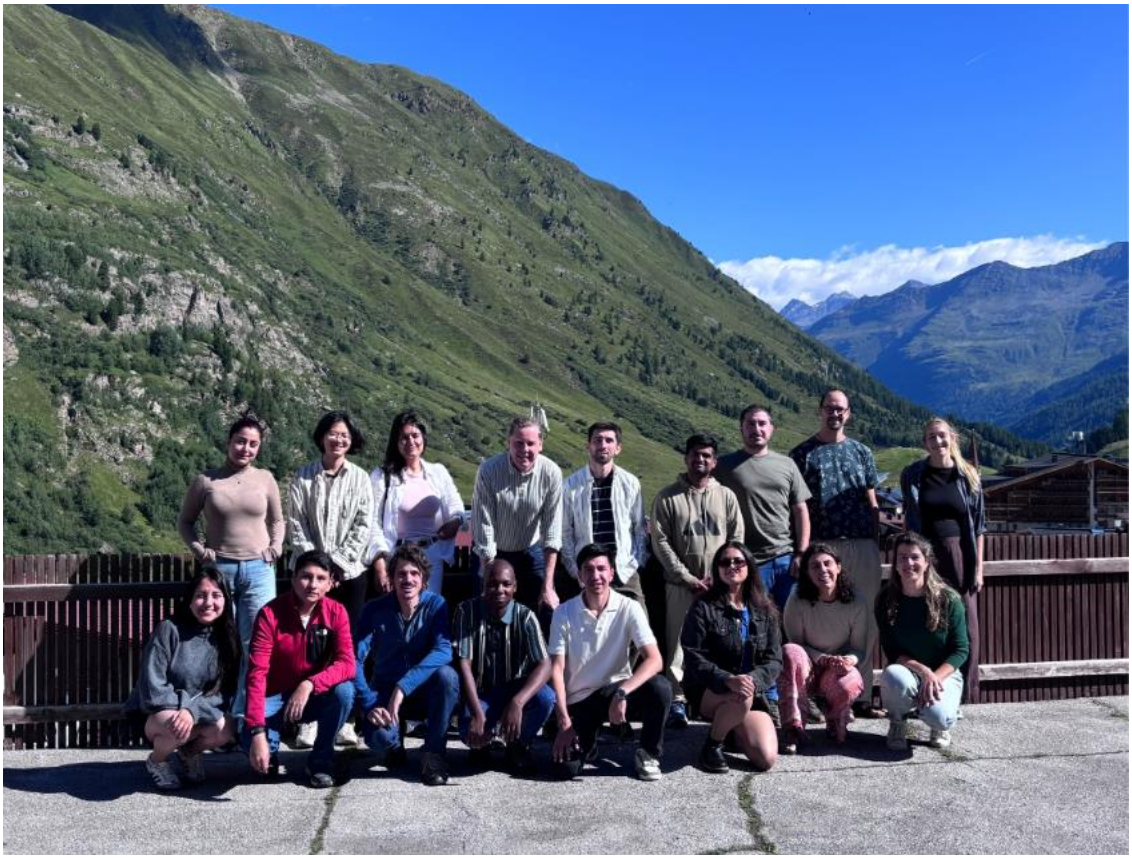
GEO Mountains Youth Ideathon 2026

Programme Report – Public version



Obergurgl, Austria, 2 – 8 July 2026

Final Report (for dissemination)

Report date: 6 August 2026

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Programme Note

Dates: 2–8 July 2026
Location: Obergurgl, Austria
Organisers: Mountain Research Initiative (MRI), GEO Mountains, Group on Earth Observations (GEO) Secretariat
In collaboration with: Regional Mountain Conference (RMC)

Introduction & Programme aims

The GEO Mountains Youth Ideathon 2026 was a hands-on capacity-sharing and innovation programme designed to empower early-career mountain researchers and practitioners to collaboratively design practical, data-informed solutions for disaster risk reduction (DRR) and resilience in mountain regions.

Launched by GEO Mountains and the Group on Earth Observations (GEO) and led by the Mountain Research Initiative, the programme builds on the proven Group on Earth Observations (GEO) Youth Ideathon model and draws on insights from GEO Mountains regional consultations conducted during Adaptation at Altitude Phase 1. It directly addresses identified needs for enhanced technical skills, improved science communication, and more effective engagement at the science-policy interface.

The Ideathon is organised in conjunction with the Regional Mountain Conference (RMC) 2026, enabling participants to engage directly with the wider mountain research and policy community during the second half of the programme.

The programme is supported by the Swiss Agency for Development & Cooperation (SDC) via the Adaptation at Altitude Programme, and aim to contribute to the GEO Mountains Implementation Plan Post-2025, by enhancing youth and Early Career engagement and participation as well as elaborating on methodologies and variables for greater integration of various sources of data and information. As a GEO Participating Organisation, GEO Mountains contributes to the GEO post-2025 strategy by enhancing capacity building, fostering cross-generational collaboration, and strengthening the integration of Earth observations with community-based knowledge systems to support evidence-based decision-making in mountain regions.

The Ideathon brought together 12 early-career researchers and practitioners from diverse mountain regions worldwide, including representatives from the five Adaptation at Altitude focal regions: Andes (Peru, Ecuador), Central Asia (Afghanistan), Hindu Kush Himalaya (Nepal, India), East Africa (Uganda), Caucasus (Georgia, Azerbaijan), as well as from Europe (Italy, Switzerland).

Objectives

The programme aimed to:

- Strengthen participant capacities in Earth Observation, data integration, and mountain disaster risk reduction.
- Facilitate knowledge sharing and exchange of best practices, methodologies, and tools among participants, experts, and stakeholders.Provide hands-on experience in developing user-oriented and policy-relevant solutions.
- Improve participant skills in science communication and science-policy engagement.
- Foster cross-regional exchange and collaboration among young mountain professionals.
- Support the development of innovative prototype solutions addressing mountain DRR challenges.
- Create long-term connections between participants, experts, observatories, and GEO Work Programme activities.

Programme Overview

Time	IDEATHON				CONFERENCE (RMC)		
	Thurs. 02.07 Day 1	**Fri. 03.07** Day 2 – Explore	**Sat. 4.07** Day 3 – Innovate	**Sun. 05.07** Day 4 – Share	**Mon. 06.07** Day 5	**Tues. 07.07** Day 6	**Wed. 08.07** Day 7
07:00	Arrivals	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
08:00		Session 2 Participants Knowledge Sharing	Session 6 Problem–Owners & Challenges	Session 10 Finalisation & Output preparation (Group work)	RMC / Work time	RMC / Work time	RMC / Work time
09:00			Session 7 Solution Design: Conceptualisation (Group work)				
10:00		Session 3 Remote-sensing based monitoring of natural hazards					Farewell Snacks @RMC
11:00							
12:00		Lunch	Lunch	Lunch	Lunch @RMC	Lunch @RMC	Departure
13:00		Session 4 Field trip to the Äußeres Hochebenkar Rock Glacier	Session 8 Solution Refinement with Problem Owners (Group work)	(Group work)	RMC / Work time	Ideathon Workshop @RMC 13:15 – 14:45, Liebenerspitze	
14:00							
15:00			Session 9 Operationalisation Planning & Prototype Development (Group work)	Session 11 Science-Policy Interface Alpine Convention Secretariat (Group work)			
16:00						Session 12 Regional Exchanges	
17:00						MRI, GEO & Ideathon Participants Keynote 17:30 – 18:00, Hochwilde	
18:00	Session 1 Welcome and Introductions	Session 5 Group Meeting – Get familiar with your challenge			Drinks & Snacks, Poster Session @ RMC	Drinks & Snacks, Poster Session @ RMC	
19:00	Dinner & informal gathering	Dinner & free/working time	Dinner & free/working time	Dinner & free/working time	Dinner & free/working time	Feedback session & Final dinner	
20:00							

Report

Thursday 2 July – Arrivals & Welcome

Session 1: Welcome & Introduction

The Ideathon officially started with a welcome and introductory session led by the organisers: Alex Massot (Mountain Research Initiative / GEO Mountains) and Samuel Amos (Group on Earth Observations Secretariat).

Alex Massot opened the session by welcoming participants and introducing the organising team. She provided an overview of GEO Mountains' objectives and main activities, emphasising the initiative's strategic priorities for 2026–2028. She explained the rationale behind organising the Ideathon: to develop and enhance youth and Early Career engagement and participation as part of the GEO Post-2025 Strategy. Alex then presented several key tools and products developed by GEO Mountains that would be relevant for addressing the upcoming challenges: the Global Mountain Explorer, the In Situ Inventory, and the Spatialised Multilateral Environmental Agreements (MEAs) Database. She also highlighted relevant GEO Mountains publications, including research on human populations in

mountains, a policy brief on mountain monitoring, and the Mountains Uncovered Series, which are a collection of resources designed to support evidence-based mountain policy.

Samuel Amos continued by explaining GEO's overarching objectives and mission: to promote free, open, and equitable access to Earth Observation (EO) data and Earth Intelligence solutions. He particularly emphasised GEO's commitment to youth engagement and presented several initiatives designed to empower young people with inspiration, knowledge, networks, and access to Earth observation experts and resources, while advocating for change and accountability for the future they envision. Samuel introduced the GEO Youth Community of Practice (GEO-YOUTH), a youth-led initiative that aims to create paid and volunteer opportunities for youth, advance youth decision-making and representation in GEO, and develop capacity building and peer-to-peer learning opportunities. He noted that GEO-YOUTH has already hosted sessions with young leaders, coordinated the GEO Youth Ideathon in 2025, and launched a GEO Work Programme Mentorship Programme.

Finally, both Alex and Samuel presented the Ideathon's specific objectives, expected deliverables, and logistical information for the week ahead. The session concluded with an icebreaker activity in which participants created a "mountain passport," allowing them to begin getting to know one another and share their backgrounds and interests.

Friday 3 July – Day 1 "Explore"

Session 2: Knowledge Sharing session

The first full working day began with participants presenting their current work, experiences, and challenges from their respective regions. Each participant delivered a 10-minute presentation sharing their expertise, field experiences, and the tools and platforms they use in their work. This session established a foundation of shared knowledge and identified existing resources that could support the development of challenge solutions throughout the week.

Anzor Giorgadze (PhD in Geology, Institute of Geophysics, Tbilisi, Georgia) presented on disaster risk reduction in Georgia, a country where over 60% of territory is mountainous and highly vulnerable to landslides, rock falls, and earthquakes due to its location in the collision zone between the Eurasia and Arabia tectonic plates. He shared case studies including the 2014 Pasanauri rock avalanche, the 2015 Tbilisi landslide, and the 2023 Shovi rock avalanche that triggered a glacier outburst flood. His methodology uses GIS, slope stability analysis, radar data, and InSAR technology for risk assessment. Anzor identified major challenges including fragmentation of data among organisations, lack of systematic data sharing, and inadequate early warning systems, stressing the need for better coordination and open data access.

Nazim Garayli (GIS specialist and PhD student, Azerbaijan) discussed land management in the northern Greater Caucasus, particularly the Quba and Qusar regions, where climate change is driving increased extreme weather, erosion, and landslides. He explained how population migration from mountain villages to cities has led to agricultural land abandonment and loss of traditional farming knowledge, while overgrazing and changing rainfall patterns contribute to soil erosion and vegetation damage. His work uses remote sensing, NDVI monitoring, land use mapping, and erosion models, with plans to integrate AI into future land management projects. Nazim emphasised the need for combining traditional monitoring with modern technologies like GIS, remote sensing, and AI for sustainable land management.

Farhad Ehsani (MSc student in Geo Informatics, Trier University, Germany) shared two projects: creating a geodatabase for Afghanistan and flood risk analysis in Trier. In Afghanistan, his team of 12 GIS and remote sensing specialists used Landsat, Sentinel-2, Planet Scope, Google Earth Engine, and ArcGIS to estimate crop yields despite challenges from mountainous terrain and lack of topographic data. They employed PCA and NDVI to differentiate crops, developing a workflow from pre-processing through classification to final reporting. His flood risk project in Trier used DEM and river data to simulate historical floods, creating an interactive online map showing building-level flood impacts.

