GEOSS Operating Principles

Open and Transparent Process

Standardized Practices and Protocols

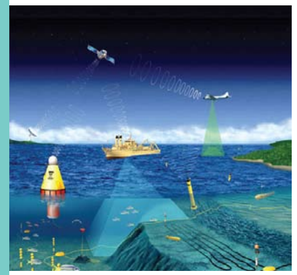
User-friendly Formats

Interoperable Components

With shared standards, vast new worlds of data can be accessible, comparable, understandable and a catalyst for enriching the quality of life for people all around the globe.

Science Without Borders

For developed and developing nations battling drought and disease, emergency managers making evacuation decisions, farmers making planting choices, companies evaluating energy costs, and coastal communities concerned about sea level rise, there is a real global need to get ahead of the curve — to provide new analytical tools, access to timely data and forecasts about emerging threats that will enable wise choices in an uncertain world.



As science without borders, the Global Earth Observation System of Systems (GEOSS) is emerging as a coordinated, comprehensive and sustained *system of systems.* GEOSS is being developed from the many thousands of individual land-, sea-, air- and space-based Earth observations working around the globe. Because these systems tend to work separately, information can be incomplete, providing only snapshot assessments that lead to critical gaps in scientific understanding. Moreover, data being collected today are just a fraction of what can be put to excellent, lifesaving use in every region of the world.

GEOSS is driving the interoperability of these separate systems so they work as nature does, in an integrated manner as a system of systems. For sound science to drive sound policy, the science must be derived from careful observations of nature and change that go beyond snapshot assessments. In vital societal benefit areas, GEOSS offers the opportunity to deliver a fuller picture, to move further ahead of the curve by working with many partners to link and leverage the capabilities of existing and planned Earth observation systems. The shared aim is to foster prediction, preparedness and prevention.

The United States is a leader of the intergovernmental Group on Earth Observations (GEO), which is developing GEOSS. The U.S. Group on Earth Observations (USGEO), a subcommittee of the White House Office of Science and Technology Policy, comprises White House offices and many federal agencies working together. GEOSS has the ministerial-level support of about 80 nations, the European Commission and over 50 international organizations.

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U.S. Group on Earth Observations

www.usgeo.gov

Group on Earth Observations

www.earthobservations.org

U.S. Group on Earth Observations

Department of Agriculture
Forest Service

Department of Commerce
National Oceanic and Atmospheric Administration

Department of Defense
United States Army Corps of Engineers
United States Navy
United States Air Force
National Geospatial-Intelligence Agency

Department of Energy

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute of Environmental Health Sciences

Department of Homeland Security
Federal Emergency Management Agency

Department of the Interior
Bureau of Land Management
Minerals Management Service
United States Geological Survey

Department of State

Department of Transportation

Environmental Protection Agency

Executive Office of the President
Office of Management and Budget
Office of Science and Technology Policy

National Aeronautics and Space Administration

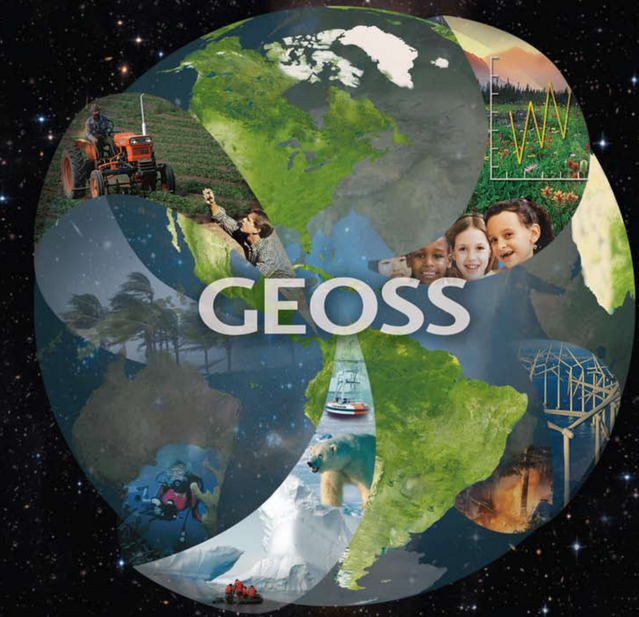
National Science Foundation

Smithsonian Institution

United States Agency for International Development

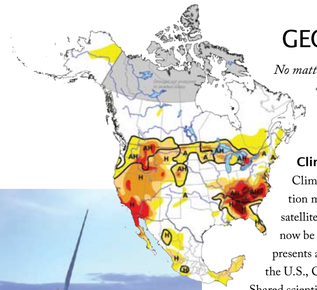
Global Earth Observation System of Systems

Revolutionizing Our Understanding of Earth



GEOSS Opens a World of Possibilities

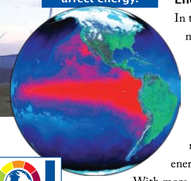
No matter how effective all our single-purpose Earth observation systems are, their value multiplies when they work in synergy. With a cross-cutting approach, GEOSS builds this synergy, reduces duplication and provides significant societal benefits in nine essential areas.



