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Statistical Approach to Estimate Station Magnitude Biases and Noise Levels

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The International Data Centre (IDC) estimates several types of seismic magnitudes. Two of them are: the body wave magnitude mb, and the surface wave magnitude Ms. Both measures are significant to the CTBT verification regime as an input for discrimination methods between earthquakes and explosions, while mb is used for yield estimation for a presumed explosion. The IDC, like other institutes, estimates event magnitudes in two steps. First, the event magnitude is estimated for each IMS station detecting the event. The network magnitude is then computed as the average of station magnitudes excluding outliers. This approach rests on the assumptions that stations magnitudes are unbiased and have the same noise level (namely, random estimation errors).
We show that these two assumptions do not hold for mb and Ms as published in the Reviewed Event Bulletin of the IDC. We suggest a different approach, whereby individual stations each have different and unknown biases and noise levels. We present algorithms to estimate these stations' biases and noise levels. We use our estimated station biases as station correction terms, and the estimated noise levels as weights for event magnitude estimation. We show that our approach yields more consistent station and event magnitudes, using Reviewed Event Bulletin data.

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Promotional text

A new method of estimating mb and Ms magnitudes is presented. Both are used within the CTBT verification regime for discrimination purposes.

Oral preference format

pre-recorded video

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