



Induced seismicity in the gas reservoirs of the Netherlands

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The Netherlands contains a large number of natural gas fields of various sizes, including the Groningen field, the largest in Western Europe. Gas production started in 1960 and is expected to be continued for more than two decades ahead. In due course, more and more of the smaller fields will become depleted and potentially available for underground gas storage. A number of fields are already being used as buffer storage for natural gas. Plans for CO₂ storage in other fields are reaching an advanced stage.

Currently, most industrial activity in the gas fields is still related to gas extraction rather than storage. The monitoring and analysis of induced seismicity that is observed today will be crucial for the assessment of storage opportunities in the near future.

Induced seismicity due to gas extraction was not observed or recognized until a first widely felt event of magnitude 3.2 (ML) in 1986, only after several decades of production. Since then a steady rate of seismicity is observed, distributed over several fields. The largest events (up to ML=3.5 so far) cause some none-structural damage and much concern to the public.

The monitoring network currently consists of 11 shallow (200m) borehole sensors and a pool of 19 accelerometers. The regional location threshold is around ML=1. The induced seismic catalogue contains more than 550 events to date and is growing at a rate of 30-50 events annually.

The current work is aimed at improving source location accuracy using 3D velocity models obtained from the gas industry and the association of events with specific fault planes. The observed seismicity pattern provides insight on the behaviour of (compartments of) the gas fields under changing stress conditions.