Clouds dominate uncertainties in predictions of 21st century Greenland melt

Plain language summary

In recent years, the Greenland Ice Sheet has become the largest single source of meltwater contributing to sea-level rise. However, most predictions about the future of the Greenland ice sheet, and hence future sea level rise, focus on the impact of different greenhouse gas emission scenarios.

In this study, the authors investigate the extent to which the representation of clouds in climate models introduces uncertainties in future projections of Greenland ice melt. It is found that these uncertainties are at least as large as those resulting from assumptions about future greenhouse gas emissions. The authors show that different choices about how clouds are represented alone have the potential to double projections of Greenland ice melt by 2100, equivalent to 40,000 Gt of ice mass or 11 cm of global sea level rise.

The variability caused by clouds mainly results from their ability to act like a blanket and control temperature at the surface of the ice sheet. The model runs that give the highest projected melt include the thicker clouds (thicker blankets) leading to greater warming at the ice surface, while the model runs that give the lowest projected melt have thinner clouds (thinner blankets) with less warming.

The findings suggest that improving how clouds are represented in climate models is required to provide more robust sea level rise predictions, which in turn requires more long-term observations of cloud properties in the Arctic.

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