Group on Earth Observations (GEO) 2017-2019 Work Programme Activities
Global **N**etwork for **O**bservations and Information in **M**ountain **E**nvironments (GEO-GNOME)

GEO-GNOME
'Status and Scoping Workshop'
UniS, Schanzeneckstrasse 1, University of Bern I 23-25 May 2018 I Bern, Switzerland

Workshop Report

Wednesday 27 June 2018

Background

Since being incorporated into the GEO Work Programme 2017-2019 as a GEO Initiative, GEO-GNOME (**G**lobal **N**etwork for **O**bservations and Information on **M**ountain **E**nvironments) has sought to connect and facilitate access to diverse sources of mountain observation data and information regarding drivers, conditions, and trends in biophysical and socio-economic processes of change at different scales. In 2017, following a change in leadership, the original 2016 GEO-GNOME Work Plan was revised with a view to consolidating tasks. In order to further refine and bring the work plan to fruition during 2018-2019, it was necessary to jointly review the GEO-GNOME work plan with active participants of the GEO-GNOME effort, as well as others identified as having key expertise on the subject matter. During the three-day Status and Scoping Workshop in Bern, the focus of the discussions lay in the spatial and thematic needs for mountain observation data and the role of GEO-GNOME in curating and making this data available. It was decided that all GEO-GNOME work should be legitimated by policy information needs. GEO-GNOME should operate at two levels: 1) communicating the global importance of mountains and the need for mountain-specific working instruments and data resources, and promoting GEO-GNOME work and products; and 2) providing mountain observation data and knowledge to meet the policy information needs. GEO-GNOME will improve the data delivery by providing a clean metadata catalogue via its GEOSS portal, currently in beta; by ensuring the collection of meaningful new data by establishing a global network for elevation transects; and by producing a new data layer capturing socio-ecological aspects. The key output and outcome of this workshop was the revised work plan, with planned actions flagged such as two targeted GEO-GNOME workshops in 2019.

Key objectives of the workshop

1. Provide an update on the GEO Work Programme 2017-2019 and its priorities;
2. Inform and provide an update on GEO-GNOME's status and the proposed restructuring of its work plan;
3. Co-define and coordinate next steps to implement the GEO-GNOME work plan; and
4. Foster existing and establish new connections and networks of collaboration to exchange ideas and proposals for a new research agenda on mountain observations.

Overview of workshop presentations

The first afternoon provided an opportunity to reflect on mountain observations, with diverse input from different experts. Douglas Cripe of GEO updated participants on the large-scale

aims and initiatives of the GEO Work Programme, while Davnah Payne from the Global Mountain Biodiversity Assessment talked about achievements in the delineation of mountain areas. Roger Sayre from the US Geological Survey then presented the Global Mountain Explorer (GME), a mountain visualization tool and key first GEO-GNOME output. This presentation was followed by Guido Colangeli of the European Space Agency, who guided the audience through the potential and functions of the GEO GEOSS data portal. Nick Pepin from the University of Portsmouth then expanded on scientific advances and open questions that still remain since the publication of a paper on elevation dependent warming in mountain regions in the journal Nature Climate Change – the product of an earlier MRI-supported workshop. He continued by discussing the global need for in-situ climate data over elevation gradients. Finally, Marc Zebisch (EURAC Research) provided a detailed and updated account on the opportunities and challenges for earth observations (EO) in the mountain context, providing examples from the Alps. Additional input was also given by the organizers, in line with the objectives of the workshop.

Picture 1. Left: participants discussing the science of mountain observatories. Right: Guido Colangeli presenting functions of the GEOSS portal to the participants.

Discussions

On the second day, participants held discussions on two different yet related topics. The first discussion on the topic 'Earth observation (EO) infrastructures and information: supply and demand, addressing knowledge needs' started by defining what and where the needs for mountain data are. An example discussed mentioned how governmental and scientific stakeholders in the Caucasus mountain region express a need for spatial and temporal data infrastructure for risk management. The Sendai framework was likely to be one factor motivating these demands at national and regional level. Therefore, understanding the types and formats of data and information required to address reporting needs under frameworks such as Sendai is important.

