

Application of fractional derivatives for simulating diffusion into porous matrix in mathematical modeling of the contaminant transport in a confined fractured porous aquifer

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Abstract

Solute transport in the fractured porous confined aquifer is modeled by the advection-dispersion equation with fractional time derivative of order γ , which may vary from 0 to 1. Accounting for diffusion in the surrounding rock mass leads to the introduction of an additional fractional time derivative of order 1/2 in the equation for solute transport. The closed-form solutions for concentrations in the aquifer and surrounding rocks are obtained for the arbitrary time-dependent source of contamination located in the inlet of the aquifer. Based on these solutions, different regimes of contamination of the aquifers with different physical properties are modeled and analyzed. Copyright © 2006 by ASME.

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