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Empirical-statistical downscaling and model error correction of daily temperature and precipitation from regional climate simulations and the effects on climate change signals

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Regional climate models (RCMs) have shown their capability to reproduce mesoscale and even finer climate variability satisfactorily. However, considerable differences between model results and observational data remain due to scale discrepancies and model errors. This limits the direct utilisation of RCM results in climate change impact studies. Besides continuous climate model improvement, empirical-statistical post-processing approaches (model output statistics) offer an immediate pathway to mitigate these model problems and to provide better input data for climate change impact assessments.
In this study quantile mapping (QM) is used to post-process results from a transient regional climate simulation (period: 1951 to 2050; general circulation model: ECHAM5; RCM: REMO) in south-eastern Europe (Hungary, Romania, Bulgaria) based on the E-OBS observational dataset which was created within the ENSEMBLES project (http://ensembles-eu.org). Firstly, the performance of QM for daily temperature and precipitation downscaling is evaluated considering the entire distribution in a cross-validation framework between 1961 and 2000 and the error characteristics are discussed. Secondly, the impact of QM on the climate change signal (2021-2050 minus 1961-1990) is analysed for monthly means as well as monthly extreme parameters, which are of interest for the climate impact community.
It is demonstrated that QM reduces RCM errors by one order of magnitude and that QM has considerable impact on climate change analyses, particularly regarding parameters for extremes.

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