

GEO Virtual Symposium 2022: 2-5 May 2022

Earth observation (EO) is the collecting of information about the Earth’s atmospheric, oceanic, and terrestrial systems, including changes to these systems over time. EO data provide essential information to policy and decision makers, enabling them to understand the issues they are dealing with and make appropriate and informed decisions. To facilitate and help ensure this information is effectively channeled to policy and decision makers, an intergovernmental partnership of more than 100 countries plus the European Commission, the Group on Earth Observations (GEO) promotes extensive use of EO data, information, and knowledge for research, policy, decisions, and action.

This specific conference, the GEO Virtual Symposium 2022, focused principally on the themes, priorities, and issues that will be reflected in the next GEO Work Programme (GWP) for 2023-2025. The next GWP is expected to be debated and approved by the by GEO’s main decision-making body, the GEO Plenary, at its November 2022 meeting. This will, by extension, set the stage for the next generation GEO, namely GEO post-2025.

In this vein, the Symposium considered a report mapping GEO engagement during the current GWP and resulting recommendations. Participants discussed how to improve policy relevance in the next GWP. They also explored the implications for the GWP of the adoption by the 2021 Plenary of a new engagement priority—Resilient Cities and Human Settlements.

In addition, the Symposium hosted a consultation on the ongoing review of the continued relevance of a concept long held to be central to the GEO’s work, the Global Earth Observation System of Systems (GEOSS). Participants discussed how to promote the principles of open data and open science in the GWP, as well as explored ways to promote greater inclusivity and diversity in GWP activities. Finally, the Symposium examined ways to deliver on a theme that will be central in the next GWP, namely translating global action into local impact.

The Symposium also provided concrete examples of the ways in which EO products and services can provide insights and evidence for policy development and decision making. For example, one session examined how several diverse EO projects might contribute to an integrated approach to environmental and socioeconomic issues in one subnational region, a lake basin in Cambodia. Another session illustrated the variety of EO projects being developed to tackle related policy and planning themes,

namely integrated coastal zone management (ICZM) and marine spatial planning (MSP). A third focused narrowly on how EO products can help a single country, Jamaica, improve its disaster risk management.

The symposium took place virtually from 2-5 May 2022.

A Brief History of GEO

GEO is a voluntary partnership consisting of Members, Participating Organizations, and Associates that are coordinating efforts to build the GEOSS. As a “system of systems,” GEOSS seeks to link existing and planned observing systems around the world and support the development of new systems where gaps currently exist, with a view to providing key data to assist policy developers and decision makers. GEO was established

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during the Third Earth Observation Summit, which took place on 16 February 2005 in Brussels, Belgium. In a resolution, almost 60 countries endorsed the 2005-2015 GEOSS 10-Year Implementation Plan and established the intergovernmental GEO to implement it.

GEO's governance structure consists of:

- the Plenary, GEO's highest and primary decision-making body, which meets annually;
- the Executive Committee that guides GEO between Plenary sessions; and
- the GEO Programme Board, which guides the GWP.

The GEO Secretariat, based in Geneva, Switzerland, executes the decisions of GEO's governing bodies and supports the work of the GEO community. The GEO Plenary has been meeting annually since 2005.

GEO Members include the European Commission and any UN Member State that formally endorses the GEO Strategic Plan 2016-2025: Implementing GEOSS. Participating Organizations are intergovernmental, international, and regional organizations with a mandate in EO or related activities who have formally endorsed the GEOSS 10-Year Implementation Plan and been approved by the GEO Plenary. GEO Associates are commercial organizations and national associations of commercial firms, as well as non-governmental and civil society organizations with EO-related mandates. GEO Associates must be registered in the territory of a GEO Member and be approved by the GEO Plenary. Currently, GEO consists of 113 Members, 140 Participating Organizations, and 19 Associates.

Since 2016, GEO's priority engagement areas have included the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs), the Paris Agreement on climate change, and the Sendai Framework for Disaster Risk Reduction (DRR). In 2021 the Plenary added Resilient Cities and Human Settlements as a fourth engagement priority.

Summary of the GEO Virtual Symposium 2022

Anthony Milne, Co-Chair, GEO Programme Board, opened the Symposium on Monday, 5 May 2022, noting this is an important and challenging time for GEO, as:

- the GEOSS concept is under review and the 2023-2025 GWP is being formulated; and
- the nature and practice of EO is rapidly changing and the geospatial community now encompasses many more disciplines than the geophysical and engineering sciences, which have traditionally served EO.

He expressed hope the Symposium would foster dialogue among GEO stakeholders and participants, promote the sharing of good practice and lessons learned, and provide insights that can be used in the next GWP.

Yana Gevorgyan, Director, GEO Secretariat, called for considering at least four aspects in the next GWP, namely:

- improving the speed of transitioning from research to operations;
- ensuring the policy and decision relevance of GEO work;
- accelerating efforts to reach end users, that is, policy and decision makers; and



Anthony Milne, Co-Chair, GEO Programme Board

- informing action and delivering environmental and socioeconomic impact, as well as communicating the story of that impact.

Babatunde Abidoye, Global Policy Advisor, UN Development Programme (UNDP), urged GEO to diagnose what geospatial products can best identify the policy solutions that are actionable at the national and local levels, and, consequently, can help realize the 2030 Agenda and the SDGs. When asked about the challenges of integration across thematic areas in projects globally at UNDP, Abidoye responded that financial mechanisms are not set up to enable such integration.

EO in Support of Integrated Coastal Zone Management and Marine Spatial Planning

Kwame Adu Agyekum, GEO Blue Planet, chaired this session on Monday exploring how EO can support ICZM and MSP, through reviewing the concepts and policy drivers, surveying available tools, and understanding user requirement inputs.

ICZM/MSP (What Is It, Why is It Needed?): Michele Quesada da Silva, Intergovernmental Oceanographic Commission (IOC) of the UN Educational, Scientific and Cultural Organization (UNESCO), discussed how EO can support MSP. She explained MSP is a multisectoral and participatory process that helps, among other things:

- protect the environment by identifying cumulative impacts and priority areas for conservation;



Yana Gevorgyan, Director, GEO Secretariat



Michele Quesada da Silva, IOC UNESCO

- increase predictability for enterprises and de-risk investment by identifying priority areas for development; and
- reduce conflicts and create synergies among users.

She introduced the [MSProadmap](#), explaining it was established to accelerate MSP processes worldwide and highlighted [MSPglobal](#), which is designed to support implementation of the MSProadmap. Da Silva said the main output of MSPglobal is the development of new international guidelines on MSP.

Da Silva underlined that MSP is more than a plan—it is a process and countries need to understand and “set the scene” for adopting MSP before starting the process. She highlighted the important role of EO, including in monitoring and evaluating the process.

Željka Škaričić, Director, UN Environment Programme (UNEP) Mediterranean Action Plan Priority Actions Programme/Regional Activity Centre (PAP/RAC), presented the Barcelona Convention’s Protocol on ICZM in the Mediterranean (ICZM Protocol), which aims to, *inter alia*, use ecosystem-based management to ensure sustainable development and the integrity of the coastal zone, its ecosystems, and related services and landscapes. She highlighted the Protocol aims to promote good governance and an adaptive management approach. Škaričić underlined the Protocol’s focus on integration, including sectoral (horizontal), administrative (vertical), and geographical integration. She also highlighted the need for political support to ensure the Protocol’s success and welcomed further with GEO.

National/Regional Coordination: Suhaib bin Farhan, Space and Upper Atmosphere Research Commission, Pakistan, described the use of integrated space technology applications for ICZM in Pakistan. He described how applications for satellite remote sensing, global navigation satellite systems, near surface remote sensing, and in situ data collection are used to monitor sea water intrusion, coastal erosion, land subsidence, and mangroves along the coast of Pakistan.

