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The impacts of bias correction on uncertain future changes in hydrological drought characteristics across the UK

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Hydrological simulations derived from future climate projections provide valuable tools to quantify future changes in hydrological extremes and inform water resource management decisions. However, quantifying future changes in hydrological extremes is challenging as they often rely on climate model simulations of the weather today and in the future. As historical and future climate predictions are often subject to considerable uncertainties and biases this can lead to incorrect and biased hydrological projections, especially when propagated through a hydrological model.

In this study, we aim to evaluate the sensitivity of future changes in drought characteristics to potential biases in the forcing data from climate model simulations. To achieve this, a HRU (Hydrological Response Unit) based hydrological model, dynamic TOPMODEL, is driven by simulated current and future rainfall and potential evapotranspiration time series from a hydro-meteorological drought event set produced using the weather@home regional climate modelling system. We assess the skill of the climate model to reproduce the frequency, severity and duration of droughts for a historical baseline period (1974 – 2004) by comparing hydrological simulations driven using 100 sequences of spatio-temporally consistent weather from the weather@home drought event set to hydrological simulations driven by observational data. We show how biases in drought characteristics vary spatially and temporally for a number of UK catchments and apply a bias correction to resolve the seasonal climate model biases. We then run 100 sequences for two future time slices (2030s and 2080s) through the hydrological model using the uncorrected and bias corrected drought event sets to investigate how the bias corrections affects our interpretation of future changes in drought characteristics across the UK. Finally, we discuss the significance of these results for climate change impact studies assessing future changes in hydrological extremes.