Investigation of screening methods for sensitivity analysis and their application to a hydrogeological model

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In many fields of environmental sciences mathematical models are used for simulation of different systems to understand and predict their potential behaviour. However, the complexity of these models increased over the years. One consequence of model complexity is that uncertainty in model prediction increased too. Thus, to quantify where does the uncertainty come from (referred to as sensitivity analysis (SA)) is one essential part during model application.
Many SA techniques are available. Screening methods as one group of such tech-niques can be used to identify parameters that control most of the uncertainty. Thus, a classification of input parameters into important and non-important ones is possible. Therefore, these methods are frequently applied when the model is computationally expensive to evaluate. One well-known screening method is the design proposed by Morris [1] which has been refined by Campolongo et al. [2]. The improvement is based on a better exploration of the input parameter space. Recently, Campolongo et al. proposed a different design using a radial scheme as sampling strategy [3].
In this work, the performance of these screening methods is investigated using analyti-cal test functions whereat different versions of the radial sampling method are used. It is shown that one version of the radial design demonstrates a superior performance in terms of computational efficiency, reproducibility, and convergence. Therefore, this method is finally applied to a hydrogeological model that calculates water flow and solute transport in porous media [4]. Strengths and weaknesses of each method are discussed and conclu-sions are drawn with respect to efficient and reproducible screening of model parameters.