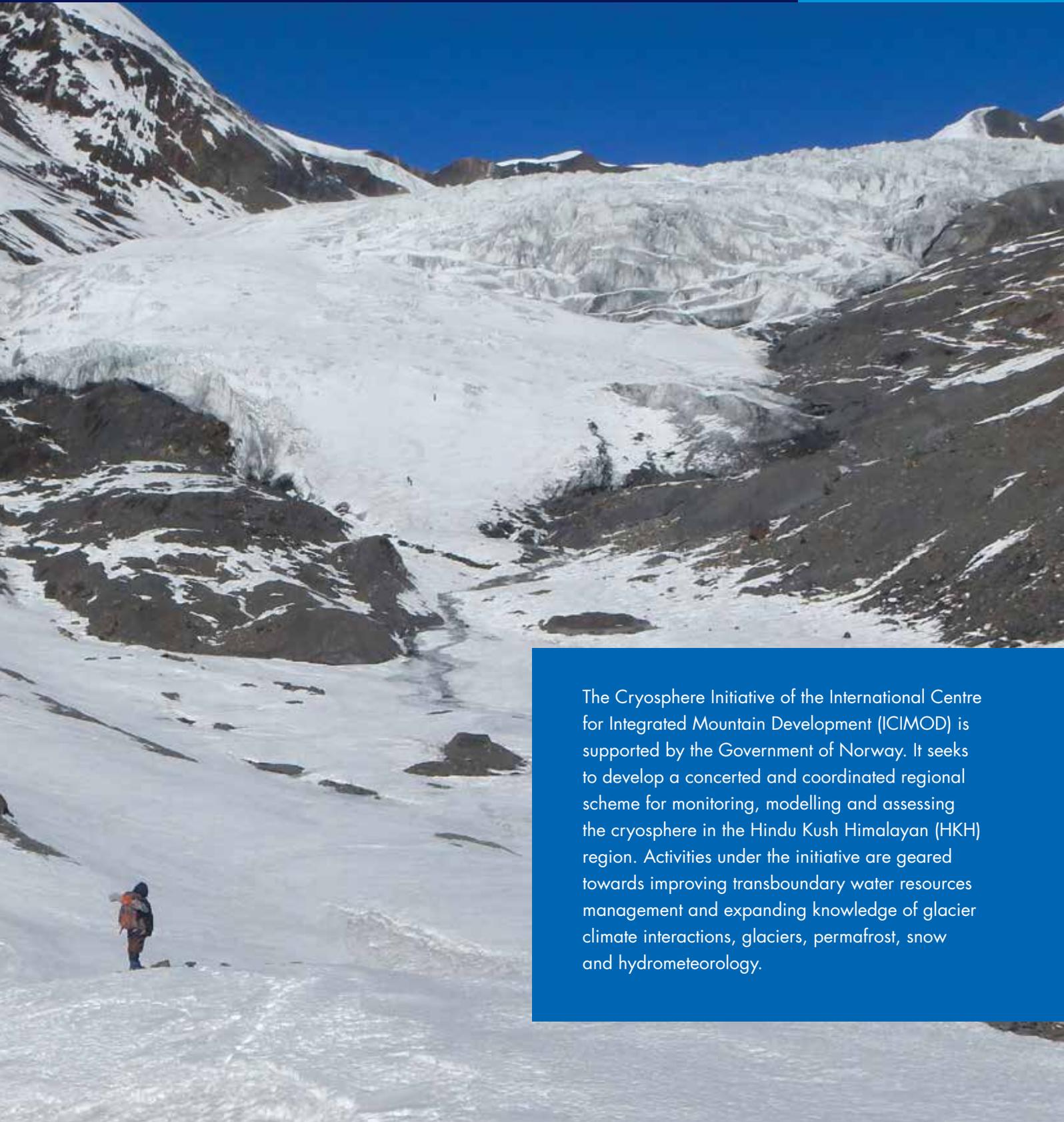


# Cryosphere Initiative Status and Results 2015

FOR MOUNTAINS AND PEOPLE



The Cryosphere Initiative of the International Centre for Integrated Mountain Development (ICIMOD) is supported by the Government of Norway. It seeks to develop a concerted and coordinated regional scheme for monitoring, modelling and assessing the cryosphere in the Hindu Kush Himalayan (HKH) region. Activities under the initiative are geared towards improving transboundary water resources management and expanding knowledge of glacier climate interactions, glaciers, permafrost, snow and hydrometeorology.



