GLOS

Great Lakes Observing System

## About GLOS – the Great Lakes node of the national Integrated Ocean Observing System

The Great Lakes Observing System (GLOS) will provide access to information on the climate, meteorology, chemistry, geology, biology and human activities that affect the Great Lakes, their interconnecting waterways and the St. Lawrence River. Data, information and knowledge about the system will be drawn from numerous sources, consolidated, and then made available to meet the needs of many communities, including resource managers, researchers, educators, commercial shippers, recreational boaters, beach users and homeland security interests.

A regional node of the U.S. national Integrated Ocean Observing System (IOOS) initiative, GLOS is a cooperative activity of many U.S. federal and state agencies as well as academic institutions, non-governmental organizations and commercial interests across the region. The development of GLOS will continue to engage Canadian federal agencies and provincial ministries.

The Great Lakes Commission is coordinating initial development of GLOS, with funding provided by the Coastal Services Center of the National Oceanic and Atmospheric Administration (NOAA).

## What is IOOS?

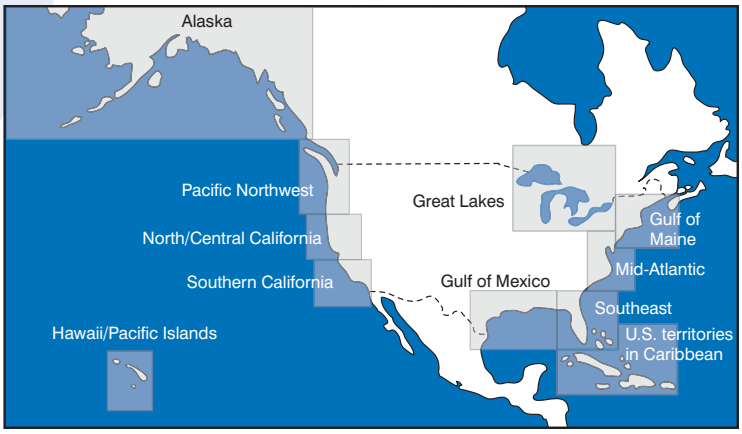
IOOS is an interagency, cooperative effort based on a sustained network of buoys, ships, satellites, underwater vehicles and other platforms that routinely collect real-time data and manage historical information. These data are needed for rapid detection and timely prediction of changes in our nation's coastal waters, including the Great Lakes. This sustained network of observations will mean more rapid advances in the marine and Great Lakes sciences. IOOS will process and disseminate the data under one umbrella for broad public access. For further information, see ***www.ocean.us***

The seven goals of IOOS:

- Improve predictions of climate change and weather effects
- Improve the safety and efficiency of coastal and marine operations
- Ensure national security
- Manage resources for sustainable use
- Preserve health and restore degraded coastal ecosystems
- Mitigate effects of natural hazards
- Minimize public health risks

## GLOS is one of 11 Regional Associations

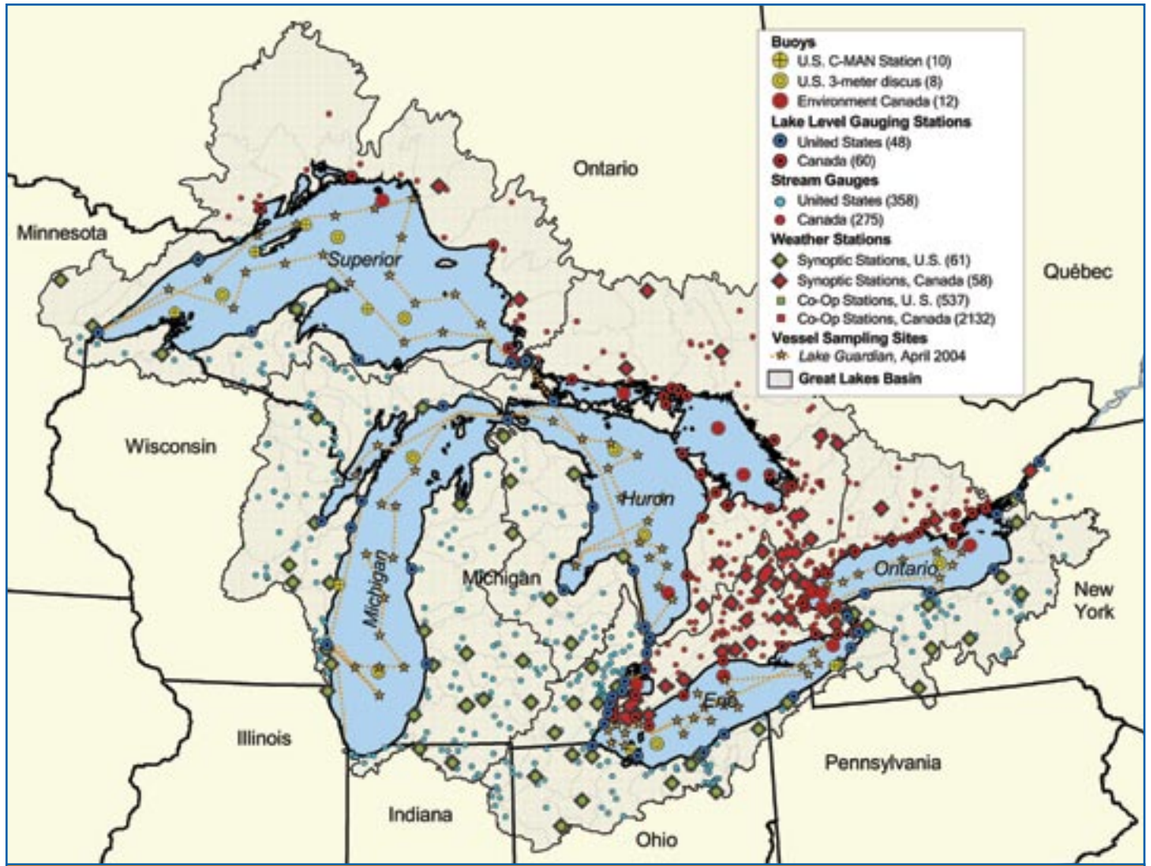
Eleven Regional Observing Systems (also known as Regional Associations, or RAs) are being established through IOOS. The RAs will be guided by the priorities of user groups within each region. The RAs will help steer programs of the U.S. federal agencies, ensuring that the national information "backbone" maintained under IOOS meets the needs of the regional Observing System nodes and their users.




