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Please fill in your abstract title.	Near-surface Model Building Using Smart Distributed Acoustic Sensing Upholes

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Abstract

Unresolved lateral velocity heterogeneities in the shallow near-surface can have a significant impact on the interpretation of seismic data. To reduce uncertainty when imaging low-relief structures, an accurate near-surface velocity model is required. Here we use data acquired from the industry's first smart distributed acoustic sensing (DAS) uphole experiment to test the capabilities of various techniques for shallow velocity building.

The novel smart DAS uphole system connects multiple shallow (vertical) wells with one continuous optical fiber that is trenched at the surface. This enables a number of techniques for near-surface model building to be tested on data acquired using the same system. Direct velocity measurements using uphole surveys are believed to provide the most accurate near-surface solution while the directivity of the DAS fiber means that horizontal sections can also be used for refraction tomography and surface-wave inversion. Velocity models using different methods are generated.

The first smart DAS uphole survey has been successfully acquired, allowing simultaneous collection of data for deep reflection imaging and near-surface characterization. Excellent early arrival waveform quality was obtained from the DAS uphole surveys, allowing an accurate velocity profile to be derived at the location of ten adjacent wells. This direct velocity measurement of the near-surface significantly reduces uncertainty in the seismic interpretation. In addition, replacing the shallow part of the depth velocity model with the DAS uphole model resulted in significant improvements in the final depth image from topography. Dense shot spacing also enables shallow reflectors to be identified in the vertical DAS data, another source of velocity information.

Finally, refracted arrivals that are suitable for picking are observed on the horizontal segments of the DAS fiber. Refraction tomography of these first-break picks enables an alternative near-surface model to be derived. Differences between the models may indicate near-surface anisotropy and be a source of uncertainty in constructed models for statics and depth imaging. Ultimately, while the uphole velocity model is only suitable for removing long-wavelength components of the near-surface variation, the refraction velocity model may allow for the correction of small-medium wavelength statics.

A novel implementation of DAS technology enables near-surface characterization using multiple techniques. Uphole, shallow reflection and refraction tomography-derived velocity models may be acquired using the same system and can be compared to better understand differences between them.