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IDENTIFICATION OF GROUNDWATER BASIN SHAPE AND BOUNDARY USING HYDRAULIC TOMOGRAPHY

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Abstract

Shapes and boundary types of a groundwater basin play important roles in groundwater management and contaminant migration issues. Hydraulic tomography (HT) is a recently developed new approach for high-resolution characterization of aquifers. HT is not only an inverse methodology but also a logic data collection approach to integrating non-fully redundant hydraulic information to provide high-resolution characterizations of aquifers. In this study, HT was applied to synthetic 2-D aquifers to investigate its feasibility to map the irregular shapes and types of the aquifer boundaries. We first used the forward model of VSAFT2 to simulate hydraulic responses of aquifers due to pumping tests under combinations of irregular shaped boundary conditions, e.g., constant head, flux, and no-flow boundaries. Then, we used SimSLE (Simultaneous Successive Linear Estimator) inverse model in VSAFT2 to estimate the spatial distribution of hydraulic properties within rectangular shaped domains with constant head boundaries. The simulations were conducted in both steady and transient state using different monitoring network to assess the ability of HT with the different network for detecting types and shapes of the boundary. Furthermore, the improvement of the estimation with prior information of T was also investigated. These cases were investigated using Monte Carlo simulations to ensure statistical meaningful conclusions.

Keyword: groundwater basin, hydraulic tomography, 2-D model, boundary.