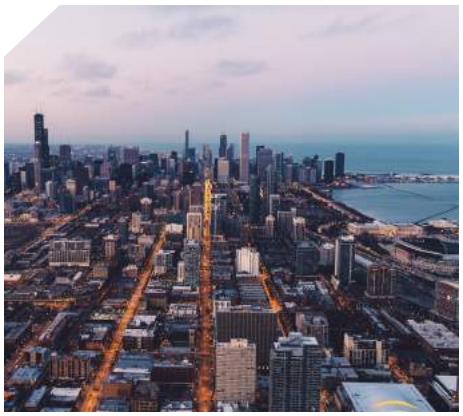
GROUP ON EARTH OBSERVATIONS


2020-2022 GEO WORK PROGRAMME

SUMMARY DOCUMENT
VERSION 1




www.earthobservations.org

Preface

This document is the first draft of the GEO Work Programme Summary Document for the period 2020 to 2022. It describes what will become the seventh such GEO Work Programme (formerly called GEO Work Plan) since GEO began in 2005.

As will be described in greater detail in the next section, the process of developing a Work Programme unfolds over a period of about one year, from the approval of the last update to the previous Work Programme, to the approval of the new Work Programme by the GEO Plenary. An important part of this process is broad consultation with all members of the GEO community, including with the organizations and individuals who contribute their time and resources to the activities that comprise the GEO Work Programme, GEO Members and Participating Organizations, and with many other stakeholders. The present document provides the first opportunity for the GEO community to see the emerging content of the 2020-2022 Work Programme and to thereby help shape it as it proceeds toward its final approval.

This Summary Document is a compilation of the Executive Summaries from the proposed Implementation Plans received by the GEO Secretariat as of 10 May 2019. Additional Implementation Plans are expected to be submitted before the 2020-2022 GEO Work Programme development process is completed. The full Implementation Plans, where available, may be accessed via the GEO website and by following links in the short titles of each of the activities.

It should be recognized that the Implementation Plans are still under review by the GEO Programme Board and the GEO Secretariat at the time of preparation of this document. For this reason, GEO Flagships and Initiatives are shown together in this version, pending decisions on classification by the Programme Board.

Comments and suggestions to improve the Implementation Plans are welcome and indeed it is the primary purpose of this consultation process to elicit such comments from a broad range of perspectives. You are invited to provide comments on specific Implementation Plans to the leads of those activities directly; their contact information is provided in this document at the end of each activity summary. You should also contact the activity leads if you are interested in contributing to or participating in an activity.

For general comments on the GEO Work Programme, or for questions regarding the Work Programme development process, please contact the GEO Work Programme Coordinator clarlee@geosec.org.

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Version 1 distributed 16 May 2019

Introduction to the GEO Work Programme

PURPOSE

The GEO Work Programme is the primary instrument used by GEO to facilitate collaboration among its Members, Participating Organizations and other partners on activities to realize GEO's Mission and Vision.

The various activities that comprise the GEO Work Programme are conceived, planned and implemented by teams of researchers, technical experts, policy analysts, commercial sector representatives, and many other stakeholders to address information needs in particular domains for which Earth observations are critical. In most of these activities, these teams work to develop Earth observation-based applications, products and services to support decisions by defined sets of users.

GEO Work Programme activities are largely funded through in-kind contributions from GEO Members and Participating Organizations on a voluntary, best-efforts basis, supplemented by financial contributions where possible. A small number of activities, the GEO Foundational Tasks, are implemented in part by the GEO Secretariat through resources contributed by GEO Members to the GEO Trust Fund.

Each new GEO Work Programme covers a fixed three-year period. The present document applies to the years 2020 to 2022, on a calendar year basis. Updates to the GEO Work Programme may be made in the intervening years. Both the original GEO Work Programme and any updates must be approved by the GEO Plenary at an annual meeting.

STRUCTURE

The GEO Work Programme includes five categories of activities, collectively known as GEO Implementation Mechanisms. Each of these categories is described below.

GEO Initiatives

GEO Initiatives, together with GEO Flagships, form the core of the GEO Work Programme. Within their defined domains, GEO Initiatives help to transition innovative results and prototypes from the research community into Earth observation-based products and services to support a wide range of users. GEO Initiatives also build communities of stakeholders that work together to identify needs and gaps and develop capacity with these communities to maximize the value of the products and services being developed. GEO Flagships and Initiatives are expected to interact closely with the GEO Secretariat and the GEO community and, in return, receive a greater degree of visibility, support and guidance from GEO.

GEO Flagships

GEO Flagships are Initiatives that exemplify the kind of impact and support to global, national, and local decision making that GEO aims to encourage and replicate. GEO Flagships have developed and continue to implement reliable, continuing services in response to defined policy mandates from international organizations, conventions, agreements or other bodies. In doing so, GEO Flagships serve as models and guides for other GEO Work Programme activities.

Regional GEOs

Regional GEOs are a new category of activity in the GEO Work Programme although they emerged from GEO Initiatives. Regional GEOs were officially recognized at the GEO-XV Plenary as distinct components of the GEO governance structure. Regional GEOs act as the implementing arms of the GEO Caucuses, which are groups of GEO Member countries within five defined regions of the world. The roles of Regional GEOs include: engagement of countries and organizations within their region, including those which may not yet be GEO Members or actively involved; coordination of GEO activities within their region, including subsets of global Initiatives and Flagships; and initiation of new activities to serve regional needs.

GEO Community Activities

GEO Community Activities range from communities of practice, to early-stage projects or pilots, to well-established services. GEO Community Activities offer an opportunity for GEO Members and Participating Organizations to collaborate and to contribute to realizing GEO's Vision and Mission with minimal requirements or structure. GEO Community Activities may serve as an entry point for new activities which may go on to become GEO Initiatives. In other cases they may represent established services that find benefit from collaboration with other Work Programme activities but which may not require the closer interaction typical of GEO Initiatives.

GEO Foundational Tasks

GEO Foundational Tasks are the means by which GEO implements certain critical activities needed to ensure coordination across the GEO Work Programme, provide selected technical services to the GEO community, and to support GEO governance bodies and routine operations. Many of the activities within the Foundational Tasks are implemented by the GEO Secretariat, although others may be undertaken by collaborative teams drawn from across the GEO community.

PROCESS OF DEVELOPMENT

Development of GEO Work Programmes is led by the GEO Programme Board, with the support of the GEO Secretariat.

The development process is initiated by a call for new and revised Implementation Plans for GEO Work Programme activities to GEO Members, Participating Organizations and the broader community of stakeholders with which GEO interacts. As these plans are received, they are reviewed by teams of Programme Board members (in the case of candidate Flagships, Initiatives and Regional GEOs) or by the GEO Secretariat (in the case of candidate Community Activities). An iterative process of review and revision to the plans continues as needed and up to the time of preparation of the version of the Work Programme that is provided to the GEO Plenary for approval.

A total of four versions of the GEO Work Programme Summary Document will be prepared:

- Version 1 (the present document) is distributed in May via the GEO website to the broad GEO community for consultation;
- Version 2 will be distributed in July to GEO Principals from GEO Members and Participating Organizations and will be made available to the broad GEO community via the GEO website;

- Version 3 will be distributed again to GEO Principals as part of the package of documents for decision at the GEO-XVI Plenary; and
- Version 4 will be posted on the GEO website following the GEO-XVI Plenary, reflecting any adjustments or additions made at the Plenary meeting.

The first two versions will be prepared and distributed by the GEO Secretariat, though reflecting the views and decisions of the Programme Board. Version 3 must be formally approved by the Programme Board for recommendation to the GEO Plenary for approval. Version 4 will be the official approved version by the GEO Plenary, although it will be subject to annual updates and revisions in 2020 and 2021.

Brief History of the Group on Earth Observations

The need for strengthened cooperation and coordination among global observing systems and research programmes in order to provide integrated global observations for the achievement of sustainable development was widely recognized at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002. Subsequent Earth Observation Summits (Washington D.C., 2003; Tokyo, 2004) underscored the importance of comprehensive, coordinated and sustained Earth observations–exchanged fully and openly–as a basis for informed decision making, and, building on existing systems, called for the establishment of a "system of systems" approach to deliver those observations.

The political will and commitment demonstrated at these Summits, confirmed by the G-8 endorsement of strengthened international cooperation on global observation of the environment (Evian, 2003), reached their culmination at the Third Earth Observation Summit (Brussels, 2005) when GEO was formally launched as a partnership of Member governments and Participating Organizations working together to implement the Global Earth Observation System of Systems (GEOSS). GEOSS was designed to deliver the data and information necessary for bringing qualitative improvements in understanding the Earth system so that global policy- and decision-making abilities that promote the environment, human health, safety, and welfare would be enhanced. In particular, GEO's initial GEOSS 10-Year Implementation Plan (2005-2015) foresaw GEOSS as a step towards addressing the challenges articulated by the United Nations Millennium Declaration (including the Millennium Development Goals), as well as the 2002 WSSD and implementation of other international environmental treaty obligations.

Beyond addressing major policy initiatives, and building on existing local, national, regional, and international initiatives, GEO also promotes the benefits of GEOSS through enhancing capacity; engaging globally with a broad range of user communities, from managers, policy makers and scientific researchers and engineers, to civil society, governmental and non-governmental organizations, international bodies and the commercial sector; and providing Earth observations data and information yielding advances in knowledge across societal benefit areas (SBAs), as defined by purpose and scope. Political support for full and open access to Earth observation data and information was affirmed by the Cape Town Declaration (2007) which called for implementation of the GEOSS Data Sharing Principles and improvements in interoperability of data systems. The Beijing Declaration (2010) took the commitment to sharing of Earth observation data and information a step further by establishing the GEOSS Data Collection of Open Resources for Everyone (GEOSS Data CORE), while urging governments to take the measures necessary to sustain and enhance both in situ and space-based observation systems. In 2014, GEO's mandate was renewed for another decade with the Geneva Declaration, which also called for both strengthening engagement with developing countries, and broadening engagement with diverse stakeholders, including non-governmental and non-profit organizations and the private sector, while taking into account commitments to UN sustainable development themes.

With the Mexico City Ministerial Summit (2015) endorsement of the GEO Strategic Plan 2016-2025: Implementing GEOSS (Strategic Plan), the threads of support for sustainable development continues to be woven into the fabric of GEO's existence. Indeed, the Strategic Plan references historical events that have transpired since the first decade of GEO's existence, including the advent of the UN Sustainable Development Goals (SDGs) as a response to

mounting global societal challenges. Since the SDGs contain quantifiable targets and indicators to serve as benchmarks against which progress towards achievement of the SDGs may be ascertained, the Strategic Plan specifically calls for the provision of open, timely and reliable Earth observation data and information to supplement statistical analyses used in assessing that progress. Similarly, the 2015 GEO Mexico City Declaration both affirmed that "GEO and its Earth observations and information will support the implementation of, inter alia, the 2030 Global Goals for Sustainable Development…" and called on GEO to "…launch a GEO initiative to leverage Earth observations to support the implementation, monitoring and evaluation of the 2030 Global Goals for Sustainable Development, building on the recent success of GEO's engagement with the United Nations on this issue." To follow these calls with concerted action, at the GEO-XIII Plenary meeting (Saint Petersburg, 2016), the GEO Engagement Priorities for 2017-2019 identified several global policy initiatives as candidates for demonstrating that GEO is "the reference global initiative that facilitates evidence-based environmental decision-making by unlocking the potential of Earth observations." The Plenary approved three of the policy initiatives (out of five) as initial priorities for GEO, including the 2030 Agenda for Sustainable Development (and associated SDGs), as well as the Paris Agreement on climate and the Sendai Framework for Disaster Risk Reduction.

Candidate Flagships and Initiatives

AQUAWATCH

Overview

Water quality is essential for human, ecosystem and economic health. Degradation of water quality can result in human exposure to disease and harmful chemicals, reduction in productivity and diversity of ecosystems and damage to aquaculture, agriculture and other water-related industries. Water quality monitoring is a large multi-faceted field that is directly related to a number of the Group on Earth Observation's societal benefit areas as well as a variety of policy and sustainable development goals. There are many available data products offered by data service providers, which are funded through a variety of regional, national, and international sources for which minimum quality standards and best practices are lacking.

The overall goal of the AquaWatch Initiative is to develop and build the global capacity and utility of Earth Observation-derived water quality data, products and information to support effective monitoring, management and decision making. The objectives to achieve this goal are:

- Facilitate effective partnerships between the producers, providers and users of water quality data, products and information.
- Improve quality, analysis, and integration of in situ and remote sensing water quality data.
- Develop and deliver best practices, minimum quality standards, and independent tools for users to assess fit-for-purpose water quality products and information services.
- Support technology transfer and access to water quality data products and information.
- Advocate for increased education and capacity for the use of water quality information for decision making.

As a GEO Initiative, AquaWatch will support the need for global water quality data, products and information. AquaWatch is currently working on a project to develop a global water quality information service. This project, as well as other activities aligned with the AquaWatch objectives, will be implemented by five working groups: 1) outreach and user engagement, 2) observations and data, 3) products and information, 4) distribution access and visualization, and 5) education and capacity building. It is expected that the work of the AquaWatch Initiative will improve decision making, support sustainable development and protect ecosystems. AquaWatch will add value by improving access to data and information, providing a venue for the sharing of best practices and advocating for the importance of sustained and routine water quality monitoring at the global scale. AquaWatch will also link communities with common interests in the freshwater and support global water quality information needs.

AquaWatch is working towards building a single network that integrates existing water quality monitoring efforts for the benefit of the global community. AquaWatch participants currently include representatives from various organizations including state, federal, and international governmental agencies, private consulting companies, nonprofit organizations, nongovernmental organizations and academic institutions. Over the coming year, AquaWatch will work to expand its focus on inclusion of representatives from the in situ and user communities and identify and develop working group activities. Over the next three years,

AquaWatch will also work to supporting related Group on Earth Observations activities and will continue work on a long-term project to develop a global water quality information service.

Planned Activities

- CEOS CalVal Working Group: Work with the CEOS Working Group on Calibration & Validation (WGCV).
- Product Validation Activities: Validation activities, since a critical need was identified for validation data sets. This might build off the inventory and gap analysis that work group 2 is tackling. The work through 2019 should inform the gap analysis indicating where data products need more information to improve quality and for more reliable use by certain regions and local users. This will be the basis to seek funding for a $20M project.
- Training Best Practices: Compilation/vetting of existing training identified up to 2019. Develop a Guidelines for principles of training. Conduct a demonstration project somewhere (suggested Bangladesh).
- Inventories: Advance work conducted through 2019 on EO water quality data inventories to develop a flashier brochure with thumbnails for users to 'shop' available data products fit for their purpose.
- Community Best Practices: Advance work conducted through 2019 on algorithm library, etc. should have been published into a review paper and posted on the AW website to complement our Knowledge Hub.
- Product Best Practices: Produce document(s) on optical standards for optical properties, include an inventory of protocols too. This document will point to other standards if they exist. This list will map standards, metadata, etc. and will notionally be like an Fiducial Reference Model but not exclusive – can list different levels and a gold standard.
- Citizen Science: Build on the efforts through 2019 by identifying more opportunities to augment EO Water quality data using well-informed Citizen Science projects. Training could utilize outcomes from other Programme tasks.
- Ensemble Effort: We wish to utilize the various outcomes of the Product Best Practices algorithm inventories and compare outputs of the various processing services (e.g. for lakes in Africa, or where there is in situ data) - create test cases. Then notionally use an ensemble approach to explain differences in the outcomes and may recommend products for decision-makers to use based on quality and uncertainties of each test case.

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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. These, in turn, require international organisations to act much more in risk prevention mitigation and preparedness through improved disaster risk reduction (DRR) policies and programmes. 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 those major initiatives supported by space agencies.

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 regions of the developing world. The main goal is to address critical issues related to DRR affecting most of the countries in a region (for example, South-East Asia or South America) through a series of projects (first demonstrators) that rely on the use of multiple-source observation data (such as space, in situ, socio-economic, model outputs, etc.).

Each project will involve data providers, data & information practitioners, regional institutions, governmental agencies, local decision makers, and scientists. The main outputs (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 during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs).

Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end users and to increase awareness within donor agencies of the promise of EO solutions. 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.

Planned Activities

Three phases are foreseen:

- Concept phase: Start at KO, end at KO+ up to 18 months. Might vary from one region to another.
- Prototyping phase: Start at approval of regional assessments, end at KO+36 months at the latest. Prototyping might start at different time depending on the project. It is not envisaged to continue the prototyping activities including its operation beyond a period of 4 years. Go/no go decision to determine sustainability and implementation of operations.
- Operational phase: On a case by case, might start for a given project at KO+36 months depending on the funding and opportunity to transition the activities from a prototype to an operational system.

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DATA ANALYSIS AND INTEGRATION SYSTEM (DIAS)

Overview

The Data Integration and Analysis System (DIAS) Initiative for the 2020-2022 GEO Work Programme will encompass the present DIAS, Water Cycle Integrator (WCI), Asian Water Cycle Initiative (AWCI), and African Water Cycle Coordination Initiative (AfWCCI) Community Activities and will coordinate their activities in line with the GEOSS Water Strategy recommendations. At the same time, DIAS Community Activity will continue to use the Integrated Global Water Cycle Observations (IGWCO) Community of Practice for coordination with other Water SBA activities.

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 reflected on the experiences of the Asian Water Cycle Initiative (AWCI) and responded 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.

In addition, DIAS is committed to contributing to society's adaptation policies for various time scales of climate change and weather events. For long-term climate change of several decades, DIAS contributes to sustainable policy decision (disaster prevention, agriculture)at local government level by downscaling the global climate change model and predicting local meteorological phenomena (rainfall, temperature, sunshine) . In addition, a phenomenon (such as drought, infectious disease etc.) that is correlated with the global climate change cycle of a medium term of several months to several years, will be predicted by DIAS which necessary information for stockpiling of local governments and institutions (water resources, medicines etc.). Furthermore, for extreme phenomena (such as torrential rain) after several hours, it is useful for evacuation planning by performing flood and inundation prediction in real time by DIAS.

Planned Activities

The goal of DIAS 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:

- Continue to 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;
- Advance development of the WCI component of 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;

- 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;
- 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, and promote and facilitate implementation of these systems in operational use;
- Human resources capacity building for water issues using inter- and transdisciplinary approach of WCI;
- Foster regional collaboration and enhance user engagement through AWCI and AfWCCI frameworks and expand collaboration with other regional and global frameworks and donor organizations;
- Collect and organize traffic, economic activities, industrial location, land use data, etc. related to Japan or overseas with the goal of making it possible to quantitatively understand what kind of impact the estimated hazard (flood etc.) will have on the local social economy and life of the residents in the application considered in the water application;
- Downscale the long-term climate change model to the regional level of Japan or overseas to make long-term predictions over several decades locally, thereby contributing to disaster prevention and mitigation measures at the local government level;
- Use a hydraulic model based on topographic and infrastructure information of large cities, and use real-time data input functions such as rainfall radar on DIAS and high-speed arithmetic processing to predict the inundation risk of large cities several hours ahead; and
- Using correlation models of medium-period meteorological cycles (La Nina etc.) and ecosystems (mosquito occurrence etc.) develop a model that predicts infectious disease (malaria, dengue fever, etc.) outbreak from global meteorological forecasts.

