

Consideration of parameters and boundary conditions uncertainties in water balance and solute transport simulation

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Abstract In this paper, a fuzzy-set theory-based approach is presented to incorporate the verbal expert knowledge with the uncertainties of the input data in a numerical model. It allows for the consideration of the fluctuation range of measurements, input parameters (e.g. soil and solute transport parameters) and boundary conditions. To extend numerical models to operate with fuzzy input parameters, interval arithmetic is used. Due to the characteristics of unsaturated zone processes, a nonlinear optimization problem occurs, where with given ranges of parameter sets min/max values must be found by means of gradient and objective function calculations. Furthermore, a second method, called fuzzy analysis library, is tested. This method provides a statistical approach based on an evolutionary algorithm so that no gradient calculations are performed. Both methods are applied to water flow and solute transport processes in the soil zone. The results of both methods are compared to each other.

Key words water balance; solute transport; fuzzy set theory; uncertainty analysis; unsaturated zone; fuzzy analysis library