

## **The broad-band seismograph network in the Netherlands**

### **Report for the Federation of Digital Broad-Band Seismograph Networks meeting, Potsdam, September 2004**

Reinoud Sleeman ([sleeman@knmi.nl](mailto:sleeman@knmi.nl))  
Royal Netherlands Meteorological Institute (KNMI)

The broad-band seismograph network in the Netherlands has four permanent stations: HGN, WTSB, WIT and OPL. All four stations are equipped with Quanterra data-loggers (Q4120, Q730) and Streckeisen sensors (STS-1, STS-2). Data collection and real-time transfer from HGN, WIT and WTSB to the KNMI is managed by SeisComp/SeedLink, running at each station on Linux PC's. Such a system will be installed at OPL before the end of 2004. All data-loggers are configured to produce two different data-streams for each channel: one continuous data-stream digitized with 40 samples per second (sps), and one data-stream of triggered data sampled with 100 sps. Next to the permanent stations the KNMI has 3 mobile broad-band stations, consisting of STS-2 sensors and Quanterra dataloggers: one Q730 and two Q330's (each with a baler).

Data communication from the permanent stations to the KNMI is over 64 kbit telephone lines (digistreams), over which the 40 sps and 100 sps data-streams are transmitted under control of SeedLink. At present station OPL is not part of this continuously transmitting network. However, we are experimenting with a GPRS modem to set up a wireless connection to OPL. Once this is operational the continuous data will be transmitted to the KNMI, also under control of SeedLink.

Data from HGN, WTSB and WIT is collected at the KNMI by SeisComp/SeedLink on a Sun Solaris system. This system manages the archival of raw waveform data (mini-SEED) on a mass storage (tape device) system and is also the export server for real-time data from stations HGN, WTSB and WIT to ORFEUS Data Center (ODC). HGN, WTSB and WIT are stations in the Virtual European Broadband Seismograph Network (VEBSN) and collected at the ODC by Antelope®. From the ODC the data is forwarded directly to IRIS-DMC using SeedLink.

Routine analysis of waveform data from HGN, WTSB and WIT is carried out daily, using in-house developed software. Phase readings and magnitudes are reported by e-mail to the ISC, EMSC-CSEM and interested users. Recently we have upgraded the software to report our seismic parameters in the IMS1.0 format following the IASPEI standard seismic phase list.

At the end of 2002 a real-time application was developed and implemented under Real-Time Linux to send (digital) data on the Internet to an analog recording system (drumrecorder). At present, data from HGN, WTSB and WIT is visualized on drumrecorders in this way, which still proves to be very attractive to press and public. Also we developed an automatic procedure to show the continuous data from HGN on the Internet by helicorders. This 'Live Seismogram' service is updated every 15 minutes and also shows VEBSN earthquake locations, details of automatic triggers and computed phase arrivals.

In 2004 we developed a stand-alone monitoring application for SeedLink, called 'NetRecorder'. This application displays (1) in real-time the waveform data from a selected station by connecting to a SeedLink server, (2) its waveform data of the last 24 hours, and (3) the VEBSN seismicity map. The application runs on Linux PC's and serves as 'digital drumrecorder'.

Table 1: BB stations in the Netherlands. Stations HGN, WTSB and WIT are international station codes, which are registered at the NEIC, and have assigned the FDSN network code NL. The code OPL is not registered.

Code	Name/Location	Start date	Longitude	Latitude	System
HGN	Heimansgroeve	Feb. 1993	5.9317	50.7640	Q4120/STS-1
WIT	Witteveen	Feb. 1994	6.6695	52.8135	Q730/STS-1
WTSB	Winterswijk	Feb. 2000	6.7989	51.9663	Q4120/STS-2
OPL	Oploo	Sep. 1998	5.8121	51.8888	Q4120/STS-2