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EARTH OBSERVATIONS AND CITIZEN SCIENCE (EO & CITIZEN SCIENCE)

Overview

The widespread adoption of mobile devices and social media platforms, coupled with the development of low cost sensors, has made it easier for the public to contribute to and engage in scientific and engineering research and monitoring. This collaborative exchange with the scientific community, in which members of the public actively join the co-creation of new scientific knowledge, is known as “citizen science”.

Citizen science observations, data and information can complement official, traditional in situ and remote sensing Earth observation data sources in many application areas relevant to GEO. Governmental entities around the globe, from Australia and Asia to Europe and North America, are supporting the development and integration of new sources of in situ EO data collection at local, regional, and global scales through citizen science observatories and projects.

Building on these initiatives, this Earth Observation and Citizen Science Initiative will focus on the following goals:

- Demonstrate the value of citizen science data for advancing the GEOSS priorities in terms of research and informing policy;
- Facilitate the creation of a linked ecosystem of open citizen science data and supporting resources under GEOSS and the GEOSS Data Management Principles; and,
- Increase the use of citizen science in GEO by supporting global coordination and collaboration within and beyond GEO.

Overcoming institutional barriers, perceptions and technical issues will be addressed and resolved by the Initiative in terms of heterogeneity in data models, flavours and data formats formed by the long tail of citizen science projects. Furthermore we will address data accessibility, metadata harvesting, data quality documentation, annotation and connectivity with the GEOSS platform.

Planned Activities

Planned activities for 2020-2022 include:

- Support and elevate demonstration projects that showcase the use and value of scalable citizen science projects (e.g., citizen observatories, Earth Challenge 2020, CSEOL pilot projects), particularly in the provision of in-situ data;
- Showcase the use of citizen science data sets (from the GEOSS-Data Core) in combination with other Earth Observation products and for validation and exploitation of EO via the Earth Challenge 2020, the citizen observatories and other projects;
- Demonstrate new technologies such as machine learning trained by citizen science data (i.e., “human in the loop”), to improve calibration/validation of sensors, increase the speed and accuracy of image processing, provide in situ ground truth data, and/or augment and enhance validation and knowledge extraction;
- Identify and prioritize gaps in in situ observations for GEOSS, and then identify existing citizen science projects that could cover these gaps, for example through the Sustainable Development Goal (SDG) framework;

- Mobilize existing and newly emerging citizen science initiatives to make the data that they collect available through the GEOSS platform (e.g., Earth Challenge 2020 and the citizen observatories);
- Increase discovery and access of open science resources including citizen science data and complementary data sets; data collection tools (hardware and software); platforms for data analysis and visualization; educational resources such as lesson plans or other toolkits; and, publications;
- Showcase best practices for discovery and access of citizen-observed data through GEOSS, and the implementation of the GEOSS Data Management Principles;
- Provide guidelines for using and managing citizen science in GEOSS incorporating use of existing standards for data collection and management;
- Working with the Open Geospatial Consortium (OGC), conduct interoperability experiments and recommend how to offer access to citizen science through GEOSS;
- Conduct interoperability experiments about data access, single sign on mechanism and data quality, data annotation and user feedback;
- Generate "data profiles" and data collection protocols that can serve for scaling up citizen science;
- Based on the work described above, develop recommendations for the increased use of citizen science data for GEO, and for using products available through GEOSS in citizen science communities; and
- Working closely with the Citizen Science Global Partnership, leverage GEO's role as a global convener to help keep track of and coordinate a range of complementary activities led by different communities.

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EARTH OBSERVATIONS FOR ECOSYSTEM ACCOUNTING (EO4EA)

Overview

The purpose of EO4EA is to further the development and use of Earth observations for natural capital accounting, consistent with the set of standards and guidelines put forth by the UN System of Environmental-Economic Accounting (SEEA) and specifically the Ecosystem Accounts (EA).

Ecosystem Accounts rely on spatial data in order to systematically assess the health and status of ecosystems and the benefits of ecosystem flows to human well-being and the economy. Through partnership, research, and practical application EO4EA will advance the application of the science of Earth observation to the practice of ecosystem accounting. EO4EA envisions a future where Earth observation systems enable environmental transparency and the value of ecosystems is incorporated into conventional economic accounts and decision making, leading to an important shift in the valuation of natural resources and the use of that information for policy and programmatic decision making.

There is a significant global demand for ecosystem accounting, with the UN Statistical Commission identifying over 70 countries that have indicated their desire to develop these accounts. However, data for many of these countries is unavailable or is not available in time series that allow analyses of trends as well as status. Our mission is to document, pioneer, develop, and test the methods and tools that will allow Earth observation technology to more effectively enable the widespread adoption of ecosystem accounting

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EARTH OBSERVATIONS FOR HEALTH (EO4HEALTH)

Overview

The use of Earth observation (EO) data among interdisciplinary and multi-agency teams can significantly advance scientific knowledge of existing public health threats to human, animal, and ecosystem health. The analysis of these geospatial data can enhance our understanding of the dynamic processes of the surrounding ecosystem and influence on human health. These data can also support disease preparedness and response actions in disease epidemic or humanitarian efforts.

Earth Observations for Health (EO4HEALTH) will serve as a global network of governments, organizations, and observers, who seek to use EO data to improve health decision-making at the international, regional, country, and district levels. The overall goal is to support the systematic collection, analysis, and application of relevant information about areas of impending risk that inform the development of strategic responses to anticipate risks and opportunities and their evolution and communicate options to critical actors for the purposes of decision-making and response.

The objectives to achieve this goal include:

- Engage with end-user communities to better understand and identify their needs and requirements;
- Develop and implement activities that address the needs and requirements of end-user communities;
- Improve the use of, and clarify future needs for, EO for health;
- Examine effectiveness and provide feedback on future EO actions for health; and
- Participate with other individuals GEO communities of practice or institutions to produce an outcome greater than that achievable otherwise.

As a GEO Initiative, EO4HEALTH will help to foster the development of integrated information systems (IIS) that improve the capacity to predict, respond to, and reduce environment-related health risks. These systems combine EO monitoring and prediction; social, demographic, and health information; interdisciplinary research; application and assessment; communication; education; and training in order to enhance preparedness and resilience. Three initial focus areas are weather and climate extremes (e.g., heat), water-related illness (e.g., cholera), and vector-borne disease (e.g., dengue, malaria).

EO4HEALTH has supported the GEO Health Community of Practice (CoP) in the development and elaboration of the CoP Work Plan. The CoP Work Plan will be aligned with the EO4HEALTH objectives and include working groups on seven specific topics: 1) heat; 2) infectious diseases; 3) air quality; 4) food security and safety; 5) health care infrastructure; 6) cross-cutting issues; and 7) integrating EO data techniques.

Previous work within the GEO Health CoP has been focused on health early warning systems for air quality, heat, infectious disease, water-related illness, and ecosystem-related health impacts. Major foci included air quality (AirNOW International, Persistent Organic Pollutants), cholera, dengue, harmful algal blooms, leptospirosis, malaria, and meningitis. The GEO Health CoP seeks to expand on this previous work and focus on developing IISs that sustain engagement between scientists and decision makers to provide useful EO data that protect

health and build resilience. The GEO Health CoP also seeks to build partnerships across public and private sectors, and to stimulate innovative and open approaches to gathering and providing useful risk assessment, monitoring, prediction, and forecasting information.

EO4HEALTH has leveraged the continued development of global networks of stakeholders that enhance shared scientific findings and promotion of EO tools and data. EO4HEALTH participants currently include representatives across the public and private sector, such as academic institutions, nongovernmental organizations, non-profit organizations, private companies, and state, federal, and international governmental agencies. Over the next year, EO4HEALTH will continue to promote interdisciplinary collaborations by expanding scientific connections and partnerships with the public health community. Over the next three years, EO4HEALTH will also support the related GEO activities and tasks that aim to strengthen the use of Earth observation data for health decision-making.

Planned Activities

Myanmar Malaria Early Warning System: This project will develop a robust satellite data driven early warning system to forecast malaria hotspots dynamically in space-time in Myanmar. It will move the satellite-based malaria forecasting beyond the narrow scope of monitoring and forecasting vector habitat suitability and potential for surge in vector prevalence.

Environmental Determinants of Enteric Infectious Disease: This project will partner with the MAL-ED cohort study and use satellite data to develop a database of relevant climate, hydrology, ecology, and human activity at study sites. This database will be used to develop statistical models of high impact enteric infectious diseases and perform objective regionalization of global tropical land areas on the bases of seasonality and environmental associations of specific enteric infectious diseases.

Predictive Assessment of Transmission Conditions of Cholera in Environment and Human Population: This project will use EO to predict the risk of outbreak (trigger and transmission) of cholera in the environment and human populations in Africa, and thereafter develop a comprehensive capacity building plan to engage end-users to incorporate this information into decision making, so that appropriate intervention strategies can be devised and deployed.

Geospatial Surveillance and Response System Resource for Vector-borne Disease in the Americas: This project will employ EO to predict the risk of outbreak (trigger and transmission) of cholera in the environment and human populations in Africa, and thereafter develop a comprehensive capacity building plan to engage end-users to incorporate this information into decision making, so that appropriate intervention strategies can be devised and deployed.

Expand the partnership with American Geophysical Union and develop partnerships with other scientific communities (e.g., European Geophysical Union, American Public Health Association): These partnerships will enhance interdisciplinary collaborations that use environmental observations to improve health decision-making.

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EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS (EO4SDG)

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 17 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.

The *2030 Agenda* specifically demands new data acquisition and integration approaches to improve the quality, coverage, and availability of data to support the implementation of the development agenda at all levels. This presents a unique opportunity for Earth observations and geospatial information to be integrated into national information systems and monitoring frameworks, as well as real-world applications that can reduce and mitigate environmental risk and disasters, creating more sustainable and resilient societies.

EO4SDG engages in efforts that advance the provision, access, discoverability, and applicability of Earth observations and geospatial information for use with the SDGs. This element draws on GEO's efforts to characterize user needs, especially in the collection of information from SDG user organizations, to help refine approaches to enable greater use of Earth observations for the SDGs. EO4SDG also serves to "federate" all of GEO's Community Activities, Initiatives and Flagships that include an SDG element to increase SDG-related knowledge sharing across the GEO Work Programme. The Initiative provides technical and other guidance for projects developed under other GEO activities, serving a coordination role to GEO's overall service to the SDGs.

The prime users of EO4SDG are National Statistical Offices (NSOs), National Mapping Agencies, line ministries, international statistical agencies, and UN entities. The Initiative promotes the emergence and scaling-up of joint efforts and collaboration between these users and the geospatial and Earth observation communities to demonstrate effective uses of Earth observation data in complementing traditional data systems such as census data, administrative data, household survey data, and vital statistics, to help achieve the SDGs.

EO4SDG participates in the Working Group for Geospatial Information (WGGI) under the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) and is actively involved in supporting a task stream of this working group titled, "Application of Earth Observations for the SDG Indicators." This task stream seeks to develop expert advice and guidance to the IAEG-SDGs and the larger statistical community, document national experiences and good practices including case studies, and provide recommendations on the role of NSOs on the uptake of Earth observations for six SDG Indicators, as a starting point.

In addition, EO4SDG works closely with custodian agencies responsible for specific Indicators relevant to their thematic expertise and mandate – such as the UN Environment Programme, the UN Convention to Combat Desertification (UNCCD), and UN Habitat – on method development, testing, refinement, adoption, and widespread, sustained use.

Planned Activities

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

- Develop good practice examples on uses of Earth observations for SDG indicators
- Develop and document examples on uses of Earth observations for SDG Targets
- Advance the development of SDG examples completed under other GEO Work Programme Activities.
- Develop the EO4SDG website into an interactive knowledge resource.

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

- Document national experiences and good practice examples, including use cases, where EO are applied for SDG analysis and/or reporting.
- Capacity Building
- EO-enabling infrastructures
- Roll out an SDG toolbox as part of the EO4SDG web-based knowledge resource.

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

- Issue annual awards on uses of Earth observations for SDGs.
- EO4SDG Website
- Analyze and evaluate the usability of EO contributions to the SDG Targets and Indicators.
- Develop satellite data requirements for a select number of SDG indicators.

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GEO BIODIVERSITY OBSERVATION NETWORK (GEO BON)

Overview

Since its inception in 2008, GEO BON has developed a global social network and community of practice for biodiversity observations. This network includes many world leaders in biodiversity observation as well as major partner organizations in that field. GEO BON moved into its second phase in 2014 by refocusing on its core goals, realistically assessing what is possible, and making strategic decisions on where its limited resources should go to achieve those goals. As a result, its focus has narrowed, though it still utilizes and builds upon the networks and communities of practice that have already been established. Now in its third phase since 2017, GEO BON reorganized its structure in order to better sustain its targeted and integrated effort to further refine and apply a framework for biodiversity observations through targeted and continued development of the EBVs and application of the EBV concept at multiple scales in partnership with national, regional and global partners. This approach will advance the theory and practice of efficient, user driven biodiversity observation design, leading to improved biodiversity observation data in support of decision-making.

GEO BON is committed to become, by 2025, a resource to governments, industry, researchers, and the public around the world, providing sustained and interoperable data, information, and knowledge on ecosystem services that derive from diverse communities of living organisms. GEO BON will be actively used by governments and their advisors, by the Convention of Biological Diversity (CBD), the Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Ramsar Convention. The data, information and knowledge will also be used to assess the progress in achieving the CBD's Aichi Targets by 2020 and the UN's Sustainable Development Goals (SDGs). The observations derived from this network contribute to the development of effective conservation actions, mitigation, and adaptation strategies that help ensure the sustainable use of resources. The scientific approach to observation contributes to the implementation of sustainable use management practices and policies regarding the world's biodiversity and the ecosystem services it provides.

Planned Activities

The activities of GEO BON can be summarized according to the two core areas of focus of the network.

The development of the Essential Biodiversity Variables, or EBVs, which are a minimum set of variables that capture the major dimensions of biodiversity change. EBVs provide guidance to observation systems at all scales by helping to prioritize observations and identify standard methods for data collection and processing. The EBVs are being developed within the different GEO BON Working Groups, and organized around the different levels of organization of biodiversity: Genetic Composition, Species Populations, Species Traits, Community Composition, Ecosystem Structure and Ecosystem Functions. Similarly, the working group dedicated to Ecosystem Services is working towards the development of the Essential Ecosystem Services Variables. Within the working groups, this translates into activities that either address the conceptual basis of the EBVs within the different classes and result in the establishment of candidate lists, or the development and application of the EBV data products per se. The GEO BON secretariat is developing, in partnership with the University of Marburg that developed the VAT System, an EBV Data Portal to facilitate the visualization, sharing and analysis of EBV products.

The reinforcement of existing, or development of new Biodiversity Observation Networks, or BONS. The role of the BONs is to develop, apply and test the concepts, methods and tools to implement and enhance operational networks; collecting observations and providing data to the community and users. The BONs can be organized at the national or regional level, or be thematic in scope (e.g. Marine BON – MBON). The BONs both produce, test and apply tools and applications and produce EBV relevant data that can be upscaled and downscaled to underpin more informed sustainable development and conservation decisions. Activities and outputs of BONs may also include the identification of Research and Development gaps and needs, the establishment of Technical Readiness Levels to help track progress towards the development of EBVs (particularly within thematic/biome scales), research papers, books, white papers, web apps, data collection and analysis (e.g. modelling) tools. To support both the work of the existing BONs and the development of new networks, the GEO BON Secretariat is developing, in partnership with the Alexander von Humboldt Institute in Colombia and online platform for capacity building and knowledge exchange, BON-in-a-Box.

Furthermore, a common trait of most activities of the GEO BON working groups, BONs, and task forces is the policy relevance of their outputs. In this regard, GEO BON will continue to work on both identifying and supporting the needs of its users, from the scientific community to policy bodies such as the IPBES and CBD.

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GEO CAPACITY BUILDING IN NORTH AFRICA, MIDDLE EAST, BALKANS, BLACK SEA (GEO-CRADLE)

Overview

The primary objectives of GEO-CRADLE are to:

- Promote the coordination of Earth observation (EO) activities within the North Africa, Middle East, and Balkans region through the sustained operation of the GEO-CRADLE networking platform (currently with 268 actors from 29 countries), the organization of additional regional workshops, and the interfacing with key initiatives (including regional GEOSS' like EuroGEOSS and AfriGEOSS as well as collaborative efforts such as PRIMA and ESA EO4SD);
- Assess the maturity of EO activities at the national level to inform targeted capacity building, by applying the novel methodology which was pioneered by GEO-CRADLE and which has been applied to date in 11 countries. The methodology uses an extensive set of 32 maturity indicators across three main fields: Capacities, Cooperation, and National Uptake and Awareness;
- Foster the progressive operationalization of EO-based services, building on the results of the four GEO-CRADLE pilots (Adaptation to Climate Change, Improved Food Security – Water Extremes Management, Access to Raw Materials, and Access to Solar Energy), linking to the GEO priorities and the national needs for achievement of SDGs and involving the private sector; and
- Further promote the effective implementation of the GEOSS Data Sharing Principles in the region and the registration of national datasets to GEOSS Platform, through the GEO-CRADLE Regional Data Hub, which is set up with free and open access, serving as a gateway that facilitates the access of the regional actors and EU partners to useful datasets and portals from the regions that use open standards (more than 25 million datasets are now available by accessing through the RDH to GEOSS and regional / local portals, including the data available through the GEO-CRADLE project pilots).

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GEO ESSENTIAL VARIABLES (GEO-EV)

Overview

The concept of "essential variables" (EVs) is increasingly used in Earth observation communities to identify those variables that have a high impact, high feasibility and relative low cost of implementation. The Global Climate Observing System (GCOS) was the first to develop a full set of Essential Climate Variables (ECV). Other examples of communities applying the same concept are oceans (Essential Ocean Variables: BluePlanet), biosphere (Essential Biodiversity Variables: GEOBON), water cycle (Essential Water Variables: GEOGLOWS), etc. ConnectinGEO illustrated that EVs can be a useful approach to several indicators for monitor SDGs.

GEO-EV proposes to review and extend the current EV framework and assign priorities in designing, deploying and maintaining EV in connection with the responsible observation networks. At the same time, EVs should be promoted among all SBAs in GEO. GEO-EV aims to be a panel of experts to discuss the current status of EVs, exchange knowledge, experiences and methodologies in EVs definition, analyze the usefulness of EVs in creating SDG indicators, and the gaps to be solved in communities in the near future. This initiative does not have the intention to interfere in the ongoing communities already working on the definition of the EVs, but to become a common forum to share expertise and to have a single voice inside GEO regarding EVs.

Planned Activities

- Meta-coordination in the elaboration of EVs among SBAs. Reduce overlaps between existing and future EVs. Share knowledge and processes for EV definition.
- Gap analysis of EVs and observation networks.
- Convergence of the definition of EVs across SBAs.
- Expanding EVs to all relevant themes in Earth observation.
- Relationship between EVs and SDGs. Further analyze the approximation of SDGs indicator's retrieval based on the use of EVs as a proxy.

