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Large Scale Geothermal Exploration in the Bavarian Molasse Basin

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The carbonaceous sediments of the Upper Jurassic aquifer in the Bavarian Molasse Basin are one of the most promising regions for geothermal energy usage in Germany. Since these sediments are dipping towards the alps, significantly higher temperatures can be produced in the southern part of Munich compared to the northern part. Therefore, the southern part of Munich with temperatures of 120 - 140 °C is used for power generation. After heat extraction, the water is reinjected with temperatures of about 80 °C into the aquifer. In the northern part, water with temperatures of 70 - 90 °C serves for district heating. Here, the water is reinjected with temperatures of about 50 °C into the aquifer.

A more efficient way of geothermal energy exploitation is investigated in a research project. Here, the coupling of a geothermal doublet system in the southern part with a geothermal doublet system in the northern part is planned. The aim is to use both bore holes in the south to produce hot water and to pipe that water via a district heating system to the north of Munich. Here, the production well is converted into a second injection well, and the cooled water is injected into the aquifer. Altogether, an increase in efficiency of about 70 % is expected.

The increased production rate at one geothermal site as well as the increased injection rate 30 km upstream could result in large-scale hydraulic changes which have to be assessed carefully. The importance of hydrogeochemical monitoring for the detection of such changes has already been shown in geothermal systems, since it is the most reliable source of reactions in the aquifer. In addition, hydrochemical changes in the aquifer due to the disruption of the equilibrium by mixing different water compositions are expected and need to be quantified prior to operation.

In a first step, provided hydrochemical data of the production wells were used to establish a hydrogeochemical model with the computer program PhreeqC. By means of that model, operation can be parametrized and possible reactions in the aquifer can be predicted.