Focused HiDef Seismic Processing Workflows to Identify Shallow Geohazards Features and Delineate Thin Reservoir in North of Sultanate Oman

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Abstract

Recently, the PDO processing team executed and implemented two HiDef seismic processing projects targeting relatively shallow formations in north of Sultanate of Oman. The main key enabler for both projects has been the frequent feedback from interpreters and QI geophysicists. Both projects went through revised linear and random noise attenuation steps, assessment and implementation of gapped/spiking deconvolution and spectral shaping. Modifications to the main standard processing workflow set for both projects resulted in better, higher lateral and temporal resolution improvements and can be easily replicated with minimum effect on the turnaround time. The first project set to delineate thin reservoir distribution at intermediate depth. The sand distribution of the reservoir is poorly predicted, hence, high risk of dry wells. The first aspect considered was preserving temporal resolution and reducing noise and multiple contamination by denoising at all frequency bands, applying proper statics especially in dunes areas and attenuate multiples. Secondly, spatial resolution by performing 5D regularization, infilling NAZ to cover for WAZ acquisition gaps. Thirdly, direct collaboration with QI team to predict reservoir distribution by inversion. An essential QC was monitoring the AVO responses. The project achieved partially its objective at enhancing resolution and continuity of the target formation and preserving spatial resolution. However, Faults in some areas were smeared out.The second project was set to investigate spatial distribution of drilling mud losses at an intermediate level within a carbonate formation. Based on latest seismic volume in the area, there were no clear indications of seismic features such as sinkholes, or karsts correlating with the drilling mud losses. Hi-def processing workflow was set to focus firstly on attenuating linear noise and removing random noise per octaves to ensure that there are no remaining noise which could mask any subsurface features. Secondly, improve temporal resolution by using spiking deconvolution. Thirdly, regularize and improve spatial resolution through the utilization of anti leakage Fourier transform for 5D regularization with an output bin size of 25m*12.5m. The final spatial sampling after migration is 12.5m*12.5m. Additionally, post migration workflow was set to ensure that no remaining noise is still observed in COV domain. Iterative processes were put in place to ensure the validity of the results, at each stage, we correlate the locations of where the mud losses are observed with areas where subsurface features are observed in semblance maps. Semblance maps were created to aid QC of each step to ensure no smearing is observed. The new final volume delivered showed sharper enhancements in semblance maps highlighting seismic anomalies that could correlate to where drilling losses are observed.