Synchronization of multifractal properties of continuous acoustic emission in the preparation and implementation of slip along model fault

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An experimental study of the correlation properties of continuous acoustic emission recorded during the preparation and implementation of the dynamic unloading in the laboratory model of the fault zone was carried out. The laboratory model of the fault zone is a classic "slider model" in which the block slides along the interface under the action of the applied shear force. Acoustic emission registration was carried out by several sensors mounted on the side surfaces of the movable block and the fixed base from different sides of the block.

To search for synchronization intervals of the statistical properties of AE in the preparation and implementation of the slip, the parameters of the multifractal spectrum of the AE signal from each of the sensors were calculated (using the MF-DFA method), and the subsequent calculations of the spectral measure of coherence for a different set of time series of spectral parameters in sliding time window of three different sizes, 13.4, 53, 429.5 seconds.

As a result of the analysis, the hypothesis about synchronization of the statistical properties of acoustic emission in the preparation and implementation of the dynamic motion was confirmed. It is shown that the observation (detection) of the effect of synchronization of the statistical properties of AE depends both on the set of parameters for which the spectral measure of coherence is calculated, and on the place of registration of the initial data.

Optimal parameters and source data sets for observing the effect of synchronization of the multifractal properties of acoustic emission before and after the dynamic slip are established. Intervals and features of precursor changes in the spectral measure of the coherent behavior of multidimensional time series of acoustic emission parameters are revealed.

The results show the promise of using this approach for acoustic monitoring of real active faults, as well as the need for further research on the detected synchronization effect in order to determine the influence on it of such factors as composition, physicomechanical properties and humidity of the aggregate, speed and slip modes.

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