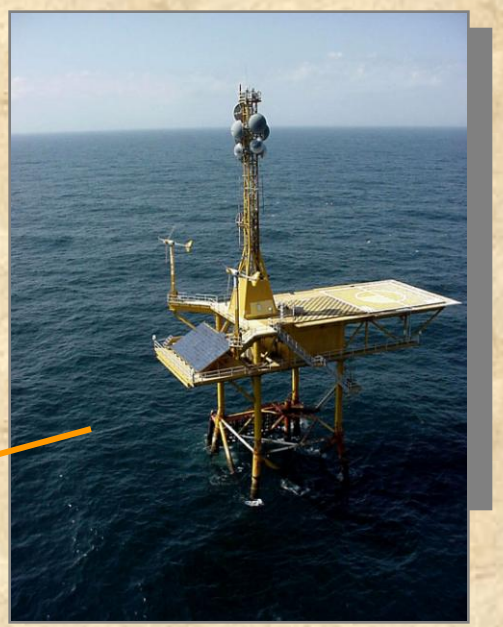
SEACOOS Members (May 2005)

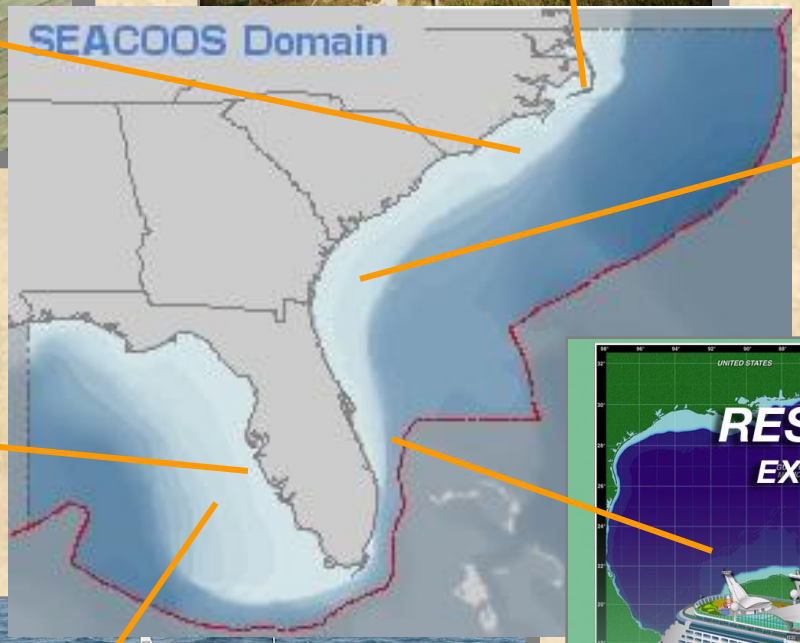
Founding Members	Affiliates	Pending Affiliates
University of North Carolina	Beaufort TACTS/NSWC/USN	NRL/USN
Skidaway Inst of Oceanography	CO-OPS/NOS/NOAA	SFOMC
University of South Carolina	FKNMS/NOAA	Field Research Facility/USACE
University of South Florida	MMAB/EC/NCEP/NWS/NOAA	CLION/DOD
University of Miami	Miami WFO/NWS/NOAA	Jacksonville WFO/NWS/NOAA
NCSU (Sea Grant)	NCDDC/NOAA	NAMOC/USN
University of Georgia	NDBC/NOAA	Florida Spaceport
University of Florida (Sea Grant)	SeaKeys/FIO	
South Carolina Sea Grant	Southeast Fisheries Science Center/NMFS/NOAA	
SCDNR	AOML/NOAA	
	Fish Wildlife Research Institute	
	Caro-COOPS	
	Beaufort, NC Marine Lab/NOAA	
	CORMP	
	SAFMC	
	CSC/NOAA	
	GRNMS/NOAA	

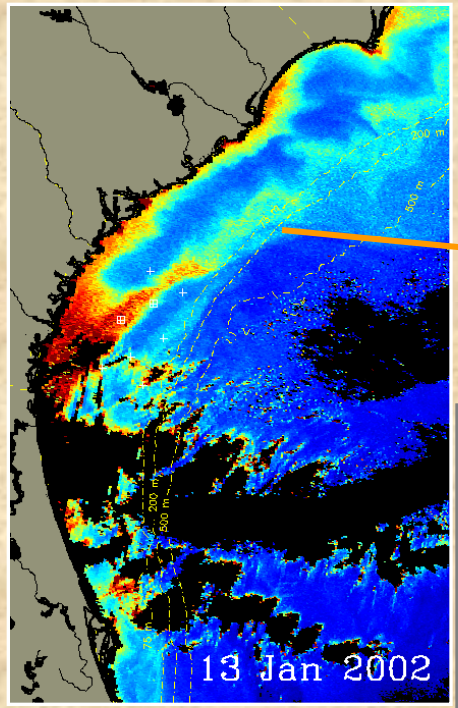
The National Backbone of NOS NWLON and NDBC CMAN & Buoys

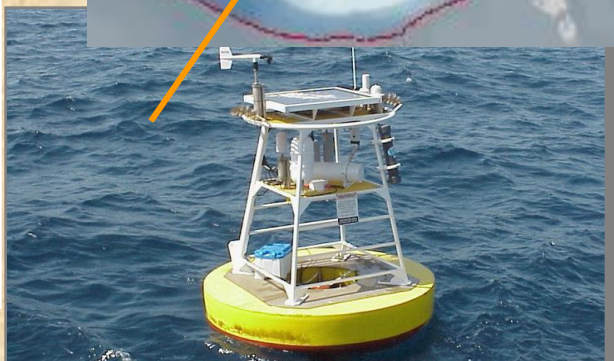
SEACOOS Partner Additions of in-situ Buoys/Towers/Coastal

Observing the Coastal Ocean with a variety of tools









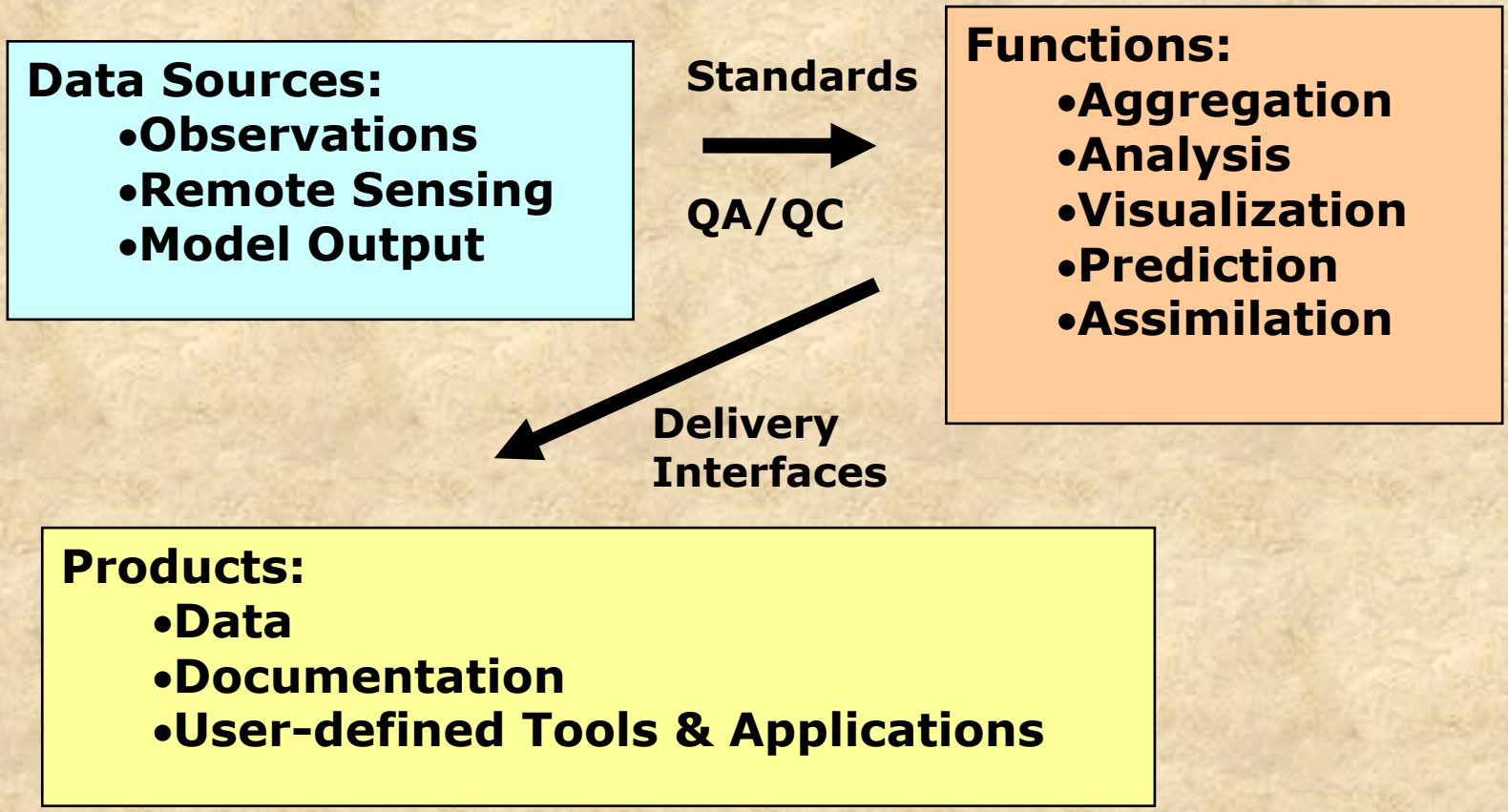
Three major bottlenecks preventing prediction or timely response to critical events:

