Climate change impact on glacier melting in Himalayas

Understanding glacier variability and local moisture recycling are crucial to understanding the potential risks to Himalayan ecology. Isotope studies could provide interesting clues

By Tirumalesh Keesari

Glaciers, being an integral part of the Earth's natural system, serve as the most reliable and sensitive indicators of climate change. Besides, they constitute a significant component of the hydrological regime. It is estimated that over 10,000 glaciers are receding at a rate of 100 to 200 feet (30 to 60 metres) per decade in the Indian Himalayas. In fact the melting is twice as fast since the year 2000 as they were 25 years before, due to human induced climate change. And it is projected that two-thirds of Himalayan glaciers will vanish by the end of this century if the current rate of greenhouse gas emissions continue (Ann Rowan, 2020).

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Another threat from warming temperatures is that of formation and bursting of glacial lakes. With warming, the temperature around ice cover stays at -2 °C compared to much cooler temperatures earlier (-20 to -6 °C), (Dailysabah, 2021). Though the ice is still frozen, it is closer to its melting point and so it takes less heat to trigger an avalanche than some decades ago. This avalanche is termed as Glacial Lake Outburst Flooding (GLOF), and many such avalanches were reported in the past. In fact, some suspect GLOF as the cause of recent disaster on 7th February 2021 in Chamoli district (Uttarakhand, India), most notably in the River Dhauliganga. Whether this particular disaster was caused by climate change or not, may be point of debate. But it is certain that the climate change can trigger natural disasters or increase the landslides and avalanches because the valleys that were earlier packed with ice open up due to warming, and this creates space for landslides to enter into, which allows the rock pieces to move downhill more easily amassing a great force.

Such disasters underscore the fragility of the Himalayan mountains where the lives of millions are being affected by climate change. It would be pertinent to assess beforehand the hazards posed by breaching of expanding lakes, considering the increased rate of occurrences and the mammoth damage they cause to human life, property as well as overall health of ecosystem.


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Environmental isotopes along with other spatial techniques have been used to understand the impact of climate on glacier melting in parts of western Himalaya. Isotopes being part and parcel of water molecules can trace the movement of water masses more accurately than other tracers. The isotope tracers like Deuterium, Tritium, Oxygen-18 of water molecule and other dissolved isotopes have potential applications in climate studies including glacier dynamics.

Some of these research activities are funded and guided by DAE through BRNS program. Isotope Hydrology Section of Isotope and Radiation Application Division (BARC) has provided technical support in setting up of water isotope measurement facility at JNU, New Delhi and played a key role in the implementation of climate change project at Chhota Shigri Glacier, Himachal Pradesh. The outcome of these projects highlight the dominant role of Westerlies over Indian Summer Monsoon on glacier variability in the Himalaya during Late Quaternary Period (Om Kumar et al., 2021; Naveen Kumar *et al.*, 2018). Also, the studies provide new evidence that improves the current understanding of the forcing factor behind glacier advances and retreat in the Western Himalaya. For the first time, δ^{17}O isotope has been used in the Indian context to infer the influence of local moisture recycling at the continental site (Ranjan *et al.*, 2021).

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