UNCERTAINTY ASSESSMENT FOR FLUID FLOW AND CONTAMINANT TRANSPORT MODELING IN HETEROGENEOUS GROUNDWATER SYSTEMS

R. William Nelson, Elizabeth A. Jacobson, and William Conbere

ABSTRACT

1. INTRODUCTION
2. FLOW MODEL CALIBRATION THROUGH STATISTICAL PARAMETER ESTIMATION
3. CONDITIONAL FLOW SIMULATIONS USING THE CALIBRATED MODEL
4. THE ENSEMBLE OF CONTAMINANT PATHLINE REALIZATIONS
5. THE STATISTICAL CONTAMINANT ARRIVAL DISTRIBUTIONS
6. SUMMARY
7. ACKNOWLEDGMENTS
8. REFERENCES
9. LIST OF SYMBOLS

J. Bear et al. (eds.), Advances in Transport Phenomena in Porous Media
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R. William Nelson, Elizabeth A. Jacobson, and William Conbere

Pacific Northwest Laboratory
Earth Sciences Department
Hydrology Section
Richland, Washington 99352, USA

ABSTRACT

There is a growing awareness of the need to quantify uncertainty in groundwater flow and transport model results. Regulatory organizations are beginning to request the statistical distributions of predicted contaminant arrival to the biosphere, so that realistic confidence intervals can be obtained for the modeling results. To meet these needs, methods are being developed to quantify uncertainty in the subsurface flow and transport analysis sequence. A method for evaluating this uncertainty, described in this paper, considers uncertainty in material properties and was applied to an example field problem.

Our analysis begins by using field measurements of transmissivity and hydraulic head in a regional, parameter estimation method to obtain a calibrated fluid flow model and a covariance matrix of the parameter estimation errors. The calibrated model and the covariance matrix are next used in a conditional simulation mode to generate a large number of 'head realizations'. The specific pore water velocity distribution for each realization is calculated from the effective porosity, the aquifer parameter realization, and the associated head values. Each velocity distribution is used to obtain a transport solution for a contaminant originating from the same source. The results are contaminant outflow arrival times for all realizations from which statistical distributions of the arrival times can be calculated. The confidence intervals for the arrival times of contaminant reaching the biosphere are obtained from these statistical distributions.