Contribution to the Discussion

ICIMOD's comments on the discussion paper 'Himalayan Glaciers: A State-of-Art Review of Glacial Studies, Glacial Retreat and Climate Change' by V.K. Raina, Ex. Deputy Director, Geological Survey of India, prepared by the Indian Ministry of Forest and Environment with GP Pant Institute of Himalayan Environment and Development.

This is perhaps the first time a comprehensive report on glacial studies has been published by the Government of India. This is highly commendable and the merits go to the new leadership of the Ministry of Environment and Forest, Government of India (MoEF). The document is presented as a discussion paper. The following sections have been prepared as ICIMOD's contribution to this discussion.

What does the report provide?

The paper has attempted to give some basic explanation of what a glacier is, which is useful information for the general public and helps to fulfil the same needs as the efforts we too are making to inform the general public and the media on this topic, for example through our recently released FAQ sheet on glaciers.

The focus of the report is on assessing the rate of deglaciation and seeking linkages (or otherwise) with climate change. The report presents an attempt to compile past and ongoing research on glaciers and its peripheral issues in the Indian Himalaya, and in particular to summarise the efforts of several institutions in India to monitor fluctuations of the termini (snouts) of glaciers. It is clear from the report that a large part of the information related to glaciers in India is based on intermittent 'expeditions' rather than systematic monitoring over a significant period of time.

The report highlights that glaciers are complex and that terminus fluctuations are the result of complex processes, with a time lag in response. While major parts of the report deal with snout fluctuations, the report highlights the importance of recognising that glacier snout fluctuations are dependent on several factors, such as mass balance (determined by climate), bottom topography, and ice temperature. The report itself provides numerous examples of glacier retreat and only a few of advancing or stagnant glaciers. The suggestion is that the retreat rate accelerated during the 1970s and 1980s, and slowed down thereafter. The report does not deny deglaciation in the Himalayas. The main argument is that the rates are not as dramatic as often reported. The report recognises that the Himalayan glaciers show different behaviour from east to west, and that altitude, size of the glacier, and other localised factors play a role.

The report indirectly maps the institutions involved in the past and present in the field of glacial research, and changing mandates of these institutions with time. It also notes that much of the data on glaciers collected by the GSI are still unavailable as they were declared classified.

What does it not provide?

The study explains the relevance of glacier mass balancing and recognises that mass balance represents the direct and undelayed response of a glacier to climatic changes. There have been some efforts made towards mass balance measurements of different glaciers in India, although they remain few. UNESCO provided training on glacial mass balance study in 2003 through the Ministry of Science and Technology (MoST), and thereafter intermittent mass balance studies have been conducted on some individual glaciers. However, the report is silent on these studies, even though unlike terminus fluctuation, mass balance changes represent the direct and undelayed response of a glacier to change. The suggested guideline for future studies is silent on the need to enhance mass balance measurements.

Apart from retreat of the glacier snout, lowering of the ice surface is also a very important indicator of change as it represents loss of ice volume. Some glaciers can lose a massive amount of ice through lowering of the ice surface while the glacier snout remains more or less stagnant. The studies described in the report do not consider such issues. Furthermore, one of the major shortcomings of all the studies described that can be inferred from the report is the lack of continuous observation for a relevant length of time. This is also not highlighted.

The report describes itself as a 'state-of-art review' of Himalayan glacier studies. It does describe the state of glacial study in the Indian Himalaya. However, many studies on glacial dynamics have been conducted in Bhutan, China, Nepal, and Pakistan, which together contain a significant portion of the Himalayas. Thus the results presented in the report cannot be taken to represent the situation in the Himalayas overall.

About the scientific basis of the report

The report title clearly indicates that this is a paper for discussion, not a peer reviewed final product. The information presented is described as based on published data, but the scientific credibility would have been improved if all important references had been cited. This would have been a great resource for the scientific community seeking further information. This absence of a clear scientific basis weakens the report considerably, and brings into question the basis of support for the report's statements on the declining glacial retreat rate and lack of linkage with contemporary climate change. It also prevents any detailed assessment of the scientific basis of the report. Nevertheless, some key scientific weaknesses can be identified.

- The discussion appears to assume that under the same warming rate the terminus retreat rate should be constant. This is incorrect. For instance, as a glacier approaches a new steady state in a warmer climate, the retreat rate will slow down. Furthermore, in some cases the increased temperature may provide more moisture in the atmosphere, leading to more snowfall on the glacier, thereby contributing towards a positive mass balance (growth in the glacier ice mass). Finally, as the thinner part of the snout melts away, the thickness of the new 'end' of the glacier may be greater than before, which will result in the retreat rate slowing down even though the loss of ice (through surface lowering) is still high.
- The estimates of the response time of Indian glaciers are incorrect. The response times for sub-tropical glaciers lie in the time frame of decades to a century, depending among others on the size of the glacier. (The suggested response times of 6000 and 15 000 years may have some relevance for large ice sheets such as the Antarctic and Greenland ice sheets[1], but not for mountain glaciers.)
- 'The response time is the time taken to reach a new steady state after climatic perturbation, in other words, the time taken until the snout reaches its new position in the new climatic situation. The immediate changes in snout position reflect the reaction time, the time taken to see any change in a glacier in response to a perturbation The reaction time for small glaciers may be as short as a few years, longer for larger glaciers. The report attempts to compare the terminus fluctuation with contemporary meteorological data year-for-year over a period of ten years (report Figures 35 and 36). This contradicts both the assumption in the report that response times are of the order of millennia, and also fails to take into account any lag time at all.

  The report also attempts to use average glacial speed as a measure of glacial response time. The time taken by ice deposited in the accumulation area to reach the snout indicates the average speed. For the Gara glacier, as an example, this is suggested to be 300 years, giving an average speed of 10 m per year. But this is not a direct indicator of response time and even less of reaction time.

[1] Pidwirny, Michael (Lead Author); Mauri Pelto (Contributing Author); Harold Ornes (Topic Editor). 2008. "Glacier." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth October 19, 2006; Last revised April 24, 2008; Retrieved November 23, 2009]. <http://www.eoearth.org/article/Glacier>

Conclusion

The report contains some important information on glacial studies in the Indian Himalayas. Scientific review of the report would have significantly enhanced its value. ICIMOD welcomes the increased interest in the glaciers in the region and their behaviour, leading to increased debate and discussion, but would urge government and research institutions to carefully review papers and reports before publishing since they otherwise may contribute more to unnecessary confusion than to increased knowledge. The report comes at a time when the world is preparing for COP-15 in Copenhagen. Stronger arguments could have helped the debate on the global impact of climate change on some of the vulnerable mountain countries and regions in the Himalayas.

Regarding Indian institutions for glacial research, ICIMOD highly commends the decision of the Government of India to create a specialised institute. Such a centre will be able to take the lead and develop state of the art methodologies. It is understood that the technologies tested in the Alps are an important learning base, but would need customisation for use in the specific situation of the Himalayas. We look forward to leadership in scientifically sound investigation, and inspiration for others to follow, from such a centre.

International Centre for Integrated Mountain Development (ICIMOD)
November 2009

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