

Development of an extended Hara model for M_W determination of moderate-magnitude earthquakes

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Abstrak

This study discusses the evaluation of Hara's model to estimate seismic moment magnitude (M_W) by using teleseismic waveform data, and then presents the development of an extended Hara model. Both models use the maximum amplitude of displacement and epicenter distance, as well as the duration of high-frequency energy radiation, of the vertical component of earthquake P-wave records. Nineteen moderate-magnitude ($5.0 \leq M_W \leq 7.0$), shallow (depths ≤ 70 km), Sumatra subduction megathrust earthquake data sets recorded by the KAPI seismograph station (Kappang, South Sulawesi) in 2010 and 2011 were used in this study. The analysis is performed to obtain the maximum amplitude of displacement, epicenter distance, and the duration of high-frequency energy radiation on the first arriving P-wave. The main results show that Hara's model (2007) overestimates M_W to be less than 7.0 compared with that obtained from the Global Centroid Moment Tensor (CMT) catalog. The extended Hara model was developed with the use of the same basic equation, and the resulting coefficients are $a = 0.538792$, $b = 0.783840$, $c = 0.242616$, and $d = 4.929095$. The mean and standard deviation of the difference between the extended Hara model and the Global CMT catalog are 0.01 and 0.14, respectively.