Petrel 2015

Recommended Seismic Volume Attributes

	Short Description	General Structural	Salt Workflow	Edge Detection (structural)	General Stratigraphic	Fracture Indicator	Channels	Carbonates	Noise Reduction	Hydrocarbon Indicator	
3D Edge Enhancement	Edge enhancing attribute that filters along planes in three dimensions, where the plane is rotated in all angles and directions.	Edge detection improving attribute.		Enhances edge detection by emphasizing larger and planer features.		Possible fracture enhancement.			Smooths away smaller features such as noise.		3D Edge Enhancement
Amplitude Contrast	Structural attribute that uses the Sobel filter to isolate areas with amplitude discontinuities. Dip guiding option is available which will help detecting phase change.	Reveals discontinuities in seismic data, either related to stratigraphic terminations or structural lineaments.	Can help highlight and isolate salt structures.	Fault detection from discontinuities or phase change if dip guiding is activated.		High amplitudes can indicate faults or fractures swarms.	Can help highlight channels in filtered seismic if dip guiding is activated.	Karst and sinkhole delineation. Detection and mapping of buildups/ reefs within layer cake depositional environments	Vertical smoothing parameter can help remove surrounding noise.		Amplitude Contrast
Ant Tracking	Patented fault enhancing attribute. Connects attribute responses by using principles of swarm intelligence ("ants").	Fault attribute enhancement and fault extraction.	WARNING: the interior of a salt accumulation can be chaotic.	Delineate laterally continuous discontinuities based on a conditioned input.		Large (seismic scale) fracture swarms detection.		Fracture corridors, Karst delineation	Filter using a stereonet to eliminate azimuthal features.		Ant Tracking
Apparent Polarity	Sign of the seismic trace where reflection strength has a local maximum value.				Can detect thick beds when seismic data is not too noisy.				Can enhance continuity of events.	May help distinguish different kinds of bright spots (due to gas, limestone).	Apparent Polarity
Chaos	Maps the "chaoticness" of the local seismic signal from statistical analysis of dip/azimuth estimate.		Delineate salt extents.	Faults and fractures identification.	Useful for identifying channel infill, gas chimneys, reef internal texture, sink holes, salt diapir, shale diaper. Also a good discriminator for seismic facies analysis.		Channel infill.	Identify stacked reefs and useful for depiction of karsting and fractures.			Chaos
Consistent Curvature	Curvature measures how bent a curve is at a specific point on the curve. Curvature is defined as the rate of change of direction of a curve.	Detects subtle changes in structural trend and/or tectonic features and lineaments, convex up (positive curvature) or concave down (negative curvature) structures. Also discerns flexure and position of anticline/syncline hinges.		Fault lineament detection, in particular in dip saturated data. Helps identify upthrown and downthrown sides of a fault. Shape and curveness, combined with filters allow to highlight linements (Al-Dossary and Marfurt 2005).	Detection of subtle depositional elements for seismic geomorphology such as platform edges, channel incisions, gullies, incised valleys, drainage patterns, and gas vents (negative curvature), or channel fills, splays, lobes, lens, isolated bars, mounds and wedges (positive curvature). Also a good discriminator for seismic facies analysis.	Curvature—for example, most-positive and most-negative curvature (Chopra and Marfurt 2007) and maximum and minimum curvature (Sigismondi and Soldo 2003)—is the main indicator for fractures faults and flexures.	Curvature can identify channel features (Al-Dossary and Marfurt 2005). In the case where channels are thinner than the seismic definition, compaction of shales around channels can deform the sediments above them and show the channel location as a most positive curvature anomaly. Most negative curvature may indicate channel thalweg (Chopra and Murfurt 2007).	Build ups, reefs, and karsts can be expressed by curvature and shape outputs (Al-Dossary and Marfurt 2005). Due to carbonate reef edges, often gentle slope curvature maps generated using a seismic sampling grid may not sufficiently enhance the reef edges (Chopra and Murfurt 2007). Changing the aperture on the curvature calculations improves definition of the reef. (Hart 2003). Combination of edge detection attribute and minimum curvature on time slices was used to map for pinnacle reefs by Chopra and Murfart (2007).			Consistent Curvature