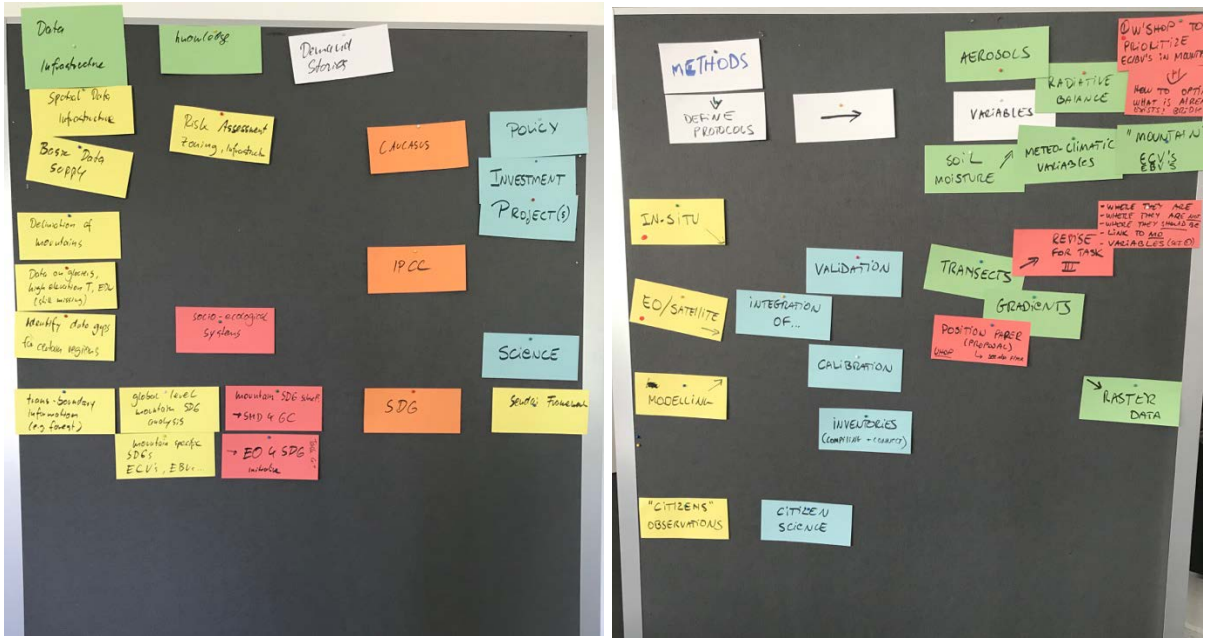
Another storyline discussed, centred on the needs from the research community to produce the types of review and synthesis publications that are useful in the context of global assessment such as those conducted by the IPCC (Intergovernmental Panel on Climate Change), IPBES (Intergovernmental Science-Policy on Biodiversity and Ecosystem Services), IRDR (Integrated Research on Disaster Risk), and others, which themselves contribute to the global policy context. Access to good quality global data is often cited as a limitation to conduct analyses on essential climate variables (ECVs) in mountains. This issue also points to certain

mountain regions that lack the monitoring capacity needed, or that remain unaccounted for in the context of global assessments. Here, GEO-GNOME was considered to play a significant role to help address these gaps. It was also agreed that GEO-GNOME should work on bringing thematically more diverse mountain data available by providing a catalogue of data providers in mountain environments.

The need for mountain specific Sustainable Development Goals (SDGs) was discussed and a global analysis on them was suggested potentially in collaboration with the GEO-initiative EO4SDG (Earth Observations for Sustainable Development Goals). A further example from a pilot project showed how the GME, as a tool, was used to visualise and compare the extent of mountain surface area using different definitions of mountains for reporting on sustainable development in mountains using the SDGs. This case study justified and clarified the type of mapping data needed, and the functions that a GEOSS portal for GEO-GNOME could provide.

At the beginning of the second discussion on the topic 'Science of mountain observations – data and processes' a complexity of changes in mountain environments was noted and a direct need for improving and homogenising observational data, as well as a need for better metadata, was identified. Also better integration of in-situ data, earth observations, modelling and eventually citizen science was seen as a major task. A transect network of in-situ climate data over elevation gradients (Unified High Elevation Observing Platform, UHOP) was suggested as a method for better understand the processes of elevation dependent climate change, and as a standardized way of producing new observational data in the mountains. The planned network of transect data would be useful in combining and standardizing in-situ climate data and earth observations. This could also serve as a template and way forward to combine other mountain-relevant parameters and variables that need to be accounted for (e.g. ecosystems, demographics, etc.).

Participants agreed that climate is the key driver of environmental and socio-ecological change in mountains, which speaks for focusing on the collection and cataloging of climate data. It is, however, important to ensure that the climate data collected is relevant for the variety of end users' knowledge needs and purposes, tackling questions and queries from different fields. Therefore, the starting point should be in identifying specific ECVs for mountains. Collecting data on other environmental processes like natural hazards, water resources and ecosystem accounting in addition and in relation to climate would strengthen GEO-GNOME's ability to provide knowledge for management problems related to disaster control.



