

Report on Progress

2011-2013

Geneva Ministerial Summit

Forward

Yes, the title above is spelled correctly. While this is a “foreword” to the Report on Progress 2011-2013, the word “forward” represents the experience and outlook of the Group on Earth Observations (GEO) in achieving its goal of creating a Global Earth Observation System of Systems (GEOSS). As with the two previous reports on progress, there have been substantial advancements and improvements in developing GEOSS, powered by the contributions of nearly a thousand experts in hundreds of organizations around the world.

GEO Members and Participating Organizations continue to improve and coordinate observation systems across the nine Societal Benefit Areas of agriculture, biodiversity, climate, disasters, ecosystems, energy, health, water and weather. The organization is a strong advocate of broad, open data-sharing policies and practices, as well as for the increased use of Earth observation (EO) data and information. Further, GEO continues to focus significant effort on building both human and technological capabilities to ensure that all parts of the world can benefit from better access to, understanding, and use of EO data, information and services.

As GEO moves into the final two years of its first Implementation phase – and beyond – we recognize that significant gaps still exist in global monitoring capabilities. The GEO community remains committed to identifying areas of need and taking collective action to address and fill these gaps. As GEO has evolved and matured,

what has become increasingly clear is that GEO’s global initiatives must be based on three fundamental concepts.

First, there must be people committed to moving an idea forward. Second, resources must be made available to develop a particular initiative and sustain its operation into the future. Third, an initiative must be based on a policy mandate to support the people and resources necessary to get the work done. These mandates could be international frameworks or conventions (e.g., Convention on Biodiversity, Framework Convention for Climate Change, Minamata Convention on Mercury) or other global, regional or national commitments to address environmental and societal challenges. Basing its work on these three pillars provides GEO with the best foundation for success moving forward.

So, while much work remains to be done to realize fully our goals, let us take a moment to reflect on the substantial progress that has been made. In that regard, I commend the Report on Progress 2011-2013 to you as a brief illustration of the achievements and potential of GEO, and I commend the GEO Members, Participating Organizations and Observers, and the substantial commitments of financial and human resources that have made these, and many other, achievements possible.

Barbara J. Ryan
Director, GEO Secretariat

Overview

This Report covers the Group on Earth Observations' (GEO) activities and initiatives since the 2010 Beijing Ministerial Summit. During that time, the GEO community made considerable progress toward its goal of implementing a Global Earth Observation System of Systems (GEOSS). GEO's work has been oriented around four primary objectives: Improve and Coordinate Observation Systems; Advance Broad Open Data Policies/Practices; Foster Increased Use of Earth Observation Data and Information; and Build Capacity. The pages that follow provide a brief overview of some of the general accomplishments of GEO and highlight a number of specific achievements. The projects describe tangible evidence of the contributions of GEO's Members, Participating Organizations (POs) and other participants in the creation of GEOSS. Yet, they are also only representations of the breadth and scope of the numerous activities, projects and Tasks undertaken by the GEO community and what has been accomplished globally.

Improve and Coordinate Observation Systems

For GEOSS ultimately to be effective requires the participation of numerous technical and scientific perspectives to ensure that the system being constructed addresses real needs, both in the present and envisioned for the future. GEOSS can only be as successful as the systems that are the sources of Earth observation data, information and services being discovered and accessed by users.

By extension, this requires the collaboration of individuals and organizations across disciplines and geographic and political boundaries. Toward that end, GEO membership has increased, since 2010, from 81 to 90 governments, including the European Commission, while the number of Participating Organizations has increased from 58 to 67.

Over the past three years, GEO has strived to facilitate collaboration among developers and users of Earth observation data and information. Countless conferences, forums, symposia, workshops and other gatherings have either been directly sponsored or co-sponsored by GEO, or had a significant GEO presence. Similarly, participation in the GEO Work Plan continues to expand. At the end of 2013, almost 850 contributors from more than 340 organizations were engaged in close to 60 individual Work Plan components. Contributors were affiliated with 40 Member governments, 35 Participating Organizations, 1 Observer organization and 7 other partners. In addition, the three-day Work Plan Symposium held each Spring in Geneva attracts, on average, 120 participants representing 40 Members and Participating Organizations.

Foster Increased Use of Earth Observation Data and Information

The key to increasing the use of Earth observation data and information is the ability of users to discover and access it. This is the foundational concept of the GEOSS Common Infrastructure (GCI) and GEOSS Portal. Tremendous progress has been made during the 2011-13 period to create a user-driven and user-friendly data system. The GEOSS Portal is the central hub for searching, accessing and using the data, information, tools and services available from provider organizations. At the end of 2013, the number of discoverable resources (products, files and images) had grown to more than 65 million. Of these resources, more than 50 million were tagged as GEOSS DataCORE, meaning they are accessible at no cost or low cost. The ability to discover and access easily the resources available through GEOSS is central to the success of the entire initiative. In 2013, a new GEOSS Portal (formerly the GEO Portal) was unveiled, greatly improving the ability of users to search, retrieve, preview and download resources. This Internet-based gateway is

powered by another significant GEOSS innovation – the Discovery and Access Broker (DAB) – which connects users and data providers to each other and increases the discoverability and accessibility of the ever-growing number of databases and information systems available around the world.

Advance Broad Open Data Policies and Practices

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All of global society – North/South; developed/emerging economies, etc. – is grappling with the dual challenge of adapting to, or mitigating, significant environmental changes, while also pursuing a sustainable development agenda that improves the lives of all peoples. Space-based and *in situ* Earth observations help us monitor and measure these global changes – changes that transcend political and geographical boundaries. To optimize the tremendous value of Earth observations to understand better how these processes behave and the impacts they cause, citizens and decision makers alike require more transparency of the data collected by satellites and other monitoring devices, especially those built and maintained with public funds.

GEO is one of the few organizations that vociferously advocates broad open data across all nine Societal Benefit Areas. When joining GEO, governments and organizations endorse the open data-sharing principles that are the foundation for GEOSS and the backbone of GEO’s work. GEO takes advantage of every opportunity

to encourage governments, scientific and technical organizations, and other institutions to create open access policies for as much of their data and information as possible.

Build Capacity

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The GEO community places a high premium on ensuring that anyone who wants or needs to access, understand and use Earth observation data and information has the ability to do so anywhere in the world. During the course of each year, GEO Task Teams, Working Groups and Communities of Practice convene to engage in intensive knowledge-sharing. In addition, GEO Members, Participating Organizations and other partners sponsor training sessions, summer schools and other capacity-building activities. A snapshot of training activities in 2013 indicates that, at a minimum, more than 1500 people – from over 90 countries – took part in some type of formal training session.

Similarly, initiatives like GEONETCast and GEOSS in the Americas provide the technological capacity for decision makers and other data and information users to access resources, best practices and other types of information, regardless of the availability of Internet access. GEONETCast has now grown to serve almost 6000 users across 169 countries, with plans to expand the network further in 2014. Across the GEO Work Plan, human and technological capacity-building are an important element of every project and Task.

GEO Selected Achievements 2011–2013



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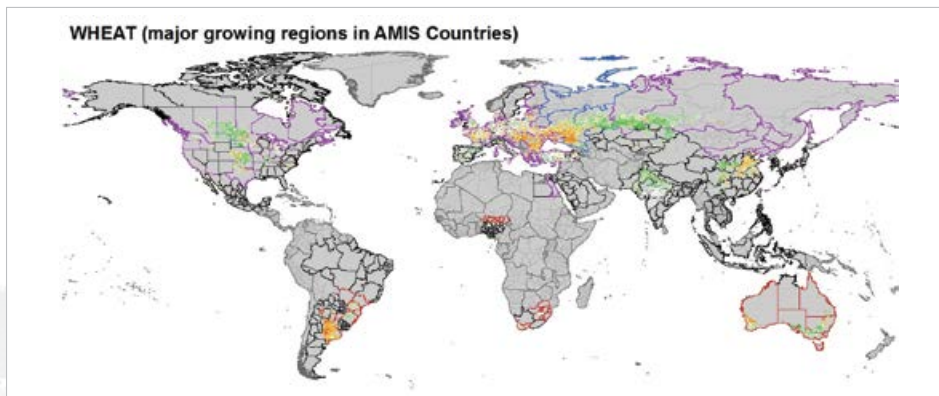
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GEO Global Agricultural Monitoring (GEOGLAM)

With timeliness and transparency, the **GEO Global Agricultural Monitoring (GEOGLAM)** initiative is designed to enhance worldwide agricultural production estimates. Beginning in August 2013, GEOGLAM started delivering monthly global crop outlooks to the Agriculture Market Information System's (AMIS) Market Monitor publication, hosted by the Food Agriculture Organization of the United Nations (FAO). www.amis-outlook.org/amis-monitoring

The crop outlooks are based on the GEOGLAM Crop Monitor, a global initiative developed in response to the G20 Agricultural Ministers' concerns about reducing market volatility for the world's major crops. GEOGLAM draws on regional expertise, ground observations and analysis of meteorological and satellite data, the latter provided by the Committee on Earth Observation Satellites (CEOS), to assess the growing conditions of four major crops – maize, rice, soybeans and wheat. These crops account for 70 percent of the calories consumed by humans worldwide.

