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Linear Regression Quantile Mapping (RQM) - A new approach to bias correction with consistent quantile trends

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Quantile mapping (QM) is an established concept that allows to correct systematic biases in multiple quantiles of the distribution of a climatic observable. It shows remarkable results in correcting biases in historical simulations through observational data and outperforms simpler correction methods which relate only to the mean or variance.

Since it has been shown that bias correction of future predictions or scenario runs with basic QM can result in misleading trends in the projection, adjusted, trend preserving, versions of QM were introduced in the form of detrended quantile mapping (DQM) and quantile delta mapping (QDM) (Cannon, 2015, 2016). Still, all previous versions and applications of QM based bias correction rely on the assumption of time-independent quantiles over the investigated period, which can be misleading in the context of a changing climate.

Here, we propose a novel combination of linear quantile regression (QR) with the classical QM method to introduce a consistent, time-dependent and trend preserving approach of bias correction for historical and future projections. Since QR is a regression method, it is possible to estimate quantiles in the same resolution as the given data and include trends or other dependencies.

We demonstrate the performance of the new method of linear regression quantile mapping (RQM) in correcting biases of temperature and precipitation products from historical runs (1959 - 2005) of the COSMO model in climate mode (CCLM) from the Euro-CORDEX ensemble relative to gridded E-OBS data of the same spatial and temporal resolution. A thorough comparison with established bias correction methods highlights the strengths and potential weaknesses of the new RQM approach.

References:

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