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Comparison of source parameters estimated in the frequency and time domains for seismic events at the Rudna copper mine, Poland

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A b s t r a c t

Source parameters estimated in the frequency domain for 100 selected seismic events from the Rudna copper mine, with moment magnitude ranging from 1.4 to 3.6, were collected to study their scaling relations and to compare them with the parameters estimated in the time domain. The apparent stress and static stress drop, corrected for the limited bandwidth recording, increase slightly in a similar manner with increasing seismic moment. The ratio of apparent stress to static stress drop, a measure of radiation efficiency, is practically constant and its mean value is close to 0.1.

For 37 seismic events, with moment magnitude between 1.9 and 3.4, source parameters were estimated in the time domain from relative source time functions, that displayed unilateral rupture propagation, and their rupture velocity could be estimated. It ranges from 0.23 to 0.80 of shear wave velocity and is almost independent of seismic moment. The fault length, estimated from the average source pulse width and rupture velocity, is clearly dependent on seismic moment and is smaller than the source radius estimated from the corner frequency on the average by about 25 percent. There is no correlation between the values of static stress drop estimated in the frequency and time domains, but the time domain stress drop is in general similar to that estimated in the frequency domain. The apparent stress increases with increasing rupture velocity, and the ratio of apparent stress to static stress drop seems also to depend on rupture velocity.

Key words: Mining-induced seismicity, source parameters, source time function, scaling relations, stress release estimates, rupture velocity.