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Present Day Slip Deficit of the Tuzla (Izmir) Fault based on GPS measurements

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How would a critically stressed fault fail? Addressing this question would play a major role on earthquake forecasting, especially to forecast slip and size of a pending destructive earthquake. In this context, we integrate geodetic, seismological and geological setting along the Tuzla Fault to understand pre-seismic behavior of this fault and therefore to forecast its co-seismic characteristics in case of a potential large earthquake. Revisiting location and size of M>5.5 earthquakes in the target region, we found that the Tuzla Fault did not completely fail since 1883. Historical earthquakes suggest a ∼140 years recurrence period. The latest two earthquakes that have potential to fail entire fault occurred in 1739 (Mw=6.8) and 1883 (Mw=6.8). Structural investigations show that Tuzla Fault is a dextral fault characterized by three main fault segments, namely Çatalca, Orhanlı and Cumalı segments, striking NE - SW in southern Izmir (Western Turkey). Its total length is ∼55 km consisting of a ∼45km on-land and a ∼10km off-shore section. Our first order calculations show that Tuzla Fault can generate an earthquake within a magnitude range of 5.3-6.8 for a slip deficit range of 1-200 cm. Boğaziçi University, Kandilli Observatory and Earthquake Research Institute, Geodesy Department has deployed a 15-station campaign based GPS network to monitor geodetic deformation along the Tuzla Fault. We analyze six epochs of GPS measurements from this network that are currently available for the time period of 2009 – 2017. The results allow us to refine tectonic velocity field in the horizontal axis and an average locking depth using the arc-tangent approach. Refined velocity field is used to characterize along-fault slip deficit using back-slip approach. Finally, the results will be combined to forecast size and slip of large earthquake that will potentially fail Tuzla Fault in future.