



Report of Transnational Access Projects

Project ID: C4-TA3-86-1-3 ATLANTIDAS

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Project title: ATLANTIDAS

Project acronym: chAracterizaTion of seafLoor eArthquakes usiNg integraTed dIstributed acoustic sensing (**DAS**) and conventional networks

Hosting installation: GFZ Helmholtz Centre for Geosciences (GFZ), Germany
 Regional Agency for the Development of Research, Technology and Innovation (ARDITI), Oceanic Observatory of Madeira

Hosting team: Online-access to data via S3 platform (GFZ).

Period of access: 2024-08-03 >> 2024-08-31 (vintage data with catalog earthquake recordings); 2024-12-03 >> 2024-12-13 (vintage data with catalog earthquake recordings); 2025-03-22 >> 2025-04-30 (vintage data with catalog earthquake recordings); **2026-03-01 >> 2026-04-21 (exclusive for TA 4th call).**

Report of activities:

The project C4-TA3-86-1-3 ATLANTIDAS enabled the team to access Distributed Acoustic Sensing (DAS) data from a 57 km offshore fiber-optic cable in Madeira, Portugal. The data consist of either windowed recordings of past earthquakes or continuous daily recordings. In the former case, the data are stored in 10-minute-long files, whereas in the latter they are stored in 10-second-long files.

Given this dual nature of the dataset, we focused either on estimating earthquake source parameters or on scanning continuous data for transient signals, using new methodologies developed by the team. Specifically, for windowed data, we tested: (a) a spectral subtraction denoiser (Pascucci et al., 2025); (b) an automatic DAS channel



selector (ORION; Bozzi et al., 2026); and (c) a hybrid network location method (LION; Bozzi et al., in prep.), which uses the subset of DAS waveforms selected by ORION.

