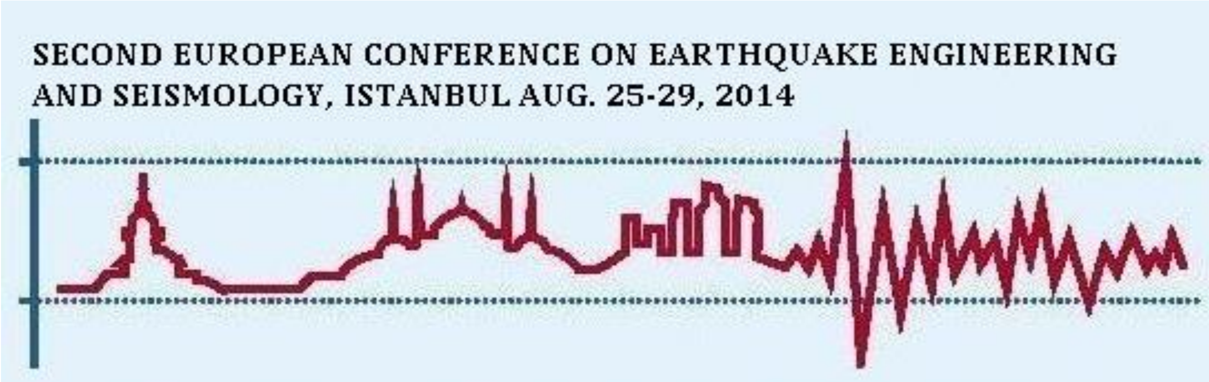

RESOLUTION OF CAVITY COLLAPSE BY MOMENT TENSOR AND SHEAR-TENSILE CRACK INVERSION USING SURFACE ARRAY OF RECEIVERS

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The resolution of cavity collapse mechanism is investigated in terms of the complete moment tensor (MT) source model and the shear-tensile crack (STC) source model representing a slip along the fault with an off-plane component (Vavryčuk, 2011; Šílený et al., 2014). A cavity collapse is hypothesized to be possibly a common source in a mining environment. The mathematically correct procedure of equivalent point source construction of a cavity collapse is adopted from Malovichko (2005), see Figure 1. The description of an earthquake mechanism using the MT is the most frequent in seismology, because it allows us to search for general dipole sources (i.e. not only for a double couple, but also for non-shear components of the source). Next, we invert for a source model which can simulate a tensile crack, optionally combined with a shear slip that may be also a good model both for natural earthquakes and induced events. Nevertheless a cavity collapse could not be exactly described by dipole source models like MT or STC and, thus, systematic error appears. The motivation is to test how these models are able to report features of the true source.

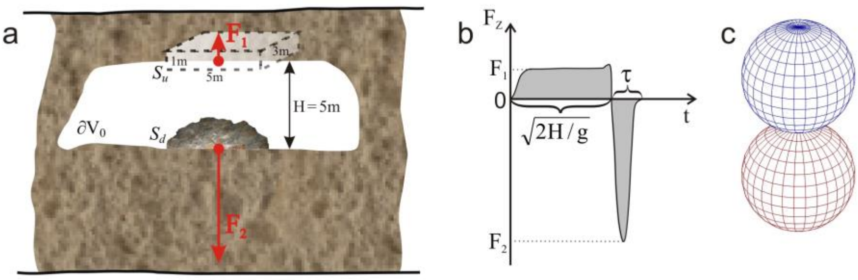

Figure 1. The model representing a cavity collapse. (a) A collapse of rock block from the floor of mine opening; (b) the behaviour of equivalent force time function in the case of inelastic impact; (c) a radiation pattern of P-waves

For the model of the source mechanism representing a cavity collapse, synthetic one- and three-component P- and S-wave amplitudes are computed at the sensors of the surface array. Noise is included as superimposed on synthetic data, and the analysis explores how the results are influenced by using three- or one-component sensors, and by inverting P- and S-wave amplitudes or P-wave amplitudes only. The source mechanisms described by a general MT and a STC source model are searched. None of these two models is able to fit correctly a cavity collapse which should be preferably expressed by a single force model. Then, the determined source mechanisms are explored

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with respect to the quality of the input dataset. The resolved source mechanisms are compared with the true source for which the synthetic data were generated.

Synthetic tests were designed and performed to explore if we are able to recognize a cavity collapse and how the resolution of the event mechanism is influenced by the quality of the dataset. We can conclude as follows: (a) there is not a significant difference between MT and STC models; (b) if P-wave data only are employed, there is no chance to recognize the inconsistent source, as inversion yields a very good fit; (c) adding the S-wave data, the fit deteriorates largely, which offers a tool to recognize an inconsistent source; and (d) regardless of the inability to retrieve the source type, the feature of its vertical orientation is obtained.

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