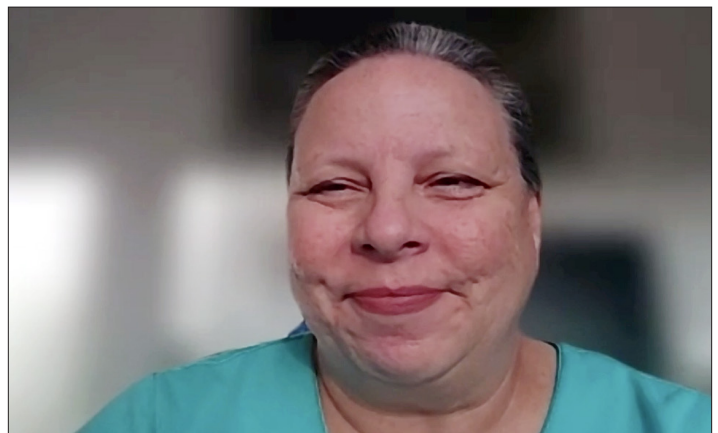
Farhan underscored that climate change is threatening coastal communities around the world. He highlighted that lessons learned from the use of space technology applications may be useful to other coastal regions in implementing ICZM. He underlined GEO can play an important role through sharing EO data, models, and techniques, and organizing necessary training sessions.

Available Tools for ICZM/MSP – Utility? Mamadou Lamine Ndiaye, Digital Earth Africa (DE Africa), presented on a DE Africa project called Coastlines, which is a modified implementation of Digital Earth Australia Coastlines, that combines satellite data with tidal modelling to map the typical location of the coastline at mean sea level for each year. He explained DE Africa Coastlines is mapping the West African coastline to visualize and calculate rates of coastal erosion and accretion.

Roger Sayre, US Geological Survey (USGS), described a collaboration between USGS, the Marine Biodiversity Observation Network, and ESRI to characterize diversity in coastal ecological settings worldwide, and provide easy web access to resulting datasets. He explained the collaboration developed a global shoreline map, broke it down into one-kilometer segments, attributed each segment with ecological setting variables, classified them into “coastal segment units” (CSUs), and clustered the CSUs into 16 globally similar ecological coastal units. He said the resulting database is available through an easy-to-use online web browser, and can be used for different applications, including ecosystem-based MSP, ICZM, conservation planning, and ecosystem accounting.

Nikelene Mclean, GEO Blue Planet, presented the [Wave-driven Flood-forecasting on Reef-lined Coasts Early warning system \(WaveForce\)](#). She explained the project aims to use EO data to provide early warning (7.5 days in advance) forecasts of wave-driven flood events for reef-lined coasts, updated every three hours. She suggested it could be useful for ICZM, putting resilience measures in place, and evacuation planning. She also mentioned GEO Blue Planet plans to work on coastline mapping to assess/monitor change over time and to explore EO potential for near-shore aquaculture site selection.

Merrie Beth Neeley, Program Manager, Committee on EO Satellites (CEOS) Coastal Observations and Applications Study Team (COAST), presented on COAST pilot projects to develop coastal products, services and tools covering: shoreline mapping; bathymetry; flooding inundation; turbidity and sediment loading; and coastal eutrophication. She said pilot projects have been launched for the Chesapeake Bay, the Bay of Bengal, the west coast of Africa, the Rio de la Plata basin, the Marshall Islands, and the US Virgin Islands.



Merrie Beth Neeley, CEOS COAST



Ana Maria Ribeiro de Sousa, EEA



Kenneth Kasera, RCMRD

Meeting User Needs: Ana Maria Ribeiro de Sousa, European Environment Agency (EEA), and Andrea Taramelli, Italy, discussed the “Copernicus Services for ICZM,” from the point of view of the producer and user. She explained Copernicus is the European Union’s EO programme and offers information services that draw from satellite EO and in situ data. De Sousa, representing the producer, noted Copernicus provides an operational system to support ICZM, and asked Taramelli whether Copernicus products meet their needs as the user.

Taramelli responded that the [Copernicus Land Monitoring Service](#) meets some user requirements, but gaps still remain, particularly with regard to coastal areas. He highlighted the “Roadmap for the evolution of Copernicus marine and land services to better serve coastal users,” and the need for continued engagement with service end users.

In the subsequent discussion, participants considered how ICZM tools are being developed and the data is being used. They discussed what ideas can be adapted in developing ICZM tools for use in various regions.

From Global Action to Local Impact: How Do We Do That?

Allison Craddock, Co-Chair, GEO Capacity Development Working Group, chaired this session on Monday. Participants addressed the relevance of an impact approach for GWP activities, shared good practices on impact design and monitoring, and explored opportunities to strengthen and maximize the impact approach within GEO.

Setting the Floor: After explaining the objectives and terminology used in impact design and monitoring, Joost Teuben, GEO Secretariat, outlined the stages that could be applied to the co-design of GEO projects, including:

- defining the needs of the target audience and outcomes desired;
- defining strategic pathways (inputs, activities, outputs) contributing to the achievement of outcomes and expected impact;
- identifying the enabling conditions needed at the organizational level for the uptake of outputs; and
- collecting evidence about whether the expected outcomes and desired impacts are being realized or, if not, determining where the results chain is breaking down.

Presentations of Concrete Impact Approaches: Kenneth Kasera, Regional Centre for Mapping of Resources for Development (RCMRD), described efforts to improve user engagement in RCMRD’s SERVIR Eastern and Southern Africa project. He explained SERVIR seeks to improve the capacity of national and regional institutions to apply geospatial technologies to improve climate resilience and adaptation and promote the SDGs, with a focus on four areas: land use; water and related disasters; agriculture and food security; and weather and climate. Kasera said RCMRD employs a service planning framework in SERVIR with four elements: consultation and needs assessment; stakeholder mapping; service design; and monitoring, evaluation, and learning.

Mark Noort, Director, HCP International, presented on the user engagement and impact of two projects: the Enhancing Food Security in African Agricultural Systems with the Support of Remote Sensing (AfriCultuReS); and Transforming Water, Weather, and Climate Information through In Situ observations for Geo-Services in Africa (TWIGA). He outlined that AfriCultuReS provides services on climate, crops, drought, livestock, water, and weather, and is currently hosting pilots in several African countries. He described some TWIGA services, such as using sensors to detect waste in rivers in urban environments to prevent floods. Noort highlighted examples of user engagement under both projects, such as the use of drones and smart phones for local crop monitoring, and closer collaboration with DE Africa.

Titus Letaapo, Sarara Foundation, Kenya, discussed the Namunyak App to support Kenya’s Samburu community to participate and contribute to decision-making processes regarding their lands, noting the application is still in the design stage. He highlighted some of the challenges facing the Samburu community, such as lack of EO data and tools, and limited access to expertise on mapping.

Letaapo said the app is being developed to help overcome these challenges and will, for instance, rely on the use of simple symbols and voice messages, as most people in the community have very old mobile phones. He outlined steps in the app co-design process, such as meeting with Samburu elders to approve the project and weekly meetings with the symbols app team to co-design the app.



Wenjiang Huang, Aerospace Research Information Centre, Chinese Academy of Sciences

Wenjiang Huang, Aerospace Research Information Centre, Chinese Academy of Sciences, presented the “Global Crop Pest and Disease Monitoring and Forecasting” project, which aims to improve the use of EO data for monitoring and forecasting of pests and diseases. He provided examples of user engagement under the project, including:

- warnings issued by the Food and Agriculture Organization of the UN to high-risk countries to guide global crop protection;
- use of pests and diseases map by Pakistani technicians and prevention staff to conduct precision control; and
- use by the Centre for Agriculture and Bioscience International to forecast risk of pests and diseases in specific areas to maximize biopesticide use.

