Ukrainian Regional Magnetic Map: the results of calculations of the geomagnetic field components for the Epoch 2015

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Method to calculate power and angular components of induction vector of the Earth's magnetic field is proposed. This method is grounded on the development of 3D model of the Earth's crust and following calculation by it of northern (ΔB_{ax}), eastern (ΔB_{ay}) and vertical (ΔB_{az}) components of anomalous magnetic field that together with corresponding components (B_{0x}, B_{0y}, B_{0z}) of normal field enable to define full values of B_x -, B_y -, B_z - components of the Earth's magnetic field. Using them the value of horizontal component (B_H) as well as the angles of declination D and inclination I of geomagnetic field are calculated. The values of power and angular components of B magnetic field on the territory of Ukraine for the Epoch 2015 year (IGRF-12) are calculated. The contribution into magnetic declination D and inclination I of its normal (D_0, I_0) and anomalous (ΔD, ΔI) components is estimated.

The internal Earth's magnetic field is the vector sum of the core field (main magnetic field) B_0 and lithospheric magnetic field ΔB. Software complex for calculate induction vector of magnetic sources was created. In this case it is proposed for the first time to calculate magnetic field ΔB_M from the magnetic model of the Earth's crust. These field ΔB_M is corresponding to anomaly ΔB. Using known values of the Earth's magnetic field components it is easy to calculate corresponding magnetic field components ΔB_{Mx}, ΔB_{My}, ΔB_{Mz}

Full vector components *B* are estimated as

$$B = B_0 + \Delta B_M, \quad B_x = B_{0x} + \Delta B_{Mx}, \quad B_y = B_{0y} + \Delta B_{My}, \quad B_z = B_{0z} + \Delta B_{Mz}$$

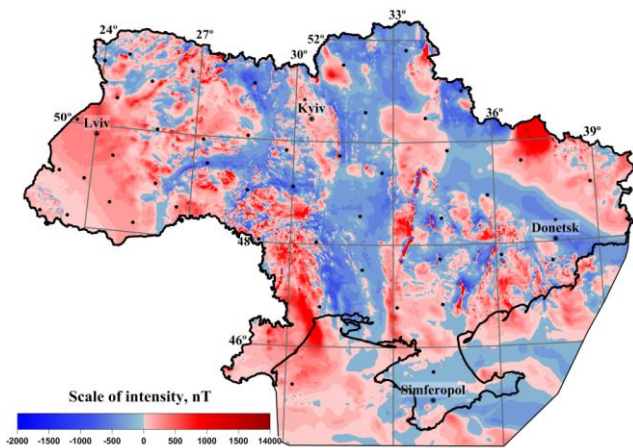$$B_H = \sqrt{B_x^2 + B_y^2} \qquad D = \arccos\left(B_x / B_H\right) \qquad I = \arcsin\left(B_z / B\right)$$

sources of Kursk and Kryvyi Rig anomalies have a magnetization more than 10.0 A/m. The values of the geomagnetic field components B_x, B_y, B_z, B_H, D and I are calculated for the Epoch 2015.

According to calculations the power components of the geomagnetic field have the following limits: Northern B_x = (17440 ÷ 25260) nT, Eastern B_y = (-2200 ÷ 7400) nT; Vertical B_z = 42700 ÷ 52700 nT, Horizontal B_H = (18000÷ 25600) nT. Magnetic declination D in the territory of Ukraine varies from -5,4° to 20.6° (Fig. 2), and magnetic inclination I from 61,1° to 69,1°. According to the results of calculation, anomaly of power and angular components of geomagnetic field are observed in areas of intense magnetic anomalies of the regional and local ranks.
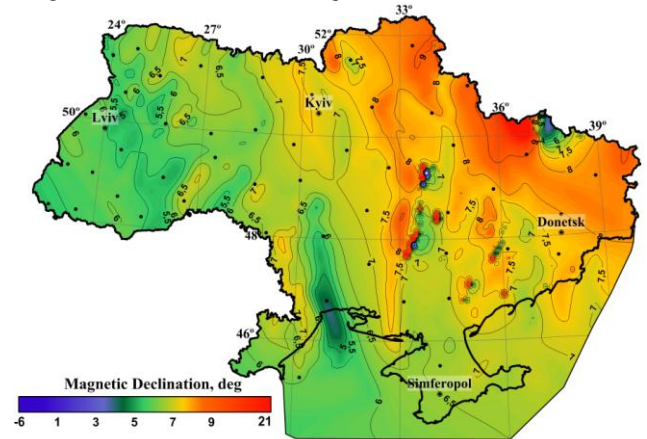

Figure 1: Magnetic Anomaly Map of Ukraine [Nechaeva et al., 2002; Orlyuk et al., 2015]

Figure 2: Magnetic declination in the territory of Ukraine for the epoch 2015.

3D magnetic model of the territory of Ukraine is represented by 230 magnetic sources. The sources of magnetic anomalies are located at depths from 1 to 10 km (sources of local magnetic anomalies) and 7-10 ÷ 30-45 km (sources of regional anomalies). Their magnetization varies from 0.1 A/m to 10.0 A/m. The

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Nechaeva T. S., Shimkiv L. M., Gorkavko V. M., 2002. Map of the anomalous magnetic field (ΔT)a Ukrainian. 1 : 1000 000. Kiev, 1 p. (in Ukrainian).

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