



Horizon 2020 Societal challenge 5:
Climate action, environment, resource
efficiency and raw materials

VERIFY

Observation-based system for monitoring and verification of greenhouse gases

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Dissemination and uptake (Who will/could use this deliverable, within the project or outside the project?)
EO, science and inversion model communities
Short Summary of results (<250 words)
This deliverable reports the actions implemented by VERIFY within the GEO and GEOSS processes, providing a summary of opportunities of the exploitation of VERIFY results within the EO community.
Evidence of accomplishment (report, manuscript, web-link, other)
Report and workshop presentation



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1. Glossary	5
2. Executive Summary	6
3. Introduction	7
3.1. Climate change and GEO	8
4. GEO interaction with VERIFY and way forward	11
5. References	13

1. Glossary

Abbreviation / Acronym	Description/meaning
BTR	Biennial Transparency Reports
CC-WG	Climate Change Working Group
CEOS	Committee on Earth Observation Satellites
CIF	Community Inversion Framework
EO	Earth Observation
GEO	Group on Earth Observation
GEOSS	Global Earth Observation System of Systems
GWP	GEO Work Programme
IPCC	Intergovernmental Panel on Climate Change
MRV	Measurement, Reporting and Verification
NAPs	National Adaptation Plans
NDC	Nationally Determined Contributions
REDD+	Reducing Emissions from Deforestation and Degradation
UNFCCC	United Nation Framework Convention on Climate Change

2. Executive Summary

The Group on Earth Observation (GEO) is a partnership of 113 nations and 140 participating organizations with the mission to boost the use of Earth Observation (EO) data globally for facilitating decisions in any relevant natural and human-driven processes. Climate change is one of the main engagement areas of GEO. A Climate Change Working Group (GEO CC-WG) was convened for the 2020-22 work programme with the aim to develop and implement a comprehensive GEO climate change action strategy to advance the use of Earth observations in support of climate adaptation and mitigation. Within the GEO CC-WG, the results of the VERIFY project were shared and regularly communicated to the GEO community, including through the direct participation of VERIFY partners. In parallel to the GEO internal communication streams, the dissemination of VERIFY outcomes within the GEO community has been done with external events such as the participation in the COP26 side event co-organized by GEO and JRC where WP1 results on the interaction between inventory and the inversion models communities have been presented (November 2021).

Verify contributed to EuroGEO workplan 2020-2022, through the provision of High Resolution emission data 2005- 2017, with its final version of VERIFY database and data management infrastructure.

VERIFY was indeed the first integrated project that involved the European inversion community in a coordinated effort in the exploitation of atmospheric GHG measurement using EO at different levels, providing pilot applications for gases monitoring and inventory verification. The connection with GEO and EuroGEO has been a first step for the dissemination and showcasing the potential of EO bottom up and top down tools for GHG inventory applications although more work needs to be done for its integration in the GHG inventories as well as for the building of an EU verification system of GHG gases. Further exploitation and promotion of the inversion models need to be done within GEO in a cross-cutting and coordinated manner, given its potentials in tracking emissions from cities (e.g. GUOI), Wetlands (GEO WELANDS), including through capacity building activities (GEO CRADLE).

3. Introduction

The Group on Earth Observation (GEO) is a partnership of 113 nations and 140 participating organizations (update in May 2022) with the mission to boost the use of Earth Observation (EO) data globally for facilitating decisions in any relevant natural and human-driven processes. Through a global network, GEO connects government institutions, academic and research institutions, data providers, businesses, engineers, scientists, and experts since 2005. A collaboration among all these parties enables an effective exploitation of the huge, unprecedented availability of data, through powerful tools and methods, to promote sustainable data-driven decisions, from socio-economic and environmental perspectives. GEO's focus on three priority engagement areas: the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. GEO also works across eight societal benefit areas, where Earth observations play a key role in decision-making (Figure 1). The need to have a global partnership is fundamental to address one of the main global issue, such as climate change, which indeed requires a global vision and actions to be tackled.

GEO is creating the Global Earth Observation System of Systems (GEOSS), with the aim to coordinate and integrate independent observing systems and share data with any public and private user. GEOSS includes more than 400 million open data resources from more than 150 national and regional providers such as NASA and ESA; international organizations such as WMO and the commercial sector such as Digital Globe. The GEO's governance structure has three bodies: 1) the GEO Plenary is the main body of designated representatives of the Members and Participating Organizations, with Members holding decision-making authority. It is the GEO's primary decision-making body and meets at least once annually. 2) the GEO's Executive Committee oversees activities when the Plenary is not in session and guide the Secretariat. 3) The Working Groups, established by the Plenary, take care of the implementation of GEOSS activities and provide a mechanism for members of the GEO community to engage full in the work of GEO. Plus, Working groups provide high-level review, advice, recommendations and support in the ongoing development and implementation of the Working Plan, which is also an useful document to monitor GEO's activities.



Figure 1 The GEO's eight societal benefit areas.

3.1. Climate change and GEO

Climate change is one of the main engagement area of GEO. A Climate Change Working Group (GEO CC-WG) was convened for the 2020-22 work programme with the aim to develop and implement a comprehensive GEO climate change action strategy to advance the use of Earth observations in support of climate adaptation and mitigation.

The Climate Change Working Group (CC-WG) was engaged during the two year work programme in different duties that, among others, included the following: review the implementation plans of all GEO Work Programme activities relevant to climate change to identify potential disconnect and synergy opportunities among them to be addressed; facilitate communication between the leads and participants of these GEO Work Programme activities and between them and relevant partners, including through the organization of dedicated meetings and workshops; stimulate the initiation of projects and case studies involving participants from multiple GEO Work Programme activities to enhance collaboration across GEO and to address identified disconnect, opportunities, or actions in relation to key issues, including through new modeling approaches and tools, and assess how GEO can support countries in the submission of reports and other communications under the UNFCCC/Paris Agreement through the enhanced use of Earth observations, including, as applicable, nationally determined contributions (NDCs), national communications, adaptation

communications, and biennial transparency reports (BTRs), assess how GEO can support countries in the improvement of national greenhouse gas inventories over time through the enhanced use of Earth observations, identifying gaps in terms of Earth observations that are requisite to the work of the IPCC and others conducting climate assessments, and leverage GEO partnerships and resources to provide the additional Earth observations needed to support decision making.

One of the main deliverables of the GEO CC-WG is the mapping of the 2020-2022 GEO Work Programme (GWP) that provides an overview on the activities undertaken by GEO in its engagement priorities (GEO 2022).

From the mapping it appears that focus of the current GWP on Climate Change mainly on Adaptation (50), that is climate change impacts, vulnerability, and adaptation measures to increase resilience. A significant number of GWP activities also address Means of Implementation (43), that is access to capacity building, technology, and finance for developing countries to implement climate mitigation and adaptation actions. Numerous GWP activities also contribute to the area of Loss and Damage (41), that is approaches to averting, minimizing, and addressing loss and damage associated with the adverse effects of climate change including slow-onset and extreme events. Another area of interest for many GWP activities, although significantly fewer compared to adaptation, is Mitigation (37), that is GHG emission reduction.



Figure 2 – Climate action workstream supported by the GWP (GEO2022)

However, only 12 GWP activities (18%) state that they provide input to the UNFCCC and Paris Agreement processes, whereas the vast majority, 48 activities (76%), does not engage with these processes. Most of these activities specified the type of engagement, which often qualifies as indirect input to the process. Few provide a direct input, with provision of observational data in support of Nationally Determined Contributions (NDCs) (C3S); reporting on GHG emissions for REDD+ (AMERIGEO); developing supplemental guidance on EO-based agricultural monitoring for National Adaptation Plans (NAPs) (GEOGLAM); and supporting the development of National Forest Monitoring Systems and associated Measurement, Reporting and Verification (MRV)

procedures to enable reporting on forest emissions to the UNFCCC in various forms and inform development of interventions to reduce national emissions and achieve NDCs. In one case (DE-AFRICA) the activity is not providing input yet, but they state that they can support national reporting under the UNFCCC.

GWP activities that are monitoring carbon dioxide or other GHG concentrations, stocks and fluxes, are mostly focusing on assessing trends of GHG concentrations in the atmosphere (16%), supporting the development of GHG inventories (15%), and assessing past and present trends of GHG by countries (14%).