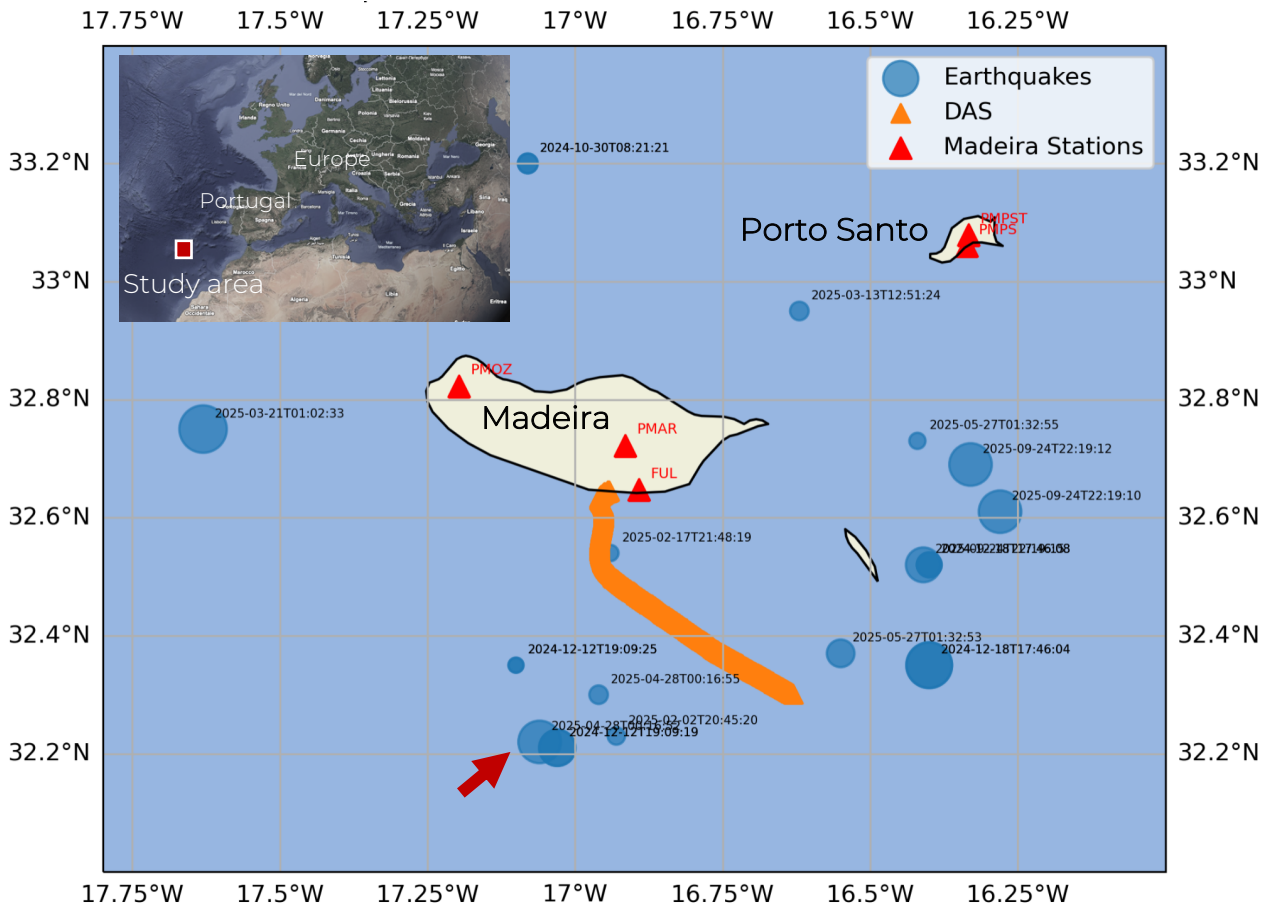


Figure 1. Overview of the catalog seismicity available through GeoInquire TA project ATLANTIDAS. Available instruments: Five three-component open-access seismic stations on land Madeira and Porto Santo and a 57 km fiber optic cable instrumented with DAS (Loureiro et al., 2025). The red arrow highlights the M 4 earthquake used to test the denoiser (Pascucci et al., 2025, Figure 2), the channel selector (Bozzi et al., 2026, Figure 3) and the hybrid network locator (Bozzi et al., in prep., Figure 4).

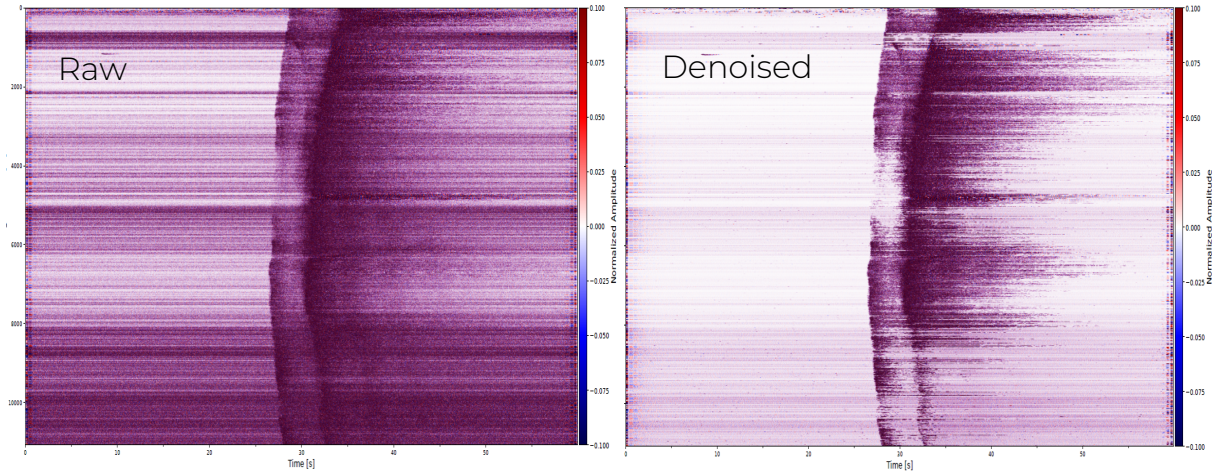


Figure 2. Raw and denoised earthquake recording (M4 2025-04-28, 00:16:52). The denoising method is a spectral subtraction method developed by (Pascucci et al., 2025) to enhance signal-to-noise ratio of seismic phases and therefore their detectability.

