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Project GeoPower: Basic subsurface information for the utilization of geothermal energy in the Danish-German border region

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Information on both hydraulic and thermal conditions of the subsurface is fundamental for the planning and use of hydrothermal energy. This is paramount in particular for densely populated international border regions, where different subsurface applications may introduce conflicts of use and require reliable cross-border management and planning tools.
In the framework of the Interreg4a GeoPower project, fundamental geological and geophysical information of importance for the planning of geothermal energy utilization in the Danish-German border region was compiled and analyzed. A 3D geological model was developed and used as structural basis for the set-up of a regional temperature model. In that frame, new reflection seismic data were obtained to close local data gaps in the border region. The analyses and reinterpretation of available relevant data (old and new seismic profiles, core and well-log data, borehole data, literature data) and a new time-depth conversion (new velocity model) allowed correlation of seismic profiles across the border. On this basis, new topologically consistent depth and thickness maps for 12 geological/lithological units were drawn, with special emphasis on potential geothermal reservoirs, and a new 3D structural geological model was developed.
The interpretation of petrophysical data (core data and well logs) allows to evaluate the hydraulic and thermal rock properties of geothermal formations and to develop a parameterized 3D thermal conductive subsurface temperature model. New local surface heat-flow values (range: 72–84 mW/m^2) were determined and predicted temperature were calibrated and validated by borehole temperature observations. Finally, new temperature maps for major geological sections (e.g. Rhaetian/Gassum, Middle Buntsandstein) and selected constant depth intervals (1 km, 2 km, etc.) were compiled. As an example, modelled temperatures for the Middle Buntsandstein geothermal reservoir are shown with temperatures ranging between 24 and 192 °C for depths of interest.