Geophysical Research Abstracts,
Vol. 11, EGU2009-13740, 2009
EGU General Assembly 2009

Application of Sequential Gaussian and transition probability-based geostatistical simulations for the interpretation of a tracer test at the Lauswiesen site, Germany

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We analyze the results of a tracer test that has been performed at the "Lauswiesen" site (Germany). Sodium Bromide is injected into a well located 52 m from a pumping well. Multilevel breakthrough curves (BTCs) are measured in the latter. We explore the relative importance of selecting (a) different conceptual models of the (geostatistical) structure of aquifer heterogeneities and (b) different mechanisms governing transport on our ability to describe the tracer experiment. Flow and transport are tackled within a stochastic Monte Carlo framework to describe key features of the depth-averaged experimental breakthrough curves observed at the pumping well. Two geostatistical simulation methods, sequential Gaussian simulation and transition probability indicator simulation were applied to create conditional realizations of geomaterials distributions within the alluvial Lauswiesen aquifer. The simulated hydraulic conductivity fields were then used in a numerical model to simulate the depth averaged measured breakthrough curve. Our modeling effort shows that accounting for both the spatial variation of hydraulic conductivity and porosity is important to be able to generate alternative equally likely realizations of the system that are consistent with the main characteristics of the observed BTC. Results obtained by the two tested geostatistical simulation methods are not visibly different (in an ensemble sense) for the scenario analyzed.