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GEO GLOBAL AGRICULTURAL MONITORING (GEOGLAM)

Overview

GEO Global Agricultural Monitoring (GEOGLAM) was initially launched by the Group of Twenty (G20) Agriculture Ministers in Paris, June 2011 during the French G20 Presidency. The GEOGLAM Initiative forms part of the G20 Action Plan on Food Price Volatility. The purpose of GEOGLAM is to increase market transparency and improve food security by producing and disseminating relevant, timely, and actionable information on agricultural conditions and outlooks of production at national, regional, and global scales. It achieves this by strengthening the international community's capacity to utilize coordinated, comprehensive, and sustained Earth observations.

GEOGLAM participants include representatives from most G20 nations, many additional countries including from food insecure regions, several international organizations and NGOs. The GEOGLAM Crop Monitor for the Agricultural Monitoring Information System (AMIS) encompasses over 80% of global production, consumption and trade volumes of targeted crops (maize, rice, wheat and soybean) and has over 40 contributing institutions feeding in information on a monthly basis. The Crop Monitor for Early Warning (CM4EW) monitors crops that are important in countries and regions that are susceptible to food insecurity. Over a dozen international food security organizations feed in to the monthly monitors and also benefit from the published results. In 2019 at the request of the United Nations Office for Coordination of Humanitarian Affairs, GEOGLAM developed the capability to produce mid-month reports in areas of emerging concern.

Both Crop Monitor publications are internationally recognized as reliable sources of information on global crop conditions and are used by a range of ministries and multi-national and international organizations to inform decisions. In recent years the early warning focus has moved to engaging national organizations. These monitors are run by mandated agencies within nations to support policy and program decision makers, and have resulted in rapid deployment of proactive policies and programs to mitigate disasters and mobilization of resources in response to emerging food emergencies.

Currently, capacity development is spread across several GEOGLAM activities. By mid-2019, a Thematic Coordination Team on Capacity Development (CapDev Team) will be developed to better coordinate and harmonize activities across the contributing initiatives. The CapDev Team will have the role of promoting a community research and operationalization agenda, developing a strategic vision for capacity development for GEOGLAM, documenting and promoting good practices around capacity development, coordinating the transfer of research-to-operations, and working with scientific leads.

Planned Activities

GEOGLAM Core Developed

Crop Monitor for the Agricultural Market Information System: Monthly updates about crop supply in major producer countries, including the G20 countries plus eight other large producers. These updates, which summarize the conditions of four major commodity crops (wheat, soybean, maize, and rice), have been included in the monthly AMIS Market Monitor publication since issue No. 11 published in September 2013.

Crop Monitor for Early Warning (CM4EW): AMIS crop monitor methods were adapted and applied to countries at risk of food production shortfalls. These countries, which represent nearly the inverse of the large market producers, are monitored and reported on in the Crop Monitor for Early Warning reports

Joint Experiment for Crop Assessment and Monitoring (JECAM): JECAM is a global research network created by the GEO Agriculture Monitoring Community of Practice with the intent to enhance international collaboration around agricultural monitoring towards the development of a "systems of systems" to address issues associated with food security and a sustainable and profitable agricultural sector worldwide.

GEOGLAM Regional

GEOGLAM Latino America: Regional coordination of GEOGLAM activities in Latin America

AsiaRice: Regional coordination of GEOGLAM rice monitoring activities in Asia

AFRIGLAM: Regional coordination of GEOGLAM activities in Southern Africa

GEOGLAM Partner Contributed

China CropWatch: Assesses national and global crop production and related information using remote sensing and ground-based indicators. Each quarter, the group's findings are published in the CropWatch bulletin, which is issued in both English and Chinese. CropWatch contributes to the AMIS and early warning crop monitors for GEOGLAM, and CropWatch Cloud platform provides a suite of cloud-based tools for customized crop condition analysis.

Sen2Agri: The Sen2-Agri system is an operational standalone processing system generating agricultural products from Sentinel-2 (A&B) and Landsat 8 time series along the growing season.

Harvest: NASA Harvest is a multidisciplinary consortium commissioned by NASA and led by the University of Maryland to enhance the use of satellite data in decision making related to food security and agriculture domestically and globally

MARS Crop Yield Forecasting System: Monitors European crops and forecasted crop yields and production since 1993. The main findings of the crop monitoring activities are collected in monthly MARS Bulletins published on the JRC website. Many of the MCYFS data and software are made freely available for access and reuse

Anomaly Hotspots of Agricultural Production: An online decision support system for early warning about hotspots of agricultural production anomaly (crop and rangeland), developed by the JRC for food security crises prevention and response planning anticipation. As part of its agricultural monitoring for food security activities, the JRC, in collaboration with external partners, has developed several open access desktop applications available for download.

Essential Agricultural Variables-CEOS Working Group: Leading the development of Essential Agricultural Variables (EAVs) for GEOGLAM and Liaison with CEOS to address data requirements, including ARD and ARD+.

Capacity Development Working Group: Development of GEOGLAM capacity development strategy and coordination of capacity development activities

GeoRice-Regional: Demonstration of national-scale rice monitoring in Vietnam, Laos, Cambodia, Thailand and Myanmar using the 12 days revisit of Sentinel-1 satellite data. The

project also addresses the research priority within Asia-RICE, a component of the Group on Earth Observations Global Agricultural Monitoring (GEOGLAM) initiative.

Sen4Stat: The SEN4Stat project aims at facilitating the uptake of EO information in the National Statistical Offices supporting the monitoring and reporting agricultural statistics. Special attention shall be given to develop and demonstrate EO products and best practices for agriculture monitoring in support of SDG 2 and R&D requirements of the GEOGLAM national monitoring systems.

E-SHAPE GEOGLAM Project: Building on existing operational tools and modifying them to meet the specific user needs of the GEOGLAM community. Integrating the above mentioned datasets with the Copernicus DIAS storage and processing power. This will allow the monitoring of several essential agriculture variables (e.g. LAI) and the development of agricultural metrics that are more quantitative and look beyond the current growing season as requested by the GEOGLAM community represented by the GEOGLAM secretariat

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GEO GLOBAL ECOSYSTEM INITIATIVE (GEO ECO)

Overview

Terrestrial and marine ecosystems provide essential goods and services to human societies and are of crucial importance for the sustainable development of our societies and for meeting the Sustainable Development Goals (SDGs). In the last decades, however, anthropogenic pressures are causing serious impacts to ecosystem integrity, diversity, functions and processes, potentially leading to constrained resilience towards environmental changes, habitat degradation, and the creation of uncertainty related to “novel ecosystems” and increased risk of collapse. All facets of different intensity of ecosystem change ranging from modification to degradation and finally collapse and replacement are linked with the loss of ecosystem services that will seriously affect human wellbeing at local and regional scales. Repercussions of biodiversity loss and ecosystem degradation are likely to amplify negative effects of global change.

Knowledge-based conservation, adapted management and restoration policies are urgently needed in order to ensure delivery of ecosystem benefits in the face of rapidly increasing anthropogenic pressures. Fundamental to all these are effective monitoring, understanding and modelling of the state and trends in ecosystem functions and services, including state changes in biodiversity, energy fluxes, carbon storage, and nutrient cycling. New analytical and monitoring methodologies are now available that combine approaches in geo- and bio-science, remote-sensing and in situ monitoring approaches. Current satellite missions, such as the European Sentinels, will provide a large amount of high-quality data on the environment and ecosystems. In situ data, usually collected independently by different research groups, is being organised and made available through international activities such as the International Long-Term Ecological Research (ILTER) network and various open access and data portals resulting in challenges for efficient data mining. Ecosystem models capable of incorporating information from Earth observations and global climate models are being further developed to maximise the utility of said information databases, thereby enhancing their predictive capacities, and are made available in Virtual Research Environments such as those provided by the European LifeWatch ERIC.

Based on these perspectives and building upon existing activities, GEO ECO intends to utilise available Earth observation data, results and information. Such activities will aid in identifying protected areas of international relevance on a global scale, extending the analysis to vulnerable, unprotected areas by adopting the view of ecosystems as "one physical system" with their environment. Furthermore, such efforts are enhanced by a strong consideration of geosphere-biosphere-anthroposphere interactions across multiple spatial and temporal scales. Both terrestrial and marine ecosystems are considered through this work, with a special focus on interactions and processes taking place in the sensitive layer at the surface of our planet (the Earth Living Skin) such as the Earth Critical Zone. This extends to include 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 protected areas, and an Ecosystem Community of Practice will be created.

Planned Activities

Under development

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GEO GLOBAL WATER SUSTAINABILITY (GEOGLOWS)

Overview

GEOGLOWS is a user-driven Initiative that brings together water and Earth observation activities around the world to guide the decision-making process. GEOGLOWS provides coordination knowledge, data, and products among diverse freshwater activities within and outside GEO, to assist in the decision making process. By bringing together global partners to improve and test much-needed tools and resources, GEOGLOWS is contributing to global water management, disaster risk reduction, and water sustainability.

GEOGLOWS activities include a comprehensive perspective on observations and services for water sustainability. Within GEOGLOWS, the term 'sustainability' encompasses humanity's goal of balancing social, economic, and environmental well-being, and as such, water sustainability, including water quality is an essential part of these broader sustainability goals. GEOGLOWS uses these three dimensions of sustainability to determine the direction of the Initiative and as a requirement in all GEOGLOWS activities.

GEOGLOWS is working to provide relevant, actionable information about water that promotes the use of Earth observations while strengthening observational networks in local operational frameworks. GEOGLOWS provides a space for self-organizing International Water Cycle observations, and its applications to forecasting (including water cycle extremes), water accounting, drought (and water stress), climate change detection, adaptation and impact mitigation, and many other freshwater activities.

GEOGLOWS also provides a forum for government to government collaboration and engagement with the academic and private sectors. In addition to the mentioned collaborations, this forum leverages and coordinates its activities among historical intergovernmental mechanisms of the UN. GEOGLOWS is a voluntary mechanism that involves informal agreement among multiple partners within and outside the UN system. With an operational focus, GEOGLOWS allows for engagement and greater integration with transboundary organizations (e.g., ECMWF) and others that are not hydromet services (e.g., CEMADEN-Brazil).

The most significant technical elements of GEOGLOWS since its inception are:

- Implementation of the GEOGLOWS technical development for the global streamflow forecasting service at ECMWF; and
- Development of a framework for the selection of audiences for the Essential Water Variables (EWVs) and a process for the selection and processing of EWVs addressing inland and coastal waters.

Planned Activities

- **Global streamflow forecasting service**: GEOGLOWS, through strategic partnerships, will continue to assist organizations with hydrological forecast responsibility to implement this unique service to complement their national and local efforts. We expect to expand the service to include other forecast services such as NOAA/NWS-GEFS.
- **Essential Water Variables**: A plan will be submitted by 2019 for coordinating the definition of EWV in support of the SDGs, Sendai, and other priority policies. By 2020, the plan will expand to leverage existing programs and organizations for the implementation of data acquisition, analysis, exchange, and distribution systems for the accepted EWVs. By

2021 the plan will expand to include a system development and governance that will provide all nations with consistent access to EWV estimates and related processing tools at preferred resolutions.

- **Regional capacity**: GEOGLOWS will work to increase regional capacity to acquire, share, store, maintain and utilize water data and information by leveraging data-exchange efforts of the Regional GEOs and will establish a web presence through these Regional efforts.
- **Water Accounting Framework**: Starting in 2019 and through a partnership with the AmeriGEOSS Platform, GEOGLOWS will pursue the development of a "Water Accounting Framework" to support sustainability in the Americas.
- **H2020 TWIGA project**: Develop new sensors, improve and extend in situ networks and provide actionable information for water management and flood risk reduction in sub-Saharan Africa.
- **Agriculture Drought Monitoring and Prediction**: In partnership with the Asian Water Cycle Initiative (AWCI), GEOGLOWS will explore collaboration in the area of "agriculture drought monitoring and prediction" contributing to the food-water nexus.
- **Data discoverability and interoperability**: Develop tests to ensure that GEOGLOWS data are easily discoverable in the GEOSS Platform. Develop a set of principles for countries and agencies to ensure the development of a coherent interoperable data system for water. Develop a collaborative platform (Tethys) where solutions to transform data into knowledge can be shared and reused.
- **Support to integrated water resources management and climate change adaptation**: This work will be in collaboration with the Space Climate Observatory over the main African basins and in close cooperation with national agencies and basin organizations. The work has started over the Congo basin and will be pursued over the Niger, Chad and Senegal basins. It aims to provide useful information about water quantity and quality derived from space observations. It will support also in-situ measurements to validate and calibrate satellite products and also to optimize the complementarity between space and ground measurements. The ultimate goal intends to define adaptation scenario and risk mitigation.

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GEO HUMAN PLANET

Overview

GEO Human Planet is committed to develop a new generation of measurements and information products that provide new scientific evidence and more integrated understanding of the human presence on planet Earth in support of global policy processes with agreed, actionable and goal-driven metrics. The goal is to generate the global-scale data and knowledge needed to advance our understanding of societal processes and their impact on Earth systems, and to generate useful indicators to inform policy.

An immediate objective of GEO Human Planet is to support several key post-2015 international frameworks: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016), the 2030 Agenda for Sustainable Development (SDGs), the UN Framework Convention on Climate Change (UNFCC), and the Sendai Framework for Disaster Risk Reduction 2015-2030. These international frameworks are accompanied by targets that are further elaborated by indicators focused on measurable outcomes. These indicators are action oriented, global in nature, and universally applicable.

GEO Human Planet relies on a core set of partners committed to producing global spatial baseline data for human settlements and population, and an enlarged community of supporting partners. The core partners and co-leads are the European Commission, Directorate General Joint Research Center (DG JRC) and the Center for International Earth Science Information Network (CIESIN) at Columbia University. The extended partnership involves more than 200 individual scientists and policy makers from 120 different organizations including academic organizations, national governmental and international institutions, and the private sector.

Planned Activities

- Global historical spatial grids on built-up and population
- Global spatial baseline data on built-up based on Sentinel sensor (10m)
- Global spatial baseline on built-up by integrating data from different sensors
- Global human settlement classification schema and indicators
- Global high resolution age-structured population maps
- Global settlements, infrastructure and population data inter-comparison
- Regional and national show cases
- Human Planet web platform
- Human Planet Atlas annual releases

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GEO VISION FOR ENERGY (GEO-VENER)

Overview

The GEO-VENER initiative was launched in September 2016 to ensure a more efficient link between the renewable energy community and the GEO community and to stress the benefits of Earth observation (EO) data for decision-making in the development of renewable energies.

GEO-VENER built on the community portal webservice-energy.org, to serve the development of renewable energies by providing easy, interoperable, and GEOSS-compliant access to documented, precise, trustable (or bankable) data, observation, information, knowledge and services related to renewable energies.

As analyzed by the International Renewable Energy Agency (IRENA), renewable energy is central for human development, sustainable growth and environmental sustainability and contribute to all SDGs of the 2030 Agenda for Sustainable Development. As the 2018 report from IRENA shows, renewable energies and energy efficiency can, in combination, provide over 90% of the necessary energy-related CO_2 emission reductions. Keeping the global temperature rise below 2 degrees Celsius (°C) is technically feasible and GEO-VENER will contribute to the 2015 Paris Agreement on climate change objectives. However, the global energy system must undergo a profound transformation, replacing the present system that is largely based on fossil-fuels. The total share of renewable energies must rise from around 18% of total final energy consumption (in 2015) to around two-thirds by 2050. Over the same period, the share of renewables in the power sector would increase from around one-quarter to 85%, mostly through growth in solar and wind power generation.

Planned Activities

- **Stakeholder engagement, governance, and funding for GEO-VENER**. This includes redefining priorities based on stakeholder input and participant interest, as well as defining governance structures based on consensus. GEO-VENER should not be approached as a project or information system to be completed, but as a set of processes on ownership, governance, information management, communication and funding to establish. As the previous activities were based on community activities, they were more built on opportunities. The first objective of GEO-VENER is to define and then share its objectives and planned activities and outputs with the broader energy services and EO community and to define the pathways to success. Means of engaging with the broader community will also be identified but will begin with a robust and sustainable Community of Practice (CoP).
- **Renewable energies essential variables (RE-EVs)**. These are key elements for providing data, observation, information, knowledge and services related to renewable energies. The H2020 ConnectinGEO project is an attempt to define RE-EVs. A set of RE-EVs has been proposed for solar, wind and marine renewable energies. The definition of RE-EVs for other renewable energies will be pursued in GEO-VENER by interacting with the whole community and by engaging with the public and private sectors.
- **Gap analysis is key within the RE domain.** No specific EO system or program dedicated to renewable energies exists, but the renewable energies domain is using EO systems and programs dedicated to others domains to extract relevant renewable energies

information. Based on the RE-EVs and on the practices of the renewable energies stakeholders, the gap analysis will be conducted through various approaches.

- **Development of in-situ meta-networks for renewable energies**. The definition and development of a renewable energy "meta-network" will continue in order to attract institutional users and subject matter experts in the solar domain. Interactions with end-users will help engage the solar community. Based on this experience and on its results, a promotion oriented to other renewable energy communities will be considered. This first work will be pursued and adapted in close cooperation with the newly hired in situ data management specialist of the GEO Secretariat. Given that the industry is investing to increase data relevant to solar production, there may be a need to consistent standards and a global approach to this could be useful. There are currently existing portals that could be assessed for these purposes, including AREMI of Australia.
- **Webservice-energy.org**. This is a community portal dedicated to renewable energies, offering access to renewable energies observations, data, information and services for the benefits of energy users. It is recognized as a GEOSS Community Portal. The webservice-energy.org platform hosts a collection of web services offering data and applications in renewable energy and environment. The exploitation of renewable energy sources such as solar and wind energy requires accurate knowledge of the resources and their availability--in space and time--as well as accurate forecasts in the different phases of an energy system life cycle. Within GEO-VENER, the webservice-energy.org community portal will be used as a focal point and will evolve to ensure the link with the energy community of practice; to cover all renewable energies (solar, wind marine, biomass, geothermal, hydro) and to offer the one-stop portal for the renewable energies community.
- Draw connections and synergies between GEO-VENER and other GEO work groups and thematic areas including regional GEO initiatives such as AmeriGEOSS, EuroGEOSS, AO-GEOSS and AfriGEOSS, and thematic areas such as resilience, disasters, and risk. Energy has reach into all sustainable SDGs and all regions therefore strengthening the connections between GEO-VENER and other initiatives will make it a more sustainable and engaging work program.

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GEO WETLANDS

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. GEO Wetlands took over this task by implementing a community portal that supports users with reporting on the status and trends of wetland ecosystems on different spatial scales. This directly serves countries with the monitoring and reporting regarding Sustainable Development Goal 6.6 Indicator 6.6.1 on water-related ecosystems. These activities are coordinated with the two custodian agencies of this indicator, UN Environment and the Ramsar Convention.

GEO Wetlands is designed to directly support the Ramsar Convention on wetlands since it aims to provide Ramsar Contracting Parties with the necessary Earth Observation data, methods and tools to better fulfil their commitments and obligations towards the Ramsar Convention. It also contributes 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*". Furthermore, it provides tools that can be used by country governments to set quantitative targets for their wetland resources.

GEO Wetlands strengthens 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 ensures that GEO Wetlands' activities are in line with the broad communities' needs and carried out in an efficient and targeted approach to facilitate the user uptake. It also allows flexible and open involvement of the full user- and developer spectrum based on a co-design and co-creation approach with the major wetland stakeholders.

