

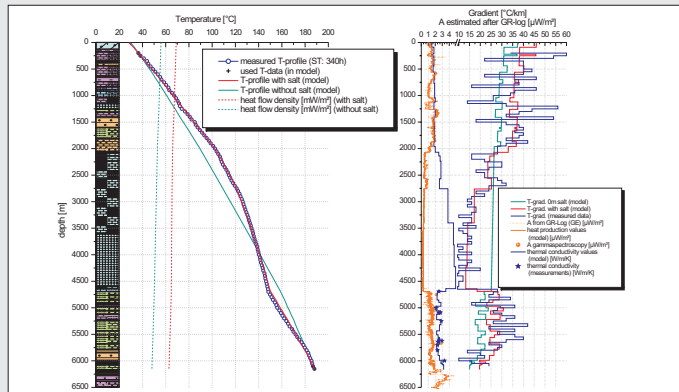
Internal thermal anomalies in sedimentary basins caused by salt structures

In sedimentary basins, structures like salt diapirs and salt pillows are common structural features and they may be of special interest for the geothermal exploration and exploitation.

Due to the thermal-conductivity contrast of salt and surrounding sediments, a salt diapir could affect the nearby temperature distribution. The reason for this is that the thermal conductivity of salt is a factor of two or three higher than that of typical sediments. Thus, heat tends to be focused through a salt diapir at the expense of heat in the surrounding basal sediments.

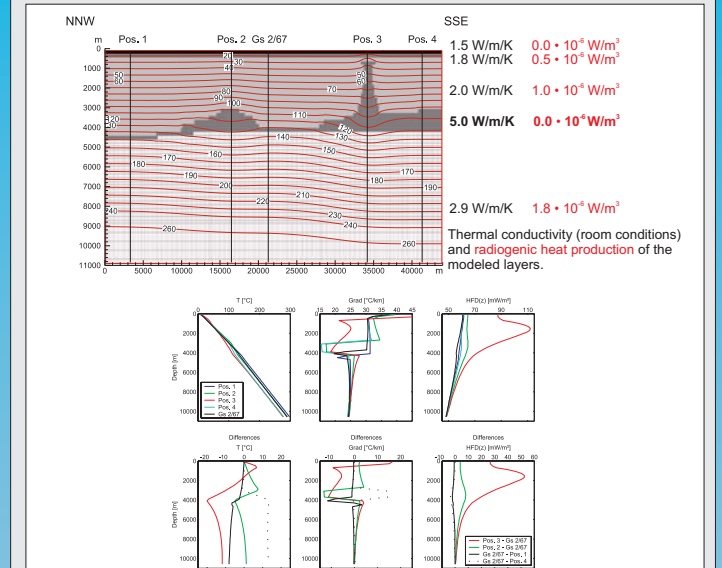
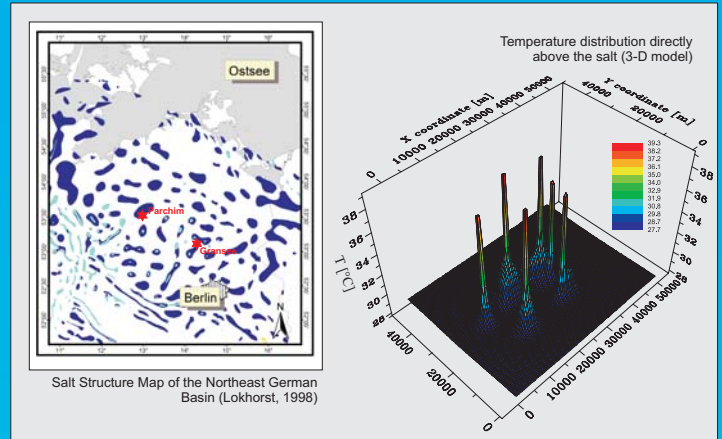
To quantify these effects for Permian Zechstein salt structures in the Northeast German Basin, thermal modeling was performed.

Thermal Modeling of Salt Structures

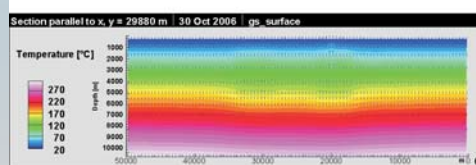
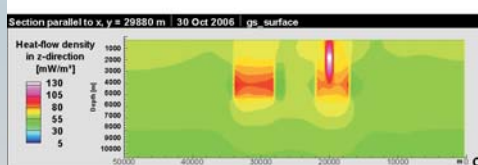
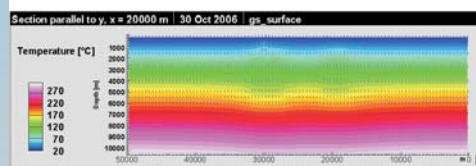
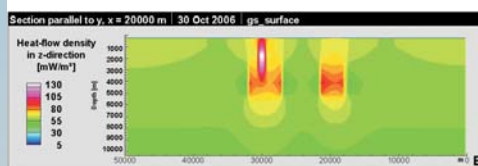
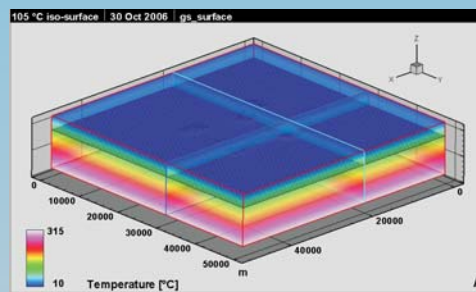
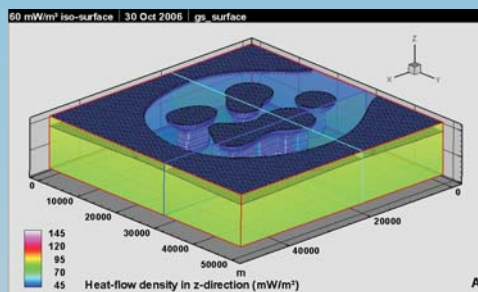


A simple 1-D model to estimate the salt influence on a real temperature profile (Parchim 1/68). Thermal conductivity values, heat production rate, and temperature data are given.

↓ **3-D model to estimate the salt influence on the temperature field at the Granssee Structure**
Thermal conductivity values and heat production rates similar to the 2-D model. The model consists of 20 layers with variable spacing (50-3250m).



2-D model to estimate the salt influence on the temperature field at the Granssee structure
Calculated temperatures (T), temperature gradients (Grad), and heat-flow density values (HFDz) are shown. The model considers the temperature dependence of thermal conductivity according to the approach of Zoth & Haenel, 1988.



- Near surface heat flow is increased by 50 mW/m².
- greatest increase of temperature amounts to 10-15 °C in a 50-100m thick interval above the salt.

Conclusions

Compared to 3-D models, 2-D models do overestimate the area of the disturbed temperature field.

Whereas the positive temperature anomaly caused by salt structures is not high in the Northeast German Basin, this may be different for other areas (e.g. Gulf of Mexico).

To perform a proper evaluation of a specific site and its suitability for geothermal applications, the salt-structure geometry and the thermal properties of the involved rocks must be known in detail.