



GROUP ON  
EARTH OBSERVATIONS

## GEO-X

15-16 January 2014

Assessment of Progress - Target and Task

Document 7 (Rev1)

*As approved at GEO-X.*



This document is divided in two parts

## PART I

### **2013 Assessment of Progress Against the GEOSS 2015 Strategic Targets**

#### **Target Assessment**

## PART II

### **GEO 2012-2015 Work Plan Implementation Report**

#### **Task Assessment**

# 2013 Assessment of Progress Against the GEOSS 2015 Strategic Targets

## Target Assessment

### INTRODUCTION

The 2013 Assessment of Progress is the second attempt by the GEO Implementation Boards to respond to the need for an evaluation of GEOSS implementation progress against the 2015 Strategic Targets. This need was expressed in the Terms of Reference of the Implementation Boards accepted by the GEO-VIII Plenary in November 2011.

The Target assessment is divided in two sub-parts:

- First, a summary assessment at the level of the Target featuring a pyramid diagram (see below) and key actions/intervention needed from GEO Members and Participating Organizations;
- Second, an annex outlining rationale, analysis, and linkages between recommended actions and Strategic Target outcomes.

### PYRAMID DIAGRAM

The pyramid diagram aims to provide a compact and comprehensive view of GEOSS implementation progress. It is based on a color-coded representation of the:

- Strategic Target (*top of the pyramid*)
- Underpinning Strategic Target Outcomes/“Demonstrated by” bullets (*middle level of the pyramid*)
- Related Work Plan Tasks (*base of the pyramid*) [Task information may be found in Part II of this document (Task Assessment)]

Color codes indicate the degree of progress and levels of priority for intervention as follows:

G	Green: Expected to be achieved. Some actions/intervention may be required
Y	Yellow: At risk of not being achieved without additional actions/intervention
R	Red: Not expected to be achieved without significant actions/intervention

To understand linkages between Targets and Tasks, it is useful to note that relationships are often diverse and complex. In effect, achieving the Outcomes of a particular Target depends on both the definition and implementation of the related Tasks. So whereas Tasks may be green (meaning that Task implementation is in line with the Work Plan), the overarching Target may be yellow or red (meaning that the orientation of these Tasks may need to be realigned in order to reach the Target).

Also, among the various Tasks geared towards the Outcomes of a given Target, some may be more relevant to those Outcomes than others. This situation may translate into a pyramid that features one red Task at the bottom (typically offset by one or more green Tasks) and a green Target at the top.

## **APPROACH**

The present Target assessment is jointly performed by the three GEO Implementation Boards:

- Infrastructure Board for the Architecture and Data Management Targets;
- Institutions and Development Board for the Capacity Building, User Engagement, and Science & Technology Targets;
- Societal Benefits Board for the nine Societal Benefit Area Targets (Agriculture, Biodiversity, Climate, Disasters, Ecosystems, Energy, Health, Water, Weather).

Sources of information for conducting the assessment include: (i) Direct Task Coordinator reports; (ii) Online Task Component Sheets (see [http://www.earthobservations.org/geoss\\_imp.php](http://www.earthobservations.org/geoss_imp.php)); and (iii) the GEO Secretariat Work Plan Implementation Report (Part II of this document).

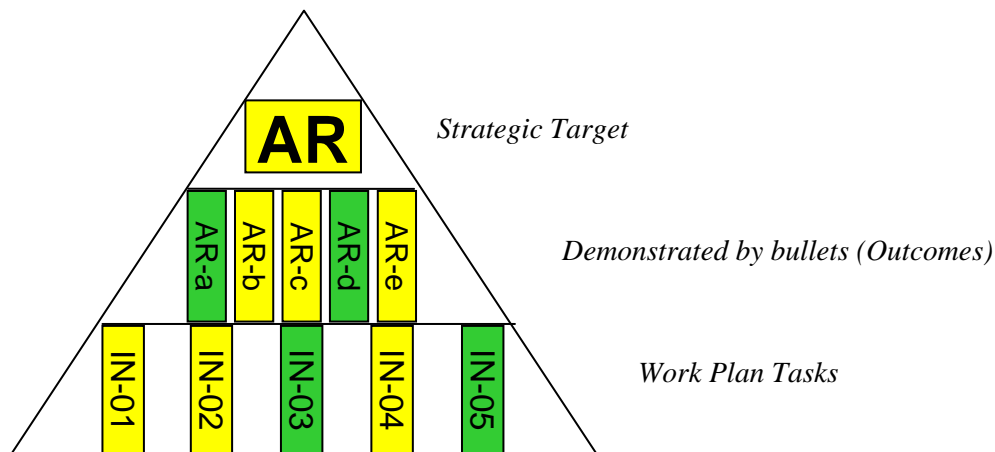
The main part of the assessment relies on qualitative analysis by Implementation Board members. Objective quantitative indicators have been used to the extent that they could be meaningfully defined (e.g. for Architecture and Data Management Targets).

Strategic Targets and underpinning Outcomes (Demonstrated by bullets) are drawn from GEO-VI Document 12(Rev1). The distribution of Tasks under each Target derives from the “Related GEOSS Strategic Targets” sections featured in the 2012-2015 Work Plan (minor adjustments have been made by Implementation Boards).

## Summary Assessment

## ARCHITECTURE

Achieve sustained operation, continuity and interoperability of existing and new systems that provide essential environmental observations and information, including the GEOSS Common Infrastructure (GCI) that facilitates access to, and use of, these observations and information.



### Rationale for Target Rating

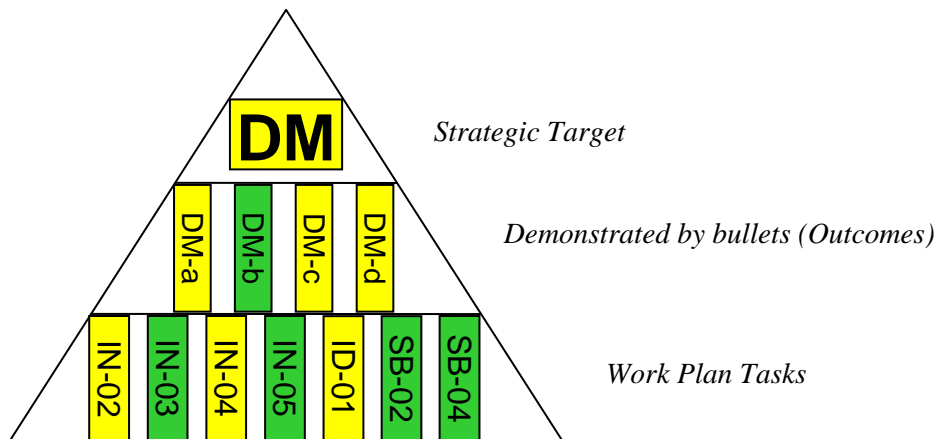
Resources discoverable and accessible via the GEOSS Portal are increasing, however access to these resources sometimes remains a challenge. The GEOSS Common Infrastructure requires continuous development to keep pace with a fast-moving digital landscape (emerging and evolving technologies) and a growing number of data infrastructure initiatives. Also, whereas coordination of space-based observing systems is improving, coordination of in-situ networks and new data sources is facing hurdles. With regard to specifying observation requirements and performing infrastructure gap analysis, there is good progress for Climate and Weather, however much remains to be done for other Societal Benefit Areas.

### Recommended Actions for GEO Members and Participation Organizations

- **AR1.** Support the providers of the GEOSS Common Infrastructure (ESA for the GEOSS Portal, Italy (CNR) for the Discovery and Access Broker, the USA (USGS/George Mason University) and IEEE for the Registries) to continue operations, accelerate improvements, and increase easy access to datasets – with priority to the GEOSS Data CORE – while encouraging providers to embed in the metadata direct links to the datasets or services
- **AR2.** Increase efforts to coordinate the provision, and improve the integration, of space-based and in-situ data at global, regional, and national levels; ensuring operations of underpinning observing systems so that gaps in availability and access are minimized. In particular, in-situ coordination should be encouraged building on the European Copernicus space/in-situ coordination efforts
- **AR3.** Ensure that initiatives aimed at developing research data infrastructures (e.g. e-infrastructures in Europe and Australia, cyber-infrastructures in the USA, Digital China) are made interoperable and accessible through GEOSS
- **AR4.** Seek opportunities to enhance GEOSS with new data sources (e.g. sensor networks and citizen-contributed information), working with the research community to deliver prototypes to be transitioned to operations post-2015

## DATA MANAGEMENT

Provide a shared, easily accessible, timely, sustained stream of comprehensive data of documented quality, as well as metadata and information products, for informed decision-making.



### Rationale for Target Rating

Data management is progressing on a number of fronts (e.g. processing, validation, quality control, modelling, visualization), however the development and implementation of best practices for data management vary a lot from country to country and organization. Also, whereas access to key environmental datasets (with metadata) is improving, harmonization is often lacking and gaps remain in historical data, model outputs and socio-economic data. On the other hand, the ability to extract information from historical, current and future source data is increasing significantly.

### Recommended Actions for GEO Plenary

- **DM1.** Establish a Task-Force to draft GEOSS Data Management Principles that would complement the GEOSS Data Sharing Principles and be accepted at the GEO-XI Plenary. Data Management Principles would cover the entire data life-cycle from planning, to acquisition, quality assurance, documentation, digitization, and archiving

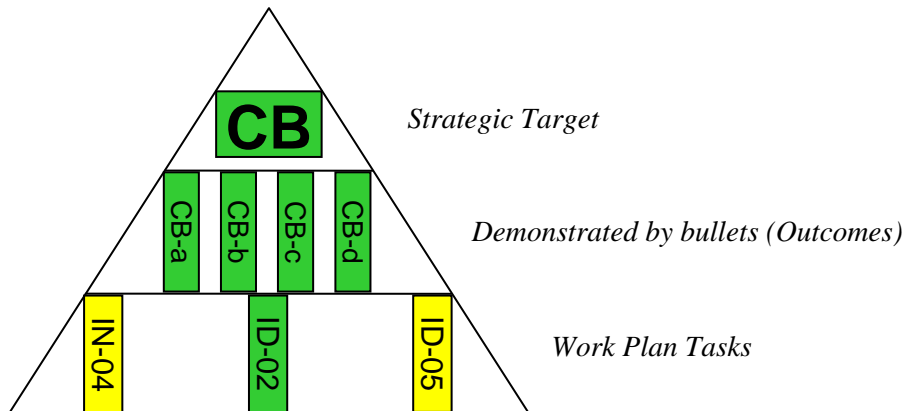
### Recommended Actions for GEO Members and Participation Organizations

- **DM2.** Increase the number of datasets contributed to the GEOSS Data CORE with priority given to those identified as critical to achieving Societal Benefit Area Targets, and with particular attention given to filling key gaps such as socio-economic data. Closer collaboration with the UN Global Geospatial Information Management (GGIM) initiative is needed
- **DM3.** Encourage data providers to better document the quality of the datasets made available through GEOSS, and to respond to requests from users to improve this quality
- **DM4.** Encourage data providers to provide access through the GEOSS Common Infrastructure to (i) historical datasets for longitudinal analysis, and (ii) outcomes of modelling and forecasting activities for future scenario analysis
- **DM5.** Ensure adequate representation on the Data Sharing Working Group from the Middle East, South America, and Asia-Pacific regions



## CAPACITY BUILDING

Enhance the coordination of efforts to strengthen individual, institutional and infrastructure capacities, particularly in developing countries, to produce and use Earth observations and derived information products.



### Rationale for Target Rating

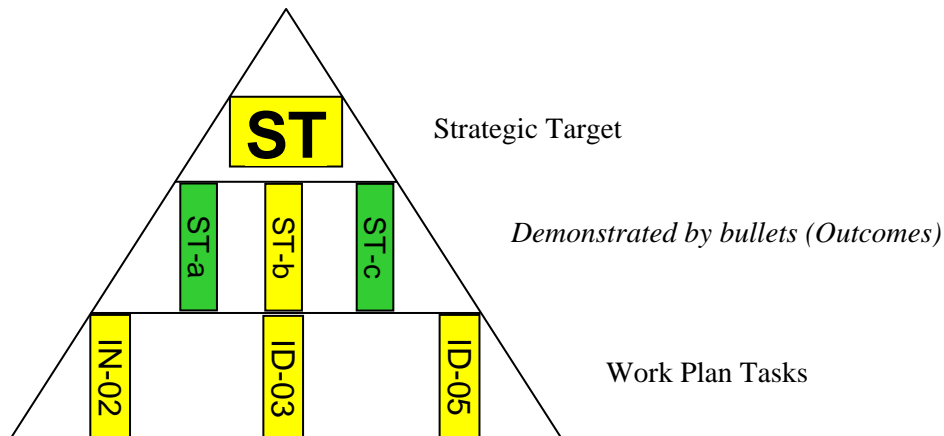
Resources are still needed. However, Tasks underpinning the Capacity Building Target are doing well. Capacity building activities have increased in number, especially for the use of the GEOSS Portal. Coordination and information exchange between GEO Tasks and Components have improved. A new generation of knowledge portals (e.g. EnerGEO) is offering theme-specific entry points for researchers, experts, and policy makers. Finally, the establishment of the AfriGEOSS initiative will provide a boost for capacity building in the countries that most need it.

### Recommended Actions for GEO Members and Participation Organizations

- **CB1.** Increase support for capacity building activities through resource allocation and outreach; ascertain resources from approved projects/programmes for GEO capacity building measures (e.g. workshops, summer schools) adhering to set standards
- **CB2.** Support capacity building initiatives such as ‘Bringing GEOSS services into practice’ to enable a better exploitation of GEOSS resources and provision of datasets and information
- **CB3.** Build on CEOS and European FP7 projects (e.g. EOPOWER, IASON) to facilitate the dissemination of capacity building information and opportunities through regional and general interfaces connected to the GEOSS Portal – to increase attractiveness of these interfaces
- **CB4.** Actively support capacity building efforts directed at the introduction of the GEOSS Discovery and Access Broker (DAB) approach – to increase the number of datasets available through GEOSS and facilitate access to research funding
- **CB5.** Align national and international (research) agendas with GEO Work Plan Tasks; Share information on (research) funding mechanisms and strategies, and support participation
- **CB6.** Complete or update the survey on capacity building activities. This survey helps raise awareness for capacity building activities within GEO, highlight regions which need more attention, and identify user needs

## SCIENCE AND TECHNOLOGY

Ensure full interaction and engagement of relevant science and technology communities such that GEOSS advances through integration of innovations in Earth observation science and technology, enabling the research community to fully benefit from GEOSS accomplishments.



### Rationale for Target Rating

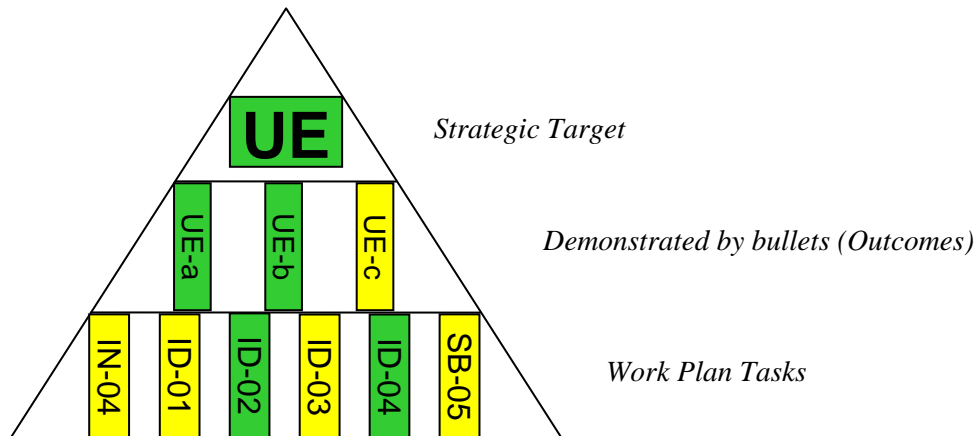
Most Tasks of the GEO Work Plan contribute to the Science and Technology Target. Taken together, related activities point to an increased use of GEOSS data by the research community. However, more support is needed for the adoption of a transverse approach to Science and Technology in GEOSS and the implementation of the GEO Roadmap.

### Recommended Actions for GEO Members and Participation Organizations

- **ST1.** Support the implementation of the GEO Science & Technology Roadmap and encourage new contributions to Work Plan activities from Asia and Africa
- **ST2.** Establish links with national and regional activities on Future Earth and the broader Sustainable Development Goal (SDG) agenda

## USER ENGAGEMENT

Ensure critical user information needs for decision making are recognized and met through Earth observations.



### Rationale for Target Rating

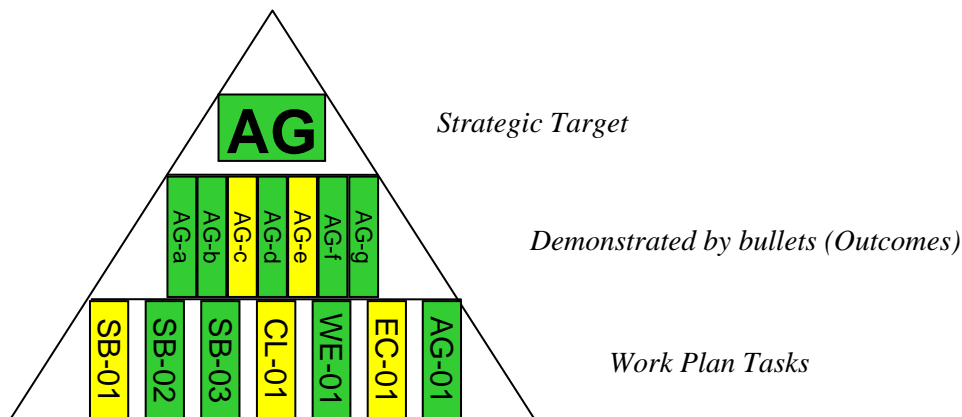
The overall Target changed from yellow to green, reflecting new contributions from three more Tasks (also rated as green) as well as additional work from the user engagement community. As more Tasks are becoming aware of their user bases, it becomes easier to achieve the User Engagement Target. More awareness leads to more engagement, and that positive cycle is now translating into progress.

### Recommended Actions for GEO Members and Participation Organizations

- **UE1.** Review Task contributions to strengthen ties to the Task’s specific user communities
- **UE2.** Support at least one User Engagement Session per year (linked to one or more Work Plan Tasks) and collocated with relevant conferences or symposia – to capture the work and needs of the users in the region. Results from those meetings should be included into the larger user engagement information
- **UE3.** Submit articles to the online journal Earthzine.org highlighting GEO contributions and related user communities

## AGRICULTURE

Improve the utilization of Earth observations and expanded application capabilities to advance sustainable agriculture, aquaculture, fisheries and forestry in areas including early warning, risk assessment, food security, market efficiency, and, as appropriate, combating desertification.



### Rationale for Target Rating

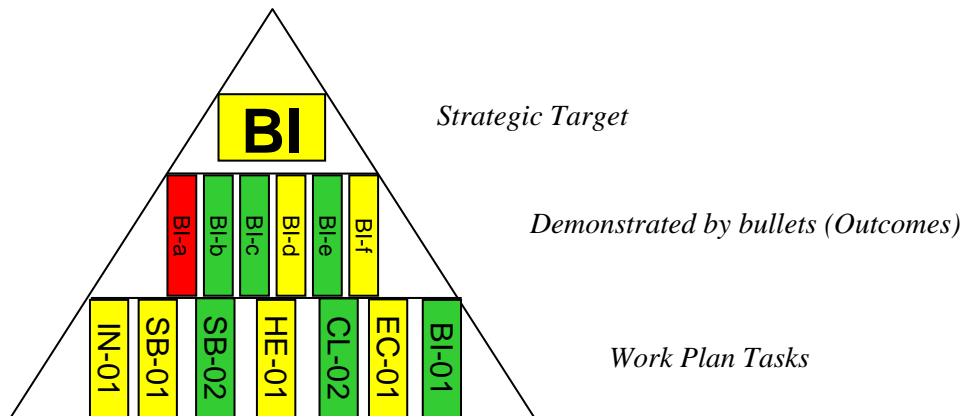
In 2013, GEOGLAM started delivering monthly global crop outlooks to AMIS (Agricultural Market Information System) using Earth observation and information as supporting evidence; GEOGLAM data requirements have been established and coordination with the Committee on Earth Observation Satellites is underway. The desertification issue should soon be addressed through new grassland/range-land activities (under development).

### Recommended Actions for GEO Members and Participating Organizations

- **AG1.** Support coordination of GEOGLAM activities by (i) appointing national contacts, and (ii) providing support for the establishment of a regional coordination office for food security within GEOGLAM
- **AG2.** Identify key agencies/institutions to (i) join a national/international network for agricultural resource management, food security and disaster mitigation, and (ii) host regional targeted workshops for GEOGLAM activities
- **AG3.** Provide commercial data as in-kind contribution to support availability of satellite data for food security related issues
- **AG4.** Conduct crop mask updates and coordinate in-country to ensure that these updates are shared and accessible through the GEOSS Common Infrastructure
- **AG5.** Support the maintenance of, and make datasets available through, the GEO Global Land Cover Information Portal; Communicate data requirements for Land Cover Land Use to the Land Cover Task Team (SB-02)
- **AG6.** For Members and Organizations advanced in Land Cover Land Use (LCLU) monitoring (e.g. Australia, Brazil, Germany, France, Russia, and CEOS): Provide technical and financial support for LCLU methodologies and the organisation of related capacity building activities (3 workshops per year mainly in developing countries)
- **AG7.** Contribute to the new GEO activities on Land Cover for Africa
- **AG8.** Propose contributions related to grassland/range-land management

## BIODIVERSITY

Establish, in conjunction with a comprehensive ecosystem monitoring capability, a worldwide biodiversity observation network to collect, manage, share and analyze observations of the status and trends of the world's biodiversity, and enable decision-making in support of the conservation and improved management of natural resources.



### Rationale for Target Rating

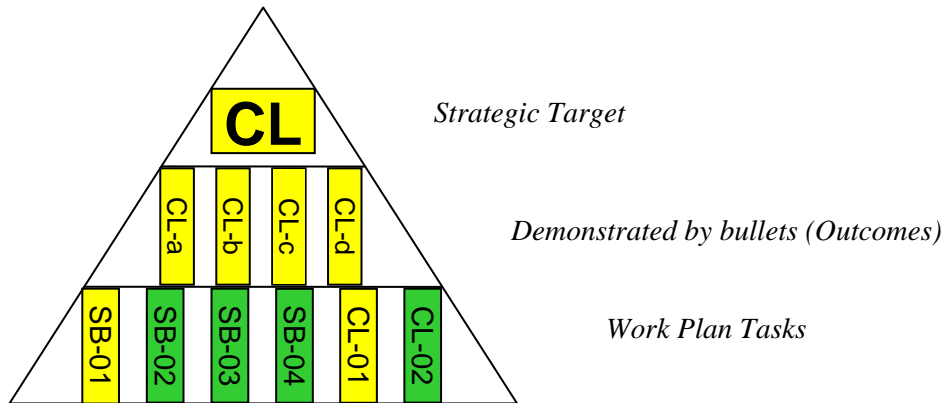
While there is significant progress on biodiversity activities (e.g. resulting in new/improved GEO BON information products), progress towards the overall Target is impaired by a lack of resources for capacity building and coordination. Also support is needed for the routine collection of long-term in-situ and remotely-sensed biodiversity observations (c.f. Essential Biodiversity Variable concept and tool box for biodiversity monitoring BON-in-a-box).

### Recommended Actions for GEO Members and Participating Organizations

- BI1. Support biodiversity monitoring and assessment through the development of information products in the following areas:
  - Terrestrial: Support sought from EC, Italy (Mountains); Australia, Norway, USA, and ITC (Tropics); and UNCCD (Drylands)
  - Marine: Support sought from EC, New Zealand, and USA
  - Wetlands: Support sought from China, Japan and African countries
  - Ecosystem services: Support sought from Australia and USA
  - Genetic: Support sought from Japan
- BI2. For CEOS and providers of biodiversity data: Support full and open access to data and information relevant to biodiversity, both remote sensing and in-situ
- BI3. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japan): Support the development of National and Regional Biodiversity Observation Networks (BONs)
- BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, South Africa, Switzerland and USA): Support the global coordination activities of the GEO BON office (2 experts, 2 Steering Committee meetings and 1 GEO BON meeting per year). South Africa hosted the office until 2013, Germany will take over from 2014.

## CLIMATE

Achieve effective and sustained operation of the global climate observing system and reliable delivery of climate information of a quality needed for predicting, mitigating and adapting to climate variability and change, including for better understanding of the global carbon cycle.



### Rationale for Target Rating

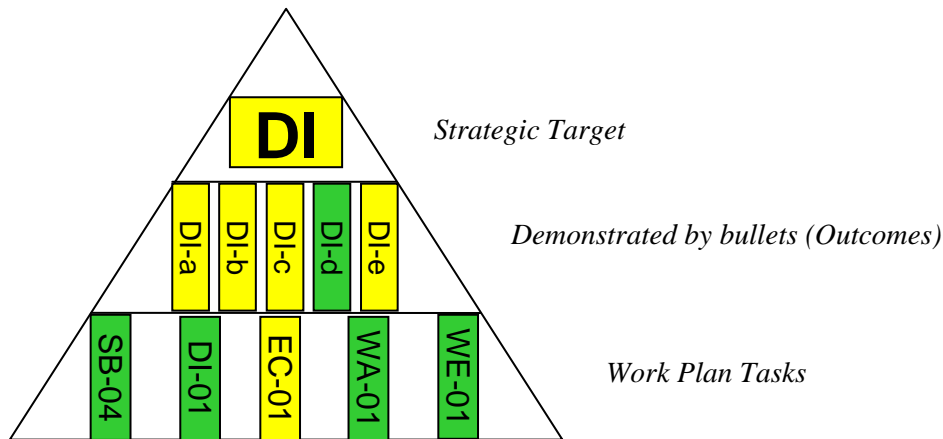
There is good progress on specifying requirements for observations, assessing the adequacy of observations and infrastructure, and planning/implementing improvements. However, important observational gaps remain and the continuity of many key observing systems is not secured. Also, although the quality and length of the climate record is increasing (e.g. through reanalysis), not all datasets meet good quality standards. Modelling and prediction are getting more robust on the seasonal scale, however more advances are needed, in particular to address adaptation needs at the local level.

### Recommended Actions for GEO Members and Participating Organizations

- **CL1.** Implement the recommended actions of the GCOS Implementation Plan (2010, GCOS-138)
- **CL2.** GCOS to revise Essential Climate Variable requirements to better address needs at the national and local levels
- **CL3.** Support the development of Climate and Earth System Models and associated downscaling techniques (e.g. Coordinated Regional Climate Downscaling Experiment, CORDEX), and of seamless weather-climate predictions from sub-seasonal to decadal time-scales
- **CL4.** Contribute national/international activities related to climate information production, use, and access – to ensure the delivery of adaptation information through the GEOSS Portal
- **CL5.** For Members and Organizations that own climate and carbon-related data: Align data policies with the GEOSS Data Sharing Principles; make the data accessible through the GEOSS Portal; and provide information on data records to the Essential Climate Variable inventory
- **CL6.** Support the development and maintenance of carbon monitoring networks and systems (e.g. for vegetation biomass and soil carbon) especially in less developed regions (e.g. Africa, South-East Asia)
- **CL7.** The European Commission is encouraged to continue supporting the GEO Carbon Office and its activities (e.g. dissemination of scientific results to appropriate national authorities)
- **CL8.** Contribute activities supporting the Research and Development Implementation Plan of the Global Forest Observation Initiative (GFOI). Support the delivery of forest carbon data to developing countries through the GFOI.

## DISASTERS

Enable the global coordination of observing and information systems to support all phases of the risk management cycle associated with hazards (mitigation and preparedness, early warning, response, and recovery).



### Rationale for Target Rating

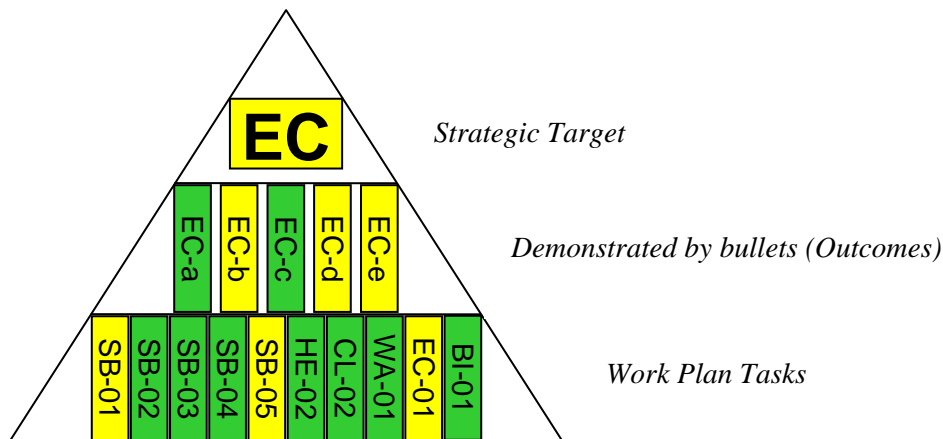
Despite increased evidence of utilization of Earth observations and information for disaster management, additional actions and intervention are required from the GEO community to (i) Improve the use of, and access to, Earth data for all phases of disaster risk management; and (ii) Develop a regional strategy in line with the Hyogo Framework for Action objectives.

### Recommended Actions for GEO Members and Participating Organizations

- **DI1.** For Members and Organizations that own data and products relevant to disaster risk mitigation (e.g. calibration/validation data): Expand national/international contributions to the Disasters Work Plan Task (DI-01)
- **DI2.** Contribute very-high-resolution and high-resolution satellite data (in the range of 0.5m-10m of spatial resolution) to the development of a Global Human Settlement Layer for Disasters Risk Assessment – to support crisis management operations
- **DI3.** Address the warning phase of predictable disasters such as floods caused by storms and hurricanes. Contribute to a new Task Component (under DI-01) proposed by CEOS to foster utilization of Earth observation remote sensing data for all phases of disaster risk management
- **DI4.** Support the expansion of the Geohazards Supersites and National Laboratories portal – for seamless access to three types of data: (i) Multi-sensor SAR data; (ii) Global Navigation Satellite System (GNSS) data; and (iii) Seismic data
- **DI5.** Maintain efforts in support of a universal access to the International Charter on Space and Major Disasters
- **DI6.** Support the implementation of the Hyogo Framework with concrete activities and projects involving local communities and users

## ECOSYSTEMS

Establish, in conjunction with a comprehensive biodiversity observation network, a wide-ranging monitoring capability for all ecosystems and the human impacts on them, to improve the assessment, protection and sustainable management of terrestrial, coastal and marine resources and the delivery of associated ecosystem services.



### Rationale for Target Rating

In 2013, activities of the Ecosystems Work Plan Task were re-invigorated thanks to the arrival of a new Task Coordinator and the contributions of new projects. Also, new initiatives were launched to better address the Ecosystems Target. More interactions across Work Plan Tasks are needed to further accelerate progress.

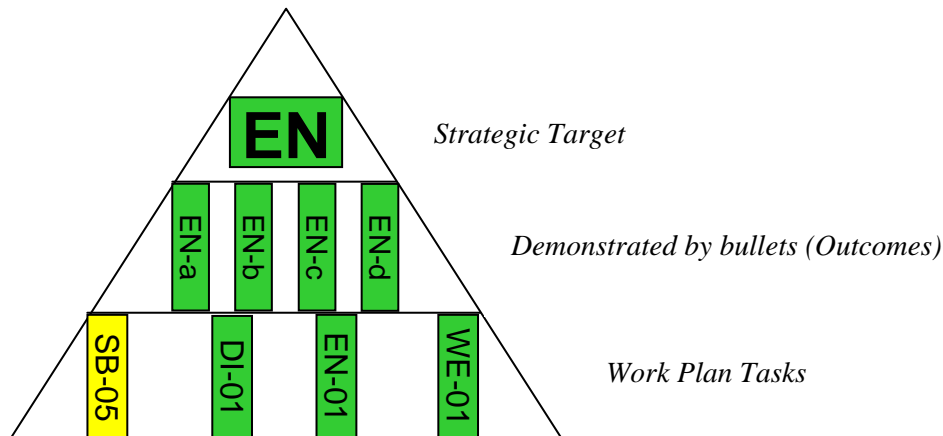
### Recommended Actions for GEO Members and Participating Organizations

- **EC1.** Support the Blue Planet initiative for the coordination of activities, organization of workshops, and development and maintenance of the website (specific funding for Blue Planet coordination ceased in March 2013)
- **EC2.** Provide technical and financial support for in-water observations in synergy with related satellite observations (e.g. through the ChloroGIN network)
- **EC3.** For Members with coastal zones (e.g. Southern Asia and Africa): Participate in coastal ecosystem management activities
- **EC4.** For Members with arid and semi-arid areas: Participate in the development of a global dryland observation network (in collaboration with UNCCD)
- **EC5.** For Members with wetlands: Support the development of a global wetlands observation system by contributing to pilot projects in Africa, Latin America and South-East Asia
- **EC6.** For Members with mountainous regions: Contribute to the development of the Global Network for Observation and information in Mountain Environments (GEO-GNOME) through pilot projects in the mountainous areas of the world
- **EC7.** Make available modelling and analysis tools that can be downloaded and used by the scientific community and stakeholders for assessing changes in ecosystem state, functions and services
- **EC8.** Contribute datasets to GEOSS DataCORE and support the development of an information website for the GEO Ecosystems Task



## ENERGY

Close critical gaps in energy-related Earth observations and increase their use in all energy sectors in support of energy operations, as well as energy policy planning and implementation, to enable affordable energy with minimized environmental impact while moving towards a low-carbon footprint.



