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Validation of the snow climate in a regional climate model at 3 km grid spacing over Scandinavia

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Observations of the northern hemisphere snow cover show that it has decreased over time. Both the length of the snow season and the maximum snow depth has generally decreased. Exceptions to this are found in some mountain regions including the Scandinavian mountains where significant trends are lacking. Projected future changes in the climate in northern Europe are among the largest in the world. The anticipated strong future warming is to a large extent connected to the positive feedback effect involving reduction in snow cover when the climate gets warmer. Uncertainties relating to how large this reduction will be relates partly to the inability of coarser scale climate models to properly represent properties of the snow climate in regions of complex topography like Scandinavia. In this study we evaluate the performance of a high-resolution regional climate model (RCM) with respect to simulated snow conditions over Scandinavia. The Harmonie-Climate model (HCLIM38-Arome) has been run at 3 km grid spacing with boundary conditions from the global reanalysis product ERA-Interim covering years from 1997 to 2017. The high resolution of the model allows for more detailed studies of the altitude-dependency of the simulated snow in mountain regions compared to global climate models or current state-of-the-art RCMs. It also allows for investigations of high-impact events including lake effect snow fall that frequently appears in the Baltic Sea region during winter. Several aspects of the snow climate are investigated and compared to observations: snow fall amount and fraction of precipitation that falls as snow, the length of the season with snow on the ground and the maximum snow depth. The long integration covering 20 years allows for evaluating the performance in reproducing interannual variability and long-term trends.