GROUP ON EARTH OBSERVATIONS

GEO WORK PROGRAMME 2023-2025
SUMMARY DOCUMENT

VERSION 3 - DECEMBER 2022

Preface

This document is the third version of the Group on Earth Observations (GEO) Work Programme Summary Document for the period 2023 to 2025. It describes what is the eighth iteration of the GEO Work Programme (formerly "GEO Work Plan") since GEO began in 2005.

As will be described in greater detail in the next section, the process of developing a GEO Work Programme unfolds over a period of approximately 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 involves broad consultation with all members of the GEO community, including 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 many other stakeholders. The present document is the product of this consultation process, which has been guided and overseen by the GEO Programme Board.

This Summary Document is a compilation of overviews from the proposed Implementation Plans received by the GEO Secretariat as of 31 May 2022. The full Implementation Plans are accessible via the hyperlinks in the respective sections of this Document.

The objectives of the 2023-2025 GEO Work Programme emphasized integration and collaboration, open knowledge, operationalization, and user orientation. These objectives will continue to be prioritized beyond the approval of the Work Programme and hence, the Implementation Plans are living documents, that will be updated and revised in line with implementation realities as well as GEO's continued efforts to prioritize the objectives of the Work Programme and identify synergies and key outputs across the GEO Work Programme in preparation for meeting GEO's post-2025 Vision.

Comments and contributions to improve the Work Programme activities are welcome and you are invited to provide them to the points of contact of those activities directly. This contact information is provided in this document at the end of each summary.

For general comments on the GEO Work Programme Summary Document or for any clarifications, including regarding the Work Programme development process, please contact the GEO Secretariat at geo-wp@geosec.org.

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Table of Changes

Key Changes Introduced with Respect to Version 2 (14 December 2022)

Where	What
Flagship	A contributor is added to GEOGLAM: United Kingdom

Key Changes Introduced in Version 2 with Respect to Version 1 (29 July 2022)

Where	What
Preface	A paragraph is added to reflect that the Summary Document is a living document which will evolve along further collaboration and integration within the Work Programme.
Status of Existing and New Activities	Clarity is made to those activities with a pending status.
Introduction to the GEO Work Programme	The role of Working Groups and other cross-cutting teams is added. A section on the road to Post-2025 is added.
Candidate Flagships	One Flagship is added: GEO-LDN Activity that made substantive changes: GFOI
Candidate Initiatives	One Initiative is added: EO4DRM Activities that made substantive changes: DIAS, EO4EA, EO4HEALTH, GEO-CRADLE, GEO-VENER, GSNL, GDIS, GOS4POPS, GWIS
Candidate Pilot Initiatives	Three more activities are added: EO4WEF, GEO-TREES and IN-SITU-ESC One activity is removed: VoRDM Activities that made substantive changes: ARCTIC-GEOSS, EO4MIN, GEODESY4SENDAI, UHCO, GEO-EV-PRODUCTS
Regional GEOs	Activity that made substantive changes: AOGEO
Acronyms	A table of acronyms is added.

Status of Existing and New Activities

Table A – Recommended Categorization of 2020-2022 GEO Work Programme Activities

GEO Work Programme Activity	Current Category	Recommended Categorization
GEO Biodiversity Observation Network (GEO BON)	Flagship	Retained as a Flagship
GEO Global Agricultural Monitoring (GEOGLAM)	Flagship	Retained as a Flagship
Global Forest Observation Initiative (GFOI)	Flagship	Retained as a Flagship
Global Observation System for Mercury (GOS4M)	Flagship	Retained as a Flagship
GEO Land Degradation Neutrality (GEO-LDN)	Initiative	Re-categorized as a Flagship
AquaWatch (AQUAWATCH)	Initiative	Retained as an Initiative
Data Access for Risk Management (GEO-DARMA)	Initiative	Did not submit a plan for 2023-2025
Data Integration and Analysis System (DIAS)	Initiative	Retained as an Initiative
Digital Earth Africa (DE-AFRICA)	Initiative	Retained as an Initiative
Earth Observations for Ecosystem Accounting (EO4EA)	Initiative	Retained as an Initiative
Earth Observations for Health (EO4HEALTH)	Initiative	Retained as an Initiative
Earth Observations for Sustainable Development Goals (EO4SDG)	Initiative	Retained as an Initiative
GEO Blue Planet (GEO-BLUE-PLANET)	Initiative	Retained as an Initiative
GEO Capacity Building in North Africa, Middle East, Balkans and Black Sea Region (GEO-CRADLE)	Initiative	Retained as an Initiative
GEO Global Water Sustainability (GEOGLOWS)	Initiative	Retained as an Initiative
GEO Human Planet (HUMAN-PLANET)	Initiative	Retained as an Initiative
GEO Vision for Energy (GEO-VENER)	Initiative	Retained as an Initiative
GEO Wetlands (GEO-WETLANDS)	Initiative	Retained as an Initiative
Geohazard Supersites and Natural Laboratories (GSNL)	Initiative	Retained as an Initiative
Global Drought Information System (GDIS)	Initiative	Retained as an Initiative
Global Network for Observations and Information in Mountain Environments (GEO-MOUNTAINS)	Initiative	Retained as an Initiative
Global Observation System for Persistent Organic Pollutants (GOS4POPs)	Initiative	Retained as an Initiative
Global Urban Observation and Information (GUOI)	Initiative	Retained as an Initiative
Global Wildfire Information System (GWIS)	Initiative	Retained as an Initiative

GEO Work Programme Activity	Current Category	Recommended Categorization
ArcticGEOSS (ARCTIC-GEOSS)	Community Activity	Applied as an Initiative. Accepted as a Pilot Initiative
Earth Observations for Disaster Risk Management (EO4DRM)	Community Activity	Applied as an Initiative. Accepted as an Initiative
Global Vegetation Pest and Disease Dynamic Remote Sensing Monitoring and Forecasting (GEO-PDRS)	Community Activity	Applied as an Initiative. Accepted as a Pilot Initiative
Global Ecosystem and Environment Observation Analysis Research Cooperation (GEOARC)	Community Activity	Applied as an Initiative. Accepted as a Pilot Initiative
Night-Time Light Remote Sensing for Sustainable Development Goals (NIGHT-LIGHT)	Community Activity	Applied as an Initiative. Accepted as a Pilot Initiative
Chinese High-resolution Satellite Data Resources and Sharing (CSDR)	Community Activity	Applied as an Initiative. Will re-structure and re-apply next year
Global Agricultural Drought Monitoring (AGRI-DROUGHT)	Community Activity	Applied as an Initiative. To be merged with GDIS
Advancing Communication Infrastructures and Services (ACIS)	Community Activity	Did not submit a plan for 2023-2025
Climate Observation, Simulation and Impacts (CLIMATE-OSI)	Community Activity	To pursue different engagement with GEO
Copernicus Atmospheric Monitoring Service (CAMS)	Community Activity	To pursue different engagement with GEO
Copernicus Climate Change Service (C3S)	Community Activity	To pursue different engagement with GEO
Digital Earth Pacific (DE-PACIFIC)	Community Activity	Re-categorized as a Pilot Initiative
Earth Observation and Copernicus in Support of Sendai Monitoring (EO4SENDAI-MONITORING)	Community Activity	Did not submit a plan for 2023-2025
Earth Observation Industrial Innovative Platform for Sustainable Development (EO-IIP)	Community Activity	Did not submit a plan for 2023-2025
Earth Observations for Managing Mineral and Non-Renewable Energy Resources (EO4MIN)	Community Activity	Re-categorized as a Pilot Initiative. Activity name updated
Earth Observations for the Atlantic Region (ATLANTIC-EO)	Community Activity	Did not submit a plan for 2023-2025
Earth Observations for the Water-Energy-Food Nexus (EO4WEF)	Community Activity	Re-categorized as a Pilot Initiative
Enhancing Food Security in African Agricultural Systems with the Support of Remote Sensing (AFRICULTURES)	Community Activity	To pursue different engagement with GEO
Forest Biomass Reference System from Tree-by-Tree Inventory Data (GEO-TREES)	Community Activity	Re-categorized as a Pilot Initiative
GEO Citizen Science (GEO-CITSCI)	Community Activity	Re-categorized as a Pilot Initiative
GEO Essential Variables (GEO-EV)	Community Activity	Re-categorized as a Pilot Initiative
GEO Global Ecosystems (GEO-ECO)	Community Activity	Will submit a plan next year
Geodesy for the Sendai Framework (GEODESY4SENDAI)	Community Activity	Re-categorized as a Pilot Initiative
Global Flood Awareness System (GLOFAS)	Community Activity	To pursue different engagement with GEO

GEO Work Programme Activity	Current Category	Recommended Categorization
Global Flood Risk Monitoring (GFRM)	Community Activity	Did not submit a plan for 2023-2025
Global Land Cover (LAND-COVER)	Community Activity	Did not submit a plan for 2023-2025
Global Observation of Deltas and Estuaries (DELTA&ESTUARY)	Community Activity	Did not submit a plan for 2023-2025
In-Situ Observations and Applications for Ecosystem Status of China and Central Asia (IN-SITU-ESC)	Community Activity	Re-categorized as a Pilot Initiative
Multi-Source Synergized Quantitative Remote Sensing Products and Services (MUSYQ)	Community Activity	Did not submit a plan for 2023-2025
Next Generation Earth Observation Services (NEXT-EOS)	Community Activity	Did not submit a plan for 2023-2025
Open Earth Alliance (OEA)	Community Activity	Re-categorized as a Pilot Initiative
Space and Security (SPACE-SECURITY)	Community Activity	Re-categorized as a Pilot Initiative
Space Climate Observatory (SCO)	Community Activity	Pursued different engagement with GEO
The International Grand Global Ensemble (TIGGE)	Community Activity	Did not submit a plan for 2023-2025
Understanding the Impacts and Value of Earth Observations (GEO-VALUE)	Community Activity	Did not submit a plan for 2023-2025
Urban Heritage Climate Observatory (UHCO)	Community Activity	Re-categorized as a Pilot Initiative
African Group on Earth Observations (AFRIGEO)	Regional GEO	Retained as a Regional GEO
Americas Group on Earth Observations (AMERIGEO)	Regional GEO	Retained as a Regional GEO
Asia-Oceania Group on Earth Observations (AOGEO)	Regional GEO	Retained as a Regional GEO
European Group on Earth Observations (EUROGEO)	Regional GEO	Retained as a Regional GEO

Table B – Recommended Categorization of New Proposed GEO Work Programme Activities

GEO Work Programme Activity	Proposed Category	Recommended Categorization
Antarctic nearshore bathymetric compilation	Pilot Initiative	Merged with two other new proposals
Carbon monitoring service toward Global Stocktake	Pilot Initiative	To pursue different engagement with GEO
Global Geochemical Observation Network and Digital Chemical Earth (CHEMICAL-EARTH)	Pilot Initiative	Accepted as a Pilot Initiative
Earth observation for the Small Island Developing States	Pilot Initiative	To pursue different engagement with GEO
EO Maturity Assessments	Pilot Initiative	To pursue different engagement with GEO
GEO Cold Regions Initiative – Service Practice (GEOCRI)	Pilot Initiative	Accepted as a Pilot Initiative
Global atmospheric environment monitoring system	Pilot Initiative	Proposal withdrawn
Cold-Water Coral Distribution Information System (CWCDIS)	Pilot Initiative	Merged with MBON under GEO BON
Global Land-Atmosphere Coupling Experiment - Vegetation	Pilot Initiative	To pursue different engagement with GEO
Global Mining Deformation Observation Initiative	Pilot Initiative	Merged with EO4MIN
Global products of Common Essential Variables from Multiple Satellite Data (GEO-EV-PRODUCTS)	Pilot Initiative	Accepted as a Pilot Initiative
Harmonization and Application of Geochemical Observation Data Based on Holographic Digital Earth basic framework	Pilot Initiative	Merged with CHEMICAL-EARTH
Earth Observations for Global Typical Karst (EO4KARST)	Pilot Initiative	Accepted as a Pilot Initiative
Real-time monitoring of geological deformation disasters	Pilot Initiative	Merged with GEODESY4SENDAI
Real-time monitoring of glaciers and ice sheets	Pilot Initiative	Merged with two other new proposals
Remote Sensing Monitoring of Antarctic Ice Sheet Mass Loss and Contribution to Global Sea Level Rise	Pilot Initiative	Merged with two other new proposals
Remote sensing monitoring of geological disasters in major global urban agglomerations	Pilot Initiative	To pursue different engagement with GEO
Rewild	Pilot Initiative	Proposal withdrawn
Urban Environment Observation and Information	Pilot Initiative	To pursue different engagement with GEO
Volunteered Rapid Disaster Monitoring and Mapping (VoRDM)	Pilot Initiative	To pursue different engagement with GEO

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, GEO Associates, and other partners on activities to realize GEO's Mission and Vision.

The 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, the 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, Participating Organizations and Associates 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 GEO Work Programme covers a fixed three-year period. The present document applies to the years 2023 to 2025, 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.

GEO Pilot Initiatives

GEO Pilot Initiative is a new category for what was formerly known as "Community Activity" as a result of Mid-term Evaluation recommendations. GEO Community Activities ranged from communities of practice, to early-stage projects or pilots, to well-established services. Revision of the name of the category makes it clear that Pilot Initiatives should intend to progress to GEO Initiative status and should do so within a reasonable period of time. GEO Pilot Initiatives 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 Pilot Initiatives serve as an entry point for new activities that may go on to become GEO Initiatives.

Regional GEOs

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 Foundational Tasks

GEO Foundational Tasks are the means through 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.

As a parallel process of evaluating GEOSS by the Expert Advisory Group (EAG) is ongoing, the development of GEO Foundational Tasks and renewal of the respective GEO Working Groups is deferred to 2023. The new Foundational Tasks will be included in the revised version of the GEO Work Programme 2023-2025 for the GEO-19 Plenary approval.

The 2020-2022 GEO Work Programme includes five Foundational Tasks: GEO Engagement Priorities Coordination; GEOSS Data, Information and Knowledge Resources; GEOSS Infrastructure Development; GEO Work Programme Support; and GEO Secretariat Operations. While many components within the Foundational Tasks are implemented by the GEO Secretariat, others are notably undertaken by collaborative teams drawn from across the GEO community. These include Working Groups that support engagement with key stakeholders to advance global policy agendas, open data and open knowledge as well as capacity development. Core functions of these groups are:

1. Capacity Development Working Group is convened to facilitate GEO's efforts on capacity development, promoting the principle of co-creation and providing conceptual support to the design, development, implementation and evaluation of capacity development activities at various levels of intervention.

2. The Climate Change Working Group is convened to develop and implement a comprehensive GEO climate change action strategy to advance the use of Earth observations in support of climate adaptation and mitigation. This includes actions related to the pillars of the Paris Agreement on Climate Change. Duties involve improving coordination and uptake of GEO Work Programme activities relevant to climate change, support countries' action within the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC) and strengthen the collaboration with GEO's partners in the climate domain.

3. The Disaster Risk Reduction Working Group is established to develop and implement a coherent and crosscutting approach within GEO to advance the use of Earth observations to support national disaster risk reduction and resilience efforts. The Working Group promotes awareness of relevant global policy frameworks, such as the United Nations Office for Disaster Risk Reduction (UNDRR) Sendai Framework for Disaster Risk Reduction 2015-2030, while serving as the primary GEO liaison to UNDRR.

4. The Data Working Group is convened to work with the GEO community and external stakeholders to address data policy, data licensing and data governance issues impacting the use of Earth observations, thereby improving the uptake of Earth observations for decision making.

5. Resilient Cities and Human Settlement Working Group is convened to develop and implement a coherent and cross-cutting approach within GEO to advance the use of Earth observations in support of urban resilience and sustainable urbanisation efforts in human settlements, cities, and countries. These efforts include those related to the provisions of multilateral agreements, with emphasis and target on the New Urban Agenda which serves as the current frame at the UN level.

It is important to mention that GEO's Equality, Diversity and Inclusion Subgroup supports the strategic aim of developing GEO as an institution that provides a fair, supportive and encouraging networking environment in which a diverse group of participants engage responsibly. Efforts are undertaken by, inter alia, the GEO Indigenous Alliance, founded by Indigenous representatives to protect and conserve Indigenous Cultural Heritage by using Earth Observations science, data and technology. Also important to mention, is the GEO Youth Community of Practice, which supports GEO's efforts towards equality, diversity and inclusion, particularly on the topic of generational inclusion, including in the GEO Work Programme activities and at GEO events.

Process of Development

The development of GEO Work Programme 2023-2025 is led by the GEO Programme Board, with the support of the GEO Secretariat.

The development process is initiated with a call for new and revised Implementation Plans for GEO Work Programme activities to GEO Members, Participating Organizations, GEO Associates and the broader community of stakeholders with which GEO interacts. As these plans are received, they are reviewed by engagement 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 Pilot Initiatives). An iterative process of review and revision to the plans continues as needed, up to the time of preparation of the version of the Work Programme that is provided to the GEO Plenary for approval following approval by the Programme Board.

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

- Version 1 was distributed on 31 July 2022 to GEO Principals of GEO Members and Participating Organizations by email and to the broader GEO community via the GEO website;
- Version 2 was distributed to GEO Principals as part of the package of documents for decision at the GEO-18 Plenary and is also made available via the GEO website; and
- Version 3 takes input from the GEO Principals during the GEO-18 Plenary and will be posted on the GEO website following the GEO-18 Plenary, reflecting any adjustments or additions made at the Plenary meeting.

Each version is prepared and distributed by the GEO Secretariat, based on the decisions of the Programme Board. Version 3 is the official version as approved by the GEO-18 Plenary.

The Programme Board identified a set of objectives for the GEO Work Programme 2023-25 for enhanced delivery and impact: greater collaboration and integration across Work Programme activities; stronger emphasis on open knowledge; more specific identification of outputs and intended/actual users; and clearer definition of the Work Programme categories.

In order to achieve these objectives, a number of efforts were prioritized. First, an online tool was developed to conduct the preparation, review and revision of Implementation Plans. The tool has tailored functionalities such as historical data ingestion, version control and tracing, as well as data extraction and analysis. Through this online tool, the activity leads and Programme Board engagement teams were able to view all the submitted Implementation Plans to identify opportunities of collaboration during the development process.

Second, concrete actions were taken by the Programme Board and the GEO Secretariat to identify potential synergies among activities and reduce redundancies in the new GEO Work Programme, inter alia, utilizing and building on mapping efforts undertaken by the GEO Working Groups.[1] Mergers between activities, particularly new activities joining existing ones, were facilitated where mutual interests exist. Workshops will be organized later this year for further coordination among the GEO Work Programme activities.

Finally, various pathways were proposed and discussed with the GEO Work Programme 2020-2022 Community Activities that did not match the criteria set for the category of Pilot Initiatives. These activities are now considering either different engagement approaches with GEO (e.g., becoming a GEO Participating Organization), or submitting a new proposal that meets the criteria of Pilot Initiatives next year.

The Road to Post-2025

The independent Mid-term Evaluation of GEO has found that the most successful activities in the GEO Work Programme are those with the ability to connect across the value chain to deliver operational services to users. Similarly, previous GEO Executive Committee and Programme

[1] 202205_mapping_the_engagement_of_the_2020_2022_gwp.pdf (earthobservations.org)

Board meetings and symposia have emphasized the need for enhanced synergies and integration across the Work Programme in the direction from research to operational services**.**

As GEO approaches the end of its 2016-2025 decade, it must define a pathway to further leverage and scale its Work Programme to systematically support and finance the development, deployment and use of Earth observation solutions in addressing social and environmental challenges. In order to do so, continued efforts to enable coordination and integration of the GEO Work Programme Activities along the Earth observations value chain under thematic areas will be prioritized.

Becoming Involved in the GEO Work Programme

GEO is a voluntary organization and depends on the interest and energy of the international Earth observations and geospatial communities to reach its goals. It seeks to provide a supportive and enabling environment for gender, generational and geographical diversity, including indigenous groups and youth. There are many ways in which nations, organizations and individuals can contribute to the success of GEO and to the implementation of the GEO Work Programme. Some ways to start are listed below.

Contact the GEO Secretariat

Secretariat staff would be pleased to explain the various opportunities available and help you to find the best match for your interests. You can reach the Secretariat by email at geo-wp@geosec.org or by telephone at +41 22 730 8505.

Contact a Member of the GEO Programme Board

The Programme Board is a GEO governance body made up of 32 GEO Members and Participating Organizations appointed by the GEO Plenary. Programme Board members, through their representatives, collectively oversee the development and implementation of the GEO Work Programme. Contact information for Programme Board member representatives may be found on the GEO website http://www.earthobservations.org/geo_pb.php.

Contact your GEO Principal

If you live in a GEO Member country or work in a GEO Participating Organization, you are invited to contact the GEO Principal, their Alternate, or other contacts to find out more about GEO activities in that country or organization. Contact details may be obtained from the GEO Secretariat.

Contact your Regional GEO

You may also become involved in activities in your region. Regional GEOs are set up to engage regional stakeholders in GEO activities and coordinate implementation of GEO activities within their region. Points of contact for each of the four current Regional GEOs may be found in the Regional GEO section of this document.

