The geothermal potential of sedimentary basins – case study for Berlin, Germany

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In this case study a method to estimate the geothermal potential is presented for the capital city of Berlin, Germany. Therefore, it is essential to know the temperature distribution in the subsurface which has been studied intensively in the past. Building on this knowledge, newly available subsurface temperature predictions have been used along with updated geometries and geophysical properties as input data for the application case of hydrothermal doublets and their comparison to earlier realizations. This shows how considering more complex geometries, boundary conditions and processes in numerical 3D thermohydraulic simulations leads to significant changes in the predicted geothermal potential and the associated controlling factors. The model area is part of the Northeast German Basin which consists of a thick sequence (up to 10 km) of differently consolidated sedimentary deposits. This sequence is made up of alternating aquifers and aquitards, wherein several encompass promising targets for different geothermal application scenarios. Namely these include the Jurassic, Middle Buntsandstein and the Sedimentary Rotliegend aquifers. The former two of these reservoirs depict a complex geometry (mainly due to deeper salt movements) leading to a wide range of predicted temperatures, while the latter (situated below the salt) has a more homogenous topography and temperature distribution. This is also connected to the efficacy of different heat transport processes at different depths.

The predicted heating power is therefore also distributed heterogeneously and reaches maxima as large as 1.25 MWth for the Jurassic, 10 MWth for the Middle Buntsandstein and 2.2 MWth for the Sedimentary Rotliegend. The models further show that the geothermal potential (or the heating power) of a hydrothermal doublet is controlled by more than merely the reservoir temperature but also the producible mass flux, which in turn depends highly on the reservoir transmissivity. Due to the high variability of predicted geothermal potentials, different utilization scenarios should be investigated in future studies, such as aquifer thermal energy storage or low enthalpy geothermal utilizations.