An Integrated Approach for AVA Amplitude Friendly Processing

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ABSTRACT

Detailed seismic reservoir characterization including Pre-stack inversion requires careful seismic data processing to preserve signal amplitude. An integrated approach that encompasses processing, inversion and interpretation is the key for success. This abstract illustrates the importance of the integrated approach using a case study from a 3D Ocean Bottom Cable survey in shallow water targeting pre-stack inversion analysis and detailed reservoir characterization. It also includes key processing QC steps between these disciplines to validate amplitude friendly processing. Pre-stack modeling and inversion for intermediate products at selected key wells were exercised to iterate processing steps for parameters optimization. The survey was acquired in shallow water with sparsely sampled sources and receivers. The seismic data processing challenge was to preserve the signal amplitude fidelity in the presence of highly aliased and dispersed linear noise. The presence of water-bottom reverberations and converted waves added to data processing challenges. Key processing milestones were validated by all disciplines and revisions were applied where necessary. Intermediate pre-stack gathers at selected key wells were migrated for well tying, correlation with pre-stack AVO synthetic gather, and pre-stack inversion (P-Impedance, Vp-Vs ratio, and Density) to validate the processing flow at early stages. This integration process was iterative till the flow became suitable for inversion. Incoherent noise and coherent linear noise were attenuated after interpolating the sources and receivers to a finer grid. Receiver side multiples and short period reverberations were addressed by geophone-hydrophone summation followed by Tau-P deconvolution. The gathers were heavily conditioned to derive a surface-consistent operator from a signal spectrum and applied to the original data. A conditioning flow for PSTM gathers was designed to attenuate residual linear and random noise, converted waves, and residual multiples to generate appropriate gathers and angle stacks for pre-stack analysis and inversion. This integration between processing, inversion, and interpretation helped optimizing the processing flow, created a dataset suitable for pre-stack analysis and inversion. The final workflow resulted in an excellent seismic-well tie and inversion match with well logs.