



GROUP ON  
EARTH OBSERVATIONS

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2007-2009 Work Plan Progress Report

Document 8

As accepted at GEO-V



## **2007-2009 Work Plan Progress Report**

(As accepted at GEO-V)

This report describes how the Group on Earth Observation (GEO) 2007-2009 Work Plan has advanced the implementation of the GEOSS 10-Year Implementation Plan since GEO-IV. It provides an overall summary assessment of the progress made in each of GEO's nine Societal Benefit Areas and four Transverse Areas and highlights the key activities and outputs that illustrate how this was achieved.

As with the 2007-2009 Work Plan Progress Report presented to GEO-IV, this report includes an annex featuring an "at-a-glance" summary table of the 73 practical Tasks around which the Work Plan has been organized. To help the reader more easily evaluate overall progress, the table has been colour-coded to assess the progress made in each Task. Those readers interested in greater detail about the progress on specific Tasks are referred to the Task Sheets, which are posted at <ftp://ftp.wmo.int/Projects/GEO/TaskSheets/2008-09/>.

### **OVERVIEW OF PROGRESS**

Marking the fourth year of GEOSS implementation, 2008 may soon be viewed as a key transition year. Until now, GEO has focused on building a community, strengthening consensus, identifying gaps and launching new activities to fill them, agreeing on roadmaps for capacity building, science and technology and designing the architectural blueprint for GEOSS. Over the next few years, this scaffolding will support the actual construction of large parts of the "system of systems". In this way, the achievements and advances made in 2008 will prove critical to the future success of GEOSS.

Earlier progress on elaborating the architecture for GEOSS was consolidated in June with the launch of the one-year Initial Operating Capability (IOC) phase of the GEOSS Common Infrastructure (GCI). Consisting of the GEO Portal, clearinghouse and registries, the GCI will provide the essential interface between GEOSS and policymakers and other users of Earth observation information. As of September, the GEO community had registered 124 components and 104 services; this momentum must be maintained over the coming months. GEO Members and Participating organizations have also started to evaluate the design and functionality of the GEO Portal and provide feedback to the Portal providers; this effort, too, must be maintained.

The work on preparing the GEO Data Sharing Principles for adoption in 2010 also made good progress this year. Together, the GEOSS Common Infrastructure and the Data Sharing Principles are fundamentally important to the next phase of GEOSS implementation.

Turning to the nine Societal Benefit Areas, the Weather and Climate Tasks have maintained their earlier momentum during the course of the year. They have traditionally been amongst the most advanced fields in Earth observation and consequently are essential components of GEOSS. Maintaining and even strengthening the commitment of the weather and climate communities to GEOSS must remain a key priority.

One of the most exciting advances in 2008 was the formal launch of the Group on Earth Observations Biodiversity Observation Network, or GEO BON. The biodiversity community consists of a highly diverse range of institutions concerned with a wide range of scientific and policy issues. Their desire to collaborate through GEO and link their databases and systems to GEOSS not only benefits decision-makers in the biodiversity field but those engaged in all SBAs. The biodiversity community has drafted a concept document and an "implementation overview" and is preparing now to create a set of "early products".

Meanwhile, the Societal Benefit Areas of Water, Health and Agriculture have all been re-energized in 2008. A large number of new water initiatives, each supported by active leads and contributors, are described below; together, these initiatives promise to visibly improve monitoring of the hydrological cycle in the very near future. Similarly, this year has seen a dramatic advance in GEO's efforts to engage the World Health Organization and other leaders in the health and environment communities and in strengthening MERIT and other existing partnerships. Under Agriculture, GEO developed its work on carbon tracking, which promises to emerge as a critical activity under the next Work Plan. In addition, major contributors to the Agriculture SBA are now actively joining forces and advancing the fields of aquaculture, fisheries, agriculture monitoring and food security.

In the Disasters SBA, GEO has focused this year on collaborating with the various existing disaster-management networks in order to integrate their seismographic, geohazards and wildfire and water risks information into GEOSS. Good progress has been made under the Ecosystem SBA on expanding the ChloroGIN network to the Indian Ocean region, building a global phenology network, assessing and monitoring protected areas, and advancing Integrated Global Carbon Observation. The Energy-related Tasks on solar data, CO<sub>2</sub> storage, environmental impact monitoring and managing energy sources are also on track.

In the Transverse Area of Capacity-Building, GEO started to concentrate more strongly on the challenge of raising resources for engaging developing countries in GEOSS implementation. In September, the European Commission, through its 7<sup>th</sup> Framework Programme, started the process of establishing an advisory capability to support capacity building for GEOSS. Progress continued to be made on GEONETCast, international training programmes and open-source software.

Finally, an important achievement in 2008 that must be acknowledged was the successful transition of the Integrated Global Observing Strategy (IGOS) themes into GEO. In particular, by strengthening the GEO Communities of Practice as well as many Task teams, this transition promises to expand the opportunity for GEO Members and Participating Organizations with shared interests and concerns to interact, share ideas and collaborate on implementing the Work Plan Tasks.

## 1 DISASTERS

2008 saw the strengthening of the Geohazards Community of Practice thanks to the transition of the IGOS-P theme on geohazards into GEO. GEO also continued to collaborate with many of the key disaster-related institutions and communities in order to expand their contributions to GEOSS and, in particular, improve the use of space observations to support disaster reduction.

Led by the French Geological Survey (BRGM), the **Geohazards Community of Practice** further consolidated its membership and activities through the transition of the IGOS-P geohazards theme and the organization of a series of workshops and events. It also designed and developed an interoperable and distributed metadata system for inventorying hazard maps (GeoHazData), collected user requirements, and published (in May) a status document on GeoHazData.

Next steps for the Geohazards Community of Practice are to start developing the GeoHazData clearinghouse for Earth observation data using a number of Geohazards SuperSites as demonstrators. The Geohazards SuperSites initiative focuses on risk and vulnerability assessments of geohazard hotspots. It seeks to stimulate scientific progress, maximize the beneficial use of and access to Earth observation data, foster the development of new applications, allow integration and assimilation of observations into models (for hazard mapping and forecasting), allow the exchange of knowledge and experience in the scientific community, and constitute an ideal framework for building capacity. Contributors include the US National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), the US Geological Survey (USGS) and the French Space Agency (CNES).

Meanwhile, GEO continues to engage the seismographic community, which is working to improve and coordinate **Global Seismographic Networks**. The Network is a cooperative partnership between Incorporated Research Institutions for Seismology (IRIS) and USGS. Particular progress has been made recently on expanding the Caribbean Seismographic Network and on enhancing the quality and delivery of various seismic products, such as PAGER (Prompt Assessment of Global Earthquakes for Response).

Freely available from USGS, PAGER uses advanced seismological methods to estimate ground motion for earthquakes where instrumental recordings are lacking. It can also rapidly estimate the societal impact of major earthquakes worldwide based on estimates of the population and property exposed to potentially damaging levels of ground motion. Seeking to support decision-making about humanitarian response, USGS is further improving PAGER by including a more comprehensive alert that features casualty estimates.

GEO's collaboration on Virtual Constellations with the Committee on Earth Observation Satellites (CEOS) is helping to advance the use of **satellites to support risk management**. Many satellite operators in this field are coordinated through the International Charter on Space and Major Disasters. The GEO Secretariat has initiated a dialogue to identify proper provisions and mechanisms for all GEO Members to access the Charter in case of emergency as well as its archives of previous interventions. In April the Charter's Board unanimously endorsed the principle of "universal access" for all states. This principle should facilitate wider access to Charter assets by all GEO Member States.

The Global Fire Monitoring Center (GFMC) is coordinating work on a **global early warning system for wildland fire**, which promises to become a major GEOSS component. Led by GFMC and the Canadian Forest Service, the GEO wildfire team is working to improve and coordinate existing warning systems and risk models. A prototype of this Global Early Warning System has already been established for sub-Saharan Africa.

GEO has initiated discussions with the World Meteorological Organization (WMO) and the International Center of Environmental Monitoring (CIMA Foundation) on adding a "flood management module" to the **Latin America Capacity Building Project on Water Management**.

This project would aim to design and implement a system for flood management in the Rio de la Plata basin in southern South America. The Italian institutions involved have expressed a willingness to proceed and contacts have been initiated with local organizations and institutions from the five countries in the basin. The next step will be to consolidate the institutional arrangements.

