Global seismic noise and global seismic danger

Lyubushin A.A.

Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences, Moscow, Russia

e-mail: lyubushin@yandex.ru

The global seismic noise, continuously recorded on a network of 229 broadband seismic stations located around the globe for 25 years, from the beginning of 1997 to the end of 2021, has been studied. To study the noise properties, we used a set of statistics estimated daily: the multifractal singularity spectrum support width Da, the minimum entropy of the squared wavelet coefficients En, and the wavelet-based Donoho-Johnston index Gamma. It is shown that the time points of local extrema of the average values of the analyzed noise properties (minima for Da and Gamma and maxima for En) tend to occur before strong earthquakes. The time interval from the middle of 2002 to the middle of 2003 is determined, when the trend of decreasing the average coherence of the noise properties in the auxiliary network of 50 reference points changed to an increase. Along with an increase in the average coherence, there is an increase in the radius of the spatial maximum coherences of noise properties. Both of these trends continue until the end of 2021, which is interpreted as a general sign of an increase in the degree of criticality of the state of the planet and, as a result, an increase in global seismic danger. After two mega-earthquakes close in time: February 27, 2010, M=8.8 in Chile and March 11, 2011, M=9.1 in Japan, there was an explosive increase in the spatial scales of the strong coherence of noise parameters, which is also a sign of an increase in the critical state. The response of seismic noise properties to variations in the length of the day (LOD) has been studied. As a measure of the response distributed over the Earth's surface, the maximum of the coherence spectrum between the LOD and the daily values of the noise properties in the network of reference points, estimated in a sliding time window of 1 year, was used. An estimate of the correlation function between the mean values of the response to LOD and the logarithm of the released seismic energy in a sliding time window of 1 year indicates a delay in energy release with respect to the maxima of the response of noise properties to LOD with a delay time of about 500 days. In connection with this result, an additional intrigue is the extreme increase in the average value of the response to LOD in 2021.

Reference

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