Consistent Dip	Consistent Dip provides a very precise Volumetric Dip estimation.	Dip and azimuth outputs provide valuable information for structure analysis.	Dip combined with illumination allow to improve the interpretation of salt domes (Barnes 2003).	Changes in dip are used to interpret faults. The difference between Dip and RMS dip are also used to detect faults.	Combination of amplitude, dip and azimuth is used to identify stratigraphic features, and quantitatively estimate onlap, offlap, conformity, angular unconformities, and other components of seismic stratigraphy. (Barnes 2000, Chopra and Marfurt 2007) vertical changes in dip may highlight stratigraphic terminations.		Edge detection attribute combined with volumetric dip azimuth has been used to interpret channels; in some cases these attributes see the compacted layers overlying the real channel.	Co-rendering of edge detection volume and dip azimuth was used by Chopra and Murfart (2007) to highlight karts feature trends.			Consistent Dip
Dip Guided Variance	Same as variance with an added principle component based guiding. Improves continuity of non-vertical events.	Reveals discontinuities in seismic data. As above, useful for structural and stratigraphic terminations.	Can help outline salt extents.	Fault detection from continuous variance response. Gas chimney mapping.	Can discriminate between low and high continuity of seismic reflections. Interpretation of progradational versus aggradational stacking patterns on stratal slices.	High variance can suggest faults or fractures swarms.					Dip Guided Variance
Dip Illumination	Estimates the dip field of the seismic and highlights the structural geology with the use of light.	Can enhance both subtle and major structural features.	Can be used to detect and highlight chaotic/noisy areas.	Can be used to detect and highlight discontinuities.		Possible fracture indicator by local high dip response.	Can highlight channels.				Dip Illumination
Directional Blending	Directional blending is very useful for identification and delineation of geologic lineaments or features by illuminating in specific azimuthal directions.	The directional blending volume attribute requires two inputs (inline and crossline components of a chosen vector attribute) and provides a single (blended) output volume at a user defined azimuthal direction.		Directional blending is very useful for identification and delineation of geologic lineaments or features by illuminating in specific azimuthal directions. A directional dip or curvature steered in desired azimuthal directions can provide an enhanced image of deformation or sweet spots which could help in correlation with borehole, microseismic, and other production measurements.							Directional Blending
Edge Evidence	Edge enhancing attribute where statistical methods are used. Connects and improves continuity of edge cubes. Used in collaboration with Ant-Tracking where enhanced continuity is needed. If used, this should be applied before using the Ant-Tracking attribute.	Fault enhancement attribute for improving continuity.		Enhances edge detection by improving continuity.		Large (seismic scale) fracture swarms enhancement.					Edge Evidence
Envelope (reflection strength)	Mainly represents the acoustic impedance contrast, hence reflectivity. Indicates the group, rather than phase component of the seismic wave propagation.				Detect lithological changes, sequence boundaries, thin-bed tuning effects. Also spatial correlation to porosity and other lithologic variations.					Detect bright spots. Also, AVO in combination with Reflection Intensity is useful for (Near-Far)/Near.	Envelope (reflection strength)
Filter	Apply a frequency filter over time gates to seismic data. Various methods and tapers are available.				Frequency filtered data is useful input for frequency based attributes.		Filtered seismic can show channels clearer.		Time gated frequency filter. Mute unwanted frequencies.		Filter
First Derivative	Time rate of change of the amplitude.				Useful for stratigraphic analysis, facies estimation, and QC interpretation (zero crossing).						First Derivative
Generalized Spectral Decomposition	Spectral decomposition unravels the seismic signal into its constituent frequencies, allowing the interpreter to delineate subtle geologic features (amplitude and/or phase) tuned at a specific frequency.	Can enhance subtle structural features.	Delineate Salt extents as separable from sediment on frequency content.	Selected frequencies can provide sharper image of small faults than the input data for input to workflows such as Ant Tracking.	Identification of thin beds and subtle stratigraphic features (e.g., pinch-out, reefs, and channels). Can be used along stratal slices for seismic geomorphology analysis. Can also be used as input to facies mapping in particular for seismic geomorphology analysis.	Selected frequencies, also combined with other attributes in an ANN, can detect possible fractures zones via attenuation analysis or, conversely, can highlight subseismic faults.	Spectral decomposition is a popular attribute for qualitative and quantitative interpretation workflows including seismic geomorphologic analysis and layer thickness determination (Marfurt and Kirlin, 2001; Partyka et al., 1999). Tuning frequency provides information oin channel thickness.	Can improve the image of subtle stratigraphic features as well as subseismic faults.	S/N can improve at selected frequencies.	Spectral decomposition has been used for and direct hydrocarbon indicator for gas charged reservoirs (Sinha et al., 2005; Xiaodong et al., 2011); bright spots ca be highlighted over background at specific frequencies (Burnett et al. 2003).	Generalized Spectral Decomposition
