The National Estuarine Research Reserve System Wide Monitoring Program

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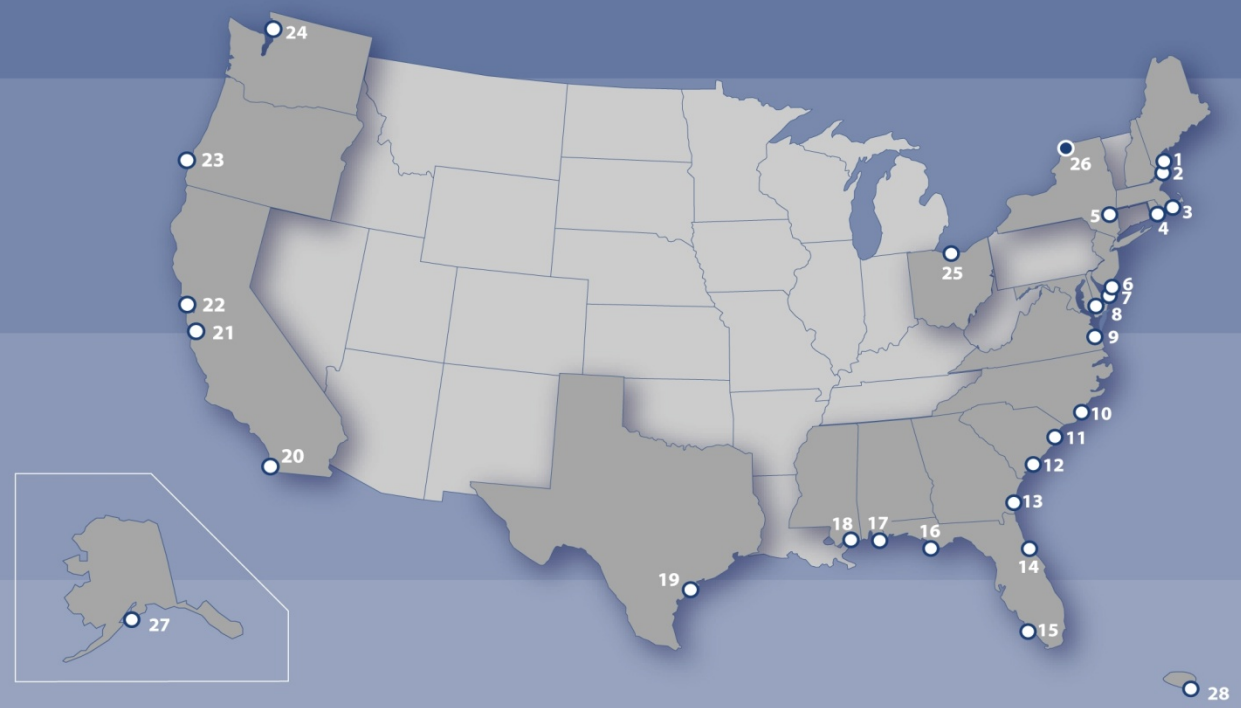
National Water Quality Monitoring Council Meeting
10 March, 2009

NATIONAL ESTUARINE RESEARCH RESERVES

A network of 27 protected areas



1. Wells, Maine
2. Great Bay, New Hampshire
3. Waquoit Bay, Massachusetts
4. Narragansett Bay, Rhode Island
5. Hudson River, New York
6. Jacques Cousteau, New Jersey
7. Delaware
8. Chesapeake Bay, Maryland
9. Chesapeake Bay, Virginia
10. North Carolina
11. North Inlet-Winyah Bay, South Carolina
12. ACE Basin, South Carolina
13. Sapelo Island, Georgia
14. Guana Tolomato Matanzas, Florida
15. Rookery Bay, Florida
16. Apalachicola, Florida
17. Weeks Bay, Alabama
18. Grand Bay, Mississippi
19. Mission-Aransas, Texas
20. Tijuana River, California
21. Elkhorn Slough, California
22. San Francisco Bay, California
23. South Slough, Oregon
24. Padilla Bay, Washington
25. Old Woman Creek, Ohio
26. Proposed—St. Lawrence River, New York
27. Kachemak Bay, Alaska
28. Jobos Bay, Puerto Rico

Reserves are protected for:

- Long-term research and monitoring
- Education
- Resource stewardship

27 reserves protecting 1.3 million acres estuarine lands and waters

NERRS Goals

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research, and education.
2. Increase the use of reserve science and sites to address priority coastal management issues.
3. Enhance peoples' ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

