Geophysical Research Abstracts
Vol. 19, EGU2017-15247, 2017
EGU General Assembly 2017

Long term monitoring of the micro-seismicity along the Main Marmara Fault, Turkey using template matching

Emanuela Matrullo (1,2), Olivier Lengliné (1), Jean Schmittbuhl (1,2), Hayrullah Karabulut (3,2), and Michel Bouchon (4)

(1) EOST, UNISTRA/CNRS, Institut de Physique du Globe de Strasbourg, France (matrullo@unistra.fr), (2) USIAS, University of Strasbourg, France, (3) KOERI, Bogaziçi University, Istanbul, Turkey, (4) ISTerre, CNRS/Université Joseph Fourier, Grenoble, France

The Main Marmara Fault (MMF) represents a 150 km un-ruptured segment of the North Anatolian Fault located below the Marmara Sea. It poses a significant hazard for the large cities surrounding the region and in particular for the megalopolis of Istanbul.
The seismic activity has been continuously monitored since 2007 by various seismic networks. For this purpose it represents an extraordinary natural laboratory to study in details the whole seismicity bringing insights into the geometry of the faults systems at depth and mechanical properties at various space-time scales.
Waveform similarity-based analysis is performed on the continuous recordings to construct a refined catalog of earthquakes from 2009 to 2014. High-resolution relocation was applied using the double-difference algorithm, using cross-correlation differential travel-time data. Seismic moment magnitudes (Mw) have been computed combining the inversion of earthquake S-wave displacement spectra for the larger events and the estimation of the relative size of multiplets using the singular value decomposition (SVD) thanks the highly coherent waveforms. The obtained catalog of seismicity includes more than 15,000 events.
The seismicity strongly varying along the strike and depth exhibits a complex structure that confirms the segmentation of the fault with different mechanical behavior (Schmittbuhl et al., GGG, 2016). In the central part of the Marmara Sea, seismicity is poor and scattered. To the east, in the Cinarcick basin, along the MMF, the seismicity is mainly located around 8-15 km in depth, except at both ends of this basin where the seismicity extends vertically up to surface. In the Yalova and Gemlik region (to the east not on the MMF) the seismicity is distributed over a wide range of depth (from surface to 15 km deep) and is characterized by several clusters vertically elongated. The spatio-temporal evolution of earthquake sequences, which repeatedly occur in specific sub-areas, and the seismic moment release reveals mainly typically two kinds of seismicity dynamics: swarm like episodes and mainshock-aftershock sequences. Similar features in the seismicity distribution are observed to the west, in the Tekirdag and Central Basin. These preliminary evidences, combined with the recent analysis on several long-lasting strike-slip seismic repeaters occurring below the Central Basin (Schmittbuhl et al., GRL, 2016) indicate the presence of both locked and creeping portions of the MMF. In the light of the accurate and extensive observations, several open questions emerge: What are the mechanisms responsible of these repeating earthquakes and of the earthquake swarms? What is the influence and the role of fluids in the generation of seismicity.