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Regional climate simulations at kilometer-scale with RegCM4: Evaluation of precipitation and future projections

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The recent increase in climate modeling activities at convection permitting scales (grid spacing under 4 km) has strongly been motivated by the increased computer capacities in the last years with the aim to reduce the model errors associated with parameterized convection and a more detailed representation of present and future regional climate. Some Regional climate projects addressing on convection permitting modeling simulations and projections have been recently implemented to make more robust conclusions on the added value of convection permitting simulation to future climate projections. Here, we present convection resolving climate simulations performed in the framework the European Climate Prediction System (EUCP) project, using the non-hydrostatic version of the RegCM model. The RegCM simulations have a grid spacing of 3 km, over three different regions (Pan-Alpine, Central Europe, and South-East Europe). These simulations were driven by initial and boundary conditions built from intermediate 12 km simulations driven by the global climate model (GCM) HadGEM2-ES. We considered three time slices each one of them covering a 10-year period, the historical (1996-2005), the near future (2041-2050) and the far future (2090-2099) under the RCP8.5 scenario. The high resolutions (3 km) simulations, over the historical period, are evaluated through comparison with available observations data sets (including in-situ and satellite-based observation of precipitation) and coarse resolution (12 km) simulation is used as benchmark. The kilometer-scale RegCM4.7 scenario (RCP8.5) simulations, driven by HadGEM2-ES, near future (2041-2050) and the far future (2090-2099), are also analyzed and presented, focusing on the future change in terms of mean precipitation, precipitation intensity and frequency and heavy precipitation on daily and hourly timescales in different seasons.