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ESM-projected global change in indices of extreme precipitation using the TR3S method of bias-correction

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The post-processing of the Earth System Models (ESMs) outputs has become a routine step that is taken in climate change impact assessments with the aim of (i) reproducing the probability distribution of the corresponding observed data and (ii) correcting the biases in the probability distributions of projected future climate. To responsibly support the decision□making processes, the climate□modeling community has been discussing about the conceptual requirements that bias□correction methods should fulfill to avoid altering the relevant information that is provided by ESMs, like the climate trends or the inter-variable physical dependence structure. Bearing in mind these discussions, a recently proposed method of bias-correction, based on TRend-preserving Synthetic Samples of Stable Distributions (TR3S), decomposes the atmospheric variables into three temporal elements that represent the climate mean state, the interannual variability, and the daily variability. This decomposition is aimed at correcting the biases at one time scale without affecting the projected climate trend or the distributional properties at other time scales. The novelty of this approach is, nevertheless, marked by the adjustment of interannual and daily variability that is made by replacing the ESM□simulated variability with synthetic samples drawn from Stable Distributions (SDs) that were previously fitted to the observed variability. The replacement prevents the transfer of the sampling variability of the calibration period while giving the corrected data the distributional properties of the observed climate. The employment of SDs was motivated by the fact that the ESM-projected changes in the scale, the symmetry, and the frequency of extremes can be measured and applied to the SDs of the observed data. In this work, we correct the biases in the global precipitation datasets generated by several ESMs using the TR3S method and present the projected changes of a few indices of extremes using online interactive maps. Furthermore, the TR3S method allowed us to document the spatial distribution of the biases in the distributional properties (i.e., scale, symmetry, and frequency of extremes) of daily and interannual variability of each ESM. We hope that the bias-corrected information can be useful to end-users in impact assessments and the analytical framework of model biases can be used by modelers to identify ways in which the ESM parameterizations could be improved.