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Comparison between Distributed Acoustic Sensing (DAS) and strain meter measurements at the Black Forest Observatory

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We present an original DAS measurement station, equipped with the Febus A1-R interrogator, which has been deployed at the Black Forest Observatory (Schiltach, Germany). The objective of this deployment is twofold. The first is to test the deployed fibre optic cables and to better characterise the recorded signals. The second is to define standards for the processing of these DAS measurements, with a view to using the equipment for passive seismic monitoring in the INSIDE project (supported by the German Federal Ministry for Economic Affairs and Energy, BMWi).

Testing sensors involving new acquisition technologies, such as instruments based on Distributed Fiber Optic Sensing (DFOS), is part of the observatory's goals, in order to assess, to maintain and to improve signal quality. Interestingly, reference geophysical instruments are also deployed on a permanent basis in this low seismic-noise environment. Our analyses thus benefit from the records of the observatory's measuring instruments, in particular a set of three strain meters recording along various azimuths. This configuration enables a unique comparison between strain meter and DAS measurements. In addition, an STS-2 seismometer (part of German Regional Seismic Network, GRSN) allows for additional comparisons.

These instruments provide a basis for a comparative analysis between the DAS records and the measurements of well-calibrated sensing devices (STS-2 sensor, strain meter array). Such a comparison is indeed essential to physically understand the measurements provided by the Febus A1-R interrogator and to characterise the coupling between the ground and the fiber, in various deployment configurations.

We present the experiment where we investigate several Fiber Optic Cable layouts, with currently our most successful setup involving loading a dedicated fiber with sandbags. We discuss different processing approaches, resulting in a considerable improvement of the fit between DAS and strain array acquisitions. The presented comparative analysis is based on the recordings of different earthquakes, including regional and teleseismic events.