

The correlation analysis of spatial anomalies of computed and measured fields by the GIS-ENDDDB system

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Abstract The GIS-ENDDDB expert-information system includes the global seismic catalogs and measurement data for various geophysical fields. Statistical processing of these data and visualization of the distributing characteristics of the seismic-geodynamic process in the form of isolines make it possible to reveal the spatial relationship between the seismicity distribution and anomalies of geophysical fields. The first attempts to identify this relationship were made with L.S. Sokolova in 2016 based on a visual comparison of maps obtained as a result of applying methods of various data analysis (in particular, the isolines maps of the maximum magnitude of recorded earthquakes M_{\max}) for different samples of seismological catalogs on the one hand, and various modifications of the measured geophysical fields (in this case, the regional component of heat flow (HF) field) on the other hand. These results were more likely qualitative, but later a correlation analysis function was implemented into GIS-ENDDDB for the quantitative comparison of the fields. The correlation analysis is carried out on a histogram of the distributing number of cells (nodes) N_C from the difference ΔF of the reduced values of the fields F_1 and F_2 (relative to the arithmetic mean $F_{i,GSR}$) in the cells that are equal for the compared fields. To identify non-random variations, N_C histograms (ΔF) are given against the background of the normal distribution curve, which allows not only visually (by the deviation of the first columns from the norm), but also quantitatively to establish the degree of correlation. For the studied territories, histograms were obtained that show: 1. a moderate correlation of HF and M_{\max} fields in the North American continent (NEIC catalog, $M \geq 5$, cell $3 \times 4^\circ$); 2. no correlation across the Asia - Far East region (COMPLEX, $M \geq 4$, $H \geq 50$ km, cell $6 \times 8^\circ$); and 3. high correlation in a rectangular region covering the Inside-Asian mountain belt ($30-40^\circ N$; $66-84^\circ E$, COMPLEX, $M \geq 5$, $H \geq 50$ km, cell $1 \times 1^\circ$).

Keywords correlation analysis, catalogs and databases, earthquake, seismic and geodynamic process, geophysical fields.

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