



GEO HIGHLIGHTS 2017-2018

—
IMPACT FOCUSED, RESULTS DRIVEN



GEO Highlights 2016-2017

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Message from the GEO Lead Co-Chair



As 2018 draws to a close, I feel a sense of achievement for the work our community has accomplished this year. Serving as Lead GEO Co-Chair during this year has given me the opportunity to get closer to the inner workings of our organization and develop a greater appreciation for the efforts and dedication it takes to execute a successful work plan in an organization that is voluntary in nature.

“Behind all progress demonstrated in the activities of the GEO Work Programme – both incremental and great – stand bright and talented individuals with a commitment to advancing the vision of GEO.”

Behind all progress demonstrated in the activities of the GEO Work Programme – both incremental and great – stand bright and talented individuals with a commitment to advancing the vision of GEO – through collaboration in science and innovation; partnerships in communications and information exchange; coordination in policy advocacy that promotes the awareness for the value of Earth observations for decisions.

The GEO community, its people, are GEO's greatest asset. I am proud that our work and our mission continue to resonate with a large audience worldwide. GEO is attracting talent and expertise of organizations big and small that used to be viewed as non-traditional partners for GEO. Today, those traditions are changing and our network grows stronger and more robust as we welcome the participation of private companies and civil society organizations that will extend the benefits of our collective knowledge farther than before.

Staying on the topic of individual commitment and dedication, I must recognize a major milestone we marked this year – the passing of the baton from one great Secretariat Director to another. Dr. Barbara Ryan,

who led the GEO Secretariat from 2012 to 2018, leaves a powerful legacy of having cultivated and strengthened relationships between GEO and strategically important partner organizations. Always an inspiring ambassador for GEO, Dr. Ryan championed and pushed the GEO community towards more open and broad data sharing, greater engagement with the global policy organizations, and more dialogue with commercial groups. Today, GEO is a growing and diverse community of Earth observation users, providers, brokers, and activists in large part thanks to Dr. Ryan's dedication and passion.

To build on Dr. Ryan's legacy, GEO has welcomed Prof. Dr. Gilberto Camara, whose professional philosophy is steeped in the principles of open access to data, authoritative and reproducible science, and service-oriented architecture and knowledge. A long-standing member of the GEO community, Prof. Dr. Camara is well positioned to apply his drive and expertise to maturing GEO's capabilities towards their optimal potential. With keen awareness for the needs of the Global South, Prof. Dr. Camara will be a strong voice and advocate for low and middle income countries who often face the harshest cataclysms and endure the long-lasting impacts from global change.

I look ahead to the next year of work with great expectations for exciting achievements by GEO and extend my sincere gratitude to every member of the GEO community, who makes it a success.

Stephen M. Volz
NOAA, United States of America

Message from the GEO Secretariat Director

Since 1 July 2018, I have had the unique opportunity to take on the role of GEO Secretariat Director. Having worked in the area of Earth observation for 35 years, and having been involved in GEO since 2002, it is an honour to serve the needs of more than 100 UN Member States. I am most appreciative of the work done by my predecessors, Barbara Ryan and Jose Achache. They have built an organization with a solid and clear mission. GEO has strong global links, and our activities span across the whole of Earth observation applications. Thanks to continued service of the GEO Executive Committee, Programme Board and contributors to our Work Programme, GEO has been able to deliver science-based evidence for policy making. The commitment, openness and collaboration of the GEO community is the basis for our success.

It is my objective to strengthen and steer our partnership towards even more explicit impact: value, services and knowledge that enable all potential users to benefit from the wealth of open Earth observations data and information resources available to them.

Reflecting on GEO's accomplishments over the past year, our work is tangible and continues to develop, and the need for our global partnership remains firm. Stand-out activities including GEOGLAM, GEOBON, Human Planet Initiative and EO4SDG, thriving regional GEO communities, and countless other activities carried out under the GEO umbrella are supporting action on the world's most pressing issues.

Our relationship with the commercial sector has evolved over the past year, and this approach has mutual benefits for all involved. Exemplary efforts have resulted in strengthened relationships and increased engagement with global policy institutions, including the World Economic Forum (WEF), UN Office for Disaster Risk Reduction (UNISDR), UN Framework Convention on Climate Change (UNFCCC), UN Convention to Combat Desertification (UNCCD), UN Environment and many more. Language concerning the value of and need for Earth observations is appearing in key global policy documents across the spectrum of thematic areas, thanks to the hard work of our community.

2019 will be a year of transition. We must adapt to a changing landscape of data and service providers, technology, policy players and global needs.

GEO needs to organize its activities so that our community can fully benefit from the new technologies of cloud computing and machine learning. We also need to encourage space agencies to work with GEO to make multi-satellite analysis-ready data openly available.

One important concern of the GEO Secretariat is to improve global access to in situ data. The more sophisticated our analysis methods become, the more data we need. The Secretariat will work with its member states to provide data management and curation services to meet their needs.

“The main challenge for GEO is how we develop our activities so that Earth observations can make a significant contribution to the Sustainable Development Goals.”

The main challenge for GEO is to develop our activities so that Earth observations can make a significant contribution to the Sustainable Development Goals. This will require much effort to combine space-borne data with statistical data. Our activities need to scale up to produce globally consistent results. This requires all of you to be bold and develop global awareness.

I look forward to maintaining our strong relationships across the community during my tenure as Secretariat Director, and thank you all for the continued engagement and support that have made the impacts of the past year possible.

Gilberto Camara
GEO Secretariat



Group on Earth Observations

YEAR AT A GLANCE, 2017-2018

The Group on Earth Observations (GEO) is an intergovernmental partnership that improves the availability, access, understanding and use of Earth observations for a sustainable planet. GEO promotes open, coordinated and sustained data sharing and infrastructure for better research, policy making, decisions and action across many disciplines. The GEO community focuses its efforts around three global priority engagement areas: the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction.

In 2017-2018, GEO continued to convene partners to address society's most pressing challenges. Together, the GEO community is working to:

- Advocate for Earth observations as irreplaceable resources that must be protected, made fully and openly accessible, integrated with other data sources and included within decision making processes to provide maximum value;
- Engage with stakeholder communities and foster strategic partnerships to address global and regional challenges; and
- Deliver data, information, and knowledge to enable informed public and commercial sector decisions, exchange of good practice, uptake of new technologies, and the creation of economic development opportunities.

New Member Countries

The Royal Government of Cambodia and the Sultanate of Oman became the 104th and 105th GEO Member Countries in 2017.

