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Seismic Data Gather Conditioning for Prestack Seismic Data Inversion

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ABSTRACT

Most seismic data is processed to optimize image quality for structural and stratigraphic interpretation, with little regard to preserving characteristics essential for successful seismic reservoir characterization. No matter how sophisticated the inversion algorithm, use of inadequately processed seismic data will severely impact the quality of the final interpretation. The objective of the paper is to quantify advantages of performing pre-stack data conditioning prior to reservoir characterization. Three specific seismic properties that will be addressed are: (1) signal-to-noise ratio (SNR), (2) offset-dependent frequency loss, and (3) gather alignment. Seismic gather conditioning improved seismic data quality prior to pre-stack inversion by improving signal/noise ratio, removing NMO stretch and aligning reflection events. Velocities from residual moveout (RMO) analysis on individual sectors were used as input to detection of fracture orientation and anisotropy. In all of our integrated studies, our goal is to offer the greatest understanding of the depositional environment, so that decisions can be made with confidence. Reservoir characterization puts hefty demands on a seismic data set. Asset teams are asking for more accurate seismic estimates of hydrocarbon fluid fill and rock properties in reservoirs. To be able to meet these increasingly stringent demands, seismic data used for reservoir characterization need to be conditioned to remove as many undesirable effects as possible. Three wave-transmission effects that are commonly removed or reduced in pre-inversion gather conditioning are random noise, NMO wavelet stretch, and non-flat reflections. The gather conditioning workflow and processing results demonstrated that data that might be considered acceptable for normal structural interpretation could still be prone to large errors when subjected to prestack impedance inversion without first being conditioned. The conditioned gathers are significantly cleaner than original and difference plot shows that most of what has been removed is linear and random noise. Signal to noise ratio and event continuity have been considerably improved. Overlapping angle ranges improved the signal to noise ratio of the angle stacks which have approximately equal fold at interval of interest. This processing step significantly improved the seismic data gather quality and provided much more reliable seismic data for pre-stack as well as post-stack inversion process.