- Access and integrated use of distributed, heterogeneous data
- Insufficient density of appropriate data observations
- Insufficient predictive model development

Access to the data is the primary limitation

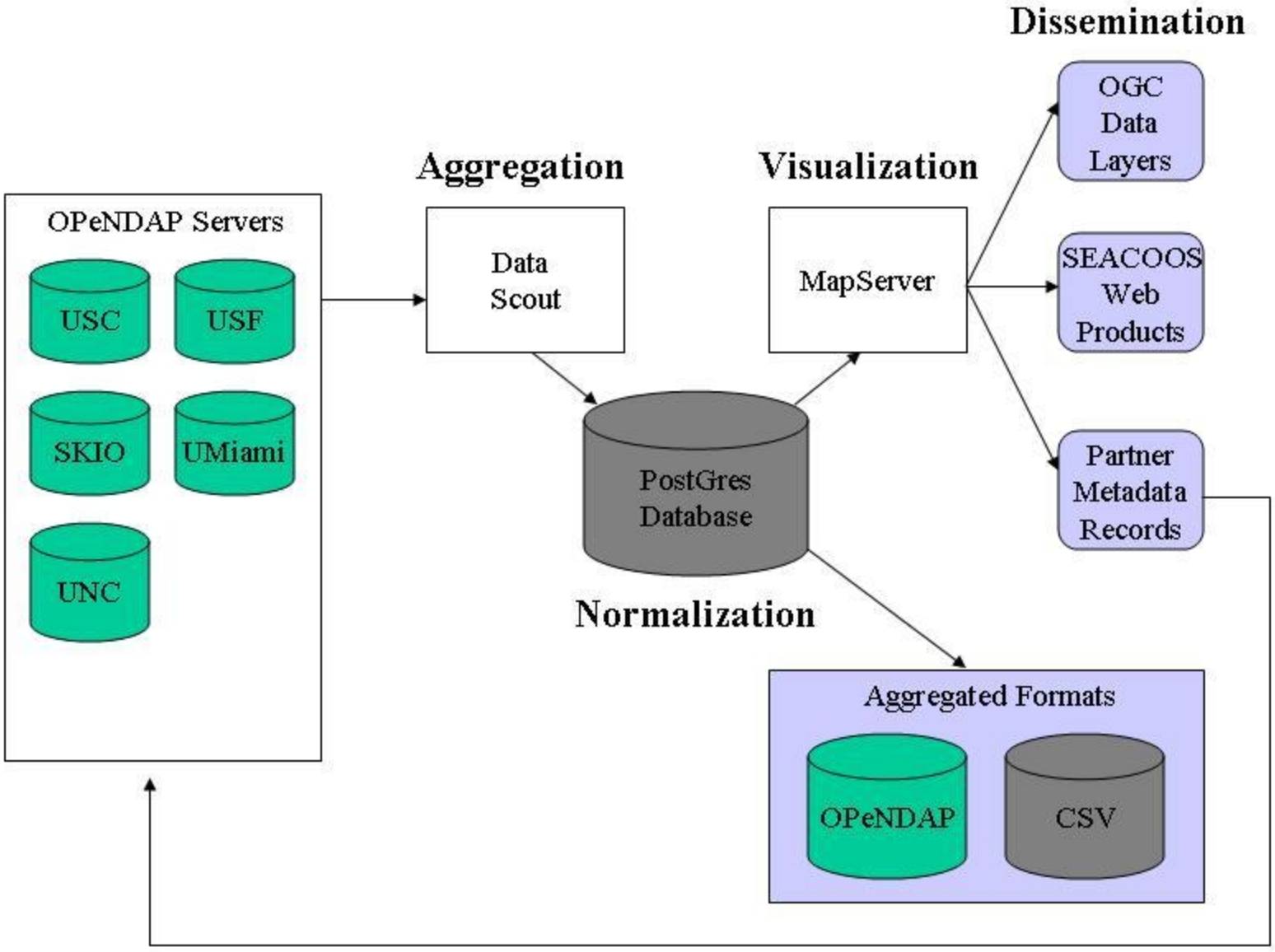
Principles of SEACOOS Information Management

- Retain observation systems and associated databases at primary sources -- no attempt to centralize
- Build upon existing resources and practices as much as possible –
  - support participant autonomy
  - conserve resources
  - promote rapid progress
- Establish “open access” policy
  - data freely accessible in a timely manner
  - IM developments could be readily adopted by others



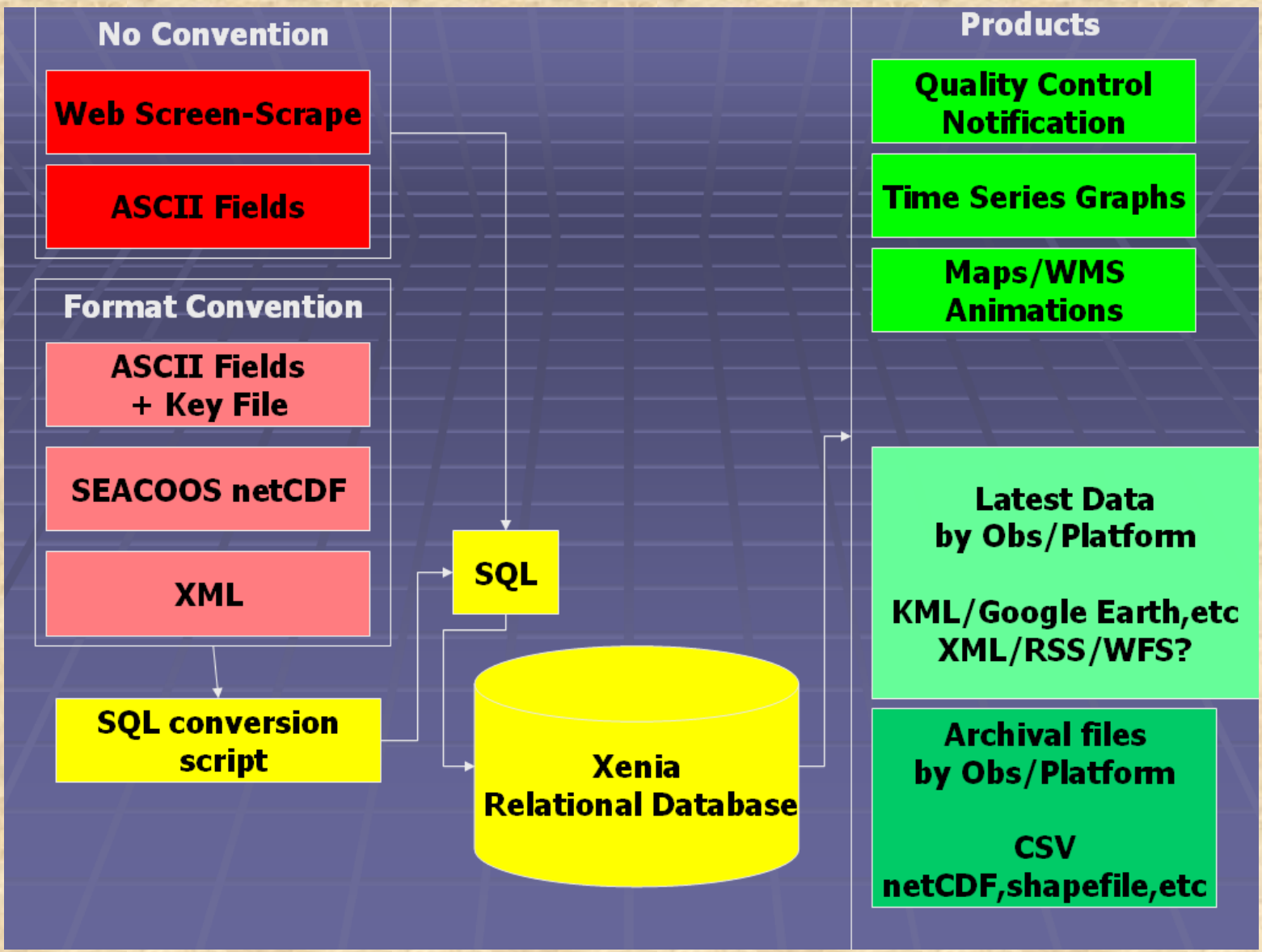
Relationship between data sources, the different ways in which data can be processed or utilized, and types of information products available to users.