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Satellite-based vegetation conditions for wheat in August 2013 (NDVI)

The Global Crop Monitor (www.geoglam-crop-monitor.org) is coordinated by the University of Maryland with contributions from the GEOGLAM Community of Practice, including Argentina (INTA), ASEAN (ASIA RICE, AFSIS), Australia (ABARES/DAFF, CSIRO), Brazil (CONAB), Canada (AAFC), China (RADI-CAS CropWatch), European Commission (JRC-MARS), India (ISRO), Indonesia (LAPAN, MOA), Japan (JAXA, RESTEC), Mexico (SiAP), Russia (IKI-RAS), South Africa (ARC), Thailand (GISTDA), Ukraine (Hydromet Center, Space Research Institute), United States (NASA, USDA), Vietnam (VAST, VIMHE), CEOS, FAO and WMO.

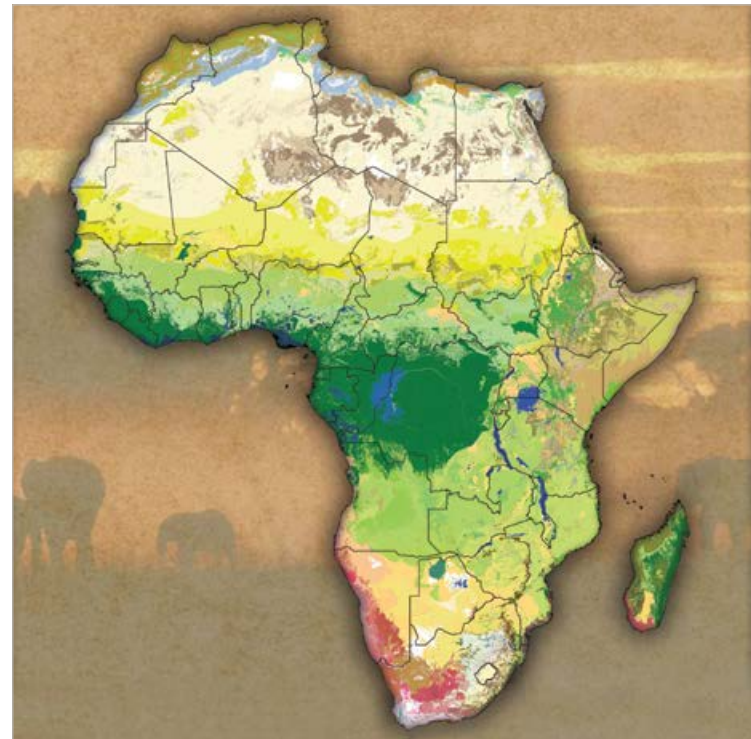
Map of Standardized African Terrestrial Ecosystems

Working with African vegetation and ecosystem experts, the US Geological Survey (USGS) and NatureServe have produced a **Map of Standardized Terrestrial Ecosystems of Africa** that fills an important gap in evidence-based decision making. As a GEO task supported by USAID, this new map was developed in collaboration with the **GEO Biodiversity Observation Network (GEO BON)**.

Standardizing global terrestrial ecosystems at a management-appropriate spatial resolution, the map offers a higher resolution (90m) product than previous products of this kind, and can be used for a wider range of purposes, especially those requiring more detailed geospatial information. The map represents a spatial integration of physical and biological information such as land surface forms, geology and climate regions. It also serves as a basis for monitoring the impacts of human activities, including climate change and mining.

Following a user-oriented approach, ecosystem categories were developed to provide users with an accessible, productive product. A hierarchical vegetation classification was developed by African ecosystem scientists and vegetation geographers, who also provided sample locations of the newly-classified vegetation units. The ecosystems – a total of 126 – were then mapped across the continent, each with multiple, repeating occurrences on the landscape.

In addition to creating several rich, new continent-wide biophysical data layers describing African vegetation and ecosystems, alternate approaches are being explored to move forward this type of standardized, continent-wide, ecosystem classification and mapping

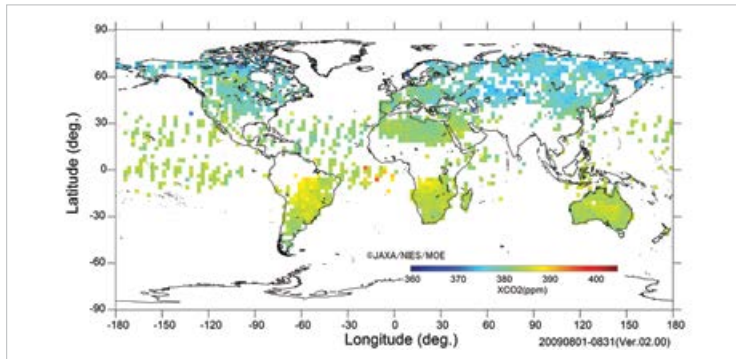


First-of-its-kind terrestrial map fills important gaps, providing rich, continent-wide data layers about Africa's ecosystems and a basis for monitoring the impact of human activities.

effort, rapidly. The team is now developing a Global Terrestrial Ecosystem map that will build on maps previously created for South America and the United States. www.aag.org/cslafricaecosystems



GEO Carbon



A time series of observations from the GOSAT satellite allows estimation of regional CO₂ fluxes and their seasonal and inter-annual variation. This information helps establish regional carbon budgets and improve our knowledge about carbon sources and sinks.

operational. The GEO Carbon initiative provides cross-coordination for the current observing and analysis systems.

The system being developed will provide decision makers with unprecedented data and information to develop informed and timely climate policies. For example, GEO Carbon is working in close collaboration with the Global Carbon Project (GCP) to develop annual updates of the global carbon budget, a new global methane budget and Global Carbon Atlas (www.globalcarbonatlas.org). Carbon-related data and information provide added value to decision makers and the public because of their importance to understanding and addressing climate change and its impacts on ecosystems and human well-being. In 2013, for the first time, some of the atmospheric stations coordinated by the WMO-GAW network contributing to the GEO Carbon initiative measured CO₂ concentrations higher than 400 ppm.

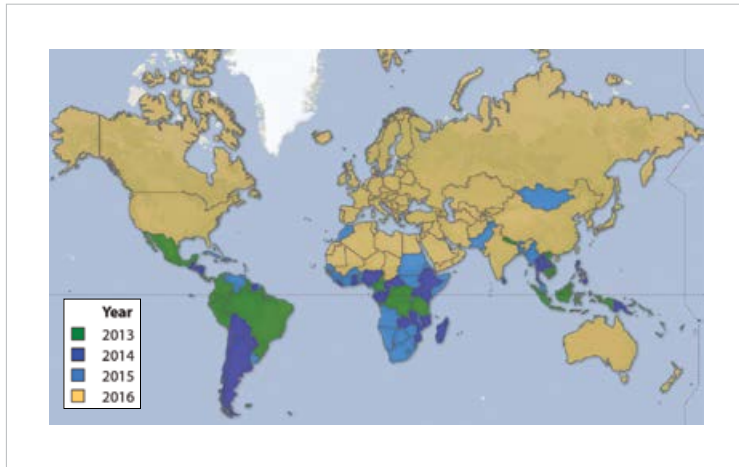
GEO Carbon's 47 partners include: Australia (CSIRO), China (BNU), European Commission (EC-FP7), France (LSCE), Germany (MPI), Italy (CMCC), Japan (JAXA, NIES), Netherlands (UvA), United Kingdom (Univ. of Sheffield), United States (NASA, NOAA, USFS), CEOS, ESA, GTOS, IOC and WMO. Many other contributions come from 21 GEO Member governments and Participating Organizations – and the number is growing.

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The **GEO Carbon** initiative is a global effort to develop and make available integrated data and information about the impact of human activities and natural processes on the carbon cycle at the national, regional and global level. Currently, many monitoring efforts (satellite, airborne and *in situ*) measure the carbon cycle, but a coordinated Global Carbon Observing and Analysis System is not yet



Global Forest Observations Initiative (GFOI)



GFOI will expand its sustained, annual satellite data acquisitions to global coverage in 2016 to enable countries to annually monitor forests and their greenhouse gas emissions.

Through GEO's **Global Forest Observations Initiative (GFOI)**, nations are receiving help to monitor their forests and forest carbon stocks. This partnership fosters sustained use of satellite and ground observations for national forest monitoring, and for measuring, reporting and verification (MRV) of forest areas, carbon stocks and greenhouse gas emissions. The aim is to help developing nations

meet the goals and requirements agreed to by the UN Framework Convention on Climate Change (UNFCCC) at the 19th session of the Conference of the Parties (COP 19) in November 2013.

GFOI emerged from the GEO Forest Carbon Tracking (FCT) project that began in 2008 focused on 11 demonstrator countries. GFOI is now expanding globally. With the goal of providing worldwide coverage by 2016, satellite data for 15 developing nations was acquired in 2013. When combined with increased capacity to process data and estimate changes in carbon stocks, these countries will have greater access to funds to preserve their forests available through the UNFCCC's Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) program.

