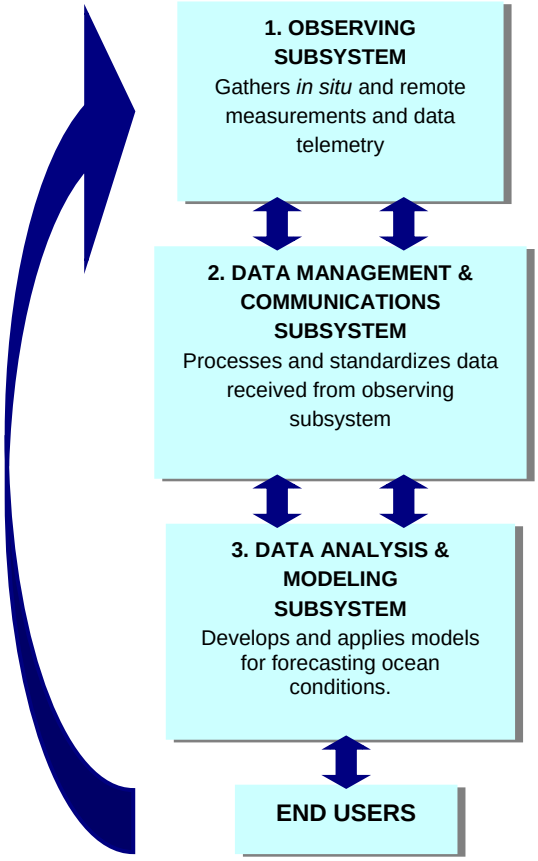
IOOS and DOE Global Climate Research

What does IOOS do?

IOOS (Integrated Ocean Observing System) is a **multidisciplinary** system designed to provide weather, climate, ocean, and coastal data in the formats, rates, and scales required for decision-making, based initially on the **integration** of existing private, federal, state, and local systems. Consisting of three major subsystems (see figure at right), IOOS will constantly evolve according to user needs. IOOS will focus initially on a series of high priorities. For example, IOOS information on sea surface temperature and winds will enhance global climate forecasting models.



Currently, numerous ocean and weather data collection systems are maintained by scores of federal, state, and non-governmental agencies and organizations (see Table 1 for a few examples). IOOS is gathering these useful but disparate and isolated data sources into integrated systems, giving users ready access to all ocean-related data gathered by all possible sources. In addition, IOOS will allow any compilation of data specified by the user to be manipulated using myriad existing forecasting models, thereby turning raw numbers into actionable information relevant to the user's specific concerns. Finally, IOOS is seeking new research and enhancements to add to its already-extensive catalog of products. In this way, IOOS becomes a flexible, adaptable system capable of keeping up with new developments while maintaining the reliable delivery of data, analyses, and forecasting results.

Table 1. Examples of already-existing data collection systems for Global Climate Research

Existing Data Source	Measurements Collected by Data Source	Representative Outcomes
Atmospheric Radiation Measurement Program (http://www.arm.gov/)	A suite of atmospheric parameters including temperature, cloud cover, irradiance measures, etc.	Data are used to research atmospheric radiation balance and cloud feedback processes, which are critical to the understanding of global climate change.
Carbon Dioxide Information Analysis Center (http://cdiac.ornl.gov/)	Concentrations of CO_2 and other radiatively active atmospheric gases, CO_2 emissions, biogeochemical cycling of greenhouse gases, climate change trends, etc.	Better characterization of CO_2 cycling and its role in global climate studies.

How can IOOS Help DOE's Climate Studies Research?

Given its ocean and coastal focus and the importance of the world's oceans in our global climate, IOOS has a great potential to help global climate researchers. Many of DOE's climate change research initiatives rely on the collection and existing availability of long-term continuous data, such as that available through IOOS. This information is critical in calibrating models to forecast and predict local and global weather patterns.

The Climate Change Research Division within DOE's Office of Biological and Environmental Research conducts process research and modeling to address the following issues:

1. Improving the understanding of factors affecting the earth's radiant energy balance;
2. Predicting accurately any global and regional climate change induced by increasing atmospheric concentrations of aerosols and greenhouse gases;
3. Quantifying the sources and sinks of energy-related greenhouse gases, especially carbon dioxide; and,
4. Improving the scientific basis for assessing both the potential ecological, social, and economic consequences of climatic changes, and the benefits and costs of alternative response options.

Many existing DOE programs focusing on climate change issues are prime examples of how DOE already benefits and will continue to benefit from IOOS. For example, the DOE Carbon Sequestration Program involves approximately 100 individual research efforts across DOE, evaluating such topics as the feasibility and techniques for sequestering carbon in the ocean, geologic formations (e.g., oil and gas reserves), unminable coal seams, deep saline reservoirs, terrestrial vegetation and soil, agricultural land, biomass croplands, deserts, degraded lands, boreal wetlands, and peatlands. Although IOOS will be highly beneficial to many of these carbon sequestration projects, it will be particularly beneficial to programs researching ocean carbon sequestration.

Ocean Carbon Sequestration

The world's oceans will eventually absorb 80 to 90 percent of the CO_2 in the atmosphere and transfer it to the deep oceans. The process, however, is slow and may take hundreds of years. DOE is exploring options to speed up this process by enhancing the natural sequestration and directly injecting CO_2. Although the technology exists to perform several of these sequestration techniques, information is lacking on potential impacts to the biological, chemical, and physical environment. By incorporating key biological, chemical, and physical parameters, IOOS can enhance modeling efforts to better predict the results of many of these techniques. Additionally, information contained in IOOS may provide estimates of CO_2 concentrations at the air-water interface in many open ocean locations throughout the world. This information may be necessary for modeling to identify key locations to implement these types of technologies.

Another example of how IOOS can support DOE climate studies research is shown through the Climate Change Prediction Program. The goal of this program is to develop, test, and apply state-of-the-science computer-based global climate simulation models, based on theoretical climate-science foundations. Additionally, the program is to take advantage of high-performance computing and information technologies to increase the accuracy and throughput of computer model-based projections of climatic variability and change. By doing so, scientists, managers, and policy makers will be able to make more informed decisions on future energy use and technology issues. Because IOOS is a system integrated with the latest high-performance computing and information technologies, the Climate Change Prediction Program and IOOS can be mutually beneficial.

What Can DOE's Climate Studies Program Do?

The value added from the integrating and sustaining power of IOOS will only be realized with Regional Association (RA) **participation** (www.ocean.us/regional_associations) and with NOAA and other federal agencies involved in IOOS. RAs are critical for engaging private and public user groups to identify regional data and information needs. Additionally, RAs can be high-value entry points for a user to get involved with specific IOOS pilot projects (many of which are happening right now) through which users help improve and refine IOOS. Pilot projects and RAs can facilitate data sharing, the cornerstone of IOOS, between previously unconnected parties. Even by sharing small amounts of data, users can reap significant benefits through invaluable forecasting results.