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Himalayan glacier data shift to the middle ground

New satellite study sparks fresh debate about the melting of Himalayan glaciers.

Jane Qiu

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Etienne Berthier

It has proved difficult to determine exactly how fast glaciers throughout the Himalayas are shrinking.

Satellites can be powerful tools to map complex changes across large, inaccessible areas — but only if researchers are able to interpret correctly what their measurements mean.

A 2010 study using measurements taken by the Gravity Recovery and Climate Experiment (GRACE) satellite reported that glaciers in the Himalayas and the Tibetan plateau were shedding roughly 50 gigatonnes of ice a year[1]. But these results were refuted two years later by another group that used the same data set but interpreted it to show that ice loss was only one tenth of that amount[2].

Now a third study of Himalayan glaciers, using a different satellite called ICESat, indicates that these glaciers lost an average of 12 gigatonnes ice a year between 2003 and 2008[3]. The work is published today in *Nature*.

The new estimate raises further questions about satellite and field measurements of alpine glaciers, and "will set the cat among the pigeons," says Graham Cogley, a remote-sensing expert at Trent University in Peterborough, Ontario, in an accompanying News and Views article[4]. Although the ICESat results show twice as much ice loss as the re-interpreted GRACE data, this figure is still three times lower than regional losses estimated on the basis of field studies[5].

Data correction

ICESat was launched by NASA in 2003 to track changes in polar ice sheets by measuring their surface elevations with a laser altimeter. "It was designed for smooth topography of the polar regions and cannot be readily used to map rough terrains such as the Himalayas," says Andreas Kääb, a remote-sensing expert in the University of Oslo in Norway, who led the latest study.

Himalayan glacier ice loss
Nature's podcast team discuss

To get around this problem, the team systematically corrected the ICESat data using elevation measurements from the Shuttle Radar Topography Mission, an international research effort to generate a high-resolution digital topographic database of Earth.

melting glaciers with Andreas Kääb. You may need a more recent browser or to install the latest version of the Adobe Flash Plugin.

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Kääb and his colleagues also checked the altitude of the adjacent terrain, which should not change over a short period of time, to make sure that any changes in elevation detected by ICESat in the glacier surface are genuine.

Once these corrections and checks were in place, the researchers used the ICESat data to map the region at a resolution of up to 70 metres. Their study shows that, between 2003 and 2008, Himalayan glaciers thinned at a rate of about 21 centimetres a year on average, significantly less than the estimated global average for glaciers and ice caps.

Glacier fate

Kääb warns, however, that the average ice change can be misleading because it conceals large glacier losses in some parts of the Himalayas that are balanced out by smaller changes, or even gains, in others. In northwestern India, for example, glaciers thinned by about 66 centimetres a year, whereas those in the Karakoram on the whole changed little.

Such regional variations “matter a lot for the millions of people living in river basins that are fed by those glaciers”, says Kääb.

“The study is the first regionally complete measurement [of Himalayan glaciers] that is in general agreement with individual field studies,” says Cogley. He points out, however, that discrepancies with other satellite studies and regional-scale field assessments remain. “We need to keep an open mind” about different satellite methods and the fate of Himalayan glaciers, he adds.

Kääb stresses that the study, like the GRACE observations, does not indicate the climate trend or the fate of the Himalayan glaciers, which would require data collected across several decades. “We are merely pointing to a new way to use ICESat, and the results can be used as a baseline for future studies,” he says.

To Lonnie Thompson, a glaciologist at Ohio State University in Columbus, there is an urgent need to understand why these satellite studies differ from each other and from some field measurements, what their sources of errors are, and how they can be better calibrated. “This is the only way to track changes in the 46,000 or so glaciers in the Himalayas and the Tibetan plateau,” he says.

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References

1. Matsuo, K. & Heki, K. *Earth Planet. Sci. Lett.* **290**, 30–16 (2010).
2. Jacob, T., Wahr, J., Pfeffer, W. T. & Swenson, S. *Nature* **482**, 514–518 (2012).
3. Kääb, A., Berthier, E., Nuth, C., Gardelle, J. & Arnaud, Y. *Nature* **488**, 495–498 (2012).
4. Cogley, G. *Nature* **488**, 468–469 (2012).
5. Bolch, T. *et al*. *Science* **336**, 310–314 (2012).