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April 16, 2015 Crete Island Earthquake (Mw=5.9) Series and its Seismotectonic Significance, Southern Aegean Sea

Hilal Yalçın (1), Akın Kürçer (2), and Levent Gülen (1)

(1) SAKARYA UNIVERSITY, GEOPHYSICS DEPARTMENT, SAKARYA, TURKEY (hdomac@sakarya.edu.tr), (2) GENERAL DIRECTORATE OF MINERAL RESEARCH AND EXPLORATION, ANKARA, TURKEY (akin.kurcer@mta.gov.tr)

The active deformation of the southern Aegean Sea is a result of the northward motion of the African and Arabian Plates with respect to the Eurasian Plate in the Eastern Mediterranean Region. The Hellenic subduction zone plays a key role in the active tectonics of the region.

On 16 April, 2015, a moderate earthquake occurred on the eastern part of Hellenic arc (south of Crete island), with a moment magnitude of Mw=5.9. A series of aftershocks were occurred within four months following the mainshock, which have magnitudes varying from Mw = 3.4 to 5.4.

Source parameters of the 16 April 2015 earthquake have been modeled in order to reveal the regional stress tensor and the tectonic style of the region. In this study, the source parameters of the main shock and 36 aftershocks that have magnitudes M$\geq$3.4 have been determined and modeled by seismic moment tensor waveform inversion method developed by Sokos and Zahradnik (2006) algorithm using the near-field and regional waveforms. The depth of earthquakes are varied from 2 to 61 km.

Stress tensor can describe reliably principle stress axes (σ1, σ2, σ3), their relative size and stress field variations. Stress tensor inversions have been carried out using the Micheal method (1984, 1987). In this study, 16 April 2015 Crete Earthquake mainshock (Mw=5.9), a total of 36 earthquake moment tensor solutions that belong to the Crete earthquake sequence and 24 earthquake moment tensor solutions of previous main shocks in the region have been compiled and used in the stress inversion calculation. Orientations of σ1, σ2 and σ3 were computed and the principal directions are projected onto a lower hemisphere Wulff net. The best fit was attained for Phi = 0.38+/$-$0.13609 and indicated that the stress regime revealed strike-slip faulting with reverse component and for the azimuth and plunge pair of (-161.6°, 21.7°) for σ1, (-11.1°, 65.4°) for σ2 and (103.8°, 10.9°) for σ3.

At the final step of the study, Gutenberg and Richter parameters (a and b values) have been calculated for this region and variation in b values has been analyzed. A comprehensive seismic catalogue has been declustered for the region. Based on the maximum likelihood solution, we obtained b = 1.03$\pm$0.04, a = 6.81 and Mc =3.9 for the time period 2002-2015.

The main goal of this study is to evaluate the regional tectonic setting and asses to seismic hazard in the region. According to the seismic moment tensor solution; the source of this earthquake is NE-SW trending a reverse fault with left lateral strike-slip component. The stress tensor analysis of studied earthquakes in the region shows that the direction of the regional compressive stress is NNE-SSW.