

GEO 2016 WORK PROGRAMME

Version v4

22 December 2015

Foreword to Version 4 of the 2016 GEO Work Programme

The GEO 2016 Work Programme is the first of the new GEO decade 2016-2025.

As explicitly requested by the GEO Strategic Plan 2016-2015: implementing GEOS, the GEO Work Programme for 2016 is of a transitional nature; in fact it bridges the first and the second GEO decades and it covers a year in which GEO will have to ensure continuation of current activities, while defining new priority actions and transitioning to the new implementation mechanisms defined by the Strategic Plan.

Considering the appointment of the Programme Board by GEO-XII Plenary, the objective would be to complete this transition in 2016 and developing the first “regular” Work Programme 2017-2019.

Version 4 of the 2016 Work Programme is the result of a process started in March 2015, fully involving the GEO Community and Governance. Major steps are reported below:

March 2015	Solicited inputs from GEO Principals and from WP 2013-15 Task Teams
May 1	Version v1 (for discussion at the WP Symposium)
May 5-7	GEO Work Plan Symposium
June 22	Version v2 (for ExCom comments)
July 7-8	ExCom meeting
July 17- Sept 3	Interactions Secretariat/Proposing Teams and check point with IPWG
September 9	ExCom Teleconference to discuss Foundational Tasks
Sept 10 – Sept 29	Actively seeking confirmation of contributions
September 29	Version 3.0, as a GEO-XII Plenary document
Until Nov. 11	Continue actively seeking contributions.
November 11-12	GEO-XII – inputs from Delegations,
Dec 22	Version v4 – Final (incorporating Plenary comments and further inputs from activities leads and contributors))

The 2016 Work Programme implements the provisions of the new Strategic Plan, the GEO Core functions dictating the definition of the activities and their description, the redefined Governance guiding the definition of the proposed management arrangements, here included a strengthened role for the Secretariat.

This Work Programme shows a clear ramp-up from the first to the second GEO decade.

There is still some work to do, in particular to continue the integration of proposed contributions, to consolidate the description of the proposed activities, and to complete the definition of the teams and of the associated resources. Nevertheless, this version 4 constitutes a solid reference to continue previous GEO activities and start new ones,

Changes introduced with respect to version v3

Where	What
Chapt. 2.1	Included reference to the Strategic Plan
Chapt 2.2	Included figure "GEO Workflow"
CA-01	Update description (China inputs)
CA-03	Changed title in the Index. Added leaders in the task description. Updated POCs.
CA-04	Updated task description
CA-04	Additional updates
CA-11	Changed lead, removed JAMSTEC contribution
CA-23	Major update
CA-29	Major update
CD-01	Updated description and contributors list
GD-01	Added full list of leads and contributors (former DSWG)
GD-02	Major changes, included coordination by the GDWG, added list of leads and contributors
GD-03	Major changes, added list of leads and contributors
GD-04	added list of leads and contributors
GD-06	added list of leads and contributors
GD-07	Major changes, added list of leads and contributors
GD-08	Changed from June to September 2016 the deadline to activate SBA process. Changed deliverable n. 3
GD-09	Included names of task leads, changed role of the Secretariat
GD-10	added list of leads and contributors
GD-11	Minor updates, added list of leads and contributors
GI-03	Corrected spelling of GFOI acronym in various places
GI-05	Updated 2016 activities description; updated resources description
GI-08	Major update
GI-10	Minor updates
GI-11	Update description
GI-14	Complete revision to include the contribution of ECO-POTENTIAL, SWOS and the USGS activities.
GI-17a	New numbering GI-17
GI-17b	New numbering GI-21 and new title "Human Planet Initiative" and
GI-18	Changed title, major update of the description
SO-04	Corrected title to "resource mobilization", corrected numbering in the Toc
Annex 1	Corrected outputs of tasks GD-08 and GD-09 (they were inverted) Updated Outputs of tasks GD-02, GD-03, GD-06, GD-07, GD-11
Annex 2	Updated resources tables CD series and Total

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 - GI-05 Global Carbon Observation and Analysis System
 - GI-06 Reinforcing engagement at regional level: AfriGEOSS for Africa
 - GI-07 Ocean and society - Blue Planet
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 - GD-06 GEOSS non-space based Earth Observation Resources
 - GD-07 GCI Development
 - GD-08 SBAs process: Systematic determination of user needs / observational gaps
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1. INTRODUCTION

The GEO Work Programme provides the framework for implementing agreed activities. It is organized into four major parts describing the proposed activities subdivided according to the four implementation mechanisms defined in the Strategic Plan (Figure 1).

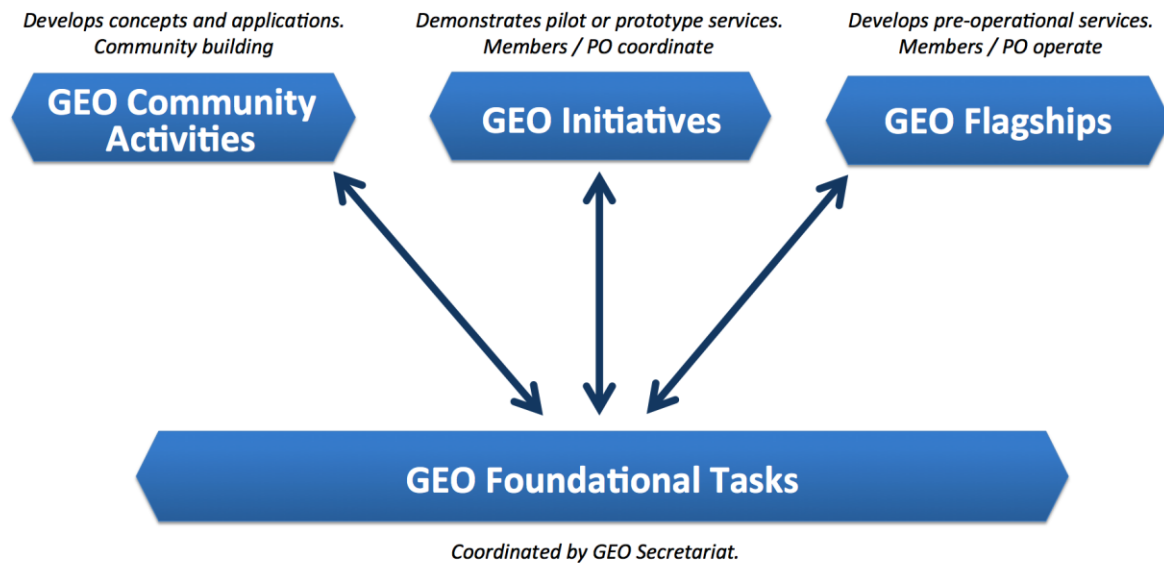


Figure 1 (from the Strategic Plan)

Each of the mechanisms serves a different purpose in attaining GEO's Strategic Objectives, allowing activities of different scale and kind to be implemented.

- **GEO Community Activities** allow stakeholders to cooperate flexibly in a bottom-up fashion and with a low initiation cost. They can include a broad variety of activities with varying degrees of coordination. GEO Community Activities may, for example, define user needs, explore new frontier applications or demonstrate technical possibilities, or agree on specific observation or analysis protocols and data exchange.
- **GEO Initiatives** allow Members and Participating Organizations to coordinate their actions and contributions towards a common objective within an agreed, yet flexible framework. They develop and implement prototype services according to GEO priorities and have identified committed resources to a certain extent. GEO Initiatives may, for example, demonstrate technical feasibilities through pilot services, or serve a user need.
- **GEO Flagships** allow Members and Participating Organizations with a policy-relevant mandate to spin-up a dedicated operational service serving common needs and/or well-defined user groups. They develop and implement near-operational services according to GEO priorities and are fully resourced. GEO Flagships may operate for as long as they are able to generate sufficient impact to attract support for their activities. Once they reach a mature, operational stage, they may be taken

up by operational organizations (e.g. GEO Participating Organizations), for their continued operation over the long term.

- **GEO Foundational Tasks** allow GEO to implement selected, often enabling, tasks to achieve GEO Strategic Objectives. These include coordination actions, gap analyses, the implementation of technical elements for accessing GEOSS, and other routine operations of the GEO Secretariat. Thus, they provide important support functions to Flagships, Initiatives, and Community Activities.

The Work Programme is supported by a “Work Programme Reference Document”(WPRD), maintained by the GEO Secretariat, which represents a compilation of the relevant Implementation Plans of GEO Flagships, GEO Initiatives and of Community activities description. It also contain important background information on overarching objectives of the actions in the Work Programme and on Monitoring and Evaluation activities.

The WPRD, because of the amount of information it will contain, will be a web-based, “electronic document” only, to allow easy consultation.

The first draft issued together with the Work Programme consists of a collection of more detailed information on the following Community Activities and GEO Initiatives, for which the proposing Teams have made additional documentation available.

CA-25	Africa Global-scale Geochemical Baselines for mineral resource and environmental management: Capacity-building phase
CA-32	Research Data Science Summer Schools (new-CODATA/RDA)
GI-01	GEOGLAM-Global Agricultural Monitoring and Early Warning
GI-02	GEOBON-Global Biodiversity Observation (GEO BON)
GI-03	GFOI Global Forest Observations Initiative
GI-04	Global Observing System for Mercury and Persistent Pollutants
GI-05	Global Carbon Observation and Analysis System
GI-06	Reinforcing engagement at regional level: AfriGEOSS for Africa
GI-07	Ocean and society - Blue Planet
GI-09	Global Wildfire Information System
GI-16	GEO-DARMA = Data Access for Risk Management (new-CEOS)
GI-17	Global Urban Observation and Information
GI-19	AmeriGEOSS (new)
GI-21	Human Planet Initiative

2. WORK PROGRAMME DEFINITION AND EXECUTION FRAMEWORK

2.1 Reference criteria

The description of the Work Programme and of the different Implementation mechanisms defined in the GEO Strategic Plan 2016-2025: implementing GEOSS (and summarized in Chapter 1) provides the reference for its development and for the definition of the overall criteria to ensure its execution.

The key requirement is for the Work Programme “to strive to optimally pursue the realization of the Strategic Objectives through implementation of GEO’s Core Functions constrained by the identifiable resources”.

The first, most important reference, which can be derived is that the Work Programme should be composed of a number of activities, well-articulated and described, that are linked during the

definition and coordinated during the execution to ensure that the GEO’s Core Functions are implemented in a satisfactory way.

The second key reference is directly provided by definition of the Implementation Mechanisms, i.e. the function of the Foundational Tasks to implement often enabling activities to achieve GEO Strategic Objectives and, equally important, to provide important support functions to Flagships, Initiatives, and Community Activities.

The third reference is constituted by the increased role that IPWG recommended for the Secretariat to assume in the Work Programme execution: not only support to external contributors, as it was for the previous Work Plans, but also a central role in coordinating and implementing Foundational Tasks.

2.2 GEO “Workflow”

Starting from the criteria above, the definition of the Foundational tasks and their implementation arrangements seem to constitute the key reference to identify what one may call a “GEO Workflow”, schematically reported in Figure 2 below, which puts in place the links among the different activities by building the working interfaces among the different teams so that they interact in a timely fashion, enabling GEO to deliver.

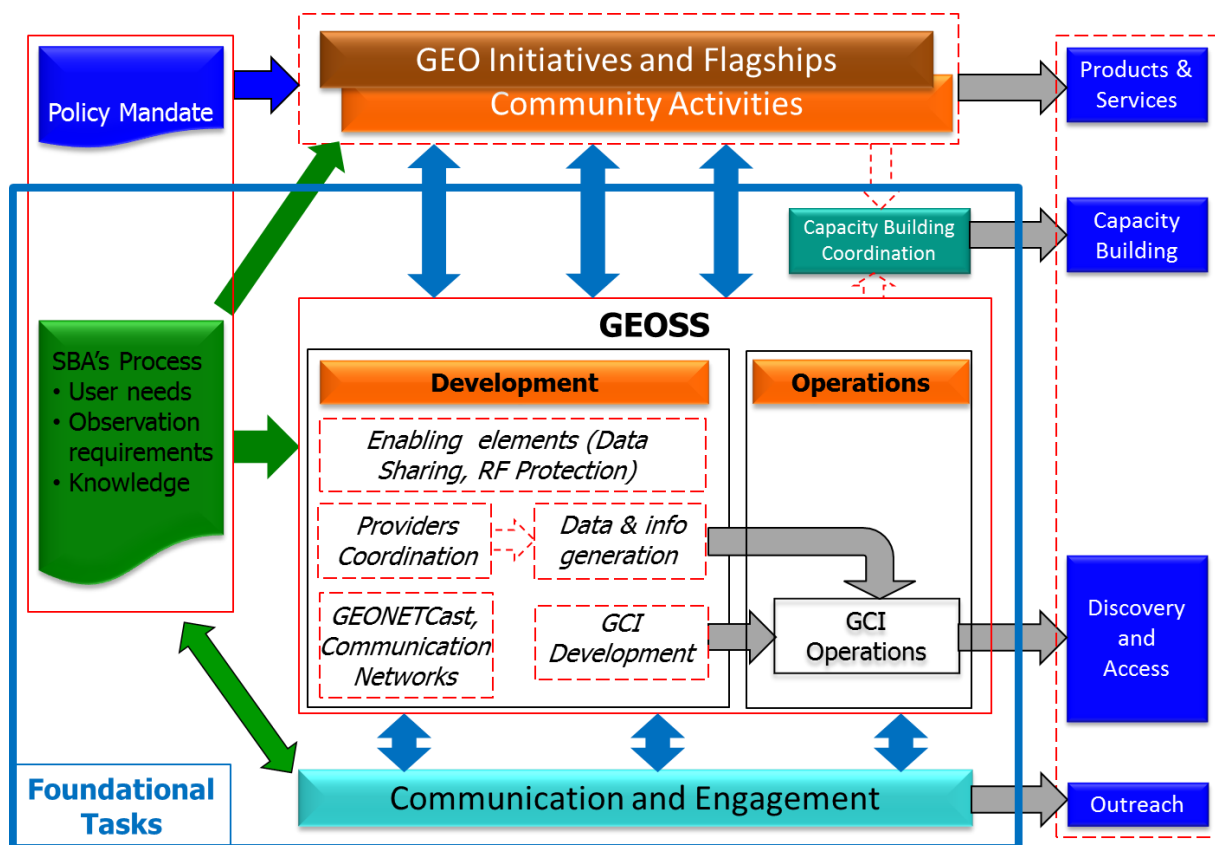


Figure 2 – GEO Workflow

The Foundational Tasks play a central role in ensuring the basic GEO “platform” is in place by

1. Directly addressing the development of key GEO elements, like GEOSS, User needs, Knowledge base, Communication and outreach, are properly developed in a coherent manner and
2. Properly interfacing and supporting the other GEO activities (Flagships, Initiatives, and Community Activities).

Implementation of each of these two key elements implies the definition of a set of arrangements, plans and working interfaces that will be better identified and progressively implemented during 2016 to become two consolidated “GEO Workflows”.

A couple of examples for the first element are represented by a) the need to ensure necessary coordination between the teams developing the GCI and those developing the knowledge base and b) the systematic interface of the communication and engagement with all other teams.

An example for the second is constituted by the need to implement the interaction between the teams developing a GEO Initiative and the teams in charge of GCI development and operations, so that the Initiative could benefit from the GEOSS data and information made available through the GCI and, in turn, define the arrangements so that what is developed within that initiative is made accessible through GEOSS.

The role the Secretariat, as articulated in the Strategic Plan, is therefore twofold, to ensure the coordination among the different teams in charge of the Foundational Tasks and to provide a clear point of reference for the other GEO activities (Flagships, Initiatives, and Community Activities).

This role is consistent with the proposed estimated resources for the Foundational tasks.

4. COMMUNITY ACTIVITIES

4.1 General

GEO Community Activities enable a broad variety of activities. They allow stakeholders to cooperate flexibly in a bottom-up fashion and with a low initiation cost.

The Work Programme includes a summary description of each of the agreed activity, while more detailed description including the planned outputs/results and the resources allocated will be part of the “Work Programme Reference Document”.

4.2 Community activities description

CA-01 Global Land Cover

Objectives/motivations:

Land Cover is one of GEO’s top-priority Earth observation parameters due to its cross-cutting importance for many Societal Benefit Areas. The GEO Global Land Cover task is working to improve coordination of land cover activities around the globe. It seeks to develop an international network where GEO Members can express their needs for land cover products, contribute mapping and monitoring efforts, and support related capacity development initiatives. Through its activities, the Land Cover task aims to meet the product needs of numerous stakeholders including environmental agencies, science communities, national mapping agencies, commercial users, and UN Conventions. However, more work is needed to efficiently coordinate activities and communicate related societal benefits and evidence of policy linkages. Despite the technological and scientific advancements made in recent years, there is an impelling need for greater harmonization of land cover data and greater collaboration among the different efforts. Reducing inconsistencies between land cover products, nesting of finer-scale information

within broader schemes, standardised accuracy assessments and collaborative information service still remain major challenges.

Some key objectives of the task:

- Provide a suite of global land-cover and land-cover change datasets, based on improved and validated moderate resolution land-cover maps,
- Develop high-resolution global land-cover and land-cover change data sets, based on international community consensus and including a robust accuracy assessment,
- Develop an independent global land cover reference dataset
- Establish a community-oriented global land cover portal and a collaborative information service platform
- Improve the use of time-series products to characterize the nature and extent of land-cover change and dynamics,
- Better understanding of land cover state and its dynamics, at global scale,
- Support policy initiatives such as those from UN Conventions and at the national level.

Leads (preliminary):

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Contributors:

Task SB-02-C1 (<http://earthobservations.org/ts.php?id=155>)

Task SB-02-C2 (<http://earthobservations.org/ts.php?id=220>)

Task SB-02-C3 (<http://earthobservations.org/ts.php?id=221>)

Activities and outputs planned for 2016:

- Reorganize Global Land Cover Task; Explore the potential to evolve into a GEO initiative
- organize a workshop on ‘Global land cover and UN Sustainable Development Goals (SDGs) in Beijing (the beginning of June or End of Aug., 2016);
- Continue work on a GEO Global Land Cover Information Portal; connect major Global and regional Land Cover websites/portals to facilitate data sharing and accuracy assessment of land-cover products
- Further develop concept for a collaborative Global Land Cover Information Service System (CoGland) and publish a concept paper in the *International Journal of Digital Earth*
- Conduct the validation of 30-m resolution global land cover data sets, organize a workshop in Shanghai (End of May, 2016), and release the preliminary results at GEO XIII Plenary. ases
- Develop methodologies for land cover mapping and change monitoring at high spatial resolution

Funding sources and indicative amounts (2016):*Projects*

- ESA Land Cover CCI
- Copernicus Land Monitoring Service
- EC Joint Research Centre (JRC) activities
- Chinese GlobeLand30 project

In kind

ESA GOFC-GOLD Land Cover Office (coordination work)

Financial

ESA GOFC-GOLD Land Cover Office (travel support for Project Officer)

Additional activities for 2016 (Recommended if additional resources made available):

- Conduct survey on national requirements (reporting processes to UN Conventions and monitoring of SDGs)
- organize a GEO/ UN-GGIM/ISPRS training course on Global land Cover mapping and service for developing countries (Beijing)

Future plans (activities and resources):

- Promote greater collaboration and harmonization of land cover data
- Work towards an operational process to generate global land cover
- Develop an independent global land cover reference dataset
- Support countries by developing a national-based approach for land use and land cover mapping
- Facilitate the use of Land Cover data to support and assess progress towards the Sustainable Development Goals
- Promote Land Cover data as a global indicator of change for all kinds of uses – ecosystem services, agriculture, water, health, disasters, forests, carbon etc.

CA-02 Land Cover for Africa

Objectives/motivations:

The Working Group on Land Cover for Africa is comprised of an Executive Board with representatives from the six regions in Africa and a Technical Advisory Group, which includes both International and African remote sensing and land cover experts. The purpose of the Working Group is to contribute to the development of a land cover programme which includes monitoring land cover change for Africa at medium and high resolution.

The major objectives of the Working Group are as follows:

- Evaluate the development of medium and high resolution land cover products for Africa, including the standardization of the process and the validation of the final products

- Advocate for Earth Observation data providers to adopt a policy of full and open access to their data
- Raise awareness of the availability of land use/land cover data, tools, applications, and land cover change dynamics among decision makers at multiple levels
- Build mutually beneficial partnerships with national and regional institutions to assess their land cover needs, such as products and tools, while increasing their involvement in data validation for the global land cover data product
- Build capacity within and among national and regional institutions to integrate land cover data into decision making processes
- Promote sound governance policies and activities that maximize the value and usefulness to decision makers of land cover data at multiple scales (e.g., data openness, data sharing, institutional transparency, common data standards)

Leads:

Name	Institution	GEO Member/PO
Hussein Farah	RCMRD	RCMRD
+ <i>Executive Board</i>		
Amadou Dieye	CSE	Senegal
+ <i>Technical Advisory Group</i>		

Contributors:

RCMRD, Gabon (AGEOS), Madagascar (University of Antananarivo), Morocco (Chouaïb Doukkali University), Nigeria (RECTAS), South Africa (NGI - National Geo-Spatial Information), United States (US DOI), AARSE, China (Tsinghua University), Egypt (NARSS), European Commission (JRC), GOF-C-GOLD, Kenya (ICIPE), Nigeria (NASRDA), Senegal (CSE), South Africa (CSIR, NEOSS), UNECA, UNEP, United States (NASA, USGS)

Task SB-02-C4 (<http://earthobservations.org/ts.php?id=226>)

Activities and outputs planned for 2016:

There is a need for the Working Group to streamline its activities to focus on tangible elements. In the short-term, a strategic guideline will be developed, describing the major tasks and the benefits for the African countries. The main activities for 2016 will be organized around the following areas:

Land Cover Inventory

One major accomplishment of the Working Group was to build an inventory of current land cover mapping activities in Africa. Work in 2016 will focus on further developing the Land Cover Inventory:

- Maintain the official version of the Land Cover Inventory spread sheet and review the master list for any duplicates or non-existent datasets
- Development of a web interface for the Inventory that allows the users to the

AfriGEOSS webpage to access information about the available or in-work land cover datasets for specific countries or regions in Africa in a comprehensive and user-friendly way. Information about the datasets will contain description of geographic extent, data sources, acquisition dates, resolution or minimal mapping scale, methodology, format, contact details, and where possible thumbnails and download links to the dataset.

User requirements

A survey will be created and conducted with preliminary results at end of 2016 to generate knowledge about the national needs and capabilities of countries in the region. There are many different types of users and hence different user requirements. Common needs and tasks exist such as reporting on greenhouse gas inventories but country-specific needs may differ substantially. In 2017, in-country capabilities will be summarized.

Classification system

Land cover products developed at the global scale often do not meet the requirements at the country level. This has been claimed by many countries. A two-level approach is considered as an optimum, with common categories for a continental scale map and individual classes for each country. The country-specific categories should have the capability to be scaled onto the broader scheme.

It has been recognized that countries in Africa have been struggling with the implementation of the new ISO standard LCCS-3 (or Land Cover Meta Language, LCML). In 2016, knowledge about this standard will be provided to the countries and assisted in their efforts to implement the new ISO standard.

One activity is to look at what other institutions are doing and how it can be shared with the community.

Funding sources and indicative amounts (2016):

A long-term strategic plan will be developed within 2016 to attract funding by organisations and developments banks.

Financial

The task has received funding from US DOI (\$20K). DOI will also provide funding for the results of the LC Inventory to be web-enabled.

Projects

- EC Joint Research Centre (JRC) activities
- Chinese efforts on 30-m land cover datasets

Future plans (activities and resources):

- Establish an Africa-focused Community of Practice for Land Use and Land Cover to facilitate networking among scientists and technicians and to bring together land cover data users (by country and region) and data producers
- Provide Information to governments and donors on where to focus their funding and capacity building resources

- Deliver products and information for policy making in environmental management

CA-03 Access to climate data in GEOSS

Objectives/motivations

In a world of exponential technological change and rapidly growing sophistication in climate and weather information driven in part by the ever increasing volumes of these data, GEOSS must evolve to promote not only the access to these data, but promote services that might provide greater understanding to all the components that make up the Earth System. These understandings must be advanced by climate and weather models that can improve global and regional guidance to the Vulnerability, Impact and Adaptation (VIA) communities of climate change and extreme weather events. There is a pressing demand for regional (extreme) weather and seasonal predictions to satisfy both the modelers themselves in the GEO community, and for use by emergency management personnel, policy makers and long-term city, energy, water and agricultural planners.

Due to a rapidly increasing scale of global climate simulations and the need for not only access but knowledge of the appropriate use of climate information (including reanalyses, observational data and climate simulations), new areas of collaboration using shared infrastructures and on-line services need to evolve within GEOSS and GCI. Initially, to advance these objectives, the primary focus of this activity would be a coherent cluster of 3 main themes: 1) data discoverability, 2) archive access, and 3) dissemination. Eventually, this Task will assist users of all levels of expertise to find and discover climate and weather information including access tools and visualization capabilities. These objectives will be advanced by leveraging and coordinating with selected national and international data, modeling and information access groups and efforts including WCRP, GCOS, WMO GFCS and others to explore new opportunities for enhanced coordination and synergy among GEO Stakeholders.

Leadership and Contributors

Lead(s):

Glenn Rutledge, Glenn.Rutledge@noaa.gov

Boram Lee, BLee@wmo.int

The task contributors will be sought from existing climate and weather modeling groups already actively engaged in distributed and federated climate and weather data centers and producers.

- CA-03 will work to leverage the IPCC WCRP CMIP infrastructure for access to climate model outputs under the ESGF international collaboration;
- CA-03 will leverage GEO's advocacy for these efforts which require some ground work and resources to publish data sets on ESGF;
- New partnerships and thrust areas surrounding access to associated observational data sets under the ESGF/obs4MIPs/ana4MIPs activities will be championed within a wider (beyond climate research) community;
- WCRP would further collaborate in the GEO arena to promote additional (e.g. modeling activities) high priority activities in the new Task plan;
- The U.S. NOMADS model data access system, already a GEO contributor will advance CA-3 goal and objectives;
- Promote the wider development and use of ESGF for climate simulations at all spatial

and temporal scales and Earth System domains, including regional downscaling (CORDEX), seasonal and decadal predictions and WCRP core projects model development and intercomparison initiatives;

- Collaboration with the Decadal Forecast Exchange data in that context. Links with contributions from the Copernicus C3S;
- Promote product development and collaborations within the geo-science communities (ocean, weather, and climate) to foster inter-disciplinary research to study multiple earth systems using collections of distributed data under a sustainable GCI system architecture;
- Advance GEO collaborations and linkages to NASA's CREATE (reanalysis clearinghouse); and Reanalysis.org;
- Promote and advance middleware capabilities for access tools such as THREDDS Data Server from Unidata in the U.S. under the ESGF framework;
- Implement multi-model and ensemble based access tools to provide a new level of access to probabilistic information rather than deterministic.

Activities and outputs planned for 2016

- Identify outreach opportunities to enhance the understanding and usability of climate and weather model output;
- Develop a new CA-03 Task Plan and identify and coordinate this plan with select contributors;
- Establish interfaces between CA-03 and GFCS;
- Develop an implementation strategy and a work plan for a GEO interface to the Earth System Grid Federation (ESGF) within or servicing for GEOSS users;

Funding sources and indicative amounts (2016)

- In kind ESGF program through NOMADS ESGF node implementation (.15FTE) and WCRP leadership/activities;
- In kind NOMADS federation and access services support (0.10FTE);
- In kind NASA CREATE reanalysis access capability (0.10FTE).

Future plans (activities and resources)

An effective international federated and distributed data service requires coordination of data infrastructure and data management principles extending beyond organizational boundaries of any individual center. The fundamental data management issue that CA-03 will address is how GEO institutions can organize their distributed data resources into a cohesive presence, then interface this with GCI to allow the users to make better, informed decisions about how nature will impact their future, either in their life or in their business decisions. Activities listed in "Leadership and Contributor's" will be advanced by engaging stakeholders and creating new and more formal agreements with related activities such as GFCS.

CA-04 Strengthen collaboration between GEO and GFCS

Objectives/motivations:

A recommended action from the 2014 GEO Progress Assessment Report for GEO Members and Participating Organizations is to improve coordination between GEO and the Global Framework for Climate Services (GFCS), and to build linkages at the national and regional level between activities implemented under both frameworks. The GFCS Implementation Plan recognizes GEO as a framework for preparing services in the GFCS priority areas (Food Security and Agriculture, Disasters, Health, Water and Energy) and the 6 priority countries (Bhutan, Burkina Faso, Dominica, Moldova, Papua New Guinea and Tanzania) and notes that there is an opportunity for GFCS to

collaborate with GEO's ongoing efforts.

General description

Therefore, this GEO task will function as a general mechanism to build synergies between GEO and GFCS. The primary focus of this task is to identify targeted areas in existing GEO projects where collaboration with the GFCS could take place through clearly identified action. The task aims on demonstrating in tangible ways in which GEO activities can be used to help implement the GFCS at the national and regional levels. This will also enable member countries to engage and help develop and implement. Concrete activities between GEO and GFCS will be identified that could help demonstrate how these two entities can collaborate. The identified areas may serve as bridging areas and showcase mutual benefits.

Since climate will be a cross-cutting topic in GEO's next decade, rather than being a stand-alone Societal Benefit Area, this task could build a general interface between climate-related activities across the new GEO SBAs, the priority areas and pillars of GFCS, especially on observation and monitoring through the Global Climate Observing System (GCOS). This will ensure to align and synergize GEO and GFCS activities in a mutually beneficial way. Task participants will be supported by both the GEO Secretariat and the GFCS office.

CA-05 TIGGE (Thorpex Interactive Grand global Ensemble) evolution into a Global Interactive Forecast System (GIFS)

The objective will be to continue to develop a one stop shop for accessing a multi-model forecasting system.

The TIGGE (THORPEX Interactive Grand Global Ensemble) archive continues to be an invaluable resource for research in ensemble forecasting.

Although the THORPEX programme concluded at the end of 2014, data providers agreed to continue to contribute to TIGGE and ECMWF agreed to continue as Data Provider and Archive Centre (the National Center for Atmospheric Research (NCAR) ceased its role as a TIGGE Archive Centre at the end of THORPEX).

TIGGE data is expected to make a major contribution to the WMO THORPEX legacy projects on Polar Prediction (PPP) and High Impact Weather Project (HIWeather).

The TIGGE archive now contains nine years of multi-model ensemble data comprising 1.25 petabytes, both from ten global models, totalling more than 4.6 billion fields at the disposal of the community.

ECMWF also continues to maintain the TIGGE-LAM archive of limited-area model ensemble forecasts for Europe. Output from eight systems is being ingested in the TIGGE-LAM archive daily, namely COSMO-LEPS, ALADIN-LAEF, COSMO-DE-EPS, DMIHIRLAM, GLAMEPS, HUNEPS, MOGREPS, PEARP.

The new WWRP (World Weather Research Programme) working group on Predictability, Dynamics and Ensemble Forecasting (PDEF) will support the THORPEX legacy projects, including S2S (Subseasonal to Seasonal project) and PPP (Polar Prediction Project).

The Terms of Reference of the PDEF include:

1. To advance the science of dynamical meteorology and predictability research
2. To improve ensemble predictions
3. To support WWRP projects
4. To promote the use of TIGGE and TIGGE-LAM and other ensemble data-sets

TIGGE would naturally feed into the development of a Global Interactive Forecast System (GIFS) to coordinate advance warnings and forecasts of high impact weather

events to mitigate loss of life and property, to be developed through voluntary contributions of national, regional, and international organizations.

CA-06 EO data in mineral and non-renewable energy resources

Description:

The exploitation of mineral resources, including non-renewable energy resources, has played a significant role in the development of many countries all over the world. The industry has been, and continues to be an important contributor to both national and regional economies and is critical to national defense. Mining, and the industries it supports, is among the basin building blocks of a modern society.

The benefit of exploitation to those countries has been many, but has come at a cost to the environment. Early mining operations have left a historical legacy of negative environmental impacts that affect our perception of mining. As countries have matured, there has been increasing recognition that environmental protection is as fundamental to a healthy economy and society as is development. The challenge is to simultaneously promote both economic growth and environmental protection.

Social impacts of mineral resource exploitation are complex and controversial. It can generate wealth, while triggering significant disruptions. A project can generate employment, transport infrastructure, education facilities and increase goods and services availability in remote poor areas; however these benefits might be unequally shared. Social tensions and conflict, sometimes riots, can rise from affected communities.

Recent initiatives for more responsible and sustainable practices in mineral resources exploitation reflect a trend in better addressing the societal acceptability issues of mining. This include international (e.g. European Industrial Partnership on Raw Materials EIP-RM) and national mineral policy strategies, responsible mining initiatives by exploiting companies, green mining initiatives, etc.

Earth Observation (EO), possibly including dedicated citizen observatories, offers a unique opportunity and varieties of methods and tools to collect and process spatial information to monitor and assess each phase of the mining cycle, from exploration to exploitation and closure. It can contribute to help improving raw material policy and better exploiting mineral resources from the territory of mineral supplying countries, as well as to demonstrate how to improve their capacity in implementing new exploitation sites for the benefit of the society.

EO has proven valuable contribution in delivering objective, reliable, affordable, undisputable information and documentation at site level, hence fostering a better dialogue between the relevant stakeholders, from national to local levels (SB-05-C2, EU FP7 projects EO-MINERS and ImpactMin).

Non-renewable energy resources (fossil fuels) and critical metals for e.g. solar panels and windmills typically fall into the energy value chain and are hence relevant to the Energy CoP.

Mineral resources however lack dedicated EO system or program and currently use EO systems and programs from other SBAs. Global coverage by high-spectral resolution sensors in particular is currently not available.

Leads and Contributors

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Lead (PoC)	France	BRGM	Stéphane Chevrel	s.chevrel@brgm.fr
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Activities and outputs planned for 2016:

Overarching activities of the EO data and mineral resources will include:

1. Develop tools and Information for the Resource Assessment, Monitoring and Forecasting of Geological Resources (including mineral and fossil resources, raw material and groundwater)
2. Develop tools for impact monitoring of mining operations
3. Identify and foster implementation of strategic measures for the competitive, reliable and sustainable management of geo-resources exploitation and treatment of re-usable materials

These activities could consist in:

- 1.a. : The definition, or refinement, of a set of area-specific essential variables to be validated by the CoP and GEO in view of measuring and monitoring the status of mineral resources assessment and exploitation
- 1.b. : The definition of methodologies and tools to map these essential variable from existing and future sensors, including citizen observatories
- 1.c. : A global mineral mapping program using existing (ASTER) or future (EnMap) missions, on the model of the Australian Mineral Map performed by CSIRO using ASTER imagery
- 1.d. : A global mining waste inventory program by adapting e.g. the PECOMINES

project methodology to currently available sensors (Landsat TM, Sentinel -2) and/or future missions (EnMap); also connected with point 3.

- 1.e. : Contacts with CEOS for the design of future high spectral resolution missions in support of the above objectives
- 2.a. : Further development of integrated EO-based products to meet stakeholder requirements and engagement at regional (mining basin) to site levels
- 2.b. : Foster their use in responsible mining initiatives, both at governments and company levels
- 2.c. : Develop methodologies and tools for illegal mining activities monitoring
- 3.a. : Develop methodologies for mapping secondary resources from identified mining wastes

Development of close interactions with other GEO societal issues will be part of the community activities e.g. cold regions (increasing activity in mineral resources exploration and exploitation in these regions), global observing system for mercury (in connection with illegal mining), water (impact of mineral resource exploitation on water quality and resource),...

CA-07 Integrated Water-cycle Products and Services

1. Overview

This activity is dedicated to improving the ability of Earth Observations to serve the management of water at the policy and tactical levels. To do this, this task seeks to ensure that all the relevant data of the entire water cycle, which were treated as separate entities are being collected, that they are integrated, analyzed and disseminated to all who need them and that the capabilities and training for people in all countries and organizations to utilize this information for the benefit of society are being developed.

This activity provides a coordination function and a framework within which divergent elements can work together. Beyond this internal coordination the water task provides coordination for the interactions between water and other SBA.

The activity brings together in-situ data with satellite data in areas where they were not previously combined in producing products (soil moisture, groundwater, snow). It also looks for integration between variables and looks at how information services can be developed across national borders and globally.

This activity develops integrated and sustained information systems and services needed for water, disaster, agriculture, and energy and health management. This activity also coordinates other water-related community activities or initiatives, such as Water quality, clouds and water vapor, great lakes, cold regions. This in order to develop a comprehensive water-cycle decision making system.

The GEO Water Cycle Integrator (WCI) will consider integration across functions (data collection, assimilation, modeling, visualization, decision support), across SBAs and across scales from continents to basins and from supercomputers to laptops.

2. Leads and contributors

Lead : Rick Lawford, Morgan University.

Principal contributors are coming from the IGWCO. Some are listed here:

US (NASA, NOAA, and to a lesser extent USGS, EPA, USAID), Japan (JAXA,

University of Tokyo), China, European Commission, France (CNES), - Germany (DLR, GTN-H), WMO, WCRP (GEWEX, CliC), CEOS, Australia, Austria, Belgium, Canada, Columbia, Chile, Estonia, European Space Agency, Indonesia, India, Kenya, Korea, Mexico, Nepal, Nigeria Norway, Pakistan, Panama, Philippines, Russia, South Africa, Sweden, Switzerland, Tunisia, United Kingdom, Viet Nam, FAO, UNESCO, UNEP, IEEE, IISD.

3. 2016 Activities

This CA is a continuation of the former GEO Water task, following activities are planned, but not limited to 2016:

- Promotion of the integration of different types of observations to produce products that will be more reliable because they build on the strengths of different observational systems.
- Promotion of integration across functions (data collection, assimilation, modeling, visualization, decision support), across SBAs and across scales from continents to basins and from supercomputers to laptops, by using the GEO Water Cycle Integrator (WCI).
- Integrated precipitation data sets and products are being used to develop warnings of extreme precipitation events, for validating models and for assessing water availability.
- Evapotranspiration products for agricultural areas are being used to monitor the use of irrigation water during the growing season on a farm by farm basis over the western USA.
- New soil moisture products are being used to monitor water use for irrigation. In some countries, governments have replaced expensive in-situ monitoring with satellite data.
- Guidance to NHMS managers on the international priorities for network expansion for hydrometric networks.
- Data inputs and estimates for groundwater resource assessments
- Consistent International data sets are facilitating research and assessments in the Great Lakes Basin (see separate activity).
- The GEOSS Water Cycle Integrator (WCI) that provides a framework for the assessment and analysis of water resources. It has been used to study flood protection, plan reservoir and dam operations and has analyzed the health effects of heavy precipitation on poor societies with limited drainage systems.
- The end-to-end approach has been used to document biodiversity water security index and the human water security index and provide insights on how investments in water infrastructure is changing the balance between these two objectives.
- Unique data sets are available for the study of Asia.
- The mechanics for directly transferring streamflow data to the GRDC have been developed and tested. A special aspect of the studies providing input to this analysis is the Water Services project which is providing standard formats for the transfer of hydrometric data.

4. 2016 Resources

The funding sources for this activity include:

- Research funding agencies which fund projects of finite duration
- Operational agencies which provide in-kind support (such as short periods of time)

for projects that are on-going.

- Activities that are carried out by volunteers who work in agencies but are not provided with time to work on their activities so they do the work on their own time.

It should be noted that Japan through JAXA and the University of Tokyo and NASA provide support for the coordination of the Water activity.

5. **Additional activities for 2016.**

Recommended if additional resources made available: no one identified yet.

6. **Future Plans**

Future plans will be defined according to the GEOSS Water Strategy report 2014.

CA-08 Water Vapor and Clouds (and Aerosol and Precipitation)

1. **Overview**

The primary objective of this activity is to develop an observation strategy to improve the synergistic understanding between water vapor and clouds, and if feasible, aerosols and precipitation. Traditionally, observing strategies (both from the ground and from space) focus on primarily a single parameter or exploit sensors that fulfill operational requirements or test out new technologies to enhance the understanding of a particular phenomenon. Some specific programs (e.g., WCRP/GEWEX, NASA EOS program, etc.) have attempted to tie together several parameters, but generally from an independent stand point in terms of organizational structure and on climate time scales (where the linkages between the physical processes are not the priority but developing climate forcings and water cycle balances are).

In order to gain an understanding of the physical processes that are related to water vapor, clouds, aerosols and precipitation, a new observation paradigm needs to be established that focuses on the physical processes rather just on the final quantity (i.e., cloud particle size distributions and not just cloud amount, etc.).

Outputs (Deliverables): To convene a workshop and/or town hall type discussion (at a scientific meeting venue) to develop concrete plans for an improved observation strategy. This could be held before the end of 2016. It's possible that the town hall discussion (if this is the proper mechanism to initiate this) could be held e.g., at the 2016 AGU meeting to flesh out the initiative concept that would then lead to a more focused workshop in 2017.

2. **Leads and contributors**

Lead: Ralph Ferraro, NOAA/NESDIS, College Park, MD USA.

Contributors: Rick Lawford, Dominique Berod, Bob Kuligowski

3. **2016 Activities**

Regardless of if we hold a town hall meeting first, then a workshop, a meeting that brings together the right mix of scientists, decision makers, satellite operators, international program officers, etc. needs to be properly considered. This meeting would not just be another science meeting but would look specifically at required measurements needed to advance the current state of understanding between the atmospheric water cycle variables. We would have to first look closely on activities already in motion within GEO, CEOS and CGMS since all of these groups are producing recommendations very similar on the observing system and may have actions already in motion – we want to leverage what is in the works and not reinvent anything. But we would also have to be realistic and examine planned operational ground and satellite missions for the next

decade or two, and then perhaps fill in observational voids through research programs. A key would be then to coordinate the observation strategy to gain the synergistic information needed.

