Earth Information System

NOAA's vision, which states, “An informed society that uses a comprehensive understanding of the role of the oceans, coasts and atmosphere in the global ecosystem to make the best social and economic decisions,” requires that we adopt a global perspective and explore science in an end-to-end manner. The complexity and volume of data involved in end-to-end science will require an end-to-end information system to access the data, explore interrelationships among the data and make accurate predictions. In addition, we must provide this information to the public and offer a vehicle for policy validation.

An Earth Information System implementing such a vision must support extremely diverse data sets, from observations to predictive models of the earth, oceans, and atmosphere, and be capable of assessing both current and proposed policy decisions. While such a system is necessarily complex, it can be viewed as a suite of simplified layers, each of which implements a well-defined component that builds upon the others. The system will support both time-critical and research applications; it is expected that this system will support the requirements of fire weather, aviation, hazards and emergency managers, and many other quasi-operational facilities.

- **Data Access**
  - Diverse data types: Meteorologic, Oceanographic, Geologic, Vegetation, Population...
  - Diverse data sets: point, polygon, gridded
  - Discovery and Web Access: local, remote, public, private, retrospective, time critical, real time data delivery
  - Formats, Standards, Conventions: OpenDAP and Open Geospatial Consortium data access standards, Climate and Forecast conventions and standard data formats: netCDF, HDF5, GRIB, BUFR
- **Visualization**
  - Viewing diverse multi-dimensional data sets
  - Capabilities: zoom, pan, progressive disclosure, user-defined defaults for location, time looping
  - Combined/Overlaid data sets
- **Interactive Visualization**
  - Sampling data values
  - Deriving new visualizations based on existing data sets (time-height cross section, etc)
- **Analysis / Discovery**
  - Exploring correlations and relationships between diverse datasets
  - Integration of existing data to create new datasets for access and display
- **Forecast / Prediction**
  - Incorporating interactive human input to make predictions
  - Information generation, decision aid tools
- **Interactive Analysis**
  - Probabilistic Forecasting and Ensembles
  - Building contingencies and multiple scenarios

With the power and versatility of this type of framework, we can answer questions such as:

- If the size of the hurricane increases, how many more people will be affected?
- What are the highest risk areas given population density and wind speed along the hurricane

path prediction?
- If the annual temperature increases in a particular area, how will the wildlife population be affected?
- If a front comes through with a given path, how will the winds, temperatures, and precipitation be affected?
- What is the correlation of coral bleaching hot spots to variations in animal populations?

On the face of it, this sounds like a very ambitious effort involving many man-hours and areas of expertise. However, it is not necessary to write a large software system that is everything for everybody. Instead, we can build a framework that can be extended to diverse applications. There are new technologies rapidly emerging and readily available which we can leverage to satisfy the need for an end-to-end information system. Rather than build a large system that provides the traditional functionality of stove-pipe systems, we can instead build a framework into which applications can plug-in.

A key feature of such a framework will be to support distributed data (as well as code) sharing similar to that pioneered by the OpeNDAP and OpenGIS Consortium technology. The next task will be to specify and build a library of primitives utilizing conventions at each layer of functionality. Finally, the framework will support event-driven tools or plug-ins for encoding interrelationships and operations on the data, allowing the framework to be easily applied and extended.

Initially, data will come from the GSD Central Facility, and select locations on the web. We expect to discover and access data through web service interfaces, OpenDAP services, and OGC compliant Web Mapping Servers, and Web Coverage Servers that will be available through the Web Services Proving Ground – a proposed development to explore and provide access to distributed data at GSD and other NOAA facilities.