New Participating Organizations

Since July 2017, GEO's Executive Committee has approved 20 new Participating Organizations - bringing the new total to 127. These organizations contribute to the work of Member Countries to support GEO's vision and mission. The new Participating Organizations include:

- African Climate Change Research Centre (ACCREC)
- AGRHYMET Regional Centre
- Asian Disaster Preparedness Centre (ADPC)
- Afriterra Foundation
- Centre for Environment and Development for the Arab Region and Europe (CEDARE)
- Central African Forest Commission (COMIFAC)
- Community Surface Dynamics Modeling System (CSDMS)
- FrontierSI
- Environment Pulse Institute (EPI)
- EuroGeographics
- Global Partnership for Sustainable Development Data (GPSDD)
- IHE Delft Institute for Water Education
- Higher Institute for Space Studies and Telecommunications (ISESTEL)
- Radiant Earth Foundation
- Resources for the Future
- Secretariat of the Pacific Regional Environment Programme (SPREP)
- The Paul G. Allen Philanthropies
- United Nations Economic Commission for Latin America and the Caribbean (UNECLAC)
- United Nations Economic and Social Commission for Western Asia (UNESCWA)
- World Resources Institute (WRI)

New Work Programme Activities and Initiatives

→ EuroGEOSS

EuroGEOSS joins AfriGEOSS, AmeriGEOSS and AOGEOSS as GEO's fourth regional Initiative. Its objective is to build a more integrated European approach to Earth observations, accelerate GEOSS adoption and engagement across Europe, and promote further incubation and scaling-up of promising user services.

Learn more on page 14.

→ GEO-CRADLE

GEO-CRADLE promotes the sustainable and continuous uptake and exploitation of Earth observation services and data in North Africa, the Middle East and the Balkans, and the implementation of GEOSS and Copernicus in response to regional needs. The Initiative focuses on four key thematic areas: adaptation to climate change, improved food security and water extremes management, access to raw materials, and access to energy. *Learn more on page 14.*

→ GEOARC (Global Ecosystems and Environment Observation Analysis Report Cooperation)

GEOARC aims to develop a framework for monitoring and analysis of biodiversity and ecosystem information. The results of this analysis are captured in a series of annual reports that support public decision making. Through GEO, GEOARC will promote the use of international standards and methods for data and information sharing and facilitate participation of other countries and organizations in the development and use of the reports.

Learn more on page 15.

→ GEO Land Degradation Neutrality

The GEO Land Degradation Neutrality Initiative (GEO LDN) will support the development, provision and use of Earth observation datasets, quality standards, analytical tools and capacity building to avoid, reduce, and reverse land degradation, with the aim of achieving LDN in all countries by 2030 (SDG 15.3).

The Initiative will connect data providers to data users, including researchers, decision makers, land use planners, commercial sector entities, donors/investors and other stakeholders in order to optimize the use of Earth observation data for LDN assessment, planning, implementation, monitoring and reporting.

Learn more on page 4.

→ Resilience.io (Integrated City-Region Systems Modelling)

Resilience.io is developing and demonstrating the world's first open-source, integrated human-ecology-economics systems platform that enables resilient disaster risk-sensitive planning, policy-making, investment and procurement for city regions around the world. It is designed to connect to many data sources, including Earth observation satellites, government and private sector data, local sensor networks, smart phones, tablets and local survey data. This data is processed by a systems model and visualized to give an improved understanding of the human, economic and ecological systems within a region and their interlinkages.

“Radiant Earth is thrilled to be a participating organization with GEO. Collaborating with GEO's member institutions is essential to enhance cooperation and create synergies across sectors and domains. Collectively, member institutions can drive innovation in Earth observation analysis for improved decision-making.”

Anne Hale Miglarese, Founder and CEO,
Radiant Earth Foundation



#EO4SDG

GEO AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Earth observations play a major role in helping countries achieve the UN 2030 Agenda for Sustainable Development and the associated Sustainable Development Goals (SDGs). Earth observations are used for monitoring and reporting on the SDG targets and indicators, and help countries develop policies, track progress and make decisions and adjustments.

Assessments by GEO and the Committee on Earth Observation Satellites (CEOS) have identified nine goals where Earth observations are most important: 2 (Zero Hunger), 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities), 12 (Sustainable Consumption and Production), 13 (Climate Action), 14 (Life Below Water) and 15 (Life on Land).

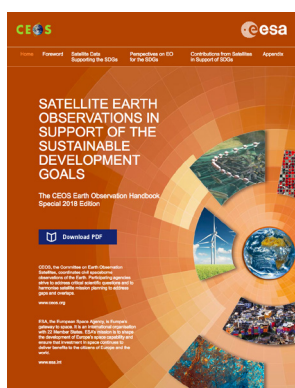
GEO promotes inclusion of Earth observations in the methodology of measuring and achieving these SDGs, working in close collaboration with custodian agencies, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) and GEO Member Countries.

→ GEO and UN Environment revise indicator methodology for SDG 6: Clean Water and Sanitation

The GEO Earth Observations for the Sustainable Development Goals Initiative (EO4SDG, eo4sdg.org) is integrating Earth observations in national SDG monitoring, reporting and implementation processes.

In 2017-18, representatives from EO4SDG, AquaWatch and GEO Wetlands worked with UN Environment and other stakeholders to explore the use of Earth observation data and tools for national monitoring and reporting on SDG indicator 6.6.1: change in the extent of water-related ecosystems over time. As a result of these activities a new monitoring methodology was developed, and in 2018 the indicator was upgraded to Tier II by the UN Inter-agency and Expert Group on SDG Indicators in recognition that it has an internationally-accepted process for tracking progress against it.

Piloted in Cambodia, Jamaica, Peru, Philippines, Senegal, Uganda and Zambia, and considered a best practice for measuring this indicator, the new methodology was developed by UN Environment in close consultation with UN-Water, and with input from the Ramsar Secretariat, the Integrated Water Management Institute (IWMI), the International Union for the Conservation of Nature (IUCN), the European Space Agency (ESA) and the Convention on Biological Diversity (CBD). Experts from the GEO Secretariat, EO4SDG, the European Commission's Joint Research Centre (JRC), NASA, and Google Earth Engine provided additional scientific expertise and completed pilot activities that informed the methodology update process.



← EO4SDG contributed input to the CEOS Handbook on 'Satellite Earth Observations in Support of the Sustainable Development Goals', available online at eohandbook.com





GEO LDN Initiative responds to UNCCD call to action for SDG 15

Land Degradation Neutrality is defined by the United Nations Convention to Combat Desertification (UNCCD) as when “the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.”

Countries need quantitative assessments and maps of degraded land to halt, and eventually reverse, current trends toward land degradation. The importance of this Earth observation-based information is recognized in SDG indicator 15.3.1 (proportion of land that is degraded over total land area), and by the adoption of Land Degradation Neutrality targets under the auspices of the UNCCD.

In September 2017, the UNCCD 13th Conference of the Parties invited GEO to support them in implementing the Convention by providing space-based information and in situ measurements. In response, UNCCD and GEO partners have developed the GEO Land Degradation Neutrality Initiative (GEO LDN). This Initiative will advance the collaborative development, provision and use of Earth observation datasets, quality standards, and analytical tools to achieve Land Degradation Neutrality.