System-wide Monitoring Program

- Goal: Promoting stewardship of the Nation's estuaries through science and education using a system of protected areas

- Purpose: To identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purpose of contributing to effective national, regional, and site specific coastal zone management

System-Wide Monitoring Program Phases

I. Abiotic Monitoring

Water Quality & Nutrients

Weather Parameters

II. Biological Monitoring

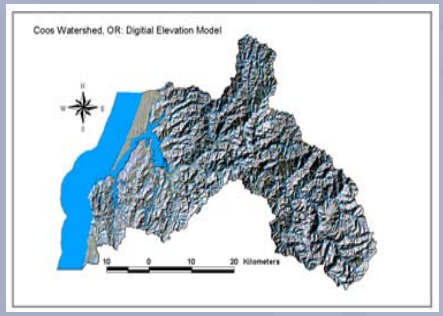
Habitat Change

Biodiversity

III. Land Cover/Use and Habitat Change

Spatial Patterns

Human Impacts



SWMP "Abiotic" Monitoring (Phase I)

Parameters Monitored

Water parameters:	Weather parameters:
pH	Temperature
Conductivity	Wind speed and direction
Salinity	Relative humidity
Temperature	Barometric pressure
Dissolved Oxygen	Rainfall
Turbidity	Photosynthetic Active Radiation
Nitrate	
Ammonia	
Ortho-Phosphate	
Chlorophyll a	

- *Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.*

Telemetry through Geostationary Operational Environmental Satellites (GOES)

GOES Satellite

Wallops Island Command and Data Acquisition Facility

DOMSAT

HADS

Hydrometeorological Automated Data System
NOAA's National Weather Service
Office of Hydrologic Development

Hydro-Meteorological Automated Data System

NERRS Weather & Water Data Collection Platforms

NERRS Satellite Receive Station at the University of South Carolina, Columbia

NERRS/ Centralized Data Management Office (CDMO)

Annually

NODC

National Ocean Data Center Archive

SWMP "Abiotic" Monitoring (Phase I)

- Currently 111 SWMP WQ stations (nominally 4/Reserve)

- Of these, 39 are telemetered for near-RT data delivery

- There are also 28 Wx Stations (1/Reserve), all of which are telemetered for near-RT data delivery

- All non-telemetered data is archived and available in provisional form within 2 weeks of collection

- *Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.*

WQ Station Deployment Strategy

Reference site

Impacted site

Initial Deployment Coverage

Non-point Source-influenced

Enhanced Deployment Coverage

"Estuarine Gradients"

- ***Salinity***
- ***Land-use***
- ***Habitat***
- ***Vertical***

SWMP Phase II Biomonitoring Pilot Projects

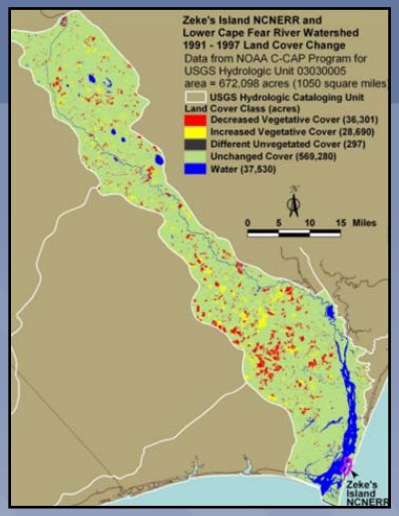
Pilot Projects: Biological Monitoring of Emergent Marshes and Submerged Aquatic Vegetation

SAV/EM Tier 2 – Habitat Quality: Ground-based Surveys of Seasonal Changes in Species & Communities