### Rationale for Target Rating

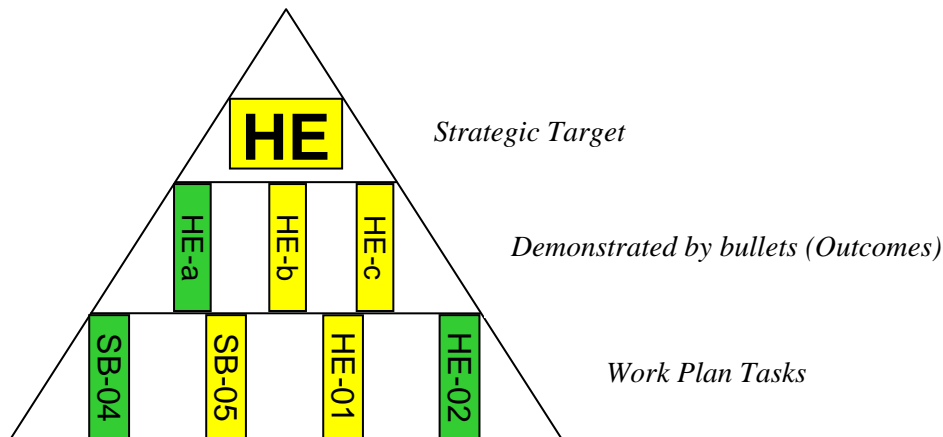
Earth observations and information are being increasingly used for the resource assessment, monitoring and forecasting of energy sources (including solar, wind, ocean, hydropower, and biomass) and geological resources (e.g. mineral, raw material). However, more applications and services are needed in the fields of ocean, hydro, nuclear, and fossil fuel energies.

### Recommended Actions for GEO Members and Participating Organizations

- **EN1.** Provide data and technical/financial support for the expansion of the Global Renewable Energy Atlas from solar and wind energy to marine, geothermal, hydropower, and bio-Energy
- **EN2.** For Members and Organizations active in renewable energy (e.g. China, Denmark, EC, Germany, South Africa, Spain, Japan, UK and USA):
  - Disseminate information about GEO energy tools and products
  - Support the development of new methodologies, tools and products for the mapping of renewable energy potential and impact assessment of energy exploitation
- **EN3.** For Members and Organizations with sustainable mining as a priority (e.g. Australia, Brazil, Canada, South Africa, and USA):
  - Participate in the working group on “mining and environment” to help evaluate and mitigate the long-term impact of extensive coal mining on local soil, vegetation, water, and biodiversity
  - Support the organization of three workshops per year (in the Americas, Europe-Africa and Asia-Pacific regions). The working group currently includes representatives from China, France, Greece, India, Turkey and the UK

## HEALTH

Substantially expand the availability, use, and application of environmental information for public health decision-making in areas of health that include allergens, toxins, infectious diseases, food-borne diseases, and chronic diseases, particularly with regard to the impact of climate and ecosystem changes.



### Rationale for Target Rating

Activities on Malaria, Dengue, Rift valley fever (using environmental information for decision-making) are underway and likely to be achieved by 2015. Activities on pollutants monitoring (e.g. mercury) are also advancing well. However several activities on water-borne diseases, including building and operationalizing a cholera early-warning system, are facing considerable funding gaps. Also there is little evidence that in-country capacity building is being done at sufficient level.

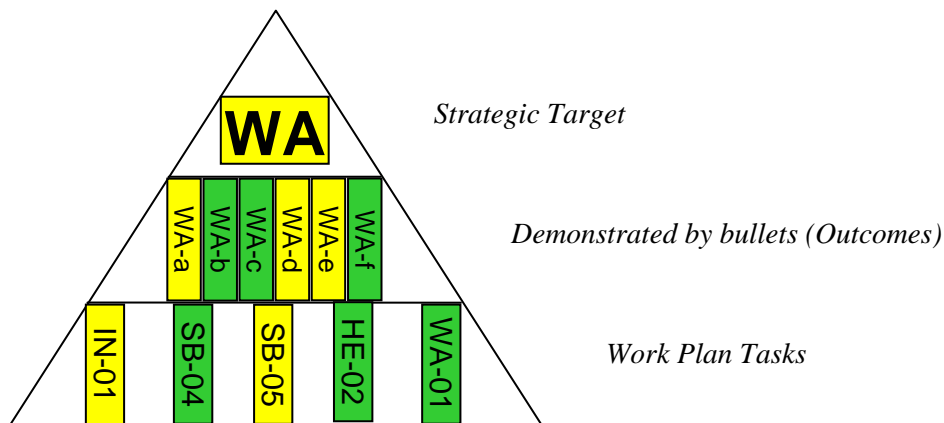
Additionally, lack of resources could restrict geographic areas of implementation and impair the development of national coordination mechanisms. Societal benefits typically depend upon the interest of local governments in adopting the tools developed.

### Recommended Actions for GEO Members and Participating Organizations

- **HE1.** Expand national and/or international participation in GEO health-related activities; Support the implementation of Tasks that are key to the achievement of the Target: Tools and Information for Health Decision-making (HE-01), Tracking Pollutants (HE-02), Global Urban Observation and Information (SB-04), and Impact Assessment of Human Activities (SB-05)
- **HE2.** Provide national health data related to atmospheric levels of Persistent Organic Pollutants and mercury, as well as human exposure data, in a standardised format; especially for developing countries. Support the establishment and expansion of related observing networks
- **HE3.** Support in-country capacity building for the sustainable use of Earth information in health decision-making

## WATER

Produce comprehensive sets of data and information products to support decision-making for efficient management of the world's water resources, based on coordinated, sustained observations of the water cycle on multiple scales.



### Rationale for Target Rating

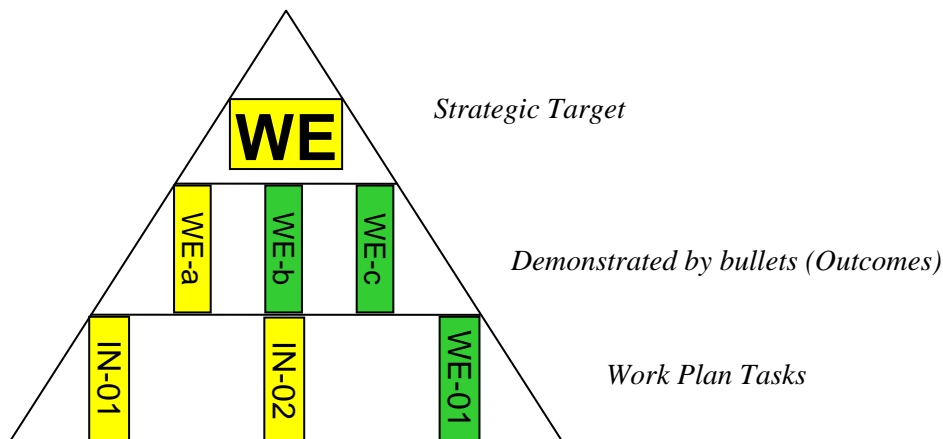
The 2012-2013 assessment of the Water Task (WA-01) focused on success areas while the 2013-2014 assessment focused on issues and areas needing development. As a result, the overall rating of the Target has turned from green to yellow as have several of the Target Outcomes. One area lacking progress is the strengthened observational networks for terrestrial hydrologic observations. Also more work is needed in the area of indicators, and for an overall enhancement of the effectiveness of the Water activities.

### Recommended Actions for GEO Members and Participating Organizations

- **WA1.** WMO in collaboration with Members and other Participating Organizations to launch a GEO initiative to strengthen the global observational network for precipitation and streamflow data, and improved dissemination of the basic data
- **WA2.** Develop a project to identify how to use water information (along with other Earth information) to produce indicators that will be useful for independently assessing how well Sustainable Development Goals are being met
- **WA3.** For Members and Organizations from Africa, Asia, and South America: Indicate national or regional contact points that will be able to provide soil moisture data to improve coverage over data-poor regions
- **WA4.** Strengthen the involvement of Members with Antarctica research stations in GEO Cold Regions. Support the development of a cold region information service and in particular:
  - Permafrost monitoring in cold areas (e.g. Canada, Russia, USA (Alaska), and Northern European countries)
  - Capacity building activities (e.g. by ICIMOD and WCRP)
- **WA5.** Review the needs and opportunities identified in the GEOSS Water Strategy and outline data and information service activities that could be contributed or funded (the GEOSS Water Strategy will be distributed at the GEO Summit)

## WEATHER

Close critical gaps in meteorological and related ocean observations, and enhance observational and information capabilities for the protection of life and property, especially with regard to high-impact events, and in the developing world.



### Rationale for Target Rating

The Weather Task (WE-01) is a key contributor to this Target. Its first Component (Global Multi-Model Prediction System for High-Impact Weather) advances sufficiently well while the second Component (Easy Access to, and Use of, High-impact Weather Information) does not due to a lack of resources (there is not sufficient time to change this by 2015). Activities under Infrastructure Tasks (IN-01 “Earth Observing Systems” and IN-02 “Earth Data Sets”) also directly contribute to the Weather Target and underpinning Outcomes.

### Recommended Actions for GEO Members and Participating Organizations

- WE1. Support the enhancement and maintenance of TIGGE (THORPEX Interactive Global Grand Ensemble), a user-friendly database of global ensemble weather forecasts, tools and products
- WE2. Identify resources for the post-2014 era (end of THORPEX programme and Europe-funded GEOWOW project)
- See also “Recommended Actions” under the Architecture Strategic Target

## Annex

Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
<b>Architecture</b>	AR-a Deployment, population, and enablement of sustained operations and maintenance of a user-friendly and user-accessible GEOSS Common Infrastructure (GCI), including the core Components and functions that link the various resources of GEOSS.	G	There has been a major effort since the last Plenary to increase the visibility and registration of EO resources that are provided to GEOSS, and in particular to the GEOSS Data CORE. Direct contact with the data providers and assistance in turning their pledges into accessible GEOSS Data CORE resources, has increased this pool of resources from 8,700 in 2012 to over 1.2 million in 2013. This remarkable success could not have been possible without direct one-to-one contact with the data providers. This effort was sustained by the European Commission but as more effort is now needed to improve data access, it is critical that the GEOSS Secretariat takes on this responsibility of working directly with the data providers, and that dedicated resources are provided to the Secretariat to do this essential work. With respect to the evolution of the GEOSS architecture, dedicated workshops held in 2013 have explored new opportunities for including models, sensors, and new partnerships. The Architecture Interoperability Pilots, now in their 6th edition, provide a flexible agile mechanisms for developing and testing new components that can be incorporated in the future in the operational GCI.	AR1. Support the providers of the GEOSS Common Infrastructure (ESA for the GEOSS Portal, Italy (CNR) for the Discovery and Access Broker, the USA (USGS/George Mason University) and IEEE for the Registries) to continue operations, accelerate improvements, and increase easy access to datasets – with priority to the GEOSS Data CORE – while encouraging providers to embed in the metadata direct links to the datasets or services
	AR-b Coordinated planning and sustained operation of national, regional and global observing and information systems within an interoperability framework.	Y	There is good progress for space-based observing systems, in particular the Climate Monitoring from Space initiative. For in-situ networks the situation is more challenging both in terms of coordination and sustainability. There is still considerable work to do to improve coordination of observing systems at national, regional, and global levels. Closer relationships with the in-situ data provider communities need to be developed in collaboration with the SBAs, and with new activities being proposed in the UN GGIM initiative.	AR2. Increase efforts to coordinate the provision, and improve the integration, of space-based and in-situ data at global, regional, and national levels; ensuring operations of underpinning observing systems so that gaps in availability and access are minimized. In particular, in-situ coordination should be encouraged building on the European Copernicus space/in-situ coordination efforts
	AR-c Continual improvement in observations and information available to users through the transition of research outcomes and systems into operational use, and through an optimal mix of space-based, airborne and in-situ observing platforms.	Y	More work needs to be done to achieve this Target, particularly in relation to in-situ observing platform and information resources. There is an increasingly dynamic landscape of initiatives that support the development of digital platforms and research cyber-infrastructures worldwide with similar aims as those of GEOSS. It should be a matter or priority for the GEO Members to ensure that interoperability arrangements are put in place to develop synergies across these investments. New sources of data are also becoming increasingly available from citizens and sensor networks. Attention should be given to the many research projects in this area identifying those that can be turned into sustainable long term operational systems.	AR3. Ensure that initiatives aimed at developing research data infrastructures (e.g. e-infrastructures in Europe and Australia, cyber-infrastructures in the USA, Digital China) are made interoperable and accessible from GEOSS  AR4. Seek opportunities to enhance GEOSS with new data sources (e.g. sensor networks and citizens-contributed information), working with the research community to deliver prototypes to be transitioned to operations post-2015
	AR-d Increased efficiency in the operation of observational systems through convergence among global, regional and national facilities.	G	For space-based observing systems, good progress is illustrated by the development of the CEOS Virtual Constellations, in particular recent achievements for Sea-Surface Temperature and Land Surface Imaging. In Europe some integration of national networks is developing in the framework of INSPIRE and Copernicus (GMES) but continued effort is needed to achieve this target.	AR3. Ensure that initiatives aimed at developing research data infrastructures (e.g. e-infrastructures in Europe and Australia, cyber-infrastructures in the USA, Digital China) are made interoperable and accessible from GEOSS
	AR-e Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products.	Y	Some gap analyses for space-based systems have been done for climate and weather observations. More work needs to be done to achieve this Target. In particular in order to influence future space missions, all requirements should expressed well in advance. This activity should be accompanied by an outreach exercise in order to be sure that potential data providers are fully ware about new or consolidated user requirements.	AR2. Increase efforts to coordinate the provision, and improve the integration, of space-based and in-situ data at global, regional, and national levels; ensuring operations of underpinning observing systems so that gaps in availability and access are minimized. In particular, in-situ coordination should be encouraged building on the European Copernicus space/in-situ coordination efforts

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<b>Data Management</b>	DM-a Increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion.	Y	The G8 Meeting in 2013 has made a strong statement in support of Open Data initiatives addressing both public sector information and research data and outcomes. Opening up data for reuse needs to be underpinned by data management plans that consider the full life-cycle of data from acquisition, to maintenance, updating, and long term preservation. There is therefore a strong need for GEO Members and Participating Organisation to share their data management best practices, and develop shared principles based on such practices.	DM1. Establish a Task-Force to draft GEOSS Data Management Principles that would complement the GEOSS Data Sharing Principles and be accepted at the GEO-XI Plenary. Data Management Principles would cover the entire data life-cycle from planning, to acquisition, quality assurance, documentation, digitization, and archiving
	DM-b Open, reliable, timely, consistent, and free access to a core set of essential environmental observations and information products, supported by adequate metadata, by users across all GEOSS Societal Benefit Areas in accordance with GEOSS Data Sharing Principles.	G	Increased effort was made this year in increasing the visibility and registration of EO resources that are provided in accordance with the GEOSS Data Sharing Principles. Direct contact with the data providers and assistance in turning their pledges into accessible GEOSS Data CORE resources, has increased this pool of resources from 8,700 in 2012 to over 1.2 million in 2013. Many of the Essential Climate Variables are now supported by accessible GEOSS Data CORE resources. More effort is now needed to support the essential variables of other communities, and fill the existing gaps, particularly in relation to socio-economic data.	DM2. Increase the number of datasets contributed to the GEOSS Data CORE with priority given to those identified as critical to achieving Societal Benefit Area Targets, and with particular attention given to filling key gaps such as socio-economic data. Closer collaboration with the UN Global Geospatial Information Management (GGIM) initiative is needed  DM5. Ensure adequate representation on the Data Sharing Working Group from the Middle East, South America, and Asia-Pacific regions
	DM-c Removal of important data management deficiencies.	Y	This "demonstrated by" is redundant given that DM-a above already covers activities needed to remove important data management deficiencies. On the other hand, there is no "demonstrated by" outcome to guide activities leading to the harmonisation of key global datasets. It would be appropriate to consider a revision of this bullet.	DM1. Establish a Task-Force to draft GEOSS Data Management Principles that would complement the GEOSS Data Sharing Principles and be accepted at the GEO-XI Plenary. Data Management Principles would cover the entire data life-cycle from planning, to acquisition, quality assurance, documentation, digitization, and archiving  DM3. Encourage data providers to better document the quality of the datasets made available through GEOSS, and to respond to requests from users to improve this quality
	DM-d Enhanced information extraction from historical, current and future source data.	Y	There has been considerable improvement in the availability of resources made accessible to users of the GCI, particularly in respect to the GEOSS Data CORE: More effort is now needed in making available historical data sets needed for longitudinal analysis as well as models and model outputs necessary for forecasting and future scenario assessment.	DM4. Encourage data providers to provide access through the GEOSS Common Infrastructure to (i) historical datasets for longitudinal analysis, and (ii) outcomes of modelling and forecasting activities for future scenario analysis

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Capacity Building	CB-a Networking activities that specifically build individual, institutional and infrastructure capacity.	G	More national capacity building activities need to be contributed to GEO	CB1. Increase support for capacity building activities through resource allocation and outreach; ascertain resources from approved projects/programmes for GEO capacity building measures (e.g. workshops, summer schools) adhering to set standards  CB5. Align national and international (research) agendas with GEO Work Plan Tasks; Share information on (research) funding mechanisms and strategies, and support participation
	CB-b Leveraging resources for Earth observation capacity building efforts.	G	National/international experience on resource mobilization should be shared	CB3. Building on CEOS and European FP7 projects (e.g. EOPOWER, IASON), facilitate the dissemination of capacity building information and opportunities through regional and general interfaces connected to the GEOSS Portal – to increase attractiveness of these interfaces  CB4. Actively support capacity building efforts directed at the introduction of the GEOSS Discovery and Access Broker (DAB) approach – to increase the number of datasets available through GEOSS and facilitate access to research funding
	CB-c Increased use of Earth observation in policy and decision making.	G	Ongoing	CB2. Support capacity building initiatives such as 'Bringing GEOSS services into practice' to enable a better exploitation of GEOSS resources and provision of datasets and information
	CB-d Enhanced participation of developing countries in GEO and GEOSS.	G	Connections with existing national/regional capacity development initiatives need to be established	CB6. Complete or update the survey on capacity building activities. This survey helps raise awareness for capacity building activities within GEO, highlight regions which need more attention, and identify user needs
Science & Technology	ST-aImproved and new instrumentation and observation system design for in-situ, airborne, and space-based observation, benefiting from advances in science and technology.	G	ST-a is being partially addressed through activities in IN-01 and IN-02	See AR3 and AR4 above under Architecture
	ST-b Increased accessibility of global sets of scientific data necessary for improved Earth System modelling in the different GEO Societal Benefit Areas.	Y	National/international contributions still needed on data management (including processing, inter-calibration and validation, quality assurance, harmonization, archiving, integration, assimilation, modelling, long-term preservation, digitization, and visualization)	ST1. Support the implementation of the GEO Science & Technology Roadmap and encourage new contributions to Work Plan activities from Asia and Africa  ST2. Establish links with national and regional activities on Future Earth and the broader Sustainable Development Goal (SDG) agenda
	ST-c Increased accessibility of data and improved coordination and maintenance of observational systems through GEOSS are realized by the research community.	G	ST-c was changed to green because of the indirect links within Tasks such as those producing the Virtual Constellations, the GEO BON, and other observing systems. The Board believes that the activities listed by other Tasks are likely to be completed either in their entirety, or in sufficient number to point to an increased use of Earth observations data through GEOSS by the research community	ST1. Support the implementation of the GEO Science & Technology Roadmap and encourage new contributions to Work Plan activities from Asia and Africa  ST2. Establish links with national and regional activities on Future Earth and the broader Sustainable Development Goal (SDG) agenda



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<b>User Engagement</b>	UE-a Establishment of an agreed core set of essential environmental, geophysical, geological, and socio-economic variables needed to provide data, metadata and products in support of all GEOSS Societal Benefit Areas.	G	UE-a has been partially met with the delivery of the Critical Earth Observations Priorities document released in 2010 ( <a href="http://sbageotask.larc.nasa.gov/US-09-01a_SummaryBrochure.pdf">http://sbageotask.larc.nasa.gov/US-09-01a_SummaryBrochure.pdf</a> ). UE-a is also being partially addressed through activities in IN-04 and SB-05	None at this stage
	UE-b Involvement of users in: reviewing and assessing requirements for Earth observation data, products and services; creating appropriate mechanisms for coordinating user requirements; utilizing data/information delivery systems; and capturing user feedback on an ongoing basis across Societal Benefit Areas.	G	UE-b was changed to green given the addition of the three ID tasks, and their user communities. Tasks ID-01, -02, and -03 were added in recognition of their extensive user focus on the data sharing, capacity building, and science and technology communities. These three communities represent large user groups in addition to the ones identified by the Infrastructure and Societal Benefit tasks.	UE2. Support at least one User Engagement Session per year (linked to one or more Work Plan Tasks) and collocated with relevant conferences or symposia, to capture the work and needs of the users in the region. Results from those meetings should be included into the larger User Engagement information
	UE-c Increased use of geo-spatial data in all Societal Benefit Areas and in particular in developing countries.	Y	Engagement of developing countries remains a challenge; see also Capacity Building	UE1. Review Task contributions to strengthen ties to the Task's specific user communities  UE3. Submit articles to the online journal Earthzine.org highlighting GEO contributions and related user communities

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	AG-a Increased use of Earth observing capabilities and supporting applications systems to produce timely, objective, reliable, and transparent agricultural and forest statistics and information at the national and regional level.	G	The task is on the right track and the accomplishment of the task results to the accomplishment of the target. Started delivering monthly global crops outlooks to the AMIS Market Monitor	AG1. Support coordination of GEOGLAM activities by (i) appointing national contacts, and (ii) providing financial and technical support for the establishment of a regional coordination office for food security within GEOGLAM
	AG-b Improved agricultural risk assessment and operational weather/climate forecast systems for early warning and food security.	G	The countries-at-risk team developed the gridded rainfall time-series. A team from University of California Santa Barbara working with FEWSNET (GEOGLAM partner) developed the Climate Hazard group InfraRed Precipitation with Station (CHIRPS). To learn more about it and access the data go to: <a href="http://chg.geog.ucsb.edu">http://chg.geog.ucsb.edu</a>	AG1. Support coordination of GEOGLAM activities by (i) appointing national contacts, and (ii) providing financial and technical support for the establishment of a regional coordination office for food security within GEOGLAM AG2. Identify key agencies/institutions to (i) join a national/international network for agricultural resource management, food security and disaster mitigation, and (ii) host regional targeted workshops related to GEOGLAM activities AG7. Contribute to the new GEO initiative on Land Cover for Africa to develop land use/land cover data for the African continent at a 30-meter resolution
	AG-c Effective early warning of famine leading to more timely mobilization of an international response in food aid.	Y	Underway, should be the ultimate outcome of GEOGLAM	AG1. Support coordination of GEOGLAM activities by (i) appointing national contacts, and (ii) providing financial and technical support for the establishment of a regional coordination office for food security within GEOGLAM AG2. Identify key agencies/institutions to (i) join a national/international network for agricultural resource management, food security and disaster mitigation, and (ii) host regional targeted workshops related to GEOGLAM activities AG7. Contribute to the new GEO initiative on Land Cover for Africa to develop land use/land cover data for the African continent at a 30-meter resolution
	AG-d Expanded monitoring of agricultural land use change, through periodic regional and global assessments.	G	Some countries such as Brazil, Australia and Argentina are continuously updating their agricultural crop masks. The SIGMA project, funded by the European commission, will also deliver up to date regional and global agricultural land use masks	AG3. Provide commercial data as in-kind contribution to support availability of satellite data for food security related issues AG4. Conduct crop mask updates and coordinate in-country to ensure that these updates are shared and discoverable through the GEOSS Common Infrastructure AG5. Support the maintenance of, and make datasets available through, the GEO Global Land Cover Information Portal; Communicate data requirements for Land Cover and Land Use to the Land Cover Task Team (SB-02) AG6. For Members and Organizations advanced in Land Cover Land Use (LCLU) monitoring (e.g. Australia, Brazil, Germany, France, Russia, and CEOS): Provide technical and financial support for LCLU methodologies and the organisation of related capacity building activities (3 workshops per year mainly in developing countries) AG7. Contribute to the new GEO initiative on Land Cover for Africa to develop land use/land cover data for the African continent at a 30-meter resolution
	AG-e Development of quantitative measurements of global and regional desertification.	Y	Some new initiatives to monitor grasslands and pasturelands have been designed. There might be opportunity to link to regional desertification mapping	AG8. Propose new contributions related to grassland/range-land management
	AG-f Increased capacity building through Targeted workshops and joint multi-institution research teams.	G	SIGMA brings new opportunities for targeted regional capacity development workshops	AG6. For Members and Organizations advanced in Land Cover Land Use (LCLU) monitoring (e.g. Australia, Brazil, Germany, France, Russia, and CEOS): Provide technical and financial support for LCLU methodologies and the organisation of related capacity building activities (3 workshops per year mainly in developing countries) AG7. Contribute to the new GEO initiative on Land Cover for Africa to develop land use/land cover data for the African continent at a 30-meter resolution

	AG-g Improved collaboration and coordination on the use and applications of Earth observations for fisheries, aquaculture, forestry and land cover mapping.	G	Underway in multiple Societal Benefit Areas (Agriculture, Ecosystems, Climate)	AG5. Support the maintenance of, and make datasets available through, the GEO Global Land Cover Information Portal; Communicate data requirements for Land Cover and Land Use to the Land Cover Task Team (SB-02) AG6. For Members and Organizations advanced in Land Cover Land Use (LCLU) monitoring (e.g. Australia, Brazil, Germany, France, Russia, and CEOS): Provide technical and financial support for LCLU methodologies and the organisation of related capacity building activities (3 workshops per year mainly in developing countries) AG7. Contribute to the new GEO initiative on Land Cover for Africa to develop land use/land cover data for the African continent at a 30-meter resolution  See also Actions EC1, EC2, EC3, and EC5 under Ecosystems and CL8 under Climate
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Biodiversity	BI-a-Increased routine collection of long term in-situ and remotely sensed biodiversity observations.	R	This outcome calls for 'Increased routine collection of long term in-situ and remotely sensed biodiversity observations'. For in-situ monitoring in particular, this is unlikely to be achieved without funding for capacity building and facilitation activities. Establishment of National/Regional BONs by members and sharing data through GEOSS will help reach this outcome. There has been no significant progress toward this outcome. Robust remote-sensing based methods for in-situ and locally-observed biodiversity information still belongs largely to the research field.	BI3. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japon): Support the development of National and Regional Biodiversity Observation Networks (BONs) BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014.
	BI-b Access through GEOSS to a large panel of biodiversity observations, including satellite, aerial and in-situ.	G	There has been increase in biodiversity information available through GEOSS as contributed by various GEO POs and GEO BON partners. There has been work in terms of data integration and interoperability, as well as development of a number of products facilitating an increase in data availability. Discussion between the RS and biodiversity communities are ongoing, involving various groups and more work is required and expected in the coming years.	BI2. For CEOS and providers of biodiversity data: Support the provision of free and open access to data and information, both remote sensing and in situ BI3. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japon): Support the development of National and Regional Biodiversity Observation Networks (BONs) BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014.
	BI-c Increased information sharing on biodiversity conservation and sustainable use of biodiversity resources.	G	A number of products developed and being developed by GEO BON and its partners aim at increasing information on the state of biodiversity. There has been an increase in availability of this kind of information through GEOSS as contributed by GEO BON partners and GEO POs.	BI1. Support monitoring and assessment of global biodiversity through the development of information products (...) BI2. For CEOS and providers of biodiversity data: Support the provision of free and open access to data and information, both remote sensing and in situ BI3. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japon): Support the development of National and Regional Biodiversity Observation Networks (BONs) BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014.

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Biodiversity	<p>BI-d Implementation of a mechanism that enables users to interact with the development of biodiversity observations systems and request services.</p>	Y	<p>While this has been done for freshwater, marine and terrestrial realms are lagging. Some activities have been put in place to try rectify this (e.g. EBVs, BON-in-a-Box), but their success by 2015 is uncertain. Funding is required for development of these two initiatives, together with user engagement and needs analysis. Other mechanisms do exist and GEO BON (BI-01) is engaging with the UN CBD (Convention on Biological Diversity) and Ramsar in addressing user needs, though this is not a formal mechanism.</p>	<p>BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014</p>
	<p>BI-e Increased availability of biodiversity information necessary to respond to and support related topics (ecosystems, health, climate, etc.).</p>	G	<p>See BI-b above.</p>	<p>BI1. Support monitoring and assessment of global biodiversity through the development of information products (...) BI2. For CEOS and providers of biodiversity data: Support the provision of free and open access to data and information, both remote sensing and in situ BI4. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japan): Support the development of National and Regional Biodiversity Observation Networks (BONs) BI5. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014</p>
	<p>BI-f Increased information to reduce the cost and support the management of biodiversity issues.</p>	Y	<p>To what extent this outcome is met by default if outcome BI-c ('increased information sharing on biodiversity conservation and sustainable use of biodiversity resources'), which is on track, is met, is uncertain (perhaps this should be green?). It is difficult to know to what extent information is taken up and used by those making decisions on the use of biodiversity resources. The bottom line however is that the information is increasing.</p>	<p>BI2. For CEOS and providers of biodiversity data: Support the provision of free and open access to data and information, both remote sensing and in situ BI3. For Members with a focus on areas of high biodiversity e.g. in Africa (Nigeria, South Africa, Tanzania), Americas (Argentina, Brazil, Mexico), and Asia (China, India, Japan): Support the development of National and Regional Biodiversity Observation Networks (BONs) BI4. For Members with biodiversity protection as a high national priority (e.g. EC, Germany, Switzerland and USA): Support global coordination activities (GEO BON office) (2 experts, 2 Steering Committee meetings, 1 GEO BON all-hands meeting per year). South Africa will support the office until 2014.</p>

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<b>Climate</b>	CL-a Improved scientific understanding, modelling and prediction of climate.	Y	There are many ongoing and growing activities resulting in improvement of models and more robust predictions. Better links between the climate observation community and the climate modelling community have accelerated the progress. However, in order to be able to better address needs of users at national and local levels further reduction of uncertainties and higher spatial resolution information is needed.	CL3. In order to achieve this Outcome there is a need to continue and strengthen efforts to improve Climate and Earth System Models and associated downscaling techniques (e.g. CORDEX), and to enable seamless predictions from sub-seasonal to decadal scales. It is recommended to further develop infrastructures such as the Earth System Grid Federation which will be instrumental in facilitating model development, evaluation and comparison with satellite and in-situ data sets.
	CL-b Accessibility of all the observational data needed for climate monitoring and services in support of adaptation to climate variability and change.	Y	A number of relevant datasets are available, however, they are often difficult to access for reasons of national data policies or lack of adequate retrieval mechanisms. There is a growing need for information at finer spatial and temporal scales to address adaptation to climate variability and change. There are a number of activities addressing climate services, but many are not connected to GEOSS.	CL2. Requirements for Essential Climate Variables need to be revised in order to better address needs at national and local scales. CL4. Ongoing national and international activities related to the production, access and use of climate information should be connected to the Climate Task (CL-01) by contributing them to the GEO Work Plan and/or providing contact information. CL5. Data policies should allow free, full and open access to national climate-relevant data, and data owners need to ensure effective and easy access to the data and link to the GEOSS Common Infrastructure. Owners of ECV climate data records should help populating the joint CGMS/CEOS/WMO ECV inventory in order to improve access to these records and facilitate the establishment of a physical architecture for climate monitoring from Space.
	CL-c Development and facilitation of a comprehensive (atmosphere, ocean, land) global carbon observation and analysis system in support of monitoring based decision-making and related environmental treaty obligations.	Y	The development of a global carbon observation and analysis system is underway. Before 2015 we should be able to have i) identified the key elements and players to be involved, ii) coordinated the most important observing systems, and iii) defined the requirements for building such a system. The first reliable policy relevant information will also be released. A single global monitoring system could be operational around 2015, if there would be the needed political, infrastructural and financial support by governments. A key issue is the lack of continuity and sustainability of many of the past and current monitoring networks. A key gap is the lack of coverage especially in less developed regions, like Africa. The Global Forest Observation Initiative (GFOI) has identified and prioritised research and development needs for all countries to implement national forest monitoring systems, but resources to address these needs are lacking. While support is available for developing countries to develop the systems they need to deliver operational national forest monitoring systems providing estimates of forest carbon stocks and greenhouse gas emissions, most developing countries do not have a sustainable mechanism in place for obtaining satellite data from international providers and additional resources and technical expertise is required to develop appropriate systems.	CL5. Not all publicly available Earth observation data are freely accessible to date  CL6. Support the development and maintenance of carbon monitoring networks and systems (e.g. for vegetation biomass and soil carbon) especially in less developed regions (e.g. Africa, South-East Asia)  CL7. The European Commission is encouraged to continue supporting the GEO Carbon Office and its activities (e.g. dissemination of scientific results to appropriate national authorities)  CL8. Contribute activities supporting the Research and Development Implementation Plan of the Global Forest Observation Initiative (GFOI). Support the delivery of forest carbon data to developing countries through the GFOI  A wide internationally-coordinated Global Land Cover mapping framework (including Earth observation data supply, processing chain and associated standardized or harmonized rules) still needs to be defined. Coordination between BI-01 and CL-02 is needed.
	CL-d Availability of all Essential Climate Variables needed by the WCRP, the IPCC and the UNFCCC.	Y	Essential Climate Variable (ECV) requirements for space-based Climate Data Records (CDR) are well specified, but further development is needed for in-situ CDRs. CDRs are being produced for all ECVs, although not satisfying GCOS criteria for all of them, and strengthened coordination and contributions are needed.	CL1. There is a need to ensure sustained and improved observations with better geographical coverage; implementing the recommended actions of the GCOS Implementation Plan (August 2010, GCOS-138) is of high priority to close observational gaps and secure the continuity of key measurements. CL2. Requirements for Essential Climate Variables need to be revised in order to better address mitigation and adaptation needs at national and local scales. Requirements for in-situ based climate data records need to be better specified. CL4. Strengthened coordination and efforts to produce Thematic Climate Data Records are needed for most ECVs. CL5. Owners of ECV climate data records should help populating the joint CGMS/CEOS/WMO ECV inventory in order to improve access to these records and facilitate the establishment of a physical architecture for climate monitoring from Space.