The strategic objectives of GEO LDN are to:

- 1) Facilitate access to space-based information and in situ measurements;
- 2) Provide expertise, tools and training to build national capacities; and
- 3) Assist with the further development of international standards and protocols for the indicator.

→ GEO activities contribute to Goal 14: Life below water

GEO activities are contributing the SDG 14 (Life below water) in a variety of areas. EO4SDG and GEO Blue Planet are working together to measure marine pollution. GEO Blue Planet recently contributed to the draft [Global Manual on Ocean Statistics](#), produced by UN Environment. At the same time, GEO Aquawatch is developing an inventory of eutrophication monitoring methods and projects to address needs of UN Environment and the Intergovernmental Oceanographic Commission (IOC)-UNESCO for SDG 14.

→ Japan's Forest Early Warning System expanded to 77 countries

As part of their GEO contribution, the Japan International Cooperation Agency (JICA) and the Japan Aerospace Exploration Agency (JAXA) have launched the '[Forest Early Warning System in the Tropics \(JJ-FAST\)](#)'; a web-based system that uses satellite data to monitor tropical forests every 1.5 months. In June 2018, the system's service coverage was expanded to include 77 countries.

This system will help countries meet SDG 15 (Life on Land) targets related to forests and biodiversity, as well as SDG 13 (Climate Action) and articles of the Paris Agreement. The Global Forest Observations Initiative (GFOI) and its partners are currently considering how the system could potentially be used by countries to detect illegal logging.

#EO4PARIS

GEO AND THE PARIS AGREEMENT

In December 2015, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to strengthen commitments to address the threat of climate change. Earth observations are required to respond to the many specific provisions of the Paris Agreement – including national reporting, mitigation measures, adaptation, technology transfer and capacity building.

In 2017-18, the recognition of the value of Earth observations for tackling climate change and of GEO's role in supporting the global climate agenda continued to expand. This was demonstrated by GEO's deepened engagement at the international policy level and through increasing contributions by the GEO community to UNFCCC efforts.

→ Value of Earth observations for the Paris Agreement reaffirmed at COP23

For the first time, GEO participated as an official exhibitor and side event organizer at the UN Climate Change Conference (COP23) in November 2017.

Together with the Global Climate Observing System (GCOS) and the Remote Sensing Technology Center of Japan (RESTEC), GEO organized an official side event that explored the role of Earth observations to support National Greenhouse Gas (GHG) Inventories and the ongoing refinement of the Intergovernmental Panel on Climate Change (IPCC) Guidelines.

During the 47th session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), this issue was formally brought forward and included in the outcome document, which noted the "increasing capability to systematically monitor greenhouse gas concentrations and emissions, through in situ as well as satellite observations, and its relevance in support of the Paris Agreement."

→ GEO holds 1st Paris Climate Workshop

In June 2018, GEO's first workshop on the Paris Agreement marked a significant milestone in GEO's efforts to engage key organizations with explicit mandates in the climate policy process.

The workshop was attended by over 100 participants, including representatives of relevant GEO activities, international organizations and Member Countries. Key speakers from UNFCCC, IPCC, the Global Climate Observing System (GCOS), the World Meteorological Organization (WMO), Committee on Earth Observation Satellites (CEOS) Coordination Group for Meteorological Satellites (CGMS) and the World Climate Research Programme (WCRP) shared their current needs and discussed opportunities for GEO to support the international climate agenda. Concrete action areas identified for GEO included:

- helping to improve climate data access;
- supporting actions on mitigation, adaptation and loss and damage;
- integrating climate with SDGs, Sendai Framework and other Rio Conventions;
- engaging with national stakeholders (e.g. in National Adaptation Planning);
- supporting IPCC processes (2019 Refinement of 2006 IPCC Guidelines on National GHG Inventories; Sixth Assessment Cycle);
- responding to actions in the GCOS Implementation Plan; and,
- enhancing the use of climate data records for a variety of application areas, including drought monitoring, renewable energy assessments and health early warning systems.



→ GEO Carbon and GHG Initiative steering committee and secretariat established

The GEO Carbon and GHG Initiative (GEO-C) is evolving into an internationally recognized forum to discuss joint activities in the carbon observation space, and to align the various organizational agendas on carbon observations across the atmospheric, oceanic and terrestrial domains.

This global endeavour promotes interoperability and fosters integration in the sector of greenhouse gas measurements, carbon stocks and fluxes. GEO-C builds on existing Initiatives and networks to support their continuity and coherence and facilitate their cooperation, in order to obtain a comprehensive, globally coordinated carbon and greenhouse gas observation and analysis system. GEO-C enables the upscaling of regional efforts to the global level, and serves as an important advocate for the use of Earth observations in the fight against climate change.

In early 2018 a GEO-C Steering Committee was established to support the implementation of the Paris Agreement. The Committee includes high-level representation from Japan, the European Commission, GCOS, WMO, UNFCCC, CEOS, IPCC and the Integrated Carbon Observation System (ICOS).

A Secretariat, hosted by ICOS, has been established to support the work of the Steering Committee, and to undertake important tasks including mapping the carbon observations landscape, and to support planning, outreach and communication efforts.





→ Copernicus GEO Initiative powers air quality alert applications

The Copernicus Atmosphere Monitoring Service (CAMS) is a GEO Community Activity that provides consistent and quality-controlled global information related to air pollution and health, solar energy, greenhouse gases and climate forcing. CAMS combines observations from satellites and from other sources with numerical models to deliver value added information about atmospheric composition and changes globally and, with refined resolution, over Europe.

In 2017, CAMS helped to expand the coverage of the Plumes Air Report - a smartphone application and website which prompts users to adapt their behavior to pollution levels - to every city in the world, by providing forecasts of the key air quality pollutants at the global scale. At the end of 2017, the Plume Air Report had been downloaded close to half million times, with 73% of users saying it has helped them make changes to avoid smog spikes in their cities.

CAMS information products have also been used in the development of the airTEXT information service. AirTEXT is a free and independent public service, currently operational in the United Kingdom and Latvia, that provides three-day air quality alerts and forecasts by SMS text message, email, voice message, and through its app twice daily.

The service provides air quality maps at street-level resolution by adding urban-scale dispersion modelling on top of CAMS information products, which are available at lower resolution. Those forecasts include key air pollutants, such as Nitrogen dioxide (NO₂), Particulates or Particulate Matter (PM₁₀) and (PM_{2.5}) and Ozone (O₃). CAMS information on ultraviolet (UV) radiation, birch and grass pollen is also provided to users.

→ Copernicus Climate Change Service Climate Data Store launched

Europe's Climate Data Store is a one-stop-shop for past, present and future climate information.

