SECOND EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING
AND SEISMOLOGY, ISTANBUL AUG. 25-29, 2014

SOURCE RUPTURE PROCESS OF THE 19 MAY 2011 KUTAHYA-SIMAV EARTHQUAKE (MW=5.8) BY WAVEFORM INVERSION

Özlem KARAGÖZ[1,2], Ali PINAR[3], Serkan IRMAK[4], Oğuz ÖZEL[5],

The Gediz graben is the largest subsidence area of the Western Anatolia which is one of the good example of extensional regimes in the world. The latest moderate size earthquake (Mw=5.8) occurred on May 19, 2011 in the Simav Fault Zone (SFZ) that is located on northwest of the Gediz graben system. The SFZ has West Northwest-East Southeast oriented active listric faults that are about 15-20 km long. The width of the zone is 2-3 km, and it is seismically active (Figure 1). After the main shock, an intensive aftershock activity with magnitudes ranging between $1 \leq M_L \leq 5$ took place in the region.

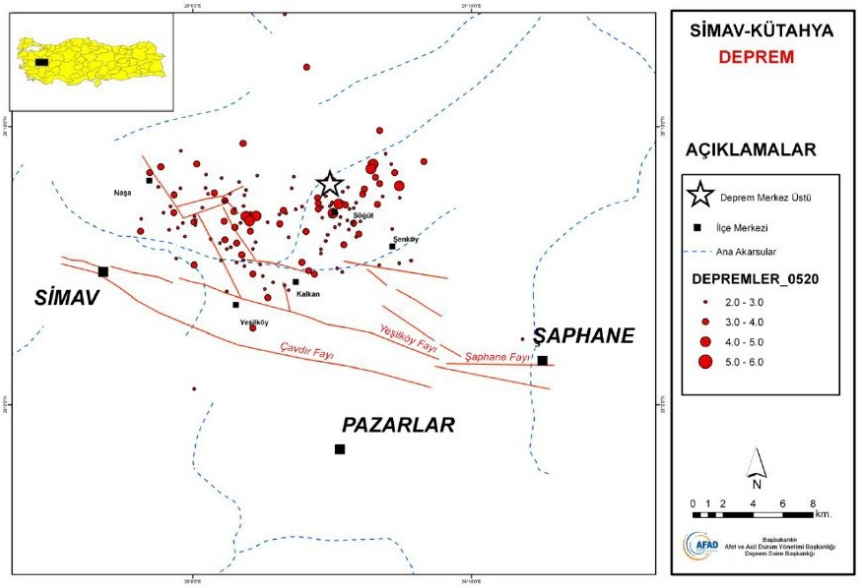

Figure 1. Tectonic structures of the 19 May, 2011 Kutahya-Simav earthquake area (AFAD, 2011). Main shock and aftershocks are given by star and circles respectively.

In this study, we have investigated the source process of shallow Kutahya-Simav earthquake using the 29 stations teleseismic P-waveforms data obtained from IRIS (Incorporated Research Institutions for Seismology) and the waveform inversion method developed by Kikutchi&Kanamori (1991) was used

[1] Department of Environmental Science and Technology, Tokyo Institute of Technology, Tokyo, Japan, karagoz.o.aa@m.depe.titech.ac.jp
[2] Department of Geophysical Engineering, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, ozlemkaragoz@comu.edu.tr
[3] Boğaziçi University Kandilli Observatory and Earthquake Research Institute, Department of Earthquake Engineering, İstanbul, Turkey, alipinar@boun.edu.tr
[4] Department of Geophysical Engineering, Kocaeli University, Kocaeli, Turkey, irmakts@kocaeli.edu.tr
[5] Department of Geophysical Engineering, Istanbul University, Istanbul, Turkey, oguzozel@istanbul.edu.tr

