

# **GEO 2009-2011 WORK PLAN**

**8 December 2010**

## TABLE OF CONTENTS

<b>GEO 2009-2011 WORK PLAN</b>	<b>3</b>
<b>1 BUILDING AN INTEGRATED GEOSS</b>	<b>3</b>
1.1 ARCHITECTURE	3
AR-09-01: <i>GEOSS Common Infrastructure (GCI)</i> .....	3
AR-09-02: <i>Interoperable Systems for GEOSS</i> .....	4
AR-09-03: <i>Advocating for Sustained Observing Systems</i> .....	5
AR-09-04: <i>Dissemination and Distribution Networks</i> .....	7
AR-06-11: <i>Radio Frequency Protection</i> .....	7
1.2 DATA MANAGEMENT	8
DA-06-01: <i>GEOSS Data Sharing Principles</i> .....	8
DA-09-01: <i>Data Management</i> .....	8
DA-09-02: <i>Data Integration and Analysis</i> .....	9
DA-09-03: <i>Global Data Sets</i> .....	9
1.3 CAPACITY BUILDING	11
CB-09-01: <i>Resource (or Seville Roadmap) Mobilization</i> .....	11
CB-09-02: <i>Building Individual Capacity in Earth Observations</i> .....	11
CB-09-03: <i>Building Institutional Capacity to Use Earth Observations</i> .....	12
CB-09-04: <i>Capacity Building Needs and Gap Assessment</i> .....	13
CB-09-05: <i>Infrastructure Development and Technology Transfer for Information Access</i> .....	13
CB-10-01: <i>Building Capacity through Outreach and Awareness Raising</i> .....	14
1.4 SCIENCE AND TECHNOLOGY	16
ST-09-01: <i>Catalyzing Research and Development (R&amp;D) Resources for GEOSS</i> .....	16
ST-09-02: <i>Promoting Awareness and Benefits of GEO in the Science and Technology Community</i> .....	16
1.5 USER ENGAGEMENT	17
US-09-01: <i>User Engagement</i> .....	17
US-09-02: <i>Socio-Economic Indicators</i> .....	17
US-09-03: <i>Cross-Cutting Products and Services</i> .....	18
<b>2 THE 9 GEOSS SOCIETAL BENEFIT AREAS</b>	<b>19</b>
2.1 DISASTERS	19
DI-06-09: <i>Use of Satellites for Risk Management</i> .....	19
DI-09-01: <i>Systematic Monitoring for Geohazards Risk Assessment</i> .....	19
DI-09-02: <i>Multi-Risk Management and Regional Applications</i> .....	20
DI-09-03: <i>Warning Systems for Disasters</i> .....	21
2.2 HEALTH	22
HE-09-01: <i>Information Systems for Health</i> .....	22
HE-09-02: <i>Monitoring and Prediction Systems for Health</i> .....	22
HE-09-03: <i>End to End Projects for Health</i> .....	24
2.3 ENERGY	26
EN-07-01: <i>Management of Energy Sources</i> .....	26
EN-07-02: <i>Energy Environmental Impact Monitoring</i> .....	26
EN-07-03: <i>Energy Policy Planning</i> .....	27
2.4 CLIMATE	28
CL-06-01: <i>A Climate Record for Assessing Variability and Change</i> .....	28
CL-09-01: <i>Environmental Information for Decision-making, Risk Management and Adaptation</i> .....	28
CL-09-02: <i>Accelerating the Implementation of the Global Climate Observing System</i> .....	29
CL-09-03: <i>Global Carbon Observation and Analysis System</i> .....	30
2.5 WATER	32
WA-06-02: <i>Droughts, Floods and Water Resource Management</i> .....	32
WA-06-07: <i>Capacity Building for Water Resource Management</i> .....	33
WA-08-01: <i>Integrated Products for Water Resource Management and Research</i> .....	34
2.6 WEATHER	36
WE-06-03: <i>TIGGE and the Development of a Global Interactive Forecast System for Weather</i> .....	36
WE-09-01: <i>Capacity Building for High-Impact Weather Prediction</i> .....	37
2.7 ECOSYSTEMS	38
EC-09-01: <i>Ecosystem Observation and Monitoring Network (GEO EcoNet)</i> .....	38
EC-09-02: <i>Ecosystem Vulnerability to Global Change</i> .....	39
2.8 AGRICULTURE	41
AG-06-02: <i>Data Utilization in Fisheries and Aquaculture</i> .....	41
AG-07-03: <i>Global Agricultural Monitoring</i> .....	41
2.9 BIODIVERSITY	43
BI-07-01: <i>Developing a Global Biodiversity Observation Network</i> .....	43
APPENDIX A: GEO COMMUNITIES OF PRACTICE	45
APPENDIX B: ACRONYMS	47
ANNEX: GUIDE TO WORK PLAN MANAGEMENT	54

# GEO 2009-2011 WORK PLAN

## 1 BUILDING AN INTEGRATED GEOSS

### 1.1 ARCHITECTURE

In this Section, Task implementation and sub-task cross-coordination within a Task are under the guidance of the Architecture and Data Committee

#### **AR-09-01: GEOSS Common Infrastructure (GCI)**

Address the core architectural principles in GEOSS as a function of user needs. Provide useful guidelines and tools to GEO Members and Participating Organizations in the establishment and operation of GEOSS.

##### a) Enabling Deployment of a GEOSS Architecture

This sub-task is led by EC (EuroGEOSS), USA (FGDC, NOAA, ddnebert@usgs.gov), ESA and IEEE

Facilitate and support the deployment and operation of the GCI, including the incorporation of contributed components and services consistent with the GEOSS architecture; the GCI consists of one single GEO web portal providing user access to information and services related to the nine Societal Benefit Areas, one single clearinghouse for searching data, information and services, and registries containing information about GEOSS components and associated standards and best practices. Define and solicit support for a contributed-systems (e.g. components, services) facilitator function. Expand the existing GEO process for interoperability arrangements including the Standards and Interoperability Forum (SIF) and regional teams, and consensus on linkages of GEOSS components and Spatial Data Infrastructure (SDI). With support from the User Interface Committee, develop user-driven system-of-systems engineering activities to ensure that the GEOSS reference and functional architecture is appropriately designed.

Define and deploy core GEOSS registry infrastructure for GEO Members and Participating Organizations to: (i) commit component systems; (ii) register related resources with GEOSS; and (iii) provide consultation to the contributed-systems facilitator. The registries in the GCI will be components and services registries, standards and special arrangement registries, best practices registry, user-requirements registry, and others as needed to support the core operations requirements of GEOSS. Address integration and user issues emerging from the initial operating capability of the GCI. Document the GEOSS convergence and interoperability supporting the high-level strategic and tactical guidelines of GEOSS implementation. Update and maintain the Strategic and Tactical Guidance Documents to reflect current practices and implementation of the GEOSS Architecture.

##### b) GEOSS Architecture Implementation Pilot

This sub-task is led by USA (FGDC, NOAA) and OGC (gpercivall@opengeospatial.org)

Develop and pilot new process and infrastructure components for the GCI and the broader GEOSS architecture through continuation of existing efforts and new activities solicited through Architecture Implementation Pilot (AIP) calls for participation and other means. Facilitate continuation of the Interoperability Process Pilot Project (IP3) as a means of coordinating cross-disciplinary interoperability studies and pilots. Coordinate societal benefit area support by the IP3 Pilots. As appropriate, incorporate GEOSS contributed infrastructure components into pilot implementations of the GEOSS Architecture in coordination with Task AR-09-01a. Develop a capacity building registry

infrastructure to include relevant information on existing Earth observation capacity building efforts and resources (the Capacity Building Committee will supply the content for this registry). Provide phased delivery of components to operations under sub-task AR-09-01a; with each phase consisting of: architecture refinements based on user interactions; component interoperability testing; and SBA-focused demonstrations.

c) GEOSS Best Practices Registry

This sub-task is led by Japan (University of Tokyo) and IEEE (ruth.duerr@ieee.org)

Support the operation and upgrade of the GEOSS Best Practices Registry. The registry should be capable of including best practices in observation, modelling and analyses, ontologies, capacity building, cost-benefit sharing mechanisms, and other relevant GEO best practices (e.g. data sharing, cooperative data acquisition, joint development, joint flight, collaborative sciences) and other relevant GEO best practices. This sub-task will work in coordination with the four GEO Committees and Members & Participating Organizations, who will provide the content for the registry.

d) Ontology and Taxonomy Development

This sub-task is led by Japan (University of Tokyo, shiba@csis.u-tokyo.ac.jp), ESA and IEEE

As part of the Best Practices Registry, create an Ontology and Taxonomy section to get an overview of available ontologies and taxonomies. Compare and analyze ontologies and taxonomies such as to avoid unnecessary overlaps and conflicts as a basis for improved interoperability. Support Standards Development Organizations to develop ontologies and taxonomies stored in the Best Practices Registry into formal standards. Assist in the deployment of a reference able ontology for Earth observation and information to link the User Requirements Registry with the Components and Services Registry. Develop an infrastructure component to use the ontology and taxonomy section of the best practices registry for discovery composition and access in the frame of the GEOSS architecture.

## **AR-09-02: Interoperable Systems for GEOSS**

Address the various interoperability aspects of contributing systems, including observing, modelling and information systems.

a) Virtual Constellations

This sub-task is led by CEOS (JAXA, kajii.makoto@jaxa.jp)

Advocate rapid development of the “CEOS Constellations Concept”. Observations from a virtual constellation would provide better temporal, spatial, and spectral resolution and related data management and dissemination. A series of virtual constellations are in definition by space agencies, in consultation with user communities within the CEOS framework, each addressing key GEOSS observation gaps in the process. Prototype Constellations address:

- Precipitation, which aims to strengthen international cooperation on space-based observations of precipitation, including realisation of the GPM mission;
- Atmospheric Chemistry, which will address many of the needs for atmospheric observations of the climate community;
- Land Surface Imaging, designed to ensure the relevant synergy with High Resolution Multispectral Imager Continuity;
- Ocean Surface Topography, designed to ensure continuity of Sea Level measurement in accordance with GCOS requirements;

- Ocean Colour Radiometry which will provide scientific data products related to marine ecosystems and ocean biogeochemistry for near-surface global ocean and coastal waters;
- Ocean Surface Vector Winds to collect observations of ocean surface vector winds over the global ice-free ocean that will be used for operational analyses and forecasts, as well as retrospective research.

Other cases, for instance constellations of SAR systems or micro-satellites for a range of Earth observation applications, will be considered along the line.

#### b) WIS

This sub-task is led by WMO (OBS/WIS, dthomas@wmo.int)

Upgrade and demonstrate the WMO Information System (WIS) as one operational exemplar of the GEOSS architecture implementation process providing improvements for multiple societal benefit areas. Extend and further improve the existing WMO Global Telecommunications System (GTS) services to ensure time and operational-critical exchange of weather, water, climate and hydro-meteorological disaster data, warnings and products in response to identified user requirements. Implement procedures and mechanisms to provide to all national and international programmes and user communities data discovery and access services, including metadata compliant with relevant international standards. Improve connectivity and access to environmental information among WMO's Member Countries, and interoperability through registration in the relevant GEOSS registers – to facilitate timely decision making and exploitation of WMO's rich information base.

#### c) Sensor Web Enablement for In-Situ Observing Network Facilitation

This sub-task is led by South Africa (CSIR, ingo.simonis@igsi.eu)

Foster the development of space-borne, air-borne, sea-based and ground-based sensing networks (advances in communication technology and ground-based in-situ technologies have made it feasible to consider webs of sensors on all types of platforms with rapid access to observations; this technology is referred to as Sensor Webs and Sensor Networks). Develop scenarios or use cases that demonstrate the value of Sensor Webs to the GEOSS societal benefit areas e.g. Disasters, Health, Biodiversity, Ecosystems and Water. Evaluate the applicable standards, and coordinate with AR-09-01.

#### d) Model Web Development

This sub-task is led by USA (NASA, gary.n.geller@jpl.nasa.gov) and IEEE

Develop a dynamic modelling infrastructure (Model Web) to serve researchers, managers, policy makers and the general public. This will be composed of loosely coupled models that interact via web services, and are independently developed, managed, and operated. Such an approach has many advantages over tightly coupled, closed, integrated systems, which require strong central control, lack flexibility, and provide limited access to products.

### **AR-09-03: Advocating for Sustained Observing Systems**

Establish actions for the maintenance and expansion of GEOSS-underpinning observing systems, including atmospheric, terrestrial, oceanic, both in-situ and space-based. Promote stable, reliable and long-term operations of Earth observing networks within the framework of national policies and international obligations. Make relevant synergies with Task CL-09-02 “Accelerating the Implementation of the Global Climate Observing System”.

#### a) Global Terrestrial Observations

This sub-task is led by GTOS (john.latham@fao.org)

Develop intergovernmental mechanisms for coordinating terrestrial observations needed for climate studies and forecasting. Develop a framework for the preparation of guidance materials, standards, and reporting guidelines for terrestrial (including land-coast interface) observing systems for climate and associated data, metadata, and products to expand the comprehensiveness of current networks and facilitate exchange of data.

#### b) Legacy of the International Polar Year 2007-08

This sub-task is led by WCRP (vryabinin@wmo.int)

Coordinate with the projects involved in the International Polar Year (IPY) to enhance the production and utilization of Earth observations in the realm of cryosphere. Advocate for an appropriate legacy for IPY projects and the continuation of relevant efforts beyond the duration of the IPY.

#### c) Global Ocean Observation System

This sub-task is led by GOOS (b.lee@unesco.org), IEEE and IOC, and is supported by the Coastal Zone Community of Practice

Enhance and improve the coordination of coastal/open-ocean observations and modelling initiatives, in support of a global ocean observation system.

Related activities will include: Improve the global coverage and data accuracy of the coastal/open ocean observing systems as well as the management and archiving of the resulting data and information. Contribute to the implementation of global coastal and open ocean observing networks using the mechanism of GOOS and Regional Alliances. In particular sustain and extend the network of Argo buoys and encourage the establishment of a Program Office to ensure the ongoing implementation of this global array of profiling floats in the ocean. Building on existing capabilities, develop a global coordinated information and data system for deep-ocean monitoring to better understand the dynamics of the ocean processes throughout the ocean water column.

#### d) Global Observing System (GOS)

This sub-task is led by USA (NOAA) and WMO (OBS, bryan@wmo.int)

Achieve a complete and stable Global Observing System (GOS). The components should include in-situ, airborne, or surface-based observations from land and ocean, and space-based observations. High priority should be given to a stable, and as much as possible automated, fully functional World Weather Watch Upper Air Network and the further development of the Aircraft Meteorological Data Relay (AMDAR) programme. The space-based component should include operational geostationary and polar-orbiting components building upon WMO efforts to (i) increase spatial and temporal resolution for geostationary imagers and sounders, and (ii) provide broader availability of polar Doppler wind profiles for initial operational testing.

#### e) Global Geodetic Observing System (GGOS)

This sub-task is led by IAG (mpearlman@cfa.harvard.edu)

Promote the further development of sustained infrastructure needed to satisfy the long-term (10-20 years) requirements for the reference frames and the monitoring of global change signals. GGOS provides observations of variations in Earth shape, gravity field and rotation, which are fundamental for monitoring of climate and global change. GGOS observations contribute to at least seven of the SBAs. Moreover, with the global geodetic reference frames (International Terrestrial Reference Frame (ITRF) and International Celestial Reference Frame), GGOS provide the foundation for most Earth observations. Among other components, geodetic monitoring of global change crucially depends on globally sustained geodetic ground networks.

### **AR-09-04: Dissemination and Distribution Networks**

Develop and foster synergies between diverse communication networks established to distribute and disseminate GEOSS data, information and products.

#### a) GEONETCast

This sub-task is led by China (CMA), Russian Federation (Roshydromet), USA (NOAA, linda.moodie@noaa.gov), EUMETSAT and WMO (OBS)

Further develop GEONETCast as a distribution system for GEOSS-related data, information and products using communication satellites and low cost, self contained, stand alone, off-the-shelf reception stations. GEONETCast is particularly useful in distributing operational or project data where a large number of users can benefit and where Internet access has low bandwidth or is unreliable. GEONETCast is evolving to a fully operational global system with cross-cutting data serving all GEOSS Societal Benefit Areas. In an effort to ensure that data is exchanged among all GEONETCast regional hubs, EUMETCast, GEONETCast America, and CMACast will, within their bandwidth capabilities, re-distribute data and products from other GEONETCast regions to all interested users in their respective regions

#### b) GEONET

This sub-task is led by DANTE, ESA (mirko.albani@esa.int) and IEEE

Establish GEONET as a global communication network of interconnected networks by which GEOSS related information, data and products can be circulated and distributed in response to users and providers needs. GEONET is based on the sharing of national, regional and global telecommunications networks and will serve all GEOSS Societal Benefit Areas. GEONET will support data access, exchange and dissemination services. GEONET will be based on communication network typologies, satellite and terrestrial (fixed and mobile networks), considered most suitable to meet the service requirements, providing access points for users and data providers at identified locations. An inventory of the available networks for access, exchange and dissemination as candidates for GEONET will be performed. The draft architecture and operations concept of GEONET will be defined and a demonstrator based on the available networks will be set-up as a first step towards a full operational system.

### **AR-06-11: Radio Frequency Protection**

This Task is led by WMO (CBS, philippe.tristant@meteo.fr)

Recognizing the fundamental importance of radio-frequencies necessary for all GEOSS components, in particular in-situ, ground- and space-based observations, as well as the increasing economical and political pressure on corresponding parts of the spectrum, undertake appropriate coordinated advocacy activities in association with Member countries, including representations to the International Telecommunication Union (ITU) and other bodies in charge of frequency management. This also includes a support to GEO Members in influencing their national and regional frequency management bodies. In particular, the case of passive bands, essential for Earth observations, will be monitored with the highest care, endeavouring to assess the potential impact of interference on Earth observation applications and final products. In this respect, it is also important to link with Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science (IUCAF).

## 1.2 DATA MANAGEMENT

In this Section, Task implementation and sub-task cross-coordination within a Task are under the guidance of the Architecture and Data Committee

### DA-06-01: GEOSS Data Sharing Principles

This Task is led by ICSU (CODATA, [codata@dial.oleane.com](mailto:codata@dial.oleane.com))

Identify steps required to further the practical application of the agreed GEOSS Data Sharing Principles: (1) There will be full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation; (2) All shared data, metadata, and products will be made available with minimum time delay and at minimum cost; (3) All shared data, metadata, and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

Under the guidance of the Data Sharing Principles Task Force, define near-term milestones needed to come to consensus on *Implementation Guidelines for the GEOSS Data Sharing Principles* and move expeditiously towards the development of working data sharing procedures for GEOSS. This will require an iterative process, whereby initial experience with data sharing policies and procedures will provide important lessons. Throughout this process, ensure data access for capacity building and work in close connection with DA-09-01a (GEOSS Quality Assurance Strategy).

### DA-09-01: Data Management

Identify and implement recommendations for best practices of Earth Observation data and information life cycle management. Improve data discovery, availability, near real-time access and traceability including data tagging for citation tracking.

#### a) GEOSS Quality Assurance Strategy

This sub-task is led by CEOS (ESA, WGCV, [pascal.lecomte@esa.int](mailto:pascal.lecomte@esa.int)) and IEEE

Develop a GEO data quality assurance strategy, beginning with space-based observations and evaluating expansion to in-situ observations, taking account of existing work in this area, and including quality issues of derived information products. Develop a GEO data quality assurance strategy and implementation process, beginning with space-based observations and expanding to in-situ observations, taking account of existing associated GEOSS quality assurance work, and including the quality issues of Earth observation information products. A Quality Assurance framework for Earth Observation (QA4EO) has been developed and is now being implemented. As a consequence of implementation, it is proposed that GEOSS data set registration include associated quality assurance information to enable harmonization and interoperability, which during the transitional phase could be a voluntary self declaration of compliance with respect to QA4EO and/or at least its underlying principles.

