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Corinth Rift active crustal fault flexure

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The mode of deformation at depth of the Corinth Rift remains debated to date even though the rift is an excellent site to study normal fault mechanics; onshore and offshore markers of Pleistocene 100ky climate cycles describe the evolving elastic flexure of the rift master fault across its strike and its footwall fluvial network characterizes it along strike. Here we analyse uplifted Late Pleistocene marine terraces and footwall catchment profiles using topography data at 2 and 20 m resolution respectively. We characterize a prominent crustal-scale mechanical flexure across and along the rift south flank, a finding that is hard to reconcile with rift growth models of continued extension with a shallow detachment. Elastic fault flexure occurs at the scale of the full rift (∼100 km along-strike) and is maximal in the rift centre, where drainage reversal of two catchments suggests very fast slip rates on the master fault. Elastic fault flexure decays along the rift shoulder, indicating smaller rates of footwall flexural uplift or younger onset of faulting along strike. The scale and amplitude of such fault flexure can be explained by a steep fault growing in a strong crust. To verify this finding, we integrate our data with an offshore seismic section and determine a subsidence/uplift (S/U) ratio of 1.2-2.4 that we use to constrain lithospheric-scale finite element models. The best fit with the S/U ratio occurs when models use a 40-60° planar fault through an elastic upper crust and a lower crust with high viscosity beneath the Corinth Rift. This rheology may define the response of continental lithosphere to rapid localized deformation. Our results support a <1 Ma shift in plate boundary conditions that is consistent with the hypothesis relating rift growth with the southwestwards process-zone tip propagation of the North Anatolian Fault.