

DISSERTATION SUMMARY

1. Motivation for the selection of research issues.

Research on the phenomenon of seismicity in the Upper Silesian Coal Basin (USCB) has been conducted for many years. Scientists gradually learned the structure of seismic phenomena and tried to determine their origins. However, the research conducted so far has not allowed for unequivocal understanding of the genesis of strong seismic phenomena in this region. There is a lack of research on the influence of tectonics, in particular neotectonics, on the generation of strong tremors in the USCB. Some existing indications of the influence of tectonic activity in the Carpathians arc and Pannonian Basin areas, as well as in the Eastern Alps and the Bohemian Massif, have been investigated in this study. Therefore, it was decided to analyze in terms of temporal and spatial changes in the occurrence of earthquakes in the studied areas, as well as to investigate the possible influence of the seismicity of the considered regions on the occurrence of strong seismic events in the USCB.

2. Scientific purpose of the doctoral dissertation.

The main scientific objective of the dissertation is to check whether seismic activity and the occurrence of strong seismic tremors in two areas: the Carpathian arc with the Pannonian Basin and the Eastern Alps with the Bohemian Massif, may affect the occurrence of strong seismic events in the Upper Silesian Coal Basin.

Therefore, a hypothesis was adopted that the seismicity of the following areas: the Carpathian arc with the Pannonian Basin and the Eastern Alps with the Bohemian Massif had an influence on the generation of strong seismic phenomena in the Upper Silesian Coal Basin.

3. Methodology.

The main aim of the study was a detailed analysis of seismic data catalogues in terms of temporal and spatial changes in the occurrence of earthquakes in the studied areas. The study of the discussed possible impact of the seismicity of the studied regions on the occurrence of strong seismic tremors in the USCB was carried out through a comprehensive comparative analysis of the seismicity of the USCB with other areas, consistent with the mathematical models used in the work. A number of statistical methods were used for the research, in particular: temporal changes in the seismic

activity – time series analysis, spatial – temporal analysis of seismicity, study of changes in the coefficient b of the Gutenberg-Richter relation, analysis of the rate of seismic energy release, time series cross-correlation and Fourier analysis of the cross-correlation function.

4. Research area.

Due to the fact that there are some indications of the influence of tectonic activity in the Carpathians arc and Pannonian Basin, as well as in the Eastern Alps and the Bohemian Massif, it was decided to investigate the impact of the seismic activity of the above regions on the generation of strong tremors in the Upper Silesian Coal Basin. Therefore, the seismic activity of three regions was thoroughly analyzed: the Upper Silesian Coal Basin, the Carpathians arc with the Pannonian Basin and the Eastern Alps with the Bohemian Massif.

5. Synthetic presentation of the most important results and conclusions.

The obtained results indicate that the seismic activity of tremors located outside the Upper Silesian Coal Basin may significantly affect the formation of tectonic or mixed induced – tectonic seismic events in this area.

The obtained high values of the cross-correlation function indicate the possibility of a significant correlation between the seismic activity of the studied regions and the seismic activity of the USCB. The occurrence of several local maxima in the cross-correlation functions, which may indicate the existence of cyclic changes in seismic activity in the compared regions, shifted in relation to each other in time.

An increase in the average level of seismic activity was found in each of the studied areas after 6300 days of observation. Increased seismic activity was recorded in all the studied regions, which may suggest the instability of the rock mass and/or the appearance of new stresses, especially in the most seismically and tectonically active Vrancea zone (Southern Carpathians). The shifting stresses could increase activity in all studied regions. This suggests that all the studied areas can interact to each other.

Also, a comparative analysis of the value of the coefficient b of the Gutenberg – Richter relation indicates the interaction of the three analyzed regions with each other.