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VSP using Distributed Acoustic Sensing at the CaMI Field Research Station in Newell County, AB - August 2018

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Summary

We examine the seismic data acquired by Fotech at the Containment and Monitoring Institute Field Research Station (CaMI FRS) in Newell County, AB in August 2018 using distributed acoustic sensing. We describe the schematic of the fibre at CaMI FRS and explain the experiment conducted in August 2018. We then show the results of various aspects of the experiment focusing on the vertical seismic profiling of the straight fibre in the two wells at the site.

CaMI Field Research Station in Newell County, AB

The Containment and Monitoring Institute focuses on subsurface monitoring and specifically develops methods for containing carbon as well as other subsurface fluids (CMC Research Institutes, 2015). Figure 1 shows a full-sweep of the fibre at the site at Source Location 155 on line 13. The source is located at the center of the trench which allows us to see the full trench as well as both wells. In comparison to the data in (Hardeman et al., 2017), the data was collected along the opposite direction of the fibre loop. From left to right in Figure 1, we see the results from the trench to well 1 to the straight fibre in well 2 to the helical fibre in well 2.

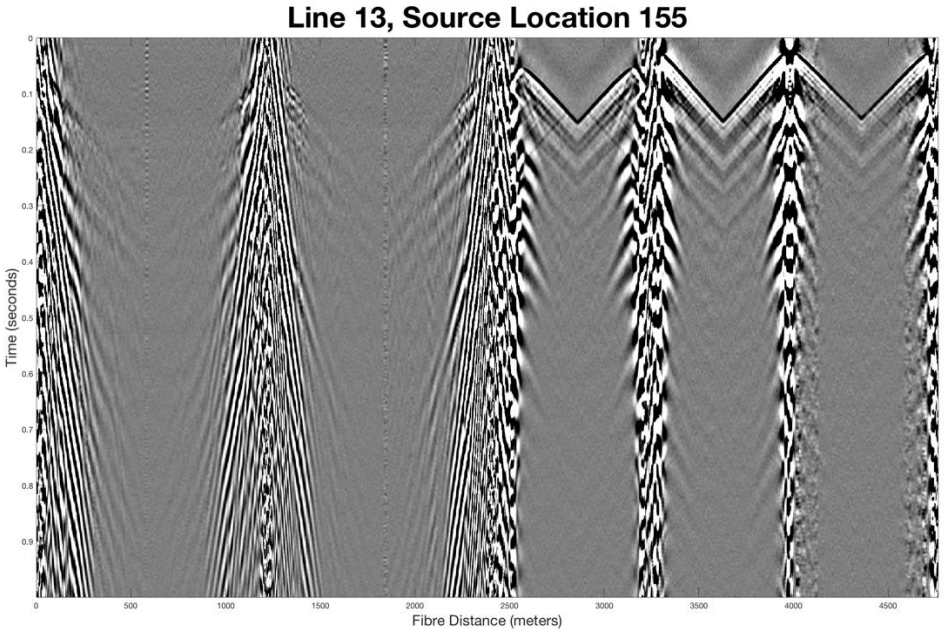

Figure 1: Full fibre data for line 13 flag 155.

