Geophysical Research Abstracts
Vol. 19, EGU2017-14447-1, 2017
EGU General Assembly 2017

3-D Modelling the effect of river excavation on surface water and groundwater relation in a bank filtration system - comparing electrical conductivity and heat as tracer

Weishi Wang (1), Sascha Oswald (1), Matthias Munz (1), and Daniel Strasser (2)

(1) University of Potsdam, Institute of Earth and Environmental Science, Subsurface Hydrology, Potsdam-Golm, Germany, (2) Bundesanstalt für Wasserbau, Karlsruhe, Germany

As a pretreatment for conventional drinking water supply, bank filtration (BF) is widely used in Europe, while in Germany it contributes 16% of potable water supply. There are usually two crucial issues for BF influencing its treatment effect, which are separately the spatial and temporal distribution of travelling times and distinguishing between the flow contribution of BF versus inflow from the ambient groundwater. Modelling is a strong tool for analyzing the behavior and development of the flow field, especially for quantification of the river recharge rate of BF and estimation of travel time distribution. Though 3-D modelling of the flow field as a comprehensive tool has been used in several studies, many simulations are limited to pure water flow. Since heads are only partially able to constrain the flow field, model non-uniqueness might lead to misinterpretation of the real flow field, especially in complex geological conditions. Some studies have shown that by including tracers, the model non-uniqueness could be reasonably constrained and the accuracy of flux estimation could be improved. Natural tracers thus are used in groundwater modelling, while differences in their properties or input may cause dissimilar behavior during the transport process.

In this study, we have set up a numerical 3-D groundwater flow model of a bank filtration site with strong geological heterogeneity and used the data of several years monitoring activities as the data basis. We were particularly interested in the seasonal dynamics but also structural changes induced by a reconstruction of the surface water including excavation and rebuilding the bank construction. By combining separately electrical conductivity and heat as tracers in the model we were able to i) understand flow field mechanisms and its changes caused by the excavation ii) conclude from the deviations of the tracer concentrations and dynamics simulated compared to the measurements on deficiencies of the flow field; and thus by the tracer study flow field could be improved iii) compare the individual behavior of the tracers in this realistic setting of transport processes also relevant for judging water quality in the pumping wells now and in the future.