2017-2019 Work Programme

This Document is submitted to the GEO-XIII Plenary for decision.

2017-2019 Work Programme

INTRODUCTION

The GEO Work Programme (GWP) presents the activities that GEO undertakes to realize its Vision, Mission and Strategic Objectives (see *GEO Strategic Plan 2016-2025: Implementing GEOSS*) through the implementation each of its Core Functions (see *GEO Strategic Plan Reference Document*). These activities, collectively known as the GEO Implementation Mechanisms, include GEO Community Activities, GEO Initiatives, GEO Flagships, and GEO Foundational Tasks.

The GWP is a living document that is updated annually, and is proposed by the GEO Secretariat based on input from GEO Members, Participating Organizations, and the greater GEO Community. The GWP is further refined and developed in consultation with the GEO Programme Board, which ultimately presents the GWP to the GEO Plenary for acceptance.

The GWP serves two functions[1]:

- It is used by GEO Members and Participating Organizations to agree on priorities and activities, including the use of the resources made available through the GEO Trust Fund and the GEO Secretariat. By quantifying resources needed for the activities including and valuating the contributions committed, the GWP provides a tool to match ambitions with available resources; and
- It provides an overview of GEO's plans, thus serving as a basis to help stakeholders align their contributions. The GWP is complemented by annual GEO Progress Reports on the developments within GEO Community Activities, GEO Initiatives, GEO Flagships, and GEO Foundational Tasks.

A GWP Reference Document (electronic, web-accessible) is maintained by the GEO Secretariat, complementing the GWP itself. It represents a compilation of the complete implementation plans of GEO Initiatives and Flagships, plus more information on Community Activities and other relevant documents. As such, the Reference document contains detailed background information on principal objectives of the actions in the GWP, their link to GEO Strategic Objectives and Core Functions, and on monitoring and evaluation activities.

THE 2017-2019 WORK PROGRAMME

The GWP is developed in three phases:

- An initiation phase to collect input from the GEO Community, the GEO Members and Participating Organizations, as well as interested third parties including United Nations Programmes, Foundations, Treaties or Conventions, and also the private sector. The initiation phase takes place during the 1st and 2nd quarters of the calendar year, during which the GEO Community may submit new Initiative or Flagship proposals, or suggest modifications to ongoing ones. Community Activities may also be proposed to the Secretariat during this phase.

[1] From the *GEO Strategic Plan 2016-2025: Implementing GEOSS Reference Document*

- A consolidation phase during which the GEO Programme Board, supported by the GEO Secretariat, reviews the implementation plans of all GEO Initiatives and Flagships. In the case of new proposals, the Board interacts with the authors in order to strengthen the implementation plans and address any gaps or concerns. In the case of existing Initiatives or Flagships, the Board reviews progress with respect to implementation plans and takes action to help address any issues. The Board also reviews all GEO Foundational Tasks included in the draft GWP and actively works to ensure the resources are available that will enable their implementation. The consolidation phase takes place during the 2nd and 3rd quarters of the calendar year, and concludes with a formal recommendation by the Programme Board of the draft GWP for Plenary acceptance
- An acceptance phase culminating in formal acceptance of the GWP by the GEO Plenary at its annual meeting. During the acceptance phase, the GEO Secretariat supports GEO delegations in preparing their commitments at Plenary through, for example, providing complementary material and reporting updates on expected resource commitments.

CONTENTS

The information contained in the GWP presents a synoptic view of GEO Foundational Tasks, Community Activities, Initiatives and Flagships, including an overview of the scope and objectives of the activity, future plans, resources, leadership, and contributors. For Foundational Tasks, complete descriptions are provided, as well as an estimation of the resources needed to produce expected outputs for the period, both in terms of Secretariat resources and external contributions. More detailed information on GEO activities, including the complete implementation plan for GEO Initiatives and Flagships, can be found in the GWP Reference document.

CONCLUSIONS

The Plenary is asked to review and approve the GEO 2017-2019 Work Programme.

Validation of the Work Programme is constituted by the confirmation from Members and Participating Organizations (POs) of the contributions that are identified in the description of the activities.

We expect GEO Principals to review the content, comment on the proposed activities, confirm proposed contributions and/or identify new potential contributions, as well as confirm the associated commitments at the Plenary meeting.

By accepting the GWP, GEO:

- **Accepts** that the GEO Foundational Tasks should be implemented with the resources indicated; and
- **Takes note** that the GEO Flagships, GEO Initiatives and GEO Community Activities are expected to be implemented with the corresponding indicative resources.

The Secretariat will issue a revision of the GWP in December after the Plenary meeting that reflects GEO Principals' inputs and the results of Plenary deliberations.

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COMMUNITY ACTIVITIES

General

GEO Community Activities allow stakeholders to cooperate flexibly in a bottom-up fashion, with a low initiation cost, and can include a broad variety of activities. 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. They are often conceptual, investigative or developmental in nature. GEO Community Activities are typically smaller-scale undertakings with commitments for contributions often disparate, made at the level of institutions or individuals. Users may be involved to the extent that they have been identified and engaged.

GEO Community Activities may form spontaneously at the initiative of interested parties. All necessary resources may not be completely identified from the beginning and the objectives may be defined at a relatively general level. Corresponding to their disparate nature, the styles of management may vary considerably among different GEO Community Activities.

Establishing GEO Community Activities

Any self-formed group within the GEO Community may propose GEO Community Activities at any time. Often, Communities of Practice (CoP) may be the natural frameworks within which ideas can be conceptualized and matured. The initiating groups develop brief proposals describing the activities, including its objectives, schedule, contributors and stakeholders. GEO Community Activities may also arise as a result of GEO's engagement activities or Memoranda of Understanding between the GEO Secretariat and other institutions.

The GEO Secretariat accepts proposed Community Activities into the GWP and associated Progress report, based on agreed criteria (see below). Most importantly, the GEO Secretariat must verify that a proposed Community Activity is aligned with GEO's objectives and direction. The Secretariat may also make recommendations on a proposal with respect to, for example, augmenting contributions, improving coordination with existing GEO Initiatives or other GEO Community Activities, or sharpening support for GEO's Strategic Objectives.

GEO Community Activities may evolve into GEO Initiatives if and when they provide an Implementation Plan that is accepted by the GEO Programme Board.

Criteria for establishing GEO Community Activities

- Objective(s) shared by a group of interested partners;
- Multi-national stakeholder group or scope; and
- Relevance to GEO's Strategic Objectives.

Contributors

Primary contributors to GEO Community Activities are Participating Organizations, GEO Members (through their corresponding institutions or *in-situ* international observation networks), and possibly other partners from the private sector. GEO Community Activities may also include contributions from individual citizens through citizen observatories.

Management and coordination

GEO Community Activities are self-organized and implement flexible arrangements defined by participants. The GEO Secretariat may facilitate communication and implementation through, for example, limited support in organizing meetings.

A Lead must be identified for the GEO Community Activity, who acts as an interface for the GEO Secretariat and other interested parties.

Reporting to GEO

The GEO Secretariat will seek information from GEO Community Activities (through the Lead) on progress and developments. Where such information can be obtained, it will be included in the annual GEO Progress Report.

Monitoring and Evaluation

The GEO Secretariat monitors the development of GEO Community Activities through regular interaction with the Lead. GEO does not evaluate Community Activities.

The Work Programme includes a summary description of each Activity, while more detailed description including the planned outputs/results and the resources allocated may be found in the "Work Programme Reference Document".

ACCESS TO CLIMATE DATA IN GEOSS

Overview

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.

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. Objectives include:

- Leverage the IPCC WCRP CMIP infrastructure for access to climate model outputs under the ESGF international collaboration;
- Leverage GEO's advocacy for these efforts which require some ground work and resources to publish data sets on ESGF;
- Forge 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;
- Facilitate WCRP collaboration in the GEO arena to promote additional (e.g. modeling activities) high priority activities in the new Task plan;
- Leverage the U.S. NOMADS model data access system, already a GEO contributor to advance the objectives of the CA;
- 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;
- Collaborate 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; and

- Implement multi-model and ensemble based access tools to provide a new level of access to probabilistic information rather than deterministic.

Activities for the period

- Identify outreach opportunities to enhance the understanding and usability of climate and weather model output;
- Develop a new Task Plan and identify and coordinate this plan with select contributors;
- Establish interfaces with 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;

Future Plans

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 this CA 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.

Resources

- 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).

Leadership

- Glenn Rutledge (NOAA/USA), Glenn.Rutledge@noaa.gov
- Michel Rixen (WCRP), mrixen@wmo.int

Linkages across the Work Programme

Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEO Carbon and GHG Initiative; GEOSS-EVOLVE.
Community Activities: Copernicus Climate Change Service (C3s).

ADVANCING COMMUNICATION NETWORKS

Overview

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.

Activities for the period

1) Document existing communication infrastructure within GEOSS and develop 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 WMO Information Systems (WIS) and GEONETCast;
2) Draft a plan delineating how individual services could complement the other networks for the benefit of GEO Members, outlining requirements for operation, maintenance and administration;
3) Engage with AfriGEOSS and potentially other Flagships and Initiatives to assess network requirements and possible improvements of data dissemination;
4) Support AfriGEOSS and the African National Research and Education Networks (NRENs) to discuss existing communication infrastructure, requirements and developing activities in the region;
5) 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.
6) Engage with GEOSS data providers to seek potential cooperation with and requirements to the GEOSS communication networks;
7) Discuss further development and seek cooperation with new GEO partners on the initial progress and findings of this task (e.g, Single Sign On, Cloud Computing, Multi Cast), which were reported at the 16th session of the WMO Commission for Basic Systems (CBS) held in November 2016.

Resources

- In-kind.

Leadership

- Beatrix Weber (GÉANT), beatrix.weber@geant.org
- Osamu Ochiai (GEO Secretariat/Japan) oochiai@geosec.org

Contributors

Members: Brazil, EC, Egypt, France, Germany.
Participating Organizations: ASREN, WMO.
Others: GÉANT (pan-European data network for the research and education).

Linkages across Work Programme

Initiatives: AfriGEOSS; GEO-EVOLVE.

AFRICAN GEOCHEMICAL BASELINES

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).

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.

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; Nickless, 2015).

Activities for the period

- 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.

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, savannah 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 Euros.

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

Resources

€ 300,000 (indicative amount).

Leadership

- Claudia Delfini (Eurogeosurveys), claudia.delfini@eurogeosurveys.org

Contributors

Participating Organizations: EuroGeoSurveys; IUGS; UNESCO.
Others: Geological Society of Africa; Organisation of African Geological Surveys.

AIRNOW INTERNATIONAL: EXPANDING NETWORKS AND INTEGRATING METHODS FOR AIR QUALITY AND HEALTH DATA

Overview

Air pollution presents substantial risk to many communities internationally. As evidenced by the Global Burden of Disease (GBD) report, air pollution health outcomes contribute substantially to mortality and morbidity in many regions.

This GEO priority topic will provide improved information for use in public health assessment tools, by building upon foundational work that integrates *in-situ* and satellite air quality measurements. This initial work will be extended to include more air quality monitoring, related estimation and modeling protocols, optimizing both remote sensing and *in-situ* platforms -- including the rapidly developing small sensor market.

This community initiative will initially 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 to provide results at a spatial and temporal resolution that is useful to citizens, communities and decision makers.

Activities for period

- At present, US EPA, which will lead this community initiative, is active in several candidate regions. In particular, EPA is working closely with India on a number of air quality programs. The Central Pollution Control Board (CPCB) of India is surveying Indian cities for a test installation of the AirNow-International system, or ANI;
- ANI uses several of the same software components as the US AirNow program, making implementation of a satellite fusion system much simpler. However, the US experience with satellite fusion has shown that a great deal of in-situ data must be analyzed and modeled in order to arrive at quality PM2.5 estimations;
- During 2016, this initiative will explore India's monitoring infrastructure and real-time data provisioning to develop a plan towards a satellite data fusion system;
- In 2017, installation of an AirNow data management center, in a pilot city to be chosen by India's CPCB, will be completed;
- During 2018, an AirNow Satellite Data Processor (ASDP)-like system could be prototyped in the region around that pilot city. As in the US, a year-long intensive evaluation can be performed and relevant case studies compiled. Also, the output of the fusion process provides statistics that can be used to show deviation, bias, and other metrics;
- Also during 2017 and beyond, other international regions could be considered as candidates. The ASDP experience in the US acts as a roadmap, which can be followed in any region that has sufficient real-time data.

Resource Summary

At present, US EPA has put forth a funding proposal to build a satellite data fusion system for one city in India. However, the AirNow system infrastructure, a critical part of this GEO initiative, is already funded and underway.

Leadership

- William Sontag (EPA/USA), sonntag.william@epa.gov

Contributors

Members: China, Mexico, USA.
Participating Organizations: UNEP, WHO.
Others: Clean Air Asia, Gates Foundation.

AQUAWATCH

Overview

Water quality monitoring is a large multi-faceted field with many areas that need to be addressed. The GEO Water Quality Community of Practice (AquaWatch) has chosen to focus on transforming data to information based on user needs within this water quality theme.

The mission of AquaWatch is to:
Deliver, on a routine and sustained basis, 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.

The overall goal of AquaWatch is to produce a global water quality monitoring and forecasting service within 10 years. It is envisioned that this will be accomplished by incrementally completing service-related projects and tasks that will be integrated into the overarching global water quality monitoring and forecasting service.

Activities for the period

- AquaWatch is beginning the development of a global 300m resolution baseline turbidity and reflectance product for freshwater and coastal areas. Where higher resolution data is available, the product will include additional layers with higher resolution information. Work in 2017 will be focused on the production of this product with additional products being pursued in 2018 depending on the availability of funds and resources;
- The AquaWatch community is currently producing a booklet highlighting the functionality of prototype projects that include in-situ data, remote sensing data and modeling. The booklet will be used to educate potential end users about available functionality in water quality monitoring and forecasting and spur interest and funding for the development of new AquaWatch prototype projects. The booklet will be completed in early 2017 with the remainder of 2017 focused on acquiring funding for future projects. Depending on available funds and resources, new prototype projects will be identified and started in 2018 and 2019;
- During 2017-2019, AquaWatch will update its website and produce other outreach materials including brochures, stock presentations and posters. AquaWatch will also work on identifying capacity building activities in 2017 and begin work on these activities in 2018.

Resources

AquaWatch is supported part time by a NOAA-funded Secretariat based in College Park, MD. Other support includes the Swiss Federal Institute of Aquatic Science and Technology (EAWAG) support of the web page. All other support (time, travel) is supported by in-kind contributions.

Leadership

- Steven Greb (Wisconsin Department of Natural Resources/USA), steven.greb@wisconsin.gov

Contributors

Over 50 individuals from various organizations including state, federal, and international governmental agencies, private consulting companies, non-profit organizations, nongovernmental organizations and academic institutions.

CHINESE TSUNAMI MITIGATION SYSTEM

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 run-up.

The 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.

Activities for the period

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

Future plans

Second year: tsunami numerical modeling, tsunami hazard analysis methodology.
Third year: framework for tsunami early warning system.

Resources

Supported by the China National Natural Science Fund.

Leadership

- WEN Ruizhi (Institute of Engineering Mechanics, China Earthquake Administration), ruizhi@iem.ac.cn

Contributors

Members: China, Japan, USA.

COPERNICUS ATMOSPHERIC MONITORING SERVICE (CAMS)

Overview

Some of today's most important environmental concerns relate to the composition of the atmosphere. The increasing concentration of the greenhouse gases and the cooling effect of aerosol are prominent drivers of a changing climate, but the extent of their impact is often still uncertain. At the Earth's surface, aerosols, ozone and other reactive gases such as nitrogen dioxide determine the quality of the air around us, affecting human health and life expectancy, the health of ecosystems and the fabric of the built environment. Ozone distributions in the stratosphere influence the amount of ultraviolet radiation reaching the surface. Dust, sand, smoke and volcanic aerosols affect the safe operation of transport systems and the availability of power from solar generation, the formation of clouds and rainfall, and the remote sensing by satellite of land, ocean and atmosphere.

To address these environmental concerns there is a need for data and processed information. The Copernicus Atmosphere Monitoring Service (CAMS) has been developed to meet these needs, aiming at supporting policymakers, business and citizens with enhanced atmospheric environmental information.

Activities for the period

- In 2017, developments will in particular focus on the uptake of the observational data from Sentinel-3 (aerosol optical depth and fire radiative power) and Sentinel-5p (launch expected in early 2017).
- In 2017, CAMS is in full operations mode, including:
  - routine operation of CAMS production systems;
  - continuous development of production systems;
  - evaluation and validation of products;
  - communications and interaction with users.
- The full range of products and services delivered can be searched using the CAMS catalogue: http://atmosphere.copernicus.eu/catalogue#/. As it is the case for all Copernicus information and data products, CAMS outputs are freely accessible to all.

Resources

The overall budget of CAMS is of the order of €12.0mil per year.

Leadership

- Vincent-Henri Peuch (ECMWF), vincent-henri.peuch@ecmwf.int

Contributors

Members: EC.
Participating Organizations: ECMWF.
Others:

- Over 30 institutions from more than 13 countries are currently involved in delivering CAMS.
- CAMS products and services are produced and delivered partly by ECMWF (mainly global atmospheric composition reanalyses, analyses and forecasts) and partly by providers, which are selected by means of open competitive tendering. The list of CAMS providers (and of their subcontractors) can be found at http://atmosphere.copernicus.eu/providers.

Linkages across the Work Programme

Community Activities: AirNow International.

COPERNICUS CLIMATE CHANGE SERVICE (C3S)

Overview

The Copernicus Climate Change Service (C3S) combines observations of the climate system with the latest science to develop authoritative, quality-assured information about the past, current and future states of the climate in Europe and worldwide. C3S will provide key indicators on climate change drivers such as carbon dioxide and impacts, for example, reducing glaciers. The aim of these indicators will be to support European adaptation and mitigation policies in a number of sectors.

The service will build upon and complement capabilities existing at national level and being developed through a number of climate-change research initiatives. It will become a major contribution from the European Union to the WMO Global Framework for Climate Services and its Climate Monitoring Architecture.

Specifically, the societal benefits from an operational Climate Change service lie in its capacity to provide information about the impact of climate change and variability on the environment. This will support informed decision-making regarding possible mitigation and adaptation policies, as well as future regulations and investment decisions in a number of key industrial areas. The Climate Change service will capitalise on state-of-the-art Earth observations and climate models, specifically: 1) sustained networks of *in-situ* and satellite-based observations; 2) re-analysis of the Earth climate with a variety of models driven by observations; 3) modelling scenarios based on a series of climate projections. These three components will allow the derivation of a range of climate indicators for both the identified climate drivers and the expected climate impacts.

Activities for the Period

Activities initiated late 2015 to support development of the proof-of-concept stage of the Service will continue throughout 2016 and 2017. These activities involve a wide user consultation and engagement process across different components of the Service, while setting up and implementing prototype elements and activating some functionalities of the Climate Data Store (CDS) and Sectoral Information System (SIS) building blocks.

2017 will be the year of transition between the proof-of-concept and pre-operational stages, and the plan therefore reflects continuation, consolidation and finalisation of activities initiated during 2016. In addition, a number of new activities will be initiated, in the area of regional reanalyses, observations, additional SIS, etc. The first deliverables and results from the sectoral applications will become available and be integrated in the CDS, as well as some elements related to the production of reanalyses and seasonal forecasts. The coordinated design of the main components of the C3S will be a critical element of the proof-of-concept and preoperational phases of the Service. The year 2016 will be pivotal for testing and validating this design, with the goal in 2017 of implementing well-defined and operational procedures ensuring that the information delivered to end users is fully traceable, quality controlled and disseminated to the satisfaction of users.

User Engagement

Engage with end-users to increase system awareness and understanding. Communicate and promote the Service to different audiences, provide training on how to make use of the wealth of climate information that will be made available through the C3S Climate Data Store (CDS).

Future Plans

Work Development of a distributed Climate Data Store infrastructure, hosting earth observations, reanalyses, seasonal forecasts and climate projections, as well as a toolbox allowing handling and manipulation of these datasets and growing the market for climate services.

Resources

All activities under Copernicus Climate Change Service (C3S) are entirely supported by the Copernicus Programme from DG-GROW.

Leadership

- Jean-Noel Thepaut (ECMWF/UK), jean-noel.thepaut@ecmwf.int

Contributors

Members: EC.
Participating Organizations: ECMWF.
Others: Various European suppliers, through competitive Invitation to Tender processes. More information is available on climate.copernicus.eu.

Linkages across the Work Programme

Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development.
Community Activities: Access to Climate Data in GEOSS.

DATA ANALYSIS AND INTEGRATION SYSTEM (DIAS)

Overview

The Data Integration and Analysis System (DIAS) Community Activity for 2017 – 2019 GEO Work Program will encompass the present DIAS, Water Cycle Integrator (WCI), Asian Water Cycle Initiative (AWCI), and African Water Cycle Coordination Initiative (AfWCCI) CAs and will coordinate their activities in line with the GEOSS Water Strategy recommendations. At the same time, DIAS CA will continue to use the Integrated Global Water Cycle Observations (IGWCO) Community of Practice for coordination with other Water SBA activities.

The Data Integration and Analysis System of Japan (DIAS) is an advanced GEOSS-compliant e-infrastructure component that addresses the challenges of a large increase in the volume of Earth Observation data by developing a core system for data integration and analysis. In the arena of water, DIAS has been developing the Water Cycle Integrator (WCI) function, which enables a holistic approach towards solutions to water-related issues by (i) harmonization of data collection and management and improvement of data interoperability and (ii) providing tools for integrating observations, modeling, research, analyses, and management systems across SBAs. The WCI efforts have been reflecting on the experiences of the Asian Water Cycle Initiative (AWCI) and responding to the community requirements in the data and science integration field. The AWCI community has exploited the DIAS and WCI capabilities and demonstrated extensively their potential. The WCI function has also been recognized by the African Water Cycle Coordination Initiative (AfWCCI) community as a powerful tool for implementing Integrated Water Resources Management (IWRM) in transboundary basins and plans have been outlined for pilot projects.

Activities for the period

DIAS Community Activity goal is to enable effective and efficient exploitation of earth observation for truly informed decisions in water resources management and disaster risk reduction. This requires a variety of activities that include following objectives:

1. Continue and improve data management covering the full data life cycle while regarding the "Big data" characteristics and in particular expand water-cycle relevant data acquisition and increase its availability and use for research as well as operational use;
2. Advance development of WCI component on DIAS with new tools and functions for interdisciplinary and transdisciplinary collaboration reflecting on (a) user community requirements and (b) opportunities arising from new earth observation capabilities and technologies;
3. Improve understanding of water-related disaster risks and resilience and identify changes in these risks and resilience through research activities exploiting earth observations and novel capabilities of WCI;
4. Provide improved decision and policy-making support including flood early warning systems, drought monitoring and warning systems, and climate change assessment and adaptation planning tools. Promote and facilitate implementation of these systems in operational use.
5. Human resources capacity building for water issues using inter- and transdisciplinary approach of WCI;
6. Foster regional collaboration and enhance user engagement through AWCI and AfWCCI frameworks and expand collaboration with other regional and global frameworks and donor organizations.

Future plans

DIAS CA will continue its efforts to populate the DIAS archive with more water-related data and assure their quality and compliance with interoperability standards. This includes satellite-derived data and products by Japan Aerospace Exploration Agency (JAXA), numerical weather prediction and reanalysis outputs by Japan Meteorological Agency (JMA), climate model outputs, and *in-situ* observations by AWCI countries and AfWCCI river basin authorities and organizations. Efforts on

providing a smooth access to data in other archives will be continued by the Committee on Earth Observation Satellites (CEOS) Water Portal activity led by JAXA in cooperation with CEOS.

Resources

The DIAS system development and administration continues to be funded from national funds of Japan under the DIAS Program project. The resources for the WCI tool development activities are contributed by the involved researchers' home organizations, in particular UTokyo, ICHARM, and JAXA. Several pilot implementations of WCI function in AWCI countries are currently carried out as part of individual projects under specific programs of contributing and collaborating organizations (ICHARM, JAXA) or donor organizations (Asian Development Bank - ADB, JICA, World Bank, UNESCO). Support from donor organizations will be also sought for operational implementations in AWCI and AfWCCI regions in collaboration with the national and/or river basin authorities. The DIAS CA coordination function is provided by UTokyo with the support from Nippon Koei Co., Ltd.

Leadership

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Contributors

Members: France, Japan, Morocco, Pakistan, South Korea, Tunisia.
Participating Organizations: UNESCO.
Others: AfWCCI river basin authority and organization representatives; AWCI country representatives; Sri Lanka.

Linkages across the Work Programme

Community Activities: In-Situ Observations and Practices for the Water Cycle.
Initiatives: AfriGEOSS; AOGEOSS; GEOGLOWS.

DIGITAL GEOMUSEUM

Overview

The philatelic culture has been integrated with earth science and stamp art in almost all countries of the world since the first stamp was issued in 1840. Most remarkable geographical surveying achievements and historical milestone events of the world had been recorded in stamps. For example, the first set of stamps of Tibet issued by China in 1898, the first post card on Dr. Nanson, famous Norwegian geographer and Nobel Peace Prize laureate issued by Norway in 1911 for remembering his achievement for the Greenland studies.

Donated by LIU Chuang from China, Paul Uhlir from USA and more than 200 contributors from South Africa, France, Brazil, USA, Thailand, Hungary, Canada, Japan, Mongolia, Germany, UK and China , more than 20,000 historical stamps and postcards issued by more than 80 countries and lasting more than 100 years were collected. The Presidents of the International Geographical Union (IGU) of ICSU, Committee on Data for Science and Technology (CODATA) and the Geographical Society of China (GSC) signed the Letter of Interest on jointly establishing an online GEO knowledge sharing platform, named as the Digital LIN Chao Geomuseum. Based on these collections and matched with the Earth science knowledge by either or both professional and crowdsourcing methodologies, the online digital GEOMUSUEM will be a special platform in disseminating GEO knowledge.

Activities for the Period

- Establish and update an operational GEOMUSEUM platform for both professional and crowdsourcing contents based on the worldwide collections of post stamps, photos, and all related collection on earth observation;
- Establish and update an operational Citizen Science and Geography of the World platform at the GEOMUSEUM for both professional and crowdsourcing contents on bio-geodiversity and disasters;
- Exhibit the GEOMUSEUM achievements recorded in the archived collections at GEO Plenary 2017, 2018 and 2019;
- Summary report of the GEOMUSEUM activities.

Future plans

- Promote collaboration with GEO members and Participating Organizations for the post stamp culture for GEO sciences in GEO communities.

Resources

Funding sources and indicative amounts (2017-2019), and projects:

- National Natural Science Foundation of China: USD 120,000;
- Geographical Society of China: USD 20,000;
- Methodology of Integrating Earth Science and Post Stamp Art, National Natural Science Foundation of China;
- Digital LIN Chao Geomuseum, Geographical Society of China.

In kind

- Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences (labor cost);
- China RS Ltd. (Technical support for the GEOMUSEUM system development);
- CODATA TG in developing countries (share the cost of the site event of GEO plenary).

Leadership

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Contributors

Members: China, India, Japan, USA.
Participating Organizations: CODATA, ICSU.

EARTH2OBSERVE

Overview

Project EartH2Observe that started in January 2014 brings together the findings from the European FP7 projects: DEWFORA, GLOWASIS, WATCH, and GEOWOW. 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. All preliminary and final project results and raw data are available via a Water Cycle Integrator portal at http://wci.earth2observe.eu and are linked to the GEOSS data core. Information about the E2O project can be found at: http://www.earth2observe.eu/

Activities for the period

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 have been organized.

Specific activities include:

- Validation of earth observatory (EO) products based on end-user needs and metrics ensuring the value of the project's final datasets for local and regional decision making;
- Integration of in-situ data on groundwater, surface water, water quality, soil moisture, precipitation and evaporation with EO driven models resulting in a multi-model and multi-data global water resources reanalysis. These datasets are now being documented;
- Development of a global reanalysis of water resources that supports efficient water management and decision making by the increased availability of information on the variability of freshwater resources worldwide. Demonstration of the usefulness of the integrated water resources time series at the operational level in regional and local case studies in Bangladesh, Colombia, Ethiopia, Estonia, Spain, Australia and New Zealand. For the case study in Australia the downscaling and testing of the global forcing data proved successful;
- Connecting to the GEOSS Water Cycle Integrator (WCI) initiatives and openly providing and sharing the datasets developed in our project to ensure the results will become part of the GEOSS Data-Core encyclopedia. The EartH2Observe data portal has been launched and contains the project's WRR-1 dataset as well as many other EO datasets. The portal is actively used within the project and already attracts users from outside the project. The WCI portal currently offers access to over 4 terabytes of data, including over 150 indicators from ecosystem model outputs an EO-data with a temporal range spanning some 30 years.

Future plans

Project EartH2Observe started in January 2014 and will be finalized in December 2017 so a number of results have already been produced. 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. All data produced in the project will be available on open dap in NetCDF and shared by the GEOSS Data-Core.

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

Leadership

- Jaap Schellekens (Deltares/the Netherlands), jaap.schellekens@deltares.nl

Contributors

Members: Australia, EC, Germany, the Netherlands, New Zealand, USA.
Participating Organizations: CEOS, EEA, FAO, WCRP, WMO.
Others: The project consortium of EartH2Observe consists of 27 partners (23 European and 4 non-European) representing 15 counties from 4 continents.

Linkages across the Work Programme

Community Activities: In-Situ Observations and Practices for the Water Cycle.

EARTH OBSERVATIONS FOR CULTURAL HERITAGE DOCUMENTATION

Overview

Cultural heritage (CH) is a testimony of past human activity, and, as such, cultural heritage objects exhibit great variety in their nature, size and complexity; from small artifacts 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).

Earth Observation can highly accelerate the documentation of CH, while engaging multi-disciplinary societies (e.g. archaeologists, architects, historians, librarians, etc.) in GEO activities, not previously interested. Recent high resolution satellite imagery provides the means to easily map areas in large scales. However, detailed specifications are needed, as well as how remotely sensed data can be used to derive accurate cartography, which UNESCO can then use in its requests to countries to provide improved cartography for the UNESCO World Heritage database.

Activities for the period

General 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.

Future plans

- 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 (e.g. UNESCO, ICOMOS, International Centre for the Study of the Preservation and Restoration of Cultural Property [ICCROM], ISPRS, CIPA).

Resources

- Baden-Württemberg Stipendium (BWS);
- European Cooperation in Science and Technology (COST);
- International Society for Photogrammetry and Remote Sensing (ISPRS).

Leadership

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Contributors

Members: China, EC, Germany, Spain.
Participating Organizations: ISPRS.

Others: International Cartographic Association (ICA); International Committee for Documentation of Cultural Heritage (CIPA); International Council on Monuments and Sites (ICOMOS).

EARTH OBSERVATIONS FOR DISASTER RISK MANAGEMENT

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 four Pilots – Floods, Seismic Hazards, Volcanoes, and Landslides. 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.

Activities for the period

- 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, Volcanoes and Landslides with direct involvement of the user community; explore the possibility of enlarging the concept of the Pilots (single and multi-hazard, unlimited 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;
- Following the publication on the Sendai Framework for Disaster Risk Reduction 2015-20302, CEOS has proposed a new initiative GEO-DARMA end 2015. After the approval of the GEO 2016 Work Plan by the 2015 GEO Plenary and the positive review of the GEO-DARMA proposal by the GEO Programme Board in 2016, the European Space Agency as current GEO-DARMA Lead (on behalf of CEOS) has further consolidated the GEO–DARMA implementation plan and set up a contract to get an initial two-year support from Industry to

[2] www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

kick-off GEO-DARMA in the last quarter of 2016 and to foster the execution of the related activities.

Future Plans
Continuation of current activities.

Resources
In-kind contributions.

Leadership
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Contributors

Members: Canada, China, Germany, EC (JRC), France, Italy, Japan, USA.
Participating Organizations: CEOS, ESA, IEEE, UNEP, UNITAR, UNOOSA.

Linkages across Work Programme:

Initiatives: GEO-DARMA, GSNL.

EARTH OBSERVATIONS FOR GEOHAZARDS, LAND DEGRADATION AND ENVIRONMENTAL MONITORING

Overview

Current and emerging Earth Observation (EO) technologies have the potential to provide regular top-surface compositional information with a high temporal rate and at high spatial resolution. Optical imageries have a great potential to map top-surface physical property together with mineral composition. Even more, with future hyperspectral systems (e.g., EnMap should be operating in orbit from 2018) it will be possible to move to a level of quantitative modelling. Thermal imageries have the ability to map top-surface temperature, emissivity and thermal capacity. Optical and thermal multi-temporal imageries can be thus used to map a complex terrestrial surface property, as well as detect dynamic changes. Radar (InSAR) based EO technology can be applied to monitor ground surface movements and deformation (e.g. monitoring subsidence due to gas production and mining activities). Taking into account the Sendai Framework for Disaster Risk Reduction 2015-2030, this activity will combine the above mentioned multi-sensor EO technologies to map and monitor wide areas affected by local scale geological and anthropogenic hazards, such as: landslide and subsidence dynamics, soil degradation and contamination due to anthropogenic activities, and glacier monitoring. Furthermore, the generation of up-to-date terrestrial surface potential hazard maps will allow building early warning and monitoring systems improving risk management and disaster resilience. Potential users could be Civil Protection Agencies, Central and Local Authorities, Mining companies, Environmental organisations.

Activities for the Period

- Develop activities and tools to join all the European stakeholders working on or being responsible for geohazards and environmental monitoring; develop common criteria for the compilation of existing databases and data sets and plans for integration of new generation satellite data;
- Develop close relations with potential users engaging them from the beginning through the whole duration of the project with the aim to meet their needs;
- Investigate the feasibility to develop monitoring services at European level (e.g., Ground Motion Monitoring Service that can target areas for potential landslides and subsidence);
- Identify the links between diverse European projects and European-scale data (in-situ, ground truth, distance data), services and other products (e.g., methods or built know how) and investigate how to join/link them to support efficient geohazard and environmental monitoring;
- Investigate the feasibility to develop new applications or monitoring systems when focusing on diverse data fusion and utilisation of the new generation satellite data (e.g., Copernicus data, EnMap).

Future Plans

- Collaborating with institutions from GEO Member countries internationally (e.g. USGS) to bring the above to a global scale.

Resources

In-kind contributions are the sole resource at this time.

Leadership

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Contributors

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EARTH OBSERVATIONS FOR MANAGING MINERAL RESOURCES

Overview

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.

Illegal and uncontrolled mining activities can generate environmental disasters, societal disasters including human trafficking, and conflicts, including armed, along with significant economic losses for the affected countries. It can also imperil the live of workers due to the lack of security precautions. A regularly updated monitoring is essential for those countries.

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, Social License to Operate (SLO) approaches, etc.

Global maps of soil mineral composition at Earth's surface made available to a wide user community may benefit not only to raw material activities, but to all human activities relying on this information.

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, opposable and mutually trusted 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.

Activities for the period

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:

- A preparatory work for global mineral mapping program using existing (ASTER) or future missions, on the model of the Australian Mineral Map performed by CSIRO using ASTER imagery, to be delivered to the GEO data archive;
- Developing a global spectral library of soils for future of quantitative soil spectroscopy from laboratory to space-borne applications, towards the definition of possible product standards for global, public hyperspectral satellite soil surface composition mapping;
- 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;
- The definition of methodologies and tools to map these essential variables from existing and future sensors, including citizen observatories;
- 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 also connected with point 3.

Activities would also include:

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

Future plans

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 (GMOS in connection with illegal mining), forests (GFOI in connection with illegal mining) and water (impact of mineral resource exploitation on water quality and resources).
Strengthening links with GI-10 and GI-18

Resources

All contributions are in-kind from participating partners. There is currently no specific resource (funded projects) available for this Community Activity.

Leadership

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Contributors

Members: Australia, China, Czech Republic, France, Germany, Israel, Japan, the Netherlands, UK, USA.

EARTH OBSERVATIONS FOR THE WATER-ENERGY-FOOD (W-E-F) NEXUS

Overview

This Water-Energy-Food (W-E-F) Community Activity supports the GEO 2017-2019 Work Plan and begins to provide links among water and other societal benefit areas. It does this by using Future Earth and the UN framework of Sustainable Development Goals (SDGs). The W-E-F project is a Future Earth Cluster project that promotes integration across the water, energy, and food sectors using Earth observations, information systems, and new governance approaches. It also advances the development of datasets, diagnostic tools, data analytics, applications, and indicators that will enable the integration for the W-E-F Nexus to benefit the water, energy, and food SDGs as well as other SDGs that are sensitive to water. The framework for SDGs, with its associated targets and indicators, has led, for the first time, to the recognition by the global development community of Earth observations as an essential element for their implementation. These opportunities are being elaborated in the development of indicators, where linkages between societal benefits are high on the agenda. This community activity will contribute to this development of linkages in the GEO context by combining water observations with other data sources to create integrated products, including co-designed products, for use by targeted audiences in other sectors, starting with the water, energy, and food goals. This community activity will also contribute to the data and information needs of the Future Earth W-E-F Cluster activity, the Future Earth Food, Energy and Water Knowledge Action Network, and the Sustainable Water Futures Programme (follow-on to the Global Water System Project [GWSP]).

Activities for the period

It is expected that the effort will contribute to the development of a knowledge platform, a W-E-F Community of Practice, and the development of a framework to accommodate Earth observations into a Future Earth research plan on W-E-F issues. It will also develop a lexicon and tools for analysing stresses in the W-E-F Nexus using different geospatial data bases. Additionally, this effort will develop a plan using Earth observations to monitor the major water-related targets found throughout the SDGs.

