Detecting stratigraphic features via cross-plotting of seismic discontinuity attributes and their volume visualization

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Fold and fault geometries, stratal architecture and large-scale depositional elements (e.g. channels, incised valley-fill and turbidite fan complexes) are often difficult to see clearly on vertical and horizontal slices through the seismic reflection data. Consequently, visualization techniques are used for viewing the data, whether it's the input seismic data or derived data in terms of seismic attributes. Such visualization helps extract meaningful information, allows for greater interpretation accuracy and improves efficiency. 3D volume rendering is one form of visualization that involves opacity control to view the features of interest 'inside' the 3D volume. A judicious choice of opacity applied to edge-sensitive attribute sub-volumes such as curvature or coherence co-rendered with the seismic amplitude volume can both accelerate and lend confidence to the interpretation of complex structure and stratigraphy.

In addition to co-rendering, we evaluate an interpretation workflow that cross-plots pairs of edge-sensitive attributes. By crossploting coherence and an appropriate curvature attribute, we can define a polygon that highlights "clusters" that exhibit low coherence (indicating a discontinuity) and high curvature (indicating folding, flexing, fault drag, or differential compaction). Modern volume interpretation software allows us to link and display these interpreter-defined clusters in the seismic volume for further examination. Once identified interactively, such visual 'clustering' can be used to supervise geobody delineation using neural networks and other classification algorithms. This saves the seismic interpreters considerable time and effort. We illustrate this new workflow through application to several 3D seismic surveys recently acquired in western Canada and demonstrate that multiattribute volume co-rendering and clustering provides a powerful tool that leads to a better understanding of the spatial relationships between seismic attributes and the geologic objectives being pursued.