# A NOVEL TRANSITION RATE TRANSFORMATION METHOD FOR SOLUTE TRANSPORT

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Advection-dispersion equation is widely used to describe solute transport in hydrology. However, using conventional methods, e.g., finite difference method, to solve this equation may result in numerical dispersion and oscillation, especially when the advection velocity is large. We propose a new transition rate transformation (TRT) method to solve the advection-dispersion equation.

From the Fokker-Planck equation, we can see that the advection-dispersion equation, similar to the form of the Fokker-Planck equation, is invariant as the transition rate function is transformed under the condition that the first and second spatial moments of the transition rates are kept unchanged. The TRT method utilizes this invariance to construct simple transition rate functions to solve the advection-dispersion equation. Our simulation shows that the results obtained by the transformed simple transition rates agree well with analytical solutions even if the transformation is rather arbitrary.

The TRT method has three main merits. First of all, it need not to solve equations for each time step. Once the transition rate between each pair of points are given, they can be used in the whole time. The concentration of solute is equal to the sum of the products of the former concentration and corresponding transition rates. Thus, the calculation is direct. Secondly, the TRT method is suitable for any advection velocity, including the cases that the product of velocity and time interval is longer than the step length of space, as long as all transition rates are nonnegative. Thirdly, the selection of transition rate functions is very free and we can conveniently choose suitable transition rates.