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Disasters	DI-a Improved use of observations and related information to inform policies, decisions and actions associated with disaster preparedness and mitigation.	Y	Despite increased evidence of utilization of EO data for disaster preparedness and mitigation additional actions/intervention are required by the GEO community to make the use of observations more systematic over all area of the World and for all tyoe of disasters.	DI1. For Members and Organizations that own data and products relevant to disaster risk mitigation (e.g. calibration/validation data): Contribute to Task DI-01
	DI-b More effective access to observations and related information to facilitate warning, response and recovery to disasters.	Y	Observations and related informations are more accessible during the response phase of major disasters. However actions/intervention are required to make the access to observations more effective during the warning and recovery phase.	DI3. Address the warning phase of predictable disasters such as floods caused by storms and hurricanes. Contribute to a new Task Component proposed by CEOS to foster utilization of Earth observation remote sensing data for all phases of Disaster Risk Management  DI4. Support the revision of the GEO Geohazards Supersites and National Laboratories portal – for seamless access to three types of data: (1) Multi-sensor SAR data; (2) Global Navigation Satellite System (GNSS) data; (3) Seismic data.
	DI-c Increased communication and coordination between national, regional and global communities in support of disaster risk reduction, including clarification of roles and responsibilities and improved resources management.	Y	A regional strategy is still needed to engage participation at community level and to improve communication and and coordination between national, regional and global communities.	DI2. Contribute Very High Resolution sand High Resolution satellite data (in the range of 0.5m-10m of spatial resolution) to the development of a Global Human Settlement Layer for Disasters Risk Assessment and to support crisis management operations.
	DI-d Improved national response to natural and man-made disasters through delivery of space-based data, resulting from strengthened International Charter on "Space and Major Disasters."	G	Much progress has been done to extend the access of the Charter to all GEO member countries, Effort to train local disaster project manager to improve the interface with the Charter must continue.	DI5. Maintain efforts in support of a universal acces to the International Charter Space Major Disasters.
	DI-e Support to the successful implementation of the Hyogo Framework for Action 2005-2015.	Y	A better link with the stakeholder of the Hyogo framework is required to help building the resilience of nations and communities to disasters.	DI6. Support the implementation of the Hyogo Framework with concrete activities and projects involving local Communities and end users

Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
Ecosystems	EC-a Implementation of a global standardised ecosystem classification system and map as a basis for worldwide inventory, assessment and monitoring.	G	Done for conterminous United States, for South America and for Africa. Ongoing for other regions	EC7. Make available modelling and analysis tools that can be downloaded and used by the scientific community and stakeholders for assessing changes in ecosystem state, functions and services EC8. Contribute datasets to GEOSS DataCORE and support the development of an information website for the GEO Ecosystems Task
	EC-b Implementation of a global, standardized inventory of major ecosystems and the protected areas within them.	Y	Progressing but not yet completed.	EC2. Provide technical and financial support for in-water observations in synergy with related satellite observations (e.g. through the ChloroGIN network) EC3. For Members with coastal zones (e.g. Southern Asia and Africa): Participate in coastal ecosystem management activities EC4. For Members with arid and semi-arid areas: Participate in the development of a Global Dryland Observation Network (in collaboration with UNCCD) EC5. For Members with wetlands: Support the development of a Global Wetlands Observation System by contributing to pilot projects in Africa, Latin America and South-East Asia EC6. For Members with mountainous regions: Contribute to the development of the Global Network for Observation and information in Mountain Environments (GEO-GNOME) through pilot projects in mountain areas of the world
	EC-c Increased operational monitoring of major ecosystems on land on an annual basis, including properties such as land cover type; species composition; vegetation structure, height and age; net ecosystem productivity; and biomass and carbon estimates of vegetation and soils based on remote sensing and sampled in-situ observations using internationally agreed standards.	G	Started activity on mountain ecosystems, transitional coastal waters, Arctic ecosystems, drylands, forests. Started the implementation of models and projections.	EC4. For Members with arid and semi-arid areas: Participate in the development of a Global Dryland Observation Network (in collaboration with UNCCD) EC6. For Members with mountainous regions: Contribute to the development of the Global Network for Observation and information in Mountain Environments (GEO-GNOME) through pilot projects in mountain areas of the world EC8. Contribute datasets to GEOSS DataCORE and support the development of an information website for the GEO Ecosystems Task See also CL8 under Climate
	EC-d Increased operational monitoring of major marine and coastal ecosystems on an annual basis including properties such as extent, water temperature, salinity, pH and pCO <sub>2</sub> , phytoplankton species composition and productivity and marine resource stocks, based on remote sensing and sampled in-situ observations using internationally agreed standards.	Y	Collaboration with Blue Planet has been modest. Most participants in EC-01 work on terrestrial ecosystems.	EC1. Support the Blue Planet initiative for the coordination of research activities, organization of workshops, and development and maintenance of the website (specific funding for Blue Planet coordination ceased in March 2013) EC2. Provide technical and financial support for in-water observations in synergy with related satellite observations (e.g. through the ChloroGIN network) EC3. For Members with coastal zones (e.g. Southern Asia and Africa): Participate in coastal ecosystem management activities EC5. For Members with wetlands: Support the development of a Global Wetlands Observation System by contributing to pilot projects in Africa, Latin America and South-East Asia
	EC-e Increased knowledge of environmental flow requirements of river baseflow and peak flow, as well as human requirements for irrigation and power plant cooling water and domestic usage.	Y	Collaboration with the Water Task has been modest. Few participants in EC-01 work on rivers.	EC2. Provide technical and financial support for in-water observations in synergy with related satellite observations (e.g. through the ChloroGIN network) EC3. For Members with coastal zones (e.g. Southern Asia and Africa): Participate in coastal ecosystem management activities EC5. For Members with wetlands: Support the development of a Global Wetlands Observation System by contributing to pilot projects in Africa, Latin America and South-East Asia EC6. For Members with mountainous regions: Contribute to the development of the Global Network for Observation and information in Mountain Environments (GEO-GNOME) through pilot projects in mountain areas of the world

Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
<b>Energy</b>	EN-a Significant increase in use of Earth observations by all sectors for improved: o Environmental, economic and societal impact assessments of energy exploration, extraction, conversion, transportation and consumption.	G	The launch of the Global Atlas for solar and wind energy (beginning of 2013) has greatly improved the use of the data sets available through this atlas. The set of activities from International Renewable Energy Agency (IRENA) are all working contributing to this. Mineral resources are also explored.	EN1. Provide data and technical/financial support for the expansion of the Global Renewable Energy Atlas from Solar and Wind Energy to Marine, Geothermal, Bioenergy and Hydropower EN2. For Members and Organizations active in renewable energy (e.g. China, Denmark, EC, Germany, South Africa, Spain, Japan, UK and USA): o Disseminate information about GEO energy tools and products o Support the development of new methodologies, tools and products for the mapping of renewable energy potential and impact assessment of energy exploitation EN3. For Members and Organizations with sustainable mining as a priority (e.g. Australia, Brazil, Canada, South Africa, and USA): o Participate in the working group on "mining and environment" to help evaluate and mitigate the long-term impact of extensive coal mining on local soil, vegetation, water, and biodiversity o Support the organization of three workshops per year (in Americas, Europe-Africa and Asia-Pacific regions). The working group currently includes representatives from China, France, Greece, India, Turkey and the UK
	EN-b Significant increase in use of Earth observations by all sectors for improved: o Prediction of potential hazards to the energy infrastructure.	G	Transmission and Distribution Operator (TSO and DSO) are already using weather predictions for surveying the potential hazards' impacts	EN2. For Members and Organizations active in renewable energy (e.g. China, Denmark, EC, Germany, South Africa, Spain, Japan, UK and USA): o Disseminate information about GEO energy tools and products o Support the development of new methodologies, tools and products for the mapping of renewable energy potential and impact assessment of energy exploitation EN3. For Members and Organizations with sustainable mining as a priority (e.g. Australia, Brazil, Canada, South Africa, and USA): o Participate in the working group on "mining and environment" to help evaluate and mitigate the long-term impact of extensive coal mining on local soil, vegetation, water, and biodiversity o Support the organization of three workshops per year (in Americas, Europe-Africa and Asia-Pacific regions). The working group currently includes representatives from China, France, Greece, India, Turkey and the UK
	EN-c Significant increase in use of Earth observations by all sectors for improved: o Prediction of the production of intermittent sources of energy.	G	Cost-WIRE (COST-Weather Intelligence for Renewable Energies) project is working to improve the existing prediction of intermittent sources of energy. TSO and DSO have also their own tools for that.	EN2. For Members and Organizations active in renewable energy (e.g. China, Denmark, EC, Germany, South Africa, Spain, Japan, UK and USA): o Disseminate information about GEO energy tools and products o Support the development of new methodologies, tools and products for the mapping of renewable energy potential and impact assessment of energy exploitation EN3. For Members and Organizations with sustainable mining as a priority (e.g. Australia, Brazil, Canada, South Africa, and USA): o Participate in the working group on "mining and environment" to help evaluate and mitigate the long-term impact of extensive coal mining on local soil, vegetation, water, and biodiversity o Support the organization of three workshops per year (in Americas, Europe-Africa and Asia-Pacific regions). The working group currently includes representatives from China, France, Greece, India, Turkey and the UK
	EN-d Significant increase in use of Earth observations by all sectors for improved: o Mapping of renewable energy potential.	G	The launch of the Global Atlas for solar and wind energy (beginning of 2013) has greatly improved the use of the data sets available through this atlas. The set of activities from IRENA are all working contributing to this. WA is in the process of providing a map to EN on Hydropower capacity	EN1. Provide data and technical/financial support for the expansion of the Global Renewable Energy Atlas from Solar and Wind Energy to Marine, Geothermal, Bioenergy and Hydropower;



Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
<b>Health</b>	<p>HE-a Access to improved environmental information and tools to support the global community of human health and environment experts.</p>	G	<p>The SDI for the Global Mercury Observation System was implemented and a test-bed was done against the OGC Web Testing Facility, which fully passed. Data have been archived and metadata associated. The SDI was not yet registered in GEOSS. The first phase of the Global Monitoring Plan for POPs was successfully implemented and transferred into the GMP information system (www.pops-gmp-org). The GMP information is now registered in GEOSS.</p>	<p>HE1. Expand national and/or international participation in GEO health-related activities HE2. Provide national health data related to atmospheric levels of Persistent Organic Pollutants and mercury, as well as human exposure data, in a standardised format; especially for developing countries. Support the establishment and expansion of related observing networks HE3. Support in-country capacity building for the sustainable use of Earth information in health decision-making</p> <p>Complete metadata, archive new data including those on human organs, tissues and cells coming from international participants/projects. Register the resource in GEOSS. A full access to data should be enabled in the next step.</p>
	<p>HE-b Increased use of environmental information and tools to support decision making in epidemics and/or disease management and planning for well-being. The effectiveness of these tools is demonstrated in at least 3 specific areas on different continents.</p>	Y	<p>Most of the planned targets have been delivered and therefore likely to be achieved. Early decision making for malaria, dengue and Rift Valley Fever in India, France, Senegal and Dakar using climate and satellite data. The use of information is related to the adoption of the Governance and Data Policy document. The Data Policy document is under its final review. Tools to view and download data are provided to end-users. No demonstration has been launched. For the purpose of the second phase of the GMP of POPs, electronic data collection software was developed and given to the parties of the Stockholm Convention in order to standardize the data formats. It will be used in all UN regions. Strategic target in health and environment has limited funding restricting it to limited geographic area and health issues.</p>	<p>HE1. Expand national and/or international participation in GEO health-related activities HE3. Support in-country capacity building for the sustainable use of Earth information in health decision-making</p> <p>Several activities under water borne diseases including building and operationalizing cholera early warning system need funding support. Demonstrate the effectiveness of implemented tools in at least 3 specific areas on different continents. Promote application of the GMP data collection tool for collection of POPs data for the purpose of the second phase of GMP in 2014 in all UN regions.</p>
	<p>HE-c Applying Outcomes from other Societal Benefit Areas to improve health and well-being.</p>	Y	<p>The task to map climate-related vulnerability of water and sanitation access and diarrheal disease is completed and was a core contribution to the WHO/WMO Global Atlas on Climate and Health. The Global Leptospirosis Environmental Action Network is operational and on track. International summer schools are being organized to support a capacity building for the GMP for POPs. Strategic target in health and environment has limited funding restricting it to limited geographic area and health issues.</p>	<p>HE1. Expand national and/or international participation in GEO health-related activities HE3. Support in-country capacity building for the sustainable use of Earth information in health decision-making</p> <p>Develop project databases of existing global air monitoring and human exposure monitoring programmes and link them to the GMP tool. Link human exposure data available in the GMP database to the WHO food and agriculture databases. Support the implementation of the task's activities in wider geographic area.</p>

Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
<b>Water</b>	WA-a An operationalized and sustained global network of in-situ observation sites.	Y	The global networks for most water-cycle variables have had a net reduction rather than a net growth in the past 5 years. The progress of the related IN-01 activities is considered satisfactory and progress has been made to the achievement of this Outcome. The in-situ soil moisture data archive continues to expand and experience is being gained in using these data for calibration of the SMOS data sets. Developing consistent in-situ data sets is very labour intensive and the availability of resources has been controlling the rate of progress.	WA1. WMO in collaboration with Members and other Participating Organizations launch a GEO initiative to strengthen the global observational network for precipitation and streamflow data, and improved dissemination of the basic data WA3. For Members and Organizations from Africa, Asia, and South America: Indicate national or regional contact points that will be able to provide soil moisture data to improve coverage over data poor regions. In-situ soil moisture data is missing from these regions
	WA-b Increased availability of information products and services for monitoring changes in the water cycle, including clouds and precipitation, appropriate for both research and integrated water resource management.	G	Drought activities at individual institutions have progressed well but coordination of these efforts has been constrained by a lack of funding  Advances in measuring water level from space have not progressed very rapidly because of uncertainty in the development and approval for the SWOT mission.	WA2. Develop a project to identify how to use water information along with other Earth information to produce indicators that will be useful for independently assessing how well Sustainable Development Goals are being met WA5. Review the needs and opportunities identified in the GEOSS Water Strategy and outline data and information service activities that could be contributed or funded
	WA-c Increased availability of data and information, including quantity and quality of both surface and groundwater, to support a water cycle decision making system.	G	The riverine activity is missing from the 2012-2015 Work Plan because the project was not funded. The WA and HE COPs have had initial discussions on the steps needed to launch WA-HE collaborations. Uncertainties surrounding the future of the GEMS water data set have led to the curtailing of some of the research plans in this area. The integration of groundwater data and surface and sub-surface water with the GRACE satellite data or other space based observations has not been undertaken on a regional or global basis. There is no common reporting platform for Persistent Organic Pollutants on surface waters. The Global Monitoring Plan database and visualization portal can be used for these purposes.	WA1. WMO in collaboration with Members and other Participating Organizations launch a GEO initiative to strengthen the global observational network for precipitation and streamflow data, and improved dissemination of the basic data WA3. For Members and Organizations from Africa, Asia, and South America: Indicate national or regional contact points that will be able to provide soil moisture data to improve coverage over data poor regions. In-situ soil moisture data is missing from these regions WA4. Strengthen the involvement of Members with Antarctica research stations in GEO Cold Regions. Support the development of a cold region information service and in particular: o Permafrost monitoring in cold areas (e.g. Canada, Russia, USA (Alaska), and Northern European countries) o Capacity building activities (e.g. by ICIMOD and WCRP) WA5. Review the needs and opportunities identified in the GEOSS Water Strategy and outline data and information service activities that could be contributed or funded (the GEOSS Water Strategy will be distributed at the GEO Summit)
	WA-d Routine, reliable production of "watershed" and human health indicators from satellite data, surface and subsurface data, and data assimilation capabilities.	Y	The Riverine activity in the work plan Note should be taken of the Watershed Health Index initiative being driven by Conservation International.	WA2. Develop a project to identify how to use water information along with other Earth information to produce indicators that will be useful for independently assessing how well Sustainable Development Goals are being met
	WA-e Development of integrated data products	Y	Integrated data products are not being vigorously pursued in the areas of surface and sub-surface flow. Advances in measuring water level from space have not progressed very rapidly because of delays in the development and approval for the SWOT mission. Although ET information is used extensively in irrigation planning and monitoring and in climate monitoring it has not been accepted as an ECV and hence receives less attention than other variables that are ECVs.	WA2. Develop a project to identify how to use water information along with other Earth information to produce indicators that will be useful for independently assessing how well Sustainable Development Goals are being met WA5. Review the needs and opportunities identified in the GEOSS Water Strategy and outline data and information service activities that could be contributed or funded
	WA-f Regional data systems and information systems in developing countries	G	Regional developments of the Water Cycle Integrator information system are proceeding well in Asia and Africa and a new SERVIR node is being planned for Asia. There is a need for further activity and a strategy in Latin and Caribbean areas.	WA4. Strengthen the involvement of Members with Antarctica research stations in GEO Cold Regions. Support the development of a cold region information service and in particular: o Permafrost monitoring in cold areas (e.g. Canada, Russia, USA (Alaska), and Northern European countries) o Capacity building activities (e.g. by ICIMOD and WCRP) WA5. Review the needs and opportunities identified in the GEOSS Water Strategy and outline data and information service activities that could be contributed or funded (the GEOSS Water Strategy will be distributed at the GEO Summit)

Strategic Target	Strategic Target Outcome ("Demonstrated by" bullet)	"Outcome" color	Analysis	Recommended Actions (as described under the Pyramid Diagrams; see previous pages)
<b>Weather</b>	WE-a Identification and addressing of critical gaps in observational networks that reflect, in particular, the needs of developing countries, the need for continuity in space-based and in-situ observations, and the potential benefits of an interactive observing system to support user needs.	Y	Progress towards this Outcome is considered satisfactory (through WMO leadership and work under IN-01). However coordination and efforts to address the needs of developing countries are still needed	WE1. Support the enhancement and maintenance of the TIGGE database, tools and related products;  WE2. Identify resources for the post-2014 era (end of THORPEX programme and GEOWOW project)
	WE-b Improvements in the range and quality of services for high impact weather forecasting due to the design, future development, and operation of global observing, data assimilation, numerical modelling, and user application techniques.	G	The GEOWOW project is on schedule. The Weather Task is about carrying out research in the development of ensemble weather forecast products and then testing and trialling these within the framework of the WMO Severe Weather Forecast Demonstration Projects (SWFDPs). Once the prototype products have been fully developed and tested it will be easier to judge possible impact on the other Strategic Targets (i.e. apart from weather). The GEOWOW project will provide some much needed resources to carry this out.	WE1. Support the enhancement and maintenance of the TIGGE database, tools and related products;  WE2. Identify resources for the post-2014 era (end of THORPEX programme and GEOWOW project)
	WE-c More accurate, reliable and relevant weather analyses, forecasts, advisories and warnings of severe and other high impact hydrometeorological events enabled by enhanced observational capabilities.	G	The GEOWOW project is on schedule. The Weather Task is about carrying out research in the development of ensemble weather forecast products and then testing and trialling these within the framework of the WMO Severe Weather Forecast Demonstration Projects (SWFDPs). Once the prototype products have been fully developed and tested it will be easier to judge possible impact on the other Strategic Targets (i.e. apart from weather). The GEOWOW project will provide some much needed resources to carry this out.	WE1. Support the enhancement and maintenance of the TIGGE database, tools and related products;  WE2. Identify resources for the post-2014 era (end of THORPEX programme and GEOWOW project)

# GEO 2012-2015 Work Plan Implementation Report

## Task Assessment

The present report describes how the implementation of the GEO 2012-2015 Work Plan has advanced since the GEO-IX Plenary. It features key outputs and activities and provides a summary of the progress made in each cross-cutting and Societal Benefit Area (SBA) of GEOSS.

Consistent with the Work Plan structure, the report is organized around Tasks to underline key lines of implementation and support the monitoring & evaluation of GEOSS implementation. Moreover the report begins with a Task assessment (summary table) featuring: (i) An “Overview” of progress and issues at the Task level (*left column*); (ii) “Highlights” of GEO Members’ and Participating Organizations’ achievements (*middle column*); and (iii) “Actions needed from GEO Members and Participating Organizations” (*right column*).

To help the reader more easily evaluate overall progress, the table has been color-coded. Readers interested in details of specific Tasks are referred to the [Task Component Sheets](#) and the [Task presentations](#) delivered during the 2013 edition of the GEO Work Plan Symposium (4-6 June 2013, Geneva, Switzerland).

The Symposium (convening about 120 participants from 40 GEO Members and Participating Organizations) represented a key opportunity to highlight progress, exchange information, and foster coordination across the whole Work Plan. The main focus was on improving the GEOSS Common Infrastructure, engaging users from developing countries, and developing cross-cutting demonstrators for the 2014 GEO Ministerial Summit and GEO-X Plenary.

<b>GEO 2012-2015 WORK PLAN</b>	<b>IMPLEMENTATION REPORT</b>	<b>SUMMARY TABLE</b>
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<b>G</b>	Green: Expected to be achieved. Some actions/intervention may be required
<b>Y</b>	Yellow: At risk of not being achieved without additional actions/intervention (see bolded actions in particular)
<b>R</b>	Red: Not expected to be achieved without significant actions/intervention (see bolded actions in particular)

**INFRASTRUCTURE**

**IN-01 Earth Observing Systems**

	Overview	Highlights	Actions Needed from GEO Members and POs
<b>Y</b>	<p>The promotion and coordination of surface-based and space-based observing systems to provide long-term continuous observations of the Earth System are underway. Interactions among communities are growing, offering good prospects of cross-fertilization. However, activities for the development, maintenance, and coordination of in-situ networks require additional support from GEO Members and Participating Organizations. Also more work is needed to identify, and in particular, fill critical gaps in observational networks, with particular focus on developing countries and observation continuity.</p>	<ul style="list-style-type: none"> <li>• Land Surface Imaging tool launched (LSI Explorer) to improve data access and interoperability; Launch of Landsat-8 and Proba-V</li> <li>• Launch of SARAL satellite (French-Indian mission for the monitoring of the environment: Altimetry (AltiKa) and contribution to ARGOS system)</li> <li>• CBERS-3 launch scheduled for Dec 2013; Set-up and upgrade of CBERS ground stations underway (Spain, Gabon, South Africa)</li> <li>• CEOS tools online to support gap analyses and mission coverage (EO Handbook <a href="http://database.eohandbook.com">http://database.eohandbook.com</a>); and (COVE) (<a href="http://www.ceos-cove.org">http://www.ceos-cove.org</a>, also in Spanish)</li> <li>• 100% of GHRSSST (Group for High Resolution Sea Surface Temperature) products discoverable through CEOS International Directory Network</li> <li>• CEOS self-study conducted on data policy. Overall, 70% of CEOS mission data is open (simple or no registration; see <a href="http://www.ceos-data.org/dev/">http://www.ceos-data.org/dev/</a>)</li> <li>• Essential Climate Variable (ECV) database populated (213 data records from 11 agencies; see <a href="http://www.ecv-inventory.com">www.ecv-inventory.com</a>) – to assess gaps in climate architecture</li> <li>• Action plan underway for realization of the GGOS-2020 International Terrestrial Reference Frame and schedule for the Decade of the Reference Frame (2014-2024)</li> <li>• Guidance on provision of in-situ data for Copernicus services provided (e.g. for hydrological data). First in-situ workshop held on “Monitoring Matters” (Copenhagen, Denmark, April 2013)</li> <li>• New cycle of discussions for radio frequency allocations underway; WMO Preliminary Position Paper for 15<sup>th</sup> World Radiocommunication Conference (WRC-15) under preparation</li> <li>• Support offered by USA (NASA) for the coordination of Task IN-01 Component 3</li> </ul>	<p><i>Management</i></p> <ul style="list-style-type: none"> <li>• <b>Strengthen support for Task IN-01 Component 3: “Promotion and Coordination across Surface-based and Space-based Observing Systems”</b></li> </ul> <p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Contribute to the development of a global framework for in-situ management building upon the GMES/Copernicus in-situ coordination (GISC) initiative</b></li> <li>• Support the expansion of the International Terrestrial Reference Frame (ITRF) through education and partnership development (e.g. in Africa)</li> <li>• Liaise with national representatives in radio-communication fora – to ensure sustained political support for radio-frequency protection</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Strengthen simulation capabilities to better understand options, scenarios, sensitivities and trade-offs in observation deployment strategies</li> <li>• Conduct studies on crowd-sourcing (aka, citizen sensing) e.g. for data collection</li> </ul>

**IN-02 Earth Data Sets**

	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>Y</b>	<p>Life-cycle data management (e.g. processing, validation, quality control, modelling, visualization) is progressing on a number of fronts. Also, global/regional datasets are getting more diverse and reliable. However, there is a need for GEO Members and Participating Organizations to contribute more data management activities to ensure synergies, improve coordination and optimize the use of resources</p>	<ul style="list-style-type: none"> <li>Numerous global datasets under development, including Global Map, OneGeology, Global Soil Map Information System, Global Human Settlement and Roadmap</li> <li>First-ever continental maps of Earth surface mineralogy released. Maps for Australia registered in the GEOSS Common Infrastructure. Feasibility of a mineral map on the global scale being explored</li> <li>Global, coordinated and integrated Digital Elevation Model (DEM) in progress based on interoperability among existing DEM data sets; Wide-area datasets validated for ALOS PRISM DSM (Digital Surface Model)</li> <li>Quality Assurance plan underway to establish QA4EO as a "quality badge" for GEO data/information/products. Case studies on flooding and ozone monitoring under preparation</li> <li>White papers to improve life-cycle data management delivered e.g. Long-Term Archive Strategies; Data Preservation Techniques; Data Lifecycle Models and Concepts</li> <li>Standard global spatial reference frame (GSRF) released for GEOSS data positioning and analysis based on a general 3D grid system (without projection and domain limitations)</li> <li>Over 70% of Earth observation datasets stored in world data centers (WDCs) linked to ESSG (Earth System Spatial Grid) for easy access and shared service. Software system under development for GEOSS datasets visualization from regional to global scale</li> <li>Training courses on Earth-system spatial-grid (ESSG) data sharing services in preparation; in particular for scientists and decision-makers in Asian-Pacific and African nations</li> <li>Recommendations to improve open access to CEOS data adopted by Space Agencies</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li><b>Contribute socio-economic datasets to the GEOSS DataCORE</b></li> <li><b>Expand national/international contributions related to data management</b> (including processing, inter-calibration and validation, quality assurance, harmonization, archiving, integration, assimilation, modelling, long-term preservation, digitization, and visualization)</li> <li>Establish connections with the UN Global Geospatial Information Management (GGIM) initiative</li> </ul>

**IN-03 GEOSS Common Infrastructure (GCI)**

	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>G</b>	<p>Work is ongoing to support the sustained operation, maintenance and enhancement of the GEOSS Common Infrastructure (GCI); in particular, with regard to user-friendly discovery and access to data. Emphasis is also given to the integration of Data-CORE datasets. Activities are supported by international projects such as GEOWOW and the Architecture Implementation Pilots (AIPs).</p>	<ul style="list-style-type: none"> <li>Number of resources discoverable via the GEOSS Common Infrastructure (GCI) increased from 14 million (2012) to 65 million (2013)</li> <li>DataCORE pledges gradually registered and made accessible</li> <li>Real-time search of multiple external catalogues enabled through GEOSS Discovery and Access Broker (DAB)</li> <li>New version of GEOSS Web Portal launched end 2013, providing faster and easier data access</li> <li>Search results from the GEOSS Portal now providing description of resources, links to resources (e.g. Web pages), Google-Earth KML files, etc.</li> <li>GCI requirements baseline under review and consolidation</li> <li>GCI Fact Sheet under development ("What can the GCI do for you?")</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>Encourage providers to make datasets accessible, flag them wherever possible as GEOSS Data-CORE, and actively contribute to GCI development</li> </ul> <p><i>User Engagement / Outreach</i></p> <ul style="list-style-type: none"> <li>Encourage GEO communities (e.g. data providers, scientists, decision makers) to: <ul style="list-style-type: none"> <li>Identify requirements and needs for the GCI</li> <li>Organize GCI testing and provide feedback to developers</li> <li>Showcase the benefits of making data available through the GCI</li> </ul> </li> </ul>

<b><u>IN-04 GEOSS Communication Networks</u></b>			
Y	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
Y	<p>Access to, and delivery of, Earth observation and information from all Societal Benefit Areas continues to progress. Access is improving through GEONETCast in developing countries and for disaster response and recovery. However, support is needed for the coordinated collection of in-situ data (e.g. through crowd-sourcing/citizen sensing) and its integration into GEOSS.</p>	<ul style="list-style-type: none"> <li>• Number of GEONETCast stations growing: EUMETCast Europe (3560); EUMETCast Africa (358); CMACast (2600); GEONETCast Americas (110)</li> <li>• New GEONETCast stations installed in El Salvador, Mexico, Belize, Eastern Europe and Caucasian countries; Users include national meteorological services and emergency management agencies</li> <li>• CMACast and EUMETCast stations upgraded in Asia and Africa resp.</li> <li>• GEONETCast approved for operational use by the International Charter 'Space and Major Disasters'. GEONETCast can be chosen as an alternative delivery mechanism for the reception of high-volume, high-resolution satellite data and value-added products to support disaster mitigation.</li> <li>• Integration of GEONETCast product navigator in GEOSS Common Infrastructure underway</li> <li>• Search capability for GEOSS data on GEONETCast channels under development; Connectivity with GEOSS broker in progress</li> <li>• User Fora organized in Americas and Africa to improve GEONETCast services</li> <li>• Preparation for routine Landsat broadcast to African countries underway; Support for projects in Africa ongoing (e.g. AMESD, MESA, AGRICAB, and EAMNET)</li> <li>• Contact established with Global Forest Observation Initiative (GFOI) and GEOGLAM</li> <li>• Interoperability in progress between WMO WIS and the GEOSS Common Infrastructure to allow for a two-way discovery of resources</li> <li>• Numerous projects and initiatives underway to support integration of citizen-sensing in GEOSS and mobile access to GEOSS data</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Provide resources to fund installations for receiving stations and communication networks</li> <li>• Build on the successful model of the European FP7 projects DevCoCast and AGRICAB to develop GEONETCast applications</li> <li>• <b>Expand national/international contributions related to citizen-sensing and mobile access to data</b></li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Enhance the integration of the satellite data distribution system 'MeteoInform-Mitra' into GEONETCast</li> <li>• Continue development of coverage over the Pacific Islands region</li> </ul> <p><i>Capacity Development / User Engagement</i></p> <ul style="list-style-type: none"> <li>• Make GEONETCast part of end-to-end projects design, especially if projects (i) take place in or target a developing country; (ii) intend to build long-term capacity; and (iii) plan to deliver data operationally to a wide user community</li> <li>• Foster partnerships and coordination with capacity building initiatives and entities</li> <li>• Assist with gathering information regarding needs in the area of communication infrastructure</li> </ul>
<b><u>IN-05 GEOSS Design and Interoperability</u></b>			
G	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
G	<p>Activities to manage the design and interoperability of GEOSS (and contributed data and service resources) are underway, building on instrumental contributions from the Architecture &amp; Implementation Pilot (AIP) and Standards &amp; Interoperability Forum (SIF). Active participation of the GEO community in these activities is key to advancing GEOSS interoperability and enabling a sustainable user-driven GEOSS</p>	<ul style="list-style-type: none"> <li>• Scenario videos demonstrating the use of GEOSS components, services, and applications made accessible from GEO Portal (AIP-5)</li> <li>• Call for Proposal to Phase 6 of the Architecture Implementation Pilot (AIP-6) issued. 17 responses received representing ca. 80 entities. Goals include: (i) Increase use of GEOSS resources by end-users; and (ii) Focus on benefits and usability for developing countries</li> <li>• AIP-6 results delivered to GEO-X Plenary and Geneva Ministerial Summit; 10 showcase videos proposed; Lead on development of Showcase 4 on Post-2015 Global Agenda</li> <li>• Tutorials for GEOSS users/providers released (help in understanding how to publish, register, discover, access, and use GEOSS resources)</li> <li>• Over 50 people from different sectors (private industry, academia, and government agencies) and countries (USA, Europe, Africa and Brazil) discussed data availability through Sensor Web and Model Web during the GEOSS Future Products Workshop (Silver Spring, USA, 26-28 March)</li> </ul>	<p><i>None at this stage</i></p>

