

Meta-analysis of the GEO Work Programme 2023-2025 Implementation Plans

This document is submitted to the Programme Board for information.

1. INTRODUCTION

The GEO Work Programme (GWP) is the primary instrument used by GEO to facilitate collaboration among its Members, Participating Organizations, GEO Associates, and other partners on activities to realize GEO's Mission and Vision. The latest GWP covers a three-year period between 2023 and 2025 and includes 48 activities.

The 2023-2025 GWP development and review process of the Implementation Plans (IPs) began in September 2021 and concluded in November 2022, with the approval by GEO Plenary of the final version of the [Summary Document](#). A total of 48 GWP activities submitted IPs, of which 5 were Flagships, 19 were Initiatives, 20 were Pilot Initiatives, and 4 were Regional GEOs.

During its 25th Programme Board (PB) meeting, the GEO Secretariat updated members on possible implementation support for the GWP 2023-2025. One of the approaches proposed by the GEO Secretariat was to base this support on the findings of an analysis of the GWP IPs.

This document aims at providing an analysis of the GWP 2023-25 IPs, with a focus on outputs, their users, their participants and related institutions, their reported financial and in-kind resources, capacity development strategies and contributing countries. It also attempts to identify common opportunities and challenges that GWP activities face based on their submitted IPs. Additionally, the document highlights the data gaps, discrepancies, and inconsistencies in reporting, which are an important limitation to the analysis.

Regional GEOs have not been included in this analysis due to the differences in the expected roles between other GWP activities and Regional GEOs. The latter are not expected to develop Earth observation-based products or services and thus are not expected to have users in the sense that other activities do, though they are expected to engage a broad range of stakeholders. Nevertheless, a similar analysis across the four Regional GEOs is recommended.

The document is structured into a series of sections. Following this introduction, a summary of findings will lead into a breakdown of analysis and concludes with a set of recommendations.

2. SUMMARY OF FINDINGS

Through the analysis conducted of the 44 IPs, the following key findings have been identified:

1. **Diverse Range of GWP Activities:** The GWP includes a broad spectrum of activities ranging from flagships to pilot initiatives, with various institutions and entities involved from 103 countries and affiliations with 689 organizations. This diversity enriches the programme's depth and breadth.

2. **Imbalances in Participation:** While there's a wide range of activities, there's an uneven distribution in terms of geographical representation. Certain regions and countries are more actively involved in the GWP than others, indicating a potential area for expansion and inclusion in the future. In addition, participation of civil society and the private sector in the GWP can be improved.

3. **Resource imbalances:** Overall, the total financial resources, self-reported by the WP activities amounts to \$102,292,492. 47.7% of all self-reported financial resources can be linked to three activities. Total other (“in-kind”)resources (including personnel, technology, and data resources) self-reported by the WP activities amounts to \$60,825,706. 97% of In-kind resources is dominated by three WP activities. A substantial number of activities reported deficiencies in resources - especially financial resources. This is a significant hurdle in achieving their desired outputs and negatively impacts the sustainability of the GWP outputs and results.

4. **Capacity Building:** The GWP activities reported a large range of capacity-development efforts, from the dissemination of new scientific tools to training sessions and strategy documentations, fostering cooperation and knowledge exchange. Capacity development is about strengthening the capacities of individuals, organisations and related (eco-)systems; the development of tools, materials, policies and conducting training, MOOCs etc. are just means (outputs) supporting that. The focus should be on the capacity development process rather than the capacity development products. In addition, there was no information shared on what efforts were made to track the impacts of these efforts. There were also limitations in the identification of target audience of these efforts (see sections 4.1 and 4.2 below).

5. **Possibilities for GWP synergies:** there are unexplored synergies between GWP activities, especially with respect to outputs and outreach to users. This can help address resource gaps and allow activities to benefit from economies of scale when it comes to outreach to donors. While the template for the IPs does not allow for thematic categorization, it did ask the activities to identify other GWP activities which firstly, they work with, and secondly, those that they would like to work with. This information has already been used by the GEO Secretariat to set up coordination workshops in the last year.

3. METHODOLOGY

This analysis is based on a total of 44 submitted IPs of GWP activities, including 5 Flagships, 19 Initiatives and 20 Pilot Initiatives. The IP tool used open-ended queries, allowing activities to answer questions without constraint. From the IP tool, sections to be included in the analysis were chosen based on GWP coordination priority areas. These were: outputs, users, participants, and participating organisations, reported resources, capacity development activities and contributing countries. From here, responses from each section were grouped into separate categories, with the aim of best describing responses.

However, challenges and limitations emerged due to the varying levels of detail within the IP submissions. Many responses were vague, potentially introducing the risk of misanalysis or drawing incorrect conclusions about activities. Some initiatives did not submit information on their resources, impacts, users etc. leading to important data gaps. Additionally, discrepancies in the data collection phase were observed, particularly regarding resources, or participants' affiliations. Another difficulty was in aggregating information given such diverse responses. This

was particularly relevant when assessing activity outputs (there were different understandings of what an output is) and users and will be explored in the subsequent sections.

A systematic comparison between the 2020-22 GEO Work Programme and the 2023-25 GEO Work Programme would have been useful in demonstrating the evolution of the activities over time, however, was not possible due to the new format of the latter. The IP tool will be used in the development of future iterations of the GWP, and will provide a more sophisticated understanding of change over time.

4. ANALYSIS OF THE GWP 2023-25 IMPLEMENTATION PLANS

4.1 ACTIVITY OUTPUTS

Outputs are the information-based products and services that are intended for users at various levels of the Earth observations value chain. These can range from observational data, to methods for using EO data for specific purposes, to end-user applications and reports. Most GWP activities produce or intend to produce multiple outputs, which may be intended for the same or different types of users.

The activities were requested to provide information on the name of outputs, the status (planned, in development or currently active), the intended users, and a possibility to provide additional information.

These outputs were subsequently organised into seven distinct categories:

- Datasets and measurements (for e.g., Global Precipitation Measurement, GDIS);
- Maps and Services (for e.g., Lava flow hazard map, EO4DRM);
- Applications (web-based, software, platforms, tools) (for e.g., Crop Monitor for AMIS, GEOGLAM);
- Capacity development methods and practices (e.g., MOOC on Earth Observations for SDGs, EO4SDG);
- Research papers, assessments and publications;
- Other (for outputs that did not fit in any of the above output types)

Figure 1 below illustrates that 38.1% of activities offer ‘Datasets and measurements’, making it the most common output category. 13.1% of outputs fall under ‘Maps and services’. The predominance of ‘Datasets and measurements’ among the outputs of activities, with only a limited number of ‘Maps and services’, could suggest that the emphasis is currently more focused on catering to scientists and individuals well-versed in the subject matter, making outputs less accessible to a wider audience (citizens, policy makers and non-experts). This will be further explored in the User section below.

