Geophysical Research Abstracts
Vol. 12, EGU2010-11232-2, 2010
EGU General Assembly 2010

The Fault Characteristics and the Rupture model of the Recent Moderate Earthquakes in Southern Marmara Region.

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The source characterization and slip history of two moderate earthquakes recently occurred in the Southern Marmara Region NW Turkey, were investigated. These two moderate size earthquakes with magnitude Mw=4.8 and Mw=4.7, occurred at the Gulf of Gemlik and the North of Manyas Lake, indicate a new seismic activity associated with the Southern Strand of the North Anatolian Fault Zone (NAFZ). This region is characterized by the normal and oblique slip E–W trending faults with moderate size earthquakes and shows evidence of spatial and temporal partitioning of deformation. Although the slip rate and seismic activity are lower than those on Northern Strand of NAF, recent investigations show that the fault segment extending between Gemlik-Bandirma segment passing through the southern part of Iznik Lake have potentials of producing destructive a earthquake.

The main objective of this study is to understand the source characteristics and of the October 20, 2006 Gemlik and October 24, 2006 Manyas Earthquakes such as source size, final slip, stress drop and make an approach to understand the rupture mechanism of these events in terms of the seismotectonics of the region. We also determined the faulting characteristics and fault plane solutions of the earthquakes and their aftershocks.
Strong motion seismograms of the earthquakes recorded by the Earthquake Research Department and broadband seismograms of the earthquakes recorded by the Kandilli Observatory were used.

The waveform inversions were performed for the frequency range of 0.1-0.5 Hz using the multiple time window linear waveform inversion methodology. To investigate the source size and final slip model 8 strong motion stations within 30 km epicentral distance were used for the October 24, 2006 earthquake and 4 strong motion stations within 90 km epicentral distance were used for the October 20, 2006 earthquake. The inversions for kinematic rupture models for both earthquakes yield a non unique solution; we therefore used two kinds of constraints to prevent unfavorable slip patterns caused by underdetermined model parameters and analyzed various rupture models until both observed and synthetic data were matched. Preliminary results indicate us max. slip of 0.34 m and seismic moment of 1.55E+16 N.m for Gemlik Earthquake and 0.32 m and 1.49E+16 N.m for Manyas Earthquake. Those results are consistent with the slip values of similar size earthquakes.

For determination of the fault plane solution we used the regional moment tensor inversion method of Dreger (2002) to infer a source process for the earthquakes. The earthquake fault plane parameters (strike, dip, rake) were obtained directly from the moment tensor description. All broadband waveforms are band pass filtered between 50 to 12 s according to data characteristics, quality and the sizes of events. The results indicate that the both fault plane solutions and rupture model for those two moderate earthquakes are well matched with the sequences of aftershocks and general fault orientation of faulting in southern Marmara region.