



Extending Theis' solution to incorporate heterogeneity into pumping test analysis

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A framework for interpreting transient pumping tests in heterogeneous transmissivity fields is developed to infer the overall geostatistical parameters of the medium without reconstructing the specific heterogeneous structure point wise. This method is applied to the field sites "Horkheimer Insel" and "Lauswiesen" (South-West Germany) to estimate the respective parameters of heterogeneity from pumping test data of each site. The methodology is based on the upscaling approach Radial Coarse Graining which is applied to deduce an effective radial description of multi-Gaussian transmissivity. It was used to derive an Effective Well Flow Solution for transient flow conditions including not only the storativity, but also the geometric mean, the variance, and the correlation length of log-transmissivity. This solution is shown to be appropriate to characterize the pumping test drawdown behavior in heterogeneous transmissivity fields making use of ensembles of simulated pumping tests with multiple combinations of statistical parameters. The whole procedure is described in detail in Zech et al. 2016 (doi: 10.1002/2015WR018509).