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From regional to local climate scenario: the effects of a statistical bias correction on different spatial scale climate change signal

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This study investigates the effects of an empirical-statistical quantile mapping bias correction method on two different spatial scale climate scenarios (regional and local).
Simulated temperature and precipitation seasonal Climate Change Signal CCS (difference of climatological means between 2061-2090 and 1971-2000 periods) was assessed before and after correction, focusing on discrepancies between original and bias-corrected results.
The regional experiment investigates bias correction effects on expected 21st century CCS over Italian peninsula, identified as high climate-change sensitivity area. Bias correction technique is applied on a six-RCMs ensemble (25 km horizontal resolution) climate projections performed in the framework of the ENSEMBLES project. Grid-cell-wise correction function is derived from E-OBS dataset, providing observed daily time series (1971-2000) spatially averaged on the same RCMs grid.
Secondly, the same bias correction method was applied to adjust and refine RCMs results towards local point-wise observation. In this configuration, bias correction method combines error correction with the downscaling of simulation to local scale. Here, climate projections are referred to Marche region (central Italy) and are extracted from higher resolution (11 km) three-RCMs (EURO-CORDEX project) ensemble. A station-wise correction function is defined on 9 precipitation and 21 temperature observed time series provided by Regional Civil Protection observational network.
The regional-experiment results show moderate dampen of the strong summer positive CCS from +4°C to +3.2/+3.5°C, especially on coastal areas and Po river basin. Summer negative precipitation CCS seems to be not affected by the correction. Dichotomous positive (negative) northern-Italy (southern-Italy) winter precipitation CCS was preserved after correction.
In the local experiment, the shift from original grid cell's to station's condition generates an effect on CCS varying from one station to another, especially on higher tails of distribution. Influence (up to ± 1°C) was indeed found over low and high temperature percentiles CCS and over high percentiles precipitation CCS (up to $\pm 15\%$).