EGU21-9469
https://doi.org/10.5194/egusphere-egu21-9469
EGU General Assembly 2021

A Comparison of Six Transport Models of the MADE-1 Experiment Implemented with Different Types of Hydraulic Data

Alraune Zech[1,2], Sabine Attinger[2,3], Alberto Bellin[4], Vladimir Cvetkovic[5], Gedeon Dagan[6], Marco Dentz[7], Peter Dietrich[2,8], Aldo Fiori[9], and Georg Teutsch[2]

[1]Utrecht University, Geoscience, Earth Science, Utrecht, Netherlands (a.zech@uu.nl)
[2]Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany
[3]Institute of Earth and Environmental Science-Geoecology, University Potsdam, Germany
[4]Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy
[5]Department of Water Resources Engineering, Royal Institute of Technology, Stockholm, Sweden
[6]School of Mechanical Engineering, Tel Aviv University, Ramat Aviv, Israel
[7]Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council, Barcelona, Spain
[8]Center of Applied Geoscience, University of Tübingen, Tübingen, Germany
[9]Department of Engineering, Roma Tre University, Rome, Italy

Six conceptually different transport models are applied to the MADE-1 field tracer experiement as a first major attempt for model comparison. The objective was to show that complex mass distributions in heterogeneous aquifers can be predicted without calibration of transport parameters - solely making use of structural and flow data.

The models differ in their conceptualization of the heterogeneous aquifer structure, computational complexity, and use of conductivity data obtained from various observation methods (Direct Push Injection Logging - DPIL, Grain Size Analysis, Pumping Tests and Flowmeter). They agree in the underlying physical transport processes, none of them considering mass transfer. Predictive capability is assessed by comparing results to observed longitudinal mass distributions of the MADE-1 experiment. We deal with data uncertainty indicated by decreasing rates of recovered mass by focusing the comparison on measures, such as peak location, position and shape of bulk mass and leading tail, and we do not normalize observation data.

Comparison of models reveals that the predictions of the solute plume agree reasonably well with observations if the models are underlined by a few parameters of close values: mean velocity, a parameter reflecting log-conductivity variability and a horizontal length scale related to conductivity spatial correlation. The robustness of the results implies that conservative transport models with appropriate conductivity upscaling strategies of various observation data provide reasonable predictions of plumes longitudinal mass distribution as long as key features are taken into account.