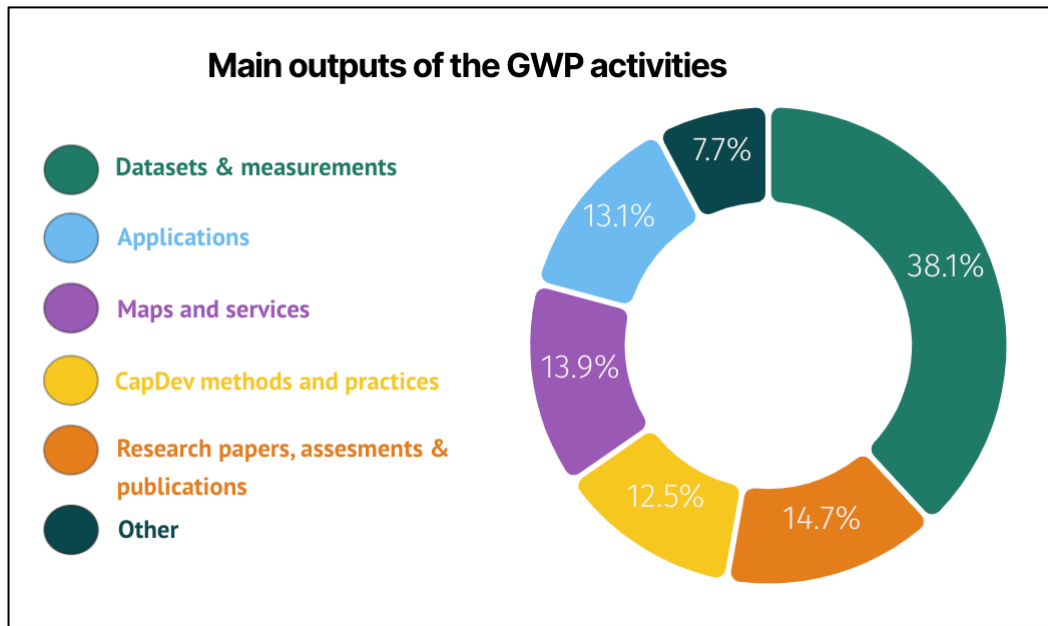


Figure 1. Reported activity outputs

The average number of outputs per activity was eight outputs per activity. The activity with the greatest number of outputs was GEOARC, with 80 outputs.

The number of outputs identified by each activity is, in part, dependent on the level of granularity applied in defining separate outputs. Most activities have chosen to define their outputs in the IP as classes of similar products or services rather than as individual specific products; for example, GOS4M includes outputs such as “Mercury concentration in oceans” and “Mercury reduction costs” and GSNL includes “Volcanic and seismic source models” and “Ground displacement maps and time series at each Supersite”. This kind of grouping of outputs is likely useful for the purposes of management of the GWP. Some Initiatives, however, have taken this grouping to a point where the information becomes much less useful, such as outputs defined as “EO data and services”, “Various on the ground pilots”, “Policy briefs”, and “Services”. In some of these cases, the outputs in question are in early stages of development, though in others it may be a question of not developing the results framework.

Regarding output availability, not all recorded outputs are currently released, with 30% of outputs being in development or still within planning stages (0 Flagships, 3 Initiatives and 9 Pilot Initiatives). As might be anticipated, all GEO Flagships and most GEO Initiatives reporting have available outputs, while fewer Pilot Initiatives report having outputs at this time.

The second question regarding output availability asked activities to name each output and categorize its status based on five categories: “regularly-updated”, “occasionally-updated”, “available but not updated”, “in-development”, and “planned”. Figure 2 below summarizes this information.

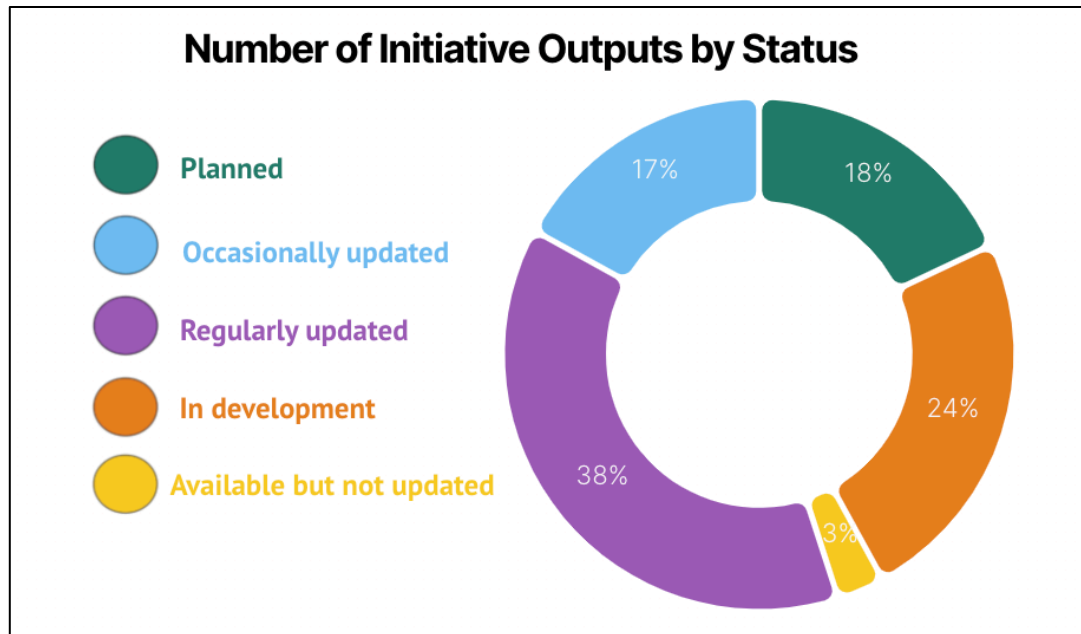


Figure 2. Number of Initiative outputs by status

More than half of the identified outputs have been completed, most of which are updated regularly or occasionally. Fifty percent of Initiatives report they have outputs that are regularly updated and 68% have outputs that are at least occasionally updated. If these reports are valid, it suggests that there is a potentially large body of resources generated by the GWP that could be shared and promoted more broadly.