Launched by the Copernicus Climate Change Service (C3S - a GEO Community Activity) in June 2018, the Climate Data Store is an open and free cloud-based service that allows policy-makers, businesses and scientists to browse and combine online petabytes of raw data, build their own applications, maps and graphs in real time, and access a wide range of climate datasets via a searchable catalogue. It greatly improves access to climate data and tools, and is changing the way society can access and benefit from climate science.

"The Climate Data Store gives a wide range of users easy access to good quality climate data in one place, and offers tools that will ultimately lead to better use of the data"

Dick Dee
Deputy Head of the Copernicus Climate Change Service, ECMWF

Available datasets include observations, historical climate data records, estimates of Essential Climate Variables derived from Earth observations, global and regional climate reanalyses of past observations, seasonal forecasts and climate projections.

The Climate Data Store includes a toolbox that enables users to analyze, monitor and predict changes in climate drivers – such as surface temperature and soil moisture – and their impact on business sectors including energy, water management or tourism. Users can access these tools to develop their own applications online.

cds.climate.copernicus.eu

→ C3S Monthly Climate Bulletins and CAMS daily air quality bulletin on Euronews

C3S's climate bulletin and CAMS air quality forecasts have been broadcast monthly and daily (respectively) on Euronews since December 2017.

C3S's Climate Bulletin provides an overview of the climate system over the previous month and continuous monitoring of key climate indicators (e.g. surface air temperature), while CAMS air quality forecasts provide daily information on air quality in the form of the European Air Quality index, ranging from 1 (good) to 5 (very bad), and considers forecasted concentrations from the main air pollutants, including ozone, NO₂ and fine particulate matter.

Euronews estimates that these programmes have been seen by 18 million viewers during the first quarter of 2018 alone.

→ European State of the Climate 2017

The first [European State of the Climate 2017](#) was compiled by C3S, CAMS, and the Copernicus Services at the European Centre for Medium-Range Weather Forecasts (ECMWF). The report covers two main themes: the climate in 2017 and Headline Climate Indicators.



#EO4DRR

GEO AND THE SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION

The United Nations Sendai Framework for Disaster Risk Reduction commits governments to create and implement national and local disaster risk reduction strategies. These strategies aim to substantially reduce the impact of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural, and environmental assets of individuals, businesses, communities and countries. Open Earth observation data and information are a major component in the reduction of disaster risk.

→ GEO and Earth observations included in Sendai Framework Data Readiness Review

Government agencies need a consistent methodology to use Earth observations in their disaster risk management plans and processes. GEO's work in support of the Sendai Framework is focused on supporting countries to incorporate Earth observations into their national disaster risk reduction strategies.

The 2017 United Nations Office for Disaster Risk Reduction (UNISDR) Sendai Framework Data Readiness Review assesses the readiness of countries to report against the targets of the Sendai Framework. Produced with input from the GEO community, the Review highlights the role that disaster-related Earth observations have in the reduction of disaster risk, and the value that Earth observation derived monitoring and methodologies have within the Sendai Framework.

“Providing a historical record of changes to the Earth – such as land use change, flood, drought and other aspects of disaster – Earth observations can be combined with demographic, statistical, and other data, to support data-driven decision-making and action across government institutions and programmes.”

Sendai Framework Data Readiness Review 2017

→ Engagement strengthened with United Nations Office for Disaster Risk Reduction

The development and strengthening of the strategic relationship between GEO and UNISDR has been a key focus for the GEO Secretariat over the last year.

In addition to the inclusion of language relating to Earth observations and GEO in the Sendai Framework Data Readiness Review, UNISDR representatives have expressed their Sendai-related requirements from GEO activities and invited GEO's Secretariat Director to participate on the Global Assessment Report (GAR) Advisory Board.

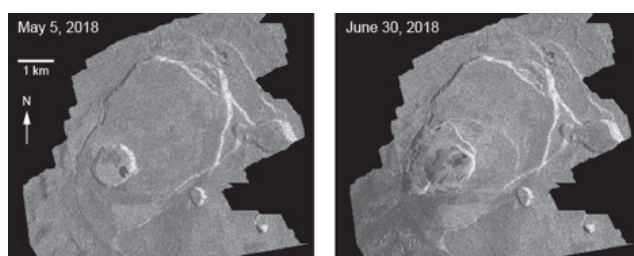
Published every two years, the GAR is a flagship UNISDR publication that includes a comprehensive review and analysis of disaster risk management globally. The Advisory Board sets the direction and content of the report, which details the progress made by countries on the implementation of the Sendai Framework.

→ GEO Initiative supports emergency response during the 2018 Kilauea eruption, Hawaii

GEO's Geohazard Supersites and Natural Laboratories (GSNL) Initiative supports geophysical scientific research and assessment to reduce risk from geological hazards. GSNL's seismic, volcanic and multi-hazard Supersites provide state of the art scientific information for geohazard assessment to local stakeholders.

From May to August 2018, the Hawaii GSNL Supersite made significant contributions to disaster response when the Kilauea Volcano experienced a summit collapse and erupted lava in the populated lower Puna district of the Island of Hawaii. Over 700 homes were destroyed by the ensuing lava flow. Although surface deformation, as revealed by radar interferometry and ground-based GPS stations, was severe in early May as many eruptive fissures opened, data provided via GSNL showed no surface deformation after late May, suggesting that no new eruptive fissures would form. This was of crucial importance to the Hawaiian Volcano Observatory, which was tasked with monitoring the eruption, and Hawaii County Civil Defense, which is responsible for emergency response operations.

In the months and years to come, the data collected by international space agencies and the Hawaiian Volcano Observatory and partners will be extensively exploited to better understand the unprecedented eruptive event at Kilauea. The results of those studies will be used to improve assessment of volcanic hazards around the world.



Cosmo-SkyMed data from Kilauea Volcano were provided by the Italian Space Agency to the Hawaii Supersite within hours of acquisition, and were invaluable in guiding hazard assessment by the Hawaiian Volcano Observatory. Data from the volcano's summit caldera on May 5 (left) and June 30 (right) illustrate the dramatic changes to the landscape which are ongoing at the volcano.



Image: NASA Earth Observatory

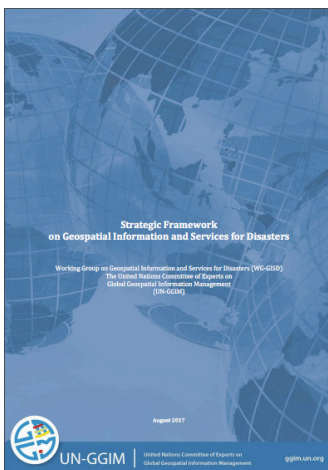


→ GEO contributes to UN Resolution on Geospatial Information and Services for Disasters

Earth observation data is readily available at the time of a crisis through a variety of channels, including the International Charter Space and Major Disasters, global platform providers, and through Volunteered Geographic Information. The accessibility and use of geospatial information from authoritative sources ensures that decision makers and other stakeholders get an accurate common operational picture of critical scenarios before, during, and after disasters.

