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Research Article

Solution Procedure for Transport Modeling in Effluent Recharge Based on Operator-Splitting Techniques

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Abstract

The coupling of groundwater movement and reactive transport during groundwater recharge with wastewater leads to a complicated mathematical model, involving terms to describe convection-dispersion, adsorption/desorption and/or biodegradation, and so forth. It has been found very difficult to solve such a coupled model either analytically or numerically. The present study adopts operator-splitting techniques to decompose the coupled model into two submodels with different intrinsic characteristics. By applying an upwind finite difference scheme to the finite volume integral of the convection flux term, an implicit solution procedure is derived to solve the convection-dominant equation. The dispersion term is discretized in a standard central difference scheme while the dispersion-dominant equation is solved using either the preconditioned Jacobi conjugate gradient (PJCG) method or Thomas method based on local-one-dimensional scheme. The solution method proposed in this study is applied to the demonstration project of groundwater recharge with secondary effluent at Gaobeidian sewage treatment plant (STP) successfully.