11 regional associations of the U.S. Integrated Ocean Observing System

## History

The binational Great Lakes – St. Lawrence System has a long history of programs for the collection, analysis, storage and archiving of physical, chemical, biological and cultural data. However, these programs are managed by a variety of agencies, organizations and academic institutions with limited coordination.




**Lake Monitoring Resources**

In many cases, monitoring of detailed observations — including water chemistry, biologic activity, hydrologic parameters and changes caused by human activities — has lagged behind the needs of the more than 34 million people living in the basin. Targeted expansion and improved coordination of monitoring programs will allow for more integrated ecological forecasting on a regional scale, greatly benefiting this valuable freshwater resource and the people who live, work and play here.

Recent advancements in environmental data gathering, Internet technologies, computer networks and distributed database tools can allow extensive integration to occur. GLOS partners will use these tools to enhance efforts specific to individual agencies, to the regional observing system and to the Integrated Ocean Observing System as a whole.

## Subsystems of GLOS

### Open Lake

Understanding the Great Lakes – St. Lawrence River system requires observations drawn from a network of fixed stations that can take consistent measurements for integration with nearshore and mobile components. The GLOS open lake observation subsystem will include substantial improvements to existing resources, possible deployment of new research buoys or buoy arrays, and expansion of National Weather Service products to include overlake precipitation estimates. The steady stream of input from this observing subsystem will provide crucial data for hydrodynamic and ecological forecasting models, and calibration of remote sensing data.

### Science Vessels

Science vessels allow seasonal sampling of sites and investigation of short-term and localized phenomena. In addition to supporting coordination and long-term management of the Great Lakes fleet, GLOS will act as a central access point for data collected by science vessels, providing repository services where needed. Database tools and user interfaces developed for GLOS will improve regional access to and integration of data from multiple vessels, and monitoring agencies.

### Interconnecting Waterways

Flows in the interconnecting waterways of the Great Lakes and St. Lawrence River affect commercial navigation, water supplies, recreational opportunities, and production of hydropower for the Great Lakes region and the majority of North America's eastern seaboard. The collection of detailed and timely observations within these highly productive river courses has been extensive in the past, but numerous additional observations are warranted. The water level gauging network on the St. Marys, St. Clair, Detroit, Niagara and St. Lawrence rivers is sufficiently dense, but little continuous information is collected on flows in these major river courses. This subsystem will include deployment of in-situ flow meters throughout these waterways, coupled with real-time continuous flow models.

### Nearshore

The U.S. Great Lakes – St. Lawrence River system has more than 6,500 miles of shoreline. The collection of detailed and timely observations over this domain has been significant in the past and is of critical importance. Continuation and expansion of the existing water level network is needed, including adding definition in major embayments of the system and meteorological and water chemistry parameters to their observation streams. Expansion of the existing geodetic control network will provide essential positioning information for electronic navigation in all weather conditions. Additional instrumentation on buoys and land-based high-frequency radar will provide critical information on the direction, magnitude and frequencies of nearshore waves and current flows. Finally, integrated coastal airborne mapping involving periodic acquisition of high-resolution imagery will provide overdue detail on changes in nearshore landforms due to littoral processes and significant returns in the determination of habitat extent, composition and health.

