DAS trace location assignment for the CaMI.FRS Fibre loop

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ABSTRACT

As our knowledge of the optical fibre loop (Figures 1 and 2), at the Containment and Monitoring Institutes Field Research Station (CaMI.FRS) continues to evolve we are better able to assign *x, y* and *z* coordinates to seismic traces recorded upon the loop using various interrogators (e.g. Figure 3). For example, gyroscope surveys conducted on observation wells 1 and 2 (OBS1 and OBS2) in the past year confirmed that neither well is perfectly vertical. Using this updated information, we have built a trace geometry model that can be easily adjusted for varying trace spacings, uncertain cable lengths, fibre indices of refraction (actual and as used in interrogator software, and other unknowns (Figure 4). For downhole data with up- and down-going fibre, we may exploit symmetry by coarsely locating the bottom of the well using cross-correlation, fine-tuning using stack-power in sliding windows over a small trace range (+/- 5 traces) and applying the geometry from our model. This strategy works well even for noisy shots, where cross-correlation by itself gives slightly varying answers from shot to shot. Quality control of fibre data geometry thus far has been by conducted by stacking data after applying geometry (Figures 5-7) and inspection of interleaved well data sorted by true vertical depth (Figure 8) or trench data sorted by easting (Figure 9). Stacking of helical and straight fibre data will require a careful trace interpolation step to compensate for differing effective trace spacings in addition to trace balancing. The helical data are observed to have significantly lower amplitudes than the straight fibre data, which is not obvious on this poster due to trace scaling that has been applied for display.

