



EVAREST - Evaluation of geological models by joint interpretation of potential field anomalies

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Structural geological models are often based on the integration of different geophysical datasets. During the last years an increasing interest in the potential field methods, i.e. gravimetry and magnetic, can be observed, even though data acquisition can cause considerable costs and logistic effort. Therefore, the specific advantages and disadvantages of the different methods were analyzed. In a case study, which was conducted in cooperation with RWE Dea and which is located in northern Germany, it was studied to which level of detail gravity and magnetic anomalies can be interpreted jointly by 3D forward modelling. Special attention was paid to the individual residuals, i.e. those parts of the gravity and magnetic anomalies which could not be interpreted satisfactorily by the joint structural / physical model. In a subsequent stage of the workflow this information was analyzed individually for each dataset to improve the geological interpretation and to identify and localize the sources of the anomalies in more detail.

For the discussed study several potential field datasets of different resolution were available, which were first analyzed by means of field transformation. While the gravity anomalies are mainly related to the occurrence of salt structures, the magnetic anomalies seem to be controlled by deep structures, most probably by the magnetic basement. Some local magnetic anomalies with amplitudes of less than 10 nT can be related to the rim synclines of the salt structures as well as to buried Pleistocene subglacial valleys.

3D forward models, constrained by existing structural information and rock physical data, have shown that, e.g., a common fitting of both anomaly fields is not possible if homogenous densities and magnetizations are assigned to the different lithological units and while considering the geometry of the source bodies to be the same for both potential field anomalies. To explain the magnetic anomalies a more detailed differentiation of the source bodies in terms of thin layers is required, while for the interpretation of the gravity anomalies vertical density gradients must be considered for specific lithologies. Furthermore, from the magnetic anomalies ideas about the maximum depth of source bodies can be derived.