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# Assessing the monitoring performance using a synthetic microseismic catalogue for hydraulic fracturing

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Hydraulic fracturing is considered among the human operations which could induce or trigger seismicity or microseismic activity. The influence of hydraulic fracturing operations is typically expected in terms of weak magnitude events. However, the sensitivity of the rock mass to trigger seismicity varies significantly for different sites and cannot be easily predicted prior to operations. In order to assess the sensitivity of microseismity to hydraulic fracturing operations, we perform a seismic monitoring at a shale gas exploration/exploitation site in the central-western part of the Peribaltic synclise at Pomerania (Poland). The monitoring will be continued before, during and after the termination of hydraulic fracturing operations. The fracking operations are planned in April 2016 at a depth 4000 m. A specific network setup has been installed since summer 2015, including a distributed network of broadband stations and three small-scale arrays. The network covers a region of 60 km2. The aperture of small scale arrays is between 450 and 950 m. So far no fracturing operations have been performed, but seismic data can already be used to assess the seismic noise and background microseismicity, and to investigate and assess the detection performance of our monitoring setup. Here we adopt a recently developed tool to generate a synthetic catalogue and waveform dataset, which realistically account for the expected microseismicity. Synthetic waveforms are generated for a local crustal model, considering a realistic distribution of hypocenters, magnitudes, moment tensors, and source durations. Noise free synthetic seismograms are superposed to real noise traces, to reproduce true monitoring conditions at the different station locations. We estimate the detection probability for different magnitudes, source-receiver distances, and noise conditions. This information is used to estimate the magnitude of completeness at the depth of the hydraulic fracturing horizontal wells. Our technique is useful to evaluate the efficiency of the seismic network and validate detection and location algorithms, taking into account the signal to noise ratio. The same dataset may be used at a later time, to assess the performance of other seismological analysis, such as hypocentral location, magnitude estimation and source parameters inversion.

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