Major expected outputs for this coming period include the operational use of GEO Wetlands tools for national monitoring, and the establishment of the GEO Wetlands knowledge base and community portal as go-to address for information, products, data, guidelines, training materials and collaboration regarding the use of EO in wetland inventory, monitoring, mapping and assessment, and in wetland conservation and restoration. GEO Wetlands activities directly contributed to the formulation of the methodological guidelines for SDG Indicator 6.6.1 as well as a Ramsar Technical Report on 'The use of Earth Observation for wetland inventory, assessment and monitoring: An information source for the Ramsar Convention on Wetlands. A longer-term goal is to receive a direct policy mandate for maintaining these activities through major global stakeholders like the Ramsar Convention on Wetlands and UN Environment.

GEO Wetlands aims to ensure long-term sustainability by converting the ownership and governance structure from the current project and best-effort level to a more sustainable longer-

term common governance structure using available project results to demonstrate the added value GEO Wetlands provides to users on different levels.

Planned Activities

Planned activities for the 2020-2022 period include:

- Seek a formal mandate for GEO Wetlands from the Ramsar Convention on Wetlands;
- Secure funding through research grants but also in the form of support for core activities like initiative and community management, portal and website maintenance etc.;
- Improve and evolve research and applications in the fields of wetland EO; and
- Provide guidance and capacity building to support users with the application of tools and methods for EO-based wetland mapping, monitoring, inventorying and assessment.

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GEOHAZARD SUPERSITES AND NATURAL LABORATORIES (GSNL)

Overview

The Geohazard Supersites and Natural Laboratories (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 (DRR).

The GSNL goal is pursued by promoting broad international scientific collaboration and open access to a variety of space- and ground-based data, focusing on areas with high geohazard and 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 international scientific community employs these data to generate new scientific results which are eventually delivered to decision makers.

The decision-making processes required to achieve effective DRR occur at national and local scales and involve a variety of public bodies. To be well received and effectively support decisions, the scientific information generated at the international scale must reach the appropriate stakeholders in the proper way and form. For this reason, the Supersites are coordinated by local geohazard scientific institutions which have a mandate, in the respective national risk management frameworks, to provide authoritative information to public decision makers and the population. This ensures a rapid uptake of the information by stakeholders, benefiting hazard assessment, disaster monitoring and response actions.

The specific objectives of GSNL are to:

- Empower the international scientific community with open, full and easy access to space- and ground-based data, knowledge, capacities and resources, over selected, high risk areas of the world: the Supersites and Natural Laboratories;
- Demonstrate over the selected sites how the Open Science approach and international collaboration can generate actionable geohazard scientific information;
- Communicate the information to public agencies and other stakeholders, supporting informed decision making in risk reduction and management; and
- Promote innovation in technologies, processes, and communication models, to enhance data sharing, global scientific collaboration, knowledge transfer and capacity building in geohazard science and risk management applications.

To achieve these objectives, in the period 2020-2022 the GSNL initiative will expand the network partnership, increasing the number of Supersites from 11 to 14, with a focus on less developed countries. We will also improve data access, management and capacity building support, strengthening the way the Supersite scientific community cooperates to generate new science, and enabling the coordinators to provide better services to the Supersite end-users.

Planned Activities

- Reform of the governance structure and enlarge the community;
- Improve knowledge exchange and the sharing of research results in digital format, ensure the proper attribution of IPRs, promote the Supersite activities and seek national resources for sustainability of the Supersite infrastructures;

- Improve communication and collaboration with other international initiatives on DRR and open data/processing infrastructures;
- Carry out capacity building in collaboration with Supersite partners and existing initiatives in GEO and in the CEOS;
- Collect EO data needs from the Supersite scientific community and request image quota allocation to the CEOS space agencies; and
- Carry out continuous monitoring activities, early warning and research at each Supersite, using the in situ and satellite data, generate new scientific results and monitoring products, and disseminate them to the Supersite national end-users.

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GEOSS FOR THE ATLANTIC REGION (ATLANTIC GEOSS)

Overview

In 2015 the UN members agreed on the 2030 Agenda for Sustainable Development, defining 17 Sustainable Development Goals (SDGs) to be achieved over the next 15 years. Implementing and monitoring progress toward many of these goals depend on comprehensive information on, and knowledge of, the oceans. Earth observation (EO) data and monitoring systems have proven to be an effective solution for a deepened understanding of the marine environment and, as a result, can support the development of better responses to emerging challenges. Atlantic GEOSS is an initiative proposed in the context of the Atlantic International Research Centre (AIR-Centre), focusing on an integrated approach for Earth observation-based services.

The goals of Atlantic GEOSS are to develop an integrated EO framework that promotes collaboration and sustainable growth within the Atlantic countries, and to engage with communities to identify and develop opportunities for EO information and services, serving the region's societal needs.

Atlantic GEOSS is focused on marine, maritime and coastal application areas, such as monitoring marine biodiversity and protected areas, fishing and aquaculture, and marine spatial planning. Geographically, the initiative is based on the extension to the South Atlantic of the Galway Statement - the Belém Statement, signed between the European Commission, South Africa and Brazil. The initiative comprises institutions from many Atlantic states from Europe, Africa and America to facilitate the creation of value-added services for federated users in support to decision-making processes.

The four pillars of the Atlantic GEOSS are:

- Federating user needs for the Atlantic leveraged mostly on the AIR-Centre's extensive network;
- Matching user needs with proven Earth observation technology and scientific players in Atlantic bordering countries;
- Engaging international and national funding institutions to support the initiatives with highest impact; and
- Promoting dedicated capacity building to ensure the local and widespread sustainability of the activities.

Planned Activities

For 2019, the focus will be on the consolidation of the support for the Atlantic GEOSS initiative and engagement of stakeholders, particularly through the AIR Centre network and meetings, and for the consolidation of this Implementation Plan, in coordination with the GEO-Sec. A task will be setup to identify relevant initiatives, programmes and projects in the Atlantic area in order to develop synergies and avoid overlapping will already active activities. The resources for the Atlantic GEOSS initial setup in 2019 will be provided as in kind contributions from the participants in the initiative, and funding for an initial batch of activities for 2020-2022 will also be pursued during this period through identified opportunities by and coordination of the participants in Atlantic GEOSS.

Starting in 2020, the governance structure will be defined and setup, and the cycles of User Federation and Challenge Identification → Preliminary Technical Assessment → Funding Rounds and Selection of Activities → Implementation in Co-design → Capacity Building → Operations will be promoted for the activity areas identified by the federated users.

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GLOBAL DROUGHT INFORMATION SYSTEM (GDIS)

Overview

The primary purpose of the Global Drought Information System (GDIS) is to develop and deploy drought-tailored early warning maps--which will mesh with those of the World Meteorological Organization (WMO) on-going rollout of the Global Framework on Climate Services--providing opportunities for early warning maps within the Regional Climate Outlook Forums. A second role of GDIS is to identify global atmospheric and oceanic factors that trigger regional and globally synchronized drought that may be monitored. GDIS's third purpose is to synthesize this information in a comprehensible form through the GDIS information portal, housed on the NOAA National Integrated Drought Information System (NIDIS) portal.

The ability to monitor and predict the formation and intensity of droughts in near-real-time is limited at the global level. Current first generation global drought monitors, such as GDIS and the Copernicus Emergency Services Global Drought Observatory use land-based precipitation station records from the Global Precipitation Climatology Centre (GPCC). This introduces a bias towards areas having extensive meteorological and hydrological grids, while neglecting many part of the world; hence, not sufficiently documenting the global distribution of droughts worldwide.

Furthermore, if the starting point of the current drought observation is in error (by using month-old information), then subsequent iterations in climate models will be in even further error. GDIS's top priority is to develop a combined space-based, ground-based drought record which will minimize these errors.

Planned Activities

GDIS is divided into five work packages:

- Portal;
- Global precipitation data processing stream;
- Global drought forecasting data processing stream.
- Development of new global drought tools for inclusion in the portal (for example Global ESI and global soil moisture mapping); and
- Development of drought-oriented software modules and educational video recordings for distribution.

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GLOBAL FOREST OBSERVATIONS INITIATIVE (GFOI)

Overview

While the land sector is a significant source of global greenhouse gas (GHG) emissions, it also offers significant potential for reducing emissions and removing GHGs from the atmosphere. To inform national policy development, improve international reporting, and transparently track progress towards their GHG emissions reduction commitments, developing countries are working to establish self-sustained National Forest Monitoring Systems (NFMS) and associated emissions Measurement, Reporting and Verification (MRV) procedures. The need for NFMS is emphasized by the Paris Climate Change Agreement and associated decisions on guidance, transparency and MRV taken during the recent United Nations Framework Convention on Climate Change's (UNFCCC) 24th Conference of the Parties (COP 24) in Katowice, Poland.

The Global Forest Observations Initiative (GFOI) was established under the Group on Earth Observations (GEO) in 2011 as a forum to coordinate forest monitoring activities through the use of earth observation data. In 2015, GFOI was endorsed as one of the first GEO Flagships.

In 2016, GFOI partners commissioned a holistic external review of the Initiative. The review found that while GFOI had succeeded in achieving many of its initial goals, it needed to evolve to meet the changing global context, including supporting the implementation of the Paris Agreement, Sustainable Development Goals (SDGs) and the rapidly evolving information needs of developing countries. Subsequently, a second phase of GFOI was developed which reprioritizes the Initiative, expands its memberships and seeks to improve collaboration for the benefit of forested developing countries. GFOI Phase II is now in the early stages of implementation and is scheduled to run for the foreseeable future, including the period the GEO Work Programme 2020-2022 period.

GFOI constitutes an informal partnership of countries and institutions who collaboratively and consistently assist developing countries to operationalize or improve their NFMS. Together, GFOI provide a larger and more detailed package of support than any one partner could provide alone. GFOI's collaborative efforts seek to help developing countries to address multiple different needs, including establishing MRV procedures for REDD+, monitoring progress towards Nationally Determined Contributions (NDCs), the Global Stock Take process under the UNFCCC, confidence in performance based emissions reduction finances, supporting the Global Forest Resource Assessment (FRA), and informing national policy development and GHG inventories.

Planned Activities

GFOI is the product of the collaborative actions of its partners. Under its second phase, the Initiative will facilitate the following key activities, which seek to help developing countries to accelerate progress in their NFMS:

- Collaborative assessment of countries' needs, gaps and priorities
- Coordinated work planning to address priority country needs for improving or operationalizing NFMS and support their application to relevant reporting frameworks, including UNFCCC
- Facilitate collaborative implementation of forest monitoring support

  - Complementary or consistent capacity building assistance delivered directly to developing countries

- Development and dissemination of user friendly guidance for REDD+ that is IPCC and UNFCCC compliant, and consistent with other international reporting requirements
- Coordinate and influence the availability, accessibility and capacity to use remote sensing and other key datasets and tools
- Coordinate R&D activities to fill knowledge gaps, overcome obstacles to progress, align the work of the research community with country needs, and enable continuous improvements.
- Other joint resources and mutually beneficial collaboration that provides targeted support and deliver tangible benefits to developing countries.

The Initiative is guided by a Leads Group, currently comprising of the Governments of Australia, Germany, Norway, the United Kingdom (UK) and the United States (US) as well as the international Committee on Earth Observation Satellites (CEOS), the European Space Agency (ESA), the Food and Agriculture Organization of the United Nations (FAO) and the World Bank. It is implemented in close collaboration with developing countries and many other partners including the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, Non-government Organizations (NGOs), academia, the private sector, individual experts and others.

GFOI partners coordinate the delivery of their forest monitoring assistance across four interlinked components (i) capacity building, (ii) methods and guidance documentation (MGD), (iii) data and tool (data) coordination and; (iv) research and development (R&D) coordination. Furthermore, through the work of CEOS as a leading partner of the GFOI's Data Component, the Initiative is also working to provide assured availability of annual wall-to-wall coverage of all the world's forested regions with remote sensing data.

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

Overview

GEO-GNOME, which was launched in 2016, aims at bringing together research institutions and mountain observation networks to collate and make available transboundary and inter- and transdisciplinary environmental and social-ecological data and information on global change in mountains. This is expected to facilitate access to key data and information to the research community for studies applicable to global assessments such as those by the Intergovernmental Panel on Climate Change (IPCC), as well as information for local, national and regional decision-makers, ensuring that 'mountains' as a topic is incorporated in the process of global agendas such as the 2030 UN Agenda and its Sustainable Development Goals (SDGs), on climate change through the Intergovernmental Panel on Climate Change (IPCC) and UNFCCC, as well as Sendai Framework for disaster risk reduction.

Planned Activities

- Delineate accurately mountain regions using best available data.
    - Explore option to compile a new layer (K4): This task will aim to add one further layer with information on socio-ecological systems superimposed to mountain delineations. A paper publication is envisaged to document the process and the result
    - Make GME accessible via GEOSS and linked via GEO-GNOME GEOSS portal: A GEO-GNOME portal in GEOSS is currently on Beta, still requires mirroring of GME from USGS host site into GEOSS.
- Identify data providers and user knowledge needs.
    - Update existing database on data providers including GEO Flagships, Initiatives and Community Activities relevant to GEO-GNOME: Registry of relevant data providers and GEO Flagships, Initiative, Community Activities that could connect to GEO-GNOME goals and objectives
    - Engage and contact data stewards and researchers for other additional relevant data: Registry of relevant data providers that could connect to and contribute to GEO-GNOME goals and objectives. Provide a gap analysis to identify and map data availability and their protocols, versus what is required for observations in mountain environments
    - Identify user needs in the specification of data and information needs in line with GEO's strategy and global policy processes focus: Conduct surveys and/or consultations to gather insights and inputs on specific user needs in line with GEO's strategy and areas of priority.
- Improve monitoring and understanding of mountain processes.
    - Support the development of UHOP to improve high-elevation climate data - from EDW to Elevation-Dependent Climate Change (EDCC): Identification of suitable regions/areas for UHOPs and document the existing capacities and infrastructure available to monitor and gather observation data as per needs / specific relevance for mountain environments.

- Workshop on ECVs for mountains: This workshop is intended to identify the essential climate variables for climate and environmental transformations and changes in mountains and along altitudinal gradients, as well as to start identifying all other mountain-relevant variables for socio-ecological high-elevation systems. The workshop is also intended to highlight the high value of combining in-situ observations, satellite data and modelling.
- Workshop to identify essential mountain variables (EMVs) for social ecological systems (linked to new task under Task 1.1. to develop a new K4 layer): Workshop planned for June 2019 as a back-back event to the ECVs workshop (see Task 3.2). Position paper (gap analysis) and inventory is envisioned as output.
- Workshop on elevational transects: Workshop to derive foundation work and information on suitable locations for elevational transects and identify key local stakeholders/observatories (for 2020)

- Communicate, link, and develop reporting capacity that responds to policy needs.
  - Communicate milestones and tasks results, and showcase products at key GEO events and at relevant global policy events: Workshop and events outcomes report available and displayed online at GEO-GNOME GEO website and MRI's current information channels (website, newsletters and social media outreach)
  - List and connect with other regional and national programmes relevant to EO in mountain environments, as well as international networks: Calendar of events and registry of key contacts/global policy events to connect to for added value and impact.

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GLOBAL OBSERVATION SYSTEM FOR MERCURY (GOS4M)

Overview

GOS4M is aimed to support all interested Parties in the implementation of the Minamata Convention. The core objective of GOS4M is to support nations, the Minamata Convention Secretariat, UN Environment and other interested Parties and stakeholders to contribute to fulfil the decisions and requests of the Minamata Convention Conference of the Parties related to, but not limited by, capacity-building and technical assistance to developing country Parties (Article 15), research, development and monitoring (Article 19) and effectiveness evaluation of the convention (Article 22).

The overarching goal of GOS4M is to promote actions aiming to provide comparable global monitoring mercury data and validated modelling frameworks. In order to achieve this objective, GOS4M's key goal is to promote the establishment of a federation of existing regional and global monitoring networks that would allow to provide global comparable monitoring data for the purpose of the Minamata Convention on Mercury. The availability of comparable mercury monitoring data would foster the validation of numerical and statistical models used to assess the fate of mercury from local to global scales with changing emission regimes and climate, and source-receptor relationships. Another important goal of GOS4M is to support nations and all interested Parties in developing their own national or/and regional monitoring programmes by providing technical assistance and promoting capacity building initiatives for setting up new monitoring sites in areas where no mercury monitoring facilities and expertise are available.

Planned Activities

- Establish a governance structure;
- Analyze current infrastructures and archived information on mercury;
- Harmonize information and production of metadata following standards;
- Implement a GOS4M Portal with GEO DAB as the core engine;
- Design, create and implement core services;
- Design, create and release tools for using and discovering information;
- Test and update services and tools; and
- Progress reporting and stakeholder engagement.

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GLOBAL OBSERVATION SYSTEM FOR PERSISTENT ORGANIC POLLUTANTS (GOS4POPS)

Overview

GOS4POPs is intended to further develop a global observation system for persistent organic pollutants (POPs) to support the Stockholm Convention and the UN Economic Commission for Europe Convention on Long-range Transboundary Air Pollution (LRTAP) and ongoing international programs, including the Global Monitoring Plan (GMP) of the Stockholm Convention on POPs and the European Monitoring and Evaluation Programme (EMEP).

The objectives of GOS4POPs are to provide:

- Increased availability and quality of Earth observation data and information needed to track these chemical pollutants and anticipated changes in the environment on the basis of chemical production and use restrictions;
- Harmonization of metadata production, archiving and sharing among networks; and
- Development of advanced services in support of the policy mandate and effectiveness evaluation of the Stockholm Convention on Persistent Organic Pollutants.

To attain these objectives GOS4POPS will further development and adoption of advanced sensors for monitoring pollutants; advocate better preparing, archiving and sharing metadata; create advanced web services for using and discovery information from metadata and data; and update web services for policy makers.

Planned Activities

Activities of the GOS4POPs in the 2020-2022 GEO Work Programme will include finalizing the updates GMP Data Warehouse to host newly listed POPs, supporting the 3rd collection of global data, and providing advanced services to the Regional Organization Groups (ROGs) and the Global Coordination Group (GCG) in their tasks of producing regional and global reports in support of the effectiveness evaluation of the Stockholm Convention measures. GOS4POPS does its internal planning in six-year cycles and the 2020-2022 GEO Work Programme period represents the second half of the current six-year plan.

Activities for the 2020-2022 period include:

- Analysis of current monitoring programmes, data infrastructures and archived information on POPs, with a special attention to newly listed POPs [first phase completed, continuous updates];
- 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 [ongoing];
- Upgrading the GMP DWH to include new POPs [to be completed in the next period];
- Design, development and implementation of core services supporting adopted procedures of the 3rd Global Monitoring Report (harmonized data collection) [will continue in 2019-2020];
- Design, development and implementation of tools supporting data accessibility, presentation and interpretation [will be completed before the 2021 COP]; and

- Testing and updating of services and tools [release of Third Monitoring Report in 2021].