#### b) Data, Metadata and Products Harmonisation

This sub-task is led by USA (FGDC) and CEOS (NOAA, [kenneth.mcdonald@noaa.gov](mailto:kenneth.mcdonald@noaa.gov))

Facilitate the development, availability and harmonization of data, metadata, and products commonly required across diverse societal benefit areas, including base maps, land-cover data sets, and common socio-economic data.

#### c) Long Term Preservation of Earth Observation Data

This sub-task is led by Canada (CSA), France (CNES), Germany (DLR), Italy (ASI), and ESA ([mirko.albani@esa.int](mailto:mirko.albani@esa.int))

Develop a GEO strategy for the preservation of Earth observation data in the long term, beginning with space-based observations and possibly evaluating expansion to in-situ observations. This strategy will be based on a set of long-term data preservation guidelines and will take into account existing work in this area across the Work Plan. Activities will also favor cooperation and harmonization in the Earth Observation data-preservation domain through common activities and studies.

### **DA-09-02: Data Integration and Analysis**

Coordinate data management approaches for data modeling and information products. Enable users to (i) more effectively define processes to efficiently generate information products through modeling and analyses and (ii) utilize large volumes of data from heterogeneous data sources.

#### a) Data Integration and Analysis Systems

This sub-task is led by Canada (University of Manitoba), Japan (University of Tokyo, shiba@csis.u-tokyo.ac.jp) and ESA

Coordinate data management approaches that encompass a broad perspective of the observation data life-cycle – from input to processing, archiving, and dissemination, including reprocessing, analysis and visualization of large volumes and diverse type of data.

#### b) Ensemble-Technique Forecasting Demonstrations

This sub-task is led by UK (Met Office, matthew.martin@metoffice.gov.uk)

Facilitate the development of demonstration projects promoting the use of ensemble-based techniques in disciplines other than weather forecasting.

#### c) Global Geodetic Reference Frames

This sub-task is led by IAG (zuheir.altamimi@ensg.ign.fr)

Ensure the availability of accurate, homogeneous, long-term, stable, global geodetic reference frames as a mandatory framework and the metrological basis for Earth observation. Identify steps towards such consistent high-accuracy global geodetic reference frames for Earth observation and the observing systems contributing to GEOSS. Promote the use of common or interoperable reference frames within GEOSS.

#### d) Atmospheric Model Evaluation Network

This sub-task is led by USA (EPA, keating.terry@epa.gov)

Demonstrate the use of web services to compare global and regional atmospheric models (including atmospheric chemistry/air quality models). Apply to a variety of Earth observations from distributed archives using standardized approaches to evaluate and improve model performance. Draw upon and contribute to the work of the Task Force on Hemispheric Transport of Air Pollution under the Convention on Long-range Transboundary Air Pollution, the IGAC-SPARC Atmospheric Chemistry and Climate Initiative, AeroCOM, and the Air Quality Model Evaluation International Initiative.

### **DA-09-03: Global Data Sets**

Provide a suite of global datasets based on improved and validated data sources. Initiate regular analysis and reporting. Facilitate interoperability among data sets using the framework, structure and methodologies of the GEO Architecture. Register the global data sets in the GEOSS registries and where new approaches are developed; contribute new best practices and interoperability arrangements to the GEOSS registries.

a) Global Land Cover

This sub-task is led by USA (USGS), CEOS (ESA, WGCV) and GTOS (GOFC-GOLD, martin.herold@wur.nl)

Provide a suite of global land cover datasets, initially based on improved and validated moderate resolution land cover maps and eventually including land-cover change at high resolution. This activity will benefit directly from the establishment of the Land Surface Imaging virtual constellation (see AR-09-02a).

b) Global Meteorological and Environmental Data

This sub-task is led by China (CMA, zhangp@cma.gov.cn)

Implement the Chinese Meteorological Satellite Program for global weather and environmental monitoring. This Program will (i) provide users worldwide with low-resolution multiple-source observation data; (ii) develop integrated multi-source satellite retrieval products shared with users; and (iii) enhance capabilities to acquire and apply Chinese meteorological satellite data and products.

c) Digital Geological Map Data

This sub-task is led by EC (OneGeology Europe, onegeology@bgs.ac.uk) and UK (BGS)

Make existing geological map data web-accessible. Transfer know-how to the developing world. Accelerate the progress of an emerging geoscience data interchange standard. Use OneGeology to raise the public profile and understanding of geoscience. One hundred and two nations and thirteen international bodies participate in the OneGeology Project.

d) Global DEM

This sub-task is led by Japan (JAXA), USA (NOAA) and CEOS (BNSC, UNOOSA, USGS, jpm@mssl.ucl.ac.uk)

Facilitate interoperability among Digital Elevation Model (DEM) data sets with the goal of producing a global, coordinated and integrated DEM. This DEM database should be embedded into a consistent, high accuracy, and long term stable geodetic reference frame for Earth observation.

e) Global Soil Data

This sub-task is led by China (ISS-CAS), EC (JRC), Netherlands (ISRIC, vincent.vanEngelen@wur.nl) and USA (USDA)

Support the development of a global soil information system building upon the work of ongoing and completed projects. The system will incorporate data from global, regional and national soil data projects into a coherent system using a common dictionary – to support implementation of major multilateral environmental agreements (e.g. UNFCCC, UNCCD and CBD) and provide harmonized and policy-relevant information to users at the global, regional and national level. The system will deliver web-based services on soil information.

f) Global Road and Human Settlements Mapping on GEO Grid

This sub-task is led by Japan (AIST, CSIS, University of Tokyo, iwao.koki@aist.go.jp) and ICSU (CODATA)

Develop a global road and human settlements map on GEO Grid. Related activities will include: (i) System development of GEO Grid towards sharing, developing and distributing data; (ii) Research & development for producing relevant data using satellite images; and (iii) Collection, maintenance, and evaluation of relevant remote sensing and GIS data.

### 1.3 CAPACITY BUILDING

In this Section, Task implementation and sub-task cross-coordination within a Task are under the guidance of the Capacity Building Committee

#### **CB-09-01: Resource (or Seville Roadmap) Mobilization**

This Task is led by Spain (AEMET, [acasalsc@aemet.es](mailto:acasalsc@aemet.es))

Implement the Seville Roadmap on Resource Mobilization<sup>1</sup>. The road map aims to mobilize resources for building the capacity of the three key contributors to Earth observations: individuals, institutions and infrastructure. It also works to strengthen links between the user and donor communities.

#### **CB-09-02: Building Individual Capacity in Earth Observations**

Identify education and training opportunities across GEOSS societal benefit areas. Develop synergies, encourage cross-fertilization and address common challenges.

##### a) Recognition of Cross Border Education and Training in Earth Observation

This sub-task is led by Netherlands (ITC, [molenaar@itc.nl](mailto:molenaar@itc.nl))

Bring together providers of (international and cross-border) capacity building, experts in recognition (credential valuation and accreditation) and governance (quality assurance) of higher education qualifications, and professionals from the Earth-observation and geographical-information sectors, to exchange knowledge and propose potential solutions on the issues of recognition and exchange of cross-border and international education & training products for Earth observation.

##### b) Summer Institute on Climate Information for Public Health

This sub-task is led by USA (CIESIN, IRI, [mthomson@iri.columbia.edu](mailto:mthomson@iri.columbia.edu))

Develop a sustainable “Summer Institute on Climate Information for Public Health” building on the efforts of the International Research Institute for Climate and Society (IRI), the Center for International Earth Science Information Network (CIESIN) and the Mailman School of Public Health. The Summer Institute will offer public health decision-makers and their partners the opportunity to learn practical methods for integrating climate knowledge and information into health decision-making processes through expert lectures, special seminars, focused discussions and practical exercises.

##### c) UN-SPIDER/GEO Summer Schools on Space-based Solutions for Disaster Management and Emergency Response

This sub-task is led by Brazil (INPE) and UNOOSA (UN-SPIDER, [juan-carlos.villagran@unoosa.org](mailto:juan-carlos.villagran@unoosa.org))

Build upon the outcome of GEO 2007-2009 Task CB-07-02 (Knowledge Sharing for Improved Disaster Management and Emergency Response) to establish and support regional training and capacity building programmes related to disaster management and emergency response.

##### f) GLOBE/GEO Climate Education Project

This sub-task is led by South Africa (DST) and GLOBE ([egeary@globe.gov](mailto:egeary@globe.gov))

Develop a student research campaign to foster the use of Earth observation and better prepare the future work force in dealing with changes in the global environment – through collaboration between

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<sup>1</sup> Document available at [http://www.earthobservations.org/ag\\_cbc.shtml](http://www.earthobservations.org/ag_cbc.shtml)

the GEO community and the worldwide community of educators, students, and partners of the GLOBE (Global Learning and Observations to Benefit the Environment) Program. The GLOBE/GEO Student Climate Research Campaign (SCRC) will complete its planning in 2009 and implement the school-based pilot project in 2010. The latter will serve as a model for potential (future) GLOBE/GEO education-research campaigns on topics such as Water, Health, Biodiversity and Energy.

g) GEONETCast Training

This sub-task is led by China (CMA), Russian Federation (Roshydromet), USA (NOAA, linda.moodie@noaa.gov), EUMETSAT and WMO

Enhance GEONETcast capacity building and user engagement activities, particularly in developing countries. In particular, develop the GEONETCast Training Channel that will focus on (i) training end-users to use products for specific purposes and to disseminate data via GEONETCast; (ii) linking GEONETCast products and product navigator (inside portal) with specific training material; (iii) transmitting training materials via GEONETCast to local trainers; and (iv) disseminating training materials on GEOSS-related environmental data.

### **CB-09-03: Building Institutional Capacity to Use Earth Observations**

Coordinate, strengthen and sustain existing capacity building networks within Earth observation communities. As appropriate facilitate the construction of new networks.

a) Building National and Regional Capacity

This sub-task is led by UNEP (norberto.fernandez@unep.org)

Build national capacity in developing countries by enabling human, technical and institutional capacity for coordinating, accessing, using and sharing environmental data, information and services. Develop and implement a participatory model for environmental networking, observing/monitoring, and data/information sharing at the national level. The model will be based on existing national mechanisms. It will include key institutions (data providers and information disseminators), integrating regional and global tools and mechanisms for environmental data and observing systems. In addition, improve in-country coordination among national statistical organisations, remote sensing agencies, environment, forests, wildlife and water related ministries for providing improved access to national environmental data.

b) Establishing Regional Capacity Building Networks

This sub-task is led by Netherlands (ITC, mannaerts@itc.nl)

Organize and reinforce international capacity building and training opportunity networks in Earth observation sciences & geo-information provision. These GEO training opportunity networks (e.g. GEOTOPS) will include virtual and e-learning based mode of knowledge transfer. A typical operational capacity building network in a world region will include key institutions in data provision (e.g. space agencies, a GEONETCast member or data provider) and academic (research-oriented capacity development) and professional higher-education institutions and regional centers. Capacity building services delivered by those institutions will be embedded in national higher-education systems (accredited, e.g. in European Union area), and internationally recognized by professionals and/or other bodies. GEO will have a coordination role using e.g. its web portal capacity building services and GEONETCast system.

d) Building Capacity for Operational Oceanography

This sub-task is led by Denmark (DMI, js@dmi.dk)

Facilitate ocean data sharing and use by stimulating a global cooperation on operational oceanography, especially in developing countries. In the first stage, establish a global operational oceanography

network connecting advanced operational forecasting centres in developed countries and quasi-operational centres in e.g. Asia, Africa and Latin America. In the second stage, establish regional cooperation projects (between advanced and less-developed operational centres). The first cooperation example will be based on EU project YEOS, a cooperation among China, EU and Korea. Examples of development of operational ocean-forecasting-system in Asia, Africa and Latin America will be demonstrated.

#### **CB-09-04: Capacity Building Needs and Gap Assessment**

Engage the user community in identifying their capacity building needs for accessing, using and producing Earth observations for societal benefit. Develop an operational capacity building presence within the GEOSS Common Infrastructure (Task AR-09-01).

##### a) Identifying Best Practices, Gaps and Needs

This sub-task is led by EC (GEONetCab, SEOCA) and Netherlands (ITC, mannaerts@itc.nl)

Create conditions for improving and increasing GEO capacity building activities and serving the bigger goal of improved effectiveness and efficiency of GEO capacity building for application in the GEOSS societal benefit areas. Activities are conducted through two complementary and interrelated EC Framework Programme Seven (FP7) projects: GEO Network for Capacity Building (GEO-Net-CaB) and the GEO Capacity Building Initiative in Central Asia (SEOCA). Whereas GEONetCab is quasi-global, SEOCA focuses more on Central Asia and Europe.

Related activities will include: [GEO-Net-Cab] (i) Identify capacity building needs, (ii) Specify Earth observations capacity building, (iii) Identify resource providers, sustainable brokerage stakeholders and mechanisms to facilitate cooperation, and (iv) Develop a global base of technical expertise for capacity building and related monitoring & evaluation mechanisms; and [SEOCA] (i) Assess the state of the art in all Central Asian countries in view of existing needs, technical and economic capacities, and potential stakeholders/providers, and (ii) Implement a Capacity Building and a Brokerage Programme in all target countries to significantly increase the regional capacity to participate in the running and planned GEO activities.

##### b) Capacity Building Performance Indicators

This sub-task is led by Morocco (DMN, nour.filali@gmail.com)

Develop reliable and widely accepted qualitative and quantitative metrics for measuring (i) the efficacy of Earth observation capacity building programs and (ii) the implementation of GEO capacity building strategy. The development of these metrics will require the engagement of the entire GEO community to ensure buy-in.

#### **CB-09-05: Infrastructure Development and Technology Transfer for Information Access**

Identify hardware, software and other technology required to access, use and develop Earth observation data, information and products for decision making. Promote technology transfer (in its very broadest sense), and advance infrastructure and information sharing.

##### b) CBERS

This sub-task is led by Brazil (INPE, julio@dpi.inpe.br), China (CRESDA) and CEOS (CSIR, INPE)

Establish and upgrade the capacity of ground stations with a footprint in Africa to receive, process, store and distribute CBERS (China-Brazil Earth Resources Satellite) imagery. Data will be distributed free of charge to all interested African countries within the footprint of the respective ground stations. Three ground stations have initially been selected: Maspalomas operated by INTA (Spain), Aswan operated by NARSS (Egypt), and Hartebeeshoek operated by SANSA (South Africa). Other

possibilities, which still require further negotiation, include: Malindi in Kenya, operated by ASI (Italy), and Libreville, which will be built and operated by AGEOS (Gabon).

c) SERVIR Expansion

This sub-task is led by USA (USAID, [cstokes@usaid.gov](mailto:cstokes@usaid.gov))

Establish SERVIR regional hubs in geographic regions other than Panama (where it was originally established to serve the Meso-American region) – starting with eastern Africa. Develop additional SERVIR tools that can provide (i) early warnings of thunderstorms, flash floods, and vector-borne diseases; (ii) climate prediction mapping; and (iii) air quality monitoring. SERVIR is a system that integrates satellite and other geospatial data for improved scientific knowledge and decision-making by managers, researchers, students, and the general public. The SERVIR system is web-based and makes available previously inaccessible Earth observation data and online decision-support tools to interpret, map and visualize (3D) this data. It is used to monitor weather, forest fires, and ecological changes, as well as to respond to severe events such as red tides, tropical storms, and flooding.

d) Geo-resources Services for Africa

This sub-task is led by EC (AEGOS, [m.urvois@brgm.fr](mailto:m.urvois@brgm.fr)) and France (BRGM)

Build upon the AEGOS project to design a pan-African infrastructure of interoperable data and user-oriented services to strengthen the sustainable use of geo-resources in Africa. Safeguard, share, and valorise the knowledge and data archived in African and European geological surveys. Support geo-scientific communities and institutional decision-makers in the design and implementation of sustainable development public policies.

e) Data Democracy

This sub-task is led by Brazil (INPE, [gilberto.camara@inpe.br](mailto:gilberto.camara@inpe.br)), China (CRESDA) and CEOS (CSIR, GISTDA and CDTI)

Strengthen the Earth observation data utilization cycle by broadening in-situ data/information access, increasing data dissemination capabilities, promoting the development and use of Open Source Software (OSS) across and along the Earth observation value chain, developing and implementing training programs (e.g. for CBERS data) and transferring technology to end-users. CEOS shall encourage its members to share their above mentioned capabilities to the users, especially in developing countries. Several CEOS agencies may serve efficiently the user community thanks to mature infrastructure and technological capabilities. Moreover users in several parts of the world still require support not only for data but also for learning to use Earth observation information tools and services.

## **CB-10-01: Building Capacity through Outreach and Awareness Raising**

Show the benefits of the use of Earth observations, through the identification and dissemination of success stories in language that can be understood by all, specifically targeted at decision/policy makers applying Earth observations. The aim is to promote the application of Earth observations into their regular operations.

a) Earth Observation Game for Youth

This sub-task is led by IEEE ([tamashiro@ieee.org](mailto:tamashiro@ieee.org))

Initiate an international contest to create a game that emphasizes the impact of Earth observation on societal conditions. Develop an outcome to work with students and young people through their recreational interest to participate in game playing. The winners will support introduction of the game on a global basis, both into schools and through community organizations.

b) Building Capacity for Non-technical Decision-makers in the Use and Impact of Earth Observation

This sub-task is led by IEEE (paul.e.racette@nasa.gov)

Maintain a GEOSS-focused web-based magazine for the general public and non-technical managers & decision-makers to complement existing capacity building efforts in GEO. Update the magazine(s) on a routine basis to inform and provide an understanding of the impacts of Earth observations on societal conditions and the benefits of global observation. Expand on existing GEOSS-focused web-pages to incorporate more material from developing countries. Enable access to the magazine(s) through the GEOPortal (AR-09-01a).

c) User Oriented Workshops for GEOSS Outreach and Feedback

This sub-task is led by IEEE (jsp@sprintmail.com), IOC, ISPRS and OGC

Organize a series of workshops to demonstrate the GEOSS Common Infrastructure to users in all societal benefit areas. Continue series of global and regional workshops to provide avenues for user inputs into the GEOSS requirements and feedback on the operational aspects of GEOSS; approximately five workshops per year will be organized which should support outreach on GEOSS capabilities. In addition, organize capacity building workshops to expose regional and local stakeholders to best practices in capacity building and to the benefits of the GEONETCast data dissemination system – in combination with open source web-based applications and service deliveries, for the various societal benefit areas, and GEOSS observation networks. As appropriate, focus workshop on societal benefit area developments and outcomes.

d) Atlases of our Changing Environment

This sub-task is led by UNEP (ashbindu.singh@unep.org)

Draw the attention of national, regional and international authorities towards environmental issues and strengthen their capacity to monitor resources using Earth observations and communicating complex scientific data and information to policy makers. Provide information that underscores the intrinsic value of harnessing, visualizing and communicating technologies to gain a deeper understanding of the dynamics and impacts of environmental changes. Atlases use a combination of ground photographs, satellite images and narratives based on extensive scientific evidence to illustrate how humans have altered their surroundings and continue to make changes to the global environment.