Daniela Cabascango Lara (Ecuadorian Institute of Geological and Energy Research, Ecuador) presented on landslide susceptibility assessment in Ecuador, a country positioned along the Pacific Ring of Fire with four distinct natural regions. Using GIS, remote sensing, fuzzy logic, and the analytic hierarchy process (AHP), she integrated 12 conditioning variables (distance to transportation routes, slope, geomorphology, vegetation cover, precipitation, soil type, distance to rivers, water and sanitation infrastructure, lithology, erosion, geological faults) to create susceptibility maps. Her project identified 279 landslides through photo interpretation in Google Earth, with the model demonstrating high accuracy when a predicted high-susceptibility area experienced a landslide four months after the December 2022 assessment. The maps support territorial planning and risk management, with next steps including database consolidation and integration into the national geological information system.

Arunima Sen (MSc student in Earth observation and geoinformatics, Universität Salzburg & Université Bretagne Sud, France) discussed her master's thesis on multimodal flood segmentation using optical and SAR data, employing foundation models trained on diverse data. Her toolkit includes Python, Google Earth Engine, QGIS, agent-based modeling (GAMA), Copernicus data, and climate datasets. She has conducted risk and vulnerability assessments for urban heat waves and flooding, including fieldwork in Romania's Carpathians. Arunima emphasised that risk is not just the hazard itself but the combination of hazards with other factors, stressing the importance of a systemic view in mountainous regions where one hazard can trigger another. She is also involved in climate advocacy, having spoken at the United Nations General Assembly, and emphasises making scientific communication accessible through interactive interfaces.

Loveleen Kour (Project Manager, Consol Geotechnologies, India) discussed mountain hazard monitoring using her background in glaciology, having studied over 150 glaciers in the Western Himalayas. Consol Geotechnologies provides geotechnical and structural monitoring using field instruments (piezometers, inclinometers, strain gauges) for hydropower projects and national highways. Her tools include QGIS, ArcMap, Leica GeoInfinity, Google Earth, Sentinel, and Landsat data, along with data from the Indian Meteorological Department, Survey of India, and Bhuvan Geoportal. She identified key lessons including lack of coordination between departments, inconsistency of hazard maps, the need for climate data integration into disaster planning, and the importance of shifting focus from large-scale infrastructure to ground-level damage assessment and community awareness. The company shares real-time monitoring data with policy stakeholders through dashboards and structured reports for early warning systems.

Hairo León Dextre (Environmental engineer and remote sensing analyst, Universidad Nacional Santiago Antunez de Mayolo, Peru) presented research on landslides and rock glaciers in the Peruvian Andes, particularly the Cordillera Blanca. He uses Sentinel-2, Landsat 5-9, SAR data, Google Earth Engine, Google Colab, and QGIS for temporal analysis of glacier and snow cover changes, landslide inventory construction, and rock glacier identification following International Permafrost Association guidelines. His research integrates high-resolution data from drones (DTM, DEM, aerial photography), global datasets (CHELSA for climatology), and regional datasets (PISCO and RAIN for temperature and precipitation). Hairo emphasised the importance of data standardisation for robust machine learning models and follows FAIR principles for data management, having published the latest landslide inventory in Pangaea for scientific community access.

Johannes Reinthaler (Research Associate, Federal Office for the Environment, Switzerland) presented the WARMA project, developing a national landslide warning and monitoring system with two pillars: warning for spontaneous shallow landslides triggered by heavy rainfall, and monitoring of permanent slow-moving landslides. The warning system uses a statistical model based on rainfall forecast data and historical landslide events with regional thresholds, currently in the testing phase. For permanent landslides, the project uses InSAR satellite observation with Permanent Scatter points for velocities under 50 mm/year and raster interferograms for faster movements, with yearly updates published on the Swiss hazard platform (GIN). Core challenges include unknown release point locations, quantifying soil moisture, including thunderstorms in forecasts, limited data coverage in forested areas, and velocity limitations. Future goals include more frequent automated updates, automated mapping using AI, automatic acceleration detection for public warnings, and inclusion of L-band satellites for better coverage. Johannes mentioned tools for the community including SZ Plugin, FSLAM (QGIS), PyLandslide, ASF OpenSARLab, HyP3, TerraTrack, ISCE, and MintPy.

Federica Ballardini (MSc student in cartography, University of Innsbruck, Austria) is researching integration of hazard information into topographic maps to enhance safety in mountainous areas. Her thesis focuses on rockfall, investigating cartographic visualisation methods to integrate this information into apps and testing usability through surveys. She uses QGIS for interactive projects, open-source tools like Affinity for vector editing, and sources data from OpenStreetMap, Open Topography, and national/local providers. Federica emphasised the importance of interdisciplinary cooperation, keeping end users in mind when creating maps to ensure information is accessible, and the potential for cartography to improve usability of existing data and turn it into actionable insights at multiple scales. Her research-based thesis will be disseminated through conferences, with interest in understanding pathways to turn research into practical applications.

Sandesh Paudel (PhD student, University of Innsbruck, Austria) presented research on analyzing flood processes and related risks in mountainous regions, particularly Tyrol, Austria. With background in civil and hydraulics engineering and experience in Nepal's Ministry of Water Resources and Irrigation since 2015, his work focuses on river hydrology, hydraulics, sediment transport, and infrastructure protection. His research involves statistical analysis of river discharge data from 1951 to 2020 to determine trends in flood frequency, timing, and intensity; bed load transport studies in steep mountainous catchments using weather stations and remote sensing; and integration of lidar, Landsat, and Sentinel data to study climate change effects. He uses Copernicus DEM, Google Earth, ArcGIS Pro, QGIS, Python, and data from the TIRIS portal. Sandesh emphasised the importance of an integrated approach combining drivers, change, and effects, the value of open government geodata portals, and sharing results with stakeholders including the Tyrol government, hydropower companies, and river management authorities.

Key takeaways from the knowledge sharing session:

- Participants brought diverse regional expertise from Georgia, Azerbaijan, Afghanistan, Ecuador, India, Peru, Switzerland, Austria, and Nepal
- Common tools included QGIS, ArcGIS, Google Earth Engine, Python, Sentinel, and Landsat data
- Major challenges identified: data fragmentation, lack of coordination, accessibility barriers, cloud cover limitations, and gaps in early warning systems
- Strong emphasis on integrating multiple data sources, combining traditional knowledge with modern technology, and ensuring accessibility for decision-makers
- Participants compiled a valuable inventory of tools, platforms, and approaches to draw upon during challenge development

Session 3: Remote-sensing based monitoring of natural hazards

Presenter: Dr. Lukas Winiwarter, Professor of Geodesy, University of Innsbruck

Dr. Lukas Winiwarter delivered an in-depth technical session on remote sensing-based surface monitoring of natural hazards, with a particular focus on geodetic principles of deformation monitoring, coordinate references, and uncertainty. The session provided participants with essential background on different remote sensing methods available for acquiring data and describing surface displacements resulting from change processes in alpine environments.

The discussion covered Earth observation, geodetic principles, and the use of satellite, airborne, and terrestrial methods. Winiwarter highlighted the accelerating Eisner in Karok Glacier, noting a 760-70m/year movement rate. He explained the importance of precise georeferencing and the use of Global Navigation Satellite Systems (GNSS) for accurate measurements. Permanent GNSS stations on rock glaciers showed 4.7m displacement over two years. Dr. Winiwarter explained the concept of differential GNSS and its benefits in reducing atmospheric and satellite errors, and the use of GNSS for laser scanning and the importance of direct georeferencing. The presentation emphasised the need for accurate data processing to distinguish natural hazard movements from noise, as well as the importance of geodesy in geospatial monitoring. Complementing the technical methods, he explained

geodetic priors such as stable coordinate reference frames that allow for absolute positioning on Earth, making long-term monitoring projects possible.

Lukas also introduced the Alps Watch Project, a collaborative mapping initiative by the Geography Department in Innsbruck that invites citizen scientists to report natural hazards using a mobile-optimised app or website. Users can geo-locate and report incidents, with others confirming and adding photos for verification, providing real-time information about natural hazards especially on remote hiking paths.

Key takeaways:

- Understanding geodetic principles is essential for interpreting remote sensing data
- Different methods are suited to different scales and types of deformation
- Long-term monitoring requires stable reference frames and consistent methodologies
- Uncertainty must be properly quantified to identify significant changes
- Citizen science can complement traditional monitoring approaches

Session 4: Field trip to the Äußeres Hochebenkar Rock Glacier

Participants embarked on a field excursion to the Äußeres Hochebenkar rock glacier, providing hands-on experience with a natural hazard site and demonstrating practical applications of the remote sensing techniques discussed in the morning session. The excursion offered participants the opportunity to observe firsthand a rock glacier that has been accelerating in recent years and is now in conflict with an access road to an alpine hut, illustrating the real-world challenges of mountain hazard monitoring and management.

The group departed the University Centre, hiking through alpine pine forest, to reach the rock glacier at approximately 2,290 meters above sea level. During the excursion, **Mia Ohlrogge** (MSc, PhD Student at the University of Innsbruck) provided expert guidance and conducted a UAV (drone) demonstration showing how high-resolution 3D data is acquired for monitoring purposes.

The field visit allowed participants to directly observe the geomorphological features of an active rock glacier, understand the practical challenges of monitoring in alpine environments, see the infrastructure threatened by rock glacier movement (the access road to the alpine hut), and witness the application of UAV technology for high-resolution terrain data collection. The excursion reinforced the morning's theoretical content with a tangible example, helping participants understand the scale, complexity, and practical implications of mountain hazard monitoring.

Session 5: Group Work – Get familiar with your team and challenge

At the end of the day, participants gathered in their assigned challenge teams for initial team-building and challenge exploration. This session provided teams with dedicated time to introduce themselves, share their backgrounds and expertise, establish working dynamics, and begin unpacking the specific challenge they would address throughout the week.

Saturday 4 July – Day 2 "Innovate"

Session 6: Problem–Owners & Challenges

Four problem owners presented the specific challenges that teams would address throughout the Ideathon, providing crucial context about mountain disaster risk reduction needs. The challenges are presented in Annex 3.

Session 7: Solution Design: Conceptualisation

Teams began the intensive process of transforming initial ideas into concrete solution concepts through structured brainstorming and design activities. The session was structured around key guiding questions (see Annex 1) that helped teams articulate specific problems in clear statements, define geographic scope and scale, identify relevant timeframes, determine what their solution would deliver and its core innovation, identify data sources (remote sensing, in situ, local knowledge), select analytical methods and tools, and envision final outputs (maps, graphs, alerts, reports). Problem-owners circulated among teams to provide guidance and help maintain focus on developing practical, user-oriented solutions.

By the end of the session, most teams had developed preliminary solution concepts with clear articulation of the problem, target users, data sources, methods, and intended outputs. Teams used whiteboards, flip charts, and collaborative digital tools to sketch workflows, create concept diagrams, and document their emerging ideas, while preparing lists of specific questions for their upcoming consultations with problem owners to validate aspects of their concepts and receive expert guidance on alternatives under consideration.

Session 8: Solution refinement with problem owners

Teams met directly with their respective problem owners for in-depth consultations to validate and refine their emerging solution concepts. These one-on-one sessions allowed teams to present their preliminary ideas, receive expert feedback on technical feasibility and practical applicability, and clarify critical aspects of data availability, methodological approaches, and user requirements. Problem owners provided guidance on constraints, operational contexts, and institutional considerations that would affect implementation, helping teams adjust their concepts to better align with actual needs and capabilities on the ground. Specific guiding questions and expected outputs are detailed in Annex 1.

Session 9: Operationalisation Planning & Prototype Development

Following refinement consultations, teams shifted focus to operationalising their solutions and developing initial prototypes or mock-ups. This session concentrated on translating conceptual frameworks into concrete implementation plans, including defining technical workflows, identifying specific tools and platforms, establishing data processing pipelines, and creating visual representations of intended outputs. Teams worked to develop demonstrable elements of their solutions, that could illustrate how their approach would function in practice and deliver value to end users. Specific guiding questions and expected outputs are detailed in Annex 1.