SEACOOS Data Flow



Interoperability requires:

- Common vocabulary – “data dictionary”
- Mechanisms for data transport
- Metadata – MetaDoor
- Dissemination tools – Map-based tools
- Documentation and information sharing – SEACOOS Cookbook

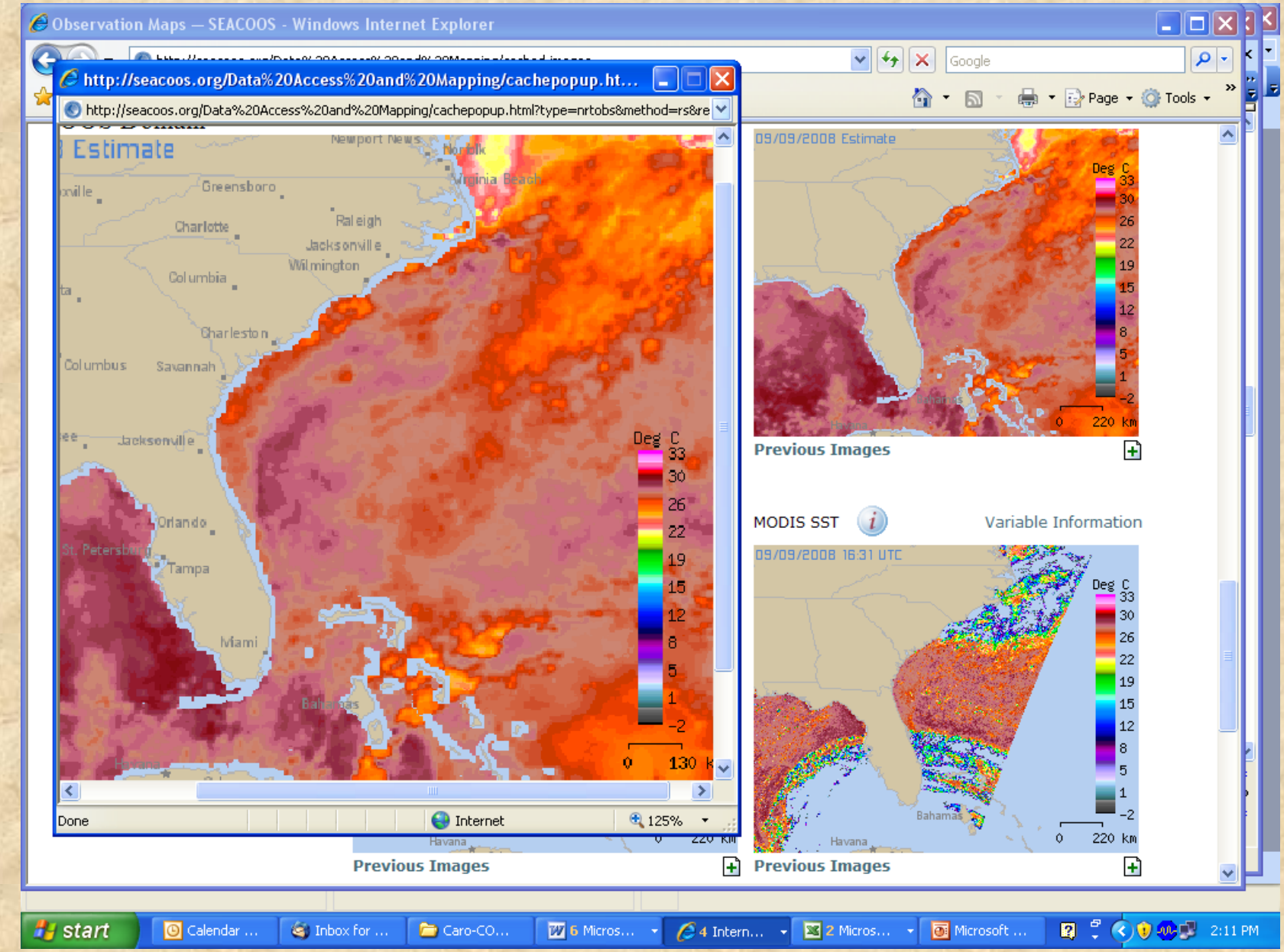


Schematic diagram representing data flow in the Xenia Relational Database, illustrating the multiple data formats and data products accommodated.

