

SEARCH FOR CHAOTIC DYNAMICS MANIFESTATION IN MULTISCALE SEISMICITY

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Abstract

This paper contains a description of the methods of studying non-linear dynamics revealed in the collected data sets, and the estimations of selected parameters of non-linear dynamics. Sets of data referring to seismic phenomena of different origin and, most importantly, different scale of observed rock fracturing and destruction processes were analysed. Collected sets were related to fracturing: starting from a microscale, i.e., seismo-acoustic emission registered in rock samples subjected to compression, through mining induced seismicity, to a macroscale that is represented by earthquakes. The data was examined in terms of the presence of non-linear dynamics and deterministic chaos.

An attempt to quantify the parameters of chaos was made in order to define to what extent the process of cracking and destruction of rocks has features common in different scales. Several parameters of chaotic dynamics were applied.

The fractal dimensions, Lyapunov's exponents, the dimension of reconstructed phase space, and the dimension of the attractor were calculated from descriptors characteristic to seismological processes, i.e., time-space distribution and energy distribution of quakes. The usefulness was assessed of the applied methods of data analysis for the description of seismological processes and seismological hazard evaluation.

Key words: chaos, natural seismicity, mining seismicity, acoustic emission.