Present Seismotectonic Behavior of the EAF from Improved Seismicity Catalog and Earthquake Source Mechanism Solutions

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The seismotectonic behavior of the Eastern Anatolia is predominantly controlled by the East Anatolian Fault (EAF). Together with the North Anatolian Fault (NAF), this ~400 km long sinistral transform fault, accommodates the westward motion of Anatolia between Anatolian and Arabian plates with a slip rate of ~10 mm/yr which is significantly slower than the motion of the NAF (25 mm/yr). Although this two major faults are similar in terms of the migration of the large earthquakes from east to west, the present seismicity of the EAF is high compared to the NAF. Except for the several earthquakes with Mw > 5, there were no devastating earthquakes during the instrumental period along the EAF. The absence of large earthquakes during the last ~50 years along the EAF indicates presence of significant seismic gaps and potential seismic hazard in the region. Recent studies indicate segmentation of the EAF with varying lengths of creeping and locked segments. Some details of the geometries and the slip rates of these segments have been estimated by the InSAR observations. Both InSAR and GPS observations indicate that the maximum creep along this the EAF is ~10 mm/yr, approximately the slip rate of the EAF.

While both geodetic data verify the existence of creep from surface deformation, its relation to the seismic behavior of the EAF is less clear. There is a ~30 km long creeping segment to the north-east of Lake Hazar which generates no significant seismicity. On the other hand, another creeping segment to the south-west of Lake Hazar, there are repeating events, below the depth of 10 km, with a horizontal extent of 15 km. The highly fractured and complex structure of this fault zone is also confirmed by the available focal mechanisms which shows significant variety.

In this study, we update seismicity catalog with improved locations to date and present a uniform and high quality focal mechanism catalog down to M4 completeness, using regional waveforms. The seismicity catalog is used to estimate the geometry of the segmentation while the novel earthquake source mechanisms are used to understand the kinematics of the segments and interactions. Moreover, we present the latest M4.9, 2019, Sivrice earthquake, pointing out a location where the stress is perturbed due to a transition from creeping segment to locked
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