Contribution ID: **511** Contribution code: **P3.5-511** Type: **e-Poster**

An Alternative Proposal for Estimation of Body Wave Magnitude Taking Account of Noise Magnitudes

Thursday, 1 July 2021 11:45 (15 minutes)

Magnitude measures the strength of an earthquake and is an important parameter for earthquake / underground test discrimination.
The IDC computes body magnitudes from the amplitude to period ratio recorded at network stations. Radzyner et al. (2017) showed that there was superior consistency of magnitudes across stations when the magnitude is computed as a linear function of the ratio, but with a slope that could differ from 1. The slopes and intercepts that describe these lines were found to be station-specific.
We extend the method by also including noise magnitude measurements in determining the station corrections. This follows the maximum likelihood (ML) magnitude estimation approach of Ringdal (1976), later applied to offset estimation for IDC data by Zaslavsky-Paltiel and Steinberg (2008).
We develop an optimization algorithm that finds joint ML estimates for the station-specific parameters that link observed seismic signals to event magnitude, taking account of noise magnitudes, as well as computing the event magnitudes themselves.
The procedure is applied to a large database of IDC events and to primary stations. We find strong support for the general, but station-specific, linear relationship proposed by Radzyner et al. for computing body wave magnitude from the amplitude to period ratio.

Promotional text

This work presents an alternative algorithm for computing body wave magnitudes which incorporates both recorded magnitudes and noise magnitudes. There is extensive analysis of IDC data.

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Session Classification: T3.5 e-poster session

Track Classification: Theme 3. Verification Technologies and Technique Application: T3.5 - Data Analysis Algorithms