4.2 USERS

The ‘Users’ field was framed in an open-ended manner, allowing activities the freedom to self-identify their users, without the constraints of a multiple-choice option. While it was expected that pre-defined categories would eventually be needed to allow for aggregation of the data across activities, allowing activities to initially define their users, without restrictions, was expected to provide a basis for constructing categories most relevant to the activities. As part of this analysis, a set of user categories were proposed based on the activities’ input into the IP tool. These categories focus on the institutional context of the users rather than the subject matter, as the latter changes between activities.

Although the self-categorisation of users allowed for more freedom of choice, one evident limitation was the difficulty of aggregating and standardising the user data for comparative purposes. An example, “all ships operating in and around sea ice in the Arctic” conveys this limitation. While this is a useful way of characterising certain users of a specific activity (ARCTIC-GEOSS), it was difficult to standardise this information within the wider user's context and thus, more difficult for a horizontal analysis across the GWP.

The categories proposed here are as follows:

- Policy/governmental users
- Commercial users
- Research/educational users
- International organization users
- Public users (including individuals and civil society users)
- Other

A sixth category (Other) was added to acknowledge users that were not clearly defined in the IPs. Examples of submissions that fall under the ‘Other’ category include: ‘the global community’, ‘participants of the initiative’, ‘practitioners’, ‘other GEO activities’, ‘donors’, ‘disaster risk community’, among others.

Figure 3 shows the breakdown of users of activity outputs. It must be noted that most outputs are associated with multiple user categories, suggesting that the GWP activities serve a broad range of users with varying needs and preferences. Only a small fraction of outputs (2 out of a total 347) are limited to just one user type, further emphasizing the inclusivity and versatility of the GWP activities as a whole.

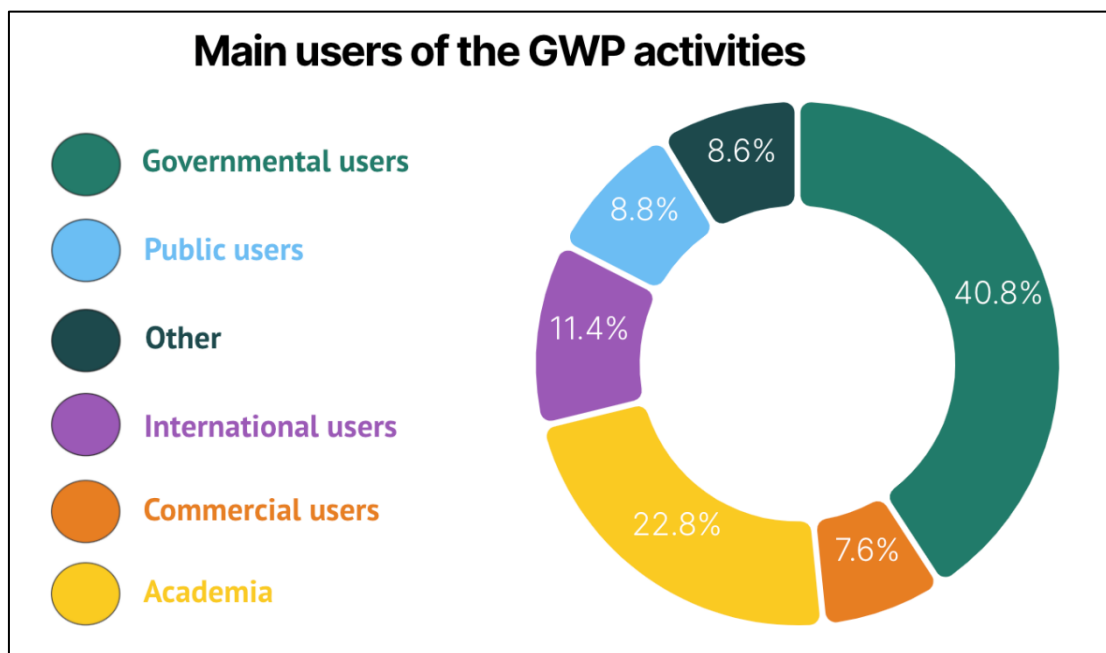


Figure 3. Reported users of the GWP activities by user category

A significant percentage of users fall under governmental users (40.8%), which can be attributed to the inherent focus of GEO’s efforts to positively influence and support national policy. By providing datasets and measurements that contribute to evidence-based policymaking, this emphasizes the crucial role that GEO activities’ play in supporting policy development and enhancing governance.

The relatively low proportions of international organization users (11.4%) (such as United Nations agencies) is somewhat surprising given the international aspect of GEO and the emphasis on policy mandates from such agencies. This may be due in part to the fact that many of the reporting activities are at early stages (new Pilot Initiatives and existing Community Activities), although the question does not assume that the outputs are currently in use by these users. This may also be due to the fact that international organizations are also captured as partners in the IPs and not necessarily users. In this scenario, there is a large significance of these organisations in further disseminating the GWP outputs amongst their own networks as additional users.

The high proportion of research/educational users (22.8%) and the low number of public users (8.8%) are interconnected by their respective objectives and interests. Researchers, being experts in their field, often seek access to detailed datasets, measurements, and scientific information. On the other hand, civil societies and civilians may not have the same need for raw data, which constitutes roughly 40% of the outputs produced under the GWP. To bridge this gap and increase engagement by public users, efforts can be made to translate the raw data into more interactive and accessible formats.

Another observation is that relatively few activities and outputs are used by commercial sector entities. The reasons for this cannot be concluded from the IPs alone, although this may be related to the high targeting of research/educational users. Since commercial sector engagement is a key priority for GEO, especially for small, medium, and micro-sized enterprises (SMMEs), it will be important to explore further why this gap exists.

8.6% of the activity outputs had unclearly defined users. Notably, Flagships tended to have more clearly defined users, which is helpful for understanding their specific reach and impact. This may indicate more developed use cases for these activities. However, to improve user definition and ensure consistency across the GWP, targeted support and guidance will be necessary, including via co-design methodologies (such as that developed by the E-shape programme).

