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Faster identifiability analysis of hydrological models using generalized FAST (Fourier Amplitude Sensitivity Test)

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Identifiability analysis is the key initial step of semi-automatic calibration of hydrological models. It aims at improving the understanding of the temporal variability of the process dominance. It is based on the analysis of the time dependent information content of the available data for the encoding of the dominant subprocesses and the identification of the corresponding parameters. Hereby, we make the assumption that data of periods with high information content provide information about optimal parameter ranges.

We propose to use a highly efficient algorithm based on generalized FAST (Fourier amplitude sensitivity test) for identifiability analysis. In contrast to established Monte Carlo based methods such as GLUE and DYNIA, this new method uses the information of the entire set of simulation runs. Also, identification of time periods of high identifiability does not depend on the selection of a support measure. Only when periods with high sensitivity are identified, a measure is selected to obtain the best performing parameter values. The optimal measure can be chosen independently for each of the different parameters.

This new method is used for the calibration of the distributed parameters of WaSiM-ETH for the Weisseritz catchment (50 km^2) in Saxony, Germany. The obtained results give insights into the behavior of this hydrological model which will then be used in the process of developing a real-time flood forecasting system for small catchments. In real time flood forecasting it is particularly important to judge the quality of the various model processes and the resulting prediction at a given time.