4. 2016 Resources

No direct funding, all contributors will provide in-kind support from their host organization. NOAA and/or CICS-MD will provide institutional resources to host (potential) workshop on topic and to send R. Ferraro to relevant meetings.

5. Additional activities for 2016.

no one identified yet.

6. Future Plans

Depend on the workshop to be held in 2016.

CA-09 Precipitation

1. Overview

Objectives for the Activity: In the 2016 Transitional GEO Work Plan the primary focus for precipitation is on providing data sets and associated information for use in other areas of the Work Plan.

Ensure users have access to stable, state-of-the-art, characterized, global precipitation datasets.

Outputs (Deliverables) Expected and Anticipated Date of Completion: In the 2012-2015 GEO Work Plan the primary focus for precipitation is on providing data sets and associated information for use in other areas of the Work Plan.

2. Leads and contributors

Lead : George Huffman: george.j.huffman@nasa.gov, GFSC, NASA, Greenbelt, MD

Contributors : JAXA, NASA

3. 2016 Activities

1. The CGMS/International Precipitation Working Group (CGMS/IPWG) will continue to update tables of publicly available, routinely produced, (quasi-)global, and long-term precipitation data sets. See <http://www.isac.cnr.it/~ipwg/data/datasets.html>. The present algorithm description pages and an “Introduction to Global Precipitation Algorithms and Data Sets” will also be updated.

2. U.S. and Japanese teams for the joint U.S./Japanese satellite mission Global Precipitation Measurement will release improved algorithms for combined-sensor products (Integrated Multi-satellite Retrievals for GPM [IMERG] and Global Satellite Map of Precipitation [GSMaP], respectively) that take advantage of GPM and CEOS-PC data.

3. The U.S. GPM User Workshop, several JAXA workshops, and the CGMS/IPWG biennial meeting will include training sessions for data users drawn from the U.S., East Asia, and Europe/Africa, respectively. The first will include on-line sessions in English and Spanish that are intended for a wide international audience.

4. The new Goddard Earth Sciences Data and Information Services Center (GES DISC) service providing averaged precipitation over areas described by a generic Graphical Information System (GIS)-standard shape file will be evaluated for more-general use.

5. The IPWG is working to create a central repository for, and routinely update graphics from, the validation statistics computed for its validation sites in Australia,

Japan, the continental U.S., South America, Western Europe, and South Africa.

6. IGWCO will work with the appropriate GEO foundational task to increase precipitation dataset availability.

7. One or more white papers on the future of the microwave constellation will be written with cooperative efforts from CGMS/IPWB, IGWCO, and CEOS-PVC

4. 2016 Resources

NASA and JAXA are the primary supporters of this work through in-kind contributions.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

The CGMS/IPWG is investigating leading a summer school on precipitation in 2017. Resources are not yet identified, and would include funding for the venue, computer resources, honoraria for the speakers, and travel/per diem for eligible students.

CA-10 Evapotranspiration (and Evaporation)

1. Overview

Objectives for the Activity: Improve global evapotranspiration products for vegetated land surfaces, and also for lakes and rivers, deserts, urban areas and snow-covered land-areas.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

Measurements of evapotranspiration (ET) are important for understanding the influence of the plant canopy on the water vapour content of the atmosphere and for estimating the rate of plant growth. FLUXNET provides in-situ eddy correlation estimates from flux towers, which tend to be concentrated in developed countries, while satellites and Land Data Assimilation Systems (LDAS) provides model estimates of evapotranspiration without strong validation in more remote areas. In terms of global products the Global Energy and Water Cycle Exchanges (GEWEX) project has launched LANDFLUX to estimate evapotranspiration from models and satellite data for a grid covering the land areas of the world. Added to these efforts are regional and national methods for producing evapotranspiration estimates for use in irrigation planning and water use monitoring.

2. Leads and contributors

Lead: NASA Forrest Melton: forrest.s.melton@nasa.gov

3. 2016 Activities

An ET workshop will be held at the World Bank sponsored by the National Aeronautic and Space Agency (NASA). Other activities in 2016 that will continue are:

1. The need for an archive of flux measurements of ET for satellite validation purposes will be reviewed.
2. GEWEX LandFlux will provide a terrestrial ET data product covering the period of SRB v3 (Surface Radiation Budget, version 3) of 1984 – 2006 at 3-hourly and 1-degree spatially, or over the period and resolution of SRB v4 if available.

3. The expansion and continuation of NASA sponsored workshops to transfer remote sensing based ET approaches to state and regional water resources and geospatial groups.
4. Development of an ET training course using satellite data

4. 2016 Resources

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-11 Soil Moisture

1. Overview

Objectives for the Activity: Develop a global soil-moisture product and services for climate, water management applications and agricultural advisory services.

Soil moisture is a critical variable because it affects the partitioning of rainfall into infiltration and runoff as well as the partitioning of energy between sensible and latent heat that is transported into the atmosphere. When water is retained in some soils, it creates a reserve of water for plant growth thereby promoting plant productivity during the growing season.

The ESA SMOS (Soil Moisture and Ocean Salinity) mission has measured soil moisture over the Earth's land masses and salinity over the oceans since 2010 and its data continue to contribute to furthering our knowledge of the role of soil moisture in the Earth's water cycle. This global coverage has been supplemented by the launch of NASA's SMAP (Soil Moisture Active Passive) in early 2015. Similarly, a number of active sensors provide high-resolution observations that can either be used for the downscaling of the SMOS/SMAP/AMSR2 observations, and eventually provide direct estimates of soil moisture at a very high resolution. The development and services of a global in-situ data archive are made available for validation of satellite products and for other applications. The harmonization of the different spatio-temporal scales of the various products are a challenge and needs to be addressed.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

Within GEO, the soil moisture focus has been on the development of a global soil moisture network and a data archive. This effort has been advanced by hosting workshops to promote the development of a global in-situ soil moisture monitoring network that could provide validation data for the ESA SMOS mission and the NASA Soil Moisture Active and Passive for Weather and Water Cycle Processes (SMAP) mission. Since soil moisture data must be archived to be of use, a global archive has been organized at the University of Vienna.

2. Leads and contributors

Lead: Peter van Oevelen (GEWEX, pvanoevelen@gmail.com) and Chris Rüdiger, Monash University, chris.rudiger@monash.edu

3. 2016 Activities

During the period of the 2016 work plan this activity will:

1. Continue to build the global soil moisture network and a data archive at Vienna University of Technology as well as establish other nodes of the network (currently one node in the USA under consideration)
2. Promote the development and adoption of standard data measurement, collection and archiving protocols for soil moisture data.
3. Develop projects that will test and show the benefits of satellite soil moisture data products at different spatial and temporal scales.
4. Develop projects that will test procedures and data interpretation steps for the use of SMAP products when they become available.

4. 2016 Resources

The activities are primarily carried out on a volunteer basis by colleagues employed at universities. The data center at the Technical University in Vienna has been receiving funding from ESA for some of its operations.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-12 River Discharge

1. Overview

Objectives for the Activity: Integrate, in a phased approach, dedicated river gauging networks of existing hydrological stations into a global runoff observation network. Make the data available through the GEOSS Common Infrastructure using standardized formats.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

Information on surface water is crucial for the management of water resources in basically all socio-economic and environmental domains. River gauge levels and discharge/runoff are critical observations for flow forecasting including floods and evaluating the hydrologic impacts of drought. They are highly relevant for the detection of climate variability and change. Through its links with the Global Terrestrial Network - Hydrology (GTN-H), the World Meteorological Organization (WMO), and Global Climate Observing System (GCOS), GEO strives to improve the network of hydrologic measurements and encourage more extensive use of these data. Efforts in this domain have focused on obtaining data from a core network of 380 major global runoff stations which monitor continental freshwater fluxes into the world's oceans. In addition, satellite data are being used to produce experimental lake level data sets. The continued establishment of Hydrological Information Systems in regions and large transboundary river basins through WMO's flagship programme "World Hydrological Cycle Observing System" (WHYCOS) contributes to improved forecasting and water management capabilities of participating countries. Complementary to river flow forecasting, the establishment of regional Flash Flood Guidance Systems will be further expanded.

2. Leads and contributors

Lead: Julius Whellens-Mensah: jwellens-mensah@wmo.int

Contributor: Wolfgang Grabs, Grabs@bafg.de

3. 2016 Activities

In the 2016 time frame GEO will focus on:

1. developing a proposal to seek upgrades to the hydrometric network and to promote the development of integrated data products.
2. undertaking technical activities related to the calibration and rating curves for select rivers and storage volume changes for large lakes and reservoirs primarily through WMO's Global Runoff Data Centre (GRDC).
3. further promoting the sharing of hydrological data and information.
4. developing a proto-type data base of surface water storage that will simulate the data that could be provided by a satellite measuring water levels.
5. continuing the planning and implementation of regional and basin-wide projects under WHYCOS.
6. continuing to provide guidance, technical services and capacity building through the WMO-GWP Associated Programme on Flood Management (APFM) developing a data base of surface water storage that will simulate the data that could be provided by a satellite measuring water levels

4. 2016 Resources

Staff support for this effort comes from the WMO office budget.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-13 Groundwater

1. Overview

Objectives for the Activity: Coordinate Global Groundwater Monitoring Network (GGMN) for a periodic assessment of global groundwater resources:

Obtain in-situ groundwater data and incorporate it into the IGRAC data base to support the calibration and validation of satellite groundwater products.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

Groundwater resources are vital for drinking water supply, irrigation, the sustainability of wetlands and rivers as well as many other important issues, including climate change adaptation. The state of groundwater resources needs to be monitored regularly to provide the basis for the assessment and prediction of their quantity and quality. Hence, water management decisions rely strongly on availability and quality of monitoring data.

There is however, a lack of information on groundwater monitoring at regional and global scale, hampering assessment and informed water management internationally. Therefore IGRAC decided to establish the Global Groundwater Monitoring Network (GGMN). The GGMN consists of two components: the GGMN People Network and the GGMN Portal (a web-based software application).

Groundwater specialists, who are members of the GGMN People Network, can access the country-dedicated workspace of the portal. This 'maintenance mode' allows users to upload, interpolate, aggregate and analyze the groundwater data from their country and to optimize the inputs from the network for assessments.

2. Leads and contributors

Lead: Neno Kukuric: Neno.Kukuric@un-igrac.org ;

Laura del Val Alonso: laura.delvalalonso@un-igrac.org

3. 2016 Activities

Activities over the 2016 time frame:

- Entering agreements with national focal points, ensuring continuous efforts and contributions;
- Continuous acquisition and uploading of new country data which is made freely available online;
- Participation in development of international groundwater specific protocol for automatic data sharing among online systems.

4. 2016 Resources

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-14 GEO Water Quality

1. Overview

The objectives for the activity aim to develop international operational water quality information systems based on Earth observation with a focus on the developing world.

2. Leads and contributors

The lead is by Steven Greb, Wisconsin DNR. Contributors are coming from the newly built water quality community of practice, including NOAA, CSIRO, ICES, NERC, BfG, UNEP, EC, eawag, RAMSAR, Odermatt & Brockmann, several universities etc.

3. 2016 Activities

Main actions will be:

- a. Continue to develop the organizational structure of the Community of Practice
- b. Review of current and future project contributions to GEO WQ goals
- c. Update of Web page and hosting Webinar series
- d. Proposal for an Inland Water Quality Essential Climate Variable to GCOS
- e. Draft and maintain a biannual Water Quality research agenda to national and international agencies
- f. Formation of working group on definition of global products: publication draft ready for submission
- g. Demonstration project of one global-scale WQ product
- h. User Work Plan agreed and published

Outputs are timely, consistent, accurate and fit-for -purpose water quality data products and information to support water resource management and decision making in coastal and inland waters.

4. 2016 Resources

There is currently no general direct funding for support of the CA. Two exceptions are the Swiss Federal Institute of Aquatic Science and Technology support of the web page

and GEO Secretariat support of telecons, meeting facilities. All other support (time, travel) is supported by in-kind contributions.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

Currently, the WQ CoP is reviewing the outcomes of the GEO Water Quality Summit. With the long-term goal (10 year) to develop an international operational water quality information system based on Earth observation, the CoP is developing a strategic and action plan to obtain this goal. This will be detailed in 2016.

CA-15 Water Cycle Capacity Building

1. Overview

The needs being addressed in this activity are primarily training needs with training events being held regularly especially in Asia but also in Latin America. In Asia and Africa the efforts also include the development and implementation of tools through the AWCI, AfWCCI, TIGER and SERVIR systems. This activity provides information on new technologies, low cost systems, personal and institutional capacity building, development of collaborations and projects in the use of new technologies.

2. Leads and contributors

The Lead is by Angelica Gutierrez-Magness (NOAA).

Partners include USA (NOAA, NASA, USAID), Japan (JICA, University of Tokyo), Chile (Universidad de la Serena), Colombia (Escuela Naval Almirante Padilla, IDEAM, National University), Mexico (University of Baja California - UBC), Argentina (Universidad Nacional del Sur-Bahia Blanca), APN, European Space Agency, European Commission, Canada (IISD), ESA, IEEE, UNESCO, the Netherlands (ITC), Kenya, Mexico, Nepal, Pakistan, Panama, Peru, Viet Nam.

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3. 2016 Activities

1. Water Cycle Integrator (WCI)

- Continue development of WCI workbenches under the leadership of the University of Tokyo (DIAS) and JAXA in further AWCI countries and seeking ODA support for such activities.
- Continue capacity building activities for maximizing utilization of DIAS data and tools (training workshops and courses).

- Pursuing ODA proposals for system developments in AfWCCI countries/basins and expanding DIAS datasets and functions to cover African region.
 - Improving and expanding DIAS tools for Water-Climate workbenches (CMIP5 GCM output data analysis tool).
2. GEO for the Millennial Generation. This is a pilot project sponsored by the University of La Serena (Chile) and seeks the incorporation of remote sensing activities into High School education. Ricardo Cabezas-Cartes, CIEHLYC's co-chair is the leader of this activity.
 3. GEO-CIEHLYC coordinates some of the training activities for GEONETCast. Countries acquiring the system provide funding and in-kind contributions.

4. 2016 Resources

There is no separate funding for these activities although JICA and APN have supported some of the training activities in Asia, USAID and NASA have supported the implementation of SERVIR systems, and Colombia has supported the implementation and training of GEONETCast in the country. The GEO Secretariat has provided the necessary support for the Webinars. NASA, NOAA, the GEOSec, and government organizations of the Americas Caucus have provided funding and in-kind contributions for CIEHLYC's activities.

The University of La Serena-Chile sponsors the Millennia's generation project, which includes travel expenses for 5 international trainers.

For the Water Cycle Integrator (WCI) there is in-kind contribution from the following organizations: (1) MEXT, Japan (support to DIAS); (2) JICA SATREPS program (Myanmar); (3) JAXA – in kind – satellite data and associated services; and (4) UTokyo – in kind – expertise, tool development, training courses.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

In 2017, CIEHLYC plans to have the third Water-Cycle Capacity Building week again in Latin America; location to be determined. Activities to obtain the necessary funding will start on mid 2016.

The future plans for (WCI) are mainly to continue in development of WCI workbenches and flood early warning systems based on WCI principles in AWCI countries and AfWCCI basins. The intention is to seek ODA support for such implementation and provide continued education services on the DIAS capabilities and promoting its exploitation.

CA-16 Global Drought Information System (GDIS)

1. Overview

Drought is a ubiquitous feature of the global water cycle that has tremendous societal and economic impacts throughout the world. It involves a broad array of physical processes and time scales encompassing the atmosphere, hydrosphere, land surface, cryosphere, and biosphere. As such, advancing our ability to predict drought requires improvements in modeling and observations encompassing all components of the physical climate system as well as improved knowledge of its impacts and interactions with human activities. Global climate change may affect drought frequency, spatial extent, and duration, and the Global Drought Information System provides the means to monitor these changes over time of drought at the global level. Since drought is affected by climate change at the global level, GDIS assists in international coordination to help

accelerate progress. Major advances in the drought prediction problem will require a interdisciplinary program that cuts across each continent, the atmosphere, and connecting oceanic basins.

2. Leads and contributors

Lead: Will Pozzi, USA

Contributors: WMO, WCRP, ECMWF, NASA among others.

3. 2016 Activities

Global Drought Information System Components

1. Global Drought Monitoring

a. The main focus will be completion of drought coverage over each continent within the Global Drought Monitor (GDM), utilizing a bottom-up approach where each region contributes to GDM, combined with a moderate number of overarching global monitoring products and brief Global Drought Monitor bulletin.

b. GDM will display Current Conditions and Interactive Map section on a global scale

2. GDIS Pilot Development

The main goal of developing GDIS pilot areas is the fill-in areas of the Global Drought Monitor that are not yet covered by a regional analysis. There are already regional products such as the North American Drought Monitor, the European Drought Observatory, the African Flood and Drought Monitor, and the Monitor from Australia. Within each of the pilot areas will be assembled near Real time Information including in-situ data, satellite data, Land Data Assimilation systems (global and regional) and drought Information, including multi model ensemble (MME) forecasts of precipitation and drought indices, as well as Hydroclimate prediction by driving land surface models to obtain soil moisture and runoff (streamflow).

3. Drought Forecasting

a. Contribution of GDIS partners (WCRP, ECMWF, etc) with a top-down approach where global forecast is made of drought-related variables, and local/regional authorities translate that into a local/regional drought forecast

b. How to interpret output for user groups within each region (or pilot area) (possibly need national interpreters)

c. Refine and improve drought-specific natural hazard forecasts and outlooks being prepared through the regional climate centres, as part of the roll-out of the Global Framework on Climate Services (GFCS)

d. Improve drought-related forecasts for drought as contributing factor to World Food Program, FEWS-Net, and other food security organizations.

4. Drought Research

a. Develop case studies and other drought research products to develop national and international collaborations to study the mechanisms and predictability of high profile drought and heat wave events

b. Develop a Drought Catalogue

5. Information system development (through the drought portal) to connect pilot information, to exchange data, drought information and feedbacks ;

a. Develop one-stop shop for drought information.

b. Use the current GDIS website to display data, drought forecasts, satellite, links to other information such as drought management (GDIS Component 5) and post information from pilot areas

- c. Develop capacity building events with GDIS partners
- d. Ensure pilot users understand data outputs and how to use them for drought forecasts and monitoring
6. Develop partnerships among institutions in the regional to form a working group for data provider, drought portal representatives, and local pilot region representatives to actively participate in the pilots;
 - a. Ensure that pilots and the GDIS share common understanding and trust
 - b. Understand what the pilot needs and develop products with the pilot region and with assistance of the GDIS community region.
 - c. Develop evaluation products for verification and user approval

4. 2016 Resources

In kind contributions

5. Additional activities for 2016.

No one identified.

6. Future Plans

Continue existing activities.

CA-17 GEO Great Lakes Activity

1. Overview

Objectives for the Activity: facilitate data management in the Great Lakes basin: discoverable, transparent and interoperable data across the border.

Outputs (Deliverables)

Increased awareness of GEOSS Metadata registry by 31 March 2017.

Development of a Great Lakes-wide Data Management Plan for the sharing of and access to binational Great Lakes data and information by 31 March 2017

2. Leads and contributors

Lead : Norm Granneman (USA) and Gail Faveri (Canada)

(Gail.Faveri@ec.gc.ca)

Some contributors :

Jessica Lucido, US Geological Survey,
Wendy Leger, Environment Canada,
Kelli Page, Great Lakes Observing System,
Nancy Stadler-Salt, Environment Canada,
Tad Slawecki, LimnoTech,
John Allis, US Army Corps of Engineers,
Mark Burrows, International Joint Commission,

3. 2016 Activities

USGS and Environment Canada both believe that the GEO GL can form the nucleus for the proposed data management network. A first step is the development of a Great Lakes-wide data management plan. The data management plan would include guidance on:

4. information architecture requirements for ensuring critical technology standards across the Great Lakes region
5. information management protocols for allowing data search, retrieval,

distribution and use

6. information management governance for ensuring on-going storage, maintenance and updating of data and information over the long-term

The data management plan cannot be developed in isolation, but rather requires the input and contributions of agencies and organizations across the Great Lakes-St. Lawrence River system, covering the southern portion of the provinces of Quebec and Ontario of Canada and the near lake portions of Wisconsin, Illinois, Ohio, Pennsylvania, New York, Minnesota and most of Michigan of the United States of America. Coordination with the International Joint Commission and agencies implementing the binational Great Lakes Water Quality Agreement is planned. The purpose is to have individuals identified to help facilitate and coordinate the collaborative development of a Great Lakes-wide binational data management plan. The resulting collaborative Data Management Plan is an essential component of a comprehensive data management network which will be used by management agencies that oversee the Great Lakes.

The development of a collaborative data management plan would comprise the following five tasks:

7. Facilitation and coordination support to work with partners in determining the needs and priorities and to coordinate between the science community and the Information Management technical community
8. An analysis of the current state of Great Lakes data and information and data management protocols (what's available, what's not, what's coordinated binationally, what's not, what data is maintained, what's not etc.)
9. a virtual on-line workshop to discuss user needs and a vision for data management in the Great Lakes system
10. A second face to face workshop to bring together data management specialists to discuss architecture and protocols, what's possible and what's not.
11. An initial data management plan that provides guidance to partner agencies on directions and actions they can take to help support a binational data management plan.

4. **2016 Resources**

Seeking \$80k US to hire a facilitator (hopefully from Great Lakes Restoration Initiative funds)

Seeking \$20k CDN to pay for face to face workshop (hopefully from International Joint Commission funds)

In-kind contributions of 0.1 PY from each member agency

5. **Additional activities for 2016.**

No one identified yet.

6. **Future Plans**

- Continuing staffed position (\$80k) providing ongoing support for the following:
- information architecture requirements for ensuring critical technology standards across the Great Lakes region
- information management protocols for allowing data search, retrieval, distribution and use

- information management governance for ensuring on-going storage, maintenance and updating of data and information over the long-term

CA-18 Water Cycle Integrator (WCI)

1. Overview

Objectives for the Activity: Develop a GEOSS Water Cycle Integrator (WCI) to provide holistic coordination of water cycle information, including integration of observations, research, modeling, and analysis; cross-SBA applications; management systems; and a sustained educational framework.

A GEOSS Water Cycle Integrator (WCI), is being developed by building on the experiences of the Coordinated Enhanced Observing Period (CEOP) of WCRP/GEWEX and GEOSS Asian Water Cycle Initiative (AWCI) data integration activities. Climate change impacts, as reported by IPCC AR4, showed the need for such a system that can bring together data and model outputs to assess the causes of these impacts in all parts of the world. The application of a comprehensive integrated and coordinated data analysis system of the WCI to current and future issues would ensure benefits are created for society.

Development of the WCI would rely on CEOS leadership in developing integrated satellite observation of water cycle products and in coordinating linkages with the following areas: atmosphere, ocean, cryosphere, ecosystem, carbon, agriculture, and forestry. A water cycle science integrator would draw on collaboration between WCRP, CEOS, and the national and regional numerical weather prediction centers.

GEOSS relies on integrated systems to meet all of the expectations for delivering data from many different sources for use in its nine Societal Benefit Areas. The requirements include systems for integrating observation, modeling, and data management systems, a system for converging observation systems worldwide, and a system for coordinating the nine Societal Benefit Areas. WCI will be an important step in the process.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

The WCI will be an extension of DIAS, which is a complement of Japan's Earth Observation and Ocean Exploration system that contributes to national security by addressing global environmental and energy security issues. This system addresses the challenges of a large increase in the volume of Earth Observation data by developing a core system for data integration and analysis that includes the supporting functions of life-cycle data management, data search, information exploration, scientific analysis, and partial data downloading. The WCI will build on this system by improving data interoperability, developing a system for identifying the relationship between data across SBAs by using ontology on technical terms and ideas and geography, and acquiring database information from various sources by developing a cross-sectoral search engine for various databases.

At present, the Asian countries cooperatively integrate data from Earth Observation satellites and in-situ networks with other types of data, including numerical weather prediction model outputs, geographical information, and socio-economic data, to generate information for making sound water resources management decisions. A similar system is being planned for Africa. The Water

Cycle Integrator will support these developments and meet the information needs for agricultural production, ecosystem conservation, ocean circulation, and fishery resources management. Furthermore it will provide users in different countries with the tools they need to access, analyze and integrate many different types of data.

2. Leads and contributors

Lead: Toshio Koike; tkoike@hydra.t.u-tokyo.ac.jp

3. 2016 Activities

The development of a prototype system under the leadership of the University of Tokyo and JAXA

The implementation of the system for a number of basins in Africa in conjunction with IWRM principles.

4. 2016 Resources

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-19 E2E Water Indicators

1. Overview

Objectives for the Activity: Develop end-to-end state of the water-cycle indicators. Provide an operational global data compendium organized as a set of electronic maps, and representing a definitive, comprehensive, and up-to-date picture of the state of hydrological systems and affiliated water resources, their accessibility and use by society.

Goal: The overall goal of the Global Water-E2E project is to provide an operational global data compendia based on assimilated water cycle variables and toolsets organized as a set of electronic maps and representing to the highest degree possible a definitive, comprehensive, and up-to-date picture of the state of the hydrologic systems and affiliated world water resources, their accessibility and use by society.

The growing pressure on the problem of maintaining an adequate assessment capability for the state of this important strategic resource especially in light of widespread closure of ground-based hydrographic monitoring networks and archives, outdated and incomplete water use statistics, and lack of global and regional syntheses. This lack of information bears important implications for identifying regions of the globe where water-related stress is highly variable and/or growing, where sector-specific inefficiencies can be readily identified, and where suitable interventions (and investments in) integrated water management could be used to prevent or ease these crises.

Satellite and other Earth system data streams have the potential to fill some of these gaps; indeed, in many parts of the world these data and information sets represent the only practical means to assess water system state. Yet the continuity of in-situ and satellite-based systems remains a problem, partly due to the evolution over time of sensor specifications, but especially due to anticipated gaps in the records resulting from delays and cancellations of planned space-

based missions and the continued operation or even expansion of conventional terrestrial observing systems. The development of a global water resources assessment component of Global Earth Observation System of Systems (GEOSS) is seen as an essential step to ensure consistent planning and implementation of integrated observational systems with high societal relevancy.

The GlobalWater-E2E(GW-E2E) project capitalizes on the early success of a three-year Pilot Study on Indicators (PSI), executed on behalf of the World Water Assessment Programme (WWAP), and representing an early testbed for operational global water resource assessment. The WWAP-PSI, designed jointly by the CUNY Environmental Crossroads Initiative, the US Army Corps of Engineers Institute for Water Resources, WWAP staff and consultants, and the WWAP Expert Group on Indicators, is now functional. It capitalizes on new environmental surveillance capabilities from the Earth system sciences, and represents a unique conjunction of (i) state-of-the-global-water-system indicator efforts organized under the auspices of the Global Water System Project (GWSP) plus (ii) data collection and provision efforts coordinated under the Global Terrestrial Network for Hydrology (GTN-H), involving several U.N. agencies and affiliates.

Outputs (Deliverables) Expected and Anticipated Date of Completion:

Deliverables: The primary deliverables of the GW-E2E project are:

1. Integrated water cycle data sets, data assimilation schemes, geospatial models, and other tools to serve needs of theme-based user communities. Extended operational components of the WWAP-PSI up until 2015 (mean states, trends in water availability (total annual renewable water resource; seasonal cross-border and internal TARWR), use, sectoral efficiencies), geospatial with country-level summaries.
2. An ongoing consultative process under the umbrella of GEOSS and involving the GW-E2E developers and contributing constituencies (WWAP, GTN-H, FAO, GWSP, GEWEX, WMO-GRDC) to further expand the content and analysis functionality of the original PSI system.
3. Posting of timely assessments on the state of global water resources.

2. Leads and contributors

Lead: Charles J. Vörösmarty, CUNY Environmental CrossRoads Initiative, City University of New York (United States); cvorosmarty@ccny.cuny.edu .

3. 2016 Activities

A review of the Global Water E2E plans will be undertaken to review priorities in the light of new global priorities such as Future Earth, Sustainable Development Goals and the Water-Energy-Food Nexus.

4. 2016 Resources

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-20 Earth2Observe
 1. Overview

Earth2Observe will integrate available earth observations from different missions, in-situ datasets from various sources, and state-of-art models to construct a consistent **Global Water Resources Reanalysis (WRR) dataset** of sufficient length (at least 30 years). The resulting reanalysis will boost the availability of information on freshwater resources worldwide, and will allow for improved insight on the status and existing pressures on global water availability in all components of the water cycle, subsequently supporting efficient water management and decision-making. The WRR will support a range of applications, at various scales and settings (i.e. from local and regional to the pan-European and global levels, from data-rich to data-poor areas), significantly enhancing the capabilities of the research, policy and business communities to evaluate water resources across catchments all over the globe, identify water stress, detect hotspots, deepen the knowledge in trans-boundary catchments, determine water related risks, and plan targeted actions. The usability and operational value of the developed outputs will be verified and demonstrated in a number of case-studies across the world, covering multiple continents, with a variety of hydrological, climatological and governance conditions: Spain, Morocco, Estonia, Ethiopia, Colombia, Australia, New Zealand and Bangladesh.

Information about the E2O project can be found at: <http://www.earth2observe.eu/>

Outputs (Deliverables) Expected and Anticipated Date of Completion:

It is the objective to validate the EO-products based on end-user needs and metrics ensuring the value of the project’s final datasets for local and regional decision-making. We also want to demonstrate the usefulness of the integrated water resources time series at the operational level in regional and local case studies. In order to achieve this, stakeholder workshops and end user need workshops will be organized.

Before Dec. 2015, an initial earth2Observe data portal will be running, towards the end of the project the final version of the portal will be available (connected to / via GEOSS). In 2016 efforts will be made in getting user feedback on the system, making people aware of how to use the system, linking the system to GEOSS functions and developing links with the GEO Data-core library.

The following table provides an overview of the water related datasets that will be developed within the earth2Observe project, together with the base-line datasets where they originate from. Not all these products will be available by December 2015.

Table 1: Water related datasets in earth2observe

Hydrological component	Description	Time-Coverage	Resolution	Base-line dataset / source
Precipitation	Algorithm for low intensity rainfall and snowfall at mid-high latitudes	1999-current (since ATOVS availability)	16 km on a satellite overpass basis	AMSU-B MHS ATMS

				GPM
Precipitation	Various PMW-based rainfall datasets (merging, morphing, rapid update) at high resolution for input into estimation error analyses	10+ years of available PMW data	0.25 arc deg Regional application (Europe, Continental US, East Africa)	TRMM, SSM/I, AMSU, AMSR-E
Precipitation	High spatial resolution precipitation dataset	2008-current (since X-SAR data availability)	1x1 km ² (on a satellite overpass basis)	COSMO SkyMed X-SAR / TerraSAR-X plus Meteosat SEVIRI / LandsatTM / MODIS
Precipitation	Retrieval of bias and resolution effect correction of satellite rainfall for heavy rainfall over complex terrain	2002-current	10 km & hourly resolutions HyMeX and Blue Nile study areas	Multi-satellite merged satellite products (TRMM 3B42-RT, NOAA CMORPH, Meteosat SEVIRI)
Precipitation	Modeling passive microwave rainfall estimation error accounting for surface wetness	10+ years of available PM data	0.25 arcdeg Regional application (Europe, US, East Africa)	Available PM (TRMM, SSM/I) rainfall products
Soil moisture	Extended ESA's CCI soil moisture dataset including uncertainty and quality information	30+ years (1979 to 2010)	0.25 arc deg	GCOM AMSR-2 MetOp-B CCI Soil Moisture data
Evaporation	Extended evaporation dataset GLEAM	25+years	0.25 arc deg	
Surface water	Long-term water level fluctuations in natural (unregulated) lakes/reservoirs	25+years	n/a	ENVISAT ERS GEOSAT Topex Poseidon
Surface water	Retrieval of global scale wetland dynamics			GIEMS
Surface water	Climatology of surface water extent (floods)	10 years	1km	Envisat ASAR DFO flood maps MODIS Sentinel-1
River Discharge	River discharge archive for a selection of large river basins			GRDC AMSR TRMM
Groundwater	Improved Equilibrium Water Table	static(global)	1km (global)	GLDAS UN-FAO soil map
Groundwater	Improved HR Regional Equilibrium Water Table (New Zealand)	regional	50m	national DTM Regional Recharge data In-situ GW level Regional Soil Maps
Groundwater	Satellite derived groundwater recharge	regional		CCI ?? Sentinel-1 GLEAM P, ET MOD16 ET
Groundwater	Processed GRACE data to be used for model validation			GRACE/CSR UT Austin
Snow	Improved satellite snowfall retrieval			AMSU-B CloudSat GPM

Snow	Snow extent (SE) and Snow Water Equivalent (SWE)	2000-2012	SE: 1 km SWE: 25 km	Globsnow IMS CryoLand MSG SEVIRI METOP MODIS
Water Quality	Improvement of lake water quality retrieval of high coloured dissolved organic matter using the "Boreal Lakes" and cyanobacteria using the "Eutrophic lakes" processors as baselines	MERIS 2002-2012 OLCI 2015? - MSI 2015? -	MERIS/OLCI 300m MSI 10-60m	Envisat MERIS Sentinel 2 MSI Sentinel 3 OLCI In-situ data
All	Water resources re-analysis	+3 decades	0.5 degrees or higher	CryoLand, GLOBSNOW, IMS, ESA-CCI soil moisture, ESA River and Lake systems
Snow, runoff, rainfall, potential / actual evapotranspiration, fog, melt water, water stress, mean terrain-corrected wind speed and direction, water storage, river flow, soil erosion, water use, human footprint, per capita water availability		1950-2000+ climate change scenarios(2050s,2080s)	1 ha or 1km, global	www.policysupport.org and geodata.policysupport.org

2. Leads and contributors

Lead: J. Schellekens (jaap.schellekens@deltares.nl)

3. 2016 Activities

4. 2016 Resources

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 603608

Total Cost: 11,327,917 €

EC Contribution: 8,869,787 €

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

The project will ensure the results will become part of the GEOSS Data-CORE encyclopedia, connecting to the GEOSS Water Cycle Integrator (WCI) initiatives and

openly providing and sharing the datasets developed in the project. Before Dec. 2015, an initial earth2Observe data portal will be running, towards the end of the project the final version of the portal will be available (connected to / via GEOSS).

The data in the table above (Table 2) will be available on opendap in NetCDF and shared by the GEOSS Data-Core. The products will be available in a tier 1 product (meaning it is not the final version) in 2015. We strongly advise on good communication between GEO and earth2Observe regarding what should and should not be shared to the Data-CORE at that stage.

CA-21 Total Water Prediction: Observations Infrastructure

1. Overview

Total Water Prediction (TWP) establishes a framework to deliver the NOAA's next generation water prediction and service delivery capability. This framework leverages significant advances in science and technology to address water challenges that heretofore have been too big or too complex. For the first time, TWP is integrating big data, data and system interoperability, Earth System modeling and high performance computing to provide "street-level" water predictions to the Nation – delivering water forecasts to millions who have not received them before, at high-resolution scales that are relevant to day-to-day decisions of virtually every citizen. Through TWP, every stream reach in the United States will be forecasted, revolutionizing the world of water prediction. However, to be fully successful this "high performance hydrology" will need to evolve into a massive consumer of Earth observations, both to constrain the intensive modeling through data assimilation and to validate the model to understand uncertainties and build confidence in prediction skill at very high resolutions. Existing observation frameworks need to be shored up and in some cases rescued, and innovative new observation frameworks are needed to fill critical gaps. TWP is built on the National Hydrologic Dataset Plus, a vector network of 2.7 million stream reaches across the country. On average, a stream reach is about 1 km in length and has a catchment area of 2-3 km². This is the fundamental national hydro "fabric" for TWP, and to resolve this network TWP is currently modeling the continental United States at two resolutions (1 km and 250 m). Nested hyper-resolution capabilities are planned for TWP, which will be based on a much finer fabric derived from LIDAR terrain data, which will allow much higher resolution modeling of flash floods, urban hydrology and flood inundation. Over the next few years, this fabric will grow to extend nationwide through the USGS 3D Elevation Program, which is aimed at providing national 2-m resolution terrain data with the associated hydrologic network derived from that terrain resolution. Thus, TWP modeling is now resolving individual stream reaches and catchments, and is moving towards resolving small hillslopes, urban hydrologic features, and true "street-level" prediction. Water modeling at these resolutions is computationally intensive and demands supercomputing; NOAA's High Performance Computing assets are major enablers of TWP. In this environment, interoperability becomes a critical issue, so TWP has adopted an Earth System Modeling Framework compliant architecture to develop and operate TWP. Adhering to such standards increases the efficiency and flexibility of transitioning science and technology advancements into the TWP framework. It also facilitates the use of NOAA's broad array of meteorological data for driving TWP models. The convergence of the Internet, microchip technology, and big databases have led to the vision of a tightly integrated, planet-wide grid of computing, information, networking, sensor and digital resources commonly known as "cyberinfrastructure". Many Federal agencies are moving in this direction, and TWP is a good example of NOAA's use of Cyberinfrastructure to deliver high impact environmental intelligence.

While it is clear that supercomputing, interoperability and other factors associated with the cyberinfrastructure vision are enabling the next generation of water prediction through TWP, it is unclear how (or if) the observations universe that is relevant to TWP is keeping pace. Relevant water observing systems are disaggregated and fall under the purview of several different Federal agencies. Many major and critical water observing systems have been declining in recent years. Currently, TWP must access most observations in very much the same ways that were in use a decade or two ago, and access to many observation datasets is obtuse. Water-related observations (i.e. not just observations of water specifically, but of myriad Earth parameters that are relevant to hydrologic processes) are equally important and have similar issues. In many cases, observation data important to TWP are declining, difficult to discover and access, use legacy formats, and in general have not improved significantly in many years. Moreover, there are very significant data gaps where innovation would be welcome. Technologies such as sensor webs and others could be part of the next generation of water monitoring to form massive observation networks that could be readily consumed by TWP.

2. Leads and contributors

Lead: NOAA. Potential partners include USGS, USACE, FEMA, the International Boundary Waters Commission, Environment Canada, Brazil, and others.

3. 2016 Activities

4. 2016 Resources

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

CA-22 Linking water tasks with wider societal benefit areas and the post-2015 global development framework.

1. Overview

Objectives for the Activity: This is to support the GEO transitional work plan and aims to provide links across societal benefit areas. It does this by using the framework of Sustainable Development Goals (SDGs) and other frameworks such as Future Earth and the Ramsar convention. The framework for SDGs with its associated targets provides an unprecedented political framework which for the first time has led to the recognition of the importance of earth observations the global development community as an essential element for implementing the SDGs. These opportunities will be elaborated in the development of indicators, where linkages between societal benefits are high on the agenda. This community activity will contribute to this within the GEO context by combining water observations and data with other data sources to produce integrated products, including co-designed products, for use by targeted audiences in other sectors. It will also contribute to the data and information needs of the Future Earth W-E-F activity, the Sustainable Water Futures Programme and the Ramsar convention.

Outputs:

Water and the Water-Energy-Food (W-E-F) Nexus:

It is expected that the effort will contribute to the development of a knowledge platform, a W-E-F Community of Practice and the incorporation of Earth Observations in a Future Earth research plan on W-E-F issues.

Water and Biodiversity/Ecosystems: SWOS will develop an operational wetland monitoring service and service portal targeted at key policy frameworks and users at different levels. This activity is a major contribution to the development of the Global Wetland Observation System and therefore builds an important link between the GEO Biodiversity, Ecosystems and Water SBAs.

Water and the Sustainable Development Goals (SDGs): This effort will develop a plan for using Earth Observations in support of monitoring of the water targets found in the SDGs.

2. Leads and contributors

Lead : Richard Lawford, Morgan State University, USA and Adrian Strauch, University of Bonn, Germany.

Some contributors :

Integrated Information and the Water-Energy-Food (W-E-F) Nexus:

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Contributors:

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Sustainable Development Goals:

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Contributors:

Richard Lawford, Morgan State University, richard.lawford@morgan.edu

3. 2016 Activities

Water and the Water-Energy-Food (W-E-F) Nexus: Integrated Information and the Water-Energy-Food (W-E-F) Nexus (Contact: richard.lawford@morgan.edu)

During 2016, two workshops will be held as part of the Future Earth initiative named “Integrated information and improved governance for sustainability in the WEF Nexus.” This GEO activity will identify the research and data needs arising for these workshops and develop plans to provide the data sets and tools needed to analyze the issues that face these the W-E-F Nexus in different parts of the world. It will also explore the role of Earth observations in establishing the connections between the W-E-F Nexus with land and environmental issues. Information gaps will be identified for the national and transboundary basin scales. Discussion will be held on the co-design of solutions and products that will be needed to fill these gaps. The development of products and knowledge of the use of these products in managing the W-E-F Nexus will contribute to our knowledge of the GEO services and expand GEO’s role in showing the value of Earth Observations in managing integrated resource programs. These efforts will also contribute to a data management system for Future Earth’s Sustainable Water Futures Programme.

Water and Biodiversity/Ecosystems: Satellite-based Wetland Observation

Service (SWOS) (Contact: Adrian Strauch, adrian.strauch@uni-bonn.de) SWOS is a Horizon 2020 Project and a consortium of 13 partners comprised of academia, private companies, national environmental agencies and international NGOs. Funding for the project started in June 2015 and will last until May 2018. The objectives of SWOS are to develop an operational wetland monitoring service targeted at key policy frameworks and users at different levels (from local to global). Further, it will provide a SWOS Service Portal that will offer a unique entry point to easily locate, access, and connect wetland information and that includes visualization and analysis tools. The project focuses on using new possibilities that are offered by the Sentinel satellites and will build on existing approaches and methods to link new data sources with already existing wetland related data and information. The diverse consortium and tight links to the stakeholder and user communities will ensure that developed products and services are directly tailored to user-needs.

