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Hydrology and Earth System Sciences Discussions

Interactive comment on "Inverse distributed hydrological modelling of alpine catchments" *by* H. Kunstmann et al.

Anonymous Referee #1

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The article deals with iterative automatic parameter estimation approach for the distributed hydrological model WaSim. The authors apply non-linear parameter estimation tool PEST, which works based on Gauss-Marquardt-Levenberg method, a gradient-based nonlinear parameter estimation algorithm. The model is applied to the alpine/prealpine Ammer catchment of having area 710 km 2. The study catchment area is heterogeneous with respect to geology, pedology and land use and shows a complex elevation difference. The authors perform four different iteration steps to estimate model parameters: in the first iteration step, three surface parameters - recession constant for direct runoff, recession constant for interflow and drainage density are calibrated. In this iteration attempt, the 2-D groundwater model is switched off and base flow is calculated using conceptual approach. The starting values are assigned based on hydrograph analysis. In iteration step 2, the 2-D groundwater model is switched on

and the values of hydraulic conductivity are calibrated. The model performance for several sub-catchments are declined as comapered to the model performance obtains in the iteration step 1. In the iteration step 3, the there surface parameters are calibrated again. In this step, the 2-D groundwater model is switched on with WaSim. The model performance is not improved considerably for majority of the sub-catchments. In the iteration step 4, the 5 snow parameters are calibrated and again the model performance is not improved. The study is then extended to perform covariance analysis to derive the confidence bounds for the calibrated model parameters.

The study shows that the application of more complex sub-model (2-D groundwater model) does not necessarily lead to better reproduction of observed discharge values at the catchment outlets. This message supposed to be interesting for the audience of HESS. I rank the paper hence to be accepted, however after revision.

The authors should spend some space on the fact of local search and global search automatic parameter estimation algorithm. The influence of the initial values are also to be stated clearly in the case of applied local search gradient-based nonlinear parameter estimation algorithm.

In the iteration step 2, the values of hydraulic conductivity are calibrated, with having the 2-D groundwater model switched on with WaSim. The observed discharge is used to calibrate the hydraulic conductivity values. The authors can highlight on the fact, if they can use ground water depths (if available) in addition to observed discharge and check whether the model performance will be improved or not.

In the covariance analysis, if I understood correctly, the authors calculated the correlation for the combination of 2 parameters at a time. If this is correct, the authors can, please check what happens among the model parameters themselves, when all the calibrated parameters are considered at a time. There might be interactions within the model parameters among themselves.

The conclusion is not clear; the authors should state their views on the acceptance of

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poor model performance using the more complex groundwater model with WaSim.

The paper also needs revision with respect to sentence structure. The cited references (van Genuchten, 1976 and Jasper et al., 2002) are missing in the reference section.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2581, 2005.