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Monitoring and modeling as a continuing learning process: the use of hydrological models in a general probabilistic framework.

G. Baroni (1), T. Gräff (1), F. Reinstorf (2), and S.E. Oswald (1)

(1) Institute of Earth and Environmental Sciences, University of Potsdam, Potsdam, Germany (baroni@uni-potsdam.de), (2) Department of Water and Waste Management, University of Applied Sciences, Magdeburg-Stendal (Germany)

Nowadays uncertainty and sensitivity analysis are considered basic tools for the assessment of hydrological models and the evaluation of the most important sources of uncertainty. In this context, in the last decades several methods have been developed and applied in different hydrological conditions. However, in most of the cases, the studies have been done by investigating mainly the influence of the parameter uncertainty on the simulated outputs and few approaches tried to consider also other sources of uncertainty i.e. input and model structure. Moreover, several constrains arise when spatially distributed parameters are involved.
To overcome these limitations a general probabilistic framework based on Monte Carlo simulations and the Sobol method has been proposed. In this study, the general probabilistic framework was applied at field scale using a 1D physical-based hydrological model (SWAP). Furthermore, the framework was extended at catchment scale in combination with a spatially distributed hydrological model (SHETRAN). The models are applied in two different experimental sites in Germany: a relatively flat cropped field close to Potsdam (Brandenburg) and a small mountainous catchment with agricultural land use (Schaefertal, Harz Mountains). For both cases, input and parameters are considered as major sources of uncertainty. Evaluation of the models was based on soil moisture detected at plot scale in different depths and, for the catchment site, also with daily discharge values.
The study shows how the framework can take into account all the various sources of uncertainty i.e. input data, parameters (either in scalar or spatially distributed form) and model structures. The framework can be used in a loop in order to optimize further monitoring activities used to improve the performance of the model. In the particular applications, the results show how the sources of uncertainty are specific for each process considered. The influence of the input data as well as the presence of compensating errors become clear by the different processes simulated.