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Fault Shadow And Sub-Reef Imaging Resolved By Interpretative PSDM Workflow In Kutai Basin

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Abstract

A depth imaging case study is presented over a geologically complex area in the South Mahakam delta. Being located structurally in a transition zone between the Paternoster high platform and the Kutai basin, the area is strongly compartmentalized. Lateral velocity variations across faults with very significant throws induce severe fault shadow effects below fault planes over the East Mandu and Jumelai fields. Pinnacle carbonate overlaid by shale produces pull up anomalies and seismic image degradation over the Stupa field. In this context, depth imaging is crucial for optimizing field development and reducing uncertainty in reserves estimation

Thanks to recent improvements of technology, pre-stack depth migration (PSDM) can now be used in a reasonable time frame and yield high quality images. The main difference with time imaging lies in the early integration of interpretation in the velocity model building. The interaction between the interpreter and the depth imager is indeed critical to build a correct depth-velocity model that will noticeably improve the seismic image.

In this type of environment, it is necessary to constrain the automated tomography approach by a strong interpretation input. Some strong lateral and vertical velocity contrasts (carbonate reefs, pinch outs, faults) have to be manually picked in order to help tomography to converge towards an adequate velocity model. Shallow velocity anomalies have also to be carefully dealt with during the tomographic process as they are crucial for image quality in the deeper zone. Anisotropy has also to be incorporated to produce a depth calibrated seismic image

Another key point is the post-processing which enhances the focusing and improves signal to noise ratio.

A comparison with conventional time imaging gives evidence of significant improvement produced by depth imaging to tackle fault shadow and sub reef imaging.