Genetic Inversion	Neural Network approached inversion process.				Better define lithology boundaries.		Can define channel edges.		Inversion is effective for noise reduction.	When combined with other inversion attributes such as Poisson's ratio/Vp-Vs.	Genetic Inversion
GLCM	Grey Level Co-occurrence Matrix (GLCM) is a method that amplifies geological features such mass transport complexes, channel, and dewatering structures by combining four parameters to define the voxel amplitude values. Three output cubes are created upon ap-plying this attribute.	Amplifies mass transport complexes, channels, and dewatering structures that have lateral patterns that exceed mere edges.	Highlights the surrounding stratigraphy around salt bodies, in addition to the stratigraphy located within the salt body.		This attributes visualizes all seismic stratigraphy and neglects chaotic features and discontinuities, where the extent of which is determined by the user.		Can be used to highlight channels.		Neglects chaotic features and reduces noise.		GLCM
Graphic Equalizer	Seismic data bandwidth filtering: Applies a bandwidth filter with frequency indexed weighting as per defined in the equalizer.	High pass filter enhances terminations and discontinuities for fault mapping. Low pass filter enhances signal/noise to improve seismic event continuity.		High pass filter enhances terminations and discontinuities for fault mapping.	Show onlap, truncations, and unconformities.		Show onlap and channel edges via frequency filtering.		Reduce frequencies from noisy seismic.		Graphic Equalizer
Instantaneous Frequency	Time derivative of the phase.				Bed thickness indicator and can detect lateral changes in lithology laterally—increasing instantaneous frequency can indicate bed thinning or pinch outs. Can also be a rock property indicator.	Fracture zone indicator, since fractures may appear as lower frequency zones.				Hydrocarbon indicator by low frequency anomaly.	Instantaneous Frequency
Instantaneous Phase	Description of the phase angle at any instant along a trace independent of amplitude. It reveals weak and strong events with equal strength		Continuity boundary of sediment at salt face.	Can help when used in combination to isolate faults.	Discriminator for geometrical shape. Good indicator of continuities, angular unconformities, faults, pinch-outs, sequence boundaries, and onlap patterns.						Instantaneous Phase
Local Flatness	Maps the "flatness" of the local seismic signal, 3D. "Flatness" is the degree to which local reflectors are flat/planar (not necessarily horizontal).			Determines to which degree local orientation is planar.	Good stratigraphic indicator—reef internal texture, sink holes, channel infill (in particular subtle features). Also a good discriminator for seismic facies analysis.			Detection and mapping of build-ups/reefs within layer-cake depositional environments.			Local Flatness
Median	The median filter is a smoothing filter that has an edge-preserving nature, and is good at removing seemingly random noise with high amplitudes (also known as salt and pepper noise). This makes it good to use on seismic where you are concerned with preserving reflector edge information and smoothing the values in between. However, it is important to note that this filter actually filters out rapidly changing signals, which can have an unwanted effect as input to chaotic feature detection attributes such as chaos and amplitude contrast.								Good for eliminating random (salt and pepper) noise.		Median
Phase Shift	A selectable phase rotation of the input signal. The Phase shift capability allows you to define the phase rotation of the input seismic trace.						Phase rotation is commonly applied to improve the match between different versions of seismic data, including adjacent surveys. A phase rotation of 180° produces a reverse polarity version of the input trace. A +90° or -90° rotation alters the seismic trace in such a way that a peak or trough on the input trace becomes a zero-crossing on the output trace and vice versa. Improves seismic well tie and comparison of seismic with well logs.				Phase Shift