Panel Discussion: Kenneth Mubea, DE Africa, and Catherine Nakalembe, University of Maryland, US, joined Kasera, Letaapo and Noort in a panel discussion moderated by Craddock. The panel agreed that:

- while describing what impact planning should be like is easy, putting it into practice is much more complex;
- the GEO Secretariat can support GEO participants in their impact planning; and
- to involve local communities in project co-design and co-development, identifying the proper entry point and taking time to fully understand their needs and challenges from the outset is key.

Towards Integrated EO Solutions in Tonlé Sap Basin, Cambodia

Megan Lewis, Co-Chair, Coordinating Board, Asia Oceania GEO (AOGEO), chaired this session on Tuesday. The session explored interactions and synergies among existing GWP activities to offer integrated EO solutions for Tonlé Sap Lake, the largest freshwater lake in Southeast Asia.

Setting the Scene: Kol Vathana, Deputy Secretary General, Cambodia National Mekong Committee, provided an overview of Tonlé Sap Lake and its ecosystem. He highlighted the vital role of EO data in enabling understanding of the lake ecosystem and developing a strategy for the sustainable development of the

Lake and the region. He outlined additional needs for the Lake region, including for more climate change risk assessments and transformative adaptation options, and for more data to support integrated solutions linking climate change, disaster risk, and sustainable development in the lake area.

Existing and Potential Projects in the Tonlé Sap Lake Region: Kumiko Tsujimoto, Okayama University, Japan, described a water-climate-agriculture integrated system adopted for use in Cambodia under the GEOSS Asian Water Cycle Initiative. She explained the system involved the use of satellite and in situ data to simulate the impact of droughts and floods on rainfed and irrigated rice production. Tsujimoto highlighted some of the research observations, such as the finding that several hydropower dams being constructed in the region are affecting river flow. She said this demonstrates the need for integration, for instance by considering energy and food production needs.

Bingfang Wu, Co-chair, GEO Global Agricultural Monitoring Initiative (GEOGLAM), presented China’s leading crop monitoring system, the [CropWatch Cloud Platform](#), and discussed how this system has been customized for use in Cambodia. He outlined that, among other things, the system has been customized to provide local language indicators, user manuals and training materials in the local language, face-to-face training and practice sessions in Cambodia, and joint field work.

Nick Souter, Conservation International (CI), outlined the various ways EO is utilized by CI in its activities in the Tonlé Sap region, for example by supporting the application of the Freshwater Health Index, a web-based tool that measures water system health through monitoring and analyzing such parameters as bank modification and land cover changes. He said EO is currently being used primarily to detect threats such as tracking deforestation and issuing wildfire alerts. Souter said CI would like to use EO to determine each community fishery’s ecological integrity using the Essential Biodiversity Variable Framework to combine on-the-ground assessments with remote sensing to model and identify important habitats, as well as assess vegetation fragmentation during flood season. He also said CI would like to use EO to support carbon stock assessments within community fisheries to identify opportunities for carbon financing.

Yongyut Trisurat, Kasetsart University, Thailand, discussed the role of EO in efforts to protect the Sarus crane, which is globally



Megan Lewis, AOGEO

listed as vulnerable but in Cambodia is listed as endangered and in Thailand is considered extinct. He said using remote sensing and spatial modeling, suitable habitats for raising the Sarus crane were found in the non-hunting zones of Thailand, and cranes recovered from Cambodia have been brought there to be protected and reproduce. Noting tracking of the crane population using GPS, he said EO will be used to monitor their habitats and any changes caused by, *inter alia*, climate change and altered floodplain.

Daniel Juhn, CI, explained that EO can enable ecosystem accounting for countries or localities on a systematic basis, rather than as a one-off assessment, to track natural assets, the services they provide, and their relationship to the economy. He highlighted the System of Environmental Economic Accounting (SEEA) framework, developed by the UN, the World Bank and others, as well as a recent “SEEA-like” analysis, using EO data, of the Pursat River Basin undertaken by CI in collaboration with the Government of Cambodia and the World Bank. Juhn reported that the analysis found the basin provides benefits worth at least USD 46 million through the provisions of water ecosystem services of flow and sediment regulation.

Panel Discussion: A panel discussion considered how the GWP can support integrated solutions, such as through: system-level solutions that can be used for multiple purposes; tools developed for the local context; EO tools for agriculture data prediction, noting farmers are mostly interested in future data; and supporting local communities to reduce their impact on natural resources while maintaining their livelihoods.

Advancing Open Data Within the GWP Through New Tools and Services

Kathy Fontaine, Earth Science Information Partners, chaired this session on Tuesday. Participants discussed the various tools and services the GEO Data Working Group (DWG) is establishing to advance the Data Sharing and Data Management Principles in GWP activities.

Key Messages of Data Analysis Survey: DWG member Helen Graves, British Geological Survey, summarized the results of the DWG survey of 2020-2022 GWP activities. She noted the challenges identified included:

- the need to develop trust-based relationships to gain access to sensitive data;
- lack of common standards and practices;
- fragmented data policies;
- limited data management capacity and resources of some providers;
- lack of open data practices/policies in some GWP activities; and
- insufficient provenance information and metadata for legacy data.

She said the GEO DWG is seeking to: promote the wider adoption of principles, standards, and practices; and engage GEO members to encourage the adoption of data management policies at the national and regional levels.

In Situ Data Strategy: Observing that GWP activities require access to essential in situ data to produce and validate their products and services and to meet end user requirements, Henrik Steen Andersen, EEA, noted the recent Programme Board decision to develop a GEO In Situ Data Strategy. He summarized Board recommendations for the strategy, namely:

- engage existing networks that coordinate in situ data within specific domains;
- identify common barriers to data sharing and propose ways to address them;
- prioritize observations needed to advance GWP activities, engaging entities best placed to provide access to key data sets; and
- focus on practical actions to increase access to data that will be most relevant for advancing the GEO engagement priorities.

He called for inputs from GEO community members about their needs and requirements, as well as any success stories they could share.

Data Sharing – Data Management Principles Success Stories: José Miguel Rubio, EEA, presented success stories of implementing the GEO Data Sharing and Data Management Principles. He said the Data Management principles include that data and metadata shall be discoverable, accessible, usable, preserved, and curated. On the Data Sharing Principles, he highlighted: open data and metadata; registration and attribution,



Kathy Fontaine, Earth Science Information Partners



Jose Miguel Rubio, EEA

if necessary; minimal restrictions when open data is not possible; and minimum time delay for making data accessible.

Rubio said the Data Sharing and Management Principles Subgroup is leading work to review and update both sets of principles to ensure they are line with current technology. He said the Subgroup's focus is on the interface with GWP activities to identify challenges and barriers to data sharing and management, look for solutions, and advocate the adoption of the principles.

Rubio then presented the Copernicus success story, noting Copernicus is fully compliant with the GEO Data Sharing Principles and has a policy of full open data. He outlined some challenges faced by the Copernicus in this regard, including national interest, technical issues, data security, copyright, and competitiveness issues. However, he noted opening of data and information has made Copernicus a global game changer in EO and will generate benefits of up to 10-20 times its cost.

He also discussed the GEO DWG's support to the International Atomic Energy Agency's [Marine Radioactivity Information System](#) to implement and overcome the challenges in implementing the Principles.

Data Sharing and Data Management Dialogue Series:

Rubio, speaking on behalf of Marie Françoise Voidrot, Open Geospatial Consortium, presented on the Data Sharing and Data Management Dialogue series. He explained the series is part of the DWG's efforts to raise awareness of the Data Sharing and Management Principles and will include webinars on specific topics, such as data life cycle and data sharing principles.

