

## The Global Earth Observation System of Systems

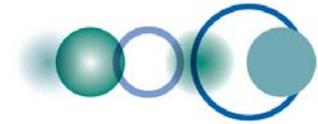
**The Global Earth Observation System of Systems (GEOSS) promises to revolutionize our ability to understand and manage the planet.** This emerging global public infrastructure will allow managers and decision makers to respond more effectively to the many environmental challenges facing modern civilization. It is already starting to generate a variety of comprehensive, cross-cutting and near-real-time environmental data sets and information services. GEOSS is being constructed on the basis of a 10-Year Implementation Plan for the period 2005 – 2015 by the Group on Earth Observations (GEO), which currently boasts 77 member governments (plus the European Commission) and 56 international organizations.

**GEOSS is interconnecting existing and future Earth observation systems.** Investments in environmental monitoring and forecasting have now reached a critical mass, resulting in a vast and expanding array of observation systems and decision-support tools. Buoys floating in the oceans monitor temperature and salinity; meteorological stations and balloons record air quality and rainwater trends; sonar and radar systems estimate fish and bird populations; seismic and Global Positioning System (GPS) stations record movements in the Earth's crust and interior; more than 60 high-tech environmental satellites scan the planet from space; powerful computerized models generate simulations and forecasts; and early warning systems issue alerts to vulnerable populations. GEOSS promises to make these and other technologies fully "interoperable".

**GEOSS reduces costs, promotes international cooperation and serves the public good.** Because the sheer costs and logistics of expanding Earth observations would be daunting for any single nation, GEOSS will make the production of comprehensive Earth observations more sustainable by leveraging investments from a wide range of partners. It will also ensure that Earth observations remain a global public good accessible to all.

**Technological advances have made GEOSS possible, while the expanding requirements of users have made it necessary.** We are entering a new era of global risks and opportunities where policy and management decisions must be based on the near-real-time environmental monitoring of the entire Earth system. This need for decision-support tools by a wide range of user groups is the driving force behind the development of GEOSS. The GEOSS Implementation Plan identifies nine distinct groups of users and uses, which it calls "Societal Benefit Areas". The nine areas are disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. Although the user groups each have their own distinctive features and needs, the Societal Benefit Areas are mutually interdependent and cannot be addressed in isolation.

**One user may require many data sets, while one data set may serve many users.** The complexity of the Earth system cannot be captured by any single observation system. Combining observations from multiple systems, however, can generate the integrated data set that a user may need. Similarly, a data set collected for one purpose will often be of value for another. For example, land-cover data gathered for the forestry and agriculture sectors could be equally useful for forecasting and abating the risks that severe weather events pose to people, infrastructure and the environment. Similarly, solar radiation data targeted to the energy sector could be useful for predicting future movements of threatened and endangered species.



**Interlinking observation systems requires common standards for architecture and data sharing.** The architecture of an Earth observation system refers to the way in which its components are designed so that they function as a whole. Each GEOSS component must be configured so that it can communicate with the other participating systems. In addition, each contributor to GEOSS subscribes to the GEO data-sharing principles, which aim to ensure the full and open exchange of data, metadata and products. These issues are fundamental to the successful operation of GEOSS. The end result will be an interlinked and interactive network of independent content providers, similar in many ways to the internet.

**GEOSS disseminates information and analyses directly to users.** GEO is developing the GEOPortal as a single Internet gateway to the comprehensive and near-real-time data produced by GEOSS. GEOPortal will make it easier to integrate diverse data sets, identify relevant data and portals of contributing systems, and access models and other decision-support tools. For users without good access to high-speed internet, GEO has established GEONETCast, a system of four communications satellites that transmit data to low-cost receiving stations maintained by the users.

## THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS



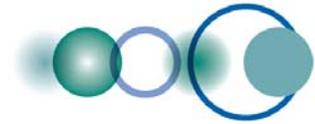
*Updated: 1 April 2009*

---

### **For more information please contact**

GEO Secretariat  
7 bis, avenue de la Paix, CP 2300  
CH-1211 Geneva 2, Switzerland  
secretariat@geosec.org  
+41 22 730 8505

**[www.earthobservations.org](http://www.earthobservations.org)**



## How GEOSS supports decision making in nine Societal Benefit Areas (SBAs)

**The societal benefits identified by the Group on Earth Observations (GEO) illustrate how GEOSS serves the needs of the international community.** The nine SBAs of disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity supply concrete examples of how decision makers can use the data and services available through GEOSS to address major global opportunities and challenges. None of the SBAs, of course, exists in isolation: the full value of the Global Earth Observation System of Systems lies in its ability to integrate information across disciplines.

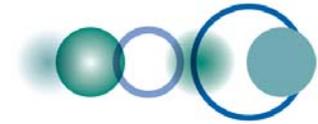
**Earth observations can help to reduce the loss of life and property from natural and human-induced disasters.** Rapid access to weather forecasts, data on land and ocean conditions, maps of transport links and hospitals, seismographic data, and information on socio-economic variables can strengthen disaster preparedness, prediction and response. Key disaster-management services available through GEOSS include the Global Early Warning System for Wildland Fire and the Sentinel Asia and (for Africa and Central and South America) SERVIR satellite monitoring systems.

**Understanding how the environment affects health can boost human well-being.** Key environmental variables include airborne, marine, and water pollutants; stratospheric ozone depletion; land-use change; food security and nutrition; noise levels; population trends; and weather-related stresses and disease vectors. For example, analyses of desertification trends and forecasts of windstorms are being used to provide early warnings of epidemics in Africa's 'meningitis belt'; this allows the World Health Organization and local health experts to target their vaccination programs more effectively.

**GEOSS is supporting efforts to advance sustainable energy.** Earth observations are vital for monitoring and forecasting fluctuations in hydropower, solar, ocean and wind energy sources; assessing and predicting the environmental impacts of energy exploration, extraction, transportation and consumption; reducing weather-related and other risks to energy infrastructure; and matching energy supply to demand. To support solar energy planners, for example, GEO is coordinating a solar data programme that offers one-stop access to databases, applications and information relating to solar radiation trends and patterns.

**End-to-end information services and sustained observing systems are essential for addressing climate variability and change.** GEO is a leading advocate for maintaining and strengthening the climate observation capacities of atmospheric, terrestrial and oceanic monitoring systems. For example, 20-plus GEO members are contributing to the global array of some 3,000 robotic Argo buoys that are monitoring ocean temperatures and salinity. GEO members are also establishing essential decision-support services, such as an innovative system for monitoring and verifying forest carbon content and a program on Climate for Development in Africa.

**Water experts are collaborating through GEO to define the data and systems needed for improved water-cycle forecasting.** National meteorological and



hydrological services, along with several United Nations agencies, are collaborating through GEO's "Integration of In-Situ and Satellite Data for Water Cycle Monitoring" project. This project aims to fill gaps in global measurements, standardize metadata, and improve the accuracy of data and predictions. Other ongoing initiatives relate to information products on precipitation, soil moisture, and groundwater.

**GEOSS is interlinking weather forecasting systems with other Earth observation systems.** By integrating weather data with the growing number of data sets available in fields such as biodiversity, health, energy, and water management, GEOSS will greatly expand the uses to which weather information and forecasts can be put. Other efforts to improve the value of weather forecasting include the WMO-led THORPEX Interactive Global Grand Ensemble project, or TIGGE, which aims to accelerate improvements in the accuracy of one-day to two-week weather forecasts.

**GEO is building international teams to monitor ecosystems and generate maps and other decision-support tools.** One team is working to improve the classification and mapping of diverse ecosystems. Another is extending a South American network for monitoring ocean temperatures and chlorophyll to the global scale. Still others are collaborating on monitoring and delineating protected areas, including UNESCO World Heritage sites; measuring the impact of tourism and other socio-economic activities on ecosystems; assessing the vulnerability of sea basins around the world; and assessing the vulnerability of mountain regions.