Sunday 5 July – Day 3 "Share"

Session 10: Group work & outputs preparation

Teams continue working on their projects, focusing on finalising their solutions and preparing deliverables for the Regional Mountain Conference presentation. This session provided dedicated time for teams to complete their prototypes, refine technical workflows, finalise visualisations and outputs, and develop their presentation materials. Teams worked to ensure all elements of their solutions were coherent and clearly articulated, from problem definition and user needs through data sources, methods, and intended outputs. Problem-Owners remained available for technical support and guidance as teams polished their work, resolved remaining technical challenges, and prepared to communicate their solutions effectively with problem-owners in the upcoming final presentations.

Session 11: Science – Policy Interface, Alpine Convention Secretariat

Felix Gertheinrich and **Raphaël Lelouvier** from the Permanent Secretariat of the Alpine Convention introduced participants to this pioneering international treaty, signed in 1991 by eight Alpine countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, and Switzerland) and the European Union. As the first international agreement covering an entire mountain range across multiple national

borders, the Alpine Convention aims to safeguard the Alps' unique natural and cultural heritage while promoting sustainable development.

The Convention operates through a framework convention complemented by nine thematic protocols addressing topics such as spatial planning, mountain farming, nature protection, mountain forests, tourism, energy, soil conservation, and transport. Its governance structure includes the biennial Alpine Conference at ministerial level, a Permanent Committee, a Compliance Committee, and nine thematic working bodies composed of national experts and observer organisations. The presenters highlighted key science-policy communication instruments, including the biennial Reports on the State of the Alps (RSA), most recently on quality of life. The Convention's Multi-Annual Work Programme 2023-2030 focuses on three priority areas: conserving Alpine biodiversity and ecosystems, taking ambitious climate action, and enabling good quality of life for Alpine populations, aligning with international frameworks such as the EU Climate Targets, the EU Biodiversity Strategy, and the UN Sustainable Development Goals.

Raphaël Lelouvier then provided a comprehensive overview on policy briefs as essential tools for translating complex research into actionable recommendations for decision-makers. He defined a policy brief as a concise document that summarises a specific policy issue and provides clear recommendations, designed for policymakers who need to understand issues quickly without having time for extensive research. Unlike academic papers that focus on research methods and findings for specialist audiences, policy briefs emphasise practical implications and applications, using accessible language free of unnecessary jargon. The typical structure may include:

- Title
- Executive summary
- Context or scope of problem
- Policy overview
- Policy recommendations
- Appendices
- Consulted or recommended sources

Raphaël emphasised that effective policy briefs require careful audience identification, clear framing of well-defined problems that can be addressed through policy action, and concise formulation of recommendations supported by relevant data. Visual aids such as graphs and charts enhance accessibility, while short sections with clear headings allow readers to quickly locate information. The process involves identifying a policy-relevant problem, framing the issue by answering key questions about its nature and scope, formulating convincing recommendations, and ultimately reaching the appropriate decision-makers through established governmental and intergovernmental channels.

Participants were given thirty minutes to collaboratively develop a joint policy brief on disaster risk reduction in mountain regions, drawing from their work on specific challenges. Each group presented their contributions: Team 1 emphasised the necessity of multisource observation for landslide risk assessment and recommended investing in community knowledge integration; Team 2 addressed the need for resilient multi-hazard models in hydropower development in the Hindu Kush Himalaya, advocating for mandatory risk assessments and participatory hazard mapping; Team 3 focused on land degradation in Lesotho, recommending geospatial data integration and connection with sustainable land management initiatives; and Team 4 highlighted territorial sovereignty issues for the Lakota people, calling for prior consultation and integration of indigenous knowledge with technical tools. The feedback session revealed several critical lessons: Felix and Raphaël emphasised the importance of using concise, accessible language tailored to specific stakeholder audiences rather than technical jargon, incorporating visual aids to enhance communication, and focusing on key data points in the main text while relegating detailed information to appendices. They highlighted the challenge of generalising recommendations across different regional contexts while maintaining relevance, suggesting focus on common issues such as institutional capacity and financial resources. Participants reflected on the difficulty of balancing power dynamics between writers and policymakers from different contexts, and the importance of identifying target audiences early in the process.

The full drafted brief developed during the exercise is available in Annex 6.

Monday 6 July – Wednesday 8 July – Regional Mountain Conference

Participants had the opportunity to attend the Regional Mountain Conference (RMC), where they were free to choose from various sessions aligned with their interests and research areas, allowing them to make valuable connections with mountain experts, researchers, and practitioners from across the region. This flexibility enabled participants to explore diverse topics, engage in discussions with specialists in their fields, and build professional networks that extended beyond the Ideathon cohort.

Tuesday 8 July – Final Day

13:15 – 14:45 – Dedicated Conference Workshop

WS 26.106 – Youth-Led Data Solutions for Mountain Disaster Risk Reduction: Presentations and Dialogue with the GEO Mountains Ideathon participants

In addition to the open conference sessions, a dedicated RMC workshop was organised specifically for the Ideathon participants, providing a focused space to integrate their collaborative work with the broader mountain research community and to share their solutions on disaster risk reduction challenges in mountain regions.The abstract submitted is available in Annex 8.

Session 12: Regional Exchanges

A final session was held to bring the participants to reflect on the Ideathon solutions presented during the conference, discuss their transferability and implementation within each mountain region, and identify region-specific opportunities and challenges.

- **Hindu Kush Himalaya (HKH)**

  Solutions are seen as replicable, but a major barrier is the lack of data and the difficulty of data sharing, especially the access to in situ data. ICIMOD currently operates only at a regional level, and the group emphasised the need for a dedicated secretariat, similar to the Alpine Convention, to coordinate cross-border data access and cooperation.

- **Andes & East Africa**

  Solutions are considered replicable, and the region is already investing in implementation. Prevention was highlighted as essential, along with the use of global datasets where local data is lacking. A key barrier identified for East Africa is the absence of information on how landslides have actually affected local populations, limiting the ability to design targeted interventions.

- **Caucasus**

  Discussion focused on the transferability of hazard and risk assessment tools. A significant barrier is that EU standards do not match local conditions or capacities, limiting direct transfer of solutions. Opportunities exist around investment in hydropower plants, but this requires additional financial resources. The region also faces a lack of social data and an increase in cascading hazards. Community-based approaches were identified as a promising path for adaptation.

- **Alps**

Transferability to the Alps is considered largely already implemented at the technical level; the main challenge lies in implementation within the local political context. Greater data openness and data transfer, along with more room for collaboration between Alpine countries, were identified as key needs going forward.

Cross-regional common themes

- Data access and sharing is a recurring barrier across nearly all regions.
- Political and institutional coordination (secretariats, cross-border cooperation) is needed where technical transferability already exists.
- Community-based approaches are seen as a strong adaptation strategy where formal/global standards don't fit local contexts.
- Financial resources remain a constraint even where opportunities are identified.

Annexes

Annex 1 – Detailed Programme

Thursday 2 July – Arrivals & Welcome

17 :30 – 18:30: Welcome and Introductions

Aim of the session: Welcome participants, defining clear objectives and outcomes of the ideathon and present the overall organization

Session Description: This opening session establishes the foundation for the week ahead. Participants will understand the programme's purpose within the broader GEO Mountains initiative, learn about the challenge-based methodology, and begin building connections with fellow participants.

Details:

1. Welcome (5')
2. Presentation on GEO Mountains, Mountain Research Initiative, Alex Massot & Glenn Hunt (10')
3. Presentation from GEO Secretariat, Samuel Amos (10')
4. Introduction to the ideathon, presentation of the programme, experts & RMC (10') + housekeeping
5. Icebreaker Activity (25')

18:30 – 20:00 Dinner

Friday 3 July – Day 1 "Explore"

07:00 – 08:00 – Breakfast

08:00 – 10:30 – Participants Knowledge Sharing session

Aim of the session: Participants will share their experiences and challenges in their current contexts and introduce fellow participants to existing tools, platforms, databases, and projects that can help them develop their solutions

Session Description: This session presents concrete examples of successful mountain monitoring projects, data integration platforms, and analytical tools that participants are currently using or are familiar with. Each participant prepares a 10 minutes presentation of their work and related topics. They should share what they do, share experiences and challenges from their fields and regions, and think about concrete tools or applications that could be useful for others.

Speakers:

- Anzor Giorgdaze, Title TBD
- Nazim Garayli, Title TBD
- Farhad Ehsani, Title TBD
- Arunima Sen, Title TBD
- Loveleen Kour, Title TBD
- Moses Kutosi, Title TBD
- Ann Frida Nandutu, Title TBD
- Hairo Léon Dextre, Title TBD
- Daniela Cabascango Lara, Title TBD

- Johannes Reinthaler, Title TBD
- Federica Ballardini, Title TBD
- Sandesh Paudel, Title TBD

Guiding questions:

1. What existing EO platforms and tools are you using?
2. What are the strengths and limitations of each tool?
3. What key datasets exist for your mountain regions / are you using it often? (climate, topography, hazards, socio-economic)
4. What lessons can be learned from your existing projects?
5. How can projects ensure long-term accessibility and reusability?
6. How do you share your results? How do you link your projects / results with policy stakeholders?

Expected participant outcomes:

- Compile a list of tools or useful resources that will help them tackle their Ideathon challenges,
- Learn from other participants experiences
- Share challenges/solutions

10 :30 – 11:00 – Coffee Break

11:00 – 12:30 – Remote-sensing based monitoring of natural hazards

Aim of the session:

- Overview of methods for remote-sensing based surface monitoring of natural hazards showcased in the Austrian Alps
- Geodetic principles of deformation monitoring, coordinate references, and uncertainty

Session description: In alpine remote sensing for deformation monitoring, different methods are available to acquire data and describe the surface displacements resulting from change processes. The session will introduce remote sensing methods that are used to monitor these changes, including laser scanning, photogrammetry, radar, and others, on different platforms from terrestrial to spaceborne. Examples in the region will underline the necessity of monitoring in case of threatened infrastructure. Complementing this will be geodetic priors, such as stable coordinate reference frames, that allow for absolute positioning on Earth making long-term monitoring projects possible in the first place. Finally, a discussion on uncertainty and significance on change will help to interpret the presented data.

Speakers:

- Dr. Lukas Winiwarter, Professor of Geodesy -- Geoinformation and AI-Applications at the University of Innsbruck

Expected participant outcomes:

- Knowledge of different remote sensing techniques for deformation monitoring, their individual advantages and usefulness, and required geodetic background

12:30 – 13:30 – Lunch break

13:30 – 17:30 – Field trip to the Äußeres Hochebenkar Rock Glacier

Aim of the session: To get to know a natural hazard face to face.

Session description: Excursion to the Äußeres Hochebenkar (AHK/HEK) rock glacier, which has been accelerating in the last years and is now in conflict with an access road to an alpine hut. Demonstration of UAV equipment to acquire high-resolution 3D data. The AHK is reachable by a hike from the Obergurgl University Center. The regular path (5.25 km) takes you through an alpine pine forest, past a waterfall, and then across meadows, while the easier path (4.8 km) goes along an alpine access road (closed to the public). The elevation difference is about 450 m (from 1920 to 2290 m a.s.l.). Note that there is little protection from the elements on the alpine slopes, so sunscreen and a hat as well as enough water are a must. As the weather can change quickly in the mountains, rain gear (jackets) are required to be brought along. The hike is doable with regular (sport) shoes, but hiking boots are recommended. For fast hikers, it usually takes 1.5 hours one-way. We will plan with 2h to look at some sights along the way.

- Leaving the University Centre at 13:00
- Arriving at AHK at 15:00 (2h hike)
- Drone demonstration until 15:30
- Hike back to University Centre until 17:30 (2h hike)

Speakers:

- Mia Ohlrogge, MSc.; PhD Student at the University of Innsbruck, Unit of Geometry and Surveying

Expected participant outcomes:

- Increased awareness for natural hazards in the Alps – field visit

17:30 – 18:30 – Short briefing & Group Work – Get familiar with your team and challenge

Aim of the session: Each team becomes more familiar with the assigned challenge and begins to exchange ideas.