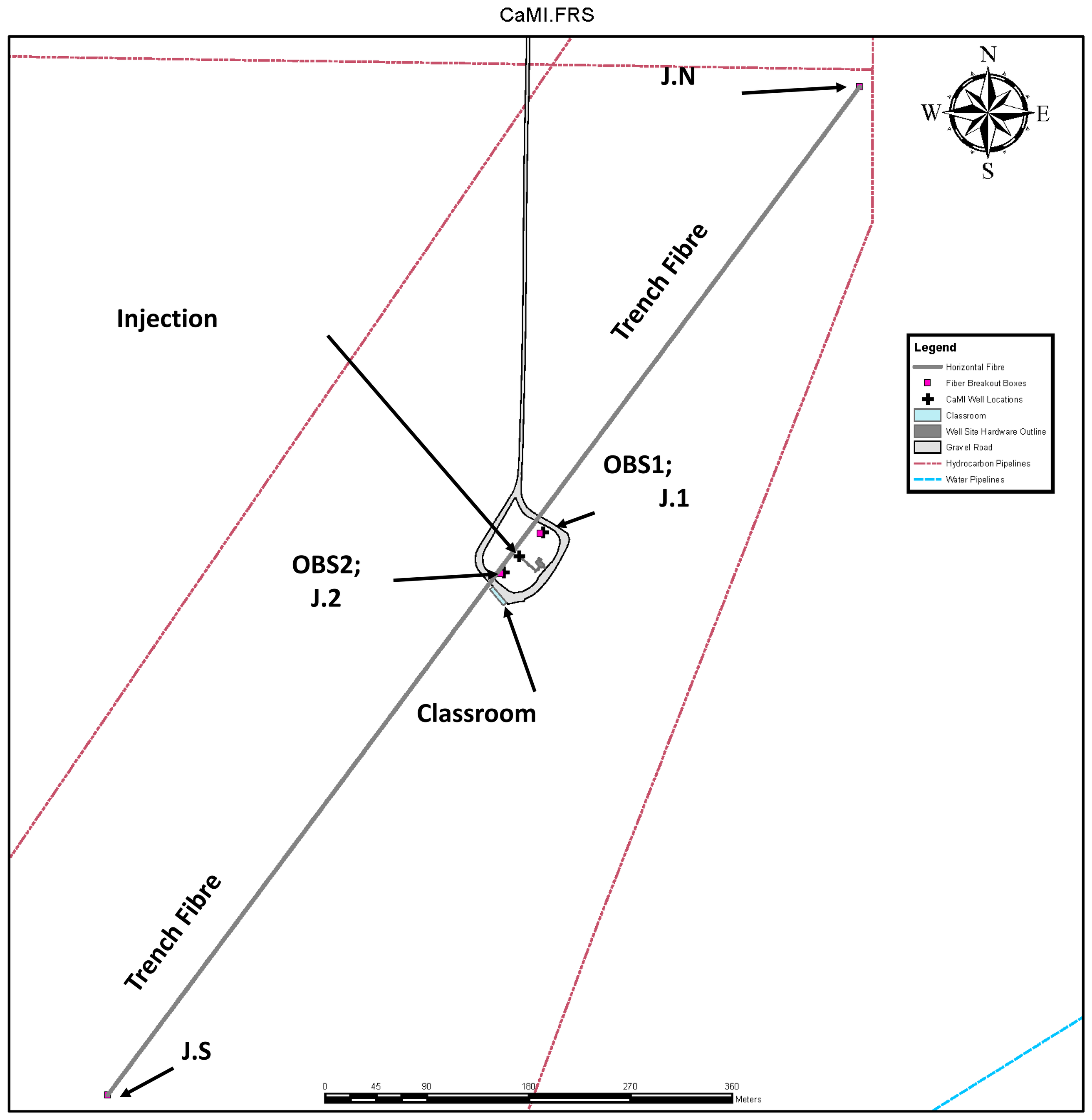

FIG. 1. Map view of Cami.FRS Fibre Loop showing locations of junction boxes (J.1, J.2, J.S, J.N) as well as locations of trench fibre and observation wells (OBS1, OBS2).

