AGU 100 FALL MEETING
Washington, D.C. | 10–14 Dec 2018

S53E-0450: On the Performance of M_L-M_C as a Depth Discriminant for Small Seismic Events Recorded at Local Distances in Yellowstone, Oklahoma, and Italy

Friday, 14 December 2018
13:40 - 18:00
Walter E Washington Convention Center - Hall A-C (Poster Hall)

A recent study by Koper et al. (2016) found that the difference between local magnitude (M_L) and coda duration magnitude (M_C) successfully distinguished shallow seismic events (mining blasts, mining-induced seismicity, and shallow tectonic earthquakes) from deeper seismic events (tectonic earthquakes) in the Utah region and could therefore be helpful for blast discrimination. Here we present tests of the performance of M_L-M_C as a depth discriminant in three regions and show that it is effective in all of them. Initially, we investigated M_L-M_C as a function of depth for seismicity in and around Yellowstone National Park recorded by the University of Utah Seismograph Stations. For 2,845 Yellowstone earthquakes with well-constrained depths varying from 0–25 km, we found that M_L-M_C decreases 0.036 ± 0.014 magnitude units (m.u.) per 1 km in depth over the depth range of 0–8 km. Then, we examined M_L-M_C values for anthropogenic seismicity recorded by the National Earthquake Information Center in northern Oklahoma and southern Kansas. We found that for 1,692 events with well-constrained depths, the slope of M_L-M_C for the shallowest 10 km in depth is 0.037 ± 0.016 m.u. per 1 km depth. Finally, we analyzed M_L-M_C for 28,721 well-located earthquakes in Italy and Sicily recorded by Istituto Nazionale di Geofisica e Vulcanologia. This region showed an increase of 0.017 ± 0.001 m.u. per 1 km depth, up to 30 km in depth. In each case, the quoted error bounds represent 99% confidence regions. We performed several robustness tests in which we varied the depth bin size, the criterion used to define a well-constrained depth, and the depth range used in the linear fit. In nearly all cases we found a positive slope for M_L-M_C vs. depth at a confidence level above 99%. Our results provide further evidence that M_L-M_C is useful as a depth discriminant for events recorded at local distances in different physiographic regions.

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