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CTRW-mediated solute transport in porous media with spatially non-uniform flow fields

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The continuous time random walk (CTRW) approach to tracer transport in saturated porous media has been applied with success to reproduce breakthrough measurements in field and laboratory experiments where the overall flow field could be assumed to be constant. This success motivated the current study which explores CTRW transport scenarios in space-dependent, but laminar flow fields, as predicted by Darcy's law. The method allows different time scales for the migrating tracer particles depending on, for example, the characteristics of the porous medium they are traversing, and/or the velocity field they encounter. This is expressed by a time- and space-dependent memory term within a Fokker-Planck-like equation. In two dimensions we first solve numerically this integro-partial differential equation in Laplace space and then Laplace invert – again numerically – its solution to obtain the time-dependent concentration profile. We are interested in different parameterisations within the memory function and discuss the method's ability to describe heterogeneous flow solute transport in porous media.