Future discharge of the French tributaries of the Rhine: a semi-distributed multi-model approach using CMIP5 projections

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Several projects studied the impact of climate change on the Rhine basin during the past years, using the CMIP3 projections (see Explore2070, FLOW MS, RheinBlick2050 or VULNAR), either on the French or German sides. These studies showed the likely decrease of low flows and a high uncertainty regarding the evolution of high flows. This may have tremendous impacts on several aspects related to discharge, including pollution, flood protection, irrigation, rivers ecosystems and drinking water. While focusing on the same basin (or part of it), many differences including the climate scenarios and models, the hydrological models and the study periods used for these projects make the outcomes of these projects difficult to compare rigorously.

Therefore the MOSARH21 (stands for MOselle-SArre-RHine discharge in the 21st century) was built to update and homogenise discharge projections for the French tributaries of the Rhine basin. Two types of models were used: the physically-oriented LARSIM model, which is widely used in Germany and was used in one of the previous projects (FLOW MS), and the semi-distributed conceptual GRSD model tested on French catchments for various objectives. Through the use of these two hydrological models and multiple sets of parameters obtained by various calibrations runs, the structural and parametric uncertainties in the hydrological projections were quantified, as they tend to be neglected in climate change impact studies. The focus of the impact analysis is put on low flows, high flows and regime.

Although this study considers only French tributaries of the Rhine, it will foster further cooperation on transboundary basins across Europe, and should contribute to propose better bases for the future definition of adaptation strategies between riverine countries.