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The 19 May 2011 Simav Earthquake (Mw=5.8) and its aftershocks, Western Turkey: Source mechanisms and spectral source parameters

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In this study, the focal parameters of Simav earthquake with a moment magnitude of 5.83 in western Turkey, and its aftershocks (M > 3.5), were estimated from time-domain moment tensor inversion method. The data were obtained from seismological network of Kandilli Observatory-Earhquake Research Institute and two broadband and one short period seismometers which were temporary deployed in the scope of the study. 2466 events (M >1.9), were located with the Geiger's conventional absolute location method and then these events were relocated by using double difference algorithm. The computed locations in a depth range between 2 km and 15 km are consistent with Coloumb stress variation in the area. Focal mechanism solutions indicate that the area is dominated by normal faults with mainly WNW–ESE trending and the main shock occurred on Simav Fault which is dipping towards north. The average variance reduction of solutions was calculated as 70%. Based on the solutions of focal mechanism, focal parameters of the main shock occurred at the depth of 11 km, were calculated as 277 / 62 / -92 (strike, dip, rake). The aftershocks were relatively shallow with variable dip direction and dip angle. Thus, this variation may point out the existence of antithetic faults of the Simav Fault. The ones having high signal to noise ratio were also studied and it was concluded that principal stress axes orientations which were calculated by Carey (1979) stress tensor inversion method that these result confirm a NNE-SSW extension (sigma 3 in horizontal plane) stress regime in the region. Additionally, by using circular source model of Brune (1970), dynamic source parameters were computed with the analysis of displacement amplitude spectra of near-field P waves from 26 earthquakes in the moment magnitude range of between 3.53 and 5.83 to estimate empirical relationships between the source parameters (stress drop, source radius and average slip). Corner frequencies vary between 1.05 and 5.40 Hz whilst stress drops are scattered between 4.80 and 115.42 bars. In addition to this, the value distributions of average slip and source radius parameters were computed as 0.72-157.55 cm and 0.46-2.07 km, respectively.

Keywords: Simav, Double-Difference, Focal Mechanism, Extension, Time-Domain Moment Tensor Inversion, Stress Drop, Source Radius, Average Slip