



Bulgarian seismological network

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In 2005, the Geophysical Institute performed overall modernization of the National Seismological Network (BNDSN). The upgraded network consists of:

- National Data Centre (NDC);
- 13 stations equipped with RefTek High Resolution Broadband Seismic Recorders – model DAS 130-01/3 and 1 station equipped with Quanterra 380;
- broadband seismometers and accelerometers.

Real-time data transfer was realized via Virtual Private Network (VPN) of the Bulgarian Telecommunication Company (BTC). The data acquisition and processing hardware redundancy at the National Data Center was achieved by two clustered SUN Fire V240 servers and two Blade 1500 Workstations. To secure the acquisition, processing and data storage processes a three layer network was designed at the NDC. Real-time data acquisition was performed using REFTEK's full duplex error-correction protocol RTPD. Data from the Quanterra recorder and foreign stations were fed into RTPD in real-time via SeisComP/SeedLink protocol and sl2rtpd demon running on Server1. Data processing was performed by the Seismic Network Data Processor (SNDP) software package running on both Servers. SNDP includes two subsystems:

- Real-time subsystem (RTS) – for signal detection; evaluation of the signal parameters; phase identification and association; source estimation.
- Seismic analysis subsystem (SAS) – for interactive data processing.

The signal detection process is performed by traditional STA/LTA detection algorithm. The filter parameters of the detectors are defined on the base of previously evaluated ambient noise at the seismic stations.

Some extra modules for network command/control and monitoring and data archiving are running as well. Three types of archive are produced in NDC - two continuous - miniSEED format and RefTek PASSCAL format; and one event oriented in format of CSS3.0 scheme.

Modern digital equipment and broad-band seismometers installed at Bulgarian seismic stations, careful selection of the software packages for automatic and interactive data processing in the data centre proved to be suitable choice for the purposes of BNDSN and NDC. Currently, the BNDC and BNDSN allow reliable automatic localization of low magnitude events $ML \geq 1.5$ within the network, and $ML \geq 2.5$ at regional distances.

Recently, an evaluation of the ambient seismic noise levels at seismic stations was done. The obtained results show that the Bulgarian seismic stations belong to the stations worldwide with middle-level noise because of the good performance of the seismological equipment and thoroughly done site selection.