Controlled phase processing of a 3C/3D multi-source, multi-survey heavy oil dataset

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Summary

Special care has always been needed to control the phase of seismic data during the merge processing of land 3D datasets, especially when multiple sources such as dynamite and Vibroseis are used. Traditionally relative differences in phase and statics between surveys that are being merged are determined from cross-correlations of stacked traces at overlapping edges of the surveys. This cross-correlation method can be effective, but it is limited by the fact that stack fold and signal-to-noise ratios can be quite low at the survey edges, so the accuracy of phase estimation can be impacted. Furthermore, it is assumed that wavelet phase does not change laterally from the edges to the interior of each survey, but unfortunately, if lateral phase changes do exist, the cross-correlation method would be unable to detect them.

The detailed high-resolution pre-stack inversions that are now routinely performed for reservoir characterization can be significantly impacted by wavelet phase instability. As a result it is highly desirable that a more comprehensive quality control of wavelet phase is performed than the cross-correlation method alone provides. We present a case history that illustrates several techniques that can be applied during 3D merge processing that help to control and measure wavelet phase. We use the PP and PS components of a mixed dynamite and Vibroseis multi-survey 3D merge from the Foster Creek area of NW Alberta for illustration.

Included in the discussion will be peak-envelope instantaneous phase measurement, multiple passes of surface-consistent deconvolution to enhance resolution and stabilize phase, simultaneous surface-consistent statics and phase estimation, Q compensation and the impact of spatial variations in bandwidth on phase.