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Added Value of Convection Resolving Climate Simulations

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Convection resolving climate simulations (CRCSs) have great potential to improve the simulations of current climate and to reduce the uncertainties of climate projections by omitting error-prone convection parameterization schemes and by better resolving the orography and surface fields. These advantages of CRCSs are especially important for climate impact studies which are focusing on hydrological extremes, the simulation of eco systems, agriculture, and hydrological modeling in general.
In this study the added value of an ensemble of CRCSs compared to coarser gridded simulations is investigated and their error ranges are analyzed. The ensemble consists of four non hydrostatic regional climate models (RCMs). With each RCM one simulation with $\sim$10 km horizontal grid spacing and one with $\sim$3 km (CRCS) is performed. The simulated temperature, precipitation, relative humidity, and global radiation fields are evaluated within two seasons (JJA 2007 and DJF 2007-08) over the entire eastern Alps and in one hilly and one mountainous sub-region.
The most important added values in CRCSs are found in the representation of precipitation:
• higher fractions skill scores indicating a better representation of the spatial frequency of precipitation,
• improved timing of the afternoon peak in the summertime diurnal cycle of convective precipitation,
• more accurate simulation of the absolute extreme values of precipitation,
• reduction of the amount of missed precipitation events
Furthermore, the spatial patterns of JJA 2 m temperature fields are improved in all CRCSs. Some systematic changes get visible in the CRCSs (e.g., a general increase in global radiation and precipitation amount) which have to be considered in the further development of CRCSs. The general error characteristics of the CRCSs are more similar to those of the correspondent 10 km simulations than to each other which points out the importance of accurate lateral boundary conditions for CRCSs.