Integrated Ocean Observing System (IOOS®)

Improving safety, enhancing the economy, protecting the environment

Emergency managers making evacuation decisions amid approaching storms, health officials issuing water quality warnings during natural hazards, and fisheries managers making sustainable yield decisions all require reliable, timely access to multiple data sources to enable wise decisions. IOOS is a federal, regional and private sector partnership providing the public with this essential service.

IOOS is the U.S. contribution to the Global Ocean Observing System, the ocean component of the Global Earth Observation System of Systems (GEOSS). GEOSS is driving the interoperability of individual Earth observation systems so they work as a coordinated, comprehensive and sustained system of systems designed to support a range of essential societal needs.

IOOS partners continuously collect ocean and coastal data with tools in the water, on land, in the air, and from space. When IOOS reaches its potential, partners will collect data through an agreed-upon system of standards, ensuring that data from various systems are compatible. The information will feed into a single portal, allowing users to access all data from one place in the same format. Modelers and forecasters will then use these data to create the information decision-makers need to take targeted action such as closing a swimming beach because of harmful algal bloom or E. coli concerns.

The Mid-Atlantic region spans the coastal states from Cape Cod to Cape Hatteras.

IOOS-derived shoreline maps help Puerto Rico's Department of Natural Resources plan for and respond to storm surge, flash floods, and sea level rise. Hourly temperatures, currents, and other data alert shellfish harvesters to conditions that trigger toxic algae, which can make shellfish unsafe to eat. IOOS is introducing technology that allows Search and Rescue crews to track ocean currents to determine the probable path of people lost at sea. This same technology helps track oil spills and other pollutants, enabling responders to minimize impacts. IOOS provides the updated sea conditions mariners need to optimize shipping routes for increased fuel efficiency and to know when it's safe to enter and leave some of our nation's busiest ports.

IOOS combines data, such as the shape of the ocean floor with coastline aerial images, so that communities can track ecological change and identify vulnerable environments that require protection, including fragile coral reefs.

ioos.gov

U.S. Group on Earth Observations (USGEO)

Enabling a healthy public, economy and planet through an integrated comprehensive and sustained Earth observation system.

The Global Earth Observation System of Systems (GEOSS) enables us to envision a world where more people will be fed, more resources will be protected, more diseases will be mitigated or prevented, and more lives will be saved from environmental disasters.

The United States is a vital contributor to GEOSS, which is being developed by the Group on Earth Observations (GEO). About 80 countries, the European Commission, and nearly 60 global organizations comprise GEO. The U.S. is one of four GEO co-chair governments. As a sub-committee of the President's National Science and Technology Council, USGEO coordinates the participation of 14 U.S. government agencies and two White House offices.

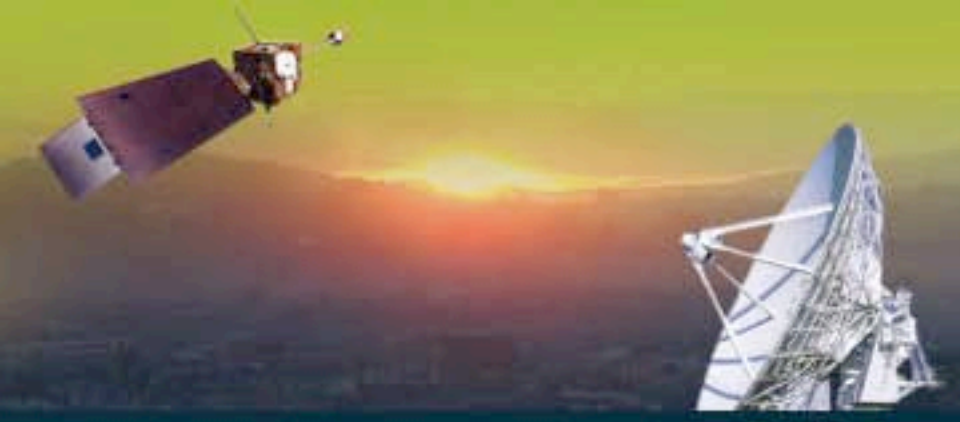
The goal is to provide the right information, in the right format, to the right people, at the right time, to make the right decisions.