Meanwhile, flood-risk managers in the Caribbean may soon benefit from better access to satellites. NASA, the UN Office for Outer Space Affairs (UNOOSA), the Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC), CEOS, the Caribbean Disaster Emergency Response Agency, the University of West Indies and the Caribbean Urban and Regional Information Systems Association have submitted their plans to GEO for advancing this goal as a contribution to GEOSS.

Finally, the GEO Executive Committee decided in March that the **Tsunami Working Group** has completed its mandate. Nevertheless, the Intergovernmental Oceanographic Commission, which was leading that Task, has confirmed its continuing commitment to contributing to GEOSS through the Global Ocean Observing Systems (GOOS).

## 2 HEALTH

2008 has seen a substantial advance in the engagement of the health and environment communities within the GEO framework. New opportunities are emerging for collaborating with the World Health Organization (WHO) on health information systems and end-to-end services; in addition to advancing the MERIT (Meningitis Environmental Risk Information Technologies) project, this should lead to end-to-end services for other diseases, such as malaria. GEO has also started to collaborate on health issues with the World Federation of Public Health Association (WFPHA), the European Center for Disease Prevention and Control (ECDC), the UN Economic Commission for Africa (UNECA) and the United Nations Environment Programme (UNEP).

Progress on using current knowledge about epidemic meningitis and its interaction with the environment has continued through the **Meningitis Environmental Risk Information Technologies (MERIT) project**. In 2008 MERIT paid particular attention to Ethiopia and engaged its Federal Ministry of Health and National Meteorological Agency under the banner of a Climate-Health Working Group. This Group could serve as a model for establishing effective climate-health partnerships in other African countries. In addition, MERIT has formalized a Steering Committee tasked with clarifying the roles and responsibilities of the project's member institutions and guiding their collaboration over the coming years. The next MERIT meeting will be held in Addis Ababa, Ethiopia in December.

The **Sand and Dust Storm Warning** Advisory and Assessment System led by WMO and the Barcelona Supercomputing Centre has also made good progress. Since last November's WMO/GEO Sand and Dust Storm Meeting in Barcelona, daily verification of a new dust model for the System has shown encouraging results across the Sahel during the winter season. The next step will be to integrate long-term dust simulations with regional epidemiology data; the results from this exercise will potentially contribute to the development of a decision-support tool that can be tested during the next meningitis epidemic season in the Sahel region.

GEO has continued its discussions with the World Health Organization on expanding collaboration into broader health and environment issues. In particular, dialogue has continued on the development of the WHO's **Open Health tool** as a public health information system and decision-support tool and its possible integration within GEOSS. The development of an Open Health "Environmental Information Module" is seen as the main avenue for developing joint proposals for stimulating investment in health information systems. The UNECA has announced that it will contribute to developing and establishing the African component.

The strengthening of the GEO-WHO relationship could pave the way for WHO to become a GEO Participating Organization and for broader **cooperation between the Health and Earth Observation communities**. Similarly, the European Centre for Disease Prevention and Control (ECDC) has expressed interest in combining its data, for example from the European Project "Emerging Diseases in a changing European Environment" (EDEN), with GEOSS data, possibly through the GEO Portal.

### 3 ENERGY

The GEO Energy Community of Practice continued to advance the projects and activities launched earlier and to integrate them into GEOSS. Active members include France, Germany, the Netherlands, the USA, the European Space Agency (ESA), the Global Ocean Observing System (GOOS), and the Institute of Electrical and Electronics Engineers (IEEE); they have now been joined by the United Nations Economic Commission for Africa (UNECA), which is starting to contribute to a number of Tasks. In addition, the European Commission is funding important energy projects through its 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes.

The **GEO Energy Community of Practice** remains active and committed to advancing the Energy SBA. For example, it served as an effective advocate for renewable energy funding during the March 2008 Washington International Renewable Energy Conference (WIREC). Key conference outcomes included pledges by government agencies and other entities to support renewable energy deployment. In particular, the NASA Applied Sciences Program put forward a pledge to support GEO's work on solar resource assessment using Earth observations, with an emphasis on products for the developing world. UNECA joined this Task team and key deliverables were added for Africa, such as maps of Africa's energy resources potential and thematic maps of Africa's energy sector, including electric power, oil and gas, biofuels, and hydropower.

Substantial progress was also made on **Energy Environmental Impact Monitoring** thanks to strong contributions from projects funded by the EC's Framework Programmes. The EnerGEO project on "Earth observation for monitoring and assessment of the environmental impact of energy use", for example, which is in the final stage of negotiation with the Commission, aims to support decision-making for diversifying energy production. To evaluate the environmental impact of producing, transporting and consuming different energy resources, the project will (i) link energy use and its environmental impact through a state-of-the-art environmental, energy and scenario model; (ii) collect the necessary datasets and indicators by drawing on global in-situ networks and GEOSS; (iii) test the EnerGEO concept through pilot projects; (iv) make the EnerGEO data accessible through a portal; and (v) upgrade the pilots to global scale.

Research on **CO<sub>2</sub> geological storage** is being coordinated via four EC-funded (FP6) projects: CO2ReMoVe (research into monitoring and verifying carbon dioxide geological storage), CASTOR (capture and geological storage of CO<sub>2</sub>), CO2GeoNET (European network of excellence on the geological storage of CO<sub>2</sub>) and GeoCapacity (assessing European capacity for geological storage of carbon dioxide). These projects benefit from contributions by various European partners and from Argentina, Canada, China, India, New Zealand, South Africa and the US.

The next phase of the GEO Early Achievement **Solar Data for Developing Countries** has been planned and implementation has started. Based on databases from the US (NASA) and France (Ecole des Mines de Paris), the service was accessed by 3,275 users by mid-May. The project is now adding databases from Germany (DLR) and possibly South America and Australia, Australia, which should help to further expand high-resolution data coverage over Asia and Africa. UNECA has also now joined the effort, thus adding key deliverables for Africa, such as guidelines for implementing African energy policy.

Activities for the **Management of Energy Sources** have expanded with the addition of two projects led by the US (NASA) and CEOS. These projects allow energy utilities to use high-resolution, weather-related Earth observation measurements for forecasting short-term loads and assessing the utility of using global climate model projections to predict regional climate change impacts on the energy sector.



## 4 CLIMATE

The implementation of GEOSS as a tool to address the cross-cutting issues of climate change is making good overall progress. Strong Leads have been identified for all the Climate Tasks. However, in some cases longer term funding remains a concern.

In May, the World Modelling Summit for Climate Prediction **called for a revolution in climate, weather and Earth-system prediction**. The Summit declaration emphasized the need for improved prediction of regional climate, especially of extreme events and high-impact weather, in order to develop adaptation strategies. The creation of a World Climate Research Facility was proposed to enable “national centres to accelerate progress in improving operational climate prediction at all time scales, especially at decadal to multi-decadal lead times”. This progress would be achieved “by increasing understanding of the climate system, building global capacity, developing a trained scientific workforce, and engaging the global user community”. These conclusions will be further discussed to the Joint Steering Committee of the World Climate Research Programme (WCRP) and the World Weather Research Programme (WWRP).

The **Year of Tropical Convection** has been launched. The relevant Numerical Weather Prediction fields are being archived as of May 2008 at the European Centre for Medium-range Weather Forecasts (ECMWF). Support is being sought from NASA and NOAA to build a comprehensive satellite database for the project, and other potential funding sources are being explored. A second meeting of the Planning Group is projected for later in 2008.

WCRP has continued to advocate for **priorities in reanalysis and ocean/atmosphere data assimilation**. Building on the outcomes of the Third WCRP International Conference on Reanalyses in Tokyo in January/February, the WCRP Observation and Assimilation Panel prepared outreach letters and articles to emphasize the need to facilitate access and digitization of historical data sets. It also stressed the importance of sustaining reanalysis efforts for all climate system components (atmosphere, ocean, land) while raising the profile of reanalysis worldwide.

Sponsored by the Global Climate Observing System (GCOS) and NOAA, an expert meeting in Germany advanced the implementation of the **GCOS Reference Upper Air Network (GRUAN)**. Such a reference network is required for providing long-term, high-quality climate records; constraining and calibrating data from more spatially-comprehensive global observing systems (including satellites and current radio-sonde networks); and fully characterizing the properties of the atmospheric column.

