VERSITA

Acta Geophysica
vol. 60, no. 3, Jun. 2012, pp. 740-757
DOI: 10.2478/s11600-012-0027-7

Simulation and Properties of a Non-Homogeneous Spring-Block Earthquake Model with Asperities

Alejandro MUÑOZ-DIOSDADO[1], Adolfo H. RUDOLF-NAVARRO[2], and Fernando ANGULO-BROWN[2]

[1]Basic Sciences Department,
Unidad Profesional Interdisciplinaria de Biotecnología,
Instituto Politécnico Nacional, Mexico D.F, Mexico
e-mail: amunoz@avantel.net (corresponding author)

[2]Physics Department, Escuela Superior de Física y Matemáticas,
Instituto Politécnico Nacional, Mexico D.F., Mexico

A b s t r a c t

The spring-block model proposed by Olami, Feder and Christensen (OFC) has several properties that are similar to those observed in real seismicity. In this paper we propose a modification of the original model in order to take into account that in a real fault there are several regions with different properties (non-homogeneity). We define regions in the network that is reminiscent of the real seismic fault, with different sizes and elastic parameter values. We obtain the Gutenberg–Richter law for the synthetic earthquake distributions of magnitude and the stair-shaped plots for the cumulative seismicity. Again, as in the OFC-homogeneous case, we obtain the stability for the cumulative seismicity stair-shaped graphs in the long-term situation; this means that the straight line slopes that are superior bounds of the staircases have a behavior akin to the homogeneous case. We show that with this non-homogeneous OFC model it is possible to include the asperity concept to describe high-stress zones in the fault.

Key words: earthquake, faulting, cellular automata, OFC model.