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The Divergent Futures of Greenland Surface Mass Balance Estimates from Different Regional Climate Models

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Arctic amplification is causing global warming to have a more intense impact on arctic regions, with consequences on the surface mass balance and glacier coverage of Greenland. The glaciers of Greenland are also shrinking, contributing to sea level rise as well. Projecting the future evolution of these changes is crucial for understanding the likely impacts of climate change on sea level rise.

In this study, we compared three state-of-the-art Regional Climate Models (RCMs) (MAR, RACMO, and HIRHAM) using a common grid and forcing data from Earth System Models to assess their ability to project future changes in Greenland's surface mass balance up to 2100. We also considered the impact of different Earth System Models and Shared Socioeconomic Pathways.

The results of this comparison showed significant differences in the projections produced by these different models, with a factor-2 difference in mass loss between MAR and RACMO on cumulative Surface Mass Balance anomalies. These differences are important as RCMs are often used as inputs for ice sheet models, which are used to make predictions about sea level rise. Furthermore, we aim to investigate the causes of these differences, as understanding them will be key to improving the accuracy of sea level rise projections.

The uncertainty of the RCMs projections are translated into uncertainties in Sea-Level-Rise projections. The results presented here open the door for deeper investigations in the climate modeling community and the physical reasons linked to these divergences. Our study highlighted the importance of continued research and development of RCMs to better understand the physics implemented in these models and ultimately improve the accuracy of future sea level rise projections.