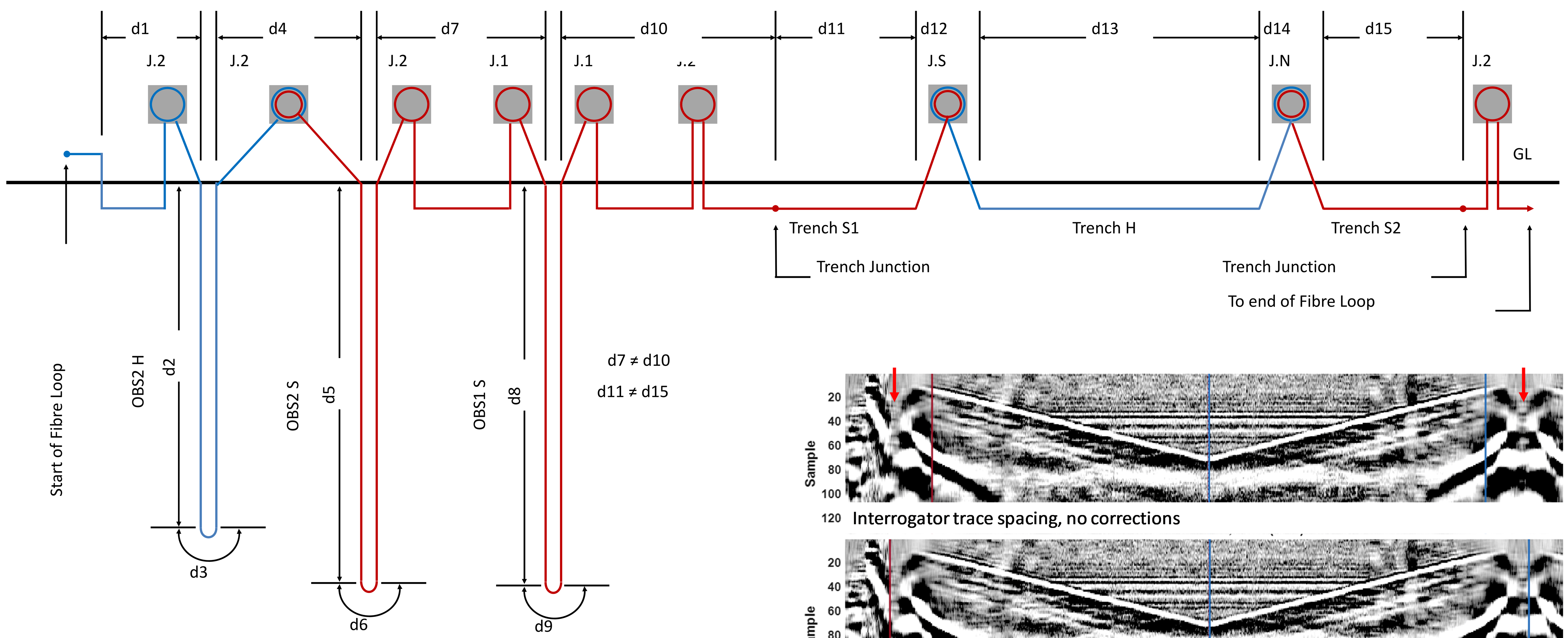

FIG. 2. Schematic of the fibre loop with helical fibre in blue and straight fibre in red. Compare with Figure 3.

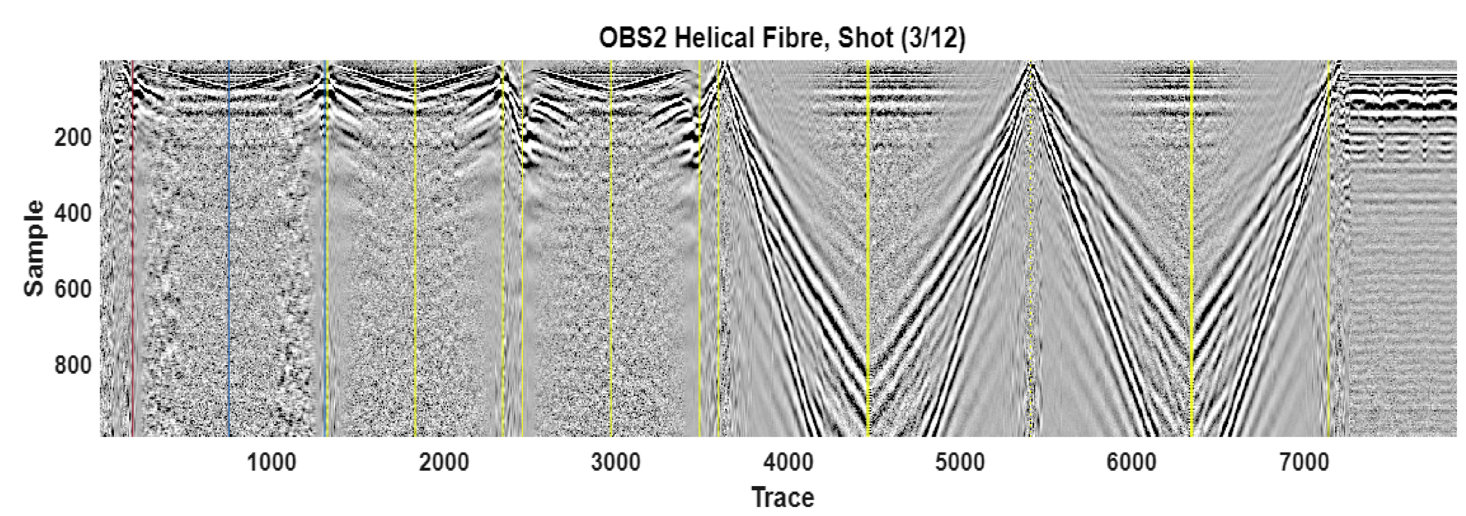

FIG. 3. Full source gather. Red, blue and yellow lines represent trace windows derived from the geometry model after coarse and fine-tuning.