GEO worked closely with UN-GGIM and its Member States to provide input to the UN Resolution on Geospatial Information and Services for Disasters, which was adopted by the UN Economic and Social Council in July 2018. The Resolution guides stakeholders in the management of geospatial information and services through better governance and policies, awareness raising and capacity building, data management, common infrastructure and services, and resource mobilization.

GEO also contributed to the updated 2018 Strategic Framework on Geospatial Information and Services for Disasters, providing information on Earth observation requirements and use cases to the UN-GGIM Working Group on Disasters, in close collaboration with UNISDR.



→ AOGEOSS facilitates global data sharing for disaster response

Under the coordination of AOGEOSS, GEO's regional Initiative in Asia-Oceania, a new mode of international disaster emergency cooperation is gradually being established. This data sharing for disasters is expected to become an important supplement for other international disaster cooperation mechanisms, and has already proven valuable in several cases over the last few years.

In 2017, over 126 Gigabytes (GB) of data collected from eight satellites operated by AOGEOSS countries was shared with Mexico during the Central Mexico earthquake to assist with disaster response and recovery. Previously, over 120GB of data was rapidly shared with New Zealand, Australia and other countries affected by the 2017 New Zealand earthquake.



TARGETED SOLUTIONS WHERE THEY MATTER

NATIONAL AND REGIONAL IMPACT

→ Early warning for crop failure enhances livelihood and food security in Uganda

As the backbone of Uganda's economy, agricultural employs over 60% of the population and contributes to over 70% of the country's export earnings. By May 2017 widespread crop failure was evident in Uganda, as drought caused crop conditions to drop below critical thresholds. By August, poor production was confirmed by GEO's Global Agricultural Monitoring Initiative (GEOGLAM) Crop Monitor for Early Warning.

While crop failure can have devastating impacts on farmers' livelihoods and on food security, early warning gives governments time to mitigate loss and damage. In Uganda, satellite data from the GEOGLAM indicated impending crop failure and triggered the country's Disaster Risk Financing fund. This fund provided US\$4 million to support 31,386 households (roughly 150,000 people) during the crisis.

"In the past we always reacted to crop failure, spending billions of shillings to provide food aid. 2017 was the first time we acted proactively because we had clear evidence from satellite data very early in the season."

Martin Owor
Commissioner, Prime Minister of Uganda

This wasn't the first time early warning proved vital for Uganda's capacity to prevent a disaster. In 2013, an Earth observation-based report led to an immediate decision to provide food aid. Prior to this, decisions were based on time-consuming field assessments.

Leveraging GEOGLAM's tools and expertise, Uganda now runs a national crop monitor, and publishes its reports as part of the Uganda National Integrated Early Warning System (U-NIEWS) bulletin.

Without open satellite data, the high cost to collect near-real-time data and information would be a massive barrier to mitigate climate risks in Uganda and other at-risk countries. Open data and analyses from the GEO community reduces this barrier, by ensuring that all countries, organizations and individuals have access to the data and information they need.

As the value of crop monitor systems become clear, with success stories from Uganda and beyond, more countries are adopting them to mitigate agricultural risk.

**This story was originally published in 'Satellites and Climate Change: Acting Together' (2018)*



→ Africa Regional Data Cube lays groundwork for first continental-scale access to analysis ready data

Launched in March 2018, the Africa Regional Data Cube is a tool that harnesses the latest Earth observation and satellite technology to help Kenya, Senegal, Sierra Leone, Ghana, and Tanzania address food security, as well as issues relating to agriculture, deforestation, and water access.

The Africa Regional Data Cube was developed by CEOS in partnership with the Global Partnership for Sustainable Development Data (GPSDD), GEO, Amazon Web Services, Strathmore University and the Government of Kenya.

In addition to helping convene and communicate activities around the Africa Regional Data Cube, GEO is now working with these partners and others, including the World Economic Forum, the Government of South Africa, and the Government of Australia, to scale up this project to the whole of Africa. The project, Digital Earth Africa, will improve understanding of Africa's changing landscape, providing much-needed insights, knowledge and analysis ready data (ARD) for more informed, strategic and inclusive decision-making across the continent.

→ Kenya's first national crop monitor set to strengthen food security

Kenya's Ministry of Agriculture, Irrigation, Livestock and Fisheries has issued the country's first national crop monitor, with support from NASA SERVIR, Regional Center for Mapping of Resources for Development (RCMRD), and GEOGLAM. Information on crop conditions from across Kenya was made publically available in the [first edition of the crop monitor](#) in May 2018.





→ **GEO-CRADLE launches Regional Tools for Soil Spectroscopy and climate data access**

A [Regional Soil Spectral Library \(SSL\)](#) for North Africa, the Middle East and the Balkans has been developed as part of the [GEO-CRADLE](#) pilot project 'Improved Food Security - Water Extremes Management'.

Healthy soils provide essential services such as food production, prevention of land degradation, water quality, and they act as carbon sinks. Monitoring of soil quality and soil properties is necessary to ensure these benefits are realized. One of the most important technologies used to monitor soils is soil spectroscopy, which uses the spectral information of soil samples to derive their properties, including soil degradation, moisture content, chemistry composition, pedogenesis, geochemistry, physics, microbiology, mineralogy, mining and more. The Regional Soil Spectral Library enables researchers and decision makers to explore a regional soil spectral dataset that contains metadata on the soils sampled, their key properties, and their spectral signature.

As part of the GEO-CRADLE 'Adaptation to Climate Change' pilot project, the [Data Extraction Application for Regional Climate \(DEAR-Clima\)](#) was developed. DEAR-Clima is an interactive web application tool that visualizes and provides time series of essential climate variables and climate indices based on high horizontal resolution Regional Climate Model (RCM) simulations from the Coordinated Regional Downscaling Experiment (CORDEX) research programme. Open, reliable and user friendly access to future climate change data from high resolution RCM projections is essential to support decision makers, stakeholders, intermediary users and end-users for climate change mitigation and adaptation.

→ **Fourth Regional GEO Initiative launched in Europe: EuroGEOSS**

Joining GEO's regional Initiatives AmeriGEOSS, AfriGEOSS and AOGEOSS, EuroGEOSS was launched during GEO Week 2017 by the European countries, the European Commission and GEO's European participating organizations.

EuroGEOSS is the European component of GEOSS, with Copernicus as a major element. It is application-oriented, serving as an umbrella for existing Earth observation initiatives and projects. A key element for this regional work is the transition from a data-centric approach to a user-driven one.

EuroGEOSS is promoting incubation and scaling-up of the most promising user-oriented Earth observation services and applications at the national and European levels. Particular emphasis is placed on tackling the 'last mile' of the innovation process, enabling pre-operational services that can support other GEO Initiatives and Flagships.

EuroGEOSS activities target regional, national and local level government decision-makers, citizens, researchers, scientists and commercial sector companies.



