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Seismic Attribute Applications for Interpreters

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Summary

Seismic attributes extract information from seismic reflection data that can be used for both quantitative and qualitative interpretation. Some attributes such as seismic amplitude, envelope, RMS amplitude, spectral magnitude, acoustic impedance, elastic impedance, and AVO measures are directly sensitive to changes in seismic impedance. Other attributes such as peak-to-trough thickness, peak frequency, and bandwidth are sensitive to layer thicknesses. Both of these classes of attributes can be quantitatively correlated to well control using multivariate analysis, geostatistics, or neural networks. Seismic attributes such as coherence, Sobel filter edge detectors, amplitude gradients, dip-azimuth, curvature, and gray-level co-occurrence matrix texture attributes provide images that allow interpreters to qualitatively use geologic models of structural deformation, seismic stratigraphy, and seismic geomorphology, to infer the presence of fractures or the likelihood of encountering sand-prone facies.

For doing an effective job or for extracting accurate information from seismic attributes, the input seismic data needs to be optimally processed. The term ‘optimally’ essentially means that any or all distortion effects, whether near-surface, or amplitude/phase related, or others are taken care of during processing if not totally eliminated. When such pre-stack or poststack data are loaded on workstations, they may still show a certain amount of noise level. This noise could be of various sorts - acquisition related, processing artifacts or random. In this presentation we focus our attention on conditioning of such data for derivation of attributes from them. Besides this, we also discuss the use of some of the procedural steps for noise filtering and dip-steering options for computation of some geometric attributes like coherence and curvature. Finally in this context, we also discuss the impact the choice of algorithm can have on the final results. All these factors ensure that the seismic attributes yield more accurate information for interpretation.

Examples will be presented for the application of curvature and coherence attributes to 3D seismic volumes to show how these attributes can aid the geophysicist in making more accurate interpretations. A final goal in this talk on seismic attributes is to update readers on the emerging trends and also talk about the directions in which seismic attributes are headed.