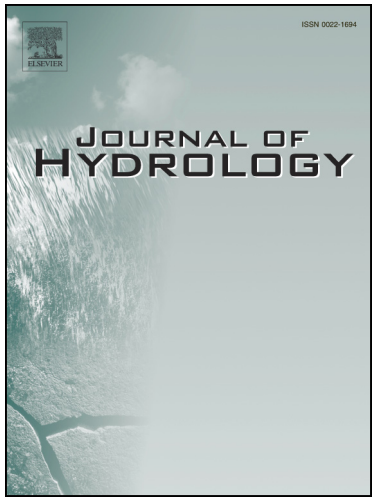

An exact explicit solution for one-dimensional, transient, nonlinear Richards' equation for modeling infiltration with special hydraulic functions

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An exact explicit solution for one-dimensional, transient, nonlinear Richards' equation for modeling infiltration with special hydraulic functions

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This work develops a simple exact and explicit solution of the one-dimensional transient and nonlinear Richards' equation for soils in a special case of exponential water retention curve and power law hydraulic conductivity. The exact solution is obtained as traveling wave based on the approach proposed by Philip (1957, 1967) and adopted by Zlotnik et al. (2007). The obtained solution is novel, and it expresses explicitly the water content as function of the depth and time. It can be useful to model infiltration into semi-infinite soils with time-dependent boundary conditions and infiltration with constant boundary condition but space-dependent initial condition. A simple analytical inverse procedure based on the proposed analytical solution is presented which allows the estimation of hydraulic parameters. The proposed exact solution is also important for the verification of numerical schemes as well as for checking the implementation of time-dependent boundary conditions.