Relative Acoustic Impedance	Physical attribute that reflects physical property contrast and provides better tie to well domain for geological analysis—assumes zero phase data. Generated by integration of seismic trace and subsequent low cut filter to remove arbitrary long wavelength trends	Reveals discontinuities and improves structural delineation.			Stratigraphic layering. High contrast indicates possible sequence boundaries. Reveals unconformity surfaces. Also provides better tie to lithology and can be related to porosity (non linear).			Can differentiate between tight or shaly and good porosity limestone.			Relative Acoustic Impedance
Remove Bias	Removes DC bias for the seismic traces. DC bias occurs when the average of the trace values departs from zero and may be caused by processing artifacts and/or geological factors.								Removes DC bias from the trace.		Remove Bias
RMS Amplitude (iterative)	The RMS Amplitude (iterative) volume attribute computes the root mean square (RMS) of single-trace samples T[i], over a user-specified vertical window with a length of n samples, for each sample in an input trace.						Detects amplitude variations for channels with density changes to surrounds.			Classical attribute for bright spot detection (highly correlated wto envelope).	RMS Amplitude (iterative)
Second Derivative	Second derivative measures the variation in the tangents of the selected seismic amplitude, directly above and below the reflection. High values indicate rapid shift from peak to trough (short wavelength).			May enhance terminations and discontinuities.	Second derivative can be used to help guiding the pick by providing continuity in areas of where reflections are poorly resolved on the raw amplitude may help resolve subtle stratigraphic patterns such as shingled/low angle pro-grading fore-sets.						Second Derivative
Structural Smoothing	Performs data smoothing by local averaging with a Gaussian weighted averaging filter. Use as input for variance, dip deviation, or chaos.	General smoothing. Increased signal/noise ratio for structural Interpretation.		Use to remove noise from the data.	Estimating local signal magnitude (absolute amplitude).					Can illuminate "flat spots" or fluid contacts.	Structural Smoothing
Structural Smoothing Options: Dip Guide, Edge Enhance	Performs data smoothing by local averaging with a Gaussian weighted averaging along flow surfaces following the local dip/azimuth.			Enhance discontinuities.	Provides increased layer continuity without sacrificing vertical resolution Increased signal/noise ratio.		Delineate channel edges.		Data conditioning step before generation of variance attribute in Ant-Tracking workflow.		Structural Smoothing Options: Dip Guide, Edge Enhance
Sweetness	Sweetness is the combination of envelope and instantaneous frequency. Sweetness=Envelope/SQRT (Inst. Freq).	Can enhance subtle features.		Can help delineate subtle discontinuities.	Can enhance subtle features.		Can be used for channel development especially when channels appear as sand bodies in shale.			Classical attribute for hydrocarbon sand detection (highly correlated with envelope).	Sweetness
Time Gain	Enables the balancing of amplitudes as a function of time. If the gain is >1 amplitudes will increase with time and if gain is <1 amplitudes will decrease with time.								Helps identify time dependent weaknesses in seismic amplitudes.		Time Gain
Trace AGC (iterative)	The Trace AGC (iterative) volume attribute automatically scales the instantaneous amplitude samples with the local root mean square (RMS) amplitude level, computed over a user-specified vertical window, and has the option to apply multiple RMS iterations, in order to get a more well-behaved (smooth) scaling function.				Enhances low amplitude sections for improved horizon interpretation. Drawback is that relative amplitude information is lost.				Boosts weak events but also boosts noise.		Trace AGC (iterative)
Variance (edge method)	Signal coherency analysis: Estimates trace-to-trace variance (1-semblance). Amplitude Invariant (but not orientation invariant); i.e., it will produce the same response for the same seismic signature, whether in a low- or high-amplitude region.	Reveals discontinuities in seismic data either related to stratigraphic terminations or structural lineaments.	Can help outline salt extents.	Fault detection from continuous variance response. Gas chimney mapping.	Can discriminate between low and high continuity of seismic reflections. Interpretation of progradational versus aggradational stacking patterns on stratal slices. Also a good discriminator for seismic facies analysis.	High variance can suggest faults or fractures swarms.	Useful for channel sweep at Z values for channel development.	Karst and sinkhole delineation. Detection and mapping of buildups/ reefs within layer cake depositional environments.			Variance (edge method)
	Short Description	General Structural	Salt Workflow	Edge Detection (structural)	General Stratigraphic	Fracture Indicator	Channels	Carbonates	Noise Reduction	Hydrocarbon Indicator	