Numerical Model to Investigate Slip Behavior of the Main Marmara Fault

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Abstract

The Main Marmara Fault (MMF) branch of the North Anatolian Fault Zone (NAFZ) has been one of the most studied fault segments in the globe, especially after the 1999 Izmit and Duzce earthquakes that occurred in the NAFZ on land east of the Sea of Marmara. Previous studies utilizing space geodesy techniques aimed to reveal the interseismic behavior of the MMF, but the distance of the GPS sites from the offshore fault trace and uncertainties on fault geometry make the problem difficult. On the other hand, the improvement of the technology enables to perform underwater geodetic observations. Two underwater studies, focused on the Western High and Kumburgaz basins, have been carried out recently and showed that, at least at the seafloor, the MMF is creeping at about 10 mm/yr on the Western High and locked in Kumburgaz Basin. Ozbey et al., (2021) showed that these results were compatible with available GPS data sets and proposed a distribution of locking on the MMF compatible with both marine and land observations. In this study, we recalculate the distribution of locking using an improved GPS data set. This new data set has smaller uncertainties on velocities and contains some additional GPS sites particularly located throughout the coastline of the northern part of the Sea of Marmara. Taken alone, this new data set indicates low coupling on the Central Marmara segment including in Kumburgaz basin, contradicting earlier inversion results. We here analyze the problem using the same method as in Ozbey et al., (2021). This method is based on a block model approach that is capable to invert block rotations, average strain rate within each block and slip deficit on the fault node points. The backslip on the fault nodes is calculated by the method given by Okada (1985, 1992). We also incorporated the seafloor geodesy data (coming from previous studies mentioned-above) into some of the models to address the effect of these new types of data in the inversions. Furthermore, we have also shifted the nodes for some block model inversions to take into consideration the sensitivity of the inversion results to the arbitrary position

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of the nodes. Our main objective in this presentation is to display the various results and discuss the differences among them. In addition, we also compare these new model solutions to published models. We believe that this comparative inquiry brings about a significant contribution to possible future models for the study area.