Geophysical Research Abstracts
Vol. 13, EGU2011-6938, 2011
EGU General Assembly 2011
© Author(s) 2011

Curie depths estimation in Germany: methodological studies for derivation of geothermal proxies using new magnetic anomaly data

Gerald Gabriel (1), Abhey Ram Bansal (2), Ingo Dressel (3), Vijay Prasad Dimri (2), and Charlotte Krawczyk (1)

(1) Leibniz Institute for Applied Geophysics, Hannover, Germany (gerald.gabriel@liag-hannover.de), (2) National Geophysical Research Institute, Hyderabad, India (abhey.bansal@gmail.com), (3) University of Bremen, Department of Geosciences, Bremen, Germany

Recently, the Leibniz Institute for Applied Geophysics published the first complete map of the anomalies of the Earth's magnetic total field in Germany [1]. The map, with a grid spacing of 100 m, consistently images the entire anomaly pattern in Germany at an altitude of 1000 m a.s.l. related to the DGRF 1980, epoch 1980.0 [2]. Because of these reference parameters and the consideration of new data, the resolution of this map is higher than any previously published map. Thereby, it provides a capable database to investigate the structure and physical properties of the Earth's crust.

One application is the estimation of the depth to the bottom of magnetic sources (DBMS) that is often interpreted as Curie depth. To compute the DBMS for entire Germany, we apply a modified centroid method which is based on a fractal source distribution [3]. This approach provides better estimates than the assumption of an uncorrelated source distribution.

For this study 31 blocks of 200 km x 200 km size are analyzed, that represent the different tectonic regions in Germany. The blocks have an overlap of 100 km. The DBMS is estimated to range between 22 km and 45 km. On the large scale an increase of the DBMS from south to north is observed. In general, the smallest DBMS values are found for the Moldanubian Region, larger ones for the Rhenohercynian Zone. The largest DBMS values are calculated for the large basin areas, i.e. the eastern part of the Molasse Basin north of the Alps and parts of the North German Basin. Regarding the geothermal properties of the Earth's crust, that are expected to control the DBMS (whenever DBMS is not related to lithological boundaries), a correlation between the DBMS and heat flow density is observed on the large scale: heat flow density decreases from south to north, whereas DBMS increases. As exception, some local areas of temperatures, which are known at 3 km depth, seem to correlate better with DBMS than heat flow density values do.

For the future we propose investigations that use varying block sizes accounting for available geological information and a significantly increased block overlap.

References

[1] Leibniz-Institut für Angewandte Geophysik (2010): Anomalien des erdmagnetischen Totalfeldes der Bundesrepublik Deutschland, 1:1.000.000. – GeoCenter Scientific Cartography; Stuttgart.

[2] Gabriel, G., Vogel, D., Scheibe, R., Lindner, H., Pucher, R., Wonik, T., Krawczyk, C.M. (in press): Anomalies of the Earth's Total Magnetic Field in Germany – the first complete homogenous dataset reveals new opportunities for multi-scale geoscientific studies. – Geophysical Journal International, doi: 10.1111/j.1365-246X.2010.04924.x.

[3] Bansal, A.R., Gabriel, G., Dimri, V.P., Krawczyk, C.M. (in review): Estimation of the depth to the bottom of magnetic sources by a modified centroid method for fractal distribution of sources: an application to aeromagnetic data in Germany. – Geophysics.