New study is 'a leap forward' in our understanding of ice sheet behavior

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The Antarctic ice sheet. Credit: Stephen Hudson / Wikipedia

In recent years, climate scientists have grown increasingly concerned that massive rivers of ice flowing into the ocean from Greenland and Antarctica could accelerate as the planet warms, leading to a catastrophic collapse of Earth's ice sheets.

This grim scenario would cause the world's oceans to rise rapidly, putting many island nations and coastal communities around the world under water.

But a new paper in *Nature* by C.R. Stokes and colleagues presents an alternative narrative of the manner in which an ice sheet can disappear, says Jason Briner, a University at Buffalo geologist who was not involved in the research.

The study will be published in *Nature* today, along with a *Nature News and Views* commentary by Briner discussing the implications of the research.

The Stokes paper examines the Laurentide Ice Sheet, which covered much of North America until about 10,000 years ago. The study presents a historical reconstruction of how ice streams behaved as the ice sheet disintegrated, and finds that ice loss through these frozen rivers did not increase rapidly as the ice sheet met its demise.

"Their evidence shows that ice streams turned on and off, and shifted from place to place, during the disappearance of the Laurentide Ice Sheet—the Antarctic-sized ice sheet that occupied Canada and the northern United States at that time," Briner writes in his *Nature News and Views* commentary. "Perhaps most notably, Stokes and colleagues find that ice-stream activity decreased as the planet warmed: the number of ice streams fell, the amount of ice expunged by them decreased and ice streams occupied a progressively smaller percentage of the ice-sheet edge."

The findings represent "a leap forward in our view of ice-stream activity on timescales longer than a few decades," writes Briner, PhD, an associate professor of geology in the UB College of Arts and Sciences.

He cautions, however, that this doesn't mean today's ice sheets will behave exactly as the Laurentide did. For one thing, the Laurentide Ice Sheet was quite different from the Greenland and Antarctic ice sheets, with one important difference that many of the Laurentide's ice streams terminated on land, while Greenland's and Antartica's flow into the ocean.

Despite these limitations, the Stokes study is an important piece of research because it provides a window into ice streams' complex behavior over long periods of time. As the Greenland and Antarctic ice sheets continue shrinking, they could become more similar to the Laurentide, with their rivers of ice eventually receding onto land, Briner says.

He adds that continued research on ice streams is extremely valuable because there is still a lot that scientists don't know about how these frozen rivers could shed ice and drive sea level rise as the planet warms.

"Greenland has three major ice streams—Jakobshavn, Kangerlussuaq and Helheim—and in the early 2000s, they all madly accelerated at the same time," Briner says. "So we had this doomsday scenario for a while, because if they continued to accelerate, their discharges into the ocean would be huge.

"Then, several years later, they slowed down again," Briner says. "There is still a lot we don't know about how these ice streams behave, and understanding their behavior is crucial for accurate modeling of future ice sheet decline."

More information: Ice stream activity scaled to ice sheet volume during Laurentide Ice Sheet deglaciation, *Nature*, [DOI: 10.1038/nature16947](https://doi.org/10.1038/nature16947)

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