In summary, the activity's specific plans are organized under three sub-activities:

1. Integrated Information and the Water-Energy-Food (W-E-F) Nexus;
2. An End-to-End Analysis System for Water-Energy-Food Nexus Studies Uniting an Integrated Typology, Data Compendia Analysis Frameworks (NEXUS-E2E);
3. Water information in support of Sustainable Development Goals (SDG) monitoring frameworks**.**

Future Plans

- In addition to the process of individual scientists seeking funding for individual initiatives, we anticipate that GEO Members will commit to making resources available for the above activities, perhaps through the GEOGLOWS Initiative in the longer term.
- Activities related to SDGs will also contribute to the GEO Earth Observations in Service of the 2030 Agenda for Sustainable Development Initiative, and are expected to play a pivotal role in 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.

Resources

- ***Integrated*** information ***and W-E-F Nexus Security***
  The regional workshops have been funded by Future Earth and the Belmont Forum through the Sustainable Water Futures Programme. Completion of the final report will be funded by the Belmont Forum budget for the overall project.
- ***Water information and the Sustainable Development Goals***
  This GEO Water SDG activity currently has no funding and is carried out by people with in-kind support. Through WHO, this project has links with the GEMI project, which will serve as one of its stakeholders.

Leadership

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Contributors

Members: Germany, USA.
Participating Organizations: FAO.

Linkages across the Work Programme

Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEOGLOWS.

FOREST BIODIVERSITY IN ASIA AND THE PACIFIC REGION: CAPACITY BUILDING PHASE

Overview

The GEO Strategic Plan (2016 – 2025) includes country capacity building as a Core Function of GEO. Accordingly, the 2016 Work Programme had 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 proposed activity aims to develop appropriate approach to enhance Regional capacity to undertake coordinated forest assessments, contribute to GEOSS strategic plans and use the information to develop policy, strategies and programmes by countries in the Region.

Proposed Activities for the period

A comprehensive capacity building strategy paper from Tropical Countries perspective was submitted to GEO on the occasion of Country Capacity Building Review Meeting. Technical support was provided to Forest Survey of India towards initiation of a National Forest Monitoring System, which became operational in July 2016. FAO is providing technical assistance in its planning and implementation. Biodiversity Assessment and conservation planning constitutes an important component of the GOI / FAO Project, which will serve as an example to other countries in the Sub-Region.

Future plans

Future plans include: (i) Providing training support to Capacity Building for Forest Biodiversity Assessment and Conservation Planning in Asia and the Pacific Region (using GIS/ new-Indian Initiative with FAO support as a practical example); and dissemination of information to other countries of the Sub-Region and Tropics as a whole.

Resources

Continuation of past activities at national level is assured as FSI has the mandate for operational implementation of country-wide forest cover monitoring, including biodiversity assessment. FSI has close linkages with Indian Institute of Remote Sensing responsible for providing Training to State Forest Departments, who are responsible for conservation and sustainable management of forests and conservation of biodiversity. It would be most useful, if GEO could assist in implementing a Asia-Pacific Capacity Building Training Course for Developing Regional Standards and Methodology using facilities of UN Centre for Space Science And Technology Education for Asia and the Pacific at IIRS, Dehradun, India.

Leadership

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Contributors

Members: India.
Participating Organizations: FAO.

Linkages across the Work Programme

Initiatives: AOGEOSS.

GLOBAL AGRICULTURAL DROUGHT MONITORING

Overview

- Bring together a small group of experts to look at agricultural drought issues;
- Develop the method of monitoring agricultural drought globally;
- Support the GEOGLAM Flagship with timely agricultural drought information;
- Understand the process and impact of agricultural drought development in the background of global change and provide the adaptation advices.

Activities for the period

- Set up a community of practice to network the experts;
- Study on the best practice of agricultural monitoring;
- Promote BRICS (Brazil, Russia, India, China and South Africa) fund and national fund to support agricultural drought monitoring proposals;
- Regional showcases on agricultural drought monitoring, possible in Asia and North America.

Future plans

- List and network the main players of agricultural drought monitoring in the world;
- Synthesis report from ongoing drought monitoring programs;
- Promote regional activities on agricultural drought monitoring;
- Compare and summarize the methods of monitoring agricultural drought;
- Work towards a global agricultural drought monitoring system.

Resources

- UNESCAP Drought mechanism in Asia;
- BRICS fund;
- National research fund.

Leadership

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- Jai Singh Parihar (former IRSO/India), jsparihar@yahoo.com
- Wu Jianjun (BNU/China), wujj@bnu.edu.cn

Contributors

Members: China, USA.
Participating Organizations: UNESCAP.

Linkages across Work Programme

Flagships: GEOGLAM.
Initiatives: GDIS.

GLOBAL FLOOD AWARENESS SYSTEM (GloFAS)

Overview

The Global Flood Awareness System (GloFAS) is independent of administrative and political boundaries and is supported by the Copernicus Emergency Management Service - Early Warning Systems. It couples state-of-the art weather forecasts with a hydrological routing model, and with its continental scale set-up provides downstream countries with information on upstream river conditions as well as continental and global overviews.

- GloFAS produces daily flood forecasts in a pre-operational manner since June 2011;
- GloFAS has shown its potential during the floods in Pakistan in August 2013 and in Sudan in September 2013;
- GloFAS has supported Red Cross operations in Africa and South America.

In its test phase this global forecast system was able to predict floods up to two weeks in advance. It is foreseen that GloFAS will become fully operational (guaranteeing a 24/7 service) as part of the Copernicus Emergency Management Service - Early Warning Systems during 2017. GloFAS principal objectives are to improve preparedness and response for floods at a global level by providing:

- added value flood forecasting information to the relevant national authorities complementary to existing national systems; and
- international organizations with global scale, comparable, and basin-wide flood forecasting information.

Activities for the period

Goal: Set up GloFAS as a fully operational flood forecasting system during 2017. Daily collection and pre-processing of numerical weather forecasts and observed data, collection of satellite information, calculation of initial conditions before the start-up of the forecasts, executing the hydrological routing model for GloFAS, post-processing of numerical model results and visualising them on a web interface. Final products are probabilistic flood forecasts at a global level with up to 30 days lead-time. Skill scores will be calculated and published online.

User engagement

Though the GloFAS Community Initiative, continue with further research and development, rigorous testing and adaptations of the system based on feedback from decision makers. These decision makers include national and regional water authorities, water resource managers, hydropower companies, civil protection and first line responders, and international humanitarian aid organisations.

Future Plans

Work with current and existing research students and staff to develop expertise in using and improving GloFAS model output. In the next phase of the project the focus will be on predictability on sub-seasonal to seasonal time scales (>2 weeks up to several months).

Resources

Resources to transition the system from the pre-operational to the operational stage will be provided by the Copernicus Emergency Management Service - Early Warning Systems.

Leadership

- Fredrik Wetterhall (ECMWF), fredrik.wetterhall@ecmwf.int

Contributors

Members: EC, UK.
Participating Organizations: ECMWF.

Linkages across the Work Programme

Community Activities: Global Flood Risk Monitoring.

GLOBAL FLOOD RISK MONITORING

Overview

Since the mid-1970s, U.S. satellite observation gathered an exceptionally valuable but still largely un-harvested 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 near-polar orbiting (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.

Activities for the period

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.

Future Plans

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).

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.

Resources

Mainly in-kind contributions.

Leadership

- David Green (NOAA/USA), david.s.green@nasa.gov

Contributors

Members: EC (JRC), USA.
Participating Organizations: CEOS, UNEP, UNESCO, WB, WMO.
Others: Development Bank of Latin America (CAF); Global Flood Partnership (GFP); International Committee of the Red Cross/Red Crescent (ICRC); United Nations Development Programme (UNDP); World Food Programme (WFP); private sector partners (e.g. Google, Coca Cola, and the insurance sector).

GFCS - GEO COLLABORATION

Overview

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 supporting climate services in the GFCS five priority areas (Food Security and Agriculture, Disasters, Health, Water and Energy) , with an 6 initial focus on six countries (Bhutan, Burkina Faso, Dominica, Moldova, Papua New Guinea and Tanzania) to demonstrate a 'proof of concept' for cross-partner collaboration. There are also opportunities for GFCS to collaborate with GEO's ongoing efforts. More recently, the support for GFCS implementation has been endorsed as a key collaboration area between GEO and WMO at the 68th Session of the WMO Executive Council.

Activities for the period

This task will function as a general mechanism to build synergies between GEO and GFCS. The primary focus is to identify targeted areas in existing GEO activities 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. Cooperation in potential areas that revolve around the priority sectors will require discussions with the GEO and GFCS leads in those areas (e.g. water, agriculture, health). These discussions will be facilitated by the GEO Secretariat and the GFCS office. Initially, a focus will be given on one or two activities to demonstrate how GEO and GFCS can collaborate. The identified areas may serve as bridging areas and showcase mutual benefits. In addition, collaboration on identifying user and data needs is envisaged.

Future plans

Since climate has become a cross-cutting topic in GEO's second decade, rather than being a stand-alone Societal Benefit Area, the long-term goal is to build an interface between climate-related activities across the new GEO SBAs and the GFCS priority areas. Appropriate linkages will also be established between GEO and the pillars of the GFCS, in particular with the "Observation and Monitoring" pillar through the Global Climate Observing System (GCOS). This will ensure to align and synergize GEO and GFCS activities in a mutually beneficial way.

Resources

Contributions are mainly in-kind. Participants will be supported by both the GEO Secretariat and the GFCS office.

Leadership

- Meredith Muth (NOAA, USA), meredith.f.muth@noaa.gov
- Stefan Rösner, (DWD, Germany), stefan.roesner@dwd.de

Contributors

Participation will be sought from the GEO and GFCS communities in the areas of agriculture, disasters, energy, health and water. A close link to the GCOS secretariat is essential in order to ensure backing by the GCOS science panels.

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, the Center for International Earth Science Information Network (CIESIN), and the United State Geological Survey (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.

Activities for the period

Building on the global mangrove database for the year 2015, the United States proposes back-casting for the year 1990 and 1980, and perform change analyses to identify the rates, patterns, causes and consequences of the changes. Additionally, we will monitor the mangrove on an annual basis.

Future Plans

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.

Resources

Funding from USGS is now secured for three years to perform this task. The project will be implemented by Environmental Protection Agency (EPA) in coordination with USGS and UNEP.

Leadership

- Chandra Giri (EPA/USA), giri.chandra@epa.gov

Contributors

Members: USA.

Linkages across the Work Programme

Flagships: GEO BON.
Initiatives: EO4EA; Oceans and Society: Blue Planet.

HARMFUL ALGAL BLOOM (HAB) EARLY WARNING SYSTEM

Overview

Harmful Algal Blooms (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.

Activities for the period

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.

Future Plans

The United States would like to partner with other countries to share best practices and methods through the GEO network. The goal would be to establish an operational HAB early warning system by 2020.

Leadership

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Linkages across the Work Programme

Flagships: GEO BON (MBON).
Initiatives: EO4EA; Oceans and Society: Blue Planet.

HIMALAYAN GEOSS

Overview

Mountain regions cover about 24% of the earth surface and provide important ecosystem services to almost half of humanity around the world. It is estimated that the Hindu Kush Himalaya (HKH) ecosystem alone provide goods and services to about 1.5 billion people living in the mountains and it's downstream. While the Himalayan ecosystem functions as a life support system, it is also recognized as one of the most vulnerable ecosystems in the world due to climate change and rapid social transformations that are taking place due to globalization.

Mountain areas with often difficult terrain and high degree of inaccessibility present a formidable challenge to collect and manage data and information. Earth observation (EO) in combination with the emerging Geo-information and communications technologies, and new innovations provide viable solutions to bridge the important data and knowledge gaps in the region as aspired by the GEO's vision.

Himalayan GEOSS will develop a platform for regional collaboration by bringing together all the GEO member organizations and thematic line agencies from the region working on EO and Geospatial technologies. Regional meetings and workshops will be organized for policy dialogs and exchanges of technical knowledge. It is expected that the activities of Himalayan GEOSS will ultimately contribute to development of SDI in the region through promotion of policy, standards and practices for open access to data, information and services.

Activities for the period

In the initial phase, the activities will focus on setting up a conceptual framework for Himalayan GEOSS and ensure participation from the member organizations and line agencies in the region. Institutional mechanism for implementation and coordination will be defined through consultations with partner organizations. More specifically, the following activities will be carried out.

- Coordinate and liaise closely with GEO and the GEO-member states in the region on the concept of Himalayan GEOSS;
- Organize workshop to brainstorm on the operationalization of the concept of Himalayan GEO and seek inputs and guidance from regional member countries and key international partners;
- Formation of a working group with representation of GEO Member States and Participating Organizations from the region;
- Encourage and catalyze for GEO Membership for Afghanistan, Bhutan and Myanmar;
- Organize a joint regional workshop on Himalayan GEOSS with all HKH countries and international partners to finalize the concept paper of Himalayan GEOSS and get endorsement by the GEO;
- Devise an institutional mechanism for Himalayan GEOSS with the formation of coordination framework and network;
- Devise a funding strategy for the implementation of Himalayan GEO and its sustainability; and
- Detail out strategies and work plan for capacity building in the member countries.

Future Plans

ICIMOD has become is Participating Organization in GEO and the third SERVIR node for the HKH region. As such, it has been able to draw a significant mileage from increasing interests from international agencies and regional and global level initiatives.

- Building on these foundations of ICIMOD and its network, ICIMOD can serve as a Himalayan node contributing to the sub-regional implementation of GEOSS with active involvement of the regional member countries and international partnerships;
- The focal organizations in the GEO member countries in the region will be the main contributors in this initiative. Participation will be sought from the relevant line agencies working in the thematic areas of agriculture, forestry, disasters and climate;

- Private sector participation will also be encouraged. ICIMOD will host the initiative within its Regional Program - Mountain Environment Regional Information System (MENRIS). Complimentary contributions will be managed through ongoing initiatives within ICIMOD such as SERVIR for co-hosting workshops/ meetings and development of tools and services.

Resources

- SERVIR is a joint development initiative of National Aeronautics and Space Administration (NASA) and United States Agency for International Development (USAID), working in partnership with leading regional organizations world-wide to help developing countries use information provided by Earth observing satellites and geospatial technologies for managing climate risks and land use. SERVIR-Himalaya was established in 2010 at the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal.
- We hope to raise the needed financing together with GEO by partnering with appropriate development partners, private sector as well as from on-going initiatives at ICIMOD in a complementary basis.

Leadership

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- Birendra Bajracharya (ICIMOD), Birendra.Bajracharya@icimod.org

Contributors

Members: Bangladesh, China, India, Nepal, Pakistan, USA.
Participating Organizations: ICIMOD.
Others: Afghanistan, Bhutan, Myanmar.

IN-SITU OBSERVATIONS AND PRACTICES FOR THE WATER CYCLE

Overview

Participants of the 12th session of the Integrated Global Water Cycle Observations (IGWCO) Community of Practice (CoP) had proposed a plan for the reduction of GEO Community activities and proposed a new Community Activity (CA) combining several existing activities contained in the transitional GEO 2016 Work Programme. The new CA should include the following CAs from the 2016 Work Programme: CA-11 (Soil Moisture), CA-12 (Streamflow), CA-13 (Groundwater) and a new activity: Surface Water Storage (to be developed). The new CA is proposed to address a variety of issues related to variable-specific activities, hence the more inclusive title.

Terrestrial *in-situ* observations including soil moisture, streamflow and groundwater in addition to other Essential Water Variables that are identical to Essential Climate Variables of the Global Climate Observation System (GCOS) are coordinated by the Global Terrestrial Network – Hydrology (GTN-H). GTN-H as a federated network of global data centres has continuously served as the *in-situ* observations component of IGWCO since its inception.

As a new CA affiliated with the *GEOGLOWS* Initiative, this CA is in a development phase that will contribute to the *GEOGLOWS* program framework and especially to activities 3 (Essential Water Variable Understanding), 4 (Earth Observations, Integrated Data Products and Applications, and Tool Development) and 5 (Data Sharing, Dissemination of Data, Information, Products, and Knowledge).

Activities for the period

The focus of plans and activities is geared to consult with shareholders of the new CA and to agree on a viable work plan in support of *GEOGLOWS*. This will be achieved through direct consultations with the International Soil Moisture Network (ISMN), Global Runoff Data Centre (GRDC) and International Groundwater Resources Assessment Centre (IGRAC) as well as through existing entities notably through GTN-H. The development of a sub-CA on Water Storage has a special priority to ensure timely close-up with already existing traditional CAs including the aforementioned ISMN, GRDC and IGRAC and in cooperation with potential custodians including the Global Database on Lakes and Reservoirs (HYDROLARE) and others, to be identified.

In particular:

- Data will be registered in the GEO Common Infrastructure (GCI) as well as in WMO´s Integrated Global Observing System/Information System (WIGOS/WIS) Platform (both are now designed to be interoperable to avoid duplication of efforts);
- Dissemination of data will take place in accordance with established data policies;
- Best practices will be used for the long-term storage of data and meta-data in state-of-the-art database systems and the application of rigorous data quality checks;
- Standards will continue to be developed/refined to ensure interoperability of data structures and archives;
- Analysis of data and the development of products need to be undertaken in a two-tiered approach: Provision of first order data analysis products that may be largely automated and tailored on-demand products that may require extra-budgetary resources;
- Close linkage will be kept between the new CA, focusing on in-situ observations and its satellite component through cooperation/coordination with the Committee on Earth Observation Systems (CEOS).

User Engagement

Whereas former CAs 11-13 already have active user communities, the new Water Storage CA will include user communities of CAs 11-13 and additional users such as those using HYDROLARE services. Broad-scale communication of the *In-Situ Observations and Practices for the Water Cycle* CA is expected to draw new users. Enhanced engagement of users will be achieved through a participatory approach for the development of products and services, sharing of user requirements and

participation in community activities such as through teleconferences, dedicated workshops and other means of interactive sharing of requirements, requests and practices.

Future plans

To provide general and specific, as well as selected tailor-made services to the GEOGLOWS program framework activities 3,4 and 5 through the provision of data provided in standard formats to users including dissemination in accordance to agreed data policies, upkeep of data archives, and the further development of standards in cooperation with the Open Geospatial Consortium (OGC) and WMO.

Resources

At present there are no extra-budgetary funds available to develop and operationalize the CA. All resources are provided on the basis of in-kind contributions and derivatives from activities already under planning and/or implementation by CA partners. The new activity on surface water storage needs to be developed on voluntary inputs from leads and contributors still to be identified.

Leadership

- Wolfgang Grabs (GTN-H/Germany), Grabs@bafg.de

Contributors

Members: Austria, Germany, USA.
Participating Organizations: WMO.
Others: IGRAC.

Linkages across the Work Programme

Initiatives: GEOGLOWS.

LAND COVER AND LAND COVER CHANGE

Overview

Understanding land cover and how it is changing is essential: these changes are happening even faster than those of climate and their impacts on the natural environment and the ecosystem services upon which humans depend are immediate. These impacts permeate many areas of interest to decision and policy makers, including water, disasters, agriculture, weather, and climate, in addition to biodiversity, ecosystems, and ecosystem services. And it is an essential input to many multilateral environmental agreements, including the Sustainable Development Goals. Thus, accurate and up-to-date land cover (LC) and land cover change (LCC) products are more important than ever. The GEO Land Cover and Land Cover Change task works to improve the availability and quality of LC and LCC data by helping to convene and coordinate the various sectors of the LC community, including data providers and consumers. Stakeholders include environmental agencies, science communities, national mapping agencies, commercial users, and UN Conventions. It is envisaged to evolve into a GEO Initiative in the future.

The goals (broad primary outcomes) are as follows:

- Operational systems that provide LC products that meet the varied needs of different users, including those at the global, regional, national, and sub-national levels;
- Informing policy initiatives, including those from UN Conventions such as the Sustainable Development Goals, and at the national level;
- Easy access to existing LC and LCC information, including making it easier for users to find the data that best meets their needs.

Key objectives (specific steps to towards the goals) include:

- Development of a new path for the generation of LC products by utilizing recent advancements in science and technology;
- Development of a coordinated LC reference database;
- Establishment of a community-oriented global LC portal and a collaborative information service platform;
- Development of shared tools to facilitate validation of LC datasets and that help standardize accuracy assessments.

Activities for the period

- Synthesize the outcome of the May 2016 Rotterdam workshop into a concept and approach for development of an operational LC generation system that can meet the varied needs of users, and develop it into a journal paper.
- 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).
- 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.
- Validate high spatial resolution global land cover data sets.

Resources

GOFC-GOLD, IIASA and JRC are supporters of this work through in-kind contributions. Several projects are contributing to the activity such as the ESA Land Cover CCI, the Copernicus Global Land Monitoring Service through the EC Joint Research Centre (JRC) and the Chinese GlobeLand30 project.

Leadership

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- Steffen Fritz (IIASA), fritz@iiasa.ac.at

Contributors

Participants of the previous GEO Global Land Cover task components (GEO 2012-2015 Work Plan):

- 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)

RESEARCH DATA SCIENCE SUMMER SCHOOLS

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. The ensemble of these skills, we define as 'Research Data Science'.

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.

Activities for the period

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.

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 'flavoured' 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 flavoured school will not necessarily run directly after a Vanilla school and may be held in a completely different location.

Discussions are on-going 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).

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.

Resources

1) The first full introductory or Vanilla course took 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 provided accommodation and subsistence for up to 120 students. The ICTP committed 15K euros, TWAS 10K euros and CODATA at least 5K euros to support student travel;
2) 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;
3) Resources for Flavoured Schools will be confirmed with the confirmation of the schools.

Leadership

- Simon Hodson (CODATA/RDA), simon@codata.org

SOCIO-ECONOMIC BENEFITS OF EARTH OBSERVATIONS

Overview

The goal of this task is to assess the socioeconomic benefits and impacts of information on individual and societal decisions. The impacts of data, information and applications on decisions need to be better understood intuitively and via quantitative assessments. The primary focus of the task will be to identify methods, create use cases/assessments, develop examples that can be broadly understood and conduct 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.

Activities for the period

The task will be performed by a Community Working Group.

The task activities are addressing the following:

- Identification and consolidation of representative case studies for collaboration and baseline analyses;
- Organization of international events to bring together natural, social and economic scientists to look at use cases and applications;
- Sessions or presentations at major conferences (such as AGU in US and EGU in Europe);
- Expansion of a related Linkedin community;
- Publication of themes and discussions in Earthzine and other publications; and
- Maintenance of a web site.

Future Plans

- Identification of GEO Initiative(s) that are interested in collaborating on societal impact analysis and benefit assessment;
- Understanding of the target community for the Initiative(s);
- Definition of a case study working with the Initiative(s);
- Examination of methodologies that are relevant to the collaborating Initiative(s) and the case study; and
- Analyses of the benefits from the Initiative(s).

Resources

- In kind contributions (Working Group)
- Support from grant or contract for joint meetings and working group

Leadership

- Francoise Pearlman (IEEE), jsp@sprintmail.com

Contributors

Members: Australia, EC (JRC), USA.
Participating Organizations: IEEE.
Others: Consultingwhere, Organisation for Economic Co-operation and Development (OECD).

SPACE AND SECURITY

Overview

The main ambition in the Space and Security domain is to ensure the wellbeing and security of countries and citizens by exploiting suitable space assets and collateral data.

A major objective is the development of capabilities and solutions to enhance:

- The resilience of the society against natural and man-made disasters;
- The protection of critical infrastructures;
- The efficiency in tasks related to border and maritime surveillance as well as to civil protection and humanitarian aid.

An important activity in supporting the primary aims of the Space and Security domain is the provision of geospatial products and services resulting from satellite and collateral data.

Earth Observation data are currently showing an unprecedented scenario in terms of variety, volume, velocity, veracity and value. Moreover datasets to be used for security applications can be composed not only by satellite data but also by data coming from social, open and other sources. Thus the key challenge 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.

This will be addressed:

- From a programmatic point of view by building and consolidating a User Community as well as looking for cooperation with key entities;
- From a technical point of view by implementing relevant solutions.

Activities for the period

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

- To provide a forum for discussion and to organize capacity building initiatives;
- To establish and foster cooperation with key entities and stakeholders;
- To collect user requirements and needs;
- To identify observational and capability gaps to be filled by space assets;
- To explore how to take maximum benefit from the usage of very large quantities of heterogeneous data (Big Data);
- To identify, develop and assess innovative applications, services and platforms encompassing the whole data lifecycle;
- To contribute to the implementation of relevant projects in the framework of R&I initiatives such as Horizon 2020 (e.g. focusing on the "Secure Societies" societal challenge);
- To build synergies with relevant GEO activities.

Future plans

SatCen will build on its existing network with the aim of enlarging the contributors to the Space and Security CA and thus more in general the EO Community. A number of activities aiming at promoting the Space and Security CA within suitable entities and stakeholders as well as some technical actions are foreseen. The outputs of these activities will allow the building of the Space and Security User Community and the implementation of solutions relevant for this community.

Resources

Activities will be carried out on a voluntary basis.

Leadership

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SYNERGIZED MULTI-SOURCE REMOTE SENSING PRODUCTS AND SERVICES

Overview

Due to a rapidly increasing of applications, multi-scale global common remote sensing product are needed based on the collaboration using shared infrastructures and on-line services need to be evolved 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) multi-source normalization processing, 2) multi-scale common product generation, and 3) Global Product Evaluation and Validation. Eventually, this Task will assist users of all levels of expertise to find and discover application 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 NRSCC, NASA, NOAA, and ESA and others to explore new opportunities for enhanced coordination and synergy among GEO Stakeholders.

Activities for the period

As more and more earth observation data accumulated, different countries have constructed kinds of product generation system based on single satellite series. However, the different remote sensing products are quite inconsistent and have non-negligible uncertainty, which become one bottleneck to seriously restrict the application. GEOSS must evolve to promote not only the access to the data, but the technology and standards to support the Multi-source Synergized Remote Sensing Data Processing, Common Product Generation, Global Product Evaluation and Validation.

The objectives include:

- Promote the international standard for GEOSS multi-source data synergized processing, common product generation, and validation;
- Promote greater collaboration for development of the GEOSS MUSYQ;
- Promote an operational common product validation network;
- Promote the GCI with the software tools, and global common products, beside only for the data sharing;
- Promote the application and services for all kinds of uses –ecosystem services, agriculture, water resources, forests and carbon etc.

Specific tasks include:

- The normalization of moderate to low resolution remote sensing data;
- The Multi-source Synergized Remote Sensing Common Product Generation platform for Products including:
    - Radiation-related: Aerosol Optical Depth (AOD), Downward Shortwave Radiation (DSR), Downward Longwave Radiation (DLR), Photosynthetically Active Radiation (PAR), Land Surface Net Radiation (LSNR), Bidirectional Reflectance Distribution Function and Land Surface Albedo (BRDF,LSA), Land Surface Temperature and Emissivity (LST, LSE);
    - Vegetation-related: Leaf Area Index (LAI), Vegetation Index(VI), biomass, Fraction of Photosynthetically Active Radiation (FPAR), phenology, Net Primary Productivity, Fraction of Vegetation Cover (FVC);
    - Hydrology-related: soil moisture, Evaportranspiration (ET).
- Develop the global Product Evaluation and Validation Network;
- Long time series remote sensing product generation and releasing;
- Demonstration application and services for all kinds of uses –radiation budget, ecosystem services, agriculture, forests and carbon etc.

Resources

Data and Software

- A remote sensing data center provides most of the remote sensing data of China;
- A software system using MODIS, FY3/MERSI & VIRR, AVHRR, HJ-1/CCD, Landsat/TM to produce some of the vegetation and radiation remote sensing products;
- A Chinese validation network in national scale where the core observation sites are the Huailai Station, the Hulunber Station, the Heihe Station and the Jingyuetan Station;
- A prototype land surface remote sensing product validation system (LAPVAS) which facilitates the implementation of desired function in data acquisition and validation techniques to validate 14 kinds of remote sensing products.

Projects and financials:

- Currently there are several related projects, including:
    - Chinese 863 key Program "Integrated space-borne, airborne and ground-based quantitative remote sensing system and applications" (8 million/yr);
    - Chinese 973 project " Remote sensing information dynamic analysis and modeling over complex terrain " (4 million/yr);
    - projects supported by the state key laboratory of Remote Sensing Sciences, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences (5 million/yr) ;
    - projects supported from the Natural Science Foundation of China (2million/yr);
    - other potential projects from Ministry of Science and Technology.

Leadership

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Contributors

Members: Australia, China, France, Italy, the Netherlands, Portugal, UK, USA.

Links across the Work Programme

Flagships: GEO BON; GEOGLAM; GFOI.
Initiatives: EO4EA; GEO Carbon and GHG; GEO ECO; GEOGLOWS; GEO-GNOME, GEOSS-EVOLVE.
Community Activities: Data Analysis And Integration System (DIAS); In-Situ Observations and Practices for the Water Cycle; Land Cover and Land Cover Change; Himalayan GEOSS.

TIGGE (THORPEX INTERACTIVE GRAND GLOBAL ENSEMBLE) EVOLUTION INTO A GLOBAL INTERACTIVE FORECAST SYSTEM (GIFS)

Overview

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.

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 started collecting data in 2006, hence holding ten years of multi-model ensemble data comprising 1.5 petabytes, from ten global models, totaling more than 5.4 billion fields at the disposal of the community.

Following the success of TIGGE, a project was established in 2013 by the World Meteorological Organization (WMO) to look into the sub-seasonal to seasonal prediction (S2S). The objectives of S2S are:

- To improve forecast skill and understanding on the sub-seasonal to seasonal timescale with special emphasis on high-impact weather events;
- To promote the Initiative's uptake by operational centres and exploitation by the applications community;
- To capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services.

The project pays specific attention to the risk of extreme weather, including tropical cyclones, droughts, floods, heat waves and the waxing and waning of monsoon precipitation.

To achieve many of these goals, an extensive archive of sub-seasonal (up to 60 days) forecasts and reforecasts (sometimes known as hindcasts) has been established, following the steps of the TIGGE database for medium-range forecasts (up to 15 days) and the Climate-System Historical Forecast project (CHFP) for seasonal forecasts.

The S2S database is hosted at ECMWF, with a secondary archive at CMA. The data portal was launched in May 2015. At present (June 2016) it contains 40 Terabytes for 1 billion fields of forecast and re-forecasts from 10 data providers. There are 11 data providers planned to contribute to the S2S database.

Activities for the period

- The TIGGE archive will continue to grow routinely with output from the data providers. This will involve all the modifications necessary to accommodate the implementations of new versions of the data providers' models;
- The TIGGE archive be extended to store output from ocean waves components through model improvements (coupled atmosphere-wave systems);
- The S2S database will be extended to include stratospheric levels and oceanic variables. The archiving of oceanic data is partly motivated by the fact that upper-ocean variability is an important source of predictability at the extended range. The inclusion of ocean output is planned for the end of 2016, with the uptake by users and applications in 2017.

Future Plans

- 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.

- The S2S archive will foster the research on the production and further use of re-forecast data. An extensive re-forecast set spanning several years is needed to calculate model bias, which in some cases can also be used to evaluate skill.

Resources

All activities and resources necessary to support the creation of TIGGE and S2S database and the data portals to provide users with access to such data are part of ECMWF's contributions to WMO Research Programmes, such as World Climate Research Programme (WCRP) and the World Weather Research Programme (WWRP).

Leadership

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- Chinese Meteorological Administration (CMA)/China.

Contributors

Members: Australia, Austria, Brazil, Canada, Denmark, France, Germany, Hungary, Italy, Japan, Russian Federation, South Korea, United Kingdom, United States.
Participating Organizations: WMO.

GEO INITIATIVES

General

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. GEO Initiatives may, for example, demonstrate technical feasibilities through pilot services. GEO Initiatives concern activities for which the user communities are known at a general level (but may not yet have been fully defined in detail), where some products and services may exist (but may have not yet been fully consolidated), and where resourcing options have been identified (but may have not yet been fully identified or analyzed). Contributions are typically made in-kind, including observation systems operated to serve the Initiative's objectives, models, funded projects, or other programmes.

GEO Initiatives have a clearly identified objective that responds to needs of GEO Members and Participating Organizations and an implementation plan setting out how that objective is to be achieved. Initial contributions by Members, Participating Organizations, and private sector players are identified to the extent known. Further commitments may often be sought during the implementation of the GEO Initiative. Relevant stakeholders should be engaged in the development of the Initiative, with the user community being integrated into the GEO Initiative as it develops. Clarifying user needs and consolidating communities should be an objective of GEO Initiatives.

Some GEO Initiatives may evolve into GEO Flagships if and when accepted by Plenary following a recommendation by the GEO Programme Board. However, GEO Initiatives may also be taken up directly by a Participating Organization, or be discontinued if, in particular, their objective has been achieved. The implementation plan should outline any expectations with respect to the final phase of the Initiative.

Establishing GEO Initiatives

Any GEO Member, Participating Organization, or the GEO Secretariat may conceptualize and propose a new GEO Initiative based on a detailed Implementation Plan. These are discussed and further developed by those proposing the Initiative together with the GEO Programme Board. The SBA Working Groups should be involved when developing GEO Initiatives. Where Communities of Practice (CoP) can contribute to the development of the Implementation Plan, they should be engaged at an early stage. Their role is described in the implementation plan. The GEO Programme Board works to establish consensus concerning the proposed objectives and the implementation plan, and to ensure that a sufficient level of resources and contributions are committed for successful implementation of the GEO Initiative. All contributions – in-kind or otherwise – are listed, described, and valued in the implementation plan. Contributions may include specific commitments from GEO Members, Participating Organizations, private sector partners, or other third parties. If and when this can be achieved, the GEO Programme Board may accept the new GEO Initiative.

By accepting a new GEO Initiative, GEO supports its objectives and commits or acknowledges the resources specified in the implementation plan.

Criteria for establishing GEO Initiatives

GEO Initiatives must meet all criteria used for Community Activities (see 1.2). In addition:

- User need or application perspective identified;
- Pilot or prototype information service or product developed or demonstrated;
- Contribution to satisfying user need;
- User institutions identified with plans to solicit their advice;
- Sufficient resources for activities identified and committed;

- Clear relevance to GEO's Strategic Objectives demonstrated;
- GEOSS Data Sharing and Data Management Principles implemented;
- Implementation Plan, detailing:
- Objective(s), shared by partners;
- The information service or product provided;
- Schedule for implementation;
- Perspective(s) for evolution;
- Quantified, itemized resources, including from Members, Participating Organizations, private sector partners and the GEO Secretariat, enabling substantial progress towards objectives;
- Partners, including target user groups;
- Capacity Building activities
- User representatives engaged, often in advisory roles;
- Governance and management mechanisms; and
- Monitoring and Evaluation procedures.

Contributors

Primary contributors to GEO Initiatives are typically Participating Organizations, GEO Members (through their corresponding institutions), and interested partners from the private sector. The specific contributions and the roles of the different contributors may vary between different GEO Initiatives and are described in the implementation plan.

Management and coordination

GEO Initiatives are generally managed as projects. The detailed arrangements may vary between different GEO Initiatives and are defined in the implementation plan. GEO Initiatives should have effective dedicated steering boards or similar mechanisms that oversee implementation of the Initiative. Members of the steering board should be representatives of those partners providing significant resources to the implementation. Representatives of user communities should also be engaged in the steering board, or advisory mechanisms, as appropriate.

GEO Initiatives may define their steering and advisory mechanisms according to their specific needs, though lessons may be learned from other Initiatives or Flagships.

Typically, an Initiative coordinator will be identified. They will typically be resourced by a contributing Member or Participating Organization. In some cases, the coordinator might be established within the GEO Secretariat. The coordinator is responsible for coordinating the implementation of the agreed implementation plan and reporting to GEO on progress and other related issues. A sufficiently resourced Initiative coordinator is an important criterion for accepting a new GEO Initiative.

Reporting to GEO

The Initiative coordinator is responsible for all reporting to GEO. This includes in particular:

- Progress reports in contribution to the annual GEO Progress Report. These will be reviewed by the GEO Programme Board; and
- Presentations to Plenary, the Executive Committee or the GEO Programme Board, as necessary.

Since many of the contributions will be made in-kind, further reporting will generally be required by individual contributors within their respective contexts.

Monitoring and Evaluation

Monitoring and evaluation activities are defined in the Implementation Plan. At a general level, the GEO Programme Board will monitor progress on the basis of the reports from the project coordinator and may recommend changes to the implementation, as needed.

The Work Programme includes a summary description of each of the Initiatives as reviewed and approved by the GEO Programme Board, along with a summary of the committed resources, while more detailed description as provided by individual implementation plans are included the "Work Programme Reference Document".

AFRIGEOSS: REINFORCING REGIONAL AFRICAN ENGAGEMENT

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 in Africa. Strong advocacy of open data-sharing policies and practices, as well as for increased use of EO data and information, are the foundation of moving forward in these vital areas. Similarly, focusing significant effort on building human, institutional and technological capabilities will ensure that all parts of the African continent benefit from better access, understanding and use of EO data, products and services. From these products and services information can be derived to better inform decisions to realize environmental and science and technology related African agendas.

AfriGEOSS is an Initiative of the African community in GEO aimed at providing a coordination framework and platform for Africa's participation in GEO. In addition it is a:

- Pan African initiative to raise awareness on EO;
- framework for strengthening partnerships within Africa;
- gateway into Africa for international partners; and
- support mechanism for the implementation of GEO objectives and programmes in Africa.

The AfriGEOSS objectives are to:

- Provide the necessary framework to initiate Africa focused mutual activities within the scope of GEO;
- Coordinate and bring together stakeholders across Africa to reduce duplication of efforts;
- Foster the participation of Africans in GEO by linking GEO activities initiatives in Africa;
- Enhance Africa's capability to access, use and manage EO for informed decision making;
- Develop a strategy for accessing and disseminating Earth observation data in Africa.
- Contribute to the implementation of the African Space Policy and Strategy; and
- Advocate for the uptake of EO in decision making to realize the African aspirations.

