Oral Session: Visualizing and Quantifying Uncertainty in Seismic Interpretations

Quantifying the Temporal and Spatial Extent of Depositional and Structural Elements in 3D Seismic Data Using Spectral Decomposition and Multi-Attribute RGB Blending

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Single and multi-trace seismic attributes are widely used to help to visualize and delineate the spatial extent of depositional bodies on interpreted horizons. Commonly, the internal complexities of these interpreted depositional bodies are not as well-resolved, due to spatial resolution constraints and low contrast. This increases the uncertainty of quantitative analyses or inferences that utilise the resulting map, e.g. reservoir presence. This also holds true in the delineatation of structural elements, i.e. faults in seismic datasets, particularly when attempting to quantify the potential for internal barriers to act as baffles to fluid flow within individual reservoir units. Therefore, there is a need for further development and understanding of seismic attribute workflows used to evaluate geological elements imaged within our post-stack seismic datasets in order to gain an enhanced understanding of the detailed morphology, spatial extent and temporal location of depositional and structural elements, to fully assess their impact on reservoir fluid-flow.

The recorded reflected seismic wavelet is the primary source of information used to interpret in the subsurface. The spectral content of the recorded seismic wavelet is dependent on the acoustic properties of the media along its propagation path, and decoding the subtleties in the variation of its spectra can provide exceptional high-resolution insight into complex geological variations. Advanced spectral decomposition techniques allow the comparison of the 3D variation in the wavelet response at different frequencies through generating and comparing different spectral attributes. The workflow presented here compares and contrasts three different techniques for extracting the spectral content; constant bandwidth filters, constant Q filters and matching pursuit decomposition. In order to visually extract the subtle details and complexity contained within the individual frequency bands, each needs to be examined and compared in a coeval visualization environment. Blending three unique frequency volumes mapped individually to an RGB channel allows the interpreter to combine the information provided by each of the individual volumes into one single ‘full colour’ 3D display. The resulting RGB blend provides the interpreter with dramatically enhanced seismic imaging of both depositional bodies and structural elements than previously obtained through traditional attribute analysis techniques. Quantitative measurements can then be extracted either directly from the RGB volumes through the use of innovative opacity based geobody extraction techniques or from more traditional horizon extraction and sculpting.