Cordgrass: *Spartina alterniflora*

Eelgrass: *Zostera marina*

SWMP Phase III: Land Use and Habitat Change

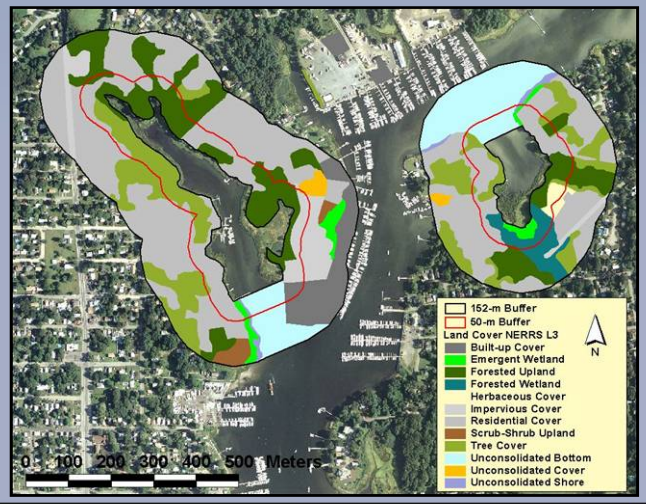


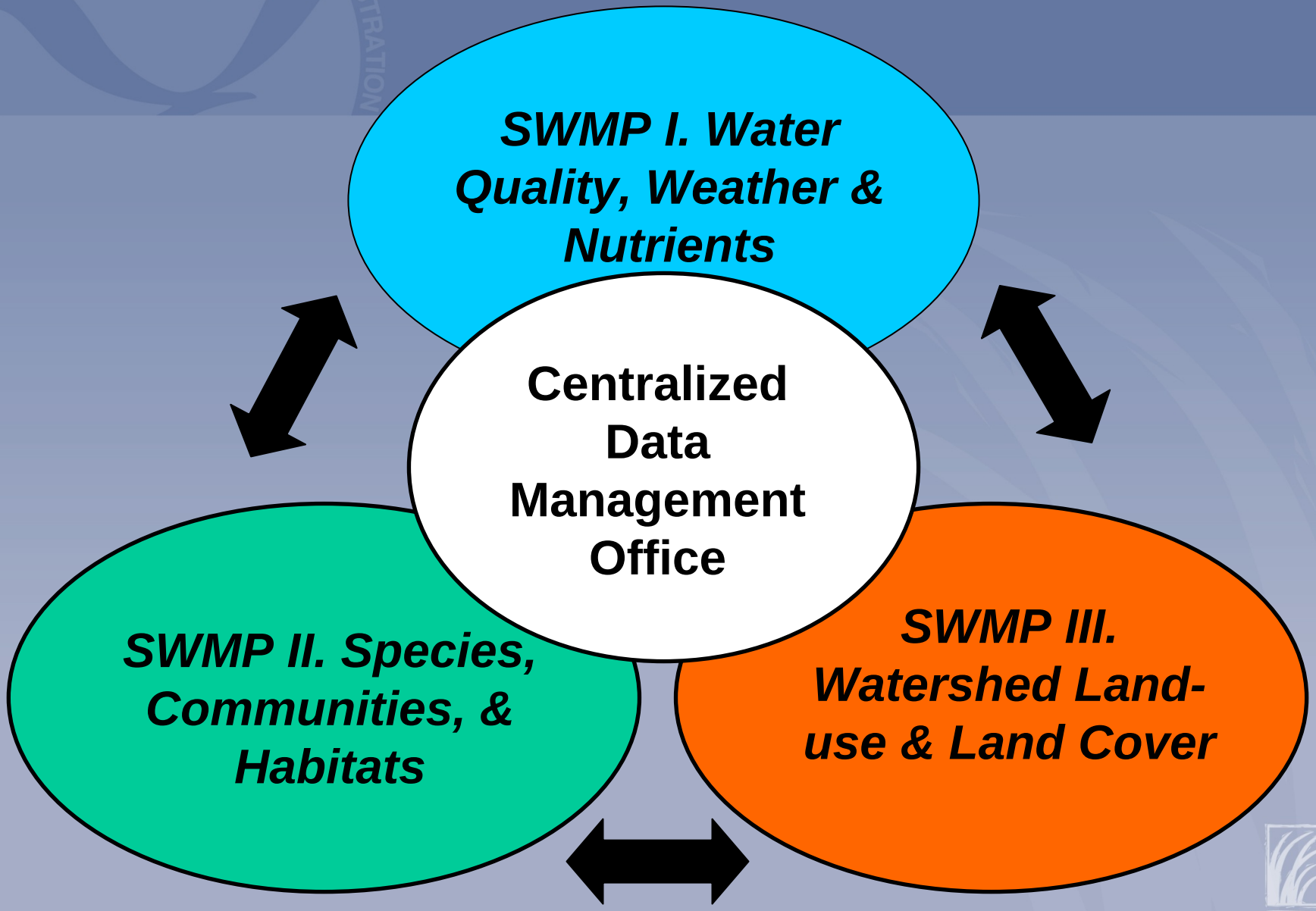
Goals

- Applying geospatial land use / land cover data to facilitate an understanding of changes in land use and climate on estuarine habitats
- Translating information to decision makers and the general public