Activities for the period

In its Implementation Plan, AfriGEOSS identified six key Action Areas:

- Continental and Regional Coordination – to undertake coordination at national (establish national GEOs) and regional level;
- User Needs and Applications: Initially focussing on:
    - Food Security and Agriculture (through AfriGAM); Sustainable Forest Management; Water Resource Management (through AfriWRM); and Sustainable Urban Planning and Growth; Land Cover for Africa (Working Group on Land Cover for Africa) and AfriGEOSS Soil Moisture Mapping and Agricultural Outreach Support Project.
- Data and Infrastructure;
    - Coordinated Earth observation satellite data over Africa; and
    - Coordinated in-situ observations network for Africa
- Capacity Building:
    - Develop Action Plan including resources for implementation; and
    - Development of an Inventory of capacity building institutions, capabilities and programmes offered.
- Resource Mobilisation:
    - Establish a Coordination Team with an Action Plan;
    - Develop a framework for consideration by Caucus Members indicating where and how institutions can contribute towards the identified budget line items; and
    - Investigate the requirements and programmes of various funding agencies such as the African Renaissance Fund and the African Development Bank

- Communication and Outreach:
  - Develop communication strategy including resources for implementation;
  - Undertake routine communication activities including website maintenance, newsletters, brochures participation and exhibiting at relevant events; and
  - Hold the annual AfriGEOSS Symposium;

User engagement

- Through coordination of activities in the African continent, the Initiative aims to strengthen efforts geared towards the uptake of Earth observations in evidence based decision-making; to build synergies and reduce duplication of efforts; and
- Promotion and awareness on the value of Earth Observations for decision making, through engagement with policy structures in the continent, building on already undertaken engagements and decisions, such as that by the African Union (AU) 26th Ordinary Session, 1st Session AU Specialized Technical Committee on Education, Science & Technology, 3rd African Ministerial Conference on Meteorology, Southern Africa Development Community (SADC) Joint Ministers of Science, Technology & Innovation, Education and Training, and AU-European Union Summit.

Future plans

- A feedback mechanism with African political structures, in particular those who have taken decisions on AfriGEOSS, will be developed, to assess progress made in implementing decisions informed by Earth observations.

Resources

- The AfriGEOSS Initiative is mainly implemented through in-kind resources from Members and Participating Organizations contributing to the Coordination Teams, Task Forces, Working Group and the governance structures of AfriGEOSS;
- The resource mobilizations action area aims to mobilize cash resources to support and strengthen the available in-kind resources; and
- South Africa has committed resources through a secondment to GEO Secretariat for 2017.

Leadership / Coordination

- Andiswa Mlisa (AfriGEOSS Coordinator, GEO Secretariat), amlisa@geosec.org

Contributors

Members: Democratic Republic of the Congo, Egypt, Gabon, Ghana, Kenya, Madagascar, Morocco, Nigeria, Senegal, South Africa, Uganda, in partnership with Canada, China, European Commission, Spain, United States
Participating Organizations: AARSE, ARCSTE-E, ASREN, CRTEAN, EIS-Africa, RECTAS, RCMRD, UNECA, in partnership with GOFC-GOLD, GRSS and UNEP
Others: Botswana, COMIFAC, Namibia, OSS and Swaziland.

Linkages Across the Work Programme

Flagships: GEO BON; GEOGLAM; GFOI.
Initiatives: African Geochemical Baselines; Climate Change Impact Observation on Africa's Coastal Zones; Global Urban Observation and Information; GEO Wetlands Initiative; Land Cover and Land Cover Change; Oceans and Society: Blue Planet.

In addition synergies are envisaged with some of GEO Foundational Tasks such as GEONETCast Development and Operations, GCI Development, SBAs process: Systematic determination of user needs / observational gaps, Communication Networks and Reinforcing engagement at national and regional level.

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 and products associated with 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.

As a first approach the Initiative will engage with the GEO Flagships and their end user communities that are from Member countries in the region, which are addressing priority areas. 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.

Activities for the period

AmeriGEOSS implements its activities through working groups. Each working group will manage their own planning, milestones, and deliverables. Coordination activities include monthly working group teleconferences, participation in relevant GEO meetings, and at least annual meetings of the AmeriGEOSS community. Specifically:

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.
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.

User engagement

AmeriGEOSS will assess its user needs through a continuous user engagement. More effective approaches are needed in a multilingual world with a wide diversity of capabilities. To facilitate the co-design of new products, a process will be developed to continuously identify, articulate, and refine user needs for products at multiple scales.

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.

Future Plans

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 at the national level.

Resources

During 2017, most of the contributions will be in-kind contributions by the participant countries and organization. NOAA, NASA, and GEO-Colombia will contribute to the coordination of activities. NOAA will contribute with the National Water Center Laboratory. NOAA and NASA will contribute with activities and the coordination of the MBON - Pole-to-Pole project. The USGS will contribute with the pilot project to develop the AmeriGEOSS Community Resource on the GEO Platform. NASA will also contribute through the DEVELOP and the NASA-ARSET Programs. The Humboldt Institute will contribute with the Bon in a Box activity. CIRMAG, Colombia and the JRC-EU will contribute through their use of hydrological data for global forecasts. NOAA and the GEO Secretariat will contribute with technical support for the Centre of Hydrologic and Spatial Information for Latin America and the Caribbean (CIEHLYC)'s monthly webinars. Data products through the GEONETCast-A system will be in-kind contributions from the contributing countries. Estimated contributions are expected to total $500,000 per year but will increase as the programme grows.

Leadership

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Contributors

Members: Argentina, Brazil, Canada, Chile, Colombia, Costa Rica, EC, Mexico, USA.
Participating Organizations: UNESCO.

Linkages across Work Programme

Flagships: GEO BON; GEOGLAM.

Initiatives: GEOGLOWS; Oceans and Society: Blue Planet.
Community Activities: GloFAS.

ASIA-OCEANIA GEOSS (AOGEOSS)

Overview

The Asia-Oceania region with its large population, numerous and fast environmental changes and frequent natural disasters pose a big challenge to the AO society. Complex geography, earthquakes and tsunamis, floods and droughts, environment deterioration and pollution, global warming and island losing, and mountain ecosystem degradation endanger the security of water, food, energy, health and ecosystem services. To confront these challenges, there is a demand to foster its application capacity and to develop an integrated, sharable, and sustained observation system. To develop such capacity, it is necessary to promote a regional cooperation on earth observation with broad involvement. Responding to these needs, GEOSS Asia Pacific Symposium has convened annually since 2007 and has strongly demonstrated the importance of fostering a forum for regional activities. On the foundation of these existing regional efforts, the Asia-Oceania GEOSS Initiative (hereinafter to be referred as AOGEOSS) attaches importance to comprehensive Earth observation application throughout the Asia-Oceania region. Through establishing the effective cooperation framework at regional, national, and global levels, the AOGEOSS initiative intends to promote the ability of AO countries to confront those challenges which pose a risk to the attainment of social sustainable development.

The AOGEOSS initiative will engage participants and stakeholders in Asia-Oceania region, and coordinate the observation infrastructure, leveraging the existing cooperation and conducting joint projects under the AO Caucus mechanism of intergovernmental GEO. Based on the several priorities in the AO regions, the dedicated AOGEOSS is specified into two categories: (1) The regional applications and services and (2) The foundational tasks.

To achieve the three Strategic Objectives of GEO, the AOGEOSS will rely on the two key functions of the previously established and very successful GEOSS Asia-Pacific Symposium as a forum that provides a regional communication and exchange platform, suitable for promoting discussion and information exchange on (i) cooperation on specific initiatives and (ii) as a scientific and technical workshop on each thematic area related to the Societal Benefit Areas.

Activities for the period

The actions will be conducted in regional applications and foundational tasks.

(1) Regional application activities:
The initiative will propose new regional applications including Monitoring and evaluation of drought in Asia-Oceania region, Environmental Monitoring and Assessment, Ocean and Island monitoring, and Himalayan GEOSS. At the same time, it will also foster the existing activities such as Asia-Pacific Biodiversity Observation Network (AP-BON), Asian Rice Crop Estimation and monitoring (Asia-RICE), Asian Water Cycle Initiative (AWCI), Ocean and Society, GEO Carbon and GHG Initiative.

(2) Foundational tasks:
The initiative will implement data sharing, AO-DataCube and user engagement and communication.

User engagement

Involvement strategy is mainly relying on the communication activities at different platform, such as conference, side events, and related activities conducted by different consortiums. The GEOSS Asia-Pacific Symposium is one of the explicit platforms, which could provide a flexible and inclusive convening platform for end-users at different level, also playing a critical role for the user engagement and capacity building. AOGEOSS also focus on its capacity building to foster the user's engagement through the existing activities.

Future plans

- AOGEOSS initiative will implement prototype information services, build the regional data sharing platform, and deliver annually report on Remote Sensing Monitoring of Ecosystem and Environment over Asia-Oceania. AOGEOSS Initiative will also demonstrate technical feasibilities through pilot projects and operational application services;
- As an integral part of implementing GEOSS, AOGEOSS will coordinate various resources including observations, technologies and applications, to deliver information services for end-users and facilitate the development of society and economy of Asia and Oceania;
- A key goal of AOGEOSS, it is to promote further cooperation among countries of Asia-Oceania region. It will promote deeper understanding for international communities on earth observation system and a wide range of applications on some important topics.

Resources

In-kind:

- Satellite data and its services, hosting the training programmes, will be provided by member countries through their space agency and institutes. China, Japan, India, Korea and Thailand have successfully launched a series of satellites;
- The annual GEOSS Asia-Pacific Symposium will be voluntarily borne in an in-kind manner by Japan as previously.

Other:

- Most member countries have expressed to invest special and/or in-kind resource on a voluntary basis for the task and subtask they are involved;
- Project funded by China MOST with USD 500,000 annually for Ecosystem and Environment Monitoring Report;
- China RADI invested USD 350,000 for China GEOSS Data Sharing Platform maintaining every year;
- Funding and projects for each task will be allocated by member countries after the approval of this proposal.

Leadership

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Participating Organizations: CEOS, GRSS, ICIMOD, ICSU, ISDE, ISPRS, POGO, UNEP-IEMP, UNESCAP, UNESCO-HIST, WMO.
Others: Laos.

Linkages across the Work Programme

Flagships: GEO BON (AP-BON); GEOGLAM (Asia-RiCE); GFOI.
Initiatives: GEO Carbon and GHG Initiative; Oceans and Society: Blue Planet.
Community Activities: Data Integration and Analysis System (DIAS).

CLIMATE CHANGE IMPACT OBSERVATION ON AFRICA'S COASTAL ZONES (GEO-CCIOACZ)

Overview

Africa has the longest coastal zone over the globe with high density of population and livelihoods. Like other coastal zones across the world, Africa's coastal zones hold great potentials for socio-economic development of the continent as well as repository of rich biodiversity. However, the impact of climate change has greatly reduced the potentials of Africa's coastal zones, a situation that is exacerbated by lack of adequate funding and capacity to collect, analyze, manage, and share relevant information on climate change impacts on Africa's coastal zones.

Therefore, the main objective of the proposed GEO Climate Change Impact Observation on Africa's Coastal Zones (GEO-CCIOACZ) Initiative is to strengthen the continent's existing capacity to collect, analyze, manage, and share up-to-date and high resolution information on climate change impacts in Africa's coastal zones in order to develop mitigation and adaptation measures as well as resilience. This main objective is further elaborated as to:

- Produce and share up-to-date and high resolution Climate change information on the coastal zones of Egypt, Kenya, Nigeria and South Africa, as a pilot for ultimately producing this information for the whole continent;
- Implement an operational EO system for coastal zone management in Africa;
- Training and capacity development on "Climate Change Mitigation and Adaptation";
- Provide Climate change Information services to end-users at the different levels (i.e. policy and decision makers, stakeholders and local communities).

This Initiative will build on the existing and other activities in Africa including the African Monitoring of the Environment for Sustainable Development (AMESD) and Monitoring for Environment and Security in Africa (MESA) projects. These two projects are using EO for environment and other services in sub-Saharan African Countries. However, the facilities and infrastructures and services will be at a point integrated with the results from this Initiative. Other integration and synergy will be with the Global Ocean Observing System (GOOS) that is working on a global scale of oceanography and marine environment.

The successful execution of "Climate Change Impact Observation on Africa's Coastal Zones - GEO-CCIOACZ" will not only strengthen the development, accessibility, and utilization of up-to-date and high resolution climate change data by various end-users and policy/decision-makers in African countries, but will also provide significant additional contribution to the Global Earth Observation System of Systems (GEOSS).

Activities for the period

- Each participating country group will collect, analyze, and manage relevant information on climate change impacts on its coastal zone using combination of remote sensing and ground based observations;
- Data to be collected include: local sea level and temperature changes, flood hazards inventory, water quality/pollution impacts, shoreline erosion, impacts on socio-economic activities, mitigation and adaptation measures;
- Implement a data sharing policy between African countries and develop an integrated system for coastal zone management for Africa utilizing data from the four countries;
- Develop an operational services for EO for coastal zone management;
- Develop scenarios for climate change implications on the coastal zone of Africa;
- Develop postgraduate courses on "Climate Change – Mitigation and Adaptation", to produce adequate middle level researchers on climate change;
- Supplementary specialist training on regional climate modeling (downscaling) for climate modelers.

- Establish African Regional Centres on Climate Change (ARCCC) in the four participating countries.

User engagement

- Short courses will be developed to target end users of climate change information, policy/decision makers, community reps and NGOs;
- ARCCC to establish link with various end-users through workshops, seminars & focused group discussions.

Future plans

This proposed Initiative will involve for the time being four African countries, namely, Egypt, Nigeria, Kenya and South Africa; however it is anticipated to engage all African Counties. The choice of these countries was influenced by need to; (i) cover the different coastal regions in Africa (North, West, East & Southern Africa), (ii) involve countries that have relatively well established remote sensing facilities/institutions and (iii) involve countries that have already established strong collaboration/cooperation between their researchers.

Resources

A dedicated budget from the participating countries will be reserved for the initial implementation of this Initiative. This will be in a form of in-kind budget that will be estimated and agreed upon from the partners on the kick off meeting. Other in-kind finance will be organized in the form of seconded staff to work on the implementation of the Initiative as well as using the resources for data collection, analysis and dissemination. Additionally, the partners will put seed money to start the Initiative and agreed to mobilize fund from national, regional and international funding agencies to ensure sustainable implementation and operation of the Initiative.

The partners will contribute by in-kind of the following essential components:

- Data: Egypt will contribute by the archive of Egyptsat 1; Nigeria will contribute by the data from Nigeriasat 1 & 2; South Africa will contribute by the archive of Sumbandilasat data. Other sources of EO data from other international satellites that are received by the African receiving stations however, this will based on the legal agreements;
- Processing: The partners will use their own resources of computing facilities to process the data and disseminate the information among the stakeholders.

Leadership

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Contributors

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Participating Organizations: RCMRD.

Linkages across the Work Programme

Flagships: GEO BON (MBON).
Initiatives: AfriGEOSS; Oceans and Society: Blue Planet.

DATA ACCESS FOR RISK MANAGEMENT (GEO-DARMA)

Overview

Increased severity of weather events and rapid urbanization has led to growing economic and human losses from disasters, requiring international organisations to act much more in risk prevention mitigation and preparedness through improved disaster risk reduction (DRR) policies and programmes, in addition to their efforts during the response phase. As part of this effort, space agencies have implemented a series of actions aimed at fostering the use of Earth observation (EO) data to support DRR and at raising the awareness of policy and decision-makers and major stakeholders of the benefits of using satellite EO in all phases of disaster risk management (DRM). GEO-DARMA is one of the major initiatives supported by space agencies as follow-on action to the "Sendai Framework for Disaster Risk Reduction 2015-2030".

GEO-DARMA aims to support operational risk reduction activities through the implementation of end user priorities in line with the "Sendai Framework", on a trial basis in several regions of the developing world (such as Latin America, South Asia and Southern Africa). One of the main objectives of GEO-DARMA is to address critical issues related to DRR affecting most of the countries in a region through a series of end-to-end projects (initially demonstrators) that rely on the use of multiple source of observation data (space, *in-situ*, socio-economic, models outputs) in response to needs of the end user communities The methodology followed for defining and implementing has already been experimented and consolidated by CEOS and its partners, during the last four years with the CEOS disasters pilots, previously a GEO component and now a Community Activity (see GEO CA: Earth Observations for Disaster Risk Management). Main outcomes (information products) from each project will be defined and generated with the objective of improving the quality and accuracy of information made available to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all DRM phases, whenever those products and services require satellite EO combined with other sources of data (*in-situ* ground observations, socio-economic, model outputs).

Activities for the period

Three phases are foreseen; the following durations are indicative and will be confirmed at the kick-off (KO). It should be noted that it is foreseen that some demonstrator projects might start earlier than other. That means that the three phases may overlap:

1. Concept phase: Definition of the regions to be considered in GEO-DARMA;
2. Prototyping phase: Definition of pilot projects. Each individual pilot project will build 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;
3. Operational phase: For each project, around the end of the Prototyping phase, the need to transition from a prototype to a sustainable solution will be assessed depending on the success of the prototype, on the request from the user community and on the availability of the necessary funding (transition and long term operations).

User engagement

The engagement of the main stakeholders at regional level (the Regional Institutions) will be key to the success of GEO-DARMA as they are the ones that will identify the most critical issues to be solved in each selected region. One of the main objectives of GEO-DARMA will be to connect with potential users and identifying use cases around the end of the Concept phase when recommendations from the Regional Institutions will be available. Each project will involve data providers, and intermediate and end users (data & information practitioners, regional institutions, governmental agencies, local decision makers, and scientists).

Future plans

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 (e.g. The World Bank, Regional development banks) 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.

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.

- Concept phase: this initial phase is a study phase that will require each actor to allocate enough time to generate and review documents, participate in monthly teleconferences, and participate in a final GEO-DARMA workshop. During this workshop, all the recommended projects will be analysed and decisions will be made regarding which of them to start;
- Prototyping phase: the number and nature of projects to be started 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. The series of projects will be defined at the end of the Concept phase and only at that time will it be possible to evaluate what specific resources will be needed for each project;
- Operational phase: International financial institutions and donor agencies will play a critical role to ensure a smooth transition from prototyping to operations, and their support of capacity building activities will be essential to ensure sustainability;
- The European Space Agency (ESA) will support the Point of Contact, a DRM Expert (via an ESA contract) being hired only for GEO-DARMA for an initial period of two years. One of his/her initial tasks will be to engage with the key Regional Institutions.

Leadership

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Contributors

Participating Organizations: CEOS.

Linkages across the Work Programme

Initiatives: GEOSS-EVOLVE.
Community Activities: Earth Observations for Disaster Risk Management.

EARTH OBSERVATIONS FOR ECOSYSTEM ACCOUNTING (EO4EA)

Overview

This initiative will seek to understand and enhance the use of Earth Observations for the development of Ecosystem Accounts based upon and consistent with the UN System of Environmental Accounts – Experimental Ecosystem Accounts. The initiative will include participants from both the Earth Observation and Ecosystem Accounting communities at all levels of the initiative.

The EO4EA initiative is fully grounded in the GEO Strategic Plan 2016-2025, seeking to "improve the effectiveness of GEO's actions, to broaden engagement and collaboration of stakeholders," as called for by the 2014 GEO Ministerial Summit. This initiative will include stakeholders and users as active partners across the public, private, academic and NGO sectors. These partners include environmental and ecosystem accountants, statisticians, environmental economists, ecologists, resouce managers and policy makers.

The Initiative also responds to the Mandate of the GEO Mexico City Declaration of 2015. Specifically, the initiative - will be an active collaboration "with statistical agencies and others to integrate Earth observations with social and economic data to multiply their collective value and to contribute solutions that are linked from the global to local levels." and that "GEO and it's Earth observation and information will support the implementation of... the UN system of Environmental and Economic Accounts."

By facilitating the development of ecosystem accounts in a more timely and accurate manner, the initiative will provide governments with tools to aid development planning and assessment and to inform management and policy options for any activity which will use of impact a country's natural capital or substantial flows of ecosystem services from those flows. EO4EA will also contribute to the implementation of the 2030 Global Goals for Sustainable Development (SDGs). It will contribute to many of the "societal benefit areas" identified by GEO.

EO4EA will compile current Ecosystem Accounting efforts across varied themes and scales to synthesize our understanding of how Earth observations (EOs) were utilized in ecosystem accounts. It will further assess the gaps in available EOs and issues associate with sampling, data and information processing and will identify further research needs.

EO4EA will assess how EOs can contribute to monitoring and assessing ecosystem extent and condition. It will also look at how EOs can contribute to the measurement and monitoring of ecosystem services.

Activities for the period

EO4EA has initially identified four related 4 work streams (WS) which should mutually reinforce each other. Each work stream will be managed by a task force with an identified lead(s).

WS 1will compile an overview of current Ecosystem Accounting efforts, at various themes and scales, and inventory the extent to which they used Earth observations (EOs). It will further assess the gaps in available EOs and issues associated with sampling, data and information processing and identify further research needs.

WS 2 will assess to how EOs can contribute to monitoring and assessing ecosystem extent and condition. The WS2 task force will review the characteristics and definitions of ecosystems and how EOs can be used to map and monitor their extent and condition. They will provide input to the UN Statistical Commission's revision of the technical guidelines for the System of Environmental-Economic Accounting (SEEA) Experimental Ecosystem Accounting (EEA) (SEEA–EEA) in 2017 and beyond. They will also develop an outline for methodological guidance on the use of EOs for Ecosystem Accounts including recommendations on definitions, indicators, scale and temporality, sampling regimes and the opportunities and challenges of using various types of sensors from satellite to in situ.

WS 3 will also look at how EOs can contribute to the identification, measurement and monitoring of ecosystem services. This effort will be done in close collaboration with the UN Statistical Commission and build on the efforts of the US EPA and EEA definitional work in these areas and look at how EOs may be able to contribute to these efforts. This work will also include the identification of research needs, with regard to tools and analytics to translate EOs into accounting frameworks and its use in valuation efforts and as a compliment to the UN Statistics Division System of National Accounts.

WS 4 will develop pilots to test improved data and methods of using EOs for Ecosystem Accounting, based on products generated at continental and regional scales and to for the development of Ecosystem Accounts at national and sub-national levels.

User engagement

The Statistical Agencies and ecosystem accountants, environmental economists,ecologists resource managers and policy makers will all participate in the initiative, which is designed to facilitate broader use of Earth observations.

Future plans

EO4EA will work closely with the UN Statistical Commission, especially its Committee on Environmental and Economic Accounts (UN-CEEA) and London Group on Environmental Accounting. It will build on and coordinate its efforts so that they complement the work of the Statistical Commission and its sub-bodies, which are the standard setting bodies for the SEEA. The EO4EA initiate also includes among its members the World Bank – Wealth Accounting and Valuation of Ecosystem Services (WAVES) Partnership. The Initiative will also reach out to the Organisation for Economic Co-operation and Development (OECD)/UN Economic Commission for Europe (UNECE) Conference of European Statisticians, and to efforts addressing land cover mapping and ecosystem services assessment.

Resources

Support is in-kind initially. Several USGEO agencies have committed resource to supporting the effort. As the initiative begins to take action, engage others and produce results we anticipate that additional resources can be identified.

Leadership

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Contributors

Members: Canada, Colombia, Mexico, the Netherlands, USA.
Participating Organizations: EEA, ESA, World Bank - Wealth accounting and the Valuation of Ecosystem Services (WAVES) partnership.
Others: Conservation International, ESRI

Linkages across the Work Programme

Flagships: GEO BON; GFOI.
Initiatives: AfriGEOSS; AmeriGEOSS; Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEOGLOWS; Oceans and Society: Blue Planet.

EARTH OBSERVATIONS IN SERVICE OF THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Overview

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 elements enable countries and the global community to measure, manage, and monitor progress on economic, social and environmental sustainability.

Earth observations, geospatial data, and derived information play insightful roles in monitoring targets, planning, tracking progress, and helping nations and 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 *EARTH OBSERVATIONS IN SERVICE OF THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT* Initiative enables contributions to the 2030 Agenda by GEO and the Earth observations community. The primary purpose of this Initiative is to organize and realize the potential of Earth observations and geospatial information to advance the 2030 Agenda and enable societal benefits through achievement of the SDGs. This Initiative supports efforts to integrate Earth observations and geospatial information into national development and monitoring frameworks for the SDGs.

Activities for the period

The Initiative encompasses activities advancing the provision, access, discoverability, and applicability of Earth observations and geospatial information for use with the SDGs, and assesses data and information needed to be available for the SDGs, while working with GEO data activities, national statistical agencies and others.

The Initiative has three goals:

Goal I: Demonstrate how Earth observations, geospatial information, and socio-economic and other data contribute in novel and practical ways to support achievement of the SDGs.

- Achieve acceptance of seven methods by the IAEG by end of 2018;
- Produce effective methods for five SDGs by end of 2018;
- Generate one sample methodology per continent by 2017 and uptake of two methodologies within each continent by end of 2019.

Goal II: Increase skills and capabilities in uses of Earth observations for SDG activities and their broader benefits.

- Engage 25 countries in trainings on rolling three-year average;
- Conduct trainings on 5 SDG themes by end of 2018;
- Develop a handbook on SDGs and Earth observations by end of 2017;
- Roll-out a SDG toolbox for Earth observations data by end of 2018;
- Produce a primer for GEO community on SDG statistical practices by end of 2017.

Goal III: Broaden interest and awareness of Earth observations' support to the SDGs and social, environmental, and economic benefits.

- Produce outreach materials on three SDGs by end of 2017 and seven by end of 2019;
- Conduct one or more annual events at UN, GEO Plenary and/or work Programme Symposium, conferences, or trade shows;
- Issue annual awards on uses of Earth observations for SDGs, showcasing the nations and stakeholders and the benefits they achieved;

- Arrange partnerships with two major institutions at the nexus of science, decision support, and sustainability, to support broader societal ownership of the Goals and Targets and strengthen the effectiveness and accountability of their implementation.

User engagement

The Initiative pursues outreach and engagement to encourage nations and stakeholders to use Earth observations as part of their SDG activities. This business line includes the creation and maintenance of a portfolio of materials that showcases effective methods, available capacity building support, and accessible data and information products to promote the consideration and adoption of Earth observations for the SDGs by nations and stakeholders.

Across all lines of business, the Initiative uses and supports GEO's efforts to characterize user needs, especially in fostering effective ways to develop methods jointly with users, enable sustained uptake of the methods, and addresses data access. The Initiative pursues partnerships as a key part of its strategy, promoting broad distribution of effective methods, data availability, training, and outreach.

Implementation activities

- The Initiative maintains four elements as lines of business: Projects, Capacity Building, Data and Information Products, and Outreach and Engagement. These lines collectively address technical, organizational, and programmatic aspects of the Initiative, and there are desirable synergies across lines. The Initiative emphasizes strong collaborations with the statistical community at national and global levels;
- The Initiative directly supports and pursues projects for method development, distribution, and adoption. The Initiative also provides technical and other guidance for projects developed under other GEO activities, serving a communication role in a federated approach to GEO's overall service to the SDGs. Capacity building activities provide support to institutions and individuals in the ideation, development, and implementation of methods. Activities draw on, and contribute to, GEO's established capacity building activities. The portfolio includes virtual and physical activities, such as trainings, webinars, joint projects, applied research, and workshops. Additionally, activities include capacity building within GEO about SDG statistical principles and practices.

Resources

The Initiative operates through in-kind contributions of financial and other resources to conduct the activities. As in-country pilot projects and other activities articulated in each two-year Work Plan mature, the Initiative Board develops a clear statement of the types of resources the Board and Team are prepared to commit to successfully implement the Initiative.

Leadership

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Others: CIESIN, GPSDD, SDSN.

Linkages across the Work Programme

Flagships: GEO BON; GEOGLAM; GFOI.

Initiatives: AmeriGEOSS; GEO Carbon and GHG Initiative; GEOGLOWS; GEO-GNOME; Global Urban Observation and Information; GEO Human Planet Initiative; GEO-VENER; Oceans and Society: Blue Planet.
Community Activities: EO for Disaster Risk Management; EO for W-E-F Nexus; AirNow International; Land Cover and Land Cover Change.

GEO CARBON AND GHG INITIATIVE

Overview

The budgets of carbon and other greenhouse gases (GHGs) have many uncertainties that make it difficult to evaluate the success of climate change mitigation strategies. Improvements in long-term, high quality observing systems within and across the atmospheric, oceanic, terrestrial, and human domains are required to quantify GHG sources and sinks, to understand changes in the carbon cycle and hence the climate system, and to assess the level of effort required in order to mitigate and adapt to climate change. Current observing efforts and initiatives are a mix of regional and global efforts, requiring a global coordinating mechanism that provides useful and comparable information to resource managers and policy makers.

The GEO Carbon and GHG Initiative is proposed in the framework of GEO to promote interoperability and provide integration across different parts of the system, particularly at domain interfaces. The intention is neither to write new strategies nor duplicate existing efforts, but instead to build on existing initiatives and networks, ensure their continuity and coherence, and to facilitate their cooperation, the interoperability of their data and efforts, including WMO's IG3IS effort and GCOS programme, to fill in the missing pieces to obtain a comprehensive, globally coordinated, carbon and GHGs observation and analysis system. The initiative shall address policy agendas and will operate as a common and open platform to plan and implement strategies and joint activities at the global level from science to policy.

The work of the GEO Carbon and GHG Initiative is motivated by the long-term vision of a data-driven system to provide comprehensive knowledge on changes in the global carbon cycle and GHG emissions as a result of human activities and global change, and to support decision makers with timely policy-relevant information. It is not intended to replace national reporting or serve as a MRV mechanism. GEO has already played an important role in the promotion of carbon emissions monitoring by describing the building blocks and coordinated implementation of an Integrated Global Carbon Observing System in the GEO Carbon Strategy (Ciais et al., 2010), and this Initiative builds on tasks of the former GEO 2012-2015 Work Plan (CL-09-03a and CL-02). Many efforts and initiatives suggested there are now in place to monitor and understand carbon cycle and GHGs, but still a globally coordinated and comprehensive initiative, ranging from science to policy, and addressing all the components of the needed Carbon and GHGs-observing system is missing.

Activities for the period

The main aim of the GEO Carbon and GHG Initiative is therefore to facilitate cooperation to develop a coordinated system of domain overarching observations for monitoring and evaluating changes in the carbon and other cycles, and GHG emissions as they relate to human activities and global change, and to provide decision makers with timely and reliable policy-relevant information. Furthermore, the GEO Carbon and GHG Initiative will establish a common platform to plan joint strategies and implement joint activities. The activities of the Initiative are organized into Tasks, as follows:

Task 1 – User needs and policy interface: to engage with users and policy makers and ensure the consistency with their evolving needs, to drive the activities of the GEO Carbon and GHG Initiative and address the policy agenda.

Task 2 – Data access and availability: to provide long-term, high quality and open access near-real-time data and data products, complying with the GEOSS principles, from a domain-overarching carbon cycle and GHGs observing system. This task is building on the former GEO tasks (CL-09-03a and CL-02) and the GEO Carbon strategy document published in 2010. The GEO Carbon and GHG Initiative will support the implementation of that strategy that is done in many infrastructures that have been constructed since then. It is a logical step forward to move from the strategy to the implementing activities and GEO can support the data access very efficiently.

Task 3 – Optimization of observational networks: to develop and implement on an ongoing basis, a procedure for achieving observations of identified essential carbon cycle variables within user-defined specifications and at minimum total cost.

Task 4 – Budget calculations and breakdown across scales to inform policy implementation: to develop consistent budgets of GHGs (CO2, CH4, and N2O) from local/urban to global scales using a combination of observations, inventories, models and data assimilation techniques.

User engagement

Task 1 (above) is devoted in its entirety to user needs and policy interface. More specifically, it includes plans to:

- Strengthen linkages with policy makers and relevant organizations (e.g. UNFCCC);
- Involve end-users and stakeholders in the activities of the proposed GEO Carbon and GHG Initiative;
- Ensure consistency with user needs to drive the activities and address the policy agenda.

Future plans

Ultimately, decision makers will be provided with policy-relevant data, information and products, of sufficient accuracy, coverage and timeliness that will support them in addressing climate policies and anthropogenic climate change. Thus, the intention is to start as a GEO Initiative and then move soon, depending on the level of maturity and available resources, to a GEO Carbon and GHG Flagship.

Resources

The 1st year of activities is guaranteed by commitments in terms of financial and in-kind resources (including person months). During this period all the key partners are committed to work at national and international level, in collaboration with GEO Secretariat, for leverage funding from the GEO Member states and other institutions/organizations, in order to seek the budget specifically dedicated to the planned activities.

Furthermore, the presence of international institutions, organizations and programmes, such as the Integrated Carbon Observation System (ICOS), the Global Carbon Project (GCP), CEOS and many others, already committed to work on carbon and GHG observations and research is a guarantee of the continuation and success of this initiative. CEOS will periodically monitor progress against the actions set up in the CEOS Response to the GEO Carbon Strategy and that have to be implemented by this initiative. This constitutes a major contribution in-kind to the GEO Carbon Initiative with individual space agencies and CEOS collectively taking responsibility.

Leadership

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Contributors

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Participating Organizations: CEOS, ESA, ICOS, IIASA.

Linkages across the Work Programme

Initiatives: Oceans and Society: Blue Planet.

GEO COLD REGIONS INITIATIVE (GEOCRI)

Overview

The "Cold Regions", including the Arctic, Antarctic, high-latitude oceans, Himalaya-Third Pole and Mountain cold areas, are experiencing the fastest rate of climate, ecological and environmental change. With its abundant Earth water and relevant phase changing, the cold regions severely affect the dynamic earth's systems, impact more than one hundred countries of billions of people living therein, and influence many aspects of society in all parts of the world. Scientific research is making it increasingly clear that "What happens in the poles doesn't stay in the poles".

Building on its accomplishments during the first ten years implementation of GEOSS, the Information Service for Cold Regions (GEOCRI) was proposed to be a Global Initiative (GI) in the transitional work program. Later in September, 2016, GEOCRI was recommended to the next implementation of GEOSS (2017-2019). GEOCRI is also a Year of Polar Prediction (YOPP) endorsed activity since 2015.

The vision of GEOCRI is to provide coordinated Earth observations and information services across a range of stakeholders to facilitate well-informed decisions and support the sustainable development of the cold regions globally. The GEOCRI mission is to develop a user-driven approach for Cold Regions information services to complement the mainly current science-driven efforts, which will strengthen synergies between the environmental, climate, and cryosphere research efforts and foster the collaboration for improved earth observations and information on a global scale.

Activities for the Work Plan period of 2017-2019

The activities conducted in GEOCRI are grouped into six thematically overarching Tasks: 1) Infrastructures, 2) Monitoring Network and Data, 3) *In-situ* and Remote Sensing Integration, 4) User Engagement and Communication, 5) Capacity Building and Knowledge Transfer, and 6) Management and Monitoring. The tasks –coordinated by Task Teams- and related activities are the fundamental elements for liaison, coordination, implementation and reporting. Contributors can assign themselves to work for different tasks and related activities; these will form Task Teams. Task Teams will decide on the planning and responsibilities of their activities, and the set milestones and deliverables will be reported to the co-leads and presented to contributors who will provide feedback. Activities are prioritized by the co-lead group, and later by the science/advisory group once established in 2017.

User engagement

GEOCRI user engagement will be done by utilizing several modalities ranging from face-to-face events and capacity building to on-line surveys and - ultimately - operational services developed in contact with the users, including scientists, policy-makers, industry, business/commerce, students, and local communities.

In 2017-2019, the initial stage of activities by the User Engagement and Communication Task Team will include the identification of current and potential user communities, and their specific features, and consultation with these user communities about their needs and expectations on the content and modality of the information services that they would like GEOCRI to offer. The ESA, EU H2020 and other national polar and cold region observation projects, the Copernicus Climate Change service, and user requirement conferences, as well as sets of dedicated tools from the newly granted projects are good examples and approaches in assessing the user requirements and advancing the user engagement.

Future plans

By leveraging the global visibility and convening power of GEO, GEOCRI will setup the pilot services and implement the coordinated network of those services. It will make a positive contribution to national, regional and international decision-making processes and science strategies. GEOCRI, via its contributors, feeds reliable, science-based Earth observation data and information for policy makers, enabling better, well-informed and more effective decisions in cold regions and beyond.

GEOCRI will work towards supporting the 2030 Agenda for Sustainable Development, the COP21 Paris Agreement and Sendai Framework for Disaster Risk Reduction 2015-2030.

