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2011 Van earthquake (Mw=7.2) aftershocks using the source spectra an approach to real-time estimation of moment magnitude

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The Converging Grid Search (CGS) algorithm was tested on broadband waveforms data from large aftershocks of the October 23, Van earthquake with the hypocentral distances within 0-300 km over a magnitude range of $4.0 \leq M \leq 5.6$.Observed displacement spectra were virtually well adapted to the Brune's source model in the whole frequency range for many waveforms.The estimated Mw solutions were compared to global CMT catalogue solutions, and were seen to be in good agreement.
To estimate Mw from a shear-wave displacement spectrum, an automatic routine named as CGS was applied to attempt to test and develop a method for stable moment magnitude estimation to be used as a real-time operation.The spectra were corrected for average an elastic attenuation and geometrical spreading factors and then were scaled to compute moment at the long period asymptote where the spectral plateau for 0 Hz is flat.For this aim, an automatic procedure was utilized: 1)calculating the displacement spectra for vertical components at a given station, 2)estimating corner frequency and seismic moment using CGS which is based on minimizing the differences between observed and synthetic source spectra, 3)calculating moment magnitude from seismic moment for each station separately, and then are averaged to give the mean values of each event. The best fitting iteration of these parameters was obtained after a few seconds. The noise spectrum was also computed to suggest a comparison between signals to noise ratio before performing the inversion.Weak events with low SNR were excluded from the computations.
The method examined on the Van earthquake aftershock dataset proved that it is applicable to have stable and reliable estimates of magnitude for the routine processing within a few seconds from the initial P wave detection though the location estimation is necessary.This allows a fast determination of Mw magnitude and assist to measure physical quantities of the source available for the real time operation.