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ON THE AFTERSHOCKS DYNAMICS AFTER SOME STRONG EARTHQUAKES OF XXI CENTURY

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An earthquake can be attributed to the area of critical phenomena. So it is natural to use a number of concepts and ideas from the theory of non-equilibrium dynamical systems and general catastrophes theory when we are analyzing the seismic data. In this work, we were guided by two well-known ideas concerning the universal properties of critical phenomena. The first one is that the amplitude of fluctuations increases with approaching the bifurcation point, so that at some moment a fairly strong internal pulse provides the critical transition (catastrophe). This transition will be called spontaneous. The second property is that sufficiently close to bifurcation the susceptibility of dynamical system dramatically increases. This means that even a weak external perturbation can cause the catastrophe. Critical phenomenon of this kind is naturally called the induced transition.

We use this knowledge in the analysis of aftershocks after three strong earthquakes occurred during XXI century namely the Sumatra-Andaman earthquake on 26.12.2004, Mw=9.1, Tohoku earthquake on 11.03.2011, Mw=9.0 and deep Okhotsk earthquake on 24.05.2013, Mw=8.2. We have found two interesting manifestations of induced seismicity.

First is the large aftershocks of these earthquakes were occurred with a time delay of about 200 min (or approximately aliquot to this value) respect to appropriate main shock. It is known that the time of seismic surface waves revolution around the Earth equal about 200 min. The idea is that the surface waves propagating outwards from the main shock return back to the vicinity of the epicenter after having made a complete revolution around the Earth and, in principle, may induce there an aftershock.

The second manifestation is the modulation of the aftershock sequence by the fundamental oscillation of the Earth $_0S_2$ excited by the main shock. This oscillation mode equal about 0.309 MHz and correspond to the period of 54 min. It was found that clear peaks with frequency about 0.309 MHz were observed on the spectrum curve of aftershock activity during some time after main shock. Thus, we obtained indirect evidence supporting the hypothesis of the modulation of seismic activity by the spheroidal oscillations of the Earth.

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REFERENCE

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