Geophysical Research Abstracts
Vol. 14, EGU2012-12441, 2012
EGU General Assembly 2012

Quantifying the relation between model complexity and predictive uncertainty of groundwater recharge - A modeling study

C. Moeck (1), P. Brunner (1), M. Schirmer (1,2), and D. Hunkeler (1)

(1) CHYN, Centre for Hydrogeology and Geothermics, University of Neuchâtel, Switzerland , (2) EAWAG – Swiss Federal Institute of Aquatic Science and Technology, Dep. Water Resources and Drinking Water, Duebendorf, Switzerland

Groundwater recharge is a key parameter for sustainable water resource management. However, quantifying its spatial and temporal distribution is difficult, because heterogeneity of the soil and the presence of vegetation affect infiltration. Numerical models are important tools to quantify groundwater recharge. These models require a high number of parameters, which are difficult to measure. Therefore, the unknown parameters have to be calibrated. Typically only a few data points of limited quality are available in the unsaturated zone. Consequently, unknown model parameters cannot be calibrated uniquely resulting in large uncertainties, which are normally not quantified. Another (and less explored) source of uncertainty is the conceptual model itself. Water flow and transport are often simulated in 1-D models, without accounting for the complexity of the soil. It is unclear to what extent the degree of simplification affects the ability of the model to predict recharge.

The goal of this study is to investigate systematically to what extent simplification of the conceptual model affects predictive uncertainty of recharge. In order to explore this issue, 100 synthetic, heterogeneous 2D-soil structures were created. Hydraulic conductivity and porosity were distributed based on prior knowledge of parameter ranges found in the literature. Relationships between hydraulic conductivity and van Genuchten parameters were applied to be certain that the model represents realistic heterogenic soil parameters. Based on these soil structures, we generated different types of synthetic observations using the fully coupled, physically based model HydroGeo-Sphere (HGS). These observations were used to calibrate a wide range of 1-D models differing in their degree of complexity. For the inverse estimation of these parameters and for the linear uncertainty analysis, programs of the "PEST" suite were used. First results indicate that a perfectly calibrated model can hold a considerable amount of predictive error and depends on the type of observation. This approach provides methodological insights into methods to quantify recharge and enable us to provide guidance on the required level of model complexity as well as on the amount and type of observation data required for future studies.