Seismo-geodetic Behavior of Basic Tectonic Elements in Anatolia

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Abstract

Understanding earthquake and faulting processes requires investigating tectonic-related surface and sub-surface movements of the Earth's crust. In this context, we jointly investigate geodetic and seismological data in Anatolia and surroundings, representing seismically the most active region of Europe. We combine GPS measurements and seismicity for the time period of 2006-2016 in order to characterize physical stage of the upper crust at different fault sections. Velocity field has been provided by CORS-TR (TUSAGA-Active) consisting of 146 permanent GPS stations monitoring the target region continuously. Earthquake catalogue has been provided by Kandilli Observatory and Earthquake Research Institute (KOERI) monitoring the target region at a magnitude detection threshold of 3.0 for the time period of our analysis. We produced grid-based distribution of residual velocity field in order to map major inter-plate faults/intra-plate tectonic regimes and their role in whole tectonic process. We also produced a map of seismicity-generated slip distribution along the entire target region. Integrating geodetic and seismological data leads us to quantitatively verify following features: (1) The North Anatolian Fault (NAF) and The East Anatolian Fault (EAF) are the major plate boundaries surrounding the Anatolian Plate. (2) NAF is the most active plate boundary accommodating a slip rates ranging between 7-23.5 mm/yr. (3) The slip rates systematically increase from the east to the west along the fault zone. (4) EAF accommodates relatively a slower inter-plate deformation at an annual slip rate range of 6-9 mm/yr. (5) Anatolian plate reflects internally a very stable tectonic behavior almost for decade. (6) Western Anatolia is however internally deformed as suggested by a variety of slip rates. This probably due to complex fault network developed under large-scale extensional regime. (7) We captured few creeping sections of NAF. (8) In the Sea of Marmara region, where a $M > 7$ earthquake is expected in near future, northern branch of NAF accommodates most of the tectonic slip. (9) Southern branch is however almost inactive based on geodetic and seismological observations.

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