Session description: Participants will work in teams on four challenges. Each challenge is presented on a poster in a designated area. The teams will gather for their first group work session to brainstorm, share their perspectives, skills, and initial ideas.

Guiding questions:

1. Personal Motivation & Contributions:
    - What motivates each team member to work on this specific challenge?
    - What expertise, skills, or knowledge can each member contribute?
    - What roles might team members take? (e.g., coding, data analysis, visualisation, communication, ...)
2. Challenge Understanding:
    - What are the core elements of this challenge based on the challenge's description?
    - What aspects need further clarification?
    - What questions should we ask the problem owner tomorrow?
3. Solution Directions:
    - What initial ideas do team members have for potential solutions?
    - What aspects should the solution incorporate to be effective and user-relevant?
    - What are the must-have vs. nice-to-have features?
4. Data & Resources:
    - What datasets might be useful for this project? (from today's sessions and team members' knowledge)

- What tools or platforms could we leverage?
- What additional resources or expertise might we need?

Expected participant outcomes:

- Form cohesive teams with clear understanding of each member's strengths
- Develop shared understanding of the challenge
- Generate initial ideas and directions to explore
- Create list of questions and data needs
- Establish team working dynamics and communication approaches

18:30 – 20:00 Dinner & free / group working time

Saturday 4 July – Day 2 "Innovate"

07:00 – 08:00 – Breakfast

08:00 – 09:30 – Problem–Owners & Challenges

Aim of the session: Introduce the four challenges that teams will address, presented by the problem owners who face these issues in their professional contexts.

Session description: Each problem owner presents a specific mountain DRR challenge from their region or area of work. These presentations provide the foundation for the week's work, helping participants understand the context, stakeholders, data needs, and decision-making processes their solutions must address.

Speakers:

- Dr. Lingfeng He (pre-recorded video)
- Dr. Yan Zhong
- Joana Eichenberger
- Diana Mastracci

Questions each problem owner should answer:

1. Context & Background:
   - What mountain region or context does this challenge address?
   - What are the key physical, social, and economic characteristics of this area?
2. The Challenge:
   - What specific disaster risk or hazard are you dealing with? (e.g., landslides, glacial lake outbursts, avalanches, floods, droughts)
   - Who is affected and how? (communities, infrastructure, ecosystems)
   - What makes this challenge particularly pressing now?
3. Current Situation:
   - What monitoring systems, data sources, or early warning mechanisms currently exist (if any)?
   - What are the main gaps or limitations in current approaches?
   - What decisions need to be made and by whom? (local authorities, emergency services, communities)
4. User Needs:
   - Who are the primary users/stakeholders for potential solutions?
   - What information do they need and in what format?

- What are the technical capacities and constraints of potential users?

5. Desired Outcomes:
   - What would an ideal solution look like?
   - How would success be measured?
   - What are the realistic constraints (technical, financial, institutional)?

Expected participant outcomes:

- Understand the four challenges in depth
- Identify initial questions to explore further
- Start considering potential data sources and approaches

09:30 – 10:00 – Group picture & Coffee Break

10:00 – 12:00 – Solution Design: **Conceptualisation**

Aim of the session: Transform initial ideas into concrete solution concepts with clear problem definitions, user needs, data requirements, and methodological approaches.

Session Description: Teams work collaboratively to develop the conceptual framework for their solutions. This is structured brainstorming and design work, moving from general ideas to specific approaches.

Guiding questions:

1. Problem Definition (Refined):
   - What is the specific problem we are addressing? (one clear statement)
   - What is the geographic scope and scale?
   - What timeframes are relevant? (real-time, seasonal, long-term trends)
   - Why is this problem important and urgent?
2. Target Users & Stakeholders:
   - Who are the primary users of our solution? (be specific: e.g., "municipal emergency managers in X region")
   - What are the secondary users or beneficiaries?
   - What are their technical capacities and constraints?
   - What information do they currently lack?
   - What format and accessibility do they need?
3. User Needs Assessment:
   - What decisions will our solution inform or enable?
   - What questions should our solution answer for users?
   - How will the solution fit into existing workflows or decision-making processes?
   - What would make the solution actually usable and useful?
4. Solution Concept:
   - What will our solution deliver? (e.g., risk map, early warning dashboard, monitoring protocol, decision support tool)
   - What is the core innovation or value proposition?
   - How does it improve upon existing approaches?
5. Data Requirements:
   - What data sources will we use? (remote sensing, in situ, etc.)
   - How will we integrate local or traditional knowledge (if needed)?
   - What are the data availability and access constraints?
6. Methodological Approach:

- What analytical methods or models will we apply?
- What processing steps are involved?
- What tools or platforms will we use?
- What is the basic workflow from data to output?

7. Outputs & Visualisation:
   - What will the final output look like?
   - How will information be visualised and communicated?
   - What formats will be provided? (maps, graphs, alerts, reports)
8. Preparation for problem owner meeting:
   - What aspects of our concept need validation or feedback?
   - What specific questions do we have for the problem owner?
   - What alternatives are we considering and need guidance on?

Expected participant outcomes:

- Completed solution concept document or visual summary
- Clear articulation of problem, users, data, methods, and outputs
- List of specific questions for problem owner consultation
- Preliminary data inventory and access plan
- Initial workflow diagram or conceptual model
- Team agreement on core approach and priorities

12:00 – 13:00 – Lunch

13:00 – 15:00 – Solution refinement with problem owners

Aim of the session: Validate solution concepts with problem owners, receive expert feedback on feasibility and user relevance, and refine approaches based on real-world insights.

Session Description: Each team meets with their problem owner for focused consultation. Teams present their conceptual solution and receive critical feedback on its relevance, feasibility, and alignment with actual user needs. This is an iterative dialogue to ensure solutions are grounded in reality and address genuine needs.

Guiding questions:

1. Concept Validation:
   - Does our understanding of the problem accurately reflect your needs and context?
   - Is our proposed solution relevant and useful for the identified users?
   - What aspects of our concept are most promising?
   - What aspects might not work in practice and why?
2. Data & Methodology:
   - Are the data sources we've identified appropriate and accessible?
   - What data quality or availability issues should we anticipate?
   - Is our proposed methodology sound and feasible?
   - What simpler or alternative approaches might work better?
3. Refinement Directions:
   - What should we prioritise in our remaining development time?
   - What adjustments would make the solution more impactful?

- What examples or case studies should we look at?

Expected participant outcomes:

- Validated and refined solution concept
- Clear understanding of what works and what needs adjustment
- Specific guidance on data sources and methods
- Realistic assessment of feasibility
- List of refinements to implement in afternoon session
- Stronger connection between solution and real-world application

15:00 – 15:30 – Coffee Break

15:30 – 17:40 – Operationalisation Planning & Prototype Development

Aim of the session: Develop detailed implementation plans, create preliminary prototypes or visualisations.

Session Description: Teams work intensively to translate their refined concepts into operational plans and prototype materials. This includes developing technical workflows, creating mockups or preliminary visualisations, drafting user guidance, and preparing materials to demonstrate how the solution would work in practice. The focus shifts from "what" to "how."

Guiding questions:

1. Implementation Workflow:
   - What are the step-by-step processes from data acquisition to final output?
   - What happens at each stage? (data download → preprocessing → analysis → visualization → dissemination)
   - What tools or software are used at each step?
2. Technical Architecture:
   - What is the overall system architecture? (create a diagram)
   - How do different components connect?
   - Where is data stored and processed?
   - How are outputs delivered to users?
   - What automation is possible vs. what requires manual intervention?
3. Prototype Development:
   - What can we create to demonstrate our solution? (mockup map, dashboard sketch, sample output, workflow diagram)
   - What example or case study can we use to illustrate the approach?
   - Can we process sample data to show proof of concept?
   - What visual materials will help communicate our solution?
4. User Interface & Experience:
   - How will users access and interact with the solution?
   - What does the user journey look like? (from need → access → interpretation → action)
   - What instructions or training would users need?
   - How can we make it intuitive and user-friendly?
5. Sustainability & Maintenance:
   - How will the solution be updated and maintained over time?
   - What happens when data sources change or become unavailable?
   - How can the solution adapt to changing user needs?

- What is the long-term sustainability model?

6. Scalability & Transferability:
   - Can this solution be scaled to larger areas or more locations?
   - What would be required to transfer it to other mountain regions?
   - What aspects are context-specific vs. generalisable?
   - How can the methodology be documented for replication?

Expected participant outcomes:

- Detailed implementation workflow and technical architecture
- Prototype materials (mockups, sample outputs, diagrams, visualisations)
- User guidance or interaction design
- Clear articulation of how the solution would work in practice

17:40 – 18:00 – Short briefing & updates session

18:30 – 20:00 – Dinner

Sunday 5 July – Day 3 "Share"

07:00 – 08:00 – Breakfast

08:00 – 14:30 – **Group work & outputs preparation** (including coffee break, 10:00 – 10:30; and lunch 12:00 – 13:00)

Aim of the session: Finalise solution concepts & outputs, refine presentations, and prepare all deliverables for the Regional Mountain Conference workshop.

Session Description: Teams work independently to consolidate their work from the previous days, refine their prototype materials, and prepare their presentations and outputs. This is dedicated time to ensure all teams are ready to communicate their solutions effectively to the RMC audience and complete required deliverables.

Expected participant outcomes:

- 10-minute presentation ready for RMC workshop
- Finalised one-page solution summary
- Polished prototype materials and visualisations
- Clear team presentation strategy and role distribution
- Confidence in communicating solution to broader audience

14:30 – 15:00 – Coffee Break

15:00 – 16:30 – **Science – Policy Interface**, Alpine Convention Secretariat

Aim of the session: Introduce participants to the Alpine Convention's role in regional governance and provide practical guidance on preparing concise policy briefs that translate scientific evidence into actionable recommendations for Alpine policy-making.

Session Description:

The Alpine Convention is the first international treaty dedicated to the protection and sustainable development of an entire mountain range. The rationale behind its

creation 35 years ago was to provide Alpine countries with a formal instrument to address challenges that are cross-border in nature.

Together with its Contracting Parties Austria, France, Italy, Germany, Liechtenstein, Monaco, Slovenia, Switzerland, and the European Union, the Convention aims to be a bridge between policymaking and the concrete realities of Alpine territories. Through its protocols, working groups and thematic expertise, the Convention can feed Alpine-specific knowledge into political debates and help ensure that mountain concerns are adequately reflected in legislation.

In these processes, science and research play a central role in helping understand the complex interactions of environmental impacts in mountain ecosystems, informing decision-making, and exchanging best practices.

This workshop will include a brief presentation of the Alpine Convention and of best practices behind the preparation of a policy brief, followed by a policy brief writing exercise for the challenge groups. It aims to introduce participants to the science-policy interface in regional governance processes.

- 20 min Presentation: "Alpine Convention & our science-policy communication"
- 5 min Explaining workshop session
- 10 min Presentation: "what does a policy brief look like?"
- 30 min Group work: each Challenge-group writes a short input on their topic for a joint policy brief
- 10 min Presentation of the joint policy brief
- 10 min Feedback

Speakers:

- Raphaël Lelouvier, Project Officer, Permanent Secretariat of the Alpine Convention
- Felix Gertheinrich, Project Officer, Permanent Secretariat of the Alpine Convention

Expected participant outcomes: Joint policy brief

18:30 – 20:00 – Dinner

Monday 6 July – Wednesday 8 July – Regional Mountain Conference

During the Regional Mountain Conference, participants will:

- Attend selected mandatory conference sessions relevant to mountain DRR, Earth Observations, and adaptation.
- Engage with international researchers, policymakers, and practitioners.
- Participate in networking and knowledge exchange activities.
- Present their Ideathon solutions during a dedicated conference workshop.
- Receive feedback from experts and stakeholders.

