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Wavelet processing of land data: current state-of-the-art and outstanding challenges

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Summary

We provide a snapshot of the current industry state-of-the-art in wavelet processing and discuss remaining challenges. Since the inception of surface-consistent deconvolution twenty-five years ago, a cursory glance suggests that very little has changed in production wavelet processing flows despite much research into important topics like wavelet non-stationarity and phase stability. A slightly more careful gaze reveals that a few additional enhancements have indeed managed to gain widespread production usage. Such enhancements include inverse Q filtering, multiple passes of minimum-phase deconvolution, various flavours of AVO-compliant spectral whitening, vibroseis minimum-phase-conversion and bandwidth-dependent scaling. Yet another important innovation, in our opinion, though not universally adopted, is the simultaneous estimation of both statics and phase via adaptation of an existing residual statics approach. The aggregate effect of these tools is to provide a significant amount of wavelet collapse and also good compensation of the short-to-medium (spatial) wavelength components of phase distortion. At the risk of some oversimplifcation, the preceding sentence essentially describes the state-of-the-art.

While this state-of-the-art provides very useful image enhancement and has helped find a lot of oil and gas over the years, some additional challenges remain. For example, on some land data sets large lateral fluctuations in bandwidth can persist even after applying the above tools. In addition, there are some cases where differential phase mismatch at multiple well-tie locations suggests the existence of long-wavelength variations in embedded wavelet phase. This presentation will take a careful look at the root cause of these challenges in the hope of providing some insights into how to better address them.