Geophysical Research Abstracts
Vol. 15, EGU2013-10738, 2013
EGU General Assembly 2013

Modeling the interrelation between asperity distributions and b-values by means of a modified Olami-Feder-Christensen model

Markos Avlonitis (1) and Gerassimos Papadopoulos (2)

(1) Department of Informatics, Ionian University, Tsirigoti Square 7, Corfu, 49100, Greece (avlon@ionio.gr), (2) Institute of Geodynamics, National Observatory of Athens, Athens, Greece (papadop@noa.gr)

The role on seismicity of fault characteristics, such as the strength of coupling and fault geometry, has been extensively examined so far. The asperity model stipulates that instead of smooth planar fault surfaces most of coupling is concentrated to the contact between irregularities of the fault surfaces. As a result the tectonic stress is accumulated across a smaller area, the real contact area, than in the total fault area.

To this end, we introduce a modification of the Olami-Feder-Christensen (OFC) spring-block model that models the dynamic evolution of faults due to the real contact areas of asperities along the fault surface. The modification is based on relaxing the assumption of global driving. Indeed, the different asperity distributions are modeled by different real contact areas between the two segments of the fault. The proposed modified OFC model, considers that leaf springs in the vertical direction are only present within the real contact area, whereas horizontal springs are everywhere in space based on the assumption that the segments exhibit elastic behavior.

This specific proposed geometry not only results to that instead of global driving, deformation is driven only by blocks within the real contact area, but also that non-conservative redistribution of forces takes place again only within the real contact area while in the rest of the fault surface there is force conservation due to lack of interactions. Moreover, two different approaches are presented in order to model the dynamic behavior of material points of the fault that lie outside of the asperities. The first is based on the classical OFC model and the second is based on a departure (correction) from the OFC model and more specifically on reconsidering the exact value of the force at each site.

The relation between different power law exponents b, of the emerged power-law distributions of the slip sizes, with the distributions of the corresponding real contact area of asperities within the fault, is estimated through simulation experiments. It is shown that for a wide range of model parameters there is a clear monotonic relationship between the real contact area of asperities and the corresponding power-law exponent b. As a result, based to the proposed model, the different macroscopic b-values can be mapped by different asperity distributions within the fault.