Products

- GIS land cover datasets and change analysis for reserves and watersheds
- DEMs and Tidal Datums for each reserve and watershed
- Analysis and dissemination of trends in land use and habitat change at multiple scales to targeted audiences




SWMP I. Water Quality, Weather & Nutrients
Centralized Data Management Office
SWMP II. Species, Communities, & Habitats
SWMP III. Watershed Land-use & Land Cover

Centralized Data Management Office

- The Centralized Data Management Office (CDMO) was established in 1995 as a partnership between USC and NOAA in order to support NERRS SWMP data management needs
  - develop, implement and manage the basic infrastructure and data protocol of the NERR SWMP, and
  - support the assimilation and exchange of data and metadata within the NERRS framework and to outside users

CDMO Data Ingestion and Dissemination

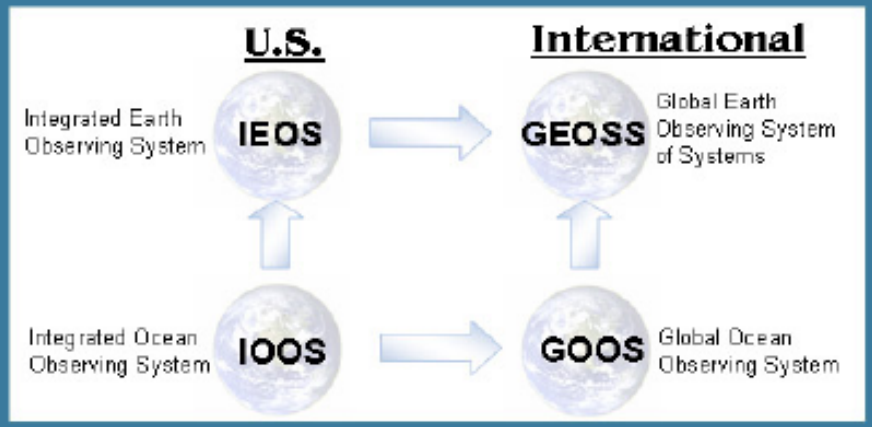
Conservatively, the CDMO reviews, archives and disseminates:

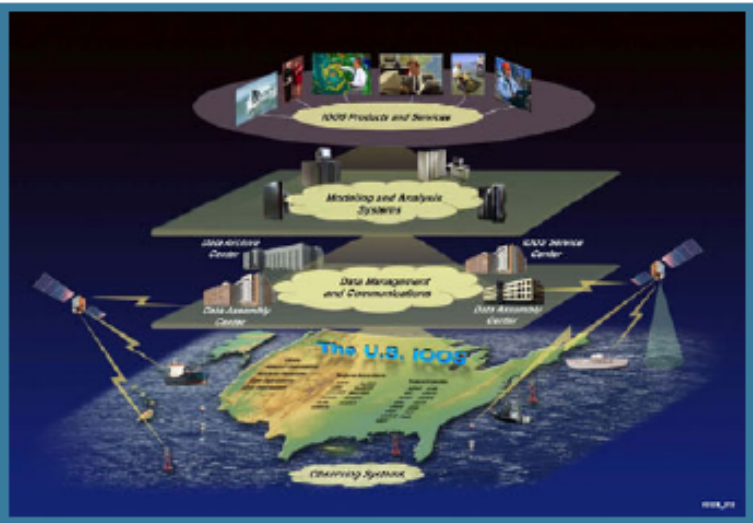
- 13.5 million data points per year for the water quality monitoring program (4 stations collecting 8 parameters every half-hour at 27 NERRS sites)
- 34.4 million data points per year for the meteorological monitoring program (1 station collecting 25 parameters quarterly, hourly and daily intervals at 27 NERRS sites)
- 31,104 data points per year for the nutrient monitoring program (4 stations collecting monthly grabs and 1 station collecting monthly diel of 6 parameters at 27 NERRS sites)

