



International Conference on Mountain Hydrology and Cryosphere (ICMHC-2023)



ICMHC-2023
NEPAL

DECLARATION



9 & 10 November 2023, Nepal



International Conference on Mountain Hydrology and Cryosphere

November 9 -10, 2023

Lalitpur and Dhulikhel, Nepal

The International Conference on Mountain Hydrology and Cryosphere (ICMHC-2023) was held in Nepal on 9 and 10 November 2023. The conference brought together 150 people from 17 countries including graduate and post-graduate scholars, researchers, scientists, engineers, planners, policymakers, development workers, and experts from related fields to present their research activities. New observations, findings, and innovative ideas for the betterment of humanity and nature were shared over 75 presentations. The four key objectives of ICMHC-2023 were to:

1. Advance understanding of mountain hydrology and cryosphere processes.
2. Assess the impacts of climate change on mountain water resources and ecosystems
3. Develop innovative solutions for water management and adaptation to climate change
4. Foster collaboration and knowledge exchange among researchers, practitioners, and policymakers

This follows the 1992 International Symposium on Snow and Glacier Hydrology in Kathmandu where the recommendations stressed the need for better water resources monitoring and better scientific understanding of processes to support water management decisions. This identified the need to develop long-term monitoring sites based on local expertise; models and techniques to predict water supply, sediment load and flood hazards; freely available databases on snow and glacier properties; innovative remote sensing techniques; collaboration between different stakeholders and structured training.

We have come a long way since 1992. Presentations in this conference included new tools and technologies e.g. use of tracers to estimate soil erosion, use of

augmented reality for journey planning and data assimilation for better snow information. New remote sensing techniques and modelling capabilities along with new scientific understanding of glacial lake outburst floods, permafrost behavior and changing glacial characteristics, supported by new automated mapping techniques. However, the need for more in situ data remains. Furthermore, the effective translation of in situ observations into actionable information is still a major challenge. There are prominent data-to-policy gaps in critical areas such as Disaster Risk Reduction (DRR) and the fortification of resilience in vulnerable environments. The value of citizen science and indigenous knowledge to the warning chain is not yet realized. Sharing and standardizing such data through implementation of national open data frameworks for these essential variables should therefore be considered as a high priority.

Following from the presentations and discussions, a number of key themes emerged and priority areas for action were identified:

- 1) In situ measurements at high elevations are lacking or very sparse. These are needed urgently to provide observations and data for change detection, process understanding, model evaluation and remote sensing calibration and/or validation. These sites should be:
 - a) At high elevations and high quality
 - b) Equipped with remote data transfer facilities
 - c) Equipped with snow depth sensors
 - d) At least one established as a long-term ecological site above 3000m elevation with weather, environmental, and geological data collection sensors
 - e) Accompanied by a training program and maintenance plan
 - f) Supported by the local community
- 2) Recognize the glacier and glacial lakes as water towers and high mountain cryo-tourism
- 3) Mountain regions are undergoing tremendous and rapid climate and environmental change. It is urgent that we enhance observations and predictions of high mountain coupled atmospheric, hydrological, cryospheric, biological and human-water interactions; that we develop

improved predictive capabilities and new process-level understanding of climate sensitivities to optimize water, food and energy sustainability. In particular, snow was underrepresented at this conference. More research is needed in the formation and evolution of frozen water resources such as the effects of changing precipitation partition from snow to rain.

- 4) We need to focus on communicating and translating scientific knowledge beyond scientific publications to encompass a diverse audience, including policy and decision makers, development practitioners, media, and other non-scientific stakeholders. Open science and open data are key principles that must be upheld.
- 5) International research should be led or co-led by those with local and/or indigenous knowledge with due consideration of equality, diversity and inclusion issues through breaking down systemic barriers.
- 6) We need regional alignment of methodologies and tools to harmonies research endeavors and thereby nurture collaborative research within the region and instigate a culture of data sharing.
- 7) Upcoming international initiatives such as the UN International Year of Glaciers' Preservation 2025 provide important opportunities to raise awareness, promote action, enhance scientific understanding, strengthen policy frameworks, and strengthen financial support, particularly for early career researchers. In particular, the International Year of Glaciers' Preservation - 2025 should be used to promote the need for increasing in-situ monitoring of ice, permafrost and snow and related hazards, and also the need for international efforts to build the necessary monitoring capacity worldwide and for all relevant early warning systems.
- 8) We need training and capacity development to allow early-career driven research priorities, building on a previously successful bottom-up approach that drove the Glaciological Expedition of Nepal in 1970.
- 9) The next international conference on mountain hydrology and cryosphere will be held in November 2025.