The relationship between ML and Mw for small earthquakes (ML < 2-4) in Italy

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Several authors empirically observed that the scaling between local magnitude ML and moment magnitude Mw computed by spectral methods is not 1:1 for ML<2-4. In particular ML is found to be about proportional to 1.5 Mw but the exact threshold below which this occurs is argued. Such behavior was explained as due to attenuation and scattering along the path or to a minimum limit in the pulse duration or equivalently a maximum limit to the corner frequency of the observed spectra imposed by surface attenuation. The frequency-magnitude distribution of ML estimates provided by the Italian Seismic Instrumental Database (ISiDe) of INGV show a strictly linear behavior with b-value»1.0 down to about ML 1.4 at least. This implies that for Mw the b-value would be about 1.5 below magnitude 2-4 and 1 above. As the frequency magnitude relationship with b-value»1 in terms of Mw is recognized as a general characteristic of seismicity all over the world, based on both empirical and theoretical considerations, the question arises on the reasons of the observed discrepancy for small shocks. One explanation might be the assumption of incorrect seismic wave attenuation properties for the computation of ML, of spectral Mw or both.