Resources

GEOCRI's resources are predominantly in-kind efforts, aimed at leveraging the resources of participating initiatives and organizations to align with GEOCRI's objectives. Contributions include:

- SAON: Documenting and understanding the Arctic data management ecosystem; Inventory of arctic observational projects as a contribution to EU PolarNet;
- SIOS: Implementation phase with a full-fledged activity during 2016, establishment of the knowledge centre. Norway will contribute at least 1M€; Italy to €100,000 to CNR Climate Change Integrated Project);
- IADC: the portal of the Italian research activities in the Arctic. The cyber-infrastructure NDAC in the frame of the Antarctic Research National Programme (PNRA), in a unique Polar Data Infrastructure (PDI) (€ 200,000);
- CNR through Climate Change Integrated Project (CCT-IP): upgrading of Ny Alesund as observation super-site in the Arctic (€100,000);
- 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. (€ 200,000);
- INTERACT: The Network for Terrestrial Research and Monitoring in the Arctic receives funding of 10 M€ funding from the EU H2020 for period of 2016-2020;
- INTAROS (Integrated Arctic Observation System) received more than 15 M€ from the EU Horizon 2020 for the period of 2016-2020, to develop an integrated Arctic Observation System (iAOS);
- Chinese Academy of Sciences granted 45M CNY ($ 6.7M) for the period of 2016~2021 for promoting pan-Third Pole environmental observations and understanding of the snow and glacier change;
- Establishment of flagship stations within the Third Pole region for observation and monitoring; (US Dollars : $200,000), rain gauge up to 6500 m in a river basin of the Tibetan Plateau. ESA – MOST / NRSCC / Hydrology and Cryosphere Theme under the 4th cycle 2016~2020 of the: program (Dragon 4). Six projects have been selected and launched in July 2016. Total resources estimated at 2M€;
- Snow Observations over Tibetan Plateau (SOTP) was funded with $120,000 from NSF. The monitoring of freezing and thawing cycle over China was granted with $140,000 from NSFC for the period 2015~2018;
- The inventory of snow over China was just proposed with an amount of $ 3.9M for the period 2017~2021;
- JAMSTEC, NIPR and Hokkaido University: Arctic Data Archive System (ADS), as a part of GEOSS Portal, in the "Arctic Challenge for Sustainability Projects (ArCS)" supported by MEXT (ca. $8.3M);
- CARD, a regular member of world data system (WDS), a data infrastructure contributes to the production, and publication of multidisciplinary dataset in Cold regions of China and its surrounding areas;
- A Chinese cubesat named TW-1A: polar sea ice observation in both Polar Regions proposed by Beijing Normal University and developed by the Chinese Academy of Sciences;
- The observations by the intended Water Cycle Observation Mission (WCOM): Monitoring of water resources as snow, sea ice, precipitation and soil moisture. ($1.5M), which will be launched in 2020, or so.

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Linkages across the Work Programme

Flagships: GEO BON, GEOGLAM, GFOI.
Initiatives: AmeriGEOSS; AOGEOSS; Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEO-DARMA; GEO ECO; GEOGLOWS; GEO-GNOME; GSNL; GWIS.

GEO GEOHAZARD SUPERSITES AND NATURAL LABORATORIES (GSNL)

Overview

The Geohazard Supersites and Natural Laboratory Initiative (GSNL) is a voluntary international partnership aiming to improve, through an Open Science approach, geophysical scientific research and geohazard assessment in support of Disaster Risk Reduction.

The GSNL goal is pursued promoting broad international scientific collaboration and open access to a variety of space- and ground-based data, focusing on areas with scientific knowledge gaps and high risk levels: the Supersites and the Natural Laboratories. For these areas a joint effort is carried out: the space agencies provide satellite imagery at no cost for scientific use, the monitoring agencies provide access to ground-based data, the global scientific community exploits these data to generate state of the art scientific results. The coordination of each Supersite is normally attributed to local geohazard scientific institutions and researchers which are already operationally providing authoritative geohazard information to support the decision makers. This process ensures that the new knowledge generated by the wider scientific community is rapidly taken up by the stakeholders to benefit hazard assessment, disaster monitoring and response actions.

Activities for the period

The first 5 years of the Initiative allowed demonstration of the validity of the Supersite concept, showing that improved access to EO and *in-situ* data is able to stimulate new science which can directly benefit the society. The process by which decision makers made direct use of the information produced and communicated by the scientific community was straightforward for some Supersites (e.g. Hawai'i, Iceland, Campi Flegrei, Ecuador). However much work will be done in the next three years to establish the conditions by which the same process can be applied on a more routine basis to all Supersites.

The specific objectives of GSNL for the period 2017-2019 are:

1. to enable the global scientific community open, full and easy access to a variety of space- and ground-based data, focusing over selected, high risk areas of the world: the Supersites and the Natural Laboratories;
2. to promote advancements in geohazard science over the selected sites;
3. to report scientific results relevant to geohazard assessment to authoritative bodies and other DRR stakeholders, supporting informed decision-making in Disaster Risk Management activities;
4. to innovate technologies, processes, and communication models, enhancing data sharing, global scientific collaboration, and capacity building in geohazard science.

To reach these goals, in the period 2017-2019 the GSNL Initiative will build on its past successes, increasing the number of Supersites (from 7 to 12-13) and improving several management and IT aspects, strengthening the way the Supersite scientists collaborate and generate new science.

User engagement

There are three main types of stakeholders involved in the GSNL Initiative:

1. The data providers (for *in-situ* and EO data). They are mostly contributors to the Initiative, however they also use GSNL to promote their activities, demonstrating the societal benefits of the data they produce;
2. The global geohazard scientific community. Scientists use the Initiative to obtain an easier and open access to a large quantity of EO data, plus *in-situ* data which may not be easily accessible outside of the Supersite framework. They are motivated by the scientific research, by the possibility to improve their capacities through a focused collaboration, and by the possibility to contribute with their work to generate direct societal benefits in DRR;

3. The final users of the geohazard scientific information. This category includes policy makers and decision makers at international/national/regional scales, the industry sector, the responders, the general public. These are what we call End-users.

Future plans

We will transfer the positive experiences and service models from the more mature Supersites to the less advanced ones, exploiting the role of the local community in the provision of scientific information services to local End-users. We will demonstrate the societal benefits of an Open Science approach to Geohazards and their related disasters, by exploiting a streamlined process by which research results from the global scientific community are operationally provided as consensus scientific information to the decision makers for direct use in DRR activities. Moreover, we will implement a process allowing the End-users to propose specific priority objectives to the global scientific community, promoting a more effective geohazard assessment, and ultimately improving the DRM actions taken at local level.

Resources

Since its inception the GSNL Initiative was mainly based on voluntary contributions (data, efforts infrastructures) from the various partners. Only the European Supersites benefited from large EC funding (€6 M each), which allowed to further develop the monitoring and ICT infrastructures. We expect that in-kind support from the participants will remain the baseline funding model for 2017-2019, even for the Supersites providing operational services, which are part of public institutional service agreements at national level.

We expect that in-kind support from the participants will remain the baseline funding model for 2017-2019, even for the Supersites providing operational services, which are part of public institutional service agreements at national level. However, more project funding is needed for some activities. We expect that direct cash-funding for Supersite-specific tasks (e.g. for developing data infrastructures, monitoring networks, capacity building) will be obtained through national or international competitive calls.

The total resources (direct and in-kind) available for this 2017-2019 IP through contributions from the partnership, i.e. the CEOS agencies (including EO data and infrastructures as the ESA GEP), the monitoring agencies (*in-situ* data and infrastructures), and the scientific community (management, research, dissemination), is estimated to be ~€5.8 M/year (of which €4.4 M/year of commercial EO data costs).

Leadership

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Others: EPOS.

Linkages across the Work Programme

Initiatives: GEO-DARMA.

GEO GLOBAL ECOSYSTEM INITIATIVE (GEO ECO)

Overview

Terrestrial and marine ecosystems provide essential goods and services to humankind and are of crucial importance for the sustainable development of societies and for meeting the Sustainable Development Goals (SDGs). 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.

Knowledge-based conservation, management and restoration policies are urgently needed in order to ensure delivery of ecosystem benefits in the face of increasing anthropogenic pressures. Fundamental to all these is effective monitoring, understanding and modelling of the state and trends in ecosystem functions and services. New monitoring methodologies are now available that combine approaches in geo- and bioscience, remotely-sensed data and *in-situ* observations. New satellite missions, such as the European Sentinels, are going to provide a large amount of high-quality data on the environment and on ecosystems. *In-situ* data are being organized and made available through international activities such as the International Long-Term Ecological Research (ILTER) network. Ecosystem models capable of incorporating the information from Earth Observations are being developed.

Based on these perspectives and building upon existing activities, the GEO ECO Initiative builds upon available Earth Observation data, results and information and use them on a global scale, identifying Protected Areas of international relevance, extending the analysis to unprotected areas and adopting the view of ecosystems as "one physical system" with their environment, characterized by strong geosphere-biosphere-anthroposphere interactions across multiple space and time scales. Both terrestrial and marine ecosystems are considered, with a special focus on interactions and processes taking place in the thin layer at the surface of our planet (the Earth Living Skin), such as the Earth Critical Zone from the rocky matrix to the top of tree canopy for terrestrial ecosystems, and the dynamics in the euphotic layer and in coastal areas for marine ecosystems. The knowledge on ecosystems acquired through the activities of GEO ECO will be built together with the people in charge of the management of the Protected Areas, and an Ecosystem Community of Practice will be created.

Activities for the period

GEO ECO activities are devoted to obtaining the integration of remote sensing and *in-situ* data, collectively called Earth Observations, and make best use of them to support the management and conservation of natural ecosystems, seen in their full complexity characterized by both biotic and abiotic components and their interactions.

Research needs are defined by the interplay of the application needs, as expressed by stakeholders and ecosystem managers, and the rigorous framework defined by scientific endeavour.

The focus will be on Protected Areas, owing to their fundamental importance in the ecosystem landscape, and the various Tasks described below will be integrated into a unified framework. Specific "storylines" will be defined for similar Protected Areas, with a focus on specific ecosystem services, functions and processes.

Seven main tasks are envisaged:

- Global mapping of Ecological Land Units (ELU)/Ecological Marine Units (EMU);
- Remote sensing observations for Protected Areas;
- Environmental Impact Assessment (EIA) big data visual platform;
- Long-Term ecological data from *in-situ* measurements;
- Ecosystem models and e-laboratories;
- Future ecosystem scenarios and related uncertainties;

- Characterization of geosphere-biosphere interactions.

User engagement

- User communities of the ecosystem information generated by GEO ECO include environmental (for example, Protected Area) managers, private users (for example, tourism companies) and citizens. In the proposed partnership, user communities are already involved. These include the Israel National Park Authority, the Gran Paradiso National Park in Italy, the Northern Limestone Park in Austria, and others;
- The GEO ECO Initiative will make data, products, information and knowledge available to a broad range of stakeholders, to allow the development and implementation of such knowledge-based policies. Starting from the European-based activity of ECOPOTENTIAL and SWOS, GEO ECO will develop strict links with the stakeholder, PA management and policy-making communities by activating a permanent stakeholder consultancy group and involving PA managers, stakeholders, nature conservation associations, economic sectors and concerned citizen groups into the definition and discussion of the crucial social and economic needs of the local populations.

Future plans

One of the goals of the EU H2020 Project ECOPOTENTIAL is to create an Ecosystem Community of Practice, composed by managers and staff of Protected Areas, policy makers, local communities and other stakeholders, with the aim of determining the applied needs that should inform the research and data collection activities**.**

Resources

At the moment, funding is secured by:

- The EU H2020 project ECOPOTENTIAL (about €16 M in the period 2015-2019);
- The EU H2020 project SWOS (about €5 M in the period 2015-2018);
- Possible funding by the Italian project NextData (expected €3 M for 2016-2017);
- In-kind and cash contributions for ELU/EMU mapping at USGS and Esri;
- In-kind and cash contributions for the activities on EIA big data visual platform based on RS-GPS -Web GIS by the Chinese Academy of Forestry;
- This leads to expected committed resources of at least €6 M/year for 2017 and 2018, and at least €3 M for 2019.

Leadership

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Participating Organizations: UNEP, UNESCO.
Others: Lithuania.

Linkages across the Work Programme

Flagships: GEO BON.
Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEOGLOWS; GEO-GNOME; GEO Wetlands Initiative.

GEO GLOBAL NETWORK FOR OBSERVATION AND INFORMATION IN MOUNTAIN ENVIRONMENTS (GEO-GNOME)

Overview

Mountains are globally distributed environments producing significant societal benefits. The ability of mountain regions to provide goods and services to both highland and lowland residents is seriously threatened by climatic and environmental changes, large-scale political and socio-economic transformations, unsustainable management of natural resources and serious gaps in the understanding of mountain systems. Decisions on policy and investment, from the level of local governments to international agencies, must be based on information and knowledge that reflect both the generalities and specificities of mountain regions. In addition, decision makers must confront the paucity of observations in high-altitude regions and the relatively poor level of understanding of mountain social-ecological systems.

The Group on Earth Observations Initiative – Global Network for Observations and Information in Mountain Environments (GEO-GNOME), will address the paucity of observations and information on mountains. GEO-GNOME will compile and provide data, both related to historical conditions and to future projections that support examination of the drivers, conditions and trends at a variety of different scales, from that of a single mountain range to that of the planet as a whole. GEO-GNOME will improve our understanding of mountain regions and therefore sharpen our ability to provide policy and investment relevant advice. GEO-GNOME will create a capacity to combine data and information to meet emerging, often as-yet unarticulated policy needs.

Activities for the period

The overarching logic of the activities is to begin with existing datasets, specifically datasets that delineate mountain regions, and then thematic datasets that are either clipped to mountain regions or are non-global legacy datasets pertaining to specific areas or specific themes. These first tasks provide a platform for mountain-related observations. Focused campaigns related to known issues will generate new data and new insights needed to convert data into knowledge and insight into the function of mountain regions. The final tasks anticipate new policy frameworks beyond the historical GEO SBAs to ensure that GEO-GNOME data can be useful in these new policy frameworks (e.g. SDGs).

Specifically, GEO-GNOME tasks fall under the following headings:

1. Delineating accurately mountain regions using best available data;
2. Compiling data that quantify ecosystem services, socio-economic measures and drivers arising from or impinging upon mountains;
3. Improving understanding and foresight through focused campaigns;
4. Developing an indicator capacity that responds to future policy needs;
5. Reporting periodically on State of the World's Mountains.

User engagement

As a network activity involving a wide range of participants, GEO-GNOME already includes actors in mountain governance. While MRI members are largely drawn from the academic world, they are not necessarily divorced from policy or decision-making. Indeed many are involved in informing policy or decision making exactly because of their status with academy.

As part of Future Earth, MRI subscribes to the notion of coproduction of knowledge, that is, that the use of new scientific knowledge in policy or decision-making is enhanced to the extent that policy and decision makers are actively engaged in the creation of that new knowledge. To achieve coproduction within mountain regions, GEO-GNOME will engage policy actors in a formal and on-going consultation process that will provide guidance not only on the nature of the data they need but also their preferred means for accessing data and other technical aspects.

Future plans

To the extent that GEO-GNOME provides a global picture of mountains, especially with respect to investment needs, it will support a variety of global decision making processes, exemplified by the Sustainable Development Goals. However the vast range of pertinent policy or decision making processes exist at regional, national or sub-national levels, and it is difficult to describe a priori all the various contexts in which GEO-GNOME will be used. While GEO-GNOME can anticipate some of these contexts through its initial user survey, it should not expect to anticipate all of them but rather should aim to maximum and open access to the data to promote its discovery and use by different actors. GEO-GNOME's emphasis on social-ecological systems and especially how they respond to drivers (including policy) as opposed to narrow disciplinary and technical foci, already aligns GEO-GNOME with the policy environment by anticipating the kinds of questions policy makers typically ask.

Resources

Specific commitments include:

- MRI has included a 40% time position and CHF 60,000 in program funds for GEO-GNOME in its next grant proposal to the Swiss National Science Foundation for the 2016-2019 period. These resources will provide the essential coordination needed for such a network project;
- The Swiss Development and Cooperation Agency has been requested to reallocate CHF 43,500 in 2016 and 2017 to ensure the completion of Task 1;
- The USGS Land Change Science Program has also indicated a strong interest in Task 1 and while the Program has not provided a financial amount, it has committed to active engagement in completing the task;
- ECOPOTENTIAL is an EU H2020-funded project coordinated by CNR-DTA. It explores the use of Earth observations for the management of ecosystems, with mountain ecosystems as a specific sub-category, and was conceived as a EU contribution to GEO. As such, ECOPOTENTIAL is expected to contribute significantly to Task 2 with its planned mountain-related activities and with the values of its contributions estimated at €1.5 million over the 2017-2019 period;
- The NextData project leaded by CNR-DTA will likewise contribute to Task 2 with the values of its contributions estimated at €1.5 million over the 2017-2019 period;
- The targeted campaigns of Task 3 (EDW and GNOMO) are currently funded by the participants themselves (in-kind contributions). A key next step for GEO-GNOME will be to use the good offices and venues of GEO to enlist more GEO Member and Participating Organization contributions to the campaigns.

Leadership

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Others: Macedonia.

Linkages across the Work Programme

Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEO ECO.

GEO GLOBAL WATER SUSTAINBILITY (GEOGLOWS)

Overview

This Initiative consolidates the positive elements of the water activities in the first phase of GEO and ensures that strong coordination and commitment is in place for links between data, information, knowledge, and applications and policy. There are many contributions being made to these goals by various GEO Member countries but these contributions are unlikely to be included in planning or in synthesis or to be linked with policy at the global scale unless they are part of a larger framework for coordinating water within and beyond GEO. Thus, when mature, GEOGLOWS could provide a coordination framework for all water initiatives under the GEO programme.

This Initiative is intended to facilitate the use of Earth observation assets to contribute to mitigating water shortages, excesses and degraded quality arising from population growth, climate change and industrial development. The Initiative is relevant to GEO Strategic Objectives and follows the model of GEO projects. It will achieve its objectives by facilitating collaborations, enabling projects, and encouraging conversations that will strengthen these programmes, increasing awareness of related activities, and promoting the leverage of existing or planned activities.

The Initiative will develop knowledge based on an analysis of Essential Water Variables (EWVs) and use the knowledge to inform applications related to minimizing Basin and Regional Risk, policies related to enhancing global water sustainability and capacity building through regional programs and alliances such as AmeriGEOSS. To achieve this objective it strives to enhance observational programs, innovate on ways to make more effective use of data, adhere to GEO principles of good data management, and implement the policy of free and open data exchange.

Activities for the period

This Initiative will involve the collection, processing, and analysis of data to produce a better understanding of water processes, improved predictions, and insights into strategies for more effective water management; models and tools that will be applied in the provision of monitoring and prediction services for water management; and general evidence and support for policy development. The scope of this work will initially cover the responsibility areas of the member nations involved and will provide the global overviews needed to make the connections between data and policy. The scientific approaches are supported by the enhancement of data collection and processing, the improvement of data services, and the expansion of capabilities to use the data by all segments of society and in all parts of the world.

The GEOGLOWS framework includes activities focusing on:

1. Enhancing Global Water Sustainability (Sustainable Development Goals; water scarcity and access; climate change; cold regions; user engagement);
2. Minimizing Basin and Regional Risk (integrated water prediction including floods and droughts; transboundary issues and Integrated Water Resources Management; Water-Energy-Food-Environment-Health Nexus; Climate Change Adaptation);
3. Essential Water Variable (EWV) Understanding (water quality and use; water cycle Variables);
4. Earth Observations, Integrated Data Products and Applications, and Tool Development;
5. Data Sharing, Dissemination of Data, Information, Products, and Knowledge;
6. User Engagement, Capacity Building, and AmeriGEOSS.

User engagement

End users will be engaged in the definition of needs for data, products and services. Emerging applications such as water quality applications and extreme event monitoring should lead to new services. Once user requirements are further clarified, an evaluation of global data centers' current holdings should be carried out to determine where new initiatives and services are required. They

will assist in the conduct of gap analysis to clarify the adequacy of existing products and services and the need for new services.

AmeriGEOSS functions as a User Engagement element through the surveys it undertakes at its meetings and training sessions to address this need. Other user engagement will be achieved through continuous active participation in the Integrated Global Water Cycle Observations (IGWCO) Community of Practice (CoP) where emphasis will be placed on engagements with users around the world. In addition GEOGLOWS will organize side events at the GEO Work Planning Symposium and Plenary meetings to inform experts in other SBAs of their activities and to stimulate cross-SBA activities. GEOLGLOWS members will be encouraged to organize scientific sessions and town halls at international science meetings to expand their activities.

Future plans

In addition to suggesting a strategy for coordination, this Initiative will also provide a set of recommendations for implementation including preliminary proposals for new activities. Part of this will involve expanding the geographical scope of GEOGLOWS by bringing more GEO Members into the Initiative.

Resources

- The investment in this Initiative currently comes from NASA, NOAA, USGS and USAID on behalf of the US Government and JRC (Europe) and Columbia for the international funding. Columbia and JRC provide $10K per year for their projects. The support from NOAA, NASA and USGS is all in-kind support at present;
- Together with contributions by NASA for funded projects and new initiatives funded through research calls and water-related projects and training funded by Latin American contributions, NASA's investment is roughly estimated to be $750K with another $35K spent on coordination;
- NOAA in-kind contributions amount to approximately $400K per year. These include GEONETCAST services, AmeriGEOSS projects in Latin America, and NOAA GEOGLOWS and AmeriGEOSS coordination. In addition, NOAA supports GEOGLOWS efforts related to Integrated Water Prediction at levels which are currently difficult to determine. NOAA and the GEO Secretariat contribute with technical support for CIEHLYC's monthly webinars. Data products supplied through the GEONETCast are in-kind contributions from the contributing countries. USGS activities have been carried out by staff involved in delivering on their normal responsibilities so it is hard to assign additional investments associated with USGS GEOGLOWS contributions.

Leadership

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Others: Barbados, El Salvador, International Association of Hydrological Sciences (IAHS).

Linkages across the Work Programme

Initiatives: AmeriGEOSS; Earth Observations in Service of the 2030 Agenda for Sustainable Development.

GEO HUMAN PLANET INITIATIVE: SPATIAL MODELING OF IMPACT, EXPOSURE AND ACCESS TO RESOURCES

Overview

The Human Planet Initiative is committed to developing a new generation of measurements and information products that provide new scientific evidence and a comprehensive understanding of the human presence on the planet and that can support global policy processes with agreed, actionable and goal-driven metrics.

The Initiative relies on a core set of partners committed in coordinating the production of the global settlement spatial baseline data and in and enlarged community of partners developing experimental activities on using the new baseline data for derived post-2015 indicators. The core partnership involved in the global baseline data production are the European Commission, Directorate General Joint Research Center (DG JRC), Global Human Settlement Layer project (GHSL), the University of Southampton WorldPop project, and the Columbia University, Center for International Earth Science Information Network (CIESIN) . The extended partnership involves more than 150 individual scientists and policy makers belonging to 85 different organizations including academies, international stakeholders, governmental bodies and private firms.

Activities for the period

The general objectives of the Human Planet Initiative in the working plan 2017-2019 are listed below:

1. Improve the state-of-the art of EO-derived global open data describing the physical infrastructures of human settlements;
2. Improve the state-of-the art of global open and public data describing population in human settlements;
3. Improve the integration of global open spatial data on population and physical infrastructures;
4. Test and demonstrate the use of new integrated global spatial data in support to the monitoring of the implementation of post-2015 frameworks.

Specific outputs include:

- Global historical baseline data on population and built-up areas 1975-1990-2000-2015;
- Global spatial baseline data on built-up areas from Sentinel sensors (10m);
- Global settlement classification schema and indicators;
- Global high resolution age-structured population maps 2000-2020;
- Global Settlements, Infrastructure, and Population Data Intercomparison;
- Regional and National show cases (porting of the advanced GHSL data mining technologies for automatic EO data classification in specific region-wide or country-wide fine-scale data scenarios, trough bilateral collaboration with local stakeholders);
- Human Planet platform (digital platform allowing open data dissemination, visual analytics, and collective discussion, tests and comparison on operationalization of indicators for monitoring the implementation of post-2015 frameworks);
- Human Planet Atlas releases (periodic publication of the Human Planet Atlas (HPA) where the core evidences and derived indicators produced by the Initiative are presented. The Atlas includes a facts-and-figures section, a cross-cutting thematic section, and an executive summary delivering periodic key messages and narratives based on the core evidences and derived indicators).

User engagement

In the Human planet Initiative all the partners are considered experts in different domains and they all contribute to both experimenting new methods and products definition. The same partner may play the “user” or “developer” role in different segments of the data processing and integration chain.

Consequently, "end-users" of the information and tools developed by the Initiative are already involved by definition because they contributed and/or are directly supporting the activities included in the Initiative.

Policy makers and international stakeholders that already contributing to the Initiative are UN agencies (Habitat, UNDP, UNEP, UNSDR), World Bank, and European Commission directorate general regional policy (REGIO). The latter supports the Global spatial baseline data on built-up areas from Sentinel sensors and the activities related to the Global settlement classification schema and indicators. International charity foundations as the Bill & Melinda Gates foundations are actively supporting specific activity streams included in the Human Planet Initiative as the Global high resolution age-structured population maps 2000-2020 coordinated by the WorldPop partner. New end-users are actively linked through the open GEOSS Data Sharing Principles, the digital platform, and the organization of special events in international conferences. Being the general aim of the Initiative the information support for global policy processes (SDG, DRR, Clima) and given the above mentioned multi-disciplinary integrated paradigm implemented in the Initiative, the "end-users" label is also translated to "Science-policy interface experts.

Future plans

The Human Planet Initiative aims to support the post-2015 international frameworks: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016), the post-2015 framework on sustainable development goals (SDGs), the UN Framework Convention on Climate Change, and the Sendai Framework for Disaster Risk Reduction 2015-2030. Post-2015 international frameworks are accompanied by targets and will be further elaborated through indicators that focus on measurable outcomes. These indicators are action oriented, global in nature and universally applicable. The Human Planet Initiative supports the implementation of a platform contributing to the UN Technology Facilitation Mechanism and enabling the test and the collective discussion of alternative options in operationalization of the indicators.

Resources

The Initiative is based on the in-kind support of the partner organizations that in the frame of their available resource allocation and working programs have manifested the interest to coordinate their activities with the Human Planet Initiative and have pre-release access to the new data and indicators developed by the community.

Leadership

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Others: Bill & Melinda Gates Foundation, UNDP, UNECE, UNHABITAT, WRI.

Linkages across the Work Programme

*Initiatives***:** Earth Observations in Service of the 2030 Agenda for Sustainable Development; Global Land Cover; Global Urban Observations and Information.

GEOSS-EVOLVE

Overview

Developing and sustaining the Global Earth Observation System of Systems (GEOSS) is critical to achieving the Mission and Vision of GEO. From the beginning GEOSS was conceived as a "system of systems", a loose confederation of existing and future Earth observation and data management systems supplementing but not supplanting their own mandates and governance arrangements. While the initial focus of GEOSS involved supporting nine Societal Benefit Areas (SBAs) of application, it was recognized that GEOSS should serve a broad range of global user communities including managers, policy makers, researchers, engineers, civil society, governmental and non-governmental organizations in further application areas. The success of GEOSS depends on building interoperability as a key principle among the different and autonomous systems so that the GEOSS can operate as a whole.

Much progress has been made during GEO's first decade in developing a distributed infrastructure allowing discovery and access to millions of datasets, many of which follow the GEOSS Data Sharing Principles and are full and open access. This infrastructure comprises both observing systems, and information and processing systems. Among the latter, the GEOSS Common Infrastructure (GCI) is a central mechanism to allow discovery and access to GEOSS information resources. The operations of the GCI are a key Foundational Task in the GEO Work Programme 2017-19. This new GEO Initiative addresses the further development of the GCI and the broader evolution of the GEOSS architecture.

The objectives of GEOSS-EVOLVE are:

1. To advance and evolve the GEOSS architecture based on the architectural principles described in the GEO Strategic Plan 2016-25, the analysis of the evolving landscape for technology and production/ consumption of Earth Observation (EO) data products and services, and the specific user requirements coming from the GEO Flagships and Initiatives;
2. To conduct research and development activities, in collaboration with public, private, and voluntary sectors, to develop and test new functionalities, solutions, and components, including those needed to advance the GCI, to support the GEO Strategic Plan objectives and user needs;
3. To prepare documentation and training materials needed to support the transition from development to operations of the new components and solutions identified.

Activities for the period

The activities of GEOSS-EVOLVE for 2017-19 are articulated in six work packages summarized below. Close collaboration with the GEO Secretariat and the Foundational tasks addressing data sharing, GCI operations and user requirements will be ensured through regular meetings and continuation of past collaborative working practices. This collaboration will also identify more clearly in 2017 which activities of GEOSS-EVOLVE are best addressed in the context of operations and may therefore be moved to one of the relevant Foundational Tasks, and which should stay in the Initiative being more focused towards development and evolution.

- WP 1: GEOSS Architecture and Evolution (Lead: US-USGS/Italy-CNR):
  - Advance and evolve GEOSS architecture based on technology watch and user requirements by selected Flagships and Initiatives;
  - Develop and Maintain the "Evolution of GCI functionalities and Architecture" document and service framework; and
  - Research, report on emerging technologies that facilitate use of Earth observation resources.
- WP2: Functionality Testing (lead China-RADI):
  Test functionalities of the GCI, the GEOSS data providers and the GEOSS community portals needed to support the requirements expressed by the users through the dedicated foundational tasks. The needs of different categories of users (decision-makers, researchers and practitioners addressing the Societal Benefit Areas at national and

regional levels, the general public) will be considered. Therefore this work package will consider usability by different user categories as a key dimension.

- WP3: Data Management Principles (Lead: ESIP, CODATA):
  - Demonstrate implementation of DMP with selected Initiatives and Flagships;
  - Revise implementation guidelines based on lesson learned; and
  - Develop and evolve training material.
- WP 4: Standards Interoperability Forum (lead IEEE):
  - Organise yearly interoperability workshops;
  - Develop and evolve training material and best practice guidelines; and
  - Support selected GEO Initiatives and Flagship in extending their interoperability arrangement.
- WP 5: Demonstrations Projects (Lead OGC):
  Implement demonstration projects with selected GEO Initiatives and Flagships that advance the functionalities of the GCI and GEOSS and address user needs.
- WP 6: Community Portals (Lead NOAA)
  - Develop community portals catalogue;
  - Develop training material and guidance for community portals to benefit from interoperability arrangements with GCI;
  - Develop recommendations based on lessons learned.

User engagement

GEOSS-EVOLVE will consider the requirements and inputs coming from the Foundational Task addressing the Systematic determination of user needs / observational gaps. This Task enables to link more clearly the needs of the GEO Initiatives and Flagship with respect to data, information, products and services. The Initiative will also develop a specific strategy for user engagement related to the evolution of GEOSS in collaboration with the GEO Secretariat, in order to structure and deliver information that address the objectives of the GEO Strategic Plan

Future plans

Given the rapid technological change taking place, the approach taken by GEOSS-EVOLVE is to plan 3-year increments aligned with the Work Program and propose new tasks for years 4-6 and 7-9 as we learn and implement. Year 10 will be dedicated to finalizing efforts and transitioning to the next iteration of the Strategic/Implementation Plan.

Resources

The resources committed are largely in-kind contributions from the organizations participating in the Initiative. Demonstration projects have in the past also involved significant contributions from both private and public sector organisations in terms of infrastructure to test applications and demonstrate proofs of concepts. As GEOSS-EVOLVE builds on a long track record of collaboration and achievements with respect to GEOSS-related tasks, continued support and commitment of resources is anticipated.

Leadership

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Contributors

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Participating Organizations: CEOS, CODATA, ESA, ESIP, ICSU, IEEE, OGC, RCMRD, WMO.

Linkages across the Work Programme

GEO Foundational Tasks

GEO VISION FOR ENERGY (GEO VENER)

Overview

Energy is an essential factor for sustainable development and poverty eradication. Renewable energy (RE) can enable the development of sustainable local sources of energy with the least negative impact on the environment and human health. 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, as well as billions of people affected by air pollution from inefficient and dirty power plants. 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 and minerals resources Societal Benefit Area should be strategically positioned to make a significant impact globally by enhancing the ongoing activities and increasing linkages with sustainable development efforts.

GEO Vision for Energy (GEO-VENER) will contribute to the Energy and Minerals resources SBA and will start by focusing on RE. Its goals are the availability and long-term acquisition of data from satellite and *in-situ* instruments and models to make possible the effective deployment, operation and maintenance of RE systems and their integration in the grid. No specific Earth observation (EO) system or program dedicated to RE exists, but the RE Domain is using EO systems and programs dedicated to others domains to extract relevant RE information. Nevertheless EO data or information sets dedicated to RE exist, and a lot of resources are available within GEOSS (from Data Core resources to web services all compliant with the GCI). Considering the SDGs in the Energy domain and the GEOSS targets, GEO-VENER will:

- Support the development of Earth observation products and services for energy management;
- Consider information to support end-to-end energy production systems (including planning, 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.

Activities for the period

A set of activities already exists and will pursue their activities in 2017. The activities described hereafter are:

- The EU 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 European Network of Earth Observation Networks (ENEON), part of the ConnectinGEO project will try to establish its activities on the long-run. Renewable energies are linked with the involvement of the private energy sector. Activities of the GEO Energy activities will contribute to ENEON;
- The-operational COPERNICUS Atmosphere Monitoring Service for Solar Radiation (http://macc.copernicus-atmosphere.eu/catalogue/#list?st=Solar%20radiation) will serve the solar community;
- A Sensor Observation Service capacity for the *in-situ* measurement for the Energy SBA has been established. This component (http://insitu.webservice-energy.org/jsClient-0.2.0/#map) has been added to the webservice-energy.org community portal. This Spatial Data infrastructure is operated by MINES ParisTech and will support GI-10;

- The launch of the call for project within EU H2020 ERA PLANET project is expected for 2016 with beginning of activities end of 2016, beginning of 2017. This project is 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/);
- Contribution of Copernicus Climate Change Service to exploration of Climate Change impacts to Energy sector through the European Climatic Energy Mixes project (ECEM);
- Exploration of collaboration between IEA and IRENA on Environmental impact assessment through the IEA PVPS task 12 through the development of impact assessment of PV systems service;
- Looking for interaction with the Terawatt Initiative;
- Organisation of the Fifth Solar training in Sophia Antipolis, France, beginning of 2017;
- Explore collaboration with GFCS for Energy;
- EU H2020 ERA NET Plus project "New European Wind Atlas" (NEWA) http://euwindatlas.eu/

User engagement

GEO-VENER plans to build up the pathway to link RE, services, data and metadata to GEOSS, to serve a large variety of users (from citizens to decision makers, including the private sector), to use EO data to enhance our knowledge and information about RE in order to increase substantially the share of RE in the global energy mix by 2030 as proposed within the SDG7 Target.

Future plans

- Increase the user community of GEO-VENER;
- Identify the policy mandate that can be given to GEO-VENER;
- Establish the GEO Renewable Energies Flagship.

Resources

- Support of the EU H2020 programme through the ConnectinGEO and the ERA Planet, ERA NET Plus NEWA and NextGEOSS projects;
- In-kind contribution of France (MINES ParisTech) to the Spatial Data Infrastructure webservice-energy.org;
- Support of Copernicus Atmosphere Monitoring Service to Solar radiation service;
- Support of Copernicus Climate Change Service (C3S) to ECEM project.

Leadership

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Contributors

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Linkages across the Work Programme

Initiatives: C3S; Earth Observations in Service of the 2030 Agenda for Sustainable Development.
Community Activities: Copernicus Climate Change Service (C3S); Earth Observations for Managing Mineral Resources.

GEO WETLANDS INITIATIVE

Overview

Wetlands are hot spots of biodiversity and provide a wide range of valuable ecosystem services, such as water purification, hydrological buffering against floods and droughts, coastal protection and climate regulation. Despite their disproportionate importance for people and nature, wetlands are one of the fastest declining ecosystem types worldwide. Information on wetland ecosystems and their services is often scattered, difficult to find, and hard to integrate into decision making. To improve this situation, the Ramsar Convention on Wetlands has been supporting the conceptualization of a Global Wetlands Observing System (GWOS) since 2007. Starting from 2011 members of the Freshwater Ecosystem Change working group of the Group on Earth Observations - Biodiversity Observation Network (GEO BON) have been coordinating this effort.

The new GEO-Wetlands initiative takes over this effort to move towards an implementation of the GWOS in a collaborative and multidisciplinary way. Therefore, it is a cornerstone of the Ramsar Convention on Wetlands since it aims to provide Ramsar Contracting Parties with the necessary Earth Observation methods and tools to better fulfill their commitments and obligations towards the Ramsar Convention. It will also contribute directly to the development and implementation of best monitoring practices for the UN Sustainable Development Goals (SDGs) on Target 6.6 *"By 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes*", supporting the development of methodological approaches and tools on the SDG indicator 6.6.1 "*percentage of change in water-related ecosystems extent over time*" and other global monitoring frameworks like e.g. the CBD Aichi Targets.

Activities for the period

The initial phase of GEO-Wetlands (2016-2017) will focus on initiating the Community of Practice and first working groups, developing a communication & dissemination plan, assessing user requirements based on the work of involved projects, develop capacity building and training concepts, develop the GEO-Wetlands and GWOS governance and management structure and ensure that all results and achievements of the involved projects are maintained, disseminated and stay available for the community.

All activities will support one or more of these overall GEO-Wetlands objectives:

- Establishing the structures for ownership and governance as well as the processes for funding in place;
- Developing, maintaining and delivering the infrastructure (Portal, Database, Knowledge-hub, Data Broker) for a Global Wetlands Observing System (GWOS) that allows centralized access to wetland related data, information and knowledge for all wetland stakeholders;
- Engaging providers and users of EO based and other wetland related data and information products from all levels (local to global) and sectors (science, industry, policy) under a common set of objectives and goals within a GEO-Wetlands Community of Practice (CoP) that functions as a network and bottom-up cooperation platform;
- Advocating the use of diverse Earth observation data and satellite-based information as a valuable tool for wetland mapping, monitoring and assessment, especially in support of global conventions and initiatives; and
- Delivering information and knowledge in a user-friendly, harmonized and quality-ensured way to policy- and decision-makers, ecosystem and protected area managers, scientists and citizens tailored to their specific needs and requirements.

