Interpretation of regional magnetic anomalies of the East - European Platform for spherical Earth

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Regional magnetic anomalies (RMA) are one of important information generators for research of deep structure of the Earth's crust and small scale forecasting of mineral deposits. RMA were selected and interpreted first in the 2D variant by Krutikhovskaya Z.A. with co-authors for the Ukrainian Shield (Krutikhovskaya at al., 1982). In future RMA it was selected for territory of Ukraine and East - European platform (EEP) (Pashkevich I.K. et al., 1990; Orlyuk M.I., 1999), and their interpretation is executed in a 3D variant (Orlyuk M.I., 1999; Orlyuk M.I., 2000). First approaching location of sources RMA and values of the magnetic susceptibility it was got as a result working out of small scale 3D magnetic models of Ukrainian Shield, territory of Ukraine and East - European platform. Thus interpretation was executed at the identical values of the magnetic field of Earth for large territories.

An account of spherical of Earth is the new stage of interpretation of RMA. The sizes of anomalies (tens kilometers in a crossing and hundreds kilometers by a slowness) require the account of spherical. All of it needed development adequate ΔB_a of the mathematical, algorithmic and programmatic providing of interpretation of RMA.

The mathematical providing and programmatic algorithmic complex was developed by V.M.Kovalenko-Zavoysky and I.M.Ivashchenko (2006), which allows to calculate the vector of magnetized sources of RMA for arbitrary correlation of the constituents vector B_a.

Presence of values of the module induction of the geomagnetic field B, component of the normal magnetic field of Earth B_0, B_{0x}, B_{0y}, B_{0z} on the epoch of calculation of anomaly ΔB_a and it ΔB_{ax}, ΔB_{ay}, ΔB_{az}- component is need for calculations. Quantitative interpretation of RMA takes into account nonlinear character of the field ΔB_a. Early during interpretation of anomaly of ΔB_a "substituted" the anomalies of vertical component of ΔB_{az}, that led to the substantial errors during interpretation.

The specific of the interpretation of RMA in spherical coordinates are used geocentric and local systems coordinates. The results of calculation are given in the geocentric system of coordinates (latitude and longitude point of the field calculation - in degrees and minutes).

This interpretation complex was used for interpretation of the RMA of the East-European platform. Interpretation was taken to the calculation and interpolation component of the normal geomagnetic field on a spherical surface and decision of direct task in spherical coordinates.

A spatial location and intensity of anomalies is taken from digital map of the regional magnetic field $\Delta B_{a.reg}$ of the East - European platform and surrounding territories (Orlyuk, 2000).

The models of sources RMA were set a few spherical blocks, each of which was characterized homogeneous magnetic susceptibility and different values of the normal geomagnetic field.

According to calculations magnetic susceptibility of sources of north part of EEP changes from χ =0,002 Si to χ = 0, 0058 Si (at the value of the normal geomagnetic field B_0 =52 500- 54 500 nT), and from χ=0,001 Si to χ= 0,006 Si for south part of EEP (at B_0 =49 500- of 52 500 nT). So, the methodical features interpretation of the geomagnetic field are considered taking into account spherical of Earth. The first variant of 3D magnetic model of the EEP is developed. Magnetic anomalies from a model are counted above ground, on height of a 5 km and on height of flight satellites (400km).

References

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