SWOS activities are tightly linked to GEO and aim to contribute to the further development of the GEOSS. For example, SWOS will be a major contribution to the Global Wetland Observation System that is being planned and coordinated by GEO BON together with other partners. As it entails data and information from different domains (e.g. ecology, biodiversity, hydrology) SWOS crosses borders between disciplines and is a GEO cross-SBA activity linking GEO water, ecosystems and biodiversity.

In January 2016 a user requirements workshop will be held by SWOS and a first prototype of the SWOS service and portal is expected to be finished at the end of 2016.

Sustainable Development Goals: (Contact: hossainr@who.int and sushel.uninnayar@nasa.gov): A global monitoring framework is being set up by UN and other agencies to support the water SDGs, which has three main components: drinking water, sanitation and hygiene (WASH), wastewater and water quality and water resources management. The latter aims to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. The global monitoring community is building an integrated water monitoring framework with data sources from earth observations, completing those from surveys, regulatory frameworks and other administrative sources, as well as new and novel sources including big data. Earth Observations have been demonstrated to fill gaps for indicators to monitoring sustainability of developments in the sector. In addition, EO can be used to estimate in a cost effective manner aspects of water availability and water quality. Finally derived properties such as population density can be a cross-cutting tool to see how population dynamics interplay with developments.

4. 2016 Resources

Integrated information and W-E-F Nexus Security: The workshops are funded by Future Earth/ Belmont Forum through the Sustainable Water Futures program. The workshops will be supported for \$60,000 with logistical support coming from the hosts of the upcoming workshops including RHM in Japan and a yet to be determined host for the final workshop.

Water and Ecosystems/Biodiversity: The SWOS project has a total budget through Horizon 2020 of approximately 5 Million Euro for its runtime from 2015 to 2018.

Water information and the Sustainable Development Goals: This water SDG activity within GEO currently has no funding and is carried out by people who have funding in kind or do not have specific funding targeted for this activity. Through WHO this

project has links with GEMI which will serve as one of its stakeholders.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

In addition to the process of individual scientists seeking funding for individual initiatives, it is anticipated that the GEO Members will be committed to make resources available for the above activities. The details of the Water and Ecosystems/Biodiversity activity (SWOS) will continue until at least May 2018 and are expected to funnel into the establishment of a long term wetland monitoring service. The activity related to integrated information and W-E-F Nexus Security will last until the end of 2016 and may be renewed at that time. Activities related to SDGs are being considered as a GEO foundational task and are expected to play a pivotal role as the next GEO implementation plan. As water provides an excellent example of the development of linkages with other societal benefit areas and the global development community, including the SDG framework, it is envisioned that in addition to specific funding provided for individual projects by research and space agencies some dedicated funding would also be made available.

CA-23 Space and Security Objectives/Motivation

The main ambition in the Space and Security domain is the protection of freedom and security of citizens. Fully in line with well-known societal challenges such as the Horizon 2020 “Secure Societies”, the Space and Security domain can include themes such as:

- to enhance the resilience of our society against natural and man-made disasters;
- to develop novel solutions for the protection of critical infrastructures;
- to improve border security;
- to support security policies in civilian tasks ranging from civil protection to humanitarian relief.

A major activity in supporting the primary aims of the Space and Security domain is the provision of geospatial products and services, mainly resulting from satellite data. In fact Earth Observation data are currently showing an unprecedented scenario in terms of variety (different sensors are in orbit on several governmental and commercial satellites), volume (data received each day from satellites are on the order of terabytes), velocity (24/7 information can be made available to users requiring fast responses), veracity (decision making and operations require reliable sources) and value (information to be provided have to be clear and useful).

Thus the key challenge in the Space and Security domain is to improve the capacity to access and analyse a huge amount of heterogeneous data to timely provide decision-makers with clear and useful information.

Leadership and Contributors

The proposed leader of the Community Activity is Sergio Albani (EU SatCen). The European Union Satellite Centre (EU SatCen) is an agency of the Council of the EU whose mission is to support the decision making and actions of the EU in the field of the Common Foreign and Security Policy (CFSP) by providing products and services resulting from the exploitation of relevant space assets and collateral data, including

satellite and aerial imagery, and related services.

As a key institution linking Space and Security as well as a primary user of satellite data and service provider in the CFSP field, the EU SatCen will be able to build on its existing network with the aim of further enlarging the EO User Community. Examples of possible entities to be involved are: GEO Members and Participating Organizations; International Organisations such as UN; Ministries of Foreign Affairs; EU and other international agencies; Associations of Space companies.

Activities and outputs planned for 2016 (highlighting User Involvement, Capacity Building and geographical coverage)

Main activities foreseen in the Space and Security Community Activity are:

- To provide a forum for discussion and to organize capacity building initiatives;
- To collect user requirements and needs;
- To identify observational and capability gaps to be filled by space assets;
- To foster the key added value of EO data;
- To identify and assess innovative tools and methodologies encompassing the whole data lifecycle;
- To explore how to take maximum benefit from the usage of very large amount of heterogeneous data (Big Data);
- To connect with relevant GEO SBAs and initiatives (e.g. those related to Disasters).

Funding sources and indicative amounts (2016)

Activities will be carried out on a voluntary basis.

Future plans (activities and resources)

The main challenge is to evolve in a GEO Community of Practice (if suitable) paving the way for the establishment of a Space and Security GEO SBA.

CA-24 Earth Observation in Cultural Heritage documentation

Overview

Cultural heritage is a testimony of past human activity, and, as such, cultural heritage objects exhibit great variety in their nature, size and complexity; from small artefacts and museum items to cultural landscapes, from historic buildings and ancient monuments to city centres and archaeological sites (Patias, 2007).

Cultural heritage around the globe suffers from wars, natural disasters and human negligence. The importance of cultural heritage documentation is well recognized and there is an increasing pressure to document our heritage both nationally and internationally. This has alerted international organizations to the need for issuing guidelines describing the standards for documentation.

Charters, resolutions and declarations by international organisations underline the importance of documentation of cultural heritage for the purposes of conservation works, management, appraisal, assessment of the structural condition, archiving, publication and research. Important ones include the International Council on Monuments and Sites, ICOMOS and UNESCO, including the famous Venice Charter, The International Charter for the Conservation and Restoration of Monuments and Sites, 1964, (UNESCO, 2005).

Only recently new nominated WH sites are proposed with some cartographic information included in the nomination file request. Terrestrial, aerial or satellite

imagery are rarely included. The problem is even worst when we consider World Heritage sites nominated some years ago. Most of them they do not have proper cartography with detailed buffer zones indicated, etc.

Recent high resolutions satellite imagery provides the means to easily map areas in large scales. Archive map and photographs are lucked. Although UNESCO provides now some minor specifications these specifications are not at all considered for old inscribed sites. Only if these detailed specifications are provided as well as about how remotely sensed data can be used to derive such cartography can the UNESCO request to the countries to provide improved cartography for the UNESCO World Heritage database.

Especially in times of either natural disasters or conflicts, the safeguarding of CH diversity almost mandates the use of EO images. Recent prominent examples are the Unesco’s Observatory for the Safeguarding of Syria’s Cultural Heritage [URL1], or UNESCO/UNITAR-UNOSAT teaming to Protect Cultural Heritage with the Latest Geo-Spatial Technologies [URL2].

Earth Observation can highly accelerate the documentation of CH, while engaging multi-disciplinary societies (eg. archaeologists, architects, historians, librarians, etc) in GEO activities, not previously interested. A quick search at the Google Trends reveal the simple fact that the terms “cultural heritage” and “cartography” are much more frequently used by the public than the more technical and less popular term “earth observation”.

The importance and global coverage of CH sites does not need much argumentation. We will only note the international institutional interest like the specific interest of UNESCO [URL3], the existence and activities of the CIPA [URL4] (a joint venture of ISPRS and ICOMOS), the extended activities in CH and EO of ISPRS [URL5], the cartographic activities of ICA [URL6] or the extended list of trans-domain projects supported by COST [URL7].

Moreover, the proposal is well in line with the GEO Objectives and the related challenged SBAs, such as: Air pollution, Man-caused hazards, Natural disasters, Climate change, etc.

Leads and Contributors

Lead: Prof. Petros Patias, GR, <http://perslab.topo.auth.gr/about-el/>

Contributors: Chen Jun, Orhan Altan, Lena Halounová, Andreas Georgopoulos, Fulvio Rinaudo, Mario Santana, Ana Almagro Vidal, Michael Doneus, Evangelos Livieratos, João Martins, Heinz Saler, José Luís Lerma, Wang Xinyuan

Key parter organizations: The International Society for Photogrammetry & Remote Sensing (ISPRS), The International Committee for Documentation of Cultural Heritage (CIPA), International Council on Monuments and Sites (ICOMOS), The International Cartographic Association (ICA), COST Trans-Domain Actions, University of Karlsruhe, University of Valencia, Chinese Academy of Sciences

2016 ACTIVITIES AND OUTPUTS

Planned Activity	Output	Place / Date	User involvement Funding source	Geogr. coverage
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Dedicated website for the activity	Dissemination	To be announced in the CIPA Symposium in Taipei, Taiwan 31/8 – 5/9 2015 http://www.cipa2015.org/	AUTH, CIPA, ISPRS Funded by AUTH	Global
Exchange of know-how, experiences and ideas, invitation to get involved	Dissemination	To be announced in COST-i2MHB meeting in Spain 27-28 January 2016 http://www.cost.eu/COST_Actions/TDP/Actions/TD1406	AUTH, COST Funded by COST	European
<u>Special Session</u> SpS7 - GEO: Earth Observation and Societal Benefits: Global issues and best practices	Capacity building	Prague, CZ 12-19 July, 2016 http://www.isprs2016-prague.com/program/scientific-program-sessions/special-sessions	ISPRS, GEO Funded by ISPRS	Global
Summer school	Training Capacity building	Valencia, Spain Summer, 2016	3 EU universities, Funded by Baden-Württemberg Stipendium BWS	Germany, Spain, Greece

Future plans

In general the envisaged Activities include:

- Mobilize multi-disciplinary communities in EO
- Provide a forum to international organizations, scientists, stakeholders and wide public
- Exchange of know-how, experiences and ideas
- Showcase best practices
- Promote innovation in use of EO/GEOSS to CH activities
- Connect CH to other SBAs
- Provide expertise in extreme/rapid calamities to international organizations
- Capitalize on previously financed activities/projects
- Organize expert meetings, dissemination info-days, capacity building workshops together with other organizations (eg. UNESCO, ICOMOS, ICCROM, ISPRS, CIPA etc)

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<http://www.international.icomos.org/charters.htm>

[Patias, P. 2007, "Cultural Heritage Documentation", Chapter 9 in "Applications of 3D measurement from images", J. Fryer, H. Mitchell, J. Chandler, editors, pp. 225-250, Whittle Publishing Co., ISBN 10: 1-870325-69-9, ISBN 13: 978-1-870325-69-1.](#)

[URL1]: UNESCO Observatory for the Safeguarding of Syria's Cultural Heritage
<http://whc.unesco.org/en/news/1135/>

[URL2]: UNESCO and UNITAR-UNOSAT Team Up to Protect Cultural Heritage with the Latest Geo-Spatial Technologies
<http://www.unitar.org/unesco-and-unitar-unosat-team-protect-cultural-heritage-latest-geo-spatial-technologies>

[URL3]: UNESCO Space for Heritage
<http://www.unesco.org/science/remotesensing/?lang=en>

[URL4]: CIPA - The International Committee for Documentation of Cultural Heritage
<http://cipa.icomos.org/>

[URL5]: ISPRS - The International Society for Photogrammetry and Remote Sensing
<http://www.isprs.org>

[URL6]: ICA - The International Cartographic Association <http://icaci.org/>

[URL7]: COST Trans-Domain Actions
http://www.cost.eu/COST_Actions/TDP/Actions, eg.:

- [TD1406 | Innovation in Intelligent Management of Heritage Buildings \(i2MHB\) | 06 May 2015 - 05 May 2019](#)
- [TD1403 | Big Data Era in Sky and Earth Observation \(BIG-SKY-EARTH\) | 13 January 2015 - 12 January 2019](#)
- [TD1308 | Origins and evolution of life on Earth and in the Universe \(ORIGINS\) | 15 May 2014 - 14 May 2018](#)
- [TD1202 | Mapping and the citizen sensor | 28 November 2012 - 27 November 2016](#)

[TD1201 | Colour and Space in Cultural Heritage \(COSCH\) | 07 November 2012 - 06 November 2016](#)

CA-25 Africa Global-scale Geochemical Baselines for mineral resource and environmental management: Capacity-building phase

Overview

Understanding the abundance and spatial distribution of chemical elements in the Earth's near-surface environment is critical for many human endeavours ranging from locating our future mineral resources to monitoring changes in the chemistry of the Earth caused by natural processes or human activities. There is worldwide concern about the potentially damaging effects of chemicals in the environment on the health of humans, animals, agriculture and ecosystems. Economic and population growth are increasing rapidly, exacerbating such problems as land degradation and pollution from uncontrolled urbanisation, industrialisation, intensive agricultural practices and over-exploitation of aquifers. These and other problems are having an impact on the geochemistry of the Earth's surface and the sustainability of its life-support systems from the local to the global scale. On the other hand, there is also worldwide concern about securing mineral and energy resources to meet the demand of our growing population. Understanding the geochemistry of the Earth's surface is vital in locating these resources and in exploiting

them in an environmentally responsible manner.

Systematic geochemical mapping is the best method available to assess and provide a basis for monitoring changes in the levels of chemical elements at the Earth's surface. Geochemical maps have traditionally been valuable in addressing a whole range of environmental problems, as well as for identifying potential mineral resources at the local to national scale. The present proposal is to develop for Africa a land base multi-element geochemical baseline database for mineral resource and environmental management according to the specifications of IGCP 259 "*International Geochemical Mapping*" (Darnley et al., 1995).

This project proposal for Africa is within the vision of GEO "*To realise a future wherein decisions and actions, for the benefit of humankind, are informed by coordinated, comprehensive and sustained Earth observations and information*". It also will be an important contribution to AfriGEOSS (2014), and the IUGS initiative "*Resourcing Future Generations*" (IUGS, 2014).

Objectives and motivations

To develop a land base multi-element geochemical baseline database for mineral resource and environmental management.

Africa is the world's second-largest and second-most-populous continent. Its area, including adjacent islands, is 30,221,532 km². According to Wikipedia, Africa consists of 54 sovereign states and 10 non-sovereign territories (https://en.wikipedia.org/wiki/List_of_sovereign_states_and_dependent_territories_in_Africa#Sovereign_states). In order for Africa to develop its vast mineral resources, and also to safeguard its environment, it urgently needs a harmonised geochemical baseline database for planning and decision-making. To develop such a database it is necessary to start a capacity-building programme for training professional applied geochemists from all African countries.

Leads and Contributors

Leads: David B. Smith, Xueqiu Wang, Alecos Demetriades, Anna Ladenberger, Aberra Mogessie, Beneah Odhiambo and Gabi Schneider

Contributing partners: EuroGeoSurveys, IUGS/IAGC Task Group on Global Geochemical Baselines, UNESCO International Research Centre on Global-scale Geochemistry, Geological Society of Africa and Organisation of African Geological Surveys.

2016 Activities

- Capacity-building: Organisation of capacity-building workshops in global geochemical baseline mapping at central locations in Northern, Eastern, Southern, Western and Central Africa. The workshops will comprise indoor lectures in applied geochemistry, including data processing and map plotting, and training in the field (selection of sampling sites, and sampling).
- User involvement: Participation of applied geochemists from all African countries.
- Geographical coverage: The whole African continent.

2016 Resources: EUR300,000 (indicative amount)

Future plans

To develop a geochemical baseline database for the entire African continent through systematic sampling and chemical analysis according to the specifications of IGCP 259 "International Geochemical Mapping" (Darnley et al., 1995) We propose using only one sample medium, depending on terrain type, namely overbank or floodplain or catchment basin sediment, which is generally alluvial (or agricultural soil).

The framework for the sampling is the Global Geochemical Reference Network (GRN) established by IGCP 259 (Darnley et al., 1995). The GRN consists of about 5000 grid cells, each approximately 160 x 160 km in size (area 25,600 km²). The 54 countries in Africa are covered by approximately 1500 GRN grid cells (see Figure 1). Five sites are identified within each cell for a total of 7500 sample sites for the continent (approximately 1 site per 4000 km²).

Sample media:

- Overbank sediment (alluvial soil) in mountainous and hilly terrains, and
- Floodplain or catchment basin sediment (alluvial soil) in desert, savanna and plain terrains.

At each site, two samples will be collected, a top and a bottom. The top (surface) sample will be collected from 0-25 cm, and the bottom (deeper) 25-cm thick sample below a depth of 75 cm. Thus, the total number of samples will be in the order of 15,000.

Duplicate field samples will be collected from at least 3 per cent of the sampling sites, giving a total of 225 duplicated field sites, with a total of about 450 samples.

The samples, after preparation at a central facility in Africa, will be analysed for 76 elements at the laboratories of the China Geological Survey (UNESCO International Research Centre on Global-scale Geochemistry). Splits of each sample will be archived and stored for future investigations at either a central facility within Africa or at a facility designated by each participating African country.

To monitor the quality of geochemical data, five large standard samples with different element concentrations (low to high) will be prepared.

The cost of sampling and sample preparation for the whole African continent, and preparation of the five standard samples, is approximately in the order of 5 million Euro.

The cost of laboratory chemical analysis for 76 elements is approximately 3 million Euro, which may be funded by China.

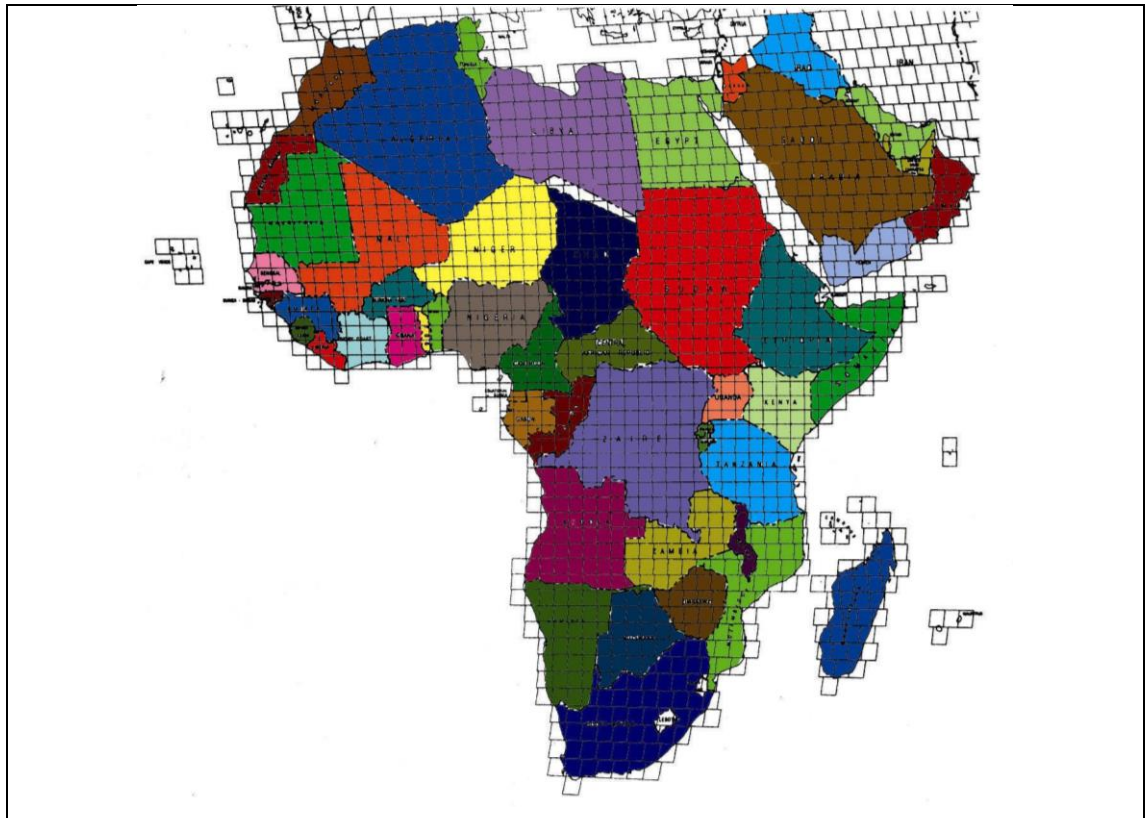


Figure 1. Map of Africa showing the GRN grid cells of 160 x 160 km.

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CA-26 Towards Chinese tsunami mitigation system under GEO framework

1. Overview

Deterministic Tsunami Hazard Analysis (DTHA) is a simple way to qualitatively assess the tsunami hazard for an interested site which has been widely used in China. However, the method for evaluating tsunami hazard in China now is starting to shift from DTHA to Probabilistic Tsunami Hazard Analysis (PTHA). We need a Chinese PTHA method by following the regular seismic hazard analysis methods in China and gave the detailed

description of framework. Furthermore, PTHA with the identification of all possible uncertainties in tsunami source parameters will be considered in following step. It is necessary to include the uncertainties associated with PTHA calculations in the processes of generation, propagation and runup.

China Tsunami Early Warning Center, now attached to Chinese National Marine Environmental Forecasting Center of State Oceanic Administration, is collaborating with U.S. Pacific Marine Environmental Laboratory (PMEL) on building real-time tsunami forecasting system in South China Sea. China Earthquake Networks consists of quite a number of seismic stations and SOA manages more than 100 marine gauges.

2. Leads and contributors

Lead : WEN Ruizhi, Institute of Engineering Mechanics, China Earthquake Administration, China

Contributors : State Oceanic Administration of China, Japanese Metrological Agency, U.S. Pacific Marine Environmental Laboratory (PMEL)

3. 2016 Activities

The research is endeavoring (1) Chinese historical tsunami event catalogue, (2) tsunami numerical tsunami modeling, (3) tsunami hazard analysis methodology and (4) tsunami early warning system.

2016 will be dedicated to the plan compiling Chinese historical tsunami event catalogue

4. 2016 Resources

Some of above works are supported by China National Natural Science Fund No. 51278473.

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

Second year: tsunami numerical modeling, tsunami hazard analysis methodology.

Third year: framework for tsunami early warning system.

CA-27 Foster Utilization of Earth Observation Remote Sensing and In Situ Data for All Phases of Disaster Risk Management

1. Overview

The *Sendai Framework for Disaster Risk Reduction 2015-2030* includes two articles with explicit references to satellite Earth observation and several articles that refer to topics for which satellite observations are needed (e.g., geospatial information or risk maps). This activity aims at improving disaster risk management and reduction by providing timely risk information relevant to the full cycle of disaster management (mitigation, preparedness, warning, response and recovery) and will be used directly by the end user community including the decision makers that have to take appropriate resilience and Disaster Risk Reduction (DRR) measures. Through this activity, the delivery of risk information will be improved through the consolidation of the delivery process for the data (from EO providers) and information (from practitioners), for three Pilots – Floods, Seismic Hazards, and Volcanoes. These Pilots, which were successfully started under the GEO 2012-2015 Work Plan and will continue through 2017, have

produced several risk products and been used in the scope of the Geohazards Supersites Natural Laboratories (GSNL). This activity will further implement the current strategies to better contribute to all phases of DRM in response to the needs of the user community while also exploring the possibility of partnership with other DRM stakeholders, enlarging the concept of the Pilots (single and multi-hazard, limited geographical areas, etc.) and also considering other potential Pilots.

2. Leads and contributors

Lead : space community: CEOS (JAXA, ESA, ASI, CNES, CSA, DLR, NASA, NOAA, USGS)

Ivan Petiteville (CEOS) (or Kerry Sawyer ?)

In situ community: UNOOSA, UNITAR, UNEP, EC (JRC)

Contributors : China, Germany, France, Italy, Japan, U.S., IEEE

3. 2016 Activities

Following actions are planned, but not limited to 2016:

- Improve disaster risk management and reduction by providing timely remotely sensed and *in situ* information relevant to the full cycle of disaster management (mitigation, preparedness, warning, response, and recovery).
- Work in parallel with *International Charter: Space and Major Disasters*, Sentinel Asia, Copernicus Emergency Management Services, and SERVIR.
- Implement the current strategy from the CEOS Agencies to better contribute to all phases of disaster risk management (DRM), in response to the needs of the user community.
- Promote timely and reliable access to *in situ* data required in emergency events.
- Coordinate efforts towards a more timely dissemination of information from globally coordinated systems for monitoring, predicting, risk assessment, early warning, mitigating, and responding to hazards at local, national, regional, and global levels.
- Demonstrate the validity of regional end-to-end systems through multi-actions single hazard pilot demonstrators with an initial focus on Floods, Seismic Hazards, and Volcanoes with direct involvement of the user community; explore the possibility of enlarging the concept of the Pilots (single and multi-hazard, limited geographical areas, etc.) and assess feasibility of developing other Pilots.
- Demonstrate the validity of multi-hazard Pilots such as the Recovery Observatory (multi-year activity which aims to analyze recovery of severely damaged areas after the *International Charter: Space and Major Disasters* data provision period ends.
- Improve the quality of risk information generated by the Pilots by combining space data with relevant *in situ* data.

4. 2016 Resources

In kind contributions

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

Continuation of 2016.

CA-28 Global Flood Risk Monitoring

1. Overview

Develop, test and apply methods to utilize satellite remote sensing and other Earth observations with models and maps to estimate location, intensity and duration of floods globally in real-time and a durable monitoring system of flood risk with climate change. An initial operational capability could be established with the appropriate community and global framework within a few years.

Further achievements and milestones will align with data sharing and integration of models, tools and new Earth observing networks. This would involve observation of flood inundation (e.g., via MODIS, VIIRS, and other sensors) and use of satellite precipitation information (e.g. via GPM) and hydrological models. Since the mid-1970s, U.S. satellite observation gathered an exceptionally valuable but still largely unharvested record of flood inundation world-wide. Commencing in late 1999, the two NASA MODIS sensors also obtained daily surveillance, year after year, of all of the Earth's flood waters; this archival record is now supplemented by frequent repeat, wide-swath ground-imaging sensors aboard NPO Suomi. Such combined EO data can be compared to the record of earthquake seismicity provided by seismographic stations; they provide the only objective characterization of many extreme, damaging flood events. This globally consistent information of past events should be deployed to its maximum utility in defining areas of flood risk, and be used as well during new floods to assist with their characterization. In the developing nations, the remote sensing archive provides the immediate opportunity, even without hydrological data infrastructure, to directly identify hazardous land areas. When coupled with U.S. satellite data-driven global hydrological models, there is also the opportunity for early prediction and characterization of flood inundation in near real time. As climate changes, flood statistics change and achieving results in this effort over the next several years will be critical. While hazard evaluation has for many decades proceeded using assumed stationarity of flood frequency distributions. New floods-of-record at any location thereby present a well-known dilemma to policy makers and to hydrologists: immediately include the new extreme flood in the flow series, and thus increase the size of the regulatory floodplain, or use the pre-flood flow records to label the exceptional new event as, for example, "the 1000 year flood" (e.g., Colorado Front Range, 2013). The remote sensing record also includes defended floodplains where levees have failed, sometimes even during relatively common floods. So remote sensing identifies the engineering failures, not only the natural flood event. We can use the powerful observations (of actual floods) as well as increasingly accurate satellite data-driven global hydrological models to accommodate floods in their changing climate and changing environment context, and address flood hazard and exceedance risk probabilities quite directly: by putting into routine operational use the observed record of inundation from actual floods, that have been obtained and are being obtained by orbital Earth observation systems.

2. Leads and contributors

The U.S. lead is NASA.

Potential contributors include NOAA, the U.S. Agency for International Development's (USAID) Office of U.S. Foreign Disaster Assistance (OFDA), the U.S. Geological Survey (USGS), the Federal Emergency Management Agency (FEMA), the Centers for Disease Control and Prevention (CDC), the U.S. Army Corp of Engineers (USACE), the National Center for Atmospheric Research and other academic partners, the Global

Flood Partnership, the Joint Research Center of the European Commission (through their Global Disaster Alert and Coordination System), the Committee on Earth Observation Satellites (CEOS), the World Food Programme, the International Red Cross/Red Crescent, the World Bank, the Latin American Development Bank, United Nations Development Programme, UNEP, UNESCO, national hydro-metrological organizations and the World Meteorological Organization's (WMO) state emergency management and water management agencies, as well as private sector partners (e.g. Google, Coca Cola, and the insurance sector), and various non-governmental organizations.

3. 2016 Activities

Planning and starting of actions

4. 2016 Resources

In kind contributions

5. Additional activities for 2016.

No one identified yet.

6. Future Plans

Depend on results 2016.

CA-29 Using Geospatial Data to Identify and Monitor Ecosystem Service and Track in a Natural Capital – Ecosystems Accounts Framework

1. Overview

Objective

Identify opportunities and challenges for greater and more systematic use of Earth Observations to identify and track of ecosystem services for ecosystem and natural capital accounting.

Background

Many governments are undertaking systematic efforts to inventory and monitor natural capital and ecosystem flows at national and sub-national levels. These efforts serve multiple purposes, informing planning, management, program and policy decisions at various levels from local and regional to nation and transboundary. These assessments may include geospatially defined areas, such as political jurisdictions, e.g., counties, states or nations; management units, e.g. a national park(s), or national forests; or ecological units such as a watershed or wetland. The information provided can be used to understand contributions and trends of ecosystems to social wellbeing and economic activities, and trade-offs of various policies and management options, including monetary and non-monetary costs and benefits.

The UN Statistical Commission approved the System of Environmental-Economic Accounting (SEEA) Central Framework in 2012 as a statistical standard and has encouraged further work and testing of the SEEA Experimental Ecosystem Accounts (EEA). These Ecosystem Accounts fill the gap in the current Central Framework by spatially identifying and mapping the sources of ecosystems services and linking them to different parts of the economy. The challenges of the ecosystem accounts are not trivial. Ecosystem accounts require integration of multiple data streams and information on the environment with economic data, statistics and accounts. Ecosystem services may be categorized as provisioning, regulatory or cultural and their valuation is often complex and in some cases is difficult or inappropriate (e.g., for some cultural values or endangered species preservation).

Ecosystem Accounts are appealing to many government and land managers because they offer a way to integrate and present complex information to decision makers and the public informing a wide policy and management practice spectrum to better consider nature, using standardized systems that most countries use for economic assessment. EA is gaining considerable global support as a systematic monitoring framework to measure the status and health of ecosystems over time, the types of ecosystem service benefits derived from ecosystems and their beneficiaries, trends in the capacity of ecosystems to provide benefits, and on the drivers and actors of change.

Ecosystem accounts may also be particularly helpful to governments and civil society as they develop and implement efforts to achieve the “2030 Goals for Sustainable Development,” both to track successes and understand unintended consequences of development policies.

Earth observations are already fundamental to these efforts. Geospatial data are critical aids to decision support, and already individual efforts include maps of: land use, land cover, land ownership, meteorological, hydrological, topographic, social and economic data and information.

However, static map products or snapshots have significant limitations, especially in identifying and tracking changes in ecosystem services over time. Using EO for ecosystem accounting will require the ability to overlay the multiple layers of earth observation products listed above, often at different spatiotemporal scales, and to integrate that information with social and economic data. Scale and resolution are critical. Periodicity of the observations are also critical, as integrating hydro-meteorological observations with those for land cover, ecosystem condition, and other metrics may be critical in periods of drought or heavy precipitation events. Efforts to understand and value “green infrastructure” and to subsequently inform policy (e.g., development restrictions), programs (e.g., payment for ecosystem services), or management decisions, will depend on systems-level integration that can provide repeat measurements at appropriate temporal intervals and be aggregated or disaggregated to appropriate scale. While there is undoubtable great opportunity here it is equally clear there is significant research and product development necessary to realize the promise we identify.

2. Leads and contributors

The U.S. lead is the State Department. Potential agency partners include NOAA, NASA, USGS

The World Bank, the European Space Agency (ESA), Eurostat, Conservation International.

Colombia, Mexico, Sweden, and Netherlands,

Possible others:

the European Commission, the UN Statistical Commission, the UN Initiative on Global Geospatial Information Management (GGIM), the Australian Bureau of Statistics, Australian GEO Representatives, the UK Natural Capital Committee, the European Forest Institute, Botswana, the Philippines, Rwanda, and academic partners.

3. 2016 Activities (Year 1)

Assemble a compendium of experiences where Earth Observations have been used to support work on the identification and tracking of ecosystem services for ecosystem and natural capital accounting. Identify gaps in geospatial data and determine the feasibility of filling any gaps. Compile examples of ecosystem accounts, ecosystem services and their use of Earth Observations.

Bring together representatives of communities representing: EO, environmental accountants, environmental economists, ecologists, land managers and policy makers (likely in March or April 2016).

Identify existing capacities, opportunities and challenges of each of the communities and consider developing knowledge packages that can support the work of other communities participating in the initiative.

4. 2016 Resources

In kind contributions

5. Future Plans

Year 2: Formalize the initiative. Define a research agenda. Continue the discussion by the various communities and begin to develop protocols for using available geospatial data streams to identify and track ecosystem services and their change at various spatial scales. Assemble packages and conduct training.

Year 3: Begin to field test the knowledge packages. Review progress.

Year 4: Continue testing packages and reassemble to determine needs for further work. Synthesize results for a peer-reviewed paper.

CA-30 Harmful Algal Bloom (HAB) Early Warning System

1. Overview

HABs can have considerable impacts on ecosystems, public health (by affecting water supplies and recreational bodies of water), and the economy. HABs produce a toxin that can cause illnesses in humans such as gastrointestinal illness (nausea, diarrhea, cramps), eye and skin irritation, and liver damage (with chronic exposure) and can also be a danger to pets. Furthermore, their presence can be an indication of increased pollution, such as agricultural or nutrient runoff. HABs can produce toxins that are a danger to public health through consumption of contaminated fish and shellfish, or through aerolized toxins. HABs also deter recreational and economic activities such as fishing and tourism. When HABs (and ABs) die, they trigger an increase in oxygen demand resulting in a depletion of oxygen in water and can cause fish die-off. HABs are on the rise globally and recent studies show that with climate change, the seasonal windows of onset and duration of blooms are likely to expand as ocean temperatures warm.

A USGEO effort to develop a domestic or U.S.-based HAB Early Warning System by 2020 would be very beneficial. One critical element of this system could be the provision of a warning system with a 24-hour lead-time. This warning system would be highly synergistic with studies/initiatives such as the EPA-led / NASA-funded study (Schaeffer PI) to characterize cyanobacteria blooms in U.S. aquatic systems and the Lake Erie hyperspectral airborne campaign led by NASA Glenn Research Center, and the NOAA Ecological Forecasting Roadmap HAB forecasting effort and related HABs bulletin. An extensive bloom of toxic algae along the U.S. West Coast (extending from Santa Barbara, California to Alaska) has been occurring since May, and is being tracked by NOAA-led researchers. In 2014, the city of Toledo, Ohio was without water for several days as a cautionary procedure due to concerns about contamination of the drinking water supply from a HAB.

2. Lead and contributors

The U.S. lead is NOAA.

The United States would like to partner with other countries to share best practices and

methods through the GEO network.

3. Future Plans

The goal would be to establish an operational HAB early warning system by 2020.

C-31 For Global Mangrove Monitoring

Overview

The overall goal of this project is to

- (i) update the global mangrove database of 2000 to 2015,
- (ii) back-cast it to 1990 and 1980 and
- (iii) perform change analysis to identify rates, patterns, causes and consequences (e.g., carbon stock change) of mangrove forest cover change of the world.

In 2011, USGS prepared the most comprehensive, accurate, and consistent mangrove database of the world using Landsat 30 m spatial resolution satellite data for the year 2000. The data is freely available from a number of organizations including Google, the World Resource Institute's Global Forest Watch, UNEP-World Conservation Monitoring Centre, CIESIN, and USGS. The data has been cited more than 500 times since its publication in 2011. The data is being used from local scales to global scales because the data is globally consistent and locally relevant. Although, extremely useful, the 2000 data is becoming increasingly dated. The United States proposes to update the global mangrove database for the year 2015. The next step will be back-casting for the year 1990 and 1980 and perform change analyses to identify the rates, patterns, causes and consequences of the changes. The United States will monitor both natural and anthropogenic changes. Mangrove could serve as an indicator of climate change and we will monitor both landward and seaward expansion. The mangrove and change database will be extremely useful for a number of applications including identification of priority mangrove conservation areas, identification of mangrove restoration areas, and enumeration of blue carbon sequestration potential.

Leads and contributors

The U.S. lead is USGS.

CA-32 Research Data Science Summer Schools (new-CODATA/RDA)

1. Overview

The ever-accelerating volume and variety of data being generated is having a huge impact of a wide variety of research disciplines, from the sciences to the humanities: the international, collective ability to create, share and analyse vast quantities of data is having a profound, transformative effect. What can justly be called the 'Data Revolution' offers many opportunities coupled with significant challenges. Prominent among these is the need to develop the necessary professions and skills. There is a recognized need for individuals with the combination of skills necessary to optimize use of the new data sets. Such individuals may have a variety of different titles: Data Scientist, Data Engineer, Data Analyst, Data Visualizer, Data Curator. All of them are essential in making the most of the data generated.

Contemporary research – particularly when addressing the most significant, trans disciplinary research challenges – cannot effectively be done without a range of skills relating to data. This includes the principles and practice of Open Science and

research data management and curation, the use of a range of data platforms and infrastructures, large scale analysis, statistics, visualization and modeling techniques, software development and annotation, etc, etc. The ensemble of these skills, we define as 'Research Data Science'.

Modern Research Data skills are common to all disciplines and training in 'Research Data Science' needs to take this into account. For example, all disciplines need to ensure that research is reproducible and that provenance is documented reliably and this requires a transformation in practice and the promotion of 'Research Data Science' skills.

It is strategic priority for both CODATA and the Research Data Alliance to build capacity and to develop skills, training young researchers in the principles of Research Data Science. Particular attention is paid to the needs of young researchers in low and middle income countries (LMICs). It is important that Open Data and Open Science benefit research in LMICs and the unequal ability to exploit these developments does not become another lamentable aspect of the 'digital divide'. On the contrary, it has been argued that the 'Data Revolution' provides a notable opportunity for reducing that divide in a number of respects.

This activity relates most specifically to the GEO Strategic Objective of 'Engage' and the 'Capacity Building' activity therein. The promotion and development of data science skills, as described here, is an important component of capacity building and essential to the greater use and reuse of earth observation data to meet Societal Benefit Areas.

The vision for the schools a series of data science short courses that use a quality assured set of reusable material, are supported by online delivery and are quality controlled and accredited by an appropriate body or bodies so that they can count towards students post-graduate qualifications. The CODATA-RDA Working Group is seeking to put the mechanisms for these important features in place.

The CODATA-RDA Research Data Science Summer Schools will:

- address a recognized need for Research Data Science skills across disciplines;
- follow an accredited curriculum;
- provide a pathway from a broad introductory course for all researchers (Vanilla) through more advanced and specialized courses (Flavors and Toppings);
- be reproducible: all materials will be online with Open licenses;
- be scalable: emphasis will be placed on Training New Teachers (TNT) and building sustainable partnerships.

2. Leads and Contributors

CODATA and RDA

For all the schools, the CODATA-RDA Working Group is collaborating with a wide number of partners and to the greatest degree possible re-using available materials.

3. 2016 Activities

1) Vanilla School

The first school, named 'Vanilla' by analogy to the most basic flavour of ice cream,

will provide a bedrock of introductory material, common to all research disciplines, and upon which more advanced schools can build. This school is designed to run for up to two weeks, for what the participants will gain, see the Reference Document. The programme will be run in partnership with the Software and Data Carpentry communities and the UK's Digital Curation Centre. Other partnerships are being explored.

The first full Vanilla School will take place on 1-12 August 2016 at the International Centre for Theoretical Physics, Trieste.

2) Flavoured Schools

Schools following Vanilla will be more advanced and specialized, refined as required to the 'Research Data Science' needs of particular disciplines. Such 'flavored' schools, which will run for 1 or 2 weeks, will allow a student to have a more specialized knowledge in Data Science, as it is applied in a more specific, disciplinary research context. A flavored school will not necessarily run directly after a Vanilla school and may be held in a completely different location.

Discussions are ongoing on schools on:

- 'Extreme Data' in collaboration with [CERN](#) and the [SKA](#);
- Bioinformatics with [Elixir](#), [H3Africa](#) and [Goblet](#);
- Geospatial Data with NASA, ESA and [GEO](#);
- Library Science with the [RDA Libraries for Research Data Interest Group](#) (including representatives of [LIBER](#), [COAR](#), [Purdue University Library](#) and the [University of Goettingen Library](#)); and
- Agricultural Science with the [RDA Interest Group on Agricultural Data](#) (including representatives of the [UN Food and Agriculture Organisation \(FAO\)](#), the [Indian Statistical Institute](#) and [INRA](#), as well as [CODATA Kenya](#) and the [Jomo Kenyatta University of Agriculture and Technology \(JKUAT\)](#)).

The first more advanced Flavored School is likely to take place over one week in the Spring of 2016 at the University of Cape Town.

4. 2016 Resources

- 1) The first full introductory or Vanilla course will take place from 1-12 August 2016 at the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy. As host, and following their general practice, the ICTP will provide accommodation and subsistence for up to 120 students. The ICTP has committed 15K euros, TWAS 10K euros and CODATA at least 5K euros to support student travel. The current funding from ICTP, TWAS and CODATA will be prioritized for participants from LMICs. The Working Group is looking for additional support from partner organizations, funders and sponsors. Thanks to the hosting support, funds will be used entirely for student and instructor travel.
- 2) Resources for Flavoured Schools will be confirmed with the confirmation of the schools.

