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Identifying Horizontal Multi-Zone Unconfined Aquifer Parameters Using Simulated Annealing

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The hydraulic conductivity is a very important parameter for quantitative and/or qualitative groundwater studies. In an unconfined aquifer, the heterogeneous phenomenon critically complicates the estimation of the groundwater flow and the spatial distribution of hydraulic head. Hence, the aquifer parameter identification should involve the structure and values of the parameters. In the past, the parameters were usually identified in a trial-and-error manner, but it is tedious and timeconsuming. When the problem is large, the trial-and error method may be convergent very slow and no global optimum is guarantee. Recently, new global optimization methods based on a heuristic search approach have emerged rapidly. Simulated annealing (SA) is one of the global heuristic methods that can accept non-optimal trial solution using Metropolis's criterion to avoid possible trap in a local optimum. Based on the above, this study uses SA coupled with an analytical solution to determine the structure and values of the aquifer parameters, which was complicated and difficult to solve in the past. The analytical solution in this study can describe the groundwater flow in a horizontal multi-zone unconfined aquifer with recharge based on Darcy's law and the groundwater flow equation. The solution demonstrates that hydraulic head varies spatially and is influenced by aquifer heterogeneity. The proposed approach may provide a valuable reference when dealing with the groundwater problem in a horizontal multi-zone unconfined aquifer.

Keywords: Parameter identification, Simulated Annealing, unconfined aquifer