Comparison of efficiency of radial basis function and finite difference methods for groundwater flow modeling

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Since the birth of Meshless Methods based on Radial Basis Functions (RBF), many researches have indicated the robustness and efficiency of them. However RBF method has not been applied widely in practical engineering problems. Actually most of studies have devoted for solving general partial differential equations, whereas solving various engineering problems with the same governing equations may be computationally different. The RBF method gives accurate results for problems including steep gradient of dependent variable and also it is more efficient than other classic methods such as finite difference (FD). On the contrary, if the changes of dependent variable are small, classic methods may compete with RBF method. The groundwater problem is one of those cases in which the hydraulic gradients are usually small and as a result of this, the RBF method application may decrease the accuracy and increase the computation efforts. In this paper firstly groundwater flow equations have been solved by RBF and Finite Difference methods, using several situations and various boundary conditions, and then the results have been compared to analytical solutions. The hypothetical problems which are used in this comparison have been already adapted for real cases. Results of this research indicate that using RBF method without sufficient prior knowledge of groundwater flow problem may not be efficient.