User engagement

GEO-Wetlands will strengthen the cross-cutting coordination of global wetland observation by involving key stakeholders on different levels, from different regions, and from all sectors (science, industry, policy) in a user-needs driven framework. This will ensure that GEO-Wetlands' objectives

and tasks are in line with the broad communities' needs and carried out in an efficient and targeted approach. The engagement of these stakeholders in the GEO-Wetlands Initiative will help to secure long-term funding and to establish a GEO-Wetlands office that allows sustained development, maintenance and provision of the GWOS and all related services. The establishment of a structured GEO-Wetlands Community of Practice will help to engage and coordinate this diverse community.

Future plans

The GEO-Wetlands Initiative aims to ensure long-term sustainability by converting the ownership and governance structure from the current project level to a more sustainable longer term common governance structure using available project resources and in-kind stakeholder contributions. Furthermore, it will establish collaboration with other ongoing initiatives and engage with the broader wetlands community.

Resources

Budgets of contributing projects that either directly or indirectly feed into GEO-Wetlands:

- SWOS: €4,979,189.36 (2015-2018);
- GlobWetland-Africa: €1,500,000.00 (2015-2018);
- DeMo-Wetlands: €346,622.93 (2016-2019);
- Wetland-Radar: €265,000.00 (2016-2018);

In total this sums up to a budget of €7,143,812.40 for the 2015-2019 period. The 2015-2016 budgets of these projects already strongly contributed to the initiation of GEO-Wetlands and to the development of tools, products and infrastructure that will directly feed into GEO-Wetlands and the GWOS development.

In addition to this direct budget, the co-leads and contributors listed below all make significant in-kind contributions by taking responsibility for carrying out specific GEO-Wetlands tasks. The broader GEO-Wetlands Community of Practice and targeted working groups will further contribute to this. These in-kind contributions cover management and coordination, report and document preparation, technical and scientific developments, capacity building, communication and dissemination until a more permanent GEO-Wetlands office is set up. One of the main tasks for the initial GEO-Wetlands phase will be the mobilization of additional resources for the establishment this office.

Leadership

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Contributors

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Participating Organizations: ESA, UNEP-WCMC.
Others: International Water Management Institute (IWMI).

Linkages across the Work Programme

Flagships: GEO BON
Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development Initiative; GEO ECO; GEOGLOWS.
Community Activities: Aquawatch.

GLOBAL DROUGHT INFORMATION SYSTEM (GDIS)

Overview

The purpose of the Global Drought Information System (GDIS) is to assist in ensuring the sustainability of the global water supply and to carry out global monitoring of the variability of water as it relates to drought and water scarcity. While considerable effort has been expended at the national level on drought monitoring and mitigation, the scientific community united together to form GDIS, to address the lack of attention that was being given to drought at the global scale (or the regional/continental scale), including assessing how changing climate at the global level would affect drought.

From the outset, GDIS's primary goal has been building up regional drought monitoring (and prediction) activities within National Meteorological and Hydrological Services (NMHSs) of countries over each continent in a "bottom up" effort to provide a more accurate, spatially detailed continent-by-continent mapping (and documentation) of global drought.

The second goal of GDIS is a "top down" system providing near-real-time global drought monitoring. Such a system is built upon real-time global precipitation monitoring that meshes long-term, land-based Climate Data Records (CDRs) of precipitation measured at synoptic stations, with real-time, satellite-based global precipitation monitoring. Such a system can detect precipitation anomalies (and deficiencies in incoming water supply) by screening Standardized Precipitation Index. However, available surface water is not determined by precipitation alone, but by the difference between precipitation and evapotranspiration. Global evapotranspiration monitoring is another Essential Climate Variable which, unfortunately, is not at the same level of maturity as global precipitation monitoring. Nevertheless, roll-out testing of combined space-based, modeled, and sampled ET is being carried out for drought detection globally. A third, more mature global monitoring technique is provided through space-based global vegetation monitoring, since drought-induced water stress can be detected as changes in vegetation health.

The Agenda 2030's new Sustainable Development Goal (SDG) for water calls for global monitoring of water usage and water stress. These also provide a way to assess drought vulnerability and drought risk. The global combined land-based, space-based precipitation monitoring used for drought monitoring can also be used for the precipitation portion of the global water supply; the remaining portions are transnational surface water flows (which can be updated from Global Runoff Data Center) and transnational groundwater flows (in certain regions). These techniques provide combined land-based and remote sensing techniques that can supplement, verify, and complement the time-averaged, "stationary" survey-based water information collected by the UN Food and Agricultural Organization (FAO) Aquastat system (as part of UN Water's Sustainable Water Goal). Space-based technologies for domestic water consumption and agricultural water use will also be investigated for adoption to complement the survey approach.

The fourth goal of the Global Drought Information System (GDIS) is to rapidly identify "hot spots" of food vulnerability and insecurity (arising out of drought-induced interruptions of water supply. For rain-fed farming areas, such as sub-Saharan Africa, "nowcasting" (monitoring of real-time conditions) is not as valuable as more reliable forecasting, which provides additional lead time. Consequently, the fourth key goal is assessing accuracy and reliability of European Centre for Medium Range Weather Forecasts (ECMWF) SEAS seasonal forecasts and North American Multi-model Ensemble forecasts (as well as those of other centers).

Activities for the period

Already existing network partners within GDIS include the North American Drought Monitor (NADM) ,the European Drought Observatory (EDO), and the Australian Bureau of Meteorology (BoM). A new continental partner drought network is being developed (as a GDIS activity) within Central and South America, also under the auspices of the World Meteorological Organization (WMO).

Global and regional pilots to be pursued, along with addition of new content to the existing data portal:

1. Development of a Regional Drought Association for South America (and Central America);
2. Development in conjunction with WMO of the "One Stop Shop" drought information service through the GDIS portal;
3. Continue development in the adaptation of the global precipitation monitoring system (for GDIS global drought monitoring) to recover global water availability maps for global water stress monitoring. Investigate space-based technologies for global water usage monitoring. Work with UN Water and FAO Aquastat's (and possibly GCOS) development of global water stress monitoring;
4. Assess global drought prediction system based upon ECMWF SEAS (seasonal forecasts) and North American Multimodel Ensemble forecasts;
5. Assess feasibility for establishing regional drought associations in South Asia with WMO and Middle East-North Africa (MENA).

User engagement

The 2nd GDIS workshop convened a South American panel, in which the Regional Climate Centers gathered together for the first time, discussing steps to form a South American regional drought association. A follow up meeting will be held in Argentina next year (2017) to formalize arrangements and prepare higher resolution South American drought maps to add to the global drought map (co-listed with AmeriGEOSS).

Future plans

The Paris agreement of 2015, concluded at the end of the 21st Session of the Conference of Parties to the UN Framework Convention on Climate Change (UNFCCC), calls for: "strengthening systematic observation of the climate system and early warning systems in a manner that supports decision making." The WMO has interpreted this clause as requiring more extensive development of the Global Climate Observing System (GCOS), including expansion of the Anthropogenic Water Usage Essential Climate Variable (ECV) into a global water stress monitoring system. GDIS will participate in development and rollout of both the Water SDG and the GCOS Water Use ECVs.

Resources

- In-kind contributions from Argentina Servicio Meteorologico Nacional (SMN), CIIFEN, CPTEC, ECMWF, NIDIS (GDIS Portal), NOAA, JRC, WMO;
- The 1st GDIS workshop was supported jointly by the World Climate Research Program (WCRP), CLIVAR, and NIDIS. The 2nd GDIS workshop was supported largely by WMO and NIDIS, with a contribution from CLIVAR.

Leadership

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Contributors

Members: Argentina, Australia, Brazil, China, EC, Pakistan, Russian Federation, USA.
Participating Organizations: ECMWF, FAO, WCRP, WMO.
Others: Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN), Intergovernmental Authority on Development (IGAD), World Food Program (WFP).

Linkages across the Work Programme

*Flagships***:** GEO BON; GEOGLAM.
*Initiatives***:** AfriGEOSS; AmeriGEOSS; AOGEOSS; GEOGLOWS; GWIS; EO for the Water-Energy-Food Nexus.

GLOBAL OBSERVATION SYSTEM FOR PERSISTENT ORGANIC POLLUTANTS (GOS4POPS)

Overview

The Global Observation System for Persistent Organic Pollutants (GOS^{4}POPs) Initiative originates from the former GEO 2012-2015 Work Plan Task HE-02 "Tracking Pollutants", established as a part of a coordinated global observation network for mercury and POPs. The Task 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)).

Thus GOS4POPs has strong foundation in the outcomes of the previous GEO Task HE-02 C2 and aims to further develop and provide new services for stakeholder engagement, and alignment with the GEO priorities and objectives. In particular, the need for an Initiative on persistent organic pollutants is timely as the updating of the Stockholm Convention to list additional POPs has created a need for the scientific community to foster the sharing of monitoring data and modelling tools so that they are available to support implementation of the Convention. Long term and high precision observations and analysis of cycles of such pollutants in the different domains of the Earth system (atmosphere, ocean), considering also anthropogenic emissions, are furthermore required to better quantify sources and sinks; understand the impact on environment and human health and address their minimization/elimination.

Activities for the period

- Task 1: Establishment of a governance structure to facilitate the involvement of the ROGs, GCG, and institutions supporting the collection of POPs monitoring information to guide the work of this effort and report on the process and deliverables;
- Task 2: Analysis of current monitoring programmes, data infrastructures and archived information on POPs, with a special attention to newly listed POPs;
- Task 3: Increasing availability and quality of data by supporting further development of monitoring programmes, harmonization of applied sensors, standardization of the analytical procedures, join interpretation of available information and production of metadata following standards;
- Task 4: Upgrading the GMP DWH to include new POPs;
- Task 5: Design, development and implementation of core services supporting adopted procedures of the 3rd Global Monitoring Report (harmonized data collection);
- Task 6: Design, development and implementation of tools supporting data accessibility, presentation and interpretation;
- Task 7: Testing, updating of services/tools to allow for release of Third Monitoring Report in 2021;
- Task 8: Progress reporting and stakeholder engagement.

User engagement

Engagement with relevant user communities and other stakeholders is crucial for this Initiative, making sure its objectives are in tune with the real-world problems and its results provide adapted solutions. The GCG and ROGs responsible for the whole data collection process and communication with data owners and the GMP Expert Panel providing a scientific and policy guidance will be the crucial players. GOS4POPs will share the outcomes, lessons learned and conclusions from a series of roundtable meetings designed to identify stakeholder needs and promote collaboration between science and policy.

Future plans

This Initiative is expected to continue to contribute in different steps of the policy implementation and evaluation process of the Stockholm and LRTAP Conventions, pending the requests of Parties to the Convention. Main potential contributions are:

- Provide up-to-date information on POPs concentrations and trends in the atmosphere, aquatic ecosystems and in humans for science and policy use;
- Support regions in developing and/or improving capacities for POPs monitoring and assessment;
- Facilitate capacity building and transfer of knowledge to developing countries;
- Facilitate cooperation with UNEP, GCG, ROGs, governments, monitoring programmes, NGOs and other stakeholders to provide scientific and technical information useful in effectiveness evaluation of measures adopted to achieve the goals set by the Stockholm Convention.

Resources

Secured and expected resources (cash and in-kind)

- Resources for implementing GOS4POPs derive from The European network for observing our changing planet (ERA-PLANET) project recently launched and aimed to strengthen the European Research Area in the domain of Earth Observation in coherence with the European participation to Group on Earth Observation (GEO) and the Copernicus. ERA-PLANET will support GOS4POPs implementation through in-kind and cash resources. Around 9 M€ (33% of EU top-up fund and 66% of in-kind) are expected to be mobilized within the project on Global change and Environmental treaties (ERA/PLANET network) which will be partially used in support of GOS4POPs activities;
- Other contributions stem from GEF medium sized projects on building capacity for implementation of the Global Monitoring Plan on POPs in the UN regions of Africa, Asia, Latin America and Pacific Islands. UNEP projects funded by US, Japan, China as well as other nationally funded projects provide resources necessary to operate the contributing POPs monitoring programmes (i.e. Canada, Czech Republic, Japan, Norway). All expected global resources for implementation of GI-XX are near 15 M€. Furthermore, in-kind resources also represent staff time of the BRS secretariat, members of GMP Regional Organization Groups and Global Coordination Group.

Sources of data and services.

Existing data infrastructure on POPs (GPM DWH: www.pops-gmp.org) will be the base on which new services will be developed.

Annual budget allocation

Considering expected resources, appx. 1 M€ can be considered as annual budget allocation until 2021.

Leadership

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Contributors

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Participating Organizations: UNEP, WHO, World Bank (Global Environmental Facility - GEF).
Others: Arctic Monitoring and Assessment Programme (AMAP); European Monitoring and Evaluation Programme (EMEP); Global Atmospheric Passive Sampling (GAPS) Programme; Monitoring Network (MONET) Programme.

Linkages across the Work Programme

Flagships: GOS4M.
Initiatives: AirNow International.

GLOBAL URBAN OBSERVATION AND INFORMATION

Overview

The Global Urban Observation and Information Initiative has set the following goals for the period of 2017-2019: (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 essential urban variables and indicators for sustainable cities for the SDG 11.

While some activities are continuous in nature or are extensions of the GEO 2012-2015 Work Plan SB-04 activities ("Global Urban Observation and Information" Task), others are proposed anew. These activities of different organizations and countries are coalesced as one GEO initiative through collaborative and affiliated projects, annual symposia, international summer school, joint fieldworks, publications, and coordinated user engagement efforts. This Initiative will generate various data products of global urban areas using Earth Observation (EO) data, provide EO-based urban data services through various systems and tools, develop new models and algorithms to detect, assess, monitor, and model urban areas and environments, create new knowledge to fill the gaps in the integration of EO and other datasets for a better understanding of cities and develop essential urban variables and indicators for sustainable cities.

Activities for the period

- Megacities Observation and Monitoring (MOM) program: Expanded from the Global Urban Supersites Initiative under GEO SB-04. These projects all focus on global urbanization of megacities 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;
- Implementing Virtual Global Urban Remote Sensing Laboratory through joint projects: The main objective is to develop an online tool for acquiring, processing, visualizing, and sharing of urban data sets;
- 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;
- Establish a Global Institute of Sustainable Cities (GISC) - Explore EO as a enable technology for supporting GEO's objectives on urban and coastal resilience by providing EO methods and technologies, supply objective information on the footprint of global urbanization, and develop essential urban variables and indicators for sustainable cities for the SDG 11;
- Organize an Annual GEO Global Urban Observation Symposium;
- Create an annual International Summer School to train and educate students and young researchers worldwide, which may be held in conjunction with Joint Field Work in Selected Cities/Regions.

User engagement

- Users/stakeholders include the World Bank, UN Habitat, and local users;
- Potential data users include: Local/regional/country scales; Involved institutions (meaning users) in the cities; Local/regional/national environment and planning agencies; EU directorate general regional policy (DG REGIO); and Energy suppliers.

Future plans

- Collaboration with ISPRS, IEEE GRSS and Elsevier to showcase and disseminate research results;
- Seek synergies with other GEO Flagships/Initiatives.

Resources

Projects:

- US National Land Cover Database (NLCD) production supported by the USGS and other 9 federal agencies in Multi-Resolution Land Characteristics (MRLC) consortium (annual budget US$ 6 mil);
- German Remote Sensing Data Center (DFD) and German Aerospace Center (DLR) have annual budget to support global urban footprint production;
- EO4Urban, funded by ESA, annual budget €100 000 during 2016-2017;
- Sentinel4Urban, funded by the Swedish National Space Board, €108 000 (1Mkr)/year 2016-2019;
- "Improving the Estimation of Impervious Surfaces Using Optical and Polarimetric SAR Data in Humid Subtropical Urban Areas" supported by Hong Kong Research Grants Council, 1/1/2016-12/31/2017, 611,000HKD;
- TREASURE: Thermal Risk rEduction Actions and tools for SecURE cities, National Observatory of Athens is partner, Greece. http://treasure.eu-project-sites.com/, DG ECHO funded project;
- ARISTOTELIS-Urban: 'Continuous Monitoring of the Distribution of Urban Temperatures in 5 Greek Cities' in Excellence Research Programme GSRT (2015–2017) ARISTOTELIS "Environment, Space and Geodynamics/Seismology 2015-2017". NOA is the beneficiary;
- NASA Interdisciplinary Science Project, "Combining satellite data and models to assess the impacts of urbanization on the continental United States surface climate";
- 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 Province, China, in support of creation of Global Institute of Sustainable Cities;
- ASTER Global Urban Area Map (AGURAM) developed by National Institute of Advanced Industrial Science and Technology of Japan and University of Tokyo;
- ABCC (CEODE, CAS & JRC): National Science Foundation of China (NSFC) project of "Comparative Study on Global Environmental Change Using Remote Sensing Technology";
- Urban impervious surface data generation for selected Chinese cities, supported by National Natural Science Foundation of China (Grant No. 71503099), RMB￥212,400, and Guangzhou Municipality Science Technology and Innovation Commission, RMB￥1,000,000;
- Characterizing global urban areas and mapping global urbanization dynamics at 30 m resolution on a cloud computing platform by Chinese Academy of Sciences, 2016-2018.

In-kind (human resources):

- Center for Urban and Environmental Change, Indiana State University, USA.

Additional in-kind contributions from the USA (NASA, USGS), China (Wuhan University, Xiamen University), Italy (University of Pavia), IEEE Geoscience and Remote Sensing Society (GRSS), and International Society of Photogrammetry and Remote Sensing (ISPRS).

Leadership

- Qihao Weng (Indiana State University/USA), qweng@indstate.edu

Contributors

Members: Austria, Brazil, Canada, China, Germany, Greece, Italy, Japan, Pakistan, Spain, Sweden, USA.

Participating Organizations: IEEE.

Linkages across the Work Programme

Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEO VENER; GEO Human Planet Initiative.

GLOBAL WILDFIRE INFORMATION SYSTEM (GWIS)

Overview

Wildfires are a global hazard that causes enormous environmental damages and economic losses and which 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, regional and global levels. However, an international initiative to pull resources and information together does not exist.

GEO provides a unique platform for international cooperation. In the area of wildfires, the Global Wildfire Information System (GWIS) 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 Global Terrestrial Observing System (GTOS) Global Observation of Forest Cover- Global Observation of Land Dynamics (GOFC-GOLD) Fire Implementation Team (GOFC Fire IT), and the associated Regional Networks, complementing existing, related activities that are on-going around the world, with respect to wildfire information gathering. Since the European Commission (EC) Joint Research Centre (JRC) is already part of the GOFC Fire IT, the collaboration with on-going initiatives of the team is ensured. GWIS will thus be an asset built by and for the GWIS partners, including the GOFC Fire IT members, the EC and the regional partner networks.

At the regional level, GWIS builds on the EC 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.

Activities for the period

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 EC in the EFFIS and the GOFC-GOLD 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 Open Geospatial Consortium (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 IT regional networks and the EFFIS network.

User engagement

User engagement is already implemented through the networks of the European Forest Fire Information System and will be further expanded to the GOFC-GOLF Fire Networks. However, up until now, the above networks are a set of disconnected networks which do not have a common information hub where wildfire information, expertise, good practices could be shared. The establishment of GWIS will thus bring all networks to a higher level of networking, information sharing and collaboration that does not exist at the moment.

Future plans

Transition to the operational phase is foreseen in the context of the Copernicus Program and supported by the activities of the GOFC-GOLD Fire IT.

Resources

GWIS is supported by the EC JRC activities on forest fire monitoring in the context of the extension of the EFFIS to the global scale. The contribution of the JRC includes the development and maintenance of a prototype GWIS. The JRC EFFIS/GWIS team consists of 10 scientific staff with expertise on remote sensing, statistical and spatial analysis, information systems, web development and interoperability. This team will be supported by other JRC colleagues with specific expertise on data harmonization, data infrastructures and interoperability, who work on the implementation of the EU INSPIRE Directive.

The participants in the GWIS Initiative will provide in-kind contribution through their participation in the meetings and teleconferences. The contributors are the owners of national and regional systems, who will contribute to the design and development of GWIS and the calibration and validation of the GWIS modules. Contributors to GWIS will provide support for the editing of documents and reports during the life span of the Initiative.

The EC JRC, 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.

Leadership

- Jesus San-Miguel-Ayanz (JRC/EC) <jesus.san-miguel@jrc.ec.europa.eu>

Contributors

Members: Canada, China, EC, Japan, South Africa, USA.
Participating Organizations: ESA, GTOS.

Linkages across the Work Programme

Initiatives: GDIS; GEO-DARMA; GEO-GNOME.

OCEANS AND SOCIETY: BLUE PLANET

Overview

We live on a Blue Planet, and Earth's waters benefit many sectors of society. In 2015, through development of a United Nations Sustainable Development Goal explicitly targeted at the oceans (SDG 14), the global community has prioritised the need for concerted action to ensure sustainable growth and management of blue economies across the planet. Sustainable Development Goals 13 and 15 (climate action and life on land) further recognise that the future of our Blue Planet is increasingly reliant on the services delivered by marine, coastal and inland waters and on the advancement of effective, evidence-based decisions on sustainable development.

The overall goal of Blue Planet Initiative is to ensure the sustained development and use of ocean and coastal observations for the benefit of society. The objectives to achieve this goal are:

- Objective 1: Increase integration of and access to *in-situ* and remote sensing ocean observation data;
- Objective 2: Conceptualize, promote and facilitate development of end-to-end ocean information services;
- Objective 3: Improve connections between the producers and providers of ocean observation data, products and information and the end users.
- Objective 4: Increase societal support and build capacity for ocean observations.

As a GEO Initiative, Blue Planet will enable direct linkages between the ocean observing community and users within an agreed, yet flexible framework. This will benefit society by facilitating informed decisions and increasing public access to and support for sustained ocean observations and information. Specific outcomes include support from the ocean community for GEO's data management principles and the demonstration of prototype/pilot services that address GEO's societal benefit areas such as:

- Improved forecasts of local sea-level rise and associated increased risk of coastal inundation for better mitigation of flood-related disasters and management of sustainable urban development;
- Monitoring of marine debris for evaluating biodiversity and ecosystem sustainability, aquaculture and public health surveillance;
- Environmental monitoring of off shore and coastal industries for energy and mineral resources management as well as water resources management; and
- Monitoring of illegal, unreported and unregulated fisheries operations for evaluating biodiversity and ecosystem sustainability in addition to food security management.

Activities for the period

To achieve the above objectives, Blue Planet activities will be organized into four major components: 1) data integration and informatics, 2) information services, 3) user engagement and 4) capacity building and advocacy. These components align with the four objectives and will be composed of working groups tasked with identifying priorities, producing prototype/pilot projects and coordinating with related GEO activities. Component activities will be focused on the thematic areas of coastal communities, healthy ecosystems and food security, the blue economy and maritime awareness. Blue Planet components work together on activities within the four themes. These activities ultimately link to GEO's societal benefit areas (SBAs) and work to facilitate informed decision making and address policy mandates. Specific activities include:

- Implementation of the Communication and Engagement Strategy;
- Special Issue: Blue Planet will arrange for the production of a special issue of the Journal of Operational Oceanography on ocean observing for societal benefits;
- 3rd Symposium: Blue Planet will organize and host the 3rd Blue Planet Symposium – "The Role of the Oceans in Earth's Life-Support System" – in College Park, Maryland, U.S.

As a living document, the Implementation Plan will be regularly updated based on community feedback and identified user needs.

User engagement

Over the coming year, Blue Planet will focus on engagement with the ocean observing community, end-users and industry with the goal of expanding its network. This will be accomplished through the production and initial implementation of a communication and engagement strategy to: 1) raise awareness among ocean observation operators, users and the GEO community about the goal of Blue Planet and opportunities for engagement, involvement and collaboration; 2) increase collaborative efforts among Blue Planet shareholders and stakeholders; and 3) establish a platform to market support of ocean observations to governments and other potential end users of Blue Planet services.

Future plans

Where possible, the activities of the Oceans and Society: Blue Planet Initiative will also address international mandates such as the United Nations (UN) Sustainable Development Goal (SDG) 14 that is explicitly focused upon the conservation and sustainable use of the oceans. Accordingly, the global community has prioritised the need for concerted action to ensure sustainable growth and management of blue or ocean economies, currently valued at USD 1.5 trillion and projected to double by 2030. More broadly the activities of Blue Planet have policy-relevance to a raft of international instruments (conventions, frameworks) and programmes that encompass disaster management, adaptation to climate change, conservation and biodiversity, environmental protection, sustainable development and maritime safety. When appropriate, Blue Planet will also facilitate the development of prototype/pilot services into GEO Flagships.

Resources

Direct contributions

- For management and representation within GEO: Partnership for Observation of the Global Oceans (POGO) Secretariat (approx. 30% FTE);
- For coordination and communications:
    - Blue Planet Secretariat node hosted by the U.S. National Oceanic and Atmospheric Administration (NOAA) (Scientific Coordinator, 1 FTE);
    - Blue Planet Secretariat node hosted by Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) (data/informatics expert and communications/graphic design support).
- Infrastructure, IT, website, database infrastructure provided by CSIRO.

In-kind contributions

- Human resources: in-kind contributions from various international, national and regional ocean observation-related programmes, organisations and individuals.

Leadership

- Primary point of contact: Sophie Seeyave (POGO), ssve@pml.ac.uk
- Ad hoc Board consisting of representatives from CEOS, the CZCP, CSIRO, GODAE OceanView, GOOS, NOAA and POGO.

Contributors

Members: Australia, EC, Japan, South Africa, UK, USA.
Participating Organizations: CEOS, GOOS, IEEE, POGO, WMO.

Linkages across the Work Programme

Flagships: GEO BON (MBON); GEOGLAM.
Initiatives: AfriGEOSS; AmeriGEOSS; AOGEOSS; Earth Observations in Service of the 2030 Agenda for Sustainable Development; EO4EA; GEO ECO; GEOGLOWS; GEO Wetlands Initiative; Global Urban Observation And Information.

Community Activities: AquaWatch; Harmful Algal Bloom (Hab) Early Warning System; Global Flood Risk Monitoring; Global Mangrove Monitoring.

GEO FLAGSHIPS

General

GEO Flagships differ from GEO Initiatives in that they respond to a referenced policy mandate, have matured to deliver a pre- or near-operational service, and serve user groups that are actively steering the Flagship. They are accepted by Plenary based on a GEO Programme Board recommendation.

GEO Flagships allow GEO Members and Participating Organizations to spin-up operational services serving common needs. They may operate for as long as they are able to generate sufficient impact to attract support for their activities. Once the services reach a mature, operational stage, they may be taken up by user institutions (e.g. GEO Participating Organizations), for their continued operation over the long term. GEO Flagships have a clear policy mandate in a convention, treaty or programme. Contributions are typically made in-kind, including observation systems operated to serve the Initiative's objectives, models, funded research projects or programmes, but may also include direct financial contributions or those that are earmarked within the Trust Fund as being in support of a particular GEO Flagship.

GEO Flagships have both a clearly identified objective and an implementation plan that describes how that objective is to be achieved. Corresponding contributions by GEO Members, Participating Organizations, and private sector players are identified at the outset. While these contributions must be sufficient to implement the initial objective of a GEO Flagship, additional contributions and partners may be added during implementation. The relevant user communities are fully engaged and assume a leading role in the implementation.

GEO Flagships may develop a service or services through to maturity, whereupon the service(s) may be taken up by a Participating Organization, or to be transferred into a new organization. The Implementation Plan outlines expectations with respect to the final phase of the Flagship.

Establishing GEO Flagships

GEO Flagships evolve from GEO Initiatives. When a GEO Initiative has matured in terms of service provision, stakeholder engagement, and is aligned with the priorities of GEO, the GEO Programme Board may recommend that Plenary accept an Initiative as a GEO Flagship. This recommendation and the corresponding Plenary decision are based on the implementation plan, which must clearly set out how the criteria for GEO Flagships are met. These include the pre-operational delivery of the necessary information, through products or services, to meet the needs of identified users. These users must be identified and involved in appropriate functions in the Flagship. The responsibility for further developing the Flagship implementation plan remains with the proposing team.

The GEO Programme Board may identify gaps in critical information to support the adequacy of the proposal vis-a-vis the criteria for Flagships. Where SBA Working Groups or Communities of Practice (CoP) can contribute to the development of the implementation plan, they should be engaged at an early stage, with their role described in the implementation plan. The GEO Programme Board works to establish consensus regarding the proposed objectives and the implementation plan and achieve a sufficient level of contributions for its successful implementation. All contributions – in-kind or otherwise – are listed, described, and valued in the implementation plan. Contributions may include specific commitments from GEO Members, Participating Organizations, private sector partners, or other third parties. If and when this can be achieved, the GEO Programme Board formally recommends the new Flagship to Plenary.

By accepting a new GEO Flagship, GEO supports the Flagship's objectives and commits and/or acknowledges the resources specified in the Implementation Plan.

Criteria for establishing GEO Flagships

GEO Flagships must meet all criteria used for GEO Initiatives (see 2.2). In addition:

- 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; and
- Implementation Plan (see 2.2), including also perspective(s) for operationalization.

Contributors

Primary contributors to GEO Flagships are typically Participating Organizations, GEO Members (through their corresponding institutions), and interested partners from the private sector. The specific contributions and the roles of the different contributors may vary between different Flagships and are described in the implementation plan.

Management and coordination

GEO Flagships are generally managed as projects; the detailed arrangements may vary among different GEO Flagships and are defined in the implementation plan. GEO Flagships should have effective dedicated steering boards that are oversee the Flagship implementation. Members of the Steering Board should involve user representatives and representatives of those partners providing significant resources to the implementation.

GEO Flagships may define steering and advisory mechanisms according to their specific needs, though lessons may be learned from other GEO Initiatives or Flagships.

Typically, a project coordinator will be appointed at the GEO Secretariat. The project coordinator is responsible for coordinating the implementation of the agreed Implementation Plan and reporting to GEO on progress and issues. A sufficiently resourced project coordinator is an important criterion for accepting a new GEO Flagship.

Reporting to GEO

The project coordinator is responsible for all reporting to GEO. This includes in particular

- Progress reports in contribution to the annual GEO Progress Report. These will be reviewed by the GEO Programme Board;
- Presentations to Plenary; and
- Presentations to the Executive Committee or the GEO Programme Board, as requested.

GEO Flagships will generally establish Steering or Advisory Groups. These mechanisms are defined in the Implementation Plan. Also, as many of the contributions will be made in-kind, further reporting will generally be required by individual contributors within their respective contexts.

Monitoring and Evaluation

The required monitoring and evaluation activities are defined in the Implementation Plan. At a general level, the GEO Programme Board will monitor progress on the basis of the reports from the project coordinator and may recommend changes to the implementation, as needed.

The GEO Work Programme includes a summary description of each of the Flagships as reviewed and approved by the GEO Programme Board, along with a summary of the committed resources, while more detailed description as provided by individual implementation plans are included the "Work Programme Reference Document".

GEO BIODIVERSITY OBSERVATION NETWORK (GEO BON)

Overview

The Group on Earth Observations Biodiversity Observation Network (GEO BON) is an initiative aimed at improving the availability of biodiversity change data to decision makers and scientists in support of policy. GEO BON initiates and coordinates efforts to design and implement interoperable national and regional biodiversity monitoring programs. Through its global network of organizations and experts, GEO BON supports the sharing and dissemination of information and technology for biodiversity observations.. GEO BON also supports the application of the most recent scientific knowledge to advance biodiversity observations collection, integration and interpretation.

GEO BON is focused on developing a network of observation systems that delivers enhanced and harmonised biodiversity information to facilitate better decision making from local to global scales. The GEO BON observation network is developed through the adoption and implementation of the Essential Biodiversity Variables (EBVs) and related monitoring guidelines, through targeted capacity building efforts at the national and regional level, including the development of the "BON in a Box" toolkit, and the engagement of National, Regional and Thematic Biodiversity Observation Networks (BONs). GEO BON has developed a global social network and community of practice for biodiversity observations. This open network includes world-renowned leaders in biodiversity observations as well as major partner organisations working in biodiversity monitoring.

GEO BON has made remarkable progress since its inception in 2008 and has developed into an internationally recognised organization. It has now over 450 partners and members and is recognised by the Convention on Biological Diversity (CBD) and by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) as a key organization for developing biodiversity monitoring globally.

Activities for the period

- GEO BON Secretariat Operations. The GEO BON Secretariat, located at iDiv in Leipzig, Germany, provides the core organizational structure of GEO BON. It plans and schedules meetings and thematic workshops, maintains the GEO BON website and other communications, and in general provides the basic infrastructure that facilitates GEO BON development and operations. In particular, the Secretariat plays an important role in linking the development of Essential Biodiversity Variables by the working groups to the various Biodiversity Observation Networks;
- GEO BON Website Enhancements. The new GEO BON website went live in 2015 and many additions are planned for 2017 with the broader implementation of BON in a Box and a prototype data portal for Essential Biodiversity Variables. The long-term goal for the GEO BON website is to become the main portal to access information on biodiversity observation networks, datasets and analyses globally;
- Enhanced Communication Materials. In addition to existing materials such as a quarterly newsletter and GEO BON flyers, a variety of new materials are planned, such as a new GEO BON video. Most of these communication materials are developed together with the global GEO BON network, especially with the GEO BON working groups;
- Task 1. Development of the "Essential Biodiversity Variables" (EBVs). Geographical scope: Global. Essential Biodiversity Variables (EBVs) are the key measurements needed to understand biodiversity change. For EBVs that have reached implementation phase by 2017, we will engage the developers towards producing biodiversity change indicators that could feed into initiatives such as the Biodiversity Indicators Partnership. GEO BON is developing an online EBV dashboard as a capacity building activity to allow a wide and coordinated user engagement in EBV development. A first version should be online in 2017;
- Task 2. Development of "BON in a Box". Geographical scope: Global scope developed with national and regional partners. BON in a Box is a capacity building and technology transfer mechanism, functioning as an online, continually updated toolkit that lowers the threshold for

a country or region to develop or enhance a biodiversity observation system. Once fully operational, BON in a Box will allow users to access the latest biodiversity observation design tools, monitoring protocols, data standards and management systems and analysis and reporting tools to facilitate more integrated and interoperable biodiversity observations. A functional version will be ready in November 2016 and updates will be continually added starting in 2017. In 2016, GEO BON will start working with three sub-Saharan countries (Ghana, Uganda and Mozambique) as part of a larger WCMC led project funded by GEF to further develop BON in a Box, to ensure it directly supports African countries' biodiversity observation and information needs;

- Task 3. Facilitating development of national, regional and thematic Biodiversity Observation Networks (BONs). Geographical scope: Global scope with thematic partners, national or regional. Networks are: The Asia Pacific BON (AP BON); The Circumpolar Biodiversity Monitoring Program (CBMP or Arctic BON); The GEO BON Marine Biodiversity Observation Network (MBON); the French BON (Ecoscope), the Sino-Bon (China), and the GEO BON Global System of Ecosystem Observatories (GSEO). Some of these BONs are in their early stage of development, operating mostly social networks, and thus further operationalization for biodiversity data generation is required. The GEO BON Data Portal will provide access to the biodiversity data generated from these networks as they develop.

Policy mandate

GEO BON's policy drivers come from a variety of sources, including:

- National Governments. National governments are GEO BON's key users . Governments need scientifically sound biodiversity data, information and knowledge to meet their national mandates (e.g. national biodiversity plans, recovering species at risk, sustaining ecosystem services) and fulfill their international obligations (e.g. the Convention on Biological Diversity, the Ramsar Convention on Wetlands, the Convention on Migratory Species, etc.). GEO BON actively engages with governments to help develop national biodiversity monitoring schemes. France, Japan, Bolivia, South Korea, China, Colombia, Nepal and Madagascar have set up official connections with GEO BON as national BONs or are developing the framework for such a cooperation. GEO BON is intensifying this activity in the period 2017-2019, to be able to support more national governments in their biodiversity observation activities;
- Convention for Biological Diversity (CBD). GEO BON has been repeatedly endorsed as a key partner for collaboration by the CBD since the 9th session of the Conference of the Parties held in May 2008 in Bonn, Germany. Also, GEO BON's role in promoting coherent biodiversity observations with regards to data architecture, scales and standards, and observation network planning, is highlighted repeatedly by the CBD protocols and programs. In addition, the Environmental Affairs Officer of the CBD is an active member of the GEO BON Advisory Board guaranteeing a strong institutional connection. In decision XI/3 (paragraph 13), the CBD COP invited GEO BON to continue its work on the identification of Essential Biodiversity Variables and the development of associated data sets (UNEP/CBD/SBSTTA/15/INF/8). In decision XII/1, the CBD COP invited parties, indigenous and local communities and other relevant stakeholders to collaborate with GEO BON and other relevant organizations that contribute to building observing systems and to biodiversity monitoring, to address the priority needs identified by Parties related to biodiversity observations and monitoring. Furthermore, GEO BON regularly represents GEO as an accredited observer at CBD plenaries;
- Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES). GEO BON is recognised by IPBES as a key partner organisation. Many GEO BON members are or have been participating in the IPBES assessments at different capacities. Also, IPBES user needs are triggering the research agenda of many GEO BON partners, as IPBES needs knowledge, scientific data and information for its work. GEO BON is especially engaged in

the "IPBES Task Force on Knowledge and Data". GEO BON is mentioned as one of three key partners to provide observation data and knowledge for the IPBES Global Assessment. This assessment will be delivered in 2019 and GEO BON will focus its activities to serve this user demand. The Executive Secretary of IPBES is an active member of the GEO BON Advisory Board. Furthermore, GEO BON regularly represents GEO as an accredited observer at IPBES plenaries;

- Ramsar Convention. GEO BON is an observer organisation to the Scientific and Technical Review Panel (STRP) of the Ramsar Convention. The GEO BON Freshwater Observation Network and the EU project SWOS contribute to the development of the Global Wetlands Observing System (GWOS), a key request from Ramsar. The GEO BON Freshwater Observation Network already closely cooperates with SWOS and will be happy to closely cooperate with the future GEO Wetland Initiative in this field.

