

## ***Interactive comment on “Investigation of the Effects of Surrounding Media on the Distributed Acoustic Sensing of Helically-Wound Fiber-Optic Cable with Application to the New Afton Deposit, British Columbia” by Sepidehalsadat Hendi et al.***

### **Anonymous Referee #2**

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The paper discusses the impact of the surrounding media around borehole(s) on the DAS response collected with Helically-Wound Cables. It is an important topic relevant to the journal. Scientific relevance is good but the current manuscript requires some significant changes in my opinion for the following reasons.

General comments.

GC1: What is new in this work is not clear enough. As currently written, it looks like the derived 2D analytical solution is the novel aspect. a) If correct, then what are the

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difference(s) and advantage(s) in comparison with the method proposed by Kuvshinov (AppendixD 2016) must be clarified. b) If not correct, i.e. if the 2D analytical solution only aims at validating the 3D FE modeling set-up, then the whole part about the analytical solution and how/if it fits with the FE modeling could remain in the appendix. c) In both cases, I suggest for the 2D analytical solution source code to be provided in order to help reproducing the results. Also not everybody can use COMSOL so this could be a valuable contribution.

GC2: FE modeling set-up and results, the main purpose of the paper, are not well enough discussed. a) No description of Fig 12 to 17 is given, so what do they exactly tell us? b) How exactly is the fiber strain extracted from this? c) Fig 15 and 16 exhibits strong strain variation inside/around the cable itself, so what exactly does the HW fiber sense? d) What does the white color mean in those plots (fig 16 and 17)? e) Why are the fiber strain values a magnitude smaller in 3D than in 2D (e.g. fig 18 versus fig 9) f) Given that 3D simulation is performed, a 3D view would be welcome!

GC3: The focus is on the HWC response exclusively. It should be clarified (ideally demonstrated and/or simulated) why the overall discussion does not apply to straight cables.

GC4: Given that the whole motivation is to explain discrepancies between Straight and HWC of Figure 22, one could discuss the impact of the fact that the gauge length of X meters results in a shorter distance with respect to the wavelength for the HWC compared to the straight cable.

GC5: Introduction part about HWC: Additional references should be made, e.g. Ning (2016, 2018 and 2019), Innanen (2017, 2019) or Eaid (2018) about directionality, multi-component sensing and other properties of HWCs.

GC6: Too many figures: a) Fig1 is a screenshot of Hornmann's youtube video and brings too little in the context. b) Fig 3 to 6 could fit in a single one. The reading would be facilitated. c) Fig 7 and 8 are too redundant. Should be merged into one and font

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size to be increased. d) Fig 9 to 11 could go in Appendix if their goal is only the FE set-up validation. e) Fig 11: Marker size probably inappropriate – where are the red curve(s)? f) Fig 12 to 17: those FE snapshots may be key results but are not even discussed in the manuscript.

GC7: Results and Discussion. How the FE modeling outputs connect to the observations in Figure 22 is globally difficult to follow and therefore is not very convincing in my opinion. One may wonder if the field data should be introduced much earlier in the paper to explain the motivation behind the choice of simulation range.

GC8: Only incident P waves have been simulated. Why? What about S and maybe Rayleigh?

GC9: Are the responses frequency dependent? You focused on the 100Hz to be consistent with the field data

Specific comments: a) Line 14: not correct: off-axial strain is partly detected. Only pure broadside is not. b) Line 24: coupling -is- achieved. c) Line 26: Could be applied – not would. d) Line 51: Missing reference about axial (in)sensitivity (e.g. Mateeva 2014). e) Line 58: Patent request HWC Den Boer publ. year is 2013. f) Line 59-61: HWC geometry are nicely explained in paper-form by Kuvshinov 2016 and others (Eaid and Innanen). Probably better than a YouTube reference. g) Line 118: It's Kuvshinov 2016 . h) Line 120-132: A table could be clearer. i) Line 158: -In- to be removed. j) Line 172: One -the- to be removed. k) Fig 18 caption: what's the definition of "cement quality"? l) Fig 18 caption: bracket missing. m) Line 226 and 312: what's the meaning of this? Why does the presence of water involve surface waves? you probably mean S-waves?

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