# Solute Transport in a Medium with Spatially Variable Porosity

## Details

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| **Meeting** | 2006 Fall Meeting |
| **Section** | Hydrology |
| **Session** | Advances in Characterization of Subsurface Transport Processes and Integration With Numerical Models I |
| **Identifier** | H41G-05 |
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| **Index Terms** | Groundwater hydrology [1829] Groundwater transport [1832] Modeling [1847] Stochastic hydrology [1869] |

## Abstract

A theory for transport of a conservative tracer through a medium with spatially variable porosity is presented. The work is motivated by observed anomalous behavior of a conservative tracer (bromide) at the Boise Hydrogeophysical Research Site (BHRS) which cannot fully be accounted for by spatial variability of hydraulic conductivity alone. In the theory we have developed, porosity, n(x), and fluid flux, q(x, t) are treated as separate random fields with stationarily connected random fluctuations. Here, separate means that we do not lump the two random fields, n(x) and q(x, t), into a single random field, namely, the velocity field, v(x, t) = q(x, t)/n(x) at the outset before proceeding with ensemble averaging of the transport equation. This leads to ensemble moment equations that are significantly different from those typically obtained using the single random field v(x, t). In this preliminary work the equation for the first ensemble moment of tracer concentration is derived and used to predict solute transport for the case of a second-order stationary porosity field, and a steady-state flow field. Preliminary results indicate that close correspondence between the predicted mean and the observed behavior of the bromide tracer at the BHRS is achievable.

**Cite as:** Author(s) (2006), Title, *Eos Trans. AGU, 87*(52), Fall Meet. Suppl., Abstract H41G-05