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Modern Data Containers for Scalable Archiving and Access of Distributed Acoustic Sensing Data

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In recent years, Distributed Acoustic Sensing (DAS) has emerged as a powerful technology in seismology, enabling the acquisition of high-resolution seismic data using optical fibers as sensors. As the number of DAS experiments continues to grow and DAS interrogators become able to record along ever longer fiber-optic cables, the volume of generated data is rapidly increasing, creating significant challenges for long-term archiving and efficient data access. These challenges include not only the storage of very large datasets—often on the order of hundreds of terabytes—but also the ability to fast random access and process subsets of the data.

Currently, the DAS ecosystem is dominated by proprietary data formats defined by individual vendors. While HDF5 is increasingly adopted as a more open alternative, it presents strong limitations regarding scalability in multi-threaded and multi-process environments. In contrast, modern data container formats such as Zarr and TileDB offer native support for parallel I/O and flexible storage backends, ranging from local file systems to on-premise and cloud-based object storage.

In this contribution, we present a comparative evaluation of these modern data formats for DAS applications, focusing on performance, scalability, and usability. We discuss the latest results obtained from the activities of the Geo-INQUIRE* project and assess the feasibility and potential benefits of their adoption for the long-term management and analysis of DAS datasets.

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