Induced Microseismicity due to Raising Mine Water Level in Former Coal Mines in the Eastern Ruhr Area (Germany)

Martina Rische (martina.rische@rub.de), Kasper D.Fischer, Wolfgang Friederich Institute of Geology, Mineralogy and Geophysics, Ruhr-University Bochum

Seismologisches Observatorium RUB

FloodRisk – seismological monitoring

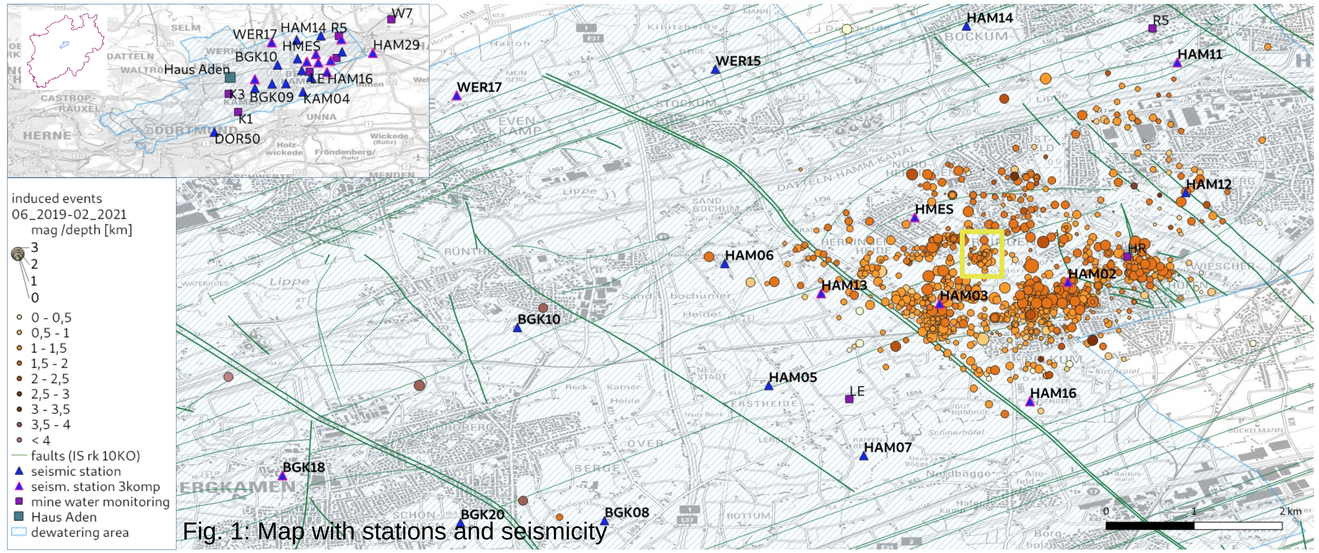

Fig. 1: Map with stations and seismicity

- Seismological network of up to now 21 short period stations
- Installed in the eastern Ruhr area
- > 1000 induced microseismic events in a magnitude range -0.7 up to 2.6 M_{LV} were located since mid 2019
- Locations focus in the eastern area of the observation region, where mining was last active
- Spacial distribution is clustered and the depth of the observed events agrees with the seismicity during active mining
- Seismicity seems to be limited by a large inactive transverse fault in the west