GWP activities that are supporting the UNFCCC Parties and process are providing information to the Global Stocktake (14%) and supporting the development and/or monitoring of NDCs (10%). GWP activities that are supporting the REDD+ mechanism under the Paris Agreement provide methods and guidance materials on REDD+ MRV (about 8%).

Recommendations:

While most activities are focused on climate change and climate action in general, the link between the GWP and the policy process appears to be indirect or lacking. Existing and future GWP activities should aim at identifying and establishing collaboration with relevant UNFCCC and IPCC national focal points, especially through national and local GWP activity partners, to provide input to international climate policy and science processes.

Satellite remote sensing measurements fill in the missing information related to the monitoring of all GHG emissions and work has begun in this space to answer these questions. Recognizing these developments, the IPCC Guidelines acknowledge the value of top-down methods for quality assurance and quality control of bottom-up inventories (GEO 2021)

4. GEO interaction with VERIFY and way forward

The involvement of VERIFY in GEO was linked to the GEO Carbon and GHG Initiative Gases (GEO-C) that was approved by the GEO Plenary in the frame of the new GEO 2016-2025 Work Plan. In the meantime, the initiative was not confirmed by the GEO Plenary (November 2019). In alternative a Climate Change Working Group (GEO CC-WG) was convened for the 2020-22 work programme with the aim to develop and implement a comprehensive GEO climate change action strategy to advance the use of Earth observations in support of climate adaptation and mitigation (see part 1.1 above). Within the GEO CC-WG, the results of the VERIFY project were shared and regularly communicated to the GEO community, including through the direct participation of VERIFY partners (CMCC is chairing the mitigation subgroup of the GEO CC-WG). In parallel to the GEO internal communication streams, the dissemination of VERIFY outcomes within the GEO community has been done with external event such as the participation in the COP26 side event co-organized by GEO and JRC where WP1 results on the interaction between inventory and the inversion models communities have been presented (November 2021)¹.

During the same period (15-18 and 19 november), GEO and JRC organized a workshop on Systematic Observation contribution and synergies for GHG&AFOLU in support of UNFCCC. The Workshop was aimed to start a dialogue between the different Earth observation community addressing the needs of UNFCCC reporting and tracking of mitigation actions both at the European level through discussions in the Copernicus programme as well as at the international level within CEOS and GEO. In particular, the workshop focused on atmospheric GHG monitoring such as inverse model with a specific contribution by VERIFY project (agenda in the annex).

Verify contributed to EuroGEO workplan 2020-2022, through the provision of High Resolution emission data 2005- 2017, with its final version of VERIFY database and data management infrastructure.

VERIFY was indeed the first integrated project that involved the European inversion community in a coordinated effort in the exploitation of atmospheric GHG measurement using EO at different level, providing a pilot application for gases monitoring and inventory verification. The connection with GEO and EuroGEO has been a first step for the dissemination and showcasing the potential of EO bottom up and top down tools for GHG inventory applications although more work need to be done for its integration in the GHG inventories as well as for the building of an EU verification system of GHG gases. Further exploitation and promotion of the inversion models need to be promoted within GEO in a cross-cutting and coordinated manner, given its potentials in tracking emissions from cities (GUOI), Wetlands (GEO WELANDS), including through capacity building activities (GEO CRADLE).

VERIFY has also contributed to the establishment of based emission estimates, have proposed the so-called Community Inversion Framework (CIF) (Berchet et al. 2021). The CIF is an initiative

¹ COP26 side event at the EU Pavillon with title: Earth observations and Emerging reporting and verification needs under the Paris Agreement (GEO-JRC side event). <https://cop26eusideevents.app.swapcard.com/event/eu-side-events-cop26/planning/UGxhbm5pbmdfNzI1Mzg>



by members of the greenhouse gas atmospheric inversion community to bring together the different inversion systems used in the community. The general idea of this approach is to provide a virtual platform where the different inversion schemes with their strengths and weaknesses can be run in parallel. This will help explore the range of systematic uncertainties in the assessment of emissions based on measurements. In fact, although referenced in peer-reviewed publications and usually accessible across the research community, most systems are not at the level of transparency, flexibility and accessibility needed to provide the scientific community and policy makers with a comprehensive and robust view of the uncertainties associated with the inverse estimation of greenhouse gases. There is potential to link this community with the GEO work.

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