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Assessment of the geothermal potential of fault zones in Germany by numerical modelling

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Fault zones with significantly better permeabilities than host rocks can act as natural migration paths for ascending fluids that are able to transport thermal energy from deep geological formations. Under these circumstances, fault zones are interesting for geothermal utilization especially those in at least 7 km depth (Jung et al. 2002, Paschen et al. 2003).

One objective of the joint project “The role of deep rooting fault zones for geothermal energy utilization” supported by the Federal Ministry for Economic Affairs and Energy was the evaluation of the geothermal potential of fault zones in Germany by means of numerical modelling with COMSOL.

To achieve this goal a method was developed to estimate the potential of regional generalized fault zones in a simple but yet sophisticated way. The main problem for the development of a numerical model is the lack of geological and hydrological data. To address this problem the geothermal potential of a cube with 1 km side length including a 20 meter broad, 1000 m high and 1000 m long fault zone was calculated as a unified model with changing parameter sets.

The properties of the surrounding host rock and the fault zone are assumed homogenous. The numerical models were calculated with a broad variety of fluid flow, rock and fluid property parameters for the depths of 3000-4000 m, 4000-5000 m, 5000-6000 m and 6000-7000 m. The fluid parameters are depending on temperature, salt load and initial pressure. The porosity and permeability values are provided by the database of the geothermal information system (GeotIS).

The results are summarized in a table of values of geothermal energy modelled with different parameter sets and depths. The geothermal potential of fault zones in Germany was then calculated on the basis of this table and information of the geothermal atlas of Germany (2016).