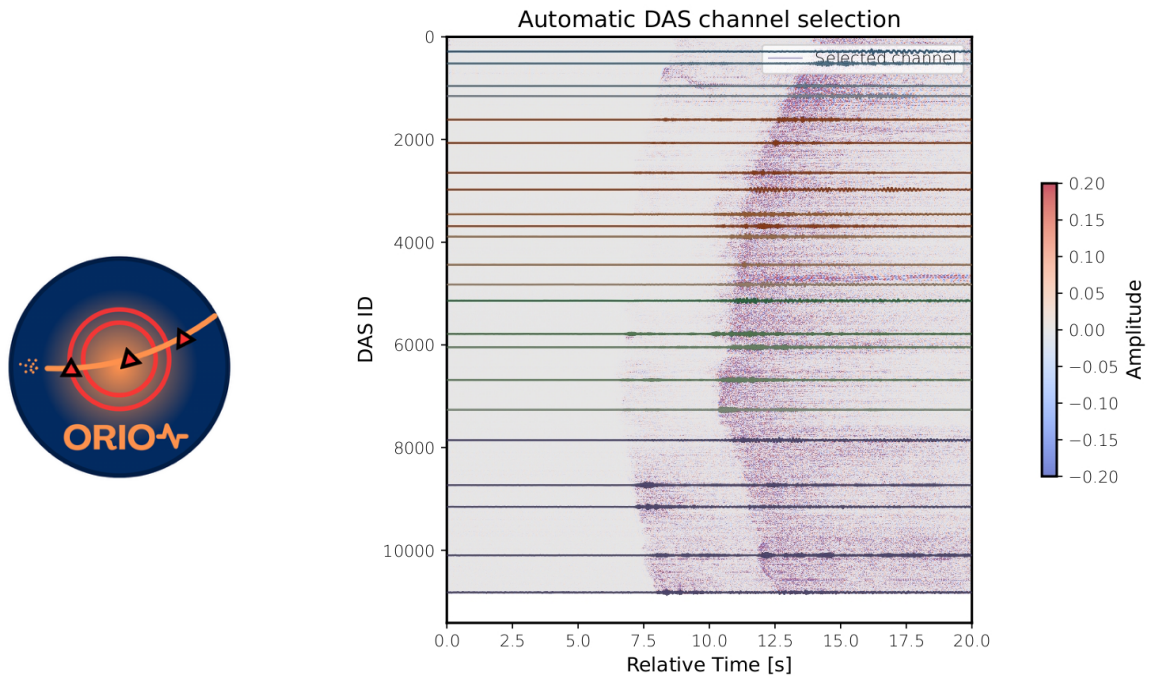


Figure 3. Application of the automatic DAS channel selector (namely ORION, Bozzi et al., 2026) to retrieve a subset of waveforms which is then merged with seismograms from three-component seismometers to estimate a hybrid location (Figure 4).