## Field-based Glacier Mass Balance and Snow Monitoring

- Glacier mass balance measurements and monitoring schemes successfully established and maintained on four glaciers in selected catchments: Yala Glacier (Langtang Valley), Rikha Samba Glacier (Hidden Valley), Mera Glacier and Pokalde Glacier (both in the Dudh Koshi Basin) as long-term climate indicators and to support water resource management
- Mass balance monitoring carried out using the glaciological method (stakes and snow observations) and independent geodetic method based on dGPS surveys along profiles and transects
- Glacier geometry measurements, including length change monitoring, ice thickness measurements with ground penetrating radar (GPR), and ice velocity measurements, complemented with ice temperature measurements carried out in Rikha Samba Glacier
- Snow sampling for black carbon and water isotope analysis
- GPR survey of debris thickness, temperature and melt measurements conducted on Lirung Glacier, Chola lake and Chhangri Nup Glacier using unmanned aerial vehicle (UAV)
- Glacier mass balance data submitted to the World Glacier Monitoring Service (WGMS)

## Field-based Hydrometeorological Observations, Monitoring, and Modelling

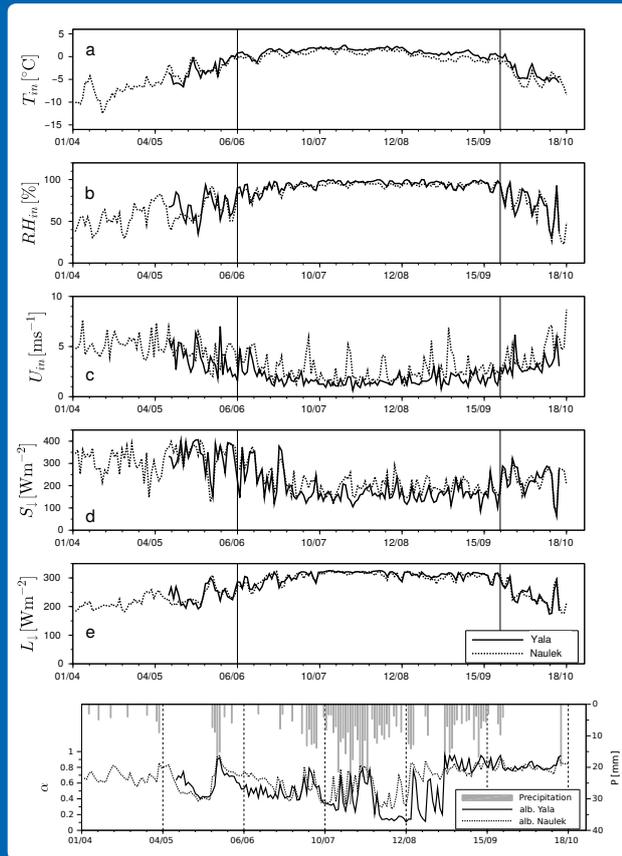
- Three automatic weather stations (AWS) and four hydrological stations installed in the Langtang and Hidden Valley basins of Nepal continue to provide important baseline climatic and hydrologic information