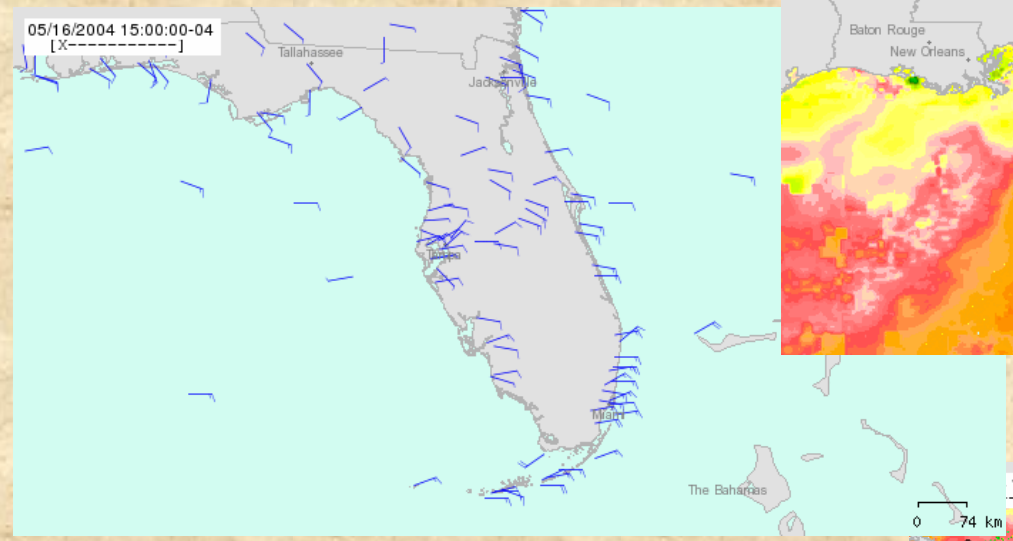
Two basic types of map presentations

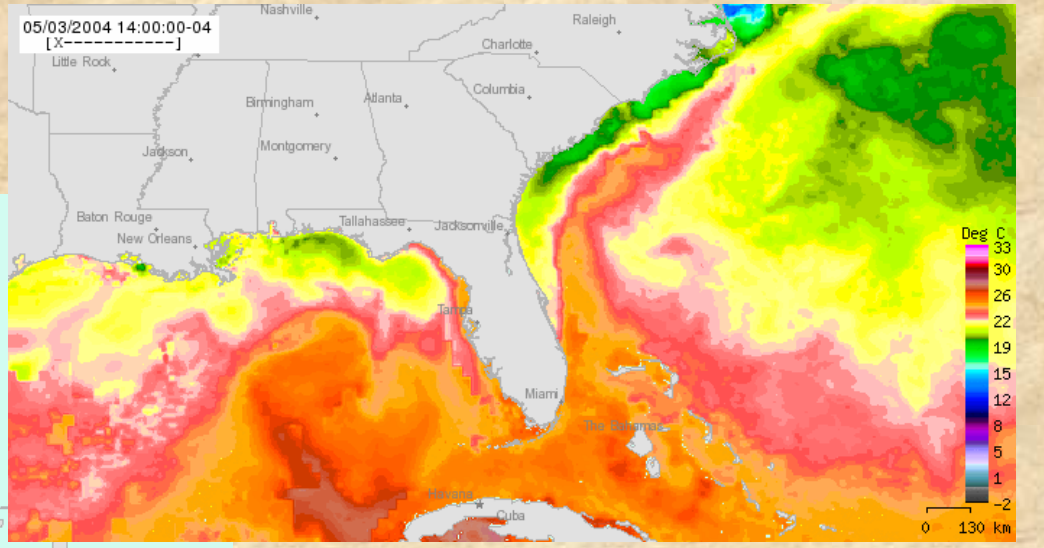
- Report-based maps
- Interactive maps

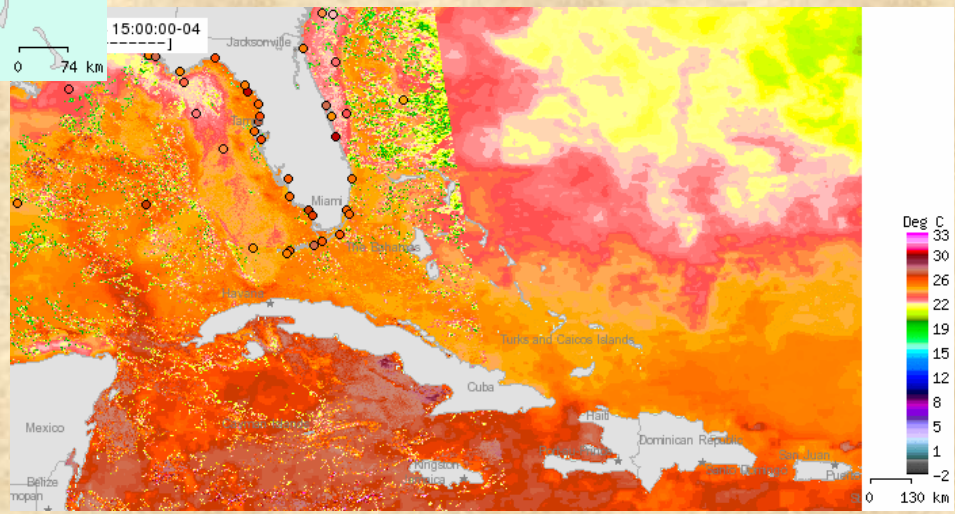
Report Based:



Visualization of real time data

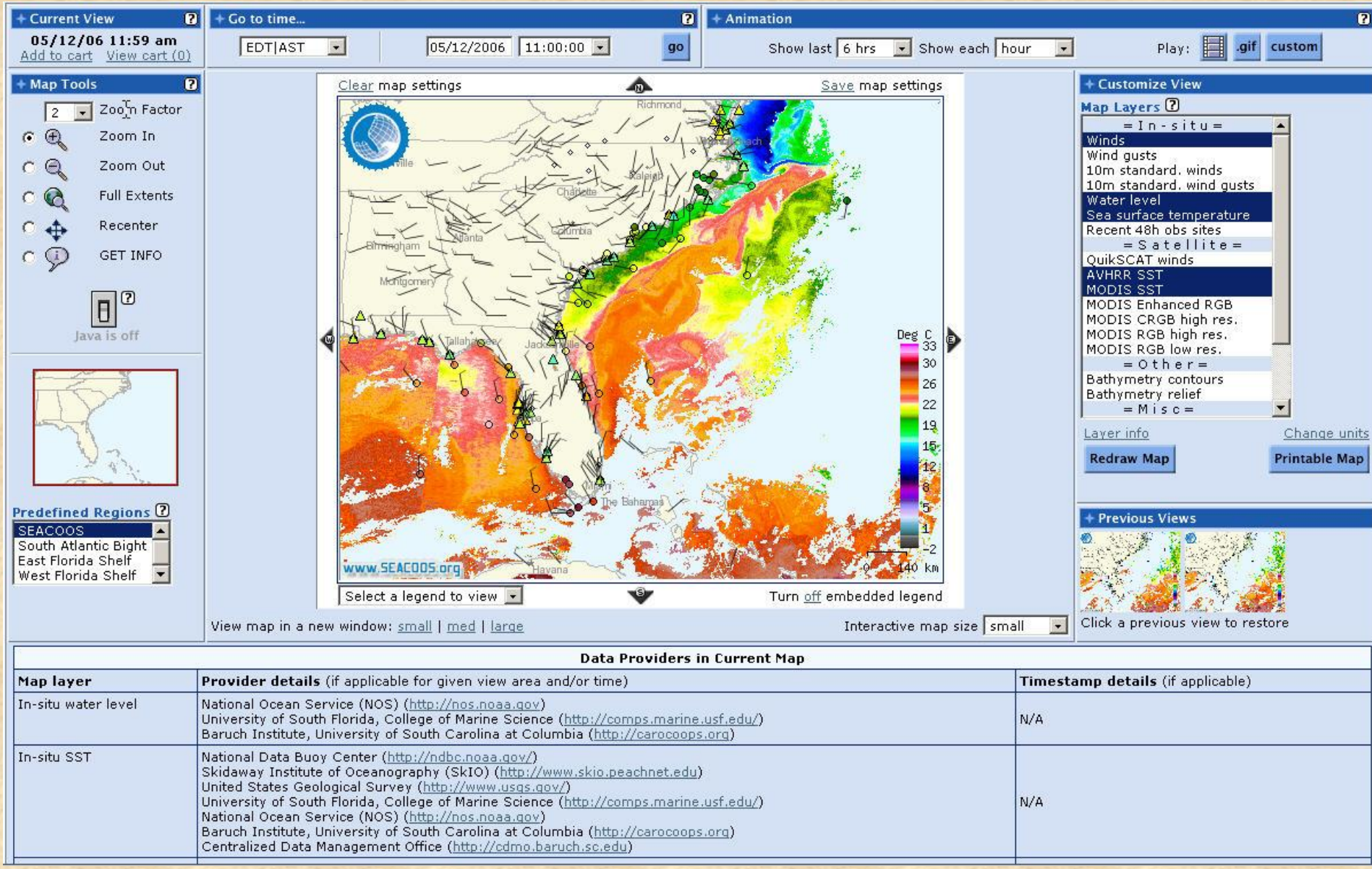






Accessing data from multiple sources

Aggregating data for visualization platforms

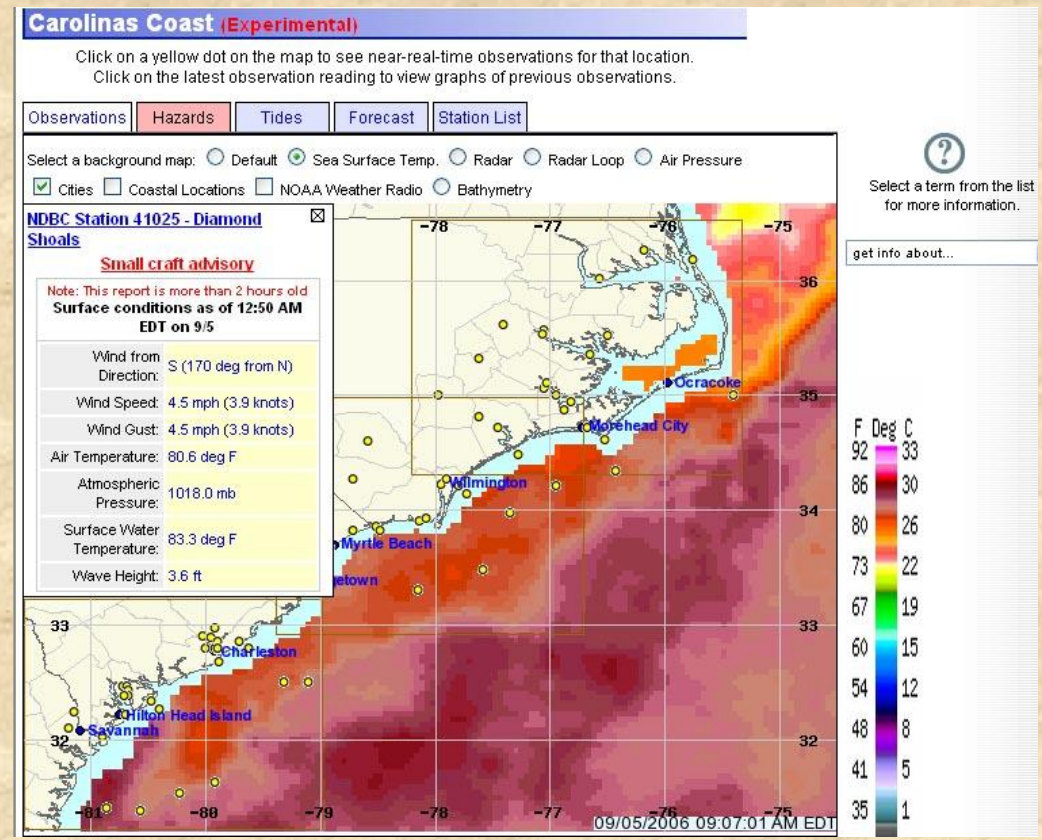


Data Providers in Current Map		
Map layer	**Provider details** (if applicable for given view area and/or time)	**Timestamp details** (if applicable)
In-situ water level	National Ocean Service (NOS) (http://nos.noaa.gov) University of South Florida, College of Marine Science (http://comps.marine.usf.edu/) Baruch Institute, University of South Carolina at Columbia (http://carocoops.org)	N/A
In-situ SST	National Data Buoy Center (http://ndbc.noaa.gov/) Skidaway Institute of Oceanography (SkIO) (http://www.skio.peachnet.edu) United States Geological Survey (http://www.usgs.gov/) University of South Florida, College of Marine Science (http://comps.marine.usf.edu/) National Ocean Service (NOS) (http://nos.noaa.gov) Baruch Institute, University of South Carolina at Columbia (http://carocoops.org) Centralized Data Management Office (http://cdmo.baruch.sc.edu)	N/A

Interactive Maps: **Screenshot showing remote sensing images of SST combined with in-situ SST, winds, and water levels**

Carolinas Coast

Built on the strengths in data aggregation and IT development by coastal ocean observing programs in the region through:



Aggregation of near real-time observations from in-situ platforms, models, and remote sensing

Application of technologies developed by SEACOOS, Caro-COOPS, and CORMP

Integration with NOAA NWS observations and products

Leveraging of outreach activities within the NWS and the coastal ocean observing programs

NATIONAL WEATHER SERVICE

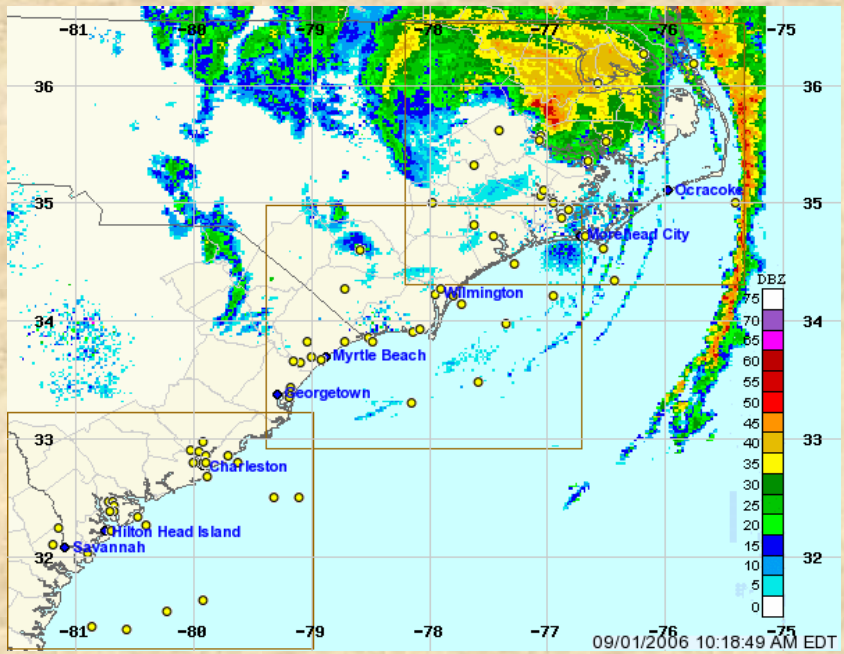
Caro-COOPS

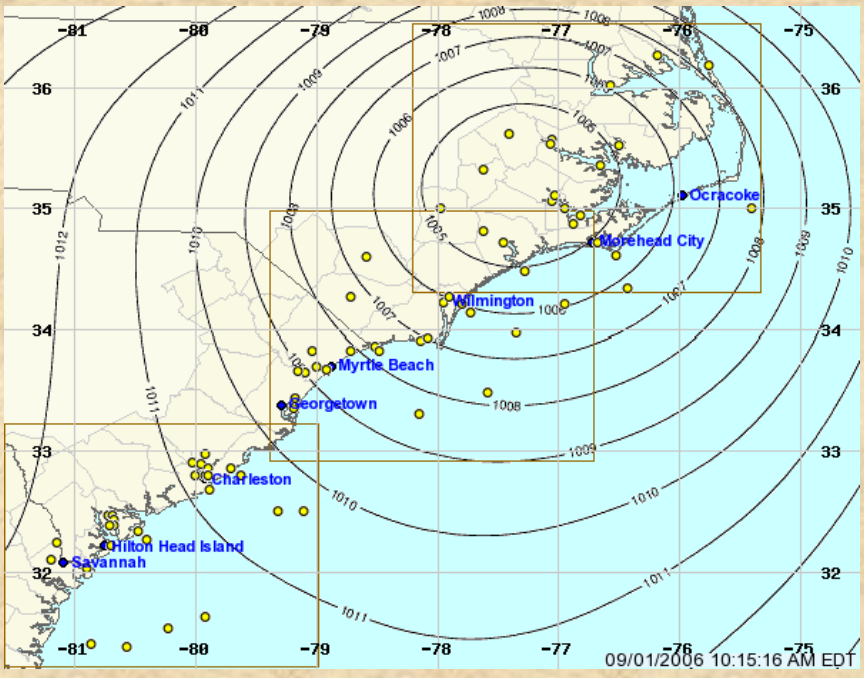
Carolinas Coastal Ocean Observing and Prediction System