## 1.4 SCIENCE AND TECHNOLOGY

In this Section, Task implementation is under the guidance of the Science and Technology Committee

### **ST-09-01: Catalyzing Research and Development (R&D) Resources for GEOSS**

This Task is led by EC (DG-RTD), USA (NASA, [kathy.fontaine@nasa.gov](mailto:kathy.fontaine@nasa.gov)) and ESA

Encourage national governments and international organizations to address GEOSS Science and Technology needs in their R&D programmes. As stated in "The Role of Science and Technology in GEOSS"<sup>2</sup>, it should be a priority for GEO Members and Participating Organizations to involve research institutions and funding agencies in GEOSS implementation. To this end, GEO Members and Participating Organizations will be encouraged to: (i) plan and conduct R&D activities in support of GEOSS implementation; (ii) Contribute relevant R&D activities (planned or ongoing) to GEOSS implementation; (iii) Identify and earmark resource sources for those activities; and (iv) promote GEOSS throughout the process.

Related activities will include: Develop proposals and guidelines to assist R&D agencies in addressing GEO needs. Engage a dialogue with decision-makers and funding agencies. Identify programmes relevant to GEOSS Science and Technology needs and encourage them to collaborate with one another.

### **ST-09-02: Promoting Awareness and Benefits of GEO in the Science and Technology Community**

This Task is led by COSPAR and IEEE ([hpplag@unr.edu](mailto:hpplag@unr.edu))

Promote awareness and benefits of GEOSS in the scientific and technological communities in order to engage the research community in GEO and GEOSS with the goal to achieve breakthroughs in the understanding of the Earth's changing environment and global integrated Earth system. The scientific community should collaborate within GEO to address interactions between the components of the global integrated Earth system, and connect natural and socioeconomic sciences.

Related activities will include: (i) Form links with major scientific research enterprises in each societal benefit area; (ii) Actively encourage relevant scientists and technical experts to contribute to GEOSS in a truly participatory way; (iii) Reach out to the world's diverse scientific and technological communities and make GEOSS more visible and attractive to them; (iv) Contact universities and laboratories to involve them in GEOSS activities; and (iv) Organize a GEO presence at major symposia and other meetings, for example through plenary presentations or side events.

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<sup>2</sup> Document available at [http://www.earthobservations.org/ag\\_stc.shtml](http://www.earthobservations.org/ag_stc.shtml)

## 1.5 USER ENGAGEMENT

In this Section, Task implementation and sub-task cross-coordination within a Task are under the guidance of the User Interface Committee

### US-09-01: User Engagement

Involve users in reviewing and assessing requirements for Earth Observation data, products and services. Create an appropriate mechanism for coordinating user requirements across societal benefit areas. Foster partnerships among and within societal benefit areas, making use of user communities where they exist and catalyzing the formation of new ones where they do not.

#### a) Identifying Synergies between Societal Benefit Areas

This sub-task is led by USA (EPA, NASA, lfriedl@nasa.gov) and IEEE

Develop a GEO process for identifying critical Earth observation needs common to many GEOSS societal benefit areas, involving scientific and technical experts, taking account of socio-economic factors and building on the results of existing systems' requirements development processes.

#### b) Communities of Practice and Partnership Development

This sub-task is led by USA (EPA, foley.gary@epa.gov)

Develop GEO Communities of Practice to identify and refine user needs, in particular for cross-cutting areas – building upon GEO's initial experience of Communities of Practice, information provided by national, regional and project-level surveys, and the extensive work of the Integrated Global Observing Strategy Partnership (IGOS-P), now transitioned into GEO. The following Communities of Practice have been recognized by the User Interface Committee: Air Quality and Health, Coastal Zone, Energy, Forest, Geohazards, Global Agriculture Monitoring, and Water and Health.

### US-09-02: Socio-Economic Indicators

Develop socio-economic data and products. Support the development of methods, models and tools required to produce GEOSS-relevant socio-economic indicators.

#### a) Socio-Economic Benefits of GEO and GEOSS

This sub-task is led by EC (EuroGEOSS), USA (NASA) and IIASA (fritz@iiasa.ac.at)

Develop methodologies and tools to assess GEOSS benefits in each of the nine GEOSS societal benefit areas. Build upon the European project EuroGEOSS to develop integrated models and assess the GEOSS added value for drought, biodiversity and forest management. Develop Geo-Wiki.org, a global land cover validation tool based on community remote sensing. Illustrate the importance of having improved land-cover data by quantifying the value of improved land-cover information for policy making.

#### b) Socio-economic and Demographic Global Data

This sub-task is led by UNECA (ISTD, PAMS, ezigbalike.uneca@un.org)

Develop global spatially-enabled socio-economic databases with an initial focus on Africa. Support the development of tools and methods for building, visualizing, and analyzing socioeconomic indicators for informed decisionmaking, policy formulation, and operational strategies for development.

### **US-09-03: Cross-Cutting Products and Services**

Foster the development and use of Earth observation products and services across the societal benefit areas of GEOSS, especially in developing countries.

#### a) Development of Global Map for GEOSS Societal Benefit Areas

This sub-task is led by Japan (ISCGM, GSI, fukushima@gsi.go.jp)

Foster the use of Global Map in societal benefit areas such as Disasters, Health, Agriculture, Biodiversity and Water. Identify the needs for basic geographic data and reflect these needs in new specifications. Global Map datasets provide a full and consistent coverage of land on the Earth – at 1 km resolution. They are composed of the following thematic layers: elevation, vegetation, land-cover, land-use, transportation, drainage systems, boundaries and population centers.

#### d) Global Phenology Data

This sub-task is led by Austria (ZAMG, elisabeth.koch@zamg.ac.at) and USA (USDA/Forest Service, USA National Phenology Network, University of Wisconsin-Milwaukee)

Coordinate the collection of in-situ phenology observations and expand existing observing networks. Identify and generate satellite-derived phenological/temporal metrics and test models for describing the phenological characteristics of natural and modified ecosystems. Changes in vegetation phenology impact biodiversity, net primary productivity, species distribution, albedo, biomass and ultimately the global climate.

## 2 THE 9 GEOSS SOCIETAL BENEFIT AREAS

### 2.1 DISASTERS

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

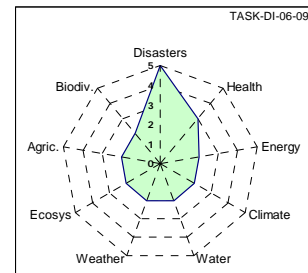
Disaster-induced losses can be reduced through observations relating to hazards such as: wildland fires, volcanic eruptions, earthquakes, tsunamis, subsidence, landslides, avalanches, ice, floods, extreme weather, and pollution events. GEOSS implementation will bring a more timely dissemination of information through better coordinated systems for monitoring, predicting, risk assessment, early warning, mitigating, and responding to hazards at local, national, regional, and global levels.

*GEOSS 10-Year Implementation Plan, Section 4.1.1*

#### DI-06-09: Use of Satellites for Risk Management

This Task is led by Canada (CSA, [guy.seguin@asc-csa.gc.ca](mailto:guy.seguin@asc-csa.gc.ca)), China (NSMC), CEOS (CSA), ESA and UNOOSA (UN-SPIDER), and supported by the Geohazards Community of Practice

Define and facilitate implementation of satellite constellations for risk management from a multi-hazard perspective. Undertake the consolidation of the validated requirements and examine options for system development and implementation, using the following steps: (i) Assessment of the use of satellite data for the management of different types of disasters and development of a Road Map; (ii) Roll-up across all disaster types to establish overall architecture requirements for Earth observation satellites; (iii) Simulation of satellite systems to respond to the requirements; (iv) Gap analysis for existing and planned satellite systems; (v) Recommendations for future satellite systems.



Deliverables will include: (i) Constellation requirement definition and performance assessment; (ii) Actions towards the Board of the International Charter and relevant CEOS members, to identify possible strengthening of Charter mechanisms and options for widening its scope; and (iii) Charter metadata catalogue.

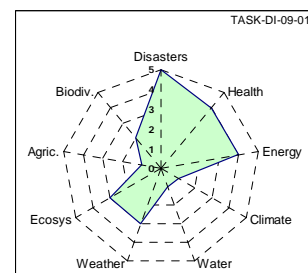
*Key related Tasks in other SBAs include: HE-09-01 (Information Systems for Health), HE-09-02 (Monitoring and Prediction Systems for Health), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management)*

#### DI-09-01: Systematic Monitoring for Geohazards Risk Assessment

Define and implement a unified and integrated approach to geohazards risk assessment. Build upon synergies and integrate data from global in-situ seismographic networks and remote sensing. Coordinate multi-level efforts and implement decision-support tools to facilitate and support data access for selected “Supersites” locations.

##### a) Vulnerability Mapping and Risk Assessment

This sub-task is led by China (CENC, IES, CAS), Greece (University of Thessaloniki), Italy (EUCENTRE, ISPRA, [fabio.dellacqua@eucentre.it](mailto:fabio.dellacqua@eucentre.it)), UNITAR and WMO (WDS), and supported by the Geohazards Community of Practice



Facilitate access to the remote-sensing & in-situ data required to perform systematic geohazards vulnerability mapping and risk assessment. Related activities will include the development, testing and application of global seismic vulnerability mapping to “Supersites” areas.

**b) Seismographic Networks Improvement and Coordination**

This sub-task is led by China (CENC), USA (USGS, choy@usgs.gov), FDSN and ISC, and supported by the Geohazards Community of Practice

Improve the capabilities of global seismographic networks such as GSN, FDSN (including regional and global components), GNSS networks and new ocean bottom networks such as VENUS, NEPTUNE and ESONET. Facilitate sharing of data and event products among GEO members. Expand and coordinate efforts to provide access, using GEOSS interoperability methods, to real time and archived seismological data and products. Develop a portal that will interlink distributed seismological data centers and provide seamless access to other GEOSS components. Broaden the scope of this activity to identify and build upon synergies across in-situ observing network types (e.g. seismological, GNSS, hydrological). Synergies could range from the use of the same best practices and operational approach, to the use of a common part of the infrastructure for collection and dissemination, and co-location of in-situ instruments.

**c) Supersites and Natural Laboratories**

This sub-task is led by USA (University of Miami) and ESA (wolfgang.lengert@esa.int), and supported by the Geohazards Community of Practice

Develop an international, sustainable and integrated approach to geohazards risk assessment, optimally utilizing the remote-sensing capabilities of GEO Members and Participating Organizations. Promote retrieval, integration and systematic access to remote sensing & in-situ data in selected regional areas exposed to geological threats (“Supersites”) – to improve geohazard monitoring and stimulate fundamental research. The initial objective is to dramatically enhance access to multi-satellite SAR data, GPS data, and seismic data for the seven Phase1 Supersites and event Supersites (connected to geological disasters). Intermediate objectives are to: (i) Develop a Supersite data portal (one-stop internet access point for in-situ and remote sensing geophysical data); (ii) Facilitate SAR-data access for other selected regional areas exposed to geological threats (Natural Laboratories); (iii) Better demonstrate the power of the Supersite concept to improve geohazards risk assessment; and (iv) Develop a governance structure for the Supersites with representation from the science community and operational users.

*Key related Tasks in other SBAs include: EC-09-02 (Ecosystem Vulnerability to Global Change)*

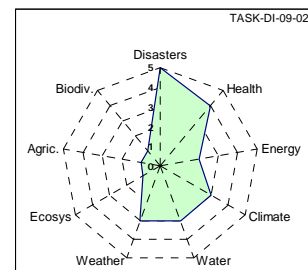
**DI-09-02: Multi-Risk Management and Regional Applications**

Define and implement an integrated approach to all phases of disaster management. Develop a framework for regional disaster management applications.

**a) Implementation of a Multi-Risk Management Approach**

This sub-task is led by WMO (WDS, mgolnaraghi@wmo.int), and supported by the Geohazards Community of Practice

Define and implement an integrated and comprehensive approach to systematically address all risk and disaster phases, including risk assessment and mapping. Support ISDR in the implementation of the Hyogo Framework for action and promote the development of a Disasters Community of Practice (CoP) that would provide guidance for activities and initiatives in the Disasters societal benefit area (the Disasters CoP would include existing hazard-thematic CoPs such as the Geohazards CoP).



b) Regional End-to-End Disaster Management Applications

This sub-task is led by CEOS (CSA, [guy.seguin@asc-csa.gc.ca](mailto:guy.seguin@asc-csa.gc.ca)) and UNOOSA, and supported by the Geohazards and Integrated Global Water Cycle Community of Practice

Implement regional and cross-cutting end-to-end projects. Potential areas of application will include: Flood-risk decision-support tools and applications supporting the full cycle of disaster management for e.g. Central America and the Caribbean, and Africa. Build upon GMES projects in the area of emergency response.

*Key related Tasks in other SBAs include: HE-09-01 (Information Systems for Health), HE-09-03 (End to End Projects for Health), EN-07-02 (Energy Environmental Impact Monitoring), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), EC-09-02 (Ecosystem Vulnerability to Global Change), AG-07-03 (Global Agricultural Monitoring)*

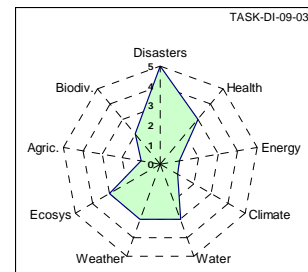
**DI-09-03: Warning Systems for Disasters**

Support the development, improvement and coordination of early warning systems for natural disasters.

a) Tsunami Early Warning System of Systems

This sub-task is led by IOC ([b.aliaga@unesco.org](mailto:b.aliaga@unesco.org)) and UNOSAT, and supported by the Geohazards and Coastal Zone Communities of Practice

Support the establishment and continuation of a multi-hazard fully-operational global tsunami early warning and mitigation system of systems. Promote full and open exchange of publicly-funded, unclassified data relevant to tsunami warning/mitigation systems and enhancement/development of mechanisms for real-time data sharing, including seismic and sea level (deep ocean and tide gauge) data. Contribute to the operationalization of comprehensive observing networks (in-situ sea level, seismic stations and remote monitoring) and data management systems (including integration of the global ocean observing system (GOOS), international seismic networks, and related global telecommunication systems). Define and promote standards/protocols for operating observing systems, and managing data exchange/transmission relevant to tsunami detection, early warning and mitigation. Build upon GMES projects in the area of emergency response and marine aspects.



b) Implementation of a Wildland Fire Warning System at Global Level

This sub-task is led by Australia (CAWCR), Canada (CFS), EC (JRC), Germany (GFMC), USA (NOAA, USDA/Forest Service) and GTOS (GOFC-GOLD, [bill.degroot@NRCan.gc.ca](mailto:bill.degroot@NRCan.gc.ca)), and supported by the Geohazards and Forest Communities of Practice

Develop a globally-coordinated warning system for wildland (vegetation) fires, including improved prediction capabilities, analysis tools and response support through sensors, information products and risk assessment models. Related activities will include: (i) Review of existing warning systems; (ii) Assessment to enhance current fire early warning systems; (iii) Development of mechanisms for the implementation of an operational global early warning system. Activities will be coordinated with the UNISDR “Global Wildland Fire Network” and the Global Fire Monitoring Center (GFMC). They will also build upon the European Forest Fire Information System (EFFIS) – providing fire danger forecasts and analyses of forest fire damages for the pan-European area and GMES projects in the area of emergency response.

*Key related Tasks in other SBAs include: WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction), CL-09-03 (Global Carbon Observation and Analysis System), EC-09-01 (Ecosystem Observation and Monitoring Network), EC-09-02 (Ecosystem Vulnerability to Global Change), AG-07-03 (Global Agricultural Monitoring), BI-07-01 (Biodiversity Observation Network)*

## 2.2 HEALTH

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

Health issues with Earth-observation needs include: airborne, marine, and water pollution; stratospheric ozone depletion; persistent organic pollutants; nutrition; and monitoring weather-related disease vectors. GEOSS will improve the flow of appropriate environmental data and health statistics to the health community, promoting a focus on prevention and contributing to continued improvements in human health worldwide.

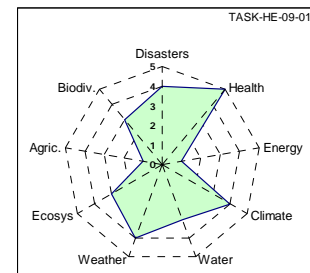
*GEOSS 10-Year Implementation Plan, Section 4.1.2*

#### HE-09-01: Information Systems for Health

This Task is led by France (CNES, [murielle.lafaye@cnes.fr](mailto:murielle.lafaye@cnes.fr)), IEEE and WHO, and supported by the Health & Environment Community of Practice

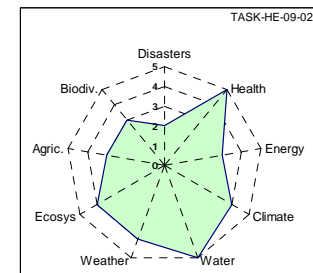
Improve in-situ environmental and health data collection for the utilization and validation of remotely-sensed data. Explore how GEOSS will support the collection & distribution of information and meet the diverse needs of the health community. Develop a global public health information network database to improve health decision-making at the international, regional, country and district levels. As a priority, connect WHO's Open Health information tool and other health and environmental information systems to the GEO Portal and GEOSS Common Infrastructure (GCI).

*Key related Tasks in other SBAs include: DI-06-09 (Use of Satellites for Risk Management), HE-09-02 (Monitoring and Prediction Systems for Health), HE-09-03 (End to End Projects for Health), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-02 (Droughts, Floods and Water Resource Management), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction)*



#### HE-09-02: Monitoring and Prediction Systems for Health

Support the development of operational health-related applications. Connect established and emerging cross-cutting observing systems to monitoring and prediction systems for health. Include and gradually consolidate contributions from different, not yet coordinated systems. This Task will feed into HE-09-01 and HE-09-03.



##### a) Aerosol Impacts on Health and Environment: Research, Monitoring and Prediction

This sub-task is led by WMO (RES, [lbarrie@wmo.int](mailto:lbarrie@wmo.int)), and supported by the Health & Environment and Air Quality Communities of Practice

Facilitate research and development activities that lead to the delivery of new services related to monitoring of the atmospheric cycles of various aerosols and their improved forecast in operational numerical models of the atmosphere. Reduce risks due to aerosol influences on health and public safety and assess aerosol effects on marine and terrestrial ecosystems. Support international initiatives such as the Sand and Dust Storm Warning, Advisory and Alert System (SDS-WAS) in developing dust storm warning system and assessments. Build upon the two WMO SDS-WAS operational regional nodes, operated by China for Asia and operated by Spain for Northern Africa/Middle East/Europe. Review current developments in the modelling and observation of bioaerosol transport/deposition and in the present understanding of impacts of the atmospheric deposition of dust (iron, phosphorus) to the ecosystem with the goal of extending the societal benefits of improved prediction of dust and aerosol.

b) Air Quality Observations, Forecasting and Public Information

This sub-task is led by China (SMB and SMPHB), USA (EPA, HCF, IRI, dickerson.phil@epa.gov), WHO and WMO, and supported by the Health & Environment and Air Quality Communities of Practice

Provide near real-time air quality observations and forecasts for the purposes of air quality and public health management, research and public information. Assimilate Earth observations data into weather models and provide reliable 2-3 day forecasts of air quality. Harmonize standards for sharing air quality observations, forecasts, and related indices and maps for public information so authorities can intervene to reduce human health responses to diseases. Relate statistically the frequency and severity of air quality episodes with health outcomes & records to better understand the transmission pathways of human respiratory diseases.