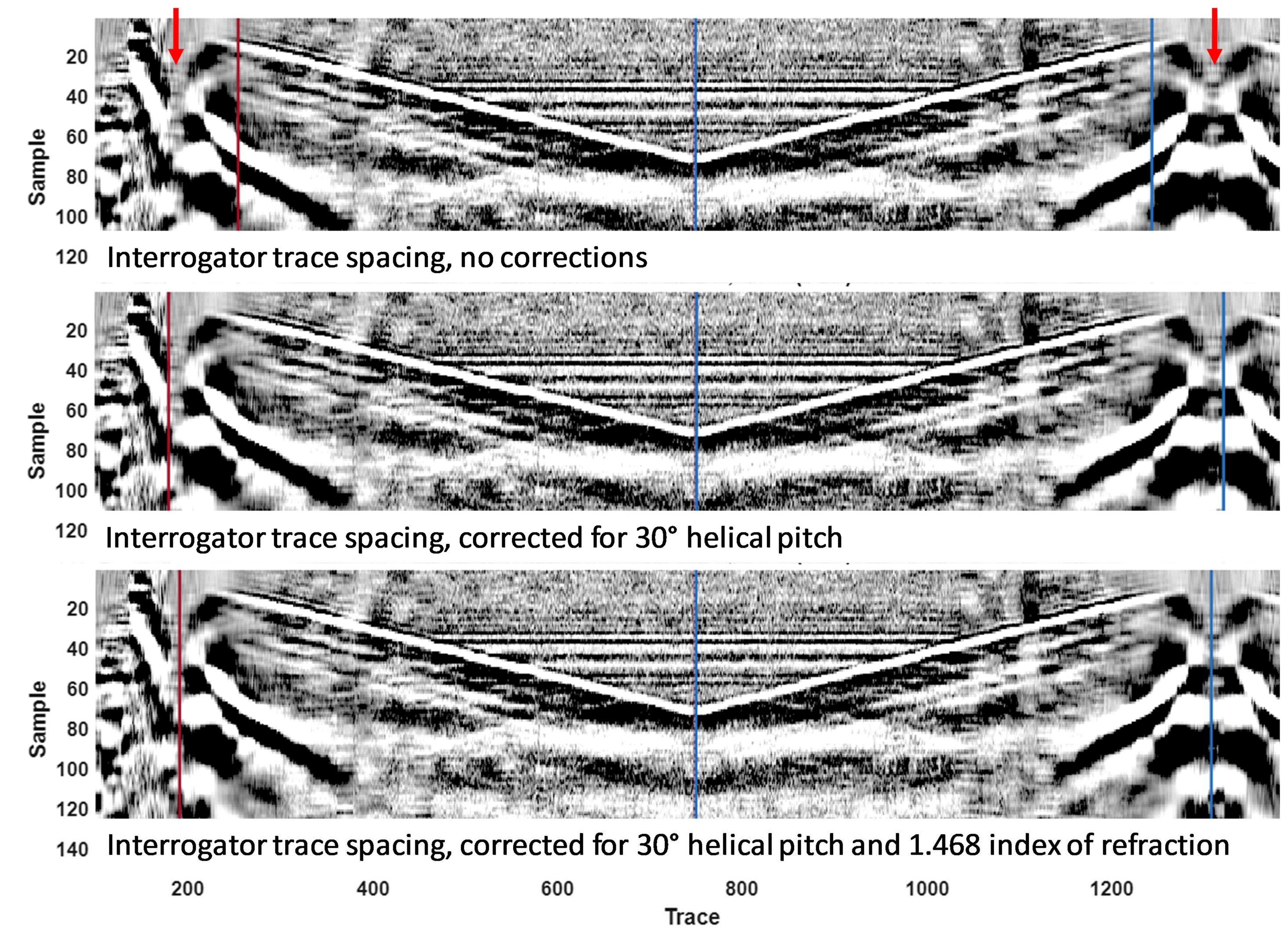

FIG. 4. Example of the effect of helical pitch and index of refraction corrections on trace geometry for helical fibre data in observation well 2 using a cable length 329.53 m. Red arrows (top) show interpreted junction box locations (J.2). Blue lines (middle) show bottom of well location, red lines (left) and blue lines (right) show calculated surface locations.

