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A Metadata Exchange Model for Distributed Acoustic Sensing (DAS)

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Distributed Acoustic Sensing (DAS) is an emerging technology that utilizes the backscattering of light from defects within a fiber optic cable to transform the cable into a dense array of seismic sensors. Rather than point measurements, as seismic and geodetic networks are traditionally operated, DAS provides strain-rate measurements at a spatial resolution of meters along cables that can be 10's or 100's of km in length and at sample rates of milli to kilohertz. The high-spatial and temporal resolution that DAS provides, combined with its low-cost per sensing location and versatility, has the potential to transform how geophysical surveys and network monitoring are performed in the future, both on land and subsea. DAS, however, is still a relatively new area of sensor technology and features such as sensor response, calibration, sensitivity levels and impact of installation environment are active areas of research. The need to compare measurements across deployments and make the data reusable by others is becoming increasingly important to move this frontier technology forward. To facilitate such data exchange, a standardization of DAS metadata in a machine-readable format is required. The capability to facilitate high-performance computing in a cloud environment is also highly desirable.

Long-standing metadata models developed for seismic data e.g., SEED, SAC or SEG-Y do not adapt well for DAS due to fundamental differences in sensor and data acquisition parameters. There may be thousands of measurement locations in one experiment, the installation environment can vary significantly along the cable, data acquisition equipment and parameters are tuned to the geophysical phenomena being studied and can be changed during an experiment or between repeated surveys. The optical fiber itself has intrinsic properties that influence measurements, and multiple fibers might be used over the course of an experiment or long-term monitoring project. In this presentation we outline a proposed metadata model that should be able to accommodate most deployment scenarios. The intent of the model is to enhance the interoperability and reusability of DAS data sets and, build reproducibility into DAS data products. The model can be represented in a JSON format but could be readily translated to XML. Here we describe the metadata model structure developed and demonstrate how it can be incorporated into hierarchical data formats such as HDF5 or Zarr.

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