Geophysical Research Abstracts
Vol. 15, EGU2013-10929, 2013
EGU General Assembly 2013

The impact of fault zones on the 3D coupled fluid and heat transport for the area of Brandenburg (NE German Basin)

Cherubini Yvonne (1,2), Cacace Mauro (1), and Magdalena Scheck-Wenderoth (1)

(1) Helmholtz Centre Potsdam GFZ, Section 4.4 Basin Analysis, Potsdam, Germany (leni@gfz-potsdam.de), (2) University of Potsdam

Faults can provide permeable pathways for fluids at a variety of scales, from great depth in the crust to flow through fractured aquifers, geothermal fields, and hydrocarbon reservoirs (Barton et al. 1995). In terms of geothermal energy exploration, it is essential to understand the role of faults and their impact on the thermal field and fluid system. 3D numerical simulations provide a useful tool for investigating the active physical processes in the subsurface.

To assess the influence of major fault zones on the thermal field and fluid system, 3D coupled fluid and heat transport simulations are carried out. The study is based on a recently published structural model of the Brandenburg area, which is located in the south-eastern part of the Northeast German Basin (NEGB) (Noack et al. 2010). Two major fault zones of the Elbe Fault System (Gardelegen and Lausitz Escarpments) vertically offset the pre-Permian basement against the Permian to Cenozoic basin fill at the southern margin by several km (Scheck et al. 2002).

Within the numerical models, these two major fault zones are represented as equivalent porous media and vertical discrete elements. The coupled system of equations describing fluid flow and heat transport in saturated porous media are numerically solved by the Finite Element software FEFLOW® (Diersch, 2002).
Different possible geological scenarios are modelled and compared to a simulation in which no faults are considered. In one scenario the fault zones are set as impermeable. In this case, the thermal field is similar to the no fault model. Fluid flow is redirected because the fault zones act as hydraulic barriers that prevent a lateral fluid advection into the fault zones. By contrast, modelled permeable fault zones induce a pronounced thermal signature with distinctly cooler temperatures than in the no fault model. Fluid motion within the fault is initially triggered by advection due to hydraulic head gradients, but may be even enhanced by buoyancy forces caused by density gradients mainly occurring due to differences in the temperature.

References:

Barton, C.A., Zoback, M.D., Moos, D., 1995. Fluid flow along potentially active faults in crystalline rock. Geology 23 (8), 683-686.