To transition Earth observation systems and programs from research to implementation, USGEO federal agencies collaborate with universities, international partners and the private sector.

From providing real-time air quality and drought forecasts and global land observations, to monitoring and measuring the impact of Earth's changing climate, a number of early USGEO accomplishments have emerged. GEONETCast Americas is transmitting information on climate, crops, water quality, air pollution and more. SERVIR is putting previously inaccessible Earth observation information to work in Central America and East Africa.

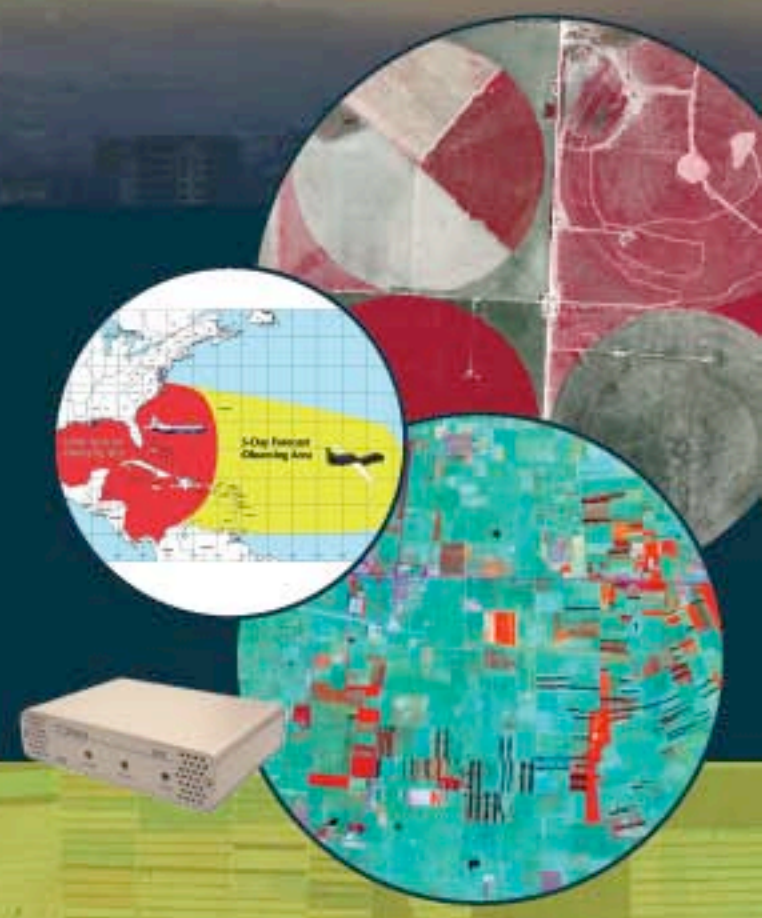
Cutting across borders, sectors and disciplines to open a world of possibilities, GEOSS is turning Earth into a new frontier. GEOSS is driving the interoperability of many thousands of separate data systems so they work not just on land, in the sea, and in the atmosphere as they do now, but as nature does, in an integrated manner as a system of systems. While data from satellite remote sensing, aerial surveys, ground-based monitoring systems and a vast array of socio-economic information are being collected, this information is just a fraction of what could be put to excellent, life-saving use in every region of the world. GEOSS recognizes that no matter how effective and efficient all of our single-purpose Earth observation systems may be, their value multiplies when they can work in synergy.

usgeo.gov



GEONETCast Americas:

Complementing Other Components to Provide Near-Global Coverage to More Effectively Manage a World of Resources



In recent years, scores of satellites and thousands of sensors on land, in the sea, and in the atmosphere have been deployed to gather environmental information. As a milestone in the emerging Global Earth Observation System of Systems (GEOSS), GEONETCast is helping to make this vital information more available around the globe, transmitting information on climate, crops, water quality, air pollution and more.

GEONETCast Americas provides a robust, low-cost and effective means of distributing data and other information about the Earth's changing environment to users, particularly those in developing countries. GEONETCast America's Training and Hazard Alert Channels provide targeted capacity-building materials and environmental alert programming. Implemented across GEONETCast's coverage area, these channels add to the broadcasts delivered by the National Oceanic and Atmospheric Administration (NOAA) to North, Central and South America and the Caribbean.