Build and sustain urban public-health advisory and warning services for chronic diseases such as Chronic Obstructive Pulmonary Disease (COPD), asthma, and other respiratory ailments. Provide high-resolution environmental information pertinent to urban scales. Focus on self-management of health outcomes, and the development and testing of tools to assist hospitals to support more efficiently patient-care. Related activities will include: the GMES Atmosphere Service projects MACC and PASODOBLE; Ozone Web; PREV' AIR; and AIRNow International.

c) Global Monitoring Plan for Persistent Organic Pollutants (POPs)

This sub-task is led by UNEP (Secretariat of the Stockholm Convention, fouane@pops.int), and supported by the Health & Environment and Air Quality Communities of Practice

Develop and implement a global monitoring plan for tracking changing levels of POPs in the natural environment and in human beings (among other benefits, this monitoring will enable the Stockholm Convention on Persistent Organic Pollutants to evaluate the effectiveness of international efforts to reduce releases of POPs). Interlink existing and emerging systems for monitoring air, water, ice caps and human health. Identify, fill in gaps and address a number of technical and financial barriers. Priorities for 2009 include producing 5 regional monitoring reports that will summarize monitoring data for the Convention's 12 POPs in ambient air & human milk or blood for the period 1998-2008.

d) Global Observation System for Atmospheric Mercury

This sub-task is led by Italy (CNR-IIA, pirrone@iia.cnr.it), Japan (NIES), South Africa (DEADP) and USA (EPA), and supported by the Health & Environment and Air Quality Communities of Practice

Develop a global observation system for mercury by harmonizing standard operating procedures for monitoring mercury and its compounds in air, atmospheric deposition, water, soil, sediments, vegetation and biota. The sharing of data from this network, allowing access to comparable and long-term data from a wide array of locations, will help understand temporal and spatial patterns of mercury transport and deposition to, and evasion from, terrestrial and aquatic ecosystems. The data produced will support the validation of regional and global atmospheric mercury models for use in evaluations of different policy options for reducing mercury pollution impacts on human health and ecosystems. Build upon the contributions of, among others, the UNEP Mercury Programme, the Hemispheric Transport of Air Pollutants Task Force (TF HTAP), and the European Monitoring and Evaluation Program (EMEP). Moreover build upon the US MercNet initiative and international monitoring and modelling efforts led by Italy, Japan and South Africa.

e) Surveillance and Prediction of Seasonal Influenza and Early Detection of Pandemic Influenza

This sub-task is led by France (CNES), USA (NASA, NOAA, richard.k.kiang@nasa.gov), WHO, and supported by the Health and Environment Community of Practice

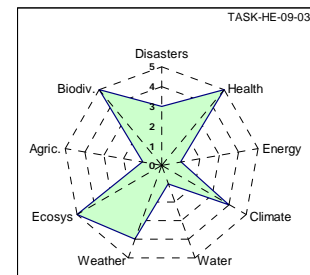
Expand the availability, use, and application of environmental information for influenza decision-making. Assess current activities, needs, and priorities in the use of Earth observations for the

surveillance, modeling and prediction of seasonal influenza and the early detection of pandemic influenza. Focus on the sharing of not only environmental data, but also influenza monitoring data – to identify observation priorities, gaps in knowledge, and overlaps in current activities (while preserving overlaps that would lend to comparison and cross-validation of techniques).

*Key related Tasks in other SBAs include: HE-09-03 (End to End Projects for Health), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-07 (Capacity Building for Water Resource Management), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction)*

### **HE-09-03: End to End Projects for Health**

Develop and implement end-to-end health-environment projects to advance the application of observation, monitoring and forecasting systems to health decision-making processes. Develop a global health-environment Community of Practice and meet requirements for reducing projected health risks from global environmental change.



#### **a) Implementation of a Meningitis Decision-Support Tool**

This sub-task is led by Spain (AEMET), USA (CDC, HCF, IRI, drogers@hc-foundation.org), WHO and WMO (CLW), and supported by the Health & Environment Community of Practice

Support the Meningitis Environmental Risk Information Technologies project (MERIT) which aims to extend current capabilities to more effectively combine environmental information with knowledge of epidemic meningococcal meningitis. MERIT implementation will have an immediate impact on public health decision-making and outcomes in Africa through increasing the effectiveness of prevention and response control strategies, and ongoing surveillance of meningitis epidemics. Priorities include the implementation of an operational decision-support tool for testing the 2009 meningitis epidemic season in Africa.

#### **b) Predicting and Reducing Incidence of Vector-Borne and Zoonotic Diseases**

This sub-task is led by France (CNES), USA (NOAA) and CEOS (NOAA, michelle.hertzfeld@noaa.gov), and supported by the Health & Environment Community of Practice

Integrate Earth observation and public-health communities to build a requirement-based system for vector-borne disease monitoring. Foster the use of satellite and in-situ data for monitoring environmental conditions conducive to the spread of vector-borne and zoonotic diseases such as malaria, dengue and Rift Valley fever. Identify and build upon best practices and ongoing projects. Engage user groups and providers as a priority.

#### **c) Ecosystems, Biodiversity and Health: Decision-Support Tools and Research**

This sub-task is led by USA (CDC, EPA, foley.gary@epamail.epa.gov) and supported by the Health & Environment, Biodiversity, and Forest Communities of Practice

Implement research activities that foster the application of tools (e.g. indicators, models) to informed decision-making and help reduce the emergence & spread of infectious diseases. Through an interdisciplinary team approach (which also includes end-users such as decision-makers), characterize the dynamics and mechanisms underlying the relationship between social stressors, changes in biodiversity, and disease transmission to humans. This sub-task is unique in its interdisciplinary “Community of Practice” approach, and in encouraging the coordination of Earth observations with field data to study this relationship.

d) Reducing Health Risk from Water-borne Diseases

This sub-task is led by USA (HCF, NOAA, juli.trtanj@noaa.gov), WHO and WMO, and supported by the Health & Environment Community of Practice

Build and sustain an international cross-disciplinary community that integrates environmental, health and social information to understand, predict, and reduce freshwater and marine disease risk. Determine the impact of climate variability and change, and extreme events on the vulnerability of water sanitation systems globally, and related burden of water-borne disease. Focus on diseases of importance identified by public-health services (e.g. cholera, vibrios, Leptospirosis). Foster the use of environmental data and products in health management at the local, national and international levels, and conduct capacity building, training and technology transfer as needed.

*Key related Tasks in other SBAs include: HE-09-01 (Information Systems for Health), HE-09-02 (Monitoring and Prediction Systems for Health), CL-09-01 (Environmental Information for Decision-making), WA-06-02 (Droughts, Floods), WE-06-03 (TIGGE), WE-09-01 (High-Impact Weather Prediction), EC-09-01 (Ecosystem Observation and Monitoring Network), BI-07-01 (Biodiversity Observation Network)*

## 2.3 ENERGY

### Improving management of energy resources

GEOSS outcomes in the energy area will support: environmentally responsible and equitable energy management; better matching of energy supply and demand; reduction of risks to energy infrastructure; more accurate inventories of greenhouse gases and pollutants; and a better understanding of renewable energy potential.

*GEOSS 10-Year Implementation Plan, Section 4.1.3*

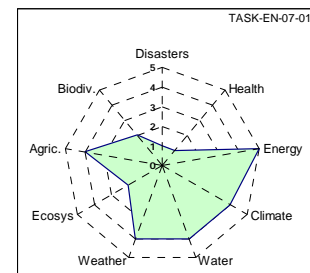
#### EN-07-01: Management of Energy Sources

This Task is led by Germany (DLR, marion.schroedter-homscheidt@dlr.de), CEOS (NASA) and IEEE, and supported by the Energy Community of Practice

Support the development of Earth observation products and services for the resource assessment, monitoring and forecasting of fluctuating energy sources (e.g. hydro, solar, wind, and ocean). Consider end-to-end systems including generation, transmission, distribution, and integrated operations (e.g. efficient integration of energy sources into the electricity grid, and electricity grid management).

Related activities will include: (i) Promote collaboration between users and providers of Earth observation applications to foster the development of innovative Earth observation services in support of energy management; (ii) Expand the use of Earth observations in the development, operation and management of energy production systems; and (iii) Assess the utility of Earth system models to inform energy sector decision-making on the future availability of resources in a changing climate.

*Key related Tasks in other SBAs include: EN-07-03 (Energy Policy Planning), WA-06-02 (Droughts, Floods and Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), WE-06-03 (TIGGE)*



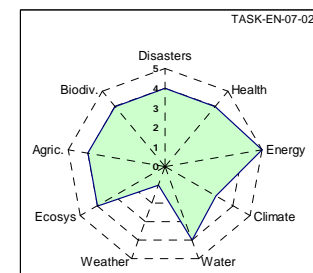
#### EN-07-02: Energy Environmental Impact Monitoring

Promote the use and development of Earth observation systems for the monitoring and prediction of environmental change. This change may relate to energy production (including exploration, extraction and transportation) and/or resource site exploitation.

##### a) Environmental Impact of Energy Production

This Task is led by EC (EnerGEO, emile.elewaut@tno.nl), and supported by the Energy Community of Practice

Promote and develop the use of Earth observation data for impact monitoring. Develop modelling systems helping to quantify and anticipate changes to the environment e.g. freshwater, biodiversity, ecosystems, atmospheric and oceanic composition, and ground elevation. Build upon the contribution of the European project EnerGEO (Earth observation for monitoring and assessment of the environmental impact of energy use) to assess the impact of current and future energy production plans.



b) Towards an Operational Carbon Capture and Sequestration (CCS) Monitoring System

This sub-task is led by Norway (NSC, l-ingo-e@online.no), and supported by the Energy Community of Practice

Foster and develop the use of Earth observation products and services for the monitoring of CO<sub>2</sub> storage sites. Build upon the ongoing ESA projects “EO services for CO<sub>2</sub> capture and storage facilities” (SciSys, UK) and “CO<sub>2</sub> capture and storage for the energy industry using high-resolution SAR” (InfoTerra GmbH, Germany). Expand as appropriate to other projects and related sites (e.g. In Salah, Algeria; Weyburn, Canada).

Related objectives will include: (i) Perform a gap analysis that will form the basis for the establishment of an operational Earth observation system for CCS site monitoring; (ii) Establish cooperation with relevant projects to secure broad international participation; (iii) Explore several methods for monitoring CCS sites, including surface deformation, hyperspectral and gravimetry methods; and (iv) Consider using Earth observations for offshore storage sites. Make relevant synergies with Task CL-09-03 (Global Carbon Observation and Analysis System).

c) Locating High-Temperature Geothermal Resources

This sub-task is led by France (BRGM, v.bouchot@brgm.fr), and supported by the Energy Community of Practice

Promote the use of Earth observations for the mapping of geothermal resources, with a focus on the East African Rift System (EARS). Locate geothermal anomalies using thermal and mineral mapping under different climate conditions (desert, savannah, rain forest). Test new techniques in different geological environments where high-temperature geothermal fields are already being explored and exploited to produce electricity. Foster cooperation and coordination with existing projects to secure broad international participation. Involve concerned parties through capacity building to develop, valorise and transfer local skills and expertise. Communicate with governments and policy-makers in East Africa and throughout the world.

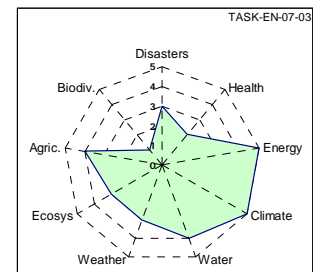
*Key related Tasks in other SBAs include: HE-09-02 (Monitoring and Prediction Systems for Health), EN-07-03 (Energy Policy Planning), CL-09-03 (Global Carbon Observation and Analysis System), WA-06-07 (Capacity Building for Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), EC-09-02 (Ecosystem Vulnerability to Global Change), BI-07-01 (Biodiversity Observation Network)*

**EN-07-03: Energy Policy Planning**

This Task is led by France (MINES ParisTech, thierry.ranchin@ensmp.fr), and supported by the Energy Community of Practice

Encourage the use of Earth observations for informed energy-policy planning in developing and developed countries.

Related activities will include: Enhance availability of data and products required to better assess countries' potential for energy production. Encourage training of decision-makers at all relevant levels for interpreting relevant data and products. Encourage the use of Earth science models to support energy scenario assessments.



*Key related Tasks in other SBAs include: EN-07-01 (Management of Energy Sources), EN-07-02 (Energy Environmental Impact Monitoring), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management)*

## 2.4 CLIMATE

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

The climate has impacts in each of the other eight societal benefit areas. Coping with climate change and variability demands good scientific understanding based on sufficient and reliable observations. GEOSS outcomes will enhance the capacity to model, mitigate, and adapt to climate change and variability. Better understanding of the climate and its impacts on the Earth system, including its human and economic aspects, will contribute to improved climate prediction and facilitate sustainable development while avoiding dangerous perturbations to the climate system.

*GEOSS 10-Year Implementation Plan, Section 4.1.4*

#### CL-06-01: A Climate Record for Assessing Variability and Change

Extend and improve the quality of the past climate record through advanced data reanalysis and reconstruction in the atmosphere, ocean, land and sea ice domains. Generate high-quality temporally-homogeneous estimates of the past climate to support analyses of climate variability and change.

##### a) Sustained Reprocessing and Reanalysis of Climate Data

This sub-task is led by USA (NOAA), CEOS (NOAA), ESA, GCOS and WCRP (trenbert@ucar.edu)

Ensure the development of international mechanisms to coordinate and maintain sustained climate data reprocessing and reanalysis efforts. With regard to the reprocessing of historical datasets (to obtain consistent long-time series of satellite records), make relevant synergies with CL-09-02b.

##### b) Extending the Record of Climate Variability at Global Scale

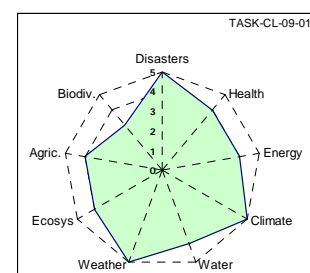
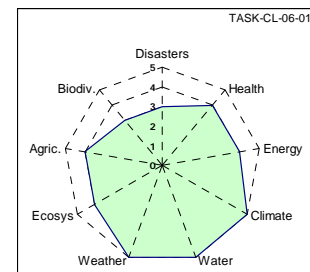
This sub-task is led by IGBP (PAGES, thorsten.kiefer@pages.unibe.ch)

Support and coordinate activities towards a global coverage of high-resolution, well-dated reconstructions of past climate parameters (e.g. temperature, precipitation, pressure) in the ocean and on land to better understand past modes of climate variability. Focus on the last 2000 years and the extension of instrumental records. Encourage activities that promote proxy calibration, quantitative data-model comparisons, and better understanding of interdecadal and longer climate change at global and regional scales.

*Key related Tasks in other SBAs include: CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), CL-09-02 (Accelerating the implementation of the GCOS), WA-06-02 (Droughts, Floods and Water Resource Management), WE-06-03 (TIGGE), EC-09-02 (Ecosystem Vulnerability to Global Change)*

#### CL-09-01: Environmental Information for Decision-making, Risk Management and Adaptation

Support the integration of climate and environmental risk management into adaptation processes. Coordinate and drive the development of tailored climate products and services. Encourage the use of this information by policy and decision makers (at all levels), and initiate user-oriented activities to do both increase the demand, and foster the supply, of climate and environmental services for development.



a) Towards Enhanced Climate, Weather, Water and Environmental Prediction

This sub-task is led by Australia (BOM), IGBP, WCRP and WMO (jcaughey@wmo.int)

Strengthen the ability worldwide to deliver new and improved climate, weather, water and environmental services. Key research activities relate to: (i) Seamless weather, climate and Earth system prediction; (ii) Multi-scale organization of tropical convection and interaction with the global circulation; (iii) Data assimilation for coupled models as a prediction and validation tool for weather and climate research; and (iv) Information to assess risks, and benefits of climate/weather predictions, for society and the global economy. This sub-task includes the continuation of former Task WE-07-01 (Data Assimilation and Modelling for Operational Use).

b) Climate Information for Decision-making, Risk Management and Adaptation

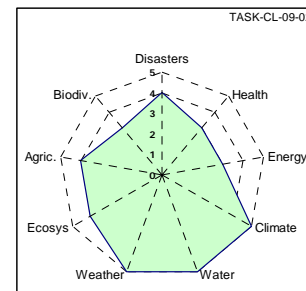
This sub-task is led by GCOS (wwestermeyer@wmo.int)

Promote the resourcing and implementation of the Climate for Development in Africa Programme (ClimDev Africa). The programme is to improve the availability, exchange and use of climate information & services at national, local and regional levels – in support of economic growth and achievement of the Millennium Development Goals. African partners include the African Union, the UN Economic Commission for Africa, the African Development Bank, and the African National Meteorological and Hydrological Services. In addition, implement the programme “Climate Observations and Regional Modelling in support of climate risk management and sustainable development.” This programme is to assist the developing and least developed countries of Eastern Africa to undertake and appropriately use climate projections in adaptation planning.

*Key related Tasks in other SBAs include: DI-09-03 (Warning Systems for Disasters), HE-09-03 (End to End Projects for Health), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction), EC-09-02 (Ecosystem Vulnerability to Global Change), BI-07-01 (Biodiversity Observation Network)*

**CL-09-02: Accelerating the Implementation of the Global Climate Observing System**

Accelerate the implementation of the Global Climate Observing System (GCOS) through enhanced support for the component systems of GCOS: The WMO Global Observing System (GOS) and Global Atmosphere Watch (GAW), the IOC-led Global Ocean Observing System (GOOS), the FAO-led Global Terrestrial observing System (GTOS), and the global hydrological networks and satellite systems. Make relevant synergies with Task AR-09-03 “Advocating for Sustained Observing Systems”.



a) Key Observations for Climate

This sub-task is led by GCOS (crichter@wmo.int), GOOS, GTOS, WCRP and WMO

Strengthen the climate-related functions and activities of the Global Observing System (GOS), Global Atmosphere Watch (GAW) and Global Cryosphere Watch (GCW), the Global Ocean Observing System (GOOS) and Global Terrestrial observing System (GTOS). Support the Implementation Actions for the Atmospheric, Oceanic and Terrestrial domains identified in the “Implementation Plan for the Global Observing System for climate in Support of the UNFCCC” (GCOS-92).

b) Key Climate Data from Satellite Systems

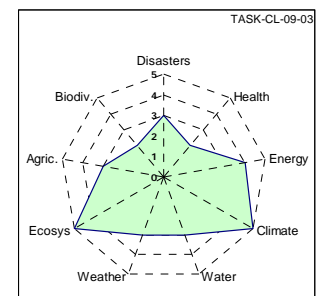
This sub-task is led by USA (NASA, NOAA), CEOS (ESA, NOAA, [mitch.goldberg@noaa.gov](mailto:mitch.goldberg@noaa.gov)), ESA, GCOS and WMO

Establish actions securing the provision of key data for climate studies and forecasting from satellite systems.

