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Climate change-driven adaptation measures in a coupled hydrological-atmospheric model

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Water managers in the Rhine basin are increasingly confronted with a continuous stream of credible scientific information on both the potential magnitude of climate change and climate variability and the vulnerability of water resources to climate change impacts. Current large-scale adaptations in the Rhine basin are developed at the country level while basin wide adaptation strategies (= 'the fine tuning of measures across countries') are still poorly addressed.

One of the main reasons that few investigations have addressed adaptations across the countries in the Rhine basin is that the modeling capacity was not sufficient to adequately calculate effects from both climate change and cross boundary adaptation measures. A coupled atmospheric-hydrological model has been developed describing both the energy and water balance for the entire Rhine basin. The model enables simulating adaptations related to land use changes and provides accurate information on the timing of extreme events. The latter by enhanced simulation of soil moisture conditions and a more appropriate description of the land surface – atmosphere exchanges and possible feedbacks. The model is based on a hydrological model, the Variable Infiltration Capacity (VIC)-model, integrated in the Regional Atmospheric Modeling System (RAMS). This coupled model is calibrated and validated for the Rhine basin using historic flood and drought data. A control experiment is set up in order to derive information of the relative influence of the coupled model simulations against the simulations of the uncoupled VIC and RAMS models.

The impact of different adaptation strategies on extreme events (one flood case and one drought case) will be presented. Changes in land use are implemented in the coupled model as a potential adaptation measure. Differences in the simulated precipitation, evapotranspiration and runoff will identify the effectiveness of adaptation measures for a historical flood and drought.