Contribute to a GEO Flagship, Initiative or Pilot Initiative

All GEO Work Programme activities are open to new participants. While experience in relevant topics is welcomed, it is not necessary to be an expert to become involved. Most GEO Work Programme activities also seek to engage actual and potential users of the products and services

being developed, as well as other stakeholders, to ensure that the activity truly addresses the needs of those it aims to benefit. You are invited to email the Points of Contact for the Flagships, Initiatives or Pilot Initiatives in which you are interested, as listed in this document.

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 commercial 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*, 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. In 2021, the Plenary adopted Resilience Cities and Human Settlements as the fourth Engagement Priority.

Flagships

GEO Biodiversity Observation Network (GEO BON)

Objective

GEO BON is a large international network of experts and a community of practice using biodiversity observations and technologies to monitor biodiversity change. This knowledge is used for decision-making in many sectors, including the conservation and sustainable use of biodiversity and ecosystem services.

Short Description

Over the last 15 years GEO BON has established a global network and community of practice for biodiversity observations and has become an internationally recognized key provider of knowledge to national and international organizations, in particular to the Secretariat and Parties to the UN Convention on Biological Diversity. More than 2200 members in 135 countries and territories are currently using GEO BON workflows to support more effective and timely conservation, management and sustainable use of biodiversity. GEO BON is entering a new phase of activities with a main objective focused on coordinating and implementing a global biodiversity observation system (GBiOS). GBiOS will be designed to fill large gaps in taxonomic, geographic, and temporal coverage of biodiversity monitoring. GEO BON will achieve this by creating a coordinated network of BONs and other monitoring schemes, thereby coordinating the flow of information that use essential variables to monitor trends and enrich the models used for proactive planning and the conservation of biodiversity worldwide. The deployment of GBiOS will enhance engagement from local to national levels and generate the enabling environment needed to curb biodiversity loss and reduce risks to humans as a result.

Why is this activity needed?

The global biodiversity crisis predicts we are on a road to a global species extinction event equivalent to a mass extinction which is impacting ecosystems and the many benefits nature provides to humans. In order to understand how our actions are affecting biodiversity, we must be able to detect and monitor patterns of biodiversity change. Although biodiversity observation systems do exist, there are large geographic and taxonomic biases in where and how these efforts are taking place. At this time, accurate estimates of biodiversity trends are unavailable for large regions of the Earth's land and oceans.

A coordinated system is needed to collate, standardize and harmonize the numerous biodiversity observation data and initiatives to bring out understanding of biodiversity change into focus. A global biodiversity observing system is needed to attribute changes in biodiversity to drivers of biodiversity loss and guide policy towards slowing or preventing negative trends.

Outputs

Output	Status	Users
National BONs	Regularly updated	AmeriGEO, AOGEO, CBD Parties

List of indicators for national reporting under UN CBD	Regularly updated	CBD Parties, UNSEEA, EO4EA
Data to EBVs to indicators for decision making	Occasionally updated	GEO Mountains, GEO Wetlands, CBD Parties
GBiOS (as a network of BONs)	Planned	CBD Parties, GEO community

Contributors

GEO Members: Australia, Canada, Colombia, Finland, Netherlands, Norway, and United States

GEO Participating Organizations: International Institute for Geo-Information Science and Earth Observation (ITC), and European Space Agency (ESA)

Points of Contact

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GEO Global Agricultural Monitoring (GEOGLAM)

Objective

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.

Short Description

GEOGLAM (GEOGLAM.org) was initially launched by the Group of Twenty (G20) Agriculture Ministers in Paris, June 2011 as part of the Minister's G20 Action Plan on Food Price Volatility. Since 2011 the GEOGLAM focus has expanded along with the G20's to also include a broader focus on global food security. GEOGLAM delivers on its mission by producing and openly disseminating consensus based, relevant, timely, and actionable information on agricultural conditions and outlooks of production at national, regional, and global scales (cropmonitor.org). GEOGLAM participants include representatives from most G20 nations as well as many other countries, and several international organizations and NGOs. Participation is from more than 120 institutions from over 50 nations, with beneficiaries from least developed nations further expanding the reach of GEOGLAM.

Why is this activity needed?

As we reflect on the impact of COVID, climate extremes and expanding conflict, food security has become one of the greatest challenges of our time. With a track record of over a decade of success, GEOGLAM has made it clear that Earth observations have a major role to play in support of efficient markets and early warning for food security. Through the 2023 to 2025 Implementation Plan GEOGLAM will strive to continually improve existing systems and evolve to address emerging food security challenges into the future.

Outputs

Output	Status	Users
Crop Monitor for AMIS	Regularly updated	National governments, International organizations, commodity traders
Crop Monitor for Early Warning	Regularly updated	International organizations, national governments, regional organizations
Special Reports	Occasionally updated	International organizations, national governments, regional organizations
Climate Forecasts	Occasionally updated	International organizations, national governments, regional organizations
Food Security and Conflict Reports	Occasionally updated	International organizations, national governments, regional organizations

Contributors

GEO Members: Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Egypt, European Commission, France, Germany, India, Indonesia, Italy, Japan, Malaysia, Mexico, Morocco,

Philippines, Poland, Russian Federation, South Africa, Spain, Thailand, Tunisia, Ukraine, United Kingdom, United States, Uruguay, Vietnam, and Zimbabwe

GEO Participating Organizations: European Space Agency (ESA), Food and Agriculture Organization of the United Nations (FAO), International Institute for Applied Systems Analysis (IIASA), International Institute for Geo-Information Science and Earth Observation (ITC), Regional Centre for Mapping of Resources for Development (RCMRD), World Food Programme (WFP), and World Meteorological Organization (WMO)

Points of Contact

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Global Forest Observations Initiative (GFOI)

Objective

Support developing countries to operationalize national forest monitoring systems and associated greenhouse gas accounting procedures.

Short Description

GFOI is a partnership for coordinating international support for improving forest monitoring and associated greenhouse gas accounting capabilities in developing countries. Through collaborative action, GFOI partners support countries to design, develop and operationalize their own national forest monitoring systems (NFMS) and associated emissions measurement, reporting and verification (MRV) procedures to inform their national decision making, international commitments, and track progress in climate action.

GFOI coordinates international assistance under four central components: 1) Capacity Building, 2) Data, 3) Methods and Guidance and 4) Research and Development (R&D). The Initiative is governed by a Leads Group with representatives from all major development partners in the forest monitoring sector.

Why is this activity needed?

In recent years, there has been a growing need for countries to better understand their forests, how they change over time and in particular the role they can play in addressing climate change. Developing countries are seeking to develop NFMS and associated MRV procedures to help inform their policy development, international reporting, transparency measures and, ultimately their efforts to reduce GHG emissions. Furthermore, this increased demand for improved information from forests has been coupled with a boom in the supply of data, tools and other forms of international support available to developing countries to help them improve their forest monitoring capabilities. Without global coordination and a targeted effort to align the boom in both the demand for forest information and the supply of new technology, developing countries would likely be inundated with different approaches and subsequently the development of their NFMS would be at risk of paralysis.

Outputs

Output	Status	Users
User friendly methods and guidance for the development and operationalization of NFMS	Regularly updated	Developing countries
Complementary or consistent capacity building activities delivered directly to developing countries	Regularly updated	Developing countries
Streamlined access to data, tools, and other technologies for forest monitoring and GHG accounting	Regularly updated	Developing countries
Targeted R&D to fill knowledge gaps and overcome obstacles to progress	Regularly updated	Developing countries
Cohesive network of international practitioners to support developing country implementation	Regularly updated	Developing countries

Targeted communications and information sharing on latest methods, technology, events and other developments in the forest monitoring sector	Regularly updated	Developing countries and international practitioners
A cohesive global network of experts that can be assigned to support countries the implement and improve their NFMS	Occasionally updated	Developing countries
An inventory of development partners' forest monitoring support activities in developing countries	Regularly updated	Developing countries and international practitioners

GFOI is the product of the collaborative efforts of its partners, who are assisting developing countries to build their own forest monitoring systems and associated GHG accounting capabilities. These are the ultimate outputs of GFOI's work but the nature of the Initiative as a voluntary partnership for coordinating support to countries means the outputs can not be assigned to GFOI itself. The outputs of GFOI are therefore limited to the collaborative efforts and products of the GFOI community.

Contributors

GEO Members: Australia, Germany, Japan, Norway, Spain, United Kingdom, and United States

GEO Participating Organizations: Committee on Earth Observation Satellites (CEOS), European Space Agency (ESA), Food and Agriculture Organization of the United Nations (FAO), and The World Bank (The World Bank)

Points of Contact

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Global Observation System for Mercury (GOS4M)

Objective

The GOS4M was designed to support nations, UNEP and all interested parties to evaluate the impacts and effect of mercury contamination of Earth system on human health and provide Earth observation datasets and validated interoperable tools.

Short Description

GOS4M developed the GOS4M Knowledge Hub which includes tools to discover and access to available in-situ mercury datasets, satellite observations used in regional and global scale chemical models, the HERMES emulator of modeling outputs for different anthropogenic emission scenarios and scientific references to the adopted methodology.

Why is this activity needed?

Mercury is a harmful substance for people exposed to its organic compounds. It is released by anthropogenic sources and natural-driven emission processes, can be transported long distances from the emission region/source and be deposited to terrestrial and aquatic receptors. Once deposited to marine and freshwater ecosystems it may partly be deposited to sediments and partly be bioaccumulated in biota. In marine and freshwater biota can be found at concentrations that increase with trophic levels. The impact on human health may occur through different patterns of exposure such as ingestion of Hg-contaminated food such as fish and seafood. Once bioaccumulated in human body it may have toxic effects on the nervous, digestive and immune systems, as well as on lungs, kidneys, skin and eyes, causing serious health problems. The growing perception of nations on the strategic importance of using EO data sets to better characterize the magnitude and spatial distributions of Hg pollution contamination led to the creation of the GEO Flagship on mercury GOS4M (www.gos4m.org) in 2016, as part of the GEO Work Programme 2016-2025.

Outputs

Output	Status	Users
In-situ Hg measurements	Regularly updated	scientists
Hg deposition scenarios	Occasionally updated	policy-makers, citizens
Anthropogenic Hg emissions	Occasionally updated	policy-makers, citizens
Hg concentration in oceans	Regularly updated	policy-makers, citizens
Hg concentration in biota	Regularly updated	policy-makers, citizens
Hg reduction costs	In development	policy-makers, citizens
Risk reduction on population	Planned	policy-makers, citizens

The GOS4M-KH provides widgets that operationalizes integrated multi-model and multi-domain computations.

Contributors

GEO Members: Argentina, Australia, China, Cote d'Ivoire, Czech Republic, Denmark, Finland, France, Germany, Greece, Russian Federation, Slovenia, South Africa, Sweden, Ukraine, United Kingdom, United States, and Italy

Points of Contact

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GEO Land Degradation Neutrality (GEO-LDN)

Objective

The GEO-LDN Initiative supports UNCCD Parties in monitoring land degradation for reporting and implementing measures to achieve or exceed LDN.

Short Description

The GEO-LDN Initiative promotes the collaborative development, and supports the provision and use, of Earth Observation (EO) datasets, quality standards, analytical tools and capacity building to avoid, reduce, and reverse land degradation with the aim of achieving land degradation neutrality (LDN) in all countries by 2030 (Sustainable Development Goal (SDG) Target 15.3). The Initiative helps connecting data providers to data users, including researchers, decision-makers, land use planners, commercial sector, donors/investors and other stakeholders in order to optimize the use of EO datasets for LDN assessment, planning, implementation, monitoring and reporting.

Why is this activity needed?

In order to halt, reduce and reverse the current trends in land degradation, there is an urgent need to enhance national capacities to measure and map degraded lands and identify the most appropriate interventions. Increased access to large EO datasets, targeted data products, improved analytical capacity and practical tools are needed to help countries understand and report on the status and trends of land degradation, set and implement LDN targets, and scale up integrated land use planning, sustainable land management and restoration efforts.

Outputs

Output	Status	Users
Postgraduate Programme on LDN (Master and Phd) including scholarship programme	In development	MSc and PhD students, next generation of spatial data scientists
Virtual Capacity Building formats such as Massive Open Online Courses (MOOCs)	Planned	Professionals in land use planning
Dialogue Forums for Stakeholder Engagement and Knowledge Exchange	In development	stakeholders of the UNCCD Parties, land use planners, national and sub-national organizations active in land use/management planning, policy makers, land users and research agencies
Minimum data quality standards and decision trees for SDG Indicator 15.3.1	Occasionally updated	Countries reporting on SDG Indicator 15.3.1 and data providers
Land Use Planning for Land Degradation Neutrality (LUP4LDN) tool	Occasionally updated	Land use planners, national and sub-national organizations active in land use/management planning, policy makers, land users and research agencies

Federated System for geospatial data integration and analysis	In development	Data analyst, geospatial professionals, environmental researchers, land use planners, reporting agencies

Contributors

GEO Members: Australia, Brazil, Burkina Faso, China, Denmark, European Commission, Finland, France, Germany, Ghana, Italy, Japan, Kenya, Netherlands, Mexico, Poland, Senegal, South Africa, Spain, Switzerland, Ukraine, United Kingdom, and United States

GEO Participating Organizations: Institut Supérieur d'Etudes Spatiales et Télécommunications (ISESTEL), African Association of Remote Sensing of the Environment (AARSE), Conservation International (CI), Secretariat of the United Nations Convention to Combat Desertification (UNCCD), Food and Agriculture Organization of the United Nations (FAO), European Environment Agency (EEA), European Association of Remote Sensing Companies (EARSC), Committee on Earth Observation Satellites (CEOS), and European Space Agency (ESA)

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Initiatives

AquaWatch (AQUAWATCH)

Objective

The 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. AquaWatch encourages activities to engage, and be led by, early career scientists.

Short Description

AquaWatch is an Initiative within the Group on Earth Observations (GEO) that aims to develop and build the global capacity and utility of Earth Observation-derived water quality data, products and information to support water resources management and decision making.

Why is this activity needed?

Water quality is a centerpiece of many international mandates including the SDGs, Sendai Framework, UNFCCC, and potentially the new Urban Resilience engagement priority. Other aquatic initiatives are focused on oceans in general (BLUE-PLANET) or water quantity (GEOGloWS). Water quality is much bigger than a subset or working group within either of those groups – also being our own initiative enables us to leverage a broader application of water quality EO tools, products, services.

Outputs

Output	Status	Users
NASA-funded Validation Workshop Outcomes and Report	Available but not updated	EO water quality Data providers and researchers
Early Career Society	Planned	Early Career scientists in the EO Water Quality Sector and those who support them
user Needs Assessment Synthesis	Planned	EO water quality data providers and satellite agencies
capacity building peer reviewed paper (in review) and survey results	Available but not updated	EO water quality data providers and satellite agencies
Water quality Best Practices	Regularly updated	EO water quality users, data providers, and private sector
recommended algorithms (intro and advanced) and Product Family Specifications	Regularly updated	EO water quality users, data providers, and private sector
Updated outreach materials and project metadata lists	Planned	EO water quality community
Communications Strategy, video and plain language messaging	In development	EO water quality community

DEI metrics	Regularly updated	EO water quality community
EO Water Quality Training Recommendations	Occasionally updated	EO water quality users
Analysis Ready Data and associated Product Family Specifications including minimum metadata standards	Occasionally updated	CEOS, EO data providers and data users
Water Quality portal of existing EO data	Regularly updated	EO water quality community

Formation of two thematic nodes (cal/Val and modelling) and a UK-European node are in progress.

Contributors

GEO Members: Australia, Bangladesh, Belgium, Germany, Ghana, Netherlands, Switzerland, United Kingdom, and United States

Points of Contact

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Data Integration and Analysis System (DIAS)

Objective

DIAS Initiative aims to contribute to national/local climate adaptation and disaster risk reduction policies through a system called the Data Integration and Analysis System (DIAS). The system integrates and disseminates Earth observation data, models and manages the scientific knowledge. This activity emphasizes on capacity development of DIAS users who can facilitate dialogue between the science community and the society to support the decision-making, policy-making, public investment, and local practices.

Short Description

The DIAS Initiative 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, the Initiative contributes to sustainable policy decisions (disaster prevention, agriculture, ecosystem management, public health, etc.) at the local government level by providing datasets and/or offering applications of downscaling model from the global climate change and predicting model of local meteorological phenomena (rainfall, temperature and radiation). This initiative will make applications to solve the specific problem associated with climate change adaptations. In this process, co-designing and co-implementing activities with stakeholders and scientists are regarded as important. DIAS initiative provides opportunities of co-designing and co-working as an information technology platform.

One of the value propositions which the DIAS initiative provides is an institutional framework of Platform on Water Resilience and Disasters, a common platform for the reduction of water-related disaster risks. The DIAS shall realize the Online Synthesis System for Sustainability and Resilience (OSS-SR), a web-based knowledge integration system for disaster risk reduction, resilience, and sustainability. Through the close collaboration among relevant stakeholders, this system provides localized scientific knowledge such as regarding real-time flood forecasting and climate change impact assessment. The OSS-SR also has an e-learning function to provide users with introductory lectures, examinations, and classes of hands-on training, widely covering issues in climate change, flood management, and disaster risk reduction. The e-learning function enables fostering Facilitators, who translate scientific knowledge and information for actors in society, including decision-makers, policymakers, government officers, DRR practitioners, civil society organizations, private sector, media, and local communities.

Why is this initiative needed?

More than 90% of the mortalities due to weather-related disasters have occurred in developing countries, though the death number has decreased significantly over the last 50 years. This fact implies that strengthening resilience, such as the development of social capacity and early warning systems, is one of the key solutions to averting water-related disasters, which will be more intensified in the future due to climate change. DIAS and OSS-SR empower the key-users ("facilitators") to establish resilient society through the power of Earth observations. Those who completed their e-Learning training through the OSS-SR, capable of utilizing the data system to send out official water related early warning/alerts, analyze risks and create hazard maps, are assigned to a city districts or communities to facilitate discussions to local adaptation action and urban planning and design, such as evacuation, contingency and land use plans. This co-designing approach contributes to bridge various stakeholders and communities in society.

Outputs

Output	Status	Users
Flood forecasting and monitoring in Sri Lanka	Regularly updated	Local community, Government agency, NGOs
Developing Platform on Water Resilience and Disasters including food forecasting and climate change impact assessment in the Philippines	Regularly updated	Local community, Government agency, NGOs
Developing Platform on Water Resilience and Disasters in Indonesia	Regularly updated	Local community, Government agency, NGOs
Developing Platform on Water Resilience and Disasters in Myanmar	Regularly updated	Local community, Government agency, NGOs
Developing water related disaster reduction platform to enhance resilience to climate change in West Africa	Regularly updated	Government users
Mirage (Fata Morgana) Forecasting using DIAS	Regularly updated	Local community, Government agency, NGOs
Monitoring Marine Debris and Micro Plastics	In development	Local community, Government agency, NGOs
Agriculture Drought Monitoring and Prediction System in Brazil	Regularly updated	Local community, Government agency, NGOs
Malaria infection forecasting and warning system in South Africa	Regularly updated	Local community, Government agency, NGOs
S-uiPS (Sekine's urban inundation Prediction System)	In development	Local community, Government agency, NGOs

Contributors

GEO Members: Indonesia, Japan, Philippines

Points of Contact

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Digital Earth Africa (DE-AFRICA)

Objective

DE-AFRICA aims to improve the lives of Africans by providing planners and policy makers with tailored Earth observation information to support better decision making and enhance sustainable development outcomes.

Short Description

DE-AFRICA is currently being established as an African-based and managed operational platform, funded by the Australian Government Department of Foreign Affairs and Trade (DFAT), and The Leona M. and Harry B. Helmsley Charitable Trust (Helmsley). DE-AFRICA provides routinely updated information, using Earth observations to deliver decision-ready products enabling policy makers, scientists, the private sector, and civil society to address social, environmental, and economic changes on the continent and develop an ecosystem for innovation across sectors. From 2023, focus of the program will be to secure funding for delivery beyond the Establishment Phase, capacity building, and delivering impact across Africa.

Why is this initiative needed?

DE-AFRICA offers significant productive gains and rapid uptake of EO data to solve problems by providing free access to continental scale analysis ready EO data and thematic products, open-source algorithms and access to compute and training to undertake regional, national or local scale analysis.

Outputs

Output	Status	Users
EO data and services	Regularly updated	Geospatial organizations, government agencies, industry, researchers
Analysis tools and training on use of EO data	Regularly updated	Geospatial organizations, government agencies, industry, researchers
In situ and validation data	Occasionally updated	Geospatial organizations, government agencies, industry, researchers

More information about the data, services and tools provided by DE-AFRICA can be found in the user guide: https://docs.digitalearthafrica.org/en/latest/. Specifically, datasets available are listed at https://docs.digitalearthafrica.org/en/latest/data_specs/index.html and analysis tools are provided at https://docs.digitalearthafrica.org/en/latest/sandbox/index.html.

DE-AFRICA's continental scale products include:

- Water Observations from Space (WOfS): a continent-wide service that allows anyone to better understand water availability. WOfS uses Landsat-2 Surface Reflection to enable users to understand the location and movement of inland and coastal water across Africa. It shows the presence and absence of water and can be used to assess the change in water extent over time and manage water resources.