The first task will analyze the state of the art of POPs monitoring programmes and data infrastructures to discover data gaps, strengths and weaknesses that will affect further development of the GMP Portal (carried out in the third task). The second task will provide harmonized information and metadata to be exported to GEOSS. The remaining tasks will support implementation of the 3rd Global Monitoring Report for effectiveness evaluation of the Stockholm Convention on POPs. The fourth task will support harmonized data collection enabling analyses and reports on trends of POPs in the environment and human tissues. The fifth task will create specific tools allowing policy makers and stakeholders to explore and use key information. The sixth task will serve to test and update services and tools to satisfy emerging needs of the effectiveness evaluation of the Stockholm Convention (new POPs, matrices, global reports) through the end of the GEO Work Programme period.

Three to five years are necessary to make the GMP data warehouse fully operational and ready to support the third global data collection campaign. The remaining time will serve to make adjustments and to better calibrate services on policy maker and stakeholders requirements and needs.

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GLOBAL URBAN OBSERVATION AND INFORMATION (GUOI)

Overview

GUOI intends to improve urban monitoring and assessment by:

- Developing a series of satellite-based essential urban variables and indicators of sustainable cities through international cooperation and collaboration,
- Providing datasets, information, technologies to pertinent urban users in World Bank, UN, Africa, South America, and planning and environmental management agencies in other developing countries; and
- Supporting UN SDG Goal 11: Make cities inclusive, safe, resilient and sustainable.

The pertinent government agencies that would most likely use GUOI datasets include city authorities and resilient offices, departments of urban and regional planning, environmental management, natural resources, metropolitan transit authority, and office of sustainability, and regional statistics. These agencies need to use the datasets to obtain information about urban land use/land cover, urban form and growth patterns, infrastructure and transport needs, ecosystems and biodiversity, human health, thermal comfort, food security, and socioeconomic development. Further, the World Bank Platform for Urban Mapping and Analysis can benefit from the datasets, products, and services that this project offers. For the scientific community, GUOI will provide new knowledge on global urbanization process and innovations on urban observation.

Planned Activities

- Develop a series of satellite based essential urban variables and indicators of sustainable cities to support UN SDG Goal 11 through international cooperation and collaboration.
- Establish a Global Institute of Sustainable Cities (GISC) to explore EO as an enabling technology for development of sustainable cities and urban resilience and coastal resilience. GISC would provide EO methods and technologies, supplying objective information on the footprint of global urbanization and assisting in the development of indicators for sustainable cities to support the UN's Sustainable Development Goals.
- Megacities Observation and Monitoring program, expanded from the existing Global Urban Supersites Initiative. This program focuses on global urbanization of megacities and provides data sets for municipalities for megacities worldwide.
- Continued generation of Global Human Settlement Layers at various international and national levels and seek synergies among them.
- Implementing a 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.
- Continuing joint projects on Impervious Surface Mapping in Tropical and Subtropical Cities (Asia, Africa, and South America). This initiative focuses on urban mapping and providing datasets and EO technology services to developing countries.
- Organize an annual GEO Global Urban Observation Symposium.
- Create an annual international summer school to train and educate students and young researchers worldwide.

- Collaboration with IEEE, GRSS and ISPRS for capacity building and to showcase and disseminate research results.
- Seek synergies with other GEO flagships/initiatives.

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GLOBAL WILDFIRE INFORMATION SYSTEM (GWIS)

Overview

Wildfires are a global hazard that cause enormous environmental damage and economic losses and which continue to present a major risk in many countries. Wildfires, as opposed to controlled fires for agricultural and fuel reduction purposes, are a major threat to humans and the environment. Recent episodes in, for example, Indonesia (2015), Chile (2016), Canada (2016 & 20117), the USA (2017 & 2018) Europe (2017 & 2018), South Africa (2017 & 2018), among others, show that wildfires are far from diminishing in their size or intensity, but may be exacerbated by the already noticeable effects of climate change. It is estimated that about 450 million ha of natural areas are burned every year causing large environmental and economic damage 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. Several national and supranational organizations have established systems aiming at providing early warning for large fire events to minimize the effects of catastrophic fires, to monitor active fire distribution, and the post-fire accounting of burned area.

Despite the above, comprehensive and accurate ground-based inventories on wildfires at the global level do not exist, nor is there a global system that is able to provide in a synthesized way information on the evolution of fire regimes and fire impacts at national, regional and global levels. Efforts to collect information at local or national level have shown that this endeavour is very difficult, making it nearly impossible to collect such datasets at the global level. The existence of different definitions of forests or wildfires, different methods in the collection of information and different systems at the national or sub-national level, makes it impossible to gather global information through the aggregation of ground collected information. This information is essential to understand fire management from the local to national to regional and at a global scale, and the use of Earth observation provides alternative ways to collect wildfire information.

Earth observations (EO) and information, derived both from space and surface networks, have demonstrated not only their maturity, but their critical role in supporting fire managers, first responders and risk managers by providing effective tools to predict severe fire danger conditions, rapidly map natural hazards, and assess impacts. Although there is an increasing amount of spatially explicit data and information on wildfires being derived from different sources and often collected at the national, regional and global levels, there is currently no international initiative to synthetize and harmonize such information, and to distribute it to users worldwide.

GWIS aims at providing a continuous and smooth platform of harmonized information on wildfires that could be used at different scales, from national to global. At the global level, where information on wildfires is scattered and not harmonized, GWIS will be a unique source of information for global initiatives and policies, while supporting the analysis of wildfire regimes at this scale. The calibration of the system and the validation of the different modules will require the close collaboration with regional and national partners. In countries that currently do not have a wildfire information system, GWIS will fill this gap and help countries engage in international collaboration. For countries and regions where wildfire information systems exist, GWIS will provide a complementary and independent source of harmonized information adding to the national/regional information sources. GWIS builds on the experience, achievements and networks established connection with the European Forest Fire

Information System (EFFIS) and the Global Observation of Forest Cover Global Observation of Land Dynamics (GOFC GOLD) Fire Implementation Team and Fire Regional Networks. Engagement with wildfire managers at national and local scale will be channelled through the EFFIS network in Europe, Middle East and North Africa, and through the GOFC Fire IT networks in the rest of the world.

Planned Activities

- Maintain and further develop GWIS, providing harmonized fire information, e.g. fire danger, active fires, burned areas, emissions, as well as reports on wildfire regimes and statistics at national, regional and global level;
- Integration of NASA Earth Science, Applied Science Program-supported GWIS project results into operations;
- Global active fire monitoring from geostationary satellites;
- Fire danger prediction, including specific calibration for regional scales;
- National/regional/global GWIS services for fire managers and fire administrations;
- Integration of global wildfire products from all sources, including results of the ESA Fire CCI products and Copernicus products from different services;
- Networking of major national and regional fire information providers by organizing an annual workshop convening key international organizations and initiatives and national and regional providers, e.g. Australia, Canada, China, Central and South America and South Africa;
- Maintain established operational links with other wildfire communities dealing with wildfire aspects at global scale (e.g. burned area assessment, emission estimation) and develop new links with other wildfire-related communities;
- Further develop GWIS by integrating and harmonizing as much as possible regional wildfire data and information sources.
- Develop, implement and promote the establishment of mechanisms for interoperability and communication among national, regional and global wildfire information systems following OGC standards and guidelines, and the GEOSS Data Sharing Principles;
- Develop methods for the global assessment of wildfire risk and implementation of this assessment at the global scale;
- Coordinate and promote capacity building and training activities in close cooperation with the GOFC-GOLD Fire Implementation Team regional networks and the EFFIS network; and
- Promote dissemination of information and training on the use of GWIS methods and tools to the wildfire community and the general public, in cooperation with NASA ARSET, the Copernicus Communication Services and the GEO Secretariat.

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OCEANS AND SOCIETY: BLUE PLANET (GEO BLUE PLANET)

Overview

We live on a blue planet, and Earth's waters benefit many sectors of society. 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. GEO Blue Planet is a network of ocean and coastal-observers, social scientists and end-user representatives from a variety of stakeholder groups, including international and regional organizations, non-governmental organizations, national institutes, universities and government agencies. GEO Blue Planet aims to ensure the sustained development and use of ocean and coastal observations for the benefit of society.

GEO Blue Planet's mission is to:

- Advance and exploit synergies among the many observational programmes devoted to ocean and coastal waters;
- Improve engagement with a variety of stakeholders for enhancing the timeliness, quality and range of services delivered; and
- Raise awareness of the societal benefits of ocean observations at the public and policy levels.

Planned Activities

During the 2020-2022 Work Programme period, GEO Blue Planet will work to identify and share best practices on stakeholder engagement and societal awareness; communications; data discovery, access and utilization; and capacity development. The initiative will collaborate with various GEO activities and partners to support GEO's engagement priorities and strengthen linkages with stakeholders. GEO Blue Planet will also work to develop the following knowledge hubs and decision-support tools:

- Knowledge hubs for fisheries, coral reefs and ocean-related SDG monitoring;
- Multi-hazard Information and Alert System for the Wider Caribbean;
- Early Warning System for Marine Flooding of Reef-lined Islands;
- Early-warning Systems for Water-associated Diseases; and
- Systems for observing, quantifying, and classifying marine debris.

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SPACE CLIMATE OBSERVATORY (SCO)

Overview

The Space Climate Observatory (SCO) is a response mechanism aiming to address global changes along with proposition of key adaptation and mitigation measures. Its ultimate objective is to fill the gap currently existing at international, regional and national levels to assess and monitor the impact of climate change using space and in-situ observations with models.

SCO will provide easier access to multisource data in addition to existing global climate datasets (e.g. ECVs) and to downscale scenarios on impacts of climate change to finer scale. SCO will reinforce climate change impact monitoring capacities, such as for forest fires, impacts on crops, coastal areas, urban heat island, ocean biology, glacier retreat, health, etc. SCO will be science based, co-built in an international partnership framework, and will take direct benefit from recently available high-resolution Earth observation data.

While international research programs on climate have already well demonstrated the role of anthropogenic impacts on climate change with identified key trends at the global level, there is still an urgent need to address climate change induced risks at finer scales to allow effective actions from all parties, including civil society, the private sector, financial institutions, cities and other subnational authorities, local communities and indigenous peoples.

To address these needs, SCO will promote at the international level an easier access to high-resolution satellite data, in situ data, as well as processing and modelling capacities that are needed for the production of finer scale climate change scenarios. This will be done through international cooperation on climate change adaptation issues between space agencies, research institutions, citizen science entities and stakeholders.

In general terms, SCO intends to support four international engagements:

- The Cancun Adaptation Framework;
- Article 7 of the Paris Agreement on climate change;
- SDG 13 and other SDGs such as SDG 6 “Take urgent action to combat climate change and its impacts” of the 2030 agenda; and
- The Sendai Framework for Disaster Risk Reduction.

While launched in the framework of the One Planet Summit in Paris (December 2017), SCO can also be considered as an outcome of the International Academy of Astronautics Mexico Summit Declaration stating that international coordination is imperative to address climate change issues.

SCO will be complementary to existing international programs and work in coordination with UNOOSA, CEOS, GCOS and will sustain the work of the UNFCCC and the IPCC. Downstream from these major programs, the SCO aims to help regions, countries and subnational entities to prepare for climate change in relation to GEO Societal Benefit Areas, to provide trans- and multi-disciplinary expertise in monitoring the impacts already visible and to build, exchange and transfer realistic scenarios to best address them across the territory.

The main outcome from SCO should be the emergence of an international forum or platform for gathering space agencies, frontier technologies, research institutions, citizen science entities, funding agencies, national and subnational stakeholders willing to promote the co-production

and use of finer-scale climate change impact scenarios, products and indicators to promote actions, strengthen resilience and reduce vulnerability with regard to climate change impacts.

Planned Activities

The following activities are planned for the first 2-year period:

- Sign an international Protocol Agreement with agencies willing to participate and define partnerships with international bodies, including: CEOS, GCOS, WCRP, and GFCS.
- Set up governance bodies, starting with the Steering Committee.
- At a technical level, the international SCO system first version could gather:
    - A web portal;
    - Space agency coordination to build up a unified space data access;
    - Referenced information about impact studies;
    - Reference to local initiatives;
    - First definition of the common architecture and common tools.
- Impact case studies, ideally for each priority area as defined by the GFCS, these being: agriculture and food security, disaster risk reduction, energy, health, and water.

Within two years from its creation, SCO should show concrete realizations in areas already presented as proofs of concept at the Toulouse Space Show in June 2018:

- Global warming, heatwaves and urban hothouses;
- Glaciers melting faster, sea level rise impact at the coasts;
- Pollutants and green gases, impact on city air quality;
- More frequent droughts: impacts on agriculture and water resources management;
- Extreme events, precipitations and floods; and
- Freshwater reserves.

Points of Contact

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Regional GEOs

AMERICAS GROUP ON EARTH OBSERVATIONS (AMERIGEO)

Overview

AmeriGEO, formerly called AmeriGEOSS, was established in 2014 by the GEO members in the Americas and is a continuation of activities conducted in the framework of "GEOSS in the Americas" since the first GEOSS in the Americas Symposium was convened by Brazil in 2007.

AmeriGEO provides a framework for cooperation among countries in the Americas in the use of Earth observations, for the benefit of society. Of the 35 sovereign states in the Americas, of those, 16 countries have become formal members of GEO while two others are observers. (The GEO members are Argentina, Bahamas, Belize, Brazil, Canada, Chile, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Panama, Paraguay, Peru, the United States of America, and Uruguay. Bolivia and Guatemala are observers). AmeriGEO's regional approach seeks to both take advantage of existing institutional and technical capabilities of its member countries and leverage resources of other GEO initiatives. AmeriGEO focuses its activities in the four priority areas selected at the 2014 Americas Caucus meeting: agriculture, biodiversity & ecosystems, disaster risk reduction, and water.

To provide strategic direction for cooperation and to advocate for the local and national interests, AmeriGEO members participate in regional and priority area working groups and other collaborations established through high-level cooperation agreements between and among countries in the Americas. AmeriGEO also seeks to increase institutional and personal capacity through cooperation, acquisition and sharing of technology, training, and through the engagement of experts, stakeholders, and decision-makers in the process of decision-making and implementation of sound policies. AmeriGEO facilitates a regional perspective within GEO's 2020-2022 Implementation Plan by reflecting the local, national, and regional interests for short and long-term planning, development, and implementation of GEO activities in the Americas. GEO strategic objectives of relevance to AmeriGEO are also outlined in this document.

Planned Activities

While AmeriGEO has made great strides since its establishment in 2014, through 2019, for 2020-2022, new activities are planned to broaden the initiative's engagement in the Americas, and further advance its core mission. We plan to continue the activities of the AmeriGEO Coordination Working Group, and hosting of the annual AmeriGEO events. It is also anticipated that the work will continue to focus on the four priority SBAs which were identified for AmeriGEO in 2014.

Other activities, some of which are in collaboration with other GEO Work Programme activities, include:

- EO4IM: Earth Observations for Indigenous-led land management. Improving sustainable land management in the Americas by strengthening the technical capacities of indigenous peoples' organizations
- GEOGLAM Latinoamerica: Regional instance of GEOGLAM

- GEO MBON: The Pole-to-Pole Marine Biodiversity Observation Network of the Americas (P2P-Americas) builds a community of practice at the continental scale that serves information needs of multiple national and international stakeholders for the conservation of marine living resources.
- SAR-CBC: This project is developing targeted educational material, webinars, and on-site trainings that build capacity in the use of SAR-based Earth observation data in decisions-making. To sustain the use or SAR resources long term, this project is developing innovative cloud-based data processing solutions that enable SAR data analysis without requiring expensive computing infrastructure.
- Needs Assessment Protocol: Development of questions, strategy for collecting information to establish priority working areas for AMA
- Resources Inventory: Collection, organization, storage, and access promotion to EO-related resources relevant in the Americas
- EO-Disaster Risk Management: EO information for disaster management
- GEO-DARMA Initiative: EO data to support DRR to decision-makers.
- AmeriGEOSS Platform: EO to products and services for communities
- GEO-GFRM: Global EO integrated assess flood risk on global scale.
- GWIS: Joint initiative of GEO - Copernicus Work Programs
- GSNL: Geophysical and geohazard assessment for DRR.
- GDIS: Global monitoring drought and water scarcity.

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ASIA-OCEANIA GROUP ON EARTH OBSERVATIONS (AOGEO)

Overview

Recognizing that Earth observation data, information and derived knowledge are critical for identifying vulnerabilities, monitoring and assessing impacts and informing the decision-makers, and the uneven development of the AO region and complexity of the geographic scope, there is an urgent demand to develop an integrated, shareable, and sustained observation system and to foster its application capacity. AOGEO will engage regional stakeholders, including national agencies and regional intergovernmental organizations, in global GEO activities and coordinate implementation of GEO activities within the AO region.

Planned Activities

AOGEO will focus on the three areas of GEO's Engagement Strategy, including 2030 Agenda for Sustainable Development (SDGs), Paris Climate Agreement within the UNFCCC (Paris Agreement), and Sendai Framework for Disaster Risk Reduction (Sendai Framework) by implementing three types of activities: Regional Application Activities, Foundational Tasks and Integrated Pilot Studies.

Regional Application Activities

- Asian Water Cycle Initiative (AWCI)
- Asia-Pacific Biodiversity Observation Network (AP-BON)
- GEO Carbon and GHG Initiative (GEO-C)
- Oceans, Coasts, and Islands (OCI)
- Agriculture and Food Security (AsiaRiCE)
- Drought monitoring and Evaluation
- Environmental Monitoring and Protection (EMP)
- Disaster Resilience (DR)
- Himalayan GEOSS

Foundational Tasks

- Data Sharing
- Data Hub and Cubes
- User Engagement and Communication

Integrated Pilot Studies.

- Mekong River Basin
- Small Island States
- Himalayan Mountains.

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EUROPEAN GROUP ON EARTH OBSERVATIONS (EUROGEO)

Overview

EuroGEO was launched in 2017 to provide a regional framework to promote coordination and cooperation among the members of the European GEO Caucus. EuroGEO will achieve a critical mass in Europe by combining existing European Earth observation assets and initiatives and demonstrating pilot applications supporting governments in their decisions, boosting innovation and improving lives in Europe.

Emphasis will be put on the following strategic actions:

- Identifying existing EO applications under development in Europe with the highest potential to respond to consolidated European user needs, but requiring further demonstration, incubation, upscaling, deployment or replication;
- Up-scaling selected pilot applications by streamlining innovation instruments available at European Union, national or sub-national levels and actively promote synergies;
- Connecting EuroGEO pilot applications and related GEO actions to allow for appropriate scaling-up (from national, through European, up to global scale) and scaling-down (from global to regional scale);
- Showcasing GEOSS benefits to European citizens, science and businesses and promoting in Europe the GEO vision to realize a future wherein decisions and actions are informed by coordinated, comprehensive and sustained Earth observations and information; and
- Supporting the consolidation of national GEO management structures across Europe.

EuroGEO builds upon, networks and promotes further incubation and scaling-up of the most promising user-driven applications conducted at national or European Union levels by the members of the European GEO Caucus. Particular emphasis is put on tackling as far as possible the 'last mile' of the innovation process, thus enabling pre-operational services that could extend or reinforce other GEO initiatives and flagships. This will accelerate the transformation of GEO from a data-centric to a user-driven partnership.

European funded project such as e-shape (EuroGEOSS Showcases: Applications powered by Europe) and PARSEC (Promoting the international competitiveness of European Remote Sensing companies through Cross-cluster collaboration) are contributing to this endeavour.

