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Specific calibration and predictive uncertainty evaluation strategies for flood propagation models

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Hydraulic models are an essential tool in many fields, e.g. civil engineering, flood hazard and risk assessments, evaluation of flood control measures, etc. Nowadays there are many models of different complexity regarding the mathematical foundation and spatial dimensions available, and most of them are comparatively easy to operate due to sophisticated tools for model setup and control. However, the calibration of these models is still underdeveloped in contrast to other models like e.g. hydrological models or models used in ecosystem analysis. This has basically two reasons: First, the lack of relevant data against the models can be calibrated, because flood events are very rarely monitored due to the disturbances inflicted by them and the lack of appropriate measuring equipment. Secondly, especially the two-dimensional models are computationally very demanding and therefore the use of available sophisticated automatic calibration procedures is restricted in many cases. This study takes a well documented flood event in August 2002 at the Mulde river in Germany as an example and investigates the most appropriate calibration strategy for a full 2D hyperbolic finite element model. The model independent optimiser PEST, that gives the possibility of automatic calibrations, is used. The aim is to minimize computational calibration time in relation to the required output of the model. Thus the assessment of the influence of the number and spatial distribution of observed maximum inundation depths on the calibration results and the predictive uncertainty of different optimisations are carried out.