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Deformation rates and localization of an active fault system in relation with rheological and frictional slip properties: The Corinth Rift case

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The Gulf of Corinth in Greece has attracted increasing attention because of its seismically active complex fault system and considerable seismic hazard. It is one of the most active extensional regions in the Mediterranean area. However, there are still open questions concerning the role and the geometry of the numerous active faults bordering the basin, as well as the mechanisms governing the seismicity. The Corinth Rift Laboratory (CRL http://crlab.eu) project is based on the cooperation of various European institutions that merge their efforts to study fault mechanics and related hazards in this natural laboratory with 10 destructive earthquakes per century (Magnitude > 6), among which 4 in the selected region of CRL. This active rift continues to open over 10-12 Km of width at a rate of 1:5 cm=yr. Most of the faults of the investigated area are in their latest part of cycle, so that the probability of at least one moderate to large earthquake (Magnitude = 6 to 6:7) is very high within a few decades.

In the first part of this work, two-dimensional

finite element models of a fault system is considered to estimate the effects of the crust rheological parameters on the stress distribution, the horizontal and vertical deformation in the vicinity of the faults, and the plastic deformation localization. We consider elasto-visco-plastic rheology with a power law viscosity for dislocation creep modelling and the Drucker-Prager yield criterion for plasticity. We investigate the rheological properties of the crust and examine their compatibility with both horizontal and vertical GPS observations recorded during campaigns conducted in the last twenty years.

The second part is devoted to simulations involving rate and slip history friction laws for earthquake occurence prediction and seismogenic depth approximation. The case of a single fault is examined first, then two active faults are considered to highlight the effect of their interactions on the seismic cycle characteristics and improve our ability to predict earthquakes.