EGU23-16307, updated on 29 Mar 2023
https://doi.org/10.5194/egusphere-egu23-16307
EGU General Assembly 2023

Local earthquake recordings using Distributed Acoustic Sensing (DAS) at BFO

Nasim Karamzadeh Toularoud[1], Ya-Jian Gao[1], Jérôme Azzola[2], Thomas Forbriger[1,3], Rudolf Widmer-Schnidrig[3,4], Emmanuel Gaucher[2], and Andreas Rietbrock[1]

[1]Karlsruhe Institute of Technology, Geophysical Institute, Karlsruhe, Germany (nasim.karamzadeh@kit.edu)
[2]Karlsruhe Institute of Technology, Institute of Applied Geosciences (AGW), Geophysical Institute, Karlsruhe, Germany
[3]Karlsruhe Institute of Technology , Black Forest Observatory, Schiltach, Germany
[4]University of Stuttgart, Wolfach, Germany

The application of distributed acoustic sensing (DAS) in seismology is rapidly expanding due to its ability to perform a large number of high-density measurements, i.e., distributed sensing, without using many point sensors, which is cost-effective. DAS application includes vertical seismic profiling, microseismic measurements, and hydraulic fracturing monitoring and mainly focuses on the event detection capability of DAS data.

Febus optics DAS interrogator (A1-R) is continuously running at German Black Forest Observatory (BFO) since May 2021, recording RAW data (selectively stored) or strain-rate data (continuously stored). Our study is in the experimental phase and focuses on testing basic concepts of DAS data, i.e., the effect of gauge-length on the amplitude of measurement and comparing the amplitude of DAS with other seismological sensors such as strain-meter array and a STS2 broadband sensor as well as synthetic simulations. Such comparison is performed using background noise characteristics (power spectral density) and examples of local and regional events that are detectable at the BFO site.

In this study, we show examples of strain rate measurements related to local earthquakes recorded by horizontal fiber optic cables, employing two different DAS interrogators, cable types and coupling of the cables to the ground. We compared simultaneous recordings using Febus A1 DAS interrogator and OptoDAS by Febus optic and Alcatel Submarine Networks (ASN), respectively, and, concluded about the frequency and gauge-length dependent sensitivity of recordings in two cases. In addition, we compare the amplitude of DAS recordings, for example of local earthquakes, with the synthetic strain simulated at lower frequency bands using the spectral-element method (Salvus) based on 3D media and analytic approach (Qseis) for 1D model.