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High-resolution dynamical downscaling of the future Alpine climate

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The Alpine region and Switzerland is a challenging area for simulating and analysing Global Climate Model (GCM) results. This is mostly due to the combination of a very complex topography and the still rather coarse horizontal resolution of current GCMs, in which not all of the many-scale processes that drive the local weather and climate can be resolved. In our study, the Weather Research and Forecasting (WRF) model is used to dynamically downscale a GCM simulation to a resolution as high as 2 km x 2 km. WRF is driven by initial and boundary conditions produced with the Community Earth System Model (CESM) for the recent past (control run) and until 2100 using the RCP8.5 climate scenario (future run). The control run downscaled with WRF covers the period 1976-2005, while the future run investigates a 20-year-slice simulated for the 2080-2099.
We compare the control WRF-CESM simulations to an observational product provided by MeteoSwiss and an additional WRF simulation driven by the ERA-Interim reanalysis, to estimate the bias that is introduced by the extra modelling step of our framework. Several bias-correction methods are evaluated, including a quantile mapping technique, to ameliorate the bias in the control WRF-CESM simulation. In the next step of our study these corrections are applied to our future WRF-CESM run. The resulting downscaled and bias-corrected data is analysed for the properties of precipitation and wind speed in the future climate. Our special interest focuses on the absolute quantities simulated for these meteorological variables as these are used to identify extreme events, such as wind storms and situations that can lead to floods.