Self-assessment Tool for GEO DMP & FAIR Principles:

DWG member Lionel Ménard, MINES ParisTech, France, discussed "e-shape" which stands for "EuroGEO Showcases: Applications Powered by Europe." He explained its objectives include: developing operational EO services with and for users active in key societal sectors; and enabling long-term sustainability of pilot projects, their penetration in public and private markets, and supporting their upscaling.

Ménard then highlighted e-shape's Data Management Plan tool, which helps projects analyze their compliance with the GEO Data Management Principles, and the FAIR (findability, accessibility, interoperability, and reusability) principles.

WorldFAIR: Making Data Work for Cross-Domain Grand Challenges: Simon Hodson, Committee on Data (CODATA), International Science Council (ISC), said CODATA's mandate is

to support open science and FAIR data. He explained that, in the ISC's view, the pressing global scientific and human issues of the 21st century can only be addressed through research that works across disciplines to understand complex systems, and which uses interdisciplinary and transdisciplinary approaches to turn data into knowledge and action.

He noted while some progress has been made on the use of FAIR data principles, "we need to be more ambitious, to push the envelope" and address interoperability, by, for example, using community accepted languages, formats, and vocabularies in data and metadata. Hodson invited the GEO community to participate in this work, and in the WorldFAIR Project funded by the EU, to be launched by CODATA on 1 June 2022.

How Funders Value Data Sharing and Data Management

Plans: Konstantinos Repanas, EUROPEAN COMMISSION, stressed the Commission's commitment to open science. He said open science, open access, and FAIR datasets are starting to be some of the factors the Commission looks at when evaluating research proposals to fund.

Repanas explained that under Horizon Europe, the EU's major research and innovation funding programme until 2027, all projects must generate and update a data management plan in line with FAIR principles. He explained Horizon will encourage, but not strictly require, that funded digital projects share not just their data, but also their software, algorithms, protocols, workflows, and models. He noted progress toward more open science because of the cooperation required to tackle the COVID-19 pandemic. However, he said more action is needed to make open science the "new normal," including reforming the research assessment system to provide incentives and rewards for open science practices.

Harnessing the Power of Inclusive Voice in GEO

Justyna Nicinska, US National Oceanic and Atmospheric Administration (NOAA), chaired this session on Tuesday, highlighting how various GEO initiatives and groups have been successful in attracting a diverse set of people and contributions.

Attracting a Diverse Set of People and Contributions

- Examples from EuroGEO: Bente Lilja Bye, CEO, BLB, Norway, presented examples of how EuroGEO is achieving diversity. Highlighting the importance of co-design, she said various EuroGEO projects and initiatives, such as e-shape and



Simon Hodson, CODATA, ISC



Justyna Nicinska, NOAA



Bente Lilja Bye, CEO, BLB, Norway

NextGEOSS, use co-design by: using pilots to co-design their data hub and platform; and developing co-design methodology through a series of showcases. Bye further discussed how ordinary citizens are engaged in EO, including through: “citizen observatories,” such as [WeObserve](#), [Ground Truth 2.0](#) and [SCENT](#); and citizen science, such as [ACTION](#), which is a participatory science toolkit against pollution.

Diversity in GEO - A Regional GEO Perspective: Stuart Marsh, Nottingham Geospatial Institute, UK, presented on work undertaken by GEO’s Equality, Diversity and Inclusion Subgroup, which analyzed diversity across the four regional groups: AfriGEO, AmeriGEO, AOGEO, and EuroGEO. He said the analysis was on diversity in gender, geography, and career stage across the groups.

For AOGEO, he reported some gender balance achieved at the chair level but not for task leads. Regarding geography and career stage, he noted progress and plans for achieving greater diversity. For AfriGEO, he noted continuing gender imbalance, reinforced by: educational bias and patriarchal communities; lack of geographical representation, for instance, from southern Africa; and lack of access by early career professionals.

For EuroGEO, Marsh noted: gender balance is being addressed, mostly due to European Commission gender guidelines; problems remain with participation of Indigenous Peoples such as those in the Arctic; and regarding career stage, bias towards professionals aged 40 and over exists, but young people are participating in some European Commission projects. For AmeriGEO, regarding gender, he noted some progress has been made but that collecting data on the issue proved difficult since it had not been considered until recently. He noted progress regarding geography and career stage.

Including Women to Preserve the Mangroves of Zanzibar: Ummul-Kulthum M. Ali, DE Africa and State University of Zanzibar, Tanzania, discussed how DE Africa is helping women in Zanzibar fight the effects of climate change by protecting the island’s mangroves. She also noted the formation of a DE Africa club at her university which provides a six-week training programme. She said it has empowered 120 “youth mappers” to identify hot spot areas and help build community awareness about the value and role of mangroves. Asked by Nicinska

how GEO can best co-design projects to involve women, Ali suggested improving awareness—noting many people in her country do not know what GEO or DE Africa are—as well as trainings and more sessions periodically rather than as one-off events.

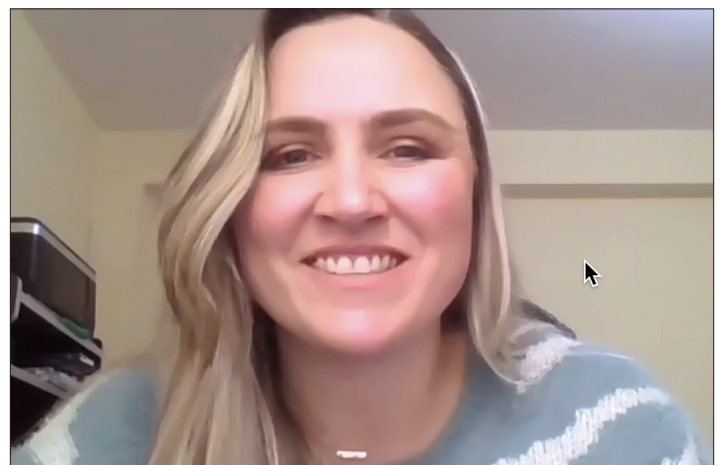
The GEO Youth Community of Practice: How to Advance GEO’s Inclusion of Young Voices: Florian Franziskakis, GEO Secretariat, provided an overview of recent GEO efforts to involve youth in GEO, including the “youth track” at GEO Week 2021, which will be replicated at GEO Week 2022. He noted work toward creating a Youth Community of Practice within GEO to:

- engage existing youth networks and establish links with GWP activities;
- create opportunities for youth in private sector EO companies to participate in GEO;
- increase the visibility of students, PhD candidates, and early career professionals at GEO events; and
- recognize contributions from young people in all areas where GEO is active and actively promote them.

Towards a National GEO: Peru Mapathon-2021: Amber Kremer, AmeriGEO, explained how a 2021 mapathon in Peru is leading to the creation of a national GEO there, bringing together regional actors from across Peru using virtual media.

The GEO Indigenous Alliance: Good Practice for Indigenous Engagement: James Rattling Leaf Sr., GEO Indigenous Alliance, discussed the Alliance, highlighting good practice for Indigenous engagement in GEO. He said the Alliance’s strategic plan is to empower Indigenous communities to access and use EO data and tools within their cultural context. He explained it focuses on: women and youth empowerment; climate action and food security; disaster risk resilience; and Indigenous data sovereignty.

Leaf outlined the Alliance’s strategic pathway which includes providing guidelines on how to engage with Indigenous communities, noting this includes promoting the Collective Benefit, Authority to Control, Responsibility, Ethics (CARE) Principles for Indigenous Data Governance. He concluded by underlining that Indigenous communities want a “seat at the table” and to be part of decision making.



Amber Kremer, AmeriGEO



Markus Konkol, University of Twente, the Netherlands



Monika Kuffer, University of Twente and EO4SDG initiative

Open Knowledge: Implications for the GWP

Markus Konkol, University of Twente, the Netherlands, chaired this session on Wednesday. The session focused on how GEO's embrace of Open Knowledge can help create a transparent and inclusive environment that enables everyone—scientists, data and knowledge providers, policymakers, and the public—to maximize the impact of EO for the benefit of all.