- Cropland Extent Map provisional service uses Sentinel-2 surface reflectance to determine the presence or absence of crop at 10m resolution. This information is fundamental to developing more complex agricultural products and empowers governments to inform decisions on food security.
- Fractional Cover describes the landscape by classifying the ground cover as bare, green and non-green, enabling analysis of environmental conditions over time. The service uses Landsat 2 Surface Reflection therefore analyses can explore decades of change (back to 1980s to current day), providing powerful insights into long-term annual as well as shorter term seasonal vegetation change.
- GeoMAD is a rich data service that condenses an entire year's worth of satellite viewing into a single cloud-free, statistically significant composite (Annual GeoMAD), and is available for both Landsat and Sentinel-2 data. GeoMAD data can be used to inform decision making on crucial sustainability issues such as water resourcing, flooding, coastal erosion, land degradation, food security and urbanisation, and is particularly useful for visualising change over time.

DE-AFRICA data and products are accessible through several open-source visualisations and analysis tools, accessible by users with different levels of technical background (e.g. Analysis Sandbox, DE-AFRICA map, GIS Web Services and ESRI's Africa Geoportal).

DE-AFRICA's free, on-line training portal is now available to both English and French speaking communities. The capacity development model has resulted in the rapid growth of our diverse user base (government, academia, industry). For example, as of mid-2020 DE-AFRICA has:

- More than 2000 registered DE-AFRICA sandbox users
- More than 300 graduates from DE-AFRICA's free, online, bi-lingual training course. More than 10,000 unique DE Africa map users
- 2 completed industry incubator studies (Ghana, Kenya) leveraging DE-AFRICA for innovation in agribusiness applications.

Contributors

GEO Members: Australia, Ghana, and South Africa

GEO Participating Organizations: Observatoire du Sahara et du Sahel (The Sahara and Sahel Observatory) (OSS), AGRHYMET Regional Centre (AGRHYMET), and Global Partnership for Sustainable Development Data (GPSDD)

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Earth Observations for Ecosystem Accounting (EO4EA)

Objective

The purpose of the initiative is to further the development and use of Earth Observations for natural capital accounting (NCA) 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).

Short Description

There is an urgent need to align the way that we manage our ecosystems with the economic systems used for decision making to ensure long-term resilience and sustainable development. Statistical agencies around the world are starting to develop ecosystem accounts to address this challenge and the earth observation community will play a critical role in operationalizing and scaling up these efforts. The Earth Observation for Ecosystem Accounting (EO4EA) Initiative seeks to advance the application of earth observations to support Ecosystem Accounting under the System of Environmental Economic Accounts (SEEA). Our mission is to enable the widespread adoption of SEEA Ecosystem Accounts by co-developing the EO standards, tools, products, and capacities that are needed by the accounting community. Our membership includes national governments, academic institutions, intergovernmental organizations, and NGOs.

Why is this activity needed?

Natural Capital Accounting, and Ecosystem Accounting in particular, is inherently spatial and requires the application of high quality, spatial explicit data on the state and condition of ecosystems. There is a need to connect the earth observation community with the accounting community to overcome technical challenge and operationalize the development of ecosystem accounts. Consistency is needed by governments implementing the SEEA because the nature of NCA is based on repeatable, replicable and ready observations and analyses.

Outputs

Output	Status	Users
Account-ready data standards	In development	EO data producers and users
Ecosystem Accounting case studies and pilots	Occasionally updated	National Statistics Offices/Account developers
Data and model interoperability guidelines for accounting	Planned	EO data users and account developers
Core EO-derived data products for accounting	Planned	National Statistic Offices/Account developers
Various on the ground pilots	In development	National Statistic Offices/Account developers

Contributors

GEO Members: Canada, European Commission, Mexico, Netherlands, and United States

GEO Participating Organizations: European Space Agency (ESA), Food and Agriculture Organization of the United Nations (FAO), The World Bank (The World Bank), Conservation International (CI), and European Environment Agency (EEA)

Associates: Environmental Systems Research Institute (Esri)

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Earth Observations for Health (EO4HEALTH)

Objective

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.

Short Description

EO4HEALTH serves as a global network of governments, organizations, and observers, who seek to use Earth observations (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: 1) engage with end-user communities to better understand and identify their data needs and requirements; 2) develop and implement activities that address the needs and requirements of end-user communities; 3) improve the use of, and clarify future needs for, EO for health; 4) examine effectiveness and provide timely insight and feedback on future EO actions for health; and 5) participate with other individuals, GEO communities of practice, and institutions to leverage expertise that can produce an outcome greater than that achievable otherwise.

As a GEO Initiative, EO4HEALTH helps foster the development of integrated information systems 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 to enhance preparedness and resilience. EO4HEALTH represents a particular element of the larger GEO Health Community of Practice (CoP), offering support to the GEO Health CoP in the development and elaboration of the CoP Work Plan and five work groups: 1) heat; 2) infectious diseases; 3) air quality, wildfires, and respiratory health; 4) food security and safety; and 5) health care infrastructure. These work groups help EO4Health to leverage the continued development of global networks of stakeholders that enhance shared scientific findings and promotion of EO tools and data.

Why is this activity needed?

The use of 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 and offer a sustainable framework for investment in research development and capacity building in environmental health. These data can also support disease preparedness and response actions in disease epidemic or humanitarian efforts.

Outputs

Output	Status	Users
EO4HEALTH projects	Regularly updated	Academic institutions
Journal publications	Occasionally updated	Global research community
GEO Health CoP Annual Meeting	Occasionally updated	Global research community
Special Edition Webinars with AmeriGEO, AfriGEO, AOGEO, and EuroGEO	In development	Global community, health ministries
Scientific support for situational awareness during the COVID-19 pandemic	Available but not updated	WHO, WMO, health ministries
GEO Health Community of Practice website	Regularly updated	Global research community
Dashboard with enhanced data integration and modelling of disease risk or prediction of environmental drivers of disease and other health outcomes	In development	Global research community, health ministries, health NGOs
Collection of water-air and vector borne prediction modeling expertise	In development	Global research community, health ministries, health NGOs
Environmental Justice Toolkit for Heat and AQ	In development	Researchers from US academic institutions, state and federal institutions
Case study on EO being integrated with food systems data to provide actionable information on food security in regions with extreme food insecurity	In development	End-users and decision-makers in the agriculture community
Database of integrated Earth observation datasets of positioning health care facilities in various states as an informative resource that can be used to assess vulnerability of local health care facilities to local environmental stressors (e.g. flooding, coastal storm surges and winds, wildfires, threats to water supplies)	In development	State and federal institutions, humanitarian agencies, international relief NGOs
Prototyping a tool for automating the extraction of the perimeter of health care facilities from Earth observation images and maps	In development	Health ministries, national and international civil protection agencies

Contributors

GEO Members: Canada, Costa Rica, Mexico, South Africa, United Kingdom, and United States

GEO Participating Organizations: World Health Organization (WHO), World Meteorological Organization (WMO), Regional Centre for Mapping of Resources for Development (RCMRD), and Central American Commission for the Environment and Development (SICA/CCAD)

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Earth Observations for Disaster Risk Management (EO4DRM)

Objective

Increase the use of satellites for disaster risk management activities relating to natural hazards.

Short Description

EO4DRM coordinates a series of risk related activities involving the use of satellite data and its integration in standard risk management practices, including work relating to hazards, vulnerability and exposure, across the full cycle of DRM. This activity serves this purpose by bringing together efforts from CEOS WGDisasters (leveraging satellite observations), in coordination and collaboration with GEO DRR-WG. Satellite-based solutions are developed and tested in pilot (standalone activity) and demonstrator (towards sustainability and scale-up) phases in the areas of numerous natural hazards such as flood, volcanoes, landslides, seismic events and wildfire, as well as multi-thematic issues on post-disaster support. Within EO4DRM, there are 6 pilot and demonstrator activities in accordance with each of the thematic areas: Wildfire Pilot, Flood Pilot, Seismic Hazards Demonstrator, Volcano Demonstrator, Landslide Demonstrator, and Recovery Observatory Demonstrator.

Why is this activity needed?

DRR/DRM has always been an important global issue, as evident in the adoption of the global agreement, Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030. The role of Earth observations, including satellites, can play in contributing to the SFDRR is well recognized that DRR has been GEO's Engagement Priority and that CEOS has created a permanent Working Group for the topic. However, data on progress towards the global targets of the SFDRR reveal a mixed picture of progress and challenges. As described in the 2021 Report of the Secretary-General to the General Assembly (A/76/240), for example, only 79 countries report having access to multi-hazard early warning systems, and 28 countries report having access to appropriate disaster risk information and assessments (global target G). EO4DRM tries to fill the gap through promoting the uptake of satellite data by risk managers and explores on a pilot and demonstrator basis methodologies and best practices for use of satellites for DRR/DRM. In the context of SFDRR halfway, the initiative may provide recommendations to DRR/DRM community for how to accelerate the implementation of the framework, benefiting from Earth observation data and tools.

Outputs

Output	Status	Users
Landslide susceptibility maps	Occasionally updated	World Bank, Practitioners, Insurance
Landslide impact map	Occasionally updated	World Bank, Practitioners, Insurance
Lava flow hazard map	Regularly updated	Crisis centers, Practitioners
Estimation of volcanoes effusion rate & flow modelling	Occasionally updated	Crisis centers, Practitioners
Ground displacement map after earthquake	Occasionally updated	Crisis centers, Practitioners

Impact assessment maps for Post Disaster Need Assessment (PDNA)	Occasionally updated	PDNA team, Governments
Fault cartography	Occasionally updated	Practitioners

Contributors

GEO Members: Argentina, Belgium, Canada, France, Italy, Luxembourg, Switzerland, and United States

GEO Participating Organizations: European Space Agency (ESA), Food and Agriculture Organization of the United Nations (FAO), and Committee on Earth Observation Satellites (CEOS)

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Earth Observations for the Sustainable Development Goals (EO4SDG)

Objective

Extend and apply Earth observations, geospatial information and derived knowledge to advance the 2030 Agenda and enable societal benefits through achievement of the Sustainable Development Goals.

Short Description

EO4SDG initiative organizes and realizes the potential of Earth observations and geospatial information to advance the 2030 Agenda and enable societal benefits through achievement of the SDGs. EO4SDG involves technical, organizational and programmatic components. Collectively, these items meld in the projects, data, outreach and engagement, and capacity development related to how Earth science information sources can support the 2030 Agenda.

Why is this activity needed?

EO4SDG serves a fundamental role to advance global knowledge about effective ways that Earth observations and geospatial information can support the SDGs. The Initiative seeks to advance the benefits of the SDGs through sustained, effective use of Earth observations. And, these uses can lead to greater awareness of, and interest in, Earth observations to enable even greater societal benefits.

Outputs

Output	Status	Users
GEO SDG Awards	Regularly updated	Global reach (see website for eligibility and award (sectoral and special) categories)
Earth Observations Toolkit for Sustainable Cities and Human Settlements	Regularly updated	List of users is available: https://eotoolkit.unhabitat.org/
Projects	Regularly updated	Countries (national statistics offices, ministries), municipalities, NGOs, civil society organizations, United Nations Agencies.
Trainings	Regularly updated	Local government and municipality authorities, national governments, networks, fora, United Nations agencies, non-public sector agencies
Country Use Cases	Occasionally updated	Countries and other relevant stakeholders
EO4SDG Website & Social Media	Regularly updated	https://eo4sdg.org/our-users/
Special Issues, Journal Publications and Articles	Occasionally updated	Global SDG and statistical community, countries, Earth science community, UN agencies, non-public sector, civil society
Events at UN, GEO, scientific conferences, and	Regularly updated	Global SDG community, statistical community, countries, Earth science community, UN agencies,

user-centric events		non-public sector, civil society
Additional SDG Toolkits	Planned	Countries and other relevant stakeholders
SDG Workshop	Planned	TBD
MOOC on Earth Observations for SDGs	Planned	Countries (national statistics offices, ministries), local governments, UN custodian agencies, non-public sector, civil society
SDG Indicator methodologies	Occasionally updated	UN entities, countries and relevant stakeholders
Annual Reports	Regularly updated	National Statistical Offices, line ministries, international statistical agencies, UN entities, as well as GEO Community Activities, Initiatives and Flagships.
AGU Book Publication: Earth Observations Application for Global Policy Frameworks	In development	Countries (national statistics offices, ministries), municipalities, NGOs, civil society organizations, United Nations Agencies, non-public sector

Contributors

GEO Members: Australia, China, Costa Rica, European Commission, Germany, Greece, Japan, Kenya, Mexico, Namibia, Netherlands, Norway, South Africa, Sweden, Switzerland, United Arab Emirates, United Kingdom, and United States

GEO Participating Organizations: Secretariat of the United Nations Convention to Combat Desertification (UNCCD), World Data System (WDS), European Association of Remote Sensing Companies (EARSC), European Space Agency (ESA), Inter-Balkan Environment Centre (i-BEC), Institute of Electrical and Electronics Engineers (IEEE), International Institute for Applied Systems Analysis (IIASA), United Nations Office for Outer Space Affairs (UNOOSA), World Health Organization (WHO), United Nations Institute for Training and Research (UNITAR), Committee on Earth Observation Satellites (CEOS), and AGRHYMET Regional Centre (AGRHYMET)

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GEO Blue Planet (GEO-BLUE-PLANET)

Objective

Bridging the gap between ocean and coastal observational data and societal needs to deliver actionable information for policy and decision making.

Short Description

GEO-BLUE-PLANET is the ocean and coastal arm of the Group on Earth Observations (GEO) that aims to ensure the sustained development and use of ocean and coastal observations for the benefit of society. Following GEO's mission, GEO-BLUE-PLANET promotes open, coordinated, and sustained data sharing and infrastructure for better research, policy making, decisions and action. 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. We do this by working with stakeholders to understand their information needs and connecting them with available data and products. We foster the development of tools that meet their requirements, and work with them to strengthen their capacity to make informed decisions. This requires a close collaboration between scientists who gather ocean and coastal data, those who extract information from observations and anticipate future conditions, and those who use the knowledge and forecasts in the management of our living world. GEO-BLUE-PLANET's activities are selected based on stakeholder needs and currently span 7 topics: marine litter, sargassum, coastline changes, eutrophication, fisheries, oil spills and climate adaptation. GEO-BLUE-PLANET functions as a network of ocean and coastal-observers, social scientists and end-user representatives from a variety of stakeholder groups, including international and regional organizations, NGOs, national institutes, universities and government agencies.

Why is this activity needed?

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 and coastal waters. For example, approximately 60 million people rely on fisheries and aquaculture for their livelihoods and over 80% of the world's trade is carried by sea (FAO, 2018; UNCTD, 2017). The social and economic future of these and many other sectors is increasingly dependent on the services delivered by marine and coastal waters. In recent years, the global community has prioritised the need for concerted action to maintain these services through the agreement on the United Nations (UN) Sustainable Development Goal (SDG) targeted at the oceans (SDG 14: Life Below Water) and the proclamation of a Decade of Ocean Sciences for Sustainable Development (2021 – 2030) (UNESCO, 2017; UNGA, 2015). Maintenance of these services relies on the advancement of effective, evidence-based decisions by governments, civil society and the private sector about sustainable development, ecosystem management, food security, ocean-resource utilization and natural disasters. Evidence-based decisions in the marine realm need to be underpinned by the collection of physical, chemical and biological data about coastal and open-ocean areas through direct (or "in situ") measurements, remote-sensing technologies and modelling capabilities, commonly referred to collectively as ocean and coastal observations. These observations are transformed into information products, ocean forecasts and services that

can be used to create knowledge for effective, evidenced- based management and policy decisions.

Outputs

Output	Status	Users
Secretariat: Development of Asian GEO-BLUE-PLANET Secretariat Office	In development	Asia-Pacific and Global Users
Secretariat: Impact and Evaluation Plan Development	Planned	GEO-BLUE-PLANET Community
Secretariat: GEO-BLUE-PLANET Symposia	In development	Stakeholders in Africa and Asia
Fisheries Working Group: SMS Fisheries Alerts for Bangladesh	Planned	The fisheries community in Bangladesh
Fisheries Working Group: Earth Observation and ocean data to support fisheries and climate change modeling	Planned	Various stakeholders including member states, fisheries organisations and the scientific community
Fisheries Working Group: Earth observation data for onshore and offshore culture fisheries	Planned	Onshore and offshore culture fisheries communities
Fisheries Working Group: Identify gaps in Earth Observation data to establish the impact of marine litter on fisheries	Planned	Fisheries communities, environmental managers and the scientific community
Fisheries Working Group: Peer-reviewed White Paper from the Tuna workshop	In development	Tuna fisheries stakeholders
Marine Litter Working Group: Peer-reviewed white paper on the current status of marine litter monitoring and data	In development	Global Partnership on Marine Litter (GPML) and other interested stakeholders
Marine Litter Working Group: Bringing communities of practice together to share information, improve international communication, and leverage existing efforts	In development	Environmental managers, policy makers and marine litter stakeholders
Marine Litter Working Group: Support co-development of a global sustained Integrated Marine Debris Observing System with policy makers and the scientific community	In development	Environmental managers, policy makers and marine litter stakeholders
Sargassum Working Group: Inventory of available Sargassum products	In development	Tourism industry, fisheries industry, scientific community and other stakeholders impacted by Sargassum
Sargassum Working Group: Community Sargassum near-real-time monitoring and coastal risk inundation tool	In development	Tourism industry, fisheries industry, scientific community and other stakeholders impacted by Sargassum
Sargassum Working Group: Sargassum	Regularly	Tourism industry, fisheries

Information Hub	updated	industry, scientific community and other stakeholders impacted by Sargassum
Coastline Changes Working Group: WaveForce development and implementation	In development	Coastal communities on reef-lined coasts
Coastal Changes Working Group: Satellite derived coastal bathymetry of Pacific Islands	Planned	Pacific Islands
Coastline Changes Working Group: Coastal Erosion/Accretion monitoring products	Planned	Coastal communities
Eutrophication Working Group: Support global reporting for SDG indicator 14.1.1a (index of coastal eutrophication)	Occasionally updated	UN Environment Programme and member countries
Eutrophication Working Group: dashboards, information hub and toolkits for SDG indicator 14.1.1a	In development	UN Environment and member countries
Eutrophication Working Group: Support development of higher resolution, locally-tuned products	Planned	Member countries
Oil Spill Working Group: Collaboration for Oil Satellite Tracking in the Americas	In development	Countries in the Wider Caribbean and Americas region
Oil Spill Working Group: Earth Observation and ocean data to support oil spill monitoring and modelling.	Planned	Various stakeholders including member oil and gas stakeholders, member states and the scientific community
Climate Adaptation Working Group: National Adaptation Plan guidance	Planned	Parties responsible for producing National Adaptation Plans in coastal nations
Climate Adaptation Working Group: Blue Carbon mapping	Planned	UNFCCC and member countries

GEO-BLUE-PLANET's activities are implemented by thematic working groups which currently include marine litter, sargassum, coastline changes, eutrophication, fisheries, oil spills and climate adaptation. All working groups support GEO-BLUE-PLANET's core action areas of Stakeholder Engagement, Cooperation and Co-Design and Capacity Development.

Contributors

GEO Members: France, European Commission, Ghana, and United States

GEO Participating Organizations: Mercator Ocean International, Institute of Electrical and Electronics Engineers (IEEE), Intergovernmental Oceanographic Commission (IOC), and Partnership for Observation of the Global Ocean (POGO)

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GEO Capacity Building in North Africa, Middle East, Balkans and Black Sea Region (GEO-CRADLE)

Objective

GEO Capacity Building in North Africa, Middle East, Balkans, Black Sea sustaining the key outputs of the relevant H2020 GEO-CRADLE project scaling-up their reach in terms of geographic coverage (Black Sea), addition thematic areas (disaster management and water resources management) and operational maturity (in conjunction with the outcomes of the e-shape project - EuroGEO Showcases).

Short Description

From its very conception and throughout its implementation, GEO-CRADLE has been in accordance with and driven by the strategic priorities laid out in the GEO Strategic Plan 2016-2025 regarding the implementation of GEOSS and with the Copernicus Regulation defining the actions towards Copernicus uptake. Following the 34 months of its activities, as well as the follow-up activities and new field up to date (e.g. e-shape Pilots 3.1, 6.4, 6.2, 6.3, 6.1, 2.4 & 1st EIC Horizon Prize on Early Warning for Epidemics, EXCELSIOR H2020 Teaming Phase 2 Project), it is now possible to demonstrate its value and underline its contribution to the achievement of GEO/GEOSS and EuroGEO goals in the region, as well as to argue for the need to maintain the existing GEO-CRADLE coordination and networking mechanism alive and further scaled up for the benefit of EU GEO supported initiatives and Copernicus. Moreover, the GEO-CRADLE Initiative provides further impetus on the GEO-CRADLE pilots and offers an opportunity to extend the relevant GEO-CRADLE services, as well as, where relevant, the services from other projects and Initiatives, beyond the geographic and thematic coverage initially considered by GEO-CRADLE, in support of the three GEO priorities, namely Climate Change, Disaster Risk Reduction and Sustainable Development Goals.

Why is this activity needed?

