Comparison of ratios of amplitudes to high frequency seismic signal durations to energy to moment ratios

*原 辰彦[1]
*Tatsuhiko Hara[1]

1. 建築研究所国際地震工学センター
1. International Institute of Seismology and Earthquake Engineering, Building Research Institute

Hara (2007a, EPS) showed that high frequency seismic signal durations and displacement amplitudes measured from tele-seismic P waves were longer and smaller for tsunami earthquakes, respectively, than those of non-tsunami earthquakes, while some non-tsunami earthquakes had similar characteristics. Hara (2017, JpGU) showed that tsunami earthquakes were characterized by longer high frequency seismic signal durations and smaller velocity and acceleration amplitudes more clearly than displacement amplitudes. In this study, we compared ratios of displacement, velocity, and acceleration amplitudes to high frequency seismic signal durations to seismic energy to moment ratios, which are used as a discriminant for tsunami earthquakes (e.g., Newman and Okal, 1998, JGR; Ebeling and Okal, 2012, GJI).

The events used in this study are large (M_w is greater than or equal to 7.2) shallow earthquakes that occurred in between 1994 and 2016. High frequency seismic signal durations, displacement, velocity, and acceleration amplitudes were measured from waveform data recorded at the GSN stations in the epicentral distance range between 30 and 85 degrees. High frequency seismic signal durations were measured following the procedure of Hara (2007b, EPS). Distance corrections for amplitude data were carried out by multiplying epicentral distances. The estimates of radiated seismic energies are taken from IRIS DMC (2013, Data Services Products: EQEnergy Earthquake energy & rupture duration, https://doi.org/10.17611/DP/EQE.1) and the M_w estimates are taken from the Global CMT catalog (http://www.globalcmt.org/).

The ratios of acceleration amplitudes to high frequency seismic signal durations correlate better with seismic energy to moment ratios than those of displacement and velocity amplitudes. This suggests that the former is helpful to distinguish tsunami earthquakes from non-tsunami earthquakes.

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