DSEBRA 2018 -- the German seismological contribution to AlpArray

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DSEBRA

DSEBRA (**D**eutsches **Se**ismologisches **Br**eitband **A**rray) comprises 100 seismological broadband stations and currently constitutes the German contribution to the European *AlpArray* Seismic Network (*AASN*). The recorded array data form the basis for scientific work of the *SPP-2017 MB-4D (Mountain Building Processes in 4D)*. DSEBRA provides real-time high-quality broadband data, which are essential to investigate surface processes, physical properties of the lithosphere and asthenosphere and allow the estimation of high-resolution images of the structure beneath the Alps-Dinarides orogenic system.

Deployment

Seventy-one differently equipped UNIBRA (**Un**iversity **Br**oadband **A**rray: collaboration of eight universities) stations, installed from autumn 2015 were replaced by now instrumentally uniform DSEBRA stations within 2018. Fifty-five stations cover the South-German northern Alpine foreland bordered by the Main River in northern direction. We additionally replaced 17 stations in Austria, some of them deployed in the high alpine mountains, which makes the logistics of installation and maintenance particular difficult. In order to better understand the lithospheric structure in the central collision zone between European and Adriatic plates and to observe the seismicity in the Niedere Tauern region, 10 further stations were installed in Austria in September 2018 to expand the high station density SWATH-D array operated by the GFZ Potsdam in North-East direction.
As the funding for stations operated by the Hungarian project partners expire in spring 2019, we plan to replace 10 further *AASN* stations in the West of Hungary. We additionally want to support the Hungarian plans for a new array in Eastern Hungary by deploying additional five stations, which will allow high-resolution seismic imaging in that area.

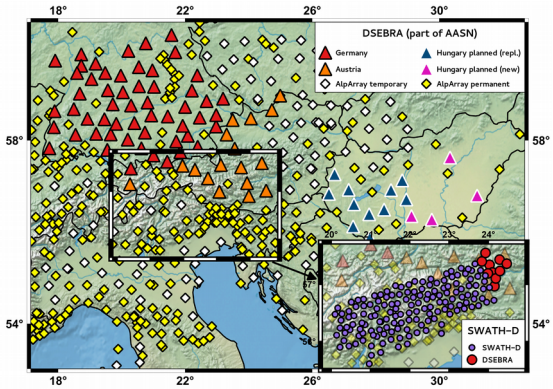

Figure 1: DSEBRA station distribution: Red/orange triangles: DSEBRA stations installed in Germany/Austria. Blue/magenta triangles: planned DSEBRA stations in Hungary (spring 2019) (Replacement-*AASN*/new). Yellow/white diamonds: *AlpArray* permanent/temporary stations occupied by project partners. Inserted map: purple circles: SWATH-D stations occupied by GFZ Potsdam. Red circles: SWATH-D extension by DSEBRA stations.

Equipment and Testing

All DSEBRA stations are equipped with a broadband seismometer (Nanometrics Trillium Horizons 120s), a 24-bit data logger (Nanometrics Centaur), a router (Teltonika RUT955), a battery (Yuasa NP38, 12V, 35Ah), a battery-charger (CTEK MXS 5.0) and an LTE- and GPS-antenna (see Fig. 2). Four stations in Austria are running on a solar power system. To guarantee a precise orientation, the seismometers were aligned to geographic North with the help of a gyrocompass (iXBlue

Quadrans). The recorded data of all DSEBRA stations are transmitted in real-time to Geophysical Observatory of the LMU-Munich via mobile connections.

Figure 2: DSEBRA station equipment.

Prior to the deployment, we performed several instrument tests to ensure consistent high-quality of the acquired data. In doing so, we tested the system noise of the data loggers to determine system errors and to verify that the data logger operates within its factory specifications.
In so called huddle tests consisting in a parallel measurement of several instruments we estimated differences in noise and signal recordings. As final tests of the specifications, we calibrated the seismometers with a calibration step table (CT-EW1 and OSOP) to confirm the generator constant.

Data Availability

With the beginning of DSEBRA, we transferred all UNIBRA and DSEBRA archive data as well as the stations metadata to LMU-Munich, who acts as an EIDA (**E**uropean **I**ntegrated **D**ata **A**rchive) subnode. The archive data are (at the moment only for the project partners) available via ArcLink protocol and FDSNWS. The real-time data are distributed to the partners via SeedLink.

Data Quality

By exchanging the UNIBRA-stations with DSEBRA stations, we were able to lower the noise floor by at least 10 dB in the frequency range of 0.1 Hz to 1 Hz. This is a significant improvement in data-quality and sets new average noise standards for field experiments.

We monitor the incoming data as well as their state of health data in order to react as swiftly as possible in case of a technical station failure. Furthermore, we work on real-time data quality monitoring and an ObsPy-toolbox to perform pre-deployment tests.

DSEBRA is also used as a platform to test and compare technical equipment, seismometer shielding methods and to determine selection criteria of suitable station locations. This leads to a continuous improvement of the array, the technical design of the stations and expand our knowledge of observational practice.

To conclude, DSEBRA currently provides an excellent contribution to the *AlpArray* project with large-aperture, high-quality, real-time data. The standalone array, equipped with state-of–the-art technology, which was extensively tested, creates the basis for complementary European or international seismological projects.