Further actions have been taken to advance the **GCOS Implementation Plan as a contribution to GEOSS implementation**. Japan (JAXA) and the US (NASA) formed a CEOS study team to establish a basis for a future Global Precipitation Constellation. The US announced plans to enhance its civil Earth observation capabilities, including the climate sensors on the National Polar-orbiting Operational Environmental Satellite System (NPOESS). Both JAXA and NASA are in the final stage of preparation for the launch of their respective satellites dedicated to the observation of atmospheric CO<sub>2</sub>: GOSAT and OCO. Both spacecraft are scheduled to be launched in January 2008 and should offer a noticeable opportunity for cross-calibration and validation. (See also Ecosystems).

The GEO community has taken important steps towards developing a **framework for terrestrial observing systems** (including the land-coast interface). Technical groups have been formed to review and finalize standard assessment reports on the land cover, fire, hydrology and water use, and biomass. The Land Cover Classification System has been undergoing a process of standardization through the International Standards Organization (ISO). Guides and manuals are being made available to users on, for example, improved estimation of greenhouse gas monitoring. Additional activities include capacity building through the European project CarboAfrica. Negotiations are also underway with FAO, WMO

and ISO to develop a final mechanism to submit to the UN Framework Convention on Climate Change

WMO and GEO advanced their planning for the **legacy of the International Polar Year (IPY)**. They will organize a major workshop on the IPY legacy in late 2008. The goal is to identify funding priorities for the post-IPY era, build upon IPY project outcomes and explore opportunities to maximize their long-term impact. Particular emphasis will be given to cryospheric activities within IPY.

Following the 9<sup>th</sup> Meeting of the Partnership of Global Oceans (POGO), new elements have been added to GEO activities for improving the **coordination of global ocean observing systems**.

## 5 WATER

GEOSS implementation in the Water Societal Benefit Area has benefited from a significant increase of activity in 2008. Among other achievements, key contributions included capacity building workshops on water resource management, a new high-resolution global monthly precipitation climatology analysis for the Earth's land surface, and the emergence of a Water Cycle Community of Practice to forge links across the spectrum of water-related concerns, from providers of observational data to end-users for effective management.

During the reporting period, the Water community **improved the monitoring of the hydrological cycle** in a number of ways:

- A Dutch consortium consisting of the UNESCO-IHE Institute for Water Education and the Dutch remote-sensing company EARS implemented a satellite-based drought monitoring and flow forecasting system in China's Yellow River basin that generates daily temperature, radiation, (actual) evapotranspiration and rainfall fields at a resolution of 5 km.
- NASA and USGS are donating wall-to-wall coverage of Landsat 7 imagery of Central America acquired mostly between late 2005 and early 2006 for use in planning sustainable development. The satellite data are available at no charge via <http://servir.nsstc.nasa.gov/MesoStor/index.html>.
- The Coordinated Energy and Water Cycle Observations Project (CEOP) has implemented a data policy allowing the sharing of in-situ reference site data, model output data and satellite data.
- The Hydrological Applications and Run-Off Network (HARON) proposal has been submitted by the University of Geneva to the European Commission Seventh Framework Programme (FP7) in response to a call for proposals on "Establishing an efficient network of hydrological observatories, river basin networks and databases, for water resources research."
- In July, a map of Groundwater Resources of the World atlas was compiled by the federal German geological survey (BGR) in collaboration with UNESCO's International Hydrological Programme and other international partners. These data are available under a prototype application for web mapping hosted by BGR at [www.bgr.de/app/fishy/whymap](http://www.bgr.de/app/fishy/whymap).
- The Global Precipitation Climatology Centre (GPCC) finalized its new global monthly precipitation climatology analysis for the Earth's land surface (highest spatial resolution: 0.25°) and an updated monthly precipitation analysis for the earth's land surface for 1901-2007 (highest spatial resolution: 0.5°). (See [gpcc.dwd.de](http://gpcc.dwd.de)).
- The British National Space Centre is developing and promoting services and transferable knowledge from the Integrated CEOS European Data Server (<http://iceds.ge.ucl.ac.uk>). This open-access Open Geospatial Consortium web-GIS server will make data accessible for users in developing countries.
- WMO has completed a questionnaire on water-quality monitoring capabilities in countries around the world and will produce a report in the near future.

The water community also explored ways of improving **hydrological model ensemble forecasts**. The Hydrological Ensemble Prediction Experiment (HEPEX) project has progressed with the identification of several testbed projects (see <http://hydis8.eng.uci.edu/hepex/>). These projects are building on the outcomes of the June 2008 HEPEX workshop on hydrological uncertainty and statistical post-processing of hydrological ensemble forecasts.

Another set of achievements has involved **capacity building for water monitoring**:

**Asia:**

- Led by Japan, members of the Asian Water Cycle Initiative have held a series of workshops on capacity building for water-resource management in Indonesia (ministerial level), Bangladesh, Pakistan, and Bhutan.
- The Asia-Pacific Network for Climate Change Research (APN) is now funding some demonstration projects in southeast Asia as part of the Asian Water Cycle Initiative. The status of these Asian capacity-building activities was reviewed at the Joint APN-AWCI Scoping Workshop in Tokyo in April.

**Africa:**

- EUMETSAT and the African Union Commission signed a Memorandum of Understanding in April on how they will contribute to the African Monitoring of the Environment for Sustainable Development (AMESD) project.
- The International Institute for Geo-Information Science and Earth Observation (ITC) has coordinated the TIGER Capacity Building Facility and will offer the expertise and training materials gained. ITC will offer the open-source GIS system ILWIS (Integrated Land and Water Information System) and will further develop tools and materials for GEONETCast.

**Latin America:**

- ITC, Bolivia's University of San Simón and Center of Aerospace Survey and GIS Applications for the Sustainable Development of Natural Resources, and the National Autonomous University of Mexico announced a joint education programme on geo-information science and Earth observation.
- The International Research Institute for Climate and Society (IRI) undertook capacity-building activities in Latin America and the Caribbean. These included research projects for promoting the use of climate information in water management, training courses for regional water resource experts and regional climate outlook forums.
- NASA continued to support the La Plata Basin Regional Hydrology Project and its goal to use Earth sciences information to extend capacity building in South America. This included workshop support and the training of students, assistance with access and application of NASA satellite and modelling products, and travel support to meetings, including visits to the US.
- The US National Oceanic and Atmospheric Administration (NOAA) Climate Programme Office continued to support both the North American Monsoon Experiment and the Climate Prediction Program for the Americas, which integrate climate science with regional planning and policy, particularly water and drought management, ecosystem resources, and public health.

Finally, the **Water Cycle Community of Practice** consolidated its membership and considered how best to interact with users and bridge the technology gap as it prepares to support the efforts of the User Interface Committee. A draft white paper on the scope and mandate of this Community of Practice has been circulated and will soon be completed.

## 6 WEATHER

Work on building the weather dimension of GEOSS is well on track. The World Meteorological Organization and other partners remain fully committed to building capacity, promoting research and development and strengthening global observing systems. Particular efforts have been devoted to advancing the WMO Integrated Global Observing System (WIGOS) and to extending the benefits of improved warnings and forecasts of high-impact weather to all GEO Societal Benefit Areas.

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The teams developing WMO's **Global Observing System (GOS)** have continued to identify and address the evolving user requirements for sustainable observations on the state of the Earth and its atmosphere. They have focused in particular on building the **WMO Integrated Global Observing System (WIGOS)**:

- The Expert Team on the Evolution of the GOS developed a draft “Vision for the GOS in 2025” and a revised Implementation Plan.
- The Ad-Hoc Steering Group meeting of the WIGOS Pilot Project for the Aircraft Meteorological Data Relay (AMDAR) developed a strategy for enhancing the delivery to users of aeronautical data from AMDAR platforms.
- The Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM), in close cooperation with the oceanographic community and the Intergovernmental Oceanographic Commission (IOC), has engaged in a WIGOS Pilot Project.
- The Joint Commission for Instruments and Methods of Observation (CIMO) Expert Team on Upper-Air Systems Intercomparisons considered the requirements for future tests and intercomparisons of upper-air systems.

