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Future response of precipitation extremes over the Nordic region in a convection-permitting regional climate model

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There is an increased need for more detailed climate information from impact researchers, stakeholders and policy makers for regional-to-local climate change assessments. In order to design relevant and informative planning strategies on these scales it is important to have reliable climate data and information on high spatial O(1km) and temporal (daily to sub-daily) scales. Such high-resolution data is also beneficial for climate impact modellers as input to their models, e.g. hydrological or urban models that operate on regional to local scales. It has been established that regional climate models (RCMs) provide added value compared to coarser global climate models (GCMs) or re-analysis (e.g. ERA-Interim). However, RCMs with standard spatial resolution O(10 − 50km) still suffer from inadequacies in representing important regional-to-local climate phenomena and characteristics, both from the implied ”smoothening” effect within each grid cell which limits the representation of fine scale surface forcings, and the need to parameterize small-scale processes like atmospheric convection. The latter particularly invokes uncertainties in future climate responses of short-duration precipitation extremes such as flash-floods. Here, we compare 20-year simulations with a very high resolution (3 km grid spacing) convection permitting regional climate model (CPRCM) with a standard high-resolution (12 km grid spacing) convection parameterized RCM and their abilities to simulate the climate characteristics of the Nordic region in Europe, with particular focus on precipitation extremes. The study covers both recent past (with boundary data from ERA-Interim and the EC-Earth GCM) and the end of the 21st century (boundary data from EC-Earth using the RCP8.5 radiative forcing scenario). The high model grid resolution combined with the extensive simulated time period which enables assessment on climatological time scales makes this study one of very few for this region.