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Analysis of the 2003-2004 microseismic sequence in the western part of the Corinth Rift

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The Corinth rift is one of the most seismically active zones in Europe. The seismic activity follows a swarm organization with alternation of intensive crisis and more quiescent periods. The seismicity mainly occurs under the Gulf of Corinth in a 3-4 km north-dipping layer between 5 and 12 km. Several hypotheses have been proposed to explain this seismic layer. Nevertheless, the relationships between seismicity, deep structures and faults mapped at the surface remain unclear. Moreover, fluids seem to play a key role in the occurrence of the seismic activity (Bourouis and Cornet 2009, Pacchiani and Lyon-Caen 2009). Recently, a detailed analysis of the microseismicity (multiplets identification, precise relocation, focal mechanisms determination) between 2000 and 2007 in the western part of the Corinth rift have highlighted north-dipping (and some south-dipping) planar active microstructures in the seismic layer with normal fault mechanisms (Lambotte et al., in preparation; Godano et al., in preparation).
A multiplet (group of earthquakes with similar waveform) can be interpreted as repeated ruptures on the same asperity due to transient forcing as silent creep on fault segment or fluid circulation. The detailed analysis of the multiplets in the Corinth rift is an opportunity to better understand coupling between seismic and aseismic processes.
In the present study we focus on the seismic crisis that occurred from October 2003 to July 2004 in the western part of the Corinth Gulf. This crisis consists in 2431 relocated events with magnitude ranging from 0.5 to 3.1 (b-value = 1.4). The joint analysis of (1) the position of the multiplets with respect to the faults mapped at the surface, (2) the geometry of the main multiplets and (3) the fault plane solutions shows that the seismic crisis is probably related to the activation in depth of the Fassouleika and Aigion faults. The spatio-temporal analysis of the microseismicity highlights an overall migration from south-east to north-west characterized by the successive activation of the multiplets. We next perform a spectral analysis to determine source parameters for each multiplet in order to estimate size of the asperities and cumulative coseismic slip. From the preceding observations and results we finally try to reproduce the 2003-2004 microseismic sequence using rate-and-state 3D asperity model (Dublanchet et al., submitted). The deformation measured during the crisis by the strainmeter installed in the Trizonia island is used in the modeling to constrain the maximum slip amplitude.