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Source parameters and ML-Mw scaling relations for micro-earthquakes

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Seismicity related to industrial mining activities poses a man-made (induced) seismic hazard that needs to be understood and quantified in order to ensure safe mining operations. While recording and location mining induced earthquakes and rock-burst is common practice, detailed source studies of such events are still lacking. Moreover, it is of great scientific interest if such events follow the common models and theories of earthquake sources, or if they obey different rupture physics. Therefore, we analyze earthquake sequences recorded in a Chinese coal mine to determine their source properties. For this purpose, we analyze 115 events of Lao Hutai coal mine induced by fault structure and mining activities. First, we compute source parameters of source dimensions, corner frequency, quality attenuation factor, energy and stress drop using spectral modeling of P waves, assuming two models based on the classical Brune model. We find that the omega-square model is a good average for the data set, but substantial scatter remains. We further analyze the relationship between these source parameters. Finally, we analyze the scaling relations between ML and Mw for our dataset. The results help us to better understand causes and consequences of mine microseismicity.