



Real-time, real-life performance of $M_{w_{pd}}$ for rapid, accurate determination of large earthquake magnitudes

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The $M_{w_{pd}}$ earthquake magnitude provides critical, early information for tsunami warning, disaster response and public information. $M_{w_{pd}}$ is a rapid, moment magnitude for large earthquakes based on P-wave recordings at regional to teleseismic distances. $M_{w_{pd}}$ can be obtained for most regions of the Earth within 5-10 minutes after the event origin with current seismic networks. The $M_{w_{pd}}$ magnitude combined with a fast, first-motion faulting mechanism forms a moment tensor proxy for rapid source characterization and analysis before a definitive, waveform moment tensor is available.

$M_{w_{pd}}$ uses a *duration-amplitude* procedure which determines apparent source durations, T_0 , from high-frequency, P-wave seismograms, and estimates moment through integration of broadband displacement waveform amplitudes over an interval of length T_0 after the P arrival time. The explicit use of source duration for integration of displacement seismograms makes $M_{w_{pd}}$ an extension to very large earthquakes ($M_w > 7.5$) of the widely used, M_{wp} , rapid-magnitude procedure.

We present an analysis of the speed and accuracy of $M_{w_{pd}}$ magnitudes determined in real-time over the past decade by the Early-est* rapid earthquake detection and analysis system. The results confirm that $M_{w_{pd}}$ matches well M_w^{CMT} and M_{ww} magnitudes for large earthquakes and is available within as little as 5 minutes after the earthquake origin.

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F. Bernardi, A. Lomax, A. Michelini, V. Lauciani, A. Piatanesi, and S. Lorito (2015), Appraising the Early-est earthquake monitoring system for tsunami alerting at the Italian candidate Tsunami Service Provider, *Nat. Hazards Earth Syst. Sci.*, 15 <https://tinyurl.com/y7e3nb3a>

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* Early-est is the module for rapid earthquake detection, location and analysis at the INGV tsunami alert center (CAT, "Centro di Allerta Tsunami", CAT-INGV has been accredited by ICG/NEAMTWS as Tsunami Service Provider), <http://early-est.alomax.net>, <http://early-est.rm.ingv.it>, <http://alomax.free.fr/posters/early-est>

For rapid notification of large earthquakes by Early-est on Twitter, please make a follow request to @QuakeEarly <https://twitter.com/QuakeEarly>