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DEVELOPMENT OF MULTI-PARAMETER BOREHOLE SYSTEM TO EVALUATE THE EXPECTED LARGE EARTHQUAKE ?N THE MARMARA SEA, TURKEY

OZEL, Oguz[1*] ; GURALP, Cansun[2] ; PAROLAI, Stefano[3] ; BOUCHON, Michel[4] ; KARABULUT, Hayrullah[5] ; AKTAR, Mustafa[5] ; MERAL OZEL, Nurcan[5]

[1]Istanbul University-Turkey, [2]Guralp Systems-UK, [3]Geoforsungszentrum-Germany, [4]CNRS-France, [5]Kandilli Observ. & Earthq. Res. Inst.-Turkey

The Istanbul-Marmara region of northwestern Turkey with a population of more than 15 million faces a high probability of being exposed to an hazardous earthquake. The 1999 Izmit earthquake in Turkey is one of the best recorded in the world. For the first time, researchers from CNRS and Kandilli Observatory (Istanbul) observed that the earthquake was preceded by a preparatory phase that lasted 44 minutes before the rupture of the fault. This phase, which was characterized by a distinctive seismic signal, corresponds to slow slip at depth along the fault. Detecting it in other earthquakes might make it possible to predict some types of earthquakes several tens of minutes before fault rupture.

In an attempt to understand where and when large earthquakes will occur, and the physics of the source process prior to large earthquakes, we proposed to install multi-parameter borehole instruments in the western part of Marmara Sea in the frame of an EU project called MARSITE. This system and surrounding small-aperture surface array is planned to capable of recording small deformations and tiny seismic signals near the active seismic zone of the North Anatolian Fault passing through the Marmara Sea, which should enable us to address these issues.

The objective is to design and build a multi-parameter borehole system for observing slow deformation, low-frequency noise or tremors, and high frequency signals near the epicentral area of the expected Marmara earthquake. Furthermore, it is also aimed to identify the presence of repeating earthquakes and rupture nucleation, to measure continuously the evolution of the state of stress and stress transfer from east to west with high resolution data, and to estimate the near-surface geology effects masking the source related information. The proposed location of the borehole system is right on the Ganos Fault and in a low ambient noise environment in Gazikoy in the western end of the North Anatolian Fault in the Marmara Sea, where the Ganos Fault goes into the Marmara Sea. The proposed instrumentation will be consisted of broadband seismometer with very wide dynamic range, strainmeter, tiltmeter, hydrostatic pressuremeter and thermometer. These instruments will be installed in 150m deep borehole. Additionally, a surface microearthquake observation array, consisting of 8-10 seismometers around the borehole will be established to obtain continuous high resolution locations of micro-seismicity and to better understand the existing seismically active structures and their roles in local tectonic settings.

Keywords: Borehole system, repeating earthquakes, slow motion, microearthquake activity, rupture mucleation, MARSITE