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Geological and geothermal 3D modelling of the Vienna Basin, Austria - pilot area of the project TRANSENERGY

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In general, sedimentary basins show high potential for the use of geothermal energy. Since the Vienna Basin is a densely populated area, (approximately 1.7 million people in the city of Vienna plus surroundings) geothermal power and heat could play a significant role in the future. The Vienna basin is a relatively cold system where the 100 °C isotherm is to be found at a minimum of about 2500 meters. This fact, meaning the need of deep thus expensive wells, adding the problem of space for drillings and geothermal power plants are challenging subjects in terms of exploitation.
The aim of the present work is to model the thermal regime of the Vienna basin and take a closer look on two exploitation scenarios in different hydrological systems (parts of the Bajuvaric and Juvavic nappes in the basement and the horizon of Aderklaa conglomerates in the Neogene sediments).
In the first phase, a geological 3D model was created using published data (surface geology, interpreted cross sections from drilling and seismic data) as well as markers from selected wells (data derived from OMV). The geometrical model was built in GoCADTM, where in a first step surfaces were created, displaced along major faults and further exported for the following numerical simulations. In total, 14 Surfaces were created, seven Neogene layers and seven structuring the basement.
The thermal modelling is realized using the finite-element software COMSOL Multiphysics© and FEFLOW.
Major surfaces were imported into COMSOL as geometry objects, which is not practicable for very complex, fine structures. To represent smaller units inside the subdomains, the associated material parameters had to be imported as functions of the three space coordinates.
To gain initial values for the exploitation scenario modelling a steady-state solution has to be achieved. For the lower model boundary, a Neumann boundary condition was set using a newly derived heat flow density map (project TRANSENERGY, Geological Survey of Austria) and a Dirichlet BC at the topography with an altitude corrected surface temperature. The scenario modelling is carried out using FEFLOW for assessment of geothermal resource quantification in respect to natural recharge phenomena.
Building the geological model and simulating different study areas with varying properties for temperature, flow rates etc. will help to understand the basin′s dynamics and the comprising geothermal potential.