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Transient Effects of Groundwater Pumping on the 3D Hydrothermal Configuration of Berlin

Maximilian Frick (1,2), Mauro Cacace (1), Magdalena Scheck-Wenderoth (1,3), and Michael Schneider (2)

(1) GFZ German Research Centre for Geosciences, Section 6.1: Basin Modelling, Telegrafenberg, 14473 Potsdam, Germany(mfrick@gfz-potsdam.de), (2) Free University Berlin, Institute of Geological Sciences, Malteserstr. 74-100, 12249 Berlin, Germany, (3) RWTH Aachen University, Institute of Geology and Geochemistry of Petroleum and Coal, Lochnerstrasse 4 - 20, 52056 Aachen, Germany

The major objective of this study is to understand the hydraulic and thermal state of the subsurface beneath the major urban center of Berlin, capital city of Germany. To achieve this goal, we implemented newly available hydrogeological data, which have been used to parametrize the 3D models of this study in space and time regarding hydraulic connectivity of surface water resources to the subsurface as well as groundwater extraction for supply purposes.

The model area is located in the Northeast German Basin and consists of a sequence of sedimentary deposits of several kilometres thickness. The sedimentary succession consists of alternating aquifers and aquitards deposited during Cenozoic times. This succession contains the freshwater aquifers that are used for municipal water supply. These are separated from the deeper saline aquifers by the local Oligocene Rupelian aquitard, which displays a heterogeneous thickness distribution due to glacial erosion, being discontinuous in some places.

Based on newly available data and aided by previous modelling studies, we found that leakage of deeper saline water through the main target aquifer is more widespread and not limited to places where the main aquitard sequence has been eroded. Pervasive leakage in and from the Rupelian aquitard (possibly leaching into the fresh water aquifer) is observed to occur also in areas where the clay layer is present in correlation with a relative strong component of hydraulic forcing from the surface.

We present results of both, the qualitative and quantitative effects of the modified hydrothermal setting of the different model scenarios, focussing on the effects of large-scale groundwater pumping.