5. Additional activities for 2016 (recommended if additional resources made available)

6. Future Plans

The Working Group is liaising with a number of partners to host schools in future years. The initiative builds on events held by CODATA in [Beijing](#), [Nairobi](#) and [Bangalore](#). As well as the various organisations mentioned, the WG is exploring whether the regional offices of the [International Council of Science](#) and [The World Academy of Science](#) can host schools from 2017.

Strong emphasis will be placed on Training New Teachers. Specific components and accreditation for participants wishing to instruct on and lead future schools will be established.

CA-33 Building capacity for Forest Biodiversity in Asia and the Pacific Region (new-Indian Institutions)

1. General Description

Based on recommendations of the 4th May Workshop, the GEO Strategic Plan (2016 – 2025) includes country capacity building as a Core Function of GEO. Accordingly, the 2016 Work Programme has identified a Foundational Task on Capacity Building Coordination, with an aim to facilitate and coordinate capacity building activities in GEO. It is envisaged that the actual capacity building activities will be undertaken within the three proposed implementation mechanisms, i.e. GEO Community Activities, GEO Initiatives and GEO Flagships. This proposal falls under the third category (viz. GEO Flagship) with the goal of country capacity building in the Asia Pacific Region, taking the societal benefit area of “Biodiversity and Ecosystem Sustainability” as an example. The **Forest Biodiversity in Asia and the Pacific Region** is most endangered compared to other continents due to high demographic pressure. The project will develop appropriate approach to enhance Regional capacity to undertake coordinated forest assessments, contribute to GEOSS and use the information to develop policy, strategies and programmes.

2. Task Leadership and Contributors

The host country resource persons are listed in Table 1. In addition to them, experts will be nominated by GEO Secretariat, as needed.

Table 1: Resource Persons in GEO CCB Programme in the Asia Pacific Region

Resource Persons	Address of Implementing Agencies	Contact Numbers / email
Dr.S. P. S. Kushwaha	Dean, Indian Institute of Remote Sensing (IIRS), 4 Kalidas Road, Dehradun,	+911352744583 spskushwaha@gmail.com

	India	
<i>Director CSSTEAP (Affiliated to UN)</i>	UN Centres for Space Science And Technology Education for Asia and the Pacific at IIRS, Dehradun, India	+911352740787/0737 cssteap@iirs.gov.in
Dr. Anmol Kumar	Director General, Forest Survey of India 23 Kaulagarh road, Dehradun, India	+918006423005
Dr. K. D. Singh ¹	Academy of Forest and Environmental Sciences, FRI Campus, Dehradun, India	+919810974026 karndeo_singh@hotmail.com

Note 1: The contact person for correspondence is: Dr. K. D. Singh. K-30 Hauz Khas Enclave, New Delhi 110016. Mobile number and email is same as given above.

3. Implementation arrangements: The Academy of Forest and Environmental Sciences

will make implementation arrangements in consultation with other institutions viz. IIRS, FSI and UN Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP). Dehradun, which will host capacity building training course. The Centre was established in India in November, 1995 and is hosted by IIRS, Department of Space.

4. Contributors responsibilities/activities:

The Indian Institute of Remote Sensing (IIRS) will provide the **Secretariat** and core Faculty. IIRS is among the advanced institutions in Training, Research & Development in the field of remote sensing and GIS in the region and has done pioneering contribution by implementing Projects in all biomes of India. FSI has the national mandate for operational implementation of two-yearly country-wide forest cover monitoring, undertaking national forest inventory and assessment of trees outside forests on a sampling basis. It has close linkages with State Forest Departments, who are responsible for conservation and sustainable management of forests under state control. The Academy of Forest and Environment is an independent scientific organization dedicated to enhance all aspects of knowledge for sustainable management and conservation of forests and promotion of cross-institutional cooperation.

5. Activities and outputs for 2016

Depending on availability of training slot, one Regional Training Workshop of 3 week duration would be organized at UN Centres for

Space Science and Technology Education for Asia and the Pacific in close association with the Indian Remote Sensing Institute (IIRS), Dehradun, during which a simple (but comprehensive) monitoring system based on remote sensing and limited field assessment will be elaborated for feasible application at country / Regional levels. A strategic work plan will be prepared for national / regional biodiversity monitoring in the framework of GEOSS with updated write up on methodologies. Side by side national and GEO network of experts will assist in exchange of information on capacity building in the framework of GEOSS. The knowledge gained on strategy for capacity building will be a major outcome.

6. Estimation of the associated resources (at individual activity level).

5 CANDIDATE GEO INITIATIVES

5.1 General

As identified in the Introduction, GEO Initiatives and GEO Flagships develop and implement prototype services according to GEO priorities. They allow Members and Participating Organizations to coordinate their actions and contributions towards a common objective within an agreed, yet flexible framework. They require the same type of programmatic definition and resource commitment, but the GEO Flagships, in addition to all criteria used for GEO Initiatives, must also meet the following ones:

- Policy mandate from international treaty, convention, programme, or strongly articulated policy obtained;
- Substantial activity in terms of resources and partners involved;
- Information service or product pre- or near-operationally provided;
- User needs satisfied to a significant degree;
- Specific user institutions fully engaged, including mechanisms to enable steering and feedback by these, e.g. an active role in a Steering Board;
- Implementation Plan (see 2.2), including also perspective(s) for operationalization;

The Work Programme includes a summary description of each of the agreed Initiative, as well as a summary of the committed resources, while more detailed description in terms of individual implementation plans are included the “Work Programme Reference Document”.

5.2 Process to confirm inclusion of a GEO Initiative or a GEO Flagship in the Work Programme

When providing a proposal to develop a GEO activity, the proposing teams will use the criteria defined by the GEO Strategic Plan 2016-2025 to identify what implementation mechanism (Initiative or Flagship) is applicable to their proposal.

Activities proposals are normally accepted for inclusion in the Work Programme as an Initiative or a Flagship by the GEO Programme Board based on the assessment of the documentation produced (in most cases a dedicated Implementation Plans) against the criteria mentioned above. (the complete criteria are included in the relevant Annex to the draft GEO Strategic Plan).

Considering the transitional nature of the 2016 Work Programme and the fact that the Programme Board will be established by the next Plenary, at the earliest, the Executive Committee has recommended to provisionally list all proposed Flagships and Initiatives “Candidate Initiatives”. They will be assessed by the Programme Board, once in place, and proposed for inclusion in the appropriate category. This approach is based on the timely provision in 2016 of the requested information about the plan of the activities and the associated committed resources.

It is important to note that the first five initiatives described below, namely

- GEOGLAM-Global Agricultural Monitoring and Early Warning
- GEOBON-Global Biodiversity Observation
- GFOI Global Forest Observation Initiative
- Global Observing System for Mercury and Persistent Organic Pollutants (PoPs)
- Global Carbon Observation and Analysis System,

have proposed themselves as GEO Flagship, after having read the applicable criteria, implicitly committing to provide a complete implementation Plan in the near future.

5.3 GEO Initiatives description

This preliminary list of GEO Initiatives is based on the inputs received by the Community.

GI-01 GEOGLAM-Global Agricultural Monitoring and Early Warning

1. Overview

The task comprises 7 components:

1. Monthly production of a Global Crop Monitor bulletin (for wheat, maize, rice and soya) and delivery to AMIS Secretariat (Agricultural Market Information System);
2. Development of a Global Rangelands and Grasslands Monitoring System (RAPP, Rangeland and Pasture Productivity)
3. Development of an Early Warning Crop Monitor (EWCM) in charge of monitoring crops in countries subject to periodic food security crises
4. Coordination of Capacity Building activities to enable new countries to develop EO-based crop monitoring activities
5. Coordination of the international Joint Experiment for Crop Assessment & Monitoring (JECAM), to coordinate R&D activities to improve crop monitoring methods
6. Keeping close links with Committee of Earth Observations Satellite (CEOS) to maintain an efficient access to EO imageries
7. Ensure delivery of EO-based information for agricultural monitoring in developing countries through the GeoNetCast network

2. Activities for 2016

The plans for 2016 and onwards include dedicated additional efforts addressing components 2, 3 and 4, namely:

- The RAPP (Rangeland and Pasture Productivity) Activity, through accurate forecasts of pasture and rangelands productivity and variability, aims at an improved global understanding of risk across all pastoral landscapes as impacted by climate and land use change.
- The Early Warning Crop Monitor (EWCM) intends to coordinate an open, timely and accurate monitoring of agricultural production in chronically food deficit countries to better anticipate food crises (users: FAO, WFP, UN-HLTF, aid agencies...)

- Capacity Building activities in new countries will allow these countries to benefit from EO-based information to better monitor their agricultural production, and therefore make better decisions in their agricultural planning.

GI-02 GEOBON-Global Biodiversity Observation

Overview

GEO BON's mission is to improve the acquisition, coordination and delivery of observations of biodiversity and ecosystem services to users, including monitoring of changes in marine, freshwater, and terrestrial ecosystems. GEO BON encompasses all scales of biodiversity, including genes, species, populations and ecosystems, across multiple dimensions such as composition and function. GEO BON has working groups dedicated to specific challenges and several sub-global and thematic biodiversity observation networks. GEO BON has close links with major space agencies and integrating remotely sensed and *in situ* measurements is an important function.

GEO BON's vision is by 2025, to be a robust, extensive and interoperable biodiversity observation network covering the major biomes of the globe. The observations derived from this network should contribute to effective and timely conservation, sustainable use, mitigation and adaptation decisions regarding the world's biodiversity and the ecosystem services it provides.

GEO BON's major user communities are **national governments** that are setting up or enhancing biodiversity observation systems, the Convention on Biological Diversity (**CBD**) and other international agreements that define strategies requiring biodiversity monitoring, the **scientific community**, which needs biodiversity observations for model development, and the *Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)* which requires biodiversity data, information and knowledge for international assessments.

2016 Activities

- Development of the “Essential Biodiversity Variables (**EBVs**)”, which are a minimum set of variables that capture the major dimensions of biodiversity change. **EBVs** provide guidance to observation systems at all scales by helping to prioritize observations and identify standard methods for data collection and processing. Also, because they lie between raw observations and indicators (which are used by decision makers), they isolate the indicators from advances in observation science and technology. EBVs will thus enable a more harmonized biodiversity monitoring system that is both efficient and focussed on user needs.
- Development of “**BON in a Box**“, which is a regionally customizable online toolkit for facilitating the start-up or enhancement of biodiversity observation systems. **BON in a BOX** gives nations, regions and others a common and scientifically sound set of biodiversity variables, monitoring methods and guidelines, mapping software, and data management, analysis, discovery and reporting tools and platforms, thereby increasing capacity and the power to detect important biodiversity trends and their underlying mechanisms.

- Facilitating development of and coordinating regional and thematic Biodiversity Observation Networks (BONs) such as the following:

Operational networks:

- The Asia Pacific BON (**AP BON**) is an example of a regional network. It includes most of the countries in the Asia Pacific Region and, via working groups and annual meetings it coordinates many of the biodiversity activities in the region.
- The Circumpolar Biodiversity Monitoring Program (CBMP or **Arctic BON**) is an international network (involving eight ‘Arctic’ countries) of scientists, governments, indigenous organizations and conservation groups working to harmonize and integrate efforts to monitor the Arctic's living resources. Launched in 2005, the CBMP has developed and is implementing pan-Arctic biodiversity monitoring plans for marine, coastal, terrestrial and freshwater ecosystems. The CBMP is endorsed by the Arctic Council and the CBD and is an official network of GEO BON.

Developing Networks:

- The GEO BON Marine Biodiversity Observation Network (MBON) is an example of a thematic network. The ambition is to create a series of interoperable regional marine networks and thus create a global network of marine biodiversity observation systems, with the first phase being a “Pole to Pole MBON in the Americas” and then moving gradually to a global coverage.
- The Global Wetland Observation System (**GWOS**), developing observations and data for the Ramsar convention, is another thematic BON. GWOS development is currently funded through the EU H2020 project **SWOS** (Satellite based Wetland Observation System) in collaboration with GEO BON following the concept of Essential Biodiversity Variables.
- The GEO BON Global System of Ecosystem Observatories (GSEO) is a developing network of field site networks focused on harmonization and coordination. Core networks within it include the Long-Term Ecosystem Research (*LTER*) network, and A Long-Term Biodiversity, Ecosystem and Awareness Research Network (*ALTER Net*).

It should be noted that GEO BON will prepare, in the summer of 2016, a new detailed implementation plan for the years 2017-2019. The implementation plans presented here are mostly derived from the 2014-2016 GEO BON Strategic Plan.

2016 Resources

Calculating in-kind contribution as well as projects dedicated to GEO BON by the many GEO BON partners is a challenge, as many partners don't specifically calculate their time spent for GEO BON activities. Therefore, we calculated only the major activities and added estimates from the key partners. Altogether, more than 16M€ (including estimated in-kind contributions) will be invested in GEO BON activities in 2016.

The GEO BON Secretariat is hosted by the **German Centre for Integrative Biodiversity Research (iDiv)** in Leipzig, Germany which supports the GEO BON Secretariat with an annual budget of 135k€ for personnel costs and 50k€ running budget. **NASA** provides in-kind expertise to GEO and GEO BON, including a full time secondment to the GEO Secretariat,

and NASA also supports the marine biodiversity observation network MBON with about USD5M in 2016. In addition, **Polar Knowledge Canada** supports the Vice-Chair position for GEO BON which is equivalent to 4 person-months (PM) in 2016. Furthermore, the **Global Biodiversity Information Facility (GBIF)** provides an in-kind contribution of 1 PM annually and **Map of Life (MoL)** provides 15PM annually to GEO BON activities. A breakdown of the resources applied to the key GEO BON activities follows (most of these are estimated).

- **EBV development:** 36 PM (funding provided by iDiv/Germany)
- **BON in a Box development:** 15 PM in 2016
- **Coordinating development of National, Regional, and Thematic BONs:** 4 PM in 2016
- **Asia Pacific BON:** 11 k€ in 2016 (funded by Japan Ministry of Environment for APBON activities)
- **Circumpolar Biodiversity Observation Program:** 1900 k€ in 2016 for their activities
- **Marine Biodiversity Observation Network (MBON):** USD6M + 135PM
- **Global System of Ecosystem Observatories (GSEO):** 90 PM in 2016
- **Global Wetland Observing System:** 115 PM in 2016 (Development of the EU SWOS project)

Recommended activities (recommended if additional resources are made available)

Of course, all GEO BON activities could benefit from additional resources as most of them depend on short term funding from projects and on in-kind contributions which are done on a best-effort basis. Additional funding, on the order of 10s of k€, would particularly benefit the BON in a Box toolkit by helping to bring the Latin America version to an operational status. Development of Essential Biodiversity Variables would also benefit from additional resources.

GI-03 GFOI Global Forest Observations Initiative **Overview**

Robust national forest monitoring based on objective observations and measurements is widely accepted as a pre-requisite for countries to participate in international agreements and incentive mechanisms related to forest carbon. To operate efficiently and sustainably, National Forest Monitoring Systems (NFMS) require a continuous, timely and affordable supply of observations.

The Global Forest Observations Initiative (GFOI) aims to foster the sustained availability of observations for national forest monitoring systems as well as to support governments that are establishing national systems by providing a platform for coordinating observations, providing assistance and guidance on utilising observations, developing accepted methods and protocols, and promoting on going research and development; working with national governments that report into international forest assessments such as the national greenhouse gas inventories reported to the UN Framework Convention on Climate Change (UNFCCC) using methods of the Intergovernmental Panel on Climate Change (IPCC). National Forest Monitoring Systems also have direct influence on decision-making in other fields such as resource management and agriculture.

Leaders and Contributors

GFOI is led by: Australia, Norway, the USA (USGS/SilvaCarbon), SilvaCarbon, The Food and Agriculture Organization of the United Nations (FAO), and the Committee on Earth Observation Satellites (CEOS). The involvement of CEOS is led by the European Space Agency (ESA), with management support provided by Australia. Other national space agencies engaged to date include those of Argentina (CONAE), Brazil (INPE), Canada (CSA), China (CRESDA, NRSCC), France (CNES), Germany (DLR), Japan (JAXA) and the USA (NASA/USGS).

The work of GFOI is undertaken by five components: Methods & Guidance, Space Data, Capacity Building, R&D, and Administration and Coordination (the GFOI Office).

In the period 2011 – 2015, the CEOS SDCG has prepared and coordinated: the initial implementation of a coordinated global baseline data acquisition strategy for EO data (Element 1) involving a number of space-based ‘core’ data that can be used and shared free-of-charge for GFOI purposes; a coordinated strategy for national data acquisitions (Element 2) which accommodates countries that have specific technical requirements or heritage and experience on working with a particular EO data source or type; and a data acquisition and supply strategy in support of GFOI R&D activities (Element 3). The SDCG for GFOI has produced a Three-Year Work Plan for 2015 – 2017, which was recently endorsed by CEOS. The Work Plan has been prepared to map out the activities of the SDCG covering the finalisation and implementation of the space data supply for GFOI.

The first version of the GFOI Methods & Guidance Documentation was released in January 2014 and has been applied in a range of countries including, but not limited to Ghana, Columbia, Cambodia, Fiji, Kenya, Papua New Guinea, facilitated by the UN-REDD programme, SilvaCarbon, the World Bank Forest Carbon Partnership Fund and bilateral programmes. Training materials, decision support tools and rapid response guidance modules have been developed to support the MGD since its publication.

Since 2011 the US Government SilvaCarbon Program has been developing capacity in all aspects of forest monitoring in four regions (Latin America, SE Asia, Central America and Central Africa), and 25 countries across those regions. SilvaCarbon has developed bilateral work plans with 10 of these countries focusing on their forest inventories and remote need sensing needs. User engagement is typically through the Capacity Building component and handled by SilvaCarbon and FAO, although individual governments such as Australia and Norway have their own focused programmes with partner countries (eg Indonesia and Kenya) for the development of national capacity.

Significant achievements and contributions of the GFOI R&D Component are the release of the 'Review of Priority Research & Development Topics' (Dec, 2013); completion of a 'Landscaping Study' (July, 2014) that maps out priority R&D topics against the interests of potential research and partner organisations and identifies possible funding sources for them; organisation of three expert workshops that provided a forum for identifying actions to progress specific R&D topics towards operational use (including sensor interoperability (June, 2014), forest degradation (Oct, 2014) and vegetation biomass estimation (Feb, 2015); and support to the (parallel) development of the SDCG Element-3 Strategy, which is a coordinated multi-sensor data acquisition strategy dedicated to supporting GFOI priority R&D.

The **GFOI Office** provides the necessary management functions to ensure coordination and communication across the range of stakeholders including advisory, leadership and “parent” bodies, the participating science and technology community, the forest countries GFOI wishes to serve, the UN bodies intended as recipients of forest country reports, potential donors, etc. The **GFOI Lead Team** has responsibility for project implementation and strategy and a larger **Advisory Committee** exists to provide a broad base of experience and advice for GFOI activities.

GFOI is unique in that it directly engages and brings together space data providers (CEOS agencies), forest monitoring/remote sensing experts (MGD, Capacity Building), and in-country partners (FAO, SilvaCarbon) in support of countries and their NFMS/MRV ambitions.

Activities 2016-17

Building upon a substantial body of foundational and initial implementation work completed since 2011, in the period 2015-17 each of the GFOI components will be working to improve existing outputs and to build new capacity in the following directions:

- **Space Data:** Continued coordination of data streams and the addition of new data streams and products to ensure multiple annual global coverages of the world's forested areas by 2016; continued development of data services tools and Pilots for data acquisition planning, data storage, data processing and delivery of tailored data packages (such as cloud computing based tools and Data Cubes); expansion of R&D data supply and coordination, including provision of space data supporting the priority activities outlined in the GFOI R&D Plan, and implementation of an effective private sector engagement mechanism; development of the SDCG Global Data Flows Study which will evaluate alternate solutions for reducing barriers to effectively accessing and using satellite data; and closer integration with MGD and Capacity Building activities.
- **Methods and Guidance:** Development of basic methodological guidance documents in several languages; translation of methodology into a hands-on user-driven MGD Web Application, which will target MRV in-country technical specialists, present material tuned to individual needs based on guidance presented in the MGD, and provide linkages between pillars of GFOI such as available tools and training materials; continued generation of MGD Rapid Response Modules and Training Materials to respond to new technologies and emerging reporting approaches; and production of MGD Version 2.0 as an update and improvement on V1.0, increasing its ease of use for non-specialists.
- **Capacity Building:** Continued GFOI regional capacity building workshops with increased MGD integration, based on regional capacity building needs and requests from countries; development of a bilateral capacity building plan for 10 countries to support specific MRV technical capacity needs; increased contributions to the MGD; preparation of training materials; and hosting of the Second GFOI Capacity Building Summit to assess progress on the *Manual for Best Practices to Implement Capacity in REDD+ Countries*, which was recommended as an outcome of the first Summit.
- **R&D:** R&D component management; initialisation and coordination of R&D activities in parallel with SDCG Element-3 strategy implementation; manage participating (external) research teams and reporting; coordinate Expert workshops and organise a GFOI Science meeting; update the GFOI Review of Priority R&D Topics and R&D Plan; contribute to the update of the GFOI MGD and the REDD Sourcebook.

All of these tasks will be underpinned by strong component coordination from the GFOI Office, which is working with GFOI's partners to address country engagement as a priority. The GFOI Office is in the process of moving from Geneva to a home within FAO HQ in Rome to promote its transition to operations.

GI-04 Global Observing System for Mercury and Persistent Organic Pollutants (PoPs)

Overview

The task HE-02 "Tracking Pollutants" was established as a part of the 2009-2011 work plan of the Group on Earth Observations (GEO) and, through the establishment of coordinated global observation network for mercury and POPs, was meant to support the international conventions on toxic compounds (i.e. Stockholm Convention (SC), UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP)) and on-going international programmes (e.g. UNEP Mercury Program, Global Monitoring Plan (GMP) of SC on POPs, European Monitoring and Evaluation Programme (EMEP)).

The task includes two major components:

- The Global Mercury Observation System (GMOS) is a worldwide observation system for the measurement of atmospheric mercury in ambient air and precipitation samples. GMOS includes ground-based monitoring stations, shipboard measurements over the Pacific and Atlantic Oceans and European Seas, as well as aircraft-based measurements. All data are made available through an ad-hoc, scalable and user-friendly infrastructure.
- The network to measure baseline data for the various POPs (including the eleven new POPs listed in the SC in 2009, 2011, and 2013); including the Data Warehouse (GMP DWH) (www.pops-gmp.org), registered for access through the GEOSS portal.

Previous achievements have also resulted in the availability of data and reports through the GEO Portal. In particular:

- The GMP DWH together with the GENASIS primary database have been registered under the GEOSS portal
- www.pops-gmp.org
- www.genasis.cz
- Data from the 2nd GMP regional reports publicly available. The GMOS SDI has been registered under the GEOSS portal
- <http://www.geoportal.org>
- <http://www.eurogeoss-broker.eu/>

User engagement

The primary stakeholders are: parties to the Stockholm, Minamata and other Conventions, governments, IGOs, NGOs; the scientific community in related fields shares the interest within the scope of the project and could contribute to gathering information and mobilizing social groups; the civil society in general, benefitting from communication of risks associated with POPs and Hg releases, contamination and exposure.

Partners

- Italy - CNR (Nicola Pirrone)
- UNEP (Katarina Magulova) Mercury Programme, the Hemispheric Transport of Air Pollutants Task Force (TF HTAP);
- Czech Republic, Masaryk University (Jana Klanova)
- CARIBIC, Germany
- GEF – Global Environmental Facility of the World Bank
- European Monitoring and Evaluation Program (EMEP);
- MercNet/AMNet initiative in USA;
- CAMNet in Canada, and other international monitoring and modeling efforts.
- RECETOX

Activities for 2016

The overarching goal of the task GF-04 (Global Observing System for Mercury and Persistent Organic Pollutants (POPs) for 2016-2017 is to further develop the global observation systems for mercury and POPs by harmonizing standard operating procedures for monitoring of these substances in air, precipitation, surface water, soil, sediments, vegetation, and biota and support open access and sharing of standardized data. Specific objectives include:

- To increase the availability and quality of Earth observation data and information needed to track chemical pollutants and anticipate changes to the environment;
- To harmonize standard operating procedures for monitoring priority pollutants, such as POPs and Hg, and their compounds in air, atmospheric deposition, water, soil, sediments, vegetation and biota.
- To understand temporal and spatial patterns of chemical pollutants transport and deposition to, and evasion from, terrestrial and aquatic ecosystems;
- To support the validation of regional and global atmospheric pollutant models for use in evaluations of different policy options;
- To evaluate the effectiveness of international efforts to reduce releases of pollutants.
- To deliver specific documents and reports as requested by the users identified above.
- Capacity building and training to assist regions in implementing new features of the GMP and filling existing data gaps (i.e. by means of the annual summer schools)

Resources and annual budget(s)

In-kind (human resources)

- Secretariat staff time; Staff time of the regional organization groups and global coordination group members, strategic partners.

Financial

- Resources from small projects of the Stockholm Convention Secretariat, contributions from strategic partners, contributions of the participating countries through resources necessary to operate the contributing POPs monitoring programmes (Canada, Czech Republic).

Other

- GEF medium sized projects on analytical procedures for new POPs, capacity building

for the implementation of the GMP in the regions.

- H2020 ERA-NET Projects, UNEP, projects funded in US, Japan, China as well as other national funded projects.

GI-05 Global Carbon Observation and Analysis System

Overview:

Climate change is one of the most important challenges that humanity will have to address in the coming decades. The Intergovernmental Panel on Climate Change (IPCC) has concluded that a large part of the observed rise of global temperature is very likely due to increasing greenhouse gases (GHG) in the atmosphere, driven by man-made emissions overtaking the natural cycles of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The perturbed global biogeochemical cycles of these greenhouse gases are a major driving force of current and future climate change. The primary agents of these perturbations are fossil fuel combustion and modifications of global vegetation through land use change, in particular deforestation. Deeper understanding of the driving forces of climate change requires full quantification of the GHG cycles. Regional GHG flux patterns, tipping-points and vulnerabilities can be assessed by long-term, high precision in-situ observations in the atmosphere and at the ocean and land surface. They are complemented by in-situ and satellite observations of carbon pools as well as total column observations from satellites. CEOS (Committee on Earth Observation Satellites) has responded to the GEO Carbon Strategy and provided coordination to all the national and regional satellite agencies; GCP (Global Carbon Project) has provided annual updates of the global carbon budget and coordinating many global and regional efforts, in particular by establishing the mean carbon balance of large regions in the RECCAP (REgional Carbon Cycle Assessment and Processes) project.

A GEO Carbon and GHG Flagship will contribute to the implementation of the next GEO Strategic Plan for the period 2016-2025. The flagship will address important issues needed to build a connected and interoperable global network for carbon cycle (CC) and greenhouse gas (GHG) observations in the atmospheric, terrestrial ecosystem and oceanic domains.

In particular the GCGF will address these questions:

- What kind of carbon cycle and GHG observations are urgently needed to support the Sustainable Development Goal: "Take urgent action to combat climate change and its impacts" (and party the Goal: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss")?
- Where are we coming from, i.e. what are the most important recent achievements in terms of science and infrastructural capacity?
- Where do we want to go, i.e. what remains to be done in the framework of GEO for the next 10 years? In particular, how can we ensure that achieved capacities can be fully explored for multiple needs and not just for the specific circumstances they were developed for?
- Who will be the important data providers, integrators and users?
- How can a sustainable structure be achieved? What is fundamental, what is desirable, what would be nice to have but not essential?
- What are the most urgent needs for integration between different information sources and across methodologies, between different regional networks and from data providers to users? What is the intent of integration? Blending? Coupling?

Transforming? How do we assess integration methods in light of relevant objectives? How can different data sources and modeling approaches be used to evaluate our understanding of processes and their emergent properties?

The main objectives of this flagship are:

- to provide more inclusive coordination among the main actors monitoring carbon cycle and GHG at global level;
- to further develop inter-operability between satellite observations; in-situ infrastructures and integration networks by
 - Data harmonization (data and metadata formats),
 - Further development of full and open data sharing,
 - Long-term sustainability of data centers and model result repositories,
 - Understanding and quantifying scale issues and process information across in-situ measurements and satellite platforms;
- to support the development of Model Data Fusion to improve parameter optimization;
- to envisage a GEO role in organising and backing intercomparison exercises;
- to establishing standard datasets for synthesis and dissemination of policy-relevant information on global carbon cycle and GHG:
 - to raise awareness and promote data use e.g. towards UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA);
 - to liaise science with policy and provide decision makers with timely and more reliable policy-relevant information
- to coordinate the periodic update and supply of comprehensive carbon budgets (covering also less studied region/ecosystems, and unknown sources, with progressively reduced uncertainty) at different levels (global, regional, domains, etc.) and integrating different approaches;
- to provide knowledge that assures the quality of national inventories and to secure the effectiveness of UNFCCC.

Other objectives for the GEO flagship process:

- to support for sustaining, developing and exploiting existing as well as promoting new observing platforms and infrastructures;
- to harmonize existing protocols for biogeochemical data collection and analysis, as well as full and open sharing;
- to contribute data to cost-benefit analyses that show the costs of better informed actions versus inaction;
- Promote further consistency of observations and specification of uncertainty that is fully traceable and accepted by the community.

2016 Activities:

- Set up a Coordinating Team (before the end of 2015) and a Steering Committee (early 2016).

.1.1 The CT team will be responsible for coordinating and running the 2016's activities, and

for the fundraising (see the following action). The SC will ensure the control and evaluation of the proper implementation and provide scientific review and guidance.

- Development of an Implementation Plan
 - Fund raising
- .1.2 During 2016 one of the main activities will be dedicated to the raising of the funding required to carry out the flagship's implementation plan. All partners involved will ensure a minimum level of funding commitment.
- Conducting a workshop
- .1.3 Subject: Assess the cost and benefits of an improved global carbon observing system

- Working structure

The first step is to decide task's titles and contents, and the working structure. The main building blocks could be the following:

- Define the elements for an optimal global carbon observing system, including the needed infrastructure
- Collect and harmonize (to make them interoperable) all the possible available observations (in different domains, from different platforms, etc.) from past series to the currently operational networks
- Improve assimilation systems and modelling efforts to ingest and process these observations and provide relevant products
- Deliver new information products, tailored to the final users (particularly decision makers)
- Develop and maintain an information portal, fully linked to the GEO portal, where all these data, information and products are visualized and freely shared
- Assess the cost and benefits of an improved global carbon observing system

2016 Resources:Initially, the resources needed for the Coordination Group and the Steering Committee will be mainly in-kind from the institutions willing to participate in the Flagship. Then, by 2016, the needed financial resources to support the Flagship will be sought.

GI-06 Reinforcing engagement at regional level: AfriGEOSS for Africa

Overview

The development and uptake of Earth observation (EO) data, information and knowledge is critical to improving the socio-economic status of the African continent. The Group on Earth Observations (GEO) Member States and Participating Organizations in Africa recognize the need to improve and coordinate observation systems across the Societal Benefit Areas. Strong advocacy of open data-sharing policies and practices, as well as for the increased use of EO data and information, are the foundation of moving forward in these vital areas. Similarly, focusing significant effort on building both human and technological capabilities will ensure that all parts of the African continent can benefit from better access to, and understanding and

use of, EO data, information and services.

AfriGEOSS is an emerging GEO initiative to enhance Africa's capacity to produce, manage and use Earth observations, while enabling the Region's participation in, and contribution to, GEOSS. The AfriGEOSS initiative is providing the necessary framework for countries and organisations to access and leverage on-going bilateral and multilateral EO initiatives across Africa, thereby creating synergies and minimising duplication.

Objectives

- Coordinate and bring together relevant stakeholders, institutions and agencies across Africa that are involved in GEO and other Earth observation activities;
- Provide a platform for countries to participate in GEO and to contribute to GEOSS;
- Assist in knowledge sharing and global collaboration;
- Identify challenges, gaps and opportunities for African contributions to GEOSS;
- Leverage existing capacities and planned assets and resources; and
- Advocate for the uptake of Earth observation in decision-making processes in Africa.

In the two years since its endorsement by the GEO Plenary, AfriGEOSS has resulted in increased:

- GEO Membership of African countries;
- African participation in GEO Boards and Working Groups;
- Participation in Africa caucus teleconferences and activities;
- African attendance at GEO events and official meetings;
- Participation in training courses (regional and international);
- Response and participation in Calls for Proposals; and
- Sharing of lessons learnt in the development of AfriGEOSS with AmeriGEOSS

2016 Activities and Outputs

In its Implementation Plan, AfriGEOSS identified six key Activity Areas, i.e.:

- Continental and Regional Coordination
 - Re-establish strong contacts with the current GEO Principals and enlarge the GEO partnership in Africa;
 - Establish national GEOs, including appointment of national focal points;
 - **Outputs:** 1) strengthened national participation in GEO 2) increased GEO Membership in Africa;
- User Needs and Applications
 - Establish Coordination Team/s with Action Plan/s, including resources, for relevant Societal Benefit Areas, such as the Working Group on Land Cover for Africa;
 - Develop an extensive inventory of current and planned initiatives and available resources. The audit of what is happening in Africa will contribute to a map of on-going activities related to the AfriGEOSS objectives and assist in managing overlaps, identifying gaps and opportunities, as well as leveraging resources to meet objectives;
 - Link existing initiatives, not yet connected to GEO, to the GEO Work Programme, clearly indicating contributions to GEOSS;
 - **Outputs:** 1) Coordination Team/s and Action Plans in place; 2) inventory of

- current projects & initiatives; 3) Increased African participation in GEO Work Programme.
- Data and Infrastructure
 - Strengthen the work of the current Coordination Team with the development of a long-term action plan;
 - Finalise proposed mechanism for EO data dissemination in Africa;
 - **Outputs:** 2016 and beyond action plan
 - **Contributors:** Egypt (NARSS), Ghana (GSSTI), Nigeria (NARSDA), South Africa (SANSA) and RCMRD
 - Human Capital Development
 - Establish Coordination Team with Action Plan including resources for the implementation of the Action Plan;
 - **Outputs:** 1) Coordination team and action plan in place;
 - Resource Contributors Coordination
 - Establish Coordination Team with Action Plan including resources to implement the Action Plan;
 - Coordinate with upcoming initiatives to ensure Africa receives full benefit from, and makes a contribution to, GEO Initiatives and Flagships;
 - **Outputs:** 1) Coordination team and action plan in place; 2) Increased African participation in relevant GEO Initiatives and Flagships;
 - Communication and Outreach
 - Establish Coordination Team with Action Plan including resources to implement the Action Plan;
 - Maintenance and update of the AfriGEOSS website;
 - Continuously share information with the community through AfriGEOSS Alerts;
 - Hold an AfriGEOSS Symposium;
 - AfriGEOSS exhibition and side event at AARSE 2016;
 - AfriGEOSS exhibition at GEO-XIII Plenary;
 - **Outputs:** 1) Promotion of AfriGEOSS and Earth observations
 - **Contributors:** AARSE, South Africa, Uganda

The work of the AfriGEOSS team will be supported by regularly teleconferences of the Coordination Teams and face-to-face meetings. The AfriGEOSS Steering Committee is envisaged to meet face-to-face at least once in 2016.

2016 Resources

- A full-time Project Officer based at the GEO Secretariat, till September 2016 will support the AfriGEOSS initiative through a secondment by South Africa;
- In-kind, human resources, contributions making up the Coordination Teams;
- Financial resources;

Additional activities for 2016 (Recommended if additional resources made available)

GI-07 Ocean and society - Blue Planet
. Overview

The GEO Strategic Plan 2016-2025 identifies eight societal benefit areas. The oceans play a vital role in every one: Disaster Resilience; Food Security and Sustainable Agriculture; Water Resources; Energy and Mineral Resources; Public Health Surveillance; Biodiversity and Ecosystem Sustainability; Sustainable Urban Development; and Infrastructure and Transportation. For example, ocean-related hazards such as tsunamis, storm surges, and extreme waves require ocean observations for early warning systems and to prepare for and mitigate the effects of disasters. Because of their role in climate, ocean observations also provide important information for the forecasts of precipitation and drought, the source of replenishment of water supplies, and of climate events that can lead to public health incidents or changes in energy demand. Ocean biological observations are critical in monitoring the health of ocean ecosystems and biodiversity, and the way ecosystem services are being impacted by a changing environment. They are also important in managing fisheries and aquaculture. In addition, observations of the ocean are critical for monitoring climate variability and change, and for generating forecasts and projections of climate that can be used in climate services. Ocean observations help improve predictions of longer-range forecasts of weather. Finally, oceans impinge on various cross-cutting initiatives in GEO, such as system architecture and capacity building.

Although various successful marine activities were conducted under earlier GEO Tasks in previous Work Plans, they were uncoordinated and often overlooked. In short, oceans did not receive the prominence they deserved. Furthermore, the distribution of the tasks in multiple SBAs did not facilitate integration and synergy between elements. The Partnership for Observation of the Global Oceans (POGO) worked hard to have this situation reversed, so that oceans would be accorded their proper place in the GEO arena. In addition, from a communications point of view, it was felt that speaking with a common voice for the oceans would be more effective than fragmented messages. The creation of the “Oceans and Society: Blue Planet” Task was started by the Partnership for Observation of the Global Oceans (POGO) in 2011, to coordinate all the existing ocean observation programmes within GEO, to add new ones to the GEO portfolio, and to create synergies between them. The Task was developed further over the past few years by POGO, in collaboration with other marine interests, notably the Committee on Earth Observing Satellites (CEOS), the Global Ocean Data Assimilation Experiment (GODAE) OceanView and the Global Ocean Observing System (GOOS). Blue Planet will build on its initial success as a Task in the GEO 2012-2015 Work Plan, in galvanising the ocean observing community and enhancing the visibility of ocean observations within GEO. In its next phase, it will add value to the work already being carried out, by developing synergies between its different components and with other parts of the GEO Work Programme, and by strengthening its focus on delivering products and services to the user communities. This was agreed at the 2nd Blue Planet Symposium, which was hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Cairns, Australia, from 27 to 29 May 2015.

In summary, Blue Planet is the ideal facilitator to enhance the coordination among the different global initiatives relevant to ocean observations and is also the ideal place to identify and reach actual end users and jointly work with them to understand and address their needs. We believe Blue Planet, through GEO, provides the right framework for creating synergies among different groups and, most importantly, linking them with policy makers.

2. Activities for 2016 (and beyond)

Blue Planet envisions an informed society that recognises the oceans' crucial role in Earth's life-support system and is committed to stewardship of the oceans for a healthy, safe and prosperous future for all. Blue Planet's Mission is to advance and exploit synergies among the many observational programmes devoted to ocean, coastal and inland waters; to improve engagement with a variety of users for enhancing the timeliness, quality and range of services delivered; and to raise awareness of the societal benefits of ocean observations at the public and policy levels.

“Oceans and Society: Blue Planet” will add value to existing observational programmes by:

- Facilitating and encouraging collaboration among them for mutual benefit, and with the broader Earth observation community;
- Improving their connections with the users of ocean observation-derived products, information and knowledge;
- Enhancing their impact within the Group on Earth Observations and other intergovernmental arenas; and
- Promoting their communication with decision makers and with the general public regarding the societal benefits of ocean observations.

Through 2016 and beyond, Blue Planet seeks to create an end-to-end service that (1) builds the capacity required for ocean observations, (2) collects data from observations, (3) manages the data and makes them widely available, and (4) transforms the data into information, products and services to be used by a variety of stakeholders for the benefit of society. This requires a close collaboration between the different partners contributing to Blue Planet. In particular, POGO, International Oceanographic Data and Information Exchange (IODE) and Scientific Committee on Oceanic Research (SCOR) play a significant role in developing the capacity required to expand ocean observations worldwide. GOOS and POGO are responsible for a large fraction of the deployment and coordination of observing systems in the open ocean; CEOS is responsible for coordination of global space-based observation of ocean and coastal zones across 31 space agencies; and CZCP focuses on the coastal zone. GODAE Ocean View coordinates the ocean forecasting efforts.

Finally, although progress has been made, there is much more work to be done to galvanise the ocean observing community, to highlight the importance of the ocean observations for policymakers and for society-at-large, and to bring products and services to users that are tailored to their needs. We already know how to observe the ocean in all its aspects, including physics, chemistry, geology, and to a lesser extent biology, at the required time and space scales. We have the ability to sample the remotest parts of the oceans, from pole to pole and into the deepest ocean trenches. However, the sustained network of coastal and deep-sea observations is unevenly distributed, and has serious gaps. There is therefore an urgent need for the scientific community to agree, for example, on the variables that need to be measured (Essential Ocean Variables) and to implement these in a systematic, sustained and globally-distributed manner. Thus, in its new phase, the Blue Planet Initiative will have a stronger focus on user engagement and will facilitate the two-way communication between data and

information providers and various user communities, by 1) identifying the users for different types and sources of data and information, (2) actively seeking their feedback on what they need and how and in what format it should be delivered to them, and (3) sharing information, advice and best practices on user engagement within the Blue Planet community. This coordination and advisory role will be taken on by a dedicated User Engagement group/component within the new structure.

3. Committed Resources and annual budget(s)

Project

- GMES marine services (MyOcean II)
- Deep Ocean Observing Strategy
- Tropical Pacific Observing System 2020 Project
- AtlantOS
- International Quiet Ocean Experiment
- The NSF-Funded RCN on Ocean Observations

In-kind (human resources)

- For overall coordination:
 - Blue Planet Secretariats hosted by NOAA and CSIRO
 - POGO Secretariat
- CEOS Secretariat(s) - CEOS Blue Planet Expert
- CEOS Working Groups
- Secretariat of the GOOS Project Office hosted by IOC (Paris, France)
- OOPC Secretariat (GCOS, Geneva, Switzerland)
- IOCCP Secretariat (IO PAS, Sopot, Poland)
- JCOMMOPS (Toulouse and Brest, France)
- IODE/OBIS Secretariat (Oostende, Belgium)
- In kind support by USA (NASA) and Australia for GOOS
- IOC field offices: Nairobi, Bangkok, Perth, Kingston
- Human resources made available by IEEE.

