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Calibration and uncertainty assessment of soil hydraulic parameters for SWAP model application

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In recent years agro-hydrological models have been increasingly used at field scale. Yet studies of uncertainties associated with its application at field scale are scarce. In this study, the generalized likelihood uncertainty estimation (GLUE) method is used to estimate the soil hydraulic (Mualem–van Genuchten) parameters of the agro-hydrological Soil–Water–Atmosphere–Plant (SWAP) model at field scale is conducted. It is based on detailed soil, water and crop related field measurements for two crops, i.e. wheat during the winter season and fodder maize during the summer season, conducted during the agricultural year 2004–2005.Water movement simulation in SWAP is based on numerical solution of Richards' equation and the soil hydraulic parameters are its most sensitive parameters. The results of the study reveal that care must be taken when calibrating the SWAP model with the soil moisture observations alone because this leads to high equifinality of the parameter values, and leads to equifinal variations in various components of the mass balance. Furthermore, the analysis of posterior distributions of calibrated soil hydraulic parameters suggests considerable amount of uncertainty in SWAP soil parameters, which may either be due to boundary conditions, grid resolution or numerical scheme used to solve Richard's equation in the field application of SWAP. Further analysis, especially with robust numerical schemes, is provided to further identify the source of such uncertainties (Kavetski and Clark, 2011).

Keywords: Calibration, SWAP, Uncertainty, GLUE

References:

Kavetski, D. and M. P. Clark (2010), Ancient numerical daemons of conceptual hydrological modeling: 2. Impact of time stepping schemes on model analysis and prediction, Water Resour. Res., 46, W10511, doi:10.1029/2009WR008896.