

INDUCED SEISMICITY DUE TO GAS EXTRACTION IN THE GRONINGEN FIELD

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Gas extraction in the North of the Netherlands causes induced seismicity. Although the magnitudes are moderate (up to $M=3.6$ today), the earthquakes are rather shallow ($\sim 3\text{km}$), and the largest ones result in considerable damage. In recent years, the rate of events has been rising considerably, especially in the giant Groningen field. Public acceptance in the region has declined dramatically, but the gas extraction cannot be stopped completely due to the national dependence for energy demands and revenues.

The first recorded induced seismic event in the Groningen Field was in 1991, after almost 30 years of production. From 1995 a regional shallow ($\sim 200\text{m}$) borehole geophone network has been in place with a typical spacing of $\sim 20\text{ km}$ and a location completeness level of $M=1.5$. The network is currently being densified to a typical spacing of $\sim 5\text{ km}$. Also, a number of deep downhole microseismic arrays are being installed. We present a case study of the passive seismic measurements in the Groningen field, including event characterization and statistics.

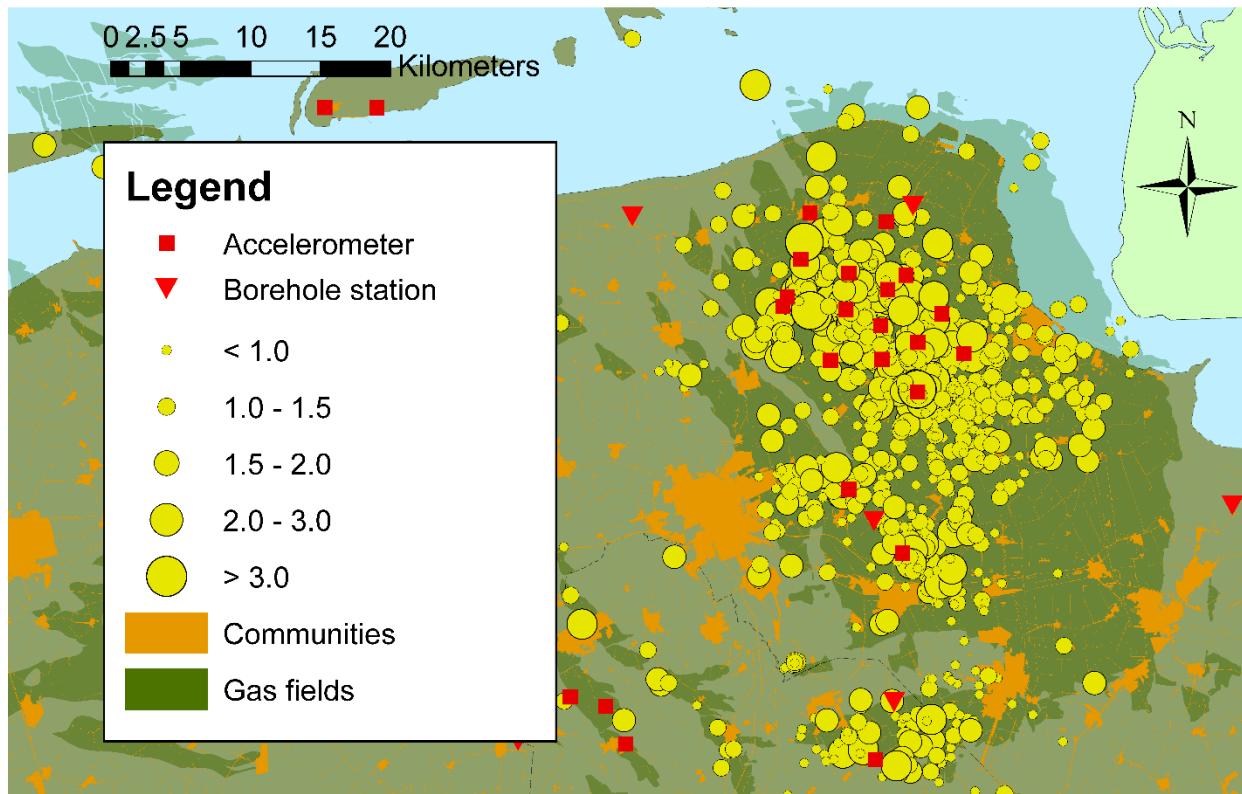


Figure: The Groningen field, regional network and observed seismicity