ICIMOD

PROCEEDINGS OF THE TRAINING ON

Identification of potentially dangerous glacial lakes based on remote sensing and geospatial techniques

15–19 July 2019 | Kathmandu, Nepal

Background

ICIMOD has been working closely with the National Water Affairs Regulation Authority (NWARA), previously the Ministry of Energy and Water (MEW), Afghanistan, under the SERVIR-HKH Initiative to produce glacial lake data and its change database for four time periods (1990, 2000, 2010, and 2015). To enhance knowledge on glacial hazards like glacial lake outburst flood (GLOF), the Strengthening Water Resources Management in Afghanistan (SWaRMA) project organized a training on "Identification of potentially dangerous glacial lakes based on remote sensing and geospatial techniques" from 15–19 July 2019.

The glacial lake database developed under the SERVIR-HKH project could provide a basis for further analysis to identify potentially dangerous glacial lakes in Afghanistan. The training allowed Afghan professionals to learn about glacial lakes, morphological classification of glacial lakes, lake and dam characteristics, source glacier characteristics, and physical conditions of the surroundings. Training participants conducted a practical exercise for generating all the fundamental parameters of a glacial lake and dam to identify potentially dangerous glacial lakes in the Kabul basin, Afghanistan and place them under three different priority levels for GLOF risk reduction.

SWaRMA is a two-year project supported by the governments of Australia and Afghanistan, and implemented by the International Centre for Integrated Mountain Development (ICIMOD) and the Commonwealth Scientific and Research Organization (CSIRO). This project aims to co-create learning opportunities to strengthen water resources management in Afghanistan. To improve cryosphere monitoring, ICIMOD has designed customized activities aimed at building capacity in different aspects of monitoring, based on the partners' needs assessment conducted in early 2018. The objective is to lay the foundation for a sustainable cryosphere monitoring programme in Afghanistan, including field-based monitoring, and remote sensing based monitoring.

Four professionals from NWARA, the ICIMOD country office in Afghanistan and Kabul University (KU), and two from the ICIMOD headquarters

participated in the training on "Identification of potentially dangerous glacial lakes based on remote sensing and geospatial techniques". During the event, participants learned about remote sensing techniques for understanding the stability of the lake (lake and dam characteristics), source glacier characteristics, conditions of the surrounding features and morphological classification of glacial lakes, and GIS tools to generate glacial lake and dam parameters and to identify potentially dangerous glacial lakes.

Continuous recession of glaciers and the formation and expansion of glacial lakes in the region has drawn a lot of attention from scientists, mainly because it poses the risk of glacial lake outburst flood (GLOF). A number of studies on glaciers show that glaciers have undergone significant changes over the past few decades due to climate variability and the rise in temperature. A major impact of glacier retreat is the formation of new glacial lakes by accumulation of melt-water between the frontal moraine and the retreating glacier or the expansion and merging of existing ones. The rapid expansion of glacial lake dammed by loose and unconsolidated moraine, and various other surrounding and natural phenomena like earthquake, landslide or avalanche from the side walls of the lake, and erosion on the moraine, lead to the breaching or slope failure of more or less unstable dam. Water from the lake is then suddenly released, causing devastating flood along the river downstream called Glacial Lake Outburst Flood (GLOF). Such glacial lakes are spread across the HKH region and many of them are potential sources of flood.

The HKH has experienced numerous GLOF events in the past. Some of them had transboundary impacts. In 2018, a GLOF occurred in the Panjshir province of Afghanistan. This was caused by the formation of a new lake that was rapidly expanding due to melting snow and glacier ice. The lake water continuously eroded the ice underneath the dam. As a result, the dam became weak and suddenly breached on 12 July 2018, impacting the Peshghor village 12 km downstream from the lake and blocking the main Panjshir River of the district. The risk for such GLOF events in Afghanistan has not been assessed yet.

The training aimed to build the capacity of professionals from the NWARA ICIMOD country office in Afghanistan, and Kabul University to identify potentially dangerous glacial lakes in the Kabul basin, Afghanistan and to categorize them into three priority levels for GLOF risk reduction. The training also developed participants' ability to use glacial lake data to monitor and identify potentially dangerous glacial lakes across Afghanistan, and to initiate GLOF mitigation measures.

Objectives

The training helped to build and enhance the capacity of professionals in the field of education, water resources research and management for identifying potentially dangerous glacial lakes in the Kabul basin. It familiarized the participants with glacial lake data and developed their ability to monitor and identify potentially dangerous glacial lakes in Afghanistan. It also helped participants develop content on glacial lakes and GLOFs for a university-level course so as to enhance the capacity of students and researchers in the field of cryosphere and glacial hazards.

Sessions

ICIMOD conducted the five-day training at its headquarters in Kathmandu, Nepal.

