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Different spatial discretization methods of fault systems on heat transport processes in hard rock aquifers

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Most hard rock aquifers, which are important for geothermal use, contain fractures of different type and scale. These fault systems are of major significance for heat flow in the groundwater. The hydrogeological characterization of fault systems must therefore be part of any site investigation in hard rock aquifers and hydraulically important fault systems need to be appropriately represented in associated numerical models. This contribution discusses different spatial discretization methods of fault systems in three-dimensional groundwater models and their impact on the simulated groundwater flow field as well as density and viscosity dependent heat transport. The analysis includes a comparison of the convergence behavior and numerical stability of the different discretization methods. To ensure defendable results, the utilized numerical model SPRING was first verified against data from the Hydrocoin Level 1 Case 2 project. After verification, the software was used to evaluate the impact of different discretization strategies on steady-state and transient groundwater flow and transport model results. The results show a significant influence of the spatial discretization strategy on predicted flow rates and subsequent mass fluxes as well as energy balances.