INSTITUTIONS & DEVELOPMENT			
ID-01 Advancing GEOSS Data Sharing Principles			
Overview	Highlights	Actions Needed from GEO Members and POs	
Y	<p>Overall, the implementation of the GEOSS Data Sharing Action Plan is making progress. The Data Sharing Working Group (DSWG) has developed an activity plan for 2014-2015 to ensure that all Actions are addressed. Additional resources are needed to ensure adequate levels of (i) participation by developing countries in Working Group activities; and (ii) outreach to data users and providers, especially in developing countries</p>	<ul style="list-style-type: none"> <li>Over 50 million GEOSS Data-CORE resources discoverable via the GEOSS Web Portal</li> <li>More than 40 organizations, initiatives and projects contacted to consolidate and expand the GEOSS Data-CORE</li> <li>Increase in number of GEOSS Data-CORE registrations in Components and Services Registry (CSR); Ongoing coordination with Architecture Implementation Pilot (AIP-6)</li> <li>Legal Interoperability White Paper delivered (comparison of the terms used to explain the “full and open” concept)</li> <li>GEOSS Data Quality Guidelines released</li> <li>Material supporting the implementation of more-open data environments in planning</li> <li>Outreach work on the benefits of data sharing underway; Links to CEOS Capacity Building activities and “GEOSS in the Americas” initiative in discussion</li> <li>Broad representation from more than 30 GEO Members and Participating Organizations on Data Sharing Working Group</li> <li>4 subgroups in action: Data-CORE/GCI; Legal Interoperability; Documentation/Data Quality; and Capacity Building (new)</li> <li>Input for GEO-X Plenary, Ministerial Summit, and Post-2015 Data Sharing Strategy under preparation (e.g. side event)</li> </ul>	<ul style="list-style-type: none"> <li>Work with the Data Sharing Working Group and the GEO Secretariat to make all resources currently pledged to the GEOSS Data-CORE discoverable in GEOSS with improved metadata, documentation, and quality information</li> <li>Establish national coordinating mechanisms to promote and monitor engagement with the implementation of the GEOSS Data Sharing Principles and provide feedback to GEO</li> </ul> <p><i>Additional Resources/ Contributions</i></p> <ul style="list-style-type: none"> <li><b>Pledge further contributions to Data-CORE i.e. increase the number of datasets made available on the basis of full and open access</b></li> <li><b>Engage with socio-economic information producers (e.g. OECD, UN offices, national statistics agencies)</b></li> <li><b>Encourage additional contributions to the Data Sharing Working Group activities, in particular from developing countries</b></li> <li><b>Ensure adequate representation from the Middle East, South America, and Asia-Pacific regions</b></li> </ul> <p><i>Capacity Development/ Outreach</i></p> <ul style="list-style-type: none"> <li>Identify successful data sharing approaches in Societal Benefit Areas and other communities to promote a more open data environment; Expand documentation of best practices in data sharing and assessments of benefits</li> <li>Promote the benefits of full and open access to data and sensitize data providers</li> <li>Raise awareness of the GEOSS Data-CORE nationally/regionally</li> </ul>
ID-02 Developing Institutional and Individual Capacity			
Overview	Highlights	Actions Needed from GEO Members and POs	
G	<p>Coordination of national and international capacity-building efforts to produce/use Earth observation and information is growing. Efforts are ongoing to identify resources for activities and clearly define roles and responsibilities for leading these activities. Strong support from GEO Members and Participating Organizations is required to reach a critical mass of GEO capacity building outputs and activities</p>	<ul style="list-style-type: none"> <li>Numerous training courses delivered, e.g. on tropical forest monitoring and carbon reporting (10 workshops in Americas and french-speaking Africa); EO2HEAVEN, mitigation of health risks (2 in South Africa &amp; Uganda); EnerGEO summer schools, renewable energies (2 in Uganda &amp; Netherlands)</li> <li>1st e-learning course of the CEOS Working Group on Capacity Building &amp; Data Democracy held. Training was for wider and easier access to Earth observation and targeted at African countries (e.g. South Africa, Nigeria, Kenya, and Tanzania)</li> <li>“Bringing GEOSS services into practice” teaching material upgraded and freely available as PDF document or iBook</li> <li>Access to data and information improved e.g. through AfroMaison Broker (portal enabling geospatial data discovery in Africa); CIMHET (virtual centres for severe weather prediction in South America); SANSa EODC (catalogue linked to South African EOS portal)</li> <li>Capacity Building Inventory Project underway; Information collected will populate an interactive website (GEONetCab Portal) to better coordinate existing capacity building efforts and inform future planning</li> <li>Launch of new versions of open source software (TerraLib, TerraView, SPRING, TerraAmazon, TerraMa2) for monitoring, analysis and alert; Update of related homepages, training material, tutorial and documentations in Portuguese, English and French</li> <li>Numerous items registered in the GEOSS Common Infrastructure, e.g. GEONETCast Toolbox; INPE Data Catalog; EnviroGRIDS portal</li> </ul>	<p><i>Management</i></p> <ul style="list-style-type: none"> <li>Contribute national capacity building activities to GEO</li> <li>Establish connections with existing national/regional capacity development initiatives</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>Support the development of capacity building cyber-infrastructure (e.g. using crowd sourcing and/or cloud computing; linking with local end-users with emphasis on interoperability with other platforms)</li> </ul>



<b>ID-03 Science and Technology in GEOSS</b>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
Y	<p>The engagement of Science and Technology communities in GEOSS is building momentum. However, raising GEO visibility and finding resources to implement activities remain a challenge. Only a handful of individuals are active and committed to realizing the deliverables of this Task</p>	<ul style="list-style-type: none"> <li>• GEO Label concept developed (based on user input); focus on labeling of geo-referenced data. Implementation underway (GeoViqua project)</li> <li>• GEOSS S&amp;T Meeting Portal launched to provide information on GEO and GEOSS-related events at major science and technology meetings</li> <li>• 3<sup>rd</sup> GEOSS Science &amp; Technology Stakeholder Workshop in planning for early 2014</li> </ul>	<p><i>Additional Resources / Contributions</i></p> <ul style="list-style-type: none"> <li>• Support the implementation of the GEO Science &amp; Technology Roadmap and encourage new contributions to Task activities e.g.- from Asia and Africa</li> <li>• Establish links with national/regional activities on Future Earth and the broader Sustainable Development Goal (SDG) agenda</li> </ul>
<b>ID-04 Building a User-Driven GEOSS</b>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
G	<p>The collection and integration of user feedbacks on products, data access and delivery is making progress. However more work is needed to truly integrate user perspectives in GEOSS development and efficiently demonstrate added-value to decision-makers.</p>	<ul style="list-style-type: none"> <li>• Tool for collecting user information and improving user experience quasi-operational (User Requirements Registry)</li> <li>• CEOS/ESA Earth Observation Handbook revised to include updated information about world's satellite missions</li> <li>• Several outreach workshops held: (i) 1-day user forum on "societal impacts and benefits of improved environmental and geospatial information", Geospatial World Forum, Rotterdam, NL, 15 May; (ii) 2-day conference on "Big Data", Rome, Italy, 6-7 June; (iii) 2-day workshop on GEO outreach in the wider Balkan area, Novi Sad, Serbia, 19-20 September</li> <li>• Outreach performed through Earthzine; new audiences encouraged</li> </ul>	<p><i>User Engagement</i></p> <ul style="list-style-type: none"> <li>• Disseminate results of relevant GEOSS workshops</li> <li>• Support the development of the User Requirements Registry to enable users to guide GEOSS implementation, and establish/sustain ongoing dialogue with user communities</li> <li>• Encourage contributions from developing countries and feedbacks on user needs</li> </ul>
<b>ID-05 Catalyzing Resources for GEOSS Implementation</b>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
Y	<p>Progress on resource mobilization for GEOSS in the areas of capacity building (individual, institutional, infrastructure) and Research and Development (R&amp;D) is picking up. Activities mainly build on individual international projects (e.g. EOPOWER, IASON). Resource mobilization is a crucial deliverable of GEO that requires strong support from Members and Participating Organizations</p>	<ul style="list-style-type: none"> <li>• GEO capacity building web established (information on low-cost and free open-source software, tutorials and training opportunities, Earth observation applications; GEONetCab project)</li> <li>• 11 marketing toolkits developed on Earth products and services (e.g. for Societal Benefit Areas)</li> <li>• New EOPOWER and IASON projects approved by European Commission; Projects should provide basic funding for several pilot projects</li> <li>• Small task force established on "Mobilizing Resources for Water" (pilot)</li> <li>• Draft plan underway for a comparative study on international research funding</li> <li>• Increased cooperation with national funding agencies; Contribution made to Belmont Forum Collaborative Research Actions Workshop: e-Infrastructures and Data Management</li> <li>• GEOSS promoted in numerous fora e.g. ISRSE35 (Beijing, China, April 2013): International mobilization of resources for water beyond the 2013 International Year of Water Cooperation</li> <li>• Showcases proposed for GEO 2014 Ministerial Summit (Capacity building web; and Cold regions seen through a modern explorer's eyes)</li> </ul>	<p><i>Additional Resources / Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Build upon the European FP7 example to mobilize funds for GEOSS implementation</b></li> <li>• Establish high-level relationships with the Belmont Forum</li> <li>• Share national/international experience on resource mobilization</li> <li>• Help increase cooperation with IGFA and UNESCO</li> </ul>

INFORMATION FOR SOCIETAL BENEFITS			
<u>SB-01 Oceans and Society: Blue Planet</u>			
Overview	Highlights	Actions Needed from GEO Members and POs	
Y	<p>The Blue Planet initiative is building momentum with new projects and activities developing. Coordination of observing, modeling, and disseminating systems is also growing through regular interactions among ocean communities. Support is strongly needed for ocean observing networks whose continuity is essential to the development of applications and key information for society.</p>	<ul style="list-style-type: none"> <li>• Ocean Biogeographic Information System database contributed to GEOSS DataCORE (33 million species observations; ongoing legacy of Census of Marine Life 2000-2010)</li> <li>• New ocean data streams integrated into the GEOSS Common Infrastructure (current focus is on ocean assessments and ecosystem applications; GEOWOW project)</li> <li>• Progress ongoing on inter-comparison and validation of ocean forecasting systems, and coastal and shelf-seas forecast model coordination (Global Ocean Data Assimilation Experiment (GODAE) OceanView, JCOMM Operational Ocean Forecasting Systems)</li> <li>• Evidence of use of ocean data/services made available (e.g. users of MyOcean services; usage statistics from Argo Programme)</li> <li>• Engagement with Transboundary Waters Assessment (1<sup>st</sup> global assessment of international waters) and UN World Ocean Assessment (on marine environment incl. socioeconomic aspects)</li> <li>• Efforts underway to promote a transatlantic initiative in ocean observing. Blue Planet recognized as a viable platform on which cooperation could be based</li> <li>• Blue Planet White Paper completed and steering committee formed with representation from agencies and institutions across the ocean spectrum</li> <li>• Periodic workshops held on societal applications in fisheries and aquaculture</li> <li>• Scholars trained and regional pilot projects initiated as part of POGO joint capacity building activities</li> <li>• Showcase proposed for GEO 2014 Ministerial Summit (Blue Planet)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Identify operational funds to develop and sustain ocean observing networks (for instance ChloroGIN), as well as initiatives such as the Societal Applications in Fisheries &amp; Aquaculture using Remotely Sensed Imagery (SAFARI)</b></li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Identify streamlined procedures for providing interoperability between ocean data portals such as OceanSITES and the GEOSS Portal</li> </ul>
<u>SB-02 Global Land Cover</u>			
Overview	Highlights	Actions Needed from GEO Members and POs	
G	<p>Progress continues towards providing a suite of global land-cover datasets, based on improved and validated land-cover scenes. This builds on major contributions from China, USA, GOC-GOLD, and EC. More work is needed to efficiently coordinate worldwide land-cover activities and communicate related societal benefits.</p>	<ul style="list-style-type: none"> <li>• International network created where GEO members can express needs for land-cover products and contribute national/international land-cover efforts</li> <li>• New land cover products delivered for 2013 (30m resolution) and 2008-2012 (300m resolution)</li> <li>• Precise mapping (30m) of global open water released after validation for 2000 and 2010</li> <li>• Concept for a collaborative Global Land Cover Information Service System under investigation</li> <li>• Independent validation database for global land cover products in preparation; Online database set up to make validation data produced through ESA Climate Change Initiative available</li> <li>• Connection of all major Global Land Cover websites underway (China NGCC, GOC-GOLD LC, EEA Eye on Earth) to facilitate data sharing and accuracy assessment of land-cover products</li> <li>• Working group on Land Cover for Africa created to lead the development of a 30m resolution map for Africa (contribution to AfriGEOSS initiative)</li> <li>• Training courses and regional network meetings held in China and Europe</li> <li>• Side-event or exhibition in preparation for GEO 2014 Ministerial Summit</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Expand national/international participation in land cover activities</li> <li>• Organize seminars and workshops connecting producers, users, and application developers</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Support data processing and information extraction/classification activities</li> <li>• Conduct/support validation activities of global land cover products</li> <li>• Initiate capacity development activities; support South-South cooperation</li> </ul>

<b><u>SB-03 Global Forest Observation</u></b>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>G</b>	<p>The Global Forest Observation Initiative (GFOI) continues to develop in support of national forest information systems for improved forest management. GFOI activities have been organised under 4 elements: Space Data, Methods and Guidance Document, Capacity Building, and Research &amp; Development (R&amp;D).</p>	<ul style="list-style-type: none"> <li>• Strategy to coordinate space data acquisition and meet GFOI needs developed and approved by CEOS (commits CEOS agencies and involves systematic and sustained wall-to-wall acquisitions of forested areas)</li> <li>• Activities in the GEO Forest Carbon Tracking National Demonstrators ongoing (e.g. data processing)</li> <li>• Landsat Data Continuity Mission (Landsat 8) satellite successfully launched on 11 February; A key asset for GFOI and continuous/consistent land cover observations worldwide</li> <li>• R&amp;D priority areas tentatively identified e.g. degradation, forest types, sensor interoperability, uncertainty and accuracy metrics, data-model integration; 1<sup>st</sup> version of R&amp;D Review</li> <li>• Draft Methods and Guidance Document completed, to be submitted to GEO-X Plenary</li> <li>• Links established with UNREDD and World Bank (Forest Carbon Partnership Facility) and REDD+ safeguards (agriculture, ecosystems, land use)</li> <li>• Extension of regional Forest Carbon Tracking workshops to SE Asia and Africa under discussion (building on Americas' experience)</li> <li>• Series of implementation meetings held in Australia (4 to 12 February), including (i) 4th Science and Data Summit; (ii) Methods &amp; Guidance Documentation; and (iii) Space Data Coordination Group</li> <li>• Operations of GFOI Office in Geneva started in February</li> <li>• Showcase proposed for GEO 2014 Ministerial Summit (how GFOI meets policy needs on forest management, deforestation, REDD+)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Plan contributions to GFOI implementation for the period 2014-2015</li> <li>• As a country, consider participating in R&amp;D demonstrators</li> <li>• Seek funding support for essential R&amp;D</li> <li>• Foster collaboration with relevant organisations e.g. UNFCCC, FAO, World Bank, IPCC</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Ensure continuity in product development for the 11 Forest Carbon Tracking National Demonstrators</li> </ul>
<b><u>SB-04 Global Urban Observation and Information</u></b>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>G</b>	<p>Coordination of activities for urban monitoring, forecasting, and assessment is growing, with new projects and products contributed and connected to GEOSS. Impediments to further progress essentially relate to a lack of funding for more community building</p>	<ul style="list-style-type: none"> <li>• New Urban Supersites Initiative launched: 8 megacities selected (Los Angeles, Atlanta, Mexico City, Athens, Istanbul, Sao Paulo, Beijing, Hong Kong); Website incl. data repository developed</li> <li>• New project (EXPLICIT) initiated to generate Land Surface Temperature datasets at 1km/15min resolution; Focus on urban heat islands and 11 mega cities (incl. 6 urban Supersites)</li> <li>• Whole image repository contributed for information extraction (includes several 100 millions of km<sup>2</sup> of data with diverse resolution, Global Human Settlement Layer (GHSL) project)</li> <li>• Global night-time lights for 2012 produced (using data collected by the VIIRS instrument)</li> <li>• Fine-scale human-settlement map of Europe for 2012 in preparation (derived from 2.5m resolution Spot data); Set up of the Global Human Settlement Layer (GHSL) database underway</li> <li>• Urban Observation Sensors Review delivered (investigates limitations and future perspectives of remote sensor technology for urban applications)</li> <li>• Proposal for a Global Urban Remote Sensing Laboratory (GURSLab) under review (tool for on-line processing, visualizing, and sharing of urban data)</li> <li>• Textbook on "Global Urban Monitoring and Assessment through Earth Observation" published in late 2013</li> <li>• Special session held on GEO Global Urban Observation and Information (Joint Urban Remote Sensing Event Conference, Sao Paulo, Brazil, April, 2013)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Connect national/international urban activities to Task SB-04</li> <li>• Dedicate national/regional funds to urban product generation, and technological development (imagery mining, data fusion, interpretation)</li> <li>• Identify/initiate international project calls and funding options for joint GEO urban activities</li> <li>• Support the organization of a GEO Urban Symposium in China (Changsha, 11-14 June 2014)</li> <li>• Help develop ties with users/stakeholders such as the World Bank, UN Habitat</li> </ul> <p><i>Technical</i></p> <p>Conduct/support validation activities of urban products (strategy and reference data)</p>

<b>SB-05 Impact Assessment of Human Activities</b>			
Y	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
Y	<p>Good progress is underway on the development of tools/services for impact monitoring and prediction in the energy and mining sectors. However, more work is needed to expand impact activities to areas other than energy and mining. Also mutually-beneficial relationships need to be developed with the private sector</p>	<ul style="list-style-type: none"> <li>• New applications produced for Europe to (i) assess the impact and performance of offshore wind farms; and (ii) optimize the siting of solar power plants (EnerGEO project)</li> <li>• EnerGEO Portal launched, registered in the GEOSS registry and successfully tested regarding cataloguing web services standards for wind, solar applications and integrated assessments</li> <li>• Pilot underway to link ozone and mercury emissions from fossil fuels to atmospheric levels of air pollutants</li> <li>• Integrated products developed to monitor environmental/societal footprint of mining activities (3 demonstration sites: Czech Republic (lignite open pit), South Africa (coal fields) and Kyrgyzstan (gold mine))</li> <li>• Importance of these products for national and international mineral policies acknowledged (Minerals and Society Workshop, Brussels, Belgium, Sept 2013)</li> <li>• e-training facility for impact monitoring of mineral resource exploitation under development (ImpactMin project)</li> <li>• Two Summer Schools delivered for “Unlocking renewable energy potentials for Africa: biomass and solar energy” (Mars 2013, Kampala, Uganda; Oct 2013, Utrecht, Netherlands). Helped develop Africa – EU research cooperation as well as individual networks in Africa</li> <li>• Working group on coal and environment under development as part of the Energy Community of Practice</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Provide incentives to industry and associations (e.g. EuroMines) to better engage in GEO activities and share data on the impact of their activities</li> <li>• <b>Contribute impact activities in areas other than energy and mining</b></li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Support the development of space-borne high-resolution hyperspectral sensors that preclude assessments of mining contaminants and effluent releases at global/regional scale</li> </ul> <p><i>User Engagement /Outreach</i></p> <ul style="list-style-type: none"> <li>• Promote Earth observation-based integrated tools in user-oriented conferences/ events</li> </ul>

<b>AG-01 Global Agricultural Monitoring and Early Warning System</b>			
G	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and Pos</b>
G	<p>Global capabilities in crop monitoring, food-supply prediction and agriculture risk-assessment are increasing significantly. Progress mainly relates to two international initiatives: GEOGLAM and GEO-JECAM. Whereas overall progress is encouraging, initiatives still require strong support from GEO Members and Participating Organizations</p>	<ul style="list-style-type: none"> <li>• Global crop outlooks delivered for N- and S-Hemisphere (wheat, maize, soybeans and rice crops), contributed to AMIS (Agricultural Market Information System) from Sept 2013; Argentina, Australia, Brazil, South Africa invited to join efforts</li> <li>• First version of Global Cropland Map (wiki-based) released; Second version planned for end 2013 and data collection started</li> <li>• New tool developed to allow for crop comparison in time</li> <li>• JECAM (Joint Experiment on Crop Assessment and Monitoring) expanded to South Africa, Russia and Ukraine (27 sites in total spanning 5 continents); provides the science foundation of GEOGLAM</li> <li>• Capacity development underway e.g. for a Pakistan Agricultural Information System</li> <li>• Space observation strategy in support of GEOGLAM developed (CEOS Plenary, Montreal, Nov 2013)</li> <li>• Plan developed for a phased GEOGLAM implementation: Phase 1 Foundation Activities (2012-2014); Phase 2: Review and Expansion (2014-2016); Phase 3: Pre-Operational (2015-2017); Phase 4: Operational (from 2017)</li> <li>• Growing support for GEOGLAM from national/regional initiatives e.g. Canada, China, EU, Japan, France, Germany, Mexico, USA</li> <li>• Several strategic meetings organized e.g. GEOGLAM session on Asia Rice Monitoring Initiative organized as part of 6th GEOSS Asia-Pacific Symposium (Ahmedabad, India, 25-27 Feb)</li> <li>• Showcase proposed for 2014 GEO Ministerial Summit (GEOGLAM)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Identify national contact points for GEOGLAM activities; for G20 countries and Egypt, Ukraine, Kazakhstan, Thailand, Nigeria</li> <li>• Expand national participation in, and funding for, GEOGLAM implementation</li> <li>• Support capacity building initiatives aimed at incorporating Earth observations in national agricultural monitoring; for producer countries (e.g. Argentina, Ukraine, Brazil) and countries at risk (focus on Africa, South Asia, Black Sea)</li> <li>• Contribute to African JECAM sites development and workshops</li> <li>• Provide resources for the GEOGLAM Project Office</li> <li>• Facilitate the dialog with UN agencies</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Secure African additional rain gauge data for food insecure regions</li> <li>• Give high priority to Landsat 8 agricultural acquisitions</li> <li>• Commit near-real-time access to Sentinel 2 data for agricultural regions</li> <li>• Give high priority to a possible Landsat 8 Sentinel 2 orbit optimization to reduce global coverage intervals and optimize in-season imagery</li> <li>• Encourage CEOS Space Data Coordination Group to supply required data</li> </ul>

<u>BI-01 Global Biodiversity Observation (GEO BON)</u>			
	Overview	Highlights	Actions Needed from GEO Members and POs
<b>G</b>	<p>The GEO Biodiversity Observation Network (GEO BON) is making progress towards becoming an integrated network that collects, manages, shares and analyzes observations on biodiversity status and trends. GEO BON impact at the international policy-level is strengthening, mainly through the Convention on Biological Diversity. However there are limitations to GEO BON progress mainly related to a lack of sustained funding</p>	<ul style="list-style-type: none"> <li>• New “Map of Life” tool delivered to monitor species distribution change for over 46,000 species (incl. birds, mammals and amphibians)</li> <li>• First version of the Digital Observatory for Protected Areas (DOPA) released as a web-based tool documenting 9’000 marine and terrestrial protected areas (greater than 150 km<sup>2</sup>)</li> <li>• New Marine Ecosystem website set up to provide free access to digital marine maps and resources (e.g. maps of countries Exclusive Economic Zones, seas and oceans boundaries)</li> <li>• New EU BON project launched to build a European Biodiversity Observation Network; 30 partners from 18 countries</li> <li>• Creation of a GEO BON Handbook underway to assist governments and organizations in setting up Biodiversity Observation Networks (BONs)</li> <li>• GEO initiative to “enhance global biodiversity observations for monitoring progress towards the Aichi Biodiversity Targets” developed and welcomed by Convention on Biological Diversity (CBD)</li> <li>• GEO BON working group formed on biodiversity indicators to bring GEO BON products to the attention of decision-makers and link them to the CBD Aichi Targets</li> <li>• 8-page leaflet on “Developing National Species Monitoring for the Aichi Targets” produced for SBSTTA-17 (Montreal, Canada, 12 Oct 2013)</li> <li>• Outreach performed through participation in high-level meetings and publications</li> <li>• GEO BON office to be hosted by Germany from 2014 (hosted by South Africa from 2009 to 2013)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Expand national/international participation in, and funding for, GEO BON</li> <li>• Develop national/regional Biodiversity Observation Networks</li> </ul>
<u>CL-01 Climate Information for Adaptation</u>			
	Overview	Highlights	Actions Needed from GEO Members and POs
<b>Y</b>	<p>Efforts are underway to develop and use climate information for adaptation. The climate record is extending (through reanalysis, reprocessing, reconstruction) thereby helping to better detect climate variability and change. Also research on polar dynamics, monsoons and tropical cyclones is advancing, offering new prospects for seasonal prediction. Activities for the development and integration of climate products/services into adaptation processes are ongoing, however they require further coordination. Also more work is needed to foster the use of climate information by policy- and decision-makers at all levels</p>	<ul style="list-style-type: none"> <li>• Reanalysis projects covering 50 years or more underway (JRA-55 completed for the period 1958-2012; ERA-CLIM underway)</li> <li>• 1000-year temperature reconstruction performed for 7 regions; Infrastructure for archiving paleo-climatological data developed and made available online</li> <li>• Implementation Plans for “Sub-seasonal to seasonal prediction” and “Polar prediction” projects finalized. Collaboration of weather and climate communities. Projects aim to improve forecast skills, quantify uncertainties and develop societal applications</li> <li>• Database of sub-seasonal forecasts under development – to improve the representation of tropical convection in weather/climate models, following TIGGE protocols (see WE-01)</li> <li>• New instruments for GCOS Surface Network stations delivered. Over 400 radiosondes supplied to Sudan, Tanzania, Armenia, Cook Islands and Maldives</li> <li>• Progress achieved on (i) quantity and quality of data from several <i>in situ</i> sources, including radiosondes; (ii) quantity, quality and variety of data from satellites; (iii) recovery and reprocessing of past data; and (iv) converging temperature information from various observational and model datasets</li> <li>• CEOS response to updated GCOS “Systematic Observation Requirements for Satellite-based Data Products for Climate” released and presented during UNFCCC COP18 (Doha, Dec 2012)</li> <li>• Portal (GOSIC) to access climate observations and Essential Climate Variables (ECVs) under continuous development</li> <li>• First ECV products generated through the ESA Climate Change Initiative (e.g. on glaciers, sea-level, ice-sheets); the latter contributed to the IPCC 5<sup>th</sup> Assessment Report (Working Group 1)</li> <li>• Linkages between research, modeling, and operational communities strengthened (via SCOPE-CM, ESA Climate Modeling User Group, CEOS/CGMS Working Group on Climate)</li> <li>• Numerous workshops and conferences held in support of the foregoing</li> </ul>	<p><i>Management</i></p> <ul style="list-style-type: none"> <li>• <b>Propose a Point of Contact for Task CL-01 Component 4 on “Easy Access to, and Use of, Climate Information”</b></li> </ul> <p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Expand national/international participation in the present Task; in particular with regard to climate information production, use, and access</b></li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Reverse the deteriorating trend of some in-situ networks and help fill gaps in relevant regions (cf. GCOS recommendations)</li> </ul>

<u><b>CL-02 Global Carbon Observation and Analysis</b></u>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>G</b>	<p>The development of a comprehensive global carbon observation and analysis system (integrated across the atmosphere, land and ocean domains) is underway, with support from a number of international/national projects and programs. More work is needed to translate observations and products into policy relevant information</p>	<ul style="list-style-type: none"> <li>• Global Carbon Budget assessed for 2012 (35 contributors from 19 countries; presented at UNFCCC COP18)</li> <li>• Surface Ocean CO2 Atlas (SOCAT) database updated for the period 1968-2011 (10mio CO2 measurements; 60% more data than in the previous version); This is the world largest sea-surface CO2 database</li> <li>• Site information and data status available for 411 FLUXNET towers (network of micrometeorological towers for CO2, Water Vapor)</li> <li>• Coordinated global carbon observation and analysis system under development (GEOCARBON project); Concept for an Integrated Global Greenhouse Gas Information System (IGIS) under design (to inform policy and strategies on GHG emissions)</li> <li>• GEOSS Data Sharing Principles adopted for GEOCARBON data and products; numerous datasets contributed to GEOSS DataCORE (full and open access)</li> <li>• GEOCARBON Portal launched to enable free exchange of carbon data and products</li> <li>• Needs for implementing a policy-relevant carbon observing system identified through a publication of the GEO Carbon Community of Practice</li> <li>• CEOS Strategy for Carbon Observations from Space under review</li> <li>• International Conferences held on "a Global Carbon Observing and Analysis System: Specifications, Uncertainties and Tropical Hot Spots" (1-2 October 2013, Geneva, Switzerland) and "Global Coordination of Carbon Observations and Analysis in the frame of GEO" (3-4 October 2013, Geneva)</li> <li>• Showcase proposed for the GEO 2014 Ministerial Summit (Tracking the global carbon cycle)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Connect national/international carbon activities to Task CL-02; provide contact information</li> <li>• Design and follow a long-term funding strategy for maintaining carbon observing/monitoring networks, beyond the funding period of research projects</li> </ul> <p><i>Outreach</i></p> <ul style="list-style-type: none"> <li>• Make national and international entities aware of available carbon information and the need for underpinning carbon measurements</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Support observing networks for carbon (particularly in less developed regions)</li> </ul>
<u><b>DI-01 Informing Risk Management and Disaster Reduction</b></u>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and Pos</b>
<b>G</b>	<p>Efforts are underway to provide timely information relevant to the full cycle of disaster management (mitigation, preparedness, warning, response and recovery). Bridges are getting built across disaster communities and progress on overall disaster risk management is significant. However more work and coordination are needed to develop multi-hazard end-to-end approaches and make Earth observations and information effectively reach decision-makers and the public</p>	<ul style="list-style-type: none"> <li>• European Supersites Coordination Initiative launched to improve interaction and collaboration between satellite and in-situ Earth observations; 3 Supersites selected (Istanbul fault; Icelandic and Italian volcanoes)</li> <li>• New version of PREVIEW Global Risk Data Platform released (multiple agency effort to share spatial data information on global risk from natural hazard)</li> <li>• Namibia Flood Dashboard improved to allow autonomous user posting of water gauge readouts, histograms, and flood bulletins; and a customized autonomous processing</li> <li>• Satellite-based Advanced Fire Information System (AFIS) developed to provide near-real-time fire information to users across the globe</li> <li>• Volcanic ash forecasting service in progress; operational LIDAR network established in Ireland and database of historic eruptions developed</li> <li>• New SERVIR-Himalaya outputs: (i) Bangladesh Flash Flood Wireless Sensor Network; (ii) Forest Fire Detection and Monitoring (Nepal and Bhutan); (iii) Multi-Scale Disaster Risk Assessment (Himalaya); and (iv) Web Based Disaster Information System (Nepal)</li> <li>• OpenGEM Platform under development to help users calculate Earthquake hazard and risk, view/analyze maps and plots, and use decision-making support tools</li> <li>• Registration process in place for national authorities interested in participating in the International Charter as an "Authorized User"</li> <li>• Initiative underway to increase the role of CEOS space agencies in all phases of Disaster Risk Management (DRM); Global Satellite Observation Strategy completed and three pilot projects launched on Floods, Volcanoes and Earthquakes</li> <li>• Joint GEO-ESA publication released to support operational practitioners and users of geo-information services</li> <li>• Showcase proposed for the GEO 2014 Ministerial Summit (Improving Tsunami Landfall and Annual Southern African Region Flood Predictions)</li> </ul>	<p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Promote a multi-hazard end-to-end approach to national/regional disaster risk management</li> </ul> <p><i>User Engagement</i></p> <ul style="list-style-type: none"> <li>• Help engage a broader set of stakeholders and practitioners working on Disaster Risk Management (e.g. operational and field users); Identify and help establish contact with end-user groups (e.g. local disaster managers)</li> <li>• Facilitate access to data infrastructure (repositories, processing, distribution) in particular for developing countries</li> </ul>

