Geophysical Research Abstracts,
Vol. 11, EGU2009-11371, 2009
EGU General Assembly 2009

Combined uncertainty assessment of soil and model parameters in distributed rainfall-runoff modelling

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Modelling rainfall-runoff processes using deterministic, spatial distributed, process-based models is affected by numerous uncertainties. One major source of those uncertainties origins from soil data, which are only available from soil maps at the mesoscale. The soil maps contain classified information of soil types delivering a large range of values of soil hydraulic parameters. We use the approach of similar soils to describe the variability of the soil hydraulic characteristics relative to a single reference soil per soil type in order to analyse the impact of uncertain soil data with respect to runoff. This allows reducing a large number of parameters and to include their correlative dependencies. Considering that the estimation and uncertainty analysis of conceptual model parameters highly depends on the soil parameterisation the method of the Bayesian inference is used to determine soil parameters and conceptual model parameters simultaneously. This procedure demonstrates exemplarily the possibility to infer spatial distributed parameters of a physically based soil water transport model from an integral catchment response (the observed runoff). Results are presented for the mesoscale Zöblitz catchment in the Ore Mountain, Germany, using the distributed hydrological model WaSiM-ETH. The resulting range of the determined soil parameters by inverse modelling is clearly smaller than the one directly derived from the soil maps. Furthermore the expected value is shifted to more drainable soil types. This points at structural deficits of the model, e.g. a missing component for the preferential flow in the soil module.