Picture 2. Collection of key concepts and ideas from the two discussions. Left: Ideas for better earth observation infrastructure and end users of the data. Right: Topics from discussion on methodology for mountain observations.

Key outcomes and outputs

Based on the output and ideas from these two fruitful sessions, a plenary discussion followed with the more concrete task of revisiting and reframing the current GEO-GNOME work plan until 2019, examining prospects for the GEO Work Programme 2020-2023, and scheduling next steps to implement the plan. The following decisions and planned actions have been implemented as changes in the objectives and tasks of the revised GEO-GNOME Work Programme for 2016-2019 (see Appendix 3 for the new outline). The detailed plan will be developed and made available via the GEO-GNOME website at GEO, and presented at the GEO Plenary in October 2018.

Conceptual decisions:

1. GEO-GNOME work strive to respond to policy and management information needs, while at the same time service the scientific community in its capacity to conduct analyses and studies that respond to these same knowledge needs;
2. This will be accomplished 1) by communicating and highlighting the global importance of mountains and the need for mountain-specific working instruments and data resources, as well as promoting GEO-GNOME work and products, and 2) by providing information derived from key outputs and deliverables for global assessments and other users.

Planned actions:

1. The data delivery will be improved by making the GME accessible via GEOSS portal as a mirror site and linked via GEO-GNOME GEOSS portal (beta).
2. The information delivery will be implemented through the provision of a metadata portal

and data catalogue and improved by compiling a database of existing data providers, including GEO Flagships, Initiatives and Community Activities relevant for GEO-GNOME in mountain environments.

3. The specific need for spatial socio-ecological data will be addressed by producing a new data layer capturing socio-ecological aspects. In addition, a possibility for a follow-up publication comparing the four different mountain layers is considered.
4. A global campaign to collect standardized in-situ data (essential mountain variables) over elevational gradients (UHOPs) will be established in order to improve the spatial distribution and utility of high elevation climate data in the context of understanding mountain climate change and its impacts in mountains.
5. Two targeted workshops will be organized in order to fulfill all the above mentioned actions:
    1) GEO-GNOME Workshop or Webinar for 'Socio-Ecological Data' with an aim to discuss how the socio-ecological data is best derived and;
    2) GEO-GNOME Workshop with sessions for
        a. 'Elevation Transect Data' which aims to identify essential climate variables (ECVs) required in high elevation contexts, define protocols for data collection and standards, and write a position paper for scientific publication.
        b. 'Mountain Climate Change', which aims to identify essential 'mountain' variables' for socio-ecological systems, including methods for integration between in-situ, EO and modelling.

Key follow-up events

1. GEO-GNOME Socio-ecological data work session *(summer 2018)*
2. GEO-GNOME Webinar to report the outcomes of the workshop *(autumn 2018)*
3. GEO Symposium *(11-12.6 http://www.earthobservations.org/me_201806_wps.php)*
4. GEO Paris Agreement Workshop *(13.6 http://www.earthobservations.org/me_201806_wps.php?t=climate_workshop)*
5. GEO Land Degradation Neutrality *(13.6)*
6. GEO Programme Board *(13-14.6)*
7. EuroGEOSS Workshop *(12-14.9 https://ec.europa.eu/easme/en/eurogeoss-workshop-2018)*
8. GEO XV Week *(29.10- 2.11 http://earthobservations.org/geo15.php)*
9. GEO-GNOME Workshop or Webinar for 'Socio-Ecological Data'
10. GEO-GNOME Workshop with sessions for 'Elevation Transect Data' and 'Mountain Climate Change' *(2019)*

We take this opportunity to thank all participants of this workshop and for sharing your valuable time and ideas to help shape the next phase of activities and outputs within the GEO-GNOME framework.

Carolina and Elisa
27 June 2018.

Appendix 1: Workshop Participants

	Name	Affiliation	Country
1	Carolina Adler	Mountain Research Initiative, MRI	Switzerland
2	Joerg Balsiger	University of Geneva	Switzerland
3	Guido Colangeli	European Space Agency, ESA	Italy
4	Douglas Cripe	Group on Earth Observations Secretariat, GEO	Switzerland
5	Nathan Forsythe	Newcastle University	UK
6	Grace Goss-Durant	Mountain Research Initiative, MRI	Switzerland
7	Yaniss Guigoz	UNEP GRID-Geneva	Switzerland
8	Juerg Krauer	University of Bern	Switzerland
9	Aino Kulonen	Mountain Research Initiative, MRI	Switzerland
10	Elisa Palazzi	Institute of Atmospheric Sciences and Climate, ISAC; National Research Council, CNR	Italy
11	Davnah Payne	Global Mountain Biodiversity Assessment, GMBA	Switzerland
12	Nicholas Pepin	University of Portsmouth	UK
13	Manuel Peralvo	CONDESAN	Ecuador
14	Jose Romero	Federal Office for the Environment, FOEN	Switzerland
15	Roger Sayre	US Geological Survey, USGS	USA
16	Maria Shahgedanova	University of Reading	UK
17	Rolf Weingartner	Mountain Research Initiative MRI; University of Bern	Switzerland
18	Marc Zebisch	Institute for Earth Observations, EURAC	Italy