<u><b>EC-01 Global Ecosystem Monitoring</b></u>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and POs</b>
<b>Y</b>	<p>Efforts to assess the present state and trends of ecosystem conditions and services are gathering momentum. Linkages with GEO BON, Blue Planet, Cold Regions and the ABCC program are gradually developing. Mountain activities are evolving into a major GEO initiative and the possibility of a global dryland monitoring system is being explored.</p>	<ul style="list-style-type: none"> <li>• New initiative proposed for a GEO Global Network for Observations and Information in Mountain Environments (GEO-GNOME)</li> <li>• NextData project contributed to the Task – to help assess the impact of climate variability on mountain ecosystems (population dynamics of selected species, Alpine lake ecosystems, changes in resource-consumer relationships)</li> <li>• First Arctic Biodiversity Assessment and released (Circumpolar Biodiversity Monitoring Program)</li> <li>• New high-resolution ecosystem map of Africa developed (provides a baseline for impact monitoring)</li> <li>• Phenology data collected over Europe and made available to the scientific community via the Pan European Phenology Database (PEP725)</li> <li>• Global datasets on ecosystems and the environment made available (e.g. on terrestrial vegetation growth, land surface water; from Global Remote Sensing Monitoring on Ecosystem and Environment)</li> <li>• World Heritage Sites, World Biosphere Reserves and World Geoparks set up for preserving key ecosystems</li> <li>• Links established with LifeWatch European Infrastructure to create a network of coastal protected areas contributing information to the GEOSS DataCORE</li> <li>• Free-access real-time platform for marine conservation under development (integrating and monitoring Earth observation and human pressure data; SEAWETRA)</li> <li>• Archive for global change data and tools under development through ABCC program (Australia, Brazil, Canada, China); Focus on dry regions, cold regions, forests, and grasslands; ABCC expanded to Germany, Malaysia, ISDE and OGC</li> <li>• Collaboration between China and Cambodia established on using Earth observation technologies for monitoring the surroundings of the Angkor Site</li> <li>• Proposal for a GEO Global Dry-land Observation Network under discussion – to provide global information on arid and semi-arid ecosystems</li> <li>• Linkages with Cold Regions (WA-01) and Oceans (SB-01) activities explored</li> <li>• GEO-X Side-Event on mountain ecosystems planned, as well as ecosystem contributions to GEO-X “Special Event on Biodiversity”</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Identify entities carrying out monitoring activities for key ecosystems (e.g. moist/dry forests, wetlands, drylands, tropical ecosystems, cold regions)</b></li> <li>• Support ecosystem mapping activities</li> <li>• Help strengthen links with UNESCO-HIST, the European Climate Research Alliance (ECRA), EU initiatives (eg, LifeWatch) and international programs such as ILTER</li> <li>• Support the development of a network of protected areas (e.g. World Heritage Sites, World Biosphere Reserves and World Geoparks) and identify related monitoring activities and available data</li> <li>• Strengthen links with the ABCC program</li> </ul>
<u><b>EN-01 Energy and Geo-Resources Management</b></u>			
	<b>Overview</b>	<b>Highlights</b>	<b>Actions Needed from GEO Members and Pos</b>
<b>G</b>	<p>Tools and information for the resource assessment, monitoring and forecasting of energy sources (including solar, wind, ocean, hydropower, and biomass) and geological resources (e.g. mineral, raw material) are developing. However, applications and services need to be developed in the fields of ocean, hydro, nuclear, and fossil fuel energies. Also, outreach work is needed to ensure that users are confident in using Earth observations and information for energy applications</p>	<ul style="list-style-type: none"> <li>• New decision-support tool delivered on energy policy (the EnerGEO Knowledge Geportal enables impact assessments of various energy mix scenarios)</li> <li>• Global Atlas for Solar and Wind Energy launched as an operational tool; the Atlas is the largest-ever initiative to assess renewable energy potential on a global scale; to be extended to Bio-Energy and Marine Energy through the Architecture Implementation Pilot (AIP-6)</li> <li>• BioEnergy Atlas for South Africa released (first outcome of BioEnergy Atlas for Africa effort); most Atlas datasets are tagged for inclusion in the GEOSS Data-CORE (full and open access)</li> <li>• Ten downstream services developed and demonstrated (e.g. related to solar, wind and biomass, electricity grid management, and building engineering); ready to interface with the private sector (ENDORSE project)</li> <li>• Several projects ongoing on “Climate Forecasting Tools for Renewable Energy Resource Mapping and Spatial Planning” (CLIM-RUN; EUPORIAS; SPECS)</li> <li>• Two EnerGEO Summer Schools held to help unlock renewable energy potential in Africa (Kampala, Uganda, 4–13 March 2013; Utrecht, NL, 15-25 Oct 2013)</li> <li>• Training course held to foster the use of Earth observations in solar energy management (Sophia Antipolis, France, 23-24 Jan, 2013)</li> <li>• GEOSS “webservice-energy.org” community portal connected to GEOSS Portal</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• <b>Develop Earth observation based applications and services in the fields of ocean, hydro, nuclear, and fossil fuel energies</b></li> <li>• Provide incentives to energy industry (hydro, nuclear, fossil) to collaborate and share data</li> </ul> <p><i>User Engagement</i></p> <ul style="list-style-type: none"> <li>• Make energy users aware of benefits of Earth observation based tools and services</li> </ul>

<u>HE-01 Tools and Information for Health Decision Making</u>			
Y	Overview	Highlights	Actions Needed from GEO Members and Pos
Y	<p>The Health Community of Practice is working to advance activities in five main areas (airborne diseases and air quality, water-borne diseases, vector-borne diseases, urban health forecasting, and infectious disease emergence/spread). While individual projects make progress, the Community of Practice is seeking to develop a “bigger picture” for the Health Societal Benefit Area, trying to connect priority areas, and identify resources and people who are able to contribute to the Task</p>	<ul style="list-style-type: none"> <li>• New Malaria map-room developed to help anticipate time and conditions suitable for malaria transmission (e.g. average temperature between 18°C and 32°C and relative humidity greater than 60%)</li> <li>• New Meningitis map-room launched to provide information tools for epidemic meningitis (e.g. observed distribution maps during 1841-1999 and predicted probability maps)</li> <li>• Meningitis outbreak prediction exercise conducted in Benin, Chad, Nigeria, Togo, Ivory Coast, and Senegal (global humidity forecasts drawn from TIGGE archive; see Task WE-01)</li> <li>• New tool developed to provide access to metadata for health surveillance, climate, ocean and environmental data sets through a single online portal (MATCH)</li> <li>• Information clearinghouse for tick-borne diseases in preparation</li> <li>• 5<sup>th</sup> Health and Environment Community of Practice meeting held (23-25 July 2013, Washington DC, USA); Main message from WHO is GEO needs to show that attainment of Sustainable Development Goals (SDGs) cannot be fully achieved without Earth observation and information</li> </ul>	<p><i>Management</i></p> <ul style="list-style-type: none"> <li>• <b>Ensure active participation from Leads and Contributors and provision of information</b></li> </ul> <p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Expand national/international participation in GEO health activities</li> <li>• Help foster integration between development agendas of GEO, Global Framework for Climate Services (GFCS), Sustainable Development Goals (SDGs)</li> <li>• Encourage WHO to become a Participating Organization of GEO</li> </ul>
<u>HE-02 Tracking Pollutants</u>			
G	Overview	Highlights	Actions Needed from GEO Members and Pos
G	<p>The development of a global observation system for mercury is advancing well. Also, the implementation of a global monitoring plan for persistent organic pollutants (Phase II) is making progress, consistently with the terms of the Stockholm Convention. However, activities to monitor pollutants and their compounds in air, water, soil, vegetation and biota remain limited to mercury and persistent organic pollutants. Efforts could be extended to additional pollutants pending on further contributions by GEO Members and Participating Organizations</p>	<ul style="list-style-type: none"> <li>• Ground-based observing system for mercury established</li> <li>• Ocean and troposphere field campaigns conducted over Mediterranean Sea and Atlantic Ocean</li> <li>• Cyber-infrastructure collecting near real-time mercury data from ground-based sites; Quality Assurance/Quality Control system implemented and under testing; Historical datasets and metadata completed; Data portal launched</li> <li>• Networking activities ongoing to develop capacity and improve instrumentation and system design</li> <li>• Data support for the newly-adopted Minamata Convention getting organized</li> <li>• Persistent Organic Pollutants (POP) concentration data in ambient air, human blood and milk evaluated; major drawbacks identified</li> <li>• Baseline data gathered for 10 new POPs listed in Stockholm Convention</li> <li>• New Global Environmental Assessment Information System (GENASIS) inaugurated to provide comprehensive information on contamination by chemicals (e.g. POPs)</li> <li>• New database developed for POPs data, incl. visualization tools (www.pops-gmp.org)</li> <li>• Showcase proposed for the GEO 2014 Ministerial Summit (Global Mercury Observation System)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Expand national/international participation in pollutant monitoring activities</li> <li>• Support full and open access to biomonitoring data (human milk and blood)</li> <li>• Increase advocacy for in-situ Quality Assurance/Quality Control procedures</li> </ul> <p><i>Technical</i></p> <ul style="list-style-type: none"> <li>• Develop more advanced sensors for Mercury and POPs to make observing systems less human dependent</li> <li>• Develop datasets on human exposure to mercury, and links between mercury in ambient air and human health</li> </ul>



<u>WA-01 Integrated Water Information (incl. Floods and Droughts)</u>			
	Overview	Highlights	Actions Needed from GEO Members and POs
<b>G</b>	<p>Water activities are making progress, mainly focusing on the development of new products, and the coordination and use of Earth observation/information. This relies on the work of the GEO Water Community of Practice as well as major regional capacity building initiatives (Asia, Africa, and Latin America &amp; the Caribbean). Progress on Cold Regions (Cryosphere) is also significant, supporting ongoing projects and programmes, and improving access to Cold Region data through the GEOSS portal</p>	<ul style="list-style-type: none"> <li>• “Strategy for Water-cycle Observations for GEO” produced (major revision of 2004 IGWCO Report)</li> <li>• JAXA Global Rainfall Watch launched, offering hourly global rainfall maps in near-real-time (approx. 4 hours after observation)</li> <li>• Final versions of monthly and daily precipitation data sets released (GPCP)</li> <li>• Black Sea catchment observation system developed (open-source portal to discover, access and process geospatial &amp; hydrological data; EnviroGRIDS project)</li> <li>• JAXA Water Cycle Portal expanded to provide access to in-situ water cycle data from the WMO Global Terrestrial Network – Hydrology (GTN-H)</li> <li>• GEOWOW water discharge project underway combining GRDC run-off data and TIGGE weather forecasts (Task WE-01)</li> <li>• Collaboration between Health and Water areas explored (e.g. on water quality monitoring and indicators; 5<sup>th</sup> Annual Meeting of Health and Environment Community of Practice (Washington DC, USA, July 2013)</li> <li>• GEO Cold Regions initiative gathering momentum; Initial contributors include Polar Data Catalogue (Canada), National snow and Ice Data Centre (USA), Norwegian Meteorological Institute, Sustaining Arctic Observing Networks (SAON), Svalbard Integrated Arctic Earth Observing System (SIOS), CryoClim, Third Pole Environment (TPE), WMO</li> <li>• Recent interactions with the Swiss Experiment Platform (SwissEx), Pan-Eurasian Experiment (PEEX), Svalbard Integrated Arctic Earth Observing System (SIOS), Southern Ocean Observation System (SOOS), and International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT)</li> <li>• Antarctica land cover mapping completed; Third Pole Environment (TPE) Database created and made publicly searchable</li> <li>• CryoClim cryosphere climate monitoring service and Cryosphere Constellation of Portals under development</li> <li>• Political consensus growing in the framework of GEO to effectively coordinate 7 African transboundary river basins (Lake Chad, Medjerda, Niger, Nile, Oougoué, Oum Erabia, Volta); African Water Cycle Coordination Initiative (AfWCCI) 3<sup>rd</sup> workshop held in El Jadida, Morocco, Feb 2013</li> <li>• Three independent webinar series inaugurated, featuring ocean acidification, water quality, and capacity building for Latin America (GEOSS in the Americas/CIEHLYC); the latter was held in English/Spanish, and recorded/made available for later viewing</li> <li>• Showcase proposed for the GEO 2014 Ministerial Summit (Online GEOSS Water Services)</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Ensure national/international participation in GEO water activities, e.g. groundwater and Cold Regions (Cryosphere) activities</li> <li>• Promote regional water initiatives in Asia, Africa, Latin America (e.g. AWCI, AfWCCI, CIEHLYC)</li> <li>• Design and follow a long-term funding strategy for strengthening in-situ water observing/monitoring networks, beyond the funding period of research projects</li> <li>• Provide funding for GEO Water coordination activities</li> </ul>
<u>WE-01 High-impact Weather Prediction and Information</u>			
	Overview	Highlights	Actions Needed from GEO Members and Pos
<b>G</b>	<p>Progress continues on the global multi-model prediction of high-impact weather and the related development of user-driven probabilistic products for improved early warning. Current funding is ensured, however major hurdles could be faced in the post-2014 era when major supporting programmes have terminated.</p>	<ul style="list-style-type: none"> <li>• Prototype early-warning products developed for: (i) tropical cyclone track &amp; strike probability, and (ii) extreme weather (heavy rainfall, strong winds, very hot or cold); To be trialled within a quasi-operational environment</li> <li>• Global weather predictions contributed by 10 leading weather forecasting centers (Australia (BOM), Brazil (CPTEC), Canada (CMC), China (CMA), France (MétéoFrance), Japan (JMA), Korea (KMA), UK (Met Office), USA (NCEP) and ECMWF)</li> <li>• TIGGE data made available for research after a 48-hour delay; regularly accessed by 100’s of users (e.g. universities)</li> <li>• TIGGE data portals under enhancement to (i) improve access to time series data, and (ii) deliver data in different formats; Connection with GEOSS Portal in progress</li> <li>• Database of European (regional) weather forecasts registered in the GEOSS Common Infrastructure and discoverable through the GEOSS Portal (apps.ecmwf.int/datasets/data/tigge_lam/)</li> <li>• Sub-seasonal to seasonal prediction dataset in planning (global forecasts up to 60 days at lower temporal and spatial resolutions)</li> <li>• Joint Water/Weather activities underway to improve the “Modeling of river discharge using weather predictions and validation based on river discharge observations”</li> <li>• Strong support from European project GEOWOW</li> </ul>	<p><i>Additional Resources and/or Contributions</i></p> <ul style="list-style-type: none"> <li>• Support the enhancement and maintenance of the TIGGE (THORPEX Integrated Grand Global Ensemble) database, tools and related products</li> <li>• Identify resources for the post-2014 era (end of THORPEX programme and GEOWOW project)</li> </ul>

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# 1 INFRASTRUCTURE

## IN-01 Earth Observing Systems

CEOS continued improving data access and interoperability of its **Virtual Constellations (VCs)** supporting the delivery of the GEOSS space segment. CEOS placed a renewed emphasis on the VC outputs to focus priorities and optimize outcomes. The latter include:

- **Ocean Surface Topography** – International consensus on measurement requirements and launch of SARAL (French-Indian mission for the monitoring of the environment: Altimetry (AltiKa) and contribution to ARGOS system)
- **Ocean Surface Vector Winds** – Data continuity and increased utilization; Rapidscat mission approval on International Space Station; new training courses for marine forecasters planned for South Africa
- **Ocean Colour Radiometry** – Multi-agency sensor calibration and validation network; two IOCCG (International Ocean Colour Coordinating Group) reports (e.g. GEO Ocean Colour observations and requirements for future sensors); 1<sup>st</sup> international Ocean Colour Science Meeting
- **Sea Surface Temperature** – 100% of GHRSSST (Group for High Resolution Sea Surface Temperature) products discoverable through CEOS International Directory Network; fully developed Climate Data Assessment Framework (CDAF)
- **Land Surface Imaging** – Land Surface Imagery (LSI) Explorer portal for improved data access; launch of Landsat-8 and Proba-V
- **Precipitation** – New Precipitation Constellation data portal initiated; GCOM-W1/AMSR-2 and Megha-Tropiques/SAPHIR data publicly available; METOP-B fully operational
- **Atmospheric Composition** – Progress on Total Ozone as an Essential Climate Variable and volcanic ash alert system; initial discussions for a GEO air quality constellation underway

Brazil (INPE) and China (CRESDA) established and upgraded **CBERS ground stations** in South Africa and Spain. Ground receiving stations are planned for CBERS-3 (launch scheduled for Dec 2013) in Hartebeeshoek, South Africa (MoU signed between China, Brazil and South Africa (SANSA)), and Maspalomas, Spain (MoU signed between Spain (INTA) and Brazil). Brazil, France and Gabon joined forces to develop the SEAS Gabon project, which will deploy an antenna and an operational ground station for receiving CBERS-3 data in **West Africa**.

A new CGMS-CEOS working group on climate was created to pursue efforts towards the definition of a Climate Monitoring Architecture for space-based observations. This includes the development of an **Essential Climate Variable (ECV) Inventory** (including 200+ data records; see [ecv-inventory.com](http://ecv-inventory.com)) to assess gaps. The first meeting of the new working group will be held in March 2014.

EEA finalized a document on “recommended solutions” for **provision of in-situ data to Copernicus**. This builds on consultation with the European Union and international in-situ providers to ensure full and open access to GMES/Copernicus data, and finalize a catalogue of in-situ needs for Copernicus services (land, atmosphere, marine, emergency). An inventory of “in-situ issues” from European GEO projects was also completed, marking the end of the current phase of in-situ coordination at EEA.

WMO further developed its Preliminary Position Paper for WRC-15 (15<sup>th</sup> World Radiocommunication Conference). The Steering Group on **Radio Frequency Protection** actively participated in several ITU-R meetings to raise the profile of WRC-15 agenda items relevant to Meteorology, Climatology and Earth observation communities. WMO maintains a website on Radio Frequency Activities containing reports of meetings ([www.wmo.int/pages/prog/www/TEM/WMO\\_RFC/index\\_en.html](http://www.wmo.int/pages/prog/www/TEM/WMO_RFC/index_en.html)). WMO continuously promotes active engagement of Member countries with national telecommunication administrations for radio frequency protection.

## IN-02 Earth Data Sets

Japan (JAXA) and the USA (NASA) progressed towards a **global, coordinated and integrated Digital Elevation Model (DEM)**, facilitating interoperability among existing Digital Elevation Model data sets. JAXA validated wide-area datasets for the ALOS PRISM DSM (Digital Surface Model).

Australia (CSIRO), with support from the ASTER Global DEM project, produced and released the **first-ever continental mineral maps**. The series of maps for Australia were registered in the GEOSS Common Infrastructure. Discussions are ongoing to identify an organization to support the creation of a mineral map on the global scale.

Two white papers related to **life-cycle data management** were delivered: GEO Long Term Data Preservation Guidelines Issue 2.0 and Browse Data Guideline.

Work advanced on the GEO **Quality Assurance (QA)** definition and the development of QA4EO implementation pilots and showcases. QA requirements were defined for several Societal Benefit Areas. An implementation plan was initiated to establish QA4EO "as a quality badge" for GEOSS data, products and information. Examples related to flooding and ozone monitoring were prepared.

Work progressed towards the development of a standard **global spatial reference frame for GEOSS** data positioning and analysis (Earth-system spatial-grid; ESSG). Best practices and guidance documents were prepared, as well as tools for cloud-based GEOSS data management, free access, and easy application. Demonstrations of an ESSG-based data sharing service for earthquake anomaly recognition and monitoring are underway. Also workshops and training courses for scientists and decision makers across Societal Benefit Areas are under preparation. In particular, training is being provided to Asia-Pacific and African nations.

CEOS increased interoperability among data sets using the GEOSS Common Infrastructure (GCI). Moreover Space Agencies adopted recommendations to improve **“open” access to CEOS data** from the GCI. Related best practice and guidance documents are under preparation.

### IN-03 GEOSS Common Infrastructure (GCI)

The GEOSS Common Infrastructure (GCI), which has the purpose to serve as a central hub for **searching, accessing and using data, information, tools and services**, continued to develop – including system monitoring, maintenance and administration of GCI-component application software and hardware platforms.

In 2013, the number of resources discoverable via the GCI increased **from 14 million to 65 million** based on registration of new Earth observation inventories (e.g. CEOS inventory). This relates to the introduction of the **Discovery and Access Broker (DAB)** from EuroGEOSS which allows real-time search of, and access to, multiple external catalogues.

Moreover new Earth observation data and products were registered in the GCI, and flagged according to their nature (e.g. **full and open access**). Efforts are ongoing to register and make accessible **Data-CORE** pledges made by Member countries and Participating Organizations. A search support for GEOSS Data-CORE was implemented. As of October 2013, 50 million potentially downloadable resources (products, files, granules, images) are tagged as GEOSS Data-CORE in the GEOSS Common Infrastructure.

A **new version of the GEO Portal** (now GEOSS Portal) and Discovery & Access Broker was launched in late 2013. The new Portal offers a number of enhancements including **better search** support and more responsive user interface. Moreover, it is faster to download (no immediate plug-ins to visualize data on the revised 2D map) and the presentation of search results has been grouped by icons, offering the possibility to **preview data** and downloading it.

Other components of the GCI have also undergone changes: the Component and Service Registry (CSR) has simplified its resource pledge and registration process. The GCI requirements baseline has been reviewed and consolidated. And the search results ranking algorithm has been improved.

These improvements were supported by the GEOWOW project (<http://www.geowow.eu/>) which helped the GCI evolve **from data discovery to data use and access**. This evolution was further supported by Phases 5 and 6 of the Architecture Implementation Pilot (see Task IN-05). As for the GCI, the Implementation Pilot priority is to (i) develop innovative methods for harmonized access and use of heterogeneous data, services, and models; and (ii) foster sharing of knowledge across disciplines for integrated assessments.

## IN-04 GEOSS Communication Networks

### *GEONETCast*

China (CMA), USA (NOAA) and EUMETSAT continued to develop GEONETCast – a **dissemination system**, which delivers GEOSS data to users **across a wide range disciplines**. GEONETCast provides **near-global geographic coverage** through data exchange between three regional Network Centers: EUMETSAT (EUMETCast, over Europe, Africa, and Americas), NOAA (GEONETCast Americas, over the Americas and Caribbean), and CMA (CMACast, over Asia and part of the Pacific).

In keeping with the goal of GEO to increase GEOSS Data-CORE, qualified **resources** in the GEONETCast Product Navigator had their metadata **flagged as GEOSS Data-CORE**.

EUMETCast and GEONETCast-Americas evolved to support national disaster management activities. These systems have been approved for **operational use by the International Charter ‘Space and Major Disasters’**. 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 the **reception of high-volume, high-resolution satellite data** and value-added products to **support disaster mitigation**.

A joint EUMETSAT-Turkish State Meteorological Service project saw **5 new EUMETCast stations** installed in the Central Asian countries of **Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Kirgizstan** by the end 2013. Work progressed on the installation of GEONETCast-Americas receiving stations in **Barbados, Belize, and Haiti**. Funding for additional GEONETCast-Americas stations in **Mexico** is being mobilized.

The capacity building project AGRICAB (with a mission to increase Africa’s capacity to use Earth observations for better agriculture and forest management) funded by EU Framework Programme 7, completed the **installations of EUMETCast-Africa stations** at the Sahara and Sahel Observatory (OSS) in **Tunisia** and at CURAT in **Ivory Coast**. EUMETSAT set up the first routine use of the EUMETCast training channel and started discussing a concept note to widen the Training Channel usage beyond meteorological community from AGRICAB project.

Preparations were made to **upgrade** the EUMETCast-Africa stations installed in context of the African Monitoring of the Environment for Sustainable Development (AMESD) project to integrate in the framework of EU **Monitoring of Environment and Security in Africa (MESA)** project. Additional stations, including some to be located in research institutes, will be established through the MESA project.

EUMETSAT organized two informational events for national hydro-meteorological services (NMHS) in **Western Balkan** countries and in **Eastern Europe** and Caucasian countries (in Sarajevo, Bosnia, April 2013 and in Baku, Azerbaijan, June 2013). In a follow-up to these events, EUMETSAT will support the **transition of the EUMETCast stations** installed in the framework of the Data Access for Western Balkan, Eastern European and Caucasian countries (DAWBEE) to DVB-S2 and will continue training. The activities for the Western Balkan NMHS will be part of the WMO-led project "Building Resilience to Disasters in Western Balkans and Turkey", funded by the EU Instrument for Pre-Accession Assistance.

**GEONETCast-Americas** held a training workshop in **El Salvador** for 15 users (April 2013). Also in April, in conjunction with the NOAA Satellite Conference, there was a WMO-sponsored “**Train the Trainers**” event on the use of GEONETCast-Americas with 22 participants. As a follow up to the event, a GEONETCast-Americas training was held through the **Virtual Laboratory** for Training and Education in Satellite Meteorology (VLab) (December 2013). In September, three people from **Barbados**, one from **Belize** and one from El Salvador came to Washington DC for a GEONETCast-Americas training held at the University Corporation for Atmospheric Research (UCAR).

Brazil (INPE) agreed to convert files provided to GEONETCast-Americas to a GEOTIFF format. This format allows for the **overlay of products**, making them more useful in accurately geo-locating features and producing **new information products**. Five products have already been converted. The USA (NOAA) will also add GEOTIFFs of **Visible, Infrared and Water Vapor** of GOES-East Full Disk images.

In early 2013, China (CMA) sent a questionnaire to all its international users regarding the operating status of the system and the users' future requirements. Several users indicated the need for **more training to operate CMACast**. CMA is working to send expert missions to carry out onsite user training in those countries. In November 2013, CMA deployed expert missions in **Mongolia** and **Nepal**, where two new stations have recently been installed.

#### *GEOSS worldwide communication network of networks*

With regard to the broader objective of developing a **GEOSS worldwide communication network of networks**, new activities were started in 2013 with an aim to enhance the GEOSS Common Infrastructure (GCI) with new data sources and mobile access capabilities. These activities complement each other also addressing the challenge of **citizen-sensing** integration into GEOSS. They include:

- The **MoblScience** initiative (IEEE), which is a system to gather Earth observation data from sensors and instruments into **mobile phones**, where it can be displayed, and then transferred into a public/private **cloud computing** system for processing, archiving and distribution. Interaction with the GCI is under study for both archiving and distribution purposes but also for allowing mobile access to other GEOSS data. MoblScience is a platform of **open source** software
- The **Omniscientis** project, which allows for odour monitoring and information system based on citizen and technology innovative sensors
- The **COBWEB** project, which aims at: (i) gathering **crowd-sourced environmental data** with an aim to aid decision making, (ii) introducing **quality measures** and reduce uncertainty, and (iii) providing tools to **fusion** crowd-sourced data with reference data.
- The **CITI-SENSE** project, which aims at the development of a sensor-based Citizens' Observatory Community for improving quality of life in cities
- The **GEOSAF Farmsupport Mobile App** project, which aims at using mobile technologies in order to access crowd-sourcing data
- The **eI4Africa** survey, which is to collect data on established and emerging e-Infrastructure applications in Africa
- The **EuroAfrica GEO-related demonstrators** (FEAST, Erina4Africa, EuroAfrica-p8, eI4Africa, AGLARBRI, SomaliREN, Ekokonnnect), which comprise lighthouse demonstrators establishing a Science Gateway (<http://sgw.africa-grid.org/>) supporting **key apps** in health, governance, and environmental monitoring.

**Interoperability** with the GCI components is being pursued. The main focus is on achieving **full and sustained integration of citizen-sensing**, as well as **mobile access to GEOSS data**, in the GCI.

The first step conducted in 2013 was to identify all actors and their complementarities. Further progress relates to defining the (i) components and tools required to perform citizen sensing, (ii) ways of the citizen-sensing full and sustained integration into the GCI, (iii) ways of the mobile access to GEOSS data into the GCI, and (iv) establish a set of demonstrators as well as a framework for showing the **benefit and value-added of integrating citizen sensing and mobile access capabilities into GEOSS**.

## IN-05 GEOSS Design and Interoperability

Progress on GEOSS design and interoperability was achieved in three main areas: (i) Architecture Implementation Pilot (AIP); (ii) Standards and Interoperability Forum (SIF); and (iii) Design and Interoperability Workshops.

### *Architecture Implementation Pilot (AIP)*

Phase 6 of the Architecture Implementation Pilot (AIP-6) was launched in early 2013 to (i) foster the use of GEOSS resources by end-users; (ii) improve the availability of GEOSS resources; (iii) increase **benefits and usability for developing countries**; and (iv) strengthen previous GEO results and technical achievements.

A Call for Proposals was launched and 17 proposals (**representing 80 organizations**) were received in response. This resulted in the formation of 11 AIP-6 Working Groups (e.g. Disaster Management & **Agriculture, Energy, Health, Water, Data Sharing**, System Design, Capacity Building, Tutorials (in coordination with the Standards and Interoperability Forum), and GCI Research).

AIP-6 will deliver results for the GEO-X Plenary and Ministerial Summit, and complete its activities in 2014 (e.g. Engineering Reports). 10 showcase videos have been proposed in support of the Ministerial Summit which translated in AIP representation in 3 of the 5 Ministerial videos. In particular, AIP (through OGC) leads the development Showcase 4: **Addressing Post-2015 Global Agenda**. Results from AIP-6 may be found at [www.earthobservations.org/geoss\\_call\\_aip.shtml](http://www.earthobservations.org/geoss_call_aip.shtml).

### *Standards and Interoperability Forum (SIF)*

The SIF continued to promote GEOSS **interoperability** principles, assist communities and providers with interoperability challenges between GEOSS resources, encourage broader use of existing standards, and support related education and outreach. The SIF published a series of **GEOSS Tutorials** assisting GEOSS users and providers in understanding how to publish, register, discover, access, and use GEOSS resources (see <http://wiki.ieee-earth.org/Documents>).

The SIF worked on two whitepapers on interoperability assessment: one on GEOSS registration alternatives, and one on **GEO Label** integration. The whitepapers will be delivered to the GEO Infrastructure Implementation Board for consideration of next steps.

The SIF contributed to the 2013 GEOSS Future Products Workshop. Also, the SIF made available a **HELP form for GEOSS contributors needing help**, for instance with interoperability, resource registration, standards, metadata, and the GEOSS Data-CORE (see <http://bit.ly/MS8COZ>).

### *Design and Interoperability workshops*

Two events were held in 2013 to identify strategic objectives for the agile development of the GEOSS **System-of-System design based on interoperability arrangements**: the GEOSS Future Products Workshop, and the GEOSS Vision and Architecture Working Meeting.

The GEOSS Future Products Workshop (March 26-28, 2013, NOAA Science Center, Silver Spring, USA) provided a unique opportunity to learn how GEOSS as a platform makes all sorts of sensor and model data available in an interoperable manner. Data streaming from in-situ and remote sensing sensors (**Sensor Web**), models (**Model Web**) offer huge potential to generate a wide portfolio of on-demand and near real time products (see <http://www.ogcnetwork.net/node/1872> and EarthZine paper [www.earthzine.org/2013/10/01/geoss-future-products-recommendations-from-a-workshop/](http://www.earthzine.org/2013/10/01/geoss-future-products-recommendations-from-a-workshop/)).

The GEOSS Vision and Architecture Working Meeting (20 September 2013, ESA, Frascati, Italy) considered the **future of the GEOSS Information System** with emphasis on new and emerging sources, processing and decision-support capabilities. The latter should inform the Post-2015 GEOSS strategy.



## 2 INSTITUTIONS AND DEVELOPMENT

### ID-01 Advancing GEOSS Data Sharing Principles

The Data Sharing Working Group (DSWG) intensified work to develop, populate and implement the GEOSS Data-CORE (see Appendix). The Data-CORE aims to provide **full, open and unrestricted access** to a core set of essential environmental observation and information products, in accordance with the GEOSS Data Sharing Principles.

As of October 2013, over **50 million GEOSS Data-CORE resources** can be discovered through the GEOSS Common Infrastructure (GCI) and it is expected that this number will further increase as a result of the contacts made by the GEOSS Data-CORE and GCI Sub-group with GEO members that have pledged data (the European Commission, which has started to transfer responsibilities to the GEO Secretariat, will continue to support Data-CORE activities until the end of 2013).

The DSWG participated in the current Architecture Implementation Pilot (AIP-6; see Task IN-05) and conducted a test to check whether the GCI can find the current licensing metadata and make it available to GEOSS users. A call for data providers to assist the group in this effort was issued. Also within AIP-6, the list of **use metrics information** to be collected started to be reviewed with the dual aim of (i) understanding how many users can access GEOSS Data-CORE data, and (ii) tracking the re-use of GEOSS data.

Individual DSWG Sub-groups also achieved significant progress. The **Data Documentation and Quality** Sub-group carried out work on data documentation and quality in coordination with the relevant Infrastructure Tasks (primarily IN-02 "Earth datasets"). In 2013, this Sub-group finalized a recommendation on guidelines for the documentation of data quality. The Sub-group is working on coordinating its activities with other GEO and non GEO bodies. For example, coordination with the Committee on Earth Observing Satellites (CEOS) has resulted in improved discussions on data quality, and a CEOS representative now serves on this Sub-group.

The **Legal Interoperability** Sub-group revised its background white paper and compiled a list of open access licenses and waivers, as well as restricted licenses, used within GEOSS and their key characteristics. The list is being submitted to the GEO-X Plenary, and will be updated before each subsequent GEO Plenary.

The Legal Interoperability Sub-group also finalized a short review paper, "Interpretation of the full and open (free and unrestricted, etc.) access to and use of (geographic) data: existing approaches". The paper focuses on the **comparison of the terms used as equivalents to "full and open"** concept for sharing data through GEOSS, and highlights the similarities and differences in approaches, policies and their implementation in various jurisdictions. The Sub-group also plans to develop educational and training materials on open access licenses and waivers for data providers and users.

The **Capacity Building** Sub-group began to develop documentation to support the establishment of national coordinating mechanisms and **more open policy framework**, and promote with data providers the benefits of full and open access to data. The overall strategy is to identify lessons learned and best practices based on the experiences of GEO Members. A questionnaire to investigate barriers that hinders data sharing and approaches to improving data sharing has been developed and should be circulated at GEO-X Plenary.

In summary, the implementation of the GEOSS Data Sharing Action Plan is making progress. The DSWG has now extended its activities to ensure that it addresses all of the actions of the GEO-VII Data Sharing Action Plan. The DSWG is also monitoring whether additional challenges emerge in sharing or accessing GEOSS data and identifying additional opportunities to further implement the GEOSS Data Sharing Principles.

