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# Impact of heterogeneous permeability distribution and salt transport on the groundwater flow of the Thuringian sedimentary basin

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Ground water flow systems of the Thuringian Basin are studied by analyzing the fluid dynamics at this real world example of a shallow sedimentary basin. The impact of the permeability distribution and density differences on the flow velocity pattern, the salt concentration, and the temperature distribution is quantified by means of transient coupled simulations of fluid flow, heat, and mass transport processes. Simulations are performed with different permeabilities in the sedimentary layering and heterogeneous permeability distributions as well as with a non-constant fluid density.

Three characteristic numbers are useful to describe the effects of permeability on the development of flow systems and subsurface transport: the relation of permeability between aquiclude and aquifer, the variance, and the correlation length of the log-normal permeability distribution. Density dependent flow due to concentration gradients is of minor importance for the distribution of the flow systems, but can lead to increased mixing dissolution of salt. Thermal convection is in general not present. The dominant driver of groundwater flow is the topography in combination with the permeability distribution.

The results obtained for the Thuringian Basin give general insights into the dynamics of a small sedimentary basin due to the representative character of the basin structure as well as the transferability of the settings to other small sedimentary basins.