Climate

Climate underpins all societal benefit areas. With near-real-time satellite vegetation measurements and climate data, including sea-surface temperatures and satellite-derived cloudiness indices, epidemics of Rift Valley Fever in East Africa can now be predicted months in advance. Combating climate extremes such as drought presents a range of other challenges. Because no single set of observations is sufficient, the U.S., Canada and Mexico have established the North American Drought Monitor. Shared scientific expertise and data exchange are producing faster, more accurate drought assessments and reducing economic loss from crop failures. Having a well-connected set of interoperable monitors, indicators and associated data increases the lead time for addressing problems and is essential to mitigation and adaptation.

Climate variations affect energy.



Energy

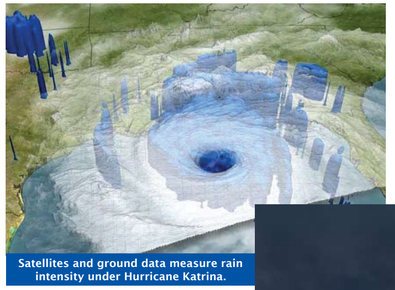
In the U.S. alone, it is estimated that forecasting temperature with just one degree more accuracy can cut annual energy costs by about $1 billion. Effective El Niño forecasts are major assets to hydroelectric power production and competing water uses. Natural gas and heating oil producers can cut losses when warmer weather is anticipated. Optimal use of solar-powered wind turbines requires solar radiation measurements. Increasingly climate data, not just weather data, will create value for energy companies as they determine when to generate, buy or sell energy across regional power grids. A study (Centrec 2003) estimated that each dollar invested by energy companies in acquiring federal climate data yields a potential $495 in savings. With more advanced observing systems, this cost-benefit ratio is expected to grow significantly.

Health

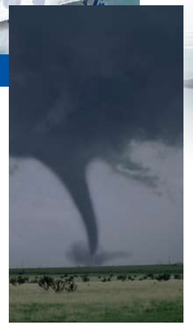
With GEOSS, we can envision a world in which the health community and public will easily access timely, comprehensive information to make real-time health decisions. Knowing that El Niño brings cholera outbreaks with each warm weather cycle already gives the health community a much better shot at getting ahead of the curve. AIRNOW is making daily real-time air quality data meaningful to policy-makers and the public and becoming an international model. As GEOSS creates opportunities to discover early indicators of harmful conditions and predictive models improve, other preventative measures will emerge. Earth observations of weather, land and ocean parameters will help predict outbreaks and trends in meningitis, malaria and other diseases. Data on weather and stream flow will be factored into better management of drinking water. Improved data on food contaminants, ultraviolet radiation and chemical emissions will contribute to prevention, early warning and more rapid problem-solving.

Disaster Management

When disaster strikes, lives can be saved with rapid access to weather forecasts, data about land and sea conditions, maps showing hospitals and transport links, and information on socio-economic variables. Delivering this information requires integrating a range of disaster-related data from diverse sources in friendly formats. After disaster strikes, integrated information can be pivotal in limiting future risks. SERVIR, for example, puts previously inaccessible Earth observation data to use in Central America and East Africa. With internationally shared standardized data from disparate data sets, people and communities throughout these regions now benefit from timely predictions of hazardous weather and, in Central America, from the first-ever regional air quality reports. In another breakthrough, satellites coupled with ground data can measure rainfall intensity, resulting in improved flood alerts, safer construction choices and many other benefits.



Satellites and ground data measure rain intensity under Hurricane Katrina.



Weather

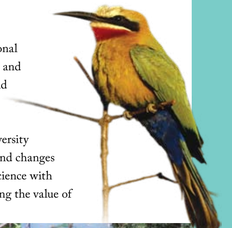
Worldwide weather data-sharing began nearly a half century ago, and the global network of monitoring instruments, databases and forecast models is a major contributor to GEOSS. Significantly expanding the reach of this information will lead to even greater societal benefits, especially as GEOSS integrates global weather data with emerging data sets in health, energy, water management and other fields. With weather- and climate-sensitive industries accounting for one-third of America's GDP, or about $4 trillion, improved Earth observations leading to improved analyses and response will greatly affect the nation's ability to keep people and property safe and secure. An integrated approach is already a cornerstone of the U.S. Tsunami Warning System, which receives real-time data from satellites following transmission from surface buoys linked to seafloor sensors.

