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A new theoretical framework to communicate uncertainties to flood forecasters

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Knowledge about input and model uncertainty can increase the benefit of flood prediction systems. In order to be useful, the final results must be easily understood by flood forecasters. One possible way to communicate uncertainties is through the use of expected costs for flooding events. We propose a framework which is based on a straight-forward representation of input uncertainty and produces easily interpretable results.

Within this new framework, input data (rainfall, snow and soil moisture) are described as random processes, which define the probability distribution of the corresponding variable at any time step. Transition between various data sources (e.g. forecasts for rainfall from a meteorological model and radar-based forecasts) is modelled as a change of the probability distribution. A simple and fast rainfall-runoff model or a meta model has to be developed and will be used to propagate the uncertainty in the input data through the hydrological model using a Monte Carlo approach. In addition, a statistical model will predict the uncertainty of the hydrological model for the current conditions. The combination of the propagated input data uncertainty and the model uncertainty provides the uncertainty of the predicted runoff again as random process. Thus, the probability to exceed a certain flood warning level can be determined and used in the subsequent decision process.

In order to further support the decision makers, a very simple socio-economic module will then be used to estimate expected costs based on the predicted distribution of water levels. The benefit of the estimated expected costs is twofold: On the one hand, it will be useful for decision makers in the case of an imminent flood. On the other hand, a set of measures to reduce input uncertainty can be analysed with respect to the expected benefit in comparison with the current state. The presented framework will

be applied to the Weisseritz catchment in Saxony, Germany, which was responsible for the severe flooding in Dresden in August 2002. The concept and outline of the study will be presented here.