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3-D Depth Migration of the Northern Monagas Trend: Eastern Venezuela

The Northern Monagas trend is a wide anticline structure located in Eastern Venezuela and producing more than 800000 bbl/day. An allochthon block above a regional thrust create major velocity pull-ups (up to 0.4 seconds) which generate false plays and misties.

Frequently, depth migration has been used to solve imaging problems and seismic misties, however, in complex areas with strong lateral velocity variations, it is difficult to find a single velocity field to obtain good seismic images and a correct time to depth conversion. Usually, surface seismic velocities are the best to obtain sharp subsurface images, and well log velocities (sonic and checkshot) give the right time to depth conversion.

In this paper, we solve the imaging and the misties problem in two steps. First, a focused image is obtained using surface seismic velocities and 3-D poststack depth migration. Second, a new velocity cube is obtained from the integration of 20 horizon maps from 3-D seismic interpretation and 90 check shot and sonic logs in the area. Geostatistical techniques were used to interpolate and extrapolate the well log velocity information constrained by the 3-D seismic interpretation. Finally, a conventional time to depth conversion was used to get the final depth image from the depth migrated data backscaled to time and this last velocity cube.

In general, the results obtained show better subsurface images than those obtained with time migration and the misties (within the wavelet resolution) problem was solved in almost all wells in the area (more than 200 wells).