Tuesday 7 July, Regional Mountain Conference & Ideathon closing sessions

13:15 – 14:45 – Dedicated Conference Workshop
"Youth-Led Data Solutions for Mountain Disaster Risk Reduction: Presentations and Dialogue with the GEO Mountains Ideathon participants"

- A dedicated RMC workshop session will provide a platform for participants to present their project concepts and prototype solutions to the wider conference audience.

15:15 – 16:00 – Session 12: Regional Exchanges

Aim of the session:
Reflect on the Ideathon solutions presented during the conference, discuss their transferability and implementation within each mountain region, and identify region-specific opportunities and challenges.

Session Description: Following the presentation of all Ideathon solutions during the conference, participants are now familiar with the projects developed by the different teams. They will meet in regional groups for a 20-minute discussion to exchange perspectives on the transferability, relevance, and implementation of the various projects within their respective mountain regions. Participants will identify common opportunities, region-specific barriers, and potential adaptations needed for successful implementation. Each regional group will appoint a rapporteur who will present the main conclusions of the discussion during a 20-minute plenary session, highlighting key messages on the applicability and transferability of the Ideathon solutions across their region.

Expected participant outcomes:

- Identification of common challenges across mountain regions
- Recognition of transferable solutions and context-specific approaches
- Regional perspectives integrated into Ideathon solution development

17:30 – 18:00 – Keynote from the MRI, GEO, and Ideathon Participants

Replacement Keynote of 25 Years of Mountain Research Initiative, from Carolina Adler, MRI Executive Director.

Note: Participants are free to join additional conference sessions of interest, while managing their time to continue working on the development of their Ideathon Challenge solutions.

18 :30 – 20 :00 – Dinner

20:00 – 21:30 – Debriefing session

- Each participant is invited to share reflexions on the programme, their expectations, what they achieve this last week, which learnings they bring forward, etc.

Wednesday 8 July – Departures

Annex 2 – Ideathon Expectations outputs

Mini Knowledge Package

As part of the GEO Mountains Youth Ideathon, each team is expected to develop a Mini Knowledge Package aligned with the GEO Knowledge Hub knowledge-sharing principles. The objective is to ensure that the knowledge generated during the Ideathon remains accessible, reusable, and valuable beyond the event itself.

The Mini Knowledge Package should document the team's proposed solution in a concise, structured, and user-oriented manner. It should clearly communicate the challenge addressed, the proposed approach, the data and methods used, the intended users, and the potential impact of the solution. Teams are encouraged to present their work in a way that supports knowledge sharing, future collaboration, and potential replication in other mountain regions.

The package should include:

- A short description of the challenge and context;
- The proposed solution and its key innovation;
- Relevant Earth Observations, in-situ, and other data sources used;
- A summary of the methodology and workflow;
- Expected outputs and intended users;
- Potential impacts, limitations, and opportunities for future development;
- Any prototype materials, visualisations, code repositories, or supporting resources developed during the Ideathon.

In addition, each team will prepare:

1. A 10-minute presentation of their solution for the Regional Mountain Conference (RMC) session;
2. A one-page solution summary;
3. Any relevant code, workflows, visualisations, or prototype materials;
4. A one-minute team reflection video.

One-Minute Reflection Video

At the conclusion of the Ideathon, each team will record a short video (maximum one minute) reflecting on their experience. The video should provide a personal and authentic perspective on the collaborative process and key lessons learned.

Teams are invited to address the following questions:

- What was your first impression when you started the Ideathon?
- What was the biggest challenge your team faced during the week?
- What was your greatest strength as a team?
- What is the main message, lesson, or insight you will take away from this experience?

The videos may be used by GEO Mountains, the Mountain Research Initiative, and the GEO Secretariat to communicate outcomes of the programme, highlight participant experiences, and promote future youth engagement activities.

Annex 3 – Challenges & Problem-Owners

CHALLENGE 1

Transforming Multi-source Observations into Actionable Knowledge for Landslide Risk Reduction

Challenge Overview

Mountain regions face escalating landslide risks, yet effective monitoring and response remain constrained by challenges in integrating multi-source Earth observation (EO) data and translating scientific insights into actionable, locally adaptive early warning systems.

Details of the Challenge

Mountain regions are highly susceptible to landslides due to complex terrain and unfavourable geological conditions, with intensified rainfall, land-use changes, and infrastructure expansion further increasing their frequency and impacts, posing serious threats to human lives, transportation networks, and critical infrastructure. Despite advances in EO and geospatial technologies, effective landslide monitoring and emergency response remain challenging. Key obstacles include integrating multimodal data (e.g., satellite imagery, UAV observations, and in situ measurements), limited real-time monitoring capabilities in remote mountainous environments, and difficulties in translating scientific outputs into timely, actionable decisions. Early warning systems often lack sufficient localization and adaptability, while communication gaps among scientists, authorities, and local communities further hinder rapid response.

These challenges underscore the need for integrated, data-driven solutions that combine multimodal data with local knowledge and field observations to enhance landslide precursor detection, risk assessment, and early warning capabilities, and to translate scientific findings into clear, policy-relevant information and actionable emergency response strategies for diverse stakeholders.

Suggested outputs:
- A multimodal EO data fusion framework for landslide monitoring and precursor detection
- Physics-constrained landslide risk mapping
- AI-assisted decision-making module for the proposal of slope reinforcement measures
- A prototype tool that integrates EO data interpretation for detection of landslide precursors, slope risk assessment, and decision-making for landslide mitigation

Problem Owner

Dr. Lingfeng He is an Associate Professor at Beihang University and a faculty member of the Regional Centre for Space Science and Technology Education in Asia and the Pacific (China) (Affiliated to the United Nations) . He received his Ph.D. from the Camborne School of Mines at the University of Exeter. Dr. He's research focuses on advancing geospatial intelligence for geohazard assessment and resilience building. His work covers intelligent remote sensing, AI-driven geospatial analytics, and multi-modal earth observation data fusion to support predictive modelling, slope stability assessment, and large-scale environmental monitoring.

Relevance to Beihang University

Beihang University is the leading institution of the GWP Pilot ‘Slope-Risk-GPT', which focuses on advancing slope risk assessment and landslide mitigation through multimodal large model technologies. Within this framework, Beihang has been actively developing methodologies that integrate multi-source Earth observation data, engineering knowledge, and artificial intelligence to support intelligent extraction of disaster-related factors, dynamic risk analysis, and decision-oriented risk interpretation. These efforts are directly aligned with the goal of transforming heterogeneous observations into actionable knowledge for real-world landslide risk reduction, as emphasized in this competition.

The Regional Centre for Space Science and Technology Education in Asia and the Pacific (China) (RCSSTEAP), operated within Beihang University, leveraging its strong academic foundation and leadership in aerospace and space technology. Supported by the UNOOSA, RCSSTEAP serves as an UN-affiliated platform for education and capacity building in space science and technology, particularly for developing countries. In the field of remote sensing, RCSSTEAP emphasizes cross-regional knowledge transfer and application, supporting the adaptation of EO-based methodologies to diverse environmental across different countries.

Together, Beihang University and RCSSTEAP provide a synergistic institutional platform that combines leadership in the ‘Slope-Risk-GPT', advanced research in remote sensing and artificial intelligence, and international capacity-building for cross-regional application. This integrated framework ensures strong relevance to the chalenge of ‘transforming multi-source observations into actionable knowledge for landslide risk reduction and practical decision support’.

CHALLENGE 2

Safer Hydropower Development in the Hindu Kush Himalaya: Integrating Hazard and Exposure Assessment

Challenge Overview

Hydropower development in the Hindu Kush Himalaya (HKH) is rapidly expanding, often in hazard-prone regions exposed to cascading events such as rock-ice avalanches, glacial lake outburst floods (GLOFs), and landslides. However, hazard and exposure assessments are often fragmented or missing in planning processes. This challenge invites participants to explore how multi-hazard information and exposure data can be integrated to support safer and more sustainable hydropower development in the mountain regions.

Details of the Challenge

Background: the Hindu Kush Himalaya (HKH) region is experiencing rapid hydropower expansion, often in steep and hazard-prone terrain. At the same time, cascading mountain hazards such as rock-ice avalanches, glacial lake outburst floods (GLOFs), and landslides are increasing risks to infrastructure. Despite this, hazard and exposure assessments are rarely fully integrated into hydropower planning.

The challenge: How can we better integrate multi-hazard information and infrastructure exposure into hydropower development planning to reduce future disaster risk?

Possible directions: participants may explore:

- Large-scale hazard modelling approaches
- Spatial identification of safer development zones
- Integration of hazard and infrastructure datasets
- Decision-support tools for planners
- Policy or governance recommendations

Expected outcomes: Conceptual frameworks, prototype tools, spatial analysis ideas, or policy-oriented solutions.

Problem Owner

Dr. Yan Zhong is a postdoctoral researcher at the Climate Change Impacts and Risks in the Anthropocene (C-CIA) Group, University of Geneva, Switzerland. Her projects focus on mountain hazard assessment and disaster risk reduction (DRR), particularly in countries of the Hindu Kush–Himalaya (HKH) region, where she has been working for the past six years. Her research interests include climate change impacts, multi-hazard modelling and assessment, glacier dynamics, GLOFs, debris flows, rock-ice avalanches, and hydropower risk management.

Relevance to the University of Geneva

Faculty of Science, University of Geneva, ranked among the world's top 50, 12th in Europe and 3rd in Switzerland, and associated with the 2019 Nobel Prize in Physics.

CHALLENGE 3

Evidence-based decision support for land degradation neutrality in mountain regions

From Knowledge to Action for Scaling Sustainable Land Management

Context

Mountains provide 40 percent of global ecosystem services not only water, biodiversity, carbon storage and climate regulation, but also food, fibre, medicine, and building material. At the same time, they are particularly vulnerable to land degradation processes such as decline in land productivity, vegetation cover and soil organic carbon - risks that are further intensified by climate change. Sustainable land management (SLM) practices have proven effective in reducing these risks while maintaining ecosystem services. However, knowledge on such practices is often fragmented, not easily accessible, or insufficiently integrated with spatial data. This limits its use in decision-making and constrains efforts to scale up restoration and prevention measures.

Challenge Overview

This challenge focuses on developing an evidence-based decision-support solution for advancing Land Degradation Neutrality (LDN) in mountain regions. Participants are invited to design a practical decision-support approach that helps policymakers and practitioners to identify priority areas for land restoration and SLM in a selected country. The solution should combine earth observation data combined with existing knowledge on SLM practices to assess where land degradation occurs, analyze its key drivers, and propose targeted, ecosystem-based interventions. The objective is to move beyond data analysis and develop a solution that translates information into actionable recommendations. These should support decision-makers in reducing disaster risks, strengthening ecosystem resilience, and guiding the implementation and scaling of SLM practices in mountain landscapes.

Details of the Challenge

You will work on one selected country: Madagascar, Lesotho, or Sri Lanka. You may choose to focus on the entire country, a specific landscape or a watershed.

- Where are the **priority areas** for land degradation?
- What are the **key drivers** (biophysical and socio-economic)?
- In this context, which **SLM practices** are most suitable to reduce risks (e.g. erosion, landslides, drought...)?
- What are the main **barriers to adoption and scaling**, and how can they be overcome?
- How can earth observation and existing knowledge platforms be combined into **usable decision support**?

Problem Owner

Joana Eichenberger is part of the WOCAT Secretariat, supporting global knowledge sharing and capacity building on sustainable land management. She holds an MSc in Geography and is currently pursuing a PhD in Geography and Sustainability at the Centre for Development and Environment (CDE), University of Bern, Switzerland. Her research focuses on how SLM practices influence water and nutrient retention in agricultural landscapes, with a particular emphasis on the Western Swiss Plateau.

