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Assessing areas of potential damage after induced events for legal regulations in Germany

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Induced and triggered seismicity in Germany is related to various mining operations such as hydrocarbon extraction, geothermal exploitation and classical mining techniques, i.e. coal and potash mining.
On average, about 14 induced events in Germany per year have magnitudes above 2 and are likely to be felt. After larger events (about three magnitude 3 events per year) small damages to buildings were observed that might have been caused by the ground shakings, e.g. more than 400 damages were claimed after a magnitude 3.1 event at a natural gas field in northern Germany in 2016. This led to public discussions on compensation and to political discussions on improving legal regulations. The possibility of damages being caused by mining induced seismic events and unclear financial compensation reduced the acceptance of mining projects in the past, e.g. geothermal projects are inhibited.
From the seismological perspective, local measurements of PGV are often rare. Thus, it is difficult to assess the damage potential of the seismic events in detail, especially if intensities are around V (EMS-98). In many cases, a relation between individual damages at buildings and the seismic event is only hardly verifiable. Actually, detailed survey reports could neither prove nor disprove the relation between damages and seismic events in some cases. In conclusion, some of the widely discussed events might have led to small damages.
In case of verified damage due to an induced event, the causative mining company has to pay compensations. For less clear cases, new legal regulations entered into force in 2016. The Federal Mining Act was revised with an improved legal situation for the population. The new legal regulations define, that damages at buildings are assumed to be caused by the seismic event, if they occur within a certain area defined by the mining authority (impact area, German: “Einwirkungsbereich”).
In 2017, a working group developed a guideline with recommendations on the general procedures and how an impact area should be defined. The guideline determines threshold values for which events impact areas have to be defined and recommends how to specify the impact area. The spatial extend of the impact area must be based on all available and suited data like peak ground velocities (PGV), macroseismic investigations and other data from empirical investigations or ground motion prediction equations (GMPE).
A brief introduction about the existing legal regulations will be presented and first experiences with the definition of the impact area for a few induced seismic events in the area of natural gas extraction in northern Germany with magnitudes between ML 2.9 and 3.6.