However, the DSWG recognizes that **additional resources** are needed to ensure desirable levels of participation by developing country representatives in Working Group activities and desirable levels of outreach to developing country data users and providers. The DSWG also recognizes the need for expanded participation in Working Group activities from Members and Participating Organizations.

The DSWG also considers it critical that contributions to the GEOSS Data-CORE are actively encouraged and followed upon, as such actions are critical to ensuring the success of GEOSS. This requires a central focal-point and a continuous effort which goes beyond the available resources of the DSWG.

The DSWG is planning a side event at the GEO-X Plenary and 2014 Ministerial Summit that will showcase the DSWG's activities and provide an opportunity to attract additional participation.

Finally, the DSWG is discussing possible strategies to be taken into consideration by the GEO Post-2015 Working Group. Topics and/or issues include: Updating the Data Sharing Principles; Increased responsibility and role of the GEO Secretariat in supporting the implementation of the GEOSS Data-CORE; The GCI and the Data Sharing Action Plan; Improving the inclusion of commercial data systems in the GEOSS; and Exploring the implication of new Earth observation concepts and technologies, such as Citizens' Observatories. The DSWG agreed to develop some options for revised Data Sharing Principles in the post-2015 era.

## ID-02 Developing Institutional and Individual Capacity

### *New initiatives for capacity building*

Two **new EU-funded projects** have been launched in June 2013: **EOPOWER** (Earth Observation for Economic Empowerment; [eopower.eu](http://eopower.eu)) and **IASON** ([iason-fp7.eu](http://iason-fp7.eu)).

EOPOWER aims to create conditions for **sustainable economic development through increased use of Earth observation products and services** for environmental applications. This purpose serves the higher goal of effective use of Earth observation for decision making and management of economic and sustainable development processes.

IASON has the ultimate goal of establishing a permanent and **sustainable network** of scientific and non-scientific institutions, stakeholders and **private sector** enterprises from the EU and developing countries located in the **Mediterranean** and the **Black Sea** regions.

Both projects build on the **legacy of former EU-funded projects** such as GEONetCab, BalkanGEONet, OBSERVE, enviroGRIDS, SEOCA and EGIDA. This legacy includes GEONetCab global and regional marketing studies, success stories, marketing toolkits and feedback from promotion activities and quick-win projects.

The “**Bringing GEOSS services into practice**” teaching material has been upgraded and is now freely available as a **PDF** document, an iBook, and all software components are already installed on a virtual machine. This material (originally developed by EnviroGRIDS) will be supported by the EOPOWER and IASON projects. More information and **download** at [unige.ch/sig/enseignements/GeossInPractice.html](http://unige.ch/sig/enseignements/GeossInPractice.html).

The CEOS Working Group on Capacity Building & Data Democracy (WGCapD) and EOPOWER are pursuing the **Capacity Building Inventory Project** which will compile results from surveys into a comprehensive resource of recent, ongoing, and planned capacity-building projects around the world in the use of space-derived Earth observation data. The information collected will populate an interactive **map website** (GEONetCab Portal; [www.geonetcab.mdweb-project.org/search/main.jsf](http://www.geonetcab.mdweb-project.org/search/main.jsf)) that can be used by all stakeholders to better coordinate existing capacity building efforts and **inform future planning**.

### *Ongoing initiatives with strong capacity building components*

Numerous activities entail strong capacity building components critical in addressing GEOSS Strategic Targets (see also IN-04). For instance:

a) The **GEONetCast Users Community Forum**, organized by GEONetCast Providers (EUMETSAT, NOAA, CMA) and CEOS (Working Group on Capacity Building & Data Democracy WGCapD), was very active in developing stronger ties among the GEONetCast Community and fostering data use

b) AFRIMET (Conference of Directors of National Meteorological and Hydrological Services of West Africa) delivered hydrological and meteorological **instrumentation** for the services of **Guinea-Bissau, Liberia, Sierra Leone, Ivory Coast and Togo**

c) CIHMET (Conference of Directors of Ibero-American Meteorological and Hydrological Services) worked to improve **station infrastructure for river systems**, as well as open source software for database management. CIHMET also held targeted workshops to improve weather & climate observation network by evaluating current operational capacity, performance & requirement for new sensors, deployment and communications

d) Activities for the development of a **Madagascar GEO website** facilitating data sharing were launched, also supporting the development of a communication network to foster benefit from available data

- e) The EU-funded EO2HEAVEN project (Earth Observation and Environmental Modeling for the **Mitigation of Health Risks**) (i) provided training courses to partners in Africa through workshops; and (ii) informed the public on the relationship between the environment and public health through newsletters
- f) The EU-funded EnviroGRIDS project produced educational material to promote the use of web-based services to **share and process large amounts of key environmental information** in the Black Sea region (<http://envirogrids.net/>)
- g) The 1st **e-learning course** of the CEOS Working Group on Capacity Building & **Data Democracy** was held in spring 2013. This was based on numerous lectures towards (i) wider and easier access to Earth observation data; (ii) increased **sharing** of software tools; and (iii) increased data **dissemination** capabilities, transferring technology to end-users ([dpi.inpe.br/ceos/e\\_learning/](http://dpi.inpe.br/ceos/e_learning/)). The course was targeted at developing countries in Africa. Thirty people participated (from **South Africa, Nigeria, Kenya, and Tanzania**) over the 4 months that the course ran, and 16 completed all of the requirements and received the certificate
- h) A series of technical workshops was held in Southeast Asia, e.g. the LEAF Forest Degradation Monitoring Experts (Bangkok, Thailand, November 2012)
- i) A series of international courses on **Tropical Forest Monitoring** was organized by Brazil (INPE) Regional Center for **Amazonia**, e.g. the 7<sup>th</sup> in November 2012 for French speaking countries (**Congo and Cameroon, Senegal and Guinea**)
- j) Activities were undertaken to define (i) GEO capacity building **performance indicators** (measurable, verifiable and relevant); and (ii) a framework for measuring GEO Capacity Building indicators, sources of measurement, procedures and measurement frequency.

#### *Tools and open-source software*

The Earth Observation community (<http://52north.org>) released and updated **open-source software** to process **GEONETCast** and ESA data (through the Data Dissemination System). Related capacity building information, hands-on exercises and sample data are **freely available** through a portal registered in the GEOSS Common Infrastructure (<http://www.itc.nl/Pub/WRS/WRS-GEONETCast>).

Brazil (INPE) further developed **TerraHidro**, a distributed hydrology modeling system created to design Geographic Information Systems (GIS) applications for **water flow in hydrographical basins**. The latter will align with the DEM (Digital Elevation Model) project developed with CEOS WGCapD. The 1st DEM Workshop (Nairobi, Kenya, 6-10 May 2013) was held to build capacity in the Eastern African region for **utilizing satellite-derived digital elevation data** (especially the newly released 30m elevation data from the Shuttle Radar Topography Mission (SRTM)) with an emphasis on hydrological models.

Training on the use of the open source software for **deforestation monitoring “TerraAmazon”** continued. An agreement was signed between Brazil (INPE) and the Development Bank of Latin America (CAF) to elaborate training material and video-classes; to be available from early 2014.

### ID-03 Science and Technology in GEOSS

A **GEOSS Science and Technology (S&T) Service Suite (GSTSS)** has been developed, including the GEOSS S&T Portfolio, a Meeting Portal, an Outreach library, a forum for discussion of research on Earth observation systems, and a user feedback utility. The GSTSS is available at <http://www.gstss.org> and is partly based on deliverables of the EU-funded project EGIDA. The Meeting Portal allows coordination and documentation of GEO-related sessions and presentations at major international S&T meetings. Outreach material will be added to the Outreach Library of the GSTSS. The comprehensive user-feedback utility allows users of GEOSS and Earth observation data to evaluate services and datasets and provide comments and reviews.

The **GEOSS Portfolio for Science and Technology** is populated and features “compelling examples” of GEO activities, projects, and Work Plan Tasks that demonstrate GEOSS benefits for science and technology communities across Societal Benefit Areas (see [gstss.org/portfolio](http://gstss.org/portfolio)). The related website notes that the portfolio shows how products accessible through the GEOSS Common Infrastructure work for S&T communities.

The **Data Citation Standard V1** has been completed. Work has begun on drafting the GEOSS Data Citation Standard Version 2 (see <http://www.geo-tasks.org/id03>). Current contributors include ESIP, ICSU World Data System (WDS) and CODATA Data Citation Task Group, and the Board on Research Data and Information of the National Academies (USA). Delivery is expected before the end of 2013.

### ID-04 Building a User-Driven GEOSS

The **User Requirements Registry (URR)** was further developed as a component of the GEOSS Common Infrastructure (GCI). The URR is for the collection of user-related information. Its primary objectives are to enable users to guide GEOSS implementation, and establish and sustain an ongoing **dialogue with user communities** (feedbacks on experience). There are still technical issues that need to be addressed, however the URR is showing great potential. IEEE will be working closely with the URR developers to ensure smooth incorporation into the GCI.

CEOS and ESA produced a new version of the **Earth Observation Handbook**. This includes comprehensive information about various Earth observation activities and a **catalog of the world’s satellites and missions**.

The **Earthzine** online publication (<http://www.earthzine.org/>) continued to grow and evolve. Primary objectives include (i) **transfer knowledge** to professionals as well as to the general public; (ii) increase interaction and engage relevant communities into GEOSS implementation; (iii) develop mechanisms for coordinating **user requirements, feedback and engagement** across all Societal Benefit Areas; and (iv) increase **awareness amongst policy and decision makers**, especially in **developing countries**, on the benefits from Earth observation and the need to support capacity building for Earth observation integration into decision making.

Numerous **outreach** activities were held in 2013 including: (i) 1-day user forum on "**Societal impacts and benefits of improved environmental and geospatial information**", Geospatial World Forum, Rotterdam, Netherlands, 15 May 2013; (ii) 2-day conference on "**Big Data**", Rome, Italy, 6-7 June; (iii) 2-day workshop devoted to GEO outreach to the wider Balkan area, Novi Sad, Serbia, 19-20 September, 2013

## ID-05 Catalyzing Resources for GEOSS Implementation

The GEONetCab report on **Marketing of Earth observation products and services** was finalized. The report provides an overview of potential applications of Earth observations, including socio-economic benefits, and discusses best practices for successful promotion and capacity building.

The document draws on 11 sets of **marketing toolkits** that address the following issues: disaster management, crop modeling, water management, environmental management, climate change, marine resources, forestry, health, energy, weather, and urban management, Spatial Data Infrastructure & land administration.

The **resource facility** of the GEONetCab project was developed and is now linked to the GEOSS Portal (see GEONetCab Portal; [geonetcab.mdweb-project.org/search/main.jsf](http://geonetcab.mdweb-project.org/search/main.jsf)). Together with other (regional) resource facilities, this ‘capacity building web’ will be enhanced during the lifetime of the EOPOWER project (June 2013 – May 2015; see Task ID-02).

In cooperation with the CEOS Working Group on Capacity Building & **Data Democracy**, preparations have been made to also use the GEONetCab Portal as a CEOS resource for information. The Portal is a first point of access for decision-makers who want to learn more about Earth observation potential.

A **dissemination strategy** was developed for two projects, supported by the European Commission: **EOPOWER**, a project dedicated to increasing the impact of Earth observation applications for the environment and GEO/GEOSS in Africa, Latin America and several European regions, and **IASON**, a project dedicated to the uptake of research results in the Mediterranean and Black Sea regions in the areas of coastal management, soil and water management and mining and mineral exploration.

Numerous **promotion activities** were organized in 2013, including:

- (i) Presentation of the GEONetCab project and ‘do’s – and - don’ts’, XVI Brazilian Remote Sensing Symposium, Foz do Iguaçu, **Brazil**, April 2013, for **scientists and professionals**.
- (ii) “Environment and risk management: the added value of satellite applications”, Brussels, **Belgium**, April 2013 - a workshop for **politicians, managers and Earth observation professionals**, organized by Eurisy and the GEONetCab project
- (iii) A session on socio-economic benefits of Earth observations, Geospatial World Forum, Rotterdam, **Netherlands**, for **politicians, managers and Earth observation professionals**.
- (iv) A Conference on “Earth observation for development”, Brussels, **Belgium**, September 2013, for **EuropeAid / EC Directorates staff**.
- (v) “The future of Earth observation in the wider Balkan area”, Novi Sad, **Serbia**, September 2013, the closing event of the BalkanGEONET project, for the **business community and the public sector** in Europe and beyond.
- (vi) International **mobilization of resources for water** beyond the 2013 International Year of Water Cooperation, ISRSE35, Beijing, China, April 2013, for **decision-makers and Earth scientists**
- (vii) Various presentations promoting the use of GEOSS, Global Geospatial Conference, Addis Ababa, **Ethiopia**, November 2013, a combined event of GSDI and AfricaGIS (EIS Africa), for the **geospatial community**

### 3 INFORMATION FOR SOCIETAL BENEFITS

#### SB-01 Oceans and Society: Blue Planet

A **Blue Planet white paper** has been developed that includes a mission statement, detailed structure, governance, added-value and resource mobilization for the Task. A **steering committee** for Blue Planet has been formed with representation from the Component Leads, as well as from agencies and institutions with an interest in the success of the Blue Planet.

The committee's Terms of Reference are designed to: (i) Oversee and guide the evolution of the Blue Planet Task; (ii) Promote the Blue Planet in appropriate international scientific fora; (iii) Constitute the governance structure for the Task; (iv) Promote the **societal applications** of ocean observations; (v) Facilitate the **interconnections** between elements of Blue Planet; (vi) Aid **delivery of benefits to society** from Blue Planet; and (vii) Assist in **securing a resource base** for execution of the Blue Planet Task.

Blue Planet is collaborating with the European Commission (EC) and North America (Canada and the USA) in its efforts to promote a **transatlantic initiative in ocean observing**. Blue Planet has been recognized by the EC as a viable platform on which the **cooperation** could be based, and the EC and Blue Planet are appearing together in a joint side event at the **GEO-X Plenary** (Geneva, 15-16 January 2014).

The Europe-funded FP7 project GEO-WOW has progressed in developing applications and **integrating ocean data streams** into the GEOSS Common Infrastructure. The main focus is on ocean assessments and ecosystem applications but will eventually extend to including all ocean data streams ([www.geowow.eu](http://www.geowow.eu)).

Progress continues to be made on inter-comparison and validation of **ocean forecasting systems**, observing system evaluation, and coastal & shelf-seas forecast model coordination. Activities mainly relate to the **Global Ocean Data Assimilation Experiment** (GODAE) OceanView, JCOMM Operational Ocean Forecasting Systems (ETOOFS), POGO, and regional plans such as Copernicus MyOcean and SOOS (Southern Ocean Observation System). In the context of GODAE Ocean View, several teams have been established to coordinate activities with the meteorological and oceanic communities. Topics include Short to Medium Range Coupled Prediction, **Marine Ecosystem Prediction**, and Coastal and Shelf Seas.

A **book** is being prepared based on the Blue Planet Kick-off Symposium (Ilhabela, Brazil, November 2012). The manuscript is finished and it will be issued by a British publisher in the spring of 2014.

## SB-02 Global Land Cover

The GEO Global Land Cover team is working to improve **coordination of land cover activities around the globe**. It seeks to develop an international network where GEO members can express their needs for land cover products and contribute mapping and monitoring efforts. Through its activities, the Land Cover team aims to meet the product needs of numerous stakeholders including environmental agencies, science (climate) communities, national mapping agencies, commercial users, and UN Conventions.

China (NASG), USA (Univ of Maryland, USGS), ISPRS and partners are advancing the production of **global land cover products at high-resolution** (both temporal and spatial: annual and **30m** respectively). The 30m global open water data will be released after validation at the end of 2013, as well as the mapping of other land cover categories (built areas, farm land etc). The complete Global Land Cover dataset will be released after extensive validation in 2014.

The ESA Climate Change Initiative is progressing on the production of global land cover data to support the monitoring of land cover as an **Essential Climate Variable (ECV)**. The first product will be released in late 2013 under the leadership of Belgium (Universite Catholique de Louvain). The GOFC-GOLD Land Cover Office participates actively in the validation of these land cover ECV products.

The USA has launched **Landsat 8** which has begun official operations on 30 May 2013. The new satellite will be a key asset for continuous and consistent land cover observations worldwide. ESA is working on the **Sentinel 2** satellite mission (to be launched in 2014). Sentinel 2 will provide **10, 20 and 60m spatial resolution data** with 5-day global revisit time (2 satellites). It will also feature additional bands for detecting the “red edge” for leaf chlorophyll concentrations and thereby improve current global land cover products.

The concept and architecture of a collaborative and dynamic **Global Land Cover Information Service System (GLC-ISS)** is under investigation. Such a web-based service system would be established by linking available global, regional and local land-cover resources and would contribute by providing online dynamic services (e.g. for validation). A concept paper has been developed and presented at the GEO/ISPRS Beijing workshop in April 2013. A follow-on proposal may be submitted to the GEO-X Plenary in Jan 2014.

GOFC-GOLD (Land Cover Office) in partnership with the USA (Boston University) and CEOS (WGCV land validation subgroup) is developing an **independent and updated validation database for global land cover products**. The database is based on multi-spectral, very high spatial resolution satellite images that are photo-interpreted. In addition, GOFC-GOLD is working on an online database to make validation data produced through the ESA Climate Change Initiative available to users. The first version was presented in April 2013 ([gofcgold.wur.nl/sites/Gofcgold\\_Symposium2013.php](http://gofcgold.wur.nl/sites/Gofcgold_Symposium2013.php)). Additional datasets will be made available in 2014.

Also, EEA is developing and testing a methodology to **augment existing global validation data** with continental, regional or national data. In a first pilot, EEA will contribute to the verification of the European parts of the Chinese 30m open water product in 2014-2015. All validation activities were discussed at a GEO/ISPRS workshop organized in April 2013 (Beijing, China).

With regard to Africa, the EC (JRC) is advancing on the (i) capturing of land-cover conversions and ecosystem disturbances at 30m resolution; (ii) validation of test sites (checked with a network of African specialists); and (iii) definition and processing of **land cover standards and change** in the African region.

In parallel, the need for a **working group on Land Cover for Africa** as a contribution to the **AfriGEOSS** initiative has emerged at the International Symposium on Land Cover Mapping for the African Continent (June 2013, Nairobi, Kenya). This working group has been launched in November 6<sup>th</sup> 2013 in Addis Ababa, Ethiopia with the nomination of an executive board and a technical advisory



board and the Terms of Reference. The initial aim of this group is to contribute to the development of the **30m resolution map for Africa** bringing together users and providers from all the African Regions.

With regard to **capacity building**, several workshops and training courses have been organized e.g. Global Land Cover mapping technique using 30 meter resolution (early 2013, China); Global Land Cover portal and dynamic information service (Oct 2013, Europe); several GOFC-GOLD regional network meetings on data sharing and capacity development; Science Education through Earth Observation for High School projects.

Other influential meetings include the 1st GEO Global Land Cover meeting (April 2013, Netherlands), and the 3rd International Workshop on High Resolution Global Land Cover Mapping (April 2013, China). The 2nd GEO Land Cover meeting will be held in Berlin, Germany as a side-meeting to the EARSeL-NASA Conference (March 2014). This workshop will aim to discuss progress with an emphasis on the development of the GEO Land Cover data portal and related contribution to the **GEOSS DataCORE**.

A special issue on Global Land Cover Mapping and Monitoring is under preparation for the ISPRS Journal ([journals.elsevier.com/isprs-journal-of-photogrammetry-and-remote-sensing/call-for-papers](http://journals.elsevier.com/isprs-journal-of-photogrammetry-and-remote-sensing/call-for-papers)). The special issue intends to shed light on progress, challenges, and opportunities for mapping and monitoring global land cover conditions at various scales, particularly at 30m resolution. The planned publication date is spring/summer 2014.

### **SB-03 Global Forest Observation**

The activities of the Global Forest observations initiative (GFOI) are organised under **5 elements**. These are the Space Data (led by CEOS, Australia and Norway), Methods and Guidance Document (led by Australia), Capacity Building (led by the USA), Research & Development (led by Norway) and the GFOI Office (supported by Norway and Australia).

#### *Space Data*

CEOS has set up the Space data Coordination group (SDCG) to assist GFOI in the space data acquisition and provision. CEOS approved the Baseline Global Acquisition Strategy for the Global Forest Observations Initiative in March 2013. This **commits the CEOS agencies** to acquire core data annually for an expanding list of countries starting in 2013 and with global coverage by 2016 (see Table below).

This baseline strategy provides for **coordinated global data acquisition strategy** involving a number of core data streams that can be shared openly and acquired free-of-charge for GFOI purposes. This involves **systematic and sustained wall-to-wall acquisitions of forested areas**, globally repeated on timescales consistent with national reporting commitments and the requirements of national forest information systems - at least annual monitoring **in support of biennial reporting for developing countries under REDD+ provisions**.

This would provide the default forest observations data for all countries without specific technical requirements, heritage or data preference (e.g. among Landsat, Sentinel 1 and 2 as they become available, and other potential sources such as CBERS-3 and -4 and RADARSAT).

The SDCG held a meeting on 4-6 September 2013 in Pasadena, USA which started development of its plan for Space Data Services, element 2 of the Baseline Global Acquisition Strategy. This involves additional services such as analysis of historical archives and monitoring acquisitions.

#### *Methods and Guidance Documents*

The first **GFOI guidance document** has been completed in December 2013. In 2014, GFOI will promote the use of this document, incorporate it into capacity development and collect feedback on its use. Additional supporting material will also be produced. The advisory group, which was appointed to provide a “user perspective” and guide the development of the documents, will consider if and when updates are needed to the document.

#### *Capacity Building*

National capacity building activities have also continued to progress. Regional capacity building workshops have been organized in the **Americas** in connection with the **US Silvacarbon** program. Repetition of a similar series of workshops in **Africa and South East Asia** will start in 2014. Some additional support and capacity building has also been provided under bilateral support provided by Australia and Norway. Initial discussions and information sharing with FAO are aimed at better coordinating GFOI and FAO capacity building programmes.

#### *Research & Development (R&D)*

Work on the **R&D Plan** has continued with the production of a review of the R&D needs of countries in order to implement practical national forest monitoring and MRV systems. This was widely reviewed by experts and country representatives and the final document released. This, together with the Methods and Guidance Document will form the basis of an R&D plan to be finalised in 2014.

*GFOI Office*

The **Global Forest Observation Initiative Office** was established on the 4<sup>th</sup> of February, with the hiring of the Office coordinator, Mr. S. Eggleston. The main aim of the office is to better coordinate the various activities of GFOI and to better coordinate GFOI with related activities undertaken by other organisations such as FAO and the World Bank.

Through the year the Lead Team met 4 times and the Advisory committee met twice to discuss the best way for GFOI to move forward. These meetings established that GFOI is best placed to support other organisations that are already working with countries such as FAO and World Bank, bilateral support arrangements and possibly NGOs.

Thus GFOI need not duplicate the country contacts directly but, working with these organisations, understand country needs and ensure the sustained supply and use of satellite data. A **work plan for 2014/15** has been drafted reflecting this approach. **Delivery of data to countries in a form they can use**, consistent with their capacity and requirements, is still a challenge and GFOI has been considering the way forward with FAO and Norway to address this.

Planned data provision by country			
Schedule	Americas	Africa	Asia & Pacific
Priority countries for systematic data acquisition for 2013	Brazil, Columbia, Costa Rica, Ecuador, Guyana, Mexico, Peru, Panama,	Cameroon, Democratic Republic of the Congo, United Republic of Tanzania,	Cambodia, Indonesia, Nepal, Viet Nam
Additional planned priority countries for 2014	Argentina, Bolivia (Plurinational State of), Chile, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay, Suriname, Uruguay	Algeria, Central African Republic, Congo, Ethiopia, Gabon, Ghana, Kenya, Liberia, Madagascar, Morocco, Mozambique, Nigeria, South Africa, Tunisia, Uganda, Zambia	Bhutan, Kyrgyzstan, Lao People's Democratic Republic, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Tajikistan, Thailand, Vanuatu
Additional planned priority countries for 2015	Belize, Dominican Republic, Jamaica	Benin, Burkina Faso, Burundi, Chad, Côte d'Ivoire, South Sudan, Sudan, Togo,	Bangladesh, Fiji, Malaysia, Mongolia, Myanmar, Pakistan,
2016	All remaining countries globally		

## SB-04 Global Urban Observation and Information

The Task Team led by the United States (Indiana State University, NASA, NOAA), China (Tsinghua University), European Commission (EC-JRC), Germany (DLR), and Italy (University of Pavia) is working towards the implementation of an **Urban Supersites initiative**. As of October 2013, eight mega-cities have been selected as Urban Supersites, namely **Los Angeles, Atlanta, and Mexico City** in North America; **Athens, and Istanbul** in Europe; **Sao Paulo** in South America; **Beijing, and Hong Kong** in Asia.

Through the Supersites initiative, analyses will be conducted focusing on urban environment, including time-series collection and reconstruction for assessing mega-cities development (e.g. **urban sprawl**) and a world-wide **inventory of human settlements** based on satellite data. Global standards and requirements for the acquisition and validation of products in urban environment will be developed. A global database for urban monitoring/assessment and climate modeling will be established to better understand the impact of climate change on urban areas.

A new **website** including a data repository for the Urban Supersites has been launched in May 2013 (see Los Angeles prototype at [www.indstate.edu/cuec/UrbanSupersites/home.html](http://www.indstate.edu/cuec/UrbanSupersites/home.html)).

The European Commission (JRC) has contributed its whole image repository for information extraction. This data, which has been generated under the Global Human Settlement Layer (GHSL) project, includes **several 100 millions of km<sup>2</sup> of data** with resolution ranging from 0.5 to 100 meters active and passive sensors.

The US (NASA) are conducting an interdisciplinary science project combining satellite data and models to assess the **impacts of urbanization on the continental United States surface climate**. Two observation-based and two scenario-based maps will be developed characterizing distant-past (pre-urban), recent-past (2001), present (2010) and near-future (2020) land-cover and land-use including urbanized areas. Impacts on the US surface climate will be simulated using a NASA modeling test-bed that includes a suite of land surface models and a weather forecast model.

In the framework of the **Sino-European Programme DRAGON 3** (2012-2016), Germany (DLR), Sweden (KTH), Italy (University of Pavia) and other partners are making use of Earth observation data to monitor urban expansion and environmental conditions in selected areas of China.

A new collaborative project called “Global Urban Remote Sensing Laboratory (GURSLab)” is under development. This project aims at developing an **on-line processing** (urban areas extraction, basic image processing, and key metrics), **visualizing, and data sharing tool**. This tool can select any urban region for processing and can integrate satellite data of different sources, resolutions, and sensors with in situ field measurements. It will provide globally distributed data (Earth observation and derived products) by developing requirements for global urban monitoring and assessment in terms of data products and expectations for data validation, archiving, update and sharing.

GEO sponsored a special session on Global Urban Observation and Information during the Joint Urban Remote Sensing Event (JURSE) Conference in Sao Paulo, Brazil (April, 2013). The session provided the Task Team with the opportunity to take stock of the work accomplished so far and to plan activities for 2014.

## SB-05 Impact Assessment of Human Activities

Three main Europe-funded FP7 projects contribute to the **impact assessment** of human activities (all coming to an end in 2013): (i) **EnerGEO** (Monitoring and assessment of the environmental impact of energy use; [energeo-project.eu](http://energeo-project.eu)); (ii) **EO-MINERS** (Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation; [eo-miners.eu](http://eo-miners.eu)); and (iii) **ImpactMin** (Impact monitoring of mineral resources exploitation; [impactmin.eu](http://impactmin.eu)).

Products delivered include two new EnerGEO applications: One to support decision-makers and private companies in assessing the **environmental impact of offshore wind farms** in Northern Europe. A portfolio of maps enables users to produce a geo-localized life-cycle-assessment of offshore wind farms. The assessment takes into account water depth, distance to coast and harbors, and potential electricity production for the North Sea and the northern Atlantic Ocean.

The second application aims to provide information on **suitable location**, and the appropriate justification, for the **installation of solar power plants in Europe**. This takes into consideration irradiance, slope of the terrain, land use, distance to infrastructure, electricity grids and electricity consumers.

An EnerGEO **Knowledge Geoportal** has been launched and registered as a Community Catalogue in the GEOSS Registry ([geoportal.energeo-project.eu](http://geoportal.energeo-project.eu)). Via this portal, web services from the wind pilot, solar pilot, and **integrated assessment** can be accessed. EnerGEO results have been disseminated through the 3<sup>rd</sup> **Summer School** and Final Event of the project (TNO, Utrecht, Netherlands, 15-25 October 2013). The Summer School was dedicated to the “environmental impact assessment of a **transition to renewable energies**”. IIASA has advanced the organization of an E-training on GEOSS ([balkangeo.net/index.php?option=com\\_content&view=article&id=111&Itemid=89](http://balkangeo.net/index.php?option=com_content&view=article&id=111&Itemid=89)).

In geo-resource exploration and exploitation, EO-MINERS has developed a set of integrated products to assess and/or monitor the **environmental/societal footprint of mining activities** and associated risks over three demonstration sites: Czech Republic (Sokolov lignite open pit), South Africa (Mpumalanga coal fields) and Kyrgyzstan (Makmal gold mine and processing plant).

Products address various environmental issues e.g. **surface run-off and drainage contamination** by mining and ore processing, geotechnical hazards and ground instability, underground coal fires, contaminated water ingress, **mud-flow extension** associated with dam failure, surface water quality, forest health, and contamination by **dust transportation**.

Products have been introduced to local stakeholders (**mining representatives, local communities** and authorities) during on-site workshops to get feedback. All products and methods have been presented during the EO-MINERS Final Conference in October and are available at the project web site ([www.eo-miners.eu](http://www.eo-miners.eu)).

A Minerals and Society workshop has been held in Brussels in September 2013, with representatives from the EC (DG RTD, DG ENTR, DG ENV) and the mineral industry. The importance of EO-MINERS-like products for **national and international mineral policies** has been acknowledged, opening a possible future for Earth-observation-based **services** in the mineral sector. ImpactMin has also issued an e-training programme to facilitate the dissemination and use of the project's results. The e-training programme is available free of charge at <http://impactmin.geonardo.com/>.

With regard to **fossil fuels**, integrated assessment models have been developed to design and evaluate mitigation strategies for fossil fuels installations. A pilot is underway to link fossil-fuel particulate matter, **ozone and mercury emissions** to atmospheric levels of air pollutants.

A **working group on coal and environment** is under development as part of the Energy Community of Practice. Participants are experts from academia and the private sector and regional/international organizations. The first meeting of the working group will be held on January 16<sup>th</sup> during the Ministerial Week in Geneva, Switzerland.

## AGRICULTURE

### Supporting sustainable agriculture and combating desertification

#### AG-01 Global Agricultural Monitoring and Early Warning

The GEO **Global Agricultural Monitoring initiative (GEOGLAM)** delivered on a number of fronts. A new panel was set up to produce Southern Hemisphere winter-spring crop outlooks (e.g. for wheat, maize, soybean and rice). This builds on the experience of the Northern hemisphere panel developed in 2012 to assess drought impact on crop production. The two panels play a key part in implementing the vision of GEO Agriculture which aims at effectively utilizing Earth observation and information for enhancing **agricultural decision-making**.

Many GEO Members (e.g. USA, European Commission, Russia, Kazakhstan, India, Brazil, Argentina, South Africa and Australia) were invited to join these expert panels and help reach **consensus** on the current crop yield outlook and related climatic variability impacts.

Outlooks were developed in June and July enabling GEOGLAM to deliver, for the first time ever, monthly **Global Crop Outlooks** to the Agriculture Market Information Systems (AMIS) Market Monitor ([www.amis-outlook.org/amis-monitoring](http://www.amis-outlook.org/amis-monitoring)). In addition, a new tool was developed to allow comparison in time and allow annotation for areas of interest ([www.geoglam-crop-monitor.org/](http://www.geoglam-crop-monitor.org/)).

Several strategic meetings were organized to support GEOGLAM, including:

- (i) A GEOGLAM planning meeting (USDA, Washington D.C., February 2013) to develop the **phased approach** for GEOGLAM as requested by GEO-IX GEO Plenary in Brazil
- (ii) 3<sup>rd</sup> Meeting of the **Agriculture Market Information Systems AMIS** (OECD, Paris, April 2013) to agree on plans for delivering monthly outlooks for global crops (wheat, maize, soy and rice)
- (iii) 4<sup>th</sup> Meeting of the Agriculture Market Information Systems (FAO, Rome Italy, October 2013) to present the latest outlook and advance the development of the **Crop Monitoring tool**
- (iv) Regional Workshop on Satellite Monitoring of Agricultural Lands in Northern Eurasia (Moscow, Russia, October 2013) to increase GEO presence among **CIS** members and, particularly, to broaden GEOGLAM participation in the region
- (v) Food Security, Earth Observations and Agricultural Monitoring (Brussels, Belgium, November 2013) to assess the situation regarding global observational facilities, models and services needed to meet the demand in developed and **developing countries**

In addition, the Global Agricultural Monitoring Community of Practice progressed on the implementation of the GEO **Joint Experiment on Crop Assessment and Monitoring (GEO-JECAM)**. The main objective of JECAM is the inter-comparison of modeling and monitoring methods for agricultural monitoring using multi-source satellite and in-situ data (see [www.jecam.org](http://www.jecam.org)). In 2013, JECAM expanded to **South Africa, Russia and Ukraine** (27 sites in total spanning 5 continents) developing data acquisition protocols for all sites (in collaboration with CEOS). JECAM also undertook cross-cutting studies integrating science and data across multiple geographic sites with a view to develop best practices and standards for agricultural monitoring. JECAM continues to provide the science foundation of GEOGLAM.