EuroGEO pilot applications will take full advantage of the operational data and information products delivered by Copernicus and the core Copernicus Services, the EU operational programme for Earth observation. The selected pilots will be of direct relevance to the GEO Engagement Priorities (including the Sustainable Development Goals) whilst leveraging Global and European EO initiatives to improve/facilitate the implementation of European environmental policy. EuroGEO applications will be focused and address specific user defined scenarios such as e.g. Identification and use of appropriate climate information required for defining building regulations with respect to flood resilience. These very specific applications are not explicitly addressed with the Copernicus Core Services and it is here where EuroGEO is able to provide additional support.

After the initial start in 2017, and a number of preparatory steps in 2018 such as the setting-up of the Action Groups, EuroGEO has entered the next stage with the launch of major European funded projects contributing to the above objectives. The first outcomes of those projects will

consolidate the specific demand for GEOSS solutions in Europe, facilitate interaction with and contribute to relevant GEO actions and stimulate the innovation process tackling unaddressed regional needs.

EuroGEO has a light governance structure to support greater engagement by the members of the European GEO Caucus. The structure includes a Coordination Group to oversee strategic implementation, and Action Groups reflecting shared thematic interest at local, national and European levels.

Planned Activities

While EuroGEO has already had an initial impact on the EO landscape in Europe since its inception in 2017, in the coming years, new activities are planned to secure the initiative in Europe, together with the Copernicus Programme, forming as such the European contribution to GEO. This will be done in close collaboration with the Coordination Group and the Action Groups. Close interactions with the GEO Flagship and Initiatives and the Foundational Tasks will be pursued.

The main spheres of activities to be conducted by the EuroGEO Initiative relate to Coordination, Combination and Collaboration (EuroGEO 3Cs):

- Coordination of GEO-relevant activities undertaken in Europe to ensure a coherent European contribution to GEOSS;
- Combination or integration of activity outputs to provide added value and to reach maximize user uptake and engagement;
- Collaboration beyond individual programmes and user communities.
- Coordination with other regional activities

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Candidate Community Activities

ACCESS TO CLIMATE DATA IN GEOSS (GEO CLIMATE DATA)

Overview

Observation data that are accessible through GEOSS needs to be augmented by reanalysis and climate simulation data to provide a complete understanding to all the components that make up the Earth system. This community activity aims to enable the integration of GEOSS with Earth System Grid Federation (ESGF) and other world-wide climate data systems to fulfill an integrated access to all these data in the GEOSS Platform. Studies in many Societal Benefit Areas, including Disaster Resilience, Public Health Surveillance, Food Security and Sustainable Agriculture, Biodiversity and Ecosystem Sustainability, will benefit from this effort.

Planned Activities

- Leverage the Intergovernmental Panel on Climate Change (IPCC) / World Climate Research Programme (WCRP) Coupled Model Inter-comparison Project (CMIP) infrastructure for access to climate model outputs under the ESGF international collaboration;
- 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 inter-comparison initiatives;
- Advance GEO collaborations and linkages to NASA's CREATE reanalysis clearinghouse and Reanalysis.org;
- Collaborate with the Decadal Forecast Exchange data in that context. Links with contributions from the Copernicus C3S;
- Leverage GlobalChangeONE to enable a collaborative analysis paradigm for reanalyses, observational data and climate simulations.

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ADVANCING COMMUNICATION INFRASTRUCTURE AND SERVICES (GEO-ACIS)

Overview

The transmission and exchange of data used in the realm of GEO and geospatial research relies upon a number of communication layers and distribution systems. These layers and systems, controlled by a number of different actors, when inter-mixed form a transparent underlying service otherwise known as the internet. In some respects, these layers are operated by a number of private (commercial), non-profit, governmental and non-governmental organizations to form a communications commons on which the GEO community relies for its systems and services to work. GEO, through collaboration with existing and new contributors, will explore possibilities of making non-commodity communication infrastructure 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.

Planned Activities

- Continued engagement and support for AfriGEOSS, aligning to their strategic aims;
- Engage and align with AmeriGEOSS strategic aims to assist in outreach to EO research organizations and data centres in Latin America;
- Engage with other GEO Flagships and GEO Initiatives to assess network requirements and possible improvements of data dissemination and federated identity management services;
- Support National Research and Education Networks (NRENs) to discuss existing communication infrastructure, requirements and developing activities in various world regions which are aligned to GEO Flagships and initiatives;
- Provide assistance to the GEO-AWS Cloud Credits programme;
- Investigate state-of-the-art information technologies, such as trust and identity and cloud services, available through existing and potential contributing networks and how these may be applied to the GEO community, GEO Flagship and other GEO initiatives;
- Engage with GEO community data providers to seek potential cooperation with and requirements to the GEO communication infrastructures and associated services;
- Investigate a potential trust and identity architecture which would allow GEO initiatives and Flagships to interconnect with other trust and identity AAI infrastructures and regional research collaborations, such as the European Open Science Cloud (EOSC).

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ARCTIC GEOSS

Overview

SAON's Vision is a connected, collaborative, and comprehensive long-term pan-Arctic Observing System that serves societal needs. The Mission of SAON is to facilitate, coordinate, and advocate for coordinated international pan-Arctic observations and to mobilize the support needed to sustain them.

The Strategy for SAON describes the following three goals:

- Create a roadmap to a well-integrated Arctic Observing System;
- Promote free and ethically open access to all Arctic observational data; and
- Ensure sustainability of Arctic observing.

The SAON Implementation Plan outlines the objectives for each of these goals and the plans for achieving these.

Planned Activities

1. Create a roadmap to a well-integrated Arctic Observing System;

The rapid on-going changes in the Arctic present an urgent need to better observe, characterize and quantify processes and properties of the Arctic system.

SAON is engaged in and facilitates connections among the producers and end-users of Arctic observations in order to create and sustain an Arctic Observing System. In order to achieve this goal, SAON believes that it is essential for participating parties to adopt a community-endorsed framework. The *International Arctic Observations Assessment Framework* (6), developed in partnership with SAON, provides such a starting point. SAON's role in further developing and implementing this framework will be to help to identify critical observations, products, and services that are relevant to the Arctic Observations *value tree*. A holistic benefit analysis can then be used to assess the responsiveness of current Observing System and identify potential expansions. The results of this analysis will be central to the creation of a roadmap to well-integrated Arctic observing that is responsive to Societal Benefit Areas. This roadmap will also be used to identify funding sources to support infrastructure required for sustaining or adding new observational capabilities as well as technological innovations to improve observation capacity.

2. Promote free and ethically open access to all Arctic observational data.

One of SAON's guiding principles is to promote ethically free and open access to ethically-collected data. The approximately sixty international participants at the 2016 *Polar Connections Interoperability Workshop and Assessment Process* agreed that the key current challenges impeding the development of a globally connected, interoperable system are social and organizational rather than technical: supporting human networks, promoting standards, and aligning policy with implementation.

A review of relevant Arctic data management efforts and results have guided the SAON vision for an open, interconnected, international system for sharing data across disciplines, domains, and cultures. Requirements and characteristics of such a system include but are not limited to:

- A distributed design that connects different data repositories and other resources. This implies and requires interoperability that supports sharing data among various information systems in a useful and meaningful manner;
- Many linked catalogues fostering ‘single window’ search;
- High quality, ethically open data sustainably preserved over time;
- Data as a responsive, “live” service rather than simple download approach;
- Inclusive of Indigenous and local perspectives and information;
- Access to “big data” and powerful analytical tools (e.g. cloud platforms); and
- Cost effective, maximizing the investments made to develop and maintain the system.

In recognizing the elements of the envisioned system and the key challenges identified by the community, SAON focuses on improving connections, and cooperation between actors. This is achieved by working with the global Arctic data community, including data providers, data scientists, funders, users and beneficiaries within society. This effort will provide the necessary collaborative foundation needed to achieve the desired system.

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CHINESE HIGH-RESOLUTION SATELLITE DATA RESOURCES (CSDR)

Overview

Since the implementation of the UN global mapping, Member States, particularly China, have been actively supporting and conducting the related work to the UN and international community benefitting the sustainable development of society and economy at domestic, regional and global levels. In recent years, the Chinese government proposed the Belt and Road (B&R) Initiative and started the co-construction with B&R countries to promote the global commerce, investment and technical cooperation. The Ministry of Natural Resources of People's Republic of China–the former National Agency of Surveying, Mapping and Geo-information (NASG)–has launched the programme to serve the B&R region with the acquisition, processing, and application of geo-information to assist the geospatial industry, institutions, commercial sectors in the global co-construction and sharing of surveying, mapping and geo-information, where it has accumulated the sufficient international EO achievements of products, resources and experience.

The Cloud Service Platform of Natural Resources Satellites Images (CSP) initiated by Land Satellite Remote Sensing Application Center, MNR (LASAC) is capable of meeting the demands of remote sensing data for natural resources management. CSP has a client management system and an instant push system as well, providing management services, distribution services and real-time push services for latest acquired images of China domestic high-resolution satellites. CSP with high-resolution satellite images has been applied to government agencies and other relevant organizations during the last 2 years. It provides data query, data purchase, data instant push, and other related services. At present, LASAC has the partners of 14 countries which have co-constructed 14 nodes in 4 continents of the network by bi-literal cooperation, while some of them are also the members of GEO. This network and mechanism are desired to take leveraging of GEO framework to strengthen and expand the network construction with more substantial outcomes. On one hand, partners of CSP will be in this CSDR programme continually to make joint efforts to promote the applications, research and engineering of Earth observation remote sensing satellites images for natural resources management. On the other hand, the construction of data sharing, data exchange, other forms of cooperation of sharing satellite resources are implemented in CSDR network.

Through the service model and mechanism, Chinese high-resolution satellite image data, mapping products and data processing technologies can be contributed to GEO members to support applications in developing countries, small islands, and south-south cooperation for the sustainable and harmonious development.

To accelerate the data applications, the multi-satellite radiation and geometric calibration will be carried out with the collaboration of Germany, Austria, France and others to guarantee data precision and the status of the satellites.

The CSDR high-resolution satellite image network architecture and application regulations will be established, in situ data cooperation and field investigation for geo-information will also be conducted in associated countries, such as in Zimbabwe and Laos.

Planned Activities

In general, the activities have been and will be conducted through joint research, technical projects and activities; organization of seminars, workshops and training courses; development of regional cooperation mechanism and infrastructure network; data sharing and results

publishing of scientific studies and cooperative projects in the cooperation areas, which are listed as but not limited to the following:

- Node construction of the Cloud Service Platform of Natural Resources Satellites Images in the associated countries;
- High-resolution remote sensing data processing, joint calibration and products verification;
- Generation and update of 1:25,000 and 1:50,000 geospatial information products based on natural resources satellite images, mainly on ZY-3;
- Geospatial information extraction and change detection based on remote sensing technology;
- Remote sensing and GIS applications in agriculture, forestry, water conservancy, land resource management, urban planning, ecological environment, disaster prevention and alleviation, and other areas.

In the year 2019, key activities are as below:

- Establish the CSDR administrative body, joint research center and secretariat;
- Provide non-charge Chinese natural resources satellites data for co-constructing technical experiments and testing, while strengthening the service model and cooperation mechanism;
- Build more international nodes for partners in the on-going CSDR programme;
- Discuss the long-term development goals and short-time action plans;
- Conduct exchange visits and technical collaboration, and co-host workshop and training courses based on CSP network.

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COPERNICUS ATMOSPHERE MONITORING SERVICE (CAMS)

Overview

The Copernicus Atmosphere Monitoring Service (CAMS) is one of the 6 core services of the European Union's flagship programme Copernicus. It provides consistent and quality-controlled information, based on Earth observation, related to air pollution and health, solar energy, greenhouse gases and climate forcing, anywhere in the world. All these CAMS information products are available to all, following a full, free, and open data policy.

CAMS has been operating in operational mode since 2015, building on a decade of research and development precursor projects and user consultation. CAMS is managed and partly implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF) and partly by means of contracts involving over 130 public and private entities from more than 28 European countries. The work programme of CAMS beyond 2021 will seek enhanced continuity and will depend upon the wider programmatic elements of the future Multi-Financial Framework of the European Commission and, in particular, the future space regulation.

Planned Activities

CAMS will continue to deliver its portfolio of operational information products and services throughout the period.

In 2019 and 2020, CAMS activities will include:

- Consolidation of the operational use of all the Sentinel-5p products available (O_3, NO_2, CO, SO_2, HCHO and CH_4) and of Sentinel-3 data (AOD and FRP, as soon as available) in the CAMS global system;
- Promotion of the first CAMS reanalysis, covering 2003 to present (calculation to be completed to cover the entire year 2018 in 2019, and the year 2019 in 2020);
- Extension from seven to nine members of the operational regional air quality ensemble, expected to bring additional performance and resilience to issues;
- Upgrade to fully new emissions datasets for both global and regional systems operations;
- Completion of the migration of CAMS products onto the Atmosphere Data Store (ADS) and DIAS; and
- Continuation of efforts to consolidate the use of CAMS policy products at the European (DG-ENV, DG-CLIMA, EEA, JRC...) and international (WMO, WHO, UN/SDGs...) levels, as well as to increase their uptake at national level.

Point of Contact

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COPERNICUS CLIMATE CHANGE SERVICE (C3S)

Overview

The Copernicus Climate Change Service (C3S) routinely monitors and analyses more than 20 Essential Climate Variables (ECVs) to build a global picture of our climate, from the past to the future, as well as developing customizable climate indicators for relevant economic sectors, such as energy, water management, agriculture, insurance, and health.

C3S is developed and operated in a way that complements the established range of meteorological and environmental services that are operated nationally. The strong involvement of current service providers and relevant academic communities ensures that C3S fully benefits from existing infrastructure and knowledge. It also ensures that the Service is implemented consistently with European Union principles of complementarity and subsidiarity. The service elements for C3S are procured by means of competitive Invitations To Tender (ITT), and are delivered by about 200 companies and organizations across Europe.

Planned Activities

The current Delegation Agreement signed between the European Centre for Medium-Range Weather Forecasts (ECMWF) and the European Commission covers the period November 2014 until December 2020. Some provisions have been made to ensure operations of the Service until mid-2021 or so. This means that the current GEO work programme 2020-2022 goes beyond the current arrangement with the European Commission and thus the Implementation Plan only includes activities envisaged until the end of 2020 (assuming continuity 6 months into 2021).

As C3S has just become “operational”, much effort during 2019 and 2020 will be dedicated to the consolidation of the Service, in many aspects:

- Inclusion of additional climate datasets into the Climate Data Store;
- Continuation of production of climate data records for climate monitoring, including from global and regional reanalyses;
- Development of an optimal environment for downstream applications and use cases on the Climate Data Store toolbox in a wide variety of economic sectors (energy, agriculture, water, tourism, shipping, insurance, health, biodiversity, disaster risk reduction, etc.);
- Ramp up of the quality assurance mechanisms and processes to ensure authoritativeness of the Service;
- Full deployment of a training strategy, including an ambitious train-the-trainer programme, focused towards Europe but also supporting third countries and programmes in need of climate information for their own services; and
- More generally, improvement of the quality of service, including user support, performance of the CDS, and documentation.

New prototype service elements will be engaged in 2019 and consolidated in 2020, corresponding to important demands by the user community for an attribution service element and a decadal (5-10 year) prediction element.

Point of Contact

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COUNTRY CAPACITY BUILDING FOR PLANNING AND IMPLEMENTATION OF NATIONAL FOREST INVENTORIES IN ASIA AND THE PACIFIC REGION (GEO FOREST INVENTORIES)

Overview

National forest inventories (NFIs) serve very useful purposes in forestry sector planning and international reporting of country action towards mitigation of global climate change, biodiversity loss and other global issues. Countries, therefore, are interested in launching NFIs to obtain reliable baseline data and make estimation of changes at a national level on a continuing basis.

Presently, only the industrialized countries have well-planned and well-executed NFIs, and established close networks among them for exchanging technical know-how on a regular basis in order to harmonize and improve the reporting system further. In contrast to above, there is almost complete lack of documentation and reporting on NFI in the case of developing countries. The key objective of this GEO initiative is to enhance capacities of the countries in the Asia Pacific Region to plan and implement NFIs on a technically sound basis in order to collect compatible data to enable problem oriented analysis at the national and international levels.

Planned Activities

The following activities are proposed during 2020-2022:

- Establish South-South and South-North Cooperation networks in the Asia-Pacific region under regional cooperation treaties (as in the European Union) for technical exchange on NFIs;
- Publish a short report on the ongoing NFIs in the region, existing country capacity and manuals on field procedures, statistical design, data processing, etc.;
- Secure international funds for organizing regional training courses at the existing UN Regional Training Centre at the Indian Institute of Remote Sensing (IIRS) Dehradun in various thematic areas of NFI such as statistical techniques, use of remote sensing, sample plot procedures, and analysis of NFI data;
- Secure funds for participation of international faculty at the regional training courses and for making country visits; and
- Assist countries to produce model NFI Reports at the state, country and international levels; and
- Participate effectively in international negotiations and developing appropriate policies for conservation and development of national forest resources.

Point of Contact

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EARTH OBSERVATION AND COPERNICUS IN SUPPORT OF SENDAI MONITORING (EO4SENDAI)

Overview

The United Nations included seven global targets in the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) and agreed on 38 indicators to measure the global progress in implementing the SFDRR. Monitoring the status and degree of target achievement globally requires the use of various data sources (for example: official data, media reports, insurance data, satellite earth observation data) which should be consistent and comparable in time and space. In the majority of states, however, the 38 Sendai indicators are currently not recorded in the way they should be reported to UNISDR and data gaps pose a challenge to the reporting mechanism.

Against this background, EO4Sendai aims at exploring how Earth observation (EO), such as the European EO Programme Copernicus, can support the implementation of the SFDRR and specifically develop guidelines and good practices about using EO for deriving selected Sendai indicators. Through this activity, the use of EO can be maximized to support national Sendai Focal Points in the Sendai reporting. The activity will be initially implemented in Germany to inform the German Sendai Focal Point, but the results shall be made usable for focal points in other countries through knowledge transfer by international and development cooperation organizations.

Planned Activities

- Assessing the feasibility of EO and derived products to derive information for Sendai indicators including a comprehensive report with results from the feasibility study;
- Developing guidelines, good practice guidance, and trainings about using EO and derived products for deriving selected Sendai indicators;
- Sharing examples how to include EO data in national Sendai monitoring processes.

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EARTH OBSERVATION INDUSTRIAL INNOVATION PLATFORM FOR SUSTAINABLE DEVELOPMENT (EO-IIP)

Overview

Increasingly advanced Earth observation (EO) technologies are driving explosive growth in EO data. However, the operational application solutions tend to lag behind the emerging techniques and EO data available. It turns out that the capacity of integrating all resources available to form solutions is very significant to EO industry, and there is a great need for a platform to accommodate solution development and also to facilitate capacity building, in particular for developing countries.

In order to enhance the integration capacity of EO industry and enable prototyping of a cooperative platform for the development of application solutions, based on cloud computing technology, an Earth Observation Industrial Innovation Platform for sustainable development (EO-IIP) is presented to incorporate the advantages of various practitioners and promote better application of EO products and services, as well to foster the adoption of the innovative technologies. EO-IIP will enable easy accessing and sharing of a wide range of EO resources and also create an attractive and transparent forum for practitioners and stakeholders to release their concerns and interests to form a virtuous circle for the sustainable development of EO industry.