Appendix 2: Workshop Program

	DAY 1 – Wed 23 May **Room B-102**	**DAY 2 – Thu 24 May** **Rooms B-102 and B-103**	**DAY 3 – Fri 25 May** **Room B-102**
09:00-12:30	Arrivals and check-in (lunch on your own)	Plenary - instruction on breakout groups, expected outcomes (*C.Adler, MRI*) Breakout groups: 1. EO Infrastructures and information: supply and demand, addressing knowledge needs (*M.Zebisch, EURAC, C.Adler, MRI)* 2. Science of mountain observation – data and processes (*E.Palazzi, CNR; A.Kulonen, MRI)*	Plenary – deliberation on GEO-GNOME's new work plan; Plenary - Allocation of tasks, agreed timelines and identify resources needed to bring the GEO-GNOME work plan to fruition, as well as ideas to continue the GEO-GNOME beyond 2019. Final words and inputs for next GEO-GNOME workshop.
12:30-14:00	Welcome coffee at 13:30	Joint lunch (MRI)	End of workshop and departures
14:00-17:30	Welcome and introductions (*C.Adler, MRI*) GEO Work Programme 2017-2019 (*D.Cripe, GEO)* Background and rationale for GEO-GNOME (*E.Palazzi, CNR*) Delineation of mountains (*D.Payne, GMBA*) Global Mountain Explorer (*R.Sayre, USGS*) GEOSS portal (*G. Colangeli, ESA*) Science of "Elevation Dependent Warming" (*N.Pepin, Uni of Portsmouth*) EO for mountains (*M.Zebisch, EURAC)* Context for Day 2 (*C.Adler, MRI & E.Palazzi, CNR*)	Plenary – Presentations from both breakout groups on key discussion points, open questions, and exchange between groups. Plenary – Joint discussion on outcomes from both breakout groups and their implications for GEO-GNOME (*C.Adler, MRI*)	
Evening	18:30 - Joint dinner (MRI) Restaurant Beaulieu Erlachstrasse 3, Bern	Free evening	

Appendix 3: Revised GEO-GNOME Work plan for 2018-2019 - Outline

OBJECTIVE I: **Delineate mountain regions using best available data**	***Task 1.1**: Create and compile a single coverage (grid) containing layers depicting different mountain definitions (K1, K2, and K3)* → *Added sub-task: explore option to compile new layer, K4.*
	***Task 1.2**: Create a data viewer portal (Global Mountain Explorer, GME)* → *Added sub-task: Make GME accessible via GEOSS and linked via GEO-GNOME GEOSS portal (beta).*
	***Task 1.3:** Comparison of areas and locations of mountains as portrayed via K1K2K3+ K4 (possible 'write-shop' and publication)*
OBJECTIVE II: **Identify data providers and user knowledge needs**	***Task 2.1**: Finalize compilation of a database of existing data providers, including GEO Flagships, Initiatives and Community Activities relevant for GEO-GNOME*
	***Task 2.2**: Engage and contact data stewards and researchers on other additional relevant data*
	***Task 2.3**: Identify user needs in the specification of data and information needs in-line with GEO's strategy and focus (revise original survey)*
OBJECTIVE III: **Improve monitoring and understanding of key mountain-relevant processes of change**	***Task 3.1:** Support development of UHOP to improve high elevation climate data – from EDW to 'elevation dependent climate change' (EDCC)*
	***Task 3.2**: Workshop on elevation transects – identify essential climate variables (ECVs) required in high elevation contexts, define protocols for data collection and standards, and write a position paper for scientific publication.*
	***Task 3.3**: Workshop to identify essential 'mountain' variables' for socio-ecological systems, including methods for integration between in-situ, EO and modelling (with Task 3.2)*
OBJECTIVE IV: **Link and develop reporting capacities that responds to future policy needs**	***Task 4.1:** List and schedule communication of tasks and associated products in line with key events and global policy opportunities for input (e.g. GEO events including Ministerial Meeting)*
	***Task 4.2:** List, connect and link with other regional and national programs as well as international networks*