*Key related Tasks in other SBAs include: CL-06-01 (A Climate Record for Assessing Variability and Change), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-02 (Droughts, Floods and Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction), EC-09-01 (Ecosystem Observation and Monitoring Network)*

**CL-09-03: Global Carbon Observation and Analysis System**

Implement a global carbon observation and analysis system addressing the three components of the carbon cycle (atmosphere, land and ocean) and providing high-quality regional information on CO<sub>2</sub> and CH<sub>4</sub> concentrations and emission variations. Combine observations, reanalysis and product development to develop tools for carbon tracking and carbon storage change evaluation. Build upon 2004 internationally accepted strategies and the work of the WMO Global Atmosphere Watch (GAW) to implement the atmospheric component of those strategies.



a) Integrated Global Carbon Observation (IGCO)

This sub-task is led by Australia (CSIRO), France (LSCE), Italy (University of Tuscia, [bombelli@unitus.it](mailto:bombelli@unitus.it)), Japan (JAXA), Netherlands (University of Amsterdam), USA (NOAA, USDA/Forest Service, USGS), GTOS and WMO (GAW), and supported by the Carbon Cycle Community of Practice

Support the development of an integrated global carbon observation system, including improved global observation networks of CO<sub>2</sub>, CH<sub>4</sub>, isotope ratios, air-surface exchange flux, surface ocean CO<sub>2</sub> and related marine biochemistry. Encourage the development of high-resolution global and regional data-assimilation and modelling systems to enhance the utility of the spatial and temporal resolution of those observations and provide relevant regional-scale information.

b) Forest Carbon Tracking

This sub-task is led by Australia (CSIRO, Dept. of Climate Change, [alex.held@csiro.au](mailto:alex.held@csiro.au)), Canada (NRC), Japan (JAXA), Norway (NSC), CEOS (ESA) and FAO (FRA), and supported by the Carbon Cycle and Forest Communities of Practice

Facilitate the definition, development and validation of robust tools and methodologies and data for measurement of forest cover and evaluation of carbon storage in forests. Build upon GEO efforts in forest monitoring, carbon observation and modeling to foster the use of these tools – coordinating the timely provision of observations required for their operational use. Promote and facilitate the development of reference, coherent and validated databases. Activities are based on the concept of establishing National Demonstrator Countries, fully involving the governments and all relevant institutional users.

Ongoing activities include: (i) Supply of data and associated processing to National Demonstrators; (iii) Review and development of methodologies and tools; (ii) Support and technical assistance to National Demonstrator countries for their mapping and monitoring activities; (iv) Support for the construction of national, regional and global datasets on forest/carbon changes; (v) Communication and outreach activities towards potential users; (vi) Liaison with the policy/negotiation community; and (vii) Definition of a sustained Global Forest Observation Initiative.

c) Global Monitoring of Greenhouse Gases from Space

This subtask is led by Japan (JAXA, RIHN, moriyama.takashi@jaxa.jp), USA (NASA, NOAA, USDA/Forest Service), CEOS (JAXA, NOAA) and ESA, and supported by the Carbon Cycle and Forest Communities of Practice

Foster the use of space-based greenhouse gas (GHG) observations and consolidate data requirements for the next-generation GHG monitoring missions. Establish an international group in close cooperation with the CEOS Atmospheric Composition constellation and the Carbon Cycle Community of Practice, to initially generate and implement plans for the end-to-end utilization of space-based GHG data, particularly those of GOSAT launched in 2009, and future missions such as OCO-2. Coordinate these efforts with ground-based systems for validation and build upon, as appropriate, existing observations and products to date – from satellites (e.g. SCIAMACHY and AIRS), aircrafts, and surface-based instruments (in-situ and total column).

*Key related Tasks in other SBAs include: DI-09-03 (Warning Systems for Disasters), EN-07-02 (Energy Environmental Impact Monitoring), EN-07-03 (Energy Policy Planning), EC-09-01 (Ecosystem Observation and Monitoring Network), EC-09-02 (Ecosystem Vulnerability to Global Change)*

## 2.5 WATER

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

Water-related issues addressed by GEOSS will include: precipitation; soil moisture; streamflow; lake and reservoir levels; snow cover; glaciers and ice; evaporation and transpiration; groundwater; and water quality and water use. GEOSS implementation will improve integrated water-resource management by bringing together observations, prediction, and decision-support systems and by creating better linkages to climate and other data. In situ networks and the automation of data collection will be consolidated, and the capacity to collect and use hydrological observations will be built where it is lacking.

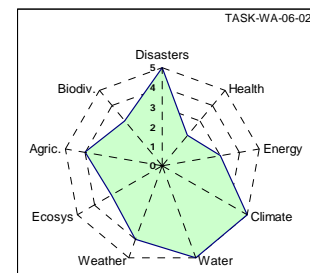
*GEOSS 10-Year Implementation Plan, Section 4.1.5*

#### WA-06-02: Droughts, Floods and Water Resource Management

Address decision-making challenges related to the management of hydro-meteorological extremes and the sustainable use of water.

##### a) Forecasting for Droughts and Floods

This sub-task is led by USA (NOAA, john.schaake@noaa.gov), and supported by the Integrated Global Water Cycle Community of Practice



Improve forecasting methods for extreme events (floods, droughts) used

by hydrological services throughout the world to help bridge the gap between research and user communities. Expand upon initiatives such as (i) HEPEX (Hydrological Ensemble Prediction Experiment) (ii) the European Flood Alert System EFAS to produce twice-daily 10-day early flood warnings for Europe, and (iii) GMES projects related to land management (GEOLAND).

##### b) Impacts from Drought

This sub-task is led by Canada (University of Manitoba, lawford@umbc.edu), EC (CEOP-AEGIS), USA (NOAA) and WMO (CLW), and supported by the Integrated Global Water Cycle Community of Practice

Track and analyze impacts from drought (including feedbacks such as soil drying) to provide a tangible and practical demonstration of the value of integrated water cycle observations. Develop a full and operational data cycle of environmental information from “producer-to-consumer”/“source to sink,” and explore the application of data products to Water and Agriculture.

##### d) Prototype Regional Drought Early Warning Test Beds

This sub-task is led by USA (NIDIS, NOAA, chad.mcnutt@noaa.gov), and supported by the Integrated Global Water Cycle Community of Practice

Explore expanding the concept of the North American Drought Monitor and drought portal through prototype drought early warning test bed activities in specific international river basins, such as on the US-Canada border, basins in Central America and the Caribbean, the Mediterranean, and other drought-sensitive regions.

*Key related Tasks in other SBAs include: DI-06-09 (Use of Satellites for Risk Management), DI-09-02 (Multi-Risk Management and Regional Applications), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-07 (Capacity Building for Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction), AG-07-03 (Global Agricultural Monitoring)*

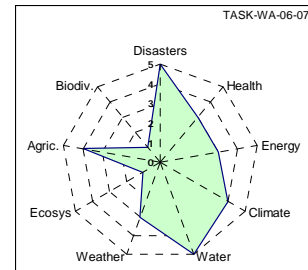
**WA-06-07: Capacity Building for Water Resource Management**

Initiate capacity building programs in support of water management, to show the value of, and develop tools for, Earth observation data.

a) Latin America

This sub-task is led by Argentina (CONAE), Canada (University of Manitoba, lawford@umbc.edu) and USA (NASA), supported by the Integrated Global Water Cycle Community of Practice

Develop a plan for a capacity building program focused on the use of Earth observation data for water resources management (surface waters, groundwater). This to help: (i) Identify data and general support from space agencies; (ii) Identify a coordinating agency to organize calls for proposals and securing reviews and monitoring of the proposals; (iii) Identify further funding sources; and (iv) Issue a call for participation to the research and development community. Linkages with existing GEO efforts will be made.



b) Africa

This sub-task is led by USA (NASA) and CEOS (ESA; diego.fernandez@esa.int), and supported by the Integrated Global Water Cycle Community of Practice

In the scope of Phase 2 of the TIGER initiative (focusing on the use of space technology for water resource management in Africa), assist African countries to overcome problems faced in the collection, analysis and dissemination of water-related geo-information. Exploit the advantages of Earth Observation (EO) technology to build the basis for an independent African capacity and set up sustainable water observation systems. In addition, build and extend the Central American “SERVIR” (visualization and monitoring using Earth science data) for hydrologic applications (e.g. flood warning) to East Africa and possibly other parts of the world. Other important projects include the hydrologic data integration and assimilation systems of the ‘Land Information System’ (LIS).

c) Asia

This sub-task is led by Japan (JAXA, University of Tokyo, tkoike@hydra.t.u-tokyo.ac.jp), and supported by the Integrated Global Water Cycle Community of Practice

Build upon the Asian Water Cycle Initiative (AWCI) to develop competencies among water management practitioners, researchers, and administrators (AWCI addresses climate change monitoring in Asia through the integration of in-situ and satellite/remote sensing). In addition, build upon Sentinel Asia to develop disaster management-support systems in the Asia-Pacific region and building capacity for utilization of satellite images.

d) Pilot Projects for Improved Water Discovery and Quality Assessments

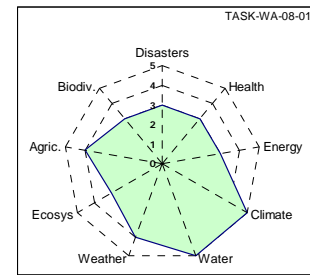
This sub-task is led by USA (EPA, USGS, pthenkabail@usgs.gov) and IEEE, and supported by the Integrated Global Water Cycle, and Coastal Zone, Communities of Practice.

Conduct pilot projects in cooperation with local, regional, and national groups, and other organizations to provide water quantity and quality assistance where it is needed, but not now available. These projects over twelve in number are focused on developing countries and realizable in the field within one year, and/or slightly more in time. They will be sustainable, reusable, repeatable, and scalable. Currently, the sub-task has submitted more than four of the Pilot Projects for potential funding by sponsor groups.

*Key related Tasks in other SBAs include: CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-02 (Droughts, Floods and Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research)*

## WA-08-01: Integrated Products for Water Resource Management and Research

Improvements and expansion of in-situ networks, combined with new satellite missions (in addition to existing space-borne Earth observing systems) and emerging assimilation and prediction capabilities, are opening the door to a new era in global water-cycle management.



### a) Soil Moisture

This sub-task is led by ESA and WCRP (GEWEX, peter.vanoevelen@gewex.org), and supported by the Integrated Global Water Cycle Community of Practice

Establish a global soil moisture network suitable for the development of multi-purpose soil moisture products. Apply in-situ based products to the calibration and validation of remotely-sensed observations. Such a global network is still to be established and is as such a high priority. Make relevant synergies with Task US-09-03 (Cross-cutting Products and Services).

### b) Runoff

This sub-task is led by Japan (University of Tokyo) and WMO (CLW, rstefanski@wmo.int), and supported by the Integrated Global Water Cycle Community of Practice

Integrate, in a phased approach, dedicated river gauging networks of existing hydrological stations into a global runoff observation network. The main output of the HARON project (Hydrological Applications and Run-Off Network) will be strengthened in-situ and satellite monitoring networks of estuaries, rivers, lakes, reservoirs, and groundwater levels.

### c) Groundwater

This sub-task is led by Netherlands (IGRAC, sophie.vermooten@deltares.nl), and supported by the Integrated Global Water Cycle Community of Practice

Establish a Global Groundwater Monitoring Network (GGMN) for a periodic assessment of global groundwater resources, using information from existing national, regional and global networks – in order to represent changes in groundwater resources at scales relevant to regional and global resource assessment.

### d) Precipitation

This sub-task is led by CGMS (george.j.huffman@nasa.gov), and supported by the Integrated Global Water Cycle Community of Practice

Under the guidance of CGMS/International Precipitation Working Group (IPWG), promote and advance the development and validation of multi-sensor satellite-based precipitation estimates, including snowfall. Inputs from the Precipitation Virtual Constellation (AR-09-02a) will supplement these efforts.

### e) Water Cycle Data Integration

This sub-task is led by Canada (University of Manitoba), EC (CEOP-AEGIS), Japan (University of Tokyo, tkoike@hydra.t.u-tokyo.ac.jp) and WCRP (GEWEX), and supported by the Integrated Global Water Cycle Community of Practice

Upcoming satellite launches and plans for new missions provide new global data sets that will supplement the in-situ networks for many water cycle variables. The Coordinated Energy and water cycle Observations Project (CEOP) under the WCRP Global Energy and Water-cycle Experiment (GEWEX) is tailoring and developing tools to access the various data collections and undertake data integration work over the Internet.

g) Global Water Quality Monitoring

This sub-task is led by USA (EPA, State of Wisconsin, [steven.greb@Wisconsin.gov](mailto:steven.greb@Wisconsin.gov)), and supported by the Integrated Global Water Cycle, and Coastal Zone, Communities of Practice

Initiate projects to develop operational observation and monitoring systems of water quality, integrating in-situ water quality monitoring methods for terrestrial sources & the coastal ocean with remote-sensed operational systems of global-scale freshwater quality. Ensure that resulting information systems are compatible and interoperable as part of the system of systems. Make relevant synergies with HE-07-02 and develop models that relate water quality databases to exposure and health effects data; and identify mechanisms for alerting public health professionals on hazardous conditions identified by the monitoring of these parameters.

*Key related Tasks in other SBAs include: HE-09-02 (Monitoring and Prediction Systems for Health), CL-06-01 (A Climate Record for Assessing Variability and Change), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management), WE-06-03 (TIGGE), EC-09-01 (Ecosystem Observation and Monitoring Network), AG-07-03 (Global Agricultural Monitoring)*

## 2.6 WEATHER

### Improving weather information, forecasting and warning

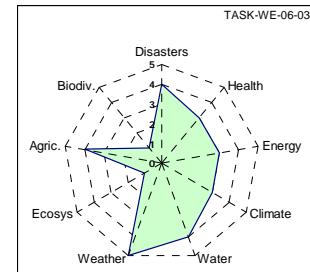
The weather observations encompassed by GEOSS are based on the requirements for timely short- and medium-term forecasts. GEOSS can help fill critical gaps in the observation of, for example, wind and humidity profiles, precipitation, and data collection over ocean areas; extend the use of dynamic sampling methods globally; improve the initialization of forecasts; and increase the capacity in developing countries to deliver essential observations and use forecast products. Every country will have the severe-weather-event information needed to mitigate loss of life and reduce property damage. Access to weather data for the other societal benefit areas will be facilitated.

*GEOSS 10-Year Implementation Plan, Section 4.1.6*

#### **WE-06-03: TIGGE and the Development of a Global Interactive Forecast System for Weather**

This Task is led by UK (Met Office), USA (NCEP) and WMO (WWRP/THORPEX, [jcaughey@wmo.int](mailto:jcaughey@wmo.int))

Develop the THORPEX Interactive Global Grand Ensemble (TIGGE) – a global multi-model ensemble weather prediction system incorporating easily accessible databases. Development of TIGGE will be an important contribution to a number of Tasks related to risk management, early warning systems, major hazards and associated impacts.



Related activities will include: Foster real-time data exchange, construct common web interfaces, design an improved archiving strategy, and develop a common toolbox to assist the development of user-driven products such as probabilistic tropical-cyclone warning services and extreme-precipitation forecasting; the latter will form the early products of a Global Interactive Forecasting System (GIFS) to internationally coordinate advance warnings and forecasts for high impact weather events. A GIFS Forecast Demonstration Project (GIFS-FDP) will be set up to benefit countries especially in the developing world. The FDP will begin with the prediction of tropical cyclone tracks and diagnostics. Subsequently it will focus on improving prediction of heavy rainfall and other problems of high priority such as contributing to food security. Later GIFS probabilistic products will include wind speed and near surface temperature forecasts. Data available from GMES projects in the area of marine and atmospheric monitoring will be used as much as possible.

*Key related Tasks in other SBAs include: DI-09-03 (Warning Systems for Disasters), HE-09-01 (Information Systems for Health), HE-09-02 (Monitoring and Prediction Systems for Health), HE-09-03 (End to End Projects for Health), EN-07-01 (Management of Energy Sources), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems), WA-06-02 (Droughts, Floods and Water Resource Management), WE-09-01 (Capacity Building for High-Impact Weather Prediction), AG-07-03 (Global Agricultural Monitoring)*

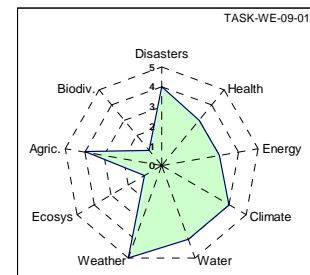
## **WE-09-01: Capacity Building for High-Impact Weather Prediction**

Develop capability for numerical weather prediction in developing countries. Focus on high-impact weather events (including, but not limited to, extremes) and foster rapid progress through enhanced infrastructure and training.

### a) Infrastructure for Numerical Weather Prediction

This sub-task is led by Korea (KMA, yongseong@korea.kr)

Develop improved system-infrastructures for the operation of numerical weather prediction in developing countries – building upon relevant WMO programmes. Identify gaps & needs and facilitate technical cooperative activities for the exchange of hardware, software, technologies, and expertise. In addition, co-organize a series of regional capacity building workshops with major numerical weather prediction centers to assist developing countries in their utilization of currently available forecasts.



### b) Socio-economic Benefits in Africa from Improved Predictions of High-Impact Weather

This sub-task is led by WMO (WWRP/THORPEX, jcaughey@wmo.int)

Improve the prediction of high-impact weather and help reduce vulnerability to climate variability and change in Africa through the WWRP-THORPEX Africa initiative. The latter is designed to both accelerate predictive skill and realize the related benefits for African society and the economy through a set of priority demonstration projects. Other activities will include development of a high impact weather information system, improved forecast verification systems, the design of optimal observing networks, enhanced use of non conventional observing technologies – establishing the predictive skill of high impact-weather events and capacity building.

*Key related Tasks in other SBAs include: CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems for Climate), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management), WE-06-03 (TIGGE)*

## 2.7 ECOSYSTEMS

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

Observations are needed on the area, condition, and natural-resource stock levels of ecosystems such as forests, rangelands, and oceans. GEOSS implementation will seek to ensure that methodologies and observations are available on a global basis to detect and predict changes in ecosystem condition and to define resource potentials and limits. Ecosystem observations will be better harmonized and shared, spatial and topical gaps will be filled, and in situ data will be better integrated with space-based observations. Continuity of observations for monitoring wild fisheries, the carbon and nitrogen cycles, canopy properties, ocean colour, and temperature will be set in place.

*GEOSS 10-Year Implementation Plan, Section 4.1.7*

#### EC-09-01: Ecosystem Observation and Monitoring Network (GEO EcoNet)

Coordinate and improve the observation, characterization and monitoring of terrestrial (forest, urban agriculture, woodlands, grasslands, and deserts), freshwater, ice and oceans ecosystems – especially in terms of acquisition and use of satellite/aerial/in-situ observation. Develop a global integrated sampling frame in coordination with the GEOSS Geodesy activities.

##### a) Ecosystem Classification and Mapping

This sub-task is led by Paraguay (Guyra Paraguay) and USA (USDA/Forest Service, USGS, rsayre@usgs.gov), and supported by the Forest and Global Agricultural Monitoring Communities of Practice

Continue efforts to produce a standardized, robust, and practical classification and map of global ecosystems at management-appropriate scales for terrestrial, freshwater, and marine environments. Integrate the global ecosystems product with existing ecosystem maps and databases, and support ecosystem (GEO Trends Analysis Network) and biodiversity (GEO Biodiversity Observation Network) monitoring approaches.

##### b) Ecosystem Functions and Services

This sub-task is led by USA (USDA/Forest Service, USGS, dmuchoney@usgs.gov), and supported by the Biodiversity, Forest and Global Agricultural Monitoring Communities of Practice

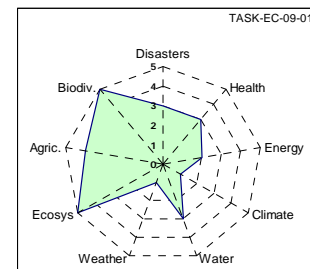
Coordinate the collection, processing and distribution of bio-geophysical and land surface parameter data (e.g. Leaf Area Index (LAI), Vegetation Index (VI), Fraction Photosynthetically Available Radiation (FPAR) and Net Primary Productivity (NPP)). Deliver this data as a service to the global modelling communities; there is a heritage of this type of effort (ISLSCP 1 and 2).

Coordinate the continuing characterization and monitoring of ecosystems status and trends. Using the GEO Ecosystem map as a framework, extract geospatial data on key indicators of all ecosystems' status, health and functioning (key indicators include time series of land cover change, climate variables, population, transportation, water and fragmentation).

