

Focal Mechanisms in the Sea of Marmara Derived from First Motion Polarities of OBS and Nearby Land Stations

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Waveform data from two Ocean Bottom Seismograph (OBS) deployments in 2014-2015 and 2015-2016 are utilized to estimate a focal mechanism for the events taking place nearby the Western and Central Marmara fault segment, a part of the North Anatolian Fault (NAF). For each observation, 15 OBS stations were deployed close to Marmara fault with their spatial intervals of about 10 km. The OBS data are integrated with the land seismic stations operated by Kandilli Observatory and Earthquake Research Institute (KOERI) so as to improve the azimuthal and take-off angle coverage. The size of the events analyzed in the study are classified as micro-earthquakes and the number of polarities generated by each micro-earthquake are limited. The data was elaborated using two different analysis routines; zSacWin and Horiuchi (1995) algorithms, where in the former case the mechanism are retrieved individually. Whereas in the later method simultaneous inversion of the polarities of cluster of earthquakes taking place in a specific region are performed to obtain a stress tensor and focal mechanism of the individual events constituting the cluster. The best stress tensor is the one that yield minimum misfit polarities for the whole data set.

1D velocity model of KOERI is used in zSacWin algorithm, whereas 3D velocity structure obtained for the area beneath the OBS stations used in Horiuchi algorithm improved the location estimations. Therefore, before inverting the polarity data set for focal mechanisms new calculations of azimuth and take-off angles are adopted. Due to limited number of polarities, the data acquired in Western Marmara segment including 58 events, the method of Horiuchi is used better to constrain equally well both the stress tensor and the focal mechanisms. The horizontal maximum compressive stress axes is oriented NW-SE indicating strike-slip tectonic regime. Yamamoto et al. (2015, EPS) and Yamamoto et al. (JGR, in revision) identified the region as tectonically and seismically complicated where NAF change strike from E-W to ENE-WSW, interaction of segments with different geometries exist, deep subcrustal seismic activity occurs. Consequently, complexity of focal mechanisms derived from such area is among the expectations. Fault segmentation of NAF creates extensional and compressional features revealed by several normal faulting and reverse fault plane solutions. Similarly, the fault plane solutions derived from the Central segments characterize both the fault segments and the interaction of the fault segments. Some focal mechanisms around the Central High show predominantly thrusting, providing evidences on uplift tectonics. Further east several focal mechanisms are derived from the events taking part in the NW corner of the Cinarcik Basin mostly showing extension.