SOUTHEAST ATLANTIC COASTAL OCEAN OBSERVING SYSTEM

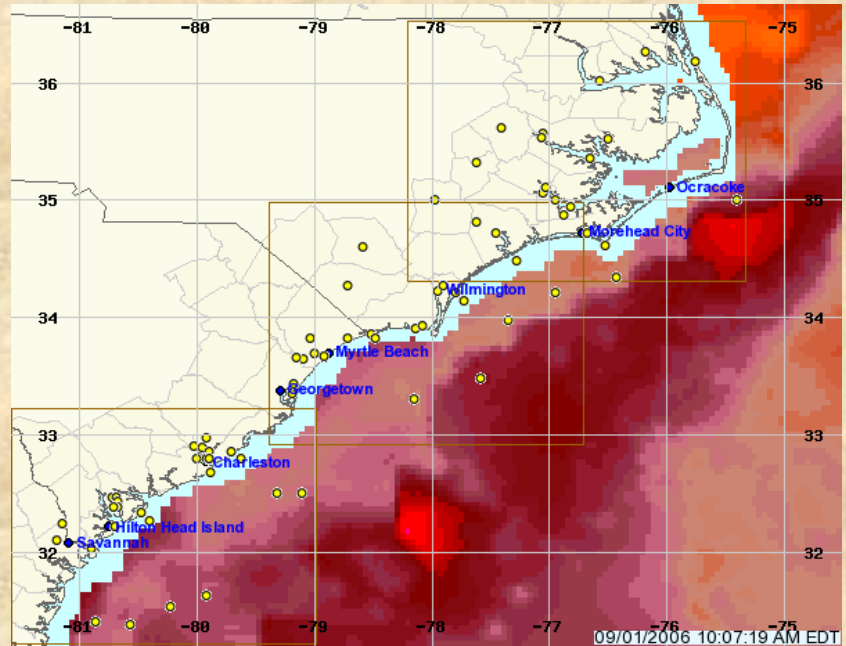
CORMP

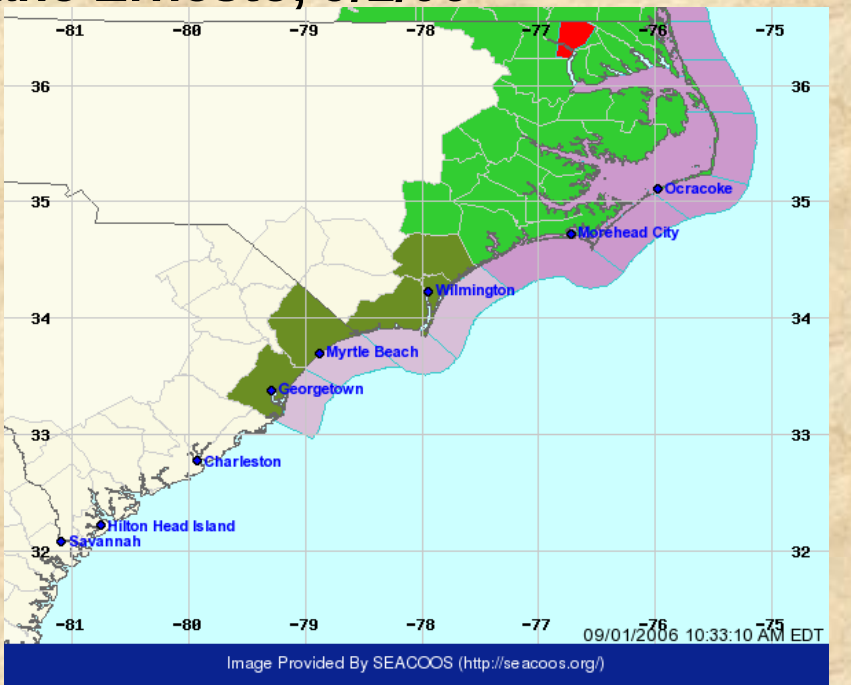
Coastal Ocean Research and Monitoring Program





Some examples from Hurricane Ernesto, 9/1/06

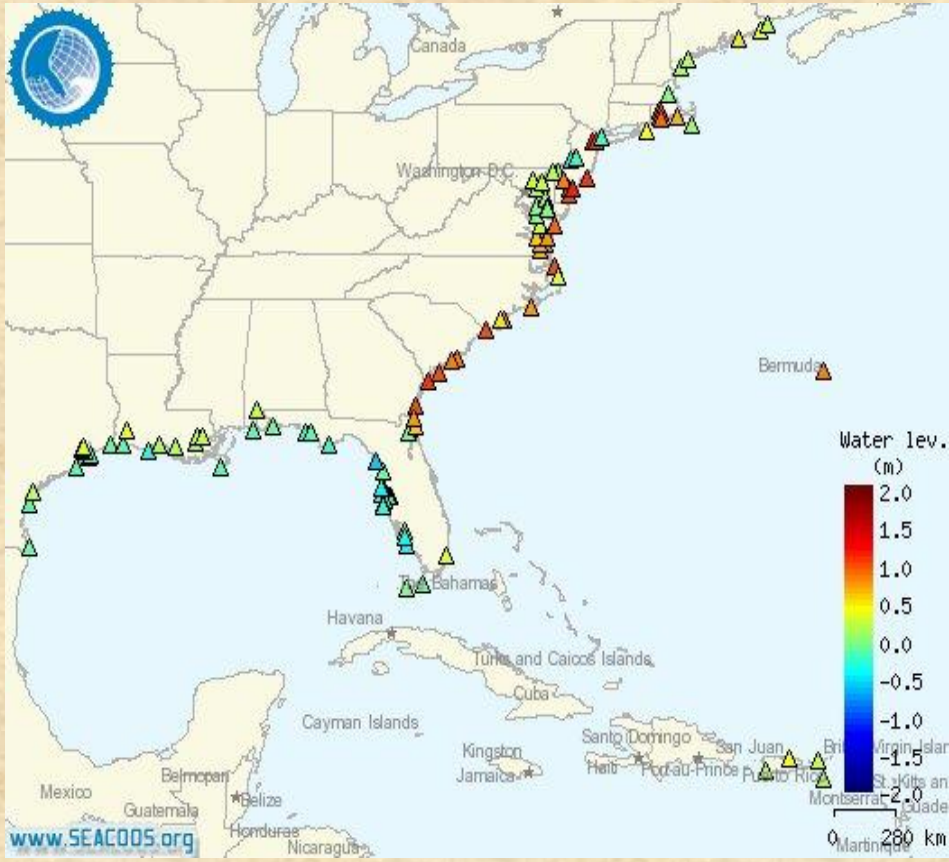




SEACOOS is transitioning to become a major component of the Southeast Coastal Ocean Observing Regional Association –

