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# Source mechanisms of a collapsing solution mine cavity

Jannes Lennart Kinscher (1), Simone Cesca (2), Pascal Bernard (3), Isabelle Contrucci (1), Anne Mangeney (3,4), Jack Pierre Piguet (5), and Pascal Bigarre (1)

(1) L'Institut National de l'Environnement Industriel et des Risques INERIS, Nancy, France, (2) GFZ German Research Centre for Geosciences, Potsdam, Germany, (3) Institut de Physique du Globe de Paris IPGP, Sorbonne Paris Cité, UMR 7154 CNRS, Paris, France, (4) University Paris Diderot, Paris and ANGE Team, INRIA, CETMEF, J.-Louis Lions, Paris, France, (5) Université de Lorraine, GeoRessources lab.,campus Artem, Nancy, F54042, France

The development and collapse of a ∼200 m wide salt solution mining cavity was seismically monitored in the Lorraine basin in northeastern France. Seismic monitoring and other geophysical in situ measurements were part of a large multi-parameter research project founded by the research "group for the impact and safety of underground works" (GISOS), whose database is being integrated in the EPOS platform (European Plate Observing System). The recorded microseismic events (∼ 50,000 in total) show a swarm-like behaviour, with clustering sequences lasting from seconds to days, and distinct spatiotemporal migration. The majority of swarming signals are likely related to detachment and block breakage processes, occurring at the cavity roof. Body wave amplitude patterns indicate the presence of relatively stable source mechanisms, either associated with dip-slip and/or tensile faulting. However, short inter-event times, the high frequency geophone recordings, and the limited network station coverage often limits the application of classical source analysis techniques. In order to deal with these shortcomings, we examined the source mechanisms through different procedures including modelling of observed and synthetic waveforms and amplitude spectra of some well located events, as well as modelling of peak-to-peak amplitude ratios for most of the detected events. The latter approach was used to infer the average source mechanism of many swarming events at once by using a single three component station. To our knowledge this approach is applied here for the first time and represents an useful tool for source studies of seismic swarms and seismicity clusters. The results of the different methods are consistent and show that at least 50 % of the microseismic events have remarkably stable source mechanisms, associated with similarly oriented thrust faults, striking NW-SE and dipping around 35-55°. Consistent source mechanisms are probably related to the presence of a preferential direction of pre-existing fault structures. As an interesting by-product, we demonstrate, for the first time directly on seismic data that the source radiation pattern significantly controls the detection capability of a seismic station and network.