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Regional hydraulic model of the Upper Rhine Graben

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The productivity of hydrothermal wells depends to a large degree on the in situ hydraulic conditions. To better predict the hydraulic behavior of such a reservoir, basin scale models can be effectively used to understand the hydraulic conditions of the system, where the reservoir is embedded.
In this study the 3D deep groundwater flow of the Upper Rhine Graben is investigated using a highly detailed numerical model extending from the Alps in the South to central Germany in the North with a maximum depth of 14 km. The model is based on many previous investigations and simulations assessing the structural and thermal configurations of the study area. The major focus of the study is to quantify the overall effects that hydraulic head gradients exert on the deep fluid flow through the sedimentary rocks within the Upper Rhine Graben.
The obtained results are indicative of a general flow direction in the sedimentary pile from the graben flanks towards its centre preferentially aligned South to North. Besides these general trends, also local heterogeneities in the shallow 3D flow field can be observed, which are structurally linked to the model parameterization of the different sedimentary sequences and their depth extent. The hydraulic field in the shallowest (Cenozoic in age) aquifer system is strongly overprinted by the hydraulic gradients of the topography from high recharge areas like the Black Forest and Vosges Mountains to the low discharge region of the Rhine valley. At greater depth, the presence of a regional aquitard (Keuper sediments) separating the shallow Cenozoic aquifer from the deeper aquifer systems decouples the topographic influence aquifer from the deep flow system, the latter being characterized by a continuous graben parallel flow with a predominant direction from south to north.
This model will provide hydraulic boundary conditions for local scale models in the Upper Rhine Graben region.