User engagement

All GEO BON activities and products are user oriented and each new activity proposed in the network needs to provide a clear user assessment of planned products and deliverables. GEO BON considers three large groups of users to target GEO BON activities: national governments, international multilateral agreements and scientists.

GEO BON's mission is to improve the acquisition, coordination and delivery of biodiversity observations and related services to users. The needs of GEO BON's user community are hence key in GEO BON's implementation plan and strategic decisions. Major users of GEO BON's product, as CBD, IPBES, Ramsar and national governments, are those mentioned in the section about GEO BON's Policy mandate above.

Services

- Development of and coordinating of national, regional and thematic Biodiversity Observation Networks (BONs);
- Delivery of Essential Biodiversity Variables (EBVs);
- Delivery of BON in a Box for harmonizing local, national, regional and global biodiversity observation methods, and capacity building.

Future plans

Transition plan to operational phase

Currently, GEO BON has a number of key operational components in development. These include the EBVs as a framework and structure for interoperable and scaled biodiversity observations from the local to global scales; template structures and processes for establishing interoperable biodiversity observation networks; global frameworks for key infrastructure for biodiversity observations (Remote Sensing for EBVs, Global System of Ecological Observatories, Global Wetland Observing System); BON in a Box toolkit for harmonizing local, national, regional and global biodiversity observation methods; and a developing biodiversity data portal for assembling data generated by the various formed and forming BONs and organized by classes of Essential Biodiversity Variables. In addition to this, GEO BON is developing, with partners, a series of global biodiversity change indicators which are modelled outputs of combined EBV datasets which, in most cases, can be scaled from 1km resolution to global, thereby facilitating and informing local to global policy and conservation management decisions.

Considering these purposeful developments, most of which were initiated in Phase 2 (2014 to 2016), GEO BON's Phase 3 Implementation Plan (2017 to 2019) focuses on completing and expanding upon these key components towards the development of an operational system. For GEO BON, an operational system is one that is built of a number of independent but interoperable parts (e.g. biodiversity observing networks) operating at various scales (local, sub-national, national, regional and

global) producing regular biodiversity observation change data that is directly fed into existing and new data structures (e.g. GBIF, GEO BON Data Portal, GCI).

GEO BON believes that its plan above for 2017-2019 puts together the key elements for building an operational system. While it will be by no means complete by 2019, the key elements will be in place (e.g. national and regional BONs, global observing systems, data portal, BON in a Box and modelled outputs). This operational frame will be continually improved and added to. This is achievable as GEO BON is purposely developing replicable structures that can be scaled and repeated. We thus expect an acceleration in the development of national and regional BONs as we make the act of designing and implementing a simpler BON through the application of BON templates and structures and BON in a Box.

Resources

The GEO BON Secretariat is hosted by the German Centre for Integrative Biodiversity Research Halle-Jena-Leipzig (iDiv) in Leipzig, Germany, which supports the GEO BON Secretariat with an annual budget of 150k€ for personnel costs and 50k€ running budget in 2017-2019.

Calculating in-kind contribution as well as projects dedicated to GEO BON by the many GEO BON partners is a challenge, as many partners do not specifically calculate their time spent for GEO BON activities. Therefore, only an estimate of the major activities carried out by the network partners as a contribution to GEO BON is possible. Altogether, more than 16M€ (including estimated in-kind contributions) will be invested in GEO BON activities annually in 2017-2019.

Leadership

- Chair: Henrique M Pereira (iDiv/Germany), hpereira@idiv.de
- Vice-Chair: Mike Gill (Polar Knowledge Canada), mike.gill@polar.gc.ca
- Executive Secretary: Laetitia Navarro (iDiv/Germany), laetitia.navarro@idiv.de

Contributors

Members: Colombia, Germany, USA.
Participating Organizations: GBIF, IOC-UNESCO.
Others: ASEAN Centre for Biodiversity (ACB), Map of Life (MOL), Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL).

Linkages across the Work Programme

Initiatives: AfriGEOSS; AmeriGEOSS; AOGEOSS; Earth Observations in Service of the 2030 Agenda For Sustainable Development**.** GEO Wetlands Initiative, GEO ECO.

GEO GLOBAL AGRICULTURAL MONITORING (GEOGLAM)

Overview

GEOGLAM, the GEO Global Agricultural Monitoring initiative, was initially launched by the Group of Twenty (G20) Agriculture Ministers in June 2011, in Paris. The initiative forms part of the G20 Action Plan on Food Price Volatility, which also includes the Agricultural Market Information System (AMIS, http://www.amis-outlook.org), another inter-institutional initiative with a Secretariat hosted by the UN Food and Agriculture Organization (FAO).

The G20 Ministerial Declaration states that GEOGLAM "will strengthen global agricultural monitoring by improving the use of remote sensing tools for crop production projections and weather forecasting".

The main objective of GEOGLAM is to reinforce the international community's capacity to produce and disseminate relevant, timely and accurate projections of agricultural production at national, regional and global scales by using Earth Observation data. This will be achieved by:

- establishing a sustained international network of agricultural monitoring and research organisations and practitioners;
- harmonizing the operational global agricultural monitoring systems based on both satellite and *in-situ* observations, including through improved coordination of satellite observations.
- enhancing national agricultural reporting systems,

Activities for the period

- Monthly delivery of the operational Crop Monitor for the Agricultural Market Information System (AMIS) since September 2013 – monthly coordination of evidence-based consensus building amongst newly and well-established global, regional, and national monitoring systems;
- Successful development and deployment of the operational Crop Monitor for Early Warning, with first monthly publication on 5th February 2016, result of collaboration amongst multiple well-established groups monitoring countries at risk;
- Growth of a regional Asia-RiCE initiative geared toward strengthening methods and developing national capacity for rice crop monitoring, under Japanese leadership supported by France/ESA in cooperation with ASEAN framework;
- Initiation and development of a Rangeland and Pasture Productivity (RAPP) activity aiming to establish a system to monitor the condition of global grazing lands and their ability to sustain animal protein production (RAPP Map: map.geo-rapp.org), while building on a Community of Practice (~ 10 pilot countries) under Australian leadership;
- Prototyping of a crop information system in Tanzania (in partnership with the MAFC National Food Security Office - NFSO) and in Uganda, funded by the Gates Foundation;
- Start of national crop monitoring demonstrations based on Sentinel-2 and Landsat-8 in producer and food secure countries in Ukraine, Mali and South Africa, funded by ESA;
- Development of EO-based products aiming at individual farmers in developing countries by projects of the G4AW programme (Geodata for Agriculture and Water), led by Netherlands space office;
- Monitoring of rice crop using satellite remote sensing (Sentinel 1, Sentinel 2 and SPOT Pleiades imagery) and GIS technologies in Northern and Eastern Afghanistan (FAO-DDNS). Rice crop area estimation /area frame and rice crop mask is being developed for selected provinces;
- Curricula and E-learning courses related to geospatial information and technology for agriculture monitoring and statistics, and environment impact assessment are being developed from FAO-DDNS, Bologna University and Twente University (under Pakistan Agriculture Monitoring and SIGMA Project);

- As partner of the Sentinel-2 for Agriculture project, the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) is testing the use of Sentinel-2 satellite images to estimate wheat area and yield for the 2016 crop season;
- FAO-DDNS is testing Sentinel 1 and Sentinel 2 data with aim to develop sustainable methods and tools for crop area and yield estimation in Iran.

Policy mandate

GEOGLAM has a clear political mandate as it has been launched by the G20 in 2011, together with the Agricultural Market Information System (AMIS). And GEOGLAM has been recently re-endorsed[3], in June 2016, during the meeting of the G20Ministries of Agriculture, in Xi'an (China).

And a proof that the Crop Monitor for AMIS is delivering what was expected can be found in the decision taken by the AMIS Secretariat in May 2016 to invite GEOGLAM to become its eleventh member, together with institutions such as FAO, World Bank, or OECD.

User engagement

User communities are already benefitting from GEOGLAM activities:

- The national and regional agricultural statistical systems community in developed countries with EO-based monitoring systems fully integrated in existing agricultural statistical systems, and where developments linked to new satellite data or new processing methods are regularly implemented; in developed countries not fully taking benefits of EO-based monitoring systems; and in developing countries, where EO-based monitoring systems could play a significant role in improving existing agricultural statistics and crop production assessments using outlook, which have been assessed as having strongly declined in the two or three last decades (cf. FAO-led Global Strategy for Agricultural and Rural Statistics);
- The Research and Development community, sharing science and benefitting from new EO data and methods, such as those currently being developed for the recently launched Sentinel satellites to develop best practices adapted to specific agro-ecosystems (e.g. in the Sahel, with small fields with irregular limits, mixed crops, presence of trees…), rice crop outlook using Agro-meteorological information derived from EO data such as GCOM-W, GPM, Himawari, MODIS (e.g. in ASEAN, monthly rice crop outlook), or rangeland condition through the Vegetation Fractional Cover product derived from the Landsat and MODIS sensors;
- The Capacity Development community, working with the research community, to transfer knowledge to operational capacities, in particular in developing countries;
- The Aid agencies, which need information on growing conditions in food insecure countries to decide when and where to intervene (cf. rice crop production information collection using ALOS-2 and other satellite data by Asia Development Bank regional capacity development technical assistance project);
- The private sector, from farmers to commodity traders, for which information on existing growing conditions are useful to manage their stocks, and buy and sell at best prices. The livestock sector is one of the key RAPP end-users when they can get information on rangeland and pasture condition which can be used to better manage grazing;
- The insurance companies, that offer products aiming at covering the risks of food crop or cattle losses in particular due to climate extremes, and which have already used or could use EO information to assess the level of damages and provide weather index insurance.

Services

- Monthly delivery of the Crop Monitor for AMIS (since September 2013);
- Monthly delivery of the Crop Monitor for Early Warning (since February 2016);

[3] http://www.g20chn.com/xwzxEnglish/sum_ann/201607/t20160707_3023.html

- Development of the Asia-RiCE programme, for rice monitoring in Asia (data set requirements, SAR/Optical rice crop production information and monthly delivery of rice crop outlook);
- Development of JECAM activities (Minimum data set requirements, Cross-site SAR experiment);
- Development of the Rangeland and Pasture Productivity (RAPP) initiative (including the RAPP Map http://map.geo-rapp.org/, the Vegetation Cover Anomaly monthly distributed on www.geo-rapp.org, and discussions around EO data requirements and modelling activities);
- Development and on-line publishing of the new GEOGLAM website (www.geoglam.org).

Future plans

- Find new resources for the GEOGLAM Secretariat (full- or part-time secondments, funding of coordination activities…);
- Expand participation to the Crop Monitor for Early Warning, and for RAPP;
- Continue the development of the Asia–RiCE programme (cf. GEO-Rice, funded by ESA);
- Continue the development of the RAPP initiative;
- Increase the Capacity Development community on agriculture monitoring based on EO technology (Curricula, E-learning, regional/sub-regional workshops and Seminars).

Resources

The direct funding of the GEOGLAM Secretariat was assessed as US $450.000 per year and the mean yearly indirect funding (i.e. the sum of the various national funding implemented by national programs and contributing to GEOGLAM) as US $6.000.000 (2015 basis). The in-kind contributions by the Community of Practice (on their own funding) were estimated to be circa $2.000.000. These latter two categories' figures are not easily estimated and are probably under-estimated (to avoid double counting).

Project secretariat and supporting organization

The GEOGLAM Secretariat is presently composed of three persons:

- Michel Deshayes (GEOGLAM Coordinator/France), mdeshayes@geosec.org
- Inbal Becker-Reshef (NASA/University of Maryland/USA), ireshef@umd.edu
- Alyssa Whitcraft (NASA/University of Maryland/USA), alyssakw@umd.edu

The GEOGLAM Secretariat works closely with the GEOGLAM Implementation Team (IT), composed of the co-leads of each of the main GEOGLAM components, and also coordinates EO data requirements with CEOS. The GEOGLAM IT holds regular teleconferences (about once a month) and meets at least once a year, generally during a side-meeting of another meeting to which many GEOGLAM partners already participate (an international conference such as IGARSS or an international research project meeting with many European and non-European partners; cf. JECAM-SIGMA-Sen2-Agri joint meetings in Kiev, October 2016). Regional and national meetings / conference related to GEOGLAM are also held by IT members (such as Asia Rice crop team meetings, RAPP workshops, etc.)

Contributors

GEOGLAM now has more than 300 members and keeps growing. Among its members are UN agencies, recognized programmes (international, national or regional), academic departments, research centres, institutions that have R&D and operational mandates in agriculture, space agencies, regional organizations and members of the private sector. The list includes:

*Members**:*** Argentina, Australia, Austria, Belgium, Brazil, Canada, China, EC, France, Italy, India, Japan, South Africa, USA.
Participating Organizations: FAO, RCMRD, WMO.
Others: Asia-RiCE team (Chinese Taipei, India, Indonesia, Japan, Malaysia, Lao PDR, Thailand, Vietnam) and AFSIS (ASEAN+3 Food Security Information project); AGRHYMET; Global Information and Early Warning System (GIEWS); International Research Centres such as IRRI (Rice), ILRI (Livestock), ICRISAT (Semi-arid tropics), CIMMYT (Maize, Wheat), IFPRI (Policy Research) all belonging to the Consortium of International Agricultural Research Centers (CGIAR) network; Permanent Interstate Committee for Drought Control in the Sahel (CILSS); Southern African Development Community (SADC); World Food Programme (WFP).

Linkages across the Work Programme

Initiatives: AfriGEOSS; AmeriGEOSS; Earth Observations in Service of the 2030 Agenda For Sustainable Development; GEOGLOWS**.**

GLOBAL FOREST OBSERVATION INITIATIVE (GFOI)

Overview

Based on the achievements of the GEO Forest Carbon Tracking (FCT) Task through 2008 to 2010 and the Global Forest Observations Initiative (GFOI) through 2011 to 2016, the GFOI seeks to further foster forest monitoring and assessment that is robust, reliable, and achievable at reasonable cost and supports planning for national development priorities including, climate change mitigation and adaptation.

The GFOI aims to:

1. Foster the sustained availability of observations for national forest monitoring systems;
2. 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 ongoing research and development;
3. Work 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).

The fundamental objective of GFOI is assist REDD+ (Reducing Emissions from Deforestation and forest Degradation, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks) developing countries to develop sovereign technical, human and institutional capacity to monitor their own forests and account for their own GHG emissions. The intention is that countries will then use this capacity to generate their own robust information to inform more reliable decision making and policy development on the appropriate management of their forests
and potentially provide confidence for REDD+ activities. The work of GFOI is undertaken by five components: Methods & Guidance, Space Data Acquisition, Capacity Building, Research and Development (R&D) Coordination, and Administration and Coordination (GFOI Office).

Activities for the period

The activities will be more focusing on country engagement, including the uptake and continued use of GFOI products and mechanisms to support in countries' forest monitoring activities. Publication of MGD2.0 and the launch of the MGD web portal. Improved coordination between GFOI components, including an 'end-to-end' demonstration of the full GFOI cycle which would involve all components working in synchrony in an initial country or countries, to test and prove the value of the GFOI model.
GFOI fosters the sustained availability of observations for national forest monitoring systems and provides broad support to governments that are establishing these systems.
Activities include:

Space Data
The SDCG for GFOI has produced a Three-Year Work Plan for 2015 – 2017, which was 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 purpose of the GFOI Space Data coordination efforts for the period 2016 and beyond will be:

- Continued coordination of core data streams and addition of new core data streams and products;
- Continued development of data services tools for data acquisition planning, data storage, and data processing to support country needs;
- Expansion of R&D data supply and improved coordination of efforts; and,

- Engagement of priority countries in the implementation of the above via all channels available, and in particular in coordination with the GFOI Lead Team (i.e. FAO) and the other GFOI components (i.e. R&D, MGD);
- Contributing to the GFOI end-to-end demonstration with the other component in targeted countries.

Methods and Guidance Documentation (MGD)

The Methods and Guidance documents have proven to be a very useful GFOI product. To improve the accessibility and utility of the document, the development of an MGD version 2.0 and a web application is operation. The second version of the MGD will be more user-friendly, with step-by-step instructions and less technical language, and will also include more linkages to training and decision support tools. An MGD web application aims to turn the MGD into a tool, providing more country-focused, customised support. Further integrating MGD 2.0 and the web application in to capacity building efforts will be pursued in 2016 and beyond. The MGD will develop additional modules to be included in the web application to cover new topics as they emerge. This work will be done in partner with the R&D Coordination Component, including identifying when R&D topics become operational and how countries can adopt these for use in their systems and methods.

R&D

After a brief hiatus, the GFOI R&D Coordination Component has recently been fully reinstated after receiving funding from ESA. In transitioning the R&D Plan in to action, the following key activities are foreseen in 2016 (and beyond):

- R&D Coordination component management;
- Initialisation and coordination of R&D activities in parallel with SDCG Element-3 strategy implementation;
- Manage participating (external) research teams and coordinate reporting and communication of results to space agencies and other GFOI components;
- Coordinate an Expert Workshops Expert Workshop on forest degradation with CONABIO in Mexico;
- GFOI Science Meeting to showcase the research supported by GFOI, and discuss the R&D coordination and data provision by GFOI to the research teams;
- Support to the update of the MGD incorporating state-of-the-art operational forest monitoring methods, ensuring complementarity with the GOFC-GOLD REDD Sourcebook;
- Further support to the capacity building activities participating in the development and update of training materials, and in the organisation of training workshop;
- Update the GFOI Review of Priority R&D Topics; and, Liaison with other GFOI components and partners.

Capacity Building

- SilvaCarbon and UNREDD will continue to provide a link between the implementing countries and the GFOI and its partners and components;
- SilvaCarbon will continue to host a series of in-country capacity building workshops;
- UNREDD will continue to work with countries to assist in the development of their forest reference emissions levels (FRELs) for REDD+, GHG inventories, efforts to access performance based payment from the World Bank's trust funds and broader forest monitoring capacities;
- The capacity building component will work on becoming more closely coordinated with the space data and MGD components; and,

- Will work with the GFOI Lead Team and GFOI partners, such as the FAO, to develop a coordinated country engagement plan and stock take of country priorities and measurement, reporting and verification (MRV) status.

Policy mandate

The United Nations Framework Convention on Climate Change (UNFCCC) has developed a new mechanism known as REDD+. REDD+ seeks to create a financial incentive for developing countries to reduce net emissions from deforestation, forest degradation, and foster forest conservation, sustainable management of forest and enhancement of existing carbon stocks nationally. In order to access international finance from REDD+, developing countries have to be able to generate verifiable emissions reductions. To do so, they must develop national forest monitoring systems (NFMS) and emission measurement, reporting and verification (MRV) processes to prove that the emissions reductions are real. This capacity will also allow countries to track progress towards their own emissions reduction targets, generate credible information to inform domestic decision making and policy development and more generally improve forest management. GFOI is seeking to assist REDD+ countries to develop their own sovereign NFMS and MRV procedures.

Remote sensing provides a cost effective input for these systems given the expectation that REDD+ should ultimately be implemented on the national scale according to the UNFCCC.

Services

- Delivery of core data streams and products;
- Services tools for data acquisition planning, storage, and processing to support country needs;
- Production of Methods and Guidance Documentation (in several languages);
- REDDcompass web based application for developing Forest monitoring and MRV systems;
- 'Training the Trainer' Workshop series.

User engagement

GFOI already has established strong links with end users. These are forested developing countries, particularly those with a national commitment to implementing REDD+.

GFOI capacity building includes a broad array training, information sharing and technology transfers. This is delivered through a combination of workshops, specific training modules, one-on-one training, exchange programs, webinars and the provision of REDDcompass which is designed to serve as an ever present buddy to accompany countries all the way through their system design and development phase.

GFOI continues to grow the involvement of REDD+ countries in its activities, by inviting them to participate in the annual open forum, regular seminars, UNFCCC side-events and additional training opportunities. This allows for GFOI partners to identify the evolving needs of their end users and adjust their assistance accordingly.

Future plans

The GFOI does not yet have a formalized data management policy, since the majority of data used through GFOI are supplied by data providers with data policies in place. However all partners agree on assisting developing countries to understand, analyze and use forest data that is freely available, open source, national, transparent, time series and operational datasets that best meet countries forest monitoring and reporting needs.

GFOI partners are also pursuing the Date Cube concept to assist in providing countries with analysis ready data that has been preprocessed to an acceptable level. Amongst other benefits, the Data Cube is hoped to help address issues with interoperability and reduce lengthy and resource intensive data processing for developing countries and ultimately help to reduce their transaction costs from participation in REDD+. At present Data Cubes are under development for Kenya and Colombia.

Resources

Financial

- Support to the GFOI office has been promised at US$ 800,000/year from Norway and Australia.

In-kind (human resources)

- Through coordination, the GFOI builds up on and adds additional value to existing partner activities. In-kind support is provided to all components from Australia, Japan, Norway, UK, USA, CEOS, ESA, and the FAO;
- Support for authors of the Methods and Guidance Document comes from a wider range of countries and organisations.

Leadership

- Thomas Harvey (FAO), thomas.harvey@fao.org

Contributors

Members: Argentina, Australia, Brazil, Canada, China, France, Germany, Japan, Norway, USA.
Participating Organizations: CEOS, ESA, WB.
*Others***:** Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD); Intergovernmental Panel on Climate Change (IPCC); United Nations Framework Convention on Climate Change (UNFCCC).

Linkages across the Work Programme

Flagships: GEOGLAM.
Initiatives: Earth Observations in Service of the 2030 Agenda for Sustainable Development; GEO Carbon and GHG Initiative.

GLOBAL OBSERVATION SYSTEM FOR MERCURY (GOS4M)

Overview

As part of the previous GEO Work Plans (2009-2011 and 2012-2015), the Task HE-02 "Tracking Pollutants" included the aim of developing a global observation system for mercury in addition to that for persistent organic pollutants (POPs). This Task supported the achievement of the goals of GEOSS and other on-going international programs (e.g. UNEP Mercury Program) and conventions (i.e., Minamata, UNECE-LRTAP TF HTAP; Stockholm). Programs such as the World Meteorological Organization's Global Atmosphere Watch (GAW) have made substantial efforts to establish data centres and quality control programs to enhance integration of air quality measurements from different national and regional networks, and to establish observational sites in under-sampled, remote regions around the world. Similarly, the International Global Atmospheric Chemistry project (of the International Geosphere-Biosphere Programme) has strongly endorsed the need for international exchange of calibration standards, and has helped coordinate multinational field campaigns to address a variety of important issues related to global air quality.

The proposed Flagship on a Global Observation System for Mercury (GOS4M) aims to: i) increase the availability and quality of Earth Observation data and information to contribute to the tracking of mercury released to the global environment and, where appropriate, anticipate changes to the environment; ii) harmonize metadata production, archiving and sharing data from the mercury network; and iii) develop advanced services in support of policy mandate through the Minamata Convention.
The way to attain the above objectives is by i) facilitating cooperation of governments and institutions tracking chemical pollutants; ii) fostering the adoption of advanced sensors in monitoring mercury and its compounds; iii) better preparing, archiving and sharing metadata; iv) creating advanced web services for using and discovery information from metadata and data; and v) creating ad-hoc web services for policy makers.

Activities for the period

- **Task 1:** Establish a governance structure:
  This Task is aimed to facilitate the involvement of the major governments and institutions supporting the collection of mercury atmospheric and environmental monitoring information to guide the work of this effort and report on the process and deliverables. Building on previous efforts this will reach out to Governments and Scientific institutions that have not been core to the GMOS and HE-02. The GOS^{4}M Flagship will launch a consultation process with representatives of regional mercury monitoring programmes and networks, potential users, and other members of the GEO community to develop specific data, metadata, and service specifications and formats to reach a consensus that will facilitate data sharing across mercury monitoring programs and with other earth observations communities;

- **Task 2:** Analysis of current infrastructures and archived information on mercury:
  The analysis of current infrastructures on mercury (global and regional) will help to discover strengths and weaknesses of current systems and support planning of new services and tools. The focus of this Task will be on metadata production that are the core elements for data publishing and design of services and tools. The analysis will be informed by consultations and open workshops to engage representatives of the major monitoring and modelling programs for mercury, as well as experts from other earth observations communities within GEO;

- **Task 3:** Harmonization of information and production of metadata following standards:
  Informed by the analysis in Task 1, the lead institutions will facilitate an open process to develop a consensus set of data, metadata, and service specifications to be adopted in the flagship that will facilitate data sharing across mercury monitoring programs and networks and with other EO communities. Where necessary a large effort will be put on translation of

older formats or production of new metadata. This information will be appropriately archived to make searching and using by the core engine fast and reliable;

- **Task 4:** Implementation of the GOS^{4}M Portal with EUROGEOSS Broker as core engine.
  Design and implementation of the Portal will be based on the EUROGEOSS Broker that will assure a real interoperability. The main function of the portal will include search and discovery by keywords, geographical area and temporal extent;
- **Task 5:** Design, creation and implementation of core services:
  This Task will analyse policy makers' requirements and design web services to support the assessments. A data analysis system based on GEOSS Data Core will be made available, which will output a customized report. A report can include for example pollutant temporal trend in different media or region;
- **Task 6:** Design, creation and release of tools for using and discovering information:
  This Task will analyse stakeholders' requirements and create specific tools to discover and use information;
- **Task 7:** Testing and updating of services and tools:
  This Task will serve to test and update services and tools until the end of the Work Plan;
- **Task 8:** Progress reporting and stakeholder engagement:
  This task will create a regular feedback and progress loop reporting to the governing bodies of the Flagship (i.e., steering committee) throughout the length of the initiative for GEO Flagship partners, with participants from governments and institutions in all regions including Europe, North America, Asia, Africa, Americas and Caribbean.

Policy mandate

The Global Mercury Partnership is a cooperative stakeholder driven effort started in 2006 to protect human health and the global environment from the release of mercury and its compounds by minimizing and, where feasible, ultimately eliminating global, anthropogenic mercury releases to air, water and land. Countries such as the USA, Canada, Japan, and China have been operating regional networks for many years that contribute to this partnership, providing the fundamental building blocks of a coordinated global monitoring network for mercury. Article 19 of the Minamata Convention on Mercury states that all monitoring activities related to mercury in environment and human health should, where appropriate, build on existing monitoring networks. By involving regional programmes and networks, the GOS4M Flagship will provide a substantial contribution to the Fate and Transport Partnership (UNEP F&T) of UNEP's Global Mercury Partnership.

This partnership has been recognised as a fundamental to supporting the preparation and development of technical and scientific knowledge in support of the future implementation of the Minamata Convention. The proposed Flagship is aimed to provide continuous information on mercury concentrations and fluxes in and between the atmospheric, marine, freshwater and terrestrial ecosystems as well as outputs from validated regional and global scale atmospheric and marine models. The potential contribution of GOS4M to provide key information to all interested parties in evaluating the impacts of the Convention are important. Information delivered through the activity of this Flagship may strongly support the periodic assessment and evaluation of the effectiveness of measures that will be undertaken to achieve the goals that will be set by COP1. The information that the GOS4M would provide shall be considered as supporting information to be provided to interested parties in their effort to evaluate the effectiveness of measures.

Services

The activities and outcomes of the Task HE-02 were already part of the policy process. GMOS is part of the UNEP F&T which has been supporting UNEP and the INC (1 to 7) during the 2010-2016 period for the preparation of the technical background reports requested to the Executive Directors of UNEP for the Minamata Convention. GMOS as well as other monitoring networks and programmes and

UNE F&T cooperate with UNEP and provide unique data and knowledge on mercury to nations (through the INC in the past and COP1 in 2017) and to a wide range of stakeholders and policy makers at national level.
This Flagship will continue to contribute in different steps of the policy implementation and evaluation process. Main foreseen societal benefits are:

- a new portal based on the EUROGEOSS Broker (www.eurogeoss-broker.eu/) aimed to discover information;
- new web services for reporting information, as for example atmospheric concentrations in different World regions, mercury' deposition/release in different environmental compartments (e.g. soil, oceans), mercury in biota; and
- a set of tools developed to include stakeholder participation in information discovery (e.g. to help pregnant women to decide how much and which fish to include in their diet).

User engagement

Engagement with relevant user communities and other stakeholders is of crucial importance for this Flagship, making sure its objectives are in tune with the real-world problems and its results provide adapted solutions. GOS^{4}M will share the outcomes, lessons learned and conclusions from a series of roundtable meetings designed to identify stakeholder needs and promote collaboration between science and policy. The roundtables will seek to build up a stakeholder dialogue with exemplary sector-specific user communities to incorporate feedback loops for the products of this Flagship, as well as to develop improvements of existing mercury data workflows. The collection of roundtable reports will provide a summarized overview of shared experiences gained in the workshops that will be organized. The roundtable reports will provide insights and exchange of ideas on highly relevant issues concerning policy, citizen science and local/regional stakeholders and its networks. Reports will be made available to the wider community.

Future plans

Steps for the transition of the Flagship from the implementation to the fully operational phase.

The operational phase will be reached once:

- current information will be harmonized;
- the portal will be established; and
- services and tool will be tested.

Operational plan, goals, objectives, requirements, challenges, threats:

- Design, implement and deploy the Portal that will link to the GMOS SDI;
- Harmonization of information and production of metadata following standards through a transparent process involving contributing partners and representatives of existing mercury monitoring programs, based on scientific consensus;
- Design, creation and implementation of core services;
- Design, creation and release of tools for using and discovering information; and
- Testing and updating of services and tools.

Resources

Secured and expected resources (cash and in-kind):

- Resources for implementing GOS^{4}M derives from the European network for observing our changing planet (ERA-PLANET) project recently launched and aimed to strengthen the European Research Area in the domain of Earth Observation in coherence with the European participation to Group on Earth Observation (GEO) and the Copernicus initiative. ERA-PLANET will support GOS^{4}M implementation through in-kind and cash resources. Around 9 M€ (33% of EU top-up fund and 66% of in-kind) are expected from development of a project on Global change and Environmental treaties;

- Contribution in-kind will be provided by several regional and national programmes and projects led by participating organizations;
- Additional resources will be derived from GEF projects within the UNEP F&T activity;
- The global expected resources for implementation of GOS^{4}M are near 12-15 M€.

Sources of funding, data, services, etc.:

- Already developed infrastructure on mercury (www.gmos.eu/sdi) will be based on new services.

Annual budget allocation:

- Considering expected resources, around 2-3 M€ can be considered as annual budget allocation until 2021.

Leadership

- Nicola Pirrone (CNR/Italy), pirrone@iia.cnr.it

Contributors

Members: Argentina, Australia, Belgium, Canada, China, Czech Republic, Denmark, France, Germany, Italy, Japan, Latvia, Norway, Russian Federation, Slovenia, South Africa, Sweden, UK, USA.
Participating Organizations: UNECE-LRTAP, UNEP.
Others: Arctic Monitoring and Assessment Programme (AMAP); Asia Pacific Mercury Monitoring Network; Cape Verde, European Monitoring and Evaluation Program (EMEP), Global Environmental Facility (GEF), Society of Environmental Toxicology and Chemistry (SETAC); Suriname.

Linkages across the Work Programme

Initiatives: AirNow International; GOS4POPS.

GEO FOUNDATIONAL TASKS

General

GEO Foundational Tasks allow GEO to implement selected, enabling tasks to achieve GEO Strategic Objectives and Targets. 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 GEO Flagships, GEO Initiatives, and GEO Community Activities. The Core Functions set out in the *GEO Strategic Plan 2016-2025: Implementing GEOSS* are the primary reference for these functions. Contributions are often made available from the GEO Trust Fund and may be complemented by further contributions – either directly or in kind – from GEO Members, Participating Organizations, or other partners.

The GEO Secretariat frequently plays a central role in implementing Foundational Tasks or coordination to ensure good progress towards its Target.

Establishing GEO Foundational Tasks

GEO Foundational Tasks are included in the GEO Work Programme (GWP) and are accepted by Plenary when it accepts each GWP in its totality. The GWP is proposed by the GEO Secretariat. It includes an indication of the resource contribution from the GEO Trust Fund, staff resources from the GEO Secretariat, and direct or in-kind contributions from GEO Members, Participating Organizations and other partners. Requests for additional funds that have not been made available from the Trust Fund, GEO Members, and Participating Organizations are also set out in the GWP. Further detailed documentation on the activity may be maintained by the GEO Secretariat.

By accepting the GWP GEO commits to resource the activities it contains at the levels indicated in the GWP.

Criteria for establishing GEO Foundational Tasks

- Implements or supports the implementation of at least one of the GEO Core Functions;
- Sufficient resources identified and committed in GWP;
- Description in the GWP detailing:
    - Objective(s) and Target(s) to be addressed;
    - Specific deliverable to be produced;
    - The activities planned over the period covered by the GWP;
    - Schedule for implementation;
    - Cost and resources, including from the GEO Trust Fund, Members, Participating Organizations, and private sector partners;
    - Requests for additional resources linked to specific activities; and
    - Role of the GEO Secretariat and other actors.

Resources

The Secretariat activities related to the Foundational Tasks 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 is the case for AfriGEOSS and GEOGLAM). Foundational tasks also include primary contributions from GEO Members, Participating Organizations, and further partners, without which the expected results could not be delivered.

A summary of the overall resources associated with the performance of the Foundational tasks in 2017, as well as the projections for 2018 and 2019, will be part of the 2017 Budget Document (Ref. GEO-XIII-4.4: Proposed 2017 Budget).

Management and coordination

Depending on the specific case, GEO Foundational Tasks may be directly implemented by the GEO Secretariat according to its internal management or by other mechanisms such as a Working Group

coordinated by the GEO Secretariat. Advisory mechanisms may be set up for individual Foundational Tasks, as needed.

Having acknowledged the supporting role of the Secretariat in the definition and approval of the Work Programme (and of the FTs), the Secretariat ensures the overall coordination of the FT execution and reports to the Executive Committee and Plenary on their progress. The Secretariat also assumes specific responsibilities and performs specific activities for each of the FTs in accordance with the relevant descriptions.

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), the Secretariat is the sole body reporting directly to the Executive Committee/Plenary on Work Programme-related topics pertaining to the Foundational Tasks.

Reporting to GEO

The GEO Secretariat will report in annual GEO Progress Report on the activities, progress and issues in GEO Foundational Tasks.

At its own initiative or at the request of GEO SBA Teams the GEO Secretariat brings particular items to the attention of GEO, such as to Plenary, the Executive Committee, or the GEO Programme Board.

Monitoring and Evaluation

The GEO Programme Board reviews the progress towards the implementation of GEO Foundational Tasks based on the annual GEO Progress Report. The GEO Secretariats regularly arranges and conducts independent evaluations of the Foundational Tasks.

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.

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 two tasks (see below), with the specific purpose to retain expertise and commitment of existing bodies and individuals when transitioning to the new implementation mechanisms.

Foundational Task List

The list of proposed FTs for 2017-2019 and relevant descriptions has been developed in consultation with the GEO Programme Board.

It is worth noting that, following the Programme Board recommendations, the following three activities, implemented as Foundational Tasks in the 2016 Work Programme, are still part of the 2017-2019 as:

GEOSS Common Infrastructure (GCI) Development:
-> GEO Initiative: GEO EVOLVE

Communication Networks:
-> GEO Community Activity: Advancing Communication Networks

Assess the benefits from EOs and of their socio-economic value:
-> GEO Community Activity: Socio-Economic Benefits of Earth Observations

The updated list of proposed FTs is reported below with the indication of the proposed working arrangement.

GEOSS Development and GCI Operations	**Implementation arrangement**
Advancing GEOSS Data Sharing Principles	WG
GEOSS Common Infrastructure (GCI) Operations	Team
GEOSS *In situ* Earth Observation Resources	Team
GEOSS Satellite Earth Observation Resources *(includes advocacy for continuity)*	Team
GEONETCast Development and Operations	Team
User Needs and Gap Analysis	Team
Community Development	
Capacity Building Coordination	WG
Secretariat Operations	
Management and Support *(includes resource mobilization)*	Team/Secretariat
Communication and Engagement	Team/Secretariat
Monitoring and Evaluation	Team/Secretariat

GEOSS DEVELOPMENT AND GCI OPERATIONS

ADVANCING GEOSS DATA SHARING PRINCIPLES

Overview

Continue promoting free, full, open and timely access to Earth observation datasets, products and services. Maintain dialogue 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. This will result in activities along the following lines:

- Update implementation guidelines on Data Sharing Principles that underpin the quality of available data, information and tools and support their integrated use;
- Track international Open Data trends and continue to evolve the next generation of Data Sharing Principles as necessary;
- Analyze and advocate the benefits of Data Sharing. Raise global awareness, including in developing countries, about the value of free and open datasets, products and services provided through GEOSS, particularly in support of measuring and monitoring the SDGs;
- Promote national coordinating mechanisms for implementing the Data Sharing Principles Post-2015 and monitor data sharing progress by GEO Member governments;
- 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; and
- Monitor, interpret, and adjust use metrics to gauge the utilization of shared resources and their value to both data providers and data users, within and across SBAs.

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

Activities for the period

- Finalize Implementation Guidelines for Data Sharing Principles for GEO Plenary approval;
- Prepare Action Plan for Data Sharing based on statistical trends for data supply and use via GEOSS and the GEOSS Data-CORE;
- Prepare data sharing progress report to the GEO Plenary, with assistance by national contacts reporting on data sharing activities;
- Maintain a living document on international open data trends;
- Maintain a document or a webpage of stories on the benefits of data sharing; and
- Hold regional data sharing workshops, campaigning on the benefits of data sharing, and building capacities on Data Sharing Principles up-take and implementation.