IAASA launched a beta-version of the **wiki-based Global Cropland Map**. A second version is planned for 2013 (data collection has started; see [agriculture.geo-wiki.org](http://agriculture.geo-wiki.org)). A proposal developed by Belgium (VITO) and several other GEOGLAM contributors was selected for **funding by the European Commission** in the context of the 7<sup>th</sup> Framework Programme (FP7). The proposal focused on environmental agricultural impacts should help accelerate GEOGLAM implementation for instance on crop mask and capacity development.

The GEOGLAM Team developed the first version of the **GEOGLAM Implementation Plan**. The plan was presented to the 28th Executive Committee in July (Document 10) under the title “Progress on GEOGLAM Implementation: First steps towards Implementation 2013-2014 Phase I and II”.

## BIODIVERSITY

### Understanding, monitoring and conserving biodiversity

#### BI-01 Global Biodiversity Observation (GEO BON)

The “**Map of Life**” tool went live in May 2013 (<http://www.mappinglife.org/>). The tool is expected to have huge impact on biodiversity monitoring. The GEO BON Marine Ecosystem Working Group launched a website providing **free access to digital marine maps and resources** ([www.marineregions.org](http://www.marineregions.org)). This is hosted and led by Belgium (Flanders Marine Institute). These include maps of countries Exclusive Economic Zones (EEZ), and seas and oceans boundaries.

A first version of the Digital Observatory for Protected Areas (DOPA Explorer) was released in November 2013 as a **web-based tool documenting 9’000 marine and terrestrial protected areas** that are greater than 150 km<sup>2</sup> (<http://dopa.jrc.ec.europa.eu/>). Protected areas with unique ecosystems and species can be identified and the pressure that they are exposed to, assessed. Ecological data derived from near real-time Earth observations are also made available although currently limited to African protected areas.

The **Digital Observatory for Protected Areas** (DOPA) is conceived as a set of distributed Critical Biodiversity Informatics Infrastructures (e.g. databases, web modelling and broadcasting services). It is combined with **interoperable web services** to provide a large variety of **end-users** with means to assess, monitor and possibly forecast the state and pressure of protected areas at local, regional and global scale. It is being developed by the EC (JRC) in collaboration with UNEP-WCMC, GBIF, IUCN and Birdlife International.

GEO BON submitted a response to the **Convention on Biological Diversity** (CBD) call for “Identification of scientific and technical needs related to the implementation of the Strategic Plan for Biodiversity 2011-2020 and its **Aichi Targets**” (see <http://www.cbd.int/sbstta/doc/submission-geo-bon-en.pdf>). GEO BON also produced an 8-page leaflet entitled “**Developing National Species Monitoring** for the Aichi Targets” for SBSTTA-17 (12 Oct 2013, Montreal, Canada). GEO BON and CBD co-organized an Expert Workshop at SBSTTA-17; see [www.cbd.int/doc/meetings/sbstta/sbstta-17/information/sbstta-17-inf-14-en.pdf](http://www.cbd.int/doc/meetings/sbstta/sbstta-17/information/sbstta-17-inf-14-en.pdf)).

GEO BON took the lead in the development of the **Global Wetlands Observing System** (GWOS) upon request of the Ramsar Convention (a first planning meeting was already been held). The **new EU BON project** was successful in obtaining funding in the context of the European Commission 7<sup>th</sup> Framework Programme. EU BON is a consortium of 30 partners from 18 countries that aim to build the European Biodiversity Observation Network (the EU BON kick-off meeting was held in Berlin in February 2013).

A new GEO BON Working Group was created **on Biodiversity Indicators** (in addition to the 8 existing ones on Genes, Terrestrial Species, Terrestrial Ecosystems, Freshwater Ecosystems, Marine Ecosystems, Ecosystem Services, Modelling, and Data). This group, led by UNEP-WCMC, aims to bring GEO BON core activities and Community of Practice to the **attention of decision-makers** at national, regional and global scales. This will be achieved through the use of indicators that will link GEO BON deliverables with the CBD Aichi Targets.

GEO BON initiated the creation of a **Handbook** (i.e. the GEO BON Handbook) to **assist governments and organizations in setting up Biodiversity Observation Networks** (BONs). All GEO BON working groups and members of the larger Biodiversity Community of Practice are part of this initiative. First draft chapters are close to completion (a complete draft of the book is expected by Jan 2014). GEO BON started conceptualizing a **BON-in-a-Box** (BiaB). The latter is a **collection of tools, templates, and examples** that can facilitate start-up and enhancement of national/regional Biodiversity Observing Networks (BONs) as well as meeting of national/regional reporting requirements (e.g. CBD, RAMSAR).

GEO BON was highlighted in numerous **publications** in Journals such as: Ecological Indicators; Journal of Environmental Planning; Current Opinion in Environmental Sustainability; Global Ecology and Biogeography; Annual Review of Environment and Resources, Trends in Ecology and Evolution, BioScience, Ecological Indicators, Biodiversity Informatics, Marine Pollution Bulletin, Annals of the New York Academy of Sciences, Taxon, PLOS Biology, and The Economics of Ecosystems and Biodiversity for Water and Wetlands.

GEO BON was also active on the outreach front, with presentations in numerous **meetings**, including:

- 8th EARSeL Imaging Spectrometry Workshop, 8-10 April 2013, Nantes, France
- Eye on Earth users' conference, GNON side event, 4-6 March, 2013, Dublin, Ireland
- Water in the Anthropocene: Challenges for Science and Governance, May 21-24, 2013 Bonn, Germany
- 17th meeting of the Scientific & Technical Review Panel (STRP) of the Ramsar Convention, 25 February - 1 March 2013, Gland, Switzerland
- Globwetland III User Consultation Workshop organized by ESA, July 19<sup>th</sup>, Frascati, Italy
- European Geophysical Union (EGU) in April 2013, Vienna, Austria
- Biodiversity Information Standards 2013 Conference, 30 Oct 2013 in Florence, Italy
- International Conference on Biodiversity Assessment, Nanjing, China, 13-15 September, 2013

In addition, GEO BON was asked to contribute to the Global BioInformatics Conference aimed at brainstorming the world's **future bioinformatics needs**. GEO BON also held a side event on Essential Biodiversity Variables at the **IPBES** (Intergovernmental Platform on Biodiversity and Ecosystem Services) meeting (January 2013, Bonn, Germany). GEO BON became part of a consortium developing a proposal for the next IUCN World Parks Congress to be held in Nov 2014, Sydney, Australia; it is entitled "Reaching conservation goals; seeing a future of green hope".

The GEO BON Steering Committee elected a new Chairperson (Henrique Pereira, Leipzig, Germany), as well as a new vice-Chairperson (Mike Gill, Environment Canada, Canada). They will take office in mid-January 2014. The **GEO BON office** will move from South Africa to **Germany** where support in the form of a secretary (50% time), executive director (100% time) and IT support person (50 % time) will be made available.



## CLIMATE

### Understanding, assessing, predicting, mitigating, and adapting to climate variability and change

#### CL-01 Climate Information for Adaptation

##### *Global Climate Record*

Japan (JMA) has completed the production of the Japanese 55-year Reanalysis (JRA-55; <http://gpvjma.ccs.hpcc.jp/~jra55/>), the **first global, atmospheric reanalysis** with a 4-dimensional variational data assimilation system (4 D-Var) that covers **more than 50 years (1958-2012)**. Data products have been progressively released for research purpose since October 2013. ECMWF has further progressed on ERA-CLIM. The focus is on the collection and preparation of input observations, boundary conditions, and atmospheric forcing data for a comprehensive atmospheric reanalysis of the **entire 20th century**.

IGBP (Past Global Changes Project; PAGES) has extended the **global paleo-climate record**. Reconstructions of regional climate **over the last 2000 years** have been performed by a network of 9 regional working groups (including one for each continent, one for the Arctic, and one for oceans). Working groups are coordinated through the PAGES 2k Network. A synthesis article was published in Nature Geoscience (see <http://www.nature.com/ngeo/journal/v6/n5/full/ngeo1797.html>). The USA (World Data Center for Paleoclimatology) has developed an improved infrastructure for archiving paleo-climatological data and making it available online.

##### *Weather, Climate and Earth-System Prediction*

WMO (WWRP-THORPEX) and WCRP have launched two joint projects: “Sub-seasonal to Seasonal” and “Polar Prediction”. These projects contribute to the common effort of the Numerical Weather Prediction and climate communities to **extend the predictability** of current forecasting systems.

The **Subseasonal to Seasonal project (S2S)** aims to improve skills for subseasonal forecasts, quantify uncertainties and develop societal applications. S2S has rapidly become a major international project **leveraging expertise of both the weather and climate communities**. A multi-model ensemble forecast database following TIGGE protocols (see Task WE-01) has been developed. The S2S community will convene at the International Conference on Subseasonal to Seasonal Prediction (10-13 February 2014, Maryland, USA; [emc.ncep.noaa.gov/gmb/ens/s2s/](http://emc.ncep.noaa.gov/gmb/ens/s2s/)) to: (i) Improve forecast skill and understanding on the **timescale of two weeks to a season**; (ii) Promote its uptake by operational centers and; (iii) Foster their exploitation by the applications community.

The **Polar Prediction Project** aims to progress on a number of fronts: (i) coupled prediction systems; (ii) integrated approach to polar boundary layer parameterizations; (iii) use of all available polar observations; (iv) quantifying predictive limits for sea ice; and (v) engaging with relevant private sector actors (e.g. the shipping industry); see recommendations from the Polar Prediction Project Workshop (ECMWF, Reading UK, June 2013). The WCRP Polar Climate Predictability Initiative (PCPI) will be implemented in close collaboration with the Polar Prediction Project.

##### *Climate Observing Systems and Essential Climate Variables (ECVs)*

Within the framework of the **GCOS Cooperation Mechanism**, a number of projects focusing on the availability of climate observation have been advanced or completed. Instruments for GCOS **Surface Network (GSN) stations** have been delivered (8 in **Angola** and 4 in **Armenia**) and others are being renovated (11 in **Madagascar** and 2 in the **Cook Islands**). Over 400 **radiosondes** have been supplied to **Sudan** and **Tanzania**, and acquisition has been supported in **Mexico**. Others have been supplied to Armenia (500 radiosondes), Cook Islands and **Maldives** (800 radiosondes and 800 balloons). Fixing

of the microwave radio-link including lightning protection is ongoing in **Congo**. An Automatic Message Switching System (AMSS) for use as Global Telecommunications System (GTS) has been delivered in **Zambia**. The report of the 8<sup>th</sup> GCOS Cooperation Mechanism Board Meeting identifies a list of activities for which requests have been expressed, but for which **funding has not been secured** ([http://library.wmo.int/pmb\\_ged/gcos\\_163.pdf](http://library.wmo.int/pmb_ged/gcos_163.pdf)).

Japan (JAMSTEC) has deployed 19 **new Argo floats** and maintained ocean monitoring with 181 floats, in addition to maintaining position tracking ability and data quality for **more than 1,500 floats deployed in Asia-Pacific regions** (Pacific Argo Regional Center; PARC). Buoy observation networks have also been maintained in the eastern Indian Ocean. An **intensive observation campaign** named VPREX has started in December 2012 for the purpose of capturing "**cold surge event**". A new mobile X-band radar has been introduced to **Indonesia** through the Japanese Official Development Assistance (ODA) framework to study severe local storm and prevent water-related disasters.

Observing networks' status descriptions and recommendations may be found in GCOS reports (see <http://www.wmo.int/pages/prog/gcos/index.php?name=Publications>). A report of the 5<sup>th</sup> Implementation and Coordination Meeting (GCOS-167), Implementation Plan for 2013-2017 (GCOS-165), Manual (GCOS-170) and Guide (GCOS-171) have been published for the **GCOS Upper-Air Reference Network** (GRUAN). A new version of the Technical Plan for Data Management of the Baseline Surface Radiation Network (BSRN) has been published (GCOS-174).

GCOS has organized a workshop on "**Observation Needs for Adaptation to Climate Variability and Change**" (26-28 February 2013, Offenbach, Germany) to identify observation requirements for the Global Framework for Climate Services (GFCS) and Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA). The resulting report (GCOS-166) is available online.

GCOS has reported on the current status of the GCOS Programme to the 39<sup>th</sup> Session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) at UNFCCC COP 19 (Warsaw, Poland, November 2013), and highlighted GCOS contribution to ESA's Climate Change Initiative and the Copernicus Earth Observation Programme.

The **Global Observing Systems Information Centre** (GOSIC; [gotic.org](http://gotic.org)) continued to be populated. The GOSIC Portal provides access to data and information identified by the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System (GTOS) and their partner programs, as well as specialized data access tools such as the GCOS Essential Climate Variables Data Access Matrix. The GOSIC is hosted at NOAA's National Climatic Data Center (NCDC) and supported by the US GCOS Program.

The 13 individual projects of the **ESA Climate Change Initiative** (CCI; <http://www.esa-cci>) have generated their first Essential Climate Variable datasets. Several of the projects have contributed to the **IPCC 5<sup>th</sup> Assessment Report** (Working Group 1), e.g. CCI Glaciers played a leading role in creating the **first globally-complete glacier inventory**, called the Randolph Glacier Inventory; CCI Sea Level produced improved **global mean sea-level estimates** using Envisat data; and the Ice sheets Mass Balance Inter-comparison Exercise, involving CCI Ice Sheets, led to improved confidence in the measurement of **ice sheet mass** balance and the associated global sea level contribution.

CEOS has delivered a formal response to the updated GCOS "**Systematic Observation Requirements for Satellite-based Data Products for Climate**" and presented it during the Conference of the Parties to the UNFCCC in Doha in December 2012 (COP-18).

Linkages between **research and operational** agency programs have been reinforced by the creation of a joint Climate Working Group between CEOS and CGMS and via the SCOPE-CM network. Linkages between the **modeling community and the Earth observation community** have been strengthened e.g. via the Climate Modeling User Group (CMUG) of ESA's Climate Change Initiative, via the Joint CEOS-CGMS Working Group on Climate and via Obs4MIPS, an initiative to make observational data sets easily accessible to the climate modeling community.

An **International Satellite Aerosol Science Network** has been established and a number of related meetings and workshops organized (e.g. Satellite Soil Moisture Validation and Application Workshop, Frascati, Italy, 1-3 July 2013; Workshop on sea ice thickness retrieval from ERS and ENVISAT radar altimeters, 15 March 2013, Cambridge, UK; and 2nd International Workshop on Passive Microwave Sea Ice Concentration, Copenhagen, Denmark, 18-19 Feb, 2013).

#### *Easy Access to, and Use of, Climate Information*

The architecture of the EC **Copernicus Climate Change Service** was developed and discussed with Copernicus Member States at the 1st Copernicus Climate Change workshop (Brussels, June 2013). The Service will be organized around four complementary blocks: (i) a Consistent Climate Data store, (ii) a Sectorial Information System, (iii) an Evaluation and Quality Control platform, and (iv) an Outreach and Dissemination platform.

An Extraordinary Session of the WMO Congress (29-31 October 2012) has established resolutions on the implementation plan, the governance structure and the budgetary provisions of the **Global Framework for Climate Services (GFCS)**. The first meeting of the **Intergovernmental Board** for Climate Services (1-5 July 2013, Geneva, Switzerland) has agreed on an operational road map. GFCS is a UN-led initiative in partnership with governments and major stakeholders to provide climate services to users worldwide; its initial focus is on agriculture, water, health and disaster management.

WMO's Office for Resource Mobilization and Development Partnerships and the GFCS Office work closely together in discussions with the donor and financing community. Large GFCS Programmes funded by the Canadian and Norwegian Governments have been developed and are currently being implemented. Also, in several countries (e.g. Belize, Burkina Faso, Chad, Mali, Niger and South Africa), workshops have been held to start establishing frameworks for climate services at the national level (e.g. to support seasonal climate outlooks; drought and flood monitoring; and heat-health alerts). These workshops are providing important lessons used for the development of guidelines that will facilitate the establishment of these frameworks for climate services around the world.

More than 300 delegates attending the Africa Climate Conference 2013 (ACC2013; Arusha, Tanzania, 15-18 October 2013; co-organized by WCRP and the African Climate Policy Centre) adopted a statement identifying four priority areas for research in order to address critical gaps in our **understanding of the African climate system** and to bridge the divide between **climate science and policy**: (i) Co-designed **multi-disciplinary research** for improving climate forecast skill and reliability across different time and spatial scales; (ii) filling the **climate data gap**; (iii) capacity building at all levels; and (iv) **mainstreaming climate services** into decision making.

The regional climate downscaling, vulnerability, impact and adaptation research communities convened during the International Conference on Regional Climate (CORDEX, Brussels, Belgium, 4-7 November 2013, co-organized by WCRP, IPCC and the European Commission). The Conference helped address cross-cutting challenges and opportunities to better **understand regional climate variability and change, and to support climate adaptation and mitigation policies**. The Conference attracted more than 500 participants from 97 countries.

## CL-02 Global Carbon Observation and Analysis

The EU-funded project GEOCARBON is developing a coordinated **Global Carbon Observation and Analysis System** (geocarbon.net). It is supported by the GEO Carbon office that aims at (i) enhancing communication flow among carbon communities and promoting their involvement in the GEO process; and (ii) disseminating project results and turning them into policy relevant information.

New Carbon products include the **2013 update of the global CO<sub>2</sub> budget** (this is a global effort led by the Global Carbon Project with the collaboration of GEOCARBON), and the **Surface Ocean CO<sub>2</sub> Atlas (SOCAT)** database (period 1968-2011), with over 60% more data than the previous version - this is the **world largest sea surface CO<sub>2</sub> database**.

A GEOCARBON **data portal** has been launched to enable **free exchange** of data and products (bgc-jena.mpg.de/geodb/geocarbon/Home.php). The **GEOCARBON data policy follows the GEOSS Data Sharing Principles**.

ESA selected the **Biomass mission** as its next Earth Explorer. This satellite will provide unprecedented measurements of forest biomass to assess terrestrial carbon stocks and fluxes from 2020 onwards.

In addition, efforts continue towards: i) **measuring and evaluating CO<sub>2</sub> and CH<sub>4</sub>** from the ground (FLUXNET, TCCON and other networks) and space (GOSAT, SCIAMACHY and other satellite missions); ii) developing, improving and integrating different Carbon Cycle Data Assimilation Systems; iii) reconciling top-down and bottom-up flux estimates across a wide range of spatial and temporal scales; and iv) analyzing calibration and validation requirements for **combining ground- and space-based data** and improving linkages between satellite-derived **land-cover change** products and forest carbon **models**.

Recent advancements and future plans about the **observing and modeling of the Carbon-cycle and greenhouse gas sources/sinks** have been discussed over a major international conference "Towards a Global Carbon Observing System: Progresses and Challenges" (Geneva, Switzerland, 1-2 October 2013) followed by a GEO CL-02 Task Team meeting (3-4 October 2013). Key aspects of the Earth system have been considered including research, monitoring networks, methodology, policy, and infrastructure. As a result, elements useful for the design of a global carbon cycle observing and analysis system have been identified and a draft list of **policy-relevant recommendations** produced.

The **Carbon Community of Practice** – author of the GEO Carbon Strategy – published a scientific paper on “Current systematic carbon-cycle observations and needs for implementing a policy-relevant carbon observing system”. The latter underlines the need for a global coordinated carbon observing system, and describes the **status of current networks** (including gaps and weaknesses), and a strategy to develop that system, highlighting the main components.

The CEOS Carbon Task Force developed the **CEOS Strategy for Carbon Observation from Space** based on the GEO Carbon Strategy. This document is currently under review.

## DISASTERS

### Reducing loss of life and property from natural and human-induced disasters

#### DI-01 Informing Risk Management and Disaster Reduction

##### *Risk Assessment and Mitigation*

The CEOS Disasters Working Group is coordinating efforts from Space Agencies and stakeholders (ASI, CNES, CSA, DLR, ESA, JAXA, NASA, NOAA, and USGS) towards the implementation of a comprehensive **strategy for the use of Earth observations from satellite in Disaster Risk Management (DRM)**.

The strategy includes the delivery of three coordinated pilots over the period 2014-2016 to demonstrate the (i) added value of increased CEOS coordination in this area; (ii) benefits of closer ties to users and ease of access to data; and (iii) potential for increased roles of space agencies in DRM beyond the current Hyogo Framework for Action in the following 10-year period starting in 2015.

Practically, the **Flood Pilot** (co-chaired by NASA and NOAA) will develop a Global Flood Dashboard (single access for multiple existing systems) and build upon three regional (sub) pilots showcasing end-user benefit of frequent high spatial resolution observations (Caribbean, Southern Africa, Mekong/Java). The **Seismic Risk Pilot** (co-chaired by ESA and DLR) will develop a demonstrator for an Earth observation-based global strain map (main focus on Alpine-Himalayan Belt).

The **Volcano Pilot** (co-chaired by USGS and ASI) will demonstrate feasibility of systematic global monitoring in regional arc (Latin America), while developing new monitoring products to feed GSNL and performing real-time in-depth monitoring of one ‘100-year’ category major eruption. CNES is also contributing to the DRM initiative a **Recovery Observatory**, whose main objective is to provide a multi-year database to support recovery from catastrophic disasters.

The GEO Geohazard Supersites and Natural Laboratories (GSNL) initiative for **open access to high-value seismic and volcanic data** continues to progress. Hawaii Supersite has become fully operational thanks to contributions from ESA, Canada (CSA), Japan (JAXA), Italy (ASI) and Germany (DLR) for satellite SAR data, and from the USA (USGS) for GPS and seismic data.

In addition, **eight Supersites proposals** have been assessed by the Scientific Advisory Committee (SAC) and sent to the CEOS Steering Group (CSG) for their approval. The more mature and consolidated proposal (ie. the Icelandic Volcanoes Supersite funded through the EC 7<sup>th</sup> Framework Programme) was approved by the 27<sup>th</sup> CEOS Plenary, while Ecuadorian Volcanoes, Marmara Region, Mt Etna Volcano, Vesuvius - Campi Flegreii, Piton de la Fournaise Volcano, New Zealand Volcanoes, and San Andreas Fault Supersites are currently being reviewed by CSG who shall eventually decide whether to ask the next CEOS SIT meeting to approve them as they are or to ask the point of contacts to review their proposals.

The GEO Supersites governance is based on a Scientific Advisory Committee (SAC) made of 25 members representing the seismic, volcano and remote sensing communities worldwide, and a Supersites Steering Group representing space agencies and in-situ providers.

The **Global Earthquake Model (GEM, [www.globalquakemodel.org](http://www.globalquakemodel.org))** and the Supersites initiatives agreed to develop joint pilot activities with the aim of incorporating GEM risk data and models into the Supersites concept. GEM will contribute vulnerability/exposure datasets to selected Supersites. The GEM initiative aims to establish uniform and open standards to calculate and **communicate earthquake risk worldwide**, by developing a global, state-of-the-art and dynamic earthquake risk model, together with the communities exposed to this risk.

South Africa (CSIR) developed a satellite-based fire information system that provides **near-real-time fire information to users across the globe**. AFIS (Advanced Fire Information System,

<http://www.afis.co.za>) provides fire prediction, detection, monitoring, alert, planning and reporting capabilities through satellites, weather forecasting models, and information/communication technologies. AFIS features near-real-time MODIS data as well as FIRMS (Fire Information for Resource Management System).

### *Regional End-to-End Pilots*

The GEO Caribbean Satellite Disaster Pilot (CSDP) and the Southern African Flood and Health Pilot (SAFHP) are developing a coordinated, timely and needs-based approach to the utilization of Earth Observation data for disaster management. The scope is the **full cycle of disaster management** (from mitigation to warning, response and recovery) from an end-to-end approach (data collection, to analysis, product generation and service delivery).

The **Caribbean Pilot** has been working with local authorities to provide satellite coverage for the **hurricane** season. A crowd sourcing for correcting reference water and flood-extent maps (using Open Street Map tools) has also been implemented (cf. Architecture Implementation Pilot 6). Additional satellite coverage includes NASA EO-1, Worldview-2 and CSA Radarsat-2 for hurricanes, earthquakes, algae blooms, wildfires, volcanoes, and landslides.

The **South African Pilot** is implementing operational services in cooperation with regional authorities. Main achievements include a Namibia **Flood Dashboard** to allow for autonomous user posting of water gauge readouts, histograms, and flood bulletins; a customized autonomous processing of disaster maps; and the development of full-resolution tiled KML overlays of disaster maps. Also with the 2013 rainy season, the Namibia Hydrological Services is issuing flood bulletins. Bulletins are sent in electronic form to several private and institutional users.

### *Support to Operational Systems*

The International Working Group on Satellite Based Emergency Mapping (IWG-SEM; including JRC, USGS, DLR-ZKI, SERVIR, Sentinel Asia, UNOSAT, UN-SPIDER, ITHACA and SERTIT) released “Guidelines for Emergency Mapping” to advocate for **effective exchange and harmonization of emergency mapping efforts** leading to improved cooperation amongst Emergency Mapping Organizations.

In August 2013, the GEO Secretariat sent a letter to all GEO Members to encourage them to join the **International Charter** on Space and Major Disasters as “**Authorized Users**”. A registration process is currently in place to help validate the ability of national authorities to access and use Charter assets for disaster response, in accordance with Charter operational procedures.

In April and June 2013, members of the International Charter on Space and Major Disasters organized 3 Project Manager (PM) **training events** in Abuja (Nigeria), Manila (Philippines), and Frascati (Italy) respectively. The goal of these events was to strengthen the Charter’s capability to work with Project Managers from all over the world (PMs coordinate Charter activations and interact with both civil protection users and space agency providers to ensure relevance of information).

Since October 2012, the International Charter on Space and Major Disasters has been **activated 44 times** (as of late October 2013). Activations include floods in West Africa, Indonesia, Pakistan, Argentina and Chad, hurricane Sandy, tropical cyclones Evan Haruna and Mahasen, and earthquakes in Guatemala, China and Pakistan.

Metadata related to these activations is available through the Charter metadata catalog at [www.disasterschartercatalog.org](http://www.disasterschartercatalog.org). The catalog allows discovering and browsing a **unique record of over 3000 images**. Besides professional users, the catalog is providing Disaster Risk Reduction scientists with a clear and thorough picture of imagery datasets and related proprietary sources available for their studies and researches.

## ECOSYSTEMS

### Improving the management and protection of terrestrial, coastal and marine resources

#### EC-01 Global Ecosystem Monitoring

A new proposal for a global effort on mountain observations and information was developed at the High Summit Conference (Lecco, Italy, Nov 2013). This is the **GEO Global Network for Observations and Information in Mountain Environments (GEO-GNOME)**, which will make full use of the partnership framework of GEO, capitalizing on existing efforts and outcomes (such as GLORIA and other global and regional initiatives).

The goal of GEO-GNOME is to (i) **provide free and open-access to data**, scientific results, information, and environmental projections; (ii) foster exchange of data and information across different mountain areas and between the scientific community and stakeholders; (iii) build capacity in mountain research, especially in remote areas; and (iv) create a distribution system for the dissemination of this knowledge, in particular to the local communities and decision makers.

The **NextData** project (<http://www.nextdatapoint.it/>), devoted to climate change in mountain regions, supported monitoring and research on the mountain environment and ecosystems. Italy (CNR), in collaboration with the Gran Paradiso National Park and other regional parks, conducted activities on **population dynamics of selected species**, Alpine lake ecosystems, and changes in resource-consumer relationships.

Italy (Ev-K2-CNR) continued to develop and maintain the **SHARE mountain ecosystems monitoring network**. SHARE (Station at High Altitude for Research on the Environment) is an integrated environmental network of monitoring stations, located in **Europe, Asia, Africa and South America**, providing high-altitude data on the atmosphere and climate. The SHARE and NextData information is openly available through the SHARE GeoNetwork, which provides a single access point to users.

Close contact was established with the International Network for Terrestrial Research and Monitoring in the Arctic (**INTERACT**), which consists of over **60 circumpolar and northern alpine research stations**. INTERACT helps build capacity for research and monitoring of arctic ecosystems and biodiversity.

The USA (USGS), RCMRD and other partners (such as AAG and NatureServe) developed a **high-resolution terrestrial ecosystem map of Africa**. Physical and biological information (e.g. land surface forms, lithology, bioclimates, thermotypes) have been merged to provide a baseline for monitoring the impact of human activity (see [http://www.aag.org/galleries/publications-files/Africa\\_Ecosystems\\_Booklet.pdf](http://www.aag.org/galleries/publications-files/Africa_Ecosystems_Booklet.pdf)).

Austria (ZAMG) and partners collected phenological data over Europe and made them available to the scientific community via the **Pan European Phenology Database PEP725** (<http://www.pep725.eu>); whereas a few data records start in the 19<sup>th</sup> century, the majority starts after 1950. PEP725 convened a session on phenology/agrometeorology at the EMS/ECAM meeting (September 2013, Reading, UK) and will co-convene a follow-up session at the EGU 2014 (Vienna, Austria).

China (NRSCC, MOST) advanced the **Global Remote Sensing Monitoring on Ecosystem and Environment** program ([http://www.csi.gov.cn/index\\_en.html](http://www.csi.gov.cn/index_en.html)), which produces global datasets on ecosystems and the environment available to users worldwide. The first Ecosystem and Environment report from 2012 has been issued, featuring global surface water and terrestrial vegetation growth products.

The **ABCC** program was expanded to Germany, Malaysia, ISDE and OGC. A scientific committee was established and the 7th workshop planned for 2014 in Quebec City, Canada. ABCC is a cooperative program of China, Australia, Brazil, and Canada to do a Comparative Study of Global

Environmental Change Using Earth Observations. The program utilizes remote sensing data to produce data, tools and information on **snow/ice, grasslands, forests and aerosol variations**.

Contacts were initiated with the **European research infrastructure** AnaEE (<http://www.anaee.com/>). AnaEE is a continental, long-term, integrated research infrastructure for **experimental manipulation in the context of global change** which can provide **quantitative measurement of ecosystem responses to climate and land changes**. Linking AnaEE results with data from observational sites across Europe and GEO will enable models to be scaled-up to larger geographical areas.

Specific plans to include ecosystem models and data analysis methods were initiated, starting with the BioVeL: **Biodiversity Virtual e-Laboratory** in Sweden, which generate analytical resources for analyzing ecosystem data with genetic and species level information, with the goal of providing fields researchers, stakeholders and users with the necessary instruments for data analysis and ecosystem modeling.

Japan (JAMSTEC) exploited field sites for studies of bio-geoscience, including **boreal forests** in Alaska and Siberia, forest and **steppe** in Mongolia, **temperate** forest in Japan, and **tropical** forest in Borneo, which are used mostly as the ground truth data for remote sensing and flux measurements.

With regard to the preservation of World Heritage Sites, UNESCO (International Centre on Space Technologies for Natural and Cultural Heritage under the auspices of UNESCO, HIST) and China (CAS CEODE) promoted the use of an **Atlas of 40 Chinese World Heritage Sites** (up to 2010). This is the first professional Atlas illustrating world heritage sites using satellite and airborne remote sensing data. Collaboration between China (HIST) and Cambodia (APSARA) was established on using Earth observation technologies for monitoring the surroundings of the **Angkor Site**.

A Global Dry-land Observation Network was discussed by UNCCD and USA with the goal of providing global information on **arid and semi-arid ecosystems**; contacts were also established with the ILTER Network for data and information on water-limited ecosystems. In addition, Italy (CNR), France (LMD-ENS) and Israel (Ben Gurion University) conducted activities on **desert and savanna ecosystems** with the goal of collecting data and modeling efforts, and provide climate and environmental change scenarios for these ecosystem types.

Strong links were established with the **LifeWatch** European Infrastructure, which provides access to ecosystem and biodiversity data, data processing tools and virtual laboratories ([www.lifewatch.eu](http://www.lifewatch.eu)). In this framework, special attention is given to **lagoon, coastal and transitional water ecosystems**, with the aim of creating a network of coastal protected areas contributing to the GEOSS DataCORE.

The CAFF (Conservation of Arctic Flora and Fauna; [www.caff.is](http://www.caff.is)) released the **first Arctic Biodiversity Assessment** (ABA; [www.arcticbiodiversity.is](http://www.arcticbiodiversity.is)) in May 2013 and an action plan to build on related recommendations is under development. CAFF continued the implementation of the **Circumpolar Biodiversity Monitoring Program** (CBMP; [www.cbmp.is](http://www.cbmp.is)) based on the long-term, coordinated, pan-Arctic monitoring of Arctic ecosystems. Development also continued on the **Arctic Biodiversity Data Service** (ABDS; [www.abds.is](http://www.abds.is)) for an online, interoperable and circumpolar data management system that will access, integrate, analyze and display biodiversity information. Other relevant CAFF products include the **Circum Arctic Boreal Vegetation Map** (CBVM; [www.caff.is/flora-cfg/circumboreal-vegetation-map](http://www.caff.is/flora-cfg/circumboreal-vegetation-map)).

A comprehensive working meeting (GEO Ecosystems) was held in Beijing, China (April 2013), to initiate and strengthen activities in Asia, especially in China. The interaction between Ecosystems and Biodiversity Tasks was discussed to improve synergies. A **GEO-X Side-Event on mountain ecosystems** was planned, as well as ecosystem contributions to the GEO-X “Special Event on Biodiversity”.