Financial

- IOC regular annual budget support for GOOS, IODE, JCOMM
- Extra-budgetary voluntary financial contributions from many Member States
- Investment in Capacity Building by POGO, approx \$500K per annum, courtesy of the Nippon Foundation
- Investment in Capacity Building by IODE, courtesy of the Government of Flanders.

Other

- An estimated USD 1-2 billion in direct support to ocean observations, data management and analysis activities, including contributions from space and in situ observations, from a broad variety of countries (national and institutional funding).
- CEOS Virtual Constellations.

GI-08 GEO Geohazard Supersites and Natural Laboratories (GSNL)

1. Overview and objectives

The [Geohazard Supersites and Natural Laboratories](#) initiative (GSNL) was launched in GEO in 2010 as a voluntary international partnership aiming to promote better scientific knowledge in the field of geohazards, focusing on Seismic and Volcanic Hazards.

The GSNL goals are pursued providing open, easier and more complete access to a variety of space- and ground-based data needed for geohazard assessment, focusing over selected, high risk areas of the world: the Supersites and Natural Laboratories.

On these focus areas a joint effort between the data providers and the scientific community is carried out. The space agencies comprised in the Committee for Earth Observations Satellites (CEOS) provide satellite imagery at no cost for scientific use, while national monitoring agencies commit to provide open access to ground based geohazard monitoring data. For each Supersite the partners also commit to facilitate the data access through standard web services and platform interoperability. Eventually, the global scientific community is enabled to exploit this continuously updated, large amount of data to generate new knowledge on the hazardous phenomena.

The benefits expected from the initiative are not only related to the production of new science, but also to the increase of knowledge transfer and capacity building, and to the promotion of a more efficient use of information resources (data, models, procedures, research products, etc.).

Moreover, as specified in the [Disaster SBA Task DI-01-C2](#), the goal of GSNL is also to provide a direct societal benefit: "... The scientific information about geological disasters is the first element of the end-to-end approach to disaster management. This information will be openly available in timely manner to local governments for risk assessment ..."

The general Geohazard Supersite concept is implemented using three instruments: the [Permanent Supersites](#), which aim to promote new science to support seismic and volcanic hazard assessment for risk prevention, the [Event Supersites](#), which have a limited duration and are dedicated to intensive scientific research on specific eruptions or earthquakes, and the [Natural Laboratories](#) which are instead larger regions of the world in which there is a high concentration of seismic and volcanic hazards (and other hazards as well), and where vulnerability, exposure and value are particularly high.

After the inception of the initial Geohazard Supersite idea in 2007, few Event Supersites were set up, then when GSNL became part of GEO, a formal management structure was emplaced and during the last 5 years seven Permanent Supersites and more Event Supersites have been established (see next section).

The management structure of the GSNL initiative is based on two governance bodies established by the main communities. The [Scientific Advisory Committee](#) (SAC) is composed of members of the scientific and in situ data provider communities, while the [Data Coordination Team](#) (DCT) of the CEOS is composed of representatives from the space agencies. The SAC and DCT evaluate new Supersite proposals, verify the commitments of the proposers, monitor the Supersite implementation and the scientific productivity, coordinate to solve the technological issues on data dissemination, and are supported by GEO Secretariat in these duties.

The baseline funding scheme for GSNL relies on voluntary in kind contributions. The management costs are borne by the single committee members, and in some cases, their agencies, while GEO Secretariat provides limited support.

The ICT costs of providing open access to in situ data are normally borne by each monitoring agency (in some cases also through well established dissemination consortia, as IRIS and

UNAVCO). The costs of satellite EO data provision and dissemination are in kind contributions from the CEOS space agencies, sometimes granted in the framework of specific science programs. Overall, the value contributed by the CEOS with commercial satellite imagery amounts to few million dollars per year for all Supersites.

While the Supersites are not projects, they can indeed attract national and international funding due to the potential benefits with respect to data availability, scientific advances, and support to risk prevention and emergency management. Some R&D funding agencies may see the opportunity to improve the monitoring and research capacities of the national communities, other agencies could effectively exploit the Supersite monitoring infrastructures and science as a service to reduce particular geohazards. An example of the first case is the funding by the European Commission of three 6 M€ projects to improve monitoring networks, data accessibility and geohazard science on four European Supersites. A good example of the second case is the provision of services to Volcanic Ash Advisory Centres by the Iceland Supersite scientific community.

2. Governance

The GSNL initiative is managed at central level by the Scientific Advisory Committee, which works in close collaboration with the CEOS Data Coordination Team. Secretarial support is given by GEO Secretariat.

The following is the composition of the **GSNL-SAC**:

Name	Role	Affiliation
Stefano Salvi	SAC Chair	Istituto Nazionale di Geofisica e Vulcanologia (INGV), Italy
Tim Ahern	Member	Incorporated research Institutions for Seismology (IRIS) Data Management System, USA
Falk Amelung	Member	Division of Marine Geology and Geophysics (MGG) University of Miami, USA
Massimo Cocco	Member	INGV and European Plate Observing System (EPOS)
Florian Haslinger	Member	Swiss Seismological Service (SED) at Eidgenossische Technische Hochschule Zurich (ETH) Switzerland
Yann Klinger	Member	Institut de Physique du Globe de Paris, France
Chuck Meertens	Member	UNAVCO, USA
Susanna Zerbini	Member	Working Group of European Geoscientists for the Establishment of Networks for Earthquake Research (WEGENER)

The following is the composition of the **CEOS-DCT**:

Name	Role	Affiliation
Brenda Jones	DCT Chair	United States Geological Survey - USGS, USA
Simona Zoffoli	Member	Agenzia Spaziale Italiana - ASI, Italy
Steven Hosford	Member	Centre national d'études spatiales - CNES, France

Christine Giguère	Member	Canadian Space Agency - CSA, Canada
Jens Danzeglocke , Jörn Hoffmann	Member	Deutsches Zentrum für Luft- und Raumfahrt - DLR, Germany
Ivan Petiteville	Member	European Space Agency - ESA, Europe
Chu Ishida	Member	Japan Aerospace eXploration Agency - JAXA, Japan
Stu Frye, Frank Lindsay	Member	National Aeronautics and Space Administration - NASA, USA
Bob Kuligowski	Member	National Oceanic and Atmospheric Administration - NOAA, USA

Each Supersite is managed by a Point of Contact (PoC), normally belonging to a national research institution or observatory:

Permanent Supersite	PoC	Affiliation
Hawaiian volcanoes	Michael Poland	<u>USGS - Cascades Volcano Observatory, USA</u>
Icelandic volcanoes	Freysteinn Sigmundsson	<u>Nordic Volcanological Centre, Institute of Earth Sciences, Iceland</u>
Mt.Etna volcano	Giuseppe Puglisi	<u>Istituto Nazionale di Geofisica e Vulcanologia, Italy</u>
Campi Flegrei/Vesuvius volcano	Sven Borgstrom	<u>Istituto Nazionale di Geofisica e Vulcanologia, Italy</u>
Marmara Region/Western North Anatolian Fault	Semih Ergintav	<u>Kandilli Observatory and Earthquake Research Institute, Turkey</u>
Ecuadorian volcanoes	Patricia A. Mothes	<u>Instituto Geofísico, Escuela Politécnica Nacional, Ecuador</u>
New Zealand volcanoes	Nico Fournier	<u>GNS Science, New Zealand</u>

3. Activities planned for 2016

In 2016 the activities of the seven established Permanent Supersites will continue, under the supervision of the SAC and DCT, which periodically verify the fulfilment of the objectives. As recently done for the Hawaii and Iceland Supersites, comprehensive reports on the last 2-year achievements will be obtained from the Mt.Etna, Campi Flegrei, and Marmara Supersites. Then following the assessment of the results, the CEOS satellite data quotas will be renewed for the next two years. The Hawaii and Iceland reports clearly outlined the success of the Supersite concept, and identified some issues which are going to be addressed by the GSNL 2.0 also during 2016.

In 2015 two new Supersite proposals have been received: for the Gulf of Corinth in Greece, and for a volcanic area in Indonesia. They are presently under evaluation and might be approved in 2016, as well as a previous proposal which is presently awaiting integrations: the San Andreas Fault Supersite.

The three European research projects funded by the EC for a total of 18 M€ will also come to an end in mid-2016, and their conclusion will be the occasion to verify whether the Supersite concept, when sustained by adequate funding resources, is really successful.

The GSNL initiative management will continue to carry out coordination, outreach, and fundraising actions.

In this respect a specific Supersite scientific session has been organized at the European Geosciences Union symposium in April 2016. Another community action planned for 2016 will be the usual Supersite splinter meeting at the American Geophysical Union Fall Meeting in December. Coordination with CEOS space agencies and their initiatives, as the Disaster Risk Management initiative, will continue, facilitated by the active participation of the GSNL SAC Chair to the CEOS WG Disasters, which involves also several other Supersite scientists.

We will exploit the agreement put in place in 2015 with the International Charter on Space and Major Disasters to provide voluntary support by Supersite scientists during emergencies which have become Charter activations and Event Supersites.

We will continue to disseminate the initiative at major stakeholder meetings, and broaden the community, promoting and stimulating the submission of new Supersite proposals, with particular attention to developing countries.

We will continue to support the Supersite PoCs and communities to facilitate their access to data, scientific knowledge and tools, and resources.

4. List of activity contributors

We list below the members of each Permanent Supersite community (Point of Contact in boldface). Several other researchers have been involved only in specific Event Supersites.

HAWAII VOLCANOES SUPERSITE		
Name	Email	Affiliation
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5. Funding sources for 2016

GSNL is a voluntary partnership, and the necessary resources are normally obtained within the various Supersite communities and at the central management level. While this scheme may be improved in the next years, the following is what is expected now for 2016.

An approximate amount of few hundred thousand Euros is the funding totally available for the completion of the three EC projects (up to mid 2016) which supported the development of four European Supersites. Support for the long term maintenance of the Supersites is being sought.

An amount of several hundred thousand Euros is available in 2016 (first project year) on a EC project aiming to build a Virtual Research platform for which the Supersite Community is one of the main Users.

In kind contributions are provided by each Supersite team for data collection and sharing; some may also receive external funding.

In kind contributions are provided by the CEOS. The large amount of commercial satellite images provided has an approximate market value of 2-3 M€ per year.

UNAVCO and IRIS provide support to the respective communities for the in situ data dissemination from the Supersite networks.

DLR provides in kind contribution in the form of a satellite data dissemination platform dedicated to the Supersite SAR data.

The ESA Geohazard Exploitation Platform (GEP) is providing in kind contribution in the form of processing time, satellite data dissemination and support.

ASI also provides in kind contribution in the form of a data dissemination platform federated with the ESA GEP.

6. Future Plans

Since 2015 a process of revision of the GSNL initiative has started, with the general objective to increase its direct societal benefits in the geological risk management chain.

In fact, while indirect societal benefits, as the easier and more complete data access and the new scientific advancements, are well addressed by the involved communities, the eventual uptake of the new knowledge and the involvement of the risk management community were not original requirements of a Supersite. The implicit assumption was that the new knowledge disseminated in the scientific literature, would eventually be taken up by the DRM users.

However, as for many other scientific disciplines, the spontaneous uptake of new geohazard science and knowledge is neither fast nor efficient, and it has increasingly become evident that the timely and effective provision of direct societal benefits, in the spirit of GEO, prompts for some adjustments to the GSNL initiative.

The most important changes of GSNL 2.0 will have to do with reinforcing the Supersite communities and assuring a better governance of the value adding processes through the following main pillars:

- promote increased collaboration and knowledge sharing within the Supersite scientific community;
- acknowledge the role of the national scientific community which is part of the local risk management chain;
- involve the Disaster Risk Management community in the Supersites (and in the GSNL governance).

Indeed, some Permanent Supersites communities already comply with the above requirements, and have demonstrated to be able to generate strong and direct advantages on hazard assessment and risk prevention.

The challenge of GSNL 2.0 is to bring the global scientific community to take more responsibility in how the new geohazard knowledge it generates can support the actual needs of the DRM community involved in a Supersite. To these aim, the GSNL 2.0 will take advantage of the positive examples of some Supersites communities and promote the transfer of their experiences into other Supersite contexts.

The resource needs for GSNL 2.0 are divided in three main sectors: the general community infrastructure, the single Supersite infrastructures, and the research work, this latter including knowledge transfer and the uptake by DRM users of geohazard information.

The general community infrastructure will be resourced through the synergic exploitation of international initiatives for geophysical data dissemination (e.g. IRIS, UNAVCO, EPOS, DLR Supersite portal, USGS Earth Explorer, etc.) and processing service provision (ESA-Geohazard Exploitation Platform). In addition, specific funding for the development of a collaborative platform for the Supersite community has already been obtained within an EC H2020 research infrastructure project for the period 2015-2018 (EVER-EST project, led by ESA).

Resources for the single Supersite infrastructures are essentially needed for the maintenance and development of the in situ monitoring networks, and for the long term Supersite management. The resources for network development should be obtained directly by the local community through national or international (e.g. development funds) projects, while long term maintenance of a Permanent Supersite requires similarly long term institutional commitments, normally obtained at national level.

The funding needed to carry out the scientific research will be for the most part obtained by the scientific community using their normal channels (e.g. national research funding agencies). In this respect the community will be able to leverage on the Supersite framework and collaborative environment, and on the clearly focused societal benefits of the initiative.

Based on the successes of the well established Supersites and on the planned improvements to the initiative, we propose the implementation of GSNL 2.0 as a GEO Flagship. An implementation plan will be submitted to the GEO Program Board in January 2016.

GI-09 Global Wildfire Information System

1. Overview

Wildfires continue to present a major risk in many countries. It is estimated that nearly 400 Million ha of natural areas are burnt every year causing large environmental and economic damages and contributing to the increase of carbon emissions worldwide. Wildfires have seasonal and regional patterns, which are reflected in different fire regimes across the globe and several National and supranational organizations have established systems aiming at providing early warning for large fire events to minimize the effects of catastrophic fires.

Earth observations (Eos) and information, derived both from space and surface networks, have demonstrated not only their maturity, but their critical role in supporting first responders and risk managers by providing effective tools to rapidly map natural hazards and assess impacts.

There is an increasing amount of spatially explicit data and information on Wildfires being collected at the national and global levels. However, the lack of an international initiative to pull resources and information together did not exist.

GEO provides a unique platform for international cooperation. In the area of wildfires, the Global Wildfire Information System initiative aims at bringing together existing information sources at regional and national level in order to have a comprehensive view and evaluation of fire regimes and fire effects at global level.

The task will build on the ongoing activities of the European Forest Fire Information System (EFFIS), the GTOS GOFC-GOLD Fire Implementation Team, the associated Regional Networks, complementing existing, related activities that are on going around the world, with respect to wildfire information gathering.

At the regional level, GWIS builds on the European Commission activities around the European Forest Fire Information System (EFFIS), which currently provides information for the pan-European territory, Middle East and North Africa, and its associated network of 43 countries in that region.

In countries that currently do not have a wildfire information system, GWIS will fill this gap and help countries engage in international collaboration. For countries and regions where wildfire information systems exist, GWIS will provide a complementary and independent source of harmonized information adding to the national/regional information sources.

GWIS includes the following activities:

1. Establish and further develop a prototype Global Wildfire Information System (GWIS) providing harmonized fire information (e.g. fire danger) – building on initial activities of the European Commission in the European Forest Fire Information System and the Global Observation of Forest Cover-Global Observation of Land Dynamics Fire Implementation Team (GOFC-GOLD Fire IT).
2. Promote the networking of major national and regional fire information providers by organizing an annual workshop convening key international organizations and initiatives (e.g. GOFC-GOLD Fire IT) and national and regional providers, e.g. Australia, Canada, China, Central and South America and South Africa.
3. Establish operational links and, if possible, arrangement with other wildfire communities dealing with wildfire aspects at global scale (e.g. burnt area assessment, emission estimation).
4. Further develop the GWIS by integrating and harmonizing as much as possible regional data wildfire information sources.
5. Develop, implement and promote the establishment of mechanisms for interoperability and communication among national, regional and global wildfire information systems following OGC standards and guidelines, and the GEOSS Data Sharing Principles.
6. Coordinate and promote capacity building and training activities in close cooperation with the GOFC-GOLD Fire Implementation Team regional networks and the EFFIS network.

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3. 2016 activities

M1 Workshop of GWIS partners – Q4 2016

M2 Consolidated prototype of the GWIS – Q4 2016

4. Resources

GWIS is supported by the European Commission Joint Research Centre activities on forest fire monitoring in the context of the extension of the European Forest Fire Information System to the global scale. The contribution of the EC Joint Research Centre includes the development and maintenance of a prototype Global Wildfire

Information System

The participants in the GWIS initiative will provide in kind contribution through their participation in the meetings and teleconferences. Contributors to GWIS will provide support for the editing of documents and reports during the life span of the Initiative. The list of participants and their contribution will be regularly updated along the duration of the project.

The European Commission Joint Research Centre, in the context of its activities within the Copernicus program, foresees the provision of financial resources for the organization of an annual workshop. No other specific financial support is provided by any of the Institutions participating in the task.

5. Additional activities for 2016

Establishment of contacts and synergies between the GOFD GOLD Fire Implementation Team regional networks and the GWIS.

GI-10 EO data and renewable energies

Overview

Energy is an essential factor for sustainable development and poverty eradication. Nevertheless, it is estimated that in 2015 still about 2.8 billion people have no access to modern energy services and over 1.1 billion do not have electricity. Furthermore, around 4.3 million people are dying prematurely every year due to indoor pollution resulting from cooking and heating with unsustainable fuels. The challenge lies in finding ways to reconcile the necessity and demand for modern and sustainable energy services with its impact on the environment and the global natural resource base in order to ensure that sustainable development goals are realized.

Given the considerable attention being paid to establishing green, sustainable economies GEO's efforts in the Energy domain should be strategically positioned to make a significant impact globally by enhancing the ongoing activities and increasing linkages with sustainable development efforts.

No specific EO system or program dedicated to Energy exists, but the Energy Domain is using EO systems and programs dedicated to others domain to extract relevant energy information. Nevertheless EO data or information sets dedicated to Energy are existing and a lot of resources are available within GEOSS (from Data Core resources to web services all compliant with the GCI).

Considering the Sustainable Development Goals in the Energy domain and the GEOSS targets, there is a need to:

- Support the development of Earth observation products and services for energy management.
- Consider end-to-end energy production systems (including generation, transmission, distribution, and integrated operations).
- Promote collaboration between users and providers of Earth observation and information.

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

2016 Activities

During 2016, an implementation plan for GI-10 during the new GEOSS work plan should be developed. In this aim, the GEOSS Energy Community of Practices will be mobilized to provide its views in links with the new organization proposed for the period 2016-2025.

For the GEO transitional work programme 2016, a set of activities is already existing. The activities described hereafter are:

- The H2020 ConnectinGEO project (2015-2017) has an activity related to identification of essential variables for renewable energies, gap analysis and industrial challenges on in-situ measurements (<http://www.connectingeo.net>)
- The pre-operational COPERNICUS MACC service for Solar Radiation (<https://www.gmes-atmosphere.eu/catalogue/#list?st=Solar%20radiation>) will be transformed into an operational service within the H2020 Copernicus Atmosphere Monitoring Service (CAMS) project.
- The Participation to AIP-8 (2015) through the ConnectinGEO project for Enhancing GEOSS Webservice-Energy SDI with Sensor Observation Service capacity for the Energy SBA.
- The launch of the H2020 ERA PLANET project, a major contribution from Europe to GEOSS, with specific inputs for Energy within the Strand 2 – Resource efficiency and environmental management
- Activities of the Federation of Earth Science Information Partners (ESIP) Energy & Climate Working Group to enhance communication between data providers at US Federal agencies and renewable energy decision makers.
- Continuation of the compilation of resources related to energy within the catalogue of the community portal <http://www.webservice-energy.org>
- Improvement of the Global Atlas for renewable energies from International-Renewable Energies Agency – IRENA (<http://irena.masdar.ac.ae/>).
- A workshop will be organized in 2016 focused on new applications using NASA and other US agency Earth science resources for energy management decision making.
- A new geospatially enabled web portal to feature upgraded renewable energy data sets derived from NASA and other observations spanning 30+ years at ½ x ½ degree resolution is being produced (<https://eosweb.larc.nasa.gov/sse/>)

2016 Resources: TBD

Additional Activities for 2016: Recommended if additional resources are being sought –

Development of the 2016-2025 implementation plan of the GEO Energy Initiative
Tentative launch of an industrial professorship dedicated to GEOSS and renewable energies.
(2015-2016)

GI-11 Information Services for Cold Regions

- **Overview**

Coordinate global, joint efforts to provide Earth observations and information services to decision-makers over the vast Cold Regions areas, including the North Pole, South Pole, Himalaya-Third Pole and Mountain areas.

Objectives and actions

- Build a global network to archive, manage, and provide access to in-situ and remotely-sensed earth status data and social humanity data for monitoring the global cold regions through appropriate national, regional and global systems, centres and programs.
- Provide sustained observations and information exchange mechanism to understand the global change over the cold regions, and address their fragile ecosystem and environmental challenges and societal influences.
- Establish a proactive framework for the development of information and related services, the Global Cold Regions Community Portal, to underpin the Global Earth System of Systems implementation by expand the outreach of, and maximize synergies among, thematically wide GEO activities and thematically deep participant activities, thereby exploiting their complementary roles.
- Advocate open data policy, and free access to the earth observations data over Cold Regions.
- Strengthen the synergies and partnerships with policy-makers, stakeholders, and funders over the cold regions' ecological and engineering fields, and improve the public awareness through the capacity building.

- **Leads and contributors**

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- **2016 Activities**

- Building connections and collaboration between the participating organizations, projects and communities (joint on-line conferences and meetings)
- Building cross-cutting connections and collaboration with cold-regions related activities within GEO (a joint committees, including programs' chairs, leaders and points of contact, as support to information services including scientific & technology group, data and information group, GEO secretariat, and users' engagement group) (GEO Plenary and other joint GEO meetings).
- Starting to plan and establish the key or essential variables for cold regions (draft paper)
- Providing observations and products on various scales from cross-continental to regional and in-situ scales (contributions to GEOSS Data-Core etc)

- Bridging the remote-sensing and in-situ communities in the field of cold regions earth observations (joint workshop/seminar in connection or back-to-back with a scientific conference etc. labeled with the GEO/Cold Regions)
- Promotion of awareness the gaps in the scientific knowledge over cold regions (outreach, user engagement, user community, policy makers and stakeholders at various levels)
- Leveraging the use of cold regions related results and products for implementation in strategic assessments by scientific organizations, policy making and other end-users (meetings and knowledge exchange with organizations, consultations etc)
- Supporting, including financially, the so-called «Polar Challenge» (<http://www.wcrp-climate.org/polarchallenge>) from The World Climate Research Programme (WCRP) and the Prince Albert II of Monaco Foundation (FPA2) This challenge aims at rewarding the first team able to complete a 2000km mission with an Autonomous Underwater Vehicle (AUV) under the sea-ice in the Arctic or Antarctic.
- Supporting the preparation phase of the Year of Polar prediction (YOPP, <http://www.polarprediction.net>; lead: Prof. Thomas Jung, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research)
- The Global Cryosphere Watch (GCW) will hold its second Asia CryoNet meeting in February 2016 in Salekhard, Russia. The goal is to further develop a regional GCW group focused on surface measurements in the Third Pole region and the Russian Arctic. A similar effort is underway in South America, with a second South America workshop planned for 2016. (\$120,000 for both workshops).
- SAON will continue to work with these contributions: Documenting and understanding the Arctic data management ecosystem; Identifying and promoting common metadata elements; Engaging in data citation and publication movement; Promoting interoperability through action - interoperability experiment; Inventory of arctic observational projects as a contribution to EU PolarNet; Community Based Monitorin (CBM) atlas.
- INTERACT continues building capacity for research and in-situ observations throughout its pan-arctic station network, and bridging of the in-situ and remote sensing communities via joint activities and events. Open access to metadata and data and will be advocated in the station network, as well as efforts to connect open access metadata and data with global data portals such as the GEOSS Data-CORE. Collaboration with arctic and polar scientific organizations and input to strategic and scientific assessments continues. Outreach activities to inform policy makers, other stakeholders and the general public will be continued in various forms. (in-kind, national and international resources for 2016 to be identified later in 2015)
- PEEEX will launch a comprehensive PEEEX metadata collection and build a Modelling Demo ("PEEX View").
- SIOS implementation phase will be supported by Italy, in the perspective of the extension of the CCT-IP concept to other areas of Svalbard (Euro : 100, 000)
- IADC (Italian Arctic Data Centre) will be implemented as the portal of the Italian research activities in the Arctic. In the frame of the Antarctic Research National Programme (PNRA) a distributed cyber-infrastructure (National Antarctic Data Center- NDAC) will also be developed. Both actions, based on the brokering approach will be integrated in a unique Polar Data Infrastructure (PDI) (Euro: 200.000).
- Establish flagship stations within the Third Pole region for observation and monitoring; (US Dollars : \$200,000),Set up rain gauge along the altitudinal range from 2000 m to 6500 m in a river basin of the Tibetan Plateau, and to obtain the elevation-dependent precipitation data.
- Snow Observations over Tibetan Plateau (SOTP) will continue to explore the remote sensing snow cover products over Tibetan Plateau, with in-kind and somehow \$120,000 support from NSFC.

- ESA – MOST Dragon 4 Hydrology and Cryosphere Theme: It is expected that the current 10 projects under Dragon 3 will be clustered and continue through fewer but larger projects. As in Dragon 3, ESA is expected to provide limited support towards PhD / postdoc work under selected research projects. MOST / NRSCC supports Dragon projects through open Call for Proposals. Total resources committed to selected projects approximately estimated at 2 106 € over the period 2016~2019.
- CNR through Climate Change Integrated Project (CCT-IP) will continue to promote the upgrading of Ny Alesund as observation super-site in the Arctic (Euro : 100.000).
- A Chinese cubesat named TW-1A aiming for polar sea ice observation is scheduled to launch in October, 2015 and will provide satellite observations from December of 2015 in both Polar Regions. This satellite is proposed by Beijing Normal University and developed by Chinese Academy of Sciences.
- The observations by the intended Chinese Water Cycle Mission (WCOM) with a dual frequency dual polarized microwave radiometer would fill a gap in current European observations and would be highly relevant to monitoring of water resources. The mission will provide observations of SWE, precipitation and soil moisture.(\$1.5M)
- Cryosphere Monitoring Programme (CMP) will continue to explore the snow, glacier, glacial lake and GLOF over Nepal. This program is extended to Bhutan and Pakistan with support from The Norwegian Ministry of Foreign Affairs (\$700,000).
- Through the Belmont Forum Initiatives Italy contributes to Cooperative Research Activities (CRA) of the Arctic Observing and Research for Sustainability and of the Mountains as Sentinels of Change. (Euro : 200.000)
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC), National Institute of Polar Research (NIPR) and Hokkaido University will jointly conduct observations of ocean, land and atmosphere in the Arctic region and continue to promote Arctic Data Archive System (ADS), which will be a part of GEOSS Data-CORE, along with the framework of the “Arctic Challenge for Sustainability Projects (ArCS)” supported by MEXT .

Identification of additional activities will take place in meeting(s) later in 2015.

- **2016 Resources**

In kind contributions. Possible other resources to be identified later in 2015.

- **Additional activities for 2016**

GI-12 Integrated Information Systems for Health (Cholera, Heat waves)

1. Overview

An Integrated Information System for health informs early warning to early action.

The systematic collection and analysis of relevant information about and coming from areas of impending risk that:

- Inform the development of strategic responses to anticipate risks and opportunities and their evolution; and
- Communicate options to critical actors for the purposes of decision-making and response

The goal of this task is to foster the development of integrated information systems that improve the capacity to predict, respond to and reduce environment-related health risks. These

systems combine Earth observations, monitoring and prediction; social, demographic and health information; interdisciplinary research, application and assessment; communication, education and training in order to enhance preparedness and resilience. Three initial focus areas are

- weather and climate extremes (*e.g.*, heat);
- water-related illness (*e.g.*, cholera); and
- vector borne disease (*e.g.*, dengue, malaria).

2. Leads and contributors

The U.S. lead is NOAA. Current or potential partners include the WMO, Regional Climate Centers, WHO (Clim-Health Africa, Climate Program, Water Sanitation and Hygiene), GFCS. Key Bilateral Partners include Canada, Mexico, Germany, South Africa, Bangladesh, Ethiopia, and Japan

3. Activities for 2016

The next step is to establish or continue robust working teams in at least these three topic areas. The teams will identify and engage health partners and clarify health needs; address training needs; identify and address; observation and prediction gaps and needs; and establish work plans with the goal of having at least one prototype system in place for each topic area by 2020.

GI-13 Integration of Methods for Air Quality and Health Data, Remote Sensed and In-Situ with Disease Estimate Techniques

1. Overview

Air pollution and resulting public health outcomes continue to dominate growing estimates of mortality and morbidity associated with environmental risks to communities and society. This GEO priority topic will seek to further develop and implement integration of air quality monitoring, related estimation and modeling protocols optimizing both remote sensing and *in-situ* platforms, including small sensors with the goal of providing improved information for use in public health assessment tools.

There will be an initial focus on the Institute for Health Metrics and Evaluation (IHME), Global Burden of Disease (GBD) estimates, in particular those related to the United Nations (UN) Sustainable Development Goals, with the goal of providing results of sufficient granularity at a scale useful to citizens, communities and decision makers.

2. Leads and contributors

The U.S. lead is EPA. Other potential partners include the Department of Health and Human Services (HHS), the National Aeronautics and Space Administration (NASA), NOAA, IHME, the Gates Foundation, the World Health Organization (WHO), Clean Air Asia, the United Nations Environment Programme (UNEP), AirNow cities and provinces.

3. Activities for 2016

The priority task in part will examine and integrate current real-time 24-hour average and annual average modeling, calculations and techniques to optimize efficient use of data sources

and platforms.

(A) Pilot(s) developed and deployed in a cloud-computing environment using the Environmental Protection Agency's (EPA) AirNow domestic and international technology will be used to test integration and modeling techniques. The resulting investigation and pilot should be completed within 2 to 3 years with further deployment over 10 years.

GI-14 GECO: the GEO Global Ecosystem Initiative

Overview:

Summary. An Ecosystems Societal Benefit Area (SBA) with a number of evolving, multi-component Ecosystem Tasks has existed since the beginning of GEO and GEOSS. For the second decade of GEO (2016-2025), a combined Biodiversity and Ecosystems Sustainability SBA has been established which features a number of new ecosystems-related initiatives. One of those initiatives is the Global Ecosystems (GECO) initiative, which combines new activities related to the H2020 ECOPOTENTIAL and SWOS projects with continuing global ecosystem mapping activities carried forward from the former GEO Ecosystems Task.

In 2014, two H2020 projects focused on the use of earth observations (both remote sensing and in situ) for the assessment of ecosystem services were funded. The two projects are: 1) ECOPOTENTIAL, a large 47-partner Consortium focused on the assessment of mountain environments, drylands, transitional coastal lagoons and Large Marine Ecosystems, and including more than 25 European and non-European protected areas of international relevance, and 2) SWOS (Satellite-based Wetland Observation Service), a smaller 13-partner project focused on developing an operational, remote sensing based, wetland observation service in support of international conventions, regulations and policy frameworks.. ECOPOTENTIAL includes a programmatic emphasis on macrosystems ecology, cross-scale interactions and coupled geosphere-biosphere processes, and it has the goal of building a GEO Ecosystems Community of Practice. The SWOS project directly contributes to the development of a Global Wetland Observation System (GWOS) together with global partners like e.g. GEO and the Ramsar Convention on Wetlands.

In addition to the H2020 activities, global ecosystem mapping work from the first decade of GEO and GEOSS is being carried forward and included in GECO. In partial satisfaction of the former GEO Ecosystems activity (EC-01-C1) to "map standardized, robust, and practical global ecosystems for terrestrial, freshwater, and marine environments", a new global terrestrial ecosystems map was produced in a collaboration between the U.S. Geological Survey, Esri, and a number of international ecosystems experts. This new global Ecological Land Units (ELUs) product is a first-of-its-kind, globally comprehensive, high resolution, and data-derived characterization. While the global terrestrial ecosystems map is now completed, the global marine and global freshwater ecosystem maps are still outstanding. A major collaboration is now underway to produce a first-of-its-kind, 3D global ecological marine units (EMUs) map in analog fashion to the ELUs. The global EMUs map will be developed as a short-term (1-2 years) foundational activity of the GI-14 GECO initiative, and an analog global ecological freshwater units (EFUs) map will be advanced as a longer term (2-3 years) GECO activity.

The scope, timeframe, significance, and resourcing of the two European projects and the two global ecosystem mapping projects (marine and freshwater) are consistent with the nature of the concept and process for developing new GEO Initiatives in the second phase (2016-2025) of its existence, and have been accepted as such. Significant H2020 funding for the two European projects, and significant in-kind support available for the global ecosystem mapping

efforts from Esri, are promising indicators of the commitment and likelihood of success for these activities in GEEO.

Description. Terrestrial and marine ecosystems provide essential goods and services to human societies. In the last several decades, however, anthropogenic pressures are causing serious threats to ecosystem integrity, functions and processes, potentially leading to habitat degradation, creation of uncertainty related to “novel ecosystems” and increased risk of collapse, with related loss of ecosystem services. Ecosystem degradation and loss of ecosystem services can seriously affect human wellbeing and climate processes at local and regional scales (<http://www.unep.org/maweb/en/Framework.aspx>), potentially amplifying the negative effects of global change.

Knowledge-based conservation, management and restoration policies are thus urgently needed in order to ensure delivery of ecosystem benefits in the face of increasing anthropogenic pressures. Fundamental to all these is effective monitoring of the state and trends in ecosystem conditions and services. New monitoring methodologies are now available that combine approaches in geo- and bioscience, remotely sensed data, and *in situ* observations. Best use should be made of existing and future earth observations (EOs) and field monitoring data complemented by appropriate interpretation tools and data services and ecosystem models using these data. Knowledge must be built together with the relevant stakeholders to identify the relevant research outputs and support the use of new data and tools. Finally, synergies must be sought with other key ecosystems-related international initiatives and projects.

The European H2020 Project ECOPOTENTIAL is designed to facilitate significant progress beyond the state of the art in ecosystems assessments and monitoring. It will focus its activities and pilot actions on a targeted set of internationally recognised protected areas (PA) in Europe, European Territories and beyond, and will include mountain, arid and semi-arid, and coastal and marine ecosystems. PAs such as those included in the scope of ECOPOTENTIAL provide essential ecosystem services, but are exposed to a variety of pressures, which can change their very nature. ECOPOTENTIAL sites include UNESCO World Natural Heritage Sites, Biosphere Reserves, National Parks and important Natura 2000 sites. Additionally, two Large Marine Ecosystems (LMEs) in the Mediterranean and the Caribbean are included. In addition to their conservation importance as recognized by official decree, many of the selected sites are directly linked to Long Term Ecological Research (LTER) sites (<http://www.lter-europe.net/>).

In order to conserve wetlands biodiversity, the distribution of wetlands in time and space, which is highly variable, must be well characterized. Remotely sensed imagery offers much promise for this temporal and spatial characterization of wetland systems, some of which are ephemeral. The European H2020 Project SWOS focuses on the development and use of remote sensing information to support conservation and sustainable management of wetlands. Therefore, it follows an application focused and policy / user driven approach to develop an operational information portal and infrastructure that makes high quality data and information products available to users on different levels (local to global) and demonstrates this based on multi-level service cases. .

As mentioned above, a new global ELU map was recently published (December 2014) and is now available for research, assessments, and policy support. The work was produced in a public/private partnership between the USGS and Esri, and is in active deployment, curation and improvement. The ELUs were developed as an integration of four global characterizations of the primary elements of ecosystem structure (bioclimate, landform, lithology, and land cover). Since its initial release, a new global landforms and a new global land cover product have been developed. Since these represent two of the four input layers, the ELUs were

remodeled using the new inputs, and a version 2.0 of the ELUs is now available.

Now turning their attention to global ecological marine units (EMUs), Esri and the USGS are teaming up again to produce a global EMU map in analog fashion to the ELUs. The EMUs will be a first-of-its-kind characterization of marine ecosystems, and will be derived from data at a relatively high spatial resolution and in true 3D. A methodology has been developed based on 3D statistical clustering of globally comprehensive marine physical environment data. The method has been successfully prototyped for marine ecosystems off the California coast, and the global implementation has commenced. A steering committee of experts from USGS, Esri, and other international organizations (e.g. UNESCO, IUCN, NOAA, NatureServe, World Bank, etc.) is actively managing and promoting the effort. The global EMU map is anticipated to be completed by January 2017. Meanwhile, a parallel global ecological freshwater units (EFUs) mapping effort is in discussion. It has not yet commenced in earnest, but will soon, and is anticipated in a 2-3 year timeframe. The EFUs will be modeled as ecologically meaningful surface waters (lakes, ponds, stream reaches, etc.) and will be overplotted (burned in) on top of the ELUs. The development of the global EFUs map will be done in close collaboration with the emerging SWOS (Satellite-based Wetland Observation Service), itself a priority activity of GECO. Together, the global EMUs and EFUs constitute a major deliverable from the GEO Global Ecosystems initiative.

Based on these existing perspectives and results, the GECO Initiative intends to build upon available results and extend them to a global scale, identifying Protected Areas of international relevance where the same methodology used in ECOPotential can be applied. Parallel to this, GECO intends to support the efforts of extending and improving the ELU, EMU, and EFU maps currently in development, and fostering other research initiatives of the same kind.

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Other contributors as appropriate as the initiative grows

2016 Activities

- Support the global ELU and EMU mapping, contributing with data and results in a close collaboration with the USGS group.
- Discuss how to export the results of ECOPotential and SWOS to other ecosystem types and regions of the world, using the know-how and expertise developed during these two projects to set up a global monitoring and modelling approach to ecosystem functions and services.
- Contribute ecosystem data, results and models to the system of GEOSS portals.
- Create a partnership of key stakeholders and start the construction of the GEO Ecosystems Community of Practice.
- Plan a set of training course on the use of Earth Observation data in the management of ecosystems and preservation of ecosystem services.

- Support the development of conservation and management policies at international level, with the participation of international entities such as UNEP, UNESCO, IUCN, the Ramsar Convention on Wetlands, and others.
- Invite representatives of Protected Areas with other ecosystem types and from other regions of the world to the General Assembly of the ECO-POTENTIAL project in mid 2016.

2016 Resources

EUR 4M (cash) + EUR 500k (in-kind) (ECO-POTENTIAL)

EUR 1.66M (cash) (SWOS)

US\$ tbd, but substantial (in-kind) (Esri/USGS)

GI-15 GEO-GNOME Initiative: GEO Global Network for Observation and Information in Mountain Environments**Overview**

Mountains are globally distributed environments, which are home to a significant fraction of the world's human population, flora and fauna. These mountainous environments are rich in endemic and, sometimes, endangered species, particularly within biodiversity hot spots. Simultaneously, mountain ecosystems and environments are directly linked to downstream regions through natural pathways (e.g. rivers and ecologic corridors) as well as human infrastructures. Through these pathways, mountains play an important sustainable development role by providing essential water resources and services to not only the communities living in proximity, but also to the surrounding downstream societies and ultimately the global community.

The role of mountain regions and the associated challenges have also been given special attention in the UN Conference on Sustainable Development Rio+20 outcome document "The Future we Want" (see mountains chapter, paragraphs 210-212) which builds on previous declarations, including the mention of mountains in Chapter 13 Agenda 21 in 1992 and other important policy documents.

All mountain areas and mountain ecosystems are sensitive to the effects of climate, global and environmental change. The threat of losing crucial goods and services and associated benefits for the well being of communities depending on mountain resources is increasing (mountain societies in particular). And although mountain regions in diverse areas around the globe share many common aspects, they are often trans-boundary in nature and have individual peculiarities, which need to be both specifically and commonly addressed. It is also important that data and information exchange between the various mountain regions be facilitated, and access to this existing body of knowledge be made more readily available to policy makers and decision makers in order to respond to the challenges faced by mountain communities.

For all these reasons, it is essential to establish a Global Network for Observations and Information in Mountain Environments (GNOME), utilizing the partnership framework of the international Group on Earth Observations (GEO). GEO-GNOME will capitalize on previous achieved results and outcomes (such as GLORIA and other global and regional initiatives), with the goal to provide free and open-access to data and products, scientific results and future climate and environmental projections; foster exchange of data and information across

different mountain areas and between the scientific community and stakeholders and better connect them; build capacity in mountain research, especially in remote areas; and create a distribution system for the dissemination of this knowledge, in particular to the local communities and decision makers to enable for change.

Particular importance will be given to the definition of national or trans-boundary *Supersites* and regional *Natural Laboratories*, such as the area of Karakoram and specific regions in South America, Africa and elsewhere, including internationally relevant protected areas. These natural laboratories can serve as pilot areas for monitoring and measuring ongoing changes, develop future scenarios with special emphasis on ecosystem services, and implement adaptation strategies through discussion with local populations and governments, taking into account also the needs of downstream populations.

