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Multi-model assessment of climate change impacts on river discharge in three different regional scale river basins on three continents

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Projections of climate impacts should be provided at the regional scale using validated regional-scale models in order to supply more reliable results for decision makers and managers. In the last decade climate impact assessment was performed for different regions and sectors using different scenarios and tools. However, the results are hardly comparable and do not allow to create a full picture of impacts and to evaluate their robustness. This study aims at comparing climate impacts on seasonal water discharge as well as on trends in projected discharge quantiles. Uncertainties from different sources are evaluated.

The intercomparison of impacts was done for three regions on three continents which are characterized by very different climate and land use conditions: the Rhine in Europe, the Upper Niger in Africa and the Upper Yellow River in Asia. The climate impact assessment was performed using scenarios from five General Climate Models (GCMs). The bias-corrected climate scenarios for this study were provided by the ISI-MIP project. The following GCMs were used: HadGEM2-ES, IPSL-CM5ALR, MIROC-ESM-CHEM, GFDL-ESM2M, and NorESM1-M. The hydrological impact assessment was conducted applying the hydrological impact models HBV, SWIM and VIC.

Our results suggest that the five GCMs contribute more to overall uncertainty of river discharge than the three hydrological models. Projected trends in river discharge are more variable and more often contradictory when different GCMs are compared. However, we also found significant opposite trend direction for projected river discharge using different hydrological models but the same climate input data.