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Authors

Kowalsky, Michael B.

Rubin, Yoram

Peterson, John E.

et al.

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Estimation of Flow Parameters Using Crosshole GPR Travel Times and Hydrological Data Collected During Transient Flow Experiments

M. B. Kowalsky and Y. Rubin

Dept. of Civil and Environmental Engineering, University of California, Berkeley, CA

J. Peterson and S. Finsterle

Earth Sciences Division, Lawrence Berkeley Laboratory, Berkeley, CA

Abstract: An approach that employs concepts from the pilot point method is used for estimating flow parameter distributions in the vadose zone with crosshole ground-penetrating radar (GPR) travel times along with hydrological data (e.g., point measurements of permeability, and water saturation values inferred from neutron probe data) collected during transient flow experiments. The methodology presented allows for estimation of the non-uniform permeability field (as well as porosity and additional uniform parameters describing the relative permeability and capillary pressure functions) and provides measures of parameter uncertainty. Various aspects of the approach, such as data collection configurations, are examined through a 2D synthetic model. In addition, inversion of data collected during an infiltration test at the Hanford field site allows for the strengths and limitations of the approach in a 3D setting to be explored.