The scope of the Initiative is strongly motivated by the need to capitalise, sustain and scale up the results mainly achieved during the implementation of the 34-month H2020 GEO-CRADLE project (02/2016-11/2018) as well as the follow-up activities up to now (e.g. e-shape, Early Warning System for Mosquito Borne Diseases - EYWA), also promoting, where is relevant, key outcomes of other EU Flagship projects and Initiatives (e.g. EuroGEO, AfriGEO, NextGEOSS, ERAPLANET, GEOGLAM, GEO-VENER). In that regard, the details of the GEO-CRADLE Initiative are strongly informed by the lessons learned during that period, and by the outcomes of various exchanges between the project and key stakeholders (most prominently GEO Secretariat, EC DG RTD and DG GROW, ESA, JRC and several regional, national and local actors in the countries within the RoI).

Outputs

Output	Status	Users
nextSENSE: solar energy nowcasting & short-term forecasting system	In development	Power transmission operators and Distributors, (The Public Power Corporation Renewables S.A. (PPCR), the National Independent Power Transmission Operator S.A. (IPTO) of Greece), Environmental and

		Energy Ministries (The Ministry of Electricity and Renewable Energy of Egypt), Large and small scale solar PV parks and concentrated solar plants, Policy Makers, Industry
ReSAgri - Resilient & Sustainable ecosystems including Agriculture & food	In development	Interamerican SA GAIA EPICHEIREIN GR Association of farmers Numerous Farmers Cooperatives GRNET
GEOSS for Disasters in Urban Environment	In development	Civil Protection Agencies, hydro-meteorological predictions agencies, disaster risk reduction institutions
Assessing Geo-hazard vulnerability of Cities & Critical Infrastructures	In development	Urban planners and managers, Policy Makers, Industry and engineering companies, Insurance companies, Civil protection authorities, Urban citizens, EU Entities, Member States
EO4D_ASH - EO Data for Detection, Discrimination & Distribution (4D) of Volcanic ash	In development	VAACs, aviation industry at large
EYWA - EarlY WArning System for Mosquito-Borne Diseases	In development	All relevant communities that are involved in the control of Vector Borne Diseases: National Health Organizations and Public Authorities, vector control companies, citizen scientists researchers
Applications in Environment & Climate (atmospheric state, pollution levels, dust monitoring, applied research of agriculture, water and land use), Resilient Society (Disaster Risk Reduction, Cultural Heritage, Access to Energy, Marine Safety and Security) and Big Earth Data Analytics (Geoinformation data management, information extraction, data merging, visualization)	In development	More than 95 organizations from academia, industry, government and society both from international and national level, including 19 Governmental Departments of the Republic of Cyprus (https://excelsior2020.eu/the-project/networks-organisations/)

Contributors

GEO Members: Cyprus, Greece, Italy, Spain, and Ukraine

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GEO Global Water Sustainability (GEOGLOWS)

Objective

To pioneer scientific and global collaboration to provide relevant, actionable water information and to promote the use of Earth observations in the decision-making process.

Short Description

The Global Water Sustainability (GEOGloWS) Initiative under the Group on Earth Observations (GEO) is a user-driven initiative that seeks to enable scientists and organizations to solve multidisciplinary challenges associated with achieving global water sustainability while promoting activities providing equitable solutions. The core innovation of the GEOGloWS effort is its combination of modern computing technologies with hydrologic sciences and satellite datasets enabled by web services and cloud computing. With an operational focus and innovations, GEOGloWS provides a space for the engagement of multidisciplinary and transboundary organizations and provides a forum for government-to-government collaboration and engagement with academia, non-profit organizations, and private sectors. GEOGloWS provides access to actionable water data, information, and knowledge to bridge the digital divide and promote global equity through a service.

Why is this activity needed?

In climate change response and disaster preparedness and mitigation, accurate streamflow indicators and forecasts play an increasingly important role in flood and drought control, reservoir operation, watershed planning, water resource management, and mitigation of the impacts of climate change by providing critical information in advance on various timescales. The GEOGloWS - ECMWF flow forecasting service responds to the global need for streamflow forecast information. The forecast service also provides a solution to the lack of data sharing in transboundary watersheds as neighboring countries do not share information.

In prosperous economies, the benefits of adopting cloud computing are already recognized for improving security and optimizing operations. On the other hand, governments and organizations in developing nations have lower budgets with priorities requiring early-win demonstrations before long-term adoption and investing in cloud computing. The core innovation of the GEOGloWS effort is its combination of modern computing technologies with hydrologic sciences and satellite datasets enabled by web services and cloud computing.

Outputs

Output	Status	Users
Streamflow forecast	Regularly updated	
Water fraction maps using in-situ streamflow data	Planned	
VIIRS-generated water fraction map	Planned	

Contributors

GEO Members: European Commission, France, Japan, Switzerland, and United States

GEO Participating Organizations: Regional Centre for Mapping of Resources for Development (RCMRD), Conservation International (CI), The World Bank (The World Bank), and World Meteorological Organization (WMO)

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GEO Human Planet (HUMAN-PLANET)

Objective

HUMAN-PLANET aims to measure, monitor and assess human presence on planet Earth and in doing so help to address hazard impact on society, societal demand for resources and societal impact on the environment.

Short Description

HUMAN-PLANET generates, integrates and compares global datasets related to the built-environment and population and its attributes. Physical size of human settlements (built-up) and population density spatial grids are the foundation variables produced by HUMAN-PLANET and available over time dating back to 1975. The two variables are regularly improved using new satellite image collections and population censuses. The physical size of settlements is also partitioned in residential and non-residential areas. VIIRS are the new satellite collection available within HUMAN-PLANET. The population spatial grids are available at different spatial resolution and generated using different dis-aggregation techniques. Population spatial grids are now also attributed to include age groups, gender and other attributes. HUMAN-PLANET also compares population and physical size spatial grids generated outside the HUMAN-PLANET and provides an evaluation and fitness for purpose. The integration of the two foundation variables has generated the human settlement model a methodology that outlines cities, towns and rural settlements used also to partition the built-environment in urban and rural areas. Physical size of settlements and population grids intersected with thematic information has generated new knowledge captured in new spatial grid including global emissions spatial grids, global hazard exposure spatial grids. The outlining of cities was used to generate the Urban Centre database a collection of over 10000 cities that each is attributed with physical and socio-economic information. The Urban Centre Database was also used to generate the functional urban areas an extension of the urban spatial extent based on commuting distances cities HUMAN-PLANET contributes to the four engagement priorities of GEO. It contributes to SDG 11, to understand disaster risk by providing global exposure layers. HUMAN-PLANET is engaged in capacity building of Regional GEO and contributes to populating the EO4SDG toolkit and the EO Risk Toolkit.

Why is this activity needed?

The initiative generates global human settlement information including global population density and built-up over time. The initiative models also past population densities and physical size of settlements dating back to 1975 and it generates population and built-up projections into the 21 century. The Information is used in the socio-economic pathways, to measure SDG indicators, to compute exposure to hazards information, to estimate emissions and demand for resources and to quantify urbanization globally.

Outputs

Output	Status	Users
Datasets: Global Built-Up spatial grids	Regularly updated	Disaster Risk, Urban Planners
Datasets: Global Population spatial	Regularly	Disaster Risk Community

grid	updated	
Datasets: Population Projections	Regularly updated	UN FCC, EU
Dataset: Global Human Settlements	Regularly updated	FAO, UN Habitat, OECD, EU
Datasets: Urban Center Database	Regularly updated	EU, UN Habitat, Other international
Datasets: Functional Urban Areas	Regularly updated	OECD, EU

Contributors

GEO Members: China, European Commission, Germany, Greece, Ireland, Netherlands, United Kingdom, and United States

GEO Participating Organizations: European Union Satellite Centre (EU SatCen)

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GEO Vision for Energy (GEO-VENER)

Objective

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 (RE). The initiative supports through the development of operational services made available to the renewable energy community, the SDG7 targets in terms of ensuring access to affordable, reliable, sustainable and modern energy.

Short Description

The initiative aims at developing and promoting the use of EO to serve the development, the operation and the maintenance of RE systems. GEO-VENER built on the community portal Webservice-energy.org, to serve the development of RE by providing an easy interoperable and GEOSS compliant access to documented, precise, trustable (or bankable) data, observation, information, knowledge and services related to RE.

Why is this activity needed?

Development of RE is key for fighting against the global warning and to ensure the transition towards an energetic system more sustainable and with less impacts on the Earth system. Today, the most promising RE in terms of increase of installed capacities are solar and wind energy. But marine energies, new biomass energies (such as biofuels), new hydro systems (others than large dams) and geothermal can also participate to a de carbonized energy mix. The development, operation and maintenance of RE systems needed a set of information that EO can provided worldwide. As an example, any commercial solar farm developed in the world need, a resource assessment step allowing to evaluate the potential of production according to the solar resource available that allow to evaluate its return on investment. For this the most adequate source of information are solar resource derived from satellite data combined with in-situ measurement.

Another type of question that GEO VENER is tackling is the daily operation of the RE systems. The operators of RE systems need to evaluate if all the RE farms is operate correctly. If one or many of the panels of solar farm are not functioning, the performance of the solar farm will be under the nominal production. Again EO (satellite data and in-situ measurements) provides an information that allows to detect issues.

The series of examples can be prolonged a lot, but here another one, where EO can support decision making on the choice of the future energy mix that contribute to the fight against climate change. Due to the drought linked with increase of the temperature, less water is available for large dams. The national energy production company of Norway has a lot a questions about the renewal or the replacement of their large dams producing hydro RE to guarantee the production of energy for its population and for exportation within Europe. If the decrease of available water for the energy production will continue, what will the best solution(s) to fulfil their duties on energy production? Here again EO data and climatologic data can support their reflection and help them to identify trends, threats and opportunities

Hence there is a large range of applications, questions, decisions where EO can help. GEO VENER is working to develop these applications, help on answering these questions and

support the decision-makers by advocating, engaging the users, delivering EO based solutions in the RE domain.

Outputs

Output	Status	Users
Copernicus Atmosphere Monitoring Service for Solar Radiation	Regularly updated	Commercial users, citizens, decision makers
compilation of resources in the catalogue of the energy community portal http://www.webservice-energy.org.	Regularly updated	Commercial users, citizens, decision makers
Copernicus Climate Change Service for Energy	Regularly updated	Commercial users, citizens, decision makers
New European Wind Atlas" (NEWA)	Regularly updated	Commercial users, citizens, decision makers
Series of tools and Applications dedicated to RE	Regularly updated	Commercial users, citizens, decision makers
series of RE pilots in the e-shape project	Regularly updated	Commercial users, citizens, decision makers
FlexiGIS	Regularly updated	decision makers for energy systems
REMIX	Regularly updated	Decisions makers

All outputs and projects in the previous table are funded and provide results. The genericity of the outputs provided by the initiative opens the floor to unplanned use of the achievements of the initiative. As an example, improving the spectral description of the solar resource (in Copernicus Atmosphere Monitoring Service) will lead to important information and services related to Photosynthetically Active Radiation (PAR) that are of great interest for Agriculture and Agri PV. This spectral description can also support activity related to health by providing information related to UVA and UVB that impacts on skin cancers.

Contributors

GEO Members: Australia, Denmark, France, Germany, Greece, Switzerland, and United States

GEO Participating Organizations: European Space Agency (ESA)

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GEO Wetlands (GEO-WETLANDS)

Objective

GEO-WETLANDS's vision is to deliver sustained information from Earth Observation to support the conservation, management, restoration and wise use of wetlands worldwide, as a contribution to the Ramsar Convention on Wetlands and other multilateral environmental agreements (e.g., Convention on Biological Diversity), and to the 2030 Agenda on Sustainable Development.

Short Description

GEO-WETLANDS is a collaborative and distributed effort, which builds on existing large-scale initiatives, activities and projects and uses the momentum and availability of funding within the wetlands community to establish a Global Wetland Observation Community of Practice (GEO Wetlands CoP), the principal objective of which is to deliver robust and cost effective EO solutions for wetland inventory, assessment and monitoring, including wetlands-based solutions. GEO-WETLANDS will also support the monitoring and reporting on SDG targets and indicators related to wetland ecosystems (e.g., SDG Target 6.6 on the protection and restoration of water-related ecosystems) and contribute to the production of the Global Wetland Outlook on the State of World's Wetlands and their services to people, the flagship publication of Ramsar Scientific and Technical Review Panel (STRP), which periodically reviews the state of wetlands worldwide.

Why is this activity needed?

Wetland inventory, assessment and monitoring constitute essential instruments for countries to ensure the conservation and wise use of their wetlands. However, information on wetland ecosystems and on their services to people (e.g., Nature-Based Solutions) is often scattered, difficult to find, and hard to integrate into decision making.

Despite recent advances, an accurate global map of wetland extent and vegetation is still not available. Most global land cover data sets have few wetland classes other than water, and accuracy estimates for the classes they do provide are often less than 60%. Regional data sets use a variety of classification systems that may not be easily reconciled. Current EO capabilities for mapping and monitoring wetlands are sufficient for most wetland types (and will be sufficient for all wetland types, with the successful launch of NISAR in 2024). We have now reached a point where the challenge to progressing to a global wetland observing system which is primarily organizational and financial, rather than technical. GEO-WETLANDS, in coordination with Ramsar, national agencies, and NGOs, will play a critical role in guiding the next steps towards development of the observing system, based on the strongest scientific expertise and inputs from stakeholders.

Outputs

The main expected outputs of GEO-WETLANDS are the delivery for operational use of integrated solutions for national wetland inventory, assessment and monitoring, and the establishment of a GEO-WETLANDS Knowledge Base and Community Portal as go-to address for open EO data, information products, open source tools, data processing and analytics platforms, monitoring guidelines, training materials and collaboration (including south to south cooperation) regarding the use of EO in wetland inventory, monitoring, mapping and

assessment, in wetland conservation and restoration, and in the implementation of Wetland-Based Solutions.

Output	Status	Users
GEO-WETLANDS Knowledge Base	Planned	Parties of Ramsar Convention
GEO-WETLANDS Community Portal	Planned	Parties of Ramsar Convention

Contributors

GEO Members: Australia, Austria, Denmark, France, Germany, Greece, Japan, Netherlands, Spain, Sweden, United Kingdom, and United States

GEO Participating Organizations: International Water Management Institute (IWMI), European Space Agency (ESA), and Conservation International (CI)

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Geohazard Supersites and Natural Laboratories (GSNL)

Objective

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.

Short Description

The goal of GSNL is to promote broad international scientific collaboration and open access to a variety of space- and ground-based data, focusing on geoscience fields with scientific knowledge gaps in locations that are at high risk from geohazards, like earthquakes and volcanic eruptions. Earthquakes, volcanic eruptions and landslides become disasters with deadly consequences when they coincide with vulnerability of the human environment. In the last 30 years, these hazards have claimed over 770,000 lives (56% of total disaster deaths), caused economic damages in excess of 785 B$/year, and affected over 135 million people and 25 million homes, most of which are located in lower-income countries. For these areas, designated as Supersites, a joint effort is carried out between: space agencies, who provide satellite imagery at no cost for scientific use; monitoring agencies, who provide access to ground-based data; and the global scientific community, who exploit these data to generate state-of-the-art scientific results. Work at each Supersite is coordinated by local geohazard scientific institutions and researchers that are already providing authoritative geohazard information in support of emergency response managers and decision makers. This process ensures that the new knowledge generated by the wider scientific community is rapidly taken up by stakeholders to benefit hazard assessment, disaster monitoring, and response actions.

Why is this activity needed?

The disproportionate loss of life and property caused by geohazards like earthquakes, volcanic eruptions, and landslides, highlights the need for focused research into how these hazards can be forecast and mitigated. Too often such research is piecemeal owing to a lack of data availability. GSNL ensures that comprehensive suites of ground- and space-based data, which might not otherwise be freely available, are open to the scientific community, thereby promoting innovative and collaborative research at sites prone to geohazards and that can serve as natural laboratories for developing science useful for understanding phenomena in other locations around the world. However, Supersites are not only laboratories where new science is developed, but also places where the scientific information is rapidly delivered to national risk managers and becomes instrumental in preventing risk and managing emergencies.

Outputs

Output	Status	Users
Ground displacement maps and time series at each Supersite	Regularly updated	Hawaii County Civil Defense, Icelandic Police – Dept. of Civil Protection, Italian Department of Civil Protection, Istanbul municipality Secretariat for Risk Management of Ecuador New Zealand Ministry of Civil Defence and Emergency Management, Greek Civil Defence
Volcanic and seismic source models	Regularly updated	
Seismic and volcanic	Regularly	

hazard assessment	updated	Ministry of Interior and Public Safety of Chile California Office of Emergency Services, FEMA, etc.
Scientific support for situational awareness during seismic and volcanic crises	Occasionally updated	

We listed two products and the main services. A number of other scientific products are generated at each Supersite, depending on the site and the phenomena under investigation. In most cases they eventually become part of the scientific information delivered by the Supersite Coordinators to the National risk managers.

Contributors

GEO Members: Argentina, Canada, Chile, China, Ecuador, Germany, Greece, Iceland, Italy, Japan, New Zealand, Portugal, Spain, Sweden, Switzerland, Turkey, and United States

Participating Organizations: Committee on Earth Observation Satellites (CEOS), European Plate Observing System (EPOS)

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Global Drought Information System (GDIS)

Objective

GDIS is an information system ingesting global space-based and land-based Earth Observations for the purpose of early detection (through monitoring and prediction) of drought, combined with the data processing capability to identify increases of drought occurrence with increases in global warming.

Short Description

GDIS provides protection to global agriculture, forests, and human habitation through innovating drought monitoring technology to enable them to operate as close as possible to near-real-time and realistic, high resolutions. GDIS investigates the relationship between rates of drought incidence and their linkages to global warming. GDIS also innovates web mapping geographical information system infrastructure, coupled with cloud processing technology, in support of user-useful maps retrievable at high resolutions order to process satellite imagery and in order to make accessible retrieval of high-resolution images, at any point on the terrestrial globe, outside polar regions in minimal time.

Why is this activity needed?

Increased temperatures, heat waves, increased evaporability accompanying global warming are increasing the predisposition towards drought formation and water scarcity.

Currently, there is little monitoring of drought at the global level. Unlike the case for monitoring some of the ECVs, drought is produced by multiple factors, and there is still lacking a universal, scientific consensus on best practices for drought monitoring at global and continental scales: large-scale drought monitoring is still under development, as witnessed in the WMO International Drought Management Program, with which GDIS is involved. Standardized incidence and severity documentation is required for documentation of world-wide drought, in a manner analogous as provided for the Essential Climate Variables. GDIS improvements and innovations in drought monitoring and forecasting feed back into the other GEO Flagships and Initiatives.

Outputs

Output	Status	Users
NOAA Climate Prediction Center morphed global Precipitation converted into Standardized Precipitation Index SPI	Regularly updated	Drought Managers for identifying regions with precipitation interruptions
Evaporative Demand Drought Index (EDDI) globally applied with NASA MERRA short time scale mesh	Regularly updated	Drought Managers for flash drought detection & weekly changes in drought intensity
Global Precipitation Measurement (GPM)	In development	
Global Precipitation Measurement--global near real time precipitation monitoring--converted into daily SPI for drought monitoring	In development	

Global Soil Moisture monitoring	In development	
“Convergence of indicators” Master "Drought Risk" map	In development	
Short-Term” vs “Long- Term” drought delineation	In development	
Synopsis Report on GDIS Current High Profile Drought Cases into a Global Drought Narrative	In development	

Contributors

GEO Members: Australia, Austria, Brazil, European Commission, Korea, Republic of, Paraguay, Slovenia, and United States

GEO Participating Organizations: European Centre for Medium-Range Weather Forecasts (ECMWF), and World Meteorological Organization (WMO)

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Global Network for Observations and Information in Mountain Environments (GEO-MOUNTAINS)

Objective

To increase the discoverability, accessibility, and usability of a wide range of data and information pertaining to mountains globally, and to apply these data to have positive impacts across key areas of science, policy, and practice.

Short Description

GEO-MOUNTAINS is a global network that brings together the providers and users of data and information on the world's mountain regions. It considers mountains as complex social-ecological systems, and therefore takes a highly interdisciplinary approach that integrates multiple thematic areas. A main objective is seeking to compile and hence ease access to existing mountain data and information resources (in situ, remotely sensed, and modelled), which it achieves on an ongoing basis via the curation and provision of inventories to the community. GEO-MOUNTAINS also seeks to contribute to wider debates and actions around mountain monitoring and data generation (e.g. the concept of Mountain Observatories and Essential Variables applicable to mountains); the identification of key data gaps (including via the consultation of data users); the organization of sessions at scientific conferences, meetings, thematic workshops and other fora; activities that can translate data into knowledge (e.g. hackathons); and training / capacity building events. It also engages extensively with regional or thematic initiatives and networks that have overlapping objectives. The initiative is underpinned by strong Open Data and Open Science principles, and was requested to contribute to the IPCC AR6 process. Launched as an activity of the GEO Work Programme in 2016, the Initiative is co-led by the Mountain Research Initiative (MRI) and the National Research Council of Italy (CNR) and funded by the Swiss Agency for Development and Coordination. GEO Mountains has a dedicated website (www.geomountains.org).

Why is this activity needed?