Konkol reviewed the [GEO Statement on Open Knowledge](#), outlining its components—open access, citizen and participatory science, open data, open reproducible research, open software, open infrastructure, open hardware, open education, and diversity of knowledge—and stressed it covers societal issues next to technical aspects. He said the next steps would be to collect good practice, draft guidelines, and develop a “living” white paper on the topic.

Open Earth Alliance and Open Data Cube: Brian Killough, Committee on Earth Observation Satellites (CEOS), presented on the [Open Data Cube Sandbox](#) as a contribution to the Open Earth Alliance, a GEO Community Activity promoting the use of open data and open technology solutions. He noted the tool is a free and open application of the “Jupyter notebook” web-based interactive computing platform to Google Earth Engine datasets that can create application products anywhere in the world without needing to download data. Killough said it has generated significant interest and mentioned a growing library of application algorithms hosted on Microsoft's GitHub host for software developers of open-source projects.

He reported CEOS is working on running the Sandbox on other cloud platforms such as Amazon Web Services, Microsoft Azure, and Sentinel Hub, generating more application algorithms, and combining satellite data with other datasets, such as those coming from drones or the Internet of Things.

Human Planet Initiative: Robert Chen, Center for International Earth Science Information Network (CIESIN), presented how the GEO Human Planet Initiative (HPI) is using EO to improve mapping and modelling of human settlements infrastructure, and population in support of diverse applications. He said to make decisions, people need trustworthy open knowledge regarding how both human and environmental systems will evolve and respond over time and across space to

complex stresses. Chen said HPI plans to expand the range of its knowledge packages to encompass more diverse topics and application areas, as well as to facilitate the integration of HPI data, tools, and services with those of other GEO initiatives, flagships, and regional initiatives through the GEO Knowledge Hub, and other interfaces such as the EO4SDG Urban Toolkit.

EO4SDG & Urban Toolkit: Monika Kuffer, University of Twente and Earth Observations for the Sustainable Development Goals (EO4SDG) initiative, presented the [Earth Observations Toolkit for Sustainable Cities and Human Settlements](#), an online knowledge resource that can be taken up by local users to support local SDG reporting and New Urban Agenda issues. She said the Toolkit's objectives include: identifying local monitoring needs; sharing guidance on relevant EO data sets and tools; and enhancing countries' and cities' capacity via direct technical support.

Kuffer explained the Toolkit develops EO use case studies to enable users to understand the potential and uses of EO data. She provided examples of existing use cases for calculating: adequate housing; land consumption rate to population growth rate; levels of fine particulate matter; and open spaces for public use.

GOS4M: Francesco d'Amore, Institute of Atmospheric Pollution of the National Research Council (CNR-IIA), Italy, discussed lessons learned from the [Global Observation System for Mercury \(GOS4M\) Knowledge Hub](#). He explained the Hub was designed to evaluate the potential effectiveness of the Minamata Convention on Mercury by collecting data on mercury pollution from sources around the world. D'Amore described how the Hub works and highlighted that its digital architecture helped overcome barriers between data and people, and created a transparent and inclusive environment to help all users maximize the impact of EO.

GEOGloWS: Riley Hales, Brigham Young University, US, presented the [GEO Global Water Sustainability \(GEOGloWS\)/European Centre for Medium-Range Weather Forecasts \(ECMWF\) streamflow hydrologic model](#) that helps local stakeholders solve water management problems such as flooding, drought, and water quality by providing the water intelligence they need to make decisions. He discussed case studies of its recent application, including hurricane preparation of dams in Honduras in 2020, work on water quality in Lake Attilan,



Riley Hales, Brigham Young University, US

Guatemala, in 2021, and flood early warning systems in Nepal in 2020 and Malawi in 2022. Stressing that GEOGloWS is “not about doing science for science’s sake” and, instead, is about empowering local people, he noted all the examples were principally driven by a local user contacting GEOGloWS to apply its open data and tools to generate customized uses.

EO4Health & D-MOSS: Quillon Harpham, HR Wallingford, UK, and Earth Observations for Health (EO4Health), discussed how free and open EO data feeds into [Dengue forecasting Model Satellite-based System \(D-MOSS\)](#), which forecasts risk of likely dengue fever outbreaks several months in advance, so local communities can take mitigation measures and plan for outbreak response. He noted the system is operational in Viet Nam and in the process of being implemented in Malaysia and Sri Lanka.

Global Systems for Local Solutions: Opportunities and Challenges for GEOSS (Expert Advisory Group Consultation)

On Wednesday, Jörg Helmschrot, GEO Secretariat, chaired this session, which sought to directly engage the GEO community and, thus, support the assessment of the GEOSS concept by the recently established Expert Advisory Group (EAG) on GEOSS.

Role of the EAG: Helmschrot introduced the EAG, explaining it provides complementary but independent input to the ongoing GEOSS reevaluation process by the GEOSS Infrastructure Development Task Team. He presented the EAG’s task of: reviewing whether GEOSS is still relevant to GEO’s mission, and whether GEO should continue to provide geospatial information and services infrastructure.

Helmschrot outlined the intended deliverables of the EAG, including:

- an assessment, with recommendations, of the overall relevance of the GEOSS concept in the context of the present day and future GEO; and
- an assessment, with recommendations, of whether GEO should provide infrastructure support in service to its mission.

He said all final documents will be presented for approval by the GEO Plenary during GEO Week 2022.

GEOSS Presentations: Sergio Cinnirella, CNR-IIA, discussed the potential and limitations of the GEOSS Platform

from the viewpoint of the GOS4M Knowledge Hub. He highlighted limitations such as information redundancy, noting the information provided by the GEOSS Platform is directly available from the source and that most researchers would download the information directly from there rather than from the Platform.

He questioned the added value of the Platform, asking if its purpose is to provide information on maps. He also underscored it is not suitable for a range of stakeholders such as the research community. He concluded by noting the GEOSS Platform and GOS4M Knowledge Hub are not really integrated and require manual updating.

James Thornton, Mountain Research Initiative, reflected on the usefulness of the GEOSS Platform for GEO Mountains. He highlighted that in situ data are crucial for mountains, but that the GEOSS Platform’s capability for displaying such data and datasets is limited. He said GEO Mountains has designed, implemented, and released its own independent solution, called the GEO Mountains Inventory of In Situ Observational Infrastructure.

Thornton added that regarding more traditional common datasets such as gridded data, GEO Mountains has also developed an independent solution, the GEO Mountains General Inventory. He explained the reason for developing independent solutions rather than adding these functionalities to the GEOSS Platform was to: “tame the ocean of data” as the GEOSS Platform can be overwhelming for users and these independent solutions provide more constrained datasets: and provide some flexibility and control to meet the needs of the mountain community. He acknowledged, however, these functionalities should be simple to mirror in the GEOSS Platform. He said they hope to do so in the future but noted the need for increased flexibility, better support for in situ data, and the ability to pre-load/render larger vector files.

Poll: GEOSS Concept and Utilization: Helmschrot then introduced a poll for participants to take consisting of 13 questions. Beyond inquiring what sector respondents work in and what part of GEOSS infrastructure they use, the poll included such questions as:

- What is meant by GEOSS?
- Is the concept of GEOSS still relevant to GEO?
- What is the biggest potential of GEOSS as a concept?
- What is the biggest limitation of GEOSS as a concept?



Jörg Helmschrot, GEO Secretariat



Carrie Stokes, US Agency for International Development

- Is the current GEOSS infrastructure and suite of tools sufficient and fit for purpose?
- Do you want more user engagement in the process of developing GEOSS infrastructure and tools?

Helmschrot explained the results will be provided to the EAG as an input to the assessment.

