Geophysical Research Abstracts
Vol. 13, EGU2011-3656, 2011
EGU General Assembly 2011

Bayesian inverse modeling of soil water dynamics at the field scale: using prior information on soil hydraulic properties

Benedikt Scharnagl (1), Jasper Vrugt (2), Harry Vereecken (1), and Michael Herbst (1)

(1) Agrosphere Institute (IBG-3), Forschungszentrum Jülich, Jülich, Germany (b.scharnagl@fz-juelich.de), (2) Department of Civil and Environmental Engineering, University of California, Irvine, Irvine, CA, USA

In situ measurements of soil water state dynamics are attractive for inverse modeling of soil hydraulic properties. The information content of these data, however, is generally limited because they do not cover the full range of soil water states. This typically results in nonidentifiable soil hydraulic parameters. In this study, we tested the usefulness of using prior information on soil hydraulic properties for improving the identifiability of effective soil hydraulic properties at the field scale. Prior information was obtained using the Rosetta pedotransfer function to predict the soil hydraulic parameters in the van Genuchten-Mualem model. In addition, we used a random sampling approach to derive the correlation structure of the soil hydraulic parameters based on the Rosetta prediction. The inverse problem was posed in a formal Bayesian framework and solved using Markov chain Monte Carlo simulation with the DiffeRential Evolution Adaptive Metropolis (DREAM) algorithm. The use of prior knowledge on soil hydraulic parameters for inverse modeling of in situ soil water dynamics greatly improved parameter identifiability. Results with synthetic soil water content data indicate that this approach is effective and robust in case of biased prior information. To be effective and robust, however, Bayesian inverse modeling required information on parameter correlation to be included in the prior probability distribution of the soil hydraulic parameters. Results with real soil water content data suggest that Rosetta provided accurate and reliable predictions of the van Genuchten-Mualem parameters. The random sampling approach used to derive the correlation structure of the predicted parameters provided realistic and useful results.