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Physical Consistency of Multi-Parameter Error-Correction and Downscaling of Regional Climate Models

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Regional climate models (RCMs) proofed to have skill in simulating past and present climate, but they still feature systematic errors and often lack the quality to be used directly as input for climate change impact studies. Statistical post-processing methods, like Quantile Mapping (QM) are one way to tailor RCM output for impact research. QM adapts modeled time series by adjusting the modeled to the observed empirical cumulative frequency distributions. Thus, additionally to the error correction, QM downscales the RCM simulation to the point-scale.
In this study we show the applicability of QM to relative humidity, global radiation, wind speed and surface air pressure on the daily scale, as QM's applicability for daily temperature and precipitation has already been shown in previous studies. RCM data were taken from the ENSEMBLES data-set. The error-correction is performed for study regions within Austria and Switzerland, defined within the Austrian climate research fund project "CC-Snow" and the EU FP 7 project "Assessing Climate Impacts on the Quantity and Quality of Water" (ACQWA) based on observational station records.
A controversial topic is the physical consistency of the error-corrected meteorological parameters, as each parameter is treated separately by QM. We investigate the correlation of the above mentioned parameters before and after the correction process and compare it with observed corellations. The hypothesis is that we conserve the state of physical consistency of RCMs on average. The correlation is evaluated for the control run (1971 - 2010) and scenario run (2011 – 2050), keeping in mind the applicability on impact studies on future climate.