Discussion: Carrie Stokes, US Agency for International Development, moderated a subsequent discussion about the confusion of terms, its impact on GEO messaging, the value-added of GEO versus GEOSS, and what might be lost if the GEOSS concept is deemphasized or no longer used.

Summary: EAG member Gregory Giuliani, Global Resource Information Database - Geneva (GRID-Geneva), summarized the session, noting:

- participants see continued value and relevance in the concept of a global “system of systems”;
- more user engagement is required;
- information technology and tools need to be better tailored to user needs; and
- potential exists to provide targeted support to agencies with reporting mandates, such as the Minamata Convention on Mercury and the UN Convention to Combat Desertification’s (UNCCD) Land Degradation Neutrality targets.

He also highlighted the possibility of integrating the GEOSS Platform and GEO Knowledge Hub, saying this could be considered in the future, but this will be subject to the EAG’s findings and recommendations.

Addressing Systemic Risk in Jamaica

This session, chaired by Nathaniel Newlands, Agriculture and Agri-Food Canada, took place on Wednesday. Participants discussed how EO is helping Jamaica address disaster risks. Newlands said GEO and the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM), with their working groups related to DRR and the Americas, are building on the outcomes of the [Aguascalientes Declaration](#) to advance the use of EO/geospatial, statistical, science and other data for addressing disasters. Newlands noted the GEO DRR Working Group is conducting a SWOT (strengths, weaknesses, opportunities, and threats) analysis of Jamaica’s national DRR strategy and legislation in terms of EO. He said Michelle

Edwards and Simone Lloyd are in the user co-design team of GEO’s forthcoming EO Risk Toolkit. He added that all parties are exploring the possibility of improved uptake and use of EO tools and services for DRR in Jamaica through the next GWP.

Setting the Scene: Jamaica’s Needs: Michelle Edwards, Office of Disaster Preparedness and Emergency Management (ODPEM), Jamaica, outlined the ODPEM mandate, Jamaica’s National Disaster/Emergency Response Network, and how the National Disaster Risk Management Council functions. She highlighted the economic damage extreme climate events have had on Jamaica over the last 20 years. Noting the complexities of hazards Jamaica must address, Edwards said it shows the need for more accurate data to conduct the types of assessments and analyses needed. She observed that while Jamaica has an EO database, it lacks a geographic information system officer or unit, although there are plans to establish such a unit in the fall of 2022. Edwards noted some ways EO data and analysis can support Jamaica’s disaster risk management, such as its National Vulnerability Ranking Index tool and platform, seismic hazard assessment, risk scenario planning, and comprehensive risk assessments.

Simone Lloyd, Ministry of Economic Growth and Job Creation, Jamaica, noted EO data has not been used much with respect to data analysis partly because of Jamaica’s small size. She highlighted opportunities to use EO for DRR and disaster risk management efforts. She said: EO options offer a way to examine trends over time to address DRR issues at various spatial and temporal scales; and access to relevant EO and their use by decision makers and other stakeholders would enable a meaningful contribution to mitigate the effects of hazards. Lloyd announced the launch on Tuesday, 3 May, of the Jamaica Systemic Risk Assessment Tool (J-SRAT), which maps climate risks to Jamaica’s infrastructure, with a focus on droughts, floods, and tropical storms.

Existing GEO Work Programme Activities on Disasters: Greg Yetman, CIESIN, presented on the HPI, highlighting opportunities for its use, including:

- guidance on exposure data and population modeling methods;
- assistance in selecting or developing methods for infrastructure valuation;
- evaluation of models for disaster impact estimation;



Angelica Gutierrez, NOAA

- business interruption; and
- integration of EO data with local data holdings.

Angelica Gutierrez, NOAA, discussed the GEOGloWS initiative and highlighted a use case in Honduras. She described how the Honduran national electrical power company (ENEE) used the Streamflow Forecast service (operated by GEOGloWS and ECMWF) which provides a 15-day discharge forecast. She explained that using the information provided by this service, ENEE was able to take the necessary preventive action ahead of Hurricane Iota and, thereby, reduce the damage to the Sula Valley caused by the hurricane.

Panel Discussion: Towards Integrated EO Solutions:

Markus Enenkel, Harvard Humanitarian Initiative, moderated a panel discussion with the speakers. Responding to his questions:

- Edwards said Jamaica's update of EO was affected by a mix of factors, some technical and some concerns about access and costs;
- Edwards agreed EO could help Jamaica conduct its more complex risk modelling;
- Lloyd said even if EO data quality was high and cost not a concern, technical capacity would still be a key concern;
- Lloyd agreed J-SRAT can be built upon to address more than just climate risks;
- Gutierrez agreed that the GEOGloWS work with Malawi, the Sula Valley in Honduras, and the Dominican Republic was relevant to other small island development states (SIDS), including Jamaica, and noted these cases are freely available to learn from via the GEO Knowledge Hub; and
- Yetman said nighttime lights EO was less useful after disasters than real-time information on power outages provided by power providers, and suggested EO instead is more useful in risk management planning since nighttime EO can provide more up-to-date information on recent settlement development than what is available through census.

The Urban Fabric: A Complex and Opportune Nexus

On Thursday, Evangelos Gerasopoulos, Institute for Environmental Research and Sustainable Development (IERSD), Greece, chaired this session. He introduced GEO's new Resilient Cities and Human Settlements engagement priority, which was adopted by the GEO Plenary in 2021. He highlighted that most cities are not only dealing with climate change and other planetary crises but are also struggling to provide basic services,

such as water supply and waste management. He explained the GEO Plenary approved the new engagement priority to accelerate and coordinate GEO's response to these challenges.

Panel Discussion 1: Where Cities Currently Stand: The Case of Yerevan, Armenia: Astghine Pasoyan, Director, Energy Saving Foundation, Armenia, shared examples of how Armenia's capital, Yerevan, uses EO data and tools to consider appropriate measures to, for instance, optimize public transport measures. She highlighted that even where political will to act exists, it must be backed by a proper diagnostic baseline, professional handling of data, and the availability of strong technical professionals not only to design the technical aspect of relevant measures, but also to advise on the financial and cost-effectiveness aspects of the measures.

Shushanik Asmaryan, Center for Ecological-Noosphere Studies (CENS), Armenia, discussed cases on the use of EO in Yerevan, highlighting: use of remote sensing to measure land surface temperature increase or decrease, and related green space; and the creation of a green wall for kindergartens, to improve air quality and increase kindergarteners' access to green spaces.

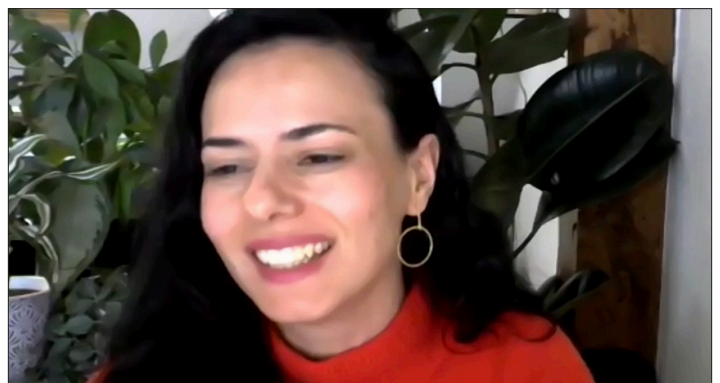
Lilit Sahakyan, Director, CENS, Armenia, described examples of collaboration between the City of Yerevan and CENS, including a functional tree planting project implemented in 2007/2008, the green wall for kindergartens, and the municipality's request to CENS to include mining areas in their investigations into street dust.