In late 2013, GFOI published its first Methods and Guidance document, which assists countries in estimating future carbon stocks to build national forest monitoring systems consistent with the UNFCCC MRV requirements and Intergovernmental Panel on Climate Change (IPCC) guidelines. www.gfoi.org

National capacity-building activities, coordinated with the FAO, continue through regional workshops such as the US SilvaCarbon program in the Americas and other bilateral support programmes. SilvaCarbon will expand to Africa and South East Asia in 2014.



Advanced Fire Information Service (AFIS)

The **Advanced Fire Information System (AFIS)** is the first near-real-time satellite fire monitoring system developed for Southern African countries. AFIS provides local fire management and suppression agencies across the globe with prediction, detection, alerting, planning and reporting capabilities. Using satellite observations, AFIS delivers the GPS location, distance and direction to user-defined reference points via cell phone texts, email and social media networks. The system provides fire information 15 minutes after scans by two key satellite-based sensors.

AFIS is built in full compliance with GEOSS data-sharing principles. Data and products are available at no cost and with minimum time delay. Information available at www.afis.co.za provides users world-wide with interoperable data standards.

AFIS provides fire managers, farmers and disaster personnel with a smart device application for quicker access to fire information across southern Africa and globally. AFIS users are national departments and agencies, regional organizations and conservation institutions responsible for environmental protection and monitoring.

The South African power utility, Eskom, uses AFIS to respond quickly to fires under transmission lines. Fires occurring within 5km of a transmission line are automatically reported via cell phone to Eskom and its field staff nearest to the fire, allowing Eskom to reduce



Advanced Fire Information Service (AFIS) application for Android and iOS5 (or higher).

damage and disruption to the power supply as fires cause about 20 percent of transmission line faults.

AFIS partners include South Africa (South African National Space Agency (SANSA), South African Weather Service (SAWS)), and the Council for Scientific and Industrial Research (CSIR)), United States (NASA Earth Science Data and Information System (ESDIS)), European Center for Medium-range Weather Forecasts (ECMWF), Dundee University, University of Wisconsin-Madison and Vital Fire Weather Service.



Caribbean Satellite Disaster Pilot (CSDP)

The **Caribbean Satellite Disaster Pilot (CSDP)** provides customized disaster management through satellite-tasking, data processing, and product delivery. CSDP work responds to a widely diverse range of disasters. Partners include Regional Centers of Excellence and national agencies from Barbados, Grenada, Jamaica, Saint Lucia and the Virgin Islands. eo1.gsfc.nasa.gov/new/sensorWebExp/

During the 2010 to 2013 hurricane seasons, CSDP produced a range of image maps for use by regional and national agencies in affected regions before, during and after disasters. These maps helped to identify susceptible areas, support the need to release or retract evacuation notices, facilitate post-event response and recovery, and justify improvements to response protocols. Satellite images also provide newsworthy pictures viewed on television and in newspapers by thousands of people.

Over the last two years, CSDP has worked with local and regional authorities to collect pre- and post-event observations in the Caribbean region and Central America for a range of events, including hurricanes, floods, earthquakes, harmful algal bloom outbreaks, wildfires, landslides, drought, oil spills and volcanoes.

Using materials developed by US NASA and the Canadian Space Agency (CSA), CSDP also provides training and conducts regular workshops. Capacity-building is conducted in conjunction with the

GEOSS AIP Capacity-Building Working Group and the CEOS Working Group for Capacity-Building and Data Democracy.

Other CSDP participants include Jamaica (University of West Indies (UWI)), the Caribbean Disaster and Emergency Management Agency (CDEMA), the Caribbean Institute for Meteorology and Hydrology (CIMH) and the Water Center for the Humid Tropics of Central America and the Caribbean (CATHALAC).



Landsat 8 image of land masses and bodies of water in Haiti provides important reference information in the event of severe flooding.



Geohazard Supersites and National Laboratories (GSNL)

The **Geohazard Supersites and Natural Laboratories (GSNL)** is an initiative of the geohazard scientific community supported by an international partnership of agencies monitoring earthquakes, volcanoes and other geohazards.

The vision for GSNL is to develop a fully integrated infrastructure to access and retrieve data and integrated data products. Anticipated results include improved estimates of volcanic unrest; better response during eruptions; improved forecasts of ash dispersion; and more accurate, reliable hazard assessments.

In addition to permanent Supersites, Event Supersites are established during, or in the immediate aftermath of, a major geological event, providing a vital and rare opportunity for scientists, end-users and data providers to investigate causes and impacts. Event Supersites were set up following major earthquakes in Wenchuan, 2008; Haiti and Chile, 2010; and Tohoku-Oki, 2011.

In Haiti, for example, rebuilding is challenged by both the scale of the devastation and the real possibility that Port-au-Prince may face another devastating earthquake within the next decade or two. This risk is a major factor in determining where and how to rebuild, especially when it comes to critical infrastructure such as hospitals and schools, power plants and government buildings.



Permanent Supersites include volcanoes in Hawaii, Iceland and Italy and a geological fault in Turkey. Candidate Supersites are volcanoes on Reunion Island and in New Zealand and the San Andreas Fault.

Acquisition of satellite data is managed by the CEOS Coordination Team (Canada (CSA), Europe (ESA), France (CNES), Germany (DLR), Italy (ASI), Japan (JAXA) and the United States (NASA)), while *in situ* observations are coordinated by EPOS in Europe and USGS in the United States. Additional support is provided by the European Commission's FP7 Programme (EC-FP7) and UNAVCO. supersites.earthobservations.org



International Charter ‘Space and Major Disasters’

The **International Charter ‘Space & Major Disasters’** is a key system that provides rapid access to crisis data. Through the Charter, 15 space agencies around the world deliver satellite data to aid civil protection agencies and humanitarian organizations responding to natural and human-induced disasters. Remotely sensed data can be used quickly to produce detailed maps and provide actionable information concerning hazard impact and identification of damaged areas.

Since 2009, GEO and the Charter have collaborated to increase awareness of the Charter among disaster management officials in GEO Member States, and to identify methods to improve broader access to the Charter. For example, GEO has supported a formal user consultation conducted by the Charter in more than fifteen African countries.

The Charter can be activated by a predefined list of ‘Authorized Users’, initially limited to users from countries of Charter member agencies. However, since its inception, the Charter has demonstrated a strong commitment to ensuring that all national disaster management agencies that could benefit have access to Charter resources.

In 2012, based on encouragement from GEO, the Charter Board adopted the principle of ‘Universal Access’ permitting any national disaster management authority to become an

Authorized User, provided a proper admission process is followed, thereby allowing it to request assistance in the event of a major disaster. www.disasterscharter.org



Satellite imagery proved invaluable in providing rapid information to responders coping with the effects of Super Typhoon Haiyan (or Yolanda) in the Philippines in November 2013.



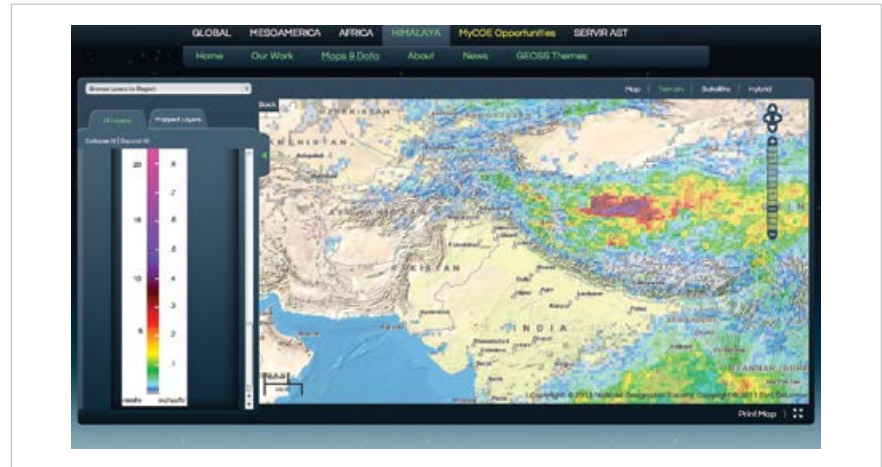
SERVIR

SERVIR is a collaborative regional visualization and monitoring system that integrates Earth observations, forecast models and local knowledge for timely, informed decision making. Developed by the United States (NASA and USAID), and in partnership with leading regional organizations around the world, SERVIR connects space to villages by applying Earth observation satellite data and geospatial technologies to address developing countries' needs. These needs include improving resilience to climate change; preparing for extreme events; protecting food, water and agriculture; improving land and forestry management; and promoting sustainable growth.

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Using data originally coordinated by the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC), scientists, educators and policy makers monitor and forecast ecological changes and impacts on biodiversity, respond to natural disasters and monitor land cover change in Central and South America.

In Nairobi, SERVIR-Africa, in cooperation with the Regional Center for Mapping of Resources for Development (RCMRD), provides stream flow models to forecast floods in Kenya and enable better Rift Valley Fever prediction. In Tanzania, climate information (rainfall and temperature) and exact location and extent of water bodies help public health and other officials determine where conditions are prone to malarial outbreaks. www.servirglobal.net



NASA/TRMM Project Office

Seven day rainfall intensity as viewed from space provides critical information to help forecast potential floods, landslides and availability of water for crops. Warm colors denote the most intense rainfall and cool colors denote lighter precipitation.