Excellent progress has been made by the **THORPEX Interactive Global Grand Ensemble (TIGGE)** Working Group. TIGGE has advanced the availability of ensemble forecast products in archiving centers and data providers and expanded the TIGGE user community:

- *TIGGE Phase-1*: spatial sub-setting is now available from at least two of the three archive centers (ECMWF and NCAR). The Working Group has agreed on the content and format of metadata. A converter from GRIB (GRIdded Binary) to NetCDF (Network Common Data Form) has been written. There is convergence on the content and format of the Limited Area Model (LAM) - Ensemble Prediction System (EPS) data archive.
- *Prototype Global Interactive Forecast System (GIFS) products*: the Working Group has arranged for the real-time exchange of tropical-cyclone-related information from global ensemble systems for use during the THORPEX Pacific Asian Regional Campaign (T-PARC) in August-September 2008 and January-March 2009. Seven of the ten TIGGE ensemble forecast centers now make information from their ensemble available in real time on their ftp sites for T-PARC. The project is a prototype for the future real-time exchange of other products relevant for various high-impact weather-forecast applications.

Australia has initiated GEO activities on **data assimilation**, drawing upon the work of the Joint Center for Satellite Data Assimilation, the International TOVS Working Group, and the International Winds Working Group. These preliminary activities aim to address complementary aspects of data assimilation within GEOSS including: (i) data availability and access; (ii) assimilation systems &

characteristics; (iii) system availability; (iv) community software; and (iv) education in data assimilation.

The final demonstration of the **Beijing 2008 Olympic Games Forecasting** Demonstration Project was conducted from July to September. During August's intensive operation period, 16 international experts from eight Forecast Demonstration Projects (FDPs) worked together to provide nowcast suggestions to forecasters at the Beijing Meteorological Bureau. During the demonstration, the systems produced more than 40 FDP products, including consensus products, every six minutes. Since June, ensemble products from the Beijing 2008 Olympic Games Research and Development Project have been produced at the Chinese National Meteorological Center using products transferred in real-time from all six participating Ensemble Prediction Systems. The Research and Development Project automatic data processing and display platform has been built, and bias correction and combination of meso-scale ensemble prediction systems have been continued.

## 7 ECOSYSTEMS

GEOSS implementation has been focusing on seeking to strengthen the monitoring and assessment of ecosystem services as well as ecosystem conditions, extent and trends. While gaps remain, work has advanced this year on the ChloroGIN network, protected areas, the Global Phenology Network and carbon monitoring.

The Chlorophyll Ocean Globally Integrated Network (**ChloroGIN**) project aims to produce decision-support tools in the form of ocean maps of chlorophyll content and sea-surface temperature and to link separate regional networks into one globally integrated network. The global network has been extended now with the addition of a Far East node. Possible links with freshwater networks (yet to be established) are now under discussion under the common theme of water quality. (For more on ChloroGIN see Capacity Building below.)

The **GEO Protected Areas Assessment and Monitoring initiative** made continued progress in 2008. Overall objectives include: (i) coordinate, facilitate, and encourage the use of Earth observations for protected area planning, characterization, mapping, monitoring, and management; (ii) predict how protected areas will be affected by change; (iii) improve dissemination of relevant data; (iii) communicate trends, status, and threats to policy makers, local peoples, and the general public; and (iv) support the delineation and update of boundaries of protected areas.

The development of a **GEO Global Phenology Network** was prepared and is now planned for early 2009. This effort is led by US National Phenology Network and builds upon existing national phenology efforts in Germany, Hungary, Switzerland, the US and elsewhere. A workshop will be held in Geneva in late 2008 to evaluate the potential benefits of initiating this Network and to consider its design and implementation.

A number of advances have been made on **Integrated Global Carbon Observation (IGCO)** and the development of a global carbon-observing system. These include:

- The Integrated Carbon Observing System 2008-2012 preparatory phase. It intends to support a large expansion of the in-situ atmospheric concentration and flux-tower network and create a centralized gas-calibration laboratory.
- A global standard for data-basing flux data, post-processing (correction, gap-filling, error removal) of flux data, and flux-site ancillary data. In addition, the observation network has expanded significantly and now includes the existing CarbEurope and AmeriFlux (North and South Americas) and the new CarbAfrica and Ozflux networks.
- The international collaboration FLUXNET its 2007 Synthesis “LaThuile” product. The data covers over 900 site years and over 170 Fluxnet sites at 30-minute temporal resolution, and has become publicly available in September 2008.
- Several commercial aircraft with in-situ atmospheric analyzers, permitting continuous sampling of upper troposphere transects and vertical profiles where the aircraft take off and land.
- NASA’s Orbiting Carbon Observatory (OCO) and the Japanese Space Agency’s (JAXA) Greenhouse Gases Observing Satellite (GOSAT) confirmed for launch in January 2009. An upward-looking network of Fourier transform spectrometers has been established for the purpose of validating the OCO mission from stations in Australia, Europe and the US.
- NASA active LIDAR mission (ASSENSDS), ESA proposed active LIDAR (ASCOPE) and p-band radar missions (BIOMASS), as part of its Earth Explorer programme. These missions will

measure atmospheric concentration profiles (ASSENDS and ASCOPE) and above-ground biomass (BIOMASS).

- The first re-processing of the GLOBCARBON products for 1998-2003 ([www.globcarbon.info](http://www.globcarbon.info)). This comprises LAI, fAPAR, phenology and burned area globally at resolutions of 1km, 10km, 0.25deg and 0.5deg.
- Significant progress in merging ocean-surface pCO<sub>2</sub> data. An international effort lead by CarboOceans is putting together 4.5 million observation points for release in 2008. Synthesis of the North Atlantic hydrography data continues, with several workshops organised over the last 12 months.
- Completion of GLOBCOLOUR ([www.globcolour.info/](http://www.globcolour.info/)) second phase with several data products now available, including chlorophyll concentrations, total suspending matter and coloured dissolved and detrital organic materials.
- A number of data-assimilation schemes including the projects GEMS (EU, ECMWF), Carbon Tracker (ERSL, NOAA), GEOSCHEM (Harvard University) and PCTM (NASA Goddard Space Flight Center). Each of these frameworks ingests data from a range of sources and using models of the atmospheric transport and the terrestrial and oceanic uptake and release derives fluxes consistent with the observations, biology and physics of the carbon system.



## 8 AGRICULTURE

Activities for developing the agricultural component of GEOSS are now on track. Major institutions in this field are joining forces and developing new initiatives in the fields of aquaculture, fisheries, agricultural monitoring and food security. These initiatives should offer a firm foundation for continued development.

The Canadian Space Agency aims to accelerate the assimilation of Earth observations into **aquaculture management** by funding the SAFARI project (Societal Applications in Fisheries & Aquaculture using Remotely-sensed Imagery) for a period of three years. SAFARI is enhancing international coordination and promoting synergies through consultations with scientists and experts from the fisheries, aquaculture, coastal-zone management and Earth-observation communities. It has also started to interact with ChloroGIN and other international networks. The first SAFARI workshop, held in March, drafted an outline for a monograph by the International Ocean-Color Coordinating Group, to be published in early 2009. A web site has been established at [www.geosafari.org](http://www.geosafari.org).

The team working on **Forest Mapping and Change Monitoring** has reached consensus on standards in land characterization, interpretation methods and validation. It has also established a framework for linking in-situ forest observations and satellite observations. Good progress has been made on designing the Forest Resource Assessment (FRA) Remote Sensing Survey based on wide consultations on the sampling framework. The Food and Agriculture Organization of the UN launched the FRA 2010 in March. The GEO team is now developing protocols for disturbances and disturbance history, assisting with GLOBCOVER and other related projects and anticipating the release of re-rectified LANDSAT data. A parallel session on forest monitoring and carbon tracking was included in April's 2<sup>nd</sup> GEOSS Asia-Pacific Symposium. The next opportunity to explore this issue in a large GEO meeting will occur at the GEO Forest Monitoring Symposium, to be hosted by the Brazil's National Institute for Space Research (INPE) and co-sponsored by Australia, Norway, the US and GOFC-GOLD on 4-7 November.

A first list of priority activities has been established for the **Training Modules for Agriculture**. They were presented to participants at the 2nd African Leadership Conference on Space Science and Technology, and a number of institutions and individuals have shown interest in contributing.

A number of strategies for **Agricultural Risk Management** have been identified. These include the use of seasonal forecasts in agriculture, forestry and land management to help alleviate food shortages, drought and desertification. The use of integrated agricultural-management and crop-simulation models with climate-forecasting systems promises the highest benefits.

