

# Field-based glacier monitoring

## Mass balance measurement and hydrometeorological station set-up

9–13 July 2019

Kathmandu, Nepal

## Background

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The International Centre for Integrated Mountain Development (ICIMOD) works closely with the National Water Affairs Regulation Authority (NWARA), previously the Ministry of Energy and Water (MEW), Afghanistan, under the project Strengthening Water Resources Management in Afghanistan (SWaRMA) project to provide support for cryosphere monitoring in Afghanistan. The Hindu Kush Himalaya, also known as the “Water tower of Asia”, has the greatest amount of water resources in the world outside of the Polar Regions. Knowledge on cryosphere monitoring is very important because a glacier is not the only a source of water but also a key indicator of climate. To enhance knowledge of glacier monitoring, ICIMOD conducted a refresher training titled ‘Fieldbased glacier monitoring: Mass balance measurement and hydrometeorological station set-up’ from 9–13 July 2019. The training, which followed the Glacier Monitoring Training of 2018, covered traditional glaciological measurement techniques for the glacier mass balance based on international observation standards, as well as the setting up of hydrometeorological stations according

to World Meteorological Organization (WMO) standards. Through this training, professionals in Afghanistan learned how to monitor glaciers according to international observation standards and gained the capacity to independently monitor glaciers in the Kabul basin, Afghanistan.

SWaRMA is a two-year project supported by the governments of Australia and Afghanistan, and implemented through ICIMOD, the Commonwealth Scientific and Research Organization (CSIRO), and national organizations. SWaRMA prioritizes capacity building of stakeholders to strengthen in-situ cryosphere monitoring in Afghanistan. ICIMOD has designed and customized training activities consisting of field-based glacier and hydrology and meteorology monitoring. These activities were designed based on a partners’ needs assessment that was conducted earlier this year. ICIMOD is working towards sustainable cryosphere monitoring in the Kabul basin, Afghanistan, with the objective to establish long-term monitoring, which includes field-based glacier monitoring and setting up of climate stations. Cryosphere-related capacity-building activities of SWaRMA focus mainly on field-based monitoring, which was also the focus of the July 2019 refresher training.

In August 2019, Kabul University (KU) NWARA, Afghanistan embarked on the first cryosphere expedition to the Pir Yakh benchmark glacier in the Kabul basin. The refresher training enhanced participants' knowledge of field measurements and safety, field plan design, and activities related to the installation of glacio-hydrometeorological stations along the Chuma Valley in Panjshir Province.

Five professionals participated in the training – one from the Ministry of Energy and Water (NWARA); one from Kabul University (KU); two from the ICIMOD country office in Afghanistan; and one from the ICIMOD headquarters. The training focused on the direct glaciological measurement method and the use of various types of measurement equipment.

## Objectives and outcomes

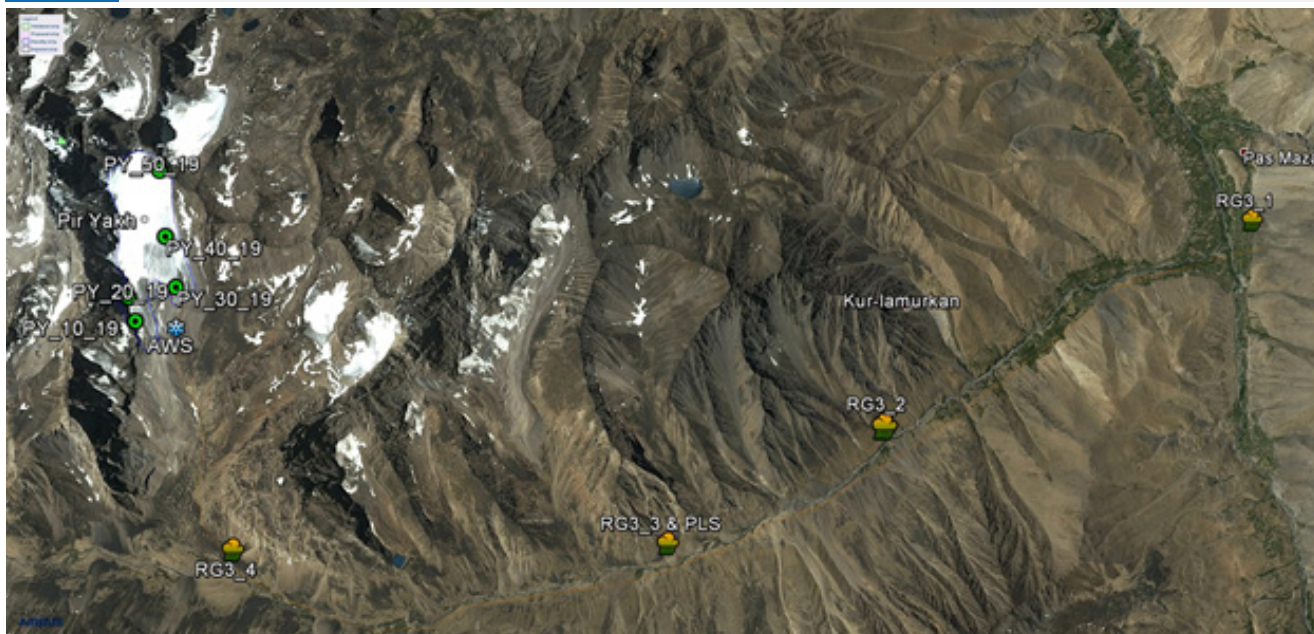
The main objective of the training on 'Field-based glacier monitoring: Mass balance measurement and hydro meteorological station set-up' was to build the capacity of professionals from different partner organizations of Afghanistan and to make them confident enough to independently take measurements in keeping with international monitoring observation standards, rules and regulations. The training covered glacier mass balance measurement protocols and processes as well as the installation of automatic

