Investigating the Boundary Effect of Sequential Pumping Test Method at Field Site for Hydraulic Property Estimations

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Over the last decades, hydraulic tomography (HT), that is an aquifer test technology has been widely developed and successfully utilized into several field sites in order to delineate the heterogeneous distributions of hydraulic properties. Yet, field uncertainties, such as earthquakes, tides, and boundary effects, may influence hydraulic properties while using HT. The data of the field site boundary conditions, for instance, cannot be easily defined and often set as prescribed heads or fluxes, leading to inaccurate findings. This study investigates possible outcomes of boundary conditions by applying HT field data in different numerical models, so to detect the most effective simulation process for hydraulic property estimations. Specifically, Three numerical models: (1) the boundary condition of prescribed head; (2) the boundary condition of variable head by kriging method; and (3) the boundary condition of variable head using the sensitivity equation method (SEM) are compared for estimating the heterogeneous distributions of hydraulic properties by using data from the sequential pumping tests at field site. According to the results, model (3) presents hydraulic property estimations more precise to the field data; therefore, it can be stated that the boundary conditions of this model can minimize uncertainties affecting the results. By establishing monitoring wells in field sites of known boundaries and recording long-term groundwater level modifications, real conditions of heterogeneous aquifers can be further defined.

Keywords: Boundary effect, Hydraulic tomography, Sequential pumping test, Heterogeneity