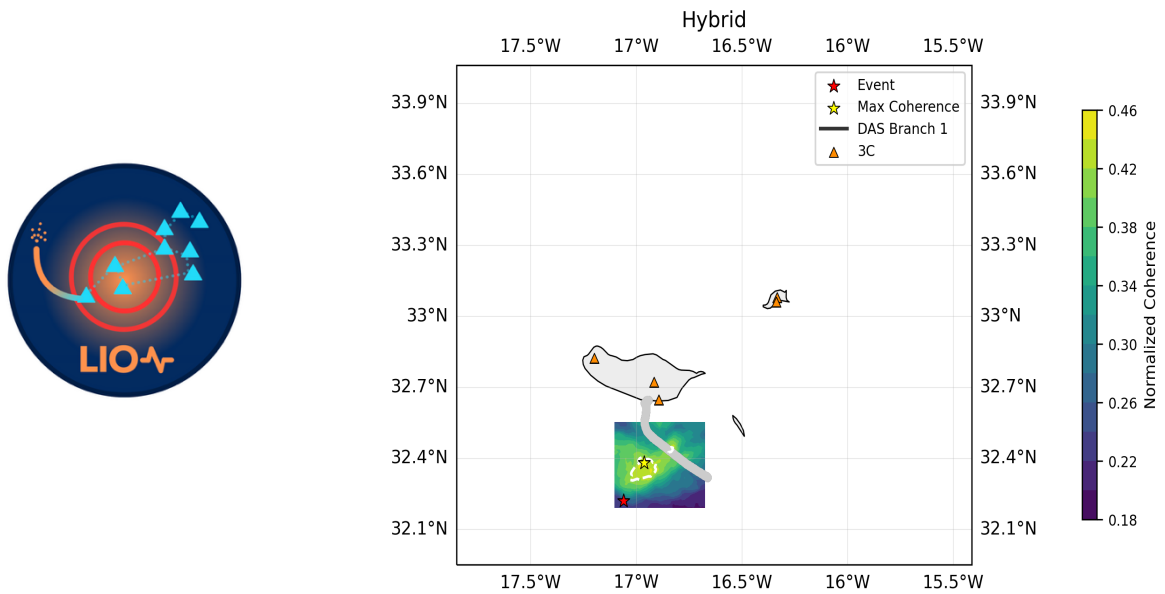


Figure 4. Estimation of the earthquake location combining data from on land seismometers and a subset of DAS channels. The method, namely LION, is currently under test (Bozzi et al., in prep.), and we are exploiting also DAS data from ATLANTIDAS project for finalizing the algorithm. Event locations are estimated with a modified version of waveform-stacking method (Grigoli et al., 2013) with yellow bright spots representing the set of grid points associated which synthetic travel times stack more energy along recorded seismic traces. The red star represents the catalog location.

Continuous recordings are currently being used to test a DAS detector (Porrás et al., 2024) for identifying transient signals that are not included in the existing earthquake catalog. A master's student (Juan Sebastian Rodriguez) completed his internship focused on adapting the detector for the ATLANTIDAS DAS dataset. The main challenges are: (a) the very large number of channels (>10,000), which significantly increases the computational cost of applying the detector to continuous data; and (b) tuning the detector parameters, particularly the geometry of the hyperbola used to identify coherent arrivals across the DAS array. This work will continue as part of his master's thesis, with the goal of completing the detection and characterization of new transient events in the period March-April 2026. Recent studies have shown that offshore fiber-optic cables can act as highly sensitive antennas for recording low-energy seismic events (Bocchini et al., 2026). Expanding the seismicity catalog could therefore reveal previously undetected fault zones or spatio-temporal patterns that cannot be resolved using only onshore seismic networks.