The work on **Operational Agricultural Monitoring Systems** has been strengthened by the transition of IGOS-P into GEO. The agriculture Community of Practice has established its web presence at [www.earthobservations.org/cop\\_ag\\_gams.shtml](http://www.earthobservations.org/cop_ag_gams.shtml). Coordination is mainly provided by India and the US. A workshop aimed at reviewing methods for integrating in-situ and Earth observation estimates of rainfall for Africa will take place in October. During an earlier workshop, activities were restructured into sub-activities to facilitate implementation. These include:

- Develop a Multi-source PAY (Production, Acreage, and Yield) database on a common platform to be provided by China, the EC and the US in 2009.
- Implement pilot studies integrating Earth observation data into national statistical reporting systems; this should lead to the production of community guidelines and protocols, with initial work in Africa likely to be led by the EC and FAO.
- Initiate regional experiments on methods, inter-comparisons and accuracy assessments, initially in Argentina, Ethiopia, Canada and China in 2008/09.

- Develop a global cropland and crop type mask at 250m resolution.
- Develop a global map of field-size distribution and cropping-system complexity in order to guide both Earth observation data acquisition and crop-area estimation methods.
- Rigorously define a standard set of products for agricultural monitoring.
- Coordinate a moderate (30m) resolution data initiative providing annual global coverage and make it available internationally. Help coordinate global data set for 2009-2010 at 60-30m resolution.
- Advocate for free and open access to satellite data and products used for agricultural monitoring and ensure continuity of Earth observations for agricultural monitoring.
- Request the relevant organizations to increase the number of meteorological stations in data-sparse regions such as Africa.
- Build capacity for integrating satellite data into operational monitoring systems in developing countries.

## 9 BIODIVERSITY

Biodiversity represents one of the key areas where GEOSS can significantly enhance the use of Earth observation data for decision-making. 2008 saw the launch of the GEO Biodiversity Observation Network, a major achievement that needs to be consolidated over the next few years. Other highlights include progress on monitoring invasive species and capturing historical biodiversity data.

The **Biodiversity Observation Network (GEO BON)** was launched in Potsdam, Germany on 8-10 April. This kick-off meeting was attended by some 100 experts representing 80 institutions and received international and German press coverage. The Potsdam meeting agreed on a GEO BON Concept Document and a process by which seven working groups would write the GEO BON Implementation Plan. An “implementation overview” document was written and submitted for the consideration of the GEO-V Plenary. Next steps will be considered at a GEO BON meeting early in 2009.

In May, the Conference of the Parties to the Convention on Biological Diversity (CBD) recognized GEO BON by adopting a decision “invit[ing] Parties, other Governments, relevant organizations, scientists and other relevant stakeholders to support this endeavour”. Following this, the GEO Secretariat Director and the CBD Executive Secretary signed a Memorandum of Understanding concerning the role of Earth observations and GEO BON in supporting the CBD targets for monitoring biodiversity.

GEO BON is now working directly with BIOSTRAT (which is developing the EU Biodiversity Research Strategy), the European Biodiversity Observation Network (EBONE) and other European Commission FP6 and FP7 activities to incorporate GEO’s requirements for biodiversity science into the European Platform for a Biodiversity Research Strategy. Meanwhile, the GEO User Interface Committee has recognized GEO BON as the Community of Practice for Biodiversity.

There has been encouraging initiatives on **Invasive Species Monitoring**. The first two workshops for Global Invasive Species Information Network (GISIN) data providers were held in 2008. A third is planned for January 2009 and small working groups will meet via teleconference to advance the difficult process of agreeing on the needed standards for data models. Five GISIN data providers are now online – FishBase, the US National Institute of Invasive Species Science, the Smithsonian Environmental Research Center, I3N-Argentina, and the Great Lakes Indian Fish and Wildlife Commission – and at least seven others are under development.

Good progress is also being made on **Capturing Historical Biodiversity Data**. An outline for a strategic plan for digitization has been created and the GEO Biodiversity Observation Network has been engaged. This activity will cooperate with the Interoperability Process Pilot Project on demonstrating the use of historical biodiversity data to study how biodiversity can adapt to climate change. This project also addresses interoperability between the Global Biodiversity Information Facility (GBIF) and components of the World Meteorological Organization Information System (WIS). In June, GBIF undertook the development of “Global Biodiversity Resources Discovery System (GBRDS)” and Integrated Provider Toolkit (IPT); in August, it called for members to join the Task Group on Global Strategy and Action Plan for mobilizing natural history data, and it participated in the GEO BON Data Working Group.

## 10 ARCHITECTURE

The progress made on developing the GEOSS architecture reflects the GEO community's strong commitment to advancing this critical issue. In particular, the GEOSS Common Infrastructure (GCI) consisting of the GEO Portals, clearinghouse and registries is now being advanced through a one-year assessment period launched in June called the Initial Operating Capability (IOC). All GEO Members and Participating Organizations are involved in registering their components and services and in evaluating the GCI. The various GEO Committees have also been engaged in this process.

GEO Members and Participating Organizations continue to address the **interoperability of Earth observation systems** as a priority issue. As of September, the GEOSS registries feature 124 components and 104 services. Accelerating the process of completing the registries is vital for the success of the Initial Operating Capability (IOC) phase, which extends to May 2009. The guidance document explaining the registration process has been widely distributed. This document has been published as a brochure and in electronic format. Three prototype GEO Portals, along with the GEOSS Clearinghouses and associated information services, have been developed and are being tested by the GEO community. The providers of the GCI components are responding to the feedback they receive from Members, Participating Organizations and Committees to further develop and improve their contributions.

The Architecture Implementation Pilot, now in its second phase, is focused on supporting the GCI Initial Operating Capability. The team carrying out this work has discussed a number of scenarios for how the emerging GEOSS architecture may support the various SBAs. 35 responses have been received to their call for participation. Scenario groups have been established, and each has developed a work plan for ensuring that the GEOSS pilot architecture supports many different user communities. Finalizing this process to ensure that the Portals, Clearinghouse and Registries meet user needs will require continuous input from, and coordination with, all GEO Committees.

Meanwhile, GEO's Standards and Interoperability Forum (SIF) has been studying the list of registered standards and special arrangements in order to test and evaluate the emerging interoperability of GEOSS components. It is also providing the help desk function for the registries, and it has evaluated a number of observing instruments and other components presented as candidates for inclusion in GEOSS through GEOSS Interoperability Process Pilot Projects (IP3). The next phase for these Pilot Projects is now being planned.

Following acceptance by the Executive Committee, a WIKI approach has been adopted for the development of the **GEOSS Best Practices Registry**. The Institute of Electrical and Electronics Engineers has offered to implement this registry and has already started development.

A GEOSS Roadmap has been posted on the web to explain the Targets in the GEOSS 10-Year Implementation Plan and provide a useful tool for tracking the progress in each of GEO's nine Societal Benefit and nine Transverse Areas.

GEO continues to collaborate with the International Telecommunications Union on ensuring international **protection for radio frequencies**. The focus is on promoting a large number of advocacy initiatives aimed at convincing national and international bodies responsible for managing radio frequencies of the critical importance of dedicating certain frequencies to Earth observations.

The availability of an accurate, homogeneous, long-term and stable **global geodetic reference frame** for geodetic data has been recognized by the Architecture and Data Committee as essential for achieving many of the societal benefits promised by GEOSS. The team working on this issue has been drafting a strategy and a reference document on the Global Geodetic Observing System (GGOS) to the year 2020 in order to provide guidance to the GEO community.

In the process of establishing itself as a GEOSS Operational Exemplar, the WMO Information System (WIS) has made steady progress in its efforts to improve the ability of national meteorological services to connect to and access environmental information. It is also working to improve accessibility and interoperability for a wider range of users through the GEOSS interoperability processes and arrangements.

## 11 DATA MANAGEMENT

The Work Plan on the transverse area of Data Management advanced significantly in 2008. Important progress has been achieved on data quality assurance, data sharing, a high-resolution digital-elevation model (DEM), and sensor webs.

A **GEOSS Data Sharing Principles White Paper** and an **Implementation Guidelines** were actively prepared and circulated to the GEO Committees for comments. The Guidelines were updated based on feedback and submitted for review to all GEO Principals. Case studies for applying the Guidelines are emerging in the various Societal Benefit Areas; some of these studies will form part of the implementation strategy for the Guidelines, which is currently under development.

Under the leadership of the CEOS Working Group on Calibration and Validation, the **GEOSS Data Quality Assurance Strategy** Task has made good progress. The Task team held its second workshop at the US National Institute for Standards and Technology. One outcome was the development of a Quality Assurance Framework for Earth Observation (QA4EO) in the context of GEOSS. A QA4EO set of “key guidelines” is currently being finalized. It will be presented for endorsement to CEOS in November and then recommended for use throughout the GEO community. An implementation strategy to encourage its worldwide use is now under development. The strategy will also address the potential evolution of the Guidelines to ensure that they meet any additional specific needs of data providers, for example those related to *in-situ* measurements.

