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RCM skill assessment applying precipitation, temperature and hydrological performance measures: comparing different RCM resolutions and bias correction methods

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Global Climate Models (GCMs) are the main tool to assess futures changes in climate and their impacts. Due to their coarse resolution, GCMs fail to accurately simulate observed climate variables at the catchment scale. Therefore, climate researchers have focused on increasing model resolution by nesting Regional Climate Models (RCMs) into the GCMs for regional areas, a process known as dynamical downscaling. Commonly, RCMs also have simulation biases at the catchment scale and therefore statistical techniques, known as bias correction methods, are used to reduce such biases. In this project the skill to simulate precipitation and temperature from five reanalysis-driven Euro-CORDEX RCMs is evaluated. Furthermore, RCM precipitation and temperature outputs are coupled with a hydrological model (the HEC-HMS model) to simulate river flow at the catchment scale. Precipitation, temperature and hydrological biases are assessed using a range of metrics combining mean, extremes, time series and distribution measures. In order to evaluate the dynamical downscaling effect, the RCMs are analyzed at two resolutions: 0.44° and 0.11°. Additionally, both resolutions are bias-corrected employing the parametric quantile-mapping method: a) temperature is bias-corrected using the normal distribution, and b) precipitation is bias-corrected using the gamma and double-gamma distributions. Four catchments across England and Wales covering different climate conditions and topographical characteristics are used as study sites. The results from this study provide an overview of the skill of current state-of-the-art RCMs and their suitability for hydrological impact analysis at the catchment scale. Furthermore, for precipitation the study analyses the performance of the commonly-used gamma distribution quantile-mapping bias-correction method comparing it to the double-gamma distribution method considering their implications towards the simulation of hydrological impacts.