SENSITIVITY ANALYSIS OF THE QUANTILES OF TRACER BREAKTHROUGH CURVES IN A ONE AND THREE CONTINUUM MODEL

D. BACHMANN, T. VOGEL, and J. KÖNGETER

Institute of Hydraulic Engineering and Water Resources Management, RWTH Aachen University, Mies-van-der-Rohe-Str.1, 52056 Aachen, Germany
(Tel: +49241-80-25272, Fax : +49241-80-22348, e-mail: bachmann@iww.rwth-aachen.de)

In recent years hard rock aquifers have become more and more important as a source for drinking water. Further, fractured rock domains receive increasing attention concerning radioactive waste repositories and oil extraction.

For the prediction of flow and transport in hard rock aquifers high standard experimental and simulation techniques are required, e.g. due to fast fluid flow and transport in fractures as well as storage effects in the matrix system. One numerical approach to model flow and transport in hard rock aquifers is the multi continuum modeling. The concept of this model approach is to represent the heterogeneous fractured medium by a set of equivalent homogenous systems with equivalent parameters (BIRKHÖLZER, 1994).

In this context a sensitivity analysis is performed, which may lead to a better understanding of natural processes and their approximations by understanding the influences of parameter perturbations. The impact of the model input parameters such as permeability, porosity or exchange parameters, on the tracer breakthrough curve (BTC) is investigated and interpreted in this paper.

The sensitivities are calculated by the method of automatic differentiation, basics of this approach are presented. Some problems by the computational implementation of this method based on the code of the numerical program are shown and a solution is proposed.

The first sensitivity analysis is performed by a one-dimensional, one continuum model. The changes of the BTC-shape are illustrated and quantified by the sensitivities of the permeability k_{xx} and the dispersion coefficient α_l. The BTC-shape is both translated and distorted by a changing of the permeability. In contrast to a changing of the dispersion coefficient, where the BTC-shape is only distorted. One point in time, the so called pivot point, is not influenced (VOGEL, 2005).

The second investigation at a one-dimensional, three continuum model point out the different phases of the tracer breakthrough, proposed by JANSEN (1999). In this case the exchange parameters between the continua get also an influence to the BTC-shape and relevant exchange processes are exhibit.

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