### Atmospheric

The air monitoring network currently in place across the Great Lakes region does not include sufficient monitoring over the lakes or at their surfaces and does not collect observations of some critical substances. This subsystem will expand monitoring of over-lake atmospheric characteristics such as meteorology, atmospheric pollutant and persistent bioaccumulative toxic (PBT) concentrations, and contaminant deposition using instrumentation on monitoring buoys, research vessels and shoreline/nearshore structures. Within GLOS, output from this subsystem will be combined with data regarding water characteristics, contaminant interactions and contaminant transport via tributaries to expand and improve computer-based models.

### Remote Sensing

Satellite and airborne remote sensing technologies play a major role in efforts to study and understand the mechanics and functions of the Great Lakes – St. Lawrence River system. Recognizing this, GLOS will support acquisition and archiving of imagery, calibration efforts related to regional data parameters, development of new tools and data analysis processes, improved/increased data access capacities, and broader user awareness and distribution of derived products. These efforts will include development of near real-time lake surface evaporation estimates for use in outflow control management.

### Data Components

- Buoy systems
- Coastal and riverine sensors
- Satellite observations
- Field measurements
- Ship observations
- Airborne observations
- Computer models
- Ecological forecasts
- Education
- Atmospheric measurements
- Information integration

### Hydrodynamic Modeling

Real-time data from remote and in-situ sensors can be assimilated to produce more accurate estimates of the distributions of state variables in open lake hydrodynamic models; and to develop, test and validate these models. The goal is to improve forecasts of coastal environmental conditions and, ultimately, changes in ecosystem health and living resources.

### Ecological Forecasting

Ecosystem-oriented monitoring and forecasting of nearshore biology provides timely and useful forecasts of the impacts of chemical, biological and physical stressors on the structure and function of Great Lakes nearshore ecosystems. Short-term needs include forecasting the spread of harmful algal blooms in a nearshore area, and forecasting pathogen contamination in the vicinity of beaches. Longer-term priorities, which require additional research to develop, include forecasting fish recruitment areas that serve as spawning and nursery grounds.

### Mass Balance Modeling

Mass balance modeling uses computer models to evaluate environmental data and estimate the flow of pollutants between water, air and sediment, and the food web. By estimating the magnitude of mass fluxes (the movement of chemicals among environmental media such as water, air and sediment), the mass balance approach integrates environmental monitoring, load estimation and research efforts within a modeling framework. GLOS will enhance the Lake Michigan Mass Balance Study where possible, then apply the methodologies to the rest of the Great Lakes. The mass balance activities will take advantage of enhanced GLOS monitoring programs so that modeling tools can, in turn, continue to improve our understanding of the complex pathways by which substances travel through this system.

### Information Integration

Information management and integration efforts will center on two major task areas: 1) integration of distributed data, information and application networks created and maintained by GLOS partner agencies; and 2) packaging, delivery and support of GLOS value-added products to users via the Internet and other communications channels such as radio, video or print, as appropriate.

### Education

The data and information developed and shared through GLOS will be of value to a wide variety of audiences. In addition to scientific research, government/regulatory efforts and commercial activities, curriculum enhancement and other education-oriented elements also rank as a high priority. The goal is to expand and enhance curriculum at all possible levels to include Great Lakes sciences.

## Timeline

A Steering Committee and Regional Interest Group have been formed to provide input for a business plan for GLOS. This business plan will outline current user needs, available information resources, the operational characteristics of an integrated regional system, funding mechanisms to sustain data collection, and the governance structure of a regional association to lead the program into the future. The business plan will be released for comment in fall 2004. It is anticipated that the regional association will be chartered in 2005 along with adoption of partnership agreements between agencies, organizations and other institutions.

To obtain further information on the GLOS initiative, contact: ***owner-glos-rig@great-lakes.net***

## Project Partners

Coastal Services Center, NOAA
Council of Great Lakes Research Managers
Great Lakes Commission
Great Lakes Environmental Research Laboratory, NOAA
Great Lakes Fishery Commission
Great Lakes Sea Grant Network
Great Lakes State Coastal Zone Management programs
International Joint Commission
Michigan Department of Environmental Quality
The Ohio State University
University of Minnesota
University of Wisconsin
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. National Ocean Service, NOAA
U.S. National Weather Service, NOAA

## Project web site: www.glc.org/glos


### GLOS Steering Committee

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