The development of the global **Digital Elevation Model (DEM)** at high spatial resolution, to be made available to GEO by Japan (Ministry of Economy, Trade and Industry) and the US (NASA), is advancing well. A first prototype should be available in early 2009 for testing and validation.

The **Sensor Web Enablement** Task team held its second workshop in Geneva in May. This sensor web is being set up as a base layer for GEOSS sensors and components. As a result of this workshop, the general focus of the Task was broadened to include not only terrestrial but also oceanographic observing systems. The Task will also focus more on sensor web technologies. The range of application domains and case studies was extended to include fire-warning systems, in addition to flood systems. Communications with other Work Plan Tasks, such as data quality assurance, has been intensified, and participation in the Architecture Implementation Pilot has been initiated.

Progress on **Virtual Constellations** was presented to the CEOS Strategic Implementation Team meeting in Tokyo. A process has been initiated to add more constellations to the four that are currently being developed by CEOS. Two additional constellation candidates were presented on ocean colour and on ocean surface vector wind observation; the inclusion of these proposals is underway.

The **Basic Geographic Data** guidance document has been updated and completed. The next GEO Work Plan is expected to extend this Task to include global geographic datasets and to link them to GEOSS.

The **Global Data Integration and Analysis System** progressed significantly and is harmonizing efforts in this area by linking to other data processing, archiving and dissemination initiatives, such as NOAA’s National Climatic Data Center, ICSU’s World Data Center and ESA’s Ground European Network for Earth Science Interoperations – Digital Repositories. A survey of 10 global data centers has been initiated as part of this Task.

## 12 CAPACITY BUILDING

Good progress has been made on implementing the GEO Capacity Building Strategy. A key challenge for the future is how to identify and mobilize resources for supporting capacity-building projects and activities.

Good progress has been made on implementing the GEO Capacity Building Strategy. A key challenge for the future is how to identify and mobilize resources for supporting capacity-building projects and activities.

During the reporting period, progress towards establishing the **Chlorophyll Ocean Globally Integrated Network (ChloroGIN)** included an update of the ChloroGIN-related web portal at Regional Centers, the linking of the ChloroGIN.org global web server to regional sites, improved connections between regional networks and receiving stations, the development of best-practice protocols for in-situ measurements, a training event and promotional activities, and participation in the EC-funded FP7 project DevCoCast on GEONETCast.

ChloroGIN has now been established in the Indian Ocean region. An automated data-processing chain is functioning, and daily images and weekly and monthly composites for the four ChloroGIN products are being disseminated through the Indian National Centre for Ocean Information Services website. In addition, eight time-series stations have been established in India's coastal waters.

Links to GEONETCast and to SAFARI (Societal Applications on Fisheries and Aquaculture using Remotely-sensed Imagery – see Agriculture section above) are well underway. Further work in the GEO framework is needed on linking ChloroGIN to relevant terrestrial networks such as HARON (Hydrological Applications and Run-Off Network – see Water section above).

Issues that must still be addressed include the potential lack of continuity for ocean-colour sensors after 2010, adequate communications bandwidth in developing countries, and funding in general. A major fund-raising effort is needed for consolidating the in-situ networks and ensuring minimum capability at sites, securing a full ChloroGIN meeting (if possible in early 2009) and organizing an early progress meeting for the Latin America ANTARES Network.

Progress on using **GEONETCast** (a system of communications satellites for transmitting data to low-cost receiving stations maintained by users) for capacity building has been substantial. The current focus is on adapting the EUMETSAT Training Channel for global use via GEONETCast. This GEONETCast service will (i) provide end-user training on the application of products and the dissemination of training data; (ii) disseminate training material to local trainers; (iii) disseminate training material focussed on environmental data; and (iv) link GEONETCast products with specific training material. In addition, regional workshops and fora are being planned to foster the development of regional user communities. The Training Channel is to be supported by each GEONETCast coordination operator (China Meteorological Administration, EUMETSAT and NOAA). The Training Channel will be demonstrated for users in Africa in October/November 2008 at the African Association of Remote Sensing of the Environment (AARSE).

In September, the European Commission, through its 7<sup>th</sup> Framework Programme, issued a call for proposals to establish a **capacity building advisory capability** in support of Earth observation and GEO activities. The primary objectives of this advisory capacity will be to work with stakeholders in new EU countries and developing countries to identify and address their capacity needs, identify possible resource providers, act as a broker to bring providers and users together, facilitate education and training in order to build a global base of technical expertise for GEOSS, and produce monitoring and evaluation mechanisms aimed at determining the efficacy of GEO's capacity-building efforts.

The use of **open-source software for training** in Earth observations remains high on the GEO capacity-building agenda. To support the TerraView and TerraLib Earth observations open-source

software, the Brazil National Institute for Space Research (INPE) has developed training materials, courses, tutorials, documentation and a website for both programmers and end-users in English. Updated versions of the two software were launched in July, and a completely new version of Spring was unveiled in June (Spring is an open-source software for remote-sensing images and geoprocessing that supports CBERS images and boasts 100,000 registered users). A next step is to develop new user interfaces for all three packages as well as tutorials and manuals in French. Another plan is to train potential users of CBERS images in Lusophone Africa using Spring. The three software were presented at the XIII International Symposium SELPER in Havana in September and at Cape Town South Africa – FOSS4G 2008.

The International Institute for Geo-Information Science and Earth Observation (ITC) organized an executive seminar on how to ensure **international recognition of educational qualifications** from nationally accredited institutions in Earth observation and geo-information. Participants included providers of international and cross-border capacity-building programmes. The seminar's outcomes and recommendations were considered in July by the Congress of the International Society for Photogrammetry and Remote Sensing.

Brazil's National Institute for Space Research (INPE) organized a GEOSS/UN-Spider Spring School on Space-based Solutions for Disaster Management and Emergency Response-Flooding for the Latin American and Caribbean region. The School drew participants from across Latin America and the Caribbean

UNEP developed and launched the **Atlas of Africa's Changing Environment** together with a related website. The Atlas is a useful resource for decision-makers on environmental issues in Africa as well as a source of information on African environmental priorities. A Latin American and Caribbean Atlas of our Changing Environment with related website are now in production.

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**ANNEX I – PROGRESS ON 2007-2009 WORK PLAN TASKS**
**Key:**

G	Green: Task progress judged to be very good to excellent.
Y	Yellow: Task is progressing but more effort is required.
R	Red: Task inactive or progress judged insufficient.

Tasks	Committee*	Status
<b>DISASTERS</b>		
<b>DI-06-02</b> Seismographic Networks Improvements and Coordination	ADC	G
<b>DI-06-03</b> Integration of InSAR Technology	STC	G
<b>DI-06-04</b> Tsunami Early Warning System of Systems	UIC	R
<b>DI-06-07</b> Multi-hazard Zonation and Maps	UIC	G
<b>DI-06-08</b> Multi-hazard Approach Definition and Progressive Implementation	UIC	Y
<b>DI-06-09</b> Use of Satellites for Risk Management	UIC	G
<b>DI-06-13</b> Implementation of a Fire Warning System at Global Level	ADC	G
<b>DI-07-01</b> Risk Management for Floods	UIC	Y
<b>HEALTH</b>		
<b>HE-06-03</b> Forecasting and Monitoring Environmental Health Hazards	UIC	G
<b>HE-07-01</b> Strengthen Observation and Information Systems for Health	UIC	Y
<b>HE-07-02</b> Environment and Health Monitoring and Modelling	UIC/STC	R
<b>HE-07-03</b> Multihazard Risk Reduction due to Atmospheric Aerosols	UIC	G
<b>ENERGY</b>		
<b>EN-06-04</b> Using New Observation Systems for Energy	UIC	G
<b>EN-07-01</b> Management of Energy Sources	UIC	G