**GEO is developing an Agricultural Monitoring System of Systems that will integrate in-situ and space data from multiple fields.** Farmers and policymakers require accurate forecasts and cross-cutting data on food production and supplies, storms and droughts, climate change and variability, water levels, market demand and changes in productive land and ocean areas. They need this information for responding to immediate challenges and opportunities, for crafting longer term strategies for adapting their farming practices to changing conditions, and for ensuring the sustainable management of fisheries and grazing lands. Enhanced Earth observations will also assist international relief organizations to plan more effectively for famines.

**Comprehensive monitoring is critical to the conservation and sustainable use of the world's biological diversity.** The GEO Biodiversity Observation Network, known as "the biodiversity arm of GEOSS", is interlinking the field's numerous stand-alone databases and observation systems to improve assessments of plant and animal populations, track the spread of invasive alien species, and promote information sharing and cost savings. It will also connect these systems to other Earth observation networks that generate relevant data, such as climate and pollution indicators.

*Updated: 1 April 2009*

---

## **For more information please contact**

GEO Secretariat  
7 bis, avenue de la Paix, CP 2300  
CH-1211 Geneva 2, Switzerland  
secretariat@geosec.org  
+41 22 730 8505

**[www.earthobservations.org](http://www.earthobservations.org)**

## **The Group on Earth Observations**

**The Group on Earth Observations (GEO) is coordinating efforts to build a Global Earth Observation System of Systems (GEOSS).** It was established in February 2005 by the Third Earth Observation Summit in Brussels. GEO was launched in response to calls for action by the 2002 World Summit on Sustainable Development and the Group of Eight (G8) leading industrialized countries. These high-level meetings recognized that international collaboration is essential for exploiting the growing potential of Earth observations to support decision making in an increasingly complex and environmentally stressed world.

**GEO is a voluntary partnership of governments and international organizations.** It provides a framework within which these partners can develop new projects and coordinate their strategies and investments. As of April 2009, GEO's Members include 77 governments and the European Commission. In addition, 56 intergovernmental, international, and regional organizations with a mandate in Earth observation or related issues have been recognized as Participating Organizations. Each Member and Participating Organization is represented by a Principal and a Principal Alternate. Members make financial contributions to GEO on a voluntary basis.

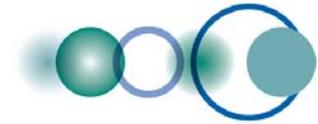
**GEO is constructing GEOSS on the basis of a 10-Year Implementation Plan.** Adopted by the Third Earth Observation Summit, the Plan runs from 2005 to 2015. It defines a vision statement for GEOSS, its purpose and scope, expected benefits, nine "Societal Benefit Areas" (disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity), technical and capacity-building priorities, and the GEO governance structure. To measure progress and maintain momentum, the Plan also sets out 107 two-year targets, 83 six-year targets and 56 ten-year targets.

**GEO is governed by a Plenary consisting of all Members and Participating Organizations.** It meets in Plenary at least once a year at the level of senior officials and periodically at the ministerial level. The Plenary held its first meeting in May 2005 in Geneva, followed by GEO-II in December 2005 in Geneva, GEO-III in Bonn in November 2006, GEO-IV (plus a Ministerial Summit) in Cape Town in November 2007 and GEO-V in Bucharest in November 2008. GEO-VI will be held in Washington DC in November 2009, and the next Ministerial Summit is expected to take place in 2010. The Plenary takes decisions by consensus.

