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Applications of fiber optical DAS equipment for teleseismic observations and tomography tasks in seismology

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We discuss experimental results on using Distributed Acoustic Sensing (DAS) technology based on fiber optic sensors [1] for several applications in geophysics. Emergence of DAS as a new technology in geosciences has outlined an inevitable trend to be involved both for teleseismic measurements and in local scale tomographic tasks [2]. For tomographic applications DAS combines active and passive methods where both approaches utilize recovering and inversion of surface wave dispersion curves for the uppermost Earth imaging. The touchstone here is reliable recording of signals and background strain noise at high frequencies to apply ambient noise tomography methodology or any modifications of multichannel analysis of surface waves [3]. T8, LLC has developed a new method of fiber-optic cable installation where subsequent cable segments are twisted in rings along the overall linear surface layout. Such arrangement has been tested and demonstrated promising enhancement in recovering of the dispersion curve on the ice floe with quality comparable to the geophone string placed nearby for comparison.

For teleseismic measurements DAS can record signals across the broad frequency range extended from several millihertz to hundreds of hertz, while providing measurements over many tens of kilometers with high spatial density of deployed virtual sensors. This capability was demonstrated during the “Global DAS month” international experiment, organized in February 2023 [4, 5] where the equipment developed and manufactured by T8, LLC was also used. A number of different DAS manufacturers provided their hardware for this effort with the measurement results available for public access. The analysis of these vast data not only provides insight into DAS potential for geosciences but also allows quality assessment of the equipment from different manufacturers.

References.

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