With this as motivation, GEO-GNOME plans to:

- Create a comprehensive partnership of key stakeholders and network of existing measurement and observation systems in the mountain areas, collecting the data and information; and making them available through the GEOSS portals.
- Stimulate new measurements and observational campaigns in mountain areas, with special emphasis on sensitive areas and UNESCO designated Biosphere Reserves, Natural Heritage Sites and internationally relevant protected areas, stimulating the design of new/better management of existing protected areas and the establishment of new parks.
- Provide the Earth observations necessary to support implementation and monitoring of international conventions and agreements, such as the Convention on Biodiversity (CBD), the United Nations Framework the Convention on Climate Change (UNFCCC) as well as regional mountain arrangements and agreements such as the Alpine and Carpathian Conventions.
- Make best use of Earth observations and remote sensing data, which can display critical aspects of mountain areas with complex topography and high elevations.
- Develop capacity-building strategies and concrete activities in mountain monitoring and sustainable development, through the provision of on-site courses and training exercises with a particular focus on developing countries with fragile mountainous ecosystem.
- Identify potential *Supersites* and *Natural Laboratories*, with the related Points of Contact and/or Regional Champions, and start operational activities in the selected areas.
- Create highly visible and valuable outputs (e.g. reports with summaries specifically dedicated to groups interested in mountain environments) to stimulate the interaction between researchers, stakeholders and in particular policy makers to identify the key environmental and associated issues in each mountain area and trigger relevant needed action on the various levels (global, regional etc).

The GEO SBAs supported include Biodiversity, Climate, Disasters, Ecosystems, Water, and Weather.

2016 Activities

1. Telecon to be held in winter, 2016.
2. One general workshop, to be held in spring/summer 2016
3. Census of the existing mountain observatories and initiatives, in collaboration with MRI
4. Collaboration with the Belmont CRA "Mountains as Sentinels of Change", especially in the in-kind activity on mountain observatories

5. Collaboration with the H2020 project ECOPOTENTIAL (for what concerns mountain ecosystems) and the newly-funded ERA-NET on climate services, to support the need for "mountain services"
6. Identification of the priority scientific issues (e.g., elevation dependent warming; mountain hydrological cycle; effect of extreme events on the mountain environment) and related strategies of implementation
7. Organization of two workshops with stakeholders, in key mountain areas of the world, to define the societal demands and challenges

2016 Resources

EUR1M (cash and in-kind)

Participation (updated spring 2015)

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GI-16 GEO-DARMA (Data Access for Risk Management)

1. Overview

GEO-DARMA aims at addressing priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030 using Earth observations (EO). GEO-DARMA will facilitate the sustained provision of accurate EO-based risk information products and services to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs). The ultimate goal is to establish an inclusive, comprehensive process to address local DRR requirements by using EO technologies efficiently. Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end users and to increase awareness within donor agencies of the promise of EO solutions. EO-related capacity building is a key challenge in many developing countries. GEO-DARMA includes a capacity building component both at the outset, from the project initiators towards early pilot countries, and throughout the project, as knowledge gained in the early phases is transferred between pilot countries and the GEO-DARMA effort is extended from early adopters to other countries in region.

Until recently, stakeholders involved in disaster risk management (DRM), including space agencies, have focused their efforts mainly on the response phase, immediately after the crisis. Independent studies from organisations including the World Bank and the European Commission have indicated that for every \$1 invested in disaster prevention, \$4 to \$7 are saved in disaster response.

Progress in every aspect of Disaster Risk Reduction (DRR) requires strong international collaboration given limited capacities and resources. GEO-DARMA aims at supporting the practical implementation of some critical elements of the Sendai Framework for Disaster Risk Reduction 2015-2030.

The broad goal is to define and implement end-to-end solutions that respond to the real needs of the user community. Space EO technology presents new opportunities in this area of work; the challenge is matching such capabilities to those end users most urgently in need. GEO-DARMA will facilitate the sustained provision of accurate EO-based risk information products and services to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs). The ultimate goal is to establish an inclusive, comprehensive process to address local DRR requirements by using EO technologies efficiently. Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end-users (e.g. Civil protection agencies, and other agencies and ministries at the national level) and to increase awareness within Donor agencies of the promise of space solutions.

The development and subsequent improvement of prototype solutions for a smaller set of initial target countries will also benefit to the neighbouring countries with marginal additional efforts through capacity building activities. EO-related capacity building is a key challenge in many developing countries. GEO-DARMA includes a capacity building component both at the outset, from the project initiators towards early pilot countries, and throughout the project, as knowledge gained in the early phases is transferred between pilot countries and the GEO-DARMA effort is extended from early adopters to other countries in region.

GEO-DARMA aims to increase the availability and accuracy of risk related information to allow decision makers to simulate the impact of risk reduction measures and make informed decisions about risk reduction investment. In the long term, national and local users will benefit from a more accurate risk-information in complement to their other tools, helping to take appropriate DRR and

resilience measures.

Previous development and results

The initiative will leverage on-going projects and initiatives as much as possible through improved coordination. For instance, relevant outcomes and experience from the CEOS Flood, Volcano and Seismic Hazard Pilots and the Recovery Observatory will be included and improved on; GEO-DARMA may become a mechanism to ensure successful elements of early pilots find a path towards sustainability. In each region, the GEO-DARMA team will examine past experience and identify elements that can be built on.

Partners

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The accomplishment of the task will require the active support of major stakeholders in the field of DRM at global, regional and national level in order to implement a series of pilot projects.

The partnership will be constructed progressively according to the implementation needs and phases.

The Partners sought for GEO-DARMA will be typically from the following groups:

- International and regional stakeholders knowledgeable about regional issues related to disaster risk management such as relevant UN agencies, Global Facility for Disaster Reduction and Recovery (GFDRR), Development banks, etc ...
- National institutions and agencies
- Representatives from the end user communities
- EO and non-EO data providers:
 - o Satellite data providers such as CEOS Agencies (incl. major space agencies in the world) and commercial satellite operators when possible.
 - o Other EO data and information providers
- Providers of risk and other relevant information derived from EO data
- o Practitioners – Value added information providers including private sector
- o Scientists

Activities description

The partners will identify and assess the critical needs of the participating disaster management communities and establish priorities. GEO-DARMA will begin by selecting a few user's defined priority themes, building on strong elements from existing initiatives and choosing those elements most likely to be scalable at a regional and global level. Once the usefulness of the implemented prototypes has been demonstrated in a few countries, the extension to neighbouring areas could be envisaged whenever applicable.

Resources

Each stakeholder engaged in the GEO-DARMA initiative will be requested to actively contribute to the various phases on a voluntary basis with contributions in kind.

The number and nature of projects to be started in the prototyping and operational phases will depend on the recommendations made by the Regional Institutions, on their assessment by the GEO-DARMA contributors and on the resources that can be allocated by the potential implementers.

GI-17 Global Urban Observation and Information

Overview:

The Global Urban Observation and Information Task has set the following goals for the period of 2012-2015: (1) Improving the coordination of urban observations, monitoring, forecasting, and assessment initiatives worldwide; (2) Supporting the development of a global urban observation and analysis system; (3) Producing up-to-date information on the status and development of the urban system - from local to global scale; (4) Filling existing gaps in the integration of global urban observation with data that characterize urban ecosystems, environment, air quality and carbon emission, indicators of population density, environmental quality, quality of life, and the patterns of human environmental and infectious diseases; and (5) Developing innovative techniques in support of effective and sustainable urban development.

For the period of 2016-2025, we support the GEO's proposal that a single GEO Initiative on urban issues will be created in the new Work Programme. All activities are continuous in nature or extensions of the GEO SB-04 activities, which make it easy for the transition in 2016.

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2016 Activities:

- Global Urban Supersites Initiative (Expanded to **Megacities Observation and Monitoring – MOM program**: Currently supported by ESA DUE Innovators III (1/1/2015 - 12/31/2016) and Hong Kong Research Council (1/1/2016 - 12/31/2017), with partners from DLR, Chinese University of Hong Kong, Indiana State University, and National Observatory of Athens, Greece. A new partner starting in 2016 is Chinese Academy of Sciences, supported by National NSF of China (Grant No. 41201357). These projects focus on impervious surface data generation and providing the data sets for municipalities for megacities in the world.
- Continued generation of **Global Human Settlement Layers** at various international and national levels and seek synergies among them. Dr. Weng has recently discussed potential collaboration with the National Administration of Surveying, Mapping and Geo-information of China, which has developed a global land cover dataset at 30 m resolution for 2000 and 2010. A special session will be held at 2016 ISPRS Congress to discuss about it.
- Implementing **Global Urban Remote Sensing Laboratory** through joint projects: This activity has one funded project with €999,870, titled “Thematic Urban Observation Hub (TURBO-Hub), supported by ESA Thematic Exploitation Platforms (TEP) program, 1/1/2015 - 12/31/2016, with Thomas Esch, DLR, as the PI with several co-Leads of SB-04 from Indiana State, National Observatory of Athens, University of Pavia, Italy, and KTH Royal Institute of Technology, Sweden. A new project has recently been awarded €200,000 through ESA DUE INNOVATOR III on Global Urban Services using Sentinel-1/-2 data (3/1/2015-2/28/2017) to University of Pavia and KTH Royal Institute of Technology.
- Initiate a joint project of Impervious Surface Mapping in Tropical and Subtropical Cities - **ISMiTSC** (Asia, Africa, and South America): This initiative focuses on urban mapping and providing datasets and EO technology services to **developing countries**. A preliminary research has been conducted in selected cities in South America, Africa, South and East Asia with data support from DLR and research collaboration between Chinese University of Hong Kong, Indiana State, DLR and University of Pavia. Preliminary result will be published in late 2015 via a book by CRC Press/Taylor & Francis Group.

- Establish a Global Institute of Sustainable Cities (**GISC**) - Explore EO as a enable technology for development of sustainable cities and for supporting GEO's objective on urban resilience and coastal resilience by supplying objective data/information on the footprint of global urbanization and assisting in the development of indicators for sustainable cities to support the UN's sustainable development goals. This initiative has recently been funded at 5 million RMB Yuan by Fujian Normal University, China, 2015-2020.
- The International Program on Global Urban Observation and Public Health (**IPUP**) - linking global urban environment monitoring with public health from space and *in situ* measurements: This initiative was initiated in Changsha, China, in June 2014, and has obtained support from Global Institute of Sustainable Cities (GISC), Fujian Normal University, China (PI, Q. Weng). An international workshop was held in Wuhan, China, June 17-18, 2015, to discuss about this initiative, and will continue the workshop every year.
- Create an annual **International Summer School** to train and educate students and young researchers worldwide in conjunction with GEO Urban annual symposium/workshop: This initiative will be discussed further during conference of the Mapping Urban Areas from Space – MUAS 2015 at ESA – ESRIN (Frascati - Italy), November 4-5, 2015.
- Organize **Annual GEO SI-13 Symposium** (in conjunction with a conference, e.g., JURSE, EORSA, or a designated workshop from a project) to showcase results, to promote GEO/GI-13 goals, to engage users, and to foster synergies among international contributors. Each symposium has a specific theme. Sponsor an urban public health workshop that will assess the integration of our data and products into public health decision makers. The 2016 Annual Global Urban Observation Symposium will be held in Fuzhou, China, in conjunction with the 4th EORSA international conference.
- **Collaboration with ISPRS and IEEE GRSS**: There will be a special session (SpS18: Earth Observation from Global Land to Urban Systems) at ISPRS Congress, July 12-19, 2016, Prague, Czech, and another special session (focus on Sensors and Sensing Techniques for Urban Areas) at 2016 IEEE International Geoscience and Remote Sensing Symposium, Beijing, July 10-15, 2016.
- Facilitate **publications** and disseminate the results through collaboration with Elsevier and Taylor & Francis: A new Elsevier journal “*Remote Sensing Applications: Society and Environment*” (starting Oct. 2014) has a focused section on urban observation and applications (G. Xian; X.L. Ding, Associate Editors); A theme issue on Earth observation from global land to urban systems is planned to publish at *ISPRS Journal of Photogrammetry and Remote Sensing* in 2016/2017; CRC Press/Taylor & Francis Group will publish a book titled “*Remote Sensing for Sustainability*” in 2016/2017.
- Continue to seek synergies with other GEO tasks/initiatives, such as Global Land-cover and Land-cover Change, Global Ecosystem Classification, Mapping and Inventory, Extension and Improvement of the Climate Record, and Air-borne Diseases, Air Quality and Aeroallergens; Investigation of the relationship between the thermal urban environment and heat-related morbidity and mortality.

2016 Resources:

Projects:

- German Remote Sensing Data Center (DFD) and German Aerospace Center (DLR) in support of global urban footprint production.
- US Geological Survey (USGS) Earth Resource Observation and Science Center (EROS) in support of national land cover datasets generation.
- “Thematic Urban Observation Hub (TURBO-Hub), supported by ESA Thematic Exploitation Platforms (TEP) program, 1/1/2015 - 12/31/2016, led by DLR.

- “Earth Observation for Urbanization” (EO4U)” supported by the ESA DUE-Innovators III program, 1/1/2015 – 12/31/2016, led by DLR.
- ESA DUE INNOVATOR III on Global Urban Services using Sentinel-1/-2 data (3/1/2015-2/28/2017) awarded to University of Pavia and KTH Royal Institute of Technology.
- “Improving the Estimation of Impervious Surfaces Using Optical and Polarimetric SAR Data in Humid Subtropical Urban Areas” supported by Hong Kong Research Grants Council led by Chinese University of Hong Kong, 1/1/2016-12/31/2017.
- TREASURE: Thermal Risk rEDuction Actions and tools for SecURE cities, supported by a European Civil Protection project, led by National Observatory of Athens, Greece.
- “Continuous Monitoring of the Distribution of Urban Temperatures in 5 Greek Cities’ in Excellence Research Programs General Secretariat for Research and Technology (Greece)- SIEMENS awarded to National Observatory of Athens, Greece, 2014-2016.
- DRAGON 3 (KTH, UNIPV, DLR) - “Urbanization project”: Use of European and Chinese EO data to monitor urban expansion in selected areas of P.R. China.
- NASA Goddard Space Flight Center/Marshall Space Flight Center Interdisciplinary Science Project, “Combining satellite data and models to assess the impacts of urbanization on the continental United States surface climate”.
- ABCC (CEODE, CAS & JRC): NSF of China project of “Comparative Study on Global Environmental Change Using Remote Sensing Technology”.
- NOAA’s National Geophysical Data Center has a long standing program to generate and provide open access to global nighttime lights from satellite data.
- Global Talents Program of Fujian Normal University, China, in support of creation of Global Institute of Sustainable Cities.
- Funding for projects related to the NASA National Climate Assessment program.
- The European Commission, JRC project: “Global Human Settlement Analysis for Disaster Risk Reduction” (GLOB-HS).
- The European Commission, JRC project “European Urban Development and Territorial Cohesion” (E-URBAN).

In-kind (human resources)

- Global Institute of Sustainable Cities, Fujian Normal University, China;
- Data, models, and related resources associated with US NASA Earth Science research and Earth observing remote sensing platforms such as Terra and Aqua, and the 40-year availability of continuous Landsat data;
- Additional in-kind contributions from the USA (Indiana State University, NASA) and China (Tsinghua University, National Satellite Meteorological Center), Italy (University of Pavia), IEEE Geoscience and Remote Sensing Society.

GI-17b Global Human Settlement indicators for post-2015 international frameworks

Overview:

The GHS initiative builds upon the positive experience of the new Global Human Settlement Working Group (GHS WG) that was launched at the first Global Human Settlement Workshop hosted by the European Commission, Joint Research Centre, on 21-22 October 2014. A *Manifesto for a Global Human Settlement Partnership*¹ was agreed among the partners and made the first nucleus of the group still under evolution. At the date of the last census (June 2015), the group included ~40 registered research teams (accounting >120 individual researchers) working in governmental and international organization, NGO, academic, and

¹ <http://www.earthobservations.org/ghs.php>

private firms. The GHSL applications (so far) include: damage and reconstruction assessment, impact assessment, disaster early warning and alerting, losses estimates, exposure and risk mapping and post-disaster need assessment (PDNA), population spatial modeling, census planning, regional development and planning, transport planning, urban and global climate modeling, spatial epidemics analysis, ecological studies, environmental protection, agricultural fragmentation studies, and historical landscape protection.

The GHS WG was originally initialized in support the GEO task SB-04-C1: “Global Urban Observation and Information” as contribution to the task *(1) Conduct global urban analyses, including time-series for assessing mega-cities development (e.g. urban sprawl) and a world-wide inventory of human settlements based on satellite data*. In the subsequent months, the GHS group evolved far from the original setup of the GEO-SB-04 task, which was made by remote sensing specialists engaged in extracting primary information products from remotely sensed data. The new community is mostly made by policy makers and political communities involved in the post-2015 frameworks, and scientists already providing support to the international negotiation processes in the specific domains: consequently the technical focus has moved from accuracy of the *remote-sensing information extraction* and inventory to fitness-for-purpose of *various-spatial-sources information integration* in support to specific policy goals. In the new perspective remote sensing is only one of the various relevant sources used for designing the indicators², the “urban” category (belonging to urban/rural dichotomy) as goal of the remote sensing data analysis is abandoned in favor of a continuous human settlement conceptualization, and the information extracted from remote sensing and integrated in the indicators goes beyond the classical boundaries of “urban” remote sensing applications.

In the above frame, it is considered the option to create a specific GEO initiative in the draft GEO Transitional Work Programme 2016³, making visible the activities of the GHS group and facilitating the evolution toward operational services that may be set up by some of the partners (tbd). In particular, the EC will support with specific programs the pre-operational phase of the GHS baseline production and yearly update using Sentinel 10m-resolution satellite data input in the perspective of a new operational Copernicus service activated in 2018+.

The scope of the GHS initiative is to develop and assess the fitness-for-purpose of a new generation of measurements and spatial statistics products in support to post-2015 international processes on sustainable and urban development, climate change and disaster risk reduction. Sustainable Development Goals are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes. These indicators are action oriented, global in nature and universally applicable. Moreover, in order to monitor the implementation of the SDGs, it will be important to improve the availability and access to data and statistics to ensure that no one is left behind in the information gaps. The GHS initiative uses a globally - consistent and universally applicable methodology, making the GHS the right platform for testing of alternative options in operationalization of the SDG indicators, particularly those related to Goal 11 on cities. Furthermore, the free and open data policy access of the GHSL information will greatly contribute to fill the information gaps at local national and international levels

In particular, the GHS initiative shall test the production and the use of new global human settlement information products derived by the integration of multi-disciplinary data, namely

² The indicators under development include various land use and land cover information and physical measurements derived from remote sensing data, combined with statistical counts, crowd sourcing (as OSM and GeoWiki), and social sensing

³ http://earthobservations.org/documents/excom/ec34/ExCom34_06_GEO%20Transitional%20Work%20Programme%202016.pdf

global remote sensing, environmental, population and socio-economic. The scope is global and multi-disciplinary, with a particular emphasis on the generation of new global fine-scale information products made available through advances in remote sensing technology and open public data access policies. In the frame of the initiative, are considered strategic global and multi-temporal thematic information (land cover) products with a spatial resolution ≤ 50 meters and open and free data access policy. The free and open data access will ensure that GHS derived indicators will be produced also in low-income countries where no census data is available.

In principle, Global Human Settlement information can support all the spatial metrics and indicators related to population and settlements: consequently modelling access (to services, market, industrial infrastructure, food, water, land), exposure (to natural disaster), or impact (ecosystem, water, land degradation). Access, exposure and impact spatial measurements are embedded in several goals and targets under discussion in the post-2015 frameworks. The new GHS initiative is committed in developing a new generation of measurements and information products that provide new scientific evidence and a comprehensive understanding and that can support global policy processes with agreed, actionable and goal-driven metrics. In particular, the GHS initiative is committed to support the following processes: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016)⁴, the post-2015 framework on sustainable development goals (SDGs)⁵, the UN Framework Convention on Climate Change⁶, and the Hyogo framework for disaster risk reduction⁷.

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2016 Activities:

Oct 2016 - Side event UN Habitat III Quito, including public release of the Landsat GHS baseline (epochs 1975-1990-2000-2014) integrated with other available (open and free) satellite derived products and spatial baseline data in an initial set of SDG indicators proposal database. EC will announce the commitment to sustain the GHS baseline production and updates with Sentinel data. Coordinated with a GHS workshop

Specifically, during 2016 the following products are planned in collaboration with the partners

- Public release of the GHS baseline on population and settlements. Built-up areas are extracted from Landsat satellite data collections in the epochs 1975-1990-2000-2014 integrated with various other open and free available spatial sources. Totals resident population grids at corresponding epochs are estimated from the Gridded Population of the World (GPW)⁸ and other data in collaboration with CIESIN.
- First public release of the population and settlements statistics and derived spatial indicators aggregated at national and sub-national administrative levels.

A prototype of web platform for testing of alternative options in operationalization of the derived indicators and dissemination of information - processing on demand specific spatial indicators and aggregating them on user-defined spatial units.

⁴ <http://unhabitat.org/habitat-iii/>

⁵ <http://sustainabledevelopment.un.org/post2015>

⁶ <http://newsroom.unfccc.int/> <http://www.un.org/climatechange/>

⁷ <http://www.wcdrr.org/preparatory/post2015>

⁸ <http://sedac.ciesin.columbia.edu/data/collection/gpw-v3>

2016 Resources:

The GHS initiative is based on in-kind support of the participating organizations interested in the development or early testing of the indicators and integration in their modeling and analytical platforms. The participating organizations are already financed by their specific programs. The EC Joint Research Center, is chairing the GHS GEO initiative in the initial phase. A specific budget is foreseen in support of the GHS GEO initiative and the support of the Sentinel GHS baseline production and update in the pre-operational phase 2016-2018. After the initial phase (~ 2 years), the chairing of the GHS initiative will be rotated among the partners with a mechanism tbd.

GI-18 Earth Observations in Service of the 2030 Agenda for Sustainable Development

1. Objectives and Overview

General objectives

The *2030 Agenda for Sustainable Development* provides a universal development agenda for all countries and stakeholders to use as a blueprint of action for people, the planet and prosperity. The agenda is anchored by seventeen Sustainable Development Goals (SDGs), associated targets, and a global indicator framework. Collectively, these items assist countries and the global community to measure, manage, and monitor progress on economic, social and environmental sustainability.

The *2030 Agenda* specifically demands new data acquisition and integration approaches to improve the quality, coverage and availability of data to support the implementation of the development agenda at all levels. The *2030 Agenda* includes efforts to exploit the contribution to be made by a wide range of data, including Earth observation and geospatial information, while ensuring national ownership in supporting and tracking progress.

Earth observations and derived information have already played key roles in supporting sustainable development. Serving the *2030 Agenda*, they can play insightful roles in monitoring targets, planning, tracking progress, and helping nations and other stakeholders make informed decisions, plans, and on-going adjustments that will contribute toward achieving the SDGs. Combined with demographic and statistical data, these sources enable nations to analyze and model conditions, create maps and other visualizations, evaluate impacts across sectors and regions, monitor change over time in a consistent and standardized manner, and improve accountability.

The primary purpose of GEO Initiative 18 (GI-18) is to organize and realize the potential of Earth observations to advance the *2030 Agenda* and enable societal benefits through achievement of the SDGs.

A primary objective is to integrate Earth observations and geospatial information into national development and monitoring frameworks for the SDGs. Activities within GI-18 underscore and support GEO's emphasis on sustained observations, open data, and capacity building. The initiative also serves to advance GEO's strategic engagement with entities at national to international levels, such as UN agencies, foundations, and development banks. Overall, GI-18 enables countries and organizations to leverage Earth observations to support the implementation, planning, monitoring, reporting, and evaluation of the SDGs and their normative societal benefits.

Areas of Action

The GI-18 initiative pursues actions in several coordinated areas, addressing technical, organizational and programmatic components. Collectively, these actions support methods,

engagement, data advancement, communications, capacity building, and evaluation on how Earth observations can support the *2030 Agenda*. The Areas of Action include:

a) *Methods I: Development of a general approach on the contributions of Earth observations data and derived information in achieving the SDGs and in monitoring the relevant indicators.* Using specific examples in selected countries, this action will examine and document case studies of methods to integrate Earth observations in monitoring, planning, and reporting the SDGs.

b) *Methods II: Development of tools and methodologies to measure relevant SDG indicators.*

This action includes suitability assessment, sensitivity analysis, frequency testing, and other factors to characterize uses of Earth observations and their appropriateness across users and regions. This action includes analyses and practices on innovative methods, visualizations, and graphic design approaches to communicate status and trends in SDG indicators.

c) *Capacity Building and Engagement: Support to countries in the implementation of all appropriate measures to properly address the 2030 Agenda.*

Drawing on capacity building activities within GEO, this action coordinates and fosters capacity building efforts at appropriate levels on effective ways to convey methods, enable data access, and sustain use of Earth observations in context of SDGs. Activities here will draw on and support GEO efforts to characterize user needs.

Given the basis of the SDGs in statistical data, this action includes engagement with the SDG statistical community about Earth observations as well as capacity building within GEO and the Earth observations community about SDG statistical principles and practices.

d) *Data Advancement: Advances in the provision, access, discoverability, and applicability of Earth observations data and derived information for use with the SDG indicators.*

This action supports the development and progressive implementation of provisions that allow the connection with the providers of basic data, information and knowledge and the access to users.

This activity includes the collection of feedback from SDG user organizations about data characteristics, usability, preferred formats, etc. to help GEO refine approaches to enable greater use of Earth observations.

e) *Communications: Development of activities for GEO community engagement of national and international entities about uses of Earth observations with the SDGs.*

This action develops a portfolio of materials, organizes events, publishes articles, and supports trainings and other activities to promote awareness about Earth observations and the SDGs.

Some activities within these Areas of Action are and will be overlapping. In addition, other Work Programme elements refer to and encompass the SDGs. This GI-18 initiative is the primary element dedicated specifically to address GEO's broad engagement on the SDGs. Coordination with all elements related to the SDGs is appropriate and expected.

Implementation approach

Under a GI-18 Implementation Plan, GEO Members and Participating Organizations use several physical and virtual tools to address the areas of action. GEO conducts them in partnership with relevant UN agencies and other involved entities. Key implementation approaches in the GI-18 Initiative include:

Projects

A series of pilot projects apply and test uses of Earth observations to support the assessment and tracking of the SDGs, including integration with national statistical accounts for the indicators. Such projects will develop and test relevant methodologies and/or capacity building approaches, scaling up existing initiatives and bringing innovative applications from other examples. Projects encompass simple feasibility studies to in-depth endeavors. Some pilot project activities may focus on one country and address several SDG indicators; others may focus on a particular SDG indicator and apply it to several countries.

Building on these projects, the GI-18 initiative documents examples, case studies, lessons learned, and smart practices using Earth observations with the SDG indicators. The initiative identifies and conveys feedback from user organizations on their experiences with and recommendations for Earth observations data and derived information, such as formats and access. The projects include efforts to support qualitative and quantitative evaluation on the benefits of Earth observations to enable societal benefits.

Outreach

A program of activities related to outreach and engagement about Earth observations and SDGs. Implementation of this includes the creation and maintenance of a portfolio of materials, such as examples, stories, articles, and web features. For instance, a series of thematic examples can articulate how Earth observations relate to specific SDGs and can be integrated with traditional statistical approaches; these examples support efforts by GEO members to engage with their national statistical offices.

Additional outreach activities envisioned include events, such as workshops and sessions at key conferences; trainings, including webinars and hands-on sessions; side events at key UN agency meetings; awards for innovative uses of Earth observations to advance the SDGs; and publications, such as a library of guidance handbooks on uses of Earth observations with SDG indicators.

Partnerships

GI-18 will work to expand GEO's current partnerships, enhance its strong relationship with the UN, and foster consolidated engagement of the individual Member countries and Participating Organizations. Associated with the SDGs, key UN entities includes the UN Statistics Division, the UN Initiative on Global Geospatial Information (UN GGIM), the UN Sustainable Development Solutions Network (SDSN). Additional potential partners including development banks, non-governmental organizations (NGO), and international entities (e.g., Skoll Global Threats Fund, Packard Foundation). Engagement and partnership with these entities help build processes, mechanisms and human capacity to include Earth observations into national development plans and integrate them with national statistical accounts to improve the measuring, monitoring and achievement of the SDGs.

2. Leader(s) and Point of Contact

TBD (the Secretariat will ensure coordination among contributors, while the task leadership is being defined)

3. 2016 Activities and outputs

- Develop a multiyear implementation plan for the initiative.
- Scope a communications and outreach strategy, plan, and calendar.
- Produce multiple examples on uses of Earth observations in the indicator framework.

- Scope a framework of projects and initiate two or more projects.
- Hold a side event at the 47th Session of the UN Statistical Commission (UNSC), where the SDG indicator framework is to be approved.
- Prepare a report on the value that Earth observations adds in SDG monitoring and implementation in support of the UNSC meeting in 2017.
- Prepare a partnership plan.
- Continue the development and implementation of the GEMI initiative (with a particular focus on integrating Earth observations into existing, traditional water quality and water management measuring and monitoring mechanisms).
- Develop a concept on methods for access to SDG related data, information and knowledge.
- Scope an Earth observations SDG toolbox capable to process EO data and information.
- Develop a general outline for a handbook describing use of Earth observations for SDGs
- Conduct a side event at GEO-XIII

4. List of activity contributors (no particular order)

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5. Funding Sources for 2016 and Indicative amounts (includes in-kind contributions)

TBD

6. Future Plans (and resource requirements).

The Initiative team strives to complete the GI-18 Implementation Plan for presentation and release at the 2016 GEO Work Programme Symposium.

GI-19 AmeriGEOSS

Overview

The proposed AmeriGEOSS initiative is a framework that seeks to promote collaboration and coordination among the GEO members in the American continent, “to realize a future wherein decisions and actions, for the benefit of the region, are informed by coordinated, comprehensive and sustained Earth observations and information”. The proposed initiative will focus its efforts in the four Societal Benefit Areas (SBA’s) selected and prioritized by the Americas Caucus country-members, which are:

- 1. Agriculture, associated with climate variability, climate change, and food security.*
- 2. Disaster risk reduction, particularly for data exchange associated with early warnings and for the generation of regional products of early warnings.*
- 3. Water, associated with the management approach of water resources and data management.*
- 4. Biodiversity and Ecosystem Monitoring including biodiversity observation in coastal, marine, and continental habitats, in the context of capacity building for better monitoring, management, and maintenance of ecosystems and biodiversity they support; also to predict future changes.*

Some GEO flagships are already addressing the AmeriGEOSS priority areas. The first approach will be to engage with the GEO flagships and their end user communities that are from member countries in the region. From there, the initiative seeks to strengthen the engagement of other Americas countries, and to work with the flagships to tailor their work to address regional needs. Regional needs will be brought to the initiative through the management coordination groups of AmeriGEOSS. In particular, unaddressed needs from developing countries will be prioritized. In each case, the decision-making processes being addressed in the flagships will be tailored to meet the needs of the decision-makers in each of the Americas nations.

AmeriGEOSS has developed a proposed management arrangement based on a review of the approaches being used by UNGGIM-Americas, GEO BON, and AfriGEOSS. This proposed arrangement will be piloted in 2016, and adjusted as needed to achieve the best regional coordination with the least resources. The management arrangements that create organized thematic and coordination-working groups provide the sustained coordination framework to ensure the success of this initiative over the next decade.

Partners in AmeriGEOSS

Point of contact: Angelica Gutierrez, NOAA, angelica.gutierrez@noaa.gov

In addition to GEO Member countries, there are many participating organizations from the Americas countries. There are non-Americas countries contributing to the development in the Americas that can serve as partners also.

Management arrangements

Also, in many Americas countries, there are embassy representatives that are active in bilateral and regional relationships and activities. AmeriGEOSS members will continue to engage the embassies as a way to increase communications and identify representatives in countries already a member, as well as a way to reach out to additional countries to join GEO. They also may be able to provide additional services, e.g. translation services.

The proposed arrangement includes several working groups, each with a Chair and Vice Chair and at least one participant from each country, and preferably two, to ensure that one member can always be present at working group teleconferences and meetings. Regional participating organizations are welcome to participate as well. The following AmeriGEOSS working groups are proposed:

1. Regional coordination working group responsible for the overall regional coordination between Americas Caucus nations, coordination with resource contributors, political coordination including engagement with other potential member nations, and coordination and reporting to Americas Caucus principles. This single coordination group will bring together the individual thematic working group contributions to form a comprehensive “view” and work to ensure/facilitate any necessary cross-communication and coordination among the individual working groups.

The regional coordinating group will report to the Americas Caucus in two ways. First, each national member(s) will report through their nation's GEO leadership and reporting structure to keep them apprised of AmeriGEOSS activities. Second, the regional coordinating group's chair, vice-chair, and/or their designated representatives will provide an overall summary of AmeriGEOSS activities to the Americas Caucus. At a minimum, this report will be provided to the Americas Caucus prior to Caucus meetings held in conjunction with GEO Plenaries and Ministerial meetings. Other reports can be made as needed, e.g. in advance of Executive Committee meetings.

2. Agriculture and food security working group responsible for the coordination with, and participation in, GEOGLAM from a regional perspective, engagement and contribution from Americas nations that add new capabilities to the overall GEOGLAM system and objectives, and linking in existing nations' agricultural initiatives that are of benefit to or could benefit from GEO Earth observation assets.
3. Disasters working group responsible for the coordination with, and participation in, other GEO disasters activities, e.g. hazards supersites and flood monitoring systems, from a regional perspective, engagement and contribution from Americas nations that add new capabilities to other GEO disasters activities and objectives, and linking in existing nations' disasters initiatives that are of benefit to or could benefit from GEO Earth observation assets.
4. Water working group – the functions of this group include coordination with, and participation in, other GEO water activities, e.g. global water cycle activities, from a regional perspective, engagement and contribution from Americas nations that add new capabilities to other GEO water activities and objectives, and linking in existing nations' water initiatives that are of benefit to or could benefit from GEO Earth observation assets.

5. Ecosystems and biodiversity working group responsible for the coordination with, and participation in, other GEO ecosystems and biodiversity activities, e.g. GEO BON, from a regional perspective, engagement and contribution from Americas nations that add new capabilities to other GEO ecosystems activities and objectives, and linking in existing nations' ecosystems and biodiversity initiatives that are of benefit to or could benefit from GEO Earth observation assets.
6. Foundational activities working group responsible for the coordination with and participation in other GEO foundational activities, e.g. infrastructure and capacity building activities, from a regional perspective, engagement and contribution from Americas nations that add new capabilities to other GEO foundational activities and objectives, and linking in existing nations' foundational initiatives that are of benefit to or could benefit from GEO Earth observation assets.

With this initiative, the Americas Caucus assumes greater responsibility for short and long term planning for the development of activities through regional cooperation that reflects the local, national, and regional interest. This responsibility will be entrenched in the technical capabilities of its country members and in the resources of other global initiatives that may be available for the benefit of the region.

2016 Activities

In 2016, the regional coordination framework will be piloted and improved. Each working group will manage their own planning, milestones, and deliverables. Coordination activities include monthly working group telecons, participation in relevant GEO meetings, and at least annual meetings of the AmeriGEOSS community. Deliverables includes telecom notes to be shared with the other working groups and periodic status briefings.

In 2016, deliverables specific to each thematic area will be defined and coordinated with the related global GEO activities.

In 2016, the national and regional needs will be assessed in each of thematic working group areas. The GEO global initiatives needs, e.g. GEO BON's needs for greater regional engagement, will also be assessed. These combined sets of needs will form the basis of the longer-term AmeriGEOSS plans.

2016 Resources

Contributions from the national governments of the Americas Caucus nations have included human resources from Caucus co-chairs Colombia and Mexico, as well as other Americas member countries. These contributions will continue through 2016 to establish the working groups and to assess national, regional, and GEO global initiatives' needs.

In 2016, additional resources will be targeted to support a sustained coordination framework.

Additional Activities for 2016

If additional resources are made available, the AmeriGEOSS working group members will participate more deeply in GEO global initiative meetings and activities. GEO foundational activities will be more fully engaged to address infrastructure and data access gaps, e.g. in nations' spatial data infrastructure.

GI-20 GEO Global Water Sustainability (GEOGLOWS) new-US

1. Objectives for the Activity:

The GEOGLOWS initiative provides a framework for effectively mobilizing Earth Observation assets to contribute to mitigating water challenges on various scales and across different climates and landscapes around the world. GEOGLOWS seeks to use Earth observations and associated tools and assets to decrease regional tensions and the risk of instability and state failure by ensuring that water is available to all even as the proportion of people living in high water stress is increasing due to climate change, population growth and economic growth; and inequities exist in nations' access to data for decision making. The elements of GEOGLOWS are shown in Figure 1.

2. Person and Affiliation of the Activity Leads:

Bradley Doorn, NASA, bradley.doorn@nasa.gov
 Angelica Gutierrez, NOAA, angelica.gutierrez@noaa.gov
 Jerad Bales, USGS, jdbales@usgs.gov

3. Outputs (Deliverables) Expected and Anticipated Date of Completion:

This activity will deliver continuous developments over the next 10 years including:

- 2016: plan integrating US agency assets to support information aspects of USGEO and GEO through GEOGLOWS.
- 2016: development of a set of principles for agencies to ensure the development of a coherent interoperable data system for the US government and other countries.
- 2016-2020: Increase the contribution of hydrometeorological products by GEO members in the Americas through the GNC-A system.
- 2016-2020: Encourage GEO members to provide contributions to the overall GEOGLOWS framework.
- 2016-2020: Provide better hydrological predictions for the participating GEO member nations.
- 2017-2018: Development of a US federal information source and portal on water for private sector, states and NGOs.
- 2017-2020: Comprehensive integrated data products for the US and other countries that have the interest in sharing this technology
- 2018-2020: GEO GLOWS overall integrated portal leveraging GEO member best practices.

Figure 1.



<p>1. Global Water Security Enhancement</p> <p>Water Scarcity and Access</p> <p>Climate Change</p> <p>Cold Regions</p> <p>Sustainable Development Goals</p>	<p>2. Minimizing Basin and Regional Risk</p> <p>Total Water Prediction</p> <p>Floods</p> <p>Droughts</p> <p>Transboundary Issues (IWRM)</p> <p>Water-Energy-Food-Environment-Health Nexus</p> <p>Climate Change Adaptation</p>	<p>3. Essential Water Variable (EWW) Understanding</p> <p>Water Quality</p> <p>Water Use</p> <p>Water Cycle Variables (Precipitation, Soil Moisture, Groundwater, Evapotranspiration, Stream Flow, Surface Water Storage (Includes Snow Pack))</p>
<p>4. Earth Observations, Integrated Data Products and Applications, and Tool Development</p> <p>5. Data Sharing, Dissemination of Data, Information, Products, and Knowledge</p> <p>6. User Engagement, Capacity Building and AmeriGEOSS</p>		

4. Description of Activities planned in 2016 (Highlight user Involvement, capacity development and geographical coverage):

Global Water Sustainability will be enhanced by launching a number of activities to address water scarcity, water access, climate change, cold regions and Sustainable Development Goals. Water security and water access will be assessed by analyzing water scarcity over specific regions and periods by measuring water cycle variables across multiple spatial and temporal scales. The impacts of climate change on water resources will be documented and monitored. Data analysis will be needed to document shifts in the timing and magnitude of peak flows and the frequency of extremes nationally and globally. The security of the cold regions, the well-being of their inhabitants and the effective development of its vast resources need to be based on accurate historical and current data from these areas. The UN is approving a set of Sustainable Development Goals and targets which involve water in many cases. Agencies with Earth Observations need to take advantage of a new openness regarding the use of Earth Observations in monitoring indicators related to the implementation of water goals.

Minimizing the effects of **Basin and Regional Risks** arising from water threats is important. Unexpected events are most damaging and are exacerbated by a lack of infrastructure and plans for dealing with the emergency. Within this context data and information are needed to address droughts with their agricultural, hydrological and socio-economic impacts, floods with their need for rapid evacuation, cleanup operations and improved protection infrastructure, improved data sharing across boundaries to minimize risk by improved integrated water resources management at the transboundary basin scale. Land and water management are very closely linked, consequently the interactions between them for industrial development and responses to extreme events must be understood and dealt with. Improved observations and information systems are needed to ensure water is available to sustain Water for Energy, Food, Environment, and Health security nexus. All of these areas require observations and predictions. Climate change adaptation requires response to the

changing water cycle through both infrastructure and policy options. The need for measurements and predictions will be documented and demonstration projects showing the value of information will be undertaken.

Within the GEOGLOWS Initiative, the US GEO National Oceanic and Atmospheric Administration's (NOAA) Total Water Prediction (TWP) investigation will establish a framework to deliver next-generation water prediction science and services to a broad range of domestic and international stakeholders. This framework leverages significant advances in water resources science and cyber infrastructure technology to address water challenges that heretofore have been too big or too complex to address on the national scale. TWP is the U.S. contribution to the *Minimizing Basin and Regional Risk* element of GEOGLoWS. TWP will integrate centrally collected datasets and system interoperability; Earth System modeling approaches; and high performance computing to deliver comprehensive "street-level" water predictions. This system will provide forecasts to over 100 million citizens who today are not provided with objectively derived hydrologic information, at high-resolution scales that are relevant to day-to-day decision making process of critical sectors and to citizens.

In order to be fully successful this "spatial hydrology at hyper-resolutions" requires massive consumption of Earth observations, both to constrain the intensive modeling through data assimilation and to validate the model to understand uncertainties and build confidence in prediction skill at the models' resolutions. For this to be expanded to global networks, existing observation frameworks need to be 'hardened' and in some cases rescued, while innovative new observation frameworks are needed to fill critical gaps.

This framework leverages significant advances in water resources science and cyber infrastructure technology to address water challenges that heretofore have been too big or too complex to address on the national scale. TWP will integrate, centrally collected datasets and system interoperability; Earth System modeling approaches; and high performance computing to deliver comprehensive "street-level" water predictions for the US.