(Figure 2). We obtained a good match between synthetic and observed seismograms. Our final inversion model has shown that the strike, dip and rake of the faulting were 271°, 51°, -100°, respectively. Then, we applied the second step of the waveform inversion, finite-fault modelling method, to investigate source-time function and rupture process. The total source time function which is expressed as the sum of the unit source time functions of each sub-ruptures indicate that the main shock rupture completed in 3 seconds. Assuming bilateral rupture propagation of 2.5 km/s rupture velocity yields approximately 15 km rupture length. The finite source modelling of Kutahya-Simav earthquake yields a 15x10 km^2 rupture area. The results show that the faulting occurred on a normal with right-lateral strike-slip fault segments. The total seismic moment of the earthquake was calculated as M_o= 5.2x10^{17} Nm. using the waveform amplitudes. The amount of slip easily calculated for each grid point by assuming the shear module μ=3.0x10^{10} MPa. The maximum displacement on the fault plane was observed to be 40 cm.

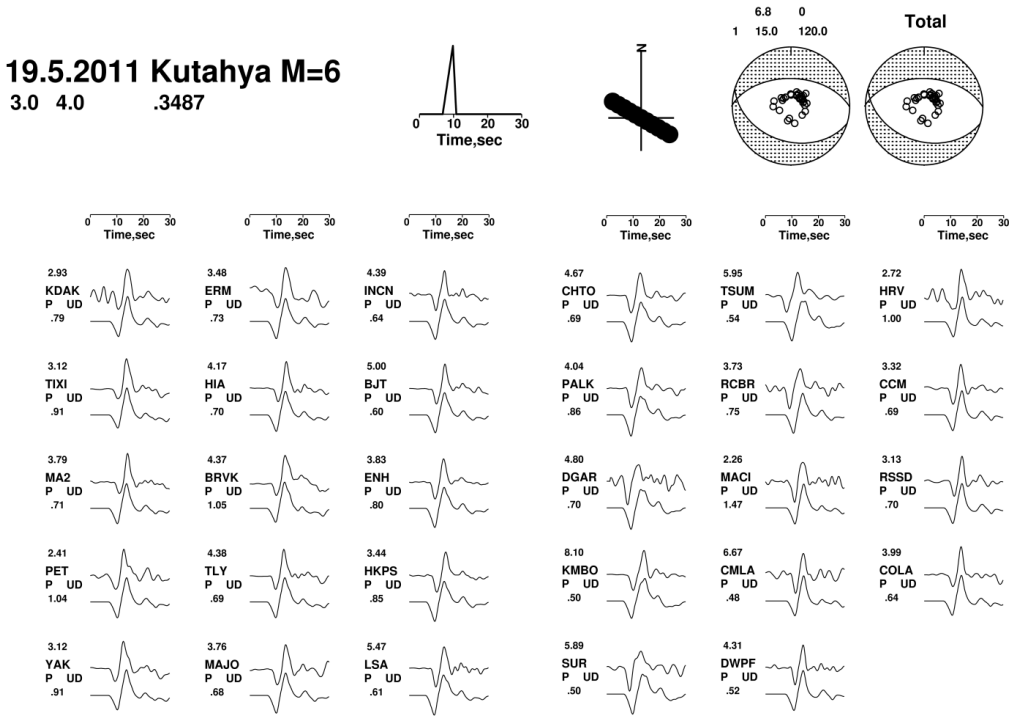

Figure 2. The source-time function and source mechanism solution of the 19 May 2011 Kutahya-Simav earthquake and compression of the P waveforms (upper: observed and lower: calculated).

REFERENCES

AFAD (2011) "Press and public information report (in Turkish)", Republic of Turkey Prime Ministry Disaster and Emergency Management Presidency (AFAD) Earthquake Department, *http://www.deprem.gov.tr/sarbis/Doc/Aylik_Rapor/MAYIS_2011_WEB.pdf,* May, 6

Kikuchi, M., and Kanamori, 1991, "Inversion of complex body waves – III", Bull. Seis. Soc. Am., 81, 2335-2350.