Temporal variations of mine water level and induced microseismicity

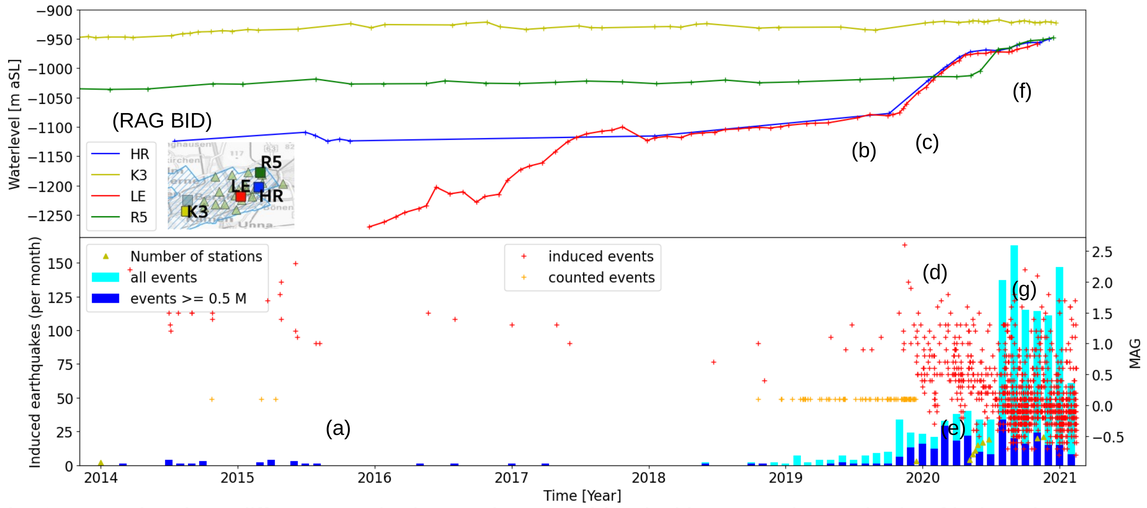

Fig. 2: Water levels at different monitoring stations combined with rate and magnitude of induced events over time

- After stop of mining in 2010 rare induced events occur (a)
- Mid 2019 pumps in dewatering area “Haus Aden” were shut down – mine water level at the monitoring points (RAG) changes slowly (b) in the first time
- Flow rate at the monitoring points LE (red) and HR (blue) doubled November 2019 (c)
- Short after this raising two induced earthquakes with magnitude 2.6 and 2.0 M_{LV} occurre in the region next to HR (d)
- The event rate has been consistently high in the following time (e)
- Variations in the rise of the water level (f) are reflected in the number of the induced events (g)

Waveform similarity

Several clusters of events were observed, which shows additionally to the spacial clustering high waveform similarity. One (yellow box in Fig. 1) is shown here with correlation Matrix and corresponding waveforms at two nearby stations.

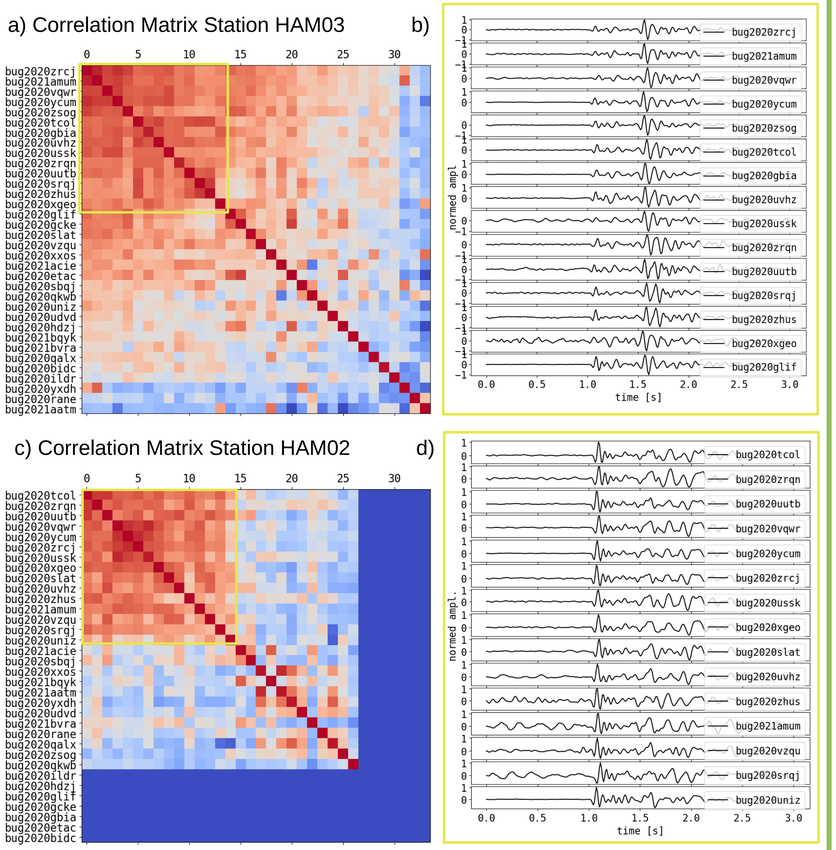

Fig. 3: a,c) red colors indicate high similarity b,d) corresponding waveforms

References

RAG BID: Mine water monitoring http://www.bid.rag.de/bid/index.htm
IS rk 10 KO: geological map
https://www.gd.nrw.de/pr_shop_informationssysteme_rksk10d.htm

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung