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Analysis of ERA40-driven RCM simulations for Europe

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The Climate Local Model (CLM) is a non-hydrostatic Regional Climate Model (RCM) based on the German Weather Service Local-Model (LM). We present a validation of long-term ERA40-driven CLM simulations performed with different model versions. In particular we use simulations with differences in boundary nudging and horizontal resolution performed for the EU-project ENSEMBLES with model version 2.4.6, and one with the latest version 4.0. Moreover, we include for comparison a long-term simulation of the hydrostatic CHRM RCM previously used at ETH Zurich. CLM and CHRM have both already been used for the EU-project PRUDENCE. We provide a thorough validation of temperature, precipitation, net radiation and circulation.
While simulations with CLM version 2.4.6 are generally too warm and dry in summer but still within the typical error of PRUDENCE simulations, version 4.0 has an anomalous cold and wet bias. This is partly due to a strong underestimation in the net radiation associated with cloud cover overestimation. Sensitivity studies with a different precipitation scheme, a different cloud diagnostic or different numerics do not correct the strong bias. Two similar CLM 2.4.6 simulations with different spatial resolutions (0.44° and 0.22°) reveal no significant benefit of the higher resolution except for better resolved fine-scale structures. While the large-scale circulation is represented more realistically with spectral nudging, temperature and precipitation are not. Overall, CLM performs comparatively to other state-of-the-art RCMs over Europe.