

Advanced Seismic Imaging Applied to the Subsalt Play in the Gulf of Mexico

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Areas like the Perdido fold belt or the Mars-Ursa basin that are surrounded by salt provide a serious challenge to seismic imaging. The large velocity contrast between salt and its neighboring sediments distorts the wavefield. Depending on the degree of distortion, which is mainly controlled by the shape of the saltbody, conventional single-valued Kirchhoff pre-stack depth migration (PSDM) methods produce subsalt images of insufficient structural resolution.

Consequently, de-risking subsalt plays requires high-fidelity imaging algorithms tuned to the scale of the problem, regional exploration, or well support. Two types of PSDM-algorithms, the wave-equation migration (WEM) and the multi-valued Kirchhoff migration, have been implemented by industry in different ways. Each implementation has its limits with respect to steep dip imaging, positioning accuracy, and amplitude integrity. For the Mars-Basin we will demonstrate that multiple PSDM's, generated with WEM and Kirchhoff algorithms, are needed to support subsalt interpretation.

Experience in the Perdido trend shows that the residual multiples left in the data after applying standard multiple suppression methods such as 2D surface related multiple elimination (SRME) or radon filtering, create migration noise that impairs the depth migrated result. To fully benefit from advanced PSDM techniques, 3D SRME or model based techniques have to be applied to increase the signal-to-noise ratio of the input data.

Another challenge in subsalt imaging is the limited velocity resolution of surface seismic data below salt. We will discuss how a subsalt velocity model can be improved by constraining the velocity update with geologic information.
