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Sensitivity analysis for a flood and inundation mapping forecasting modelling chain

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The development of a hydrometeorological flood forecasting chain adapted to quantify predictive uncertainty is challenged by the very short time available to run its models, evaluate flood probabilities, alert the population at risk and manages emergency responses. Forecasting systems often integrate several models in a chain of input-output simulations that altogether provide the hydrological information needed for decision-making. Each model is a component of the system that needs to be understood and evaluated in terms of its contribution to enhance the accuracy of the final prediction. In this study, we investigate a flash flood forecasting system based on two existing simulation models: the hydrological model GRSD (de Lavenne et al., 2016), which provides streamflow time series at gauged and ungauged catchments, and the MHYST model (Rebolho et al., 2018), which is a flood inundation model that aims to map inundation extents at the river reach scale. Each model has its own set of parameters that might influence differently the results of the simulations, modifying this way the overall performance of the forecasting system. Here, we use the Sobol sensitivity analysis to investigate the influence of the individual model parameters but also the interactions sensitivities of the parameters within each model and when considering the modelling chain that integrates both models. We evaluate sensitivity with regard to flood peaks, flood peak timing and flood inundation extent. Our case study is the Loing river, a tributary of the Seine river in France, which was severely affected by floods in May-June 2016. Results highlight sensitivity rankings for both models and how the real-time information acquired can be useful to define calibration and data assimilation strategies based on both point and spatial data during the forecasting.

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