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Quantification of high-resolution dynamical downscaling error components in the Alpine region

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Climate change impact studies, particularly in the field of hydrology and in mountainous areas, require spatially high resolved climate scenarios as input. Currently available input data are often based on dynamically downscaled global climate scenarios using regional climate models (RCMs). The spatial resolution of established regional climate scenarios corresponds to model grid spacings from 50 km to 25 km, while the emerging generation of new regional climate scenarios is often given on 10 km grids. Such high resolution is particularly useful in mountainous and climatologically complex areas like the European Alpine region where it enables to resolve climate features of small sub-regions (50 x 50 km scale) which are not adequately represented in the coarser scale regional climate scenarios. However, the sub-regional downscaling errors of these high-resolution simulations is not well characterised yet.

In the presented study we quantify the major downscaling error components in the European Alpine region (errors due to spatial setup, model structure, physical parameterisation, and provision of lateral boundary conditions) of temperature and precipitation on a sub-regional basis. The study is based on a set of about 25 one-year hindcast-simulations performed with two different RCMs (CLM and MM5) driven by the ERA-40 reanalysis. The results aim to provide downscaling error estimates on scales relevant for climate impact research on the one hand and to advise regional climate modelers by identifying the most important high-resolution downscaling error sources on the other hand.