Deliverables for 2017

- Revised Implementation Guidelines for Data Sharing Principles;
- National Data Sharing Progress Report;
- Living document on international open data trends;
- Living document or webpage on the benefits of data sharing; and
- A Regional workshop on data sharing.

Future Plans

To be developed in 2017.

Resources

GEO Trust Fund (Secretariat Staff).

In kind (contributors)

Leadership

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b) National contact points for data sharing

GEO Secretariat requested GEO Principals to name national contact points for data sharing (25 August 2016).

Secretariat Support:

- Overall coordination of the task;
- Data sharing point of contact to the external world; and
- Promotion and extension of GEOSS DataCORE

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GEOSS COMMON INFRASTRUCTURE (GCI) OPERATIONS

Overview

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 by others. Continuously engage with data and service providers and user communities to connect new resources.

The task activities address the following:

- GCI Component operations including maintenance, administration, monitoring and integration – covering both software and hardware;
- Maintain partnership with Data and Service Providers and ensure resources are discoverable and accessible through the GCI in mutually agreed methods. Connect new providers who are relevant to Flagships and key Members and Participating Organizations;
- Collect requirements and feedback from User Communities and Stakeholders for improving current GCI capabilities to ensure reliable products and services; and
- Develop and operate a user Helpdesk for data and technical assistance and support services to Data and Service Providers, User Communities and Stakeholders.

Activities for the period

GEOSS Portal

Recognizing the user centrality as one of the main drivers of the GEO strategy, the GEOSS Portal project in the 2017-2020 time frame, has the ambition to reach users and make steps in meeting their full satisfaction, and will do so by enhancing the Portal, in compliance with functionalities expressed by the GCI User requirements, with the following high-level objectives in mind:

- Better respond to user needs. The expected outcome is an enhanced user interface exposing new and evolved capabilities that are useful, i.e., that respond to user needs, as opposed to technology mandates. Furthermore, the aim is that the overall GEOSS Portal is complete and innovative, in the sense that the addressed communities can find whatever they need to accomplish their activities. In addition, the GEOSS Portal will emphasize openness, by promoting the GEOSS Data CORE and encouraging relevant contributions from providers;
- Improve user experience. The enhanced GEOSS Portal will abide by the usability rules to pursue intuitiveness and ease of use, where "easy" means "obvious" and "self-explanatory". Particular attention will be paid to data quality and, in particular, to the integrity of the information provided, which, as a result of a fruitful cooperation with the other actors, shall be correct, verifiable and appropriate for the purpose;
- Serve a Comprehensive Community of Users. Providing usable and useful functionalities may still be not enough to attract certain users, if this means to force them to completely abstract from their specific domain or abandon their working habits. For example, GEO and scientific communities have their specific needs, and therefore require that the GEOSS Portal offer capabilities that are customizable. Similarly, citizens might not be attracted if mobile use is not supported, as this is often the main means by which one interacts with the Internet. Finally, to guarantee a comprehensive audience, accessibility shall be addressed carefully, particularly regarding browser compatibility, response time and compliance with standards;
- Raise Interest in and Awareness of GEOSS. Evolving it into a trusted place for exchange of ideas, education and outreach, where, users can, establish a dialogue with the providers, will raise even more interest and increase GEOSS awareness. Enhanced social interconnectivity will be achieved through a social platform, offering the social network mechanisms well-known by the users. Moreover, to convey to them a feeling of involvement and control, the

GEOSS Portal will put in place mechanisms for user feedback. Awareness will be pursued through dissemination and exploitation activities run during the project.

- Open Source code. By end of 2017 establishment of repository to host open source code of the Portal – open to GCI contributors for additional, future developments.

GEO Discovery Access Broker (DAB)

- Broker the additional resource providers (data, information and knowledge, including the databases generated by the SBA user needs process) recognized to:
  - Reach the necessary GEOSS capacity, i.e. geographic and thematic balance among regions and topics;
  - Address the requirements stemming from the SBA user needs process;
  - Address the needs coming from the GEOSS Portal; and
  - Address the needs of selected GEO Flagships and Initiatives.
- Refine the operative ranking scheme utilized to prioritize discovery matching results, applying User needs;
- Approve a formal brokering process for GEOSS resource Providers, based on a brokering agreement approach;
- In addition to the CNR-IIA, train and establish supporting operational teams that have knowledge to run the brokering process for the new data and services Providers;
- Online form to advise/communicate new data Providers to be brokered l for given community;
- Dissemination activities and training workshops on the GEO DAB APIs and how to use them to leverage the entire GCI resources and develop thematic/geographic portals – with objective to increase usage of the GCI functionalities, noticeably for EO application Developers;
- Implement a service "Status Checker" in the DAB framework –by leveraging the services offered by the component already developed by USGS;
- Support the functionalities required by the knowledge base to manage non-data resources (e.g. documents, workflows and semantic resources); and
- Consolidate and improve the online DAB statistics moving towards the development of a dashboard for the GEOSS resource Providers.

GCI Resource Quality

- Enhance the quality of metadata supplied by the GEOSS resource Providers, presently brokered by the DAB, by establishing a set of minimum essential metadata elements that are compulsory to be filled –see also the GEOSS Data Management Principles;
- Implement the GEOSS Data Management Principles;
- Create a Community of the GEOSS resource Providers and organize training and workshops on a regular basis; and
- Establish a "Yellow Pages" service to maintain a live data base of GEOSS Data Providers along with their description and a reference to the specific brokering agreements.

User Help Desk

- Implement the "GEOSS User Help Desk" service in 2017.

Community Portals and Applications Guidelines

- Provide a set of Guidelines to facilitate the development of specific Community-centered applications (e.g. Community Portal), using the GCI resources via the GEO DAB APIs – see also the DAB action on the DAB APIs dissemination; and
- Develop web templates, that have the same look and feel as the GEOSS Portal, that have already implemented the GEO DAB APIs, to facilitate non – technical users to establish a Community/SBA portal for a given thematic or spatial area.

Pilots/Applications

- Create a set of significant User-driven Pilots utilizing the resources available in the GCI to demonstrate its usability, effectiveness and importance for users and decision making.

Annual Events in support of the Operations

- GCI Annual Workshop;
- GCI Data Providers workshop;
- GCI Capacity Building related events (GEO DAB APIs, advocacy) etc.; and
- Support to showcase end users case studies in large events.

Future Plans

Will be developed in 2017 and beyond along the objectives and activities described in the overview.

Resources

GEO Trust Fund (Secretariat Staff)

In kind resources (Leads and Contributors)

Expected cash contribution from EC and ESA for Portal and DAB improvements and operations.

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Secretariat Support

- Overarching coordination and GCI configuration management including to maintain the GCI documentation and the list of the GCI Component and related representative persons;
- Helpdesk;
- Coordinate to improve capabilities of existing providers and also to connect new data providers; and
- Integrate GCI performance measurement tracking and reporting capabilities across GCI Components and Services.

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GEOSS IN-SITU EARTH OBSERVATION RESOURCES

Overview

The global, domain-related observing systems are key components of GEOSS.

The task will analyze the current state, trends, and needs, assess gaps, and develop new scenarios for in situ measurements as they constitute a key element of these global systems that need strengthening. The task will put particular focus on coordination and access to data and will provide various coordination opportunities in order to advocate for new systems, to sustain and strengthen existing and planned ones and to encourage integration and linkages.

The main objectives of this activity, with a specific focus on *in situ* observations, are therefore:

- support the improvement and coordination of individual *in situ* observing systems;
- strengthen the existing and planned global observation systems characterizing the Earth system domains (Atmospheric, Oceanic, Terrestrial); and
- foster and facilitate the development of new global systems, federating existing ones and advocate for observational and informational gaps closure.

The regional scale would be considered as the reference to start.

The activity is subdivided in the following subtasks:

Subtask A: Tracking status, gaps, opportunities for in situ observations
Subtask B: Atmosphere
Subtask C: Ocean
Subtask D: Terrestrial (including freshwater, vegetation/ecosystems, land cover/use)
D.1 - Freshwater observations including water quality
D.2 - Vegetation and ecosystems
D.3 - Land cover and use

Subtask A – Tracking status, gaps, opportunities for in situ observations

Lead: [Potentially, two co-leads selected from the leads of subtasks B, C, D]

Participants: all those identified above in Components B, C, D with the support of the GEO Secretariat.

Across all domains: develop common reporting of GEOSS in situ implementation state, trends, needs, gaps, and new scenarios, for GEO Plenary, drawing on existing mechanisms as much as possible [including for example the EC ConnectingGEO project]. Identify and highlight opportunities for improved coordination between components in the implementation of activities.

Promote and coordinate non space-based observing systems (including both in situ and remote sensing airborne, land and ocean based systems, collectively denote here as in situ 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 in situ data resources needed by GEO (including flagships, initiatives and community activities) to achieve the objectives of the GEO Strategic Plan. Coordinate increased interoperability of in situ 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 in situ observing networks and develop common strategies and actions to ensure sustained observations. Advocate for adequate resources to maintain systems that provide continuity of observations.

The task activities are addressing the following:

- Cooperate with in situ operators to promote and coordinate development activities related to in situ observation infrastructures and networks; build upon ongoing coordination efforts & activities;
- Explore and determine how in situ 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;
- Improve coordination and facilitate access to in situ data resources;
- Develop a global database of in situ 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 in situ gap assessments and coordination with the space-based observation community. Coordinate the database development with the development of the GEO Knowledge Base and the GMES GISC database structure. Inform in situ operators on the benefits of such a database for the in situ and space-based observation communities;
- Coordinate increased interoperability among in situ datasets, between space and in situ datasets, and new in situ 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);
- Identify the domain-specific in situ coordinators on a global level and seek their preparedness to lead the in situ coordination in these domains;
- Interact with the SBA User needs Process in order to coordinate filling the gaps; and
- Identify and coordinate the necessary actions for the protection of the radiofrequecy bands necessary to ensure proper operation of EO instruments.

Activities for the period

(2017)

Consolidate and complete the activity plans and the teams for each subtask.

Start the development of a document describing GEO plans to support existing systems and facilitate development new ones.

Produce a report on “Inventory of Global Earth Observation Systems contributing to GEOSS”, identifying potential gaps, duplications and synergies, as well as initial options for a way forward.

Update the 2016 GEO *In Situ* Status Report and identify gaps where the task needs to devote time/energy to develop a strategy to fill gaps.

Subtask B: Atmosphere:

Highlight the current state, trends, and needs; assess gaps, and new scenarios for *in situ* measurements, based on the core of WMO's WIGOS activities, and considering complementarity to and integration with satellite observations.

Ensure access to the generated datasets through the GCI

Lead: WMO [TBC]

Participants: …

Subtask C: Ocean:

Highlight the current state, trends, needs, assess gaps, and new scenarios for *in situ* measurements, based on the activities of the Global Ocean Observing System (GOOS), its Regional Alliances and projects, the activities of GEO BON / MBON; in close cooperation with the GEO Blue Planet Initiative requirements; considering complementarity to, and integration with, satellite observations, and with sensitivity to a regional perspective and coastal observations. Include sea ice.

Ensure access to the generated datasets through the GCI.

Lead: GOOS

Participants: GEO BON / MBON, Blue Planet Initiative, POGO, ...

Subtask D: Terrestrial (including freshwater, vegetation/ecosystems, land cover/use):

Initiate a coordination activity amongst terrestrial observing networks and community activities, filling an identified gap, and with sensitivity to a regional perspective. The ultimate long-term goal will be to federate diverse terrestrial *in situ* observing networks/activities, plus the necessary satellite observation and ensure access to the generated datasets through the GCI.

Subtask D.1: Freshwater observations including water quality:

[Covering water quantity, quality, wetlands, and including link to ocean observations]

Leads: ...

Participants: [to include WMO, GEO Initiatives related to water including GEOGLows, AquaWatch]

Subtask D.2: Vegetation and ecosystems:

Leads: ...

Participants: [to include GEO BON, GFOI, ...]

Subtask D.3: Land cover and use:

Leads: ...

Participants: ...

(it may be addressed as a specific activity of the Land Cover Land Cover Change CA)

Future Plans

To be developed as the project takes hold.

Resources

GEO Trust Fund (Secretariat Staff)

In kind resources (leads and contributors)

Lead

See different subtasks

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Secretariat Support

The Secretariat provides general support to the Task Team and specific support for subtask A.

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GEOSS SATELLITE EARTH OBSERVATION RESOURCES

Overview

Satellite Earth observations are critical to understand 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 GEOSS and a key enabler of 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. The task activities are addressing the following:

- 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;
- Promote the development and implementation of technologies and the uptake of best practices to enhance space data access in support of the evolution of the GEOSS, particularly focusing on enhanced access to space data via the GCI;
- 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;
- 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; and
- Identify and coordinate the necessary actions for the protection of the radiofrequecy bands necessary to ensure proper operation of EO instruments.

This activity is complementary to activities focused on formalizing user requirements and providing space data in support of specific activities.

The task activities are implemented by a task Team.

Activities for the period

1. Review the strategy and plans for the implementation of Virtual Constellations to ensure they continue to develop to support GEO objectives; and
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;
3. Provide inputs for the preparation of the World Radio Communication Conference 2019 (WRC-19).

Future Plans

Rolling activities, response to newly identified/consolidated user needs.

Resources (2017)

GEO Trust Fund (Secretariat Staff)

In kind contributions from CEOS and from member agencies and associates.

Lead

The task is led by the Committee on Earth Observation Satellites (CEOS) coordinating delivery through member Space Agencies, Associates and Partners.

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Secretariat Support

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GEONETCAST DEVELOPMENT AND OPERATIONS

Overview

GEONETCast is a global network of sustained and cost-effective satellite-based dissemination systems. It delivers Earth observation (EO) data and products to GEO community activities, initiatives and flagships on a routine basis. GEONETCast currently serves approximately 6,000 users in 169 countries. GEONETCast and is also used for EO data transmission where high-speed landlines and/or internet are not available, or in regions where terrestrial communication lines have been disrupted by disasters. More than 350 users in Africa rely on GEONETCast for data access. In the Americas, GEONETCast has extended access to GEOSS resources to over several dozen national networks including in Brazil, Costa Rica, El Salvador, and Mexico. The use of the GEONETCast system is based on GEO's founding principles of open data sharing, so country participation in the utilization of GEONETCast system promotes GEO's strategic objective of advancing broad open sharing of EO globally. GEONETCast also engages with partners in public and private sectors, and in academia to build capacity in the use of Earth observation in a wide range of application areas through hands-on training events.

The main activities during the 2017-2019 period will be to continue operating GEONETCast — while improving links with GEO initiatives and services provided to Users worldwide.

The task activities are coordinated by a task Team, supported by the Secretariat. The system operation is ensured by EUMETSAT, NOAA and CMA (each one operating its own "hub"). Some data providers and partners are also involved (e.g. INPE, VITO and WMO).

The task activities include:

i. Operate GEONETCast infrastructure:
   - Disseminate GEO-related data to users operationally;
   - Exchange data between the GEONETCast Hubs;
   - Integrate GEONETCast performance measurement tracking and reporting capabilities and
   - Pursue the integration of the GEONETCast collections catalogue with the GEOSS Common Infrastructure

ii. Further integrate it with other GEO initiative and flagships, and increase user base:
   - Evolve GEONETCast into a fully operational global data dissemination system providing support to GEO Flagships, Initiatives and Community Activities (considering also regional priorities);
   - Engage, through the GEO Secretariat, with GEO initiatives, flagship and community activities to assess at early stage needs for data access and dissemination;
   - 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; and
   - Foster relationships with GEO data providers and users to enhance data content in line with the SBAs, and evolving needs of users and decision- makers.

iii. Improve Service to users:
   - Expand interaction with networks of users in developing countries to improve access to data in areas with limited data accessibility (e.g through AfriGEOSS as well as through projects such as MESA, GMES&Africa);
   - Expand the GEONETCast broadcast footprint over the Pacific region;
   - Enhance the integration of other existing or emerging satellite data distribution systems;
   - Build capacity for using GEONETCast information, particularly in developing countries;
   - Develop GEONETCast Training Channels to (i) train end-users; and (ii) transmit training materials to local trainers; and
   - Support Help Desk activities put in place by GEO Secretariat (see below), through

coordination with existing GEONETCast Hub Help Desks.

Activities for the period

- Continue GEONETCast operations (2017-2019) and include performance reporting – see point i. above;
- Increase number of station and users as well as quantity and diversity of data disseminated via GEONETCast;
- Establish close cooperation with at least three GEO initiatives/flagships in ensuring disseminated of related data via GEONETCast (e.g GEOGLAM, GFOI, Blue Planet, etc);
- Establish close cooperation with GEO existing or future regional initiatives (AfriGEOSS, AmeriGEOSS, etc) (as per point a. ii) above);
- Improve services to users (as per point a, iii) above);
- Progress towards achieving global coverage (i.e. Pacific region) (2017-2019); amd
- Develop and test a GEONETCast Help Desk tool with a friendly User Interface (including a service desk) (2017-2019).

Future Plans

Will be developed in 2017 and beyond along the objectives and activities described in the overview.

Resources

GEO Trust Fund (Secretariat Staff)

In kind resources (Leads and contributors)

Leads

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Contributors

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Secretariat Support:

- Overarching coordination and GEONETCast configuration management including to maintain the GEONETCast documentation and the list of the GEONETCast Components and related representative persons;
- Facilitate engagement of GEONETCast with GEO Initiatives, Flagships and Community Activities to assess at early stage needs for data access and dissemination; and
- Provide a service desk operation for User Communities and Stakeholders.

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USER NEEDS AND GAP ANALYSIS

Overview

Establish a comprehensive overview of user needs and observational requirements and carry out gap analyses to identify gaps in observations and derived products meeting these requirements and needs. The Societal Benefit Areas (SBAs) will provide the framework to perform this task by engaging a wide range of stakeholders from end-users to data providers in different domains, different regions, and different roles. The task has two key objectives:

- Implement a structured approach to identifying user needs and to translate these needs into requirements for observations and services and apply this approach to the GEO SBAs. Carry out regular, systematic analysis of the resulting global and regional observational requirements to identify, document, prioritize and close gaps in the information value chain. Publicize gap analysis and the need to close them; and

- Document the results of the process using a tool to store and disseminate the user needs and gap analyses; the tool is 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 proposed approach builds on the lessons learned from past experiences having comparable, global objectives (such as IGOS-P, the former GEO Tasks US-06-1a and US-09-01, the development of the GEOSS User Requirements Registry, and WMO's development of OSCAR database) and has provisions to coordinate with, and incorporate results from, similar processes that are on-going at global and regional levels. A substantial contribution will also come from the GEO Initiatives and Flagships.

The process would also leverage the existing Communities of Practices and be constructed in such a way to facilitate the consolidation of new ones.

It is proposed to implement a phased approach, first demonstrating suitability and feasibility of the SBA-by-SBA process and then progressively moving to a more articulated process addressing the full scope of the GEO Strategic Plan provisions.

Once in place and running the process is also expected to provide other key outputs such as constituting the "reference platform" for SBAs communities to work and to engage users.

The knowledge base tool will document the relations between the user needs and the data and processes (models, workflows, algorithms) needed to develop the information meeting these user needs.

In coordination with the existing and developing functionality of the GCI, 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 deriving the observational needs from user information needs, 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). Rules will be included to define the observation needs for these indicators.

The GEO Knowledge Base will be developed as a community-based open source tool and will leverage as far as possible existing repositories and databases and documenting what is being developed in association with GEO activities. It will include user feedback with respect to the identified user needs, the gap analysis results, and the fitness for purpose of both data and processes.

The task will be coordinated by the GEO Secretariat.

The Secretariat will activate the SBA-related processes, building on the activities of the communities that are already active within each SBA and progressively covering the totality of the SBAs.

A dedicated Team will develop the tool to document and make accessible the results of this process (the knowledge base).

Activities for the period

2017

- Issue a document describing the SBA user needs process and how it will be implemented (based on the report of a dedicated Working Group to be issued in 2016);
- Activate the SBA-by-SBA process. Initial recommendations from the group indicate the Food Security and Sustainable Agriculture and Sustainable Urban Development as the preferred candidates with which to start;
- Continue the analysis of user needs related to the SDG indicators;
- Start the compilation of available knowledge resources;
- Continue the design and finalize the development of the prototype the knowledge base; and
- Convene GEOSS Science and Technology Stakeholder (GSTS) Workshops to support the collection of user needs, gap analysis and prioritization.

2018-2019

Continue the SBA process and operationalize the knowledge base. Interact with the GEO initiatives and activities that support the Agenda 2030 to ensure the best possible service for these groups. Convene additional GSTS Workshop as needed.

Future Plans

Rolling process

Resources

GEO Trust Fund (Secretariat Staff)
In kind resources (leads and contributors)

Lead

Overall coordination and the SBA users process
GEO Secretariat
Knowledge Base tool development
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Contributors

GEO SBA Initiatives and Activities
GEO Communities of Practice
The GEOSS Science and Technology Stakeholder Network

Secretariat Support

Foster the participation of key stakeholders to the agreed activities, foster their engagement and the exchange among them and create the relevant linkages to GEO activities (Community, Initiatives and Flagships).

Ensure dialogue between the community developing the knowledge base and the GCI Team with the goal of developing solutions to make knowledge available through the Portal.

Giovanni Rum (GEO Secretariat) grum@geosec.org

COMMUNITY DEVELOPMENT

CAPACITY BUILDING COORDINATION

Overview

This task covers the coordination of the capacity building activities associated with the acquisition, processing and use of Earth Observation data and information for policy and decision-making. It includes the definition and use of clear mechanisms for identification of the "global CB offer", its gaps and promotion of coordinated actions to address them.

The task will be implemented by a Capacity Building Working Group (CB-WG), supported by the Secretariat in order to facilitate linkages with other GEO activities.

Annual meetings will play a key role in accomplishing this task; in particular three annual events are planned:

A CB Symposium, which will assemble all major institutions active in CB programs, providing the opportunity to present 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 – nominally prior to the Work Programme Symposium and prior to Plenary;

The nature of the task implies the execution of "recurring activities" that can be summarized as follows:

1. Undertake a baseline assessment of capacity building in GEO and an annual review of activities;
2. Periodic review and update of the resource facility - the GEOCAB Portal - (relevance, maintenance and marketing);
3. Periodic review of capacity building needs;
4. Develop and maintain a database with resource providers, ongoing programmes and activities;
5. Develop and maintain a calendar of capacity building events, and post it on the GEO website;
6. Undertake brokering activities - match needs with capabilities; and
7. Develop impact assessment – M&E – guidelines.

Activities for the period

2017 Deliverables

1. GEO capacity building baseline assessment and annual review;
2. Maintain resource facility (GEOCAb Portal);
3. Two meetings of the CB Working Group;
4. Two meetings of the Capacity Building Forum (with participation of GEO Initiatives and Flagships Representatives);
5. GEO Capacity Building Symposium;
6. Capacity building database with resource providers, ongoing programmes and activities;
7. Calendar of training activities;
8. Brokered activities - match needs with capabilities; and
9. Annual report on capacity building needs and activities in GEO.

Future Plans

The Task consists of rolling activities.

Resources

In kind contributions (CB-WG)

GEO Trust Fund (Secretariat support)

Leadership & Contributors

The ask is led by a Capacity Building Working Group (CB-WG)

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Secretariat Support

- Assist CB-WG will all activities and Community engagement;
- Review GEO Work Programme for CB activities and establish CB Forum; and
- Maintain databases and calendar of CB events.

Andiswa Mlisa (GEO Secretariat) amlisa@geosec.org

SECRETARIAT OPERATIONS

MANAGEMENT AND SUPPORT

Overview

This task comprises the overall management and administrative activities performed by the Secretariat, with some additional support from Members and Participating Organizations to ensure the strong functioning of the Organization.

Three kinds of activities are included:

1. Supporting GEO Governance and convening GEO Stakeholders:

i. Preparation and execution of Summits, Plenaries, Executive Committee and Programme Board meetings, documents preparation and reporting;
ii. Support to Programme Board activities ;
iii. Development of annual Work Programmes;
iv. Development and operation of the Information Technology tools (website, ftp, etc.);
v. Organization of meetings to make the GEO cooperation framework work, such as the Work Programme Symposium, AP Symposium, etc.;
vi. Support travel of seconded experts dedicated to initiatives/flagships (AfriGEOSS, GEOGLAM);
vii. Support travel of developing countries experts to GEO-related events;
viii. Performing all the internal activities to ensure a well-functioning Secretariat, including Human and Financial Resources Management.

2. Ensure that the level of resources contributed by GEO Members is compatible with the planned GEO activities and facilitate their effective and efficient use.

3. Support the implementation of Community Activities, GEO Initiatives and GEO Flagships in the various phases of their definition and execution:

i. Ensure interaction and collaboration among the teams developing CAs, GIs and GFs and the teams in charge of the other foundational tasks, for example with those in charge of GCI operations, so that each activity could benefit from the GEOSS data and information made available through the GCI and that, in turn, there will be an early definition of the arrangements that would allow activity results be accessible;
ii. Support each activity in identifying new potential contributors;
iii. Support the teams in channeling results into the main GEO "processes", like Progress reporting, M&E, Plenary/Executive Committee documents and meetings andcommunication activities; and
iv. Provide a clear point of reference at the Secretariat for each team.

Activities for the period

- Organization and execution of the planned activities;
- Resource mobilization;
- Define guidelines and practices for resource mobilization for GEO activities; and
- Engage with international funding organizations to define mechanisms to secure resources for specific GEO activities.

Future Plans

Will be developed on an annual basis along the objectives and activities described in the overview.

Resources

GEO Trust Fund (Secretariat Staff).

In kind contributions from the organizers of yearly meetings outside Geneva

Lead

Barbara Ryan (Director) bryan@geosec.org
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Contributors

Organizers of yearly meetings outside Geneva.

Secretariat Role

Overall coordination and execution of the activities.

COMMUNICATION AND ENGAGEMENT

Overview

This task implements the Engagement Strategy delineated in the Strategic Plan and further detailed in the "Engagement Strategy document" developed by a subgroup of the Executive Committee and submitted to GEO-XIII Plenary for approval. This task uses the outputs and results of the other GEO activities as the foundation for communication and engagement 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 these activities will include:

- Development or updating, and implementation of, an engagement and communications strategy, including identification of critical partners and targeted stakeholders;
- development of multiannual GEO Engagement Implementation 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 the GEO community;
- organization of dedicated events targeting users and decision makers;
- utilization of social media;
- enforcement of the 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);
- identify and implement systematic actions to promote and facilitate the uptake of EO in decision-making, in collaboration with GEO Members and Participating Organizations;
- support GEO Members in establishing and strengthening national coordination mechanisms;
- undertake active recruitment of new Member and Participating Organizations; and
- provide information and support to Members and Participating Organizations on how to better engage in GEO and participate to GEO activities.

The task, led by the GEO Secretariat, will be supported by the Programme Board, for the development of the 3-year Engagement Strategy Implementation Plans, and by Members and Participating Organizations for executing the agreed activities, according to the respective roles identified in the GEO Engagement Strategy.

Activities for the period

A 3-year Engagement Strategy Implementation Plan 2017-2019 will be finalized before the end of 2016. This Plan will be based on the engagement priorities proposed by the subroup mentioned above, reviewed by the Programme Board, finalized by the Executive Committee and ultimately approved by GEO-XIII Plenary.

Future Plans

The GEO Engagement Implementation Plan will be updated every three years, to match the cycle of the Work Programme.

Resources

GEO Trust Fund (Secretariat Staff)
In kind resources (Contributors)

Leadership

Steven Ramage (GEO Secretariat)
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Contributors - To be defined in the multiannual GEO Engagement Implementation Plan.

MONITORING AND EVALUATION

Overview

The purpose of monitoring is to track the progress of the completion of GEO Work Programme activities; it will be performed on a continuous basis with results being delivered through an annual Work Programme Progress Report.

The purpose of the evaluation is to assess the progress towards achieving targets, including intended outputs and outcomes, as the basis to improve GEO's actions. The evaluation will consider not only the outcome of the GEO Work Programme activities but also those outcomes that are directly linked to the Work Programme, but are attributable, at least in part, to GEO's actions. Results of the evaluation will also help determine what difference GEO has made (effectiveness).

Two independent and comprehensive evaluations will be conducted by *ad-hoc* Evaluation Teams, one mid-way through the Strategic Plan period and the other near the end.

The task includes all the activities comprising the GEO M&E Framework and will be performed on a yearly basis. It will also include oversight of the existing literature and latest developments (the latter with a focus on related activities developed by the GEO Community, as Community Activities or GEO Initiatives) assessing the socio-economic benefits of EO use in decision making, as this constitutes a key element for the uptake of EO-based solutions. The medium term objective would be the broadening of the performance of these analyses across all GEO activities.

Activities for the period

- Consolidate the Monitoring and Evaluation Framework including the definition of Target performance indicators, the process to calculate them and their expected use;
- Produce yearly Work Programme Progress Reports;
- Produce reports on indicators, as requested;
- Progressive update of the database on Socio Economic benefits;
- Develop a dedicated page on the GEO website on Socio Economic Benefits from EO use and start to populate it with compelling examples and best practices; and
- Design and perform the first independent evaluation *(for 2019)*.

Future Plans

Continuous execution of M&E activities.

Resources

GEO Trust Fund (Secretariat Staff)

In kind contributions (Programme Board and independent Evaluation Teams)

Lead

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Contributors

Member and PO nominated representatives **serving on** the Programme Board and independent Evaluation Teams.

Secretariat Support

- Overall coordination;
- Propose indicators and methodologies for their computation;
- Perform yearly evaluation activities as agreed with the Programme Board;
- Development and update of the database on Socio Economic benefits;
- Support the independent evaluations; and
- Conduct monitoring on an on-going and systematic basis.

APPENDIX 1: ACRONYMS

AAD	Australian Antarctic Division
AARI	Arctic and Antarctic Research Institute
AARSE	African Association of Remote Sensing of the Environment
AB	Advisory Board
AC	Arctic Council
ACAP	Arctic Contaminants Action Program, AC Working Group
ACB	ASEAN Centre for Biodiversity
ACMAD	African Centre of Meteorological Application for Development
ADC	Arctic Data Committee
ADIE	Association for the Development of Environmental Information
ADS	Arctic Data archive System
AfriGAM	AfriGEOSS Agricultural Monitoring
AFSIS	ASEAN+3 Food Security Information Project
AfWCCI	African Water Cycle Coordination Initiative
AGEOS	Gabonese Studies and Space Observations Agency
AGI	Association of Geospatial Industries
AGU	American Geophysical Union
AH	Arctic Health
AI	The Arctic Institute
ALOS-2	Advanced Land Observing Satellite-2
ALTER Net	A Long-Term Biodiversity, Ecosystem and Awareness Research Network
AMAP	Arctic Monitoring and Assessment Programme (AC Working Group)
AMCOMET	African Ministerial Conference on Meteorology
AMESD	African Monitoring of the Environment for Sustainable Development
ANI	AirNow-International system
AntON	Antarctic Observing Network
AP	Arctic Portal
AP BON	Asia Pacific Biodiversity Observation Network
APECS	Association of Polar Early Career Scientists
APN	Asia-Pacific Network for Global Change Research
ARC	Agricultural Research Council
ARCCC	African Regional Centres on Climate Change
ArCS	Arctic Challenge for Sustainability Projects
ARCSSTE-E	African Regional Centre for Space Science and Technology Education
Arctic BON	Arctic Biodiversity Observation Network
ARSET	Applied Remote Sensing Training
ASDP	AirNow Satellite Data Processor
ASEAN	Association of Southeast Asian Nations
ASREN	Arab States Research and Education Network
AUC	African Union Commission
AUV	Autonomous Underwater Vehicle
AWCI	Asian Water Cycle Initiative
AWI	Alfred Wegener Institute
BAI	Bulgarian Antarctic Institute
BAS	British Antarctic Survey
BOEM	Bureau of Ocean Energy Management (US)
BoM	Australia Bureau of Meteorology
BON	Biodiversity Observation Networks

BRICS	Brazil, Russia, India, China and South Africa
BSC PS	Commission on the Protection of the Black Sea Against Pollution, BSC PS, Permanent Secretariat
CA	GEO Community Activity
CAF	Development Bank of Latin America
CAFF	Conservation of Arctic Flora and Fauna, AC Working Group
CARD	Cold and Arid Regions Science Data Center at Lanzhou
CAREERI	Cold and Arid Regions Environmental and Engineering Research Institute
CAS	Chinese Academy of Sciences
CATHALAC	Water Center for the Humid Tropics of Latin America and the Caribbean
CBD	Convention on Biological Diversity
CBERS	China–Brazil Earth Resources Satellite program
CBMP	Circumpolar Biodiversity Monitoring Program
CBS	Commission for Basic Systems (WMO)
CC	Creative Commons Organization
CCIN	Canadian Cryospheric Information Network
CCS	CO_2 capture and sequestration
CCT-IP	Climate Change Integrated Project (CNR)
C-DAC	Centre for Development of Advanced Computing
CEOS	Committee on Earth Observation Satellites
CGER	Center for Global Environmental Research (Japan)
CGIAR	Consortium of International Agricultural Research Centers
CGMS	Coordinating Group for Meteorological Satellites
CHFP	Climate-System Historical Forecast project
ChloroGIN	Chlorophyll Globally Integrated Network
CIEHLYC	Centre of Hydrologic and Spatial Information for Latin America and the Caribbean (Comunidad para la Información Espacial e Hidrográfica para Latinoamérica y el Caribe)
CIESIN	Center for International Earth Science Information Network
CIIFEN	International Research Centre on El Niño (Centro Internacional para la Investigación del Fenómeno de El Niño)
CILSS	Permanent Interstate Committee for Drought Control in the Sahel (Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel)
CIMMYT	International Maize and Wheat Improvement Center (CGIAR)
CIPA	International Committee for Documentation of Cultural Heritage
CIRMAG	Center for Scientific Investigation of the Magdalena River (Centro de Investigación Científica del Rio Magdalena/Colombia)
CliC	Climate and Cryosphere
CLIVAR	Climate and Ocean: Variability, Predictability and Change
CMA	China Meteorological Administration
CMCC	Euro-Mediterranean Center on Climate Change Foundation (Italy)
CMO	Caribbean Meteorological Organization
CNES	National Center for Space Study (Centre national d'études spatiales/France)
CNR	National Research Council (Italy)
CODATA	Committee on Data for Science and Technology
COMIFAC	Central African Forests Commission
COMNAP	Council of Managers of National Antarctic Programs
CONABIO	National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad/Mexico)
CONTRAIL	Comprehensive Observation Network for TRace gases by AIrLiner
CoP	Community of Practice

COP	Conference of the Parties
COSPAR	Committee on Space Research
CPCB	Central Pollution Control Board (India)
CPTEC	Center for Weather Forecasting and Climate Study (Centro de Previsão de Tempo e Estudos Climáticos/Brazil)
CRA	Cooperative Research Activities
CRTEAN	Regional Center for Remote Sensing North Africa States
CSIC	Spanish National Research Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CZCP	Coastal Zone Community of Practice
CUAHSI	Consortium of Universities for the Advancement of Hydrologic Science Inc.
DAB	Discovery and Access Broker
Data-CORE	Data Collection of Open Resources for Everyone
DCT	Data Coordination Team (of the CEOS)
DEM	Digital elevation model
DEVELOP	Digital Earth Virtual Environment Learning Outreach Project
DFD	German Remote Sensing Data Center
DIAS	Data Integration and Analysis System
DLR	German Aerospace Center
DMI	Danish Meteorological Institute
DMP	GEOSS data Management Principles
DOW	Document of Work
DP	Data Policy
DRAGON	ESA – NRSCC Program / Hydrology and Cryosphere Theme
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DTHA	Deterministic Tsunami Hazard Analysis
EARSC	European Association of Remote Sensing Companies
EARSel	European Association of Remote Sensing Laboratories
EAWAG	Swiss Federal Institute of Aquatic Science and Technology
EBV	Essential Biodiversity Variable
ECEM	European Climatic Energy Mixes project
ECMWF	European Centre for Medium-range Weather Forecasts
EC-PHORS	WMO Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services
ECV	Essential Climate Variable
EDO	European Drought Observatory
EDPC	Elevation dependent precipitation change
EDW	Elevation dependent warming
EEA	European Environmental Agency
EFFIS	European Forest Fire Information System
EGU	European Geosciences Union
EIS-AFRICA	Environmental Information Systems – AFRICA
EMEP	European Monitoring and Evaluation Program
ENEON	European Network of Earth Observation Networks
ENSO	El Niño-Southern Oscillation
EO	Earth Observation
EOV	Essential Ocean Variables
EPA	Environmental Protection Agency (US)
EPOS	European Plate Observing System