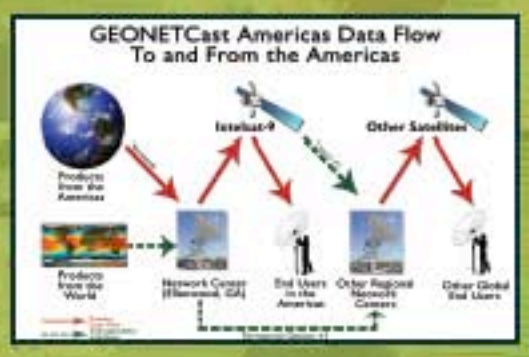
As a low-cost, global environmental information delivery system by which satellite and *in situ* data and services from GEOSS are transmitted to users through communications satellites, GEONETCast offers near-global coverage. Using a multicast, broadband capability, GEONETCast provides information essential to protecting lives and property. It allows for faster decision-making and policy response.

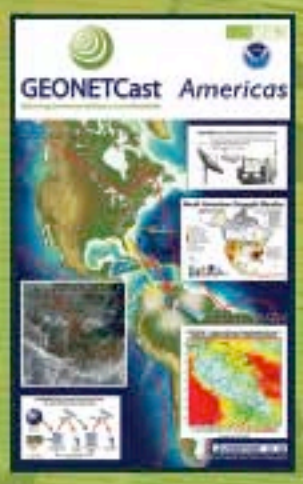
Communication satellite providers broadcast using a standard protocol interface. Different data streams and products are available on channels organized by issue and provider. The user determines which data are to be received, managed and saved locally. No Internet connection is required. The receiving station is simply a standard personal computer, an off-the-shelf satellite television dish, and a few computer cards.

The total cost…around 2,000 U.S. dollars per set-up. The result is expanded, automatic, worldwide dissemination of urgently needed environmental data to users located just about anywhere on the planet 24 hours each day.

The communication satellite for each sector of the globe is provided by one or more GEONETCast partners. Current coverage is based on contributions from the European Organisation for the Exploitation of Meteorological Satellites, the U.S. National Oceanic and Atmospheric Administration, and the Chinese Meteorological Administration. As a GEONETCast partner, the World Meteorological Organization contributes its experience in coordinating globally interoperable telecommunications systems for weather-related information.

geonetcastamericas.noaa.gov





AIRNow—International

Real-Time Air Quality Data and Forecasts to Protect Global Public Health

Air Quality Index (AQI) Values:	Levels of Health Concern	Colors
When the AQI is in this range:	...air quality conditions are:	...as symbolized by this color:
0 - 50	Good	Green
51 - 100	Moderate	Yellow
101 - 150	Unhealthy for Sensitive Groups	Orange
151 - 200	Unhealthy	Red
201 - 300	Very Unhealthy	Purple
301 - 500	Hazardous	Maroon

Air. The average adult breathes 13,000 liters each day. Yet poor air quality is an insidious problem. To better protect public health by providing real-time air quality data and forecasts, the U.S. Environmental Protection Agency (EPA) created the AIRNow program in 1995. Growing from a small regional program with three updates per day, AIRNow today is a nationwide program featuring hourly data, forecasts, hundreds of maps, and other vital information on air quality.

The Air Quality Index makes real-time data meaningful to the general public. A color-coded scale that ties air quality concentrations to health effects, the Air Quality Index ranges from "good" and "moderate" to "unhealthy for sensitive groups," "unhealthy," "very unhealthy" and "hazardous." When the Air Quality Index registers "unhealthy," everyone may experience some health effects. "Hazardous" signals emergency conditions. The information AIRNow provides allows citizens, the media, and the health community to effectively prepare and respond when air quality is poor. AIRNow has also developed a national community that has shown that sharing air quality information leads to better understanding and awareness of air pollution.

