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Interseismic deformation and low angle normal faults: effects of fault geometry and crustal rheology with application to Central Apennines

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The interpretation of surface deformation recorded in extensional areas with low angle normal faults (LANF) is a challenging issue due to the mechanical inconsistency of the orientation of fault planes with respect to the lithostatic load. Nonetheless, LANF are not only present in many regions (such as western North America, Eastern Alps, Gulf of Corynth), but also seismically active in some cases such as in the Central Apennines, where diffuse microseismicity has been recorded along the Alto Tiberina fault. We model a 2D section across the Central Apennines chain where extensive geophysical surveys have been performed in the past and good knowledge of the main structural features has been achieved. In this area geodetic estimates show a present day extension rate of about 2.5 mm/yr at the surface in addition to geological investigations suggesting an average slip rate of about 1 mm/yr accommodated by the Alto Tiberina fault during the last 2 million years. We compare the interseismic GPS velocities observed in the last decade to predictions of a finite element model taking into account the fault system, its frictional properties, crustal layering and rheology. Our purpose is to constrain some key parameters of the system such as the locking depth of the LANF, and check how observed deformation may be affected by frictional properties of the upper crust and thermal state of the lower crust. Additionally we try to enlighten the relationships between the Alto Tiberina fault and other antithetic structures such as the Gubbio fault where about 3000 earthquakes have been recorded since January 2013 culminating with a M=4.0 event in early January 2014.