Geophysical Research Abstracts
Vol. 18, EGU2016-14895, 2016
EGU General Assembly 2016

The use of the Finite Element method for the earthquakes modelling in different geodynamic environments

Raffaele Castaldo and Pietro Tizzani
IREA, CNR, Naples, Italy (castaldo.r@irea.cnr.it)

Many numerical models have been developed to simulate the deformation and stress changes associated to the faulting process. This aspect is an important topic in fracture mechanism. In the proposed study, we investigate the impact of the deep fault geometry and tectonic setting on the co-seismic ground deformation pattern associated to different earthquake phenomena. We exploit the impact of the structural-geological data in Finite Element environment through an optimization procedure. In this framework, we model the failure processes in a physical mechanical scenario to evaluate the kinematics associated to the Mw 6.1 L'Aquila 2009 earthquake (Italy), the Mw 5.9 Ferrara and Mw 5.8 Mirandola 2012 earthquake (Italy) and the Mw 8.3 Gorkha 2015 earthquake (Nepal). These seismic events are representative of different tectonic scenario: the normal, the reverse and thrust faulting processes, respectively.
In order to simulate the kinematic of the analyzed natural phenomena, we assume, under the plane stress approximation (is defined to be a state of stress in which the normal stress, sz, and the shear stress sxz and syz, directed perpendicular to x-y plane are assumed to be zero), the linear elastic behavior of the involved media. The performed finite element procedure consist of through two stages: (i) compacting under the weight of the rock successions (gravity loading), the deformation model reaches a stable equilibrium; (ii) the co-seismic stage simulates, through a distributed slip along the active fault, the released stresses.
To constrain the models solution, we exploit the DInSAR deformation velocity maps retrieved by satellite data acquired by old and new generation sensors, as ENVISAT, RADARSAT-2 and SENTINEL 1A, encompassing the studied earthquakes. More specifically, we first generate 2D several forward mechanical models, then, we compare these with the recorded ground deformation fields, in order to select the best boundaries setting and parameters.
Finally, the performed multi-parametric finite element models allow us to verify the effect of the crustal structures on the ground deformation and evaluate the stress-drop associated to the studied earthquakes on the surrounding structures.