Trends in Urban Policy and Climate Adaptation: The Need for Holistic Impact Assessment and Monitoring: Daniella Rizzi, ICLEI Europe, explained ICLEI's [UrbanByNature](#) capacity-building programme is assisting many cities across the world with their green action plans. She explained the programme does this by, for instance, establishing a baseline, which is where EO is often most useful, as well as through strategies, implementation, monitoring, and evaluation, where EO can also help. She noted a growing interest among cities in nature-based solutions (NBS), and observed four lessons from ICLEI's work with NBS, namely:

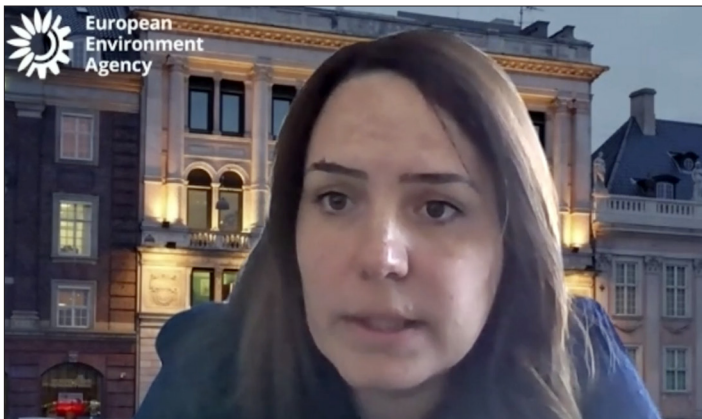
- NBS implementation differs by biogeographical regions, such as boreal, temperate, subtropical, and tropical, because it must be adapted to local conditions;
- different potentials exist for different ecosystems and scales;
- NBS implementation depends on ecological, land use, social, cultural, and political contexts and conditions; and



Evangelos Gerasopoulos, IERSD, Greece



Daniella Rizzi, ICLEI Europe



Christiana Photiadou, EEA

- although some definitions of NBS are emerging, different understandings of NBS around the globe remain.

Christiana Photiadou, EEA, said the Agency is trying to address urban climate challenges holistically through [Climate-ADAPT](#), the climate adaptation platform it hosts on behalf of the European Commission. She reviewed some tools the platform currently provides to address urban adaptation, and noted plans to: develop guidelines and tools for implementing adaptation solutions; assist in efforts to improve monitoring and reporting among EU Member States; develop adaptation indicators; and document and provide best practices across Europe.

Photiadou noted work is underway for the 2024 edition of the Urban Adaptation Report the EEA produces every four years.

Panel Discussion 2: The Growing Role of GEO in the Urban Nexus: Addressing Everyday City Pressures: Matthew Foote, Willis Towers Watson, and Member, GEO Programme Board, underscored the importance of GEO's work in providing better climate and disaster risk information on cities, given the percentage of people living in cities, their vulnerabilities, and their importance to global GDP. Using examples of projects in Viet Nam and the Philippines financed by the Asian Development Bank, he showed how trusted, reliable, up-to-date, and open EO data on risks can support the development of infrastructure disaster protection strategies or multi-city disaster insurance pools, as well as urban risk models.

Linda See, International Institute for Applied Systems Analysis, discussed the role of citizens in tackling urban issues, highlighting:

- the co-creation of urban solutions;
- the adoption of sustainable practices such as urban mobility; and
- engagement as citizen scientists to, for instance, monitor air pollution and the quality of green spaces.

She outlined impediments to the integration of citizen science into GEO, such as GEO's data interoperability requirements, and the fact that most citizen science projects take place at the local level and, on their own, might be insufficient to address the global problems addressed by GEO. She highlighted the need for increased engagement, funding, and projects.

Urban Monitoring Frames: Argyro Kavvada, National Aeronautics and Space Administration (NASA), US, focused on



Jennifer Bailey, IERSD, Greece

the EO Toolkit for Sustainable Cities and Human Settlements, which aims to support the use of EO to advance SDG 11 (sustainable cities and communities) and the New Urban Agenda. She provided some use cases of this Toolkit, including its use in Colombia to estimate the area of open public spaces, as well as their accessibility and openness to different segments of the population, looking at gender, age, disability, and other categories.

Jennifer Bailey, IERSD, Greece, presented the Urban Heritage Climate Observatory, a GEO community activity that aims to support the use of EO in cultural heritage conservation. She highlighted that one of its main objectives is to use EO for climate adaptation and it, therefore, aims to mobilize the untapped potential of urban heritage EO. Bailey discussed the potential for EO to support World Heritage Cities such as Urbino, Italy, and George Town, Malaysia, through, for instance: integrating heritage into the urban development plan; supporting the design of NBS for development; and increasing the accuracy and efficiency of agriculture systems.

Improving Policy Relevance and Delivery of the Next GWP

Sara Venturini, GEO Secretariat, chaired this Thursday session, which addressed the findings and recommendations contained in a recently completed report, "Mapping the Engagement of the 2020-2022 GEO Work Programme in Capacity Development, Disaster Risk Reduction and Climate Action."



Sara Venturini, GEO Secretariat

Introduction to the GWP Mapping Report: Rui Kotani, GEO Secretariat, said the report had been jointly produced by three GEO Working Groups on two of the GEO engagement priorities (DRR and Climate Action) and one cross-cutting issue (capacity development) following a mapping exercise spanning two years. She said a separate report will be issued on the third engagement priority, the SDGs. Kotani explained the fourth priority, Resilient Cities and Human Settlements, was not covered explicitly because a working group has not yet been established to do the mapping, but that most of its elements are reflected in other areas.

Highlights and Recommendations: Veronika Neumeier, GEO Secretariat, reviewed the general recommendations of the report, namely to:

- prioritize Arctic/cryosphere and small islands that entail cross-cutting EO activities between land and water;
- leverage the strengths of existing water-related activities to bring relevant initiatives together and capitalize on knowledge and products;
- identify concrete targets for on-the-ground implementation and collaboration with user communities for user uptake, particularly national governments and business sectors;
- deliver EO data, knowledge and, products that directly support global policy agendas; and
- revise the selection criteria of GWP activities to align more closely with global policy agendas and GEO engagement priorities.

Virginia Burkett, USGS and Co-Chair, GEO Climate Change Working Group, presented the report's findings and recommendations concerning climate change. She said the report recommends, *inter alia*:

- identifying and establishing collaboration with relevant UN Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change national focal points;



Veronika Neumeier, GEO Secretariat

- developing or improving EO tools, services, and methodologies that contribute to adaptation and loss and damage, notably knowledge products targeting support to developing countries for national adaptation plans;
- enhancing the EO needed to support climate finance decisions to implement the Paris Agreement, including supporting business and financial institutions in climate risk assessments, and supporting least developed countries and SIDS in improving the climate rationale of project proposals for adaptation and mitigation; and
- focusing on nexus areas to develop an integrated approach to address climate change impacts across key sectors, such as climate-health-cities, climate-energy-infrastructure, and climate-ocean-biodiversity.

David Borges, NASA and Co-Chair, GEO DRR Working Group, presented the report's findings and recommendations regarding DRR. He said the report recommends, *inter alia*:

- engaging with national DRR focal points and users, such as Sendai Framework national focal points and civil protection agencies;
- developing or improving tools, services, and methodologies that contribute to specific Sendai Framework targets and indicators, notably on early warning (Target G) and targets common to both the SDGs and the Sendai Framework; and
- seeking opportunities to collaborate with other GWP activities, regional GEOs, and the Climate Change Working Group through focusing on nexus areas where disaster events overlap and interplay with multiple risk drivers.

Nancy Searby, NASA and Co-Chair, GEO Capacity Development Working Group, presented the report's findings and recommendations on capacity development. She said the report recommends, *inter alia*:

- considering "capacity sharing" for more inclusive and culturally sensitive terminology and practices;
- tailoring tools and resources to current target users and considering strategies for including and engaging with less targeted user groups, alongside strategies for strengthening effective dissemination and delivery; and



Virginia Burkett, USGS and Co-Chair, GEO Climate Change Working Group

- making available an inventory of capacity development resources, potentially as a function of the GEO Knowledge Hub.