SERVIR-Himalaya, supported by the International Centre for Integrated Mountain Development (ICIMOD), has developed a forest fire monitoring system in Nepal that helps fire managers and local/national authorities detect, locate, characterize and monitor forest fires, as well as assess the effects of fire on agriculture and the environment. The system includes fire notifications via email and text message on mobile devices, enabling officials to warn individuals of impending danger.



Global Land Cover

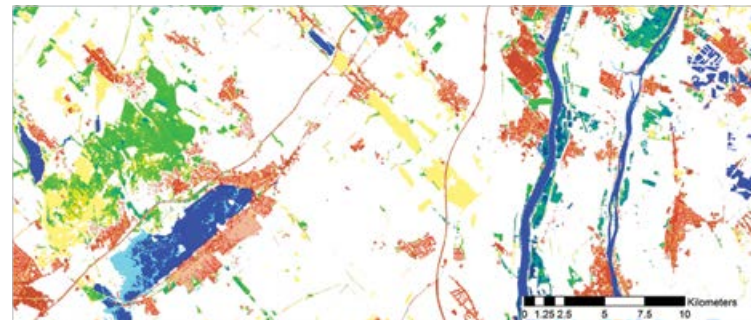
The GEO **Global Land Cover** team is working to improve coordination of land cover activities around the world. The team is developing a land cover portal to enable users to access and validate existing land cover and land-use products. It also is creating an international network through which community members can identify their needs for land cover products and contribute to additional mapping and monitoring efforts. www.gofcgold.wur.nl/sites/gofcgold_refdataportal.php

Land cover is recognized as a priority in seven of the nine GEO Societal Benefit Areas and ranked fourth on the GEO user-based list of the 25 highest-ranked Earth observations.

Several institutions and their partners are advancing the production of global land cover products at high resolution. They include China (NASG, Tsinghua University), European Commission (JRC), United States (NASA, USGS, University of Maryland), EEA, ESA, GOFC-GOLD and ISPRS. Developed by China at high resolution, the 30m global open-water dataset was released in late 2013. After extensive validation, the complete Global Land Cover dataset will be released in 2014.

In addition, a working group on Land Cover for Africa was launched in November 2013 as a contribution to the AfriGEOSS initiative. Based on a product developed by Tsinghua University, the initial

goal is to create a 30m resolution map of Africa by bringing together users and providers from all regions of the continent. The Technical Advisory Group for this initiative will include GEO Global Land Cover team members working in Africa, along with regional and international experts from Egypt (NARSS), Gabon (AGEOS), Madagascar (Antananarivo University), Morocco (MARSE), Nigeria (NASRDA) and United States (USDOI); UN representatives (UNEP, UNECA); and international organizations (RCMRD).



High resolution (20m) layer of land covers serves as the base for many types of environmental monitoring. Legend: Water bodies (dark blue), wetlands (light blue), and forest, urban and grassland areas (green, brown and yellow respectively).



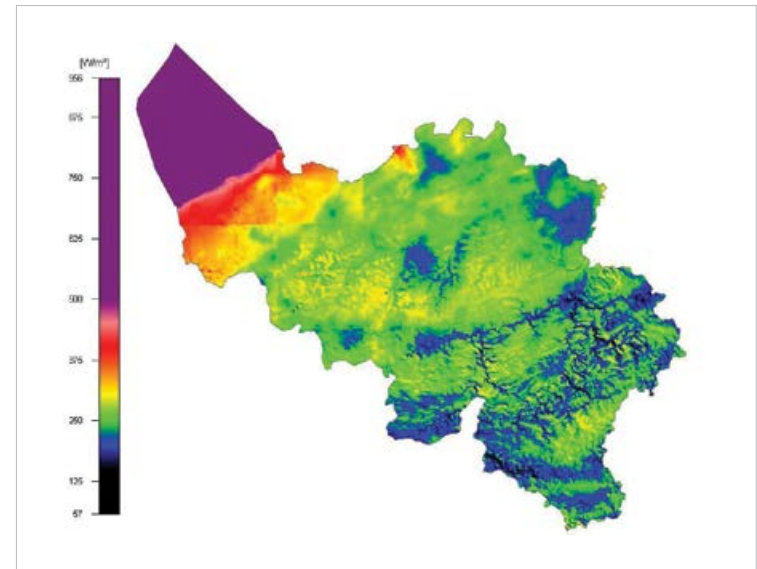
ENDORSE (ENergy DOWnstReam Services)

As energy supply diversification increases, so does the need for policymakers and private companies to have case-specific data to make informed decisions on siting renewable energy facilities. Supported through the European Commission's FP7 Programme (EC-FP7), the **ENDORSE** project has developed a portfolio of renewable energy-related services based on Earth observation information, ranging from power production from renewable energy technologies such as solar, wind and biomass, to distribution to energy efficiency.

Based upon existing European Space Agency (ESA) Copernicus capabilities and recent research results, these tools have been customized in collaboration with private sector energy companies and other end-users. The scale of the services varies from the house level (e.g., lighting energy savings) to the local level (e.g., design, performance and profitability analysis of Concentrating Solar Power Systems in Italy). Current users are from the energy production (solar, wind and biomass) and utility industries, and other private and public sector organizations.

Tools are being deployed by users interested in developing a solar plan in South Europe (France, Italy and Spain) and Morocco; a wind farm in Belgium; and a bio-energy plan (Germany and Brazil). An additional demonstration involves assessing the impact on the power grid of integrating new types of production units.

Principal partners in **ENDORSE** include MineParisTech, German Aerospace Center (DLR) and ULM University of Applied Science. www.endorse-fp7.eu



Map of wind power content [W/m^2] at 100 meters above ground level in Belgium. The wind power potentials increase from black to purple.

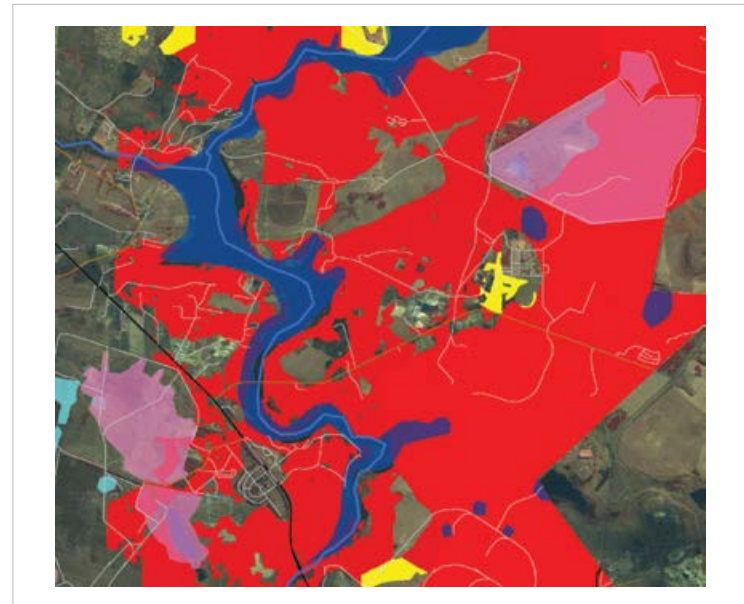
EO-MINERS

The societal and environmental impacts of mining are of greater interest today than ever before. As country economies continue to develop, governments and citizens will seek to establish environmental policies that will affect mining operations into the future. Issues will include how to manage and minimize environmental impacts that may affect communities and the natural habitat near mining operations, including land cover change, waste rock and tailing disposal, dust and noise, water use and re-use, and pollution. Earth observations can play an important role in informing this process by providing valuable information about mining operations to regulators, industry and affected communities.

EO-Miners enables mining companies and regulatory authorities to monitor the sustainability of mining and mining-related activities. A dialogue among mining companies, regulatory bodies and other stakeholders, conducted in the Czech Republic, Kyrgyzstan and South Africa, identified 11 environmental and socio-economic indicators affecting mining communities and the natural habitat near mining operations. Integrating these indicators into Earth observation tools will help governments develop sensible policies and regulations around mining activities that will balance profitability, environmental conservation, and the development of the local community. Sound environmental management of mining activities can avoid high remediation costs, thereby preserving public and private funds. www.eo-miners.eu

Supported through the European Commission's FP7 Programme (EC-FP7), the multi-sector EO-Miners consortium includes the

German Aerospace Center (DLR), government geological agencies from the Czech Republic, France, Slovenia, South Africa, and United Kingdom; mining companies from the Czech Republic, Kyrgyzstan and United Kingdom; and research organizations and universities from France, Germany, Israel and Kyrgyzstan.



The impact of mining activities on the environment in eMalahleni, South Africa. Mining areas in pink; highly significant/irreplaceable, important/necessary and protected areas in red, yellow and green, respectively.

