

Topic 2: Climate change of high-altitude glaciers and downstream effects

Topic 2 break-out group:

John, Reynolds, (Chair, UK), Miriam Jackson (Norway), Duncan Quincy (UK), Karma Chopel (Bhutan), Igor Seversskiy (Kazachstan), Rakstan Roohi (Pakistan), Pradep Mool (Nepal), Pablo Zenteno (Chile), Vijay Kumar (India), Nitesh Shrestha, Eddy Moors (Reporter, Netherlands)

Definition of high-altitude glaciers

Are HMG's decreasing because of global warming?

- Because of disintegration the number may increase, but the general trend is a decreasing mass/volume.
 - (there are exceptions, e.g. Karakorum, Central Andes)

Has the frequency of GLOF's changed?

- Frequency and intensity has increased.
- This is also the case for glacier outbursts.
- Number of glacier lakes and the volume of lakes are increasing.
- Risk is increasing, also because for example people are starting to life in the hazardous zones.

Reporting has improved, but still the total number is underestimated in the databases. Taken this uncertainty into account the number of GLOF's and glacier outbreaks have increased over time.

How important are glaciers for freshwater supply to downstream populations?

- This differs from basin to basin and in time.
- Should be made specific over the stretch of the river.
- Glaciers can redistribute water over the seasons. Glacier melt is important for irrigation purposes. This is especially important for the upstream part of the basin. For the lower parts of the basin, this depends on the precipitation contribution and timing.
- Glaciers can especially contribute in years with high temperatures.

Data availability vs data accessibility

- Not enough data available.
 - What data there is, is only limited accessible, or only at a higher abstraction level.
- Data contribution of glacier melt, snow melt and precipitation is needed.
 - In Kazakhstan only 1 station above 3000 m. This is exemplary
 - Data is stored by the responsible department, but the procedure is cumbersome to obtain the data. Often the data are collected by the Ministry of Defense and are considered sensitive data.
 - Obtaining data in Bhutan and Nepal is easy.
 - Money is often needed, but not crucial
- Trans-boundary sharing, may lead to liability issues if damage is caused
 - Regional institutes like ICIMOD can play a crucial role in coordinating a database for data sharing the region. This can also be connected with global databases
- Sampling of information at high altitudes is missing
 - Measurement of precipitation and other weather data at different altitudes is needed
 - Spatial sampling is also not well covered
 - Data on volcanic glaciers are missing

Data availability vs data accessibility

- Every glacier is unique!
 - Kazakhstan mountains: character of the central Asian glaciers are quite different
 - Andes: Rock glaciers are not included in inventories at the moment.
 - Sampling of information at high altitudes is missing
 - Measurement of precipitation and other weather data at different altitudes
 - Spatial sampling is not well covered
 - Lack of good mass balance series (i.e. long time series are more needed than a large number of datasets on different glaciers)
- Access to remote sensing data is quite good
 - RS can be used to scale up based on ground data. RS can help to select a good site that can be used as a main ground station.
 - RS may also help to get information on glaciers that are difficult to access by one way or another.
 - Good data to define the relations between area and mass/volume is needed.

Data availability vs data accessibility

- GLOF's/glacier outburst:
 - Data on the GLOF's/glacier outburst are sporadic
 - better data needed at high altitude but also downstream on discharge measurements
- Modelling data of RCM's and GCM's
 - No problem to access the data
 - Regional data for validation of RCM's is needed.
- Logistic problems
- Data consistency: QA/QC: Global standards should be used to make sure data can be compared
- Institutional commitment is not there!
- Communication between data providers and data users is not always working well. (reciprocation)

What are the knowledge gaps?

Research and geographical gaps?

- East Himalaya and Andes: glacier is decreasing (data gap) because winter monsoon is decreasing, but knowledge gap on sublimation/ablation contribution
- Karakoram: some increase, the processes behind this are unknown.
- Glacier outflow
 - Underground ice contribution to runoff is unknown
 - Breach mechanism GLOF's
 - Sub-glacial and end-glacial reservoirs outbursts is not well understood
 - Forming of glacier caves important as part of GLOF's and formation of glacial reservoirs
 - Depth of ice thickness are at the moment inferred from area measurements. Glaciers cannot be classified to get regional relations between area and thickness.
- Timing of snow melt, snow fall
- Validation of models (at the moment primarily hampered by the lack of data)
- Risk management of glacial lakes, benefit for local population

Local and country priorities, and capacity building.

Short term:

- Glaciar hazards management. This could be improved by regular inventories on glacier hazards (preferably every 5 years).

Medium term:

- Seasonal water availability for irrigation.

Long term:

- Long-term change to decide on large infrastructure investments.

Bottlenecks:

- Lack of human resources, and equipment
- Accessibility (Himalaya and Andes), No exposure wanted, sensitive areas because of hydropower and mining activities. This may hamper the ease to access the glaciers.
- Physical and administrative accessibility.

Solutions:

- Trans-boundary problems may be solved by regional institutes like ICIMOD. Basin approach should be followed to assess the downstream effects.
- Create regional data base.
- Encourage the agency in each country to adopt a consistent approach
- Policy guideline on updating glacier database (every 10 years)

Capacity building

- Capacity building following the indicated priorities
- Public awareness

Additional issues

- Donor coordination is sometimes lacking, which may hamper an efficient use of resources.
- Although a fair representation, not all countries were present