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Optimization of a physically-based Catchment Model with Shuffled Complex Evolution Algorithms applying different objective Functions

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The calibration procedure of physically based and spatially distributed hydrological models contains certain difficulties due to the nonlinearity of the underlying hydrological processes, their interdependencies and the amount of model parameters. Furthermore, in many cases different parameter sets give a similar goodness-of-fit (equifinality). The model equifinality often occurs if local optima instead of the global optimum in the calibration procedure are detected and / or the objective function is not appropriately chosen. To avoid these obstacles the University of German Armed Forces, Institute for Hydrosciences, coupled the **S**huffled **C**omplex **E**volution Optimization Algorithm (SCE-UA, Duan et al., 1993) with the well-known WaSiM-ETH model (Schulla, 2001). The optimization method – in combination with different objective functions – ensures that a global optimum will find an unique model parameter set. This research was carried out within the framework of the RIMAX-project *Risk Management of Extreme Flood Events*, which is founded by the German Federal Ministry of Education and Research (BMBF).

After the introduction of the RIMAX-project HORIX (*Development of an Operational Expert System for Flood Risk Management Considering Prediction Uncertainty*) a short description of the catchment area in Bavaria is given. Afterwards, the main features of the spatial distributed catchment model WaSiM-ETH are briefly discussed and a parameter sensitivity study is carried out with the Generalized Sensitivity Analysis (GSA). It can be clearly proved that the parameter which determines the in-

terflow is most sensitive. That can be explained by the underground characteristics of the catchment.

The main issue of the presentation is the coupling and testing of the SCE-UA method with the WaSiM-ETH model using different objective functions. Concerning the model quality we achieved satisfactory calibration results using the overall Root Mean Squared Error (oRMSE). The SCE-UA method provides not only good results concerning the flood event hydrograph but also for single discharge components (direct flow, interflow and base flow). Therefore, crucial conditions for a well-done optimization procedure are the adequate choice of the objective function and a plausible relation of the discharge components.