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Uncertainties in discharge projections in consequence of climate change

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The fourth assessment report of the IPCC summarizes possible effects of the global climate change. For Europe an increasing variability of temperature and precipitation is expected. While the increasing temperature is projected almost uniformly for Europe, for precipitation the models indicate partly heterogeneous tendencies. In order to maintain current safety-standards in the infrastructure of our various water management systems, the possible future floods discharges are very often a central question. In the planning and operation of water infrastructure systems uncertainties considerations have an important function. In times of climate change the analyses of measured historical gauge data (normally 30 – 80 years) are not sufficient enough, because even significant trends are only valid in the analyzed time period and extrapolations are exceedingly difficult. Therefore combined climate and hydrological modeling for scenario based projections become more and more popular.
Regarding that adaptation measures in water infrastructure are in general very time-consuming and cost intensive qualified questions to the variability and uncertainty of model based results are important as well.
The CEDIM-Project “Flood hazards in a changing climate” is focusing on both: future changes in flood discharge and assess the uncertainties that are involved in such model based future predictions.
In detail the study bases on an ensemble of hydrological model (HM) simulations in 3 representative small to medium sized German river catchments (Ammer, Mulde and Ruhr). The meteorological Input bases on 2 high resolution (7 km) regional climate models (RCM) driven by 2 global climate models (GCM) for the near future (2021 – 2050) following the A1B emission scenario (SRES). Two of the catchments (Ruhr and Mulde) have sub-mountainous and one (Ammer) has alpine character.
Besides analyzing the future changes in discharge in the catchments, the describing and potential quantification of the variability of the results, based on the different driving data, regionalization methods, spatial resolutions and model types, is one main goal of the study and should stay in the focus of the poster.
The general result is a large variability in the discharge projection. The identified variabilities are in the annual regime mainly attributable to different causes in the used model chain (GCM-RCM-HM). In winter the global climate models (GCM) bring the main uncertainties in the future projection. In summer the main variability refers to the meteorological downscaling to the regional scale (RCM) in combination with the hydrological modeling (HM). But with an appropriate ensemble statistic are despite the large variabilities mean future tendencies detectable. The Ruhr catchment shows tendencies to future higher flood discharges and in the Ammer and Mulde catchments are no significant changes expected.