

the Application of MWP in the Near Field and the March 11, 2011 Tohoku Earthquake

Tsunami Warning Centers have used Mwp to issue Tsunami Warnings 5–10 min after Earthquake origin time since 2002. However, because Mwp is based on the far-field approximation to the P-wave displacement, we should only very carefully apply Mwp to data obtained in the near field, at distances of less than a few wavelengths from the fault. On the other hand, the surface waves from Great Earthquakes, such as the 2011 Tohoku earthquake, clip seismographs located near the fault. Because the first arriving P-waves from such large events are often on scale, Mwp should provide useful information, even for these Great Earthquakes. We therefore calculate Mwp from 18 unclipped STS-1 broadband P-wave seismograms, recorded at 2–15 distance from the Tohoku epicenter to determine if Mwp can usefully estimate Mw for this earthquake. Our analysis indicates that Mwp does indeed give reliable results (Mw 9.1) beginning at about 11 distance from the epicenter. The values of Mwp from seismic waveforms obtained at 11–15 epicentral distance from the Mw 9.1 off the east coast of Tohoku earthquake of March 11, 2011 fell within the range 9.1–9.3, and were available within 4–5 min after origin time.

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Track Classification: Theme 2: Events and Their Characterization