EO-IIP will also establish an operational application solutions pool for EO community and serve as a media for industrial social networking to improve the efficiency of cooperation and integration. The platform is also open to academic communities and will jointly contribute to operational technologies and real-world problem solving. It will benefit industrial and academic communities, local governments, international organizations, enterprises, capacity building stakeholders, and others, thus the project can continuously serve and inform a wide range of areas for sustainable development, climate change and disaster risk reduction as well.

Planned Activities

The key activities are generally planned in three categories:

- Organize and manage the systems of project in order to design the plans and maintain the development agenda on key issues;
- Build a forum to activate interactions with various stakeholders and review the needs and trends, and as well to organize high quality technical exhibitions and expert panels to attract practitioners;
- Prepare guidelines on the use and contribution of best practices and project resources, to pay efforts for capacity-building, to facilitate international collaboration and support appropriate GEO activities by providing industrial expertise.

Points of Contact

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EARTH OBSERVATIONS FOR MANAGING MINERAL AND NON-RENEWABLE ENERGY RESOURCES (GEO4MIN)

Overview

In a global context where a tremendous demand for minerals and raw materials is expected to face the needs for a low-carbon society and renewable energy production, Earth observation (EO) data, including in-situ data, can contribute to the production of objective, reliable, affordable and indisputable integrated products and documents that can be used to: i) assess mineral resources, and ii) educate, demonstrate, inform, alert and reassure the general public on the impacts of mining and enforce regulation, hence contributing the UN Sustainable Development Goals.

Overarching goals of the GEO4MIN Community Activity are two-fold:

- Development of web-based platform(s) for EO data collection, management and processing to make publicly accessible tools and services for the assessment, monitoring and forecasting of geological resources (including mineral and fossil resources, raw materials); and
- Development of web-based platform(s) for EO data collection, management and processing to make publicly accessible tools and services for monitoring the environmental and societal impacts of mining operations, in particular in a Social Licence to Operate (SLO) perspective.

Planned Activities

During 2020-2022, actual and planned activities will focus on the acquisition of data and knowledge that together will enable reaching these goals on a longer term. These include:

- Identification of essential variables relevant of the extractive industries that can serve for the assessment and monitoring of their footprint,
- Acquisition of soil reflectance reference spectra and the contribution to global and/or regional Soil Spectral Library made accessible through dedicated portal(s),
- Development, in the QGIS environment, of dedicated algorithms for global soil and mineral mapping applications that will be freely available from the web, worldwide and,
- Implementation of capacity building programmes to develop skills and expertise at the intersection between EO data and stakeholders in the mining sector.

Points of Contact

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GEO MULTI-SOURCE SYNERGIZED QUANTITATIVE REMOTE SENSING PRODUCTS AND SERVICES (GEO-MUSYQ)

Overview

This Community Activity was included in the 2017-2019 GEO Work Programme. Since 2016, it has delivered more than ten kinds of long time series of global biophysical parameter products by synergizing multi-sensor datasets including MODIS-Terra/Aqua, MERSI-FY3A/B/C, and VIRR- FY3A/B/C. Following existing progresses, GEO-MUSYQ will enhance data sharing and collaboration to provide analysis-ready data in 2020-2022.

Planned Activities

In 2020-2022, GEO-MUSYQ will focus on:

- Improving multi-source remote sensing data processing, normalization, or standardization, especially for Chinese satellite data;
- Improving the inversion algorithms to enhance the accuracy of quantitative remote sensing products;
- Establishing an operational common quantitative remote sensing product validation network; and
- Promoting the data sharing of the common quantitative remote sensing products for applications.

Point of Contact

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GEO SATELLITE BASED CLIMATE DATA RECORDS PRODUCTION AND SERVICE (GEO CDR)

Overview

A Climate Data Record (CDR) is defined as "a time series of measurements of sufficient length, consistency, and continuity to determine climate variability and change". Many agencies and institutions are producing the CDRs from satellite observations; however, the same CDR may come from different satellite data, with different qualities, temporal ranges, and spatial and temporal solutions.

The main objective of this project is to enhance the international community's capability to produce long-term, highly consistent and accurate CDRs from satellite observations by coordinating the production methodology development, validation, access and applications.

Planned Activities

To achieve the above objective, GEO CDR activities will be organized into six major components:

- Current status of satellite CDR development and future needs;
- Satellite CDR production framework for multiple satellite data;
- CDR inter-comparisons;
- Data services;
- Cooperation building and advocacy; and
- Scientific applications and social outputs.

Point of Contact

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GEO SPACE AND SECURITY

Overview

GEO Space and Security aims at ensuring the wellbeing and security of countries and citizens by exploiting suitable space assets and collateral data.

GEO Space and Security intends to:

- Provide a forum for discussion and organize capacity building initiatives;
- Establish and foster cooperation with key entities and stakeholders;
- Collect user requirements and needs;
- Identify observational and capability gaps to be filled by space assets;
- Explore how to take maximum benefit from the usage of very large quantities of heterogeneous data;
- Identify, develop and assess innovative applications, services and platforms encompassing the whole data lifecycle;
- Contribute to the implementation of relevant projects in the framework of R&I initiatives; and
- Build synergies with relevant GEO activities.

GEO Space and Security aims at enhancing:

- Resilience of society against natural and man-made disasters;
- Protection of critical infrastructures;
- Efficiency in tasks related to border and maritime surveillance as well as to civil protection and humanitarian aid; and
- Capacity of relevant stakeholders to achieve the security-relevant Sustainable Development Goals (SDGs).

Furthermore, GEO Space and Security works towards raising awareness and adoption of open data, citizen science, in situ data and advanced technologies in the space and security domain.

Planned Activities

Over the 2020-2022 period, GEO Space and Security activities will focus on the consolidation of the Community and on the implementation of initial solutions. The identified key activities for the period are:

- To grow GEO Space and Security by incorporating new members;
- To enhance internal communication within GEO Space and Security and external communication in relevant fora;
- To identify user scenarios and potential pilot projects for the Community Activity.

Points of Contact

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GLOBAL AGRICULTURAL DROUGHT MONITORING (GLOBAL AGRI-DROUGHT)

Overview

Global Agricultural Drought Monitoring aims to coordinate work on agricultural drought issues, jointly develop the method of monitoring agricultural drought towards a global coverage, and finally support the GEOGLAM project with timely agricultural drought information. Over time, it hopes to understand the processes and impacts of agricultural drought development in the background of global change and provide the adaptation advice for the global community.

Planned Activities

- Prepare an inventory of current agricultural monitoring systems at regional and global levels around the world;
- Develop best practices for agricultural drought monitoring with remote sensing;
- Coordinate global agricultural drought monitoring systems towards a coordinated global agricultural drought information release;
- Develop regional showcases on agricultural drought monitoring, possibly in Asia; and
- Advocate for international and national funding to support agricultural drought monitoring proposals.

Point of Contact

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GLOBAL CROP PEST AND DISEASE HABITAT MONITORING AND RISK FORECASTING (GLOBAL CROP PEST)

Overview

Pests and diseases are major threats to food security in the world, especially for wheat, rice, and soybeans, the dominant foods around the world. Approximately 10 percent yield loss is caused by crop pests and disease every year, while in some regions the loss may higher than 30 percent. Crop pests and diseases habitat monitoring and risk forecasting at continental and global scale are important to assess the effects of global change on agricultural production. Earth observation is very important for global crop monitoring and pest & disease forecasting due to its capability of producing large-scale data quickly and efficiently.

In 2018, GLOBAL CROP PEST used satellite images and reanalysis datasets to monitor global wheat growth and the habitat of main wheat pests and diseases, including surface temperature, humidity, surface radiation, and released the first global wheat aphid and rust monitoring and forecasting product and report. In 2020-2022, GLOBAL CROP PEST will consider three main crop types, these being wheat, rice and soybeans, aiming to map the main pests and diseases for these crops, which include wheat aphids (*Rhopalosiphum padi*) and rust (*Puccinia striiformis f. sp. tritici*), rice planthopper *(Nilaparvata lugens*) and blast *(Magnaporthe oryzae)*, soybean aphids (*Aphis glycines*) and mosaic virus.

GLOBAL CROP PEST will focus on retrieving global crop planting areas, growth condition, pest and disease habitat, and risk forecasting based on some high spatial and temporal resolution satellites will be included, such as GF series, ZY series, HJ series in China, and Sentinel series in EU, MODIS and Landsat in NASA. First, we will combine land surface products and remote sensing indices to ascertain soil temperature and moisture which provides information about crop habitat, which allows us to ascertain which habitat types are attractive to pests and diseases and provide some information on where they may migrate to. Second, climatic and forecast data will be analysed to give a probability of immigration or dispersal of pest and disease. Finally, crop growth condition, crop pests and diseases habitat monitoring, and pest and disease biological dispersal models will be integrated to map crop pest and disease spatial distribution and damage levels.

Planned Activities

Three main work packages are included in the project:

- Satellite data (e.g. MODIS and Landsat) and other higher-level remote sensing / EO products (such as re-analyses and weather forecasts) will be used to perform a classification of vegetation surface in order to ascertain the habitat of the crop pests and diseases;
- Geographic and plant protection information will be assimilated to the remote sensing data and then a risk forecasting model will be built to assess the risk of the target pests and diseases; and
- An application and dissemination platform will be developed to deliver outputs to end users to control pests and diseases and enhance yield and quality.

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GLOBAL ECOSYSTEMS AND ENVIRONMENT OBSERVATION ANALYSIS RESEARCH COOPERATION (GEOARC)

Overview

GEOARC mainly focuses on ecological and environmental monitoring at global or regional scales to provide information and knowledge services to support GEO priorities, including Sustainable Development Goals (SDGs), Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. This activity promotes a cooperation network to release an annual report and share related datasets through training courses or workshops.

Planned Activities

- Integrate multi-source data for global or regional terrestrial ecological and environmental monitoring, and provide analysis-ready data sets for sharing;
- Analyze and evaluate the global and regional ecosystem and environmental status and provide policy-oriented information for human health and environmental protection.
- Compose and release an annual report to the public. The annual report and the related data products will be shared by the GEOSS portal, the Global Change Research Data Publishing and Repository, and the ChinaGEOSS DSNet.
- Organize side events at the GEO Plenary and special sessions in different international conferences; hold or attend training workshops for the annual report and data product applications.

Point of Contact

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GLOBAL FLOOD AWARENESS SYSTEM (GLOFAS)

Overview

The Copernicus Emergency Management Service (CEMS) consists of four operational services: Emergency Mapping; European and Global Flood Awareness Systems (EFAS, GloFAS); European Forest Fire Information System (EFFIS); and the European Drought Observatory (EDO). These services provide monitoring and early warning of a range of natural hazards on European and global level.

CEMS-Floods operates as a complement to national and local warning systems with the aim to provide information in a consistent way. The Global Flood Awareness System (GloFAS) is part of CEMS-Floods and provides complementary, added-value flood forecasts independent of administrative and political boundaries. It couples state-of-the-art weather forecasts with a hydrological routing model, and with its global-scale set-up provides downstream countries with information on upstream river conditions as well as continental and global overviews.

GloFAS can predict floods up to 30 days in advance depending on the situation and river size. It can also provide a seasonal outlook with a lead time of eight weeks. It became fully operational in 2018, which guarantees a 24/7 service as part of the Copernicus Emergency Management Service.

The principal objectives of GloFAS 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;
- International organizations with global scale, comparable, and basin-wide flood forecasting information; and
- A sub-seasonal to seasonal outlook of low and high flows.

Planned Activities

The current framework contract with ECMWF and the Joint Research Centre of the European Commission (JRC) covers the period August 2014 until August 2020. The framework contract allows for an extension up to 6 months. As a result, only activities envisaged until the end of 2020 are included in the Implementation Plan.

As GloFAS recently became fully operational, much effort during 2019 and 2020 will be dedicated to further development of the services. Most important over the coming period will be to improve the hydrological model and release additional global assessments of forecast performance. A new release is planned for late 2019/early 2020. This will also include a better archiving of the data in the MARS archive and dissemination of these data through the Copernicus Climate Data Store.

Point of Contact

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GLOBAL FLOOD RISK MONITORING (GLOBAL FLOOD RISK)

Overview

Global Flood Risk Monitoring integrates information from multiple Earth observation systems to derive and deliver environmental intelligence characterizing intensive flood risk for the benefit of decision makers. This includes the coordination and analysis of timely, reliable and suitable observations with Earth system modeling and geospatial data management. To be more resilient to flood perils, GFRM enhances the ability to prepare for the anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.

As a Community Activity, Global Flood Risk Monitoring is an inherently collaborative and transdisciplinary capability, which creates key partnerships and maintains engagement among diverse stakeholders and actors. Contributors promote shared access and use of open data for research, development and operations. Routine and timely coordination and cooperation through projects, workshops and capacity development drives the pace of innovation, improves modeling and mapping skills, spreads learning and advances readiness of research results for application. This in turn builds trust and modifies local behavior through greater certainty, learning, and awareness of flood perils and security measures.

To realize these goals, Global Flood Risk Monitoring initiated a formalized community of practice, creating a space where new and existing data/product providers and consumers, researchers and operators, and other stakeholders can work together. This community of practice provides incentives for partnerships to demonstrate the viability of flood risk monitoring on a global level informed by Earth observations in concert with meteorological and hydrological modeling, thereby creating new connections that increase the use of flood risk information in decision-making.

Planned Activities

Elements of Global Flood Risk Monitoring implementation include:

- A community of practice able to collect, process, and analyze changes due to complex and rapid flood stresses. Through early and ongoing stakeholder engagement, Global Flood Risk Monitoring will assess impacts and apply knowledge to fill gaps with trusted data to yield scientifically-defensible guidance supporting timely, reliable and suitable decisions;
- Pilot projects to increase access of diverse data sets, models and visualization products while testing the ability to provide efficient and actionable information;
- Demonstration projects to extend global reach of applications to ensure consistent intelligence products for risk-sensitive assessments and planning;
- Integration projects to bring together tool sets and capacity building to develop and maintain resilience and risk reduction efforts; and
- End-to-end integration of research and application within an Earth system framework to prevent new, reduce existing, and manage residual flood risk through increased analysis of exposure, vulnerability and coping capacity.

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GLOBAL LAND COVER

Overview

Information regarding land cover and change over time (LCC) is essential for a variety of uses such as environmental change analysis, geographical condition monitoring, urban and rural management, and Earth surface process modeling. While the world is now moving towards the implementation and monitoring of the United Nations 2030 Agenda, users are demanding more reliable LCC data at higher spatial, temporal, and thematic resolutions, as well as results-oriented services. With this background, Global Land Cover is aiming to support the 2030 Sustainable Development Goals (SDGs) with reliable LCC information and value-added applications.

Planned Activities

- Using LCC to define and generate essential SDG variables (ESDGVs) through workshop(s) and pilot testing jointly with the GEO Initiative EO4SDG and the UN Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) and its Working Group on Geospatial Information (WGGI);
- Documenting new approaches and tools for automated updating of global and regional land cover data and efficient generation of LCC-related ESDGVs through workshop(s) or journal special issue (s) jointly with the International Society for Photogrammetry and Remote Sensing (ISPRS) and the European Space Agency (ESA);
- Support the inter-comparison and valuation of new global and regional LLC data products (such as GlobeLand30- 2015, Copernicus global land, CCI) jointly with ESA, National Geomatics Centre of China (NGCC) and other stakeholders; and
- Organize LCC related education and capacity building activities jointly with UN-GGIM and ISPRS.

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GLOBAL MANGROVE MONITORING (GLOBAL MANGROVE)

Overview

Mangrove forests provide important ecosystem goods and services to the world's dense coastal population and support important biosphere functions. Deforestation and degradation of mangrove forests can lead to the reduction of important ecosystem goods and services and impair critical biosphere functions (for example: coastal protection, carbon sequestration and biodiversity conservation) at both local and global scales. However, mangrove forests are under threat from both natural and anthropogenic forces, thus threatening the resilience and vitality of global coastal social-ecological systems.

Despite the importance of mangrove forests, reliable, accurate, and timely information on world mangrove forest cover change is not available. Remote sensing could play an important role in providing this information. Recent advancement in remote sensing data availability, image-processing methodologies, computing and information technology, and human resources development have provided an opportunity to observe and monitor mangroves from local to global scales on a regular basis. Spectral and spatial resolution of remote sensing data and their availability has improved making it possible to observe and monitor mangroves with unprecedented spatial and thematic detail. Novel remote sensing platforms such as unmanned aerial vehicles, and emerging sensors such as Fourier transform infrared spectroscopy and Lidar can now be used for mangrove monitoring. Furthermore, it is now possible to store and analyze large volumes of data using cloud computing.

Planned Activities

The following major activities are planned:

- Complete global mangrove mapping for the year 2020;
- Complete change analysis between the years 2000 and 2010;
- Identify the causes and consequences of mangrove forest cover change from 2000 to 2020; and
- Capacity building.

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GLOBAL MARINE ECOSYSTEM MONITORING (MARINE ECOSYSTEMS)

Overview

Global marine ecosystems are an integral part of the Earth's biogeochemical cycles, which are coupled to and influence the climate through a myriad of physical, chemical, biological and ecological processes. Establishing a comprehensive system to understand these complex processes and quantify global marine ecosystems would be a wise investment for the coming decade along with climate change.

Global Marine Ecosystem Monitoring expects to realize a technique-service-community-application framework for monitoring and understanding global marine ecosystem. The actual and planned outputs focus on advanced data collection techniques, a comprehensive data service platform, an active scientific community, and several important science questions and social problems. Engineers, scientists, young scholars, students, society and government can all benefit from the main outputs of Global Marine Ecosystem Monitoring.

Planned Activities

- Development of cutting-edge monitoring technologies;
- Data collection and sharing service;
- Cooperation and exchange activities; and
- Application demonstration and social benefits.

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HIMALAYAN GEOSS

Overview

Himalayan GEOSS community activity focuses on the Hindu Kush Himalaya (HKH) mountain region with a geographic scope in the HKH countries which include Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. The Himalayan GEOSS addresses the gaps in EO applications in the thematic areas of agriculture and food security, water resources, snow and glacier, disaster risk reduction, land use, land cover change and ecosystem services. Further, it promotes access to and sharing of data, standards and methodologies, fosters regional cooperation to build complementary efforts to address common issues and works towards building capacities of individuals and institutions addressing the needs in the region.

Planned Activities

Himalayan GEOSS will develop a community portal to provide one stop access to data and information systems in the HKH region. The portal will be connected to data providers from the region. The capacity building will be another key activity of the Himalayan GEOSS. With the support from AOGEOSS, it will work on establishing a regional training center and conduct trainings on key mountain issues and emerging technologies. It will initiate linkages with the Himalayan University Consortium, a network of universities, for collaboration with the academia. Further, it will collaborate with relevant agencies in the region to out-scale and upscale relevant services developed by SERVIR-HKH initiative at ICIMOD. SERVIR-HKH is a regional hub of SERVIR – a partnership of NASA, USAID, and leading technical organizations for developing innovative solutions using EO and geospatial technologies to improve livelihoods and foster self-reliance in Asia, Africa, and the Americas.

