# UCI, NASA JPL researchers detail causes of glacier retreat in West Antarctica

Ice-ocean interactions are accelerating melting into Amundsen Sea Embayment.
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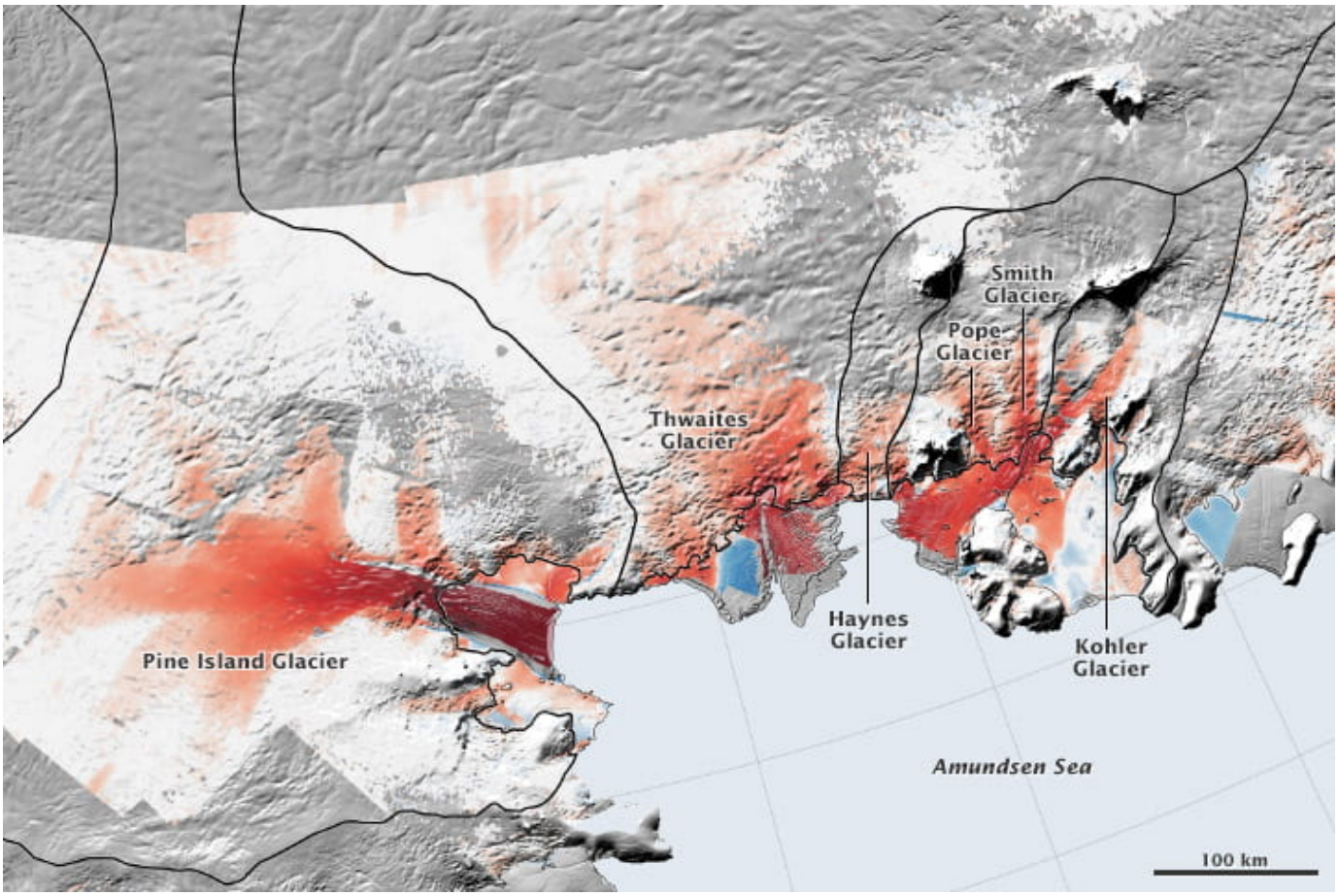


For a recent paper in Nature Geoscience, UCI, NASA JPL and other researchers used satellite data to study the Pope, Smith and Kohler glaciers that drain into the Amundsen Sea Embayment in West Antarctica. They gained valuable information about ice-ocean interactions that have led to the rapid retreat of these and other Antarctic glaciers, helping them to better model the future impact on global sea level rise.