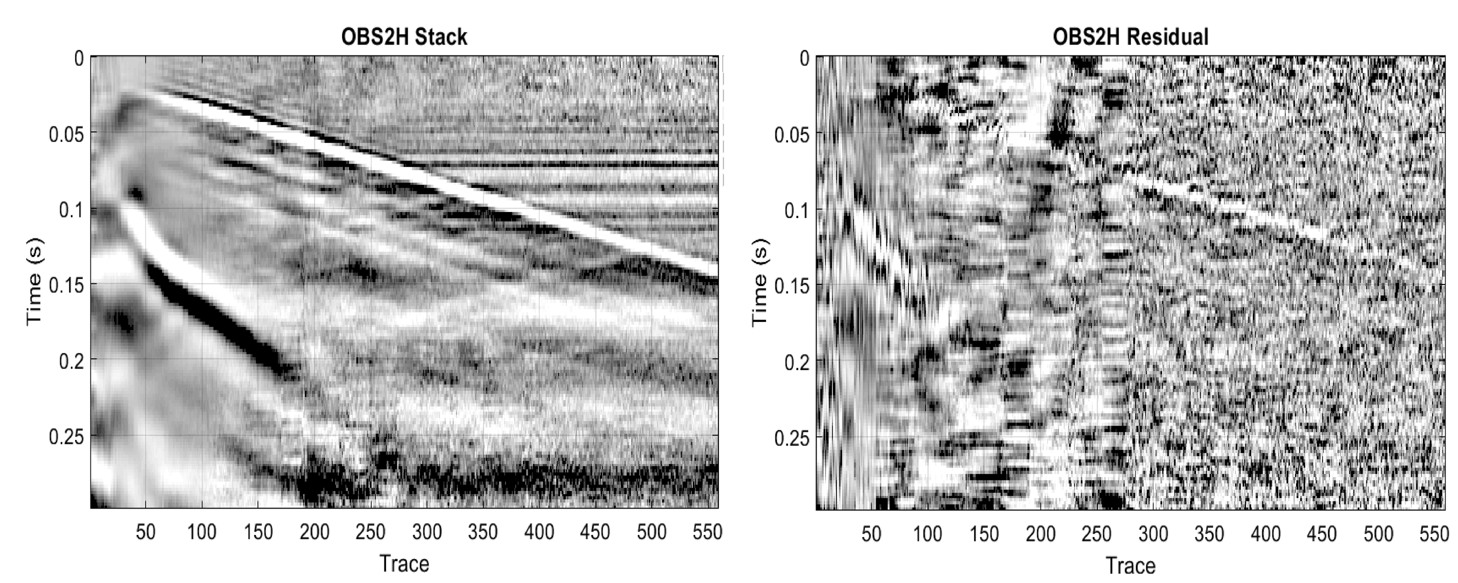

FIG. 5. Observation well 2 helical (OBS2H) fibre stack and residual.

