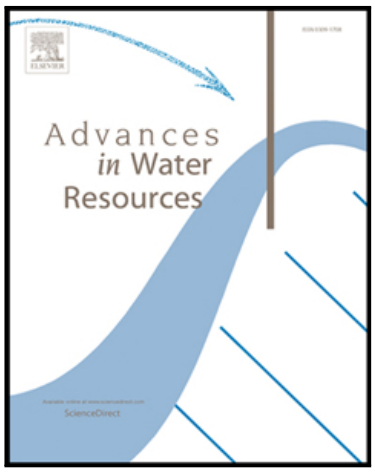

Contaminant attenuation by shallow aquifer systems under steady flow

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Contaminant attenuation by shallow aquifer systems under steady flow

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Abstract

We present a framework for analyzing advection-dominated solute transport and transformation in aquifer systems of boreal catchments that are typically shallow and rest on crystalline bedrock. A methodology is presented for estimating tracer discharge based on particle trajectories from recharge to discharge locations and computing their first passage times assuming that the flow pattern is approximately steady-state. Transformation processes can be included by solving one-dimensional reactive transport with randomized water travel time as the independent variable; the distribution of the travel times incorporates morphological dispersion (due to catchment geometry/topography) as well as macro-dispersion (due to heterogeneity of underlying hydraulic properties). The implementation of the framework is illustrated for the well characterized coastal catchment of Forsmark (Sweden). We find that macro-dispersion has a notable effect on attenuation even though the morphological dispersion is significantly larger. Preferential flow on the catchment scale is found to be considerable with only 5% of the Eu-

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