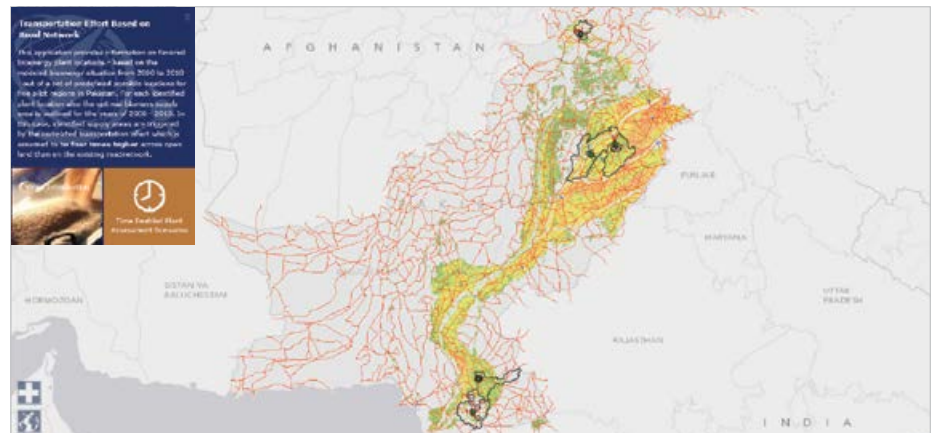
GEO Biomass Initiatives

Through GEO, the international scientific community and collaborating national authorities are tackling the complex issue of balancing land use for food security vs. bioenergy. The GEO Energy team is developing bioenergy potential maps from global to continental to national scale, as well as tools to enable governments and local leaders to make informed decisions on the siting of bioenergy production facilities.

Pilot projects in regions such as Africa and Europe, and in countries such as Pakistan and South Africa, have identified bioenergy potentials based on transportation networks and factors including weather, soil, crops, cultivation techniques and wood species. Newly-developed tools are used to evaluate the benefits of various renewable energy approaches in specific locales – an effort that can be adapted to the particular characteristics and needs of end-users in specific geographical areas.

In Pakistan, the Space and Upper Atmosphere Research Commission requested that the GEO Energy team members working on the European Commission’s FP7 Programme (EC-FP7) project, **EnerGEO**, develop an application to identify preferred bioenergy plant locations. GEO Energy team members working on the EC-FP7 project, **ENDORSE**, are developing policy making tools related to second-generation biofuels from non-food biomass.

In Africa, the **Bioenergy Atlas for Africa (BAfA)** is building on the South African Bioenergy Atlas. Led by South Africa, this first-of-its-kind initiative addresses the major issue of energy access, and efficient and sustainable use of energy resources, in the under-powered and under-connected African continent. The BAfA initiative is supported by South Africa in collaboration with the Brazilian National Institute for Space Research (INPE), the German Aerospace Center (DLR), the International Renewable Energy Agency (IRENA) and the National Renewable Energy Laboratory (NREL). energeo.researchstudio.at/energeo/catalog/main/subpage_biomass.page




Favored biomass plant locations in five regions of Pakistan based on models of bioenergy potentials from 2000-2010 and existing transportation networks.



AirNow-International

Under GEO, **AirNow-International (AirNow-I)** is leveraging the US Environmental Protection Agency's (EPA) AirNow program by building capacity to provide real-time air quality conditions and forecasts. AirNow-I is already in place in China's Shanghai and Zhejiang provinces, and in Monterrey, Mexico. It also is actively engaged in the European Environment Agency's Eye on Earth programme, which serves 27 European countries.



Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.

AirNow-I allows public access to air quality data, a function that can increase public support for voluntary and regulatory emission-reducing actions.

AirNow-I gives decision makers at multiple levels of government the tools they need to assess air quality quickly and accurately and to provide the public with consistent information about air quality conditions, including during wildfires and dust storms. AirNow-I allows public access to air quality data, a function that can increase public support for voluntary and regulatory emission-reducing actions. Regional data can be exchanged among adjacent cities, provinces and countries, and cooperation is promoted among air quality agencies worldwide. share.airnowinternational.org

AirNow-I's system can be customized to meet organizational needs. The Data Management System (DMS) enables the collection and

organization of air quality and other environmental data. The Information Management System (IMS) provides a way to distribute and create products to share. Multi-lingual user-interfaces are available for both DMS and IMS.

More than 100 million Shanghai-area residents and visitors have already benefited from real-time data and forecasts, while the Monterrey pilot is paving the way for a national AirNow-I system in Mexico. Regions across the globe are demonstrating strong interest in AirNow-I, and talks are underway in several other countries to establish air quality monitoring systems.



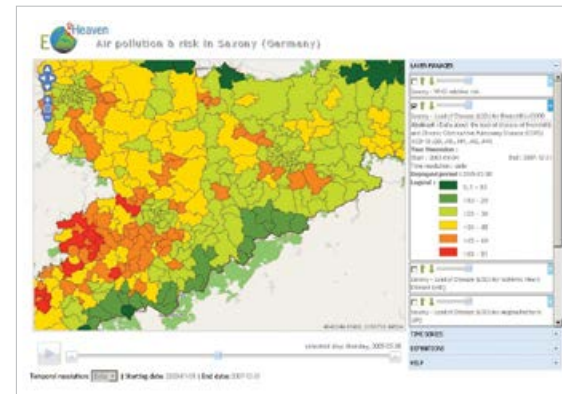
EO2HEAVEN

EO2HEAVEN (Earth Observation and Environmental Modeling for the Mitigation of Health Risks) contributes to a better understanding of the complex relationships between environmental changes and their impact on human health. Under the project, public health stakeholders worked closely with technology and service providers in both satellite and *in situ* monitoring to develop models and visualization tools relating environmental data with exposure and health data.

Ground-breaking studies were conducted in Dresden, Germany (environmental effects on allergies and cardiovascular diseases); South Durban industrial basin, South Africa (pollution and respiratory diseases); and Uganda (impact of climatic variables on the outbreak of cholera). Results of these studies will help scientists and policy makers better understand the complex relationship between climate change and the emergence of health effects and infectious diseases.

EO2HEAVEN provides a foundation for stakeholders from the health community to exploit the potential of applying Earth observation data and information across various economic and social scenarios to achieve a healthful environment, plan mitigation actions and realize early warning systems for the public and individuals.

EO2HEAVEN made significant contributions to the development of the Global Earth Observation System of Systems (GEOSS) by providing valuable input to this information system and linking



One of the primary outputs of EO2HEAVEN is software to generate maps of expected illnesses in relation to environmental stressors (e.g., Saxony, Germany above). Inputs include air pollution; temperature; Load of Disease (LOD) and health insurance data.

ongoing research and developments from various areas of expertise in the health, environment and Earth observation fields. Through its participation in the GEO Health & Environment Community of Practice, EO2HEAVEN strengthened work in this domain.

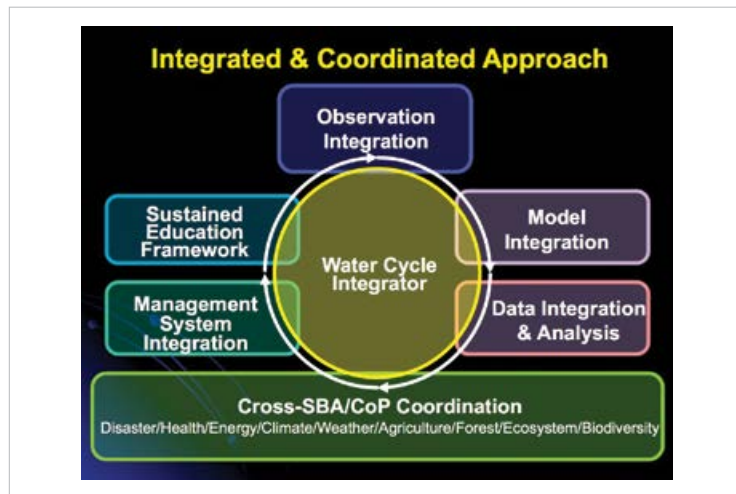
EO2HEAVEN was funded under the European Commission's FP7 Programme (EC-FP7) and coordinated by Fraunhofer IOSB with 13 partners from Europe and Africa. www.eo2heaven.org



Asian Water Cycle Initiative

Approximately 60 percent of the world’s population lives in Asia, a region where agriculture is highly dependent on rainfall during the annual Monsoon. Variation in components of the Asian water cycle can wreak havoc on food security and cause both catastrophic droughts and floods, engendering tremendous human and economic damage.

The GEO **Asian Water Cycle Initiative (AWCI)** is designed to understand better the variability and predictability of the Asian water cycle. AWCI works to coordinate and harmonize acquisition, processing, quality-checking and archiving of watershed data for 18 national river basins across Asia. Through GEO, this data is then integrated and used to assess water environments in different countries to help mitigate water-related disasters and promote the efficient use of water resources. The AWCI is led by the Asia-Pacific Network, Asian Development Bank Institute, The World Bank, and Japan (JICA, MEXT, University of Tokyo).



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The GEOSS Water Cycle Integrator establishes “work benches” where partners share data, information and applications; exchange knowledge and experiences; and collaborate to respond to both environmental mitigation and adaptation issues.