Further investigation into the submissions revealed that out of 347 outputs, 95 included at least one user identifiable by name. Among 44 activities, 23 provided specific user information, such as relevant counties' names or the names/types of national, sub-national organisations, NGOs, and research organisations. Examples of specific users included entities like 'FAO' (and other international organisations) and local communities or governmental agencies like 'the fishing community in Bangladesh' or 'the Ministry of Energy Supply in Uzbekistan'. Identifying specific users may indicate that the development and design of the project have involved a strong co-design process and will give a better understanding of the geographical reach of GEO's products and services.

It must be noted that during the data collection phase, we observed instances where certain GEO activities identified other GEO activities as targeted users. Notably, the GEO Initiative EO4SDG explicitly referred to 'GEO Community activities, Initiatives, and Flagships' as its intended users. While this may appear somewhat ambiguous, and needs further elaboration, it

is encouraging to witness this intended collaboration and connection between some GWP activities.

4.3 PARTICIPANTS AND PARTICIPATING ORGANIZATIONS

This section focuses on the countries in which participants are employed and the corresponding affiliations. A total of 1603 participants, from 103 countries, affiliated with 689 organizations were identified by the GWP in their IPs.

It is important to note that the information presented below in Figure 4 relates to the participant’s country of operation rather than their nationality.

A substantial number of participants are affiliated with institutions in the United States (324), followed by China (196) and Italy (103). Notably, the sole African country included in this ranking is South Africa, with a total of 33 participants.

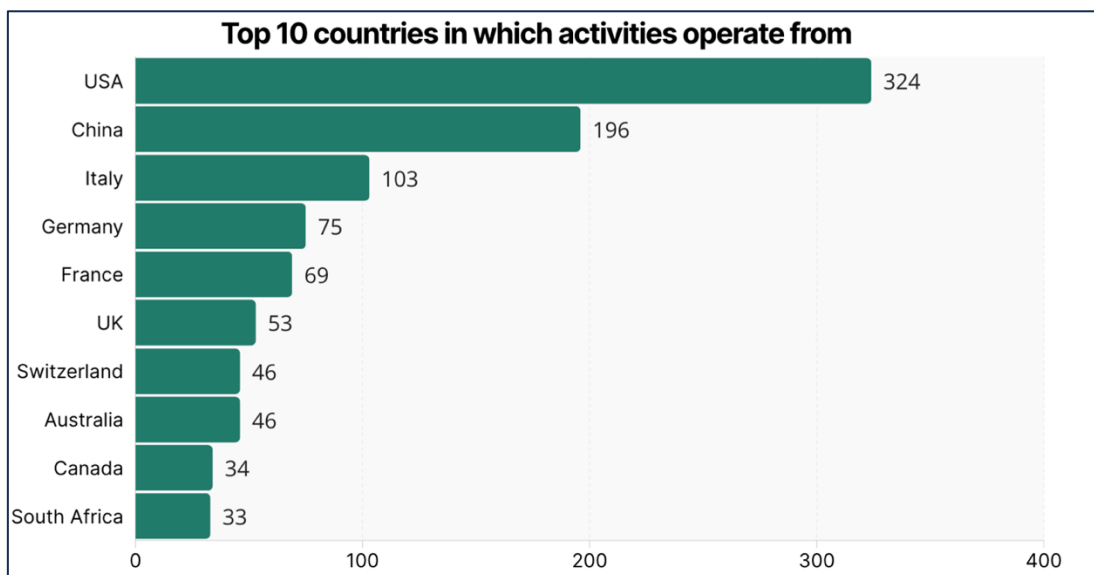


Figure 4. Top 10 countries in which participants of the GWP operate in

It is evident that most participants operate within High Income Countries (HIC). This participation may be affecting the diversity of perspectives and priorities within the GEO community. Geospatial challenges and environmental issues vary across regions, and a lack of representation of specific regions may result in overlooking the perspectives of different key regions.

Eight categories were formed to categorize the institutional affiliations of individual participants of the GEO Work Programme:

- Academic institution (for e.g., Chinese Academy of Sciences)
- Governmental Organisation (for e.g., National Aeronautics and Space Administration)
- Research Institute (for e.g., USDA-ARS Northern Great Plains Research Laboratory)
- International organization (for e.g., United Nations Statistics Division)
- Intergovernmental organization (for e.g., European Space Agency)
- Non-profit organization (for e.g., Conservation International)
- Other

‘Other’ refers to either where a participant’s primary recorded institution was recorded as one of the GEO activities or when this information was not submitted by the activity themselves.

Figure 5 provides an overview of the primary types of institutions represented by GWP participants, with academic institutions (418), governmental organizations (413), and research institutes (384) emerging as the top three categories. Notably, these three classifications surpass the remaining types of institutions in terms of frequency of mention.

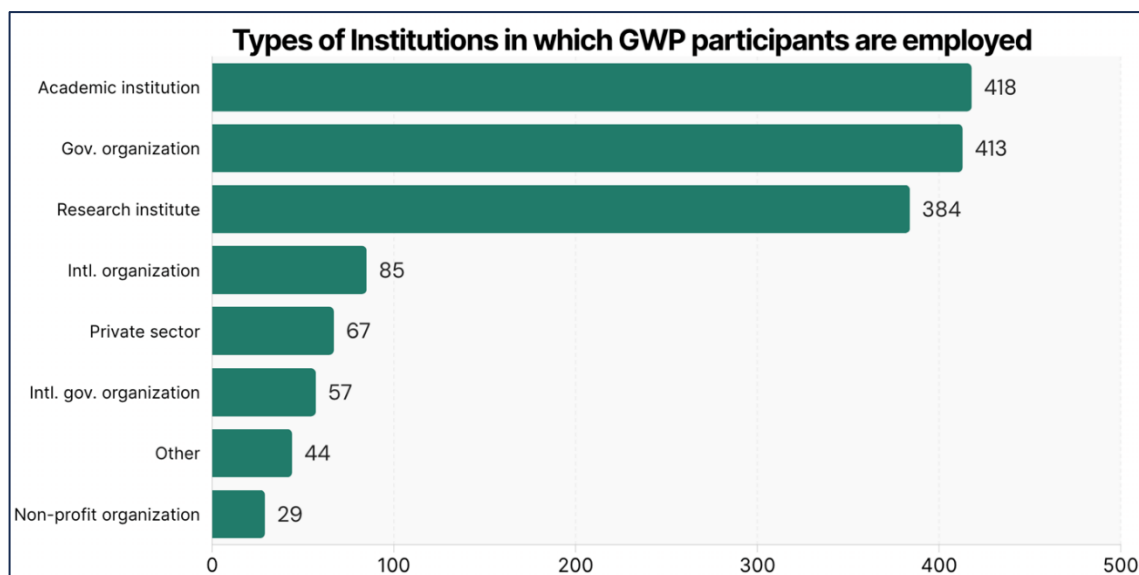


Figure 5. Types of institutions in which participants of the GWP activities are employed

Figure 6 explores the top 10 most mentioned institution where the Chinese Academy of Sciences (68) and the National Aeronautics and Space Administration (60) top the list.