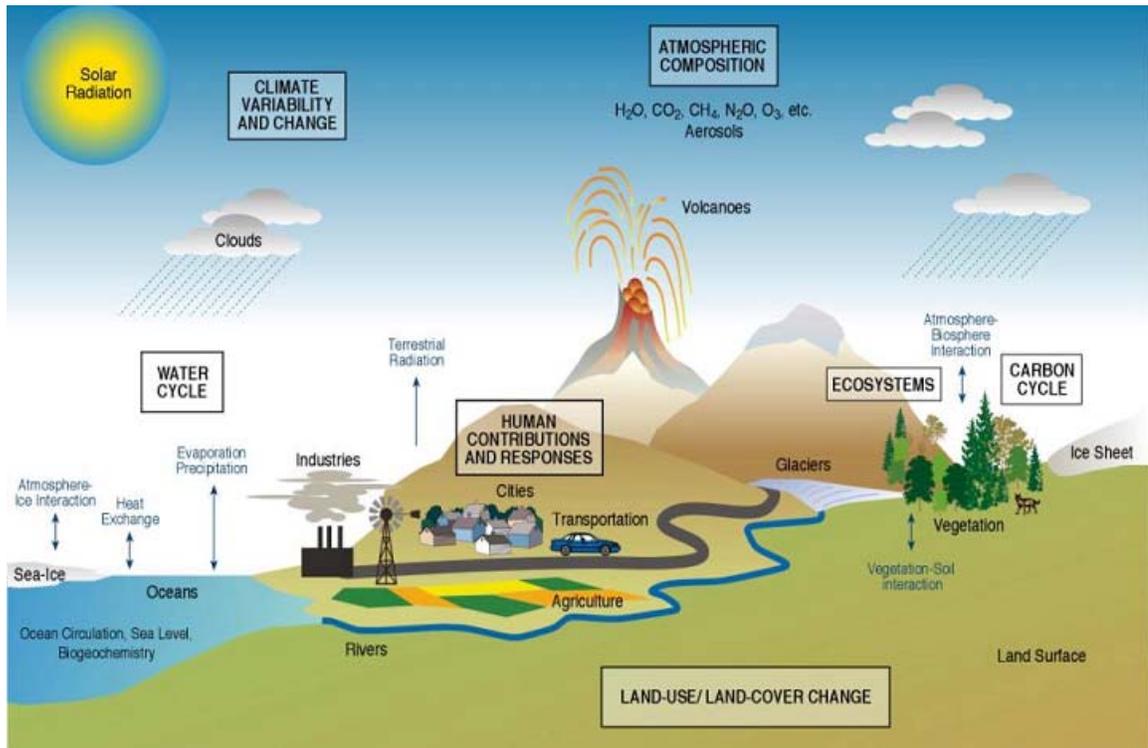
**An Executive Committee oversees GEO activities when the Plenary is not in session.** The Committee consists of 12 representatives elected from the five GEO regions, including three each from the Americas, Asia and Europe, two from Africa, and one from the Commonwealth of Independent States. The Committee is also responsible for guiding the Secretariat. The GEO Members elect four Co-Chairs who preside over both the Plenary and the Executive Committee.

**GEO-I established four Committees to guide the implementation of the 10-Year Plan.** The Committees address themes that cut across, and are relevant to, each of the nine issue-specific Social Benefit Areas. These four permanent bodies are the Architecture and Data, Science and Technology, User Interface, and Capacity Building Committees.

**GEO-V adopted the current GEO work plan for the period 2009 – 2011.** The first GEO work plan, adopted at GEO-III and crafted for 2007 – 2009, has therefore now been replaced by this new, overlapping three-year plan. As a "living" document, the work plan is updated annually and sets out some 70 overarching Tasks. Each Task supports one of the nine societal-benefit or four transverse areas and is carried out by interested Members and Participating Organizations.



**The GEO Members and Participating Organizations are supported by a Secretariat.** Based in Geneva, Switzerland, the Secretariat consists of a Director appointed by the Executive Committee, several international civil servants, and approximately 14 technical and scientific experts who are seconded to the Secretariat for two to four years. The Secretariat is responsible for coordinating the Tasks and other activities that are driving the 10-Year Implementation Plan for GEOSS. It also services the Plenary and the Committees and implements outreach and other support activities.



**Diagram of the Earth System**

*Updated: 1 April 2009*

**For more information please contact**

GEO Secretariat  
7 bis, avenue de la Paix, CP 2300  
CH-1211 Geneva 2, Switzerland  
secretariat@geosec.org  
+41 22 730 8505

**[www.earthobservations.org](http://www.earthobservations.org)**