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Uncertainties due to soil data in Flood Risk Forecasts with the Water Balance Model LARSIM

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Reliable flood forecasts with quantitative statements about contained uncertainties are essential for far reaching decisions in disaster management. In this paper uncertainties resulting from soil data are analysed for the in the German-speaking world widely used water balance model LARSIM and quantified as far as possible.

At the beginning a structural and statistical analysis about the wittingly simple designed soil module is performed. It consists of a storage volume with four separate runoff components only defined by the storage size. Additionally, the model structure is examined with regard to effects of uncertain soil data using a soil map from the Bavarian State Institute for Forestry which already contains estimated minimum and maximum values for important soil parameters.

For further analysis, two German catchments in Upper Franconia located at the White Main with a size of 250 km^2 each, covering a huge variety of soil types are used as case examples. Skeleton is identified as an important source of uncertainty in soil data comparing the quantifiable information of available soil maps and using field and laboratory analysis. Furthermore, surface runoff and fast interflow fluxes show up to be sensitive for peaks of flood events, whereas slow interflow and base flow fluxes have smaller and more long term effects on discharges and the water balance. A reduction of the soil storage basically leads to a more intensified reaction of discharges than an enlargement.

The calculation of two extreme scenarios within the statistical analysis result in simulated gage measurements varying from -42 % till +218 % compared to the scenario with the main value of the map. A percental variation of the soil storage shows a doubling of the flood discharges, if the storage size is halved and a reduction up to 20% using a doubled one. Finally, a Monte Carlo Simulation is performed using the statistical data of the soil map combined with a normal distribution, whereby the uncertainty bands of discharges are reduced significantly.