Three Approaches to Interseismic Slip Rates on the Marmara Faults and Their Tensorial Correlations with the Kostrov-Based Strain Rates

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The interseismic slip distribution in the Marmara fault system represents both observational and modelling challenges. The observational challenge is obvious: the faults are under water and to understand their interseismic behavior (creeping versus locked) requires expensive and logistically difficult underwater geodetic measurements, alongside those on land. Up to now, two such underwater studies have been conducted and they suggest that the segment to the south of Istanbul zone (so-called Central segment) is locked while some creep is probably going on along the neighboring segment to the west. Given these two important findings, the slip distribution problem is still non-trivial due to the fact that our experiments so far demonstrate that the block-based slip inversions and those that only consider a single fault (with the same geometry as one of the boundaries of the blocks) give significantly different results. In this study we approach the problem using three methodologies: block models with spatially non-varying strains within individual blocks, a boundary element approach and a continuum kinematic approach. Although the block model does not give spatially varying strains, the inversion results from the block model can be used as an input to model strain field in the vicinity of the fault. We constract a formulation to correlate the results from these with the strain rates obtained using focal mechanism summations.

GPS velocities are taken from previous studies around the Marmara Sea such as Reilinger et al., (2006), Aktuğ et al., (2009), Ergintav et al., (2014), Özdemir et al., (2016) and Özdemir and Karslıoğlu, (2019). Since all studies have different processing strategies or by choosing different reference frames, the GPS velocity fields could not be combined directly. Hence, we combined all velocity fields by minimizing the residuals between the velocities of the common sites in the

studies. For this purpose VELROT program (Herring et al 2015) was used. Reilinger et al., (2006) was selected the reference field and other velocity fields were aligned one by one on it. If the combined sigma of the pairs of velocity estimates in the residuals are greater than 2 mm yr^{-1}, that sites are excluded from the final velocity field. As a result, 127 GPS velocities were used in the developed models.