

Determination of earthquake magnitudes using duration of high-frequency energy radiation and maximum displacement amplitudes: application to the April 16, 2016 27km SSE of Muisne, Ecuador earthquake

We applied the magnitude determination method of Hara (2007) to the April 16, 2016 27km SSE of Muisne, Ecuador earthquake (the origin time: 23:58:37 UTC; the location 0.372°N 79.940°W depth=19.2 km after USGS). In this method, an earthquake magnitude, M , is calculated by the following formula:

$$M = 0.79 \log A + 0.83 \log \Delta + 0.69 \log t + 6.47$$

where A is the maximum displacement (m) during high-frequency energy radiation from the arrival time of a P-wave, Δ is the epicentral distance (km), t is duration (s) of high-frequency energy radiation. The duration of high-frequency energy radiation is estimated by band-pass filtering of first arriving P-waves.

Figure 1 shows an example of measurements of high-frequency energy radiation. The estimated duration is 59.8sec. The estimated magnitude using the above formula is 7.80 which is consistent with M_{ww} 7.8 from USGS W-Phase Moment Tensor solution, and M_w 7.8 from the Global CMT solution.

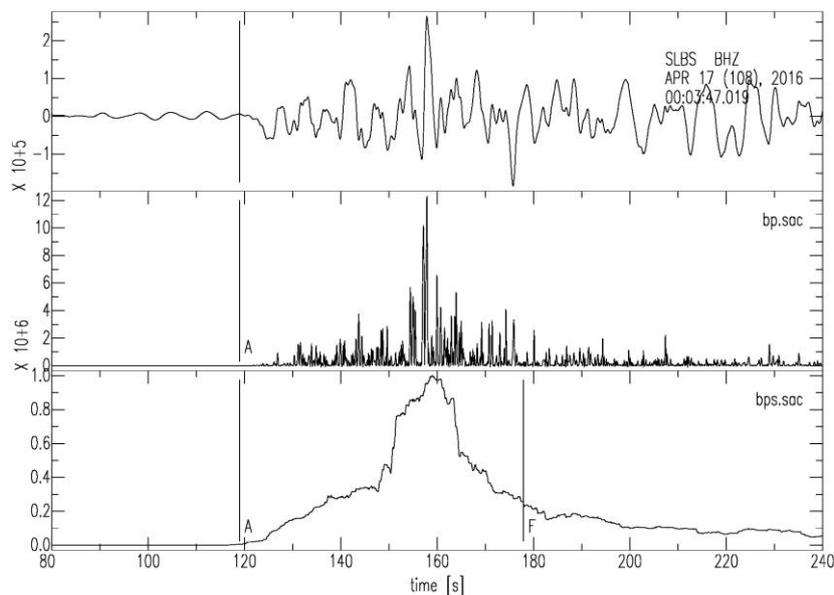


Fig. 1. An example of measurements of high frequency energy radiation. The upper, middle and lower traces are an observed seismogram, the squares of the band-pass (2-4 Hz) filtered seismogram, and its smoothed time series (normalized by the maximum value), respectively. “A” and “F” in the lower trace denote the arrival of P-wave and estimated end of high frequency energy radiation, respectively.

Acknowledgements

We analyzed BHZ channel waveform data recorded at the Global Seismograph Network (GSN) stations. We retrieved the data from the IRIS DMC (Incorporated Research Institutions for Seismology, Data Management Center). We used SAC (Seismic Analysis Code) (Goldstein et al., 2003; Goldstein and Snoke, 2005) for seismic waveform data analyses.

References

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This analysis was done by Tatsuhiko Hara.

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