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A global uncertainty and sensitivity procedure for the assessment of groundwater recharge distribution via hydrological models

G. BARONI, S. E. OSWALD & C. A. RIVERA VILLARREYES

Institute for Earth and Environmental Science, University of Potsdam, Germany

baroni@uni-potsdam.de

Abstract Groundwater recharge is the key driver for groundwater flow and resulting transport at the catchment scale, but it is difficult to quantify. Hydrological models provide an option for evaluating an estimate of groundwater recharge. They can generally be used to estimate groundwater recharge rates over large spatial and temporal scales, and they can be applied for current or future scenario analysis as climate or land use changes. However, a serious limitation of current model applications is the non-availability of data and input parameters. In order to improve the reliability and the performance of hydrological models, in this study a general approach for the assessment of performance in the simulation of the groundwater recharge estimation is proposed. A so-called global uncertainty analysis is developed as a tool to evaluate the performance of the models. A global sensitivity analysis is defined and used as a complementary tool to find the most important sources of uncertainty. The procedure can take various sources of uncertainty into account, i.e. input data, parameters, either in scalar or spatially distributed form. This procedure is iterated in a loop for improving the performance of the models and to optimize the resource allocations. As a test example, the procedure is applied at an experimental site in northern Germany on a field scale, using the SWAP model, a 1D physical-based hydrological model. Further research will involve other spatially distributed hydrological models of different complexity and application on larger spatial scales.

Key words groundwater recharge; Richards equation; global sensitivity analysis