North American ice sheets drove dramatic sea-level rise at the end of the last ice age

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Midnight view of the Greenland Ice Sheet near Ilulissat in July 1991. The background shows the vast ice sheet, while the foreground fjord is choked with icebergs released by one of the world's fastest-moving outlet glaciers. During the last ice age, this ice sheet was directly connected to the ice masses that covered most of Canada. (Photo by Torbjörn Törnqvist)

Melting ice sheets in North America played a far greater role in driving global sea-level rise at the end of the last ice age than scientists had thought, according to a Tulane University-led study published in *Nature Geoscience*.

The findings overturn decades of conventional wisdom about how Earth emerged from its last great freeze and could reshape how scientists view the risks of climate change in today's warming world.

Between 8,000 and 9,000 years ago, retreating North American ice sheets alone caused more than 30 feet (about 10 meters) of global sea-level rise. For years, scientists assumed Antarctica was a more important contributor during this period, but the new study shows the opposite: Antarctica's role was comparatively small, while North America's ice masses were the dominant driver.

"This requires a major revision of the ice melt history during this critical time interval," said Torbjörn Törnqvist, Vokes Geology Professor at Tulane and co-author of the study. "The amount of freshwater that entered the North Atlantic Ocean was much larger than previously believed, which has several implications."

The North Atlantic is one of the most sensitive parts of the global climate system, powering ocean currents such as the Gulf Stream that keep the weather in Northwest Europe much milder than it would be otherwise. Decades of research have shown that those currents can weaken due to the influx of freshwater, for example from Greenland's melting ice. This would not only lead to dramatic cooling in Europe but could also change rainfall patterns in the Amazon.

The Tulane findings suggest the system was surprisingly resilient in the past, which differs from recent studies that have concluded that a weakening or even a collapse of the Gulf Stream is imminent

"Clearly, we don't fully understand yet what drives this key component of the climate system," Törnqvist said.

Reconstructing past sea levels from more than 8,000 years ago is notoriously difficult because it often requires offshore drilling. A breakthrough came when former Tulane postdoc Lael Vetter discovered deeply buried ancient marsh sediments preserved just across the Mississippi River from New Orleans. Carbon-14 dating of those samples pushed the sea-level reconstruction back to more than 10,000 years.

Building on that work, former PhD student Udita Mukherjee combined the Mississippi Delta record with data from Europe and Southeast Asia. The global comparison revealed striking differences in sea-level rise rates — differences that only a much

larger North American ice melt could explain.

“This research provides a stark reminder of the complexities of our climate system and melting ice sheets,” said Mukherjee, now a postdoctoral fellow at the University of Hong Kong. “Broadening our focus beyond North America and Europe to include valuable high-quality data from Southeast Asia was critical for this study. By embracing a truly global perspective in climate studies, we can enhance our understanding and work together towards a sustainable future.”

The research was funded by the U.S. National Science Foundation and co-authored by colleagues from the University of Ottawa and Memorial University in Canada, Maynooth University in Ireland and the University of South Florida.

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