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Bias correction of multi-variate indices: Heat stress in Switzerland

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High resolution regional climate model (RCM) simulations are important tools to provide the meteorological variables required in climate impact assessments. Despite the advances towards higher spatial resolution and better resolved physical processes, RCMs often cannot be directly used in impact studies due to their partly substantial biases. In the climate change context, distributional bias correction (BC) methods are frequently used to deal with systematic model biases. BC methods can correct either some parameters of the distribution (e.g. the mean via distributional shift or scaling) or all quantiles (e.g. via the empirical quantile mapping). The empirical quantile mapping (QM) is widely used in the literature to bias correct individual variables (e.g. temperature, precipitation), in a few cases also for variables such as humidity or wind.

In the present work we analyze the suitability of QM to derive a multi-variate index (the wet bulb temperature, WBT) from the new generation of climate change scenarios for Switzerland (CH2018). WBT is a relatively simple proxy for heat stress on the human body. It is a simple, but non-linear multi-variate index that depends on temperature and humidity. Since extreme heat stress conditions occur at sub-daily scale but only daily values are usually available from RCMs, we analyze the sensitivity of the WBT to the use of different daily aggregated values in its calculation, compared to the maximum WBT obtained from observed hourly data. Further, we show that the separate correction of temperature and humidity allows reproduction of the distribution of the daily maximum WBT. Additionally, we explore climate change projections of WBT comparing the results from bias corrected and raw RCM data using a selection of EURO-CORDEX RCM simulations.