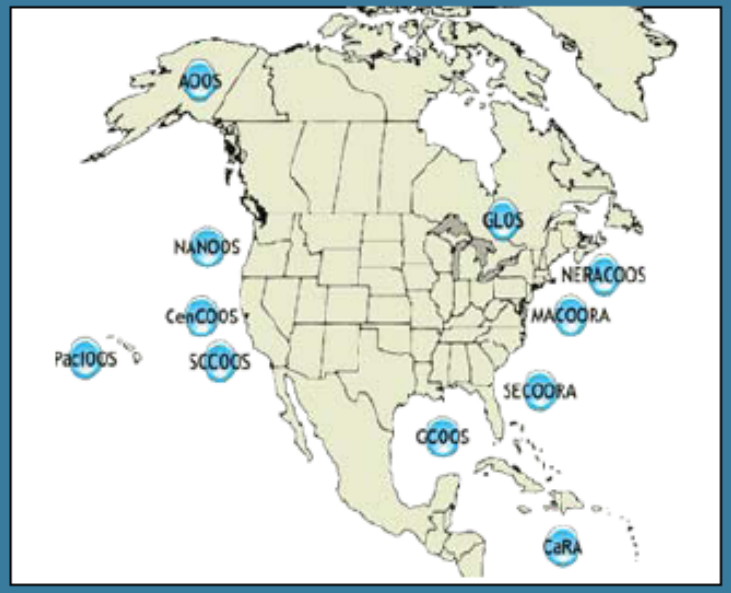
NERRS Contributes to IOOS

IOOS Development Plan defines:

1) **Global Component**
2) **Coastal Component**
   - **17 Federal Agencies**
   - **11 Regional Associations**







3 subsystems: Observing, Data Management and Communication, Modeling and Analysis;
2 cross cuts: Research and Development: Education

Slide courtesy of C. Alexander

NERRS Data Translation Work

- **Metadata translation effort**

Developed a conversion program that takes existing metadata and reformats for importation into Meta-Door.

Meta-Door then converts to FGDC compliance

NERRS Data Translation Work

- **Metadata translation effort**

Start with text

```
ACE Basin National Estuarine Research Reserve Water Quality Metadata Report
January-December 2000
Latest Update: May 22, 2001

I.    Data Set & Research Descriptors
1.    Principal investigator & contact persons:

SCDNR/Marine Resources Division          ACE Basin NERR field station
217 Fort Johnson Road                    15717 Bennetts Point Road
Charleston, SC  29422                    Green Pond, SC 29441
(843) 762-5000                           (843) 844-8822

Contact Persons:
Dr. Elizabeth Wenner, Research Coordinator
   E-mail: wennere@mrd.dnr.state.sc.us;  (843) 762-5050
Saundra Upchurch, Reserve Biologist
   E-mail: upchurchs@mrd.dnr.state.sc.us;  (843) 762-5000 ext. 2032
Amy Whitaker, Reserve Technician
   E-mail: whitakera@mrd.dnr.state.sc.us; (843) 762-5000 ext. 2078

2.    Entry verification:
      The data are directly downloaded from the YSI Model 6000 sonde to comma-
delimited files (*.csv) and PC6000 files (*.dat). The comma-delimited files are
imported into Excel 97 where they are formatted and processed by macros that are
supplied by the CDMO. Various macros are designed to: 1) check data files for
```

End with XML

```
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    - <citation>
      - <citeinfo>
        - <origin>
            Principal investigator(s) and contact persons SCDNR/Marine Resources
            Division ACE Basin NERR field station 217 Fort Johnson Road 15717
            Bennetts Point Road Charleston, SC 29422 Green Pond, SC 29441 (843)
            762-5000 (843) 844-8822 Contact Persons: Dr. Elizabeth Wenner,
            Research Coordinator E-mail: wennere@mrd.dnr.state.sc.us; (843)
            762-5050 Saundra Upchurch, Reserve Biologist E-mail:
            upchurchs@mrd.dnr.state.sc.us; (843) 762-5000 ext. 2032 Amy Whitaker,
            Reserve Technician E-mail: whitakera@mrd.dnr.state.sc.us; (843) 762-5000
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            Metadata Document: acewq01-12.00m.txt 0ACE Basin National Estuarine
            Research Reserve Water Quality Metadata Report January-December 2000
            Latest Update: May 22, 2001
          </title>
```

NERRS Data Translation Work

- **Metadata translation effort**

And publish FGDC-compliant metadata

Metadata also available as - [Questions & Answers] - [Parseable text] - [SGML] - [XML] - [DIF]

Metadata:

- Identification_Information
- Data_Quality_Information
- Spatial_Data_Organization_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:

Citation:

