



Source Parameters of March 8, 2010 Karakocan (Elazig, SE Turkey) Earthquakes: Synthesis of Time Domain Regional Moment Tensor and Teleseismic Body-Waves Inversions

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The goal of this study is to analyze source parameters of Basyurt-Karakocan and Gokdere - Palu (Elazig) earthquake series occurred on 8 March 2010 and following days. We investigated geometry of active fault structures and seismotectonic characteristics of the region by using seismological data. The main shock of this activity is March 08, 2010 Basyurt – Karakocan (Elazig) ($M_w=5.9$) earthquake which occurred at 02:32:34 UTC. This earthquake was followed by many aftershocks during the following months. We analyzed 7 earthquakes with magnitudes (M_L) > 4.0 in Elazig region (SE Turkey). Most of them are concentrated on the left-lateral East Anatolian Strike Slip Fault Zone (EAFZ). We used teleseismic ($30^\circ \leq \Delta \leq 90^\circ$) long-period P- and SH-, broad-band P- waveforms, and first motion polarities of P-waves recorded by GDSN stations to determine the source parameters of the March 8, 2010 Karakocan (Elazig) earthquake using body-waveform inversion method of Nábélek (1984) and MT5 version of McCaffrey and Aber's (1989) algorithm. Synthetic and observed seismograms were compared in terms of shape and amplitudes. Source parameters obtained from the inversion are source depth, fault geometry (strike, dip and rake angles), seismic moment (M_0) and source-time function that shows the propagation of the rupture in time. In addition, regional moment tensor methodology which is known as Time Domain Moment Tensor Inversion (TDMT_INV) was used in this study to find source parameters of earthquakes recorded at regional distances ($1^\circ \leq \Delta \leq 10^\circ$). This code was developed by Dreger (1992), Dreger and Helmberger (1993) and it is widely accepted technique due to availability of number of high quality broad-band stations.

Source mechanism solution of the main March 8, 2010 Elazig earthquake ($M_w = 5.9$) is determined by using 17 P- and 24 SH- waveforms. We obtained that this earthquake shows left-lateral strike slip faulting with a focal depth of 6 km. Strike, dip and rake angles were determined as 48° , 79° and 2° , respectively. We also found that seismic moment of the earthquake (M_0) is $781E15$ Nm, moment magnitude (M_w) is 5.9, and the rupture time is approximately 3s. Another earthquake occurred on March 8, 2010 ($M_w = 5.4$) at 7:47:20 UTC. We determined minimum misfit solution of this earthquake by using 5 LP (Long Period) and BB (Broadband) P- and only 1 SH- waveforms, and it shows left-lateral strike-slip faulting mechanism similar to the main earthquake. The focal depth is found to be as 9 km. Both solutions also were supported by the near-field P- wave first motion polarities. By using the time domain regional moment tensor inversion method, we also obtained source mechanism parameters of five Elazig earthquakes ($4.0 \leq M_L \leq 6.0$) with good signal / noise ratio and high variance reduction. Similar to teleseismic inversion results, all earthquake source parameters indicate left-lateral strike slip faulting mechanisms with shallow focal depths along the East Anatolian Fault Zone (SE Turkey). These results are consistent with the geological and tectonic structures of the region.