The first session was facilitated by Anna Sinisalo, Programme Coordinator of the Cryosphere Initiative. Arun B Shrestha, Regional Programme Manager for River Basins and Cryosphere delivered the welcome remarks. He said that glaciers are melting due to climate change; when a glacier melts, it can lead to the formation of a new lake or the expansion of an existing lake. The increase in the lake area can make some of the glacial lakes potentially dangerous and identifying such

dangerous lakes is crucial for reducing risks. He said the training would allow participants to gain knowledge of glacial lakes and build their capacity to identify potentially dangerous glacial lakes in the Kabul basin, Afghanistan. He expressed his hope that the participants would be able to identify the potentially dangerous glacial lakes (PDGLs) in the basins of Afghanistan and monitor these dangerous lakes on their own. The participants then introduced themselves and stated what they expected from the training. Sharad Joshi from Water and Air and Finu Shrestha from Geospatial Solutions shared the purpose of the field-based glacier monitoring training and remote sensing based PDGL identification training respectively and gave an overview of the training programme. Neera S Pradhan, Programme Coordinator of SWaRMA, presented the updates on the SWaRMA project. Hedayatullah Arian from Kabul University presented his work on glacier monitoring in Afghanistan. Esmatullah Joya from the ICIMOD country office presented his work on glacial lakes and potentially dangerous glacial lakes in Afghanistan.

The training proceeded according to schedule. Each participant was provided with training materials, in both digital and print formats. The training included both theoretical sessions and interactive sessions with hands-on exercises, which enabled the participants to understand key concepts as well as gain practical knowledge.

On the final day, training feedback was collected via a training evaluation form completed by participants. Hedayatullah Arian and Esmatullah Joya shared their thoughts on the training noting he found it very useful and that he would pass on his knowledge of glacial lakes and PDGL identification to his students. Joya said that studying PDGLs in Afghanistan has become more important since the GLOF event of July 2018. The training shed light on the various parameters that characterize a PDGL. The participants were awarded certificates of achievement and the resource persons received certificates of appreciation from David Molden, Director General, ICIMOD, and Arun B Shrestha. Molden and Shrestha congratulated the participants for successfully completing the training. Molden said he believed the training had strengthened capacity. Shrestha said he was delighted that Afghanistan had selected its first benchmark glacier through deliberations during the training for long-term monitoring. He added that GLOFs have become a high-priority subject since the July 2018 event in Afghanistan, and expressed his hope that the training had built the participants' capacity to identify dangerous lakes in the country. Neera S Pradhan said that the participants had come up with short-, medium- and long-term action plans and that SWaRMA or other projects will monitor these for implementation. She added that the training on PDGLs would contribute to long-term monitoring of dangerous lakes. She ended the session with a vote of thanks.

Outcomes

After the training, the participants were able to identify potentially dangerous glacial lakes (PDGLs) in the Kabul basin of Afghanistan using remote sensing and geospatial techniques. They will do further work to identify PDGLs in all the basins of Afghanistan.

Training evaluation

Participants provided positive feedback on all aspects of the training – training materials, lectures and hands-on exercises. They said the training was very useful and informative. The evaluation form helped the organizers understand the participants' views on the quality of the training, the usefulness of each session and their expectations from future trainings.

The participants were asked to rate the training and training quality on a scale of 1–5, where 1 = Extremely high; 2 = High; 3 = Medium; 4 = Low; and 5 = Not at all. In the technical evaluation section, they

were also asked to rate their confidence level on a scale of 1–4: Highly confident (1), Relatively confident (2), Basic confidence (3), and No idea (4). Overall, the participants were satisfied and rated the training quality 'extremely high' to 'medium', and they were 'highly confident' to 'relatively confident' about using the software on their own to identify the PDGLs.

However, they also said that the training period was too short for them to be able to complete the exercise and practice properly. They suggested that computers featuring high-processor capacity would be good for running the software and working on the data effectively. They have come up with short-term (within six months), medium-term (in two years) and long-term (beyond two years) plans of action. Their short-term plan is to develop necessary data for identifying PDGLs. In the medium term, they will continue working on the identification of PDGLs. A participant from Kabul University has also planned to start a course on this topic. In the long term they will continue to study and monitor the PDGLs. They will also acquire high-resolution images for monitoring and conduct further studies.

Feedback to the organizer

Any comments on technical sessions

- The training was very informative and got to learn about it in detail
- Duration was not enough to practice properly
- All of the training session was excellent apart from the occasional power shortage

In what ways could this training have been improved to better suit you need?

- The PC should be provided. Our laptop is not of high end processor to run the software properly
- Training duration was short. Some covered all part of the manual, but some didn't. The training days need to be extended
- Everything was carried out in an excellent manner, and all my queries were address properly

Other comments

- Gave an insight and got to learn about different techniques
- Provide PC and extend the training duration
- Hope to apply this skill for any assessment in the related field and in the near future

How do you apply this training after you go back to Afghanistan?

SHORT TERM STRATEGY (WITHIN 6 MONTHS)

- As PDGL needs the specific data to work on, we need to prepare the require data
- To identify potentially dangerous glacial lake in the Kabul River basin

MEDIUM TERM STRATEGY (IN 2 YEARS)

- As this is just the start point of PDGL studies in Afghanistan, we will start and continue it based on our facilities
- We should work on regularly because lakes are changing so fast due to climate change
- I will try to put it in teaching programme

LONG TERM STRATEGY (BEYOND 2 YEARS)

- It is good to continue the study and monitor based on what data we have prepared
- We should get access to high resolution map for better mapping

Additional event information and materials are available at:
https://www.icimod.org/event/training-on-identification-of-potentially-dangerous-glacial-lakes-using-remote-sensing-and-geospatial-techniques/

File links:
Programme agenda
List of participants
Evaluation results
Training evaluation sheet

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International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal
T +977 1 5275222 | **E** info@icimod.org | **www.icimod.org**