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Transport Mechanisms in the Shallow Sedimentary Basin of Thuringia

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Salty groundwater reaching the surface or coming close to it is a phenomena that can be observed in many places in the Thuringian Basin. By means of numerical investigations we aim to determine the main transport mechanisms of this shallow sedimentary basins.

Simulations of fluid flow and mass transport have been carried out in order to understand the role of geological features such as hydraulic parameters, faults and fluid density differences. For this purpose a 2D cross section model representing the geological setting and incorporating major fault structures of the basin has been constructed. Preliminary numerical investigations indicate that the brine migration is mainly determined by the regional groundwater flow, which depends strongly on the local hydraulic parameters. Density effects only play a minor role.

With regard to the large uncertainty involved in measurements of hydraulic conductivity a qualitative sensitivity analysis on input parameters for aquifer permeability is performed. Additionally different hydraulic characteristics of the faults – from sealing up to more permeable – are tested. Furthermore heterogeneity is taken into account using geostatistics. Log-normal distributed permeability fields have been applied for every aquifer and aquitard unit.

The results underline the findings that hydraulic parameters are the decisive factor for the regional groundwater flow pattern. Relatively small differences in permeability can strongly impact on the development of the local flow regime. Also significant effects for heterogeneous permeability distributions can be observed.

With this work we contribute to the understanding of fluid convection processes influenced by density differences and local geological characteristics at basin scale. The described mechanism could develop in any shallow sedimentary basin with conditions comparable to those in the Thuringian basin.