

## **New Seismic Attributes Sensitive to Channel Geomorphology**

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The promise for the future is for computer-assisted geomorphology, where an interpreter will identify alternative stratigraphic components and depositional environments – progradations, turbidites, dewatering features, slumping, unconformities, diapirism, reefal buildup, or other features of interest and thereby build a ‘training’ data set for the computer. While the tools for such computer-assisted classification, including geostatistics, principal components, and artificial neural nets, are in reasonably good shape, the geopsychological definition of what the interpreter actually sees is considerably more challenging. The first challenge is to identify features on a small window around each seismic sample, providing rudimentary seismic attribute building blocks. The second, more difficult step is to put these attributes in context on a larger scale, much as an interpreter draws a fault through a seismic reflector that looks continuous, by using the more obvious discontinuities above and below it.

In this paper we will show recent advances in developing new building blocks sensitive to channel geomorphology. Our geometric attributes include the well-established coherence measures, coupled with recent developments in spectrally limited estimates of volumetric curvature and coherent energy gradients. Coherence estimates allow us to measure lateral changes in waveform that are sensitive to changes in lithology and bed thickness. Amplitude gradients allow us to measure effects related to changes in lithology, fluid, and porosity. Reflector dip, azimuth, curvature, and rotation are all measures of the reflector shape. These three families of attributes are mathematically independent, but are coupled to each other through the underlying geology.

We find that coherence, especially when combined with an edge-preserving smoothing filter, may clearly define margins of amalgamated or incised channels, but fails to illuminate channels where reflectors inside and outside of the channels are equally strong. Coherent energy (amplitude) gradients best image thin or subtle channels, while dip/azimuth and curvature allow us to detect compaction-related differences in channel fill. Because of effects of compaction, positive curvature attributes identify sand-filled channels as well as levee systems, whereas negative curvature attributes distinguish clay-filled channels. The comparison between multiple attributes provides a workflow for determining channel geomorphology and channel evolution.