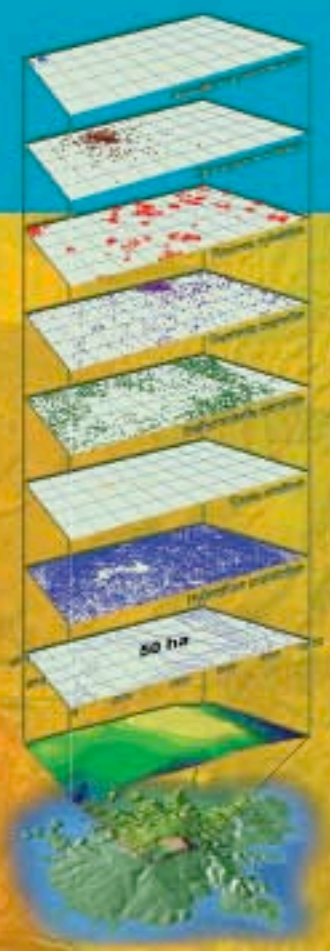
EPA developed AIRNow-International, or AIRNow-I, to use this experience to bring real-time data-sharing, processing and distribution to other parts of the world. AIRNow-I software features data processing, quality control, system monitoring, and mapping. AIRNow-I is designed for compatibility with GEOSS. In addition to bringing air quality information to the public in more places, AIRNow-I's data- sharing capabilities can be extremely useful to the air quality research and management communities. As different local entities begin to share air quality information, new discoveries will be made about the behavior and causes of regional air pollution. EPA is currently working with the Shanghai Environmental Protection Bureau to implement AIRNow in Shanghai.

AIRNow-I promises to become a catalyst for world-wide integration and standardization of real-time air quality data. With agreed upon standards for sharing data, AIRNow-I will interface seamlessly with existing systems. AIRNow-I will also become a focal point for communicating air quality conditions, forecasts, and healthy suggestions to decision-makers, the press and the public.

airnow.gov

Smithsonian Institution Global Earth Observatories (SIGEO)

A Research Platform to Measure the Global Impact of Climate Change



Over the past 25 years it has become clear that tropical forest populations are incredibly dynamic and responsive to climate change. Large-scale and standard forest census methods pioneered by the Smithsonian Tropical Research Institute in the Barro Colorado Nature Monument in Panama proved to be a powerful approach to studying the dynamics of tropical forests. By 1990, scientists around the world had replicated the methods and a global network of research plots emerged. From the first forest research plot on 50 hectares of lowland tropical forest on Barro Colorado Island, the network grew to individual forest plots administered by the Smithsonian and led by partner institutions in countries throughout the Americas, Asia and Africa.

This network provides a basis for determining quantitatively how trees and forest ecosystems are responding to changing climate. By 2009, there were 34 research plots in 20 countries monitoring 3.5 million trees comprised of at least 7,500 species.

Now the Smithsonian is transforming the network, known as the Center for Tropical Forest Science, into SIGEO, a platform for a broader range of scientific investigations. CTFS research on tropical forest dynamics continues, but joins new initiatives to study carbon fluxes, temperate forests and the impacts of climate change on biodiversity and forest function. SIGEO will monitor the effects of anthropogenic increases in atmospheric CO2, nitrogen and general air pollution at local, regional and global scales. New plots in China, the United States, the United Kingdom, Brazil, and Canada expand the network into the temperate zone.

