Estimating of aquifer parameters from the single-well water-level measurements in response to advancing longwall mine by using particle swarm optimization

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We estimated transmissivity and storage coefficient values from the single well water-level measurements positioned ahead of the mining face by using particle swarm optimization (PSO) technique. The water-level response to the advancing mining face contains an semi-analytical function that is not suitable for conventional inversion shemes because the partial derivative is difficult to calculate . Morever, the logaritmic behaviour of the model create difficulty for obtaining an initial model that may lead to a stable convergence. The PSO appears to obtain a reliable solution that produce a reasonable fit between water-level data and model function response. Optimization methods have been used to find optimum conditions consisting either minimum or maximum of a given objective function with regard to some criteria. Unlike PSO, traditional non-linear optimization methods have been used for many hydrogeologic and geophysical engineering problems. These methods indicate some difficulties such as dependencies to initial model, evolution of the partial derivatives that is required while linearizing the model and trapping at local optimum. Recently, Particle swarm optimization (PSO) became the focus of modern global optimization method that is inspired from the social behaviour of birds of swarms, and appears to be a reliable and powerful algorithms for complex engineering applications. PSO that is not dependent on an initial model, and non-derivative stochastic process appears to be capable of searching all possible solutions in the model space either around local or global optimum points.