An Experimental Investigation of Distribute Acoustic Sensing Versus Geophones in Near-Surface Application

Yue Hu[1,2], Frederik J. Simons[1]
1. Department of Geosciences, Princeton University, NJ, USA
2. Institute of Geophysics and Geomatics, China University of Geosciences, Wuhan, Hubei, PRC

Distribute Acoustic Sensing (DAS) is a relatively new technology which uses a fiber-optic cable as a sensor. It has been widely used in the oil and gas industry. Recently it starts to show some applications in the surface horizontal arrays. The advantages of DAS in terms of cost, the deployment mechanism make it more attractive than the conventional geophones. For near-surface seismic applications the fiber optic cables were buried at the shallow depth which is less than one meter. An experimental array of DAS and geophones were deployed in a same line for comparisons at a test site in Princeton, New Jersey, USA. In this test site, several hundred meters of fiber optic had been buried at sub-meter depth in two loops. 16 vertical geophones were installed at the surface along the line of the cable. The sledgehammer was used as the seismic source to create the elastic seismic waves, which can be simultaneously recorded by both the DAS and geophones. Firstly, the conventional surface wave method, Multichannel Analysis of Surface Waves (MASW) was used to evaluate the response of DAS and geophones to the surface waves. In addition, the coherence function was calculated for signals recorded from different frequency ranges. Although the seismic data recorded with geophones provided higher fidelity results, the DAS array also shows its suitability for long term survey in near-surface geophysics applications.

Upper panel: the DAS data. Down panel: the geophone data.