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# Data Source, Data Quality and Error Propagation Effects on Simulated Flow in a Deep Unsaturated Zone

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Simulating flow and transport in the deep vadose zone requires accurate estimation of three-dimensional hydraulic parameter fields based on often limited field and/or laboratory data. Based on an extensive research program at the Maricopa Agriculture Center (MAC) in Arizona that was started in the mid-nineties we will compare several methods that can be used to generate the hydraulic parameter fields, while accounting for the effects of error propagation that are inherent to each method. The methods are evaluated on infiltration (28 day) event, followed by a 300-day drainage phase. Water content dynamics were measured at 400 locations (nine wells, increments of 25 cm, down to 14.5 m). Directly measured hydraulic properties are sparse: only 21 cores were retrieved for laboratory measurements, while field retention curves can only be established at four depths. However, abundant secondary information is available with regard to particle size distributions (429 samples) and bulk density (224) and it is therefore attractive to use estimation methods (pedotransfer functions) to generate hydraulic properties. Several approaches are available. For example, existing general pedotransfer functions (PTF, e.g. Schaap et al., 2001) can be used, or the existing site data can be used to develop site-specific models as well as Bayesian approaches which merge site-data with existing models. Each set of hydraulic parameter estimates (approx 22,000 locations in a 50x50x14.5 meter domain) is used to simulate numerically space-time variations in water content for the infiltration-drainage experiments (328 days). Parameter estimates are then further conditioned on measured water contents through inverse simulation. Results indicate that PTFs calibrated against site data provide hydraulic parameter estimates with significantly lesser bias and uncertainty than estimates with a general PTF, resulting in much improved reproduction of observed moisture content dynamics (methods of moments). Preliminary conclusions indicate that collection of hydraulic site data is needed and that some form of model inversion leads to superior results. Analysis of error propagation is still ongoing.

キーワード: unsaturared flow, soil, hydraulic properties, pedotransfer functions, simulation, error propagation
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