



Crustal Deformation of Western Anatolia based on Upper Mantle Convection

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Western Anatolia is stretching in the north-south direction and its hot crust is thinning. On the other hand, high Bouguer gravity values, uplifted terraces, and positive residual topography suggest that the area is rising (despite the stretching). The anomalous topography may be related to underlying mantle dynamics, but the concurrent crustal deformation may be important too, and has not been considered in previous studies. It can be postulated that pull of attached (western) part of the subducting African slab can generate SW-NE extensional deformation in Western Anatolia. However, the extension in the region is almost pure N-S, in lateral dimension, based on GPS measurements. Further, based on interpretations of seismic tomographic inversions eastern part of the subducted slab, south of the Western Anatolia, seemed to be detached from the African plate and hence may not generate a strong southward slab-pull force.

We model mantle flow in conjunction with active crustal deformation to explain the tectonics in the region. N-S extension (~ 20 mm/yr) of the crust in the models was driven by mantle circulation based on a thermal structure derived from seismic tomography profiles for the region. Using various combinations of rheological and mechanical parameters, we systematically designed and carried out more than a thousand experiments. The modelling is notable also because it uses temperature data converted from heat flow values for the crust of the Western Anatolia which is characterized by high heat flow. In general, instead of using assumptions using observed data for model inputs causes better results. We compare the numerical topography results with observed residual topography based on crustal models interpreted from recent receiver function studies. A good correlation of experimental results with the observations suggests that the accelerating diffuse lateral extensional deformation of the crust in Western Anatolia has been generated by mantle convection, which also results in considerable uplift of the surface.