Mountains host complex social-ecological systems that provide numerous important goods and services to wider human populations and societies. They are also considered "hotspots" of global change (including climate and biodiversity change), and so understanding and predicting how these systems will evolve is crucial to adapt to changes / mitigate risks with a view towards sustainable mountain development. However, for various reasons, the components of mountain systems are difficult both to observe comprehensively using in situ and remote techniques and to model. Those observational datasets that do exist are typically extremely "scattered" (e.g. obtained by a very large number of different organizations) and/or non-comparable/standardised. A global, interdisciplinary network is therefore required to bring together the data and information resources generated by more regional/thematic efforts, and provide "thought leadership" and evidence that can be applied in practice with respect to monitoring and data (e.g. helping to set priorities, protocols, and data gaps), and to provide a coherent mountain voice, informed by evidence, in global assessments and policy processes.

Outputs

Output	Status	Users

The GEO-MOUNTAINS In Situ Inventory	Occasionally updated	Predominantly researchers and practitioners
The GEO-MOUNTAINS General Inventory	Occasionally updated	Predominantly researchers and practitioners
GEO-MOUNTAINS' Knowledge Package on Human Populations in Mountains	Available but not updated	Predominantly researchers and practitioners, but may also be relevant for policy-makers
GEO-MOUTAINS' Compilation of Training / Capacity Development Materials	Regularly updated	Students / Educators / Researchers / Practitioners / Decision Makers
Toward a definition of Essential Mountain Climate Variables	Available but not updated	Researchers, policy-makers, practitioners
Coverage of in situ climatological observations in the world's mountains	Available but not updated	Authorities / organisations responsible for in situ climate monitoring (national, regional, international)
GEO-MOUNTAINS Regional Data Consultations Report	In development	Data providers and users in selected regions, researchers, policy-makers, practitioners
Policy brief: State of observations and information in mountain environments (exact title tbc). This policy brief is a contribution to the observance of the International Year of Sustainable Mountain Development 2022, proclaimed by the UNGA in December 2021.	In development	Policy-makers, donors, authorities / organisations responsible for supporting or developing monitoring campaigns
GEO-MOUNTAINS Website (as a service to the community)	Regularly updated	Network community and general public

Several of the Tasks listed under the "Technical Synopsis" section of this form will likely result in additional important outputs or products. Furthermore, we also have the capability to seek input and contributions from members of our network on behalf of other organizations (e.g. FAO Taskforce for the Review of the SDG Indicator 15.4.2 – Mountain Green Cover Index; currently in progress).

Contributors

GEO Members: Austria, European Commission, Italy, Switzerland, United Kingdom, and United States

GEO Participating Organizations: The Mountain Research Initiative (MRI), and International Centre for Integrated Mountain Development (ICIMOD)

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Global Observation System for Persistent Organic Pollutants (GOS4POPs)

Objective

To further enhance functionalities of the Global Observation System for Persistent Organic Pollutants (GOS4POPs) and thus support global efforts to monitor and regulate hazardous chemicals.

Short Description

GOS4POPS is intended to further develop a global observation system for persistent organic pollutants (POPs) to support the implementation of the Stockholm Convention and the UN Economic Commission for Europe Convention on Long-range Transboundary Air Pollution (LRTAP) and of ongoing international programs, including the Global Monitoring Plan (GMP) of the Stockholm Convention on POPs and the European Monitoring and Evaluation Programme (EMEP).

Why is this activity needed?

The recent focus on combatting pollution by addressing the most hazardous chemicals requires the scientific community to expand data sharing from environmental monitoring and establish modelling tools to support policy makers highly pertinent. The continuous expansion of range of chemicals in the Stockholm Convention requires major support as to the monitoring as well as visualization of these substances which substantiates further development of GOS4POPs.

Outputs

Output	Status	Users
Analysis of current monitoring programmes, data infrastructures and archived information on POPs, with a special attention to newly listed POPs	Regularly updated	Stockholm Convention, Academia.
Upgraded GMP DWH that includes new POPs;	Regularly updated	Stockholm convention
Core services in place that support adopted procedures of the 4th Global Monitoring Report (harmonized data collection)	Regularly updated	Stockholm Convention
Tools supporting data accessibility, presentation and interpretation designed, developed and implemented. Advanced knowledge hub in place visualizing data and levels for policy makers, experts and general public	Regularly updated	Academia, general public, policy makers
Possibilities to link GOS4POPs to the forthcoming EU Common Open Platform for Chemical Safety Data explored.	In development	Academia, general public
Enhance visibility of GEO services to sectors of biodiversity: synergies between chemicals, waste and biodiversity clusters	In development	Academia, general public, policy makers

Comment regarding last point: reporting under SC has its own process and is guided by Conference of Parties decisions: it´s not possible to upload any specific documentation.

Contributors

GEO Members: Australia, Brazil, Cameroon, China, Costa Rica, Czech Republic, Denmark, Greece, Italy, Japan, Kenya, Morocco, Norway, Russian Federation, Slovenia, Spain, Sweden, and Uruguay

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Global Urban Observation and Information (GUOI)

Objective

GUOI will generate various data products of global urban areas using Earth Observation (EO) data, provide EO-based urban data services through various systems and tools, develop new models and algorithms to assess and monitor urban environments, create a better knowledge of cities and to develop essential urban variables and indicators for sustainable cities for SDG Goal 11.

Short Description

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; to provide datasets, information, technologies to pertinent urban users in World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries; and to support UN SDG Goal 11: Make cities inclusive, safe, resilient and sustainable.

Why is this activity needed?

GEO advocates the value of Earth observations, engage communities and deliver data and information in support of Sustainable Urban Development by assisting in the development of resilient cities and assessment of urban footprints; in order to make cities and human settlements inclusive, safe, resilient and sustainable through identifying economic externalities, managing environmental, climate and disaster risks, and building capacity to participate, plan and manage based on objective information regarding urban development. The objectives and activities of GUOI are to support GEO's objective on Sustainable Urban Development. In particular, GUOI supports the development of urban resilience (including coastal resilience) by supplying objective data and information on the footprints of global urbanization and cities, developing essential urban variables and indicators for sustainable cities in support of UN's SDG Goal 11, and developing innovative methods and techniques in support of effective management of urban environment, ecosystems, natural resources and other assets, and the adaptation and mitigation of urbanization adverse impacts as well as climate change.

Outputs

Output	Status	Users
Urban data sets	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries
Models and algorithms	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries
Systems and tools	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries
Services	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other

		developing countries
Knowledge base	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries
Book	In development	Academia, researchers, and practitioners on urban observation and informatics
Engagement workshops	Planned	Urban data and technologies users in Asia, especially in land use, planning and environmental management agencies
Annual Symposium	Planned	All researchers and students

Contributors

GEO Members: Austria, Brazil, Canada, China, Germany, Greece, India, Japan, Pakistan, Spain, and United States

GEO Participating Organizations: Geoscience and Remote Sensing Society (GRSS)

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Global Wildfire Information System (GWIS)

Objective

Monitor and assess the effects of wildfires globally.

Short Description

GWIS aims at providing a continuous and standardized information on wildfires at different scales, from national to global. At the global scale, where information on wildfires is scattered and not harmonized, GWIS has become a unique source of information for global initiatives and policies, while supporting the analysis of wildfire regimes at this scale. Near-real time and historical wildfire information is disseminated through web services that provide a quick and easy access to georeferenced and statistical data on wildfires at country and sub-country level, globally. The calibration of the system and the validation of the different modules is an ongoing process that requires 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 is channelled through the EFFIS network in Europe, Middle East and North Africa, through the EU project on support to wildfire management in the LAC and through the GOFC Fire IT networks in other areas of the world.

Why is this activity needed?

Comprehensive and accurate ground-based inventories on wildfires at the global level do not exist, nor exists a comprehensive 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 endeavor 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 that provides comprehensive information on different phases of fire management at the global scale, prior, during and after the events.

Outputs

Output	Status	Users
Fire danger forecast	Regularly updated	Over 47000 users from 160 countries in 2021
Thermal anomalies	Regularly updated	Over 47000 users from 160

		countries in 2021
Country profiles	Regularly updated	Over 47000 users from 160 countries in 2021
Monthly and seasonal temperature and precipitation anomalies	Regularly updated	Over 47000 users from 160 countries in 2021
Weekly reports on wildfire activity	Regularly updated	Countries in South America
Near-real time statistical trends on wildfires	Regularly updated	Just published March 2022

Contributors

GEO Members: Argentina, Australia, Brazil, Canada, China, European Commission, Germany, Greece, Indonesia, Mexico, Netherlands, New Zealand, Portugal, South Africa, Spain, United Kingdom, United States, and Zimbabwe

GEO Participating Organizations: European Centre for Medium-Range Weather Forecasts (ECMWF), European Space Agency (ESA), and Food and Agriculture Organization of the United Nations (FAO)

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Pilot Initiatives

Community Activities accepted as Pilot Initiatives

ArcticGEOSS (ARCTIC-GEOSS)

Objective

The aim of this activity is to advance the operationalization of an integrated pan-Arctic observing system. The ArcticGEOSS is a collaborative and distributed effort, building on existing initiatives, activities and projects and using the momentum and availability of already funded initiatives within the Arctic observing community. ArcticGEOSS shares the vision of the Sustaining Arctic Observing Networks (SAON): A connected, collaborative, and comprehensive long-term pan-Arctic Observing System that serves societal needs.

Short Description

The rapid ongoing changes in the Arctic present an urgent need to better observe, characterize and quantify processes and properties of the Arctic system. Full integration of ground-based and satellite observing systems is fundamental to achieving this overarching target. ArcticGEOSS will offer policy-relevant services as the link from the observing system to societal benefits. The need for this link has been identified in the International Arctic Observations Assessment Framework (IAOAF, 2017).

The expected outcomes for the Initiative in the years 2023-2025 can be summarized as following:

- The development and implementation of a series of well-defined priority variables (so-called Shared Arctic Variables, SAVs)
- Develop a series of pilot services based on these SAVs with documented high societal benefits that will support policy implementation. Through these implement the observation of climate change and related impacts in the Arctic (for selected variables)

Why is this activity needed?

Earth observations in the Arctic contribute to key national and international objectives across a range of important domains, including food, energy, water security, transportation, and natural resource development. ArcticGEOSS could help GEO to tie into an international policy framework to drive its mission of Earth Observations (EO) for societal benefits.

Outputs

Output	Status	Users
Integrated Fire Risk Management Pilot Service	In development	Arctic communities, people involved in wildfire risk management
Pan-Arctic requirements-driven Permafrost Service	In development	Research Community, Arctic Permafrost Geospatial Centre, NSF Permafrost Discovery Gateway, INTERACT station managers and users, local community, land managers, policy makers, decision

		makers
Improving safety for shipping in the polar seas	In development	All ships operating in and around sea ice in the Arctic
Support Indigenous food security and food sovereignty in the Pacific Arctic sector	In development	Indigenous and other Arctic communities, research community, resource managers

Contributors

GEO Members: Canada, Finland, Germany, Italy, Netherlands, Norway, Portugal, United Kingdom, and United States

GEO Participating Organizations: Sustaining Arctic Observing Networks (SAON)

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Digital Earth Pacific (DE-PACIFIC)

Objective

Digital Earth Pacific will provide a fundamental digital infrastructure that will ensure every nation in the Pacific has access to free, open and operational earth observation data, tools and technologies to routinely monitor and track national development challenges through robust decision-ready products.

Short Description

Digital Earth Pacific will provide a fundamental digital infrastructure that will ensure every nation in the Pacific has access to tools and technologies to routinely monitor and track challenges such as coastal inundation, deforestation, illegal fishing through robust decision-ready products. The system condenses decades of freely available datasets to provide a near real-time understanding on issues such as how disasters have changed coastlines, the impact climate-change is having on lagoon health, where hot spots for wave energy are located, and to combine weather outlooks and agricultural production for farmers across countries.

Initiated in March 2021, Phase I for Digital Earth Pacific focused on stakeholder engagement to better understand the needs and priorities of PICTs. An Interim Steering Group, as the governance mechanism, was created inclusive of member countries and international organizations. A needs assessment was conducted by holding national, multi-stakeholder consultations with the Marshall Islands, Vanuatu and Tonga (with Fiji planned for March 2022 due to earlier COVID restrictions). Outreach and engagement was conducted through regional and international events and an approach developed raising funds and developing a sustainable financing plan. A strategic partnership with Microsoft was also formulated to have the Planetary Computer power Digital Earth Pacific. A prototype as a minimum viable product was developed with early demonstration data products generated. Lastly, inputs from this entire process were used to generate this business case.

Why is this activity needed?

Pacific Island Nations are among the most vulnerable from the effects of climate change. Issues related to food security, disaster management and biodiversity loss are of huge concern to this region and countries have called for better access and use of earth observation data to address these needs. Further, Digital Earth Pacific will not only make the data accessible, but provide an operational service that makes the data, products and applications available at scale for every country routinely and reliably based on updated satellite data.

Outputs

Output	Status	Users
Vegetation index for crop detection	In development	SPC, country stakeholders
Coastline change detection	In development	SPC, country stakeholders
Inundation areas and flooding	In development	SPC, country stakeholders
Mangroves	In development	SPC, country stakeholders

Contributors

GEO Members: Australia, Tonga, and United States

GEO Participating Organizations: Secretariat of the Pacific Community (SPC), Committee on Earth Observation Satellites (CEOS), and World Food Programme (WFP)

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Earth Observations for multi-scale monitoring of mining impacts (EO4MIN)

Objective

The purpose of the EO4MIN activity is to increase awareness and use of state-of-the-art EO data and methods which represent novel means for sustainable monitoring and management of mineral resources and efficient multi-scale monitoring mining impacts.

Short Description

To meet strategic objectives on zero-pollution, the entire mining life cycle (exploration, extraction, closure, mine-site rehabilitation) needs to develop minimal impact exploration and monitoring technologies. In this respect EO and relevant in-situ data bring significant contribution for both, sustainable management of mineral resources and efficient multi-scale monitoring of mining impacts.

To tackle some of these challenges our initiative will focus on the following strategic areas:

1. Showcasing state of the art EO methods depending on the scale of mining and how those methods can help mitigate and monitor mining activities. More specifically, following topics will be further developed:
    - Defining and promoting interoperable strategies and other relevant standards for spectral in-situ data collection (e.g., soil and mineral spectral libraries) and demonstrating how these data can be up-scaled to different EO image data;
    - Demonstrating and communicating cutting edge EO data and methods (e.g, hyperspectral approaches) for mineral mapping and environmental monitoring to speed up the transmission of scientific and technological EO innovations and accelerate adoption globally;
    - Promoting freely available EO data, platforms and tools.
2. based on the theories and methods of differential interferometry and three-dimensional topographic mapping, to develop efficient and intelligent deformation and mining volume monitoring technology. To carry out application research in typical regions around the world. To produce and release monitoring products and valuable cases for sustainable development, disaster mitigation and energy security assessment of mining areas. So as to provide assistance in improving the impact of GEO activity.
3. Identifying the main challenges and barriers hindering efficient use of EO data and methods in the mining sector; building community within EO4MIN and supporting capacity building for EO data use and management while focusing on different end-users (academia, environment agencies, mining stakeholders)

Why is this activity needed?

Currently most of the developed countries are highly dependent on the import of raw materials from a few third countries (3rd Raw Materials Scoreboard, 2021) and the supply might be restricted due to different unpredictable disruptions (e.g., Russian invasion of Ukraine, Omicron) in the future. Therefore, they need to improve the strategic autonomy an increase domestic raw material production. The World Bank and the International Energy Agency indicate that the

production of mineral raw materials may increase by up to 500% by 2040 (IEA 2021; World Bank, 2017). On the other hand, the long-term global sustainability visions including aspects such as “clean energy”, “cutting-edge clean technological innovation” and “resilient industry” needs to be taken in account. In this respect EO data and methods which are contactless, non-destructive and scalable represent optimal tools and means for sustainable management of mineral resources, mine security and monitoring and efficient multi-scale assessment of mining impacts (e.g., tailored solutions for artisanal vs. large open pit mining); hence contributing significantly to the UN Sustainable Development Goals.

Outputs

Output	Status	Users
EnMAP toolbox	Regularly updated	Remote Sensing community
Novel EO and AI based tools for multi-scale monitoring of mining impacts	Planned	Remote Sensing community
Surface deformation datasets in mining areas	In development	Government departments, mining companies, etc
Open pit volume change datasets	Planned	Government departments, mining companies, etc

Contributors

GEO Members: China, Czech Republic, France, Germany, Greece, Israel, Pakistan, and Portugal, Switzerland

GEO Participating Organizations: United Nations Environment Programme (UN Environment), and The Association of the Geological Surveys of the European Union (EuroGeoSurveys)

Associates: Planet

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Earth Observations for the Water-Energy-Food Nexus (EO4WEF)

Objective

The main purpose of the EO4WEF Pilot Initiative is to foster the development and delivery of products and services that will be used by practitioners of the WEF Nexus approach to resource management and to further develop the community of WEF Nexus (also referred to herein as the FEWS Nexus) users who rely on Earth observations for decision-making. This will be done through the development of prototype products, case studies, and services that will disseminate WEF Nexus research-to-practice capabilities for all stakeholders through the applications of Earth observations and Earth science modeling.

Short description

This initiative blends three streams to foster support planning and decision-making for the WEF Nexus stakeholders and users over both the short-term and long-term time horizons. The short-term component takes advantage of the extensive data sets and products as well as tools for analyzing these information streams for application in different sectors-within the WEF Nexus. The long-term component involves the development of a climate model that can be used to explore options for the development of an integrated assessment climate- WEF-Policy framework model that can be used to explore decision-making tradeoffs and options to support integrated resilience planning for WEF infrastructure and climate response activities in the WEF Nexus sectors.

Why is this activity needed?

In general, the water, energy, and food activities are managed as separate silos both within and outside government. This leads to many inefficiencies and potential conflicts when the interests, concerns, and policies.

Outputs

Output	Status	Users
Service to WEF stakeholders	Planned	Users: farmers, resource managers
Strategy for linking GEO initiatives in WEF area	Planned	GEO Members, GEO Initiatives
Strengthening WEF networks	Regularly updated	Expert community that supports the development of the WEF approach
Assessment tools for agrivoltaics	In development	Farmers, Government policy makers
Irrigation Management for selected areas	Regularly updated	Farmers
Irrigation Management on a national basis	In development	Farmers, Government policy makers
Assessment of national hydropower output from snow melt	In development	Government planners
Advisory services on climate	In	Government planners, the public

change impacts	development	
Basin-wide information portal	In development	Government planners, farmers water managers, energy producers
WEF scenarios uner climate change	In development	Planners and managers for WEF Sectors

Contributors

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Forest Biomass Reference System from Tree-by-Tree Inventory Data (GEO-TREES)

Objective

Establish a fair and equitable funding mechanism to support the collection of tree by tree forest inventory data for the validation of EO based biomass maps.

Short Description

GEO-TREES shall support the establishment and development of a global activity of in situ biomass reference measurement sites, the Forest Biomass Reference System (FBRS), to complement existing and planned space- based forest biomass observation instruments. These sites will provide integrated, multi-observational, multi- scale reference data to support global space-based forest biomass mapping and will include high-quality georeferenced data on tree biodiversity. Climate change concerns impose an immediate and urgent demand for verifiable and consistent measures of forest biomass in order to reduce the major uncertainties in calculations of carbon stocks and fluxes associated with the terrestrial biosphere. International agreements have made it imperative to obtain accurate estimates of biomass and its changes: under the Paris Agreement (Article 4, paragraph 2) each nation needs to prepare, communicate and maintain successive Nationally Determined Contributions (NDCs) that it intends to achieve.

Why is this activity needed?

This activity is needed to provide the data required to validate EO-based above ground forest biomass products.

Outputs

Output	Status	Users
AGB in t/ha @ 1 ha resolution	Planned	EO and modelling communities

Contributors

GEO Members: Austria, Brazil, France, Germany, United Kingdom, and United States

GEO Participating Organizations: European Space Agency (ESA), International Institute for Applied Systems Analysis (IIASA)

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GEO Citizen Science (GEO-CITSCI)

Objective

Demonstrate the value of citizen science data, facilitate the creation of a linked ecosystem of open citizen science data and increase the use of citizen science in GEO by supporting global coordination and collaboration.

Short Description

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 and professionals in which members of the public actively contribute to the co-creation of new knowledge is known as “citizen science”. It also introduces new challenges in terms of fragmentation, interoperability, and coordination.

Building on these initiatives, this GEO Citizen Science Pilot Initiative (GEO-CITSCI) focuses on the following goals:

- Demonstrate the value of citizen science data for advancing the GEOSS priorities in terms of research, informing policy and awareness raising;
- 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.

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

Why is this activity needed?

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

Outputs

Output	Status	Users
Portfolio of exemplary citizen science projects that can support GEOSS, particularly if citizen science data are combined with EOs	Planned	GEO insitu community
A technical demonstration on the integration of Citizen Science, Internet of Things and in-situ data	In development	GEO insitu community
Sensor Things API plus best practice document	Occasionally	Standards

	updated	community
Workshop (side event) on the benefits of Citizens Science in GEOSS and the Benefits that GEOSS provides to Citizen Science	Planned	GEO insitu community
User engagement plan	Planned	GEO insitu community

Contributors

GEO Members: Australia, Austria, European Commission, Greece, European Commission, Norway, Spain, United Kingdom, and United States

GEO Participating Organizations: IHE Delft Institute for Water Education (IHE), International Institute for Applied Systems Analysis (IIASA), Secure World Foundation (SWF), and Regional Centre for Mapping of Resources for Development (RCMRD)

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GEO Essential Variables (GEO-EV)

Objective

To be a panel of experts to discuss about the current status of the EVs, exchange knowledge, experiences and methodologies in EVs definition, analyse the usefulness of some of them in creating SDG indicators and the gaps to be solved in communities in the near future.

