

Rainfall or parameter uncertainty? The power of sensitivity analysis on grouped factors

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Hydrological models are typically used to study and represent (a part of) the hydrological cycle. In general, the output of these models mostly depends on their input rainfall and parameter values. Both model parameters and input precipitation however, are characterized by uncertainties and, therefore, lead to uncertainty on the model output. Sensitivity analysis (SA) allows to assess and compare the importance of the different factors for this output uncertainty. Hereto, the rainfall uncertainty can be incorporated in the SA by representing it as a probabilistic multiplier. Such multiplier can be defined for the entire time series, or several of these factors can be determined for every recorded rainfall pulse or for hydrological independent storm events. As a consequence, the number of parameters included in the SA related to the rainfall uncertainty can be (much) lower or (much) higher than the number of model parameters. Although such analyses can yield interesting results, it remains challenging to determine which type of uncertainty will affect the model output most due to the different weight both types will have within the SA.

In this study, we apply the variance based Sobol' sensitivity analysis method to two different hydrological simulators (NAM and HyMod) for four diverse watersheds. Besides the different number of model parameters (NAM: 11 parameters; HyMod: 5 parameters), the setup of our sensitivity and uncertainty analysis-combination is also varied by defining a variety of scenarios including diverse numbers of rainfall multipliers. To overcome the issue of the different number of factors and, thus, the different weights of the two types of uncertainty, we build on one of the advantageous properties of the Sobol' SA, i.e. treating grouped parameters as a single parameter. The latter results in a setup with a single factor for each uncertainty type and allows for a straightforward comparison of their importance. In general, the results show a clear influence of the weights in the different SA scenarios. However, working with grouped factors resolves this issue and leads to clear importance results.