→ **AOGEOSS pilot study assesses impacts from changes to the Mekong River Basin**

An ongoing AOGEOSS pilot study is using satellite data and in situ measurements to address issues related to disaster monitoring, climate change and sustainable development in the Mekong river basin. As part of AOGEOSS efforts to strengthen the regional use of planetary data for sustainable development, this pilot is demonstrating the value and impact of Earth observations in the region.

The Mekong river originates from the Tibetan Plateau and runs through China, Myanmar, Laos, Thailand, Cambodia, and Viet Nam. Human activities and climate change are primary causes of environmental changes in the river, with impacts on water management, agriculture, flooding, energy, health, biodiversity, environmental pollution and transportation.

As part of the pilot study, AOGEOSS co-lead countries Australia, China, Japan, and the Republic of Korea are working together to share data and technical resources in order to assess the societal impact from changes to the river system. Satellite remote sensing data is being provided, including low/medium resolution data to cover the entire river basin, and high resolution data for specific areas of interest, including Luang Prabang Province (Lao People's Democratic Republic), Tonlé Sap Lake (Cambodia), and the Mekong Delta of Viet Nam.

Findings from this and future case studies conducted through AOGEOSS will be used to prepare analyses and action plans that can help address priority issues in the region.



→ **GEOARC supports public decision making in Asia and beyond**

In 2017, GEOARC published several thematic 'Global Ecosystems and Environment Observation and Analysis Annual Reports' and corresponding data sets. GEOARC's series of annual reports support public decision making and promote the use of international standards and methods for data and information sharing.

The GEOARC report on China's 'Belt and Road Initiative Ecological and Environment Conditions' looks at ten terrestrial regions and twelve ocean regions, and provides a comprehensive analysis of the terrestrial ecosystems, ecological environment and development conditions of critical urban areas, road connectivity conditions, the status of terrestrial solar energy resources, land water budgets, and marine disasters in key ocean areas.

The 'Impacts of Global Natural Disasters on Vegetation' report evaluates the impacts of major disasters (drought, flood, forest fire and earthquake) on terrestrial vegetation over the past 30 years, analyzing spatial distribution characteristics, occurrence frequency and influence of all selected disaster events.

Find these and other GEOARC reports at:
www.chinageoss.org/geoarc/en

BRIDGING GAPS FOR WORLDWIDE IMPACT

COORDINATING GLOBAL OBSERVING SYSTEMS

→ GEO Wetlands Community Portal now online

GEO Wetlands strengthens capabilities for mapping, monitoring and stocktaking of wetlands globally to support sustainable management of these fragile ecosystems – from local ponds to global governance.

The new GEO Wetlands Community Portal is the pilot for a global wetland observation system being developed in support of the Ramsar Convention on Wetlands and other global frameworks. It builds on developments within the Satellite-based Wetland Observation Service (SWOS) European Union Horizon 2020 project, and will become a core part of the forthcoming GEO-Wetlands knowledge hub.

The portal is designed to support wetland-related decision making at all levels, and to facilitate SDG monitoring and reporting processes. The portal provides guidelines and user stories to highlight the uses of Earth observations for wetland mapping and monitoring. It contains maps and results from projects, and allows discovery of and access to relevant satellite data.



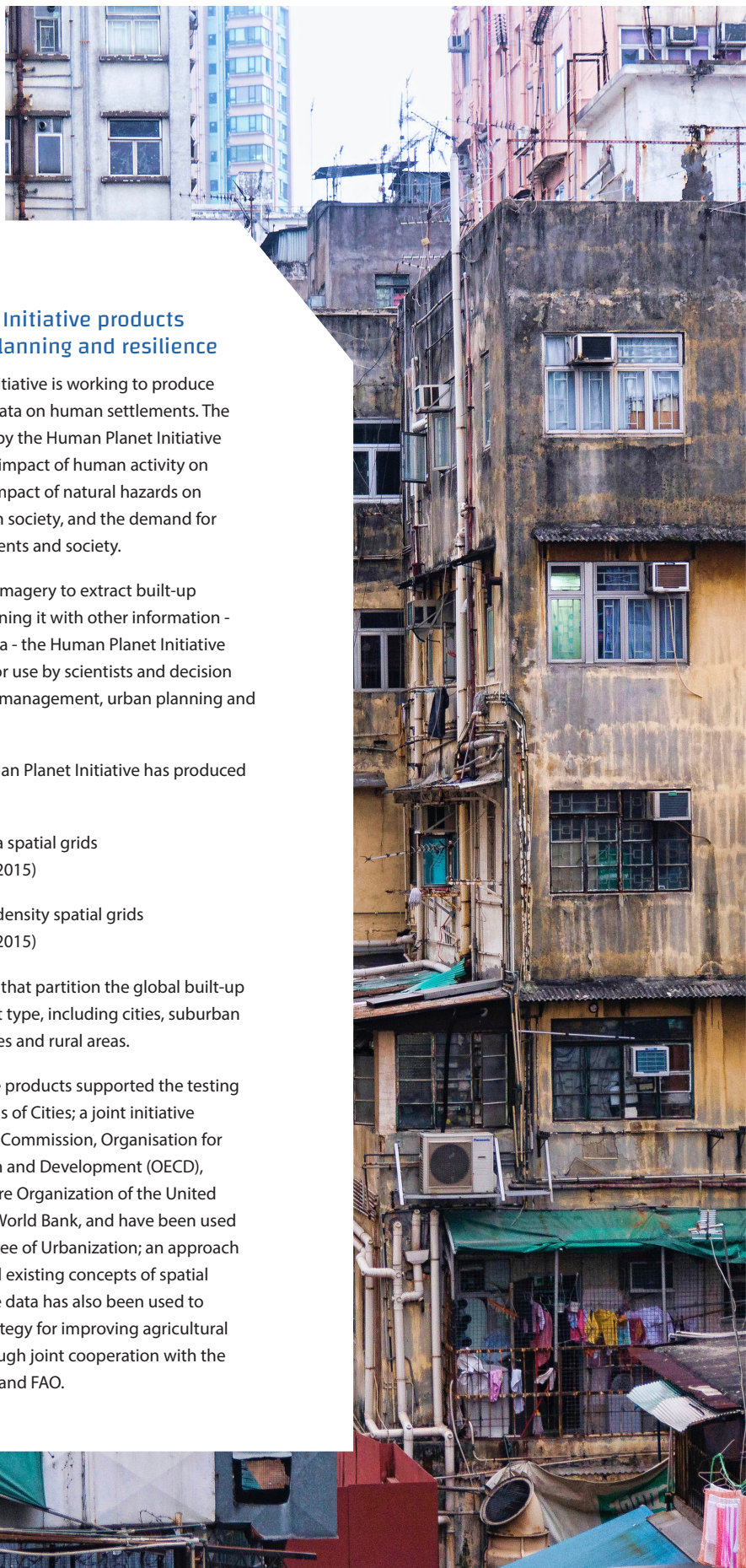
→ Global mercury monitoring for Minamata

The Global Observation System for Mercury (GOS4M), a GEO Flagship Initiative, provides monitoring data and modelling tools to support the UN Environment Global Partnership on Mercury Fate and Transport Partnership and the implementation of the Minamata Convention on Mercury.

