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# Moment Magnitude Determination for Marmara Region-Turkey Using Displacement Spectra

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Abstract

The main purpose of the study is to determine moment magnitude M using displacement source spectra of earthquakes occurred in Marmara Region. The region is the most densely populated and fast-developing part of Turkey, bounded by 39.0°N to 42.0°N and 26.0°E to 32.0°E, and have experienced major earthquake disasters during the last four centuries with destructive earthquakes and probabilistic seismic hazard studies shows that the region have significant probability of producing M>7 earthquake within the next years. Seismic moment is a direct measurement of earthquake size (rupture area and static displacement) and does not saturate, spectral analysis at local distances is a very useful method which allows the reliable determination of seismic moment and moment magnitude. We have used converging grid search method developed by L. Ottemöller, and J. Havskov, 2008 for the automatic determination of moment magnitude for local distances.

For data preperation; the time domain signal of S waves were extracted from the vertical component seismograms.Data was transformed from time to frequency domain by applying the standart fast fourier transform (fft). Source parameters and moment magnitudes of earthquakes are determined by applying spectral fitting procedure to classical Brune's model. The method is first manually and then automatically performed on the source spectrum of S waves within 20 sec. Mo and fc (Aki;1967, and Brune;1970) were determined by using the method which the model space is divided into a grid and the error function detected for all grid points. A smaller grid with denser spacing around the best solution is generated with an iterative procedure. The moment magnitudes of the earthquakes have been calculated according to the scale of Kanamori (1977) and Hanks and Kanamori (1979).

A data set of 279 events recorded on broadband velocity seismograms extracted from KOERI (Kandilli Observatory and Earthquake Research Institute) seismic network were studied from small to moderate ($2.0 \leq M \leq 4.7$) size earthquakes occurred in Marmara Region. According to procedure, both automatic and manual solutions for Mo and fc parameters correlated with each other well. Application of the method proved that there is no lower magnitude limit to determine the seismic moment from the source spectra and it is applicable not only for small magnitude but also moderate to big earthquakes as well and can be applied to all earthquake activity for routine process. Although there is no lower magnitude limit for this method (Hanks, 1982), good Signal/Noise ratio is essential, which depends on both the earthquake size and the hypocentral distance.