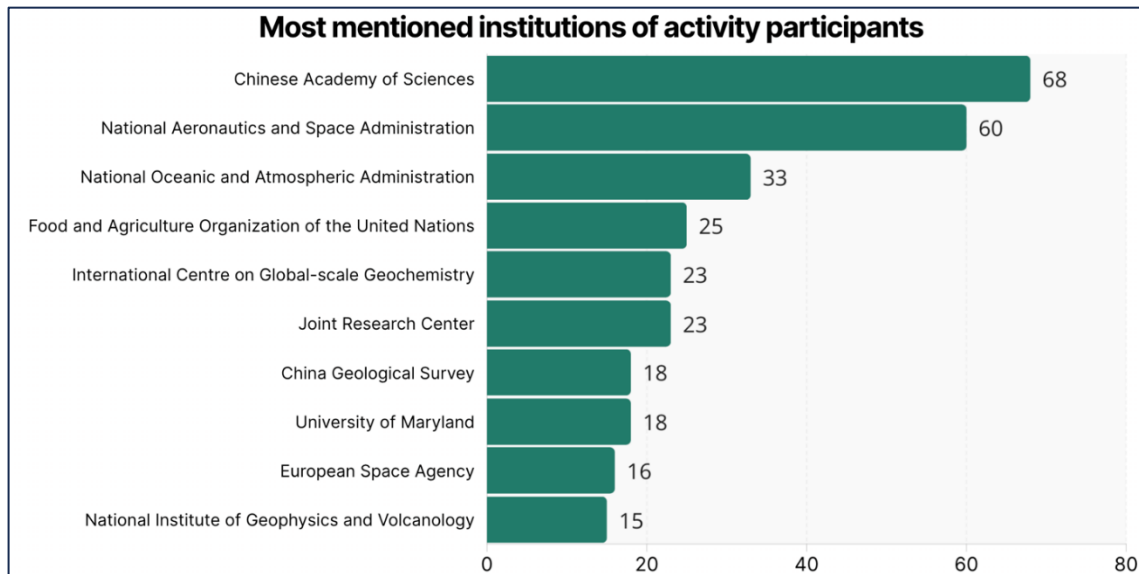


Figure 6. Name of the most mentioned institutions in which participants are employed

However, it is essential to address data gaps and discrepancies that surfaced during the data collection phase. Certain participants frequently exhibited inconsistencies between their current affiliation and the affiliation reported in the Implementation Plan. A disparity between the participant’s affiliation and the country from which they were operating in was also observed.

4.4 REPORTED RESOURCES

The IP reporting tool made a distinction between activities’ financial and in-kind resources. Activities were required to disclose resources valued at or exceeding \$50,000. ‘Financial resources’ refers to monetary funds acquired by activities by respective sponsors. ‘In-kind resources’ encompass various resource types, including but not limited to expertise, equipment, and logistics costs, which are provided or made available to the activities.

Out of the 44 activities, only 29 provided details regarding both their financial and in-kind resources. However, among these 29 activities, 10 disclosed only their financial resources, indicating a lack of reported in-kind resources.

Overall, the total financial resources, self-reported by the WP activities amounts to \$102,292,492. 47.7% of all self-reported financial resources can be linked to three activities. Arctic GEOSS has a reported \$21.5 million, Digital Earth Africa with \$17 million and Global Ecosystem and Environment Observation Analysis Research Cooperation with \$10.1 million.

Total in-kind resources (including personnel, technology, and data resources) self-reported by the WP activities amounts to \$60,825,706. 97% of In-kind resources is dominated by three WP activities, namely Antarctic Ice sheet Monitoring (\$36 million of in-kind resources), Geohazard Supersites and Natural Laboratories (\$11.5 million) and Forest Biomass Reference System from Tree-by-Tree Inventory Data (\$11 million). However, it is important to note, that only 10 activities reported on in-kind resources within the IP.

As the section below outlines, there are methodological limitations to the self-reported financial and in-kind resource reporting. In future WP development, a clearer methodology and resource reporting should be outlined to the GWP activities when developing future work plans.

In figure 7 below, which shows the reported Flagship resources, the GEO Land Degradation Neutrality (GEO-LDN) initiative has the highest financial resources, totaling \$6.5 million. Conversely, the Global Forest Observation Initiative (GFOI) has not provided any information on either financial or in-kind resources.

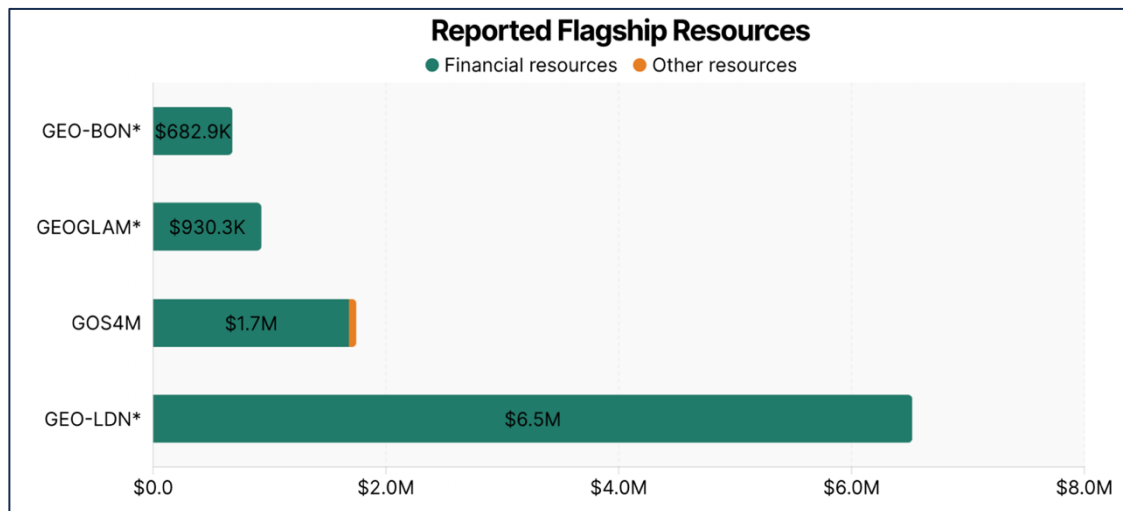


Figure 7. Reported financial and other resources (Flagships)

