Microseismicity distribution and inferred fault geometry beneath the western Marmara Sea, Turkey, deduced from long-term ocean bottom seismographic observations

*Yojiro Yamamoto[1], Dogan Kalafat[2], Ali Pinar[2], Narumi Takahashi[3,1], Zeynep Coskun[2], Remzi Polat[2], Haluk Ozener[2], Yoshiyuki Kaneda[4,1]

1. Japan Agency for Marine-Earth Science and Technology, 2. KOERI, Bogaziti University, 3. National Research Institute for Earth Science and Disaster Resilience, 4. Kagawa University

The North Anatolian Fault (NAF) is the transform plate boundary between Eurasian and Anatolian plates. The reginal rate of its dextral strike-slip displacement is about 25 mm/yr. In particular, a part of NAF beneath the Marmara Sea is recognized as a seismic gap for M >7 earthquake during more than 100 years. Earthquake hazard and disaster mitigation studies in Marmara region are sensitive to detailed information on fault geometry and its coupling status beneath the Marmara Sea. However, it is difficult to obtain precise hypocenter location from only onshore permanent seismic stations. Thus, we have started a series of long-term ocean bottom seismographic (OBS) observations beneath the western and central Marmara Sea since 2014. First, we have installed 15 OBSs along the western part of Main Marmara Fault (MMF) from 2014 to 2015. Using these data, Yamamoto et al. (2017) identified a segment boundary of the MMF beneath the central basin of the Marmara Sea (28.05˚E). Besides, they proposed that the zones of no seismicity within the upper crust appear to indicate locked sections of the MMF. In this study, we analyze the second observation data (from 2015 to 2016). The OBS location for first and second observations were almost same. We have conducted the double-difference relocation by using 3-D velocity model obtained by Yamamoto et al. (2017), and obtained 818 relocation results.
The result shows that the feature of hypocenter distribution, including the location of no seismicity zones obtained by Yamamoto et al. (2017), is not changed, suggesting that the coupling status along the fault is almost same during at least two years. The largest no seismicity zone extended over the upper crust is located between 28.45˚E and 28.65˚E, where strong coupling is suggested from seafloor geodetic observation (Lange et al., 2019; Sakic et al., 2016). By combining the relocation result of first and second phases, the detailed fault geometries were clarified. Beneath the Western High and western Central Basin (27.75˜28.05˚E), we found two branch faults whose dip angles are gentler (30˜60) than that of MMF (almost vertical). The cross point of two branch faults and MMF locates about 15 km depth of MMF. Although these faults might relate to the pull-apart or negative flower structure around the Central Basin, we could not find similar structure in eastern Central Basin.

Keywords: The North Anatolian Fault, Marmara Sea, Seismicity, Fault geometry

