Impacts of climate change on flooding in the river Meuse

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Abstract
The impact of climate change on flooding in the river Meuse is assessed on a daily basis using spatially and temporally changed climate patterns and three constructed hydrological models. This is achieved by selecting a hydrological modelling framework and implementing appropriate model components (processes, spatial and temporal scales, formulations) into the selected framework (HBV). Additionally, two river basin models of differing complexities are set up to evaluate the sensitivity of the model results to model complexity and to allow for a verification of the model appropriateness procedure. Generations of a stochastic precipitation model under current and changed climate conditions have been used to assess the climate change impacts.

The average and extreme discharge behaviour at the basin outlet is well reproduced by the three models in the calibration and validation, the results become somewhat better with increasing model complexity. The model results with synthetic precipitation under current climate conditions show a small overestimation of average discharge behaviour and a considerable underestimation of extreme discharge behaviour. The underestimation of extreme discharges is caused by the small-scale character of the observed precipitation input at the sub-basin scale. The general trend with climate change is a small decrease of the average discharge and a small increase of discharge variability and extreme discharges. The variability in extreme discharges for climate change conditions increases with respect to the simulations for current climate conditions. This variability results both from the stochasticity of the precipitation process and the differences between the climate models. The total uncertainty in river flooding with climate change (over 40 %) is much larger than the change with respect to current climate conditions (less than 10 %). However, climate changes are systematic changes rather than random changes and thus the large uncertainty range will be shifted to another level.