weather stations. The major objectives of the training were to:

- Refresh participants' knowledge of measurement processes and practices
- Facilitate hands-on practice sessions using snow density kits and stream drills, Kovacs ice drills and related equipment
- Conduct demonstrations and provide practical tips on launching and reading pressure level sensors, temperature and relative humidity sensors, wind sensors and tipping bucket (precipitation) gauges, and set up a weather station with these sensors as well as conduct necessary post processing
- Familiarize participants with benchmark glacier selection criteria and processes

FIGURE 1

A GOOGLE EARTH MAP SHOWING THE PROPOSED MASS BALANCE STAKES AND HYDROMETEOROLOGICAL STATIONS AT PIR YAKH GLACIER AND ITS DOWNSTREAM VALLEY



# Introduction

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The five-day refresher training was conducted for professionals from NWARA, Kabul University, and ICIMOD from 9–13 July 2019 at the ICIMOD headquarters in Kathmandu, Nepal.

The opening session was facilitated by Anna Sinisalo, Programme Coordinator of the Cryosphere Initiative. Arun B Shrestha, Regional Programme Manager, River Basins and Cryosphere, welcomed the participants and explained the importance of glaciers. Glaciers are one of the essential climate variables. Due to the impact of climate change, glaciers are melting and forming glacial lakes, which are expanding and posing risks. He stressed that the refresher training would enhance participants' knowledge and enable them to put their knowledge to use in one of the benchmark glaciers in the Kabul basin, Afghanistan right after the training.

Then the training participants introduced themselves and shared their expectations from the training. Sharad Joshi (from Water and Air), coordinator of the refresher training, and Finu Shrestha, Research Associate from Geospatial Solutions, gave an overview of the field-based glacier monitoring and remote sensing-based PDGL identification training, respectively. Neera S Pradhan, Programme Coordinator of SWaRMA, presented the updates on the SWaRMA project. Hedayatullah Arian from Kabul University and Esmatullah Joya from ICIMOD's country office in Afghanistan each presented on 'Glacier Monitoring in Afghanistan' and 'Glacial Lake Mapping and Monitoring in Afghanistan', respectively.

The opening session was followed by a group photo session. Thereafter the training formally started with lectures on mass balance basic principles. The training

materials (digital and hard copies) were provided to all participants. The training included interactive practical sessions to ensure that participants would be able to put their knowledge into practice in the field without guidance.

On the final day participants provided their feedback on the training by filling out a training evaluation form. Neera S Pradhan, SWaRMA Programme Coordinator, delivered the closing remarks, and Hedayatullah Arian and Esmatullah Joya shared their thoughts on the training. Arian said that the training was very useful and that he would soon apply the knowledge to establish the first benchmark glacier in Pir Yakh Glacier in Kabul, Afghanistan. He added that he would pass on his knowledge to his students and build their capacity for cryosphere research in order to minimize the data gap.