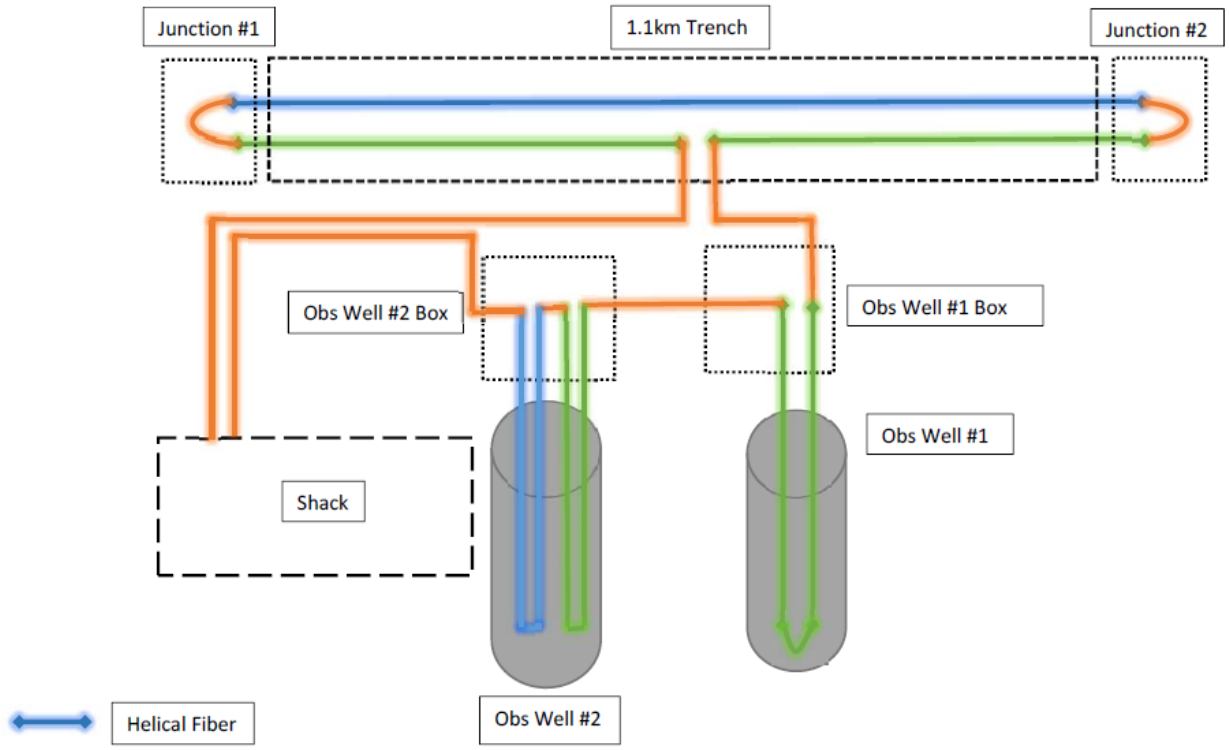

Figure 2: A schematic of the fibre at the site in Newell County, AB.

We provide a schematic of the Field Research Station's fibre loop in Figure 2. In the schematic, the straight fibre is designated by the green lines and the helical fibre is represented by the blue lines. The orange lines depict the connecting fibre. The full schematic begins with the fibre leaving the shed and connecting to the straight fibre for half the length of the trench. The fibre then goes along the trench helically for 1.1 km and then returns halfway along the trench straight. Afterwards, the fibre connects to well 1 where it descends into the earth straight for approximately 300 m before returning the the surface. It then proceeds to well 2 where it goes down into the well and returns to the surface straight. Then it descends again into well 2 helically before returning to the surface at which point it returns to the shed.

Experiment in August 2018

For the experiment, a Vibroseis truck generated 110 source locations, numbered 101 to 210, along the 1.1 kilometers of the trench. The source locations were approximately 10 meters apart. A total of 448 shots were acquired on one full line, Line 13. The raw backscattered data was processed to obtain the optical phase. Each shot was cross-correlated with the pilot sweep and then stacked. Each stack consisted of 4 shots.

