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Improving the study of the seismicity in the western and central parts of the Sea of Marmara using Ocean Bottom Seismometers

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The Marmara Sea is located between the Agean Sea and the Black Sea, along the North Anatolian strike-slip fault, which experienced a sixty year sequence of earthquakes since 1940. Prior to this sequence, which ended with the Izmit and Duzce earthquakes in 1999, at the eastern end of the Sea of Marmara (SoM), the fault ruptured to the west in 1912 in Ganos, with an estimated moment magnitude of 7.4. Therefore, a major earthquake is expected within the SoM seismic gap.

In order to better understand the seismicity and to reduce the threshold of detection, a network of ten OBS with four components was deployed by Ifremer with R/V Yunus of Istanbul Technical University, in the western and central parts of the Marmara Sea to record the micro-seismicity from the immediate vicinity of the main Marmara Fault, between April and August, 2011. The network was specifically designed to survey the segments crossing the Western High, where gas hydrates where recently found, the Central Basin and the Kumburgaz Basin. During this period more than one hundred earthquakes were detected by the EMSC (European-Mediterranean Seismological Centre) in the Sea of Marmara.

Because the basins of the Sea of Marmara are filled with more than 5 km of Plio- Quaternary soft (“slow”) sediments, it is of critical importance to take into account the velocity structure of the offshore domain, which is drastically different from the one onshore, and the bathymetry. To improve the localization of seismic events, a 3D velocity model was thus considered and implemented in the Sytmis software developed by INERIS. This model is based on the tomographic data collected in 2001 using a controlled source experiment and on the numerous multichannel seismic profiles that provide information on, respectively, the deeper structures and the upper, sedimentary layers.

Preliminary results are presented. Special focus will be given on the clustering of the micro-seismicity in the Western High and on a swarm event. As a perspective to future work, an attempt will be made to improve earthquake locations using the dataset from the permanent, cabled, Ocean Bottom Broad-Band Seismometers network operated by KOERI.