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An improved earthquake catalogue in the Marmara Sea region, Turkey, using massive template matching

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After the 1999 Izmit earthquake, the Main Marmara Fault (MMF) represents a 150 km unruptured segment of the North Anatolian Fault located below the Marmara Sea. One of the principal issue for seismic hazard assessment in the region is to know if the MMF is totally or partially locked and where the nucleation of the major forthcoming event is going to take place. The area is actually one of the best-instrumented fault systems in Europe. Since year 2007, various seismic networks both broadband, short period and OBS stations were deployed in order to monitor continuously the seismicity along the MMF and the related fault systems. A recent analysis of the seismicity recorded during the 2007-2012 period has provided new insights on the recent evolution of this important regional seismic gap. This analysis was based on events detected with STA/LTA procedure and manually picked P and S wave arrivals times (Schmittbuhl et al., 2015).
In order to extend the level of details and to fully take advantage of the dense seismic network we improved the seismic catalog using an automatic earthquake detection technique based on a template matching approach. This approach uses known earthquake seismic signals in order to detect newer events similar to the tested one from waveform cross-correlation. To set-up the methodology and verify the accuracy and the robustness of the results, we initially focused in the eastern part of the Marmara Sea (Cinarcik basin) and compared new detection with those manually identified. Through the massive analysis of cross-correlation based on the template scanning of the continuous recordings, we construct a refined catalog of earthquakes for the Marmara Sea in 2007-2014 period.
Our improved earthquake catalog will provide an effective tool to improve the catalog completeness, to monitor and study the fine details of the time-space distribution of events, to characterize the repeating earthquake source processes and to understand the mechanical state of the active fault systems in this area.