- Station upgrading and maintenance carried out after the April 2015 earthquake
- Successfully implemented the 'Snow Accumulation and Melt Processes in Himalayan Catchment' (snowAMP) project and installed four snow monitoring automatic weather stations in the Langtang Valley. The stations will provide accurate measurements of snow height and snow water equivalent. The data collected will be used to validate snow evolution models and to study the contributions of snowmelt to water runoff in the selected catchment. The snowAMP project is a collaboration between ICIMOD, the Norwegian Water Resources and Energy Directorate (NVE), the Department of Hydrology and Meteorology (DHM) of the Government of Nepal, Kathmandu University, and Tribhuvan University
- Fully distributed Topographic Kinematic Approximation and Integration (TOPKAPI), a physically based glacio-hydrological model established by partner ETH (Swiss Federal Institute of Technology Zurich, Switzerland) for the Langtang Valley
- Pioneering use of unmanned aerial vehicles (UAVs) for monitoring debris-covered glaciers in the Himalayas

## Remote Sensing-based Observations and Monitoring

- MODIS imagery with operational snow cover mapping and data is being regularly shared with ICIMOD's regional member countries
- MODIS based snow cover products for the Hindu Kush Himalayan region for the last decade, basin level associated statistics, and current information are provided on a fortnightly basis.
- Time-series glacial lake database of 1990 – 2014 completed for the Nepal and Bhutan Himalayas using RS/GIS tools
- A glacier inventory of five major basins of the HKH region – Amu Darya, Ganges, Indus, Brahmaputra, and Irrawaddy – was shared and also listed in the Global Land Ice Measurement from Space (GLIMS) glacier database system. This was done with the objective of disseminating glacier-related information more widely and making it available to the public through an interactive mapping website

## AWS on Naulek and Yala glaciers (left) and measured data (daily averages) (right)



### Knowledge Hub

- The Regional Cryosphere Knowledge Hub at ICIMOD continues to store, share, and disseminate knowledge of the HKH cryosphere for operational services and research in the HKH region and globally
- Cryosphere data is being transferred to ICIMOD's Regional Database System, a portal that provides easy access to cryosphere-related data and analyses of glaciers, snow, glacial lakes, and other information
- ICIMOD organized and co-sponsored the 'International Symposium on Glaciology in High-Mountain Asia', held in Kathmandu from 2–6 March 2015. The conference brought together 250 scientists and students from the region and around the world
- Regularly published peer-reviewed publications on station observations, modelling, glacier contributions to streamflow and other cryosphere-related papers in 2015. Publications have helped enhance understanding of climate, the cryosphere, and cryosphere water interactions as well as supporting policy making with regards to water resources in the region





## Capacity Building

- Continued support for the MSc. Glaciology course at Kathmandu University
- Five students (2 women and 3 men) graduated from the course in 2015. To date, a total of 15 students (4 women and 11 men) have completed the course. Graduates of the course are employed in relevant sectors in the region or are pursuing post-graduate study
- Training conducted for students and regional partners in 2015 include theoretical and field-based training in glacier mass balance monitoring and in remote sensing based monitoring and assessment of the cryosphere
- ICIMOD and Bhutanese partners visited the Mo Chu Basin from 20 July to 10 August 2015 to investigate a glacial lake outburst flood (GLOF) event that occurred in Lemthang Tsho on 28 June 2015 and to assess future risk and damages and losses downstream
- Remote sensing-based decadal data on glaciers and glacial lakes for four decades were released on 14 August 2015
- Representatives of ICIMOD, DHMS, and NVE conducted a joint field visit to Thana Glacier in September 2015 for mass balance monitoring and hydrometeorological research

## Cryosphere Monitoring Programme in Bhutan

- Monitoring and assessment of changes in glaciers, snow, and glacio-hydrology initiated with the Department of Hydro-Met Services (DHMS), Royal Government of Bhutan

## Cryosphere Monitoring Programme in Pakistan

- A Letter of Agreement has been signed with Karakoram International University in Pakistan for collaboration on cryosphere monitoring programme in Pakistan



## For further information contact

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**Photos:** Jitendra Bajracharya, Maxim Litt, Sarad Joshi, Laxmi Rai, Tika Gurung

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