Among GEO Initiatives (Figure 8), Digital Earth-Africa (DE-AFRICA) boasts the highest financial resource allocation, amounting to \$17.1 million. Furthermore, it is crucial to highlight the value of in-kind resources (data and equipment), \$11.5 million, which has been reported by Geohazard Supersite and Natural Laboratories (GSNL), with \$70,000 in financial resources.

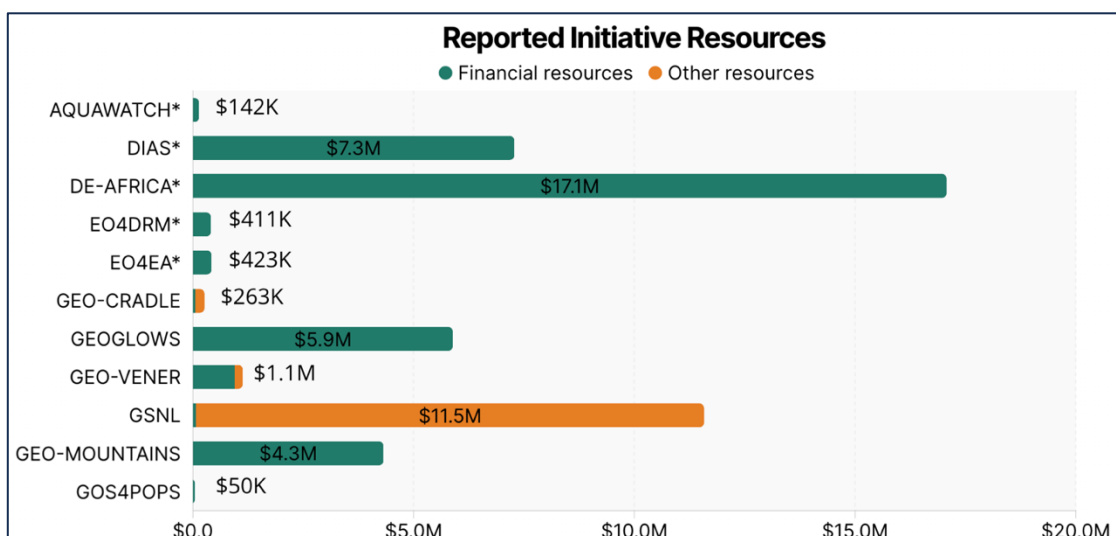


Figure 8. Reported financial and other resources (GEO Initiatives)

Overall, 11 out of the total 19 Initiatives have disclosed information concerning their allocated resources. The Initiatives that did not submit information include Earth Observations for Health (EO4HEALTH), Earth Observations for Sustainable Development Goals (EO4SDG), GEO Blue Planet (GEO-BLUE PLANET), GEO Human Planet (GEO-HUMAN PLANET), GEO Wetlands (GEO-WETLANDS), Global Drought Information System (GDIS), Global Urban Observation and Information (GUOI), and Global Wildfire Information System (GWIS).

Among Pilot Initiatives (Figure 9), AIS-MONITORING has the highest overall resources, at \$36.6 million in in-kind resources, namely equipment. Regarding financial resources, Arctic GEOSS has reported resources of \$21.5 million, followed by GEOARC with \$10.1 million. Additionally, GEO-TREES reported \$11.2 million, primarily categorized as data resources.

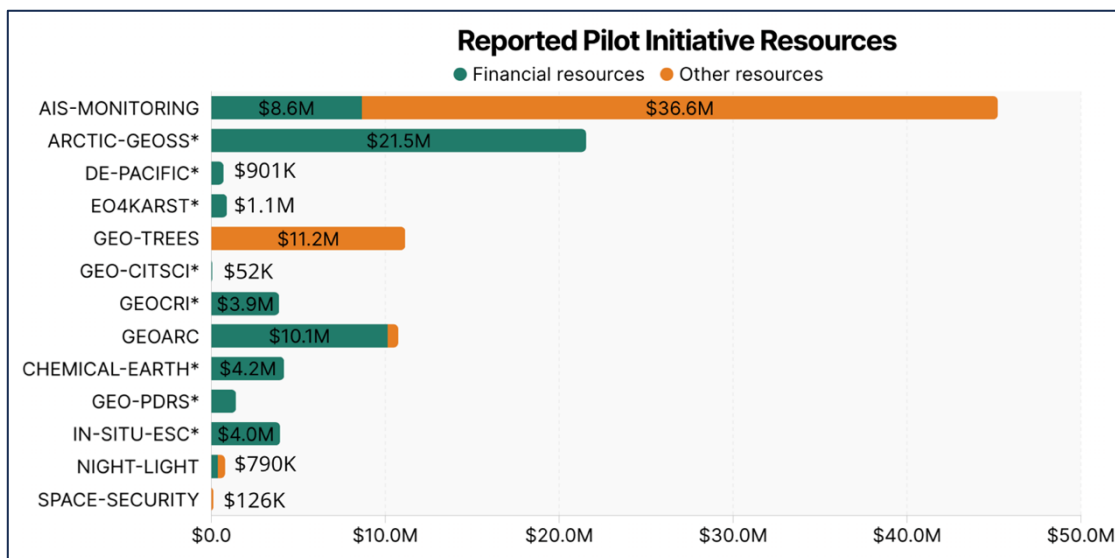


Figure 9. Reported financial and other resources (GEO Pilot Initiatives)

Overall, 13 out of the total 20 Pilot Initiatives submitted information regarding their allocated resources. The Pilot Initiatives that did not submit resource information include Earth Observation for multi-scale monitoring of mining impacts (EO4MIN), Earth Observations for the Water-Energy-Food Nexus (EO4WEF), GEO Essential Variables (GEO-EV), Geodesy for the Sendai Framework (GEODESY4SENDAI), Open Earth Alliance (OEA), Urban Heritage Climate Observatory (UHCO), and Global Products of Common Essential Variables from Multiple Satellite Data (GEO-EV-PRODUCTS).