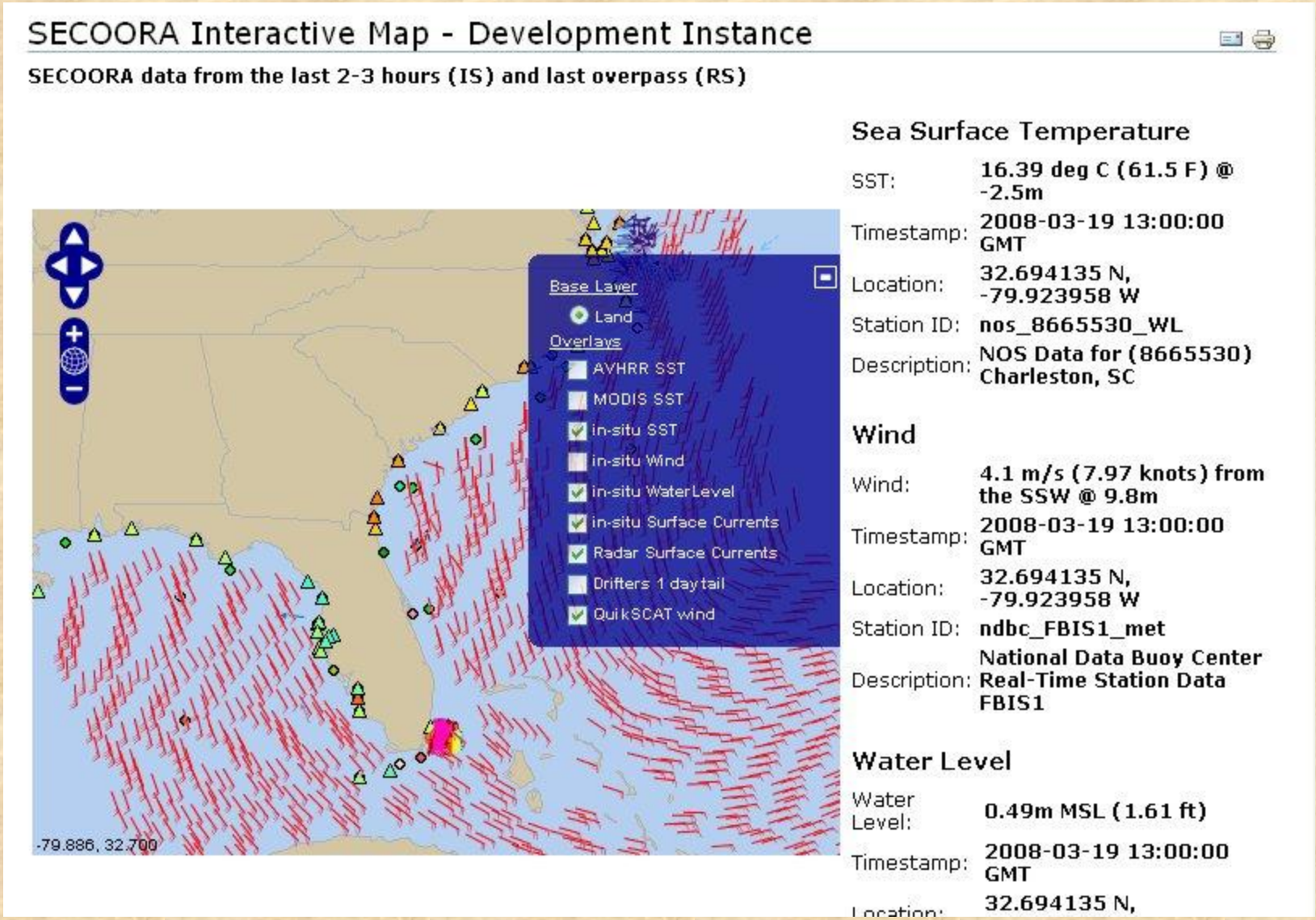
SECOORA

SECOORA Maps/WMS(OGC Web Mapping Service) via MapServer - animations via javascript



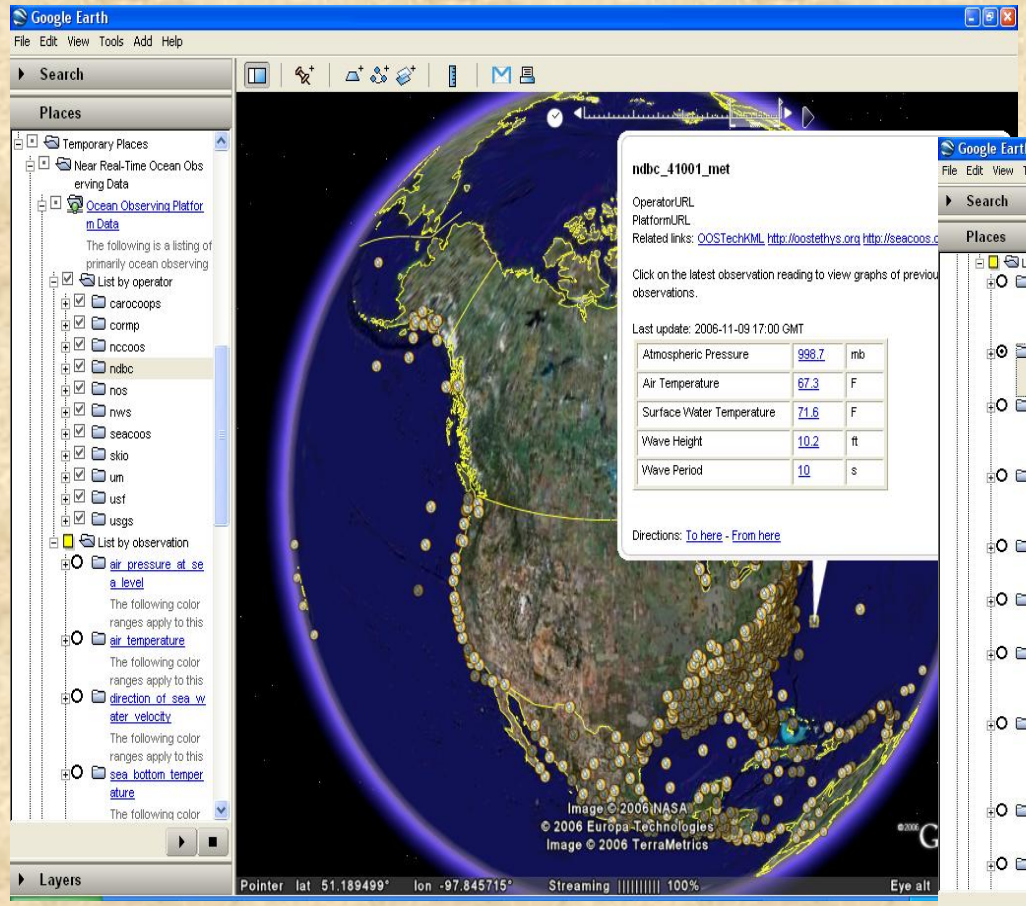
DODS/OPeNDAP access to basic tables (organization, platform, sensor, multi_obs)

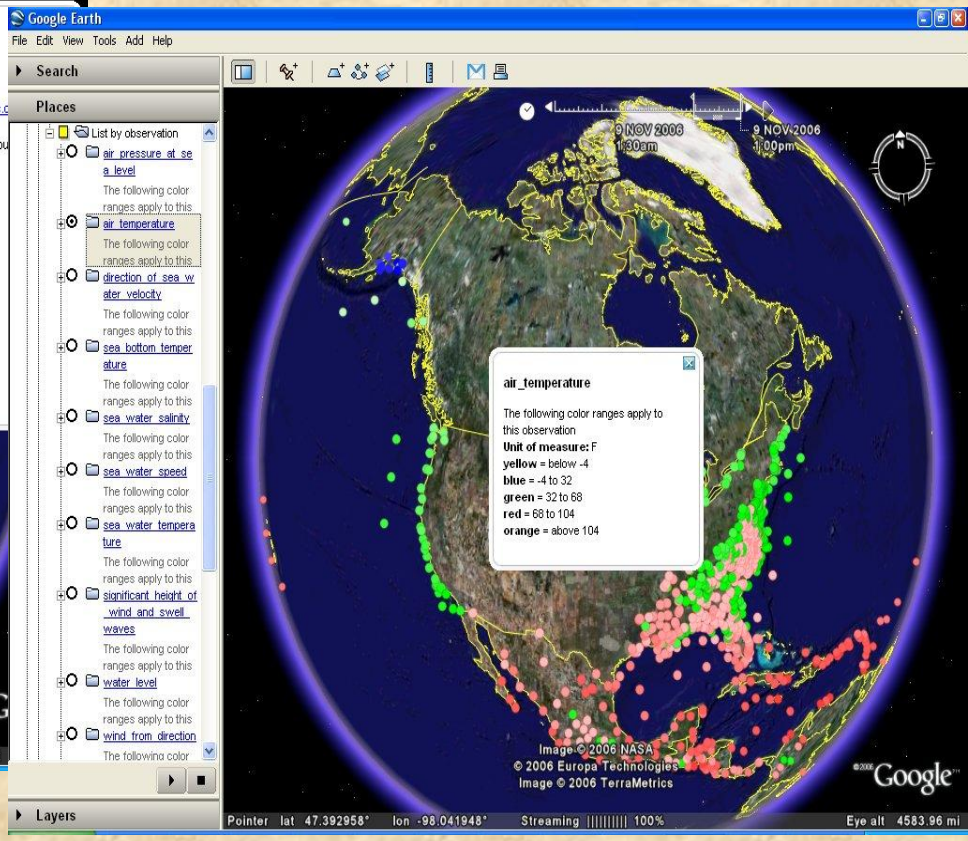
SECOORA interactive maps via javascript (OpenLayers http://openlayers.org)



Latest data products

KML (Keyhole Markup Language) which is the XML format used to visualize data in Google Earth and potentially other 3D Globes such as NASA WorldWind and ESRI ArcExplorer