## ENERGY

### Improving management of energy resources

#### EN-01 Energy and Geo-Resources Management

A major EU-funded project was completed, delivering a powerful **decision-support tool** (the EnerGEO Knowledge Geoportal) as its ultimate output. The **EnerGEO portal** (<http://geoportal.energeo-project.eu/>) brokers information that enables impact assessments of various energy mix scenarios.

Users can either discover information or register datasets, services or applications. The EnerGEO portal relies on international standards that form the foundation for information exchange based on metadata of spatial and non-spatial resources. It has been tested through a case study on biomass growth in Pakistan looking into options to cover energy demand.

The Global Atlas for Solar and Wind Energy was launched as an operational tool; the Atlas is the **largest-ever initiative to assess renewable energy potential on a global scale** ([irena.org/GlobalAtlas](http://irena.org/GlobalAtlas)). Data and web-services have been registered in a catalog developed and operated by France (MINES ParisTech). The catalog can be harvested by the GEOSS Broker and its content made discoverable through the GEOSS Portal.

The **Global Atlas for Solar and Wind** is part of the responses to the AIP-6 Call for Participation ([www.ogcnetwork.net/node/1887#MINES](http://www.ogcnetwork.net/node/1887#MINES)). The Atlas will be extended to Bio-Energy and Marine Energy through the Architecture Implementation Pilot (AIP-6).

The EU-funded project ENDORSE developed and demonstrated **ten downstream services** ready to interface with the private sector (<http://www.endorse-fp7.eu/>). This user-driven project builds on Copernicus Core Services such as MACC, SAFER and Geoland2. It addresses (i) energy sources such as the sun, wind and biomass; (ii) electricity **grid management**; and (iii) **building engineering** through daylighting in buildings. Users are part of the implementation team to ensure sustainable and transferable downstream services.

Collaboration on the development of a **BioEnergy Atlas for Africa** continued to increase. South Africa provided ZAR 2 million in initial funding until 2014 and engaged with the International Renewable Energy Agency (IRENA), Germany (DLR), USA (NREL), Brazil (INPE), and Austria (Z\_GIS) through the FP7 Project EnerGEO.

First results include data sets published under the BioEnergy Atlas for South Africa, and metadata made available through the GEOSS Broker. Most of these data sets are in the public domain, tagged for inclusion in the **GEOSS Data-CORE**. A workshop on the Bioenergy Atlas for Africa was organized at the African Association of Remote Sensing for the Environment (AARSE 2012; 27 October - 02 November 2012, Morocco) to plan activities for the coming two years.

With regard to capacity building, two **Summer Schools** were held in the context of the EnerGEO project. The second EnerGEO Summer School, entitled “**Unlocking renewable energy potentials for Africa**” (Kampala, Uganda, 4–13 March 2013), focused on modeling of biomass and solar energy supply and demand, and the impact on the environment. It was organized by Makerere University, **Uganda** and Salzburg University, Austria (see [www.energeo-project.eu/calendar/2nd-energeo-summer-school-2013.html](http://www.energeo-project.eu/calendar/2nd-energeo-summer-school-2013.html)).

The third EnerGEO Summer School, entitled “Environmental impact assessment of a transition to renewable energies” (Utrecht, Netherlands, Oct 15-25 2013), trained students from 9 countries (e.g. **Zimbabwe, Zambia, Nigeria, Ethiopia, India, Russia**) on the use of models for **assessing energy potentials, environmental impact**, life cycle analysis and renewable-energy use.

The course was rounded off by interdisciplinary dialogues on the energy policy context. Lectures were jointly organized by Salzburg University (Z\_GIS), Austria, and TNO, Netherlands with support from EnerGEO partners e.g. IIASA, France (MINES ParisTech), Germany (DLR) and Austria (Research Studios Austria; iSPACE); see [www.energeo-project.eu/calendar/3rd-energeo-summer-school-.html](http://www.energeo-project.eu/calendar/3rd-energeo-summer-school-.html).

IIASA organized an E-training session on GEO and GEOSS in the frame of the EU-funded Balkan GEO Net project ([balkangeo.net/index.php?option=com\\_content&view=article&id=111&Itemid=89](http://balkangeo.net/index.php?option=com_content&view=article&id=111&Itemid=89)).

## HEALTH

### Understanding environmental factors affecting human health and well-being

#### HE-01 Tools and Information for Health Decision-Making

A **new Malaria Map-room** was developed by the USA (NASA) and the International Research Institute for Climate and Society (IRI) to produce maps of Seasonal Climatic Suitability for Malaria Transmission (SCSMT). The maps show the number of **months suitable for malaria transmission**, based on climatological averages (e.g. rainfall estimates, MODIS vegetation products at 250m spatial resolution, MODIS Land Surface Temperature). Suitability is defined as the coincidence of precipitation accumulation greater than 80 mm, average temperature between 18°C and 32°C, and relative humidity greater than 60%. The latter are factors of **mosquito development time** as well as an indicator of Plasmodium parasite development within the mosquito vectors ([iridl.ldeo.columbia.edu/maproom/Health/Regional/Africa/Malaria/CSMT/index.html](http://iridl.ldeo.columbia.edu/maproom/Health/Regional/Africa/Malaria/CSMT/index.html)).

Likewise, a **new Meningitis Map-room** was launched to provide information tools for epidemic meningitis ([www.iridl.ldeo.columbia.edu/maproom/Health/Regional/Africa/Meningitis/](http://www.iridl.ldeo.columbia.edu/maproom/Health/Regional/Africa/Meningitis/)). The latter features **observed distribution maps** of meningitis epidemics **during 1841-1999** and **predicted probability maps** of meningitis epidemics. These risk maps are derived from an environmentally-driven model using absolute humidity profiles and land-cover type.

The US (NCAR, NSF) and the WHO made progress in utilizing humidity forecasts for predicting **meningitis** outbreaks. A recent WHO 2012-2013 **Outbreak Prediction Exercise was conducted for Benin, Chad, Nigeria, Togo, Ivory Coast, and Senegal**. Several meteorological centers produced global forecasts which were used to estimate future humidity 2 weeks in advance (available through the THORPEX-TIGGE archive; see Task WE-01).

The **Global Environmental and Occupational Health (GEOHealth)** Program brought together US and other regional research institutions, NGOs, and government ministries in order to plan research, training, data management, and development activities. Phase I consists of pairing a US research institution and **low- or middle-income country (LMIC)** institution, to address priority needs and build on existing strengths in core sciences (e.g. epidemiology, biostatistics, genetics) in subject areas ranging from **air (indoor and outdoor)**, and water quality, **workplace safety** and occupational health, to climate change and agricultural health.

The **Metadata Access Tool for Climate and Health (MATCH)** was developed by the US Global Change Research Program (USGCRP) as a searchable clearinghouse that provides **access** to metadata for health surveillance, climate, ocean and environmental data sets through a single online portal. MATCH characterizes and provides links to **publicly available US data sets, early warning systems, and tools** related to health impacts of global climate change; it is designed to facilitate and improve the quality of research and data stewardship, and includes points of contact and caveats about data ([match.globalchange.gov](http://match.globalchange.gov)).

Several US agencies worked together within the Federal **Tick-Borne Diseases (TBD)** Integrated Pest Management Workgroup to develop an **information clearinghouse** on TBDs. Recent activities include completing a White Paper on needs & strategies; conducting a two-day symposium in March 2013; systematically collecting data on local needs; and conducting outreach to stakeholders.

## HE-02 Tracking Pollutants

Italy (CNR-IIA) and partners are developing an EU-funded **Global Mercury Observation System (GMOS)** by harmonizing standard operating procedures for monitoring mercury and its compounds in air, precipitation samples, surface water, soil, sediments, vegetation and biota. The sharing of data from this network helps understand temporal and spatial patterns of mercury transport and deposition to, and evasion from, terrestrial and aquatic ecosystems.

As of end 2013, the GMOS **monitoring network has been fully established** and historical datasets and metadata have been completed. A **cyber(e)-infrastructure** is collecting **near real-time data** from ground-based sites and a **Quality Assurance/Quality Control** system has been implemented and is undergoing testing. A new data portal has been established at [www.gmos.eu/sdi](http://www.gmos.eu/sdi).

Key contributors include the UNEP Mercury Programme, the Hemispheric Transport of Air Pollutants Task Force (TF HTAP), the European Monitoring and Evaluation Program (EMEP), MercNet/AMNet initiative in USA, CAMNet in Canada, and other international monitoring and modeling efforts.

Networking activities are carried out that specifically build **individual, institutional and infrastructure capacity** related to GMOS. Increased use of Earth observation in policy and decision making is promoted, encouraging enhanced participation in GEO and GEOSS.

GMOS should directly support the implementation of the **Minimata Convention** that was adopted by a thousand delegates from about 140 nations on 10 October 2013 in Kumamoto, Japan. Under the Convention, “each party shall not allow, by taking appropriate measures, the **manufacture, import or export of mercury-added products**” after the phase-out date of 2020, referring to a list of products including fluorescent lamps. The treaty also seeks to decrease the discharge of mercury into the **air, water and land**, to promote proper storage and disposal of mercury, as well as **reduce the use and discharge of mercury** in the process of **gold mining in developing countries**.

UNEP (Stockholm Convention Secretariat), in cooperation with the Czech Republic (RECETOX), is leading the implementation of a Global Monitoring Plan (GMP) for **Persistent Organic Pollutants (POPs)**. The GMP aims to support the monitoring of POPs and the effective evaluation of the **Stockholm Convention**.

For the second phase of the GMP (2010-2015), attention is given to gathering baseline data for the **10 new POPs** listed in the Stockholm Convention, in addition to covering existing data gaps and assessing how POPs **concentrations have evolved** since first monitoring reports.

Data on POPs have been collected from both the active and passive air monitoring networks. A web portal is now providing **access to this data, and visualization tools** have been developed, all of which are available at: [www.pops-gmp.org](http://www.pops-gmp.org)

The Global Environmental Assessment Information System (GENASIS) has been inaugurated by the Czech Republic (Masaryk University) to provide **comprehensive information on contamination of the environment by chemicals** with a focus on persistent organic pollutants (POPs). GENASIS provides up-to-date information on spatial and temporal trends in POPs concentrations in the environment, and includes analysis and visualization tools as well as GMP data management systems.

The Stockholm Convention is a **global treaty to protect human health** and the environment from POPs through a range of measures aimed at reducing and ultimately eliminating their releases. POPs are recognized as chemicals of global concern due to long-range transport in the atmosphere, persistence in the environment, ability to bio-accumulate and bio-magnify in ecosystems and significant negative effects on human health and the environment. The POPs listed under the Convention are **pesticides, industrial chemicals** and by-products including dioxins and furans, and other chemicals.

## WATER

### Improving water-resource management through better understanding of the water cycle

#### WA-01 Integrated Water Information

##### *Water Cycle Products and Services*

Japan has launched the **JAXA Global Rainfall Watch** (<http://sharaku.eorc.jaxa.jp/GSMaP/>) offering **hourly global rainfall maps in near-real-time** (approximately 4 hours after observation) using a combined MW-IR (MultiWavelength-InfraRed) algorithm. Maps also feature infra-red cloud images merged from Japan (JMA) MTSAT satellite, US (NOAA) GOES satellites and EUMETSAT Meteosat satellites. A JAXA Water Cycle portal has been further developing to expand access to water cycle data. By developing linkages with the WMO Global Terrestrial Network – Hydrology (GTN-H) data centers more in-situ data are now being made available through the system.

A number of US (NASA) **Tropical Rainfall Measuring Mission (TRMM)** products have been reprocessed with revised algorithms for **1998-present** (moving from Version 6 to 7 TRMM products). The Global Precipitation Climatology Project (GPCP) has released final datasets for Version 2.2 of the monthly, and Version 1.2 of the daily, satellite-gauge precipitation estimates. These datasets provide **monthly estimates** on a 2.5°x2.5° global grid for the period **1979-2010**. The Global Precipitation Climatology Centre (GPCC) has also released new (Version 6) data sets. The primary change is in improved gauge coverage and accuracy in China. GPCP and GPCC are WCRP (GEWEX) activities.

**Indonesia** has joined the **Global Drought Information System** (<http://www.drought.gov/gdm/>). The Water Center for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC) is helping develop the Americas component of the Global Drought Information System. Progress has also been made developing a **South American regional network** for in-situ soil moisture and flux tower data. A journal article entitled “Toward Global Drought Early Warning Capability: Expanding International Cooperation for the Development of a Framework for Monitoring and Forecasting” has been published by the Bulletin of the American Meteorological Society (BAMS) in its June 2013 edition.

The “GEO Inland and Coastal **Water Quality**” working group advanced, through a webinar series, timely topics such as Global Observatory of **Lake Responses to Environmental Change** (Globolakes), Global Lakes Sentinel Services (GlaSS), Global Lake Ecological Observatory Network (GLEON), Networking Lake Observatories in Europe (NETLAKE), and Global Lake Temperature Collaboration (GLTC).

Collaboration between the **Health and Water** areas has been explored at 5<sup>th</sup> annual meeting of the Health and Environment Community of Practice (23-25 July 2013, Washington DC, USA). Areas of cross-Task interaction centered on water quality monitoring and indicators.

The Integrated Global Water Cycle Observations (IGWCO) Community of Practice, in collaboration with CEOS and Japan (JAXA), has produced the 1st draft of a major revision of its 2004 Report – to be delivered to the GEO-X Plenary in 2014. The new Report proposes **a strategy for water-cycle observations in GEO**. The IGWCO met twice (7-8 Dec 2012, San Francisco, USA; 17-18 April 2013, Barcelona, Spain) to review progress and solicit comments from experts. IGWCO has also participated in populating the User Requirements Registry (URR) with water projects.

The Budapest Water Summit (8-10 October 2013) was a high-level event with definition of **Sustainable Development Goals (SDGs)** for Water as the principal topic of discussion. During the Summit, IGWCO members worked with the Global Water System Project (GWSP) to explore the role of GEO in support of the Sustainable Water Future Programme (SWFP), which will serve as research and advisory component within the framework of the Future Earth initiative to implement SDGs for water. SWFP has the potential to become a **global initiative for the Water Societal Benefit Area**.

A number of presentations have been made by IGWCO members e.g. on Earth observation contributions to Water Security (Rio + 20), and the Water-Energy-Food Nexus and Sustainable Development goals at the Water in the Anthropocene Symposium on 22-23 May 2013 in Bonn, Germany.

#### *Information Service for Cold Regions*

The **GEO Cold Regions initiative** has been launched to facilitate project coordination and data interoperability within GEOSS. A white paper and a website are currently under development under the leadership of Switzerland (WSL/SLF). A LinkedIn group has also been set up to disseminate information and engage users.

The GEO Cold Regions initiative aims to be comprehensive and include **national/international programs and projects over the Arctic, Antarctic, the Third Pole and mountainous cold regions**. Participants include the: WMO Global Cryosphere Watch, US National Snow and Ice Data Center, Sustaining Arctic Observing Networks (SAON), Canadian Cryospheric Information Network/Polar Data Catalogue, Norwegian Meteorological Institute, Antarctic land cover mapping; Third Pole Environment (TPE) Program, and ICIMOD.

Recent activities have also helped to engage **new partners** such as the Swiss Experiment Platform (SwissEx), the Pan-Eurasian Experiment (PEEX), the Svalbard Integrated Arctic Earth Observing System (SIOS), and the Southern Ocean Observation System (SOOS). The International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT) has also joined, bringing capacity from over **60 circumpolar and northern alpine research stations** to the initiative.

Discussion is underway with the Canadian Cryospheric Information Network (CCIN) to determine if selected **Polar Data Catalogue (PDC)** data sets can be **registered in the GEOSS Common Infrastructure**. This decision relies partly on receiving approval from dataset providers. Additionally, subject to availability of resources, data management of the Canadian International Polar Year collection will continue, in collaboration with other Canadian partner organizations.

The Global Cryosphere Watch (GCW) is developing prototype portals based on existing **cryosphere data archives and observation stations**. Portals will be linked through the WMO Information System (WIS) using GEOSS interoperability standards where possible. GCW has initiated the development of its network of surface measurement sites (CryoNet) over Europe, Canada and Asia.

Support for **pan-Arctic data sharing systems** is being encouraged through participation in planning workshops and provision of advice on international data management and interoperability standards. The aim is to link existing and future portals of cryospheric information like OSISAF, CryoClim and NORMAP from the Norwegian Meteorological Institute (met.no) to the GCW portal to establish a **Cryosphere Constellation of Portals**. Compatibility with other contributions will be ensured.

The Department of Earth and Environment (DTA) runs a **distributed cyber-infrastructure to collect, manage, publish and share polar research results**. This infrastructure provides multi-disciplinary interoperability following a brokering approach, supporting SCAR (Scientific Committee on Antarctic Research) data policy and in accordance with European and international standards, including GEOSS and INSPIRE.

There are several activities related to the **Interagency Arctic Research Policy Committee (IARPC)** implementation plan ([nsf.gov/geo/plr/arctic/iarpc/start.jsp](http://nsf.gov/geo/plr/arctic/iarpc/start.jsp)). The NSF is supporting the Arctic and **Antarctic Data Consortium (A2DC)**, aimed at coordinating activities among different funded groups to archive, manage and curate data from Polar projects. The **Arctic hub** (<http://www.arctichub.net>) favors the connection among the Arctic observing communities, providing a forum for exchanging ideas and best practices. US agencies are taking action to address the **executive order of the US President on open data** ([whitehouse.gov/sites/default/files/microsites/ostp/2013opendata.pdf](http://whitehouse.gov/sites/default/files/microsites/ostp/2013opendata.pdf)).

A **Third Pole Environment (TPE) Database** (<http://www.tpedatabase.cn>) has been created and made **publicly searchable**. The Chinese snow pack observation project for the Tibetan Plateau is now

in its second year, and the data portal and website are under construction using the GEO framework (**Snow Observations over Tibetan Plateau**, <http://www.tibetsnow.org/>).

Finally, Japan (JAMSTEC) has been providing capacity through the Cryosphere Data Archive Partnership (CrDAP) ([jamstec.go.jp/acdap/](http://jamstec.go.jp/acdap/)), and Norway (Norwegian Space Centre) and ESA have been building the **CryoClim cryosphere climate monitoring service**. CryoClim has produced satellite data derived glacier products for mainland Norway and Svalbard, and global aggregated sea-ice products (1979-present) and snow products (1982-present). These products are accessible from the CryoClim **Portal** ([www.cryoclim.net](http://www.cryoclim.net)).

A **GEOSS community portal for cold regions** paper was initiated through the GEO infrastructure and application portal activities, such as the SAON portal, to improve GEOSS portal utility and portal customization.

A GEO Cold Regions workshop was held (Geneva, Switzerland, June 2013) to initiate activities on GEO information services across frozen areas. This workshop kicked off the GEO Cold Regions community. A **Side-Event on Information for Cold Regions** was planned for the GEO-X Plenary, to highlight the role of the GEOSS portal in the cold regions initiative.

#### *Capacity Development and Maintenance*

A series of “**GEOSS in the Americas GEO Overview Webinars**” has been held during the months of October and November 2013. The webinars are bi-lingual English/Spanish and designed to build interest across Latin America, describe GEO global technical activities and progress, understand end-user needs and the status of **GEO activities in individual countries**, identify upcoming meetings and workshops of mutual interest, and discuss approaches others have used to engage with GEO activities. Each webinar is **recorded and made available** for later viewing through the GEO website ([http://earthobservations.org/webinar\\_ga.shtml](http://earthobservations.org/webinar_ga.shtml)).

The **African Water Cycle Coordination Initiative** (AfWCCI) held its 3<sup>rd</sup> workshop (El Jadida, Morocco, 4-5 February 2013) as a follow-up to the 3rd GEOSS African Water Cycle Symposium (Libreville, Gabon, 2012). The AfWCCI is focusing initial efforts on working with river basin organizations to enhance current capacity through **improved data collection, analysis, integration, and sharing**. It is also using the GEO framework to develop the **political consensus** needed to effectively **coordinate transboundary river basins**. **Seven African river-basin organizations** participated in the workshop (Lake Chad, Medjerda, Niger, Nile, Oogoué, Oum Erabia, Volta) and a principal outcome was the development of an implementation plan for Integrated Water Resources Management (IWRM), which now will be ratified by each of the river-basin organizations.

## WEATHER

### Improving weather information, forecasting and warning

#### WE-01 High-Impact Weather Prediction and Information

The WMO World Weather Research Programme (WWRP) has developed TIGGE (THORPEX Interactive Grand Global Ensemble) – a **user-friendly database of global multi-model ensemble weather forecasts** for improved predictions of high-impact weather events. Forecast providers include: Australia (BOM), Brazil (CPTEC), Canada (CMC), China (CMA), France (MétéoFrance), Japan (JMA), Korea (KMA), UK (UKMO), USA (NCEP) and ECMWF.

The TIGGE data is made available for scientific research via **three data portals**, hosted by **ECMWF** (<http://tigge.ecmwf.int/>), **USA** (NCAR; <http://tigge.ucar.edu>) and **China** (CMA, <http://bridge.cma.gov.cn:8080/tigge/>). The ECMWF portal is also improving access to time series data, delivering data in **different formats** and further developing the Ensemble Prediction Systems (EPS).

The Europe-funded FP7 project GEOWOW is underway. Its weather aim is to provide improved access to the TIGGE archive through the **GEOSS Common Infrastructure** (see Task IN-03). Also GEOWOW is developing TIGGE LAM, an extension of the global TIGGE archive to include regional Limited Area Model ensembles for Europe (Figure 1). Another aspect of GEOWOW is the interoperability of data between different scientific domains. One GEOWOW **cross-domain activity (weather and water)** is the **modelling of river discharge** using TIGGE meteorological inputs, validated against river flow observations (see Figure 4). Work also includes the standardisation of hydrological data in order to improve **data exchange**.

TIGGE activities mainly relate to the optimal generation and combination of multi-model ensemble forecasts, and to the development and testing of prototype **multi-model ensemble products** through the WMO Severe Weather Forecast Demonstration Projects (SWFDP). Examples of products 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 probabilities leading to the warnings are calculated both from individual ensembles and from the Multi-Model Grand Ensemble – combining forecasts from ECMWF, Japan JMA, US NCEP, and UKMO (see Figure 5; [http://tparc.mri-jma.go.jp/TIGGE/tigge\\_warning.html](http://tparc.mri-jma.go.jp/TIGGE/tigge_warning.html)).

Work also continues in close conjunction with SWFDPs to assess the potential **benefits and utility** of TIGGE ensemble products for severe weather prediction. Prototype products have been developed based on gridded forecast data (e.g. for **tropical cyclones** or **heavy rainfall risk**, see Figures 2-3). Research and development to identify the optimal way of using ensemble predictions is also being planned.

Improvement in the prediction of high impact weather on the African continent has been rather slow due to **lack of resources** (previous bids for funding have not been successful). The focus is now on completing research into four cases of **extreme weather events across the African continent**, and in particular how these were handled by the available numerical prediction models. Resources remain an issue but there is hope that the case studies will be completed by the end of 2014.



## APPENDIX

### Update from the Data Sharing Working Group

#### 1. Introduction

The GEOSS Data Sharing Working Group (DSWG) was established by the GEO-VIII Plenary for the purpose of supporting GEO in its goal of putting into practice the Implementation Guidelines for the GEOSS Data Sharing Principles and the GEOSS Data Sharing Action Plan. It is also responsible for executing the GEO 2012-2015 Work Plan Task ID-01: Advancing the GEOSS Data Sharing Principles. The DSWG works with GEO collectively, including the Implementation Boards and all other Tasks, and Working Groups in the Work Plan, to enable effective implementation of the GEOSS Data Sharing Principles by:

- Supporting and expanding the GEOSS Data Collection of Open Resources for Everyone (GEOSS Data-CORE), a distributed pool of documented datasets with full, open and unrestricted access at no more than the cost of reproduction and distribution;
- Ensuring that the framework for full and open access to data is addressed in the implementation of the GEOSS Common Infrastructure and the GEOSS;
- Monitoring the use and impact of resources made available with full and open access;
- Promoting the efficacy of the Data Sharing Principles in delivering societal benefits;
- Evaluating the outcomes of the GEOSS Data Sharing Action Plan and recommending further actions, including promoting comprehensive data documentation and any mechanisms needed to further enhance the ability of the GEOSS architecture to provide access to data, metadata and products;
- Assisting GEO Members in establishing national coordinating mechanisms, with the support of relevant Participating Organisations, to promote and monitor engagement with the implementation of the GEOSS Data Sharing Principles and provide feedback to GEO;
- Supporting GEO Members in developing policy frameworks, with the support of relevant Participating Organisations, to further implement the GEOSS Data Sharing Principles and GEOSS Data Sharing Action Plan.

To facilitate its work, the DSWG initially established three sub-groups (SG): the GEOSS Data-CORE and GCI SG; the Legal Interoperability SG; and the Documentation and Data Quality SG. The DSWG has now established a fourth sub-group, the Capacity Building SG. Brief reports on the work being carried out by each of these sub-groups are given below.

In addition, the DSWG has established an ad-hoc working group to possibly propose an updated formulation of the GEOSS Data Sharing Principles for GEO Post 2015. The ad hoc working group is looking into possibilities of rewording or otherwise updating the current GEOSS Data Sharing Principles in order to further encourage full and open sharing of data, products and services within GEOSS. Based on the outcomes of this activity, the DSWG will decide whether to propose any such updated formulation of the GEOSS Data Sharing Principles to the GEO Plenary (next year).

## 2. The GCI and GEOSS Data Core Subgroup

In 2013, work on developing, populating and implementing the GEOSS Data-CORE has continued in order to provide **full, open and unrestricted access** to a core set of essential environmental observation and information products, in accordance with the GEOSS Data Sharing Principles.

There are presently **more than 1 million GEOSS Data-CORE resources that can now be discovered** using the GEO Portal and it is expected that this number will still continue to increase as a result of the contacts made with GEO members that have pledged data to the GEOSS Data-CORE. The European Commission has started to liaise with the GEO Secretariat in this exercise, and will still continue to support these activities until the end of 2013.

Therefore, with the support of the European Commission on behalf of the DSWG, the GEO Secretariat sent a new reminder to GEO Members and Participating Organisations who pledged some resources to the GEOSS Data-CORE but still had not taken any action to effectively tag their resources as such. Unfortunately so far only a few responses have been received – only three out of 23 people contacted have responded to the call.

## 3. The Legal Interoperability Subgroup

The Legal Interoperability Subgroup is in the process of revising its background white paper and compiling a list of recommended open access licenses and waivers, as well as restricted licenses that can be used within GEOSS for sharing data through the GEOSS Data-CORE and their key characteristics. These recommended licences will be submitted to the GEO-X Plenary, and updated before each subsequent GEO Plenary, and will be discussed in the white paper “Legal Options for the Exchange of Data through the GEOSS Data-CORE”. In addition, the SG is working on the longer paper to be published in a peer-reviewed law journal in 2014. This paper will be based on the GEO white paper, but goes further to analyse the legal interoperability issues that may arise when GEOSS Data-CORE are used together with data that are shared through GEOSS with restrictions.

Based on the preparatory work of the SG, the DSWG is at the moment finalising a short review paper “Interpretation of the full and open (free and unrestricted, etc.) access to and use of (geographic) data: existing approaches”. The paper focuses on the comparison of the terms used as equivalents to “full and open” concept for sharing data through GEOSS, and highlights the similarities and differences in the approaches, policies and their implementation in various jurisdictions.

This SG also plans to develop educational and training materials on open access licenses and waivers for data providers and users. Another planned activity is to look at the nine Societal Benefit areas to see how they can interact and what the opportunities and barriers for legal interoperability and sharing of data are within each of them. This analysis will aid DSWG efforts to develop recommendations and feedback relevant to science and technology activities (e.g., implementation of open access licenses and waivers and associated **digital rights** management technologies). The SG is drafting a longer article that helps substantiate in greater detail the summary white paper.

## 4. The Documentation and Data Quality Subgroup

The Documentation and Data Quality SG continued its work on data quality and documentation issues. It finalized the text of the Data Quality Guidelines in June, and the full DSWG approved the guidelines. This final text was sent to the last Executive Committee. A major topic of discussion this summer was to consider the next steps in exposing the Data Quality guidelines to the GEOSS data providers. The SG is also considering ways to obtain feedback from the GEO community on the Data Quality Guidelines.

During these past few months the SG has spent time on coordinating its activities with other GEO and non GEO bodies. For example, coordination with the Committee on Earth Observing Satellites (CEOS) has resulted in improved discussions on data quality, and a CEOS representative now serves on the DDQ SG. DDQ has also reached out to other GEO Members and Participating Organizations.

A major activity has been the consideration of future work by the SG. Candidate activities include work on the GEO label, further amplification of documentation procedures for GEOSS data sets, and support to relevant standards that are useful for data set documentation.

## **5. Capacity Building Subgroup**

The DSWG has established a new Capacity Building SG which plans to provide support to GEO Members in enabling them to establish national coordinating mechanisms, develop flexible policy frameworks and to promote with data providers the benefits of full and open access to data. The SG will assist to maximize the number of documented datasets made available through the GCI.

The overall strategy is to identify lessons learned and best practices based on the experiences of GEO Members who have already established national coordinating mechanisms or developed flexible policy frameworks. This will form the basis for documentation that can help GEO Members that would like to establish their own national coordinating mechanism or work to develop flexible policy frameworks. A questionnaire to investigate barriers that hinders data sharing and approaches to improving data sharing is being developed.

## **6. Post 2015 Working Group contribution**

The GEO Data Sharing Working Group, DSWG, is working on a Post 2015 Data Sharing Strategy that when completed will be forwarded to the GEO Post 2015 Working Group for their consideration. The purpose of this note is to inform the GEO Post 2015 Working Group on some issues that the DSWG considers important for post 2015 GEO. The DSWG hopes that these issues can be adopted for recommendation by the Post 2015 Working Group or at the minimum included for discussion and resolution at a later date.

The draft outlines issues regarding:

- Possible restatement of data sharing principles;
- Strengthening the evaluation of the progress of GEO data sharing;
- Emphasizing reference data sets and interoperability;
- Consideration of new data sharing issues arising from new emergent observation systems;
- Developing a Strategy of Education and Communication of Earth Observations in the World (SECEOW).

## **7. Conclusion**

The overall implementation of the GEOSS Data Sharing Action Plan is making progress. The DSWG has now extended its activities to ensure that it addresses all of the actions in the Data Sharing Action Plan. The DSWG will also monitor whether additional challenges emerge in sharing or accessing GEOSS data and identify additional opportunities to further implement the GEOSS Data Sharing Principles.

The Data Sharing Working Group recognizes that **additional resources** are needed to ensure desirable levels of participation by developing country representatives in Working Group activities and desirable levels of outreach to developing country data users and providers.

The DSWG also recognizes the need for expanded representation and participation in the working group and its activities by Members and Participating Organizations. The DSWG is planning a side event at the upcoming Plenary and Ministerial that will showcase the DSWG's activities and provide an opportunity to attract additional participation.

The DSWG considers it critical that contributions to the GEOSS Data-CORE are actively encouraged and followed-up, as such actions are critical to ensuring the success of GEOSS. This requires a central focal-point and a continuous effort which goes beyond the available resources of the DSWG. In this sense, the DSWG is pleased to see that the GEO Secretariat is starting to liaise with the DSWG in order to be more involved in this effort and take it over after 2013.

The DSWG is discussing possible strategies to be taken into consideration by the GEO post-2015 Working Group. Topics and/or issues include: updating the data sharing principles; increased responsibility and role of the GEO Secretariat in supporting the implementation of the GEOSS Data-CORE, the GCI and the Data Sharing Action Plan; improving the inclusion of commercial databases in the GEOSS; and exploring the implication of new Earth Observation concepts and technologies, such as Citizens' Observatories.

## 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
ASSENDS	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
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, Columbia University, USA
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
CUAHSI	Consortium of Universities for Advancement of Hydrologic Science
CURAT	Ivory Coast Centre Universitaire de Recherche et d'Application en Télédétection
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
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
GFZ	German National Research Center for Earth Sciences
GGMN	Global Groundwater Monitoring Network
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
GSICS	Global Space-based Inter-Calibration System
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
ISDE	International Society for Digital Earth
ISDR	International Strategy for Disaster Reduction
ISESCO	Islamic Educational, Scientific and Cultural Organization
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
MEPS	Meso-scale Ensemble Prediction Systems
MERIS	Medium Resolution Imaging Spectrometer
MERIT	Meningitis Environmental Risk Information Technologies
MODIS	Moderate Resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding
NADM	North American Drought Monitor
NARSS	National Authority for Remote Sensing and Space Sciences, Egypt
NASA	National Aeronautics and Space Administration
NASG	National Administration of Surveying, Mapping and Geoinformation
NBII	National Biological Information Infrastructure
NCAR	US National Center for Atmospheric Research
NCDC	US National Climatic Data Center
NCEP	US National Centers for Environmental Prediction
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
OSFAC	Observatoire Satellitaire des Forêts d'Afrique Centrale
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 MOniTORing (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
RECETOX	Research Centre for Toxic Compounds in the Environment
RDP	Research and Development Project
SADC	Southern African Development Community
SAFARI	Societal Applications in Fisheries & Aquaculture using Remotely-Sensed Imagery
SAR	Synthetic Aperture Radar
SBA	Societal Benefit Area
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCOR	ICSU Scientific Committee on Oceanic Research



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	NOAA 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
USOFDA	US Office of Foreign Disaster Assistance Project Management
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