UC Irvine team track massive ice loss from Berry Glacier in West Antarctica

Satellite data enabled scientists to see the intrusion of warm water in subglacial cavities.

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UC Irvine researchers analyzed decades worth of satellite data to better understand the causes of the rapid retreat of Berry Glacier, a tributary of the Getz Ice Shelf (pictured) in West Antarctica.

Picture Credit:
NASA

- Berry Glacier, which holds 22 centimeters of sea level rise potential, is rapidly melting, according to UC Irvine researchers.
- Intrusion of warm ocean water into glacier grounding zone is causing aggressive deterioration of ice.
- NASA supported the research.

Berry Glacier, a tributary of the Getz Ice Shelf in West Antarctica, has deteriorated dramatically in the past three decades, according to researchers in the Department of Earth System Science at the University of California, Irvine. In a study published recently in *Nature Communications*, the scientists documented that in the period spanning 1996 to 2023, the glacier retreated seven-tenths of a kilometer per year for a total of 18 kilometers, about 11 miles.

Berry Glacier thinned by 11 meters per year during the study period, and its retreat velocity increased by 64 percent, resulting in a loss of 130 gigatons of ice mass. The team derived these results by analyzing synthetic-aperture radar interferometry data from several missions, including ERS-1/2, ALOS-1/2 PALSAR, Sentinel-1, COSMO-SkyMed and the RADARSAT Constellation Mission.

“From these data it is clear that the rapid retreat of Berry Glacier can be attributed to the intrusion of warm circumpolar deep water beneath the ice,” said lead author Hanning Chen, UC Irvine postdoctoral scholar in Earth system science. “The bathymetry, or topography of the Earth’s surface, underneath Berry Glacier facilitates the injection of seawater of a temperature sufficient to rapidly melt basal ice, and the result an alarming reduction in ice mass in this vulnerable region of West Antarctica.”

The Getz Ice Shelf contains a volume of frozen water equivalent to 22 centimeters (nearly 9 inches) of sea level. Berry Glacier accounts for about 10 percent of the ice drainage from Getz.

“Berry Glacier isn’t an outlier,” said Chen, who began working on this study in 2023 as UC Irvine Ph.D. student. “Where warm seawater can intrude beneath glaciers sitting on retrograde beds, intense basal melting is likely. Accounting for these intrusions in ice-sheet models will likely raise projections of ice loss and sea-level rise.”

Study co-author Eric Rignot, UC Irvine Distinguished Professor of Earth system science, said the array of Earth observation satellites that he and his team used enabled them to pinpoint grounding lines, where glaciers depart land and begin to float in ocean water, and grounding zones, GLs that migrate on the frequency of tides.

Radar interferometry technologies have become so sensitive that researchers can observe the vertical movement of ice with a precision of between 5 and 10 centimeters. “This change in elevation is from the flexing of huge slabs of ice, a process that enables warm water to reach the undersides of glaciers to cause aggressive melting,” Rignot said.

Collaborating with Chen and Rignot on this project were Bernd Scheuchl, Ratnakar Gadi, Enrico Ciraci and Jae Hun Kim of UC Irvine’s Department of Earth System Science; Mathieu Morlighem of Dartmouth College in New Hampshire; Pietro Melillo of the University of Houston in Texas; and Luigi Dini of the Italian Space Agency in Matera, Italy.

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