Specific activities of TWP in 2016 and conducted by the US National Water Center include:

- Operationally implement the initial version of the US National Water Model (WRF-hydro) to produce a suite of water resources budget variables. Limited visualization and data services will facilitate community evaluation of this system.
- Launch the initial version of the Water Resources Data Service (WRDS) that will centrally acquire, archive, and service critical datasets leveraging community adopted, open and machine-readable formats.
- WRF-hydro model will be upgraded to quantify and simulate anthropogenic impacts on the water cycle.
- The *Strategic Research Engagement* will continue with the academic community and in collaboration with CUAHSI, and the National Science Foundation (NSF). The Summer Institute will be hosted at the US NWC in Tuscaloosa, AL, USA.

On a regional scale, new hydro-meteorological products are being developed and shared through various data dissemination systems among among nations in America. El Salvador and Costa Rica contribute with WRF model output and the .5 KM NCEP model outputs for Central America, the Caribbean, and South America. This contribution will continue in 2016. Brazil, will implement 23 new GNC-A receiver stations in each of their regional hydro-meteorological services throughout the country and plans to broadcast radar data through the system. The hydro-met service in Colombia (IDEAM) has offered to contribute with hydro-met and GEOBON products in 2016.

Essential water variables will be collected and analyzed to generate understanding and knowledge for better water management. Coordination of water cycle variables (precipitation, soil moisture, evapotranspiration, streamflow, etc.) are needed to estimate water availability for management purposes and to support water cycle research. Water Quality data will be collected, improved and analyzed to set standards for uses including public health, protection of ecosystems and biodiversity and the assessment of point and non-point pollution. Water Use data is critical to monitoring water security and will be addressed nationally and globally by EO data and surveys that enable use estimates for domestic, industrial and agricultural water use. The USGS maintains ground water and water quality monitoring networks and information systems to support the dissemination of these data. The Water Quality monitoring supports a Framework for Water Quality Monitoring which sets a standard internationally. The National Groundwater Monitoring Network (NGWMN) collates all of the monitoring data from springs and wells to generate data and products to address questions about the availability and quality of the Nation's ground water. In addition, the USGS undertakes a comprehensive survey program as a major input to the National Water Use inventory prepared for the US on a periodic basis.

Different thrusts in data gathering, analysis and information systems will be undertaken to develop information system that can meet many of these needs. **Earth Observations, Integrated Product and Applications, and Tool Development** use integrating tools such as data assimilation and data fusion systems to bring data sets together for higher resolution products and more complete coverage. Data handling tools are needed to accommodate the social media and citizen data and will make products more useable within users' decision support frameworks.

The **Dissemination, Data Sharing and Transfer of Data**, information, products, and knowledge is a critical aspect for services. Dissemination and data sharing will be carried out in accordance with GEO principles on data sharing. The use of GEONetCast and the range of water-related products available through this service will be increased. Data providers will work with users to determine when anomalies exceed thresholds and actions are needed. This transition from data to information and finally to knowledge will be repeated in many domains.

GEOGLOWS will place a high premium on **User Engagement and Capacity Development**. User groups will be developed for some variables and users will work with data providers to co-design products that will address specific information needs. Capacity Building through AmeriGEOSS, SERVIR applications and training courses will be used to disseminate the developments in the US to the world community – a critical step in ensuring security through water security and data democracy.

Specific Activities within AmeriGEOSS include:

The National Water Center continues to leverage and adopt technologies that have been demonstrated through CUAHSI member organizations, or initiatives supported by NSF in cyber infrastructure and hydro-informatics. This knowledge, and lessons learned, will be disseminated through capacity building activities (webinars and training workshops) organized by the USGEO working group in the Americas (CIEHLYC), and in collaboration with hydro-met organizations in the region and CUAHSI members. Existing tools and WMO frameworks are leveraged by this effort.

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6. Funding Sources for 2016 and Indicative amounts (includes in-kind contributions):

During 2016, most of the contributions will be in-kind until there is time to budget for this activity within the US federal system. Contributions will be made from NOAA for the coordination of activities and the National Water Center Laboratory. NASA will also contribute to the coordination and to research calls which will initiate projects that will contribute to the various aspects of this program. NOAA and the GEO Secretariat will contribute with technical support for the CIEHLYC monthly webinars. Data products through the GEONETCast-A system will be in-kind contributions from the contributing countries. Estimated contributions are expected to be \$300K/year but will increase as the program grows.

7. Future Plans (and resource requirements): TBD

GEOGLOWS will establish itself initially as a coordinating mechanism for the Americas and as other nations accept their potential to benefit they will join and expand this framework to a global framework. TWP will continue with the hyper-resolution flexible mesh implementation project to produce high-resolution hydrologic output for hydraulic analysis in a complex environment (e.g., urban); this is a 5-yr project for the US.

GI-21 Human Planet Initiative

Overview:

The initiative builds upon the positive experience of the new Global Human Settlement Working Group (GHS WG) that was launched at the first Global Human Settlement Workshop hosted by the European Commission, Joint Research Centre, on 21-22 October 2014. A *Manifesto for a Global Human Settlement Partnership*⁹ was agreed among the partners and made the first nucleus of the group still under evolution. At the date of the last census (June 2015), the group included ~40 registered research teams (accounting >120 individual researchers) working in governmental and international organization, NGO, academic, and private firms. The GHSL applications (so far) include: damage and reconstruction assessment, impact assessment, disaster early warning and alerting, losses

⁹ <http://www.earthobservations.org/ghs.php>

estimates, exposure and risk mapping and post-disaster need assessment (PDNA), population spatial modeling, census planning, regional development and planning, transport planning, urban and global climate modeling, spatial epidemics analysis, ecological studies, environmental protection, agricultural fragmentation studies, and historical landscape protection.

The GHS WG was originally initialized in support the GEO task SB-04-C1: “Global Urban Observation and Information” as contribution to the task *(1) Conduct global urban analyses, including time-series for assessing mega-cities development (e.g. urban sprawl) and a world-wide inventory of human settlements based on satellite data.* In the subsequent months, the GHS group evolved far from the original setup of the GEO-SB-04 task, which was made by remote sensing specialists engaged in extracting primary information products from remotely sensed data. The new community is mostly made by policy makers and political communities involved in the post-2015 frameworks, and scientists already providing support to the international negotiation processes in the specific domains: consequently the technical focus has moved from accuracy of the *remote-sensing information extraction* and inventory to fitness-for-purpose of *various-spatial-sources information integration* in support to specific policy goals. In the new perspective remote sensing is only one of the various relevant sources used for designing the indicators¹⁰, the “urban” category (belonging to urban/rural dichotomy) as goal of the remote sensing data analysis is abandoned in favor of a continuous human settlement conceptualization, and the information extracted from remote sensing and integrated in the indicators goes beyond the classical boundaries of “urban” remote sensing applications.

In the above frame, it is considered the option to create a specific GEO initiative in the draft GEO Transitional Work Programme 2016¹¹, making visible the activities of the GHS group and facilitating the evolution toward operational services that may be set up by some of the partners (tbd). In particular, the EC will support with specific programs the pre-operational phase of the GHS baseline production and yearly update using Sentinel 10m-resolution satellite data input in the perspective of a new operational Copernicus service activated in 2018+.

The scope of the GHS initiative is to develop and assess the fitness-for-purpose of a new generation of measurements and spatial statistics products in support to post-2015 international processes on sustainable and urban development, climate change and disaster risk reduction. Sustainable Development Goals are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes. These indicators are action oriented, global in nature and universally applicable. Moreover, in order to monitor the implementation of the SDGs, it will be important to improve the availability and access to data and statistics to ensure that no one is left behind in the information gaps. The GHS initiative uses a globally -consistent and universally applicable methodology, making the GHS the right platform for testing of alternative options in operationalization of the SDG indicators, particularly those related to Goal 11 on cities. Furthermore, the free and open data policy access of the GHSL information will greatly contribute to fill the information gaps at local national and international levels

In particular, the GHS initiative shall test the production and the use of new global human settlement information products derived by the integration of multi-disciplinary data, namely

¹⁰ The indicators under development include various land use and land cover information and physical measurements derived from remote sensing data, combined with statistical counts, crowd sourcing (as OSM and GeoWiki), and social sensing

¹¹ http://earthobservations.org/documents/excom/ec34/ExCom34_06_GEO%20Transitional%20Work%20Programme%202016.pdf

global remote sensing, environmental, population and socio-economic. The scope is global and multi-disciplinary, with a particular emphasis on the generation of new global fine-scale information products made available through advances in remote sensing technology and open public data access policies. In the frame of the initiative, are considered strategic global and multi-temporal thematic information (land cover) products with a spatial resolution ≤ 50 meters and open and free data access policy. The free and open data access will ensure that GHS derived indicators will be produced also in low-income countries where no census data is available.

In principle, Global Human Settlement information can support all the spatial metrics and indicators related to population and settlements: consequently modelling access (to services, market, industrial infrastructure, food, water, land), exposure (to natural disaster), or impact (ecosystem, water, land degradation). Access, exposure and impact spatial measurements are embedded in several goals and targets under discussion in the post-2015 frameworks. The new GHS initiative is committed in developing a new generation of measurements and information products that provide new scientific evidence and a comprehensive understanding and that can support global policy processes with agreed, actionable and goal-driven metrics. In particular, the GHS initiative is committed to support the following processes: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016)¹², the post-2015 framework on sustainable development goals (SDGs)¹³, the UN Framework Convention on Climate Change¹⁴, and the Hyogo framework for disaster risk reduction¹⁵.

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2016 Activities:

Oct 2016 - Side event UN Habitat III Quito, including public release of the Landsat GHS baseline (epochs 1975-1990-2000-2014) integrated with other available (open and free) satellite derived products and spatial baseline data in an initial set of SDG indicators proposal database. EC will announce the commitment to sustain the GHS baseline production and updates with Sentinel data. Coordinated with a GHS workshop

Specifically, during 2016 the following products are planned in collaboration with the partners

- Public release of the GHS baseline on population and settlements. Built-up areas are extracted from Landsat satellite data collections in the epochs 1975-1990-2000-2014 integrated with various other open and free available spatial sources. Totals resident population grids at corresponding epochs are estimated from the Gridded Population of the World (GPW)¹⁶ and other data in collaboration with CIESIN.
- First public release of the population and settlements statistics and derived spatial indicators aggregated at national and sub-national administrative levels.

A prototype of web platform for testing of alternative options in operationalization of the derived indicators and dissemination of information - processing on demand specific spatial

¹² <http://unhabitat.org/habitat-iii/>

¹³ <http://sustainabledevelopment.un.org/post2015>

¹⁴ <http://newsroom.unfccc.int/> <http://www.un.org/climatechange/>

¹⁵ <http://www.wcdrr.org/preparatory/post2015>

¹⁶ <http://sedac.ciesin.columbia.edu/data/collection/gpw-v3>

indicators and aggregating them on user-defined spatial units.

2016 Resources:

The GHS initiative is based on in-kind support of the participating organizations interested in the development or early testing of the indicators and integration in their modeling and analytical platforms. The participating organizations are already financed by their specific programs. The EC Joint Research Center, is chairing the GHS GEO initiative in the initial phase. A specific budget is foreseen in support of the GHS GEO initiative and the support of the Sentinel GHS baseline production and update in the pre-operational phase 2016-2018. After the initial phase (~ 2 years), the chairing of the GHS initiative will be rotated among the partners with a mechanism tbd.

5. PROPOSED FOUNDATIONAL TASKS

5.1 General

GEO Foundational Tasks implement the GEO Core Functions through selected, often enabling, tasks necessary to achieve GEO Strategic Objectives and Targets.

They will be performed as a joint effort between the Secretariat and the GEO community.

From the Secretariat side, they are expected to use the totality of the GEO Trust fund resources (cash contributions as well as the time of seconded Experts), except those earmarked for specific Initiatives or Flagships (as it was the case for GFOI). They will also include the necessary contributions from GEO stakeholders in order to achieve the planned outputs.

5.2 Foundational Tasks Grouping and Working arrangements

The Foundational Tasks have been grouped in three groups in such a way to provide a clear picture on how major GEO functions are implemented:

Group GD GEOSS Development and GCI Operations

Group CD Community Development

Group SO Secretariat Operations

Foundational Task Overall Management

Having acknowledged the supporting role of the Secretariat in the definition and approval of the Work Programme (and of the FTs), it is proposed that the Secretariat will ensure overall coordination of the FT execution and will report to the Executive Committee and Plenary on their progress.

The Secretariat will also assume specific responsibilities and perform specific activities for each of the FTs in accordance with the relevant descriptions.

It is also recommended that, also in view of the functions and duties of the Program Board (among which is the ability to establish Task Forces or Advisory Groups on specific topics as

needed), no other Bodies are established that report directly to the Executive Committee/Plenary on Work Programme-related topics.

Foundational Task Working Arrangements

Two working arrangements are proposed:

1. The Task Team, with a lead for each Task occurring in most cases; and
2. The Working Group, proposed for three tasks (see below), with the specific purpose to retain expertise and commitment of existing bodies and individuals when transitioning to the new implementation mechanisms.

As mentioned above the role of the Secretariat is different from Task to Task and can be summarized by a combination of the following roles:

Coordination	The Secretariat is the Task Leader.	C
Activities Execution	The Secretariat is actually executing a subset of Task activities. H: Secretariat performs the majority of the activities. M: Secretariat performs a fair share of the activities. L: Secretariat performs a few of the activities.	E-H E-M E-L
Support	The Secretariat provides general support to the Task Team.	S

5.3 Foundational Task List

The list of proposed FTs and relevant descriptions have been developed in consultation with Work Plan Symposium participants and Task contributors. The updated list of proposed FTs is reported below (with some annotation, when necessary, to better characterize the content), and with the indication of the proposed working arrangement and of the role of the Secretariat.

GD	GEOSS Development and GCI Operations	Implementation arrangement	Secretariat role
GD-01	Advancing GEOSS Data Sharing Principles	DSWG	S, E-L
GD-02	GCI Operations (<i>including access to Knowledge</i>)	Team	C, E-M
GD-03	Global Observing and Information Systems (<i>includes systems like WIGOS, GCOS; and reference datasets</i>)	Team	C, E-M
GD-04	GEONETCast Development and Operations	Team	S, E-L
GD-05	GEOSS Satellite Earth Observation Resources (<i>includes advocacy for continuity</i>)	Team	S
GD-06	GEOSS non-space based Earth Observation Resources (<i>includes inclusion of citizens' observatories</i>) (<i>includes advocacy for continuity</i>)	Team	S, E-L
GD-07	GCI Development (<i>includes development of Data Management guidelines</i>)	WG	S
GD-08	SBA process: Systematic determination of user needs / observational gaps	Team	C, E-M
GD-09	Knowledge Base development	Team	C, E-L

GD-10	Radio-frequency protection	Team	C
GD-11	Communications Networks	Team	C, E-L
CD	Community Development		
CD-01	Capacity Building Coordination	WG	S, E-L
CD-02	Reinforcing engagement at national and regional level (<i>includes EO uptake for decision making</i>)	Team	C, E-H
CD-03	Assess the benefits from EOs and of their socio-economic value	Team	S, E-L
SO	Secretariat Operations		
SO-01	Management and Support	Secretariat	C, E-H
SO-03	Communication and Engagement	Team	C, E-H
SO-02	Monitoring and Evaluation	Secretariat	C, E-H
SO-04	Resource Mobilization	Team	C, E-H

5.4 Foundational Tasks Description

The description of each FT includes:

- General description
- Implementation approach and responsibilities
 - Contributors
 - Secretariat
- Planned activities and outputs in 2016

ANNEX 1 Provides a summary of the expected outputs of all the Foundational Tasks

GD GEOSS development and GCI operations

In addition to the management arrangements identified for each of the GD tasks below, it is proposed that, during the 2016 transitional period, the Working Group responsible for the implementation of the task GD-07 (GCI development) will also ensure coordination of the task GD-02 (GCI Operations).

GD 1 Advancing GEOSS Data Sharing principles

1. General Description

Continue promoting free, full, open and timely access to Earth Observation datasets, products and services. Maintain dialogues with Governments and support the up-take and

implementation of the GEOSS Data Sharing principles by GEO Members and Participating Organizations. Raise awareness of the technical, organizational, and resource implications of implementing the GEOSS Data Sharing Principles.

2. Implementation approach, respectively responsibilities

The activities will be performed by a dedicated Working Group, supported by the GEO Secretariat.

Task leads (May change according to ToR of the Working Group.)

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Responsibilities

a. Task Members

- i. Update implementation guidelines on Data Sharing Principles that underpin the quality of available data, information and tools and support their integrated use.
- ii. Keep track of international Open Data trends and continue to evolve the next generation of Data Sharing Principles as necessary.
- iii. Analyze and advocate the benefits of Data Sharing. Raise global awareness, including in developing countries, about the free and open datasets, products and services provided through GEOSS including support of measuring and monitoring of the SDGs.
- iv. Promote national coordinating mechanisms for implementing the Data Sharing Principles Post-2015 and monitor data sharing progress by the GEO member governments.
- v. Analyze Data Commons in GEO SBAs that enable data sharing across various SBAs. Address legal interoperability of datasets across various SBAs, through recommended mechanisms to share data as part of GEOSS DataCORE or compatible open licenses.
- vi. Monitor, interpret, and adjust the use metrics to gauge the utilization of shared resources and their value to both data providers and data users, within and across SBAs.

b. GEO Secretariat

- i. Support the coordination and the administration of this task
- ii. Data sharing point of contact to the external world and helpdesk function, in coordination with the SIF, for Data Providers and Users
- iii. Promotion and extension of GEOSS DataCORE
- iv. Manage and operate a Use Metrics component of the GCI.

3. Planned activities and outputs for 2016

- i. Hold at least one meeting of DSWG.
- ii. Update Implementation Guidelines on Data Sharing Principles for Plenary approval in 2016.
- iii. Produce a report on international Open Data trends.
- iv. Draft a summary of mechanisms for monitoring the status of GEO Members in establishing and implementing Open Data Policies.

GD 2 GCI Operations (including access to Knowledge)

1. General description

Operate and maintain a user driven GEOSS Common Infrastructure (GCI) to discover and access GEOSS resources (e.g. datasets and services). Ensure routine operations, whilst maintaining the GCI as the architectural framework essential to supporting the GEOSS Data Sharing Principles. Support the integration of new GCI capabilities as developed and tested in GD-07. Continuously engage with data and service providers and user communities to connect new resources.

2. Implementation approach, respective responsibilities

The task activities will be performed by a task Team under the coordination of the GEOSS Development Working Group (GDWG), see task GD-07. The role of current operators will be kept for 2016, progressively adding user support functions by the Secretariat.

a. GCI Components operators (ESA, CNR, USGS, IEEE)

- i. Perform GCI Components operations including maintenance, administration, monitoring and integration – covering both software and hardware
- ii. Maintain partnership with Data and Service Providers and improve these Providers discoverable and accessible through the GCI in mutually agreed methods Connect new providers which are relevant to Flagships and key members and participating organizations
- iii. Collect requirements and feedback from User Communities and Stakeholders for improving current GCI capabilities to ensure reliable products and services

b. GEO Secretariat

- i. Overarching coordination and GCI configuration management including to maintain the GCI documentation and the list of the GCI Component and related representative persons
- ii. Develop a service desk operation concept paper by April of data and technical assistance and support services to Data and Service Providers, User Communities and Stakeholders. Support will be provided by Standard and Interoperability Forum (SIF)
- iii. Coordinate to improve capabilities of existing providers and also to connect new data providers
- iv. Integrate GCI performance measurement tracking and reporting capabilities across GCI Components and Services

3. Planned activities and outputs for 2016

1. Continue GCI operations

2. Develop a concept paper on user desk will work by April 2016, with interactions and support by SIF. User desk should be operational in 2016
3. Start the configuration control of GCI
4. Improve capabilities of existing brokering providers in particular more accessibility
5. Connect new providers giving priority to those relevant to Flagships, Initiatives and Community Activities and key members and participating organizations
6. Definition of improvements of early next year to be incorporated in the next 3year WP
7. Test and release new GEOSS resource registration process, including the synchronization of the CSR and the DAB.

4. Task Team (*preliminary*)

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i.

GD 3 Global Observing and Information Systems (*Leveraging WIGOS, WIS and other Systems*)

1. General description
GEOSS as a 'system of systems' will proactively be interoperable with together existing and planned observing and information systems around the world and

support the development of new systems where gaps currently exist. These Observing and Information Systems are foundational components of GEOSS. In this regards, the task will provide various coordination opportunities in order to advocate new systems, to sustain and strengthen existing and planned systems and also to encourage integrating and linking different systems.

2. Implementation approach, respective responsibilities

The task will be coordinated by the Secretariat.

a. Contributors (WMO)

- i. Improve the integration of different Observing systems by defining metadata of Observation systems contributing to GEOSS (e.g., WIGOS, similar systems and other emerging new observing systems). Start leveraging and promoting WIGOS OSCAR and WIGOS 2040 Space vision activities to GEO for seeking the way to integrate WIGOS into GEOSS effectively and also for involving more systems to take part in this task.
- ii. Sustain and improve existing operational and new emerging Information systems contributing to GEOSS (e.g., WIS, similar systems and other emerging centers of excellence). Start leveraging and promoting WIS to GEO for involving more systems to take part in this task.
- iii. Make efforts to implement the GEOSS Data Sharing Principles.
- iv. Make efforts to ensure interoperability with GEOSS and GEOSS Common Infrastructure (GCI).
- v. Develop data model for each system, implementing the GEOSS Data Management Principles.
- vi. Maintain and improve the operational network diversities such as satellite based, ground based and internet.

b. GEO Secretariat

- i. Coordinate Observing and Information Systems how the best way to interoperable with GEOSS.
- ii. Support implementing GEOSS Data Sharing Principles, Data Management Principles and interoperability with GEOSS and GCI.
- iii. Identify potential gaps, duplications and synergies in GEOSS;

3. Planned activities and outputs for 2016

1. Resume coordination and consultations with Global Observing and Information Systems. In 2016, start leveraging and promoting WIGOS and WIS in GEO Community. Seeking other systems to take part in the task.
2. Start the development of a document describing GEO plans to support existing systems and facilitate development new systems, including their connection with GCI.
3. Start the development of a report on “Inventory of Global Earth Observation and information systems contributing to GEOSS”, identifying potential gaps, duplications and synergies.

4. Task Team (*Preliminary*)

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GEO Secretariat		Osamu Ochiai	Oochiai@geosec.org

GD 4 GEONETCast Development and Operations

1. General description

Further develop GEONETCast – a distribution system for GEOSS information using communication satellites and low cost, off-the-shelf reception stations – and improve the service provided to Users.

2. Implementation approach and respective responsibilities

The task activities are implemented by a task Team, supported by the Secretariat.

a. Contributors (CMA, EUMETSAT, NOAA)

- i. Evolve GEONETCast into a fully operational global system disseminating data and products to the GEO community (including flagships, initiatives and community activities)
- ii. Pursue the integration of the GEONETCast collections catalogue with the GEOSS Common Infrastructure
- iii. Foster relationships with data providers and users to enhance data content in line with the evolving needs of users and decision-makers
- iv. Expand interaction with networks of users in developing countries to improve access to data in areas with limited data accessibility. In particular, facilitate improved access to disaster information in developing countries through collaboration with key disaster management mechanisms, including the International Charter on Space and Major Disasters
- v. Enhance the integration of other existing or emerging satellite data distribution systems
- vi. Expand the GEONETCast broadcast footprint over the Pacific region.
- vii. Build capacity for using GEONETCast information, particularly in developing countries
- viii. Develop GEONETCast Training Channels to (i) train end-users; and (ii) transmit training materials to local trainers.

b. GEO Secretariat

- i. Overarching coordination and GEONETCast configuration management including to maintain the GEONETCast documentations and the list of the

GEONETCast Components and related representative persons

- ii. Provide a service desk operation for User Communities and Stakeholders.
- iii. Integrate GEONETCast performance measurement tracking and reporting capabilities

3. Planned outputs in 2016

Continue GEONETCast operations

Test options for truly global coverage

Develop and test a GEONETCast planning tool and a friendly User Interface (including a service desk)

Develop a GEONETCast User Guide

4. Task Team

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GD 5 GEOSS satellite Earth Observation Resources (*includes advocacy for continuity*)

1. General description

Satellite Earth observations are critical to understanding all components of the Earth System (atmosphere, ocean, terrestrial, ice, solid earth) across temporal and spatial scales. Satellite Earth observations have unique value, and play a foundational role in enabling all other Earth observations to be understood in context, at global and regional scales, over long time periods.

This cross-cutting task aims to ensure the long-term availability of the sustained, coordinated, comprehensive satellite Earth observation data that is a critical component of the GEOSS and a key enabler of all current and future GEO Community Activities, Initiatives and Flagships.

This task recognizes the long lead-times for satellite development and launch, and the operating lifetimes of satellites. Satellites can typically provide data that supports different applications and domains, making the ability to assess requirements and coordinate missions and data systems across domains key to the long-term success of GEOSS. This activity is complementary to activities focused on formalizing user requirements and providing space data in support of specific activities.

2. Implementation approach, respective responsibilities

The task activities are implemented by a task Team.

- a. Contributors (The Committee On Earth Observation Satellites coordinating delivery through member Space Agencies, associates and partnerships)
 - i. Specify, develop, launch, operate and coordinate space missions to provide new observations, sustain critical time-series, and fill or minimize spatial or temporal gaps in the satellite observations required to support sustained production of fundamental variable sets as defined through the GEO requirements analysis processes.
 - ii. Promote the development and implementation of technologies and the uptake of best practice to enhance space data access in support of the evolution of the GEOSS, particularly focusing on enhanced access to space data via the GCI.
 - iii. Support broader GEO efforts to promote Earth observation by providing evidence of the unique, and complementary, value of satellite data to successful delivery of major regional and global initiatives.
 - iv. Coordinate increased interoperability among space data infrastructures and develop integrated global and regional space datasets that support validated and prioritized requirements identified through GEO processes.
- b. GEO Secretariat
 - i. The Secretariat provides general support to the Task Team

3. Planned activities and outputs for 2016

1. Review the strategy and plans for the implementation of Virtual Constellations to ensure they continue to develop to support GEO objectives.
2. Develop options on how CEOS can foster space agency planning and

coordination processes that will be responsive to user needs/observation requirements identified through the SBA-based rolling requirements processes.

4. Task Team

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GD 6 GEOSS non-space based Earth Observation Resources (includes inclusion of citizens' observatories) (includes advocacy for continuity)

1. General description

Analyze the current trends and develop new scenarios for non space-based measurements, coordination, and access to data, which would allow inclusion of new types of data (such as drones, citizens' observatories) and their provenance. The regional scale would be considered as the reference to start.

Promote and coordinate non space-based observing systems (including both in situ and remote sensing airborne, land and ocean-based systems) to provide long-term continuous observations of all components of the Earth System (atmosphere, ocean, terrestrial, ice, solid earth). Identify critical gaps in existing observational networks with a particular focus on: the needs of developing countries, the need for continuity of observations, and the potential benefits of enhanced observing systems. Individual Earth observing systems operated by national, regional and international entities are integral to GEOSS.

Identify data resources needed by GEO (including flagships, initiatives and community activities) to achieve the objectives of the GEO Strategic Plan. Coordinate increased interoperability of non space-based data including new data flows from the private sector and the public, and develop global and regional datasets supporting the GEO community.

Compile global perspectives on existing plans for new non space-based

observing networks and develop common strategies and actions to ensure sustained observations. Advocate adequate resources to maintain systems that provide continuity of observations.

Promote coordination of non space-based and space-based observation networks to provide calibration and validation sources, to fill measurement gaps, and to promote technology sharing and infusion between the two communities. Promote communication between the non space-based and space measurement communities by sponsoring workshops, side events, and educational material as needed.

2. Implementation approach

The task activities are implemented by a task Team, supported by the Secretariat

a. Contributors

- i. Cooperate with non space-based operators to promote and coordinate development activities related to non space-based observation infrastructures and networks; build upon ongoing coordination efforts & activities
- ii. Explore and determine how non space-based coordination frameworks put in place for national, regional (e.g. Copernicus, ConnectinGEO, ENEON, AfriGEOSS) and global (e.g. Eye on Earth) levels benefit most effectively the GEOSS objectives
- iii. Improve coordination and facilitate access to non space-based data resources
- iv. Improve global coordination of non space-based atmospheric observations (e.g., instrumented aircrafts, drones, balloons)
- v. Improve global coordination of non space-based ocean observations and promote the development of new and enhanced measurements (e.g., global high-frequency-radar network to measure coastal surface currents)
- vi. Improve global coordination of non space-based land surface observations and promote the development of new and enhanced measurements
- vii. Explore how citizen science observation initiatives can contribute to filling non space-based observational gaps
- viii. Develop a global database of non space-based activities (i.e., regional and global projects), organized by domain (land, ocean, atmosphere) that includes information on the activities, its measurements and data access. Such a database will be essential for non space-based gap assessments and coordination with the space-based observation community. Coordinate the database development with the development of the GEO Knowledge Base.
- ix. Coordinate increased interoperability among non space-based datasets, between space and non space-based datasets, and new non space-based data flows from private sector and the public, and develop global and regional datasets supporting the GEO community. Coordinate this activity with the global observing systems, including the Global Geodetic Observing System (GGOS).

b. GEO Secretariat

- i. Overarching coordination with administrative support
- ii. Promote coordination between space and non space-based observation communities and conduct gap assessments, as needed.

3. Planned activities and outputs in 2016

- a. Develop a plan of activities for the task with defined leadership roles
- b. Publish a report on the status of global non space-based coordination and frameworks. Include content addressing sustainability of existing measurements, investigating new non space-based measurements, facilitating the transition from research to sustained long-term operations, and coordinating the integration of space-based and non space-based observations.

1. Task team (*preliminary*)

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GD 7 GCI Development (*includes development of Data Management guidelines*)

1. General description

Describe and update the GCI evolution strategy and architecture based on documented and emerging user requirements, the analysis of the evolving landscape for technology and production/ consumption of Earth Observation (EO) data products and services. Conduct research and development activities, in collaboration with public, private, and voluntary sectors, to develop and test new

functionalities, solutions, and components needed to support the GEO Strategic Plan objectives and user needs. Prepare documentation and training materials needed to support the transition from development to operations of identified new components and solutions.

2. Implementation approach and respective responsibilities

This task will be implemented by the GEOSS Development Working Group (GDWG) in collaboration with GD02 (GCI Operations *including access to Knowledge*) task, and will include major contributors. The GEO Secretariat will support the GDWG and ensure that its activities are fully supportive of the GCI.

- a Contributors (JRC, USGS, CNR, ESA, OGC, IEEE, NOAA)
 - i. Develop a GEOSS Architecture based on documented and emerging user requirements informed by the GD08 (SBA process), GD09 (Knowledge Base Development), Flagships, Initiatives, Community Activities, and analysis of the evolving landscape for technology and production/consumption of EO data products and services
 - ii. Develop and test new GCI functionalities, solutions, and components
 - iii. Collect and analyze the survey results supporting the Data Management Guidelines and develop a process to implement the Guidelines for providers
 - iv. Implement subsequent Demonstration Pilot Projects this year in 2016 to test solutions and to promote the use of GEOSS data in developing products and services. Demonstration Pilots will 1) discover assets that respond to a flagships EO data needs, 2) efficiently access and harvest the responsive assets and 3) operationally integrate those resources into a short-term or long-term GEOSS product or service for societal use. (ex. GEOGLAM Crop)
 - v. Promote the advancement of GEOSS interoperability through the Standards and Interoperability Forum (SIF)
 - vi. Engage the GEOSS community through guidelines and tutorials that explains the utilization of the GEOSS and the GCI.
 - vii. Continue to develop the Community Portal Recommendations paper that provides best practices, examples and lessons-learned to promote and facilitate communities' use of the GCI and assist them in contributing their capabilities to GEOSS.
- b GEO Secretariat
 - i. Overarching coordination and support
 - ii. GCI Requirements consolidation and update

3. Planned activities and outputs for 2016

- ✧ Draft document of GEOSS Architecture
- ✧ Consolidate/update a document "Evolution of GCI functionalities and architecture" including following topics:
 - A report on "GCI Operations options" for 2016
 - Plenary decision and implementation starting from 2017
- ✧ Interact with GD08 (SBA process) and GD09 (Knowledge base) to collect requirements for designing the new functionalities

- ✧ Implement new functionalities in 2016 to improve the accessibility and usability of GCI resources.
- ✧ Report results on Demonstration pilot Projects
- ✧ Approved Data Management Guidelines at GEO-XIII and draft a process of implementation with Flagships, Initiatives and Community Activities with training and workshops.
- ✧ Organize a GEOSS Interoperability Workshop in 2016 and conduct virtually (arranged and managed by the SIF)
- ✧ Publish new guidelines and tutorials in the Best Practices Wiki (The process is managed by the SIF.)
- ✧ Deliver an updated version of the Community Portal Paper with specific recommendation based on interactions between community components and the GCI.

4. Task Team (*preliminary*)

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GD 8 SBAs process: Systematic determination of user needs / observational gaps

1. General description

Undertake regular, systematic analysis of global observational requirements to identify, document, prioritize and close gaps in the information value chain. Publicize gap analysis and the need to close them.

Societal Benefit Areas will provide the framework to perform this analysis by providing an important function in engaging stakeholders from different domains, different regions, and different roles – including from end users to data providers.

Once in place and running this process is also expected to provide other key outputs such as contributing to user engagement and to knowledge development.

2. Implementation approach and respective responsibilities

The GEO Secretariat will activate this SBA-related process, building on the activities of the communities that are already active within each SBA and progressively cover the totality of the SBAs themselves.

The Secretariat will coordinate the participation of key stakeholders to the agreed activities, will foster their engagement and the exchange among them and create the relevant linkages to GEO activities (Community, Initiatives and Flagships).

The GEO Secretariat will coordinate and support this SBA process by appointing one expert for each of them and by assigning dedicated resources in the trust fund, to support their activities.

3. Planned activities and outputs in 2016

The 2016 will be used to activate this process, starting from the SBAs already active and ensuring participation by all the actors involved in the Information value chain from the observations to the end user service, (here included the private sector) as well as by the developers of the GCI. Expected outputs:

1. Issue a document describing the process and how it will be run
2. Define initial plans for each SBA
3. Activate of the process for at least **three** SBAs by 2016

GD 09 GEO Knowledge Base development

1. General description

The key objective of this task is to “develop a comprehensive interdisciplinary knowledge base defining and documenting observations needed for all disciplines. This will allow sharing not just data but also how these data can be used to address key policy or scientific question, and link also to the community of users addressing similar problems.

The Knowledge base will document the relationships between the data and the processes (models, workflows, algorithms) needed to develop the selected information/indicators.

The functionality of the knowledge base will support the GEOSS infrastructure in facilitating availability and accessibility of the observations to user communities. The knowledge base will include the rules for defining the observational needs and how to link them to user requirements, addressing a wide range of environmental and socio-economic information needs. *Of particular interest are those information needs that are linked to indicators supporting the advocacy and monitoring of the Sustainable Development Goals (SDGs).* The knowledge base will include rules to define the observation needs for these indicators.

The GEO Knowledge Base will be developed by leveraging existing knowledge repositories and databases and documenting what is being developed in association with GEO activities.

It will include user feedback with respect to the fitness for purpose of both data and processes.

2. Implementation approach and respective responsibilities

The activities will be performed by a Task Team lead by

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The Secretariat will ensure dialogue between the Community -developing Knowledge- and the GCI development Team, developing solutions to make it available through the Portal. Key inputs are expected to come from task GD-8.

a. Contributors (IEEE, CNR, others TBD)

- i. Identify relevant existing and developing knowledge bodies in various domains.
- ii. Develop the concept for a comprehensive interdisciplinary knowledge base defining and documenting observations needed for all disciplines, including the rules for deriving the observational needs from user’s requirements.
- iii. Design and develop the functionalities in order to support the GEOSS infrastructure, including the DAB, in facilitating discoverability and usability of observations to user communities;
- iv. Implement a prototype of the knowledge base and import the contents of the GEOSS User Requirements Registry to the prototype –i.e. one of the knowledge bodies.

b. GEO Secretariat

- i. Support the task Team
- ii. Support the development and population of the Knowledge Base and engage user communities, including S&T communities, in these activities.
- iii. Document the relevant existing and developing knowledge bodies in various domains and establish organizational links where needed.
- iv. Coordinate the utilization of the knowledge base (e.g. in the GCI) and contribution to the knowledge base from all GEO activities (community, initiatives, flagships) and ensure coordination with capacity building activities.

3. Planned activities and outputs for 2016

1. Form and convene the Team
2. Issue a report on GEOSS knowledge base concept and development approach
3. Start the compilation of available knowledge resources
4. Design and prototype a database to host GEO-developed knowledge

GD 10 Radio-frequency protection

1. General description

Perform all the actions necessary to ensure the protection of the frequency spectra used by EO instruments

2. Implementation approach and responsibilities

The task will be coordinated by the Secretariat.

a. Contributors (WMO, ESA, GEO members)

For radio frequency, develop their own position towards use of frequencies and coordinate them within the GEO framework.

b. GEO Secretariat

- i. Overarching coordination
- ii. Drafting documents and communications
- iii. Representing GEO and voice EO needs and requirements at the appropriate events

3. Activities in 2016

Specific plans are TBD. The reference for the plans will be the events where decisions on frequency allocation are expected to be taken.

4. Task Team (*preliminary*)

Lead	WMO	Jose Arimatea de Sousa Brito	josearimateabrito@gmail.com
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Contributor	WMO	David Thomas	Dthomas@wmo.int	
Contributor	ESA	Edoardo Marelli	Edoardo.Marelli@esa.int	TBC
Contributor	EUMETNET	Philippe Tristant	philippe.tristant@eumetnet.eu	
GEO Secretariat		Osamu Ochiai	Oochiai@geosec.org	

GD 11 Communications Networks

1. General description

GEOSS information exchange has been principally based on the Internet and contributing information distribution systems such as GEONETCAST, the Global Telecommunications Network (GTS) component of the WMO Information System (WIS). GEO, through collaboration with existing and new contributors will explore possibilities of making other communication resources available and advocate for adequate resources to develop the communication infrastructure that will ensure wider and sustainable access to and use of EO data and information. A key counterpart will be the ITU.

2. Implementation approach and responsibilities

The task will be coordinated by the Secretariat.

a. Contributors (GEANT, ...)

- i. Document existing communication infrastructure within GEOSS and develop a concept architecture for a worldwide communication network of networks available to GEOSS. This concept should incorporate how to complement existing use of the Internet and operational data transmission services such as the GEOSS Common Infrastructure (GCI), the WMO Information Systems (WIS) and GEONETCast.
- ii. Draft a plan delineating how such a network of networks would be implemented and outlining requirements for operation, maintenance and administration.
- iii. Engage with AfriGEOSS and potentially other flagships to assess network requirements and possible improvements of data dissemination.
- iv. Investigate state of art information technologies, such as cloud services, available through existing and potential contributing networks and how these may be applied to GEOSS.

b. GEO Secretariat

- i. Overarching coordination
- ii. Drafting documents and communications
- iii. Representing GEO and voice EO needs and requirements at the appropriate events

3. Activities in 2016

1. It is envisaged to hold a meeting with all contributors to exchange information

and discuss on existing requirements, architecture and solutions and present the output to the GEO Programme Board.

2. Facilitate meeting with AfriGEOSS and the African NREN organizations to discuss existing communication infrastructure, requirements and developing activities in the region.
3. Participate in the 2016 activities of WMO's Expert Team on Telecommunications Infrastructure (ET-CTS) with an aim to refining the conceptual architecture.
4. Report on the initial progress and findings of this task to the 16th session of the Commission for Basic Systems (CBS) to be held in the second half of 2016, seeking further commitment to this GEOSS activity.

Activate a specific advocacy action with ITU for improvement of communication infrastructure in developing countries.

4. Task Team (preliminary)

Lead	GEANT	Beatrix Weber	Beatrix.Weber@geant.org
Contributor	GEANT	John Chevers	John.Chevers@geant.org
Contributor	WMO	David Thomas	Dthomas@wmo.int
Contributor	WMO	Remy Giraud	remy.giraud@meteo.fr
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GEO Secretariat		Osamu Ochiai	Oochiai@geosec.org

CD Community Development

CD 01 Capacity Building coordination

1. General description

Coordination of the capacity building activities associated with the acquisition, processing and use of EO data and information for policy and decision-making. They include definition and use of clear mechanisms for identification of the "global CB offer", its gaps in and promotion of coordinated actions to address them.

2. Implementation approach and responsibilities

This task will be implemented by a Capacity Building Working Group (CB-WG), which will include major contributors. The GEO Secretariat will support the CB-WG and facilitate linkages with other GEO activities.

Working Group composition

Mark Noort	HCP International	m.noort@hcpinternational.com
Gregory Giuliani	UNIGE & UNEPGRID	gregory.giuliani@unepgrid.ch
Nancy Searby	NASA, CEOS WGCapD	nancy.d.searby@nasa.gov
Eric Wood	USGS, CEOS WGCapD	woodec@usgs.gov

Angelica Gutierrez	NOAA	angelica.gutierrez@noaa.gov
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Ben Maathuis	ITC	b.h.p.maathuis@utwente.nl
Simon Hodson	CODATA	simon@codata.org

Annual meetings will play a key role; in particular three annual events are planned:

- A CB Symposium, which will assemble all major institutions active in CB programs, providing the opportunity to know their priorities, plans, and how they work; it will also be used to maintain the database on needs and resources;
- A CB forum, which will assemble all CB component coordinators of the GEO Flagships and Initiatives; the CB-WG will engage with the Forum at least twice a year - prior to Work Program Symposium and prior to Plenary;

3. Activities and outputs in 2016

a. CB Working Group

- i. Periodic review and update of the resource facility (relevance, maintenance and marketing)
- ii. Periodic review of capacity building needs
- iii. Develop and maintain a database with resource providers, ongoing programmes and activities
- iv. Undertake brokering activities - match needs with capabilities
- v. Strengthen links with the Permanent Networking Facility (PNF) for improved stakeholder interaction

b. GEO Secretariat

- i. Overarching coordination
- ii. Develop and maintain a database with resource providers, ongoing programmes and activities
- iii. Impact assessment - M&E – guidelines

Outputs

1. **Two** meetings of the CB Working Group
2. Holding the GEO Capacity Building Symposium
3. **Develop and maintain** a database with resource providers, ongoing programmes and activities
4. Undertake brokering activities - match needs with capabilities starting from January 2016
5. Holding a Capacity Building Forum (with participation of GEO Initiatives and Flagships Representatives)
6. Annual report on capacity building needs

CD 02 Reinforcing engagement at national and regional level (*includes EO uptake for decision making*)

1. General description

Provide support to GEO Members in establishing and strengthening national coordination mechanisms. Undertake active recruitment of new Member and Participating Organizations. Provide information and support to Members and POs on how to better participate in GEO activities and engage in GEO processes.

