

Benefits of 5D Seismic Interpolation: A South Texas 3D Survey Example

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5D or multi-dimensional/multi-channel prestack trace interpolation in the last decade, has become a standard procedure in seismic data processing to regularize data and fill in missing traces that are not recorded in the field due to acquisition and/or cost constraints. Old vintage, low signal quality and sparsely shot 3D surveys with missing offsets and azimuths may benefit from this seismic data processing procedure.

Different 5D methods are used in the industry to fill in missing data. The methods currently in use are: the anti-leakage Fourier transform (ALFT) method, the projection onto convex sets (POCS) method, the minimum weighted norm interpolation (MWNI) method, the prediction filter method, the rank reduction or Cadzow method, the tensor based method and the least-squares migration driven method. The anti-leakage Fourier transform (ALFT) method was used for 5D interpolation in this work. The obvious advantage of the ALFT method is that traces are not snapped into bin centers during interpolation. This non-snapping of traces into bin centers prevents spatial smearing, meaning fault edges will be better preserved. The workflow involves processing the input raw seismic data to prestack time migration with 5D interpolation followed by AVO analysis of the gathers and generation of seismic attributes from the stacks.

The results show the benefits of anti-leakage Fourier transform (ALFT) 5D interpolation in filling gaps in the data, increasing the signal-to-noise ratio and enhancing volumetric seismic attributes such as coherency/similarity, spectral decomposition and curvature. The ALFT 5D interpolation has also improved the AVO analysis results of this dataset.