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Dynamic identifiability analysis of runoff controlling parameters of the hydrological model WaSiM-ETH

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Optimum model parameters are often specific for the time period or event data included in the calibration process and can not be transferred to other events or periods. Only for long periods of calibration data general optimum parameters may be determined at the cost of unsatisfactory model fit for specific events or periods. Current model structures in process-oriented hydrological models consider parameters to be constant over time. Little research, however, has focused on the question, weather temporal or event-specific changes of optimum model parameters can be referred to functional relations, such as nonlinear or threshold behaviour not included in model equations. These effects were studied for the hydrological model WaSiM-ETH in a 170 km^2 subcatchment of the Weiße Elster River Basin in Saxony, Germany. Based on a Monte-Carlo simulation including seven model parameters, we investigated temporal and state dependent changes of parameter identifiability using the Dynamic Identifiability Analysis (DYNIA) algorithm. The DYNIA methodology evaluates parameter probability distribution of a Monte-Carlo simulation for each time step i based on a moving window algorithm. Simulations were carried out in daily time steps for a simulation period of 8 years. A similar analysis was carried out for a small scale catchment, the 3.18 km^2 Rietholzbach catchment in NE-Switzerland, using a well calibrated WASIM-Model in hourly time steps for summer discharges of 1994, including the runoff controlling parameters kd, ki and drd. The DYNIA analysis revealed temporal changes of identifiability for the snow melt runoff parameter cmelt, which is only identifiable during winter runoff, and for the interflow parameter drd. The drd parameter was closely related to observed discharge (as a surrogate of catchment moisture), when re-ordering the time series by discharge, suggesting a functional relation to catchment moisture state not considered in model equations. The DYNIA analysis

for the Rietholzbach catchment again revealed a strong relation between drd and observed discharge, strengthening the assumption of a functional relation. The DYNIA methodology revealed structural problems with regard to the parameter drd, which are not yet completely understood and require further investigation. The proposed continuous relationship may as likely be an artefact of the moving window filtering, masking threshold behaviour. Therefore further analysis and consideration of additional field data is necessary to understand these findings.