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Quantification of uncertainty associated with the estimation of hydraulic parameters for saturated porous media

Wednesday, 2 June 2021 10:00 (1 hour)

Estimation of subsurface hydraulic parameters is always complicated often due to lack of the available information. For the reliable estimation of the hydraulic parameters i.e. hydraulic conductivity (Ks) and porosity (Θs), experiments are conducted at lab scale but for field scale it's expensive, time consuming and not feasible. The alternative approach is to use empirical relation based on physical properties of the aquifer material. Since these empirical relation are well established and are used extensively for the estimation of in-situ hydraulic parameters. This study is conducted to highlight the uncertainties associated with various empirical relations for the estimation of hydraulic parameters of heterogeneous porous medium. During the estimation of input parameters for these empirical relations, spatial variability in soil characteristics along with interpolation error, unsteadiness of flow and the instrument calibration errors impose varying degrees of uncertainty. Classical uncertainty methods such as zero order, first order and second order uncertainty were applied to empirical equations that were often used for estimating hydraulic conductivity in groundwater flow modeling. The combination of uncertainty quantification method with different empirical equations lead to several cases which were compared for the variance and mean estimates to identify the model of less uncertainty along with reliable mean estimate of hydraulic conductivity. The values of the hydraulic parameters obtained from the empirical equations are then compared with the experiments conducted on three mini aquifer systems i.e. glass beads, sand and soil. Further the applicability of various empirical equations were delineated with the experimental results for a particular mini aquifer system. It is concluded from results that the uncertainty estimated from second order was more as compared to the first order uncertainty method, however mean value of Ks estimate was in close range. Further, we found that applying second order uncertainty is computationally complex which leads to the application of first order uncertainty analysis. Nevertheless, comprehensive evaluation of various uncertainty method is crucial in groundwater flow modeling especially for the parameters of high variability such as considered here.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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