##### c) Regional Networks for Ecosystems

This sub-task is led by POGO (shubha@Dal.Ca), and supported by the Coastal Zone Community of Practice

Build upon the successful extension of the regional-scale ANTARES project (South America) to the global-scale ChloroGIN project – under POGO and IOCCG. Further develop existing initiatives (e.g.



IOC-sponsored regional networks; GOF-C-GOLD regional networks and ILTER for terrestrial domains).

d) Protected Areas Assessment and Monitoring (GEO PAAM)

This sub-task is led by USA (NASA, Nature Conservancy, NPCA, USDA/Forest Service, USGS), IUCN and UNEP (WCMC, [andrew.cottam@unep-wcmc.org](mailto:andrew.cottam@unep-wcmc.org)), and supported by the Forest and Global Agricultural Monitoring Communities of Practice

Apply Earth observation to the characterization, mapping and monitoring of global protected areas consisting of UNESCO World Heritage sites & Biosphere Reserves; RAMSAR Wetlands, natural areas; and sites of cultural, geological and archaeological significance. Use Earth observation and other geospatial data to support the delineation and update of protected areas boundaries. Improve dissemination of Earth observation data to protected area planners and managers.

e) Forest Mapping and Change Monitoring

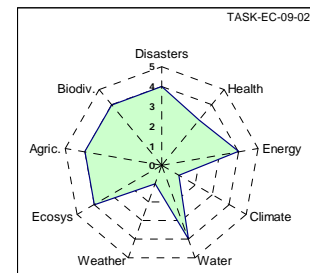
This sub-task is led by USA (USDA Forest Service, USGS), FAO (FRA, [adam.gerrand@fao.org](mailto:adam.gerrand@fao.org)) and GTOS (GOF-C-GOLD), and supported by the Forest Community of Practice

Integrate international efforts on assessment and monitoring of forests and forest changes using a combination of ground and satellite information and internationally agreed standards. Make relevant synergies with CL-09-03b (Forest Carbon Tracking) and DI-09-03b (Implementation of a Fire Warning System at Global Level).

*Key related Tasks in other SBAs include: HE-09-03 (End to End Projects for Health), EN-07-02 (Energy Environmental Impact Monitoring), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems), CL-09-03 (Global Carbon Observation and Analysis System), AG-07-03 (Global Agricultural Monitoring), BI-07-01 (Biodiversity Observation Network)*

**EC-09-02: Ecosystem Vulnerability to Global Change**

Identify and assess the risks posed by global change and human development to the environment, society and regional economies. Support the development of adaptation strategies to reduce these risks and mitigate impacts at local, regional and global levels.



a) Impact of Tourism on Environmental and Socio-Economic Activities

This sub-task is led by Greece ([greekgeo@admin.noa.gr](mailto:greekgeo@admin.noa.gr))

Map potential impacts of global change on key sectors of Eastern Mediterranean's economy and society. Potential impacts include: (i) changes in agricultural production, fisheries and water supplies; (ii) Sea-level rise and its impact on tourism, manufacturing, land use, and urban areas; (iii) Impact on employment and other economic variables; and (iv) Intra-regional and extra-regional migration. Based on this mapping, identify potential measures for mitigating impacts. The tourism-intensive Eastern Mediterranean region features an extensive shoreline, thousand of islands, highly sensitive agricultural lands and an unstable economy. As a result, small environmental changes can negatively affect the region's social and economic conditions.

b) Impact of Transport Infrastructure Development

This sub-task is led by UNECA (NRID, [tguebo@uneca.org](mailto:tguebo@uneca.org))

Identify, map and assess environmental risks to support the development of transport infrastructure in Africa, strengthening the continent effort in regional integration, economic development and poverty alleviation. In particular produce a comprehensive geo-spatial database, with appropriate applications, to support the preparation of an integrated, all-modes transport infrastructure master plan for Africa.

#### c) Vulnerability of Sea Basins

This sub-task is led by EC (EnviroGRIDS, anthony.lehmann@unige.ch), Switzerland (University of Geneva) and UNEP

Develop a collaborative management system to store, analyze, visualize and disseminate crucial data and information on past, present and future states of European seas – to assess their sustainability and vulnerability. Build upon the European project EnviroGRIDS (gridded management system for environmental sustainability and vulnerability) to develop a Black Sea basin observation and assessment system. Make relevant synergies with AR-09-01 (GCI). EnviroGRIDS will rely on ultra-modern technology using the largest gridded computing infrastructure in the world.

#### d) Vulnerability of Mountain Regions

This sub-task is led by Italy (Ev-K2-CNR, elisa.vuillermoz@evk2cnr.org), EC (ACQWA), WCRP (GEWEX, CEOP-HE) and WMO (CLW), and supported by the Integrated Global Water Cycle Community of Practice

Produce and disseminate more complete information on the local, regional and global impact of climate change in mountain regions. Provide high-quality, long-term data (e.g. meteorological, glaciological or hydrological) and implement a high-elevation climate and environment monitoring network, starting with the existing SHARE: Stations at High Altitude for Research on the Environment network. Build upon the European project ACQWA (Assessing Climatic change and impacts on the Quantity and quality of WATER) to analyze the future of water resources in vulnerable mountain regions and deliver water-policy recommendations to decision-makers.

#### e) Risk and Vulnerability Atlas

This sub-task is led by South Africa (DST, leluma.matoane@dst.gov.za)

Facilitate and enhance the science-policy interface in order to support sustainable development. Make information related to environment risks and vulnerability easily accessible to a wide range of decision-makers through a centralized platform. Build upon the example of the South African Atlas that comprises three components: (i) an electronic spatial database system; (ii) a repository of global change-related information; and (iii) human capacity development. Because of its interoperability with other spatial database systems, the electronic Atlas allows information stored in a range of locations to be combined. The electronic Atlas software can be customized for different countries and regions. The human capital development component of the Atlas is designed to build capacity and capability within different sectors of the economy and the society as a whole. The long-term aim is to replicate the Atlas across the Southern African Region, together with partners from countries in the region.

*Key related Tasks in other SBAs include: EN-07-02 (Energy Environmental Impact Monitoring), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), WA-06-02 (Droughts, Floods and Water Resource Management), EC-09-01 (Ecosystem Observation and Monitoring Network), AG-06-02 (Data Utilization in Fisheries and Aquaculture), AG-07-03 (Global Agricultural Monitoring), BI-07-01 (Biodiversity Observation Network)*

## 2.8 AGRICULTURE

### Supporting sustainable agriculture and combating desertification

Issues addressed by GEOSS will include: crop production; livestock, aquaculture and fishery statistics; food security and drought projections; nutrient balances; farming systems; land use and land-cover change; and changes in the extent and severity of land degradation and desertification. GEOSS implementation will address the continuity of critical data, such as high-resolution observation data from satellites. A truly global mapping and information service, integrating spatially explicit socio-economic data with agricultural, forest, and aquaculture data will be feasible, with applications in poverty and food monitoring, international planning, and sustainable development.

*GEOSS 10-Year Implementation Plan, Section 4.1.8*

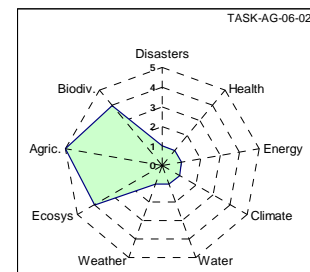
#### AG-06-02: Data Utilization in Fisheries and Aquaculture

This Task is led by Canada (BIO, CSA, forgetmh@mar.dfo-mpo.gc.ca), and USA (NOAA), and supported by the Coastal Zone Community of Practice

Identify opportunities for the enhanced utilization of Earth observations in fisheries and aquaculture. Consult with experts from fisheries, aquaculture, coastal zone management and Earth observation communities at regional and international levels. Support the implementation of the SAFARI project and IOCCG monograph. Make relevant synergies with (i) AR-09-02a, the proposed Virtual Constellation on Ocean Colour Radiometry, and (ii) EC-09-01c, the ChloroGIN Project.

Through these two GEO Tasks, products related to marine ecosystems and ocean biogeochemistry for near-surface global ocean and coastal waters will be provided and accessible to end users.

*Key related Tasks in other SBAs include: EN-07-02 (Energy Environmental Impact Monitoring), EN-07-03 (Energy Policy Planning), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems), EC-09-01 (Ecosystem Observation and Monitoring Network), EC-09-02 (Ecosystem Vulnerability to Global Change), BI-07-01 (Biodiversity Observation Network)*



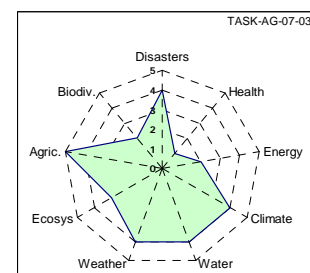
#### AG-07-03: Global Agricultural Monitoring

Support sustainable agriculture management and improve food security through the increased use of Earth observation data. Enhance current global capabilities in the areas of agriculture monitoring, famine early warning, food-supply prediction and agriculture risk assessment. Build the capacity necessary to utilize Earth observation information, especially within the developing world.

##### a) Global Agricultural Monitoring System

This sub-task is led by China (IRSA/CAS), EC (JRC), India (SAC/ISRO, parihar\_jaisingh@yahoo.com), and USA (University of Maryland, NASA, USDA), and supported by the Global Agricultural Monitoring Community of Practice

Develop and improve a global operational agricultural monitoring system – enhancing current capabilities in the areas of monitoring, famine early warning and food security. Related activities will include: (i) Global mapping and monitoring of changes in distribution of cropland area and associated cropping systems; (ii) Global monitoring of agricultural production leading to accurate and timely reporting of national agricultural statistics, accurate forecasting of shortfalls in crop production, and reduction of risk & increased productivity at a range of scales; (iii) Development of early warning systems for famine, enabling timely mobilization of international response in food aid.



#### b) Agricultural Risk Management

This sub-task is led by WMO (CLW, rstefanski@wmo.int), and supported by the Global Agricultural Monitoring Community of Practice

Develop and improve analytical tools and methods for agriculture risk assessment, particularly for crop failure. Establish common standards and formats. Facilitate the implementation of pilot-projects linking Earth system models to end-user application models (such as crop-yield models) to improve food-supply prediction.

#### c) Expanding Earth Observation Applications in Agriculture and Promoting Capacity Building in Developing Countries

This sub-task is led by China (Zhejiang University) and Uganda (DPRTRP, johnson.owaro@gmail.com), and supported by the Global Agricultural Monitoring Community of Practice

Develop training modules and expand the use of Earth observations for agricultural purposes in Africa, Asia, Latin America, Central and Eastern Europe, and Small Island States. Training modules will be underpinned by practical exercises using multi-source satellite data.

*Key related Tasks in other SBAs include: DI-09-02 (Multi-Risk Management and Regional Applications), DI-09-03 (Warning Systems for Disasters), EN-07-02 (Energy Environmental Impact Monitoring), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), CL-09-03 (Global Carbon Observation and Analysis System), WA-06-02 (Droughts, Floods and Water Resource Management), WA-06-07 (Capacity Building for Water Resource Management), WA-08-01 (Integrated Products for Water Resource Management and Research), WE-06-03 (TIGGE), WE-09-01 (Capacity Building for High-Impact Weather Prediction), EC-09-01 (Ecosystem Observation and Monitoring Network), EC-09-02 (Ecosystem Vulnerability to Global Change)*

## 2.9 BIODIVERSITY

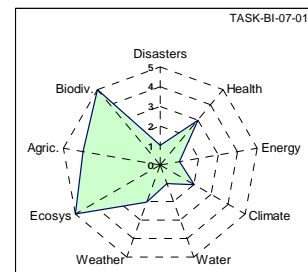
### Understanding, monitoring and conserving biodiversity

Issues in this area include the condition and extent of ecosystems, distribution and status of species, and genetic diversity in key populations. Implementing GEOSS will unify many disparate biodiversity-observing systems and create a platform to integrate biodiversity data with other types of information. Taxonomic and spatial gaps will be filled, and the pace of information collection and dissemination will be increased.

*GEOSS 10-Year Implementation Plan, Section 4.1.9*

#### BI-07-01: Developing a Global Biodiversity Observation Network

Coordinate and improve biodiversity (animals, plants, genes, etc) observation, assessment and conservation – especially in terms of acquisition and use of satellite, aerial and in-situ observation. Develop a global observation network to facilitate coordination among information users and providers. Improve the quality and quantity of observation and advocate for a better understanding of trends and conservation.



##### a) Biodiversity Observation Network (GEO BON)

This sub-task is led by EC (EBONE), USA (NASA) and DIVERSITAS (anne@diversitas-international.org), and supported by the Biodiversity Community of Practice

Further develop the GEO Biodiversity Observation Network that was launched in April 2008. GEO BON will provide a global, scientifically-robust framework for observations designed to detect biodiversity change by coordinating the data gathering and delivery of biodiversity change information. GEO BON should build upon existing systems (such as GBIF and WCMC) and based on analysis of existing information, highlight areas of importance (e.g. those supporting migratory, endemic or globally threatened species, and those whose biodiversity is of socio-economic importance) for further targeted data collection and monitoring.

Specific objectives include: (i) Develop a strategy for assessing biodiversity at the genetic, species and ecosystems level; (ii) Facilitate the establishment of monitoring systems that enable frequent, repeated, assessment of trends and distributions of species and ecosystems of special conservation merit; and (iii) Facilitate consensus on data collection protocols and the coordination of the development of interoperability among monitoring programs. The marine biodiversity component will be made as strong as possible to animate mutually-beneficial dialogue between terrestrial and marine components.

##### b) Invasive Species Monitoring System

This sub-task is led by USA (USDA/Forest Service, USGS, asimpton@usgs.gov), and supported by the Biodiversity Community of Practice

Characterize, monitor and predict changes in the distribution of invasive species. Characterize the current requirements and capacity for invasive species monitoring, identify gaps, and develop strategies for implementing cross-search functionality among existing online invasive species information systems from around the globe. Invasive alien species (IAS) threaten biodiversity and exert a tremendous cost on society for IAS prevention and eradication. They endanger natural ecosystem functioning and seriously impact biodiversity and agricultural production. The Task will be coordinated by members of the Global Invasive Species Information Network (GISIN).

### c) Capturing Historical and New Biodiversity Data

This sub-task is led by GBIF (vchavan@gbif.org), and supported by the Biodiversity Community of Practice

Develop a strategic plan for the capture and mobilisation of various types of “fit-for-use” historical and new biodiversity data through multi-cultural, heterogenous and distributed data custodians. Develop criteria for Data Rescue Centres. Develop strategies for industrialisation of capture, digitisation and mobilisation of primary biodiversity data. Develop strategies for mobilisation of biodiversity data generated through “ad-hoc” and “non-primary” projects. Promote uptake of Global Biodiversity Resources Discovery System (GBRDS). Review and develop primary biodiversity data capture standards. Implement the strategic plan for capturing historical biodiversity data from natural history collections and the research community.

*Key related Tasks in other SBAs include: DI-09-03 (Warning Systems for Disasters), HE-09-03 (End to End Projects for Health), EN-07-02 (Energy Environmental Impact Monitoring), CL-09-01 (Environmental Information for Decision-making, Risk Management and Adaptation), AR-09-03 (Sustained Observing Systems), EC-09-01 (Ecosystem Observation and Monitoring Network), EC-09-02 (Ecosystem Vulnerability to Global Change), AG-06-02 (Data Utilization in Fisheries and Aquaculture)*

## APPENDIX A: GEO COMMUNITIES OF PRACTICE

### DEFINITION

A Community of Practice (CoP) is a user-led community of stakeholders, from providers to the final beneficiaries of Earth observation data and information, with a common interest in specific aspects of societal benefits to be realized by GEOSS implementation.

### OBJECTIVES

Each CoP will have slightly different objectives, however common objectives will include:

- a. Identify, gather, and seek agreement on their particular user community requirements;
- b. Provide a forum for cooperation of activities where GEOSS adds value to existing initiatives, to identify linkages and opportunities for collaborative strategic and technical projects and to coordinate the delivery of some GEOSS targets to enable the realization of societal benefits.
- c. Report on progress and provide updates to the User Interface Committee, GEO and other stakeholder communities as appropriate;
- d. Advise the User Interface Committee, other CoPs and GEO on matters relating to their particular area of interest or societal benefit, and on cross-cutting issues of interest to the CoP.
- e. Provide an informal point of contact for members or other jurisdictions on the specific benefit or interest area that affect more than one organization;

### PARTICIPANTS

Each Community of Practice should include representatives from GEO Members, Participating Organizations and any other stakeholders that have similar interests, goals, and or objectives - working closely together to create a forum for efficient and effective intelligence and advice to be provided to GEO for the successful implementation of GEOSS. Both developing and developed countries will be represented.

#### *Air Quality*

*Participants:* Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Switzerland, UK, USA, CEOS, EEA, ESA, ECMWF, ICSU, ISPRS, WMO

*Contact:* Gary Foley (foley.gary@epa.gov)

#### *Atmospheric Chemistry* (former IGOS Atmospheric Chemistry theme – IGACO)

Under development

#### *Biodiversity*

*Participants:* Australia, Botswana, Brazil, Canada, Columbia, Denmark, Estonia, France, Germany, Ghana, Hungary, India, Iran, Israel, Italy, Japan, Mexico, Namibia, Netherlands, Nicaragua, Niger, Nigeria, Norway, Panama, Paraguay, Philippines, Portugal, South Africa, Switzerland, Thailand, Tunisia, UK, Ukraine, Uruguay, USA, ASEAN Centre for Biodiversity, BioNET-INTERNATIONAL, BirdLife International, Census of Marine Life, Conservation International, Convention on Biological Diversity (CBD), DIVERSITAS, ESRI, GBIF, Guyra Paraguay, IUCN, LIFEWATCH, The Nature Conservancy, UNEP, UNESCO

*Contact:* Woody Turner (woody.turner@nasa.gov), Anne Larigauderie (anne@diversitas-international.org), Rob Jongman (Rob.Jongman@wur.nl)

**Carbon**

*Participants:* Australia, Canada, France, Germany, Italy, Japan, Netherlands, Norway, South Africa, UK, USA, CEOS, ESA, GCOS, GTOS, WMO, WCRP

*Contact:* Antonio Bombelli (bombelli@unitus.it)

**Coastal Zone**

*Participants:* Algeria, EC, Egypt, Germany, Greece, Italy, Israel, Spain, Sweden, USA, IOC

*Contact:* Michael Bruno (Michael.Bruno@stevens.edu), Paul DiGiacomo (Paul.DiGiacomo@noaa.gov), Hans-Peter Plag (hpplag@unr.edu)