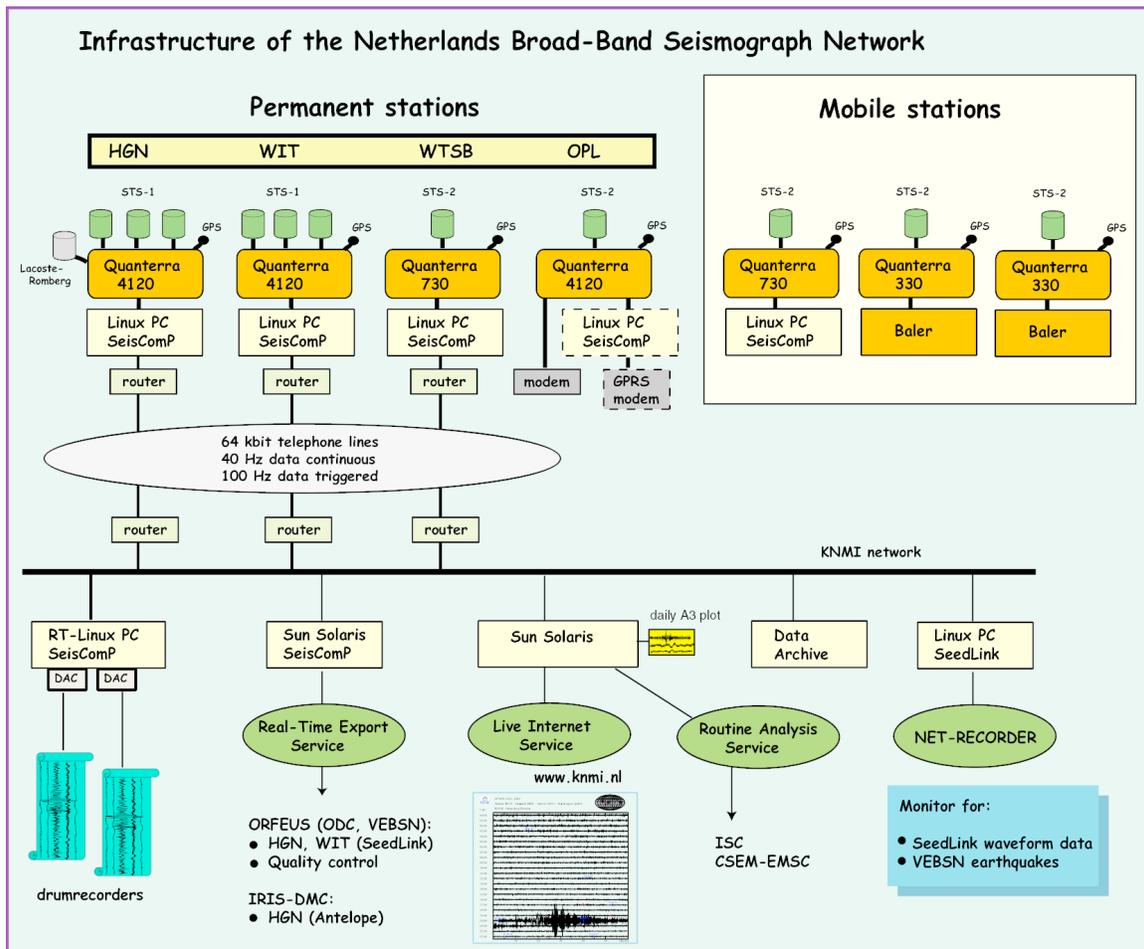
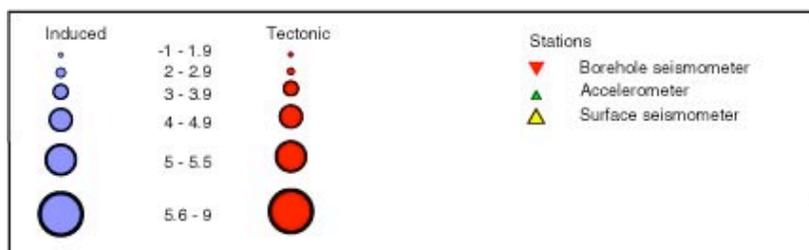
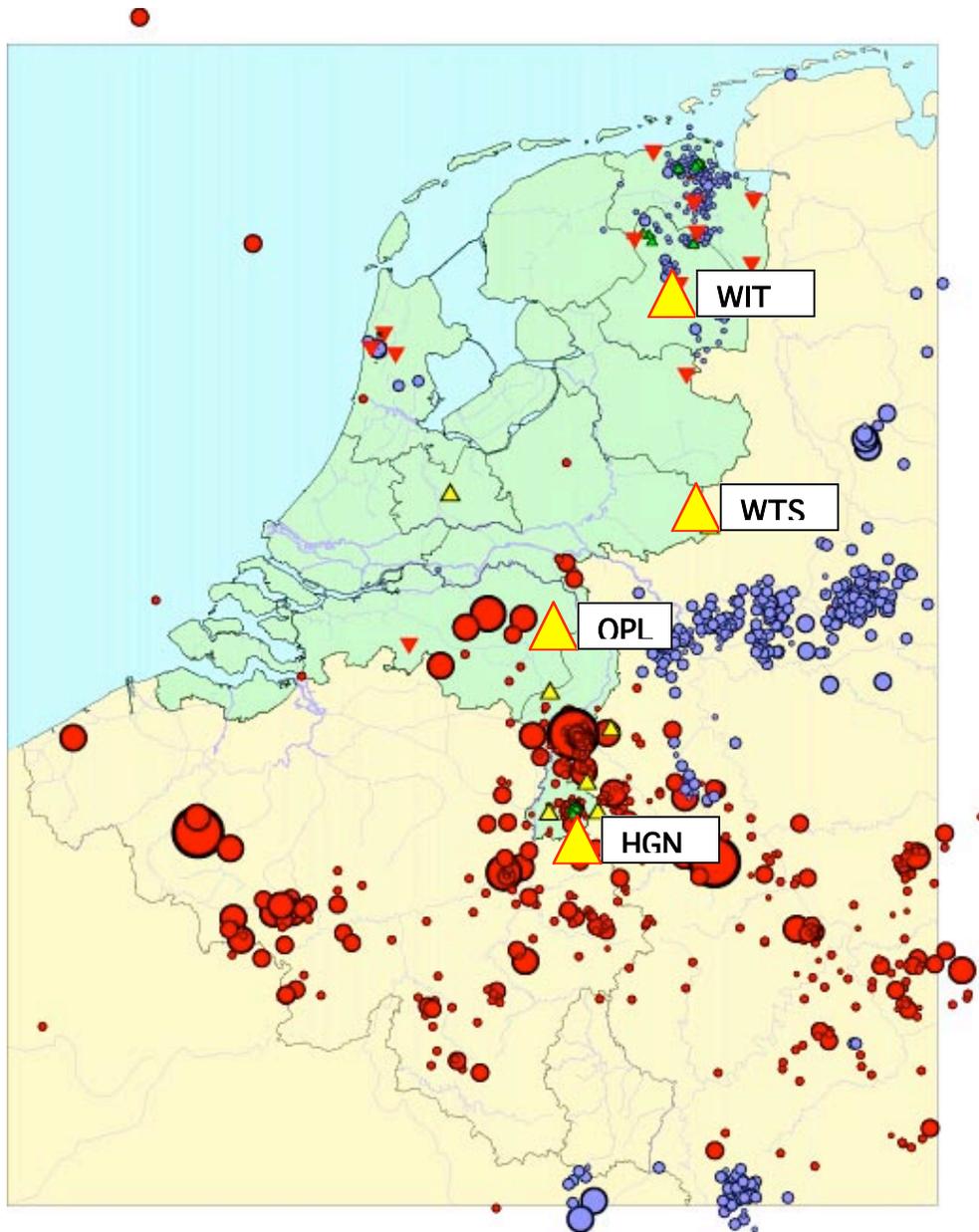


Figure 1: Infrastructure of the Netherlands BB network.



*Figure 2: Geographical map of seismicity (1905 – 1996) and seismograph stations in the Netherlands*