Geophysical Research Abstracts, Vol. 9, 04829, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04829

Evidence of a self-affine asperity fault model in preseismic electromagnetic activity

K. Eftaxias (1), Y. Contoyiannis (2), K. Karamanos (3), M. Kalimeri (1), G. Balasis (4), J. Kopanas (1), G. Antonopoulos (1), and K. D. Nomicos (5)

(1) Solid State Section, Physics Department, University of Athens, Panepistimiopolis, Zografos, 157-84 Athens, Greece, (2) Section of Nuclear and Elementary Particle Physics, Department of Physics, University of Athens, Panepistimiopolis Zografou, Athens 15784, Greece, (3) Centre for Nonlinear Phenomena and Complex Systems, Universit'e Libre de Bruxelles, Campus Plaine, C.P. 231, Boulevard du Triomphe, B-1050, Brussels, Belgium, (4) Department of Earth's Magnetic Field, GeoForschungsZentrum Potsdam, Telegrafenberg, 14473, Potsdam, Germany, (5) Department of Electronics, Technological Education Institute of Athens, Egaleo, 12210 Athens, Greece

An important open question is whether the spatial and temporal complexity of earthquake and fault structures emerges from geometrical and material built-in heterogeneities or from the chaotic behaviour inherent to the nonlinear equations governing the dynamics of these phenomena. Here, we address this question through a detailed analysis of well established preseismic kHz electromagnetic emissions. We use a self-affine asperity model for the earthquake nucleation that mimics the fault friction by means of two fractional Brownian profiles that slide one over the other. An earthquake occurs when there is an overlap of the two profiles representing the two fault faces. At the points of collision, when the pressure around a point of collision exceeds a certain threshold, it causes breaking of the smallest asperity and, consequently, electromagnetic energy is emitted during the breaking of bonds. This allows the stress to relax and the energy, previously accumulated, to redistribute all around; the stresses "siege" a different point of collision and so on. In this way the fracture propagates inside the activated fault. We argue that the sequence of the detected kHz electromagnetic pulses ("electromagnetic earthquakes") witnesses the fracture of two fractional Brownian profiles. The results of present study also suggest that the activation of a single earthquake (fault) is a reduced self-affine image of the whole regional seismicity and a magnified self-affine image of the "laboratory seismicity" in terms of acoustic

or electromagnetic emission.

Acknowledgments: The project is co-funded by the European Social Fund and National Resources - (EPEAEK II) PYTHAGORAS (70/3/7357)- Archimedes.