The Himalayan GEOSS will organize regional workshops and participate in global forums on EO and geospatial applications and innovative solutions. It will develop project proposals that are of regional nature and will aim to secure potential resources for their implementation

Financial and in kind resources will be leveraged through on-going initiatives like SERVIR and other regional and country programs. Capacity building and fostering regional cooperation are other strategic focus areas of the Task.

Partnerships with the space agencies in the regional countries will help in building synergies and building capacities across the region. In the past, initiatives such as GFOI and GEOGLOWS have leveraged experiences and resources from SERVIR-HKH.

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IN-SITU OBSERVATIONS AND PRACTICES FOR THE WATER CYCLE (IN-SITU WATER)

Overview

IN-SITU WATER aims to provide general and specific, as well as selected tailor-made, services to GEOGLOWS program framework activities 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.

Using mainly in situ earth observations in the water domain, IN-SITU WATER provides improved services in terms of standardized and openly accessible data and products to the international community to improve assessments and trends in water resources and extremes at regional and global scales.

Planned Activities

- Soil Moisture: Expand the International Soil Moisture Network (ISMN) by integrating new networks (with a focus on data-sparse regions) and extending existing datasets; transferring processing chain from programming language IDL to Python; continue investigating and improving quality control procedures. Future opportunities could include citizen science support as thousands of citizens maintain soil moisture stations in Europe using low cost soil moisture sensors
- River Discharge
- Groundwater
- Surface Water Storage

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NIGHT-TIME LIGHT REMOTE SENSING FOR GLOBAL SUSTAINABILITY (GEO NIGHT LIGHT)

Overview

The United Nations 2030 Agenda for Sustainable Development aims to solve a number of key issues, such as extreme poverty, income inequality, and disaster risk reduction. Evaluating the implementation progress of the 2030 Agenda is critically important. Remote sensing has played an indispensable role in monitoring natural resources, environment pollution as well as social development. Night-time light remote sensing, observing visible lights at night, provides a unique perspective on the human activities and socioeconomic dynamics. It has shown powerful capabilities in analyzing a number of issues in sustainable development, such as urban growth measurement, economic growth evaluation, humanitarian crisis evaluation, natural disaster damage assessment, as well as light pollution analysis.

A number of night-time light remote sensing satellites are now available. Since the 1970s, night-time light images acquired by the United States Defense Meteorological Satellite Program's Operational Linescan System (DMSP/OLS) have been applied to monitoring oil field combustion, estimating socioeconomic parameters and light pollution. In 2011, the Suomi National Polar-orbiting Partnership satellite's Visible Infrared Imaging Radiometer Suite (Suomi NPP/VIIRS) emerged with significantly improved performances compared with DMSP/OLS, ushering in a new era to the night-time light remote sensing community. China's Wuhan University launched Luojia-1 satellite in June 2018, providing global night-time light images at 130 m resolution. High quality night-time light remote sensing data is critical to retrieve detailed information on the geographical distribution of human population and their properties for disaster risk reduction and sustainable development.

Planned Activities

- Develop high resolution night-time light products for sustainable development. The existing coarse resolution night-time light remote sensing imagery can help monitor human settlements at large scales but cannot provide sufficient spatial details at the street level. Finer resolution images are very useful in mapping human settlements details but their application to large scales is often limited. The purpose of this community activity is to highlight human settlements by integrating 30 m resolution Landsat and the coarse resolution night-time light remote sensing data. Considering that both Landsat and night-time light remote sensing have long historical archives, we expect our investigation on combining them together will also enable tracking human settlements expansion over time.
- Develop standard night-time light products, including poverty maps, regional inequality maps and urban growth trajectory, for general applications of sustainable development based on the high resolution night-time light products. Develop special night-time light products, such as humanitarian disaster maps, for hotspot areas such as extremely poor countries and conflict regions.
- Build a data sharing network. Exchange research ideas between different data providers and product developers. Advocate building a data sharing platform (e.g. website interface and contact information lists) from different night-time light data provider and product developers.

- Develop a user network. Contact current and potential users, from the social science community, the natural science community, the banking system, governmental departments as well as Non-Government Organizations (NGO), of night-time light products. Summarize the users' requirement on the night-time light products.
- Collaborate with regional and global organizations. Provide the night-time light products to the United Nations, NGO groups and investment agencies. Train these organizations to analyze the issues of sustainable development such as poverty, humanitarian disasters and impact of aid projects by use of night-time light products.
- Disseminate research results. Participation in international conferences, workshops and sessions. Publication of scientific articles.

Points of Contact

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THE INTERNATIONAL GRAND GLOBAL ENSEMBLE (TIGGE)

Overview

TIGGE (The International Grand Global Ensemble) is a dataset, established by the World Weather Research Programme in 2006, comprised of operational global ensemble forecast data from ten weather forecasting centres. TIGGE is designed to span the medium-range (out to day 15), but a similar multi-model ensemble, the Sub-seasonal to Seasonal Prediction Project (S2S) dataset, a joint World Weather Research Programme (WWRP) and World Climate Research Programme (WCRP) effort, has been created in 2015 with contributions from 11 centres to extend across the sub-seasonal to seasonal range (up to day 60). Both systems provide data bases of ensemble predictions, for scientific research on predictability and development of probabilistic weather forecasting methods.

Planned Activities

During 2018, the S2S Project proposed a Phase II implementation plan (November 2018 - December 2023), which includes:

- S2S database enhancements;
- Research activities; and
- Enhancement of operational infrastructures and user applications, such as Research to Operations (R2O) and real-time pilot for S2S applications.

The complete S2S Phase II implementation plan is available online.

Point of Contact

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Foundational Tasks

GEO ENGAGEMENT PRIORITIES COORDINATION

Overview

The Engagement Priorities Coordination Foundational Task leads GEO's efforts in engaging key stakeholders in supporting GEO's Mission and Vision and, more specifically, on GEO's engagement priorities: the UN 2030 Agenda on Sustainable Development; the Paris Agreement on Climate Change, and the Sendai Framework on Disaster Risk Reduction. It is also responsible for coordinating engagement with UN agencies and other organizations, including those within the GEO community (that is, within GEO Member countries or Participating Organizations) and external organizations, in support of the broader mandate of GEO, including the GEO Work Programme.

Expected Outcomes

- Implementation of a consistent and coordinated GEO strategy for engaging external organizations, in particular with respect to the GEO engagement priorities, across the GEO community.
- Increased and stronger connections between GEO Work Programme activities and international policy organizations and with national ministries in GEO Member countries.
- Increased engagement of commercial sector organizations in the GEO Work Programme, especially small, medium and micro-sized enterprises (SMMEs).
- Broader awareness and understanding of GEO, its activities, and its results among users and potential users of Earth observations.
- Increased investment in the GEO Work Programme from non-traditional sources, including foundations and philanthropies.

Components

1. GEO Engagement Priorities Coordination

   Coordination of GEO's engagement with UN agencies and other organizations responsible for various components of the policy frameworks. Engagement with GEO Members, Participating Organizations and GEO Work Programme activities regarding their contributions toward implementation of projects and services, and use of EO in decision making, related to the engagement priorities.

2. Commercial Sector Engagement

   Identification of opportunities for commercial sector involvement in the GEO Work Programme, particularly of small, medium, and micro-sized enterprises (SMMEs), and communication of those opportunities to commercial sector organizations.

3. Communications

   Development and implementation of the GEO Communications Plan, including targeted communications messages, campaigns, content and products. Fostering press relations, support to event promotion and coordination of GEO events, promotion of relevant events, opportunities and media coverage with the GEO community. Facilitation of

information flow within the GEO community, particularly through the GEO Communicators Network, liaison with GEO Work Programme activity leads, cross-promotion of activities and campaigns, promotion of brand standards, and dissemination of examples of Earth observation use and impact.

4. Resource Mobilization

   Development and implementation of a strategy for outreach to potential funders. Provision of guidance and support to GEO Work Programme activities and others regarding funding applications.

Implementing Bodies

- GEO Secretariat
- GEO Climate Working Group (pending discussion by Paris Agreement Subgroup)
- GEO Sendai Framework Working Group

Point of Contact

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GEOSS DATA, INFORMATION AND KNOWLEDGE RESOURCES

Overview

This Task will analyze the current state and trends (including needs and gaps assessments), with respect to Earth observing systems (both remotely-sensed and in situ). The Task will also advocate open data sharing and data life-cycle management, while exploring methods for facilitating access to data and developing information resources based upon latest advances in technologies.

Expected Outcomes

- Promote sustainability of current Earth observing systems; advocate new fit-for-purpose systems based on needs assessments.
- Increase number of openly and freely accessible Earth observations datasets, in adherence to GEOSS Data Sharing and Management Principles.
- Lower barriers for uptake of Earth observations and open-source technology to produce applications for environmental monitoring.

Components

1. Satellite Observations:

   Support GEO's efforts to promote Earth observations by providing evidence of the unique, and complementary, value of satellite data to successful delivery of GEO Flagships and Initiatives. Coordinate uptake of satellite observations into data aggregators and cloud storage for use in analyses and global policy reporting, closely linked with the GEO Knowledge Hub. Produce integrated multi-satellite Analysis Ready Datasets (ARD).

2. In situ Observations

   Focus on improving access to in situ data and providing various coordination opportunities where needed , advocating new collection systems, and encouraging integration of user requirements with respect to in situ data which will be closely linked with the GEO Knowledge Hub.

3. Advancing GEOSS Data Sharing and Management Principles

   Continue promotion of free, full, open and timely access to Earth observation datasets, products and services. Maintain dialogue with governments and support the uptake and implementation of the GEOSS Data Sharing and Management Principles by GEO Members and Participating Organizations, and raise awareness of the technical, organizational, and resource implications of their implementation.

4. Advocacy for Radio Frequency Protection for Earth Observation

   Advocate the protection of radio-frequency bands necessary to ensure proper operation of Earth observation instruments.

Implementing Bodies

- CEOS, WMO
- GEOSS Data Sharing Working Group
- GEO Secretariat

GEOSS INFRASTRUCTURE DEVELOPMENT

Overview

The GEOSS Infrastructure Development Foundational Task leads the development and implementation of the common infrastructural elements that support the implementation of GEO Flagships, Initiatives and Community Activities, as well as the realization of the GEOSS Data Sharing and Data Management Principles.

For the purpose of this document the GEOSS Infrastructure includes, at the present time, the GEOSS Platform, GEOSS web services, and emerging new components such as the GEO regional infrastructures and the GEOSS Knowledge Hub (pending approval by GEO Plenary).

Expected Outcomes

- Broad open access and re-use of the data, information and knowledge resources developed by GEO Flagships, Initiatives and Community Activities.
- Easy discovery and access to data and information resources made available by GEOSS data providers, including customization for particular user groups or communities.
- Documented user expectations and requirements regarding GEOSS services, expansion of the user base, an improved user experience, and increased user satisfaction.
- Continual improvement of GEOSS services to ensure they meet user needs and take advantage of new developments in technologies and standards.
- GEOSS platform architecture development, operation and evolution.

Components

1. GEOSS Platform Operation

   Continue to maintain the functioning (i.e. operating) of:

   - GEOSS Portal as the public interface of the GEOSS Platform, with the data and information resources brokered through the GEO DAB;
   - GEO DAB refining the ranking scheme used to prioritize discovery matching results and improving the online DAB statistics;
   - Status Checker describing the Quality of Service of the online services published by GEOSS data providers; and
   - GEO Yellow Pages service describing the GEOSS data providers and their brokering arrangements.

2. Support GEO Community data and information needs

   Broker additional providers of data and other resources, addressing the request coming from the GEO Community (GEO Flagships, Initiatives, CA), in close synergy with the “GEOSS Observations, Data and Information Resources” FT.

3. GEO Knowledge Hub Development

   Design and implement the GEO Knowledge Hub, as a new component of the GEOSS infrastructure. The Knowledge Hub is envisioned as a set of curated and linked documents that contain relevant information for Earth observation applications and which is integrated with the GEO website. It is intended to provide an authoritative and

validated content for evidence-based policy and decision-making. Content for the GEO Knowledge Hub will be provided by GEO Flagships, Initiatives and Community Activities.

4. GEONETCast Operation

   Continue operations of this global network of sustained and cost-effective satellite-based dissemination systems and ensure close connections with the other components of the GEOSS infrastructure and with GEO Flagships, Initiatives and Community Activities.

5. GEOSS Platform Documentation

   Document the GEOSS Platform architecture, services, and APIs in order to facilitate interoperability and the growth of a GEO ecosystem.

6. GEOSS Infrastructure Evolution

   Advance the evolution of the GEOSS Infrastructure architecture, based on analysis of the evolving landscape of information technology, changing patterns of production and use of Earth observation products and services, and the specific user requirements expressed by GEO Flagships and Initiatives. Main actions include:

   - Design the architecture of the evolving GEOSS Infrastructure.
   - Develop and test new GEOSS Infrastructure functionalities, solutions and components (to address the new architecture), engaging the GEO Community.
   - Facilitate the principle of interoperability of all the GEOSS components, including regional GEO infrastructures
   - Facilitate the sharing and reusability of the data, services and models generated to satisfy regional GEO user needs to enrich the global GEO community.
   - Prepare documentation and training materials describing the new components and solutions.

7. Open-source Solutions

   Support the use of open-source software, web services and cloud computing to enable low-barrier solutions for the development of applications making use of open and freely accessible Earth observations, especially for countries of the Global South.

Implementing Bodies

- GEOSS Infrastructure Development Task Force
  - Oversees the various activities and components within the Foundation Task, ensuring their connection and synergy. (See terms of reference below).
- GEOSS Platform Operations Team
  - Daily operations of the GEOSS Platform components (GEOSS Portal, GEO DAB, Status Checker and GEO Yellow Pages), and their documentation.
- GEOSS Infrastructure Evolution Working Group
  - Responsible for the GEOSS Infrastructure Evolution task (including members from the former GEOSS EVOLVE).

- GEONETCast Operations Team
    - Daily operations and further development of the GEONETCast network.
- GEO Secretariat

Point of Contact

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TERMS OF REFERENCE FOR THE GEOSS INFRASTRUCTURE DEVELOPMENT TASK TEAM

Purpose

Ensure coordination, and integration as appropriate, among the various components of the GEOSS infrastructure for management and sharing of data, information and knowledge resources.

Duties

- Design the overarching architecture of the GEOSS Infrastructure, along with their main components.
- Establish performance expectations for each component and means to measure their achievement.
- Monitor progress of each component at regular intervals against the performance expectations.
- Prepare a report on progress of the Foundational Task for inclusion in the annual GEO Work Programme Progress Report.

Membership (to be approved by the Programme Board)

- Representatives from GEO Member States and Participating Organizations that provide resources to the components of this Foundational Task.
- Representatives from the GEO Secretariat

Operating Procedures

- The Task Team shall operate by consensus.
- The Task Team will select three co-chairs, one of whom nominated by the GEO Secretariat.
- There will be at least three meetings of the Task Team each calendar year.
- Meetings will generally be held as teleconferences unless there is agreement from members to hold an in-person meeting.
- Documents for decision by the Task Team should be distributed at least two weeks in advance of the meeting unless there are exceptional circumstances.

GEO WORK PROGRAMME SUPPORT

Overview

The GEO Work Programme is the primary coordination and planning instrument used by GEO to select and prioritize its activities. The GEO Programme Board is the governance body which is tasked with overseeing the development, implementation and monitoring of the GEO Work Programme. The purpose of the GEO Work Programme Support Foundational Task is to provide the operational capacity to advise the GEO Programme Board and to implement their decisions and recommendations.

Expected Outcomes

- GEO Programme Board has the information, advice and other support required to fulfill its functions and duties.
- Decisions by GEO Members and GEO governing bodies are informed by analyses and reports based on regular collection of data and information on GEO Work Programme activities.
- Leads and participants of GEO Work Programme activities have the information, tools and support required to effectively implement their activities.

Components

1. Programme Board Support

   Preparation of Programme Board meeting agendas and documents, in consultation with the Programme Board co-chairs. Logistics, analysis and document support to Programme Board subgroups.

2. GEO Work Programme Development

   Coordination of the development process for triennial GEO Work Programmes. Review of Implementation Plans for GEO Flagships, Initiatives and Community Activities. Drafting of Implementation Plans for GEO Foundational Tasks. Preparation of GEO Work Programme summary documents and updates.

3. GEO Work Programme Monitoring

   Development and coordination of requests for data and information from GEO Work Programme activities. Maintenance of databases for GEO Work Programme monitoring. Analysis of monitoring data and preparation of reports on progress in the GEO Work Programme. Development and production of indicators derived from monitoring data.

4. Liaison with GEO Work Programme Activities

   Implementation of regular contact with GEO Work Programme activity leads. Provision of guidance and assistance to GEO Work Programmes.

5. GEO Work Programme Capacity Development

   Provision of targeted advice and assistance to GEO Work Programme activity leads and participants to enable them to design, implement and measure the effectiveness of co-design and co-production, user engagement and capacity development within their activities.

Implementing Bodies

- GEO Secretariat
- Capacity Development Working Group

Point of Contact

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GEO SECRETARIAT OPERATIONS

Overview

The GEO Secretariat Operations Foundational Task is intended to support sound management and administration of the resources of the GEO Trust Fund and to provide logistical support for GEO statutory meetings such as Ministerial Summits, GEO Plenary, GEO Executive Committee and GEO Programme Board.

Expected Outcomes

- GEO Trust Fund resources are managed in accordance with Annex D of the GEO Rules of Procedure.
- Secretariat human resources are allocated and managed to support the highest priorities of GEO, within the framework of the staffing plan approved by GEO Executive Committee.
- Financial and in-kind resources to the GEO Trust Fund and Secretariat are available to support the activities of the Secretariat, as approved by the GEO Executive Committee.
- Effective and efficient conduct of GEO meetings.

Components

1. Management of the GEO Trust Fund

   Preparation of a draft Trust Fund Budget and financial income and expenditure accounts. Management of Secretariat mission travel planning and reporting. Management of incoming contributions. Management of extra-budgetary resources for specified activities and associated reporting requirements. Contract administration. Support to the Budget Working Group.

2. Management of Secretariat Human Resources

   Preparation of staffing plans. Management of staff recruitment and performance review processes. Coordination of secondments and liaison with home institutions.

3. Conference and Meeting Management

   Coordination with external meeting hosts. Preparation of Ministerial Summit, Plenary and Executive Committee documents. Participation on and support to working groups for the preparation of GEO Plenary meetings and Ministerial Summits. Management of registration processes and support to participants from developing countries.

4. Relations with GEO Members, Participating Organizations and GEO Associates

   Maintenance of contact databases of GEO Members, Participating Organizations and Associates. Management of processes for review of Participating Organization and Associate applications. Implementation of activities to mobilize financial and in-kind resources for the GEO Trust Fund and GEO Secretariat.

5. Coordination of GEO Evaluations

   Preparation of evaluation terms of reference and briefings for GEO governance bodies. Coordination of calls for nomination to evaluation teams and provision of support to evaluation teams.

Implementing Bodies

- GEO Secretariat
- Budget Working Group
- GEO Week and Ministerial Summit Working Groups
- Host nations of GEO Plenary and other GEO meetings.

Point of Contact

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Indexes and Supplementary Information

Index by Sustainable Development Goal (to be added in version 2)

Index by Societal Benefit Area (to be added in version 2)

Table of Acronyms (to be added in version 2)