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Updated seismic hazard on East Anatolian Fault Zone, Turkey

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It is widely accepted that earthquakes change the stress, both positively and negatively, on neighbouring faults. Modelling these coseismic stress changes together with the postseismic deformation and the inter-seismic stress loading enables us to better understand the state of stress on a particular fault in a given region.

In this research, we analyse a sequence of 11 well constrained earthquakes (M>6) along the East Anatolian Fault Zone (EAFZ) to assess its stress evolution during 1822-2013 period. In order to calculate static Coulomb stress values, 3D stress perturbations of previous earthquakes were resolved on their actual 3D orientations and slip directions. A total of 204 points (˜2.5 km intervals) were used with the actual (irregular) strike, dip and rake values along the EAFZ (580 km). We used the Nalbant et al. (2002) methodology for calculating coseismic and secular loading periods. According to postseismic GPS and InSAR data, we have modelled the viscosity of lower crust and/or upper mantle values ranging between 10̈17-10̈20 Pa s on different earth stratification models. Sensitive viscoelastic stress change calculations have been carried out to assess the robustness of the results using 8 different earth stratification models, each with different coefficient of friction values. Mantle viscosity values, for each models, are kept constant at ηlc/ηm=50 changing between 10̈18-10̈20 Pa s. In turn, for the upper crust viscosity values, values are kept constant at ηm/ ηlc=50 changing between 10̈18-10̈20 Pa s.

Seismic hazard results show that there are two regions of the EAFZ with high stress increase; a region extending from south of the city of Kahramanmaras to south of city of Malatya, and a region between east of the city of Elazig and north east of the city Bingol. Those results are consistent with the Nalbant et al. (2002) findings. Additionally, sensitive postseismic stress calculations have shown greater stress build up along the fault line.