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MESSI: An engineering tool for conceptual hydrological modeling using SUPERFLEX, MOSCEM and GLUE

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The progress of hydrology as a science is mentioned quite often and indeed lots of theoretical research is done to improving hydrological rainfall-runoff (RR) modeling. At the same time however, it is concluded that engineering practice lags behind on this scientific progress by at least a couple of years.
In this research, it is investigated how this gap can be closed. An engineering tool is developed called Model Ensemble, Sampling, Selection and Interpretation (MESSI) and tested in the engineering environment. The tool uses the model hypothesis framework SUPERFLEX to build an 'a-priori' ensemble of possible model structures for the case at hand. Then, the Multi-objective Shuffled Complex Evolution Metropolis algorithm (MOSCEM) is used for sampling of the parameter space. Finally, the Generalized Likelihood Uncertainty Estimation (GLUE) methodology is used to select a posterior ensemble which is then interpreted using the Pareto front and generated uncertainty bounds.
During the trial it was found that MESSI provides a plug-and-play method which is able to provide catchment process information, a mathematical optimal model and a measure of uncertainty based on the observation. Most important, it is shown that with a little effort new techniques can be brought directly to the engineering arena which will improve the interaction between the scientist and the engineer.