The AWCI features the Water Cycle Integrator (WCI) as a means to combine observational data with data from numerical weather prediction models, geographical information and socio-economic data, and then transform these data into usable information which may be disseminated for sound decision making by water resource managers. monsoon.t.u-tokyo.ac.jp/AWCI/

Climate change impact assessments in the 18 Asian river basins have been conducted using *in situ* data and climate model products to improve water security projects in countries such as Cambodia, Indonesia, Pakistan, Philippines and Vietnam. These projects range in scope from hydro-power generation and flood control to improving rice yields. Further, the WCI allows water resource managers to anticipate flood and landslide events, plan for drought and water scarcity, track water pollution and ecosystem degradation, and assess impacts of climate change on water resources.



Chlorophyll Global Integrated Network (ChloroGIN)

The **Chlorophyll Global Integrated Network (ChloroGIN)** is an international federation of monitoring networks created to assess the state of marine, coastal and inland water ecosystems. Focused on developing countries in Africa and Latin America, ChloroGIN promotes *in situ* measurements of chlorophyll in combination with satellite-derived estimates. This data supports decision makers who are implementing sustainable, ecosystem-based management of aquaculture, coastal zones, fisheries and inland water bodies.

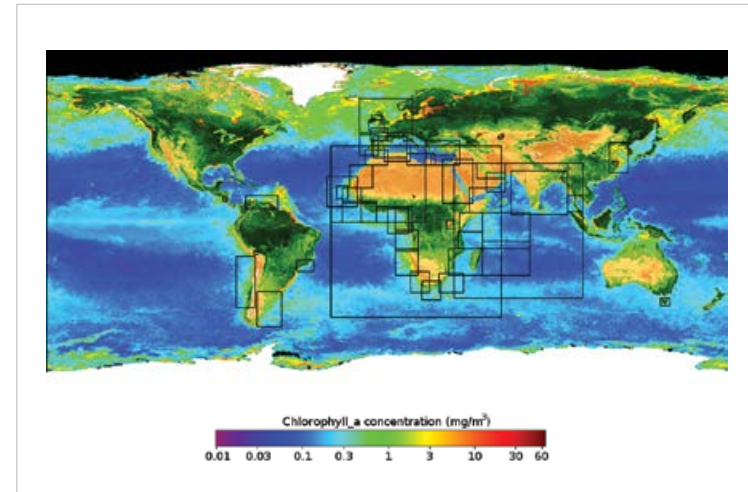
The ChloroGIN Portal enables links to near-real-time and archived Earth observation data.

Data are supplied by ESA, US NASA, and regional portals in Africa and South America, among others. GEONETCast transmits ChloroGIN information to regions lacking sufficient Internet access. To provide users with access to the wide range of resources, a link also is constructed between the ChloroGIN and GEOSS Portals.

ChloroGIN data play a significant role in delineating potential fishing zones; establishing “allowable catch” estimates; identifying the location and fate of harmful algal blooms; and improving early warning drought forecasts. With support from the European Commission’s FP7 Programme (EC-FP7), the ChloroGIN Africa Portal has developed ocean colour and sea-surface temperature data for the entire coast of Africa and the western Indian Ocean.

The ChloroGIN project is part of the GEO Oceans and Society, Blue Planet initiative. Primary contributors include the European

Commission (JRC), South Africa (University of Cape Town), United Kingdom (Plymouth Marine Laboratories (PML)), Global Ocean Observing System (GOOS), International Ocean Colour Coordinating Group (IOCCG) and Partnership for Observation of the Global Oceans (POGO). www.chlorogin.org



Global map of Chlorophyll concentrations provides an indication of phytoplankton concentrations in the surface layer of the ocean. Marine phytoplankton plays a key role in the marine food chain, and is also an indicator of changes in the ocean environment due to pollution or shifts in the global climate system.

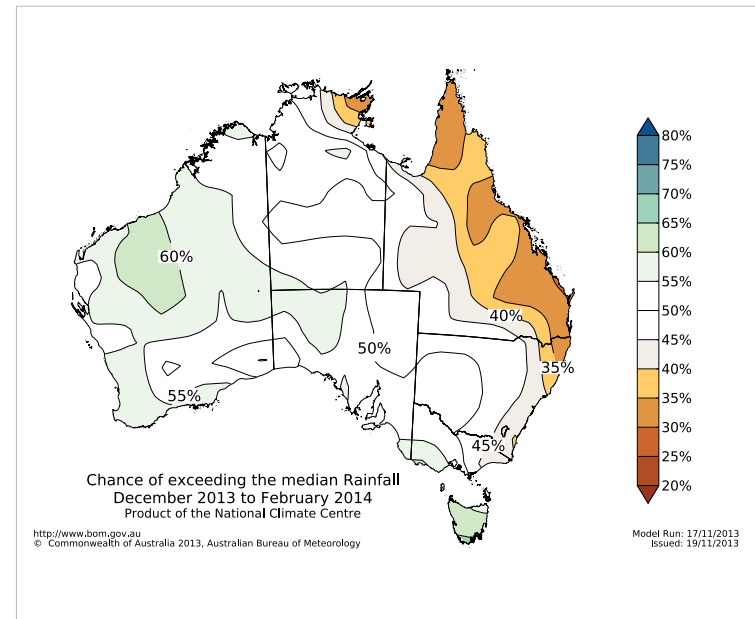


Global Drought Early Warning System (GDEWS)

Since first proposed at the 2007 GEO Ministerial Summit in Cape Town, South Africa, there has been continuing progress on creating a **Global Drought Early Warning System (GDEWS)**. With support from the WMO, this collaborative effort has four regional components: Australia's Department of Agriculture and Bureau of Meteorology monitor; the European Commission JRC's European Drought Observatory; US NOAA's North American Drought Monitor; and Princeton University's African Drought Monitor. Additional contributors include Argentina, Brazil's Province of São Paulo, Mongolia, Pakistan and the GEO Asian Water Cycle Initiative.

Central to this effort is the web-based Global Drought Monitoring Portal (GDMP) www.drought.gov/gdml, designed and hosted by the US National Integrated Drought Information System (NIDIS) for use by any national or regional system. The GEOSS 4th Architecture Implementation Pilot (AIP) served as the platform to enable individual information systems to seamlessly connect to the single GDMP.

Through the GDMP, users can obtain comparable drought monitoring data and information from all participating regional systems, choosing summary and global data or regional and national system information. This nested structure avoids duplication and reduces costs. Pooling resources enables governments to strengthen decision making in priority areas such as food security, economic policy, water resource management and humanitarian relief. There is also improved forecasting of agricultural commodity prices and support for scientific studies and global climate modeling.



Through the GDMP, users can obtain comparable drought monitoring data and information from all participating regional systems, choosing summary and global data or regional and national system information.

Future plans call for expanding the global drought monitor into a Global Drought Information System (GDIS) with additional capabilities, such as assessing drought impacts and mitigation options due to climate change and providing seasonal drought predictions.



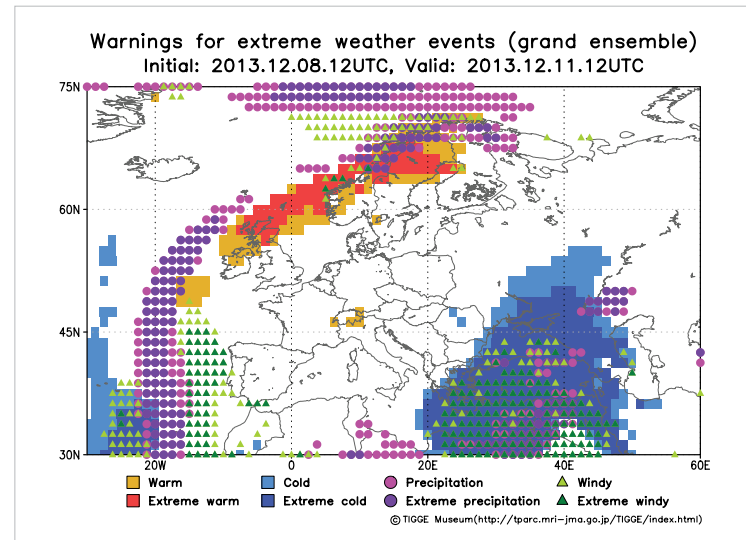
THORPEX Interactive Grand Global Ensemble (TIGGE)

The **THORPEX Interactive Grand Global Ensemble (TIGGE)** is a key component of THORPEX, The Observing System Research and Predictability Experiment, a WMO World Weather Research Programme initiative to improve severe weather forecasts up to two weeks ahead of time. Ensemble forecasts are collected in near-real-time using a common format and are archived at three data distribution centers: China Meteorological Administration (CMA); European Centre for Medium-range Weather Forecasts (ECMWF); and US National Center for Atmospheric Research (NCAR).

Forecasts are provided by 10 global numerical weather prediction centers throughout the world: Australia (BOM), Brazil (CPTEC), Canada (CMC), China (CMA), France (MétéoFrance), Japan (JMA), Korea (KMA), United Kingdom (UKMO), United States (NCEP) and ECMWF. tigge.ecmwf.int

TIGGE has become a focal point for research on ensemble forecasting, predictability and the development of products to improve the prediction of severe weather. Examples include ensemble-based early warnings produced in quasi-real-time. The warnings summarize four types of extreme weather (warm, cold, precipitation, wind) by plotting colors and symbols on a single map.