EN-07-02 Energy Environmental Impact Monitoring	STC	G
EN-07-03 Energy Policy Planning	CBC	G
<b>CLIMATE</b>		
CL-06-01 Sustained Reprocessing and Reanalysis Efforts	STC	G
CL-06-02 Key Climate Data from Satellite Systems	ADC	G
CL-06-03 Key Terrestrial Observations for Climate	UIC	G
CL-06-05 GEOSS IPY Contribution	UIC	G
CL-06-06 Global Ocean Observation System	ADC	G
CL-07-01 Seamless Weather and Climate Prediction System	STC	G
<b>WATER</b>		
WA-06-02 Forecast Models for Drought and Water Resource Management	STC	G
WA-06-07 Integrated Earth Observation Water Resource Management	CBC	G
WA-07-01 Global Water Quality Monitoring	STC/UIC	G
WA-08-01 Integration of In-Situ and Satellite Data for Water Cycle Monitoring	ADC/STC/UIC	G
<b>WEATHER</b>		
WE-06-01 Surface-based Global Observing System for Weather	ADC	G
WE-06-02 Space-based Global Observing System for Weather	ADC	G
WE-06-03 THORPEX Interactive Global Grand Ensemble (TIGGE)	STC	G
WE-06-05 Numerical Weather-Prediction Capacity Building	CBC	G
WE-07-01 Data Assimilation and Modelling for Operational Use	STC	Y
WE-07-02 Weather Demonstration Project for Beijing 2008 Olympic Games	UIC	G
<b>ECOSYSTEMS</b>		
EC-06-01 Integrated Global Carbon Observation (IGCO)	STC	Y
EC-06-02 Ecosystems Classification and Mapping	STC	G
EC-06-07 Regional Networks for Ecosystems	CBC	G

<b>EC-07-01</b> Global Ecosystem Observation and Monitoring Network	STC	Y
<b>AGRICULTURE</b>		
<b>AG-06-01</b> GEOSS Agriculture Strategic Plan	UIC	R
<b>AG-06-02</b> Utilization in Aquaculture	STC	G
<b>AG-06-04</b> Forest Mapping and Change Monitoring	ADC	G
<b>AG-06-07</b> Training Modules for Agriculture	CBC	Y
<b>AG-07-01</b> Improving Measurements of Biomass	STC	R
<b>AG-07-02</b> Agricultural Risk Management	UIC	Y
<b>AG-07-03</b> Operational Agricultural Monitoring System	ADC	G
<b>BIODIVERSITY</b>		
<b>BI-06-03</b> Capturing Historical Biodiversity Data	STC	G
<b>BI-07-01</b> Biodiversity Observation Network	UIC	G
<b>BI-07-02</b> Invasive Species Monitoring System	STC	G
<b>USER ENGAGEMENT</b>		
<b>US-06-01</b> Identify Priorities and Synergies between SBAs	UIC	G
<b>US-06-02</b> Pilot Communities of Practice	UIC	G
<b>ARCHITECTURE</b>		
<b>AR-06-11</b> Radio Frequency Protection	ADC	G
<b>AR-07-01</b> Enabling Deployment of a GEOSS Architecture	ADC	G
<b>AR-07-02</b> GEOSS Architecture Implementation Pilot	ADC	G
<b>AR-07-03</b> Global Geodetic Reference Frames	ADC	G
<b>AR-07-04</b> WIS -- GEOSS Operational Exemplar	ADC	G
<b>DATA MANAGEMENT</b>		
<b>DA-06-01</b> GEOSS Data Sharing Principles	ADC	G
<b>DA-06-02</b> GEOSS Quality Assurance Strategy	ADC	G

<b>DA-06-03</b> Ensemble-Technique Forecasting Demonstrations	STC	G
<b>DA-06-04</b> Data, Metadata and Products Harmonisation	UIC	Y
<b>DA-06-05</b> Guidance Document for Basic Geographic Data	ADC	G
<b>DA-06-09</b> GEOSS Best Practices Registry	ADC	G
<b>DA-07-01</b> Digital Elevation Model Interoperability	ADC	G
<b>DA07-02</b> Global Land Cover	<i>UIC?</i>	G
<b>DA-07-03</b> Virtual Constellations	ADC/UIC	G
<b>DA-07-04</b> Sensor Web Enablement for In-Situ Observing Network Facilitation	ADC	G
<b>DA-07-05</b> Higher Level Data Product Tools	UIC	Y
<b>DA-07-06</b> Data Integration and Analysis System	ADC	G
<b>CAPACITY BUILDING</b>		
<b>CB-06-04</b> GEONETCast	ADC	G
<b>CB-07-01a</b> Engaging Donors	CBC	G
<b>CB-07-01b</b> Identifying Best Practices, Gaps and Needs	CBC	Y
<b>CB-07-01c</b> Capacity building Performance Indicators	CBC	Y
<b>CB-07-01d</b> Building National and Regional Capacity	CBC	G
<b>CB-07-01e</b> Open Source Software	CBC	G
<b>CB-07-02</b> Knowledge Sharing for Improved Disaster Management and Emergency Response	CBC	G
<b>CB-08-01</b> Recognition of cross border Education and training capacity building in Earth Observation	CBC	G

\*Committee assignment as agreed at 13 April 2007 C4 meeting.

**LIST OF ACRONYMS**

AARSE	African Association of Remote Sensing of the Environment
ACQWA	Assessing Climatic change and impacts on the Quantity and quality of Water
ADC	Architecture and Data Committee
AeroCOM	Aerosol Comparisons between Observations and Models
AG	Agriculture
AIT	Asian Institute of Technology
AMDAR	Aircraft Meteorological Data Relay
AMESD	African Monitoring of the Environment for Sustainable Development
ANTARES	A Network for the Enhancement of the Education and Scientific Research
APEC	Asia-Pacific Economic Cooperation
APFM	Associated Programme on Flood Management
APN	Asian Pacific Network for Climate Change Research
AR	Architecture
ASCOPE	ESA Active LIDAR
ASEAN	Association of Southeast Asian Nations
ASI	Italian Space Agency
ASSEDS	NASA Active LIDAR
AVHRR	Advanced Very High Resolution Radiometer
AWCI	Asian Water Cycle Initiative
B08FDP	Beijing 2008 Olympic Games Forecasting Demonstration Project
B08RDP	Beijing 2008 Olympic Games Research and Development Project
BGR	German Geological Survey
BI	Biodiversity
BIOMASS	ESA p-band radar for above-ground biomass
BIOSTRAT	Specific Support Action (SSA) funded by the EU Sixth Framework Programme and aims to further develop the EU Biodiversity Research Strategy
BRGM	French Geological Survey
CASTOR	Capture and geological STORage of CO <sub>2</sub>
CATHALAC	Water Centre for the Humid Tropics of Latin America and the Caribbean
CB	Capacity Building
CBC	Capacity Building Committee
CBD	Convention on Biological Diversity
CBERS	China-Brazil Earth Resources Satellite

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CEOP	Coordinated Energy and Water Cycle Observations Project
CEOS	Committee on Earth Observation Satellites
CFP	Call for Participation
CGIAR	Consultative Group on International Agricultural Research
CGMS	Coordination Group for Meteorological Satellites
ChloroGIN	Chlorophyll Ocean Globally Integrated Network
CIESIN	Center for International Earth Science Information Network
CIMA	(CIMA Foundation) International Center of Environmental Monitoring
CIMO	Joint Commission for Instruments and Methods of Observation
CL	Climate
CMAP	Merged Analysis of Precipitation
CNES	French Space Agency
CO2GeoNET	European Network of Excellence on the geological storage of CO <sub>2</sub>
CO2ReMoVe	Research into Monitoring and Verifying Carbon Dioxide geological storage
CoP	Community of Practice
CPC	Climate Prediction Center
CSIR	Council for Scientific and Industrial Research, South Africa
DA	Data Management
DEM	Digital Elevation Model
DevCoCast	Provides processed land and ocean satellite data and value-added products in Developing Countries
DI	Disasters
DIVERSITAS	An international programme of biodiversity science
DLR	German Aerospace Center
EARS	Dutch Remote-Sensing Company
EBONE	European Biodiversity Observation Network
EC	Ecosystems
EC	European Commission
ECDC	European Center for Disease Prevention and Control
ECMWF	European Centre for Medium-range Weather Forecasts
ECV	Essential Climate Variables
EDEN	Emerging Diseases in a changing European Environment
EEA	European Environmental Agency
EN	Energy
EnerGEO	Earth observation for monitoring and assessment of the environmental impact of energy use

