Advanced Wavelet Analysis Tools for QI Specialists

Jason® WaveletTools enables Quantitative Interpretation specialists to correctly account for a wide range of particular reservoir characterization situations. **WaveletTools** facilitates the interpolation of spatially-varying wavelets and provides Q compensation functionality. It is also possible to design deconvolution filters for zero-phasing seismic or for designing operators to perform Coloured Inversion. As part of **WaveletTools**, **Jason** users have access to a broadband add-on to the Estimate Multi-Stack Wavelets application.

Estimating lateral and vertical variations in wavelets provides users with the ability to model real-life situations commonly found in the subsurface. The wavelets obtained from this process will result in more accurate reservoir characterizations, better-designed well programs, and increased production. Accurate wavelet estimation is absolutely critical to the success of any seismic inversion. The inferred shape of the seismic wavelet may strongly influence the seismic inversion results and therefore subsequent assessments of the reservoir quality. **Jason** has invested a great deal of resources in developing and implementing the most advanced wavelet estimation methods and a wide variety of QC capabilities to ensure that a high-quality wavelet is obtained.

WaveletTools delivers added functionality for wavelet estimation:

Spatially-varying wavelets are derived from multiple wavelets that are interpolated in the frequency domain by independently interpolating their amplitude spectra, unwrapped phase spectra and start times. The interpolation uses weighted interpolation schemes, and relies on the X,Y coordinates of each wavelet. You can edit the coordinates if needed. The resulting file is a volume (.mod file) of datatype wavelet.

Q-based wavelets

Seismic traces show decreasing amplitudes with increasing time due to attenuation. In addition, there may be smaller amplitude changes due to seismic data processing. Using this option, you can estimate amplitude changes due to attenuation and processing.

Reef play: Spatially-varying wavelet weights
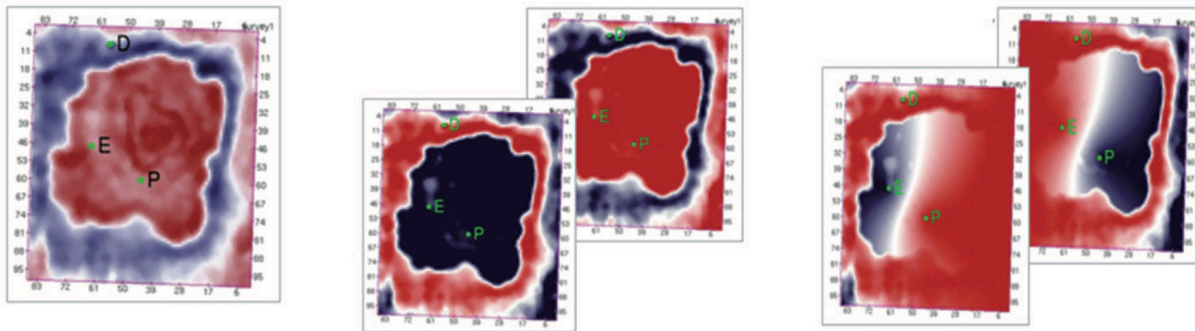
It is required that well D has influence outside the reef (red in the left-middle figure) while wells E and P are used to model the reef interior (red in the right-middle figure). Furthermore, wells E and P have different areas of influence within the reef (reds inside the reef in the right figures). The well weights displayed in the middle and right figures are then used to define the well log interpolation which builds the final reef model. This might then be used, for example, to provide a low-frequency model for inversion.

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To estimate the Q factor and the scale factor, this module compares the spectrum of the input seismic data in a moving window to the seismic spectrum in the reference window. The moving window is shifted within the specified time gate. The spectral differences are used to compute the Q factor. This computation is performed in the frequency domain.

You can estimate the attenuation by selecting either a constant Q factor for each trace, or a Q factor that varies vertically along the traces. By QC'ing the estimated Q factor, you can infer the attenuation in the seismic data. Additionally, scaling factors are estimated in order to account for possible changes in amplitude that were applied during the seismic data processing (for example AGC and NMO correction).

The Q and scale factors can be used directly in **InverTrace®Plus™** and **RockTrace®** to compensate for attenuation during inversion.

Deconvolution filter design

Deconvolution filters reshape an input wavelet to a target wavelet. The filter is computed so that its convolution with the input wavelet gives the smallest least-squares error relative to the reference (target) wavelet. It can be used in a workflow to design and apply an operator to perform Coloured Inversion.

Broadband wavelets

A broadband option, licensed under **WaveletTools**, is located as an add-on in Estimate Multi-Stack Wavelets. It facilitates the determination of the long broadband wavelets required to successfully complete broadband inversions.
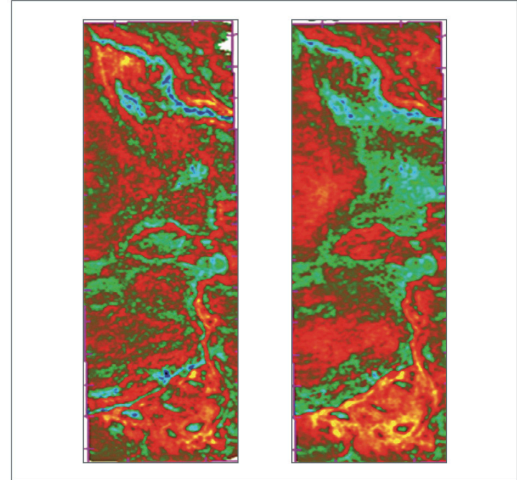
Above are slices from a Conventional inversion (left) and a Broadband inversion (right). The addition of the low frequencies results in a broadband inversion which is much more geologic and representative of the play.
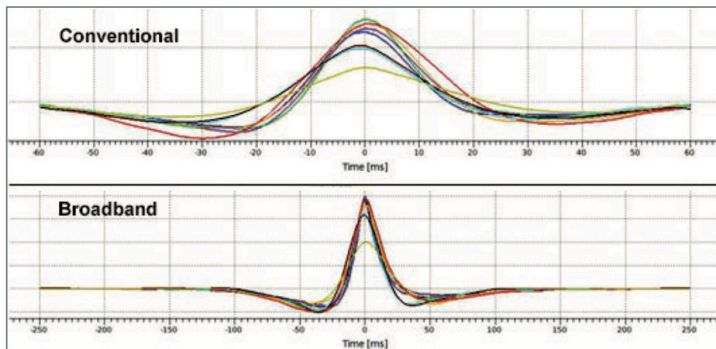
Conventional (upper) and Broadband (lower) wavelets for inversion corresponding to a set of partial-angle stacks. Note the increased frequency content of the broadband wavelets.