Water

Even as the world's supply of clean water continues to dwindle, current Earth observation systems cannot adequately monitor long-term changes in the global water system and their impact on people, climate and biodiversity. Because the amount of available freshwater is affected by many variables, GEOSS will help track these variables by filling information gaps, integrating data sets from various monitoring systems, developing better forecasting models, and disseminating the results to a wider range of decision-makers. The Great Lakes, for example, hold one-fifth of the Earth's surface freshwater and will benefit greatly from such activity. Coupled with research and other resources, improved remote sensing and *in situ* observations can lead to improved water quality, better control and prevention of invasive species, critical wetlands banking, and healthier fish and wildlife habitat.

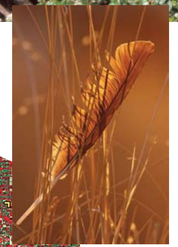
Ecosystems and Biodiversity

Because society will benefit from "ecosystem forecasts" that work like today's weather reports, the National Ecological Observatory Network (NEON) will lead continent-spanning research to detect, understand and forecast the consequences of climate change, land use change and invasive species on our ecosystems and their services. The Smithsonian Institution Global Earth Observatories (SIGEO) forest network is an innovative global research platform developed to measure ecosystem and climate change and carbon sequestration. By coordinating Earth observations with experimental field data, the Initiative on Biodiversity and Human Health, another new GEOSS program, will investigate links between emerging diseases and changes in biodiversity. Earth scientists, epidemiologists, economists and social scientists will integrate Earth science with shared knowledge of human behavior, ecology and disease transmission, opening a path to understanding the value of biodiversity in reducing disease.



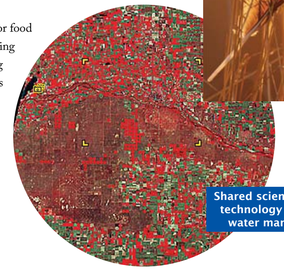
Oceans and Coasts

Understanding climate means first understanding the oceans. Given the highly stressed conditions of coastal areas, our understanding now just skims the surface. As a major shift in the approach to ocean observing, the Integrated Ocean Observing System (IOOS®) is bringing together many disparate systems to produce the continuous data essential to making informed decisions about America's oceans, coasts and Great Lakes. The aim is to build the national infrastructure needed to respond to climate variability and other events. Complementing this effort, the Ocean Observatories Initiative (OOI) is conducting research designed to deepen our understanding of the oceans and lead to new and improved technologies. By enabling access to long-term ocean and seafloor measurements, for example, OOI will investigate how seafloor seismic readings can provide early warnings of the undersea earthquakes preceding tsunamis.



Agriculture

Land is transitioning from agriculture and forestry. Crops for food are competing with crops for fuel. Climate change is increasing stress from fragmentation and invasive species. As monitoring land change grows more urgent, single-purpose observations working in synergy are demonstrating great added value. Aerial photography is being combined with field and satellite data. Landsat and remotely sensed data are being used to evaluate sensitive land conditions. Shared science ranges from monitoring locusts to assessing crops and estimating food security. By bringing collaborative initiatives to affected people and regions, GEOSS encourages better land management and the development of sustainable practices.



Shared science, data and technology are vital to water management.

GEOSS in the Americas

GEOSS in the Americas is a partnership using Earth observations to improve health, safety and well-being for people in the Western Hemisphere. Over 150 regional scientists and policy-makers are engaged in bringing data, analytic tools and GEO's pioneering spirit to the region. In turn, their work is contributing to the global GEO effort.

Leveraging the Earth observation resources of the U.S. and other countries, SERVIR (Spanish for "to serve") is putting once inaccessible, now standardized data from multiple sources to use in regional decision-making in areas such as disaster response, weather forecasting and environmental management. Following successful implementation in Central America, SERVIR expanded to East Africa. In 2008, in Panama, SERVIR introduced a prototype for the first regional air quality monitoring system in Central America and the Caribbean.

Through GEOSS participation, TerraLib, Brazil's advanced Amazon deforestation measurement system of GIS tools, is now available at no cost for use by governments and organizations worldwide. The tools automatically measure deforestation, which produces as much as 25 percent of the world's annual emissions of greenhouse gases.

GEONETCast Americas, a regional component of the global low-cost GEONETCast information delivery system, is putting near-real-time satellite and *in situ* data into the hands of scientists, decision-makers and many others when and how they need it. The receiving station is a standard personal computer, an off-the-shelf satellite television dish and a computer card, making essential environmental information readily available even without Internet access.