Enhancing Analysis of 4C Data in the Gulf of Mexico from Results of 9C Data Onshore

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Abstract

As petroleum exploration and production moves toward the marine environment, so must our focus in the evolution of seismic technologies, including those traditionally limited to onshore environments.

We endeavor to determine necessary adaptations and processing steps needed to derive maximum interpretive results from marine 4C data. In particular, the application of land S-wave seismic from controlled polarization 9C data, to the marine environment. This is important for addressing fracture analysis and reservoir properties themselves, from seismic anisotropy observations.

Consequently, a process must be developed that utilizes a 3D 3C surface seismic data set, itself a subset of a 9C data set, to arrive at concurring seismic attributes and interpretations between both the C-wave data and P and direct S-wave data.

VSP surveys were used to precisely correlate reflections in a 3D 3C surface seismic data set. A scanning methodology was used to determine the apparent S1 and S2 polarization from the radial and transverse components. This is iteratively applied to prestack data to arrive at the most accurate polarization for improved imaging and confident analysis of anisotropy. Rotations of direct S-wave components are made as if the S-wave source components are limited to C-wave data with only a radial component. Concurrently, a second 3D 3C data set (analogous to a marine 3D 4C data set) with a less complete distribution of azimuths was processed in parallel to determine polarization of the S1 and S2 waves and the results of the azimuthally limited data compared to the nearly ideal data set.