

Determination of the coefficients of M_{hdd} for regional data*Tatsuhiko Hara¹

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Hara (2007, EPS) developed a formula to calculate magnitudes using durations of high frequency energy radiation (HFER) and maximum displacement amplitudes using tele-seismic P waves. Hara (2013, SSJ) referred to a magnitude calculated by this formula as M_{hdd} . Hara (2014, JpGU) tried to revise the coefficients of the formula by a grid search to reduce the dependences of differences between M_{hdd} and M_w on epicentral distance and HFER duration. M_{hdd} calculated by the obtained coefficients were underestimates for larger earthquakes.

Hara (2015, SSJ) investigated the characteristics of M_{hdd} for tele-seismic data by another grid search, in which the dependence of M_{hdd} on M_w was taken into account in addition. He proposed a revised formula with small dependences of the differences between M_{hdd} and M_w on epicentral distance, HFER duration, and M_w allowing a slightly larger RMS of their differences.

In this study, we applied the procedure of Hara (2015) to regional data to determine the coefficients of M_{hdd} appropriate for regional distance range. We used broadband data recorded at FDSN stations in the epicentral distance range between 10 and 30 degrees for 60 events that occurred in between 1995 and May 2015. We retrieved data from the IRIS DMC. We conducted the grid search for the M_{hdd} coefficients following Hara (2015) and evaluated the dependences of the differences between M_{hdd} and M_w on epicentral distance, HFER duration, and M_w . As was observed for tele-seismic data, there is a significant M_w dependence for the set of the coefficients which provides the minimum RMS of the differences between M_{hdd} and M_w . As Hara (2015) showed for tele-seismic data, when we allow a slightly larger RMS of their differences, it is possible to find a set of the coefficients for regional data for which the dependences of their differences on epicentral distance, HFER duration, and M_w are small.

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