Geophysical Research Abstracts, Vol. 9, 02595, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02595


# Transformation of frequency-magnitude relation prior to large events in the model of block structure dynamics

A. Soloviev (1,2)

(1) International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Russia (soloviev@mitp.ru / Fax: +74953107032), (2) The Abdus Salam International Centre for Theoretical Physics - SAND Group, Italy

The model represents a seismic region as a system of absolutely rigid blocks divided by infinitely thin plane faults. The blocks interact between themselves and with the underlying medium. The system of blocks moves as a consequence of prescribed motion of the boundary blocks and of the underlying medium. As the blocks are absolutely rigid, all deformation takes place in the fault zones and at the block base in contact with the underlying medium. Relative block displacements take place along the fault zones. Block motion is defined so that the system is in a quasistatic equilibrium state. The interaction of blocks along the fault zones is viscous-elastic ("normal state") while the ratio of the stress to the pressure remains below a certain strength level. When the critical level is exceeded in some part of a fault zone, a stress-drop ("failure") occurs (in accordance with the dry friction model), possibly causing failure in other parts of the fault zones. These failures produce earthquakes. Immediately after the earthquake and for some time after, the affected parts of the fault zones are in a state of creep. This state differs from the normal state because of a faster growth of inelastic displacements, lasting until the stress falls below some other level. This numerical simulation gives rise a synthetic earthquake catalogue.

The behaviour of the frequency-magnitude (FM) relation (Gutenberg-Richter plot) was analysed for a simple structure consisting of 4 square blocks. It has been found that the FM relation demonstrates “upward bend” prior to large (with magnitude $M \geq M_0$) synthetic earthquakes. The similar phenomenon was found formerly for observed seismicity and in other models. The experiments with the block structure model show that this phenomenon is displayed only if a relevant value of $M_0$ is selected. In this case the phenomenon is detected both for the whole structure and for its

parts.