The European Commission's FP7 Programme (EC-FP7) project **GEOWOW (GEOSS Interoperability for Weather, Oceans and Water)** accelerates access to TIGGE data through the GEOSS Common



Ensemble-based forecasting products include early warnings of four types of extreme weather, such as this map showing cold weather warnings in the Middle East.

Infrastructure (GCI) for scientists and data users in National Weather Services, universities and international organizations more quickly, which is especially important for users with limited internet bandwidth. ECMWF, the UK Met Office and Météo-France are leading the further development, accessibility and exploitability of TIGGE global weather forecast data products in GEOSS.



AfriGEOSS: Implementing GEOSS in Africa

Endorsed by the GEO-IX Plenary in November 2012, and formally launched in November 2013, **AfriGEOSS** is designed to enhance Africa's capabilities to produce, manage and use Earth observations and information. Building on the current GEO membership of 22 African countries and five Participating Organizations, AfriGEOSS is helping to strengthen "infrastructural" capabilities at regional (continental), sub-regional and national scales. Data democracy and data-sharing are clear priorities which build upon on-going initiatives. www.earthobservations.org/afrigeo

The capability to develop and sustain networks to collect EO data and generate products and services will enable policy makers to make informed decisions about a range of priorities, including food security, access to clean water and sanitation, natural resource degradation, and coastal, disaster and marine management.

The first AfriGEOSS Workshop, held immediately following the launch, was attended by 35 participants representing 16 countries, the African Union Commission, UNECA, AARSE and several private companies. The goal is to finalize an Implementation Plan by late 2014. Regional coordinators are currently conducting surveys to target specific projects in each region of the continent. These projects will relate to infrastructure, applications, services, education and training programs.

The AfriGEOSS initiative provides the necessary framework for countries and organizations to access and leverage ongoing bilateral and multilateral EO initiatives across Africa, creating synergies and



Endre Hansen

Ground measurements campaign has started in Armani Validation Site, Tanzania.

minimizing duplication for the benefit of the entire continent. AfriGEOSS will play a vital role in building a global GEOSS. Key contributors are Gabon (AGEOS), Nigeria (NASRDA) and South Africa (CSIR, DST).



GEONETCast

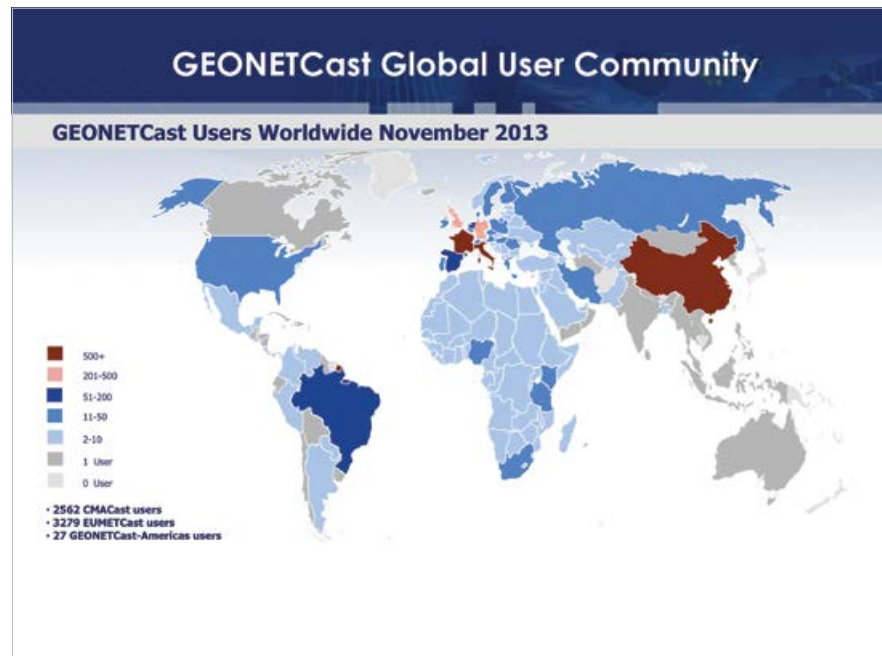
GEONETCast is an expanding global network of low-cost, satellite-based dissemination systems that provides global information as a basis for sound decision making in critical areas. These areas include agriculture, climate, ecosystems, energy, natural disasters, public health, water and weather. GEONETCast provides vital Earth observations and information to nearly 6,000 users in 169 countries.

GEONETCast-Americas support national disaster management activities. In the event of an activation of the Charter, GEONETCast can be chosen by Charter Project Managers and Authorized Users as an alternative delivery mechanism for high-volume, high-resolution satellite data and value-added products to support disaster mitigation activities. www.earthobservations.org/geonetcast

When access to Earth observations and information is limited, developing nations can face severe challenges. GEONETCast addresses these challenges by providing access to information in areas underserved by e-infrastructures. As a key component of GEOSS, GEONETCast helps GEO build and expand institutional and individual capability to use Earth observations for better-informed decisions and to save precious resources. GEONETCast helps ensure access to clean water in India; reliable weather forecasts in Brazil; and greatly improved productivity of once-degraded soil in Kenya.

GEONETCast provides near-global coverage through collaboration among the China Meteorological Administration (CMA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the US National Oceanic and Atmospheric Administration (NOAA).

Now approved for operational use by the International Charter 'Space and Major Disasters', EUMETCast and



With near-global coverage, GEONETCast provides data and information to nearly 6000 users in 169 countries.



GEOSS in the Americas

GEOSS in the Americas is a proud supporter of DEVELOP’s collaboration with the Chilean government through the Commonwealth of Virginia. Emerging from an in-person webinar series developed to explain GEOSS and invite feedback on GEOSS’ applicability in Latin America, DEVELOP addresses the challenge of forecasting water availability in the mountainous and drought-stricken Coquimbo region.

Each October, a local water group makes water allotment decisions based on potential run-off during the coming growing season. However, with limited *in situ* measurements, and lacking remote sensing observations, the risk of inaccuracies has been high. In particular, critical snow cover measurements in the adjacent Andes Mountains have been lacking. www.youtube.com/watch?v=eOEyGlrQdU

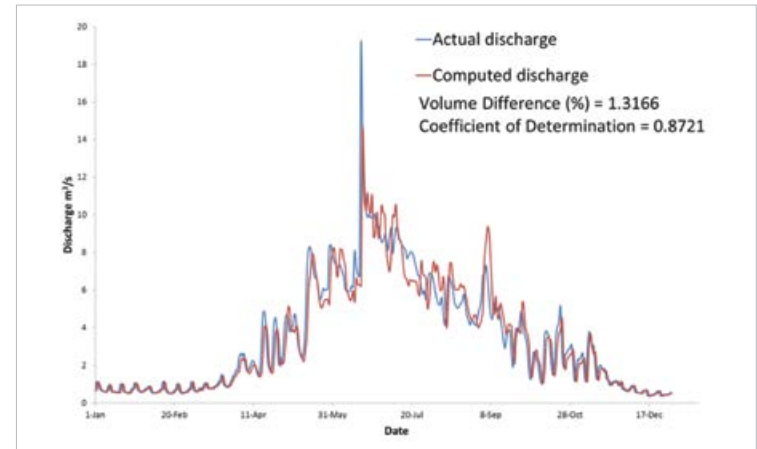
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To observe snow cover more accurately, US NASA’s DEVELOP and Chilean teams introduced the synergy of integrated observations, incorporating NASA snow cover observations into the US Department of Agriculture (USDA) Snowmelt Runoff Model under US NOAA’s scientific guidance. Work focused on the region’s largest river basin, which produces more than 70 percent of the area’s exports and provides almost 50 percent of the water required by Coquimbo’s agricultural areas.

Building capacity for sustained use through methodological and technical training is ongoing between DEVELOP and Chile’s Centro de Informacion de Recursos Naturales (CIREN). CIREN is enhancing its capability to collect all needed data, run the hydrological model,

and improve regional water management. More Chilean regions and Latin American countries are expressing interest in applying GEOSS’s integrated approaches to their river basins.

GEOSS in the Americas is chaired by Canada. Leading contributors to the DEVELOP Chile initiative include the Embassy of Chile, CIREN, CIEHLYC, OAS PAIGH, USGEO and the Commonwealth of Virginia.



Discharge forecast from NOAA hydrological model using NASA snow cover measurements compared to in situ measurements provided by CIREN – results for Limarí River basin in northern Chile.



GEOSS Common Infrastructure / GEOSS Portal

Through the **GEOSS Common Infrastructure (GCI)**, GEOSS resources, including Earth observation data (satellite, *in situ*, models), information services, standards and best practices, can be searched, discovered and accessed by scientists, policy leaders, decision makers, and those who develop and provide information services across the entire spectrum of users.

In 2013, the number of discoverable resources available via the GCI increased from 14 million to 65 million. Of these discoverable resources, more than 50 million (products, files, images) are tagged as **GEOSS DataCORE**, meaning that they can be accessed without restriction and free of charge or for the cost of reproduction.



