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Seismic Parameters Re-Determined from Historical Seismograms of 1912-Murefte-Sarkoy, 1935-Erdek-Marmara Island and 1963-Cinarcik Earthquakes

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Marmara Region has witnessed many destructive earthquakes where some of them caused tsunami. Examination of these earthquakes through analyzing of analog records is crucial for the interpretation of seismotectonics and to assess the level of seismic hazard in this region. Many geological field surveys and geophysical studies to date indicated that 1912, Sarkoy-Murefte event, occurred on the Ganos Fault Zone, was one of the largest earthquake in the western Marmara Sea and caused tsunami. The same is also valid for 04.01.1935, 14:41, M=6.4 and 16:20 M=6.3 Erdek-Marmara Island, and 18.09.1963, 1963, M=6.3 Cinarcik Earthquakes. The purpose of this study is to contribute to the seismotectonics of this region by examining these earthquakes and revaluate source parameters of these shocks using seismic waveforms, which were previously not carried out by modern techniques.
In this study, the original seismograms from various countries for 1912 Sarköy-Mürefte, 1935, Erdek Marmara Island and 1963, Cinarcik Earthquakes were digitized. The magnitude Mw, seismic moment Mo, the radius of circular source zone R and stress drop $\Delta\sigma$ values were redetermined using digitized original seismic waveforms from displacement spectra for these historical events. For this purpose, a large number of seismic station bulletins have been consulted for the instrumental information to remove the instrument response. In addition, the epicentral locations have been calculated using available readings from original records and also ISS bulletins for 04.01.1935-14:41 and 16:20 Marmara Island-Erdek Earthquake and 18.09.1963-16:58 Cinarcik Earthquake. For the 1912 event, the magnitude Mw=7.13 and radius of the fault area R=41 km were determined. Also, 04.01.1935-14:41 and 16:20 Earthquakes showed a fault radius of about 15 km with magnitudes Mw=6.0 and Mw=5.9, respectively. The epicenter determinations showed that the first event in 04.01.1935 was located at 40.72 N-27.72 E while the second one occurred at 40.61 N-27.43 E. Another finding is of the 1963 event, which gave a fault radius of approximately 13 km with a magnitude Mw=5.9. The 1963 event was located at 40.80 N-29.18 E. Furthermore; moment tensor inversion method was applied on these earthquakes by using original seismograms collected from various observatories. The fault mechanisms for 04.01.1935-14:41 and 16:20 Earthquakes were determined using moment tensor inversion from the original seismic waveforms for the first time. Likewise, fault mechanism for the 1963 Cinarcik Earthquake was also obtained. The results showed that these earthquakes have normal fault mechanism. The application of moment tensor inversion method to the historical earthquakes records will give an opportunity to understand the geometry of the known faults possibly shed light some unknown structures and illuminate the seismotectonic features of Marmara Region based on the retrieved fault mechanism solution.