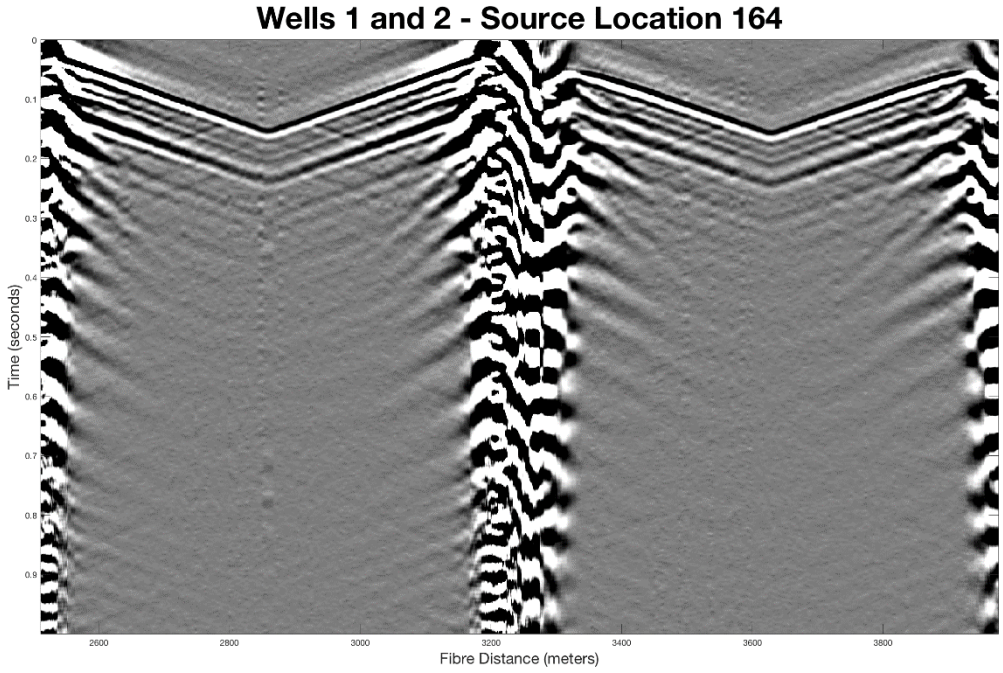

Figure 3: Well 1 and Well 2 at source location 164.

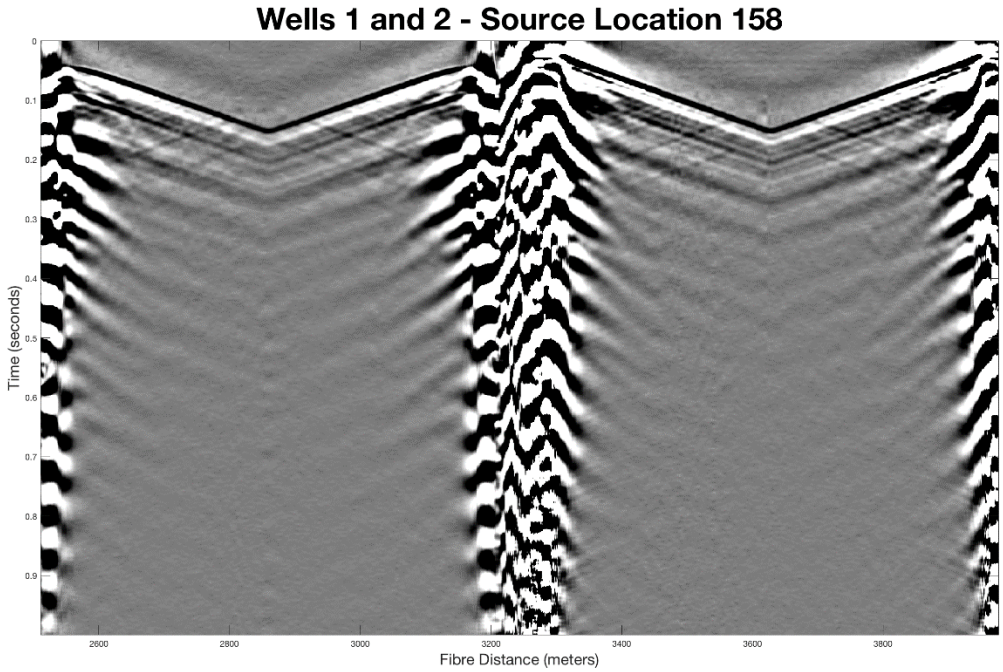

Figure 4: Well 1 and Well 2 at source location 158.

Figure 3 and 4 show the straight fibre in well 1 and well 2 from left to right at two different source locations. We found source location 168 to be the closest source to well 1 and source location 154 to be the closest source to well 2 for the purposes of computing vertical seismic profiles. In both data sets, we can identify the target (a carbon dioxide plume). We can also see some AVO effects as well as P-wave and S-wave responses in the data from both source locations.

Conclusions

We began with a discussion of the Containment and Monitoring Institute's Field Research Station. We focused on the schematic of the fibre loop at the site. The experiment conducted in August 2018 was explained. We looked at the straight fibre in wells 1 and 2 at 2 different source locations along the trench. The first location (SL 168) is used to process the vertical seismic profiles for well 1. The second location (SL 154) is employed for the vertical seismic profiles of well 2. Standard processing techniques have been applied to the data from both Figure 3 and Figure 4 to find the vertical seismic profiles for each well.

Acknowledgements

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