Geophysical Research Abstracts
Vol. 13, EGU2011-10539, 2011
EGU General Assembly 2011

How sensitive are thermal models? A 3D case study for the area of Brandenburg

Vera Noack (1,2), Magdalena Scheck-Wenderoth (2), Björn Lewerenz (2), Mauro Cacace (1,2)
(1) University of Potsdam, (2) GFZ German Research Centre for Geosciences, Basin analysis, Potsdam, Germany (vera.noack@gfz-potsdam.de)

Based on newly available data of both, the structural setting and thermal properties, we compare thermal models of the area of Brandenburg (NEGB) to assess the sensitivity of our calculated temperatures. The models cover an area of about 250 km times 210 km, located in the Northeast German Basin, with a horizontal resolution of 1 km. The basin fill of the models consist of 11 layers with different dominant lithologies assigned uniform to each layer. These are mainly clastics, apart from the Upper Cretaceous chalks, the Muschelkalk carbonates, the Zechstein salt and the Permocarboniferous volcanics. The structural complexity of the basin fill is given by the configuration of the Zechstein salt that rises up to 4500 m where diapirs pierce their overburden. This special configuration is very relevant for the thermal calculations because salt has a distinctly higher thermal conductivity than the other sediments.
We calculate the temperature by using a FEM to solve the steady state heat conduction equation in 3D. Our results depend on the parameters thermal conductivity and radiogenic heat production and on the choice of boundary conditions. To validate our model results we compare modelled temperature data with measured temperatures to show the influence of different thermal properties and boundary conditions on the calculated temperatures.

We compare 4 different thermal models that have the same structural configuration of the Permian to Cenozoic basin fill. The reference thermal model 1 (Noack et al., 2010) reaches downward to the crust-mantle boundary (Moho); integrating a homogenous layer for the crust. For model 2 we change the lower boundary condition by extending the reference model to the lithosphere-asthenosphere boundary (LAB) and include a differentiated crust. For both models we assign the same thermal properties after Bayer et al., (1997). For model 3 and 4 we assign newly available thermal properties to each unit of the basin fill, measured in wells (Norden and Förster, 2006; Norden et al., 2008 and Fuchs and Förster, 2010). The difference between both models is given by the configuration of the underlying crust. Model 3 has the same homogenous configuration of the crust as used for the reference model 1, whereas for model 4 we use the crustal differentiation of model 2.

The reference model 1 is slightly colder than model 2, but comparison with measured temperatures from different structural locations of the basin shows a good fit to the predicted temperatures for both models. Model 3 and model 4 are distinctly colder than model 1 and model 2.

References

Bayer, U., Scheck, M. and Koehler, M., 1997. Modeling of the 3D thermal field in the northeast German basin. Geologische Rundschau, 86, 241-251.
Fuchs, S. and Förster, A., 2010. Rock thermal conductivity of Mesozoic geothermal aquifers in the Northeast German Basin. Chemie der erde – Geochemistry, 70, Suppl. 3, 13-22.
Noack, V. et al., 2010. Assessment of the present-day thermal field (NE German Basin) – Inferences from 3D modelling. Chemie der Erde - Geochemistry 70, Suppl. 3, 47-62.
Norden, B. and Förster, A., 2006. Thermal conductivity and radiogenic heat production of sedimentary and magmatic rocks in the Northeast German Basin. AAPG Bulletin, 90(6), 939-962.
Norden, B., Förster, A. and Balling, N., 2008. Heat flow and lithospheric thermal regime in the Northeast German Basin. Tectonophysics 460, 215-229.