When queried about resource gaps, 26 overall activities acknowledged deficiencies in financial resources (3 flagships, 11 initiatives, 12 pilot initiatives), 11 identified gaps in human resources (2 flagships, 5 initiatives, 4 pilot initiatives) and 7 reported gaps in data access (0 flagships, 3 initiatives, 4 pilot initiatives). The Resource Mobilization Toolkit has taken into consideration all the information provided by activities, including the identified resource gaps in financial and human resources. Further in-depth analysis has been undertaken for the development of the

Toolkit to explore potential opportunities for resource mobilization to address these gaps effectively.

4.5 CAPACITY DEVELOPMENT ACTIVITIES

Capacity development activities represent an important element for GEO activities, fostering collaboration and cooperation to encourage the sharing of best practices, experiences, and resources for addressing common challenges.

Seven types of capacity-development activities (linked to the reported outputs) were identified from the submitted IPs:

- Dissemination of new scientific tools
- Co-design of Earth Observations products and tools
- Training sessions, workshops, seminars, meetings, or side events
- Report and strategy documents
- Webinars on environmental/socio-economic data
- Supporting countries to produce their own Disaster Risk Reduction (DRR)/Climate policies

Based on information provided by activities, shown in Figure 10, a fairly equal distribution of all the capacity development types is observed. Notably, the co-design of Earth observations products and tools emerges as the most prevalent category, accounting for 27% of the overall activities.

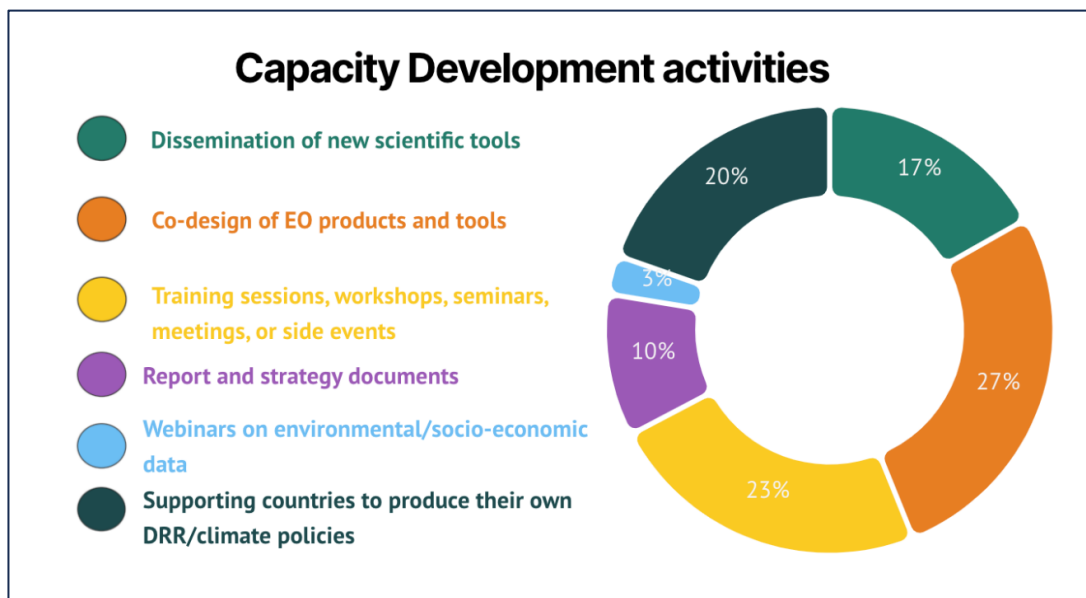


Figure 10. Capacity Development activities by GEO activities

Upon closer examination of figure 11 below, where the Capacity Development activities are categorized based on the GEO activity types, we observe a balanced distribution of activity types within the Flagships. Additionally, a relatively comparable distribution of activities is observed

among both the GEO Initiatives and the Pilot Initiatives, suggesting that all activities, no matter their developmental stage, all take active efforts towards capacity building.

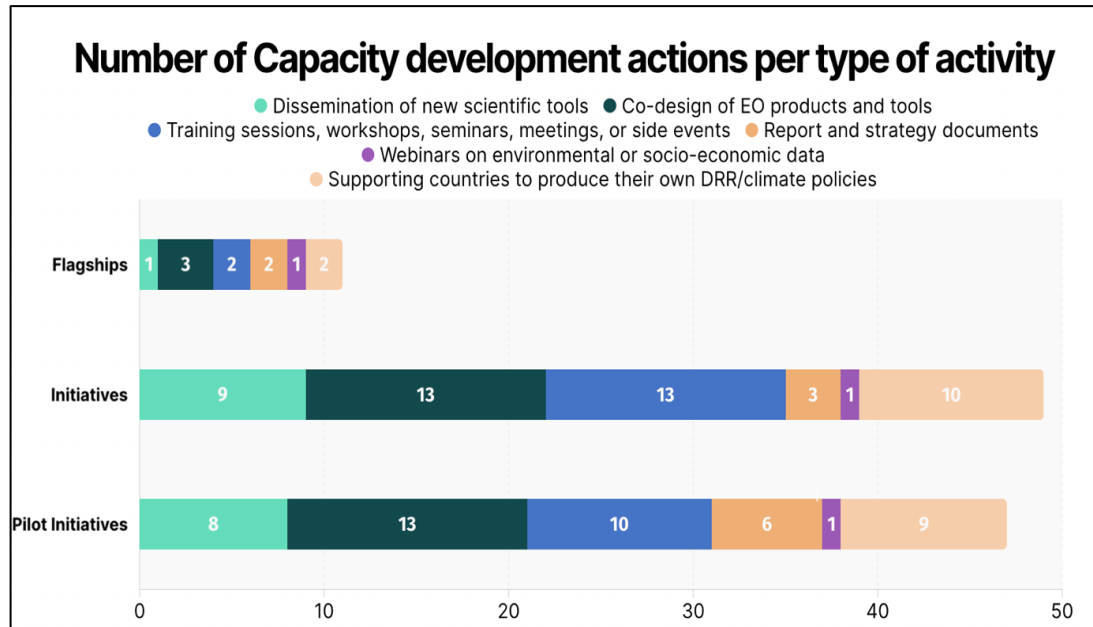


Figure 11. Capacity Development activities by activity type (Pilot Initiative, Initiative and Flagships)

This information does leave more questions open, than answered. There is little reported information on what the GWP activities do to track the impacts of their capacity-development activities. In addition, capacity development is about strengthening the capacities of individuals, organisations and (eco-)systems; the development of tools, materials, policies and conducting training, MOOCs etc. are just means (outputs) supporting that. The focus should be on the capacity development process rather than on the capacity development products.

