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On the use of original and bias-corrected climate simulations in regional-scale hydrological scenarios

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Small Mediterranean catchments represent particularly vulnerable systems to both dry and wet extremes.
These systems, are expected to be seriously impacted by next decades anthropogenic climate change, in terms of an alteration of extremes frequency and magnitude as connected to an acceleration of the hydrological cycle.
As long as climate change response of large basin hydrology has been tackled by several studies, the response of the hydrology of small catchments is still relative unexplored. Regional Climate Models (RCMs) are the established tool for evaluating expected impacts on hydrology. However, due the relatively low spatial resolution and systematic errors affecting RCMs, a preliminary statistical post-processing is routinely applied in impact studies. Nevertheless, this techniques can impact the climate change signal produced by original RCMs and implicitly the impact model results. Whether or not this is a beneficial effect is still debated. In this work, we take advantage of 5 high-resolution (12.5 km) Regional Climate Model 3-hourly runs from EURO-CORDEX initiative, to study the response of hydrological cycle to the expected 21st-century climate change over the Aterno-Pescara catchment (Abruzzo region, Central Italy). Climate simulations consider two radiative forcing (RCPs 4.5 and 8.5). Precipitation and temperature simulations have been post-processed through widely used statistical bias correction/downscaling technique Empirical Quantile Mapping (EQM) to reduce systematic RCM errors and increasing the spatial resolution as well. EQM correction functions are derived considering point-scale weather station observational time series, provided by the Abruzzo Region Hydro-graphic service. Original and bias-corrected climate simulations will be used to drive the CETEMPS hydrological model ChyM, operationally used over Abruzzo region to predict flood occurrences. Future hydrological trends in the Aterno-Pescara catchment and surrounding areas are assessed by means of mean discharge changes and a hydrological alarm index, able to detect catchment segments most likely stressed by weather extremes. The impact of the climate simulations bias correction will be investigated by means of a comparison between hydrological change signals driven in turn by original and bias corrected climate simulations considering RCP 4.5 and RCP 8.5 emission scenarios.