SECULAR CHANGES IN GRAVITY IN UKRAINE

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Repeated measurements of gravity at the same points, carried out at intervals of several years, suggest that during this time gravity undergoes changes on the order of tenths of a milligal. Although these changes often lie within the limits of measurement accuracy, indirect confirmation of their reality is provided by a sufficiently good correlation over large areas between the distribution of these changes and the arrangement of elements of the geological setting (for example, tectonic elements) of the region under study. Such a correlation may be explained by the existence of a connection between present-day deep-seated processes in the Earth' s interior, which affect the gravitational field, and the indicated setting. Consideration of the material by area (and not at individual points, or even along profiles) substantially increases the objectivity of the correlation with the geological setting and the reliability of attributing discrepancies in gravity to secular variations ([1], [2]).

In 1962 and 1969, under the direction of E. A. Azarkina (the Spetsgeofizika Trust), observations of gravity were carried out by the same method at 36 points uniformly distributed over the territory of Ukraine. The second series of observations was conducted specifically to establish secular variations. The root-mean-square error of determining the points in 1962 was $±$0.06 mGal (Worden gravimeter), and in 1969 $±$0.05 mGal (gravimeters of the Institute of Physics of the Earth, USSR Academy of Sciences). Thus, the error in determining the differences in gravity acceleration is $±$0.08 mGal. No dependence was noted between the detected differences Δg and the measured increments of gravity ($g - g_{\text{ref}}$). This indicates that the influence of possible errors in the scale value of the gravimeters used may be neglected. From the results of repeated observations, differences Δg over a period of 7 years from +0.4 to −0.5 mGal were obtained relative to the initial point in Kiev, where the value of gravity (g_{ref}) was conventionally assumed to be unchanged. On the compiled map of differences Δg (Fig. 1), extensive areas of positive and negative values stand out, with a very smooth transition between them.

A correlation is observed between the detected discrepancies in gravity and the tectonic elements of Ukraine ([3]), which makes it possible to explain these

Fig. 1. Diagram of isolines of Δg_t for Ukraine.

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discrepancies to a considerable extent by secular variations Δg_t (in our case $\Delta g_t = g_{1969} - g_{1962}$). The area of positive Δg_t values covers the Ukrainian Shield and the zone of subsidence of the basement toward the Ciscarpathian trough. Northeast of this area, on the Voronezh Massif, the values of Δg_t decrease to −0.5 mGal. The Dnieper-Donets aulacogen is characterized by transitional values of Δg, although on the whole it seems to be marked by some increase in Δg_t, especially in the southeastern part—in Donbass. Negative Δg_t values characterize the zone of subsidence of the basement toward the Black Sea depression.

Between the two noted series of observations (1962 and 1969), interesting work was carried out to reveal secular variations along the Kharkov—Lvov profile ([4]), with an interval between measurements of one

year (1965-1966). Between the results obtained along this profile and those described in the present work, agreement is observed only in the most general outlines. This makes it possible to recommend that future work be carried out not along a profile but over an area, which, as was already noted, makes it possible

Fig. 1. Diagram of isolines of Δg_t for Ukraine. The mean interval between the initial and repeated observations is 7 years.
1 —values of Δg_t in mGal; 2 —isolines of Δg_t at intervals of 0.2 mGal; 3 —uplifts (A —Ukrainian Shield, B —Voronezh Massif); 4 —Dnieper-Donets aulacogen; 5 —regions of Alpine folding.

to judge more objectively the role of secular variations in the obtained differences in the force of gravity (especially if these differences are close to the magnitude of the error).

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Note: Figure translations are in progress. See original paper for figures.