The **GEOSS Portal** is the single Internet gateway to the comprehensive data produced by the GEOSS community. A new version of the portal was launched in December 2013. Developed by the European Space Agency (ESA), this new Portal makes it easier and faster to integrate diverse data sets; identify relevant data and portals of contributing systems; access models and other decision-support tools; and preview data before downloading. The

*The **GEOSS Portal** is the single Internet gateway to the comprehensive data produced by the GEOSS community.*

Portal is powered by the Discovery & Access Broker (DAB) developed by the National Research Council of Italy (CNR). The DAB connects users to an ever-increasing number of databases and information systems around the world. www.geoportal.org



Acronyms

AAFC	Agriculture and Agri-Food Canada	CSIRO	Commonwealth Scientific and Industrial Research Organisation
AAG	Association of American Geographers	DAB	Discovery and Access Broker (driver of GEOSS Portal)
AARSE	African Association of Remote Sensing of the Environment	DataCORE	GEOSS Data Collection of Open Resources for Everyone
ABARES/DAFF	Australian Bureau of Agricultural and Resource Economic Sciences/ Department of Agriculture, Forestry and Fisheries	DLR	German Aerospace Center
ADB	Asia Development Bank	DMCii	DMC International Imaging
AFIS	Advanced Fire Information System	DOI	United States Department of the Interior
AfriGEOSS	Initiative to enhance Africa's capabilities to produce, manage and use Earth observations and information	DST	Department of Science and Technology
AFSIS	ASEAN Food Security Information System	EC	European Commission
AGEOS	Agence Gabonaise d'Etudes et d'Observations Spatiales	EC-FP7	European Commission Seventh Framework Programme for Research
AIP	Architecture Implementation Pilot	ECMWF	European Centre for Medium-range Weather Forecasts
APN	Asia-Pacific Network	EEA	European Environmental Agency
AQMD	Air Quality Management District	EMEP	European Monitoring and Evaluation Program
ARC	Agricultural Research Council	ENDORSE	Energy DOWNstREAM SERVICES
ASEAN	Association of Southeast Asian Nations	EnerGEO	EO for monitoring and assessment of the environmental impact of energy use
ASI	Italian Space Agency	ENTPE	École Nationale des Travaux Publics de l'État
AWCI	Asian Water Cycle Initiative	EO	Earth Observations
BNU	Beijing Normal University	EO2HEAVEN	Earth Observation and Environmental Modeling for the Mitigation of Health Risks
BOM	Australian Bureau of Meteorology	EPA	United States Environmental Protection Agency
BRGM	French Geological and Mining Research Bureau	EPOS	European Plate Observing System
CAMnet	Canadian Atmospheric Mercury Measurement Network	ESA	European Space Agency
CATHALAC	Water Center for the Humid Tropics of Central America and the Caribbean	ESDIS	NASA Earth Science Data and Information Service
CDEMA	Caribbean Disaster and Emergency Management Agency	EUMETCast	EUMETSAT Broadcast System for Environmental Data
CEOS	Committee on Earth Observation Satellites	EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
ChloroGIN	Chlorophyll Ocean Globally Integrated Network	FAO	Food and Agriculture Organization of the United Nations
CIEHLYC	Center of Hydrologic and Spatial Information for Latin America and the Caribbean	FCT	Forest Carbon Tracking
CIMH	Caribbean Institute for Meteorology and Hydrology	FP7	European Commission Seventh Framework Programme for Research
CIREN	Centro de Información de Recursos Naturales	GAW	WMO Global Atmosphere Watch
CMA	Chinese Meteorological Administration	GCI	GEOSS Common Infrastructure
CMACast	CMA contribution to GEONETCast	GCP	Global Carbon Project
CMC	Carbon Management Canada	GDEWS	Global Drought Early Warning Systems
CMCC	Italian Euro-Mediterranean Center for Climate Change	GDIS	Global Drought Information System
CNES	French Space Agency	GDMP	Global Drought Monitoring Program
CNR	Italy National Research Council	GEO	Group on Earth Observations
CNR-IIA	Italy National Research Council - Institute for Atmospheric Pollution	GEO BON	Group on Earth Observations Biodiversity Observation Network
CNSA	China National Space Agency	GEOGLAM	GEO Global Agriculture Monitoring
CONAB	Companhia Nacional de Abastecimento	GEONETCast	Near real time, global network of satellite-based data dissemination systems
CONAE	Argentinean National Commission of Space Activities	GEOSS	Global Earth Observation System of Systems
COP 19	19th session of the Conference of the Parties to the UNFCCC	GEOWOW	GEOSS Interoperability for Weather, Oceans and Water
CPTEC	Centro de Previsão de Tempo e Estudos Climáticos	GFOI	Global Forest Observations Initiative
CSA	Canadian Space Agency	GIS	Geographical Information System
CSDP	Caribbean Satellite Disaster Pilot		
CSIR	Council for Scientific and Industrial Research		

GISTDA	Geo-Informatics and Space Technology Development Agency	NCEP	National Centers for Environmental Protection
GMOS	Global Mercury Observation System	NIDIS	US National Integrated Drought Information System
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics	NIES	Japan National Institute for Environmental Studies
GOOS	Global Ocean Observing System	NII	National Institute of Informatics
GOSAT	Greenhouse gases Observing SATellite	NOAA	United States National Oceanic and Atmospheric Administration
GPS	Global Positioning System	NREL	United States National Renewable Energy Laboratory
GSNL	Geohazard Supersites and Natural Laboratories	OAS/PAIGH	Organization of American States/Pan American Institute of Geography and History
GTOS	Global Terrestrial Observing System	OGC	Open Geospatial Consortium
ICHARM	International Centre for Water Hazard and Risk Management	PML	Plymouth Marine Laboratory
ICIMOD	International Centre for Integrated Mountain Development	POGO	Partnership for Observation of the Global Ocean
IASA	International Institute for Applied Systems Analysis	PO	GEO Participating Organization
IKI RAS	Space Research Institute of the Russian Academy of Sciences	RADI-CAS	Institute of Remote Sensing and Digital Earth/Chinese Academy of Sciences
INPE	Brazilian National Institute for Space Research	RCMRD	Regional Centre for Mapping of Resources for Development
INTA	Instituto Nacional de Tecnología Agropecuaria	REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
IOC	Intergovernmental Oceanographic Commission	RESTEC	Remote Sensing Technology Center of Japan
IOCCG	International Ocean Colour Coordinating Group	ROSCOSMOS	Russian Federal Space Agency
IOSB	Fraunhofer Inst. for Optronics, System Technologies, Image Exploitation	SANSA	South African National Space Agency
IPCC	Intergovernmental Panel on Climate Change	SAWS	South African Weather Service
IRENA	International Renewable Energy Agency	SBA	Societal Benefit Area
ISPRS	International Society for Photogrammetry and Remote Sensing	SERVIR	Regional Visualization and Monitoring System
ISRO	Indian Space Research Organization	SiAP	Servicio de Informacion Agroalimentaria y Pesquera
ITC	International Training Centre	STi	Sonoma Technology, Inc.
JAXA	Japan Aerospace Exploration Agency	TFHTAP	Hemispheric Transport of Air Pollutants Task Force
JICA	Japan International Cooperation Agency	THORPEX	The Observing System Research and Predictability Experiment
JMA	Japan Meteorological Agency	TIGGE	THORPEX Interactive Global Grand Ensemble
JRC	Joint Research Center of the European Commission	UKMO	United Kingdom Meteorological Office
KARI	Korea Aerospace Research Institute	UMD	University of Maryland
KMA	Korea Meteorological Administration	UNAVCO	Non-profit university-governed geodesy consortium
LAPAN	Lembaga Penerbangan dan Antariksa Nasional	UNECA	United Nations Economic Commission for Africa
LSCE	Laboratoire des Sciences du Climat et de l'Environnement	UNEP	United Nations Environment Programme
MARSE	Moroccan Association for Remote Sensing of the Environment	UNFCCC	United Nations Framework Convention on Climate Change
MEXT	Japan Ministry of Education, Culture, Sports, Science and Technology	USAID	United States Agency for International Development
MetOffice	United Kingdom Meteorological Office	USDA	United States Department of Agriculture
MINES ParisTech	French Institutes of education and research	USFS	United States Forest Service
MOA	Indonesia Ministry of Agriculture	USGEO	United States Group on Earth Observations
MPI	Max Planck Institute	USGS	United States Geological Survey
MRV	Measurement Reporting and Verification	UvA	University of Amsterdam
NADP/AMNET	National Atmospheric Deposition Program/Atmospheric Mercury Network	VAST	Vietnam Academy of Science and Technology
NARSS	National Authority for Remote Sensing and Space Sciences	VIMHE	Vietnam Institute of Meteorology, Hydrology and Environment
NASA	National Aeronautics and Space Administration	WCI	Water Cycle Integrator
NASG	China National Administration of Surveying, Mapping and Geo-information	WMO	World Meteorological Organization
NASRDA	Nigeria National Space Research and Development Agency	ZEMC	Zhejiang Environmental Monitoring Center
NCAR	National Center for Atmospheric Research	Z_GIS	University of Salzburg, Department of Geoinformatics

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