4.6 CONTRIBUTING COUNTRIES

The map below illustrates the countries that have actively contributed to one or more activities within the GWP. a reasonably balanced representation of North and South American countries, with a few exceptions can be seen. The European continent exhibits a notable level of involvement; however, it is worth noting that the Balkan region and Eastern Europe are absent. Focusing on the African continent, a comparatively low number of represented countries can be seen, although AFRIGEO is a particularly active Regional GEO.

Lesotho is the sole non-GEO member country actively participating in the GWP. Similarly, the Middle East region exhibits a similar participation rate, with the United Arab Emirates standing as the sole participating country in the region's GEO activities. Finally, a substantial portion of the Asian continent, including Australia, demonstrates active engagement in the GWP.

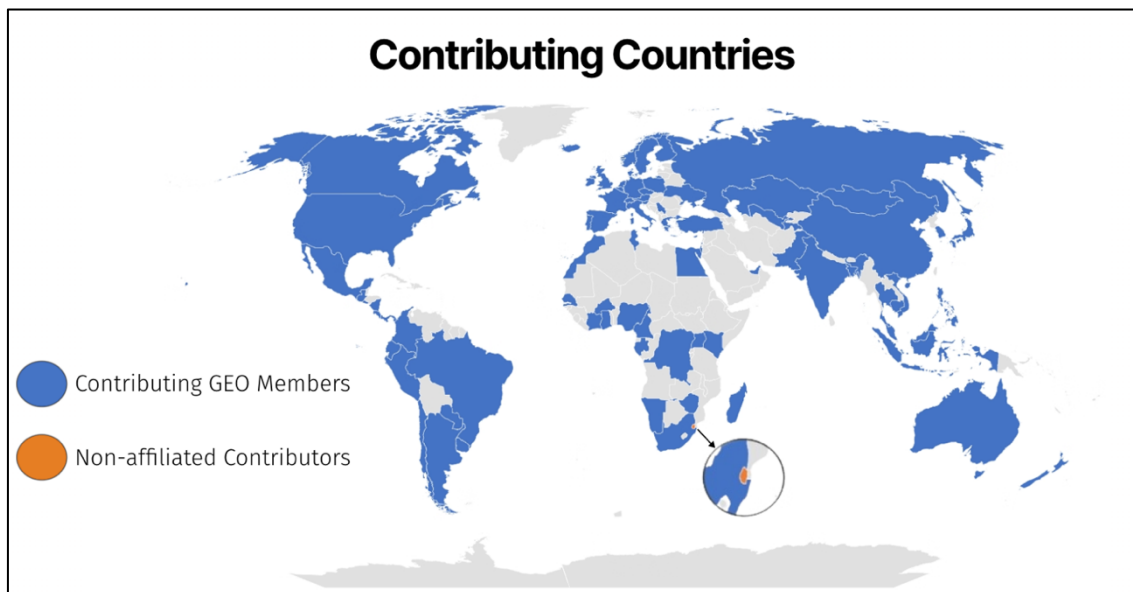


Figure 13. Countries that have actively contributed to one or more GEO activity.

5 CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are proposed based on the analysis and findings captured within this report:

- a. **Strengthen Collaborations and Engagements:** Given the diversity of activities and participation, there's an opportunity to foster stronger collaboration. Regular workshops or webinars can be organized to allow stakeholders from different initiatives and beyond to exchange ideas and explore synergies. GEO's Working Groups can also be leveraged in this regard. This can also be used to strength diversity and engagements, including from under-represented countries and regions, international organizations, NGOs, private sector or others
- b. **Monitoring and Evaluation:** A more structured approach to monitoring and evaluation should be implemented. This can be done by setting clear KPIs for each activity and having periodic reporting and reviews, as well as evaluations. This will help in refining the initiatives over time. In addition, when reporting on achievements, the activities should provide an overall view of what has been achieved by them rather than an activity-specific view of what has been done.
- c. **User-Centric Design and Implementation:** Organize workshops emphasizing user-centric design (or co-design) principles and methodologies. Understanding the needs and challenges of users will be crucial. This will include, developing, in consultation with GWP activities and the Programme Board, a set of user categories that may be used over time and will provide time series evidence of changes in user targeting.

- d. **Addressing resource gaps:** GEO should provide capacity-building for activities that are unable to secure resources. The ongoing development of the resource mobilization toolkit is key and its future deployment, subject to resources, should consider training and coaching. In addition, GEO should explore the possibility of diversifying its funding sources. This might involve seeking out new partnerships, grants, or sponsorships, particularly targeting those initiatives with the most significant resource deficiencies.
- e. **Expand Capacity Development Initiatives:** Recognizing the importance of capacity development, more focused and coordinated programmes can be introduced. This could include online courses, mentorship programs, and hands-on workshops. The ongoing development of the Capacity Development Toolkit for the GWP will be helpful in this regard, as could be the focused efforts of the Capacity Development Working Group.

Specifically, for the IP template and development process, the following recommendations are proposed:

- a. **Clarify terminology:** There is a need to clarify terminology used in the template – for example, what is meant by capacity development, an output, impact etc. This will need to be communicated to the Programme Board’s Engagement Teams and the GWP activities.
- b. **Fill information gaps and improve analysis:** For future GWP iterations, it will be efficient to build on existing information and engage with activities to fill in key data gaps and on harmonizing inputs. In addition:
 - Subject to resources, the IP tool could be strengthened with a dashboard that reflects standard analyses from the GWP online system and make this information, perhaps in some cases at an aggregate level only.
 - GEO should establish a more transparent and standardized reporting mechanism for WP activities to report their financial and in-kind resources. This would help in assessing the actual resource requirements and in allocating funds more judiciously.