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Distribution of deformation on an active normal fault network, NW Corinth Rift

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Over the last 20-25 years, geodetic measurements across the Gulf of Corinth have recorded high extension rates varying from 1.1 cm/a in the east to a maximum of 1.6 cm/a in the west. Geodetic studies also show that current deformation is confined between two relatively rigid blocks defined as Central Greece (to the north) and the Peloponnesus to the south. Active north dipping faults (<1 Ma) define the south coast of the subsiding Gulf, while high seismicity (major earthquakes and micro-seismicity) is concentrated at depth below and to the north of the westernmost Gulf. How is this intense deformation distributed in the upper crust? Our objectives here are (1) to propose two models for the distribution of deformation in the upper crust in the westernmost rift since 1 Ma, and (2) to place the tectonic behaviour of the western Gulf in the context of longer term rift evolution.

Over 20 major active normal faults have been identified in the CRL area based specific characteristics (capable of generating earthquakes M> 5.5, active in the last 1 M yrs, slip rate >0.5 mm/a). Because of the uncertainty related to fault geometry at depth two models for 3D fault network geometry in the western rift down to 10 km were constructed using all available geophysical and geological data. The first model assumes planar fault geometries while the second uses listric geometries for major faults. A model for the distribution of geodetically-defined extension on faults is constructed along five NNE-SSW cross sections using a variety of data and timescales. We assume that the role of smaller faults in accommodating deformation is negligible so that extension is fully accommodated on the identified major faults. Uncertainties and implications are discussed. These models provide estimates of slip rate for each fault that can be used in seismic hazard models.

A compilation of onshore and offshore data shows that the western Gulf is the youngest part of the Corinth rift having initiated around 400 Ka. Current N-S extension rates and total extension decrease westward along the Gulf from Aegion to Rion. The older rift (Plio-Pleistocene) that is preserved in the northern Peloponnesus records a northward migration of fault activity since initiation of rifting around 5 Ma, and a stepwise acceleration of N-S extension that was accommodated on fewer, larger faults. The current high extension rates are recent, probably Holocene. At around 400 ka deformation stepped westward and northward to overlap with the eastern limits of the Patras rift. This migration and acceleration of deformation is thought to be related to larger scale regional tectonics such as the underlying subduction and/or the SW propagation of the North Anatolian Fault at depth.