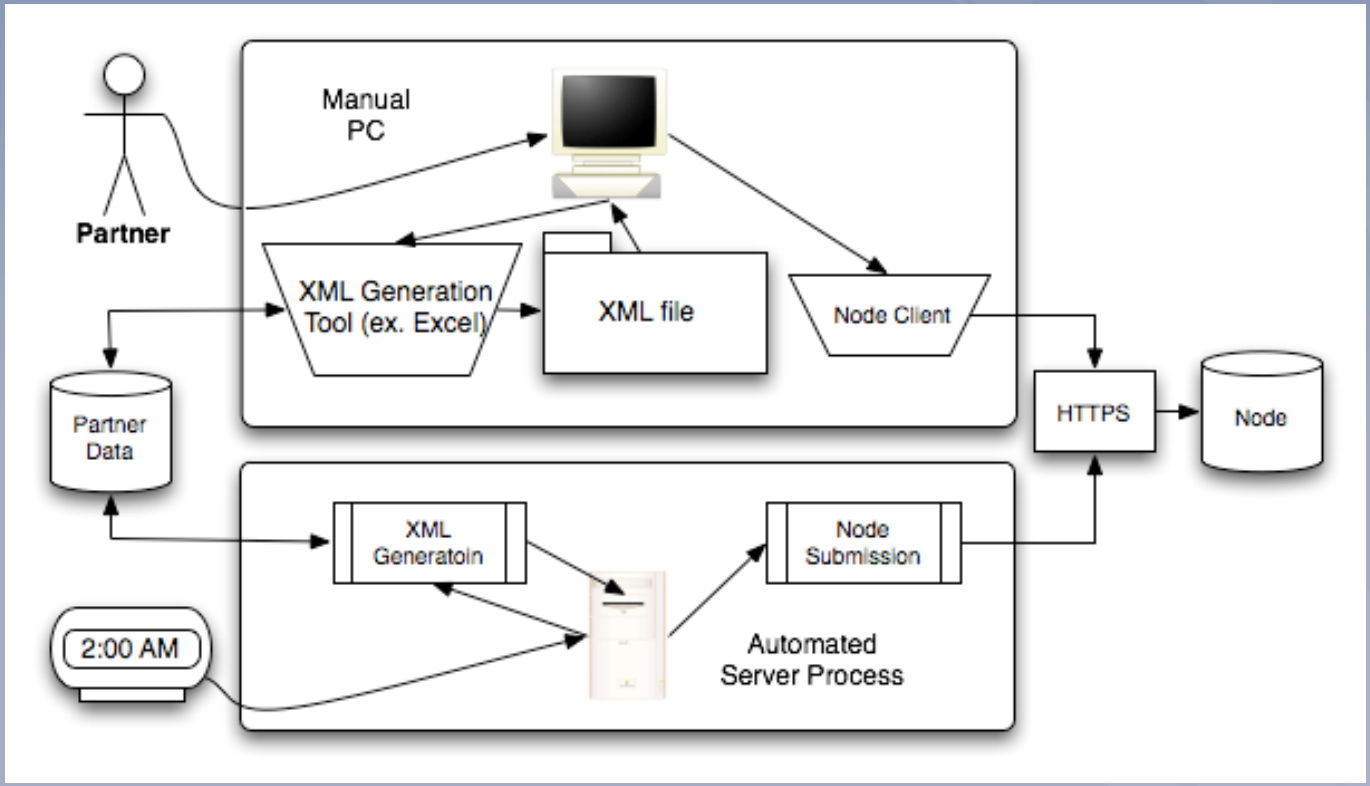
Citation_Information:

Originator:

Principal investigator(s) and contact persons Wendy Allen, Manager, wallen@belle.baruch.sc.edu Tracy Buck, Research Specialist, tracy@belle.baruch.sc.edu Chris Buzzelli, Research Coordinator, cbuzz@belle.baruch.sc.edu Address: Baruch Marine Laboratory University of South Carolina PO Box 1630, Georgetown, SC 29442 Phone: (843) 546-6219 Baruch

NERRS Data Translation Work: Exchanging Environmental Data for the Gulf of Maine

- Create XML from Partner Data
- Submit to Node via HTTPS (Firewall friendly)
- GoMOOS to assist with node client setup



Data Exchange Template Development

Will use:

- Exchange Network (EN) data standards
- Water Quality Exchange (WQX) 2.0 data exchange template
- any other standards/templates/schemas to help build template (NBII, JGOF, Environment Canada, IOOS, modeling, others?)
- can add things to template not covered by data standards
- consider different types of data from partners: physical/chemical, biological, spatial, modeling, buoy etc.
- do have the option of using the WQX as is