



Synchronization of multifractal parameters of regional and global low-frequency microseisms

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Low-frequency microseismic oscillations is an important source of information about processes within Earth's crust although their origin is mostly due to atmospheric and oceanic processes. The Earth's crust is a propagation media for such oscillations and the changes within Earth's crust follows in changing of statistical properties of microseisms.

The vertical seismic records with sampling rate 1 Hz obtained from global IRIS broad-band seismic network (2004-2005, 123 stations) and Japan F-net (1997-2010, 83 stations) were analyzed by estimating their multifractal singularity spectra parameters (the width of singularity spectra support and generalized Hurst's exponent, i.e. argument providing maximum to singularity spectra) within adjacent "short" time windows of the length 30 minutes.

The seismic stations were split into a number of spatial clusters (7 clusters for global IRIS network and 5 clusters for Japan F-net). The median values of singularity spectra parameters were taken from stations in each cluster within 30 minutes time windows - this operation is a spatial smoothing and give a possibility to get rid of gaps within registration on some stations. Thus, a multi-dimensional time series of medians of singularity spectra parameters with uniform sampling time interval 30 minutes were obtained.

A multiple correlation measure (as the product of absolute values of by-component robust canonical correlations) estimated within "long" moving time window (4 months for global IRIS, 2004-2005, network data and 1 year for Japan, 1997-2010, F-net records) was estimated for these median time series. Using of long time windows for estimating multiple correlation measure allows to average influence of storms and hurricanes.

The main results are the following: 1) a synchronization of global microseisms multi-fractal parameters was observed during 160 days prior to catastrophic Sumatra earthquake, $M=9.1$, 26 of December, 2004; 2) a synchronization of regional microseisms multi-fractal parameters in Japan started 0.5 year before Hokkaido earthquake, $M=8.3$, 25 of September and the level of synchronization remains high since the end of 2003 till now - this could be a flag of approaching catastrophic earthquake in Japan.