**Cryosphere**

*Participants:* EC, Germany, Japan, Norway, USA, CEOS, ESA, GCOS, WCRP

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**Energy**

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## APPENDIX B: ACRONYMS

ACQWA	Assessing Climatic change and impacts on the Quantity and quality of Water
AEGIS	Asian-monsoon systEm with Ground satellite Image data and numerical Simulations
AEIOS	African-European Georesources Observation System
AEMET	Spanish Meteorological Agency
AeroCOM	Aerosol Comparisons between Observations and Models
AG	Agriculture
AIP	Architecture Implementation Pilot
AIRNow	A cross-agency Web site on Air Quality News
AIST	National Institute of Advanced Industrial Science and Technology
AMDAR	Aircraft Meteorological Data Relay
ANTARES	A Network for the Enhancement of the Education and Scientific Research
APEC	Asia-Pacific Economic Cooperation
APFM	Associated Programme on Flood Management
AR	Architecture
ASEAN	Association of Southeast Asian Nations
ASI	Italian Space Agency
AVHRR	Advanced Very High Resolution Radiometer
AWCI	Asian Water Cycle Initiative
BGR	German Geological Survey
BGS	British Geological Survey
BI	Biodiversity
BIO	Biotechnology Industry Organization
BioNET-Intl	Global Network for Taxonomy
BirdLife-Intl	Global Partnership of conservation organizations
BNSC	British National Space Centre
BOM	Australian Bureau of Meteorology
BRGM	French Geological and Mining Research Bureau
CARSA	China Association for Remote Sensing Application
CAS	Chinese Academy of Sciences
CAWCR	Centre for Australian Weather and Climate Research
CB	Capacity Building
CBD	Convention on Biological Diversity
CBERS	China-Brazil Earth Resources Satellite
CDC	Centers for Disease Control and Prevention
CENC	China-Europe GNSS Technology Training and Cooperation Center
CEOP	Coordinated Energy and Water Cycle Observations Project
CEOS	Committee on Earth Observation Satellites
CFS	Canadian Forest Service
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
CL	Climate
ClimDev Africa	Climate for Development in Africa
CMA	Chinese Meteorological Administration
CMACast	CMA contribution to GEONETCast; utilises the AsiaSat 4 satellite beam to broadcast data and products to a user community in the Asia Pacific region
CNES	French Space Agency
CNR-IIA	Italy National Research Council - Institute for Atmospheric Pollution
COCOS	Coordination of Carbon Observing Systems
CODATA	ICSU Interdisciplinary Scientific Committee on Data for Science and Technology
CONAE	Argentinean National Commission of Space Activities
Conservation Intl	Organization applying solutions to protect Air, Water and Resources
CoP	Community of Practice
CRESDA	Center for Resource Satellite Data and Applications, China
CSA	Canadian Standards Association
CSIR	Council for Scientific and Industrial Research, South Africa
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSIS	Center for Strategic & International Studies
DA	Data Management
DANTE	Delivery of Advanced Network Technology to Europe
DEADP	Department of Environmental Affairs and Development Planning, South Africa
DEM	Digital Elevation Model
DevCoCast	Provides processed land and ocean satellite data and value-added products in Developing Countries
DG-RTD	EC Directorate-General for Research and Technological Development
DI	Disasters
DIVERSITAS	An international programme of biodiversity science
DLR	German Aerospace Center
DMI	Danish Meteorological Institute
DMN	Morocco Direction de la Météorologie Nationale
DPRTRP	Disaster Preparedness and Refugees Transition and Recovery Programme for North and Eastern Uganda
DST	Department of Science and Technology, South Africa
EBONE	European Biodiversity Observation Network
EC	Ecosystems
EC	European Commission
ECMWF	European Centre for Medium-range Weather Forecasts
EcoNet	Ecosystem Observation and Monitoring Network
EEA	European Environmental Agency
EFAS	European Flood Alert System
EFFIS	European Forest Fire Information System

EMEP	European Monitoring and Evaluation Program
EMSO	European Multidisciplinary Seas Observation
EN	Energy
EnerGEO	EO for monitoring and assessment of the environmental impact of energy use
ENSMF	Mines National College of Paris
EnviroGRIDS	Gridded management system for environmental sustainability and vulnerability
EO	Earth Observations
EPA	United States Environmental Protection Agency
ESA	European Space Agency
ESONET	European Seas Observatory Network
e-SOTER	Web-based Regional Pilot Platform with data, methodology, and applications, using remote sensing to validate, augment and extend existing data
ESRI	Environmental Systems Research Institute
EUMETCast	EUMETSAT Broadcast System for Environmental Data
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EuroSITES	European Ocean Observatory Network
Ev-K2-CNR	High Altitude Scientific and Technological Research
FAO	Food and Agriculture Organization of the United Nations
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
FDSN	International Federation of Digital Seismograph Networks
FGDC	Federal Geographic Data Committee
FP7	European Union 7 <sup>th</sup> Framework Programme
FPAR	Fraction Photosynthetically Available Radiation
FRA	FAO Global Forest Resources Assessments
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
GEO BON	Group on Earth Observations Biodiversity Observation Network
GEO PAAM	Group on Earth Observations Protected Areas Assessment and Monitoring
GEO	Group on Earth Observations
GEOBENE	Global Earth Observation Benefit Estimation: Now, Next and Emerging
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
GEOSS	Global Earth Observation System of Systems
GEOTOPS	GEO Training Opportunity Networks
GEWEX	Global Energy and Water Cycle Experiment
GFMC	Global Fire Monitoring Center
GGMN	Global Groundwater Monitoring Network
GHG	Greenhouse Gas

GIFS	Global Interactive Forecast System
GIS	Geographical Information System
GISIN	Global Invasive Species Information Network
GISS	Geo Information Systems Section, UNECA
GLOBE	Global Learning and Observations to Benefit the Environment
GLOVIS	Global Soil Information System
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
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GSI	Geological Survey Institute
GSN	Global Seismographic Network
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunications System
Guyra Paraguay	Non governmental organization that promote and coordinate progress towards the conservation and sustainable use of biodiversity
HARON	Hydrological Applications and Run-Off Network
HCF	Health and Climate Foundation
HE	Health
HTAP	Hemispheric Transport of Air Pollutants
IAG	International Association of Geodesy
IAS	Invasive Alien Species
ICSU	International Council for Science
ICT	Information and Communication Technology Section, UNECA
IEEE	Institute of Electrical and Electronics Engineers
IEO	Spanish Institute of Oceanography
IES	International Education of Students
IFRC	International Federation of Red Cross and Red Crescent Societies
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
IGOS-P	Integrated Global Observing Strategy Partnership
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

IMTSSA	Institut de Médecine Tropicale du Service de Santé des Armées, France
INM	Spanish National Meteorological Institute
INOV	Portuguese Innovative Company on Electronics and Telecommunications
INPE	Brazilian National Institute for Space Research
InSAR	Interferometric Synthetic Aperture Radar
INTA	Instituto Nacional de Técnica Aeroespacial, Spain
IOC	Intergovernmental Oceanographic Commission
IOCCG	International Ocean Colour Coordinating Group
IP3	GEOSS Interoperability Process Pilot Projects
IPWG	International Precipitation Working Group
IPY	International Polar Year
IRI	International Research Institute for Climate and Society
IRSA	Institute of Remote Sensing Applications
ISC	International Seismological Centre
ISCGM	International Steering Committee for Global Mapping
ISDR	International Strategy for Disaster Reduction
ISLSCP	International Satellite Land-Surface Climatology Project
ISPRA	Italy Institute for Environmental Protection and Research
ISPRS	International Society for Photogrammetry and Remote Sensing
ISRIC	International Soil Reference and Information Centre
ISRO	Indian Space Research Organisation
ISS-CAS	Institute of Soil Science, Chinese Academy of Sciences
ISSG	IUCN/SSC Invasive Species Specialist Group
ISTD	ICT Science and Technology Division, UNECA
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
JRC	Joint Research Center of the European Commission
KMA	Korea Meteorological Administration
LAI	Leaf Area Index
LAM	Limited Area Model
LIFEWATCH	e-Science and Technology Infrastructure for Biodiversity Data and Observatories
LIS	Land Information System
LSCE	Laboratoire des Sciences du Climat et de l'Environnement, France
MercNet	Web access information straight from Mercury's system
MERIS	Medium Resolution Imaging Spectrometer
MERIT	Meningitis Environmental Risk Information Technologies

MKFES	Mariolopoulos-Kanaginis Foundation of Environmental Sciences
MODIS	Moderate Resolution Imaging Spectroradiometer
NADM	North American Drought Monitor
NARSS	National Authority for Remote Sensing and Space Sciences, Egypt
NASA	National Aeronautics and Space Administration
NRC	National Resource Council Canada
NBII	National Biological Information Infrastructure
NEPTUNE	The North-east Pacific Time-series Undersea Network Experiments
NIDIS	USA National Integrated Drought Information System
NIES	Japan National Institute for Environmental Studies
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration
NPCA	National Parks Conservation Association
NPN	US National Phenology Network
NPP	Net Primary Productivity
NSC	Norwegian Space Centre
NSMC	China National Satellite Meteorological Center
NWP	Numerical Weather Prediction
OCO	Orbiting Carbon Observatory
OGC	Open Geospatial Consortium
OS	Open Source
OSS	Open Source Software
PAAM	Protected Areas Assessment and Monitoring
PAGES	Past Global Changes
PAMS	Poverty Analysis and Monitoring Section, UNECA
POGO	Partnership for Observation of the Global Ocean
POPs	Persistent Organic Pollutants
PREV' AIR	Air Quality Forecasts and Observations in France and Europe
R&D	Research and Development
RAMSAR	Convention on Wetlands
RIHN	Research Institute for Humanity and Nature, Japan
SAC	Space Applications Centre, India
SAFARI	Societal Applications in Fisheries & Aquaculture using Remotely-Sensed Imagery
SAR	Synthetic Aperture Radar
SBA	Societal Benefit Area
SCRC	Student Climate Research Campaign
SDI	Spatial Data Infrastructure
SDS	Sand and Dust Storm
SERVIR	Regional Visualization and Monitoring System
SIF	Standards and Interoperability Forum
SMB	Shanghai Meteorological Bureau, China
SMPHB	Shanghai Municipal Public Health Bureau, China

SPOT	Système Probatoire d'Observation Terrestre
SPOT-VGT	SPOT Vegetation
SPRING	Freeware and Open-Source Geo-Processing Software
SSC	Species Survival Commission
SST	Sea Surface Temperature
TerraLib	Open source GIS software library
TerraView	GIS application built on the TerraLib GIS library
TF	Task Force
THORPEX	The Observing-system Research and Predictability Experiment
TIGER	ESA-launched initiative focusing on the use of space technology for water resource management in Africa
TIGGE	THORPEX Interactive Global Grand Ensemble
TNO	Netherlands Organization for Applied Scientific Research
UCAR	University Corporation for Atmospheric Research
UCL	UK University College London
UK	United Kingdom
UN	United Nations
UNAM	Universidad Nacional Autónoma de México
UNCCD	United Nations Convention to Combat Desertification
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNOOSA	United Nations Office for Outer Space Affairs
UNOSAT	United Nations Operational Satellite Applications Programme
US	User Engagement
USA	United States of America
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VENUS	Victoria Experimental Network Under the Sea
VI	Vegetation Index
WA	Water
WAS	Warning, Advisory and Alert System
WCMC	UNEP World Conservation Monitoring Centre
WCRP	World Climate Research Programme
WE	Weather
WGCV	Working Group on Calibration & Validation, CEOS
WHO	World Health Organization
WIS	WMO Information System
WMO	World Meteorological Organization
WWRP	World Weather Research Programme
ZAMG	Austria Central Institute for Meteorology and Geodynamics

## **ANNEX: GUIDE TO WORK PLAN MANAGEMENT**

- I. The 2009-2011 Work Plan
- II. Task Management
- III. Role of GEO Committees

*Note: Where reference is made in the following text to "Tasks", this should be taken as being equally applicable to both Overarching Tasks and sub-tasks. Where necessary, specific reference will be made to either Overarching Tasks, or sub-tasks.*

## I THE 2009-2011 WORK PLAN

The 2009-2011 GEO Work Plan provides the agreed framework for implementing the GEOSS 10-Year Implementation Plan (2005-2015). It is a living document that is updated annually. In 2009, this update was particularly important since it took full account of the work on revising the GEOSS Targets and defining a GEOSS Performance Monitoring and Evaluation Framework.

The 2009-2011 Work Plan takes the GEOSS 10-Year Implementation Plan up to and beyond its mid-way point. While the first phase of GEOSS development, from 2005 to 2008, focused on building the GEO community and engaging countries and organizations, the next phase will increasingly focus on actually putting the components of GEOSS into place. As GEOSS takes shape over the next several years, connections will be realized between diverse observing, processing, data-assimilation, modelling, and information-dissemination systems. This will make it possible to obtain a dramatically increased range of data sets, products and services on the key aspects of the Earth system.

The 2009-2011 Work Plan was prepared according to a set of written guidelines reflecting the conclusions of the GEO-IV Plenary and Cape Town Ministerial Summit about how the Work Plan should evolve. It incorporates the proposals and comments received from the GEO community during 2008, 2009 and 2010.

The 2009-2011 Work Plan differs from its 2007-2009 predecessor in three main ways: (i) it groups the Tasks into two thematic parts; (ii) it consolidates GEO activities developed in the first years of GEOSS implementation under a smaller number of Overarching Tasks; and (iii) it enhances the role of users and Communities of Practice – taking full account of the IGOS transition into GEO. The latter marked the start of a reinvigorated effort to ensure that users are engaged with GEO, actively involved in implementing the Work Plan, and starting to realize the benefits of GEOSS through improved decision-making.

### (i) A Two-part Structure

The Work Plan has been organized into two major parts to provide a clear overview of GEO activities. Part 1, “Building an Integrated GEOSS”, features the fundamental, cross-cutting components of GEOSS, such as the GEOSS Common Infrastructure. Part 2, “The Nine GEOSS Societal Benefit Areas”, describes the services and end-to-end systems that will support decision-making in each of the Societal Benefit Areas (SBAs). These two parts are intimately linked and fully complementary; they can be seen as representing the two faces of the GEOSS coin.

### (ii) A Small Number of Overarching Tasks

The 2009-2011 Work Plan, as accepted as a living document by the GEO-VI Plenary, contains 44 Overarching Tasks – most of which are underpinned by two or more sub-tasks. Sub-tasks are implemented by a *Task team* composed of *Co-Leads* (GEO Members and Organizations), a *Point of Contact* (representing one of the Co-Leads) and *contributors* (further Members and Organizations); see Section II on Task Management.

#### *Overarching Tasks, Sub-tasks and Coordination*

Following GEO-IV recommendation, Overarching Tasks were introduced in the 2009-2011 Work Plan to (i) Link together 2007-2009 Work Plan Tasks that share a strategic objective and/or a common methodology; (ii) Improve coordination and cross-fertilization of GEO activities; (iii) Highlight key lines of GEOSS implementation; and (iv) Move the GEO Work Plan to a more strategic level. In addition, Overarching Tasks provide a platform for communicating progress on GEOSS implementation (cf. Ministerial Summits, Plenary Meetings, Work Plan Progress Reports, Newsletter, etc) and monitoring & evaluating progress on GEOSS implementation.

In order to ensure that Overarching Tasks move forward in a coherent manner, the GEO Committees, and GEO Secretariat have already initiated a number of actions (e.g. the Work Plan Symposium) to encourage sub-task teams to interact with one another – promoting synergies and cross-fertilization amongst respective sub-tasks and contributing to a more focused GEOSS implementation.

Moreover to reinforce coordination at the Overarching Task level, Task mentors should be nominated drawn from the Committees (for Tasks from Work Plan Part1) and from the GEO Secretariat (for Tasks from Work Plan Part2). The role of the mentor would be to encourage the various sub-task Leads to interact with one another, identify synergies and make recommendations as appropriate, including the expansion of Communities of Practices. The mentor would provide a direct link to the Committees allowing issues and blockages to be discussed. The mentor would also look across Overarching Tasks to look for synergies and areas that would benefit from coordination. The current list of Overarching Task mentors is appended to the present “Guide to Work Plan Management”.

#### *Distribution of Tasks: The Cross-Cutting Nature of GEOSS*

GEOSS is inherently cross-cutting and so are the individual Tasks in the Work Plan. Each Task typically involves two or more transverse areas (Architecture, Data Management, Capacity Building, Science & Technology, User Engagement), Societal Benefit Areas (Disasters, Health, Energy, Climate, Water, Weather, Ecosystems, Agriculture, Biodiversity) or system types (such as observing, modelling, information). Therefore, Tasks may fit under more than one Area.

For example, many Tasks in the Work Plan strongly involve capacity building however not all of these Tasks are listed under Section 1.3 (Capacity Building) – see e.g. in Part 2 “The Nine GEOSS SBAs”: HE-09-03 (End to End Projects for Health), EN-07-03 (Energy Policy Planning), CL-09-01 (Environmental Information for Decision-making), WA-06-07 (Water Resource Management), WE-09-01 (High-Impact Weather Prediction), EC-09-02 (Ecosystem Vulnerability to Global Change), AG-07-03 (Global Agricultural Monitoring) and BI-09-01 (Biodiversity Observation Network).

In the Work Plan Part 2, the cross-cutting dimension of Tasks is made more explicit through (non-exhaustive) lists of “*Key related Tasks*” and “*Spider-web diagrams*”. These diagrams – to be regularly reviewed by Task teams and Committees – grade the relevance of each Task to all SBAs from a minimum of 0 to a maximum of 5 (note that in Part 1, Tasks are transverse and by definition relevant to all SBAs).

#### **(iii) An Enhanced User-driven Approach**

The 2009-2011 Work Plan reflects the input and engagement of the GEO Communities of Practice and former IGOS themes – which transitioned into GEO and Communities of Practice in 2008 (for a complete list of Communities of Practice, see Appendix A). These Communities of Practice strongly contribute to the implementation of the Work Plan (see cross-references in Part 2): engaging users and building partnerships; providing support to Leads and participants for many Task teams, offering strategic insights and fresh ideas, and promoting dialogue between users and providers of Earth observations.

Taken together, these changes to the Work Plan approach should make the vision of a cross-cutting and user-driven GEOSS clearer for all contributors and participants. By making the linkages between Tasks and components explicit, this more focused approach should help bring the 10-Year GEOSS Implementation Plan for 2005-2015 closer to realization.

## II TASK MANAGEMENT

The 2009-2011 Work Plan contains 44 Overarching Tasks – most of which are underpinned by two or more sub-tasks (e.g. AR-09-01). A few Overarching Tasks are also self-contained (e.g. EN-07-01) typically because the communities involved (e.g. the Energy Community of Practice) are comparatively mature and coordinated. Each self-contained Task is implemented by a Task team with its own “Leads”, “Point of Contact” and set of “contributors”.

### (i) Getting Engaged

The process starts with an informal “signing in” procedure through which representatives of GEO Members or Participating Organizations volunteer to lead or contribute to a Task. This is typically done through an email addressed to the GEO Secretariat at [secretariat@geosec.org](mailto:secretariat@geosec.org), and welcome anytime in the year.

Those volunteering to take on the role of Task Leads should then receive from the GEO Secretariat a non-binding letter acknowledging their role, so that they are officially recognized by GEO. Enclosed with this letter would be recommendations useful for the Task Lead on GEO Task management (as in the following). This letter would also be copied to the respective GEO Principal.

### (ii) Leading a Task (or sub-task)

When a Member or Participating Organization agrees to lead a GEO Task, it takes responsibility for ensuring, on a best-effort basis, that Task milestones are reached and outputs are produced. Moreover it takes responsibility for:

#### a) *Implementing the Task*

- Identify, in cooperation with other co-Leads and contributors, key outputs and milestones with expected dates for achieving these milestones
- Monitor progress towards these milestones and outputs
- In cooperation with other Leads and contributors, take steps to support contributors so that they can carry out their work in support of the Task
- Identify gaps in the skills and resources of the Task team and encourage additional contributions to address these

#### b) *Reporting*

- Communicate to the Point of Contact the progress made on implementation – this may relate to outputs, milestones, activities or any other information relevant to the Task Sheet (see below)
- Inform GEO discussions needed for achieving the objectives of the Task

#### c) *Engaging the Communities of Practice*

- Coordinating with other Leads, consider participating in a relevant Community of Practice to capture users perspectives and requirements in the Task development

#### d) *Point of Contact (an individual volunteer should be identified from among the Leads to serve as the Task Point of Contact – PoC)*

- Provide a single point of communication for all those involved in the Task
- Serve as a liaison with GEO Committees, Communities of Practices and the GEO Secretariat
- In the framework of the twice-yearly Task Sheet update, report on progress to the GEO community (including input from other Co-Leads and contributors)
- Support coordination at the overarching Task level, if applicable
- Bring any issue requiring guidance or information to the attention of the relevant Committee and/or Community of Practice

Ideally, more than one Member or Participating Organization should agree to lead a Task and share the work of implementation (the order in which co-Leads are listed in the Work Plan is alphabetical, with countries coming first and organizations second). Commitments to lead or contribute to GEO Tasks are entered into voluntarily in the spirit of advancing GEOSS under the terms of the GEOSS 10-Year Implementation Plan.

