

Orientation of Stress Field in the Proximity of the Creeping Section of the North Anatolian Fault Zone, Turkey

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The 1500 km long North Anatolian fault zone (NAFZ) accommodating the motion between the Eurasian plate and the Anatolian block is one of the most active transform faults in the world. The relative motion of the Anatolian block in Eurasian fixed frame is westward including considerable counterclockwise rotation component. The slip rate along the NAFZ as estimated by the recent geodetic studies is about 25 mm/yr. In the last century during the 1939-1999 period eight major earthquakes ($M > 7$) successively propagated westward rupturing more than 1000 km of the entire length of the fault.

Ismetpasa segment is a 70 km long fault section of the NAFZ that was ruptured by the 1944 major earthquake ($M=7.3$) and the 1951 large event ($M=6.9$). About a decade after the identification of a creeping event along the San Andreas fault triangulation and creepmeter measurements studies carried out in 1970s indicated that NAFZ is not locked around the Ismetpasa segment and ongoing slip is taking place. Recently, the thirty-year long triangulation and creep-meter data was enriched with InSAR and GPS data. The modeling of the geodetic data shows that the slip rate in the middle portion of Ismetpasa segment is about 11 mm/yr and gradually decreases towards the end of the segment to 8 mm/yr and the fault creeps at a shallow depth between 0-7 km (Cakir et al, 2005, EPSL 238, pp 225-234). Moreover, the time history of various measurements of fault-creep indicates that the creeping rate gradually decreased from 50 mm/yr to present day rate of 8 mm/yr showing that creeping observed along the Ismetpasa segment is a transient event.

Several broadband seismic stations were deployed during the last few years in the vicinity of Ismetpasa segment as part of the National seismic network operated by Kandilli Observatory and Earthquake Research Institute. We analyze the seismic records at these stations to retrieve the source parameters of nearby small to moderate size events using the method given at Kuge (2003). Until present we could estimate the CMT parameters of 48 events ranging between $3.0 < M_w < 4.8$ most of which are confined to the upper crust. Few of events are on the main fault and most of them are tens of km away from the main trace of the fault. The stress tensor inversion of these focal mechanisms which are mostly predominantly strike-slip, yield a maximum compressive stress axis directed at high angles (80-100 degrees) to the NAFZ. The P-axis of the focal mechanisms of the events close to the NAFZ is approximately 45 degree to the main trace of the fault while the distant ones tend to be at higher angles. These features are not specific just for the Ismetpasa segment but rather they extend far beyond along the NAFZ.

Keywords: Focal mechanism, stress tensor inversion, creeping fault, North Anatolian fault zone, Turkey