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

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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 of future climate that is provided by Earth System Models (ESM). 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 in a way that the ESM–projected changes in the scale, the symmetry, and the frequency of extremes can be measured and applied to the probability distribution of the observed data. The TR3S method differentiates from common quantile –mapping –type methods in that the quantiles (of variability) are corrected considering the change in several distributional properties instead of only the change in that particular quantile. In this work, we corrected the biases in the global surface temperature and precipitation generated by several ESMs using the TR3S method and present the projected changes of a few indices of extremes using an online Atlas of interactive maps. Furthermore, the TR3S method allowed us to document the spatial patterns 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 this new analytical framework of model biases can be used by modelers to identify ways in which the ESM parameterizations could be improved and by end–users to support the climate change impact assessments.

Keywords: climate model, bias correction, climate Atlas, extreme weather indices