Short Description

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 community of GCOS was the first to develop a full set of Essential Climate Variables (ECV). Other examples of communities applying the same concept are oceans (EOV - BluePlanet), biosphere (EBV - GEOBON), water cycle (EWV - GEOGLOWS), etc. ConnectinGEO illustrated that EVs can be a useful approach to several indicators for monitor SDGs. ERA-PLANET GEO-Essential proposes a need to review and extend the current EV framework and a priority assignment 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. The GEO-EVs Pilot Initiative aims to be a panel of experts to discuss about the current status of the EVs, exchange knowledge, experiences and methodologies in EVs definition, analyse the usefulness of some of them in creating SDG indicators and the gaps to be solved in communities in the near future. This Pilot Initiative does not have the intention to interfere in the on-going communities already working on the definition of the EVs, but to become a common point to share expertise and to have a single voice inside GEO regarding EVs.

Why is this activity needed?

To identify variables that correspond to high impact on the Earth system and are a priority for monitoring.

Outputs

Output	Status	Users
White paper on EVs	In development	all the GEO community
ENEON graph	Regularly updated	all the GEO community

Contributors

GEO Members: Belgium, Spain, Switzerland, and United States

Points of Contact

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Geodesy for the Sendai Framework (GEODESY4SENDAI)

Objective

Geodesy is the science of measuring the earth's size, shape, orientation, and gravity. Our Earth is constantly changing, even if these changes are not immediately obvious, and the positioning information obtained through geodesy enables all other Earth observation technologies and techniques to function at their optimal levels of use and impact. The need to know our location on earth down to the smallest possible measurement may only be satisfied by international collaborations in geodesy; and no country has the capacity, be it physical, infrastructural, analytical, or financial, to make such precise geodetic measurements on its own. By collaborating with international partners and NGOs, we are able to collectively leverage limited assets to the top of current geodetic knowledge and capability, and ensure the sustainability of current geodetic infrastructure and applications - as well as the ever-expanding number of unanticipated benefits of geodesy to disaster risk reduction and the sustainable development goals.

Geodesy4Sendai works to support existing technical collaborations with policy and advocacy for geodetic contributions to disaster risk reduction and resilience.

Short Description

Geodetic observations have a clear role in helping to reduce the risk of disasters, as well as contribute to disaster preparedness with better mitigation and response.

- Supporting geodetic development and capacity building for disaster risk reduction and resilience
- Identifies existing resources and stakeholder communities, and makes connections
- Identifies geodetic elements of targets and indicators of the Sendai Framework for Disaster Risk Reduction
- Provides opportunity for other GEO efforts to interact with geodesy community
- Integration with UN Sustainable Development Goals and UN-GGIM World Bank Integrated Geospatial Information Framework

Why is this activity needed?

Geodesy is scientific discipline that forms the core of the United Nations Global Geodetic Reference Frame (GGRF) is the foundation of virtually every aspect of the collection, management and use of national geospatial information and global monitoring of the Earth.

Geodesy and the GGRF underpins:

- Earth and Climate science
- Economic Development and Sustainability Public Safety and Disaster Management
- Land and Water Administration, and Environmental Management

We recognize unique value proposition of GEO as the best possible forum to connect our technical work in geodesy to policy, advocacy, and capacity sharing.

Outputs

Output	Status	Users
Collaboration with ITU/WMO/UNEP on AI for Natural Disaster Management	Regularly updated	Developers of artificial intelligence applications for disaster risk management
Policy briefs	In development	policy makers in tsunami prone regions
Targeted improvement and support for geodetic infrastructure collocated with other EO instrumentation	In development	small island developing states, IAG technical services, atmospheric analysis community
Contributing paper to UNDRR GAR	Occasionally updated	UNDRR, policy makers
Technical collaborations and assistance to small island developing states	In development	
International network building and advocacy	Regularly updated	

Contributors

GEO Members: Australia, China, France, Germany, Italy, Japan, Switzerland, Tajikistan, Tonga, and United States

GEO Participating Organizations: International Association of Geodesy (IAG), International Union of Geodesy and Geophysics (IUGG)

Points of Contact

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Global Ecosystems and Environment Observation Analysis Research Cooperation (GEOARC)

Objective

Taking the GEO priorities as the central task, the activity aims at providing technological guidance and product services in forms of research study, dataset, toolkit and integrated platform for governments, international organizations, research institutes, enterprises and individual users in scenarios of scientific study, real-life application, decision-making and policy-making process.

Short Description

To monitor global and/or regional terrestrial ecosystem and environment conditions, GEOARC will closely collaborate with related stakeholders focusing on Ecosystem Service Functions, Biodiversity Protection, Carbon Sequestration, Food Security, Vegetation in Arid Regions, Hydrology and Ecology in Large River Floodplains, Arctic Sea Ice Remote Sensing Observation and Application, Human Activities and Carbon Cycle.

GEOARC will produce deliverables by means of data sharing, product validation, knowledge services, and targeted solutions. In terms of integrating multi-source data and products, GEOARC also seeks to cooperate with other data sources. With respect to extending cooperation network, GEOARC will actively get involved in joint observation and expedition and participate in various symposia and conferences.

Why is this activity needed?

Since the mid-20th Century, rapid development of global economy has resulted in degradation of terrestrial ecosystems and loss of biodiversity. Driven by both human activities and climate change, the sustainable development of global ecosystem is under threats and tough challenges as never before. GEOARC plays a significant role in Global Ecosystem and Environment Observations a prerequisite to informed decision making on sustainable development. Contributions under the GEOARC framework from 2012 to 2021 include the release of 29 reports of “Global Ecological Environment Remote Sensing Observation” and 109 datasets to the world users free of charge.

Outputs

Output	Status	Users
Reports and datasets on terrestrial vegetation	Regularly updated	UNEP, IPCC, UNCCD, Future Earth NEXUS KAN, Government and Researchers
Reports and datasets on land surface waters	Regularly updated	UNEP, Government and Researchers
Reports and datasets on urban resilience and human settlement	Regularly updated	Government and Researchers
Reports and datasets on crop production and food security	Regularly updated	UNEP, FAO, Government and Researchers
Reports and datasets on the cryosphere	Regularly	UNEP, ICIMOD, Government

	updated	and Researchers
Reports and datasets on natural disasters	Regularly updated	UNEP, UNSPIDER, Government and Researchers
Reports and datasets on climate change	Regularly updated	UNEP, IPCC, Carbon Stock/Market, UNFCCC Government and Researchers
Reports and datasets on land degradation	Regularly updated	UNCCD, Government and Researchers
Reports and datasets on ecosystem and environment changes at regional scales	Regularly updated	UNEP, UNESCAP, ASEAN, Government and Researchers
Reports and datasets on ecosystem and environment change in fragile area	Regularly updated	UNEP, UNCBD
vegetation dynamic models	Planned	Carbon Stock/Market
intelligent grazing products	Planned	Government and Researchers
Arctic Sea Ice products	Planned	Scientists, Arctic shipping vessels
Sea Ice information system and route planning services	Planned	Arctic shipping vessels
Joint Arctic field study	Planned	Government and Researchers
renewable energy facilities remote sensing recognition methods and toolset in cloud platform	Planned	Needs users
terrestrial ecosystem carbon disturbance products	Planned	Needs users
cooperation network for global terrestrial ecosystem carbon disturbance monitoring;	Planned	Needs users
a platform for hydrological connectivity assessment	Planned	NRA, WI

Remote Sensing Product are generated based on multi-source remote sensing data, including Land Cover (LC), Solar Radiation (SR), Photosynthetically Active Radiation (PAR), Photosynthetic Thermal Productivity (PTP), Precipitation, Evapotranspiration (ET), Fraction of Vegetation Cover (FVC), Leaf Area Index(LAI),Vegetation Index(VI), Biomass, Phenology, Fraction of Absorbed Photosynthetically Active Radiation(FAPAR), Albedo, Net Primary Productivity (NPP), Gross Primary Productivity(GPP), Urban Heat Island, Arable Land use Intensity, Cropping Index, Planting Proportion, etc.. Annual reports composed by experts from various organizations or countries are utilized to analyse the ecosystem and environment conditions, to evaluate the process of implementing SDGs, to propose suggestions for policymaking based on the remote sensing products and comprehensive analysis, with data products, annual reports, methodology/algorithm and demonstration applications released on the GEOSS portal. By organizing side events, attending in international conferences, hosting training workshops, GEOARC aims to publicize the annual reports and data products, to discuss the methodology/algorithm, and to demonstrate application showcases in GEO Week,

symposium, etc. Cloud service platform conducts research and develops specialized remote sensing products for environmental monitoring based on EO data. GEOARC also develops analysis platform covering monitoring of ecosystems, forests, cities, and atmosphere. Capacity building activities are also carried out for remote sensing monitoring of environmental changes such as deforestation, urban expansion, and air quality for developing countries.

Contributors

GEO Members: Australia, China, Israel, and Russian Federation

Points of Contact

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Global Vegetation Pest and Disease Dynamic Remote Sensing Monitoring and Forecasting (GEO-PDRS)

Objective

This initiative aims to achieve efficient and accurate monitoring and forecasting of vegetation pests and diseases, and deliver EO-based vegetation pest and disease monitoring and forecasting products and services to multi-scale wider users.

Short Description

In recent years, global climate change has led to an increase in the severity of vegetation pests and diseases. To achieve international food security and maintain ecological sustainability at a large scale, there is an urgent need to develop timely and accurate remote sensing-based monitoring and early forecasting programmes. This initiative is built upon the previous two GEO community projects CROP PEST MONITORING 2017-2019 and 2020-2022. This initiative aims to develop and optimize remote sensing habitat monitoring and risk forecasting models for major migratory and epidemic vegetation pests and diseases (fall armyworm, locust, rust, pine wilt disease, etc.); construct comprehensive products to meet the needs of multi-level users (governments, extension departments, commercial companies, farmers, etc.); deliver services to actual and intended users to issue warnings and conduct plant protection activities. This initiative will promote our users to achieve maximized benefit and further to help them recover loss, save money, conserving biodiversity, etc. We build a community of stakeholders to improve our capacity to support the SDG2 & SDG13 of UN's 2030 Agenda, and disaster prevention and reduction objects of Sendai Framework. Ultimately promoting global cooperation in vegetation pests and diseases control to help ensure global food security and sustainable development of ecosystem.

Why is this activity needed?

At present, there is a rapid increase in the area and frequency of vegetation pest and disease around the world, which is detrimental to the vegetation growth and poses a serious threat to global food security and ecological stability. According to statistics, more than 10% of annual food production losses are caused by pest and disease, and may exceed 30% in some areas. The untimely information of pest and disease monitoring and forecasting leads to the later prevention, which increases the use of chemical pesticides, causing significant damage to the ecosystem. At the same time, the ability of vegetation to sink and emit carbon can be affected by pest and disease, which in turn disrupts ecosystem cycles. To ensure global food security and ecological sustainability, there is an urgent need for multilateral cooperation to achieve multi-scale remote sensing monitoring and forecasting of major vegetation pest and disease. Meanwhile, it is necessary to provide spatial information services for some international organizations (such as, GEO, GBIF, CABI, departments in Somalia, Eritrea and Ethiopia, etc.), countries suffer from pest and disease (such as Pakistan, Ghana, Kenya, etc.) and pest and disease control companies, etc., to help them apply the suitable prevention measures and strategy to ensure food production, reduce chemical pesticide use, and thereby protect the environment, promote the sustainable development of global agriculture and ecosystems.

Outputs

Output	Status	Users
Metadata	In development	**Actual users:** FAO, CABI, GBIF, NATESC, NFGA; **Intended users:** UN-SPIDER, AOGEO, GEO Knowledge Hub, PMAS Arid Agriculture University, Pakistan Academy of Sciences;
API	Regularly updated	**Actual users:** FAO, GBIF, MMU, University of Technology Sydney, NATESC, NFGA; **Intended users:** UN-SPIDER, CABI, GEO Knowledge Hub, CNR-IMAA, King's College London, PMAS Arid Agriculture University, Pakistan Academy of Sciences, Agriculture and Agri-Food Canada, CBCGDF;
Map	In development	**Actual users:** FAO, GBIF, CABI, PMAS Arid Agriculture University, Pakistan Academy of Sciences, CNR-IMAA, King's College London, Ethiopian Space Science and Technology Institute, Agricultural Extension Department of Eritrea, Iraqi Ministry of Agriculture, Welthungerhilfe in Somalia, UN-SPIDER, CBCGDF, NATESC, NFGA, Assimila Ltd., Tekever Ltd., Anyang Quanfeng Aviation Plant Protection Technology Co., Ltd., Hangzhou Waobot Technology Co., Ltd; **Intended users:** AOGEO, GEO Knowledge Hub, GEO community, MMU, University of Technology Sydney, Agriculture and Agri-Food Canada;
Software	In development	**Actual users:** CABI, FAO, GBIF, CBCGDF, Agriculture and Agri-Food Canada, Ethiopian Space Science and Technology Institute, Agricultural Extension Department of Eritrea, Iraqi Ministry of Agriculture, Welthungerhilfe in Somalia; **Intended users:** AOGEO, GEO community, PMAS Arid Agriculture University, Pakistan Academy of Sciences, MMU, King's College London, CNR-IMAA, UN-SPIDER, University of Technology Sydney, Assimila Ltd., Tekever Ltd., Anyang Quanfeng Aviation Plant

		Protection Technology Co., Ltd., Hangzhou Waobot Technology Co., Ltd;

Contributors

GEO Members: China, Italy, Pakistan, and United Kingdom

GEO Participating Organizations: Food and Agriculture Organization of the United Nations (FAO), Global Biodiversity Information Facility (GBIF), Centre for Agriculture and Bioscience International (CABI)

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In-Situ Observations and Applications for Ecosystem Status of China and Central Asia (IN-SITU-ESC)

Objective

To improve the ecological networks monitoring capabilities, promote the ecological monitoring data sharing in the “Belt and Road” regions of China and Central Asia, provide support for the monitoring and evaluation of "sustainable development goals" SDGs15, also provide support for management: a) regional decisions, e.g. support carbon peaking and carbon neutrality goals through carbon sink advisory reports and also support grassland management policies in these Central Asian countries, etc.; b) global decisions (provide materials for GCP)

Short Description

The conservation, restoration and sustainable utilization of ecosystems and their services is a shared mission of Group on Earth Observations (GEO) and Sustainable Development Goals (SDGs) 15. It is of great significance to improve the ecological networks monitoring capabilities in the "Belt and Road" region of China and Central Asia, make up for the lack of in-situ observation data of GEO, and scientifically assess ecosystem services. Due to the inconsistency between China and Central Asia's ecosystem research network monitoring indicator system and SDGs15 report requirements, and the lack of methods for developing data products, it is urgent to improve the ecological monitoring technical specifications aiming at supporting ecosystem service assessment, enhance ecological network monitoring capabilities, and promote the ecological monitoring data sharing in the “Belt and Road” region of China and Central Asia to provide support for the monitoring and evaluation of SDGs15. This initiative covers four Central Asian countries, which include Kazakhstan, Uzbekistan, Kyrgyzstan and Tajikistan.

Why is this activity needed

The monitoring indicator system of Ecosystem Research Networks in China and Central Asia is inconsistent with that in the requirement of report writing for SDGs15. Besides, the indices provided by us are different from GEOBON. These Essential Biodiversity Variables provided by GEOBON are defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity should play the role of brokers between monitoring initiatives and decision makers. They provide the first level of abstraction between low-level primary observations and high-level indicators of biodiversity. The main EBVs include Genetic composition, e.g. Genetic diversity, Species populations, e.g. Species distributions, Ecosystem functioning, Ecosystem phenology and Ecosystem structure e.g. Ecosystem distribution etc. While we focus on the ecosystem function indices, e.g. Net primary productivity, Water conservation and Soil conservation etc. We assess these indices based on the ecosystem process model, combining the model data fusion method and multi-source observation data to optimize the model sensitive parameters and improve the model simulation accuracy. In the process model, net primary productivity was expressed directly as net primary productivity, i.e., the difference between gross primary productivity (GPP) and vegetation autotrophic respiration, water conservation is calculated using the water balance method, and soil retention is calculated by integrating the universal soil loss equation.

Outputs

Output	Status	Users
Crucial data products related to in-situ observation of typical terrestrial ecosystems inthe ‘Belt and Road‘ region of China and Central Asia	In development	GEO, researchers, government personnel,general public
Satellite remote sensing standardized dataset of crucial ecological parameters for grasslandin Tajikistan	In development	GEO, researchers, government personnel,general public
Technical Specification for developing terrestrialecosystem monitoring data products	In development	Ecological networks and stations in
GEO's Knowledge Hub inCentral Asia	In development	GEO, Ecological networks and stations in
Support for management: a) regional decisions, e.g.support carbon peaking and carbon neutrality goals through carbon sinkadvisory reports and also support grassland management policies in these Central Asian countries, etc.; b) global decisions (provide materials for GCP)	In development	government personnel

Contributors

GEO Members: China, Kazakhstan, and Tajikistan

GEO Participating Organizations: United Nations Environment Programme (UNEP)

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Night-Time Light Remote Sensing for Sustainable Development Goals (NIGHT-LIGHT)

Objective

Use night light remote sensing to evaluate socioeconomic condition in developing countries where statistics is insufficient.

Short Description

Satellite-observed night light images are able to reflect spatiotemporal patterns of socioeconomic dynamics especially for the regions where statistical data is difficult to access. In Central Asia, human settlements with low-density of population are widely distributed due to geography and history. Considering that significant socioeconomic fluctuation is common in this region in the past three decades, evaluating socioeconomic conditions of these human settlements are valuable for both the national governments and international organizations such as Asian Development Bank, while statistical survey in such large area with low density of population is very costive.

In this project, we aim to use multi-source night light images to evaluate three socioeconomic aspects in this region, including electricity supply, impact of COVID-19 on economy and poverty. Night light images with high resolution from two satellites owned by Wuhan University will help to evaluate the micro aspect, the poverty, while night light images with low resolution from USA's Suomi NPP satellite will serve to evaluate the macro aspects such as impact of COVID-19 on the economy and stability of electricity supply. Based on the developed technique from our undergoing GEO project "Night-time light remote sensing for sustainable development goals" as the Community Activity Project during 2020-2022, time series analysis and socioeconomic parameter estimation methods will be employed to complete this task. The output of this project will be used by governmental departments, such as Ministry of Energy Supply in Uzbekistan, Ministry of Economic development and poverty reduction in Uzbekistan, Ministry of Tourism and international organizations for decision making.

Why is this activity needed?

Surveying socioeconomic conditions in human settlements of low population density such as Central Asia is urgently needed for making socioeconomic strategies such as poverty reduction and energy development. However, taking such survey is costive because the residents are scattered in large area, while night light remote sensing data has been proved to be an efficient proxy for socioeconomic variables by a number of distinguished geographers and economists (e.g. William Nordhaus, the Nobel Prize laureate in Economics). Therefore, in this Initiative, the night light remote sensing will be used to survey socioeconomic conditions in the human settlements.

Outputs

Output	Status	Users
Electricity supply map	Regularly updated	Ministry of Energy Supply in Uzbekistan; Ministry of Tourism in Uzbekistan
Poverty map	Regularly updated	Ministry of Economic development and poverty reduction in Uzbekistan

Economic recovery map	Regularly updated	Ministry of Economic development and poverty reduction in Uzbekistan

Contributors

GEO Members: China, and Uzbekistan

GEO Participating Organizations: United Nations Institute for Training and Research (UNITAR)

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Open Earth Alliance (OEA)

Objective

As a GEO Pilot Initiative, the Open Earth Alliance (OEA) will support global sustainability and understanding through the use of open technology solutions (e.g. Open Data Cube), open algorithms, and open earth observation data.

Short Description

As a GEO Pilot Activity, the Open Earth Alliance (OEA) will support global sustainability and understanding through the use of open technology solutions (open geospatial data infrastructures, open earth observation data, and open algorithms and analytics). In short, the Open Earth Alliance seeks to close the gap that exists between open EO data and end-user.

To achieve its goals, the Open Earth Alliance will focus on the following three key activities:

- Development and deployment of Data Cube solutions. Currently, each organization has bespoke ways of deploying data cubes, which takes a lot of engineering time and effort. Standardization and knowledge sharing of deployment procedures, scripts and best practices would decrease the difficulty in deploying the data cube on various cloud computing platforms.
- Creation of an Algorithm Hub providing a centralized repository of algorithms and software codes, along with a sandbox to run the algorithms.
- Creation of Analysis Hub supporting user collaboration and shared analysis. Currently produced analyses are either not shared or have software and data environment dependencies.

In addition, the OEA will also support the following activities:

- Development support of the Open Data Cube open source software project
- Development and delivery of capacity building and training for the Open Data Cube initiative.
- Support efforts toward building a Knowledge Hub supporting knowledge sharing of EO data applied to sustainable development problems.
- Creation of a Storytelling Hub allowing users to immerse themselves in EO data, information, and knowledge with the goal of providing better understanding and communication.