Each training participant was awarded a certificate of achievement and the resource persons received certificates of appreciation from David Molden, Director General, ICIMOD, and Arun B Shrestha, Regional Programme Manager, River Basins and Cryosphere. Both congratulated the participants for successfully completing the training and said they believed the training had strengthened their capacity to establish the first benchmark glacier in Kabul, Afghanistan. Shrestha said he was delighted that Afghanistan had selected its first benchmark glacier within a very short time for long-term monitoring.

Neera S Pradhan said the participants had come up with short-, medium- and long-term action plans and emphasized that the selected glacier should be monitored by SWaRMA or any other project that would be implemented in the future. She said she was hopeful that monitoring of the benchmark glacier would become a historic milestone and represent a major outcome of results-based action of SWaRMA. She concluded the session with a vote of thanks.

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## Training evaluation

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At the end of the training, participants were asked to rate the effectiveness of the trainers and training, the usefulness of the training, difficulty level, confidence, their overall level of satisfaction and confidence, and what topics they would have liked to learn more about.

The training participants were appreciative of the resource materials, lectures and hands-on session on the preparation of mass balance stake and station set-up. The participants found the theoretical training informative, useful and interesting. Majority of the participants said the training had built their confidence and that they would be able to independently monitor both mass balance measurement and station set-up.

# Remarks

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The 'Field-based Glacier Monitoring Training' was successfully completed in July 2019. Some of the trainees had received monitoring training in 2018, and the refresher training further enhanced their capacity for long-term glacier monitoring in Afghanistan. The training laid the groundwork for expanding cryosphere research and building a network for long-term sustainable cryosphere monitoring in Afghanistan. It gave the participants the confidence to independently carry out cryosphere monitoring activities in keeping with international observation standards and to submit their findings to international data depository organizations such as the World Glacier Monitoring Service (WGMS).

During the training participants came up with short-term (within six months with immediate action), medium-term (two years) and long-term (>two years) action plans. As short-term action, participants plan

to process the procurement of hydrological and meteorological research equipment, schedule the expedition, and finalize logistics. They then plan to test the stations involved and the equipment needed before the expedition to the first benchmark glacier, i.e., Pir Yakh glacier. Similarly, as medium- and long-term actions they plan to continue glacier monitoring, as well collect data from those hydrometeorological stations and maintain the station.

The participants requested additional training on other field-based glacier monitoring skills and techniques in the future. Below are some of their comments:

- The training would enhance the capacity of students in the field of cryosphere and help Kabul University develop a glaciology course
- Five days is not enough for mass balance monitoring training; there should be many short trainings
- More hands-on training on the use of mountaineering equipment is needed
- Gender balance should be maintained

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# Feedback

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Aspects participants want to learn more about as part of theoretical training on in-situ glacier monitoring – mass balance and measurement

- Relation of climatic components with glaciation, especially pressure
- More hands-on practice using mountaineering equipment to increase experience
- Energy balance and mass balance modelling

Aspects participants want to learn more about as part of demonstrations – methods and instruments for glacier mass balance monitoring

- Snow measurement methods
- Details of the Pico ice corer

Aspects participants want to learn more about as part of training on the glacier hydrometeorological station set-up

- Practical aspects of operating the pressure level sensor and analyzing its graph
- Knowledge on other automatic weather stations like the Campbell, which is widely used in cryospheric research

Participant comments of theoretical training on in-situ glacier monitoring – mass balance and measurement

- More practical lessons on discharge measurement needed
- Provision to work remotely with facilitating team after return to home country a big positive
- Five days not enough for mass balance monitoring training; multiple short term trainings necessary
- Good gender balance achieved



Comments on demonstration – methods and instruments for glacier mass balance monitoring

- Greater instruction and guidance on using mountaineering equipment needed
- Gender balance is important

Comments on training on the hydrometeorological station set-up

- More time on covering analysis of PLS graphs
- Gender balance is important

Aspects participants would like to learn more about

- Analysis of PLS graphs
- Mass balance – this is a new step in Afghanistan so long-term support from ICIMOD is necessary

Parts of the training most liked by the participants

- Mass balance measurement methods
- Overall, the sessions on hydrometeorological station installation and downloading data

Suggestions to improve the training

- More field-based sessions and training on the use of the PLS sensor
- Better time accuracy

**Additional event information and materials are available at:**

<https://www.icimod.org/event/refresher-training-on-field-based-benchmark-glacier-monitoring/>

**File links:**

[Training schedule](#)

[List of participants](#)

[Evaluation results](#)

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