



DMO processing on the Ketzin 3D seismic data

Fei Huang, Christopher Juhlin, Monika Ivandic, and Fengjiao Zhang
Geophysics, Uppsala University, Uppsala, Sweden (fei.huang@geo.uu.se)

The Dip-moveout (DMO) correction is a process which attempts to make the finite offset data closer to zero offset data after the normal-moveout (NMO) correction. The NMO correction is then dip independent and reflections with different dips will stack coherently. DMO plays a critical role in seismic processing by enhancing the final image quality of the seismic data.

In this study, we apply 3D Squeezing DMO (Hale and Artley, 1993) to seismic data from the Ketzin pilot CO₂ site after NMO to study the impact of DMO on time-lapse seismic imaging and to investigate if it enhances the CO₂ seismic monitoring technique. This 3D DMO method is based on an integral approach and incorporates Hale and Artley's (1993) modifications for variable velocity with time. A constant velocity algorithm is used with a gamma correction function which depends on the velocity function. An anti-alias velocity of 3000 m/s is used for the DMO. After DMO the data are stacked and F-XY deconvolution is applied. Finally, 3D finite-difference migration using the final smoothed NMO velocities is performed for each data set. We then apply a time-lapse analysis to the 3D seismic data sets and compare the results with and without DMO processing.

The most important aspect of the DMO processing is determining the velocity field for the NMO step. This is done by using the initial smoothed velocity field obtained from the conventional velocity analysis before DMO as a first estimate. The data are input into the DMO process and then inverse NMO is applied. These data are then subjected to a new velocity analysis and the velocity field is updated and used as input for the NMO process. A number of iterations are generally required until the velocity field does not need further updating. In this study velocities were picked at every 20th CDP in the inline and crossline directions.

Compared to the velocity spectrum without DMO processing, the velocity trend is improved and the ambiguity in the velocity picks is eliminated after DMO correction. The improved accuracy of velocity picking makes it easier to interpret the velocity spectrum and obtain correct interval velocities. Considering the stacked section, DMO suppresses the random noise to a greater extent and thus the signal-to-noise ratio is enhanced. From the comparison of the amplitude difference horizon at the reservoir level, the shape of the anomaly observed in the data with DMO processing is similar to that observed in the data without DMO processing. However, the amplitude anomalies of the former are stronger than those of the latter, especially close to the injection well. In addition, one stronger amplitude anomaly in the DMO time-lapse horizon indicates a preferred trend of the CO₂ migration in WNW direction due to the reservoir heterogeneity.

Hale, D. and Artley, C. [1993] Squeezing dip moveout for depth-variable velocity. *Geophysics*, 58(2), 257-264.