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High resolution modelling of surface mass balance in Western Greenland

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We have downscaled the regional climate model HIRHAM to a 500-m gridcell increment using SnowModel to simulate the temporal evolution of the hydrological cycle evolution in Western Greenland for the period 1950-2080. HIRHAM was forced with boundary conditions from the ECHAM5 atmosphere-ocean general circulation model. Projected changes in surface mass budget (SMB) and runoff from the Greenland Ice Sheet have important implications for potential hydropower production as well as the projection of ecosystem changes in the sensitive fjord systems of Western Greenland. We find an increase of mean annual surface air temperatures by almost 4 K and and an increase in precipitation by 95 mm water equivalent for the period 1950 to 2080. For the Kangerlussuaq region in particular, we find a decrease of the SMB, caused by an increase in both precipitation and mass loss by evaporation, sublimation and runoff. By 2080, the spring runoff season is projected to begin approximately three weeks earlier than under present-day conditions. We further present an estimate of the increase of runoff due to SMB changes for the Kangerlussuaq region. We then compare these results to new very high resolution simulations over Western Greenland, where we obtain SMB directly from the improved HIRHAM surface scheme.