Why is this activity needed?

In recent years, the explosion of freely available Earth Observation (EO) Satellite data has presented significant opportunities and challenges for society, researchers, and industry. The opportunity to leverage free and open satellite data for public good is balanced by the technical challenge of properly storing, processing, and analyzing this invaluable big data. While there has been some emphasis placed on the management the data, less emphasis has been placed on the end-user. An opportunity exists to add value to the entire decision-making value chain from data to user experience. The Open Earth alliance is focused on providing technology solutions with the end-user in mind.

Open Earth Alliance will improve the end user experience by hosting the Algorithm hub to unlock insights from the Remote sensing literature with illustrative code snippets that can be run in a common data science environment. GEO has the ability to convene the multiple international members of the Open Data Cube community and encourage them to share their internal knowledge and tooling for the benefit of the public.

Outputs

Output	Status	Users
Development and deployment of Data Cube solutions	In development	Global / Regional / Local stakeholders
Creation of an Algorithm Hub providing a centralized repository of algorithms and software codes	In development	Global userbase
Creation of Analysis Hub supporting user collaboration and shared analysis	In development	Global userbase

Though our long-term vision is to be technology and platform agnostic, we will heavily leverage the Open Data Cube in the near-term (opendatacube.org). Members of the Open Earth Alliance are also founding partners of the Open Data Cube initiative.

Contributors

GEO Members: United States

Points of Contact

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Space and Security (SPACE-SECURITY)

Objective

To find synergies and develop solutions to improve the safety and security of citizens and societies by exploiting EO data, collateral data and associated technologies.

Short Description

The Space and Security pilot initiative gathers partners involved in security-related activities that benefit or are willing to benefit from the exploitation of space assets, with particular focus on EO and collateral data. The initiative provides a forum for discussion that establishes and fosters cooperation among key entities and stakeholders. At the same time, SPACE-SECURITY participants interact with their respective users to collect needs and identify initiatives to be put in place, looking at enhancing:

- The resilience of the society against natural and man-made disasters, with a focus on civil security;
- The capabilities to assess and mitigate potential risks for the security of citizens in cross-domain scenarios, such as climate security, food security or energy security;
- The protection of critical infrastructures;
- The efficiency in tasks related to border and maritime surveillance, civil protection and/or humanitarian aid;
- The capacity of relevant stakeholders to achieve the Sustainable Development Goals (SDGs) relevant for Security;

Furthermore, the Pilot Initiative works towards raising awareness and adoption of open data, citizen science, in-situ data and advanced technologies in the space and/or security domains.

SPACE-SECURITY partners are involved in different activities in the space and/or security domains and work towards:

- Identifying observational and capability gaps to be filled by space assets;
- Exploring how to take maximum benefit from very large quantities of heterogeneous data
- Identifying, developing and assessing innovative applications, services and platforms along the whole data lifecycle to fill the gaps identified.

In addition, SPACE-SECURITY contributes to the implementation of relevant projects in the framework of R&I initiatives and builds synergies with relevant GEO and any other significant activities.

Why is this activity needed?

The entire world is facing challenges that are more diverse and less predictable than before. Areas like urbanization, social movements, political instability and even climate change are challenging the current international state of play in the Security domain. This highly dynamic geopolitical situation raises Security issues all around the world, forcing decision makers to take suitable actions to respond in due time to complex situations. International initiatives - including

the United Nations (UN) 2030 Sustainable Development Agenda, the Paris Agreement and the Sendai Framework - are working towards a more sustainable future, with clear targets defined including peace and wellbeing of the population. To support the achievement of these targets from a security perspective, EO is a recognized key asset that provide relevant and trustable information for decision-making processes. In particular, space-based EO is an outstanding mean to support these initiatives at global level. Within GEO there are different initiatives dealing in some way with security-related topics as, for instance, climate change impact, food security, disasters or health security, but the different results are spread and it is difficult to fully exploit them to address the complex security scenarios that humanity needs to face today. This fact justifies the existence and need of SPACE-SECURITY, which aims at being an entry point to access civil security-related applications and a collaboration forum to address scenarios in which events in different domains are interconnected.

Outputs

Support the elaboration of relevant security policies (e.g. civil security) as well as international cooperation initiatives (e.g. UN and EU programmes), providing the outcomes described below

Output	Status	Users
A research and innovation platform (GEO-DAMP) provided by SatCen to foster joint cooperation in the exploitation of EO data and collateral sources for security	Regularly updated	SPACE-SECURITY partners. SatCen and its stakeholders. Potentially available to other users for collaborating purposes.
EO products to address landslides related to underground water extraction in vulnerable regions, resulting from the pilot application under development in the SPACE-SECURITY 2020-2022 Implementation Plan.	In development	World Food Programme and its field offices. Plan to extend users to entities working in water and food security that are affected by underground water extractions.
Water extraction risk assessment maps in vulnerable regions, extending the coverage of the products, planned in the 2023-2025 Implementation Plan.	Planned	Users working in water and food security that are affected by underground water extractions.

Contributors

GEO Members: Germany

GEO Participating Organizations: European Space Agency (ESA), The Association of the Geological Surveys of the European Union (EuroGeoSurveys), IHE Delft Institute for Water Education (IHE), World Food Programme (WFP), and European Union Satellite Centre (EU SatCen)

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Urban Heritage Climate Observatory (UHCO)

Objective

The Urban Heritage Climate Observatory (UHCO) provides a forum for relevant partners to share good practices, needs and expertise to enrich and coordinate processes for the preservation, monitoring, and management of urban heritage, as well as communication and advocacy around local, national and international Climate Action through co-producing targeted innovative tools and services focusing on climate change risks and impacts to urban heritage.

Short Description

Climate change is one of the most critical issues of our time and its impacts on World Heritage properties are more evident than ever. Increasing exposure both to slow-onset climatic processes, as well as extreme weather events, are the most obvious of threats to the existence of cultural and natural heritage properties. In the case of urban heritage, there is an additional critical need to integrate different aspects of the sustainable development agenda, including urban resilience and sustainable urbanization, with the protection of heritage values, especially in World Heritage Cities, considering the centrality of cultural heritage's social, ecological and economic dimensions for sustainable urban development. Earth observations (EO) hold great potential to shield urban heritage from climate change risks. Especially in World Heritage Cities, EO derived information can facilitate the creation of bridges between climate change and cultural heritage communities and offer a framework for the design of joint, multi-disciplinary and multi-governmental approaches to tackle climate change risks and impacts on cultural heritage. Yet, gaps exist in relation to integration and usability of different EO assets, along with increasing technical capacity. UHCO, led by the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Centre (WHC) and the Greek GEO Office (GGO), aims at developing a network of competent stakeholders for the effective and coordinated preservation, monitoring, and management of urban heritage.

Why is this activity needed?

Climate change impacts on both cultural and natural World Heritage are indisputable, with increasing exposure both to slow-onset climatic processes, such as desertification and sea level rise, and extreme weather events including floods, droughts, storms, wildfires and temperature extremes. Such processes and events directly threaten the preservation and existence of cultural heritage sites and their built structure, and also pose an indirect threat to the local communities and the transmission of intangible cultural heritage, as well as to associated tourism and other socio-economic activities. In the case of urban heritage, there is a critical need to identify and address climate change risks and impacts, while also furthering aspects of the sustainable development agenda and building urban resilience focusing on disaster risk, to ensure the preservation of past lessons and safekeeping for future generations.

Outputs

Output	Status	Users
A global platform to collect and integrate EO-based data, information, and composite indicators to address climate	Planned	UNESCO and its consulting bodies, cultural heritage practitioners, national and local governments, urban planners, policy makers, conservation practitioners, site managers

change risks and impacts on urban heritage		
Co-created global methodology and the foundation for the use of EO in cultural heritage preservation and conservation	In development	UNESCO and its consulting bodies, cultural heritage practitioners, national and local governments, urban planners, policy makers, conservation practitioners, site managers, research communities
Collection of use cases where testing and evaluation of the methodologies will take place.	Available but not updated	UNESCO and its consulting bodies, cultural heritage practitioners, national and local governments, urban planners, policy makers, conservation practitioners, site managers, research communities, GEO community

Considering the size and diversity of the consortium, the different communities and approaches that are needed to be brought together, other potential conflicts and priorities by participating entities (esp. at the UN level), the need is created for UHCO to remain as much flexible as possible in the ways and means to pursue the substantiation of its objectives (and outputs).

Contributors

GEO Members: Austria, Canada, Cyprus, Ecuador, France, Germany, Greece, India, Israel, Italy, South Africa, Spain, United Kingdom, and United States

GEO Participating Organizations: Eurisy (Eurisy), Mariolopoulos-Kanaginis Foundation for the Environmental Sciences (MKF), United Nations University, Institute for Environment and Human Security (UNU-EHS), European Centre for Medium-Range Weather Forecasts (ECMWF), and African Climate Change Research Centre (ACCREC)

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New Proposals of Pilot Initiatives

Antarctic Ice Sheet Monitoring (AIS-MONITORING)

Objective

This activity aims to produce data products with high precision on Antarctic Ice Sheet (AIS) mass change and the seafloor topography beneath the Antarctic ice shelves, which will reduce uncertainties in sea-level change projection.

Short Description

In view of the increasing number of satellite and airborne observations in Antarctica and the increasing demand for ground validation, this initiative integrates large-scale, long-term satellite observations, high-precision ice surface monitoring data, and airborne geophysical observations of Antarctica and its surroundings to build a comprehensive observation system for the AIS and surrounding oceans. The initiative will develop new algorithms to reduce the uncertainty in mass balance estimation of AIS. Moreover, the terrestrial monitoring platform integrates GNSS antennas, laser rangers, meteorological devices, and corner cube retroreflectors. It obtains real-time ablation and accumulation conditions of the AIS and enables validation of airborne and satellite observations. The key parameters and products for the mass balance estimate of AIS are still lacked. The airborne geophysical observation facility overcomes the difficulty that traditional shipborne multibeam echo-soundings are unavailable in regions covered by ice shelves. It collaborates with international institutions for coordinated airborne surveying plans; develops advanced inversion methods and tools to infer high-accuracy, high-resolution (2–10 km) sub-ice-shelf seafloor topography from airborne geophysical observations in Antarctica; and uses the inferred seafloor topography model to simulate the future evolution of the Antarctic marine-terminating glaciers driven by ocean forcing.

Why is this activity needed?

Under climate change, the AIS experiences mass balance loss, but with large uncertainty. Moreover, several key products related to AIS mass balance are lacked, such as high-accuracy elevation change data and nearshore bathymetry of the Antarctic, which is covered by ice shelves. The development of new technologies, such as GNSS, 4G transmission, laser and airborne gravity, facilitates the establishment of various platforms that provide high-precision ice sheet mass balance and the seafloor topography beneath the Antarctic ice shelves.

Outputs

Output	Status	Users
New glacier movement shown in web	Regularly updated	GEO members, IPCC, The general public
New snow ablation and accumulation shown in web	Regularly updated	GEO members, IPCC, The general public
New algorithms for surface elevation change of AIS	Occasionally updated	GEO members, IPCC, The general public
New mass balance datasets of AIS	Occasionally updated	GEO members, IPCC, The general public

New gravity anomaly grids	Occasionally updated	Geophysics, Geology, Mineral exploration
New sub-ice-shelf seafloor topography grids	Occasionally updated	Oceanography, Glaciology, Climate Change, Geology, Geophysics, Ship navigation

Contributors

GEO Members: Australia, Belgium, China, Denmark, France, Germany, Italy, New Zealand, Norway, Sweden, United Kingdom, and United States

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Earth Observations for Global Typical Karst (EO4KARST)

Objective

Objective 1: Enable effective data sharing on karst resources and environment based on observation networking in typical karst areas.

Objective 2: Establish comprehensive models for karst areas' sustainability under human activities in water resources, land resources and landscape resources, which could be important references for policies making.

Objective 3: Develop an intelligent system for users to assess the status of resources and environment in typical karst areas and make early intervene for possible hazards, share the related data and support for related policies making.

Objective 4: Foster outreach and capacity building for the use of the outputs through training, education, internship, workshops, etc.

Short Description

As a GEO pilot initiative, EO4KARST would like to support the sustainable development of karst areas in context of their abundant resources but fragile environment. The Initiative wants to realize the support from the following approaches: 1)to set up a database that could be accessed easily by the users based on the data from the enlarging observation network for typical karst areas on resources and environment that integrate RS data and in situ observation data and keeps enlarging by absorbing the existing observation stations or the newly set up stations in typical karst areas; 2) to develop integrated models by taking karst resources sustainable utilization into consideration to find out the thresholds that may guide human's over development; 3) to develop an intelligent system (integrating control centre and an app) that could be used for the decision makers to make policies based on the models, or for the administrator to make early intervene for the possible hazards; or for the common users to share the related data; and 4) to make outreach and enhance the capacity building through products generation and activities like training, further education, internship, workshops, science popularization, etc.

Why is this activity needed?

Karst distributes widely in the world, covering about 22,000,000 km2 of the land. Currently, about 16.5% of the global population lives in karst areas, and about 25% of the world population lives on karst water. Karst is featured by beautiful landscapes (e.g. South China Karst World Natural Heritage), abundant water resources that are not stable because of the double hydrogeological structure (aboveground and underground are connected by conduits or fissures due to the dissolution of the carbonate rocks). The soluble rocks and double hydrogeological structure enabled easy impacts of human activities on surface to the underground and spread to other parts through the conduits network. How to calculate the threshold of human activities to restrict the bad influence is in a urgent need now, yet there is not any work focusing on this point.

Outputs

Output	Status	Users
Karst environment and resources database	In development	The practitioners in the countries involved in this initiative
EO4KARST intelligent system	In development	The decision makers of the related countries, the administrators of the areas under in situ observation, the participants of the initiative
Sustainable development models for typical karst areas	In development	The decision makers of the countries involved in this initiative
The international standards on sustainable utilization of karst landscape resources	In development	Karst geosites administrations and its technical supporting team involved
EO4KARST outreach products (like brochures, video, etc)	In development	All the decision makers of related countries, the practitioners of related countries

Contributors

GEO Members: Brazil, China, Indonesia, Philippines, Serbia, Slovenia, South Africa, Thailand, and Zimbabwe

GEO Participating Organization: International Research Centre on Karst under the auspices of UNESCO

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GEO Cold Regions Initiative (GEOCRI)

Objective

Cryosphere Data Stream Services in Cold Regions through the Derived and Integrated Earth Observation Products - to facilitate the provision and standardization of satellite information products in the cryosphere dominated cold regions to meet the needs of societies, including high elevation and high latitude cold regions.

Short Description

Under a global warming scenario, the high elevation and high latitude cold regions, dominated by the cryosphere elements, are inherently fragile to the environment, where changes in the phase of water and the induced result to the environment affect billions of human lives there and the downstream area. Societal and economic development has been leading to a growing dependence on natural, ecosystem, and environmental resources. The warming reshaped the cryosphere and its embed regions, influencing the societal benefits of water availability in the downstream areas, transportation in opening Northern Sea Routes (NSR), the infrastructure and road stabilities in permafrost-rich areas, food and agriculture strategy by blooming ecosystem, climate and weather forecasting service, and challenges addressing and assessment to the sustainable development of cold regions. Timely and accurate information on the cryosphere elements, like snow, glaciers, permafrost, freshwater ice, sea ice, and even solid precipitation, is necessary to protect fragile ecosystems and the environment, facilitate sustainable exploitation of environmental resources, provide forcing data to hydrometeorological services, support the safe use of the land and ocean facilitates, and thus evaluate and foster addressing the sustainable development goals.

GEOCRI brings together the efforts of different science and industry communities' activities currently and stakeholders in the world's cold regions. The core interest of the GEOCRI is to bring fruitful information, gathered continuously by the national and multi-national, growing infrastructures of diverse and complementary Earth observations, to users on a global scale. The contributors to the objectives of GEOCRI are currently operating observational and data infrastructures with high-performance data streaming processing capabilities with open data principles on an international platform. Likewise, data systems have been developed and are hosting rich data assets. We expect the initiative to generate continuous data streams on Essential Cold Regions Variables (ECRVs), and provide pilot services on the water availabilities in the cold mountain area, safety transportation for the land and northern sea routes, emerging cryosphere disaster mitigation, and assessment supporting the UN Sustainable Development Goals (UN SDGs), etc.

Why is this activity needed?

The world's cold regions, where the cryosphere and its changes characterize the Earth system and human activities, have been highly influenced by global warming in the last decades and will be ongoing to global carbon neutrality. Its importance and driven force were described in the Conclusion and Recommendations from GEO Cold Regions Side Event in GEO X Plenary and Geneva Ministerial Summit (GEO, Switzerland, 2014), it recalls,

(1) More than one hundred countries around the world have cryospheric elements (various forms of frozen water). These elements are the main source of fresh water, which needs long-term monitoring and modelling, especially mass balance measurement.

(2) Cold Regions are the most ecologically and environmentally sensitive areas, and changes to these areas comprehensively affect the dynamic Earth system, impacting many aspects of society in all parts of the world.

(3) A global, comprehensive Cold Regions Information Service will strengthen synergies among the activities of the Environmental, Climate, and Cryospheric communities across poles and mountain Cold Regions. In particular, it will support the efforts of scientists, experts, and decision-makers to ensure the sustainability of these environmentally stressed areas in an increasingly complex political and economic context.

(4) With its strong link to user communities, GEO is developing a user-driven approach to Cold Regions that will complement the current science-driven effort.

Outputs

Output	Status	Users
Snow Cover (FSC and SCA)	Regularly updated	ICIMOD, Pakistan, and other countries
Snow Water Equivalent (SWE)	Regularly updated	Water Management, Agriculture, and energy (ICIMOD, Pakistan)
Lake ice	Regularly updated	Transportation and fishery
River ice	Regularly updated	Transportation
Sea Ice	Regularly updated	Transportation and climate actions
Permafrost	Occasionally updated	Transportation and infrastructure
Frost	In development	Transportation and energy risk management
GLOF	Occasionally updated	Disaster, climate actions
Ice Jam Warning	In development	Disaster
Snow Avalanche Warning	In development	Disaster/ Transportation
Glacier Surface Flow Velocity	Available but not updated	SDG13, climate actions
Glacier Thickness Change	Available but not updated	SDG13, climate actions, Water Availability
Glacier Extent	Available but not updated	SDG13, climate actions, Water Availability
Glacier Surge Warning and adaption	Available but not updated	Disaster, SDG13

Ice Chart	Available but not updated	Disaster/ Transportation
Snow Melt-related Flooding	In development	Disaster/ Transportation
Rain-on-snow (ROS)	Planned	SDG13, climate actions
Ice lens formation	Planned	SDG13, climate actions
Permafrost degradation and subsidence	Planned	SDG13, climate actions
Iceberg tracking Calving from the marine-terminated glacier (related MICI, MISI)	In development	Water management, climate change
Derived phenology in snow and ice area	In development	Transportation, energy, climate actions

Contributors

GEO Members: Canada, China, Finland, Germany, Italy, Japan, Netherlands, Norway, and United States

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Global Geochemical Observation Network and Digital Chemical Earth (CHEMICAL-EARTH)

Objective

To establish a global geochemical reference network to observe the content, distribution and changes of chemical elements in the surface of the earth for the global sustainable development of natural resources and environment; To provide technical training for developing countries in the field of geochemistry; To provide a platform for equal access to global geochemical data services and knowledge sharing, bridging the scientific community, policy makers and the public.

Short Description

The initiative will focus on the following: 1) establishing a Global Geochemical Baselines Network for documenting baselines of nearly-all natural chemical elements in the Earths near-surface environment; 2) formulating a guideline and protocol for Global Geochemical Observation Networks through the establishment of the China Geochemical Observation Network, which will be based on the China Geochemical Baselines (CGB) Network completed between 2008 and 2014, for temporal sampling and analysis (every 3 to 5 years) to recognize and quantify potential environmental changes of chemical elements, including potentially toxic elements, radioactive elements and natural carbon; 3) providing baseline datasets of around 50 ore-related elements for mineral resource assessment; 4) determining possible geochemical response to major historic geological events, such as extinction episodes and ancient climate change; 5) compiling the Silk Road Geochemical Atlas from Asia to Europe; 6) updating the digital Chemical Earth platform allowing anyone to access vast amounts of geochemical data and maps through the Internet.

Why is this activity needed?

The primary purpose of geochemistry is to determine quantitatively the composition of the earth and its parts, and to discover the laws which control the distribution of the individual elements (Goldschmidt, 1937). How do we know the distribution of the individual elements on the Earth in time and space? Geochemical mapping is a principal technique to illustrate the spatial distribution of elements and their compounds by systematic sampling of minerals, rocks, soils, drainage sediments and waters. The data will provide a current baseline for the analyzed chemical elements and will also allow the recognition of changes in the geochemistry of Earths near-surface environment over time caused by either human activities or natural processes.

Outputs

Output	Status	Users
Crucial data and atlases products related to Global Geochemical Baselines Network	In development	Researchers, government personnel, general public
Crucial data products related to the China Geochemical Observation Network	Regularly updated	Researchers, government personnel
Chemical datasets of around 50 ore-	In	The practitioners in the countries

related elements for mineral resources assessment	development	involved in this initiative
Chemical datasets of beneficial and toxic elements of crops	Planned	Researchers, government personnel, commercial sector participation
Digital Chemical Earth platform	Regularly updated	Researchers, government personnel, general public, commercial sector participation

The output of the initiative will support the sustainable development of the global natural resources and environment, build up a bridge between the scientific community, decision makers and the general public and contribute China's strength.

