Preface

Himalayan cryology

The Himalayan region, including Karakoram, possesses a large concentration of mountain glaciers. In addition, large area is also covered by seasonal snow during winter. Snow and glacier melt during summer provides water to the major Indian rivers. This makes these rivers perennial and they are considered as the lifeline of millions of people living along the banks. However, water availability can be affected due to changes in global and regional climate. This will have a profound impact on the livelihood of millions of people living in the region. Therefore, understanding changes in the cryosphere is important to assess future changes in water availability and its influence on the people. In this context, this special section in *Current Science* highlights the latest understanding of the Himalayan cryosphere.

To understand the future changes in the Himalayan cryosphere, we need to understand the changes in temperature and precipitation in the Himalaya. Also, being a rugged and remote terrain, very few field observations are available in the region. Therefore, observations by Negi *et al*. (**page 760**) are important. In the Western Himalaya, an overall warming of around half a degree Celsius for a period of 25 years starting from 1991 is observed. In addition, for the same period, snowfall amount has decreased and rainfall has increased. This will have profound impact on the distribution of snow and glaciers.

Mass balance and ice thickness are the important parameters in assessing the effect of changing climate. Bandyopadhyay *et al.* (**page 771**) suggest that Chorabari glacier has been retreating since 1976. Also, the analysis of mass loss by geodetic method indicates a negative mass balance for the year 2010–11. Singh *et al.* (**page 776**) have studied the ice thickness of Patseo glacier using both direct and indirect methods. Ground penetrating radar (GPR) surveys conducted in 2004 and 2013 indicate a reduction in ice thickness.

An important yet unexplored aspect of glaciers is supraglacial debris cover. Direct measurements of ice thickness are not available for the debris-covered glaciers in the Indian Himalaya. Therefore, the results put forward by Mishra *et al.* (**page 785**) are notable. The study measures thickness of debris-covered Satopanth glacier using GPR. These direct measurements of ice thickness are essential for validation of values estimated by indirect methods. Pratibha *et al.* (**page 792**) indicate a linear increase in supraglacial debris cover in Baspa basin for the period 1997–2014. The study can be extended to larger spatial scales in different regions of the Himalaya.

However, the influence of changes in temperature and precipitation on the distribution of snow cover is unclear. Rathore *et al.* (**page 800**) have analysed the trends in snow cover area from 2004 to 2014 using AWiFS data of the Indian Remote Sensing Satellite. They suggest no significant trend in the snow cover for ten years starting from 2004, possibly due to large variability in snow cover, short period of observation and lack of snow depth information. To assess snow melt, a constant value of environmental lapse rate is generally assumed. Kulshreshtha *et al.* (**page 808**) show a significant variation in lapse rate across months and advocate the implementation of monthly varying values. The study is important in the context of melt run-off computations.

Thus, the impact of climate change on different aspects of Himalayan cryosphere is significant. If the global warming continues at the same rate, the region can experience reduced glacier area, changes in stream run-off pattern and reduction in water availability. This special section has brought out many noteworthy studies using a combination of satellite and field measurements. This has helped us understand changes in the Himalayan cryosphere and its response to climate change. However, more detailed investigations on the cryosphere and a possible mitigation strategy are needed.

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