Scientists link climate change to melting in West Antarctica

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Edge of the Getz Ice Shelf in West Antarctica, as seen from a helicopter, January 2018. Credit: Pierre Dutrieux

A new study has for the first time presented solid evidence that human-caused global warming is linked to melting of the West Antarctic Ice Sheet. Scientists already knew that periodically changing winds in the region have caused an increase in warm ocean conditions around key glaciers in West Antarctica, and that this is causing them to lose ice. But they did not know whether changes in the winds could be linked to global warming. The new study shows that changes in the winds have indeed been influenced in part by warming climate, along with shorter-term natural variations in climate. The findings are published today in the journal *Nature Geoscience*.

Satellite monitoring has shown that large areas of the West Antarctic Ice Sheet are losing ice, and that the loss has increased substantially in the last few decades. If the trend continues, the melting could cause tens of centimeters of sea-level rise by the year 2100. Scientists have known for some time that varying winds in the region cause relatively warm or cool water to be driven toward key glaciers at different times. But it has not been clear whether these swings are caused by natural climate variations, or are linked to human-induced climate change.

Atmospheric warming has been linked by researchers to the loss of ice in the Antarctic Peninsula, the northernmost part of the continent. But air temperatures have remained quite low in the rest of Antarctica, including West Antarctica, causing scientists to look to the ocean as the cause for ice loss there.

A team of scientists from the United Kingdom and the United States combined observations and climate model simulations to show how the winds over the ocean near West Antarctica have changed since the 1920s in response to rising greenhouse gas concentrations. Previous observations had shown that ocean temperatures in this region changed between cold and warm conditions as the wind varied from decade to decade. The new results show that human-caused climate change has

caused a long-term change in the winds, so that conditions favorable for warm ocean conditions have gradually become more prevalent.

"We knew this region was affected by natural climate cycles lasting about a decade, but these didn't necessarily explain the ice loss," said study coauthor Pierre Dutrieux of Columbia University's Lamont-Doherty Earth Observatory. "Now we have evidence that a century-long change underlies these cycles, and that it is caused by human activities."

Lead author Paul Holland, of the British Antarctic Survey, said, "The impact of human-induced climate change on the Antarctic Ice Sheet is not simple. This is the first evidence for a direct link between human activities and the loss of ice from West Antarctica. The results imply that a combination of human activity and natural climate changes have caused the sea-level rise resulting from ice loss in this region."

The team also looked at model simulations of future winds. Holland said that if high greenhouse-gas emissions continue in the future, the simulated winds will probably keep changing, and there could be a further increase in ice melting. However, if emissions of greenhouse gases are curtailed, there would probably be little change in the winds from present-day conditions. "This shows that curbing greenhouse gas emissions now could reduce the future sea-level contribution from this region," he said.

Coauthor Eric Steig of the University of Washington said the results "solve a long-standing puzzle. We have known for some time that varying winds near the West Antarctic Ice Sheet have contributed to the ice loss, but it has not been clear why the ice sheet is changing now."

More information: Paul R. Holland et al. West Antarctic ice loss influenced by internal climate variability and anthropogenic forcing, *Nature Geoscience* (2019). DOI: 10.1038/s41561-019-0420-9