Relevance for WOCAT

The World Overview of Conservation Approaches and Technologies (WOCAT) is a key partner in the upcoming project: *Scaling the capacity of UNCCD Parties for inclusive decision support in land degradation neutrality*. The project aims to strengthen the capacity of countries to assess, plan, implement, monitor, and report progress towards land degradation neutrality (LDN) through inclusive and evidence-based decision support. The project aims to strengthen the capacity of countries to assess, plan, implement, monitor, and report progress towards land degradation neutrality (LDN) through inclusive and evidence-based decision support.
In order to achieve LDN in mountain regions, SLM practices need to be spread including large-scale land restoration and rehabilitation efforts. LDN provides opportunities to stabilise or increase the amount and quality of mountain land resources globally by 2030.
By improving access to and use of SLM knowledge, and by integrating it with spatial data and decision-support processes, WOCAT supports countries in prioritizing interventions, overcoming implementation barriers, and scaling out successful practices. This contributes directly to efforts to prevent and reverse land degradation, enhance resilience, and sustain ecosystem services in mountain landscapes.

Criteria

- The solution addresses the challenge in a meaningful and context-specific way
- The solution contributes to reducing disaster risk and achieving LDN
- Diverse knowledge sources are combined
- The solution actually supports decisions and action
- Can realistically be implemented, also in low-resource contexts
- The solution can be applied beyond the case study

CHALLENGE 4

Black Hills: Indigenous Earth Observation for Water and Land

Challenge Overview

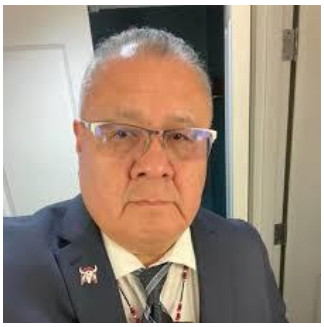
Around the Black Hills in South Dakota, United States — a sacred landscape and headwater system for multiple Tribes — water quality, land disturbance, and restoration are increasingly under pressure. Yet these dynamics are often understood in isolation, rather than as part of one connected watershed. This challenge asks participants to explore how Earth observation can help make those connections visible in ways that support real decisions on the ground — linking water systems, land condition, and restoration priorities across the landscape. Solutions should be practical and decision-oriented, with the ability to combine satellite data with locally grounded knowledge and support Indigenous stewardship approaches to watershed resilience. Suggested outputs could include visualisation tools, decision-support platforms, or other approaches defined by the teams.

Details of the Challenge

Participants are invited to design practical EO-based approaches that help connect water quality, land disturbance, drought, restoration priorities, and culturally significant areas across the Black Hills watershed. The challenge should support Indigenous-led decision-making by combining satellite-derived evidence with locally grounded knowledge, helping identify where protection, restoration, or further monitoring may be most needed.

Problem Owner

Phil Two Eagle (Sicangu Lakota)



Philimon D. Two Eagle is Executive Director of the Sicangu Lakota Treaty Council in Rosebud, South Dakota. Mr. Two Eagle was born and raised on the Rosebud Sioux Indian Reservation in South Central, South Dakota. Mr. Two Eagle has served in the US Army from 1982 to 1986 and has been working for the Rosebud Sioux tribe in various capacities. He has been working on preserving the inherent rights and treaty rights of the Sicangu Lakota Oyate (Rosebud Sioux Tribe). Mr. Two Eagle believes in preserving his Lakota language as he recognizes Language as the source of Inherent Sovereignty and a connection to the ancestors. Mr. Two Eagle works with the elders and Spiritual leaders, Traditional knowledge, treaty rights, Lakota language, Climate Crisis and the Environment with the Oceti Sakowin Oyate (the Seven Council Fires) of the Lakota, Dakota and Nakota people to have the US Federal Government to honor the Fort Laramie treaties that they signed with the Lakota people. He believes the Tiwahe (the family unit) as the very first form of Lakota traditional government and that life teachings begins in the Tiwahe. The Tiwahe is the also the very first line of education for the children. Mr. Two Eagle wants the Oyate to return to Tiwahe and to begin the process of healing, his work lead's him to build an indigenous economy together return to the circle.

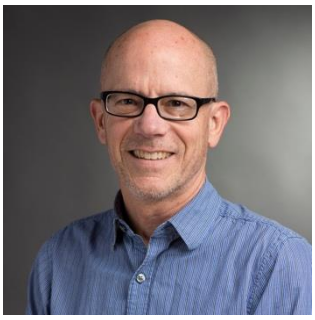
James Rattling Leaf Sr.

Mr. Rattling Leaf is a citizen of the Rosebud Sioux Tribe and founding member of the GEO Indigenous Alliance, developing programs that utilize the interface between Traditional Ecological Knowledge (TEK) and Western science. He applies his expertise in Earth observation technology to convey how TEK can be used with Western science to address the impacts of climate change. He also teaches Cultural Intelligence methods, supports Indigenous engagement strategies, and serves Indigenous nations' efforts through effective and respectful data application. He holds leadership roles with the University of Colorado-Boulder, North Central Climate Adaptation Center, Rosebud Sioux Tribe, Group on Earth Observations Indigenous Alliance, and the Ecological Society of America.

Diana Mastracci Sanchez

Diana is the Founder of Space4Innovation and the Intentional Strategi Liaison of the GEO Indigenous Alliance. She works at the intersection of Earth observation, Indigenous-led innovation, ethical AI, biodiversity monitoring, analog space missions and space governance. She has worked at NASA, ESA, Oxford University, and the GEO Secretariat. Her fieldwork has taken her to remote regions from the Amazon to the Arctic and northern Kenya, where she has worked with Indigenous communities to co-design technology and foresight approaches that support climate resilience, environmental stewardship, and community-led decision-making. She holds an MSc in Biodiversity, Conservation and Management from Oxford University and an MA with Joint Honours in Social Anthropology and Russian from the University of St Andrews.

Online mentor: Prof. Anthony Vodacek



Anthony Vodacek is a Full Professor of Imaging Science at Rochester Institute of Technology (RIT). He received his B.S. (Chemistry) in 1981 from the University of Wisconsin-Madison and his M.S. and Ph.D. (Environmental Engineering) in 1985 and 1990 from Cornell University. His areas of research lie broadly in multi-modal remote sensing with a focus on the coupling of imaging with modeling for application to monitoring human and natural terrestrial and aquatic systems. His specific expertise is in spectral phenomenology, image interpretation, machine learning, and dynamic data driven applications systems. He has recently worked on applying these methods for projects addressing vehicle tracking, precision agriculture, and harmful algal blooms. His newest research areas involve remote sensing of the African Great Lakes and remote sensing of insects in the context of biodiversity assessment. He has worked in East Africa on various teaching and research projects for more than a decade. Vodacek completed a Fulbright Specialist project in 2019 in Malaysia, is an Associate Editor for the Journal of Great Lakes Research, is a Senior Member of IEEE, supports the IEEE Geoscience and Remote Sensing Society Global Activities as the liaison to Sub-Saharan Africa, and is a Corresponding Fellow of the Pan-African Scientific Research Council. He has worked with the Shuar Nation in the Ecuadorian Amazon and with the Samburu tribe in Northen Kenya through the Indigenous project on Ethical AI: Ltome-Katip.

Relevance to Space 4 Innovation & GEO Indigenous Alliance

This challenge aligns with the mission of the GEO Indigenous Alliance and Space4Innovation to support Indigenous-led use of Earth observations for land, water, and biodiversity stewardship. It reflects a shared commitment to combining satellite data with locally grounded

knowledge to inform practical decision-making, while advancing community-led innovation and resilience approaches rooted in Indigenous priorities and governance.

Suggested outputs could include:

- a watershed visualisation showing links between water quality, land disturbance, and restoration areas
- a decision-support map highlighting priority zones for protection or intervention
- a tool to track changes in water systems over time (e.g. drought, contamination risk, land use pressure)
- a scenario view comparing current conditions with potential restoration or protection actions
- a way to combine satellite data with locally grounded knowledge to inform planning

Annex 4 – Solutions Summaries

Challenge 1 – Transforming Multi-source Observations into Actionable Knowledge for Landslide Risk Reduction

Solution: Global Multi-source Earth Observation-Based Landslide Early Warning System

Group members: Arunima Sen, Moses Kutosi, Johannes Reinthaler

Overview
Mountain regions face escalating landslide risks due to climate change, earthquakes, and human activities on the slopes. Limited monitoring systems and existing fragmented datasets have hindered timely warnings and informed decision-making. We address this challenge by fusing multiple Earth Observation datasets into a globally applicable tool for Landslide early warning.

The solution
The prototype integrates static landslide conditioning factors and dynamic triggering factors using multi-source Earth observation data to generate simplified, location-specific landslide risk estimates. An interactive dashboard that enables users to visualize current and forecasted landslide risk, which supports disaster preparedness and management.

Key input data
The tool has been built from the integration of both static and dynamic landslide conditioning and triggering factors. The static data include terrain slope (SRTM), land cover, and recent forest loss acquired from Hansen Global Forest Change, and population derived from WorldPop. For Dynamic data, surface soil moisture was obtained from NASA SMAP, Precipitation anomalies from SPI proxy and CHIRPS, and earthquake history from USGS. Additionally, Sentinel 2 was also incorporated for data quality and to calculate slope angles.

How the tool works
Users can either select a location or click one of the mountainous regions displayed, a forecast period (current or up to 5 days ahead), and a precipitation scenario (more or less than forecasted). The tool will combine conditioning and triggering factors and classify landslide risk as Low, Elevated, or High, display precipitation forecasts, and the total population at risk.

Benefits of the tool

- Supports decision making for landslide risk reduction and management.
- Provides meaningful risk estimates in data-scarce regions.
- Integrates near-real-time Earth observation and weather forecasts.
- It is user-friendly.

Limitations and future improvements
The current prototype provides simplified landslide risk estimates and relies on coarse resolution datasets. However, it does not replace local observations or expert assessment.
Future work includes improved SPI computation, local calibration, expanded country guidance, and translation into natural language explanations for non-technical users.

Challenge 2: Integrated Multi-Hazard and Exposure Assessment Framework for Safer Hydropower Development in High Mountain Asia

Solution: A Conceptual Decision-Support Workflow Demonstrated Using the Dudh Koshi Basin, Nepal

Group members: Loveleen Kour, Sandesh Paudel, Dr. Anzor Giorgadze

Executive Summary

Mountain regions across High Mountain Asia are experiencing accelerated environmental change due to climate warming, increasing the frequency and complexity of hazards such as glacial lake outburst floods (GLOFs), landslides, rock–ice avalanches, debris flows, earthquakes, and flash floods. At the same time, hydropower development is expanding rapidly to meet growing energy demands, often in steep and hazard-prone terrain. While hazard assessments are routinely undertaken during project planning, they are typically conducted independently and rarely account for interactions between hazards or their cumulative impacts on critical infrastructure.

This Mini Knowledge Package presents a conceptual decision-support framework that integrates multi-hazard assessment with infrastructure exposure analysis to support safer hydropower planning in High Mountain Asia. The framework combines Earth Observation (EO) datasets, historical hazard inventories, geotechnical information, and hydropower infrastructure inventories within a structured workflow that enables risk-informed planning from site selection through long-term monitoring.

To demonstrate the proposed methodology, the Dudh Koshi Basin in Nepal was selected as a representative case study because of its proposed hydropower developments and documented history of mountain hazards. Due to the limited duration of the Ideathon and restricted access to operational datasets, the project focused on developing a transferable conceptual framework rather than generating new regional hazard products. Existing modelling approaches—including landslide susceptibility assessment, slope stability analysis, and RAMMS debris-flow simulations—were used to illustrate how multiple hazard analyses can be integrated into a unified planning process.

The framework is intended to serve as a reusable methodology for governments, hydropower developers, engineers, researchers, and local authorities. By documenting recommended datasets, analytical workflows, and decision pathways, it contributes to the GEO Knowledge Hub objective of promoting open, reusable, and collaborative knowledge for sustainable mountain development.

Proposed Solution and Key Innovation

Our team developed an **Integrated Multi-Hazard and Exposure Assessment Framework** that combines hazard assessment, infrastructure exposure analysis, and risk classification within a single decision-support workflow.

Unlike conventional planning approaches that assess hazards individually, the proposed framework explicitly evaluates three forms of hazard interaction:

- **Single hazards**, where each hazard is considered independently;
- **Cumulative hazards**, where multiple hazards contribute simultaneously to overall risk; and
- **Cascading hazards**, where one hazard initiates another, amplifying downstream impacts.