Picture Credit:
NASA

**Irvine, Calif., March 10, 2022** – An analysis of Antarctica's Pope, Smith and Kohler glaciers by researchers at the University of California, Irvine, NASA's Jet Propulsion Laboratory, the University of Houston and other institutions has revealed an aggressive pattern of retreat connected to high melt rates of floating ice in the Amundsen Sea Embayment sector of West Antarctica.

In a paper published recently in *Nature Geoscience*, the team reports that the grounding line – where ice moves off the land and begins to float – of Pope Glacier retreated 3.5 kilometers in 3.6 months for an average of nearly 12 kilometers per year in 2017. Between 2016 and 2018, the western portion of Smith Glacier retreated at 2 kilometers per year and Kohler Glacier at 1.3 kilometers per year.

Observations from 2018 to 2020 showed a slowing of these rates, but the movement is still faster than anticipated by the glaciology community's yearly numerical models, according to the researchers.

"Alpine glaciers retreat by about 1 kilometer per century, so it's alarming to see these Antarctic glaciers receding at as much as 12 times that rate per year," said co-author Eric Rignot, UCI Donald Bren Professor and Chancellor's Professor of Earth system science and NASA JPL senior research scientist. "This pace is at the upper limit of what our models can replicate."

The Pine Island, Thwaites, Haynes, Pope, Smith and Kohler glaciers flow into West Antarctica's Amundsen Sea Embayment, which covers an area roughly the size of Texas. The volume of non-floating ice in these glaciers is equivalent to a 1.2-meter (nearly 4-foot) increase in global sea level.

Rignot and his colleagues surveyed the glaciers multiple times per year via synthetic aperture radar interferometry observations from Italy's COSMO-SkyMed satellite system. Combining these data with digital elevation models of the ice surface generated through readings from the German Aerospace Center's TanDEM-X satellite, the glaciologists were able to gain valuable information about the movement of glacier grounding lines and ice sheet thickness since 2014.

Rignot said the main culprit in the rapid glacier retreat is the interaction of floating ice and seawater, particularly in newly formed cavities at the ice-ocean boundary.

“Pressurized seawater intrudes into sub-glacial gaps and melts grounded ice,” said lead author Pietro Milillo, an associate project scientist in UCI’s Department of Earth System Science during this research project who’s now an assistant professor of civil and environmental engineering at the University of Houston. “This process has an added effect of reducing basal resistance, which speeds up glacier retreat.”

Equivalent to about 6 centimeters of global sea level rise, the Pope, Smith and Kohler glaciers account for a relatively small contribution in the Amundsen Sea Embayment sector. But the physical dynamics of the retreat of these three smaller glaciers that were the focus of the UCI/NASA JPL study are also in effect for the Thwaites and Pine Island glaciers, according to Rignot.

“The destabilization of the Thwaites and Pine Island glaciers, which are also subject to rapid retreat from the intrusion of ocean water beneath the ice, can raise global sea level by more than a meter and cause the destabilization of a huge swath of West Antarctica,” he said. “When that happens, which could be in as soon as a few years, we will have a major problem on our hands.”

Joining Rignot and Milillo on this project – which was funded by NASA’s Cryospheric Sciences Program and the Natural Environment Research Council/National Science Foundation’s International Thwaites Glacier Collaboration – were Bernd Scheuchl, associate project scientist, and Jeremie Mouginot, associate researcher, of UCI’s Department of Earth System Science; Paola Rizzoli, Jose Luis Bueso-Bello and Pau Prats-Iraola of the German Aerospace Center’s Microwaves and Radar Institute; and Luigi Dini of the Italian Space Agency in Matera.

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