

# When the Earth rumbles



## Sensors

KNMI registers seismic and acoustic events around the clock, 24/7:

- GPS (monitoring of volcanoes)
- Seismometers (ground motion; installed at the surface)
- Borehole seismometers (subterranean ground motion)
- Microbarometers (atmospheric, inaudible sound)

KNMI operates a network of sensors throughout the country. Most of them in the province of Groningen.

KNMI measures and researches the origin, impact and magnitude of vibrations in the Earth's subsurface and atmosphere. Our mission is to inform the inhabitants of the Netherlands about the effects of earthquakes, explosions and volcanic eruptions.

Two types of earthquakes occur in The Netherlands:

### Induced earthquakes

Caused by gas extraction. When natural gas is extracted from the porous sandstone layer, the subsurface contracts unevenly. This can cause earthquakes and surface vibrations. These type of quakes occur particularly in the northeast of the Netherlands in the province of Groningen.

### Naturally occurring earthquakes

Caused by a sudden movement along natural fault lines deep in the Earth's crust. This type mainly occurs in the southeast of the Netherlands in the province of Limburg.



### Earthquakes due to gas extraction

Strongest: 3.6 (Richter)  
Huizinge, 2012

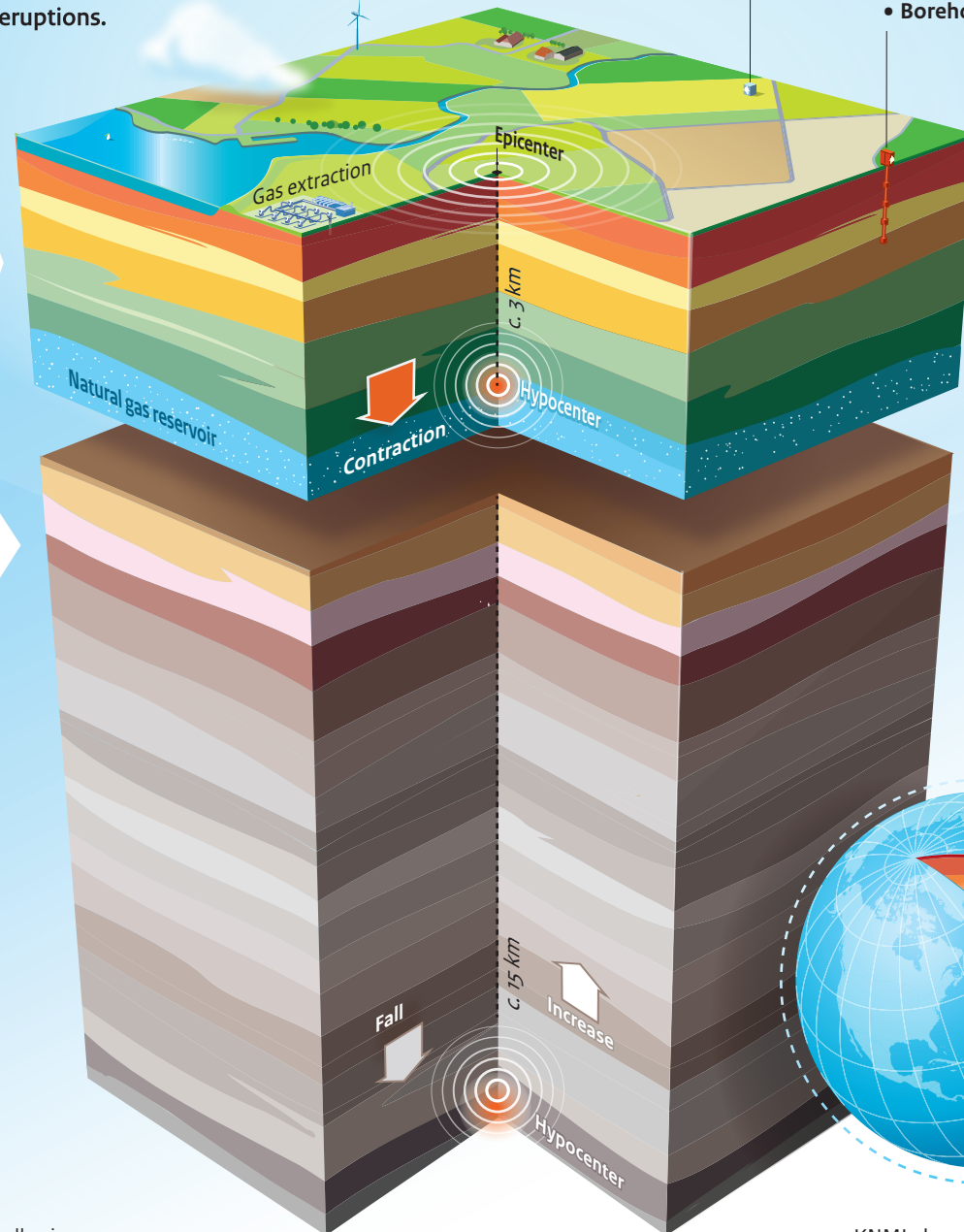
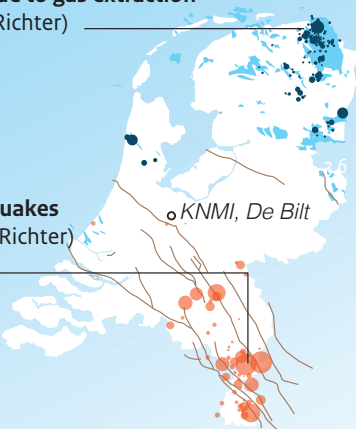
□ Gas fields

### Natural earthquakes

Strongest: 5.8 (Richter)  
Roermond  
1992

○ KNMI, De Bilt

— Fault lines



## Data processing

KNMI researchers collect and analyse the data in order to understand the impact of the seismic or acoustic event on society.



KNMI provides online access to the data and informs all parties involved.

Online surveys available to residents are used to map out the effects of seismic and acoustic events.



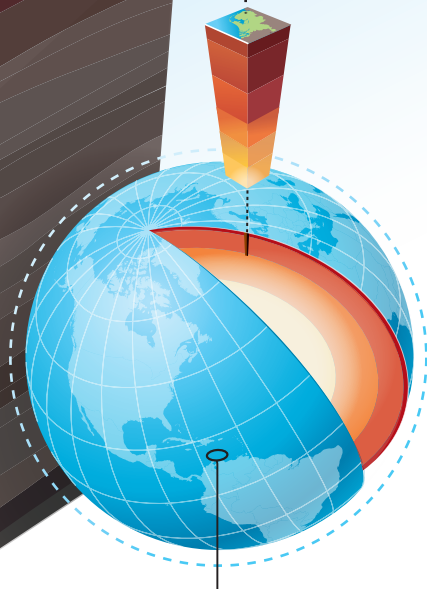
## International Responsibilities

### ORFEUS data center

Collection of seismic data from European countries. Data is used by the international community.

### Nuclear Test Ban Treaty

A global network of sensors to detect nuclear tests anywhere on Earth (underground, under water or in the atmosphere). KNMI provides advice on such detections to the Dutch government.



KNMI also monitors seismic and volcanic activity in the Dutch Caribbean.