



ICIMOD

FOR MOUNTAINS AND PEOPLE

The Cryosphere Initiative

Cryosphere in the Hindu Kush Himalaya

The Hindu Kush Himalaya (HKH) contain the largest expanse of snow, glaciers and permafrost outside of the polar region. This vast accumulation of snow and glaciers acts as a natural water reserve, contributing significantly to ten major Asian river systems.

Increased glacier melt, increased frequency and magnitude of associated extreme weather events, and shifts in monsoon patterns due to rising temperatures, especially at higher altitudes, impact the amount and timing of water available for agriculture, domestic needs, industry and hydropower. These affect the water supply needed to maintain ecosystem services. It is critical to improve our understanding of the changes taking place in the cryosphere and determine their implications for the region's water reserve and management.

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The Cryosphere Initiative of the International Centre for Integrated Mountain Development (ICIMOD) focuses on the monitoring of glaciers, snow, permafrost, glacial lakes and glacio-hydrology with an emphasis on in situ measurements, remote sensing and modelling.

The Cryosphere Initiative supported by the Government of Norway is working with its partners to establish ICIMOD as a Regional Cryosphere Knowledge Hub to collate and share knowledge generated by partners working in the region. Working with regional and international institutions that focus on the cryosphere

and cryosphere hydrology, the initiative is enhancing the capacity of institutions in ICIMOD's regional member countries to generate and access relevant data and knowledge about the cryosphere and sustained cryosphere monitoring. This will contribute to the development of effective measures and policies for water resources and risk management in the HKH.

Goal

Increased understanding of changes in the cryosphere in the HKH, contributing to improved water resource and risk management.



Cryosphere Monitoring Approach

To develop and implement cryosphere monitoring activities in a sustained manner, activities under the initiative are categorized into three main components:

- Field based observations and monitoring
- Remote sensing based observations and monitoring
- Modelling of cryosphere and related processes

Activities under these three components ensure an interdisciplinary approach to developing comprehensive assessments of cryosphere water resources, cryosphere related disaster risks and future water availability scenarios.

Field-based Snow and Glacier Monitoring

The current status of benchmark glaciers and their response to climatic variations as well as current water resources at the catchment and sub-basin scales are assessed through:

- Glacier mass balance and glacier dynamics monitoring
- Glaciological measurement campaigns
- Meteorological and hydrological monitoring
- Snow cover and precipitation monitoring
- Ground surface temperature monitoring for permafrost studies



Remote Sensing based Monitoring

ICIMOD maintains a multi-level remote sensing based observation system for snow and glacier monitoring, including:

- Mapping and monitoring of glaciers and glacial lakes using Landsat and other high resolution satellite images
- Snow cover monitoring using MODIS
- Glacier mass change monitoring using unmanned aerial vehicles (UAV) and high resolution stereo satellite images
- Detailed investigation of glaciers in representative basins/sub-basins

Modelling of Cryosphere and Related Processes

Model applications are used to understand cryosphere-related processes, to fill data gaps and to extend observations spatially and temporally, including:

- Modelling glacier mass balance and dynamics
- Developing glacio-hydrological and snow melt models
- Modelling future changes in glacier meltwater contributions to overall discharge

Regional Cryosphere Knowledge Hub

The Regional Cryosphere Knowledge Hub is a collaborative effort to share and disseminate cryosphere-related data by:

- Providing a web-based interactive portal for the dissemination and visualization of cryosphere data
- Publishing a quarterly e-bulletin about cryosphere-related activities at ICIMOD and its regional member countries
- Organizing conferences, seminars and workshops
- Providing a platform for regional knowledge sharing events



Capacity Building

Capacity building features strongly within the Cryosphere Initiative and its activities, including:

- Support for a two year MSc programme in glaciology at Kathmandu University
- Scholarships for MSc students
- Short-term training courses and study tours
- Short-term personnel exchange and on-the-job training for professionals from the region

Regional Networking and Collaboration through the Cryosphere Initiative

To foster synergy among countries in the HKH, the Cryosphere Initiative has initiated the Cryosphere Monitoring Programme (CMP), a collaborative project with the National Center for Hydrology and Meteorology in Bhutan, the Department of Hydrology and Meteorology,

Kathmandu University, Tribhuvan University, the Water and Energy Commission Secretariat in Nepal, and Karakoram International University in Pakistan. CMP was established to strengthen the capacity of partner institutions in the region to sustain cryosphere monitoring activities beyond the programme period in these countries.

Our partners

Key stakeholders in the Cryosphere Initiative include Norwegian Water Resources and Energy Directorate (NVE), Swiss Federal Institute of Technology Zurich (ETHZ) Switzerland, Utrecht University, Institut de Recherche pour le Développement (IRD), Global Land Ice Measurements from Space (GLIMS), World Glacier Monitoring Service (WGMS) and individuals who make use of glaciological data and knowledge, or who help collect and share data through ICIMOD. The initiative also collaborates with many other regional and global initiatives.



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