TTI Tomography for Dual-Azimuth Data in Gulf of Mexico

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ABSTRACT

Over the past decade, the majority of deepwater blocks in the Gulf of Mexico have been covered multiple times with seismic data from narrow-azimuth, towed-streamer acquisition (NAZ). In complex subsalt areas, each NAZ dataset provides unique subsurface illumination benefits. Multiple-azimuth data are now frequently integrated to provide extended subsurface coverage and for better imaging of complex subsalt structures. Multiple-azimuth seismic data, with shot and receiver locations covering a large portion of the two dimensional surface, present a new challenge for deriving a single velocity model that satisfies both datasets.

In exploration and development work in the deepwater Gulf of Mexico, there has been an increasing demand to incorporate anisotropy in prestack depth imaging workflows. Incorporating anisotropy improves image quality and well/seismic misties. While most pre-stack depth imaging involves vertical transverse isotropy (VTI) anisotropy, transverse isotropy with tilted symmetry axis (TTI) is generally overlooked. Shale layering near steeply-dipping salt flanks can cause TTI anisotropy issues. In such a case, ignoring the tilted symmetry of salt flank bedding causes image blurring and mispositioning of the salt flank structure. Velocity variation with azimuth is observed in an orthogonal dual-azimuth streamer dataset, as well as wide-azimuth data in the deepwater Gulf of Mexico. The paper presents a study to build a single TTI anisotropy model for pre-stack depth imaging of dual-azimuth data in the deepwater Gulf of Mexico to yield an anisotropy model that flattens gathers for all azimuths, as well as improves focusing and spatial positioning of steeply-dipping salt flanks.

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