Although Task Leads are always entities (countries or organizations), the actual leadership comes from individuals who take up responsibility for the Task. Leads coordinate internally within their country or organization so that the appropriate competencies of all of its relevant agencies, divisions, or units are brought into the Task as necessary. Leads also provide any financial and in-kind resources necessary for implementing the Task, drawing on sources internal to their agency, institution or organization. Throughout Task implementation, Task Leads encourage other organizations and entities to participate on a best effort basis as contributing organizations in the Task, particularly from developing countries whenever possible.

Leads should clarify and confirm that their country or organization agrees to lead a GEO Task, and that he or she is the responsible party. Moreover they should directly inform the GEO Principal (details of GEO Principals may be obtained from the GEO Secretariat at [secretariat@geosec.org](mailto:secretariat@geosec.org)).

### **(iii) Contributing to a Task**

Contributors support the implementation of a Task through selected activities and projects indirectly providing financial or in-kind resources. This contribution is coordinated with the Task Leads. Contributors also assist in recruiting additional contributing organizations to the Task, particularly within their own country, region, or discipline, and provide other support to the Task Leads where possible. Contributors further provide advice and information to the Task Leads on user requirements and best practices and endeavor to engage user communities.

Based on the Task Sheet updates, the Secretariat produces periodic Work Plan progress reports. These reports are presented to the Executive Committee several times a year, and an annual report is presented to the GEO Plenary. Progress reports are also circulated to Committees and Communities of Practice, as appropriate.

### **(iv) Informing the GEO Community – Task Sheets**

All information pertaining to a Task is compiled into a document referred to as the *Task Sheet*. The Task Sheet contains information on achievements to date, contributors to the Task (contact details), and the work to be performed.

Task Sheets may be updated anytime in the year however Task teams (through the Point of Contact) are invited to all provide updates at the same time twice a year (March and August). This is to simultaneously inform the GEO community of all Task progress and support the monitoring of GEOSS implementation. The most recent version of the Task Sheets is available online at [http://www.earthobservations.org/geoss\\_imp.shtml](http://www.earthobservations.org/geoss_imp.shtml).

Based on the Task Sheet updates, the Secretariat produces periodic Work Plan progress reports. These reports are presented to the Executive Committee several times a year, and an annual report is presented to the GEO Plenary. Progress reports are also made available to the GEO Community (including Committees and Communities of Practice) to facilitate information exchange.

With regard to access, exchange and reporting of Work Plan information, the GEO Secretariat is developing an interactive Work Plan Information Management System that the GEO community will soon be able to access on-line. This new web-based system will allow the GEO community to access, exchange and report information relating to the GEO Work Plan. In this way, it will support Task implementation and Task Sheet reporting, and promote the flow of information both within and

between Task teams. It will also allow users to generate reports by, for example, searching across all of the Task sheets to collate information on a particular organization, country or theme.

#### **(v) Updating the Work Plan – Targets**

Every year, the Secretariat prepares an update of the Work Plan based on consultations with GEO Members and Participating Organizations and inputs from Committees. This process allows for adjustments of various kinds and introduction of new activities. The update is then submitted to the GEO community for review and then to the GEO Plenary for review and acceptance as a living document.

[Note: In 2009, a special update process was set up to take full account of the GEOSS Target revision and the definition of a GEOSS Performance Monitoring & Evaluation Framework, including a reconciliation meeting which took place from 30 March to 1 April in Geneva.]

### III ROLE OF GEO COMMITTEES

With the growing maturity of GEOSS and the launch of 2009-2011 Work Plan, the importance of the four GEO Committees is increasing. The Committees and their individual members will need to maintain the momentum of their existing efforts while tackling new challenges. While working within their existing terms of reference, the Committees will take additional measures to ensure that GEOSS progresses to the next level and that this progress is recognized by Ministers at the next GEO Summit.

#### (i) Guiding the Work Plan

As described in the GEO Rules of Procedure, the four GEO Committees “provide high-level review, advice, recommendations, and support in the ongoing development and implementation of the GEOSS 10-Year Implementation Plan”. The Committees also actively promote the implementation of GEOSS activities as described in GEO Work Plans. In particular:

\* *The Architecture and Data Committee* supports “the Group on Earth Observations (GEO) in all architecture and data management aspects of the design, coordination, and implementation of the Global Earth Observation System of Systems (GEOSS) for comprehensive, coordinated, and sustained Earth observations.”

Consistently in the present Work Plan, the ADC oversees the Tasks dedicated to building a transverse GEOSS Common Infrastructure, organizing data management and implementing the GEOSS Data Sharing Principles. These are described in Sections 1.1 and 1.2.

\* *The Capacity Building Committee* supports “the GEO in strengthening the capability of all countries, in particular developing countries, to use Earth observation data and products in a sustainable manner and to contribute observations and systems to GEOSS. The GEO capacity building strategy will follow the World Summit on Sustainable Development (WSSD) concept of a global partnership between those whose capacity needs development and those who are able to assist in the process, recognizing that activities have intertwined social, environmental, and economic impacts”.

The CBC, therefore, helps to define and review the five Tasks dedicated to building capacity for a transverse GEOSS (see Section 1.3). CBC members should also review the capacity-building components in all other Tasks (which are described in a dedicated capacity-building “box” in each Task Sheet) in order to promote synergies, reduce duplication and address gaps.

\* *The Science and Technology Committee* engages “the scientific and technological communities in the development, implementation and use of a sustained GEOSS in order to ensure that GEO has access to sound scientific and technological advice”.

Accordingly, the STC supports the implementation of the Work Plan Science and Technology Tasks (Section 1.4). It ensures that all Tasks reflect the most up-to-date scientific and technological understanding of Earth systems and Earth observation tools. This responsibility includes developing, reviewing and periodically updating the GEOSS Science and Technology Roadmap. The Roadmap describes the major scientific and technological gaps that need to be addressed so that GEOSS can achieve its full potential. STC members also interact with various expert fora, as appropriate.

\* *The User Interface Committee* engages “users in the nine societal benefit areas in the development, implementation, and use of a sustained GEOSS that provides the data and information required by user groups on national, regional and global scales. The User Interface Committee has a specific goal to address cross-cutting issues by coordinating user communities of practice, ensuring continuity and avoiding duplication”.

The UIC then supports the implementation of the User Engagement Tasks (Section 1.5). It also takes the lead in assessing the needs, requirements, and priorities of the end-users of Earth observations and ensuring that user needs are reflected in the Work Plan Tasks. GEO recognizes that user groups need

to be engaged actively in the design and construction of GEOSS so that GEOSS will deliver what users truly need. In conjunction with other Committees, the UIC supports the application of Earth observations to decision-making and to the realization of societal benefits. The UIC also develops methods and processes to engage a broad range of users in GEOSS.

In addition to the above responsibilities, the four GEO Committees jointly help to coordinate the various sub-tasks of each Overarching Task by encouraging Task teams to interact with one another and by making recommendations as appropriate. Whereas the ADC primarily focuses on the transverse Tasks, the CBC, STC and UIC have more cross-cutting mandates; they too address transverse Tasks, but each one, based on its particular mandate, also identifies and guides a number of Tasks from the nine societal benefit areas in Part 2 of the Work Plan. To re-enforce coordination within and across Overarching Tasks, a joint session of the four GEO Committees may be organized on an annual basis, possibly at the time of the GEO Plenary.

To carry out their work, Committees interact with Task Leads and review Task Sheets and progress reports issued periodically by the Secretariat. Committees recommend corrective actions when needed. Each Committee also plays an important role in helping to identify Leads and contributors for all Work Plan Tasks. Hence Committees provide expertise, ideas, contacts, recommendations and practical support to the Task teams.

### **(ii) GCI and Data Sharing: the Two Cornerstones of the 2009-2011 Work Plan**

If the 2009-2011 Work Plan is to succeed in securing the foundations of GEOSS, the four Committees need to make an essential contribution to advancing two GEOSS cornerstones: the GEOSS Common Infrastructure (GCI) and the implementation of GEOSS Data Sharing Principles. The ADC plays a key role in guiding the construction of these two cornerstones, while other Committees provide additional insight from their particular perspectives.

The *GEOSS Common Infrastructure (GCI)* consists of web-based portal(s); clearinghouses for searching data, information and services; and registries containing information about GEOSS components and associated standards and best practices. Its implementation requires specific contributions from each Committee. The CBC contributes to the GCI by ensuring the proper development of the capacity-building components of the GEO Portal. In parallel, the STC ensures that the GCI reflects the best scientific knowledge and technology available. The UIC ensures that the GCI is providing the data sets, products and tools that users need.

During the first year of the Work Plan, the Committees contributed via the GCI Initial Operating Capacity (GCI-IOC) Task Force. The GCI-IOC phase was launched in June 2008 and will continue until September 2009. Based on the experience of the GCI-IOC, the Common Infrastructure will evolve to become fully operational. The success of GEOSS over the long-term will be measured by the quality, number and diversity of datasets, services and components that can be accessed through the Common Infrastructure. Consequently, it is vital that each Task team that is developing an operational component registers this component with the GCI. Teams must also ensure that components incorporate the GEOSS interoperability standards and comply with the GEO data sharing principles.

Meanwhile the GEO Principals and the Committees will continue to explore ways and means for sustaining the operations of GEOSS, the Common Infrastructure and the various components. This could include efforts to mobilize resources and contributions from both donors and the private sector.

Developing and implementing the *GEO Data Sharing Principles* should also be a key priority for all Committees during the first two years of this Work Plan's implementation. The aim is to build consensus amongst GEO Members and Participating Organizations for adopting the Principles at the GEO-VII Plenary and Ministerial Summit in 2010.

### **(iii) Engaging the GEO Community**

In addition to the responsibilities described above, the CBC, STC and UIC contribute to Work Plan implementation by engaging the users and producers of Earth observations and reaching out to resource providers and other interested groups. In particular:

*The Capacity Building Committee ensures*

A Coordinated and Effective Approach to Capacity Building – CBC members ensure that the GEO community maintains a coordinated and effective approach to capacity building throughout this Work Plan. CBC members support the analysis of national strategies for capacity-building and proactively seek to ensure that those strategies are coordinated and mutually supportive. The ultimate aim is to ensure that all countries have the capacity to use Earth observation data and products and to contribute observations and systems to GEOSS.

Resource Mobilization – The CBC helps to mobilize resources to foster the use and understanding of Earth observations, as described in the GEO Capacity Building Strategy (available on the GEO website). Committee members individually and collectively identify priorities and resource needs for addressing human, institutional and infrastructural capacity in Earth observation. They then seek to identify and engage donors and other providers of resources; see also Overarching Task CB-09-01.

*The Science and Technology Committee works towards*

Catalyzing Research and Development (R&D) Funding for GEOSS – STC members work with national governments and international organizations and encourage them to integrate the science and technology needs of GEOSS into their national, regional and international R&D programmes. STC members develop proposals and guidelines to assist R&D agencies to respond to GEO's needs, and dialogue with key decision-makers and funding entities. STC members also identify programmes relevant to GEO's scientific and technological priorities and encourage them to collaborate with one another; see also Overarching Task ST-09-01.

Engaging the Research Community in GEO – STC members support the research needs of GEOSS by reaching out to the world's diverse scientific and technological communities and making GEOSS more visible and attractive to them. To achieve this, STC members may organize a GEO presence at major symposia and other meetings, for example through plenary presentations or side events. They may contact universities and laboratories to involve them in GEOSS activities, form links with major scientific research enterprises in each Societal Benefit Area, and actively encourage relevant scientists and technical experts to contribute to GEOSS in a truly participatory way. The STC has already produced a document describing how GEOSS can benefit the research community ("The Role of Science and Technology in GEOSS" is available on the GEO website); see also Overarching Task ST-09-02.

*The User Interface Committee focuses on*

Engaging Communities of Practice – Communities of Practice (CoPs are listed in Appendix A) are contributing in essential ways to the GEO Work Plan and to identifying user needs. Some CoPs, however, still need to be introduced to and engaged by GEO, while others need to be better integrated into the Work Plan. The UIC – as well as other GEO Committees – interacts with the Communities of Practice in order to engage them in GEO Tasks and to identify the needs of the well-organized user groups that the CoPs represent; see also Overarching Task US-09-01.

Identifying Synergies between Societal Benefit Areas – The UIC identifies cross-cutting issues and data sets that could strengthen synergies between Societal Benefit Areas. It develops and maintains processes for identifying critical Earth observation needs common to more than one SBA by interacting with scientific and technical experts; see also Overarching Task US-09-01.

**(iv) Coordination and Planning**

While allocating differing responsibilities to each of the four Committees is a practical necessity, it is also essential that their work remains fully coordinated. The Committee Co-Chair Coordination (C4) takes responsibility for ensuring that the Co-Chairs of the various Committees share information and ideas on a regular basis. It may decide, as appropriate, to convene a joint session of the four GEO Committees on an annual basis, possibly as part of the GEO Plenary.

In addition, the work of the Committees is kept in synch by the master schedule adopted at GEO Plenary meetings. Under the current master schedule, each Committee meets twice a year within two general time slots. The exact dates are chosen in a manner that best supports the yearly Work Plan process and feeds into the meetings of the Executive Committee and GEO Plenary. In order to foster interaction and information exchange, the meetings are co-located when possible. In addition to these two meetings, Committees may choose to organize a third meeting at the time and location of the annual Plenary meeting.

**GEO 2009-2011 Work Plan – List of Overarching Task Mentors, as of 21 September 2010**

AREAS	OVERARCHING TASKS	OVERARCHING TASK MENTORS as designated by GEO Members, Participating Organizations, Committees and GEO Secretariat
ARCHITECTURE	AR-09-01: GEOSS Common Infrastructure (GCI)	Ivan DeLoatch (USA), ideloatch@usgs.gov
	AR-09-02: Interoperable Systems for GEOSS	Ivan Petiteville (CEOS), Ivan.Petiteville@esa.int
	AR-09-03: Advocating for Sustained Observing Systems	Barbara Ryan (WMO), bryan@wmo.int
	AR-09-04: Dissemination and Distribution Networks	Jay Pearlman (IEEE), jay.pearlman@ieee.org
	AR-06-11: Radio Frequency Protection	Barbara Ryan (WMO), bryan@wmo.int
DATA MANAGEMENT	DA-06-01: GEOSS Data Sharing Principles	Ivan DeLoatch (USA), ideloatch@usgs.gov
	DA-09-01: Data Management	Alessandro Annoni (EC), alessandro.annoni@jrc.ec.europa.eu
	DA-09-02: Data Integration and Analysis	Ryosuke Shibasaki (Japan), shiba@csis.u-tokyo.ac.jp
	DA-09-03: Global Data Sets	Jiashen Zhang (China), zhangjs701@gmail.com
CAPACITY BUILDING	CB-09-01: Resource Mobilization	Ana Casals (Spain), acasalsc@aemet.es
	CB-09-02: Building Individual Capacity in Earth Observation	Yolanda Berenguer (UNESCO), Y.Berenguer@unesco.org
	CB-09-03: Building Institutional Capacity to Use Earth Observation	Jane Shiel (EC), Jane.Shiel@ec.europa.eu
	CB-09-04: Capacity Building Needs and Gap Assessment	Andiswa Mlisa (South Africa), andiswa@umvoto.com
	CB-09-05: Infrastructure Development and Technology Transfer	Hilcea Ferreira (Brazil), hilcea@dpi.inpe.br
	CB-10-01: Building Capacity through Outreach & Awareness Raising	Tyra Brown (USA), Tyra.Brown@noaa.gov
SCIENCE & TECHNOLOGY	ST-09-01: Catalyzing R&D Funding for GEOSS	Kathy Fontaine (USA), kathy.fontaine@nasa.gov
	ST-09-02: Promoting Awareness and Benefits of GEO	Hans-Peter Plag (IEEE), hpplag@unr.edu
USER ENGAGEMENT	US-09-01: User Engagement	None following UIC recommendation
	US-09-02: Socio-Economic Indicators	None following UIC recommendation
	US-09-03: Cross-Cutting Products and Services	None following UIC recommendation
DISASTERS	DI-06-09: Use of Satellites for Risk Management	Guy Seguin (Canada), guy.seguin@space.gc.ca
	DI-09-01: Systematic Monitoring for Geohazards Risk Assessment	Francesco Gaetani (GEO Secretariat), fgaetani@geosec.org
	DI-09-02: Multi-Risk Management and Regional Applications	Francesco Gaetani (GEO Secretariat), fgaetani@geosec.org
	DI-09-03: Warning Systems for Disasters	Francesco Gaetani (GEO Secretariat), fgaetani@geosec.org
HEALTH	HE-09-01: Information Systems for Health	Murielle Lafaye (France), murielle.lafaye@cnes.fr
	HE-09-02: Monitoring and Prediction Systems for Health	Masami Onoda (GEO Secretariat), monoda@geosec.org
	HE-09-03: End to End Projects for Health	Masami Onoda (GEO Secretariat), monoda@geosec.org
ENERGY	EN-07-01: Management of Energy Sources	Marion Schroedter-homscheidt (Germany), marion.schroedter-homscheidt@dlr.de
	EN-07-02: Energy Environmental Impact Monitoring	Fernando Ramos (GEO Secretariat), framos@geosec.org
	EN-07-03: Energy Policy Planning	Thierry Ranchin (France), thierry.ranchin@ensmp.fr
CLIMATE	CL-06-01: A Climate Record for Assessing Variability & Change	Seonkyun Baik (GEO Secretariat), sbaik@geosec.org
	CL-09-01: Environmental Information for Decision-making	Seonkyun Baik (GEO Secretariat), sbaik@geosec.org
	CL-09-02: Accelerating the Implementation of the GCOS	Seonkyun Baik (GEO Secretariat), sbaik@geosec.org
	CL-09-03: Global Carbon Observation and Analysis System	Seonkyun Baik (GEO Secretariat), sbaik@geosec.org
WATER	WA-06-02: Droughts, Floods and Water Resource Management	Doug Cripe (GEO Secretariat), dcripe@geosec.org
	WA-06-07: Capacity Building for Water Resource Management	Doug Cripe (GEO Secretariat), dcripe@geosec.org
	WA-08-01: Integrated Products for Water Resource Management	Rick Lawford (Canada), Lawford@umbc.edu
WEATHER	WE-06-03: TIGGE and the Development of GIFS	Jim Caughey (WMO), jim.caughey@gmail.com
	WE-09-01: Capacity Building for High-Impact Weather Prediction	Koki Iwao (GEO Secretariat), kiwao@geosec.org
ECOSYSTEMS	EC-09-01: Ecosystem Observation and Monitoring Network	Bradley Reed (GEO Secretariat), breed@geosec.org
	EC-09-02: Ecosystem Vulnerability to Global Change	Bradley Reed (GEO Secretariat), breed@geosec.org
AGRICULTURE	AG-06-02: Data Utilization in Fisheries and Aquaculture	Marie-Hélène Forget (Canada), forgetmh@mar.dfo-mpo.gc.ca
	AG-07-03: Global Agricultural Monitoring	Fan Jinlong (GEO Secretariat), jfan@geosec.org
BIODIVERSITY	BI-07-01: Developing a Biodiversity Observation Network	Bradley Reed (GEO Secretariat), breed@geosec.org