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A robust seismic structure along the North Anatolian Fault beneath the Central Marmara Sea, and its implication for seismogenesis

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The offshore part of the North Anatolian Fault (NAF) beneath the Marmara Sea is a well-known seismic gap for future $M > 7$ earthquakes in the sense that more than 250 years have passed since the last major earthquake in the Central Marmara region. Here, an assessment on the location of possible asperities to host the expected next large earthquake is done based on the heterogeneities on the seismic velocity structure. Using long-term ocean bottom seismograph (OBS) observation data, seismic tomography and precise hypocenter estimations have been conducted. As a result, about five times more microearthquakes than the events in a land-based catalog has been detected. A comparison with previously published results suggests that the seismicity pattern has not changed during the three years period between Sep. 2014 and Jun. 2017. The obtained velocity model shows strong lateral contrast whose changing points locate at 28.10°E and 28.50°E . The western corner of the area (28.10°E) corresponds to a segmentation boundary where the dip angle of the NAF segments changed. The high velocity zones in the tomographic images are characterized by low seismicity eastward from the segment boundary at 28.10°E . Eastern 28.50°E , the high velocity zone becomes thicker in the depth direction. These zones are interpreted as asperities to be ruptured by the next large earthquake which are possibly accumulating strain since the mainshock rupture associated with the May 1766 $M_{s}7.3$ earthquake.