It is proposed that, as a measure to reinforce engagement and internal coordination, Members and POs publish a yearly report addressing their achievements in implementing the GEO objectives in different areas such as contribution to GEO activities, data policy, observation systems development and operations, use of Eos in decision making at various levels, development of the EO-related commercial sector. These reports will provide valuable information for several purposes.

2. Implementation approach and responsibilities

The task will be led by the Secretariat. Members and POs will have an active role in implementing the agreed guidelines and practices, in accordance with their respective responsibilities.

3. Activities and outputs in 2016

a. Contributors (Members and POs)

- i. Provide national Earth observations reports
- ii. Establish and run national GEOs

b. Secretariat

- i. Overarching coordination
- ii. Develop table of contents for national reports
- iii. develop guidelines for national coordination mechanism.
- iv. Support Members in preparation and publishing their national Earth observation reports.
- v. Assist international development and donor organizations with local knowledge and expertise from our country-principals and GEO coordinating organizations. This will ensure that the investment will strengthen the institutional capacity of the organizations with the legal responsibility to operate and manage monitoring and infrastructure related to GEO principles.
- vi. Outreach to potential and new Members

Outputs

1. Issue Template for EO reports
2. Outreach to potential and new Members

3. Members/POs Earth observations reports
4. Issue guidelines for national coordination mechanism.
5. Support Members in preparation and publishing their national Earth observation reports.

CD 03 Assess the benefits from EOs and of their socio-economic value

3. General description

The goal of this task is to assess the socioeconomic benefits and impacts of information on decisions and society. The impacts of data, information and applications on decisions need to be better understood, not only intuitively, but also through quantitative assessments. The primary focus of the task will be on developing methodologies, creating use cases/assessments, developing examples that can be broadly understood and conducting training. The work will build upon prior developments carried out by JRC in support of INSPIRE, the efforts supporting NASA Earth Science applications, the USGS economic analyses and case studies that are currently under examination. We anticipate that this multi-year effort will support a range of GEO activities including GEO Flagships and other GEO Initiatives.

2. Implementation approach and responsibilities

The task will be performed by a Task Team supported by the Secretariat Task Leader and Contributors

Jay Pearlman, IEEE – Task Lead
Richard Bernknopf, IEEE (also University of New Mexico)
Andrew Coote, Consultingwhere
Max Craglia, JRC European Commission
Claire Jolly, OECD
Jamie Kruse, University of East Carolina
Francoise Pearlman, IEEE
Hans-Peter Plag, IEEE
Alan Smart, ACIL Allen

2. Planned activities and outputs in 2016

The work in 2016 will consist of defining methodologies that can be applied to Flagships and Initiatives. This will include an international workshop at OECD in March 2016 and selected case studies. The latter will provide for assessment of applicability to GEO activities. Existing case studies will be consolidated to facilitate ready access. An essential element of this Task is outreach to the community, both to professionals and to the public that has an interest in Earth observation. The core information will be made available through a task website and through contributions of material to GEO website. Professionals will participate in a Linked-in community to exchange ideas and approaches for impact assessments. For the public, Earthzine will provide a base for the outreach through the inclusion of articles and themes supporting GEO and this task. Additionally, results of this Task will be presented at selected international

meetings.

- a. Contributors
 - I. Identification and consolidation of representative case studies for baseline analyses.
 - II. International Workshop at OECD in March 2016 to bring together natural, social and economic scientists to look at use cases and applications.
 - III. Sessions or presentations at major conferences (AGU in US and one in Europe)
 - IV. Expansion of a related LinkedIn community
 - V. Publication of themes and discussions in Earthzine and other journals.
 - VI. Maintenance of a web site.
- b. GEO Secretariat
 - i. Coordinate and develop the LinkedIn virtual community.
 - ii. Support organization and documentation of, and attend, the workshop in March 2016.
 - iii. Provide relevant material about GEO to an SEB web site and and material for articles in Earthzine.
 - iv. Provide input material into the GEO website and keep it current based on inputs from the team.
 - v. Support the coordination of key areas of impact assessment through information from GEO tasks and consolidation of use cases.

SO Secretariat Operations

SO 01 Management and Support

1. General description

This task consolidates the definition of the activities (and of the associated resources) currently performed by the Secretariat, with some additional support from Members and POs, to ensure the functioning of the Organization.

Two kinds of activities are included:

Supporting the GEO Governance and convening the GEO Stakeholders:

- i. Preparation and execution of Summits, Plenaries, Executive Committee meetings, documents preparation and reporting.
- ii. Support Program Board activities
- iii. Development of Work Programmes,
- iv. Development and operation IT tools (website, ftp, ..)
- v. Organization of meetings to make the GEO cooperation framework working, such as the WP Symposium, AP Symposium,
- vi. Support travel of seconded experts dedicated to initiatives/flagship (AfriGEOSS, GEOGLAM)
- vii. Performing all the internal activities to ensure a functioning Secretariat, such as Human and financial resources Management

2. Planned activities and outputs in 2016

- a. Contributors
 - i. Support organization of and participation to GEO meetings and events

b. GEO Secretariat

- i. Development and maintenance of a GEO Calendar
- ii. Overarching coordination and execution of the activities

SO 02 Communications and Engagement

1. General description

This task utilizes the outputs and results of the other GEO activities as the foundation for Engagement and Communications with Stakeholder Communities. The task also develops tools and activities to increase the visibility and awareness of GEO and its achievements.

The main tools to implement the Communications and Engagement activities will include:

- Development or updating, and implementation of, an engagement and communications strategy, including identification of critical partners and targeted stakeholders;
- development of annual Communications and Engagement Plans;
- continued development of the GEO website;
- utilization of web-based magazines focused on GEO and Earth observations;
- development of dedicated Communications material in conjunction with GEO community experts;
- identifying and arranging GEO's participation in selected events within and outside of the GEO community;
- organization of dedicated events targeting users and decision makers,
- utilization of social media;
- developing and implementing guidelines on the use of the GEO "brand," including consistent representation of GEO by its volunteer partners (e.g., use of logo, GEO colors, GEO name); and
- identifying and implementing systematic actions to promote and facilitate the uptake of EO in decision-making, in collaboration with GEO community experts.

2. Implementation approach and responsibilities

The task will be led by the Secretariat, which is expected to perform the majority of the activities. It will be supported by a "Communications and Engagement Team" whose main function would be to identify opportunities for GEO to engage with stakeholders within and beyond the GEO community, and provide access to GEO Member and PO resources to implement relevant actions.

3. Activities in 2016

Based on the Engagement Strategy approved at the 34th Session of the GEO Executive Committee, during 2016, the Communications and Engagement activities will focus on the following:

- Overarching communication activities, which will lay the foundation for GEO's outreach to a global audience, and will include development of foundational materials and communication channels;
- Developing engagement messages geared toward identified "priority" stakeholders, to be delivered at targeted events, based on GEO's strengths and competencies compared to existing or emerging national, regional and global

challenges;

- Assisting in convening a limited number (2-3) of segments of the GEO community with interested stakeholders in face-to-face workshops, forums and one-on-one dialogues to identify stakeholder needs and potential GEOSS-based solutions; and
- Developing partnerships between interested stakeholders and GEO experts to deliver the added-value of GEO and GEOSS directly to these “strategic partners”.

Working in close collaboration with the SBA communities, the Secretariat will provide support in the following initial areas of focus:

1. Assisting the Disasters SBA in developing pilot projects in one or more developing countries focused on building human and technological capacity to implement the Sendai Framework for Disaster Risk Reduction;
2. Assisting the GEOSS/GCI community in developing a strategic data infrastructure partnership with Future Earth to address domain-specific needs collaboratively identified by the Future Earth and GEO communities;
3. Developing new or deepening existing partnerships with the UN organizations responsible for specific Multilateral Environmental Agreements (MEAs) (e.g., Sendai Framework for Disaster Risk Reduction (UNISDR), Ramsar Convention on Wetlands of International Importance (Ramsar), Convention on Biodiversity (CBD)); working with Member States and other stakeholders to integrate Earth observations into national processes to measure, monitor and achieve agreed MEA goals;
4. Integrating Earth observations into decision-making in International Development Banks and Non-Governmental Organizations (NGOs); through partnerships with international development banks, demonstrating the value of Earth observations in decision-making in developing countries, understand country-specific needs and help to develop capacity to use Earth observation information in decision-making through the delivery of products and services tailored to those countries’ needs. Similarly, GEO will encourage systematic use of Earth observations in the various project management phases of the development banks – assessment, monitoring and evaluation, as appropriate;
5. Developing partnerships with international development banks and NGOs (e.g., The Nature Conservancy, Conservation International, The Natural Capital Coalition), to assist governments in developing national ecosystem accounts and integrating Earth observations into Environmental Ecosystem Accounting, thus establishing a critical link between Earth observations and the core efforts of the UN Statistical Commission System of Environmental-Economic Accounting (UNSEEA);
6. Deepening existing or developing new, strategic partnerships with national, international and global foundations to help develop in-country capacity to utilize Earth observations in the implementation of funded and future projects, with an initial focus in the agriculture, health and water domains;
7. Developing partnerships with selected companies, and their Associations, to facilitate contributions to and increase up-take of GEOSS resources for the development of applications, information and products to be used by decision

makers;

8. Identifying and convening potential partners (valued-add providers, mobile application developers, data integrators, etc.) to collaboratively identify user needs and GEO capabilities to develop value-products for specific user needs. GEO will also seek to engage companies to help deliver user driven applications, tools and resources in GEO initiatives and activities; and
9. Building on its existing partnership with the Belmont Forum, assist in the implementation of the recommendations of the E-infrastructures and Data Management Collaborative Research Action (pending approval of the recommendations in October 2015).

SO 03 Monitoring and Evaluation

1. General description

Perform all the Monitoring and Evaluation activities identified by the M&E Framework attached to the Strategic Plan. In general terms they include:

2. Implementation approach and responsibilities

(from the Strategic Plan Reference Document)

The purpose of monitoring is to track the progress of the completion of the GEO Work Programme. The GEO Secretariat will conduct monitoring on an on-going and systematic basis, making use where possible of indicators and coinciding timelines with the development of the forthcoming GEO Work Programme and meetings of the Programme Board.

The purpose of the evaluation is to inform improvement of GEO's activities by conducting assessments of the progress towards achieving targets, including intended outputs and outcomes. The evaluation will take note of other contributing activities that are not included in the GEO Work Programme, but are attributable, at least in part, to GEO's actions. Results of the evaluation will help determine what difference GEO has made (effectiveness).

The evaluation previously performed by the Monitoring and Evaluation Working Group is implemented through a Foundational Task included in the Work Programme. Reports are used by the Programme Board.

An independent Evaluation Team, supported by the Secretariat, should be set up for each evaluation to execute the evaluation processes. Two comprehensive evaluations should be conducted with one mid-way through the Strategic Plan period and the other near the end.

3. Activities in 2016

a. GEO Secretariat

- i. Identify performance indicators for the Targets identified in the Strategic Plan, for ExCom endorsement
- ii. Track progress of Work Programme activities, including feedback on implementation mechanisms
- iii. Measure baseline values for performance indicators.
- iv. Propose 2019 and 2024 values for the performance indicators, for Plenary approval

SO 04 Resource Mobilization

1. General description

Ensure that the level of resources contributed by GEO stakeholders is compatible with the planned GEO activities and facilitate their use.

2. Implementation approach and responsibilities

The task will be led by the Secretariat, with the support of a small team (To be identified). Members and POs will have an active role in implementing the agreed guidelines and practices, in accordance with their respective responsibilities.

a. Contributors

i. (Members and POs) Establish internal processes to identify resources for contribution to GEO activities and to coordinate their use

ii. (support team) support the Secretariat in define guidelines and engaging with funding agencies

b. GEO Secretariat

i. Overarching coordination

ii. Define guidelines and practices for resources mobilization within GEO

i. Support the definition of the resources for the implementation of GEO planned activities

ii. Engage with international funding agencies to secure resources (different mechanisms may be applied)

3. Planned activities and outputs for 2016

1. Define guidelines and practices for resource mobilization for GEO activities

2. Engage with (2-3) international funding organizations to define mechanisms to secure resources for specific GEO activities

5.5 Foundational Tasks Resources Summary

Preliminary resource estimation has been performed by the Secretariat and its results are presented in ANNEX 2 at the level of individual task, grouped in the three blocks identified above, and as an Overall summary, for a total of four tables

GEO Secretariat human resources are identified in terms of hours x year and estimated using two average reference values, one for professional personnel and one for support personnel. Seconded experts involvement will be identified in terms of hours x year; 1750 hours is the reference total hours x year.

The total estimated resources (both in cash and in kind, i.e. seconded experts) form the basis for the definition of the 2016 Budget and of the associated Secretariat staffing plan.

External contributions are identified in terms of total hours contributed and of actual costs to be incurred for the performance of the activities identified.

Annex 1 – Table: Foundational Tasks – Summary of 2016 Deliverables

GD	GEOSS Development and GCI Operations	Key Deliverables
GD-01	Advancing GEOSS Data Sharing principles	<ol style="list-style-type: none"> 1. Hold at least one meeting of DSWG 2. Draft Implementation Guidelines on Data Sharing Principles for Plenary approval in 2016 3. Produce a report on international Open Data trends 4. Draft a summary on monitoring the progress of GEO Members in establishing and implementing Open Data Policies
GD-02	GCI Operations (<i>including access to Knowledge</i>)	<ol style="list-style-type: none"> 1. Continue GCI operations 2. Develop a concept paper on user desk will work by April 2016, with interactions and support by SIF. User desk should be operational in 2016 3. Start the configuration control of GCI 4. Improve capabilities of existing brokering providers in particular more accessibility 5. Connect new providers giving priority to those relevant to Flagships, Initiatives and Community Activities and key members and participating organizations 6. Definition of improvements of early next year to be incorporated in the next 3year WP 7. Test and release new GEOSS resource registration process, including the synchronization of the CSR and the DAB.
GD-03	Global Observing and Information Systems (<i>includes systems like WIGOS, GCOS; And reference datasets</i>)	<ol style="list-style-type: none"> 1. Resume coordination and consultations with Global Observing and Information Systems . In 2016, start leveraging and promoting WIGOS and WIS in GEO Community. Seeking other systems to take part in the task. 2. Start the development of a document describing GEO plans to support existing Systems and facilitate development of new ones, including their connection with GCI 3. Start the development of a report on “Inventory of Global Earth observation and information systems” with identifying potential gaps, duplications and synergies
GD-04	GEONETCast Development and Operations	<ol style="list-style-type: none"> 1. Continue GEONETCast operations 2. Test options for truly global coverage 3. Develop and test a GEONETCast planning tool and a friendly User Interface (including a service desk) 4. Develop a GEONETCast User Guide
GD-05	GEOSS satellite Earth Observation Resources	<ol style="list-style-type: none"> 1. Review the strategy and plans for the implementation of Virtual Constellations 2. Develop options on how better support the SBA’s rolling processes on User Needs/Observation Requirements

GD	GEOSS Development and GCI Operations	Key Deliverables
GD-06	GEOSS non-space based Earth Observation Resources	<ol style="list-style-type: none"> 1. Develop a plan of activities for the task, with defined leadership roles 2. Publish a report on the status of global non space-based coordination and frameworks, addressing also the sustainability of existing measurements, facilitating the transition from research to sustained long-term operations, and the integration of space-based and non space-based observations.
GD-07	GCI Development	<ol style="list-style-type: none"> 1. Draft document of GEOSS Architecture 2. Consolidate/update a document “Evolution of GCI functionalities and architecture” including following topics: <ol style="list-style-type: none"> a. A report on “GCI Operations options” for 2016 b. Plenary decision and implementation starting from 2017 3. Interact with GD08 (SBA process) and GD09 (Knowledge base) to collect requirements for designing the new functionalities 4. Implement new functionalities in 2016 to improve the accessibility and usability of GCI resources. 5. Report results on Demonstration pilot Projects 6. Approved Data Management Guidelines at GEO-XIII and draft a process of implementation with Flagships, Initiatives and Community Activities with training and workshops. 7. Organize a GEOSS Interoperability Workshop in 2016 and conduct virtually (arranged and managed by the SIF) 8. Publish new guidelines and tutorials in the Best Practices Wiki (The process is managed by the SIF.) 9. Deliver an updated version of the Community Portal Paper with specific recommendation based on interactions between community components and the GCI.
GD-08	SBAs process: Systematic determination of user needs / observational gaps	<ol style="list-style-type: none"> 1. Issue a document describing the process and how it will be run 2. Define initial plans for each SBA 3. Activate the process for at least three SBAs by 2016
GD-09	Knowledge Base development	<ol style="list-style-type: none"> 1. Convene the team 2. Issue a report on GEOSS knowledge base concept and development approach 3. Start the compilation of available knowledge resources 4. Design and prototype a database to host GEO-developed knowledge

GD	GEOSS Development and GCI Operations	Key Deliverables
GD-10	Radio-frequency protection	Actions will be activated to prepare GEO positions for the events requiring strong support to EO instruments working frequencies protection.
GD-11	Communications Networks	<ol style="list-style-type: none"> 1. It is envisaged to hold a meeting with all contributors to exchange information and discuss on existing requirements, architecture and solutions and present the output to the GEO Programme Board. 2. Facilitate meeting with AfriGEOSS and the African NREN organizations to discuss existing communication infrastructure, requirements and developing activities in the region. 3. Participate in the 2016 activities of WMO's Expert Team on Telecommunications Infrastructure (ET-CTS) with an aim to refining the conceptual architecture. 4. Report on the initial progress and findings of this task to the 16th session of the Commission for Basic Systems (CBS) to be held in the second half of 2016, seeking further commitment to this GEOSS activity. 5. Activate a specific advocacy action with ITU for improvement of communication infrastructure in developing countries.

CD	Community Development	Key Deliverables
CD-01	Capacity Building coordination	<ol style="list-style-type: none"> 1. Two meetings of the CB Working Group 2. Holding the GEO Capacity Building Symposium 3. Develop and maintain a database with resource providers, ongoing programmes and activities 4. Undertake brokering activities - match needs with capabilities starting from January 2016 5. Holding a Capacity Building Forum (with participation of GEO Initiatives and Flagships Representatives) 6. Annual report on capacity building needs
CD-02	Reinforcing engagement at national and regional level <i>(includes EO uptake for decision making)</i>	<ol style="list-style-type: none"> 1. Issue Template for EO reports 2. Outreach to potential and new Members 3. Members/POs Earth observations reports 4. Issue guidelines for national coordination mechanism. 5. Support Members in preparation and publishing their national Earth observation reports.
CD-03	Assess the benefits from EOs and of their socio-economic value	<ol style="list-style-type: none"> 1. Define case studies for baseline analyses. 2. Holding an International Workshop at OECD in March 2016 3. Ensure presence at major international events (such as AGU in US and EGU Europe) 4. Publication of themes and discussions in Earthzine and other journals 5. Maintenance of a web site 6. Develop and coordinate the LinkedIn virtual community 7. Update GEO website and keep it current based on inputs from the team

SO	Secretariat Operations	Key Deliverables
SO-01	Management and Support	<ol style="list-style-type: none"> 1. Convene GEO Governance meetings (preparation and execution of GEO-XIII Plenary, Executive Committee meetings, documents preparation and reporting. 2. Support Program Board activities 3. Development of Work Programme 2017-19, 4. Development and operation IT tools (website, ftp, ..) 5. Organization of meetings to make the GEO cooperation framework working, such as the WP Symposium, AP Symposium 6. Perform all the internal activities to ensure a functioning Secretariat, such as Human and financial resources Management
SO-03	Communication and Engagement	<ol style="list-style-type: none"> 1. Perform communications campaign 2. Develop foundational materials/ communication channels 3. Develop and deliver targeted engagement messages 4. Assist in convening a limited number (2-3) of segments of the GEO community with interested stakeholders in face-to-face workshops, forums and one-on-one dialogues to identify stakeholder needs and potential GEOSS-based solutions, including developing partnerships between interested stakeholders and GEO experts to deliver the added-value of GEO and GEOSS directly to these “strategic partners” 5. Assist specific communities in engagement activities (Disasters - Sendai framework, GEO-Future Earth) 6. Strengthen/Develop partnerships to foster use of EO’s, with: Un Conventions, MEAs (including Environmental Ecosystem Accounting), Development Banks, NGOs, Foundations, Companies / Associations. 7. Assist in implementing Belmont Forum recommendations on e-infrastructure and data management
SO-02	Monitoring and Evaluation	<ol style="list-style-type: none"> 1. Identify performance indicators for the Targets defined in the Strategic Plan, for ExCom endorsement 2. Track progress of Work Programme activities, including feedback on suitability of GEO implementation mechanisms development 3. Measure baseline values for performance indicators. 4. Propose 2020 and 2025 values for the performance indicators, for GEO-XIII approval
SO-04	Resource Mobilization	<ol style="list-style-type: none"> 1. Define guidelines and practices for resource mobilization for GEO activities 2. Engage with (2-3) international funding organizations to define mechanisms to secure resources for specific GEO activities

Annex 2 - Foundational tasks Resource Summary (1)

TASK	GEO Secretariat resources										External Contributions	
	GEO Trust Fund									Secondments	Personnel (hours)	Direct expenditure K\$
	Personnel					External services CHF	Travel CHF	Meetings support CHF	TOTAL (CHF)	Personnel (hours)		
	Professional Time	CHF	Support Time	CHF	Total CHF							
GD-01 Data Sharing	849	121	170	14	135	2	11	8	157	0	1900	56
GD-02 GCI Operations	892	127	170	14	141	0	44	2	187	1486	9975	340
GD-03 Global Observing and Information Systems	255	36	42	3	40	0	8	0	48	0	2500	10
GD-04 GEONETCast Development and Operations	255	36	0	0	36	0	8	0	44	0	2625	130
GD-05 GEOSS satellite Earth Observation Resources	170	24	0	0	24	0	10	0	34	0	10000	0
GD-06 GEOSS in situ Earth Observation Resources	340	49	0	0	49	0	10	0	59	0	3500	20
GD-07 GCI Development	340	49	170	14	62	0	76	0	139	679	12950	670
GD-08 SBAs process: Systematic determination of user needs / observational gaps	849	121	170	14	135	0	13	34	182	5349	4000	100
GD-09 Knowledge Base development	255	36	170	14	50	0	34	0	84	5349	2250	112
GD-10 Radio Frequency Protection	85	12	0	0	12	0	0	0	12	0	500	0
GD11 Communications Networks	127	18	0	0	18	0	0	0	18	0	350	0
TOTALS	4415	631	892	71	702	2	215	44	963	12863	50550	1438
								WMO Administration Costs	7.00%	67		
								GRAND TOTAL		1031		

Foundational tasks Resource Summary (2)

Community Development Summary	GEO Secretariat resources										External Contributions	
	GEO Trust Fund									Secondments	Personnel (hours)	Direct expenditure K\$
	Personnel					External services CHF	Travel CHF	Meetings support CHF	TOTAL (CHF)	Personnel (hours)		
	Professional		Support		Total							
Time	CHF	Time	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF	
CD-01 Capacity Building coordination	0	0	340	27	27	0	68	0	95	866	2318	70
CD-02 Reinforcing engagement at national and regional level	467	67	170	14	80	0	30	0	110	0		
CD-03 Assess the benefits from EOs and of their socio-economic value	446	64	0	0	64	0	4	5	72	722	1125	66
TOTALS	913	130	509	41	171	0	101	5	277	1588	3443	137
								WMO Administration Costs	7.00%	19		
								GRAND TOTAL		297		

Foundational tasks Resource Summary (3)

Secretariat Operations Summary	GEO Secretariat resources										External Contributions	
	GEO Trust Fund									Secondments	Personnel (hours)	Direct expenditure K\$
	Personnel					External services CHF	Travel CHF	Meetings support CHF	TOTAL (CHF)			
	Professional		Support		Total							
Time	CHF	Time	CHF	CHF								
SO-01 Management and support	6903	986	3863	309	1295	335	235	305	2171	3838	4100	390
SO-02 Monitoring and Evaluation	1248	178	170	14	192	0	8	0	200	0	0	0
SO-03 Communication and Engagement	2675	382	442	35	417	76	59	0	553	0	300	0
SO-04 Resource Mobilization	1274	182	85	7	189	0	8	0	197	0	400	10
TOTALS	12099	1728	4559	365	2093	412	311	305	3121	3838	4800	400
								WMO Administration Costs	7.00%	218		
								GRAND TOTAL		3339		

Foundational tasks Resource Summary (4)

TOTAL FOUNDATIONAL TASKS	GEO Secretariat resources										External Contributions	
	GEO Trust Fund									Secondments	Personnel (hours)	Direct expenditure K\$
	Personnel					External services CHF	Travel CHF	Meetings support CHF	TOTAL (KCHF)	Personnel (hours)		
	Professional		Support		Total CHF							
Time	CHF	Time	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF		
GEOSS Development and GCI Operations	4415	631	892	71	702	2	215	44	963	12863	50550	1438
Community Development	913	130	509	41	171	0	101	5	277	1588	3443	137
Secretariat Operations	12099	1728	4559	365	2093	412	311	305	3121	3838	4800	400
TOTALS	17427	2490	5960	477	2966	413	627	354	4361	18289	58793	1975
							WMO Administration Co.	7.00%	305			
								GRAND TOTAL	4666			

Projected trust fund for 2017: 5.4 MCHF

Average Secretariat staff during 2016:	
Professional staff	10
Support staff	3.5
Seconded experts	10

Planned Secretariat staff at the end of 2016:	
Professional staff	11
Support staff	4
Seconded experts	12

GEO Work Programme 2016 version v4 List of Points of Contact

CA	Description	Point of Contact	email	GEOSEC
CA-01	Global Land Cover	Brice Mora, GOFC-GOLD Chen Jun (NSDI, China) Chris Steenmans, EEA Andreas Brink, JRC Zoltan Szantoi, JRC	brice.mora@wur.nl chenjun@nsdi.gov.cn chris.steenmans@eea.europa.eu andreas.brink@jrc.ec.europa.eu zoltan.szantoi@jrc.ec.europa.eu	André Obregon aobregon@geosec.org Gary Geller ggeller@geosec.org
CA-02	Land Cover for Africa	Farah Hussein, RCMRD Amadou Dieye	farah@rcmr.org dieye@cse.sn	André Obregon aobregon@geosec.org Gary Geller ggeller@geosec.org
CA-03	Access to climate data in GEOSS	Glenn Rutledge, NOAA Michel Rixen, WCRP	glenn.rutledge@noaa.gov mrixen@wmo.int	André Obregon aobregon@geosec.org
CA-04	Strengthen collaboration between GEO and GFCS	Meredith Muth, NOAA, USA Stefan Rösner, DWD, Germany	meredith.f.muth@noaa.gov stefan.roesner@dwd.de	André Obregon aobregon@geosec.org
CA-05	TIGGE (Thorpex Interactive Grand global Ensemble) evolution into a Global Interactive Forecast System (GIFS)	Jean-Noel Thepaut, ECMWF	jean-noel.thepaut@ecmwf.int	André Obregon aobregon@geosec.org
CA-06	EO data and mineral resources (Includes also the, Impact Monitoring System for Geo-Resource Exploration and	Stephane Chevrel, BRGM, France	s.chevrel@brgm.fr	André Obregon aobregon@geosec.org

CA	Description	Point of Contact	email	GEOSEC
	Exploitation)			
CA-07	Integrated Water-cycle Products and Services - Overall coordination	Richard Lawford, Morgan State University, USA	rlawford@gmail.com	Dominique Berod dberod@geosec.org
CA-08	Water Vapor and Clouds (and Aerosol and Precipitation)	Ralph Ferraro, NOAA/NESDIS USA	Ralph.R.Ferraro@noaa.gov	Dominique Berod dberod@geosec.org
CA-09	Precipitation	George Huffman: GFSC, NASA, USA	george.j.huffman@nasa.gov ,	Dominique Berod dberod@geosec.org
CA-10	Evapotranspiration (and Evaporation)	Forrest Melton NASA USA	forrest.s.melton@nasa.gov	Dominique Berod dberod@geosec.org
CA-11	Soil Moisture	Peter van Oevelen, GEWEX	pvanoevelen@gmail.com	Dominique Berod dberod@geosec.org
CA-12	River Discharge	Julius Whellens-Mensah WMO	jwellens-mensah@wmo.int	Dominique Berod dberod@geosec.org
CA-13	Groundwater	Neno Kukuric IGRAC	Neno.Kukuric@un-igrac.org ;	Dominique Berod dberod@geosec.org
CA-14	GEO Water Quality	Steven Greb, WDNR USA	steven.greb@wisconsin.gov	Dominique Berod dberod@geosec.org
CA-15	Water Cycle Capacity Building	Angelica Gutierrez-Magness, CIEHLYC	Angelica.Gutierrez@noaa.gov	Dominique Berod dberod@geosec.org
CA-16	Global Drought Information System (GDIS)	Will Pozzi USA	will.pozzi@gmail.com	Dominique Berod dberod@geosec.org
CA-17	GEO Great Lakes Activity	Gail Faveri Canada Norman Granneman USA	Gail.Faveri@ec.gc.ca nggranne@usgs.gov	Dominique Berod dberod@geosec.org
CA-18	Water Cycle Integrator (WCI)	Toshio Koike Japan	tkoike@hydra.t.u-tokyo.ac.jp	Dominique Berod dberod@geosec.org

CA	Description	Point of Contact	email	GEOSEC
CA-19	E2E Water Indicators	Charles J. Vörösmarty, CUNY Environmental CrossRoads Initiative, City University of New York USA	cvorosmarty@ccny.cuny.edu	Dominique Berod dberod@geosec.org
CA-20	EartH2Observe	J. Schellekens, The Netherlands	jaap.schellekens@deltares.nl	Dominique Berod dberod@geosec.org
CA-21	Total Water Prediction: Observations Infrastructure (new-US)	Angelica Gutierrez, NOAA, USA	angelica.gutierrez@noaa.gov	Dominique Berod dberod@geosec.org
CA-22	Linking water tasks with wider societal benefit areas and the post-2015 global development framework	Richard Lawford, Morgan State University, USA and Adrian Strauch, University of Bonn, Germany.	rlawford@gmail.com ; adrian.strauch@uni-bonn.de	Dominique Berod dberod@geosec.org
CA-23	Space and Security	Sergio Albani, European Union Satellite Centre (EU SatCen)	Sergio.Albani@satcen.europa.eu	Osamu Ochiai oochiai@geosec.org
CA-24	Earth Observation in Cultural Heritage documentation	Petros Patias, the Aristotle University, Greece	patias@auth.gr	Wenbo Chu wchu@geosec.org Chao Xing cxing@geosec.org
CA-25	Africa Global-scale Geochemical Baselines for mineral resource and environmental management: Capacity-building phase	Claudia Delfini, Eurogeosurveys	claudia.delfini@eurogeosurveys.org	Gary Geller ggeller@geosec.org
CA-26	Towards Chinese tsunami mitigation system under GEO framework	WEN Ruizhi, Institute of Engineering Mechanics, China Earthquake Administration, China	ruizhi@iem.ac.cn	Dominique Berod dberod@geosec.org Chao Xing cxing@geosec.org

CA	Description	Point of Contact	email	GEOSEC
CA-27	Foster Utilization of Earth Observation Remote Sensing and In Situ Data for All Phases of Disaster Risk Management (new-CEOS)	Ivan Petiteville (CEOS) Kerry Sawyer (CEOS)	Ivan.Petiteville@esa.int	Dominique Berod dberod@geosec.org
CA.28	Global Flood Risk Monitoring (new-US)	NASA, USA David Green	david.s.green@nasa.gov	Dominique Berod dberod@geosec.org
CA.29	Using Geospatial Data to Identify and Monitor Ecosystem Service and Track in a Natural Capital – Ecosystems Accounts Framework (new-US)	State Department USA John Matuszak	MatuszakJM@state.gov	Gary Geller ggeller@geosec.org
CA-30	Harmful Algal Bloom (HAB) Early Warning System (new-US)	NOAA USA, Juli Trtanj	juli.trtanj@noaa.gov	Gary Geller ggeller@geosec.org
CA-31	For Global Mangrove Monitoring (new-US)	USGS USA Chandra Giri	cgiri@usgs.gov	Gary Geller ggeller@geosec.org
CA-32	Research Data Science Summer Schools (new-CODATA/RDA)	CODATA and RDA Simon Hodson	simon@codata.org	Andiswa Mlisa amlisa@geosec.org
CA-33	Building capacity for Forest Biodiversity in Asia and the Pacific Region (new-Indian Institutions)	K. D. Singh Academy of Forest and Environmental Sciences, FRI Campus, Dehradun, India	karndeo_singh@hotmail.com	Andiswa Mlisa amlisa@geosec.org

GI	Description	Point of Contact	email	GEOSEC
GI-01	GEOGLAM-Global Agricultural Monitoring and Early Warning	Michel Deshayes	mdeshayes@geosec.org	Michel Deshayes mdeshayes@geosec.org
GI-02	GEOBON-Global Biodiversity Observation (GEO BON)	Jörg Freyhof GEO BON Executive Director Germany	joerg.freyhof@idiv.de	Gary Geller ggeller@geosec.org
GI-03	GFOI Global Forest Observation Initiative	Stephen Ward, GFOI Office Coordinator, Australia	mail@stephenward.net	Gary Geller ggeller@geosec.org
GI-04	Global Observing System for Mercury and Persistent Pollutants	Nicola Pirrone, CNR Italy	pirrone@iia.cnr.it	Douglas Cripe dcripe@geosec.org
GI-05	Global Carbon Observation and Analysis System	Antonio Bombelli, CMCC- Italy Werner Kutsch . ICOS Headoffice-Finland	antonio.bombelli@cmcc.it werner.kutsch@icos-ri.eu	André Obregon aobregon@geosec.org
GI-06	Reinforcing engagement at regional level: AfriGEOSS for Africa	Andiswa Mlisa	amlisa@geosec.org	Andiswa Mlisa amlisa@geosec.org
GI-07	Ocean and society - Blue Planet	Sophie Seeyave and Trevor Platt, POGO	ssve@pml.ac.uk tplatt@dal.ca	Douglas Cripe dcripe@geosec.org
GI-08	GEO Geohazard Supersites and Natural Laboratories (GSNL)	Stefano Salvi, INGV Italy	stefano.salvi@ingv.it	Dominique Berod dberod@geosec.org

GI	Description	Point of Contact	email	GEOSEC
GI-09	Global Wildfire Information System	Jesus San Miguel, EC/JRC	jesus.san-miguel@jrc.ec.europa.eu	Dominique Berod dberod@geosec.org
GI-10	EO data and renewable energies	Thierry Ranchin MINES ParisTech/ ARMINES . PSL - Research University, France	thierry.ranchin@mines-paristech.fr	André Obregon aobregon@geosec.org
GI-11	Information Services for Cold Regions	Yubao Qiu Institute of Remote Sensing and Digital Earth (RADI) under the <i>Chinese</i> Academy of Sciences (CAS), China	qiuyb@radi.ac.cn	Dominique Berod dberod@geosec.org
GI-12	Integrated Information Systems for Health (Cholera, Heat waves)	NOAA USA Juli Trtanj	juli.trtanj@noaa.gov	Douglas Cripe dcripe@geosec.org
GI-13	Integration of Methods for Air Quality and Health Data, Remote Sensed and In-Situ with Disease Estimate Techniques (new US)	EPA USA Phil Dickerson	Dickerson.Phil@epa.gov	Douglas Cripe dcripe@geosec.org
GI-14	GECCO: the GEO Global Ecosystem Initiative	A. Provenzale, CNR Italy	antonello.provenzale@cnr.it	Gary Geller ggeller@geosec.org
GI-15	GEO-GNOME Initiative: GEO Global Network for Observation and information in Mountain Environments	A. Provenzale, CNR Italy	antonello.provenzale@cnr.it	Gary Geller ggeller@geosec.org

GI	Description	Point of Contact	email	GEOSEC
GI-16	GEO-DARMA = Data Access for Risk Management (new-CEOS) <i>(to support the implementation of Sendai framework 2016-30)</i> .	Ivan Petiteville (CEOS)	Ivan.Petiteville@esa.int	Dominique Berod dberod@geosec.org
GI-17	Global Urban Observation and Information	Qihao Weng, Indiana State University - USA	qweng@indstate.edu	André Obregon aobregon@geosec.org Wenbo Chu wchu@geosec.org
GI-18	Earth Observations in Service of the 2030 Agenda for Sustainable Development	TBD		Robert Samors rsamors@geosec.org Giovanni Rum grum@geosec.org
GI-19	AmeriGEOSS (new)	Angelica Gutierrez, NOAA, USA	angelica.gutierrez@noaa.gov	Giovanni Rum grum@geosec.org
GI-20	GEO Global Water Security (GEOGLOWS) new-US	Bradley Doorn, NASA, Jerad Bales, USGS, USA	bradley.doorn@nasa.gov ; jdbales@usgs.gov	Dominique Berod dberod@geosec.org
GI-21	Human Planet Initiative	Martino Pesaresi, JRC/EC	martino.pesaresi@jrc.ec.europa.eu	André Obregon aobregon@geosec.org Wenbo Chu wchu@geosec.org

PROPOSED FOUNDATIONAL TASKS

GD	GEOSS Development and GCI Operations			
	Description	Point of Contact	email	GEOSEC
GD-01	Advancing GEOSS Data Sharing principles	Data Sharing WG Co-chairs Robert Chen (ICSU) Catherine Doldirina (EC/JRC) Michel Schouppe (EC) Lerato Senoko (RSA) Paul Uhlir (ICSU) Greg Withee (US)	bchen@CIESIN.COLUMBIA.EDU catherine.doldirina@JRC.EC.EUROPA.EU michel.schouppe@ec.europa.eu lerato.senoko@DST.GOV.ZA puhlir@NAS.EDU gwithee@MSN.COM	Wenbo Chu wchu@geosec.org
GD-02	GCI Operations	Mirko Albani ESA	mirko.albani@esa.int	Paola De Salvo pdesalvo@geosec.org
GD-03	Global Observing and Information Systems	Lars-Peter Riisojgaard, WMO-WIGOS	lriishojgaard@wmo.int	Osamu Ochiai oochiai@geosec.org
GD-04	GEONETCast Development and Operations	Chunfang Wang, CMA Mike Williams, EUMETSAT Eric Madsen, NOAA	wangcf@cma.gov.cn mike.williams@eumetsat.int eric.madsen@noaa.gov	Osamu Ochiai oochiai@geosec.org
GD-05	GEOSS satellite Earth Observation Resources	Brian Killough CEOS	brian.d.killough@nasa.gov	Osamu Ochiai oochiai@geosec.org
GD-06	GEOSS non space-based Observation Resources	Osamu Ochiai	oochiai@geosec.org	Osamu Ochiai oochiai@geosec.org
GD-07	GCI Development	Ivan B. DeLoatch, USGS	ideloatch@usgs.gov	Paola De Salvo pdesalvo@geosec.org

	Description	Point of Contact	email	GEOSEC
GD-08	SBA processes: Systematic determination of user needs / observational gaps	Secretariat Experts		Giovanni Rum grum@geosec.org
GD-09	Knowledge Base development	Hans Peter Plag, IEEE Stefano Nativi, CNR Italy	hpplag@odu.edu stefano.nativi@cnr.it	Douglas Cripe dcripe@geosec.org
GD-10	Radio-frequency protection	Jose Arimatea de Sousa Brito, WMO	josearimateabrito@gmail.com	Osamu Ochiai oochiai@geosec.org
GD-11	Utilization of Communication Networks	Beatrix Weber, GEANT	Beatrix.Weber@geant.org	Osamu Ochiai oochiai@geosec.org

CD	Community Development			
	Description	Point of Contact	email	GEOSEC
CD-01	Capacity Building coordination	Gregory Giuliani, University of Geneva, CH Mark Noort, HCP International Hilcea Ferreira, INPE, Brazil	gregory.giuliani@unepgrid.ch m.noort@hcpinternational.com hilcea@dpi.inpe.br	Andiswa Mlisa amlisa@geosec.org
CD-02	Reinforcing engagement at national and regional level	Secretariat Expert		Andiswa Mlisa amlisa@geosec.org Wenbo Chu wchu@geosec.org
CD-03	Assess the benefits from EOs and of their socio-economic value	Jay Pearlman, IEEE	jay.pearlman@jandfent.com	Robert Samors rsamors@geosec.org Giovanni Rum grum@geosec.org

SO	Secretariat Operations			
	Description	Point of Contact	email	GEOSEC
SO-01	Management and Support	Secretariat Expert		Patricia Geddes pgeddes@geosec.org
SO-02	Communication and Engagement	Secretariat Expert		Robert Samors rsamors@geosec.org
SO-03	Monitoring and Evaluation	Secretariat Expert		Chao Xing cxing@geosec.org
SO-04	Resource Mobilization	Secretariat Expert		Robert Samors rsamors@geosec.org