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Constraining hydrological impact simulations over Europe through weighting the climatic forcing

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Global hydrological models (GHMs) have become an established tool to simulate water resources on continental scales. To assess the future of water availability and various impacts related to hydrological extreme events, these models usually use sets of atmospheric variables (such as e.g., precipitation, humidity, temperature) obtained from (regional) climate model simulations as input data. The uncertainty associated with the climate projections is transferred onwards into the impact simulations and is usually accounted for through the use of large model ensembles. These ensembles thus enable assessments addressing the robustness of projected hydrological changes and impacts. Given recent efforts within the European Climate Prediction (EUCP) project to test existing and develop new techniques to constrain/weight climate model ensembles, we use here different methods to specify the large-scale meteorological input to an ensemble of regional climate models that provide the input data for a state-of-the-art GHM. The climate models are weighted/constrained based on the key large-scale climatic and meteorological drivers shaping the hydrological characteristics in different regions and large river basins across Europe. To assess the potential benefits of the different techniques, we compare simulation ensembles using unweighted input data obtained from the full ensemble of regional climate models against an ensemble based on constrained/weighted forcing data. Given the large uncertainties usually associated with hydrological impact simulations forced by the full range of available climate models, processing the ensemble output of GHMs based on uncertainty assessments of the underlying climate forcing could lead to more robust projections of water resources in general and hydrological extreme events in particular.