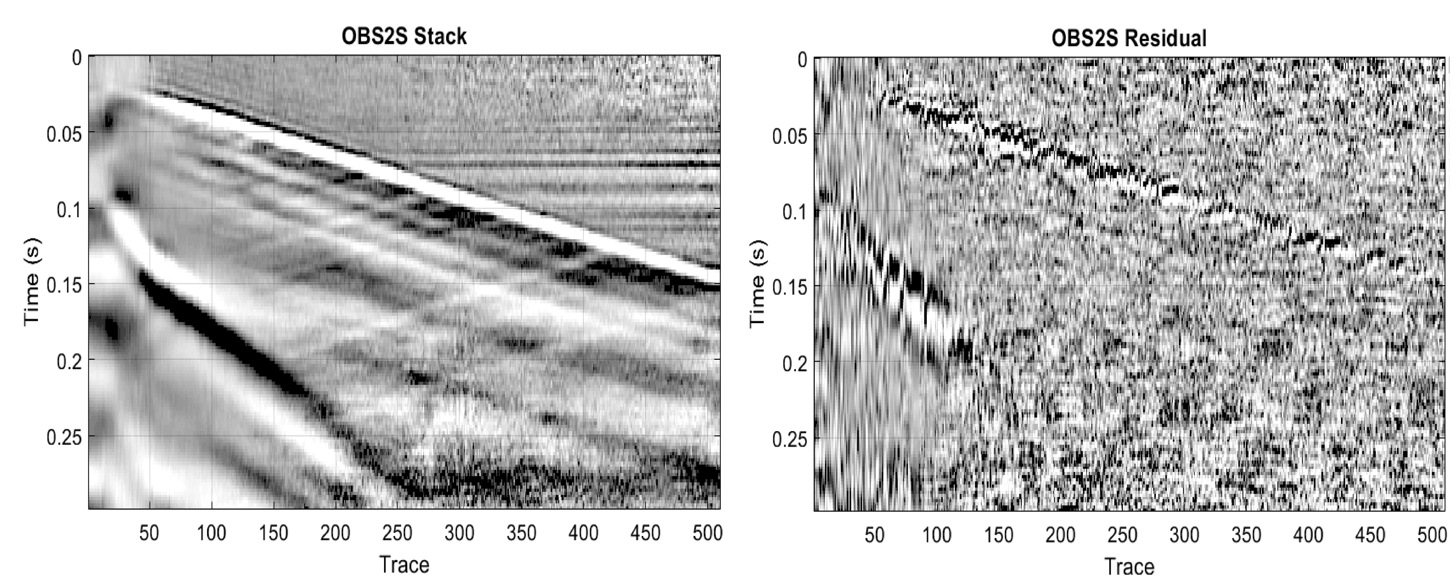

FIG. 6. Observation well 2 straight (OBS2S) fibre stack and residual.

