A calibrated local magnitude of Thailand

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ABSTRACT

The original local magnitude scale, commonly known as the "Richter scale," was initially developed based on ground characteristics in Southern California. Consequently, calculating local magnitudes in different regions requires accounting for the unique ground motion characteristics of that specific area. This study focuses on calibrating the local magnitude scale for Thailand by conducting a comprehensive analysis of regional earthquakes and their corresponding observed seismic waves. To accomplish this, we employed a dataset comprising 2,448 amplitude records collected from 77 seismic stations, covering 479 earthquakes. Through an iterative grid search process, we determined optimized distance correction coefficients. These coefficients include a geometrical factor (α) of 1.218 and an anelastic attenuation factor (k) of 0.00072. Notably, the relatively low anelastic attenuation factor suggests the presence of highly rigid crustal properties in Thailand. The importance of station correction (Sj) factors in accurately calculating earthquake magnitudes in Thailand becomes evident through our magnitude residual analysis. The calibrated local magnitude formula for Thailand is expressed as follows:

$$M_L = \log_{10}(A) + 1.218\log_{10}(\tfrac{R}{100}) + 0.00072(R-100) + S_j$$

Furthermore, a statistical assessment is employed to characterize the station correction factors associated with each seismic station, revealing a wide range of variability spanning from -0.71 to 0.60 within the region. This variability underscores the complex nature of seismic propagation, which is influenced by the heterogeneous geological features present throughout Thailand.

Keywords: Local magnitude, Thailand, Station correction, Magnitude calibration

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