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Multi-Objective procedures for parameter and model predictive uncertainty estimation

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In common modelling practice the different sources of uncertainties affecting model results are not considered systematically. Using the model for predictive purposes the reliability of extrapolations has to be assessed in the presence of uncertainty. For this reason the influence of particular uncertainty sources has to be known to specifically reduce model predictive uncertainty.

A related controversial issue of hydrologic modelling is about to the appropriate complexity of process representation and hence model structure. Often the natural systems modelled are of higher complexity than the information of system behaviour available from observations. The crux of the problem is to properly identify model structure and parameters facing sparse available data. Although complex distributed models include more detailed representations of internal processes compared to lumped conceptual counterparts it has been argued that parsimonious models provide more reliable model results due to more precise identification of model parameters. This statement does not hold for the case of extrapolations of system behaviour.

The potential benefit of applying multi-objective optimisation approaches to parameter identification of distributed models is examined. In detail the analysis includes the application of multiple objective functions, simultaneous evaluation of multiple rainfall events and making use of reference hydrographs at different sites. The degree of resulting parameter uncertainty of the different parameter estimation strategies are compared. Also, different levels of model complexity related to spatial detail in representation of system characteristics and system forcing are analysed and evaluated by comparison of model results to observed output data.