Over the past year, GOS4M has developed a conceptual Minamata Convention Knowledge Hub. The Hub includes a variety of tools for pre- and post-processing of observational data and modeling outputs. The Hub is being designed to assist policy makers assess the fate of mercury from emission sources to terrestrial and aquatic receptors, and to evaluate the relative contributions of different natural and anthropogenic sources on total mercury entering terrestrial and aquatic ecosystems. The Hub is in testing to assess the possible link between past trends in atmospheric deposition fluxes with mercury concentrations found in top predators (i.e., fish, marine mammals and birds). The Knowledge Hub is expected to launch at the end of 2019.

In September 2017, GOS4M's director was nominated by the Presidency of the European Union as one of five Europeans to serve on an ad-hoc group of experts established at the first meeting of the Conference of the Parties to the Minamata Convention. The group will explore the need for comparable data and establish an evaluation framework. The group is now exploring a formal agreement between the GEO and Minamata Convention Secretariats to formalize GOS4M's support for the future activities of the Convention.





→ **Human Planet Initiative products facilitate urban planning and resilience**

GEO's Human Planet Initiative is working to produce global, free and open data on human settlements. The information produced by the Human Planet Initiative enables analysis of the impact of human activity on the environment, the impact of natural hazards on settlements and human society, and the demand for resources from settlements and society.

By processing satellite imagery to extract built-up information and combining it with other information - in particular census data - the Human Planet Initiative produces knowledge for use by scientists and decision makers, supports crisis management, urban planning and resilience.

In its first year, the Human Planet Initiative has produced the following products:

- Global built-up area spatial grids (1975, 1990, 2000, 2015)
- Global population density spatial grids (1975, 1990, 2000, 2015)
- Settlement models that partition the global built-up areas by settlement type, including cities, suburban areas, towns, villages and rural areas.

Human Planet Initiative products supported the testing of the Global Definitions of Cities; a joint initiative between the European Commission, Organisation for Economic Co-operation and Development (OECD), the Food and Agriculture Organization of the United Nations (FAO) and the World Bank, and have been used to define the New Degree of Urbanization; an approach for harmonizing several existing concepts of spatial population density. The data has also been used to improve the global strategy for improving agricultural and rural statistics through joint cooperation with the European Commission and FAO.



→ **GEOGLOWS Global Streamflow Forecasting Pilots**

The GEO Global Water Sustainability Initiative (GEOGLOWS) provides knowledge, data, and products that help water resource managers around the world make better decisions. By bringing together global partners to improve and test much-needed tools and resources, GEOGLOWS is contributing to global water management and disaster risk reduction.

Within the framework of GEO, experts from around the world have collaborated on an open global hydrologic information system. This system provides vital information in places where little or none exists, and fills gaps to strengthen national, regional, and local water management efforts.

GEOGLOWS partners are leveraging advances in cloud computing, physics-based modeling, data sharing standards, and data visualization that have enabled a more holistic Earth system approach to modeling the hydrologic cycle - addressing a gap that no single organization has been able to address.

As a result, GEOGLOWS has developed a practical and technical approach that translates raster information from ECMWF to forecast streamflow discharge for river networks around the world.

GEOGLOWS Global Streamflow forecasting pilots - led by researchers at Brigham Young University - have been undertaken in the Dominican Republic, Colombia, Bangladesh and Nepal, in order to assist with the analysis of past floods, forecasting of future floods and damage, as well as other water resource uses based on local needs.

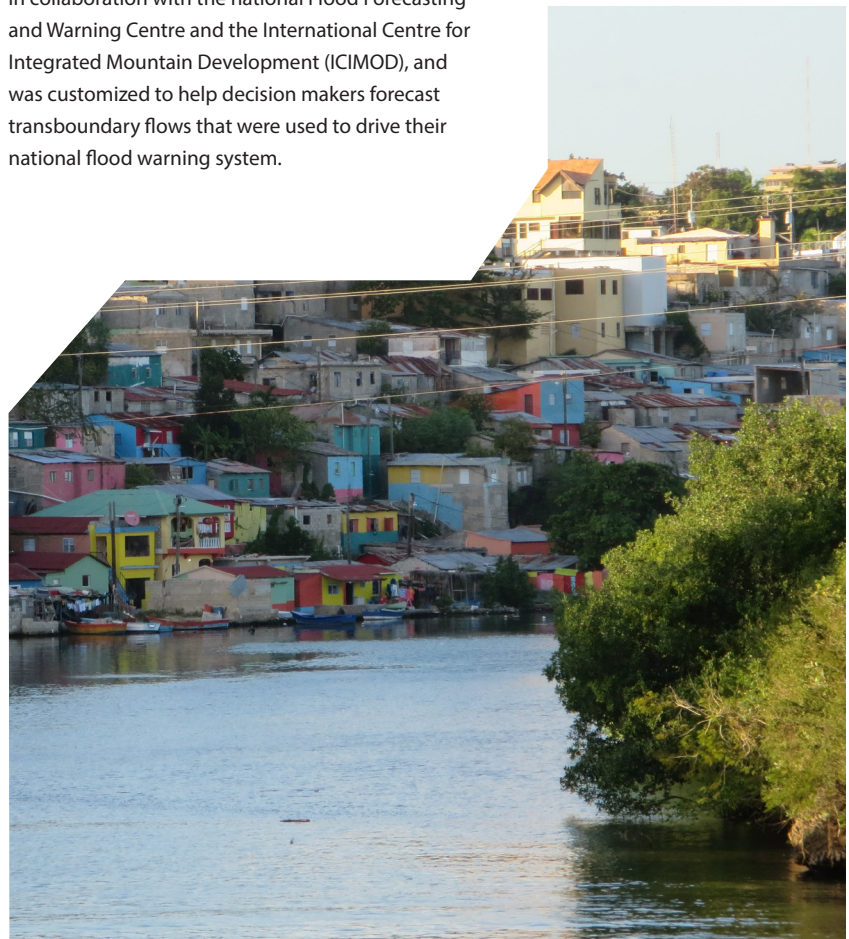
In the Dominican Republic, GEOGLOWS worked closely with the National Institute of Hydraulic Resources (INDRHI) to create customized applications for nationally-defined needs in the areas of flood protection, agricultural demand and reservoir management.

In Colombia, the customized GEOGLOWS application enables the Institute of Hydrology, Meteorology and

Environmental Studies (IDEAM) to visualize water levels and historical data from their 200+ monitoring stations, in order to both assess the ECMWF-based simulations and more accurately identify areas at risk of flooding.