Interaction with Participants and GWP Leads: Venturini displayed the results of a snap poll conducted of session participants which showed that 94% supported or strongly supported the report's recommendations. Recommendations receiving more than 50% support from respondents characterizing them as "most relevant" included those on capacity sharing, tailoring capacity development resources to the target users, aligning GWP selection criteria to global agendas, and focusing on EO tools and services for adaptation and loss and damage.

She then moderated a discussion among session participants who offered further ideas and proposals to consider as the 2023-2025 GWP is finalized in the coming months, including to:

- conduct educational sessions for the GEO community about the Sendai Framework, its targets and indicators, and opportunities for collaboration and support using EO data, tools, and services;
- support the formation of national GEOs where they do not yet exist;
- prioritize covering Antarctica as well as the Arctic;
- consider ways to make existing capacity sharing in thematic activities more discoverable and interoperable so other GWP activities can learn from them;
- step up engagement with the private sector who "hold the purse strings" and make financial decisions, are in many cases ignorant of the wealth of EO data and analysis already available, and, if better informed and more involved, could provide more funding for further EO work; and
- increase the youth involvement in GWP activities.

Closing Session

Andiswa Mlisa, South African National Space Agency, and Co-Chair, GEO Programme Board, moderated the Symposium's closing session. She asked speakers to address any takeaway messages they picked up during the Symposium regarding



Andiswa Mlisa, South African National Space Agency and Co-Chair, GEO Programme Board



Bapon Fakhruddin, Tonkin Taylor International, New Zealand, and Member, GEO Programme Board

GEO's intent to move from addressing global agendas to focusing more on on-the-ground solutions for local stakeholders.

Shushanik Asmaryan, CENS, Armenia, urged caution in attempting to translate global agendas to local solutions, given the ecological, social, and political sensitivities in some countries and the need to adapt solutions to local conditions. She also urged caution regarding GEO advocacy of open data, as some governments are sensitive about sharing their data about their environmental and socioeconomic status in open databases.

Marie-Josée Bourassa, Canadian Space Agency, and Member, GEO Programme Board, said very often GEO has not been taking global solutions to local decision makers, and instead has focused on scientists that use EO data. She suggested considering the intended end user for all GWP activities, asking "are we seeking to help 50 people living along some coastline or are we trying to support global agenda setters?"

Bapon Fakhruddin, Tonkin Taylor International, New Zealand, and Member, GEO Programme Board, praised the sessions providing case studies of how EO can be used for local impacts. He stressed the importance of co-design and co-development of GEO products and services with end users.

Invited by Mlisa to offer closing thoughts, GEO Secretariat Director Yana Gevorgyan reminded participants that all of them, not just the Secretariat, are GEO. She said they are the ones who should get actively involved within their countries and organizations to improve coordination, promote GEO's work, link up with climate and DRR focal points, and improve and promote capacity sharing. She highlighted that change requires action from everyone and urged all members to put their words to action by, for instance, diversifying within their respective organizations and impressing upon their GEO Principals to continue to raise the profile of GEO's mission across networks.

Noting members' desire to continue dialogue on the evolution of GEO and the GWP between meetings, she promised the Secretariat will find a way to promote ongoing dialogue, perhaps through a forum on the GEO Knowledge Hub.

The meeting closed at 5:05 pm CEST.

Upcoming Meetings

UNCCD COP 15: UNCCD negotiations will focus on, among others, the work of the fifth session of the Committee on Science and Technology and the 20th session of the Committee for Review of the Implementation of the Convention, as well as other major issues, including land tenure, land degradation neutrality, and drought. **dates:** 9-20 May 2022 **location:** Abidjan, Côte d'Ivoire **www:** www.unccd.int/cop15

Seventh Session of the Global Platform for Disaster Risk Reduction (GPDRR 2022): The GPDRR is the main global forum to assess and discuss progress on implementation of the Sendai Framework for DRR. The meeting will take stock of Sendai Framework implementation, recommend actions for policymakers, highlight good practices, and raise awareness. The outcomes will be synthesized in the Co-Chair's summary and will contribute to the intergovernmental midterm review of the Sendai Framework scheduled for 2023. **dates:** 23-28 May 2022 **location:** Bali, Indonesia **www:** www.undrr.org/event/seventh-session-global-platform-disaster-risk-reduction-gp2022

Stockholm+50: "Stockholm+50: a healthy planet for the prosperity of all – our responsibility, our opportunity" will take place five decades after the 1972 United Nations Conference on the Human Environment. The event will provide leaders with an opportunity to draw on 50 years of multilateral environmental action to achieve the bold and urgent action needed to secure a better future on a healthy planet. **dates:** 2-3 June 2022 **location:** Stockholm, Sweden **www:** www.stockholm50.global/

UNFCCC Subsidiary Bodies: The 56th sessions of the UNFCCC Subsidiary Body for Implementation (SBI) and Subsidiary Body for Scientific and Technological Advice (SBSTA) will prepare for COP 27 scheduled for November 2022 in Egypt. **dates:** 6-16 June 2022 **location:** Bonn, Germany **www:** unfccc.int/event/first-sessional-period-2022

WUF11: The Eleventh Session of the World Urban Forum will take place on the theme, "Transforming Our Cities for a Better Urban Future." WUF11 aims to provide greater insights and clarity on the future of cities based on existing trends, challenges, and opportunities, as well as disruptive conditions, including valuable lessons learned from the COVID-19 pandemic. It will suggest ways cities can be better prepared to address future pandemics and a range of other shocks. **dates:** 26-30 June 2022 **location:** Katowice, Poland **www:** wuf.unhabitat.org/

HLPF 2022: The 2022 meeting of the High-level Political Forum on Sustainable Development will convene under the theme "Building back better from the coronavirus disease (COVID-19) while advancing the full implementation of the 2030 Agenda for Sustainable Development." The 2022 meeting will hold in-depth reviews of SDGs 4 (quality education), 5 (gender equality), 14 (life below water), 15 (life on land), and 17 (partnerships for the Goals). **dates:** 5-7 and 11-15 July 2022 **location:** UN Headquarters, New York **www:** sustainabledevelopment.un.org/hlpf

CBD COP 15: This Conference comprises the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP 15), the tenth Meeting of the Parties to the Cartagena Protocol on Biosafety (Cartagena Protocol COP/MOP 10), and the fourth Meeting of the Parties to the Nagoya Protocol on Access and Benefit-sharing (Nagoya Protocol COP/MOP 4). **dates:** 29 August – 9 September 2022 (tentative) **location:** Kunming, China **www:** www.cbd.int/meetings/

GEO Week 2022: GEO Week will include the 18th meeting of the GEO Plenary, which will consider the 2023-2025 GWP. It also will feature "anchor sessions" on multiple topics linked to the global policy agendas that underpin most of the GEO community's work, special industry and youth "tracks," and side events. **dates:** 31 October – 4 November 2022 **location:** Geneva, Switzerland **www:** earthobservations.org/



Participant group photo at the end of the Symposium

Glossary

CEOS	Committee on Earth Observation Satellites
DDR	Disaster risk reduction
DE Africa	Digital Earth Africa
DWG	Data Working Group
EAG	Expert Advisory Group on GEOSS
EEA	European Environment Agency
EO	Earth observations
GEO	Group on Earth Observations
GEOGloWS	GEO Global Water Sustainability
GEOSS	Global Earth Observation System of Systems
GWP	GEO Work Programme
ICZM	Integrated coastal zone management
MSP	Marine spatial planning
SDGs	Sustainable Development Goals
UNDP	UN Development Programme
UNEP	UN Environment Programme