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Flood forecasting for decision makers: coupling uncertain flood predictions with a flood loss model.

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Flood prediction systems need to consider both, input and model uncertainty. However, in the context of reservoir management, the final results must be easy to interpret because decisions must be made fast under difficult conditions. One possible way to communicate uncertainties is through the use of exceedence probabilities as well as expected costs caused by flood events. We present a system which is based on a straightforward representation of input uncertainty and produces easily interpretable results.

Within this system, input data (rainfall, snow and soil moisture) are defined as probability distribution of the corresponding variable at any time step. Uncertainty in the input data is propagated through the hydrological model using a Monte Carlo approach.

A statistical model is used to assess the predictive 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. Thus, the probability to exceed a certain flood warning level can be determined and used in the subsequent decision process.

To support the decision process, it is necessary to communicate the results of the hydrological model. Therefore, an analysis of potential losses is performed. Discharge data is used as input for the flood routing model (HecRas), by which inundation pattern and depths within the floodplain is simulated. For a given flood scenario the flood loss model FLEMO estimates the direct economic flood losses in the residential sec-

tor in dependence of water level, building type and building quality. Losses in the commercial and industrial sectors are distinguished into loss to buildings and loss to equipment and contents. Loss functions are based on empirical data. Flood scenarios cover the range from low floods without economic losses to very severe events that may cause large economic losses.

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, the influence of input uncertainty reduction on the overall uncertainty of the flood prediction can be evaluated. This allows to estimate an expected benefit in comparison to the current state.

The area of this study is the catchment of Weisseritz, a tributary of the River Elbe, in Saxony (Germany).