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Application of 3-D field and inversion techniques to shallow refraction seismology

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3-D seismic reflection surveys are standard in oil and gas exploration. Shallow depth seismic measurements, targeting engineering and environmental tasks, are mostly carried out with a 2-D field layout, despite the fact that 3-D information would be superior. In our paper, we will present a field technique, which allows for efficient gathering of 3-D refraction seismic data. The inversion of such data is carried out using methods developed for the evaluation of lithospheric refraction seismic data (Brückl et al. 2003 and submitted to JGR). The method is best suited for situations, where a complex overburden covers a refractor. The seismic velocity structure of the overburden is resolved by tomographic methods. The refractor is imaged in the velocity field of the overburden, using a method based on the delay time decomposition. The shortcomings of the delay time method are overcome by a downward continuation of the data (shot and receiver locations, travel times) to a datum near the refractor. The technique also includes stacking, to enhance the signal to noise ratio. The accuracy and resolution of the 3-D methods presented will be demonstrated with data from a landslide. The results will be compared with 2-D evaluations of data from inline shots along individual lines.

Brückl, E., Behm, M., Chwatal, W., 2003. The application of signal detection and stacking techniques to refraction seismic data. Oral Presentation at AGU, San Francisco, 08-12 December 2003