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Intercomparison and validation of Greenland ice sheet surface mass balance calculated with three regional climate models

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Calculation of the likely contribution of melting ice sheets to sea level rise requires accurate simulation of ice sheet surface mass balance (SMB). This in turn requires accurate calculation of snowfall, snow melt, and refreezing of meltwater. However, the amount and location of precipitation are strongly dependent on orography; additionally, the location of precipitation can influence whether it falls as rain or snow. Snow melt and refreezing are also temperature-dependent, and thus vary with elevation. A reliable calculation of snowfall, snow melt and refreezing therefore requires a detailed representation of the orography, which varies on a fine scale. In the case of Greenland, the orography near the coast is very steep, and cannot be represented sufficiently at the resolutions normally used in general circulation models (GCMs). A high-resolution regional climate model (RCM) is therefore required.

In the ice2sea project (www.ice2sea.eu), the Greenland SMB is calculated with three different RCMs (HadRM3, HIRHAM5 and MAR), driven by several different sets of boundary conditions. These SMB calculations will be used as input to dynamical ice sheet models, the output from which will ultimately be used to obtain projections of sea level rise. Here, we present results from the intercomparison of components of SMB from these RCMs, and their validation against relevant observations.