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Sources of Uncertainty in Greenland Surface Mass Balance in the 21st century.

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The surface mass balance (SMB) of the Greenland Ice Sheet is subject to considerable uncertainties that complicate predictions of sea-level rise caused by climate change.
We examine the SMB of the Greenland Ice Sheet and its uncertainty in the 21st century using a wide ensemble of simulations with the surface energy and mass balance model "BE*rge*n Snow SImulator" (BESSI). We conduct simulations for four greenhouse gas emission scenarios using the output of 26 climate models from the sixth phase of the Coupled Model Intercomparison Project (CMIP6) to force BESSI. In addition, the uncertainty of the SMB simulation is estimated by using 16 different parameter sets in our SMB model. The median SMB across climate models, integrated over the ice sheet, decreases for every emission scenario and every parameter set. As expected, the decrease in SMB is stronger for higher greenhouse gas emissions. The uncertainty range in SMB is considerably greater in our ensemble than in other studies that used fewer climate models as forcing. An analysis of the different sources of uncertainty shows that the differences between climate models are the main reason for SMB uncertainty, exceeding even the uncertainty due to the choice of climate scenario. In comparison, the uncertainty caused by the snow model parameters is negligible. The differences between the climate models are most pronounced in the north of Greenland and in the area around the equilibrium line, whereas the ensemble of simulations agrees that the SMB decrease is greatest in the west of Greenland.