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Parameter estimation for flow in heterogeneous unsaturated porous media

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The unsaturated zone is an important part of the hydrologic cycle and in modeling of large systems it provides the important link between the land surfaces and groundwater systems. One of the problems when modeling water fluxes in the unsaturated zone is to estimate the model parameters from observations. Due to heterogeneities of the soil, these parameters depend on length scale. Furthermore, even if a perfect measurement of a soil parameter would be available, the difference in scale between measurement and model would still cause a need to upscale the measurements into effective parameters. Given certain properties of the soil structure, this study looks at how much measurement data is required to make a good estimation of the effective parameters for a flow scenario in the unsaturated zone.

The estimation of local and effective parameters is done within a Bayesian framework, using a Markov Chain Monte Carlo (MCMC) sampling strategy. MCMC methods have the advantage of not only giving best estimates of parameters, but also provide the full distribution of the estimate, hence making uncertainties and eventual multimodalities easily accessible. In this study the Differential Evolution Adaptive Metropolis (DREAM) algorithm (Vrugt et al. 2008) is used.

For the study, data from lab-scale drainage experiments in heterogeneous sand columns of M. Vasin (Vasin et al 2008) are used. In the experiments, the depth averaged water content in two sand columns with different heterogeneous structure was monitored during successive drainage steps using neutron radiography. We estimate the flow parameters for the columns taking successively observations into account. In particular we integrate observations of spatially averaged water content. Results will be presented and discussed on the poster.

References

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