



Spots of Seismic Danger Extracted by Properties of Low-Frequency Seismic Noise

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A new method of seismic danger estimate is presented which is based on using properties of low-frequency seismic noise from broadband networks. Two statistics of noise waveforms are considered: multi-fractal singularity spectrum support width D and minimum normalized entropy En of squared orthogonal wavelet coefficients. The maps of D and En are plotted in the moving time window. Let us call the regions extracted by low values of D and high values of En as "spots of seismic danger" - SSD. Mean values of D and En are strongly anti-correlated - that is why statistics D and En extract the same SSD. Nevertheless their mutual considering is expedient because these parameters are based on different approaches.

The physical mechanism which underlies the method is consolidation of small blocks of the Earth's crust into the large one before the strong earthquake. This effect has a consequence that seismic noise does not include spikes which are connected with mutual movements of small blocks. The absence of irregular spikes in the noise follows the decreasing of D and increasing of entropy En . The stability in space and size of the SSD provides estimates of the place and energy of the probable future earthquake. The increasing or decreasing of SSD size and minimum or maximum values of D and En within SSD allows estimate the trend of seismic danger.

The method is illustrating by the analysis of seismic noise from broadband seismic network F-net in Japan [1-5]. Statistically significant decreasing of D allowed a hypothesis about approaching Japan to a future seismic catastrophe to be formulated at the middle of 2008. The peculiarities of correlation coefficient estimate within 1 year time window between median values of D and generalized Hurst exponent allowed to make a decision that starting from July of 2010 Japan come to the state of waiting strong earthquake [3]. The method extracted a huge SSD near Japan which includes the region of future Tohoku mega-earthquake and the region of Nankai Trough. The analysis of seismic noise after March 2011 indicates increasing of probability of the 2nd mega-earthquake starting from the middle of 2013 within the region of Nankai Trough which remains to be SSD.

References

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