

Rapid magnitude estimation using long-period components of seismic waves

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The Japan Meteorological Agency (JMA) usually uses estimations of hypocenter and magnitude for the tsunami forecast to issue tsunami warning as soon as possible. JMA-magnitude (M_J) that JMA estimates rapidly is almost the same as M_W up to around 8 on average. However, when a magnitude is more than 8 such as the 2011 off the Pacific coast of Tohoku Earthquake, M_J is underestimated due to the saturation of amplitude-magnitude.

JMA uses several countermeasures for judging the M_J underestimation. The long-period components monitor of seismic waves is one of them, which is to monitor peak-amplitudes of composite displacements filtered with bandpass of 100s to 500s at broadband seismograph stations (JMA,2013). JMA can recognize that an earthquake has greater M from an empirical formula for the long-period components monitor, even if M_J is underestimated. The formula which was made using only the 2011 off the Pacific coast of Tohoku Earthquake and the Tokachi-oki Earthquake in 2003, is consist of a peak-amplitude and an epicentral distance.

We think that the long-period component monitor would be applicable also for detection of a tsunami earthquake which has the long source rupture duration because the pass band of 100s to 500s is long enough compared with the rupture durations of tsunami earthquakes.

We showed that M_J underestimated the size of tsunami earthquakes by 1 or more magnitude unit compared with M_W (in Seismological Society Fall Meeting 2020). It can even be under 7. In this study we try to reconstruct an empirical formula for the long-period components monitor so as to adapt it to earthquakes in the latter of $M6$ and above. We will also show results in the case that the reconstructed formula is applied to tsunami earthquakes.

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Keywords: tsunami earthquake, magnitude

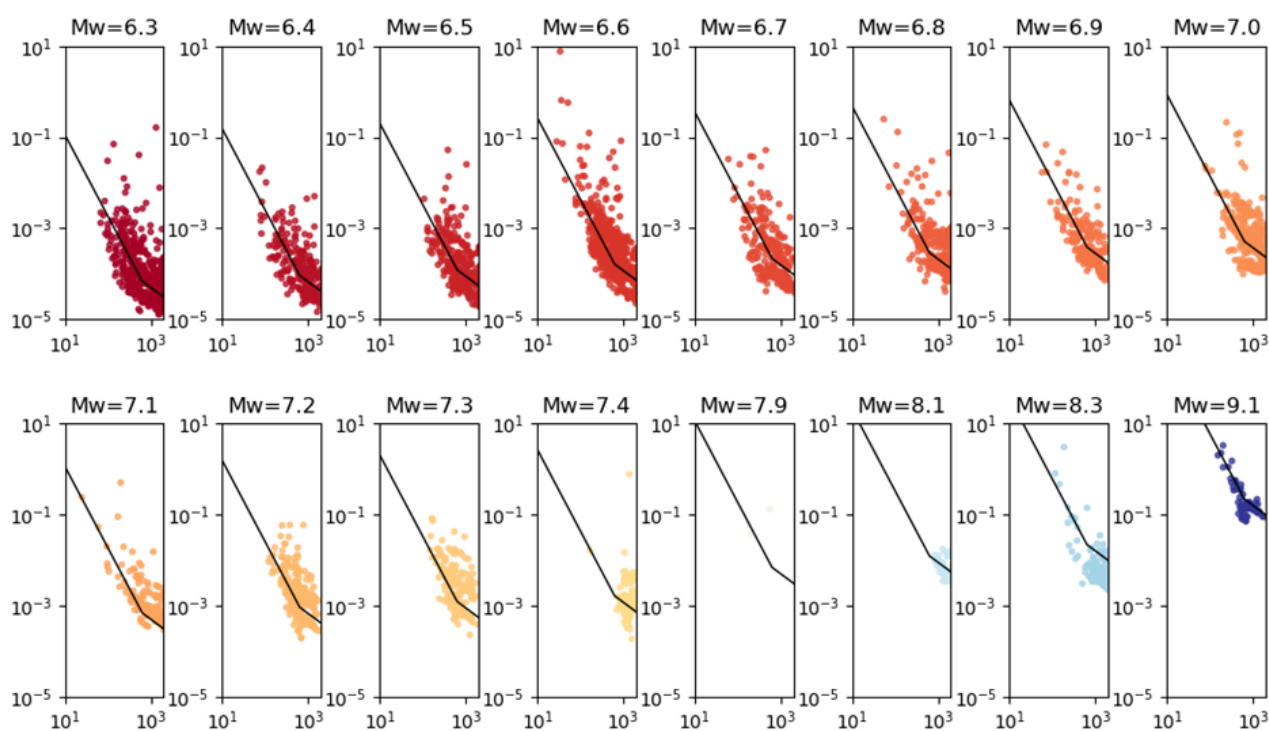


Figure: Obtained empirical formula from observational data

The vertical lines show composite peak-amplitude of long-period component obtained from seismic wave in m.

The horizontal lines show hypocentral distance in km.

The solid lines show empirical formula (preliminary).

The color-coded circles for each M_w show peak-amplitudes obtained from observed seismic waves.