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Statistical methodologies for biases correction of precipitation for a convection-permitting climate model and their spatio-temporal patterns in North-Eastern Italy

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We investigate the spatial and temporal patterns of annual and seasonal biases in extreme precipitation simulated by a convection permitting climate model forced with reanalysis data (Era Interim driven COSMO-CLM model) across a 10-years period (2000-2009). Specifically, we aim at developing an adjustment procedure able to preserve extremes at different temporal and spatial scales, and which can be applied to future scenarios.

The biases are here defined as the ratio between simulated and observed rainfall at 130 rain gauges. The quantile-based analysis reveals a general overestimation for gauges located in foothill or mountain areas (elevation > 500 m asl), and a general underestimation over lowland sites. This behavior is recurrent for various investigated quantities, such as annual or seasonal biases, and their counterparts estimated upon Extreme precipitation Values (EV) or wet periods. We also observe a temporal heterogeneity of the biases estimated in different years or seasons. Dry years (e.g. 2003) are characterized by remarkably high biases, while those estimated upon springs and autumns data within the investigation period are generally overestimated and underestimated, respectively.

We explore two preliminary adjustment approaches: Quantile Mapping (QM) and Linear Scaling (LS) adjustments. QM corrects simulated rainfall series but can affect the rainfall temporal autocorrelation. Conversely, LS preserves the autocorrelation but fails in the correction of seasonal and annual biases. EV-related biases are not properly corrected, and further statistical methods need to be formulated to correct EV simulated rainfall while both respecting their ACF and taking into account orographic effects.