

The impact of climate change on river flooding: model appropriateness and uncertainties

Effect of spatial and temporal resolution

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Abstract

How good should a river basin model be to assess the impact of climate change on river flooding for a specific geographical area? The determination of such an appropriate model should reveal which physical processes should be incorporated and which data and mathematical process descriptions should be used at which spatial and temporal scales. It should be based on sensitivities and a right balance between uncertainties of inputs, parameters and process descriptions resulting in an output uncertainty acceptable for the model user and feasible in view of data availability and computational possibilities.

Important characteristics of an appropriate river basin model are the spatial and temporal resolution of the model and of the rainfall input. In this lecture the effect of input and model resolution on flooding (extreme discharge) of a large river basin is assessed in order to give some indication on appropriate resolutions. A simple stochastic rainfall model and a river basin model with uniform parameters and multiple rainfall input have been developed and applied to the river Meuse basin in Northwest Europe. Results show that the effect of the model resolution on extreme river discharge is much larger than the effect of the input resolution. The highest model resolution (10-20 grid points/ spatial correlation length; 7-10 time steps/ temporal correlation length) seems to be quite accurate in determining extreme discharge for large river basins with a similar rainfall regime. These results will not significantly be affected when using other parameter values in the river basin model as shown by the sensitivity analysis.

Although the results should be interpreted with caution, they may give an indication on the appropriate input and model resolution for a similar river basin with a similar rainfall regime. This may give some support when an appropriate model has to be chosen for the determination of extreme discharge of a large river basin with climate change.