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1 The synchronization of microseismic variations in minute range of periods

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A great role in the SOC model is attached to the correlation of widely spaced seismic events (the collective behaviour) within a seismically active block including the rupture of a future earthquake and substantially exceeding it in linear dimensions. The physical mechanism of the possible remote correlation in seismology is not clear as yet; general theories of catastrophes and phase transitions in open energy systems need to be elaborated in relation to heterogeneous media. Supposedly, such phenomenon can give rise to periodic variations. In this research the several methods were used of detecting periodic components in the sequence of microseismic events. One of them includes estimating point process intensity model including Poisson part and periodic oscillations by maximum likelihood approach. Such estimates within moving time window allow detect non-stationary periodic components in a flow of events. The events could be either usual earthquakes or seismic records peaks over threshold. Another approach consists in direct processing broad-band seismic records (10-10^{-4} Hz) using their wavelet and wavelet-packet decompositions. Well known advantages of wavelet analysis is its ability to detect transient signals. This property allows construct scale-dependent measures of non-stationary behaviour for detecting hidden low-frequency events, probably a series of small “slow earthquakes” preceding large “usual” earthquakes (which could be a new type of precursors). Methods of periodic components detecting within series of events combining with scale-dependent wavelet analysis and adaptive local polynomial filtering present a flexible toolbox for investigating seismic regime before large earthquakes. We analysed the records of IRIS

broadband stations Petropavlovsk, Magadan, Sackhalinsk, Yakutsk and Obninsk that were obtained before the December 5, 1997, Kronotski = 7.7 earthquake on Kamchatka. These stations were located at the distances 310, 900, 2360, 3750 and 8060 km from epicentre. Periodic vibrations in the microseismic background at periods of 10 to 100 min arising during the foreshock process were discovered. They accompanied in some cases by the anomalies of hidden low-frequency events and wavelet, wavelet-packet decompositions. Comparison of records obtained on different stations allows estimating the regional and local peculiarities of such anomalies. Possible mechanisms of the vibrations are discussed in terms of a metastable state of the seismically active zone, the concept of self-organized criticality and triggering effects. This phenomenon broadens the list of earthquake precursors. The work was supported by grant NSh-1270.2003.5.