The framework then integrates hazard information with geolocated hydropower assets—including dams, powerhouses, intake structures, transmission lines, access roads, and operational facilities—to classify project risk and support evidence-based planning decisions.

The principal innovation of the framework lies not in developing a new hazard model, but in bringing together established hazard assessment methodologies within a unified, modular workflow that can be adapted across mountain regions.

Expected Outputs and Intended Users

The framework is designed to generate:

- Multi-hazard susceptibility maps;
- Hazard interaction assessments;
- Infrastructure exposure analyses;
- Project-level risk classifications;
- Decision-support information for planning and investment;
- Recommendations for monitoring, mitigation, and emergency preparedness.

The intended users include government agencies, hydropower developers, engineering consultants, investors, plant operators, researchers, and local communities involved in mountain risk management and sustainable infrastructure development.

Challenge 3: Evidence-Based Decision Support for Land Degradation Neutrality in Mountain Regions

Solution: An integrated geo-data driven decision support for Lesotho

Group members: Farhad Ehsani, Federica Ballardini, Nazim Garayli

Challenge & Context
Mountains supply roughly 40% of the world's ecosystem services - water, biodiversity, carbon storage, climate regulation, food, fibre, medicine and building material - yet they are disproportionately exposed to land degradation: declining land productivity, vegetation loss and falling soil organic carbon, all intensified by climate change. Sustainable Land Management (SLM) practices are proven to reduce these risks, but knowledge of them remains fragmented, hard to access and poorly linked to spatial data, which limits its use in real decision-making and slows the scaling of restoration.

Challenge 3, set by the WOCAT Secretariat, asked participants to design a practical decision-support approach that helps policymakers and practitioners identify priority areas for land restoration and SLM in one of three countries - Madagascar, Lesotho or Sri Lanka - by combining Earth observation data with existing SLM knowledge to locate degradation, diagnose its drivers, and recommend targeted, ecosystem-based interventions. The brief sits within WOCAT's upcoming project to scale UNCCD Parties' capacity for inclusive, evidence-based LDN decision support, contributing to the global push to stabilise and improve mountain land resources by 2030.

Country focus: Lesotho
Our team selected Lesotho. Almost 9% of the country's territory is degraded, driven mainly by overgrazing and overstocking, invasive brush encroachment, and increasingly frequent drought and erratic rainfall. Degradation costs an estimated US$57 million a year (3.6% of GDP), threatens the livelihoods of much of the rural population, and heightens exposure to hazards such as landslides. Lesotho has committed to Land Degradation Neutrality by 2030, targeting the restoration of 600,000 hectares, but limited financial and institutional capacity continues to constrain restoration at scale - the exact gap this decision-support prototype is designed to help close.

Proposed Solution & Key Innovation
The team built an interactive, map-based decision-support tool that layers Earth-observation-derived degradation hotspots with climate and demographic data, and pairs the result with a short, evidence-backed menu of SLM interventions drawn from the WOCAT database. Rather than stopping at 'where is the land degrading', the tool answers the more decision-relevant question: where is degradation both severe and putting the most people's livelihoods at risk right now.

Key innovation
- Triple-lens prioritisation: biophysical degradation hotspots (Trends.Earth composite, 2010–2022) are overlaid first with rainfall as a drought proxy, then with population density, turning a standard degradation map into a triage tool that ranks locations by how many people depend on the land that is failing.
- Direct link from diagnosis to action: each hotspot is connected to a short, locally-matched list of WOCAT-documented SLM technologies chosen specifically for Lesotho's dominant driver - overgrazing on rangeland - instead of a generic global catalogue.
- Built for low-resource use: the entire tool runs on free, open-source components (QGIS, the Trends.Earth plugin, open EO and demographic datasets) and is published as a lightweight public website, so it can be reused by institutions without specialised GIS budgets.
- Designed to travel: the same three-phase pipeline (mind-map → _Trends.Earth 1OAO hotspot detection → _climate/population overlay) is country-agnostic and was built so it could be re-run for Madagascar or Sri Lanka with minimal adaptation.

Challenge 4: Black Hills: Indigenous Earth Observation for Water and Land

Solution: WIZIPAN Restoration Priority App

Group members: Hairo León Dextre, Daniela Cabascango Lara, Ann Nandutu

The WIZIPAN project proposes a comprehensive monitoring and decision-support methodology, structured around three fundamental pillars that operate in an articulated manner. The first pillar consists of satellite analysis using spectral indices calculated from Landsat 8/9 imagery. This component makes it possible to identify spatial patterns of environmental degradation through indicators such as water turbidity (NDTI), chlorophyll or algae presence (NDCI), loss of vegetation cover (NDVI), water stress (NDMI), water body delineation (NDWI and MNDWI), and the identification of burned areas (NBR). All these indices are integrated into a normalized Hydro-Environmental Priority Index (HEPI) ranging from 0 to 1, which classifies the territory into five priority levels—from very low to very high—allowing for clear identification of areas requiring the most attention.

The second pillar is community monitoring using KoboCollect, a mobile tool that enables youth and community members to record georeferenced information directly from the territory. Through forms specifically designed for the Lakota context, community monitors can document observations about turbid water, erosion, waste presence, affected vegetation, bare soil, or other anomalies, accompanied by photographs and detailed descriptions. This component includes a four-stage training process: training, field data collection, information validation, and community action, ensuring that the data generated is reliable and useful for decision-making.
The third pillar is the development of a geospatial dashboard that integrates the results of satellite indices with data collected by the community. This visual and dynamic platform allows users to consult thematic maps, visualize community reports, analyze statistics on environmental anomalies, and generate automatic reports on priority areas. The dashboard functions as a decision-support hub that answers key questions such as: where are environmental anomalies concentrated?, which sub-watersheds require additional monitoring?, where should restoration be prioritized?, and what is the community reporting about the condition of the territory?

The Key Innovation of WIZIPAN

The most significant innovation of WIZIPAN lies in its ability to combine satellite technology with locally grounded knowledge, integrating Traditional Ecological Knowledge with Western science. This integration is not merely technical but deeply political and cultural, as it directly responds to the context of the Lakota people's struggle for territorial sovereignty. By generating tangible and visual evidence about the condition of the territory, WIZIPAN provides the community with concrete tools to assert their treaty rights and their historical demand for the return of their sacred land, under the principle that "The Black Hills are not for sale."

Another key innovation is the focus on youth empowerment as a central axis of community monitoring. WIZIPAN does not limit itself to collecting data; rather, it transforms young people into active stewards of the watershed, strengthening their
technical capacities and their connection to the territory. This strategy responds to the Lakota worldview that considers Tiwahe (the family unit) as the first form of government, and seeks for the Oyate (the people) to return to their roots to initiate healing processes and build an Indigenous economy based on territorial stewardship.

Consequently, the WIZIPAN methodology stands out for its practical and decision-oriented character. The Hydro-Environmental Priority Index, with its five-level classification, translates complex information into clear and actionable criteria for the community and authorities. The integration of satellite data with community reports and visualization in an accessible dashboard ensures that information does not remain in the hands of specialists but is appropriated by the community as an instrument of territorial management. Ultimately, WIZIPAN is not merely a technical environmental monitoring tool but an

instrument of community empowerment and territorial sovereignty that aligns Earth observation with the Lakota worldview and their historical demands for the control and protection of the Black Hills.

Item	**Summary**
Challenge	Lakota-led monitoring requires accessible ways to connect environmental observations across water, land, vegetation, and local field knowledge. Satellite data can help, but it must be interpreted with community priorities and field context.
Solution	WIZIPAN is a review-support web application that organizes spatial monitoring locations, Earth Observation indicators, field evidence, and local observations in a single interface. It helps identify places where closer review may be needed.
Main users	Community representatives, monitoring teams, researchers, and partners supporting environmental review and restoration planning.

Main features

- Overview map: real working areas, HydroSHEDS regional context, and real monitoring locations.
- Water module: demonstration workflow for Landsat 9 water indicators, valid water pixels, cloud conditions, and field data comparison.
- Land and riparian module: demonstration workflow for vegetation condition, riparian change, and persistence through time.
- Community observations module: session-based entry of local observations about water, vegetation, land, or other environmental concerns.
- Transparency: clear separation between real spatial inputs and demonstration environmental indicators.

Status	**Details**
Real project inputs	Working areas, hydrographic context, and 13 monitoring locations. Twelve locations are ready for EO extraction; one requires spatial review.
Demonstration data	Water indicators, land/riparian indicators, field evidence, local observation examples, and review-priority classes.
Next step	Run real Landsat 9 extraction, link outputs to real site_id values, and validate evidence with community and field data.

Keynote: WIZIPAN does not decide where restoration must happen. It connects evidence to help communities and partners discuss where closer review and restoration prioritization may be needed.

Annex 5 – Participant list

Name	Affiliation	Ideathon Role
Alexandrine Massot	Mountain Research Initiative	Main Coordinator
Ann Frida Nandutu	Shunya Yetana Community Based Organizaion	Participant (online)
Anzor Giorgadze	National Environmental Agency, Georgia	Participant
Arunima Sen	Université Bretagne Sud	Participant
Daniela Cabascango Lara	Instituto de Investigación Geológico y Energético IIGE Ecuador/Institute of Geological and Energy Research IIGE Ecuador	Participant
Diana Mastracci	Space4Innovation, GEO Indigenous Alliance	Problem-Owner
Farhad Ehsani	Trier University	Participant
Federica Ballardini	Erasmus Mundus MSc in Cartography	Participant
Felix Gertheinrich	Permanent Secretariat of the Alpine Convention	Expert
Glenn Hunt	Mountain Research Initiative	Coordinator (on-site)
Hairo Léon Dextre	Research Center for Environmental Earth Science and Technology (ESAT) - Santiago Antunez de Mayolo National University (UNASAM)	Participant
Joana Eichenberger	University of Bern, WOCAT	Problem-Owner
Johannes Reinthaler	Federal office for the environment (FOEN), Switzerland	Participant
Lingfeng He	Beihang University	Problem-Owner (online)
Loveleen Kour	Consol Geotechnologies Private Limited	Participant
Lukas Winiwarter	University of Innsbruck	Expert
Mia Ohlrogge	University of Innsbruck	Expert
Moses Kutosi	Makerere University Centre for Mountain Resources and Disaster Management	Participant
Nazim Garayli	Institute of Geography	Participant
Raphaël Lelouvier	Permanent Secretariat of the Alpine Convention	Expert
Samuel Amos	GEO Secretariat	Main Coordinator
Sandesh Paudel	University of Innsbruck	Participant
Yan Zhong	University of Geneva	Problem-Owner

Annex 6 – Draft Policy brief developed during the Alpine Convention Workshop

Policy Brief - A wake-up call for data-based mountain risk reduction

Mountain regions are increasingly exposed to complex socio-ecological challenges driven by climate change, biodiversity loss, land-use change, and intensifying natural hazards. Addressing these issues requires stronger integration of Earth Observation (EO), in-situ monitoring, local knowledge, and science-policy engagement...

Transforming Multi-source Observations into Actionable Knowledge for Landslide Risk Reduction

Landslides are a major and growing threat to mountain communities worldwide. Their frequency and severity are being amplified by climate change — through more extreme and more variable rainfall — and by rising populations in exposed areas. No single Earth observation dataset can capture the full picture, because landslide risk emerges from multiple interacting factors: terrain, rainfall, soil conditions, vegetation, and human land-use pressures. Multi-source observations are therefore not a technical preference but a necessity for meaningful assessment.

At the same time, the data that exists rarely reaches the people most affected by it. Scientific outputs are often produced in formats and language inaccessible to the communities living in landslide-prone areas, or to the local authorities acting on their behalf. There is no one-size-fits-all solution — risk, exposure, and capacity for response differ substantially between regions.

Recommendation 1
Invest in mechanisms that incorporate community knowledge and feedback into risk assessment.

Recommendation 2
Integrate landslide risk information into development plans.

Safer Hydropower Development in the Hindu Kush Himalaya: Integrating Hazard and Exposure Assessment

Climate change hydropower plants face unprecedented cascading threats (e.g, extreme weather triggering landslides leading to floods and infrastructural failure); traditional risk assessment methods are no longer sufficient. Building resilient multi-hazard models required bringing together experts from different disciplines to identify blind spots. Although HKH countries are expanding hydropower to meet growing energy demands and climate goals, policies often lack mandatory integration of multi-hazard risk assessments, climate projections, and exposure analysis throughout the project lifecycle. Limited data sharing, fragmented institutional coordination, and inadequate inclusion of local community knowledge further reduce the effectiveness of current planning and disaster risk management. Recent updates to international standards emphasize the need for systematic, multi-hazard risk mapping. This challenge is no longer mathematical but organisational. However, capturing interconnected hazards requires geologists, hydrologists, seismologists, ecologists, and data scientists. A resilient hydro-power plant begins with a resilient risk model by shifting policy to not accept but actively mandate multidisciplinary friction; the energy sector can build infrastructure capable of withstanding the complex, interconnected hazards.

Recommendation 1
For the sustainable development of hydropower in the growing threat of climate change, a multi-hazard risk assessment should be performed, considering the cumulative and cascading impacts on exposed infrastructure. This would help hydropower developers, government authorities, and donors make informed decisions at various stages, from project planning to operation and maintenance, based on the risk assessment.

Recommendation 2
Community knowledge in hydropower (infrastructure) planning should be integrated. Institutionalization of local and indigenous knowledge is needed through participatory hazard mapping, community consultations, and citizen reporting, while combining scientific data with local observations will improve hazard identification and incincrease community trust and preparedness.

Recommendation 3
The risk assessment method should preferably be replicable to other basins or even other mountain regions to build common tools or examples to follow, such that they can even be modified, improved, updated, and adapted based on new climate and geo-data.

Evidence-based decision support for land degradation neutrality in mountain regions

Land degradation is the deterioration of land caused by processes such as soil erosion, loss of vegetation, and declining soil fertility. In mountain regions, these problems are often intensified by climate change, reducing ecosystem services and increasing the vulnerability of local communities.
Lesotho is particularly affected by land degradation. Almost 9% of the country's territory consists of degraded land, mainly due to overgrazing, overstocking, invasive brush species, and increasingly frequent droughts and erratic rainfall. These factors contribute to annual economic losses of around 57 million USD (3.6% of GDP) and threaten the livelihoods of much of the rural population. To address this, Lesotho has committed to achieving Land Degradation Neutrality (LDN) by 2030, with a target of restoring 600,000 hectares of degraded land. However, limited financial resources and institutional capacity continue to hinder large-scale restoration efforts. Moreover, even though solutions related to Sustainable Land Management exist, knowledge is fragmented and communication between different stakeholders is hard.

Recommendation 1
Integration of Geo-data for identifying areas of severe land degradation requiring urgent Intervention:

Integrating earth observation data, climate data, and socio-economic data into a unified geospatial platform can help identify vulnerable, degraded land areas. This approach allows for visualizing the surrounding socio-economic conditions and analyze historical climate patterns. With these insights, responsible entities can make evidence-based decisions that have a greater impact.

Moreover, through this unified geospatial platform, stakeholders can develop a simple, user-friendly app that addresses community needs. This app can communicate the challenges of land degradation to local residents and provide them with educational materials. The system is highly data-driven, and, with the integration of AI, it has the potential to operate within an automated workflow.

Recommendation 2
Connect with other initiatives focused on sustainable land management practices, such as Area Closure and Controlled Stocking Rates, to explore innovative solutions. Engage in large-scale collaborative processes that involve stakeholders across various levels, including Land Chiefs, Grazing Organizations, and farmers. This will help assess the feasibility and potential implementation of these solutions in Lesotho.

Black Hills: Indigenous Earth Observation for Water and Land

The lack of territorial sovereignty of the Lakota People is a critical issue that affects their ability to protect, manage, and make decisions about their ancestral lands. Although these territories have deep cultural, spiritual, environmental, and historical value, the Lakota People have limited authority over the activities that take place within them. Governmental restrictions and external economic interests often determine land use, reducing the community’s capacity to defend its territory according to its own values, traditions, and needs.

As a consequence, activities such as mining, agriculture, and livestock farming may expand without sufficient control or meaningful participation from the Lakota communities. These activities can contribute to soil degradation, water contamination, loss of vegetation, habitat disturbance, and the alteration of sacred landscapes. Beyond environmental impacts, this situation also affects the health, well-being, cultural identity, and long-term development of local inhabitants.

This problem reflects not only an environmental concern but also a matter of justice, rights, and self-determination.

Recommendation 1
Strengthen the territorial sovereignty of the Lakota people by ensuring their direct participation in decision-making regarding the use, management, and protection of their lands. To this end, processes of prior, free, and informed consultation must be implemented before approving mining, agricultural, or livestock activities in territories of cultural, environmental, and spiritual significance to the community.

Recommendation 2
It is recommended to strengthen integrated land management by incorporating an indigenoos led natural disaster risk reduction approach, through the identification and monitoring of areas vulnerable to flooding, landslides, droughts, mining, and wildfires. To this end, it is essential to combine the ancestral knowledge of the Lakota people with technical tools such as geographic information systems, Earth observation, and risk maps, in order to guide appropriate land use, limit productive activities in fragile areas, and protect water sources, ecosystems, and sacred sites. This approach must be participatory, preventive, and respectful of territorial sovereignty, allowing local communities to be directly involved in planning, prevention, monitoring, response, and recovery in the face of extreme natural events.

Annex 7 – Communication Plan

The communication activities will aim to:

- Showcase youth-led innovation for mountain disaster risk reduction (DRR);
- Highlight the use of Earth Observation (EO) and data-driven solutions in mountain regions;
- Promote GEO Mountains, GEO, MRI, Adaptation at Altitude, and partner activities;
- Increase the visibility of participants and their solutions;
- Capture lessons learned and create reusable knowledge resources for future initiatives.

Links to LinkedIn Posts

From GEO Mountains Secretariat (MRI LinkedIn page):

1. Friday, 3 July: https://www.linkedin.com/feed/update/urn:li:activity:7478801410055254019
2. Friday, 3 July: https://www.linkedin.com/feed/update/urn:li:activity:7478906238823710720
3. Saturday, 4 July: https://www.linkedin.com/feed/update/urn:li:activity:7479240047192539136
4. Sunday, 5 July: https://www.linkedin.com/feed/update/urn:li:activity:7479653614400131072
5. Monday, 6 July: https://www.linkedin.com/feed/update/urn:li:activity:7479864682552520705
6. Tuesday, 7 July: https://www.linkedin.com/feed/update/urn:li:activity:7480381840827191299
7. Wednesday, 8 July: https://www.linkedin.com/feed/update/urn:li:activity:7480666395781890048

Other LinkedIn posts (from participants & experts):

Yan Zhong, Problem-Owner: https://www.linkedin.com/posts/yan-zhong-geo_geomountainsyouthideathon-regionalmountainconference-activity-7480593167688491010-eTLn?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "(…) collaboration is where solutions begin."

Diana Mstracci Sanchez, Problem-Owner: https://www.linkedin.com/posts/diana-nauriaq-mastracci_geomountains-rmc2026-earthobservation-activity-7481473297139036160-ofns?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q

Nazim, Garayli, Participant: https://www.linkedin.com/posts/nazimgarayli_geomountains-rmc2026-mountainresearch-ugcPost-7482371403141472257-nli4/?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q

Daniela Cabascango Lara, Participant: https://www.linkedin.com/posts/daniela-cabascango-lara-738127208_geomountainsyouthideathon2026-geomountains-activity-7482600069263790080-cyS-?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "This experience reinforced something I strongly believe: satellites can tell us where change is happening, but the people who know and live in a territory are the ones who can help us understand what that change truly means."; "I leave this experience with new tools, meaningful lessons, valuable connections, and an even stronger conviction: observing the Earth is not only about seeing it from above it is also about listening to and valuing the people who know it from the ground."

Loveleen Kour, Participant: https://www.linkedin.com/posts/activity-7481312477100523520-j3Bu?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "Working alongside a brilliant group of young professionals from different regions and disciplines reinforced something I believe strongly: we may not have decades of experience, but we bring curiosity and the willingness to challenge conventional

approaches.
That combination matters. Because the problems mountain regions face today won't be solved by expertise alone-they'll be solved by people willing to keep asking better questions."

Anzor Giorgadze, Participant: https://www.linkedin.com/posts/anzor-giorgadze-geologist_rmc-mountainresearch-mri-activity-7480591074298744832-yJ-f?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "Navigating different academic perspectives, refining massive concepts into actionable solutions, and building cohesive strategies tested our resilience and teamwork, which was truly amazing experience.
Collaborating with such a diverse group of young researchers proved that when we combine our unique backgrounds, we can develop highly innovative approaches to disaster risk reduction in mountainous regions."

Ann Frida Nandutu, Participant: https://www.linkedin.com/posts/activity-7481822436385099776-MBab?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "Working alongside brilliant minds from the Andes to the Himalayas taught me that data is only half the story. The real magic happens when remote sensing meets local, community-rooted knowledge."

Farhad Ehsani, Participant: https://www.linkedin.com/posts/farhad-ehsani_ourchangingmountains-eo4mountains-earthobservations-activity-7479830131285401600-hTzB?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q – Quote: "Beyond science, this experience was about collaboration, networking, friendships, and unforgettable moments in the beautiful mountains of Obergurgl"

Arunima Sen, Participant: https://www.linkedin.com/posts/arunimasen_earlier-this-month-i-had-a-remarkable-opportunity-ugcPost-7487471666957234177-YZOJ/?utm_source=share&utm_medium=member_desktop&rcm=ACoAACUhA40B_N-nTq9bLo2bgoXV8HuAxgK7c_Q

Participant Testimonials
Short video interviews (60 seconds) per team collected throughout the week.

Photo and Media Library
Link to the Media Library: https://geosecretariatgeneva-my.sharepoint.com/:f:/g/personal/samos_geosec_org/IgDk1V3uarhRSa32kF5aseFvAZQ-a6cw7RyEQjUtiPsB81s?e=4FfVCY

Aftermovie Video (expected in August / September) – Add link once done
The video will be published through GEO Mountains, GEO, MRI, and partner communication channels.

Event Summary Blog Post (add link once published on GEO Mountains website – August NL)

Annex 8 – RMC workshop abstract

ID: WS 26.106 #RMC26

2026-07-07, 13:15 - 14:45 (LT)| Liebenerspitze|**Talks**

Youth-Led Data Solutions for Mountain Disaster Risk Reduction: Presentations and Dialogue with the GEO Mountains Ideathon participants

Chair: Massot, Alex
Co-Chair(s): Amos, Samuel; Adler, Carolina; and Hunt, Glenn

Session/Description
Ahead of the RMC 2026, the GEO Mountains Youth Ideathon brings together early-career researchers and young professionals from mountain regions worldwide to co-develop data-informed solutions for disaster risk reduction (DRR). Over several days, participants engage in field visits, technical training, expert mentoring, and collaborative project work, culminating in prototype concepts designed to address real DRR challenges in mountain environments.

This workshop will showcase the results of the Ideathon. Several groups will present their solutions to the proposed challenges in the region, highlighting the problem addressed, the data and EO approaches used, and the potential policy or societal relevance of their concept, but also the replicability and upscaling of their solutions, which should be an integrative part of their work.
The second part of the session will focus on interaction and feedback. Participants and RMC attendees will join small-group discussions where Ideathon teams can receive input from experts, practitioners, and researchers. The aim is to provide constructive critique, identify opportunities for refinement or implementation, and strengthen links between the next generation of mountain professionals and established DRR and EO communities.

This workshop provides an open, applied space for youth-driven innovation, promotes the visibility of emerging professionnals, and fosters dialogue across generations, disciplines and regions, supporting goals of enhancing collaboration and developing actionable, data-informed solutions for mountain regions.