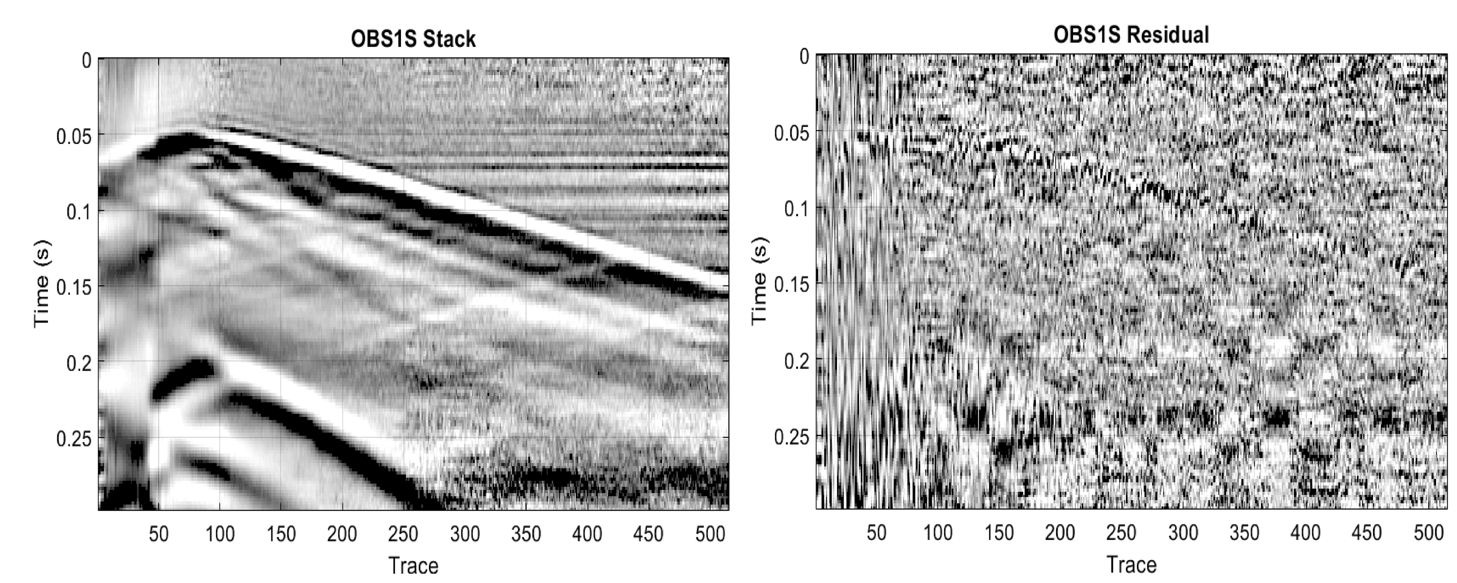

FIG. 7. Observation well 1 straight (OBS1S) fibre stack and residual.

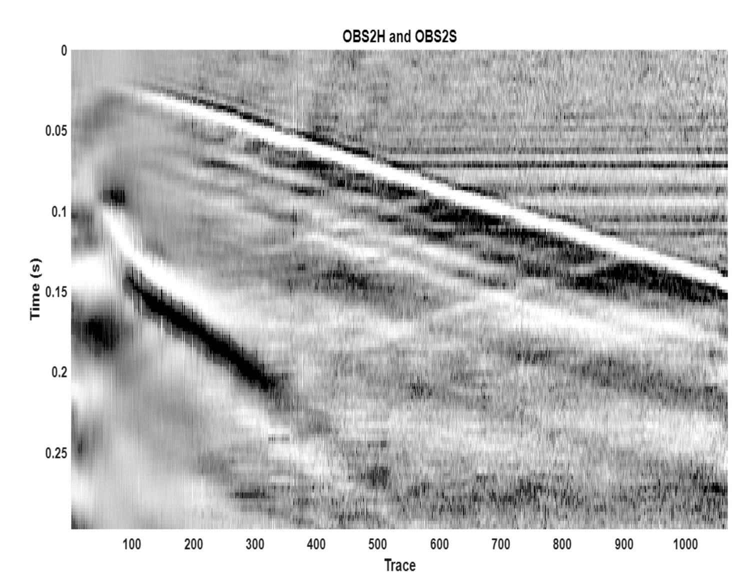

FIG. 8. Observation well 2 helical and straight (OBS2H and OBS2S) fibre interleaved by true vertical depth.

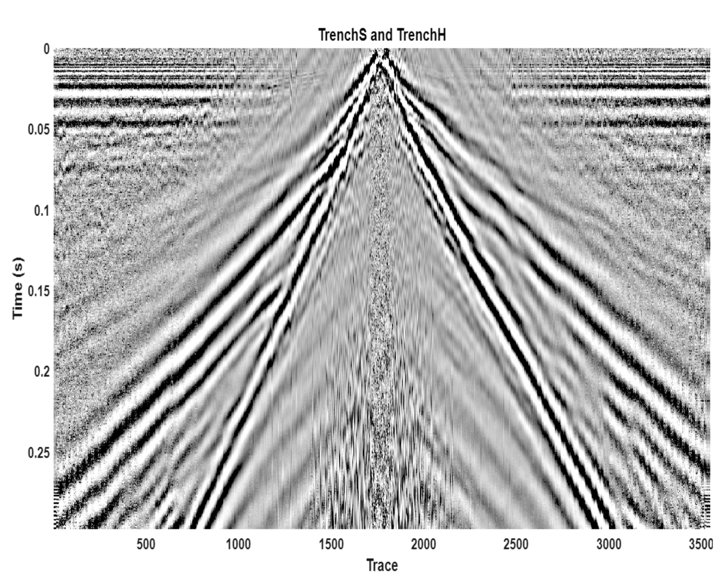

FIG. 9. Trench helical and straight (TrenchS1, TrenchH and TrenchS2) fibre interleaved by easting.