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Modelling the coupled fluid and heat transport in a geothermal site: First results from Groß Schönebeck, NE-German Basin

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Predicting the temperature distribution in the subsurface becomes increasingly important in the course of recently intensified exploration for geothermal energy. Numerical models considering both the physical processes controlling heat transfer as well as the structural setting of the subsurface are an important option to assess variations in the temperature distribution.

The geothermal in-situ laboratory "Groß Schönebeck" located 40 km north of Berlin is one of the key sites of geothermal exploration studies in the North German Basin. 3D numerical simulations of coupled fluid flow and heat transfer processes are carried out to investigate the geothermal field. The Goal of the study is to quantify the impact of variable rock parameters and geological structures on the resulting thermal distribution. The Zechstein salt as a prominent feature in the North German Basin is of particular interest in this context because it locally modifies the geothermal field.

Our first attempts to model coupled fluid flow and heat transfer processes confirm the strong impact of the Upper Permian Zechstein salt. Furthermore, our results indicate that conduction is an important heat transfer mechanism below the Middle Triassic layers. Conversely, the more than 3000 m thick and permeable sediments above the Middle Triassic Muschelkalk unit favour the formation of convection cells. Here, especially high degrees of coupling result in remarkable convective heat transport. We assess the sensitivity of these results, and discuss implications for temperature predictions.