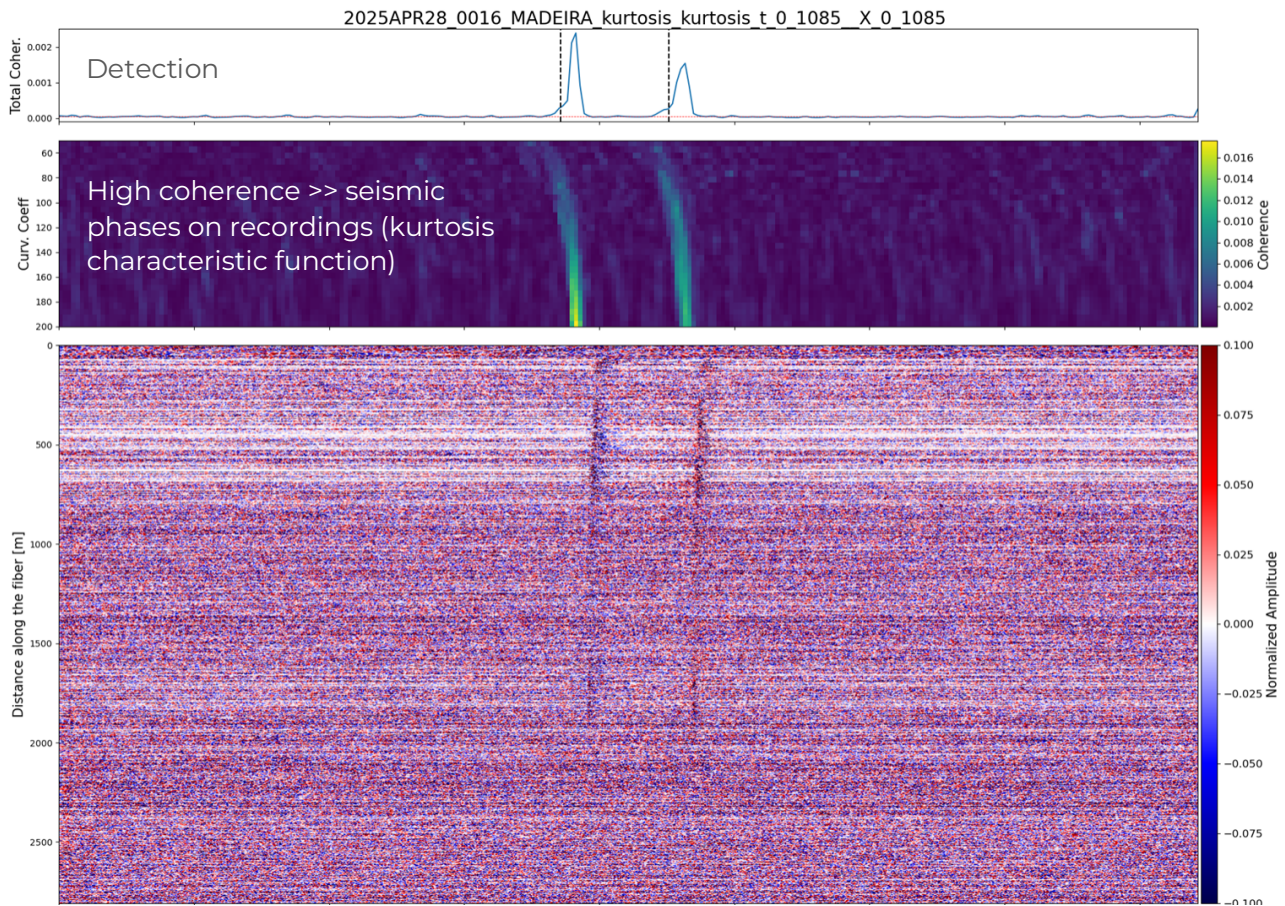


Figure 5. Preliminary tests of the DAS detector (Porrás et al., 2024) on the same earthquake shown in figures 1-4, but spatially downsampled (25 % of the channels). Yellow-green bright spots correspond to detected P and S-wave phases. The same detector is currently under test on continuous data from March 2026.

Project outcomes:

As of June 30th, 2026 ATLANTIDAS project has the following outcomes:

- a) Curricular internship of Juan Sebastian Rodriguez, Planned date of the open-source master thesis: end of the year;
- b) Accepted poster presentation at the next European Seismological Commission (ESC) Annual meeting in Istanbul (sesion-06, <https://www.esc2026.org/sessions>);

“NEREIDS and ATLANTIDAS: natural laboratories to test onshore and offshore integrated DAS and seismometer networks” Emanuele Bozzi¹, Gian Maria Bocchini², Giulio Pascucci², Giacomo Rapagnani¹, Afonso Loureiro³, Marco Roth², Rebecca Harrington², Francesco Grigoli¹

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- c) Participation to the Geo-Inquire Jupyter Notebook Meeting, Ifremer Brest Centre, 1625 Rte de Sainte-Anne, 29280 Plouzané, 28th-29th May 2026.
- d) Data from ATLANTIDAS has been used for the lectures of the 1st summer school on fiber optic sensing for geological, Geophysical and Environmental Applications, June 30th-July 3rd, 2026 at the University of Pisa (<https://www.unipi.it/didattica/corsi/summer-schools/fiber-optic-sensing-for-geological-geophysical-environmental-applications/>).

References:

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- Bozzi, E., Pascucci, G., Rapagnani, G., Bocchini, G. M., Harrington, R., Ugalde, A., ... & Grigoli, F. (2026). Near real-time channel selection for Distributed Acoustic Sensing technology. *Seismica*, 5(1).
- Grigoli, F., Cesca, S., Vassallo, M., & Dahm, T. (2013). Automated seismic event location by travel-time stacking: An application to mining induced seismicity. *Seismological Research Letters*, 84(4), 666-677.
- Loureiro, A., Schlaphorst, D., Matias, L., Pereira, A., Corela, C., Gonçalves, S., & Caldeira, R. (2025). First DAS observations from the GeoLab fibre in Madeira, Portugal. *Seismica*, 4(2).
- Pascucci, G., Gaviano, S., Pozzoli, A., & Grigoli, F. (2026). Signal Enhancement of Distributed Acoustic Sensing Data Using a Spectral Subtraction-Based Approach. *Seismological Research Letters*, 97(3), 1905-1918.
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