Lessons learned

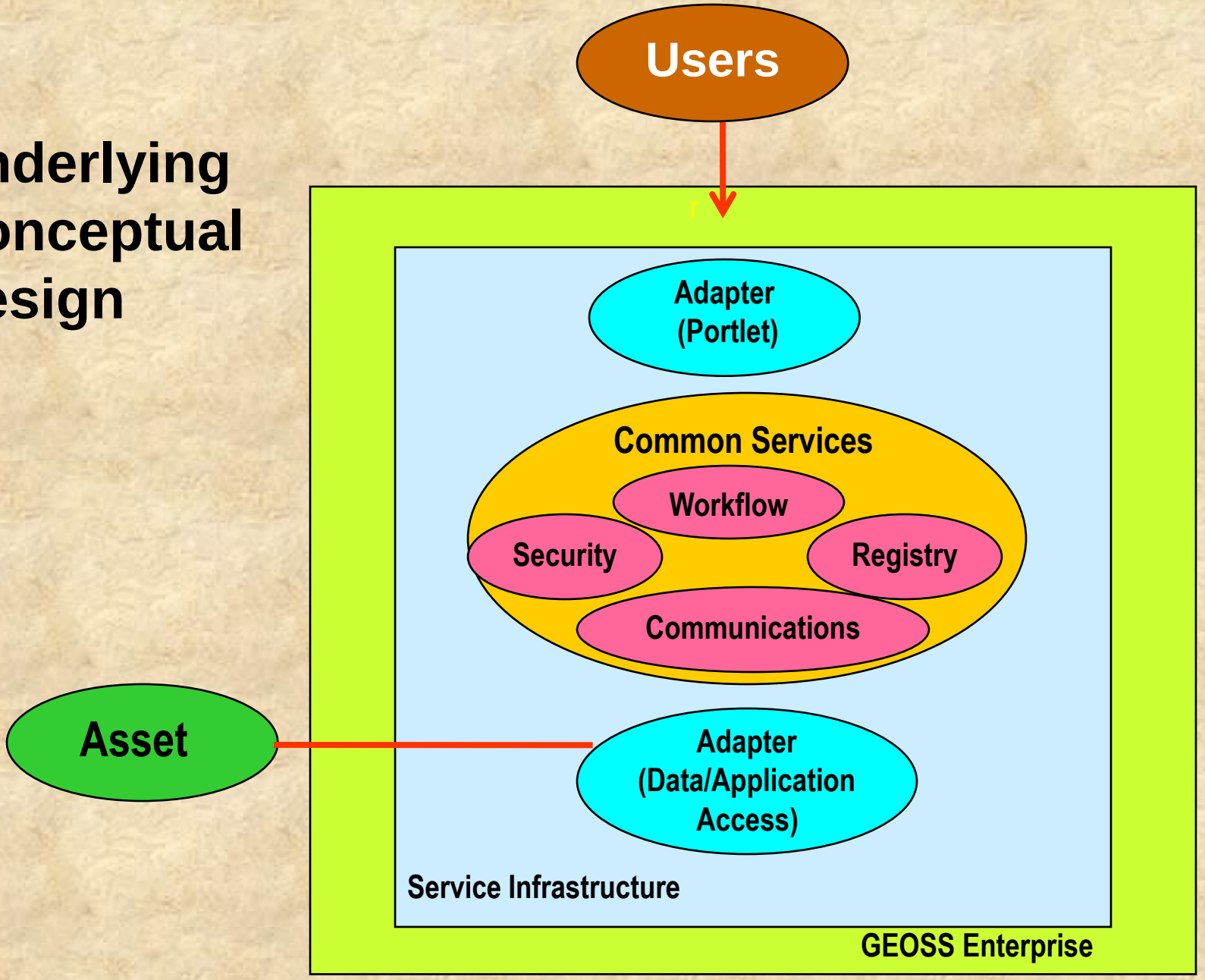
- Data managers and programmers are likely to form highly productive, networked, problem-solving communities.
- Information Management should be recognized as a core function and be supported accordingly.
- Standards must be identified --requires committed effort and consensus.
- Appropriate redundancy and back-up must be established.
- Both real-time data and historical databases should be accommodated.

Information management is not only essential for IOOS system data…

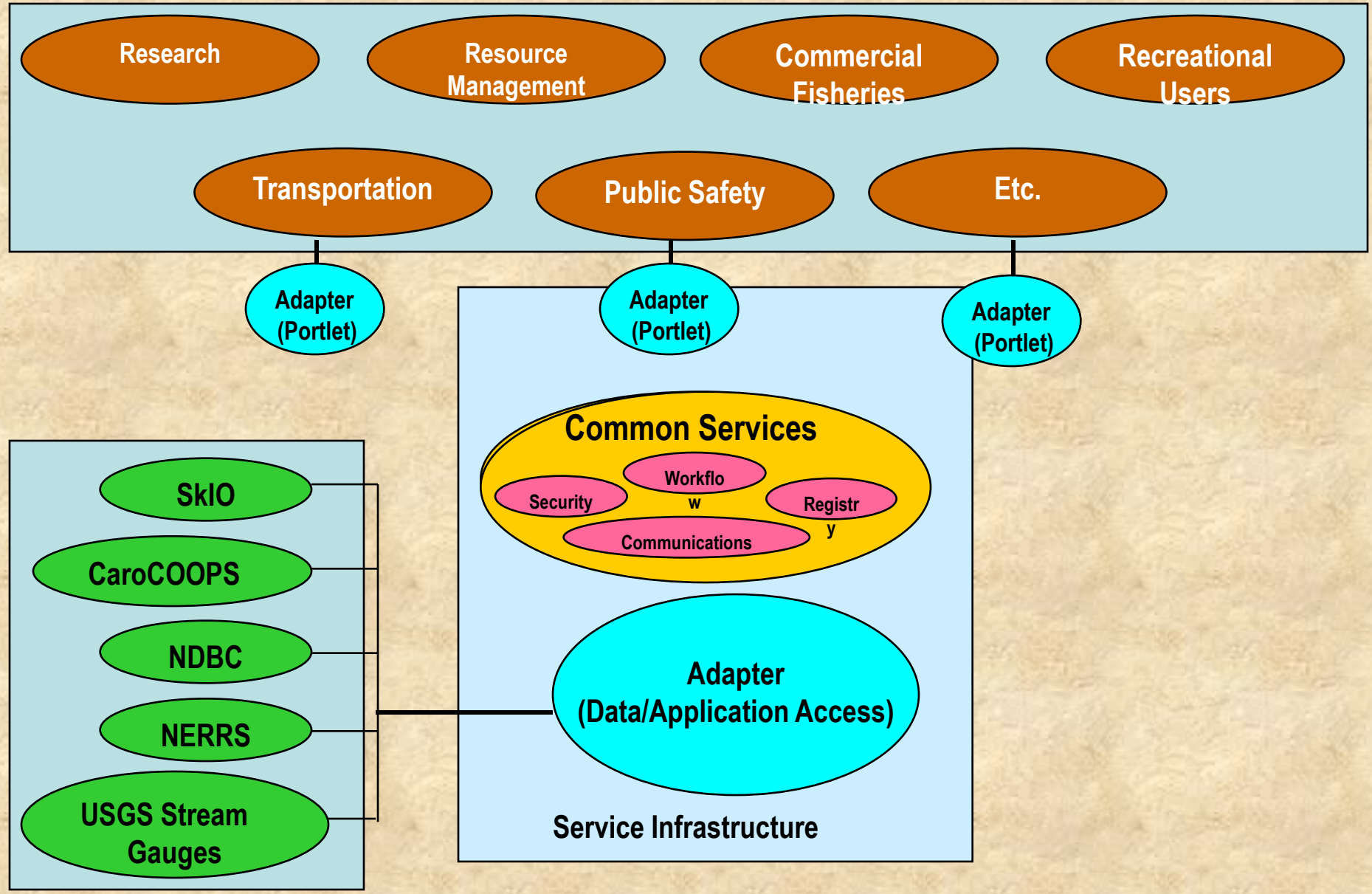
It can also provide access to additional monitoring systems and databases that can be integrated for development of broader applications.

One example: new center for Integrated Information Systems (collaborative with Raytheon)

Underlying Conceptual Design



Proof of principle was demonstrated on a limited scale:



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- **U Miami: Ed Kearns, Liz Williams**
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- **Charlton Galvarino**

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