Groundwater Flow and Transport Modeling With Correlated Possibilistic Data

Metin Ozbek
ENVIRON International Corporation

James L Ross
University of Vermont

Abstract. Stochastic groundwater modeling involves the propagation of probabilistic uncertainty from model input parameters to model estimates, usually via a Monte Carlo method. With the increasing reliance upon expert knowledge to define model inputs, and both fuzzy set and possibility theories to characterize this expert knowledge, alternative means of executing model equations are needed. While the fuzzy extension principle is commonly used to propagate such uncertainty, unless approximated, its implementation can be intensive for transient groundwater problems; and an alternative more practical approach to modeling with fuzzy and possibilistic data is warranted. In the proposed alternative approach, correlated hydraulic conductivity possibility distributions are sampled using their random set representations and crisp realizations of the hydraulic conductivity field are generated using a Latin hypercube lattice sampling technique, and ultimately operated upon by groundwater flow and transport model equations. The resulting uncertain concentration estimates based on these realizations are assembled as possibility distributions. We demonstrate an application of the approach to a site in Woburn, MA.