In this work, we present two recently developed seismic approaches supposed to significantly improve survey and understanding of seismic and aseismic rock response compared to classical monitoring approach in underground mines.

(1) The first approach is based on an automatic real-time detection and location work-flow using full wave forms that is able to deal with a wide range of mining noise sources and high sampling rate data (8 kHz).

(2) The second approach is related to matching and relocation of numerous seismic repeater occurrences probably linked to aseismic creep of weak rockmass materials in response to blasting.

Repetitive phenomena are considered the likely cause for repeated noise or aseismic activity in the surrounding rockmass. Sinusoidal or even repetitive transients are observed in several cases. They are thought to be related to the propagation of flexural waves in the surrounding structure. The detected repetitive activity is possibly due to repetitive slippages between asperities of the rockmass.

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References


Acknowledgment

Approach (1) and (2) are currently implemented into Ineris cloud monitoring technology e-cenaris at Garpenberg mine to improve anticipation of nucleation phases of potential larger dynamic rupture and rockburst events and to monitor in detail the seismic and aseismic rock response. Indeed, approach (1) improves detection capacity by almost a factor 100 and provides reliable detection and location in (near)real-time even during periods of strong microseismic activity. The resulting increase of detected events in turn improves significance of statistical analysis in space and time and estimation of standard hazard parameters like the b-value of the Gutenberg Richter law, the p-exponent of the Omori law and gamma value of the inter-event times. In addition, ongoing works regarding semi-automatization of analysis (2) (i.e. matching and relocation) provide the basis for monitoring of aseismic slip of weak rockmass in response to blasting and to provide advanced criteria for seismic hazard assessment as aseptic density and interaction and to anticipate larger dynamic rupture potential.