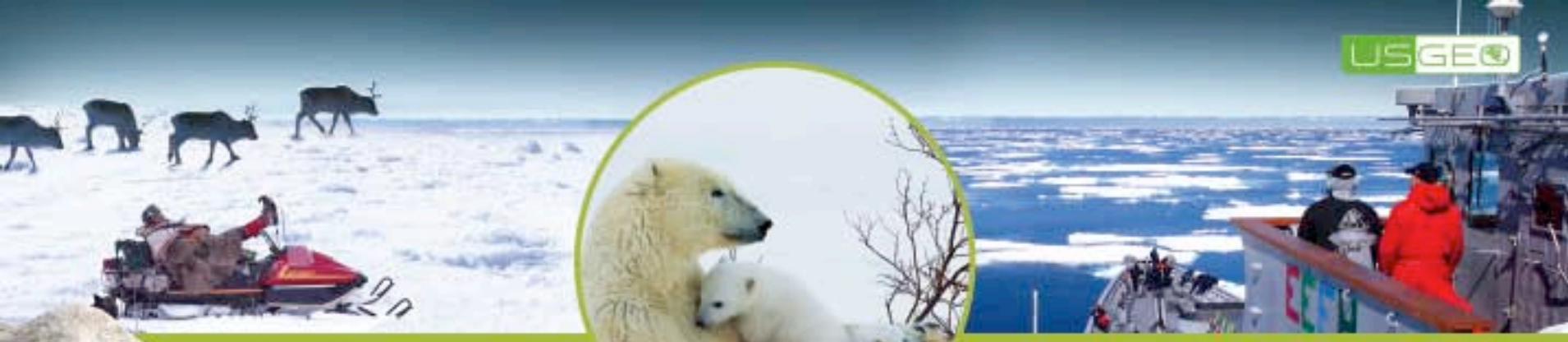
This work will enhance global carbon research, filling gaps in understanding the role of forests in the global carbon budget and whether temperate and tropical forests behave differently under changing global conditions.

These Global Earth Observatories also will look beyond the trees, improving assessment of the impact of global change on biodiversity through focused surveys of vertebrates, invertebrates and microbes, and providing training in developing countries leading to sustainable management of natural resources.

sigeo.si.edu

neoninc.org

remotesensing.usgs.gov



The Arctic

"Long ago, in my childhood, we followed the seasons and the weather. Even the animals, the caribou followed the weather. Now there are hardly any caribou on the island. Life has become unpredictable for all of us."

Sarah Kuptana, Sachs Harbour, Canada*

The Arctic's climate has been changing faster than models predict. Spring thaws are earlier, fall freeze-ups are later. Sea ice is shrinking. Unfamiliar species of plants and animals are appearing. Intense storms are more frequent.

This has significant consequences for the Arctic itself and the lower latitudes. The effects of climate change in the Arctic include rapid melting of sea ice, alteration of ocean currents, and a decrease in permafrost. This, in turn, has serious implications for global trade patterns, tourism, native species, and the indigenous peoples that rely upon them.

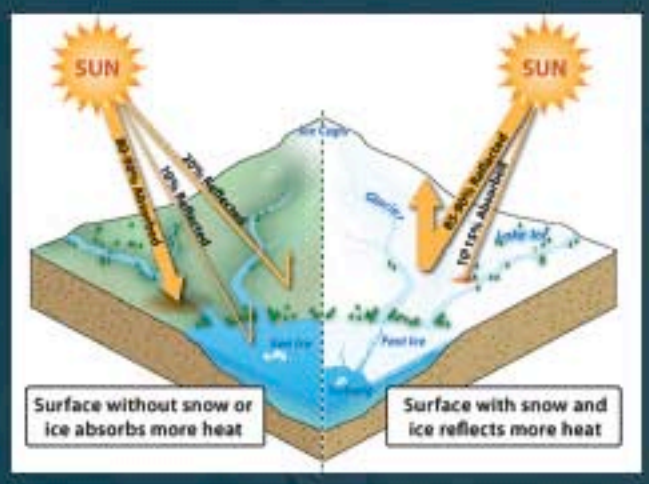
Increased observations in the Arctic can provide the data necessary to contribute to a greater understanding and sound management of this complex environment in years to come.

Started in the International Polar Year, the Sustained Arctic Observing Network (SAON) utilizes existing networks and sites for sustained observing and increasing participation of Arctic residents in climate and environmental monitoring. This initiative is co-led by the National Science Foundation and National Oceanic and Atmospheric Administration (NOAA) with international partners.

The National Ice Center, jointly managed by the US Navy, US Coast Guard, and NOAA provides snow and ice information—such as the Arctic ice extent—required to understand and monitor conditions in the Arctic and the implications for the global environment.

The ability to observe and predict changes in the Arctic is an essential element in predicting weather and climate for the whole globe. The international Arctic science community will need to deploy its resources in the most effective manner to gain adequate understanding of the changes, their impacts, and their predicted future course.

*from the Smithsonian exhibit: *Arctic: A Friend Behaving Strangely*

saon.arcticportal.org

natice.noaa.gov