In Nepal, GEOGLOWS partnered with the national Department of Hydrology and Meteorology (DHM) on a pilot application that increased capacity to identify and forecast flood events and their impact.

In Bangladesh, the pilot application was developed in collaboration with the national Flood Forecasting and Warning Centre and the International Centre for Integrated Mountain Development (ICIMOD), and was customized to help decision makers forecast transboundary flows that were used to drive their national flood warning system.



FROM DATA TO KNOWLEDGE ADVANCING GEOSS

A central part of GEO's mission is to build the Global Earth Observation System of Systems (GEOSS): a set of coordinated, independent Earth observation information and processing systems that interact and provide access to diverse information for a broad range of users in both public and commercial sectors. GEOSS links these systems to strengthen the monitoring of the state of the Earth.

GEOSS facilitates the sharing of environmental data and information collected from the large array of observing systems around the world, and ensures this data is accessible, quality checked, traceable and interoperable, in order to support the development of tools and the delivery of information services.

The GEOSS Platform, via the GEOSS Portal, offers a unique online access point for data, imagery and analytical software packages relevant to all parts of the globe. It connects users to existing databases and portals and provides reliable, up-to-date and user-friendly information – vital for the work of decision and policy makers.

→ New and Improved Features

To better serve Earth observation user communities, the GEOSS Platform has incorporated several new and customizable instruments and services over the past year. Critical components were implemented to improve user experience. A simplified procedure for registering new data systems has consolidated the resource sharing process, and the service provision for developing community applications and portals was improved. During the registration process, data providers now receive an interoperability test report that assesses their adherence to GEO's Data Sharing and Management Principles.

→ New resources

The number of new Earth observation data providers contributing to the GEOSS Platform has grown significantly each year, and now includes more than 180 brokered data catalogues from over 7000 data providers, and consists of 415 million discoverable Earth observations. In the last year alone, 23 new data catalogues have been added to the GEOSS Platform:

- Copernicus Marine Services
- Copernicus Atmosphere Monitoring Services
- UNESCO IIWQ EO Map World Water Quality
- UNESCO Water Information Network System (WINS)
- World Resource Institute (WRI) Open data
- World Bank Data Development Hub
- World Bank Global Facility for Disaster Reduction and Recovery (ThinkHazard!)
- Climate Change Centre Austria
- Sierra Nevada Global Change Observatory
- Sustainable Caucasus Catalogue
- Economic Community of West African States
- AtlantOS
- European Commission Joint Research Centre Water Data Portal
- Hydroshare
- EnviDat
- FAO GeoNetwork
- Dynamic Ecological Information Management System (DEIMS) Data Integration Portal (DIP)
- EURAC research
- World Data Centre for Soils (ISRIC)
- Healthsites.io
- China GEO
- Cyprus GEO PORTAL
- Water-Switch ON



→ Users and outreach

The GEOSS Platform team has continued to improve outreach efforts with data users and providers across the GEO community. The Platform team has strengthened linkages with GEO Flagships, Initiatives and Community Activities by leveraging new customizable components that provide data and information resources for specific user communities. The Platform has also integrated Earth observation information products and services generated by GEO activities, including GOS4M, GEO Wetlands, and AmeriGEOSS.

GEOSS is opening up to a wider spectrum of data providers and users, including decision makers from the public and the commercial sectors. The [transition from the former GEOSS Common Infrastructure \(CGI\) to a modern GEOSS Platform](#) opened the door for contributions from a range of technology and knowledge providers, including IT experts, mobile app developers and artificial intelligence specialists.

The increase in data in the Platform has coincided with a higher number of queries from multiple sectors, with notable increases in users from universities and the commercial sector. WMO was the Platform's biggest user in 2017-2018, via machine-to-machine connections.

→ 3rd GEO Data Providers Workshop drives forward global technical cooperation on data for development

The 3rd [GEO Data Providers Workshop](#) brought the GEOSS community together at the ESA headquarters in Frascati, Italy, to improve the way Earth observation data is managed, communicated, disseminated and used through the GEOSS Platform.

Building on previous editions of this event, the 3rd GEO Data Providers Workshop demonstrated the strengthening and growth of the GEOSS ecosystem. Since its launch, the workshop has doubled in size each year. Over 200 participants from more than 130 organizations, 33 countries, and 5 continents attended the 2018 Workshop.

→ China and Japan release millions of satellite data resources through GEOSS

Over the course of 2017, China progressively opened up their Earth observations resources through the GEOSS Platform. Initially linking 200,000 metadata resources as a precursor to connecting more than 1 million datasets, this data release was achieved in part through the open data policy work done by the GEO Secretariat and engagement with international data providers.

The 2018 opening of the Japanese open data catalogue, with over 40 million open Earth observations resources, was another major advance for GEOSS. These resources will be registered to the GEOSS Platform by the end of 2018.



3rd GEO Data Providers Workshop, ESRIN (ESA), Frascati, Italy / Photo: ESA

Acronyms

ARD	Analysis ready data
C3S	Copernicus Climate Change Service
CAMS	Copernicus Atmosphere Monitoring Service
CBD	Convention on Biological Diversity
CEOS	Committee on Earth Observation Satellites
CORDEX	Coordinated Regional Downscaling Experiment
DEAR-Clima	Data Extraction Application for Regional Climate
DHM	Department of Hydrology and Meteorology (Nepal)
ECMWF	European Centre for Medium-Range Weather Forecasts
EO4SDG	Earth Observations for the Sustainable Development Goals
ESA	European Space Agency
FAO	Food and Agriculture Organization of the United Nations
GAR	UNISDR Global Assessment Report
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GEOARC	Global Ecosystems and Environment Observation Analysis Report Cooperation
GEO-C	GEO Carbon and GHG Initiative
GEO-CRADLE	Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS
GEOGLOWS	GEO Global Water Sustainability Initiative
GEOSS	Global Earth Observation System of Systems
GHG	Greenhouse Gas
GFOI	Global Forest Observations Initiative
GOS4M	Global Observation System for Mercury
GPSDD	Global Partnership for Sustainable Development Data
GSNL	Global Supersites and Natural Laboratories
ICIMOD	International Centre for Integrated Mountain Development
ICOS	Integrated Carbon Observation System
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies (Colombia)
INDRHI	National Institute of Hydraulic Resources (Dominican Republic)
IUCN	International Union for the Conservation of Nature
IWMI	Integrated Water Management Institute
JRC	European Commission Joint Research Centre
LDN	Land Degradation Neutrality
OECD	Organisation for Economic Co-operation and Development
RESTEC	Remote Sensing Technology Center of Japan
RCM	Regional Climate Model
RCMRD	Regional Center for Mapping of Resources for Development
SDGs	Sustainable Development Goals
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management
UNISDR	United Nations Office for Disaster Risk Reduction
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WRI	World Resources Institute



www.earthobservations.org

www.geoportal.org