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EO	Earth Observations
EPS	Ensemble Prediction System
ERSL	Environmental Remote Sensing and Image Processing Laboratory
ESA	European Space Agency
ESRI	Environmental Systems Research Institute
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAO	Food and Agriculture Organization
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
FDPs	Forecast Demonstration Projects
FDSN	International Federation of Digital Seismograph Networks
FLUXNET	Network of Regional Networks Integrating Worldwide CO <sub>2</sub> Flux Measurements
FOSS4G	Free and Open Source Software for Geospacial
FP6	European Commission funded projects
FP7	European Union 7 <sup>th</sup> Framework Programme
FPAR	Fraction Photosynthetically Available Radiation
FRA	Forest Resource Assessment
GAW	Global Atmosphere Watch
GBIF	Global Biodiversity Information Facility
GBRDS	Global Biodiversity Resources Discovery System
GCI	GEOSS Common Infrastructure
GCOS	Global Climate Observing System
GDEWS	Global Drought Early Warning Systems
GEMS	Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data
GEO	Group on Earth Observations
GEO BON	Group on Earth Observations Biodiversity Observation Network
GEOBENE	Global Earth Observation Benefit Estimation: Now, Next and Emerging
GeoCapacity	Assessing European Capacity for geological storage of Carbon Dioxide
GeoHazData	Interoperable and distributed metadata system for inventorying hazard maps
GEONETCast	Near real time, Global Network of Satellite-based Data Dissemination Systems designed to distribute space-based, air-borne and in situ data, metadata and products to low-cost receiving stations maintained by users
GEOSCHEM	Goddard Earth Observing System-CHEMistry
GEOSS	Global Earth Observation System of Systems
GEWEX	Global Energy and Water Cycle Experiment
GFMC	Global Fire Monitoring Center
GGMN	Global Groundwater Monitoring Network

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GGOS	Global Geodetic Observing System
GIFS	Global Interactive Forecast System
GIS	Geographical Information System
GISIN	Global Invasive Species Information Network
GLOBCARBON	ESA Global Land Products for Carbon Model Assimilation
GLOBCOLOUR	ESA Node for Global Ocean Colour
GLOBCOVER	ESA Global Land Cover Service
GMES	Global Monitoring for Environment and Security
GNSS	Global Navigation Satellite System
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
GOOS	Global Ocean Observing System
GOS	Global Observing System
GOSAT	Greenhouse Gases Observing Satellite
GPCC	Global Precipitation Climatology Centre
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GRIB	GRIdded Binary
GRUAN	GCOS Reference Upper Air Network
GSN	Global Seismographic Network
GTOS	Global Terrestrial Observing System
HARON	Hydrological Applications and Run-Off Network
HE	Health
HEPEX	Hydrological Ensemble Prediction Experiment
IAG	International Association of Geodesy
IAS	Invasive Alien Species
ICSU	International Council for Science
IEEE	Institute of Electrical and Electronics Engineers
IGACO	International Global Atmospheric Chemistry Observations
IGAC-SPARC	International Global Atmospheric Chemistry - Stratospheric Processes And their Role in Climate
IGBP	International Geosphere-Biosphere Programme
IGCO	Integrated Global Carbon Observation
IGOS	Integrated Global Observing Strategy
IGRAC	International Groundwater Resources Assessment Centre
IGWCO	Integrated Global Water Cycle Observations (former IGOS Water Theme)
IIASA	International Institute for Applied Systems Analysis



ILTER	International Long Term Ecological Research network
ILWIS	Integrated Land and Water Information System
INPE	Brazilian National Institute for Space Research
InSAR	Interferometric Synthetic Aperture Radar
INTA	Instituto Nacional de Técnica Aeroespacial, Spain
IOC	Initial Operating Capability
IOC	Intergovernmental Oceanographic Commission
IOCCG	International Ocean Colour Coordinating Group
IP3	GEOSS Interoperability Process Pilot Projects
IPT	Integrated Provider Toolkit
IPWG	International Precipitation Working Group
IPY	International Polar Year
IRI	International Research Institute for Climate and Society
IRIS	Incorporated Research Institutions for Seismology
ISC	International Seismological Centre
ISCGM	International Steering Committee for Global Mapping
ISDR	International Strategy for Disaster Reduction
ISLSCP	International Satellite Land-Surface Climatology Project
ISO	International Standards Organization
ISPRS	International Society for Photogrammetry and Remote Sensing
ISSG	IUCN/SSC Invasive Species Specialist Group
ITC	International Institute for Geo-Information Science and Earth Observation
ITC	International Training Centre
ITU	International Telecommunication Union
IUCAF	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science
IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
IUGG	International Union of Geodesy and Geophysics
JAXA	Japan Aerospace Exploration Agency
JCOMM	Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology
LAI	Leaf Area Index
LAM	Limited Area Model
LANDSAT	Earth Resources Technology Satellite
LIDAR	Light Detection and Ranging
LIS	Land Information System

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MEPS	Meso-scale Ensemble Prediction Systems
MERIS	Medium Resolution Imaging Spectrometer
MERIT	Meningitis Environmental Risk Information Technologies
MODIS	Moderate Resolution Imaging Spectroradiometer
NADM	North American Drought Monitor
NARSS	National Authority for Remote Sensing and Space Sciences, Egypt
NASA	National Aeronautics and Space Administration
NBII	National Biological Information Infrastructure
NCAR	US National Center for Atmospheric Research
NEPTUNE	The North-east Pacific Time-series Undersea Network Experiments
NetCDF	Network Common Data Form
NMHS	National Meteorological and Hydrological Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	Net Primary Productivity
NWP	Numerical Weather Prediction
OCO	NASA Orbiting Carbon Observatory
OECD	Organization for Economic Cooperation and Development
OGC	Open Geospatial Consortium
OS	Open Source
OSS	Open Source Software
PAAM	Protected Areas Assessment and Monitoring
PAGER	Prompt Assessment of Global Earthquakes for Response
PAY	Production, Acreage, and Yield
PCTM	Parameterized Chemistry and Transport Model
POGO	Partnership for Observation of the Global Ocean
POPs	Persistent Organic Pollutants
PROMOTE	PROtocol MO尼TORing (for the GMES Service Element: Atmosphere)
PUMA	Project supporting African nations in their use of data and services provided by the new Meteosat Second Generation (MSG) family of European weather satellites.
QA4EO	Quality Assurance Framework for Earth Observation
RAMSAR	Convention on Wetlands, Ramsar, Iran, 1971
RDP	Research and Development Project resource management in Africa
SAFARI	Societal Applications in Fisheries & Aquaculture using Remotely-Sensed Imagery
SAR	Synthetic Aperture Radar

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SBA	Societal Benefit Area
SBSTA	Subsidiary Body for Scientific and Technological Advice
SDI	Space Data Infrastructure
SDI	Spatial Data Infrastructure
SDS	Sand and Dust Storm
SELPER	Sociedad Especialista Latinoamericana en Percepción Remota (Latin-American Specialist Society in Remote Perception)
SIF	Standards and Interoperability Forum
SIT	Strategic Implementation Team
SIT22	CEOS Strategic Implementation Team meeting in Tokyo
SPOT	Système Probatoire d'Observation Terrestre
SPOT-VGT	SPOT Vegetation
SSC	Species Survival Commission
SST	Sea Surface Temperature
STC	Science and Technology Committee
TerraLib	Open source GIS software library
TerraView	GIS application built on the TerraLib GIS library
THORPEX	The Observing-system Research and Predictability Experiment
TIGER	ESA-launched initiative focusing on the use of space technology for water
TIGGE	THORPEX Interactive Global Grand Ensemble
TOVS	NOOA TIROS (Television Infrared Observation Satellite) Operational Vertical Sounder
T-PARC	THORPEX Pacific Asian Regional Campaign
UIC	User Interface Committee
UK	United Kingdom
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNESCO-IHE	Institute for Water Education
UNOOSA	United Nations Office for Outer Space Affairs
UNOSAT	United Nations Operational Satellite Applications Programme
US	User Engagement
USA	United States of America
USGS	United States Geological Survey
VENUS	Victoria Experimental Network Under the Sea

VI	Vegetation Index
WA	Water
WCRP	World Climate Research Programme
WDC	World Data Center
WE	Weather
WFPHA	World Federation of Public Health Association
WHO	World Health Organization
WIGOS	WMO Integrated Global Observing System
WIKI	Page or Collection of Web pages designed to enable anyone who accesses it to contribute or modify content, using a simplified markup language
WIREC	Washington International Renewable Energy Conference
WIS	WMO Information System
WMO	World Meteorological Organization
WWRP	World Weather Research Programme