EPPR	Emergency Prevention, Preparedness and Response, AC Working Group
ESA	European Space Agency
ESIP	Federation of Earth Science Information Partners
ESSL	European Severe Storms Laboratory
EST	Education, Science and Technology
ET	Education and Training
ET	Evapotranspiration
ETC-UMA	European Topic Centre – University of Malaga
ETS	Emission Trading Schemes
EU-BON	European Biodiversity Observation Network
EU H2020	The EU Framework Programme for Research and Innovation 2014-2020
EUMETNET	Network of European Meteorological Services/Composite Observing System
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EUMON	EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest
EUREC	European Renewable Energy Centres Agency
EU SatCen	European Union Satellite Centre
EWV	Essential Water Variable
FAO	Food and Agricultural Organization
FDSN	Federation of Digital Broad-Band Seismograph Networks
FGDC	Federal Geographic Data Committee
FIES	Food Insecurity Experience Scale
Fire IT	Fire Implementation Team
FLUXNET	Network of regional flux networks
FSI	Forest Survey of India
FT	GEO Foundational Task
GAW	Global Atmosphere Watch (WMO)
GBD	Global Burden of Disease
GBIF	Global Biodiversity Information Facility
GCI	GEOSS Common Infrastructure
GCOM	Global Change Observation Mission
GCOS	Global Climate Observing System
GCP	Global Carbon Project, Int.
GCW	Global Cryosphere Watch
GDIS	Global Drought Information System
GÉANT	Pan-European research and education network that interconnects Europe's National Research and Education Networks
GEF	Global Environment Facility
GEM	Global Earthquake Model Foundation
GEO	Group on Earth Observations
GEO BON	GEO Biodiversity Observation Network
GEO-CRADLE	Coordinating and integRating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS
GEOCRI	GEO Cold Regions Initiative
GEO-DARMA	GEO Data Access for Risk Management
GEO ECO	GEO Global Ecosystem Initiative
GEOGLAM	GEO Global Argicultural Monitoring
GEOGLOWS	GEO Global Water Sustainability
GEO-GNOME	GEO Global Network for Observation and Information in Mountain Environments

GEO PB	GEO Programme Board
GEOSS	Global Earth Observation System of Systems
GEP	Geohazards Exploitation Platform
GEUS	Geological Survey of Denmark and Greenland
GEWEX	Global Energy and Water cycle Exchanges Project
GFDRR	Global Facility for Disaster Reduction and Recovery
GFOI	Global Forest Observations Initiative
GFP	Global Flood Partnership
GGIM	UN Initiative on Global Geospatial Information Management
GHG	Greenhouse Gas
GI	GEO Initiative
GIEWS	Global Information and Early Warning System
GINR	Greenland Institute of Natural Resources
GIS	Geographical Information System
GISC	Global Institute of Sustainable Cities
GLERL	Great Lakes Environmental Research Laboratory
GLISN	Greenland Ice Sheet Monitoring Network
GLMS	Glacier Lake Monitoring System
GLOBE	Global Learning and Observations to Benefit the Environment
GLOBIS-B	GLOBal Infrastructures for Supporting Biodiversity research
GLODAP	GLobal Ocean Data Analysis Project
GLOF	Glacial Lake Outburst Flood
GloFAS	Global Flood Awareness System
GLOS	Great Lakes Observing System
GLOWS	Global Water Security
GMBA	Global Mountain Biodiversity Assessment
GMOS	Global Mercury Observation System
GMW	Global Mangrove Watch
GNC	GEONETCast
GNOMO	Global Network of Mountain Observatories
GNSS	Global Navigation Satellite System
GODI	Global Open Data Initiative
GOFC	Global Observation of Forest Cover
GOLD	Global Observation of Land Dynamics
GOOS	Global Ocean Observing System
GOSAT -2	Greenhouse Gases Observing Satellite
GO-SHIP	Global Ocean Ship-based Hydrographic Investigations Program
GPCC	Global Precipitation Climatology Centre
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GRACE	Gravity Recovery and Climate Experiment
GRSS	Geoscience and Remote Sensing Society
GSAC	Geodetic Seamless Archive Centers
GSC	Geographical Society of China
GSDI	Global Spatial Data Infrastructure
GSEO	Global System of Ecosystem Observatories
GSFC	Goddard Space Flight Center
GSMaP	Global Satellite Map of Precipitation
GSNL	Geohazard Supersites and Natural Laboratories
GSSTI	Ghana Space and Technology Institute
GTN-H	Global Terrestrial Network for Hydrology
GTN-P	Global Terrestrial Network for Permafrost

GTOS	Global Terrestrial Observing System
GTS	Global Telecommunications System (WMO)
GWOS	Global Wetlands Observing System
GWSP	Global Water System Project
HDDS	Hazard Data Distribution System (USGS)
HIWeather	High Impact Weather Project
HKKH	Hindu Kush –Karakoram– Himalayas
HMA	High Mountain Asia Workshops
HOT	Humanitarian OpenStreetMap Team
HRCF	Himalayan Research and Cultural Foundation
HRPP	High-Resolution Precipitation Products
IAEG	Inter-agency and Expert Group
IAF	International Astronautical Federation
IAG	International Association of Geodesy
IAGOS	In-service Aircraft for a Global Observing System
IAHS	International Association of Hydrological Sciences
IASC	International Arctic Science Committee
i-BEC	Inter-Balkan Environment Centre
IC	Implementation Committee
ICA	International Cartographic Association
ICARP III	The Third International Conference on Arctic Research Planning
ICC	Implementation Coordination Committee
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICIMOD	International Center for Integrated Mountain Development
ICOMOS	International Council on Monuments and Sites
ICOS	Integrated Carbon Observation System
ICRC	International Committee of the Red Cross/Red Crescent
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics (CGIAR)
ICSU	International Council of Scientific Unions
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia
iDiv	German Centre for Integrative Biodiversity Research
IEEE	Institute of Electrical and Electronics Engineers
IFPRI	International Food Policy Research Institute (CGIAR)
IG^3IS	Integrated Global Greenhouse Gas Information System, Intl.
IGAD	Intergovernmental Authority on Development
IGBP	International Geosphere-Biosphere Program
IGRAC	International Groundwater Resources Assessment Centre
IGU	International Geographical Union
IGWCO	Integrated Global Water Cycle Observations
IHDP	International Human Dimensions Program
IHME	Institute for Health Metrics and Evaluation (US)
IHO	International Hydrographic Organization
IHP	International Hydrologic Programme
IIA	Institute of Atmospheric Pollution Research
IIASA	International Institute for Applied Systems Analysis
IISD	International Institute for Sustainable Development
IISL	International Institute for Space Law
ILRI	International Livestock Research Institute (CGIAR)
ILTER	International Long-Term Ecosystem Research Network

IMAU	Institute for Marine and Atmospheric research Utrecht (the Netherlands)
INCOSE	International Council on Systems Engineering
INPE	Instituto Nacional de Pesquisas Espaciais - Brazil
InSAR	Synthetic Aperture Radar interferometry
INTERACT	International Network for Terrestrial Research and Monitoring in the Arctic
INVEMAR	José Benito Vives de Andréis Instituto de Investigaciones Marinas y Costeras
IO3C	International Ozone Commission
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange
IPA	International Permafrost Association
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPRs	Intellectual Property Rights
IREA-CNR	Institute for Electromagnetic Sensing of Environment
IRENA	International-Renewable Energies Agency
IRI	International Research Institute (Columbia University)
IRIS	Incorporated Research Institutions for Seismology
IRRI	International Rice Research Institute (CGIAR)
ISAC-CNR	Institute of Atmospheric Science and Climate
ISCGM	International Steering Committee for Global Mapping
ISDE	International Society for Digital Earth
ISMiTSC	Impervious Surface Mapping in Tropical and Subtropical Cities
ISPRS	International Society for Photogrammetry and Remote Sensing
ISRO-SAC	Indian Space Research Organization – Space Application Center
IT	Information Technology
ITC	International Institute for Geo-Information Science and Earth Observation
ITP	Institute of Tibetan Plateau Research
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
IWMI	International Water Management Institute
IWP	Integrated Water Prediction
IWRM	Integrated Water Resources Management
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JAXA	Japan Aerospace Exploration Agency
JBGIS	Joint board of Geospatial Information Societies
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology
JMA	Japan Meteorological Agency
JpGU	Japan Geoscience Union
JRC	Joint Research Centre (EC)
KO	Kick-Off
LMIC	Low and Middle Income Country
LPI	Living Planet Index
LRTAP	Convention on Long-range Transboundary Air Pollution (UNECE)
LSCE	Climate and environmental sciences laboratory (Laboratoire des Sciences du climat et de l'environnement, France)
LST	Land surface temperature
LTER	Long-Term Ecological Research
MBON	Marine Biodiversity Observation Network

MC	Management Committee
MESA	Monitoring for Environment and Security in Africa
MENA	Middle East-North Africa
MGD	Methods and Guidance Documentation
MKF	Mariolopoulos-Kanaginis Foundation for the Environmental Sciences
MRI	Meteorological Research Institute (Japan)
MRI	Mountain Research Institute
MRV	Measuring, Reporting and Verification
MODIS	Moderate Resolution Imaging Spectroradiometer
MOEJ	Ministry of the Environment of Japan
MOL	Map of Life
MOM	Megacities Observation and Monitoring
MSFD	European Marine Strategy Framework Directive
MTS	The Marine Technology Society
MUL	Method Usability Level
NADM	North American Drought Monitor
NARSDA	National Space Research and Development Agency
NARSS	National Authority for Remote Sensing & Space Sciences (Egypt)
NASA	National Aeronautics and Space Administration
NCEP	National Centers for Environmental Prediction (US)
NEON	National Ecological Observatory Network (US)
NERSC	Nansen Environmental and Remote Sensing Center
NEWA	New European Wind Atlas
NGO	Non-Governmental Organization
NGWMN	National Groundwater Monitoring Network
NHYM	National Hydrologic Model
NIDIS	National Integrated Drought Information System (US)
NIES	National Institute for Environmental Studies (Japan)
NIPR	National Institute of Polar Research
NLCD	National Land Cover Database (US)
NMHS	National Meteorological and Hydrological Services
NMME	North American Multi-model Ensemble
NOAA	National Oceanic and Atmospheric Administration (US)
NPO	Near-Polar Orbiting
NRENs	National and Regional Research Networks
NRT	Near Real Time
NSC	Norway Space Centre
NSF	National Science Foundation (US)
NSIDC	National Snow and Ice Data Center (US)
NWC	National Water Center (US)
NWS	National Weather Service (US)
OBFS	Organization of Biological Field Stations
OBIS	Ocean Biogeographic Information System
OCCCO	Office for Coordination of Climate Change Observation (Japan)
OCO-2	Orbiting Carbon Observatory-2
ODIP	Ocean Data Interoperability Platform
OECD	Organisation for Economic Co-operation and Development
OGC	Open Geospatial Consortium
OpenDRI	Open Data for Resilience Initiative
OSS	Sahara and Sahel Observatory

PA	Priority Area
PAGE21	Changing Permafrost in the Arctic and is Global Effects in the 21st Century
PAME	Protection of the Arctic Marine Environment
PB	GEO Programme Board
PDC	Polar Data Catalogue
PEEX	Pan-Eurasian Experiment Program
PM	Person Month
PMEL	Pacific Marine Environmental Laboratory
POGO	Partnership for Observation of the Global Oceans
POP	Persistent Organic Pollutant
PPP	Polar Prediction Program
PRCC	Polar Regional Climate Centre
PREDICTS	Projecting Responses of Ecological Diversity In Changing Terrestrial Systems
PTHA	Probabilistic Tsunami Hazard Analysis
RADI	Institute of Remote Sensing and Digital Earth (Chinese Academic of Science)
RAPP	Rangeland and Pasture Productivity
R&D	Research and Development
RCC	Regional Climate Center
RCMRD	Regional Centre for Monitoring of Resources for Development
RCOF	Regional Climate Outlook Forum
RDA	Research Data Alliance
RE	Renewable Energy
RECs	Regional Economic Community
RECCAP-2	Regional Carbon Cycle Assessment and Processes-2
RECTAS	Regional Centre for Training in Aerospace Surveys
REDD	Reducing Emissions from Deforestation and forest Degradation
REDD+	REDD in developing countries
S2S	Sub-seasonal to seasonal prediction
SAC	Scientific Advisory Committee
SADC	Southern African Development Community
SAFARI	Societal Applications in Fisheries and Aquaculture of Remote-sensing Imagery
SALSA	South American Land Data Assimilation System
SANSA	South African National Space Agency
SAON	Sustaining Arctic Observing Networks
SAR	Synthetic Aperture Radar
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SB	Small Baseline
SBA	Societal Benefit Area
SCAR	Scientific Committee on Antarctic Research
SCOR	Scientific Committee on Oceanic Research
SDC	Swiss Development Cooperation Agency
SDG	Sustainable Development Goals
SDSN	Sustainable Development Solutions Network
SEC	Stakeholder Engagement Committee
SEEA–EEA	System of Environmental-Economic Accounting (SEEA) Experimental Ecosystem Accounting (EEA)
SERVIR	The Regional Visualization and Monitoring System (“to serve” in Spanish)
SES	Social-ecological system

SETAC	Society of Environmental Toxicology and Chemistry
S:GLA:MO	Slope Stability and Glacial Lake Monitoring
SICA/CCAD	Central American Commission for the Environment and Development
SIOS	Svalbard Integrated Arctic Earth Observing System
SLC	Science Leadership Council (MRI)
SNSF	Swiss National Science Foundation
SOCAT	Surface Ocean CO_2 Atlas
SOCCOM	Southern Ocean Carbon and Climate Observations and Modeling project
SOOS	Southern Ocean Observing System
SOPAC	South Pacific Applied Geoscience Commission
SOS	Sensor Observation Service
SOTP	Snow Observations over Tibetan Plateau
SPI	Standardized Precipitation Index
SPOT	Satellite for observation of Earth (Satellite Pour l'Observation de la Terre)
SRON	Netherlands Institute for Space Research (the Netherlands)
SSARA	Seamless SAR Archive
STC	Specialized Technical Committee
STI	Science, Technology and Innovation
STRP	Scientific and Technical Review Panel of the Ramsar Convention
SWF	Secure World Foundation
SWFP	Sustainable Water Future Programme
SWOS	Satellite Wetland Observation Service (EU Horizon 2020 Project)
TanSat	Chinese Carbon Dioxide Observation Satellite Mission
TBC	To Be Confirmed
TBD	To Be Defined
TCCON	Total Carbon Column Observing Network
TPE	Third Pole Environment
TREASURE	Thermal Risk rEduction Actions and tools for SecURE cities
UCAR	University Corporation for Atmospheric Research
UHOP	Unified high elevation observing platform
UN	United Nations
UNAVCO	University NAVSTAR Consortium
UNCCD	Secretariat of the UN Convention to Combat Desertification
UN-CEEA	UN Committee on Environmental and Economic Accounts
UNDP	UN Development Programme
UNECA	UN Economic Commission of Africa
UNECE	UN Economic Commission for Europe
UNEP	UN Environment Programme
UNEP-GRID	UNEP Global Resource Information Database
UNEP-WCMC	UNEP World Conservation Monitoring Centre
UNESCAP	UN Economic and Social Commission for Asia and the Pacific
UNESCO	UN Educational, Scientific and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
UNGGIM	UN Initiative on Global Geospatial Information
UNISDR	UN office for Disaster Risk Reduction
UNITAR	UN Institute for Training and Research
UNOOSA	UN Office for Outer Space Affairs
UNSC	UN Statistical Commission
UNU-EHS	UN University, Institute for Environment and Human Security
UN-SPIDER	UN Platform for Space-based Information for Disaster Management and Emergency

	Response
URCM	Urban and Regional Carbon Management
USAID	US Agency for International Development
USAP	US Antarctic Program
USGEO	US Group on Earth Observations
USGS	US Geological Survey
VOS	Voluntary Observing Ship
VRE	Virtual Research Environment
WAVES	Wealth Accounting and Valuation of Ecosystem Services (World Bank Partnership)
WCDRR	World Conference on Disaster Risk Reduction
WCI	Water Cycle Integrator
WCRP	World Climate Research Programme
WDCDGG	World Data Center-D for Glaciology and Geocryology
WDCGG	World Data Centre for Greenhouse Gases
WDS	World Data System
W-E-F	Water-Energy-Food (Nexus)
WFP	World Food Program
WFPHA	World Federation of Public Health Associations
WG	Working Group
WGDisasters	Working Group on Disasters (CEOS)
WHO	World Health Organization
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WOC	World Ocean Council
WOVO	World Organization of Volcano Observatories
WP	Work Package
WRDS	Water Resources Data Service
WRF	Weather Research Forecast (model)
WWRP	World Weather Research Programme
YOPP	Year of Polar Prediction
ZSL	Zoological Society of London

APPENDIX 2: LIST OF POINTS OF CONTACT FOR COMMUNITY ACTIVITIES, GEO COMMUNITY ACTIVITIES, INITIATIVES AND FOUNDATIONAL TASKS

Secretariat support contact information:

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GEO Community Activity	Leadership	Secretariat support
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AFRICAN GEOCHEMICAL BASELINES	Claudia Delfini (Eurogeosurveys), claudia.delfini@eurogeosurveys.org	Geller
AIRNOW INTERNATIONAL: EXPANDING NETWORKS AND INTEGRATING METHODS FOR AIR QUALITY AND HEALTH DATA	William Sontag (EPA/USA), sonntag.william@epa.gov	Cripe
AQUAWATCH	Steven Greb (Wisconsin Department of Natural Resources /USA), steven.greb@wisconsin.gov Emily Smail (NOAA/USA), emily.smail@noaa.gov	Aellen
CHINESE TSUNAMI MITIGATION SYSTEM	WEN Ruizhi (Institute of Engineering Mechanics, China Earthquake Administration), ruizhi@iem.ac.cn	Xing/Aellen
COPERNICUS ATMOSPHERIC MONITORING SERVICE (CAMS)	Vincent-Henri Peuch (ECMWF), vincent-henri.peuch@ecmwf.int	Obregón
COPERNICUS CLIMATE CHANGE SERVICE (C3S)	Jean-Noel Thepaut (ECMWF/UK), jean-noel.thepaut@ecmwf.in>	Obregón

GEO Community Activity	Leadership	Secretariat support
DATA ANALYSIS AND INTEGRATION SYSTEM (DIAS)	Toshio Koike, Japan (University of Toyko/ICHARM/Japan), tkoike@hydra.t.u-tokyo.ac.jp	Aellen
DIGITAL GEOMUSEUM	lchuang@igsnrr.ac.cn	Xing
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EARTH OBSERVATIONS FOR CULTURAL HERITAGE DOCUMENTATION	Petros Patias (Aristotle University/Greece), patias@auth.gr	Chu
EARTH OBSERVATIONS FOR DISASTER RISK MANAGEMENT	Ivan Petiteville (CEOS), ivan.petiteville@esa.int Kerry Sawyer (NOAA/USA), kerry.sawyer@noaa.gov	Sawyer/Aellen
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EARTH OBSERVATIONS FOR MANAGING MINERAL AND NON-RENEWABLE ENERGY RESOURCES	Stéphane Chevrel (MinPol/France), chevrel@chevrel.eu	Obregón
EARTH OBSERVATIONS FOR THE WATER-ENERGY-FOOD (W-E-F) NEXUS	Richard Lawford (Morgan State University/USA), rlawford@gmail.com Charles J. Vörösmarty (CUNY Environmental CrossRoads Research Group, City University of New York/USA), cvorosmarty@ccny.cuny.edu Rifat Hossain (WHO), hossainr@who.int	Aellen
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GLOBAL AGRICULTURAL DROUGHT MONITORING	Fan Jinlong (RADI/China), caufjl@263.net Jai Singh Parihar (former IRSO/India), jsparihar@yahoo.com Wu Jianjun (BNU/China), wujj@bnu.edu.cn	Aellen/Obregón
GLOBAL FLOOD AWARENESS SYSTEM (GloFAS)	Fredrik Wetterhall (ECMWF), fredrik.wetterhall@ecmwf.int	Obregón/Aellen
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GFCS - GEO COLLABORATION	Meredith Muth (NOAA, USA), meredith.f.muth@noaa.gov Stefan Rösner, (DWD, Germany), stefan.roesner@dwd.de	Obregón
GLOBAL MANGROVE MONITORING	Chandra Giri (EPA/USA), giri.chandra@epa.gov	Geller

GEO Community Activity	Leadership	Secretariat support
HARMFUL ALGAL BLOOM (HAB) EARLY WARNING SYSTEM	Juli Trtanj (NOAA/USA), juli.trtanj@noaa.gov	Geller
HIMALAYAN GEOSS	Basanta Shrestha (ICIMOD), Basanta.Shrestha@icimod.org Birendra Bajracharya (ICIMOD), Birendra.Bajracharya@icimod.org	Chu
IN-SITU OBSERVATIONS AND PRACTICES FOR THE WATER CYCLE	Wolfgang Grabs (GTN-H/Germany), Grabs@bafg.de	Aellen
LAND COVER AND LAND COVER CHANGE	Andreas Brink (JRC/EC), andreas.brink@jrc.ec.europa.eu Zoltan Szantoi (JRC/EC), zoltan.szantoi@jrc.ec.europa.eu Brice Mora (GOFC-GOLD/GTOS), brice.mora@wur.nl Martin Herold (GOFC-GOLD/GTOS), martin.herold@wur.nl Chen Jun (NGCC/ISPRS/China), chenjun@nsdi.gov.cn Steffen Fritz (IIASA), fritz@iiasa.ac.at	Obregón/Geller
RESEARCH DATA SCIENCE SUMMER SCHOOLS	Simon Hodson (CODATA/RDA), simon@codata.org	Mlisa
SPACE AND SECURITY	Sergio Albani (SatCen), Sergio.Albani@satcen.europa.eu	Ochiai
SYNERGIZED MULTI-SOURCE REMOTE SENSING PRODUCTS AND SERVICES	LIU Qinhuo (RADI-CAS/China), liuqh@radi.ac.cn	Chu
TIGGE (THORPEX INTERACTIVE GRAND GLOBAL ENSEMBLE) EVOLUTION INTO A GLOBAL INTERACTIVE FORECAST SYSTEM (GIFS)	Manuel Fuentes (ECMWF), Manuel.Fuentes@ecmwf.int Chinese Meteorological Administration (CMA)/China	Obregón

GEO Initiative	Leadership	Secretariat support
AFRIGEOSS: REINFORCING REGIONAL AFRICAN ENGAGEMENT	Andiswa Mlisa (GEO Secretariat/South Africa), amlisa@geosec.org	Mlisa
AMERIGEOSS	Angelica Gutierrez-Magness (NOAA/USA), angelica.gutierrez@noaa.gov	Cripe/Geller
ASIA-OCEANIA GEOSS (AOGEOSS)	Xingfa Gu (RADI/CAS/China), guxingfa@radi.ac.cn David Hudson (Geosciences Australia), David.Hudson@ga.gov.au Toshio Koike (The University of Tokyo/Japan), tkoike@hydra.t.u-tokyo.ac.jp	Chu/Ochiai
CLIMATE CHANGE IMPACT OBSERVATION ON AFRICA'S COASTAL ZONES (GEO-CCIOACZ)	Mahmoud Ahmed (NARSS/Egypt), mahahmed_narss@narss.sci.eg	Cripe/Obregón
DATA ACCESS FOR RISK MANAGEMENT (GEO-DARMA)	Ivan Petiteville (ESA), ivan.petiteville@esa.int	Sawyer/Aellen
EARTH OBSERVATIONS FOR ECOSYSTEM ACCOUNTING (EO4EA)	John Matuszak (Department of State/USA), MatuszakJM@state.gov	Geller
EARTH OBSERVATIONS IN SERVICE OF THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT	Lawrence Friedl (NASA/USA), lfriedl@nasa.gov Chu Ishida (JAXA/Japan), ishida.chu@jaxa.jp Jose Eduardo De LA Torre Barcena (INEGI/Mexico), jdelatorre@inegi.org.mx	Rum
GEO CARBON AND GREENHOUSE GAS INITIATIVE	Antonio Bombelli (Euro-Mediterranean Center on Climate Change Foundation/Italy), antonio.bombelli@cmcc.it	Obregón
GEO COLD REGIONS INITIATIVE (GEO CRI)	Yubao Qiu (RADI/China), qiuyb@radi.ac.cn	Aellen
GEOHAZARD SUPERSITES AND NATURAL LABORATORIES (GSNL)	Stefano Salvi (INGV/Italy), stefano.salvi@ingv.it	Sawyer/Aellen
GEO GLOBAL ECOSYSTEM INITIATIVE (GEO ECO)	Antonello Provenzale (CNR/Italy), antonello.provenzale@cnr.it	Geller
GEO GLOBAL NETWORK FOR OBSERVATION AND INFORMATION IN MOUNTAIN ENVIRONMENTS (GEO-GNOME)	Gregory Greenwood (MRI), greg.greenwood@giub.unibe.ch Elisa Palazzi (CNR/Italy), e.palazzi@isac.cnr.it	Geller

GEO Initiative	Leadership	Secretariat support
GEO GLOBAL WATER SECURITY (GEOGLOWS)	Bradley Doorn (NASA/USA), bradley.doorn@nasa.gov Angelica Gutierrez (NOAA/USA), angelica.gutierrez@noaa.gov Nathaniel Booth (USGS/USA), nlbooth@usgs.gov	Aellen
GEO HUMAN PLANET INITIATIVE: SPATIAL MODELING OF IMPACT, EXPOSURE AND ACCESS TO RESOURCES	Martino Pesaresi (JRC/EC), martino.pesaresi@jrc.ec.europa.eu	Obregón/Chu
GEOSS-EVOLVE	Ivan DeLoatch (Federal Geographic Data Committee/USA), ideloatch@usgs.gov Max Craglia, (JRC/EC), massimo.craglia@jrc.ec.europa.eu	Ochiai
GEO VISION FOR ENERGY (GEO VENER)	Thierry Ranchin (MINES ParisTech/France), thierry.ranchin@mines-paristech.fr	Obregón
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GLOBAL OBSERVATION SYSTEM FOR PERSISTENT ORGANIC POLLUTANTS (GOS4POPS)	Jana Klánová (Research Centre for Toxic Compounds in the Environment-RECETOX/Czech Republic), klanova@recetox.muni.cz Katarina Magulova (UNEP)-Secretariat of the Basel, Rotterdam and Stockholm Conventions), katarina.magulova@brsmeas.org	Cripe
GLOBAL URBAN OBSERVATION AND INFORMATION	Qihao Weng (Indiana State University/USA), qweng@indstate.edu	Obregón/Chu
GLOBAL WILDFIRE INFORMATION SYSTEM (GWIS)	Jesus San-Miguel-Ayanz (JRC/EC), jesus.san-miguel@jrc.ec.europa.eu	Sawyer/Aellen
OCEANS AND SOCIETY: BLUE PLANET	Sophie Seeyave (POGO), ssve@pml.ac.uk	Cripe

GEO Flagship	Leadership	Secretariat support
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GEO GLOBAL AGRICULTURAL MONITORING (GEOGLAM)	Michel Deshayes (GEOGLAM Coordinator/France), mdeshayes@geosec.org Inbal Becker-Reshef (NASA/University of Maryland/USA), ireshef@umd.edu Alyssa Whitcraft (NASA/University of Maryland/USA), alyssakw@umd.edu	Deshayes
GLOBAL FOREST OBSERVATION INITIATIVE (GFOI)	Thomas Harvey (FAO), thomas.harvey@fao.org	Ochiai
GLOBAL OBSERVATION SYSTEM FOR MERCURY (GOS4M)	Nicola Pirrone (CNR/Italy), pirrone@iia.cnr.it	Cripe

ANNEX: BRANDING GUIDELINES

BRANDING GUIDELINES FOR GEO

BRANDING GUIDELINES FOR GEO

The following Branding Guidelines are designed to increase GEO's visibility by better communicating, through use of consistent branding, the work being done within the GEO framework. Common and consistent usage of the GEO logo will create more alignment and visibility within the GEO community and externally, thereby reinforcing the significant contributions the GEO community is making globally to coordinated, comprehensive and sustained Earth observations.

From its inception, GEO has been designed to integrate data and information, largely created by its Members and Participating Organizations, and to facilitate the development of products and services using this integrated information. So while the actual ownership of the composite parts lie with the contributing institutions, it is the sum total of these global contributions that are branded as enabled by the GEO framework.

These Branding Guidelines are designed to visually and thematically reinforce the *GEO Strategic Plan 2016 – 2025: Implementing GEOSS*, particularly GEO's mission, to connect the demand for reliable and timely environmental data and information with the supply of data and information available through the Global Earth Observation System of Systems (GEOSS). Quality, consistent branding is essential to maintain the visibility and credibility of GEO as a sound intergovernmental organization as well as bring increased recognition of the added value that working within the GEO framework brings by building on community contributions across, and among, the immense range of stakeholders involved. Branding guidelines are provided for consistent use of

I. The GEO logo, GEO tagline; and GEO Vision;
II. Increased use of the GEO brand in, and for, GEO Flagships, Global and Regional Initiatives, Community Activities, National GEO logos and GEOSS references and data.

Resources for the GEO logo, templates and up-to-date standard texts are available on the branding page of the GEO **website**.

These branding resources are provided to organizations, entities and individuals contributing to the GEO Work Programme as tools to aid implementation of the branding guidelines.

GEO Flagships are required, and GEO Initiatives are encouraged, to show how they will comply with these guidelines as part of their proposals for inclusion in the GEO Work Programme.

1 THE GEO LOGO, GEO TAGLINE, AND GEO VISION

1.1 GEO Logo

Use of the GEO logo is intended for events (conferences, meetings, symposia), publications, reports, websites and other on-line material produced within the GEO framework and/or co-sponsored by GEO.

The GEO logo has been branded with both form and a colour palate. One of the three logos shown below may be used, depending on function, format, space available and audience familiarity with GEO. For further branding recommendations, see the *GEO Style Guide*.

1.2 Standalone GEO Logo

For broad use in banners and event information such as websites or pamphlets which include a list of other organizations and their logos. This is particularly useful when the audience is familiar with GEO, and therefore does not need the organizational name. It is concise, strong and holds up very well in comparison to many other organizational logos.

1.3 GEO logo with organization name

For use where audience familiarity with GEO is limited, or lacking altogether.

1.4 GEO logo - letterhead

For use on letterhead– generally GEO Secretariat use only.

1.5 Use of the GEO tagline

A tagline can also reinforce participation in GEO. We therefore encourage use of taglines as another means to show connections to GEO. The following are suggested GEO taglines that can be used at the bottom of web pages and on relevant reports and publications:

1. Contributing to the Vision of GEO;
2. Contributing to GEO Objectives;
3. Developed within the GEO Framework (for reports);
4. Powered by GEOSS (for GEOSS-linked applications).
5. Enabled by GEO and/or Enabled by GEOSS

1.6 GEO Vision

"To realize a future wherein decisions and actions, for the benefit of humankind, are informed by coordinated, comprehensive and sustained Earth observations and information."

1.7 GEO Background Text

Standard background text is maintained on the GEO website to describe GEO's Vision and organization, with the most up-to-date information on the number of Members, Participating Organizations and Observers.

For the current text, see the branding page, and current list of Members, Participating Organizations and Observers.

2 INCREASED USE OF THE GEO BRAND IN, AND FOR, GEO FLAGSHIPS, GLOBAL AND REGIONAL INITIATIVES, COMMUNITY ACTIVITIES, NATIONAL GEO LOGOS, AND GEOSS REFERENCES AND DATA

2.1 GEO Flagships or GEO Initiatives

Logos for GEO Flagships (required) and GEO Initiatives (recommended).

GEO Flagships are required, and GEO Initiatives are encouraged, to show how they will comply with GEO branding guidelines as part of their proposals for inclusion in the GEO Work Programme.

When the Flagship or Initiative name includes the letters 'GEO', the three-letter logo (font and colors) described above should be used. Integrating this logo into the Flagship/Initiative logo helps make the GEO connection instantly recognizable. When the name does not include GEO, using GEO's color palates and logo font (Segoe UI Semibold) can produce a similar effect. Examples of both include:

2.2 GEO Flagship or GEO Initiative Taglines

A tagline that makes explicit reference to which institutional decision-making process the Initiative supports is recommended for GEO Flagships and GEO Initiatives. The GEO Secretariat is available to work with Flagships and Initiatives to compose appropriate taglines.

The suggested format is along the following lines:

Initiative name / action / *policy framework /* with / *output service.*

e.g. GEOGLAM, through its Early Warning Crop Monitor, harnesses data and information to support the G20 Agriculture Ministers' Directive and the Global 2030 Agenda on creating a more food secure world.

2.3 Branding Templates for GEO Flagships and GEO Initiatives

Templates for GEO Flagships and GEO Initiatives will be made available on the branding page of the GEO website for the following:

- Publications, brochures, other reports, e.g. the Flagship/Initiative should feature the GEO logo on the front cover of the publication, preferably top left;

- Pamphlets should be produced in A5 size to conform with existing information pamphlets about GEO Flagships/Initiatives;
- PowerPoint presentations;
- Posters; and
- Banners.

Web pages: the GEO logo should appear in the top left of the home page banner, with the GEO Flagship/Initiative appearing top right. The GEO logo in the Flagship/Initiative banner should be a hyperlink to the GEO website homepage, as the Flagship/Initiative logos are hyperlinked to their websites from the GEO website homepage. Hyperlinks to the relevant GEO webpage are also suggested when a GEO Initiative publishes information about an event or meeting.

2.4 Branding for GEO Community Activities

Community Activities, while much more distributed, can also take advantage of the GEO Brand. The example below is from the European project titled ConnectinGEO, which clearly shows the linkages with GEO.

2.5 Branding GEOSS

A logo for GEOSS, the Global Earth System of System has also been created.

GEOSS GEOSS
Global Earth Observation System of Systems

The graphics below reflect the renewed commitment to build a Global Earth Observation System of Systems (GEOSS) for societal benefit.

Additional Societal Benefit Area graphics are available on the GEO website branding page.

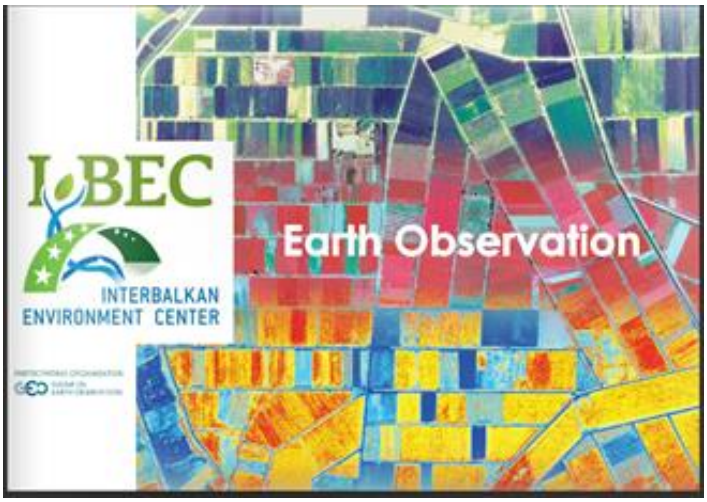
2.6 National GEOs

Increasingly, GEO Members are creating logos for their national efforts. Shown below are some very good examples where the GEO Branding Guidelines have been employed by Austria, China, France, Greece and South Africa.

As shown above, the national logo should integrate the GEO logo. Font and colour schemes for additional letters are available in the Style Guide.

2.7 Branding by GEO Participating Organizations

Some Participating Organizations have also implemented these branding guidelines as a means to give their participation in GEO more visibility, as well as give more visibility to GEO and its brand. A good example of this is shown below from the GEO Participating Organization – the Inter-Balkan Environment Center (i-BEC).



2.8 Branding data

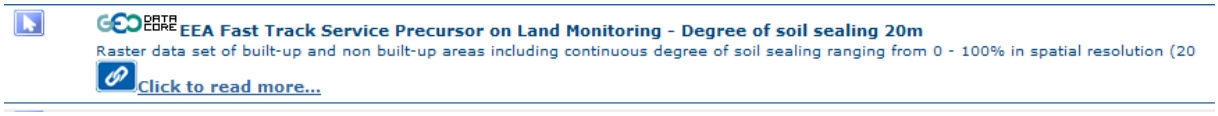
GEO recognizes that the societal benefits arising from Earth observations can only be fully achieved through the sharing of data, information, knowledge, products and services. GEO has therefore promoted fundamental principles for data sharing and re-use, expanding the trend towards open data worldwide. Use of data provided by the GEO community through the GEOSS Common Infrastructure (GCI) is growing. From January to June 2016 there were more than 4.2 million queries to the GCI, double the number of queries from the previous year, and an order of magnitude more than in 2014.

GEOSS Data Sharing Principles

Data outputs from GEO Initiatives and GEO Flagships are to conform to this latest version of the Data Sharing Principles:

- Data, metadata and products will be shared as Open Data by default, by making them available as part of the GEOSS Data Collection of Open Resources for Everyone (Data-CORE) without charge or restrictions on reuse, subject to the conditions of registration and attribution when the data are reused;
- Where international instruments, national policies or legislation preclude the sharing of data as Open Data, data should be made available with minimal restrictions on use and at no more than the cost of reproduction and distribution; and
- All shared data, products and metadata will be made available with minimum time delay.

Data that conforms with the Data Sharing Principles is branded in the GCI as GEOSS Data Collection of Open Resources for Everyone (GEOSS Data-CORE). A tagline of "part of GEOSS Data-CORE" may also serve useful in some instances. The Data Core logo and tag line may also be used in other organizational or community portals for datasets conforming to GEO's Data Sharing Principles.



GEOSS Data Management Principles

To further maximize the value and benefits arising from Earth observation data, GEO continues to work with partners to promote the use of the GEOSS Data Management Principles adopted at GEO-XII Plenary in 2015. The 10 principles address the need for common standards and interoperability arrangements to facilitate re-use of data, and are laid out under five headings: discoverability, accessibility, usability, preservation and curation. A dataset that adheres to these principles is considered valuable, and through the use of a GEO data label for the data management principles, can be recognized more easily for its quality.

Data outputs from Community activities, GEO Initiatives and GEO Flagships that conform to the Data Management Principles may be branded either with an integrated label showing conformity with principles or individual icons for each data management principle. The integrated label or the icons may also be used in organizational or in community portals or websites for datasets conforming to the GEO Data Management Principles. Information on how to apply the Data Management Principles as well as icons both for the integrated GEO label icon and also for individual principles is available at www.geolabel.info

Example of a proposed icon for data discoverable in the GCI, one of the 10 Data Management Principles.