Contributors

GEO Members: Argentina, Brazil, Cambodia, China, Colombia, Ireland, Mongolia, Peru, Russian Federation, Thailand, and Turkey

GEO Participating Organizations: International Centre on Global-Scale Geochemistry (ICGG)

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Global Products of Common Essential Variables from Multiple Satellite Data (GEO-EV-PRODUCTS)

Objective

To consolidate the high-level satellite products of common terrestrial essential variables for serving multiple GEO projects and the GEO community at large.

Short Description

Various terrestrial essential variables (EVs) have been proposed, evaluated and used by different GEO projects. To effectively characterize their spatial and temporal variations on regional and global scales, high-level satellite products that are transformed from raw observations have to be relied. These products need to be accurate, temporally sufficiently long, continuous and consistent.

With the rapid development of cloud computing and storage, many institutes and even individual scientists are generating various high-level satellite products of terrestrial EVs. These products have been shared on different platforms through internet, but they are usually produced from different satellite data, therefore having highly variable spatial/temporal resolutions and coverage, quality and accuracy. This initiative is a community activity, for a panel of experts to evaluate the current status of the high-level satellite products, assess the characteristics of the satellite products of common EVs, inter-compare multiple products by using in situ measurements, develop new methodology for generating the consolidated products from multiple satellite raw observations, and bridge the product developers and the users by interacting with the relevant working groups of various GEO projects.

Why is this activity needed?

GEO has successfully coordinated the share of raw satellite observations from various sources, but most applications require high-level products that have to be converted from raw satellite data. Generation of high-level satellite products requires a high-degree of expertise and vast resources, but such activities have not been well coordinated. Multiple products of even the same EV are often scattered in the internet, but the users have difficulties to find and also hard to decide which products to use since the quality and accuracy of those products are unclear. Many GEO projects have their own working groups to create the data records of certain EVs. There is a urgent need for a coordination of product generation, evaluation, inter-comparison and validation, particularly on the products of the common EVs that are relevant to multiple GEO projects.

Outputs

Output	Status	Users
a data inventory and portal for existing products	Planned	all GEO Members
various improved satellite products	Planned	all GEO Members
quality and accuracy assessment reports	Planned	all GEO Members
forum between the products developers and the users		

Contributors

GEO Members: Australia, China, European Commission, France, Spain, United Kingdom, and United States

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Regional GEOs

African Group on Earth Observations (AFRIGEO)

Key priorities of the Regional GEO

- Continental, Regional and National Coordination;
- User Needs and Applications: Agriculture and Food Security, Land Cover and Land Degradation Neutrality, EO for Health, Sustainable Forest Management, Sustainable Urban Development, Water Resource Management while taking into account climate change impacts and Disaster risk reduction within these thematic areas of focus
- Data and Infrastructure;
- Human Capital Development;
- Resource Mobilization;
- Communication and Outreach.

Thematic priorities of the Regional GEO

- Sustainable Forest Management
- Agriculture and Food Security
- Water Resource Management
- Sustainable urban development
- Land Degradation Neutrality
- Data and Infrastructure
- EO4Health
- Disaster Risk Reduction

Contributors

GEO Members: Congo, Republic of the, Egypt, Gabon, Ghana, Kenya, Madagascar, Morocco, Nigeria, Senegal, South Africa, Uganda, and Zimbabwe

GEO Participating Organizations: Regional Centre for Mapping of Resources for Development (RCMRD), Arab States Research and Education Network (ASREN), Commission des Forets d'Afrique Centrale (COMIFAC), Environmental Information Systems - AFRICA (EIS-AFRICA), Observatoire du Sahara et du Sahel (The Sahara and Sahel Observatory) (OSS), United Nations Economic Commission for Africa (UNECA), African Regional Centre for Space Science and Technology Education (ARCSSTE-E), and AGRHYMET Regional Centre (AGRHYMET)

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Americas Group on Earth Observations (AMERIGEO)

Key priorities of the Regional GEO

- Address user-identified gaps and coordination
- Develop actionable tools and services
- Strengthen the institutional capacity in GEO-member countries by leveraging existing expertise, technology, and efforts in-country and across the region. AMERIGEO's activities are entrenched in the institutional and technical capabilities of the country members and the resources of GEO Work Program activities. AMERIGEO promotes collaboration and coordination among GEO members in the Americas, international and local organizations, NGOs, GEO Associates, and GEO Participating Organizations.
- Apply the knowledge and capabilities of partner members to address gaps and challenges.

Changed priorities since the 2020-2022 Implementation Plan

In 2019, Health was added as the fifth priority area of the region. In 2021, Climate Change became the overarching umbrella under which the Priority areas would establish multidisciplinary collaboration.

Thematic priorities of the Regional GEO

Agriculture, Disaster Risk Reduction, Water and food security, Biodiversity/Ecosystems, and Health.

Contributors

GEO Members: Argentina, Brazil, Canada, Chile, Colombia, Costa Rica, Ecuador, Panama, Mexico, Paraguay, Peru, El Salvador, Guatemala, Nicaragua, and United States

GEO Participating Organizations: Central American Commission for the Environment and Development (SICA/CCAD), and Cooperation Latinoamerica de Redes Avanzades (CLARA)

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Asia-Oceania Group on Earth Observations (AOGEO)

Key priorities of the Regional GEO

- Identify regional needs for Earth observation applications and relate these to global GEO activities;
- Facilitate regionally coordinated Earth observation activities and utilize available infrastructure, resources and capacity to develop integrated and sustained observations in the AO region;
- Provide a platform for regional countries to advance data sharing and services;
- Promote dialogue, communications and cooperation among the AOGEO Members and other participants, as well as with other Regional GEOs; and
- Support sound decision-making at local, national and regional scales by making maximum use of Earth observation data and information.
- More fully implement data and product sharing services by focusing on user needs, practical problem solving and training, in the first instance using Southeast Asia and Pacific Islands as examples.
- Promote regional users' capacity-building and train young scientists in the field of earth observations for developing countries by organizing a series of training workshops.
- Work with partners in the Integrated Priority Studies (IPS) to integrate satellite remote sensing and ground observation data, and build a data product and system platform for SDGs, climate change and disaster prevention and mitigation with the help of AI, big data, cloud computing technologies.
- Encourage the use of facilitators as trusted human resources by making effective use of e-Learning.

Thematic priorities of the Regional GEO

- Water Cycle consilience
- Biodiversity
- GHG monitoring
- Disaster Resilience
- Agriculture
- Ocean and Coasts
- Mountain
- Drought characteristics in relation to climate extremes and human activities; impacts of droughts on agriculture
- Environmental Monitoring

Contributors

GEO Members: China, Australia, Korea, Republic of, France, India, Indonesia, Japan, Malaysia, United States, Philippines, Thailand, United Kingdom, and Vietnam

GEO Participating Organizations: Food and Agriculture Organization of the United Nations (FAO), and Intergovernmental Oceanographic Commission (IOC)

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European Group on Earth Observations (EUROGEO)

Key priorities of the Regional GEO

The Initiative will focus on the following strategic actions:

- Engaging with a broad range of users in Europe for identifying their needs for EO based services or products, building on the wide range of European EO assets, and addressing also the inter-connections between various groups and policy areas.
- Demonstration, incubation, upscaling, downscaling, or replication of existing EO services and products across Europe (and beyond), also through streamlining innovation instruments available at EU, national or sub-national levels and actively promote synergies;
- Connecting European EO research communities, service providers, including the private sector, and users to allow for mutual learning and spreading of good practices and successful business models across Europe;
- Further the design of a European digital ecosystem that supports access and inter-operability of EO data and provides benefits to businesses, citizens, and scientists/researchers and promotes the GEO vision in Europe to realise a future where decisions and actions are informed by evidence;
- Supporting the consolidation of national GEO management structures across Europe and ensure alignment of EuroGEO with the GEO engagement priorities.

Thematic priorities of the Regional GEO

While the overarching European Green Deal policy drives the priorities and orients the themes developed by EUROGEO, nine action groups (open innovation partnerships) have been created by EUROGEO following a call for expression of interest towards the European EO community around the following themes: Applications for Agriculture/Food; Applications for general Land use/land coverage; Urban applications (including urban air quality and urban health); Applications for Disaster Resilience; Applications for Biodiversity & Ecosystems; Marine applications; Applications for Climate (including impacts on Cultural Heritage); Applications for Atmosphere; Applications for Energy.

EUROGEO already has an impact on the EO landscape in Europe since its inception in 2017. In the coming years, new activities are planned to continue and strengthen the initiative in Europe, and thus together with the EU Space Programme and the legislative European package (INSPIRE and Open Data Directives, Data Act, Data Strategy, …), further strengthen the European contribution to GEO.

This will be done in close cooperation with the EuroGEO Coordination Group and the Action Groups. Close interactions with the GEO Flagships, Initiatives, Pilot Initiatives and the Foundational Tasks have been and will be pursued.

The main spheres of activities to be conducted by the EUROGEO Initiative are as follows:

- Coordination of GEO-relevant activities undertaken in Europe to ensure a coherent European contribution to the GEO initiatives and priorities;

- Implementing a user-driven research and innovation agenda to maximise uptake and engagement of EO applications that are addressing the GEO priorities, and require further demonstration, incubation, up-scaling, or replication
- Supporting cooperation among individual European and national programmes and user communities (e.g. Copernicus, ESA, NMHIs, European observing networks and Research infrastructures, etc.);
- Cooperation with other Regional GEOs, in particular with view to sharing data, applications and good practices globally.

Contributors

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Table of Acronyms

AARSE	African Association of Remote Sensing of the Environment
ACCREC	African Climate Change Research Centre
ACIS	Advancing Communication Infrastructures and Services
AFRICULTURES	Enhancing Food Security in African Agricultural Systems with the Support of Remote Sensing
AFRIGEO	African Group on Earth Observations
AGRHYMET	AGRHYMET Regional Centre
AGRI-DROUGHT	Global Agricultural Drought Monitoring
AIS	Antarctic Ice Sheet
AIS-MONITORING	Antarctic Ice Sheet Monitoring
AMERIGEO	Americas Group on Earth Observations
AMIS	Agricultural Monitoring Information System
AOGEO	Asia-Oceania Group on Earth Observations
AQUAWATCH	AquaWatch
ARCSSTE-E	African Regional Centre for Space Science and Technology Education
ARCTIC-GEOSS	ArcticGEOSS
ASEAN	Association of Southeast Asian Nations
ASREN	Arab States Research and Education Network
ATLANTIC-EO	Earth Observations in the Atlantic Region
BON	Biodiversity Observation Network
CABI	Commonwealth Agricultural Bureaux International
CAMS	Copernicus Atmospheric Monitoring Service
CBCGDF	China Biodiversity Conservation and Green Development Foundation

CBD	Convention on Biological Diversity
CCAD	Commission for the Environment and Development
CEOS	Committee on Earth Observation Satellites
CGB	China Geochemical Baselines
CHEMICAL-EARTH	Global Geochemical Observation Network and Digital Chemical Earth
CI	Conservation International
CLARA	Cooperation Latinoamerica de Redes Avanzades
CLIMATE-OSI	Climate Observation, Simulation and Impacts
CNR	National Research Council of Italy
CNR-IMAA	Institute of methodologies for Environmental Analysis
COMIFAC	Commission des Forets d'Afrique Centrale
CoP	Community of Practice
CSDR	Construction and Services of Chinese High-resolution Satellite Data Resources
CWC	Cold-water Coral
CWCDIS	Cold-water Coral Distribution Information System
DE-AFRICA	Digital Earth Africa
DE-PACIFIC	Digital Earth Pacific
DELTA&ESTUARY	Global Observation on Deltas and Estuaries
DFAT	Australian Government Department of Foreign Affairs and Trade
DG GROW	Directorate General for Internal Market, Industry, Entrepreneurship and SMEs
DIAS	Data Integration and Analysis System
DRM	Disaster Risk Management
EA	Ecosystem Accounts
EAG	Expert Advisory Group

EARSC	European Association of Remote Sensing Companies
EC DG RTD	European Commission's Directorate-General for Research and Innovation
ECMWF	European Centre for Medium-Range Weather Forecasts
ECRV	Essential Cold Regions Variables
ECV	Essential Climate Variable
EDDI	Evaporative Demand Drought Index
EEA	European Environment Agency
EFFIS	European Forest Fire Information System
EIS-AFRICA	Environmental Information Systems – Africa
EMEP	European Monitoring and Evaluation Programme
EO	Earth Observation
EO-IIP	Earth Observation Industrial Innovative Platform for Sustainable Development
EO4DRM	Earth Observations for Disaster Risk Management
EO4EA	Earth Observations for Ecosystem Accounting
EO4HEALTH	Earth Observations for Health
EO4KARST	Earth Observations for Global Typical
EO4MIN	Earth Observations for Managing Mineral and Non-Renewable Energy Resources
EO4SDG	Earth Observations for Sustainable Development Goals
EO4SENDAI-MONITORING	Earth Observation and Copernicus in Support of Sendai Monitoring
EO4WEF	Earth Observations for the Water-Energy-Food Nexus
EPOS	European Plate Observing System
ERAPLANET	The European network for observing our changing planet
ESA	European Space Agency

ESRI	Environmental Systems Research Institute
ET	Evapotranspiration
EU	European Union
EU SatCen	European Union Satellite Centre
EUROGEO	European Group on Earth Observations
EuroGeoSurveys	The Association of the Geological Surveys of the European Union
EV	Essential Variable
EYWA	Early Warning System for Mosquito Borne Diseases
FAO	Food and Agriculture Organization of the United Nations
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
FEMA	Federal Emergency Management Agency
FSC	Forest Stewardship Council
FVC	Fraction of Vegetation Cover
G20	Group of Twenty
GBIF	Global Biodiversity Information Facility
GBiOS	Global biodiversity observation system
GCOS	Global Climate Observing System
GDIS	Global Drought Information System
GEO	Group on Earth Observations
GEO BON	GEO Biodiversity Observation Network
GEO Wetlands CoP	Global Wetland Observation Community of Practice
GEO-BLUE-PLANET	GEO Blue Planet
GEO-CITSCI	GEO Citizen Science
GEO-CRADLE	GEO Capacity Building in North Africa, Middle East, Balkans and Black Sea Region
GEO-DAMP	Research and innovation platform provided by SatCen

GEO-DARMA	Data Access for Risk Management
GEO-ECO	GEO Global Ecosystem Initiative
GEO-EV	GEO Essential Variables
GEO-EV-PRODUCTS	Global products of Common Essential Variables from Multiple Satellite Data
GEO-LDN	GEO Land Degradation Neutrality Initiative
GEO-MOUNTAINS	Global Network for Observations and Information in Mountain Environments
GEO-PDRS	Global Vegetation Pest and Disease Dynamic Remote Sensing Monitoring and Forecasting
GEO-TREES	Forest Biomass Reference System from Tree-by-Tree Inventory Data
GEO-VALUE	Understanding the Impacts and Value of Earth Observations
GEO-VENER	GEO Vision for Energy
GEO-WETLANDS	GEO Wetlands Initiative
GEOARC	Global Ecosystems and Environment Observation Analysis Research Cooperation
GEOCRI	GEO Cold Regions Initiative – Service Practice
GEODESY4SENDAI	Geodesy for the Sendai Framework
GEOGLAM	GEO Global Agricultural Monitoring
GEOGLOWS	GEO Global Water Sustainability
GEOSS	Global Earth Observation System of Systems
GEOSS Data CORE	GEOSS Data Collection of Open Resources for Everyone
GFOI	Global Forest Observations Initiative
GFRM	Global Flood Risk Monitoring
GGO	Greek GEO Office
GHG	Global greenhouse gas
GLOFAS	Global Flood Awareness System

GMP	Global Monitoring Plan
GMP DWH	Global Monitoring Plan Data Warehouse
GOFC GOLD	Global Observation of Forest and Land Cover Dynamics
GOS4M	Global Observation System for Mercury
GOS4POPs	Global Observation System for Persistent Organic Pollutants
GPM	Global Precipitation Measurement
GPML	Global Partnership on Marine Litter
GPP	Gross Primary Productivity
GPSDD	Global Partnership for Sustainable Development Data
GRSS	Geoscience and Remote Sensing Society
GSNL	GEO Geohazard Supersites and Natural Laboratories
GUOI	Global Urban Observation and Information
GWIS	Global Wildfire Information System
HUMAN-PLANET	GEO Human Planet
i-BEC	Inter-Balkan Environment Centre
IAG	International Association of Geodesy
IAOAF	International Arctic Observations Assessment Framework
ICGG	International Centre on Global-Scale Geochemistry
ICIMOD	International Centre for Integrated Mountain Development
IEA	International Energy Agency
IEEE	Institute of Electrical and Electronics Engineers
IHE	IHE Delft Institute for Water Education
IIASA	International Institute for Applied Systems Analysis
InSAR	Interferometric Synthetic Aperture Radar
IOC	Intergovernmental Oceanographic Commission

IPCC	Intergovernmental Panel on Climate Change
IPTO	Greek National Independent Power Transmission Operator S.A.
ISESTEL	Institut Supérieur d'Études Spatiales et Télécommunications
ITC	International Institute for Geo-Information Science and Earth Observation
ITU	International Telecommunication Union
IWMI	International Water Management Institute
JRC	Joint Research Centre
LAND-COVER	Global Land Cover
LC	Land Cover
LDN	Land Degradation Neutrality
LRTAP	Long-range Transboundary Air Pollution
LUP4LDN	Land Use Planning for Land Degradation Neutrality
MKF	Mariolopoulos-Kanaginis Foundation for the Environmental Sciences
MMU	Manchester Metropolitan University
MOOC	Massive Open Online Course
MRI	Mountain Research Initiative
MRV	Measurement, reporting and verification
MUSYQ	Multi-Source Synergized Quantitative Remote Sensing Products and Services
NASA	National Aeronautics and Space Administration
NATESC	National Agro-tech Extension and Service Center
NCA	Natural capital accounting
NEWA	New European Wind Atlas
NEXT-EOS	Next Generation Earth Observation Services
NFGA	National Forestry and Grassland Administration

NFMS	National Forest Monitoring System
NGO	Non-governmental Organization
NIGHT-LIGHT	Night-time Light Remote Sensing for Global Sustainability
NOAA	National Oceanic and Atmospheric Administration
NPP	Net Primary Productivity
NSR	Northern Sea Routes
OEA	Open Earth Alliance
OECD	Organisation for Economic Co-operation and Development
OSS	Observatoire du Sahara et du Sahel
PAR	Photosynthetically Active Radiation
PDNA	Post Disaster Need Assessment
POGO	Partnership for Observation of the Global Oceans
POP	Persistent Organic Pollutant
PPCR	Public Power Corporation Renewables S.A.
PTP	Photosynthetic Thermal Productivity
R&D	Research and Development
RCMRD	Regional Centre for Mapping of Resources for Development
RE	Renewable Energy
ReSAgri	Resilient & Sustainable ecosystems including Agriculture & food
ROS	Rain-on-snow
S-uiPS	Sekine’s urban inundation Prediction System
SAON	Sustaining Arctic Observing Networks
SAV	Shared Arctic Variable
SBA	Societal Benefit Area
SCO	Space Climate Observatory

SDG	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SFDRR	Sendai Framework for Disaster Risk Reduction
SMAP	Soil Moisture Active and Passive
SPACE-SECURITY	Space and Security
SPC	Secretariat of the Pacific Community
SPI	Standardized Precipitation Index
SR	Solar Radiation
STRP	Ramsar Scientific and Technical Review Panel
SWE	Snow Water Equivalent
SWF	Secure World Foundation
TIGGE	Thorpex Interactive Grand Global Ensemble Evolution into a Global Interactive Forecast System
UHCO	Urban Heritage Climate Observatory
UN	United Nations
UN Environment	United Nations Environment Programme
UN FCC	United Nations Framework Convention on Climate Change
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management
UN-SPIDER	The United Nations Platform for Space-based Information for Disaster Management and Emergency Response
UNCBD	United Nations Convention on Biological Biodiversity
UNCCD	Secretariat of the United Nations Convention to Combat Desertification
UNCTD	United Nations Conference on Trade and Development
UNDRR GAR	United Nations Office for Disaster Risk Reduction, Global Assessment Report
UNECA	United Nations Economic Commission for Africa

UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNITAR	United Nations Institute for Training and Research
UNOOSA	United Nations Office for Outer Space Affairs
UNU-EHS	United Nations University, Institute for Environment and Human Security
US	United States
UVA	Ultraviolet A-rays
UVB	Ultraviolet B-rays
VAAC	Volcanic Ash Advisory Center
VI	Vegetation Index
VIC	Variable Infiltration Capacity
VME	Vulnerable marine ecosystem
VoRDM	Volunteered Rapid Disaster Monitoring and Mapping
WDS	World Data System
WFP	World Food Programme
WHC	World Heritage Centre
WHO	World Health Organization
WMO	World Meteorological Organization
WOfS	Water Observations from Space
WSSD	World Summit on Sustainable Development