

Author response to comments on revised manuscript "Wireline distributed acoustic sensing allows 4.2 km-deep vertical seismic profiling of the Rotliegend 150°C-geothermal reservoir in the North German Basin" by Jan Henniges et al. from the topical editor Zack Spica

Dear editor,

thank you for your comments and suggestions to our revised manuscript, which we gratefully follow. In the following, we have listed the individual comments, followed by our answers in italic font, including the response to the comments from the referee. The revised manuscript text with all changes highlighted is provided as a separate document, as requested by the SE upload form.

Thank you and best regards,

Jan Henniges (on behalf of all authors)

1) p1.130: "because DAS provides continuous point measurements along the cable [...]". DAS does not provide point measurements but an integrated measure of strain (rate) over a gauge length. For this reason, a DAS channel and a geophone, even if collocated, will never provide the exact same seismogram.

Response: Our formulation was indeed a bit misleading, and we have changed "continuous point measurements" to "continuous measurements".

2) Fig. 2b: can you clarify what are the horizontal green line and the vertical red line?

Response: The horizontal green line marks the actual wavelength, and the vertical red line a gauge length to spatial wavelength ratio of 1, above which the wavelet shape is distorted. We have added this information to the caption of Figure 2.

3) I could not find your data either. Importantly, please provide a direct link to the data, not a link to the data portal. The doi provided is not recognized.

Response (also see response to comment no. 4 from the reviewer): In the revised manuscript we have included a direct link to the data publication with the doi 10.5880/GFZ.4.8.2021.001. This doi number is currently reserved but not activated yet, because the data publication is still in preparation and under review. A preview of the metadata is nevertheless already available under the following link:

<https://dataservices.gfz-potsdam.de/panmetaworks/review/3ea650a18f1bfd5993ac9d33d6a47fb6848133d64b1969501c2921ac7d2a51da/>

The data publication will be finalized in the coming days and the doi will then be activated. We will update the reference to the data publication, which currently is Henniges et al., in review, during the final print proof stage.

4) Please update the "in review" references if there is any change since the last submission.

Response: There is no change of the status of the two concerned references "in review" since the last submission. But we expect that we can do this in the final print proof stage.

Author response to report # 1 on revised manuscript “Wireline distributed acoustic sensing allows 4.2 km-deep vertical seismic profiling of the Rotliegend 150°C-geothermal reservoir in the North German Basin” by Jan Henninges et al. from referee #2 Ariel Lellouch

Dear Ariel,

thank you for your additional comments and suggestions to our revised manuscript, which are again very constructive and helped us to further improve the manuscript. In the following, we have listed the individual comments, followed by our answers in italic font. The revised manuscript text with all changes highlighted is provided as a separate document, as requested by the SE upload form.

Thank you and best regards,

Jan Henninges (on behalf of all authors)

1) I think it would be useful to mention the multi-gauge length recording property of hDVS.

Response: We have now included this information into the corresponding sentence in section 2, line 102, as follows: “After testing of several different gauge length values (see Henninges et al. in review), which can be varied with the hDVS interrogator, a gauge length value of 20 m was selected for online DAS data processing during recording.”

2) I don’t know about Solid Earth’s policy, but it is worth checking if papers under review/preparation can be referenced.

Response (also see comment no. 4 by the topical editor): The SE policy for references like these is: >>Works “submitted to”, “in preparation”, “in review”, or only available as preprint should also be included in the reference list.<< We expect to be able to update the two concerned references in the final print proof stage.

3) I’d be very interested in reading alternative theories on why the SNR patterns changed throughout the experiment (if they exist).

Response: We would also be very interested in such theories. But we are not aware that similar observations, or theories which could explain them, have been described elsewhere until now.

4) The link to the data isn’t working for me.

Response (also see comment no. 3 by the topical editor): In the revised manuscript we have included a direct link to the data publication with the doi 10.5880/GFZ.4.8.2021.001. This doi number is currently reserved but not activated yet, because the data publication is still in preparation and under review. A preview of the metadata is nevertheless already available under the following link:

<https://dataservices.gfz-potsdam.de/panmetaworks/review/3ea650a18f1bfd5993ac9d33d6a47fb6848133d64b1969501c2921ac7d2a51da/>

The data publication will be finalized in the coming days and the doi will then be activated. We will update the reference to the data publication, which currently is Henninges et al., in review, during the final print proof stage.

Line 32 >> Stay consistent between geophone chain (abstract) and string (here). I prefer string

Response: For consistency, we have now used the expression “borehole geophone string” throughout the text.

Line 47 >> Within **the** two research wells existing at the site (since you already mentioned them)

Response: We have changed this part of the sentence to “(...) within the GrSk3 and GrSk4 wells.”

Line 50 >> I'd explicitly state that this formation is the target of the study.

Response: We have modified the corresponding section to: “(...) and to image structural elements within the reservoir interval of the Rotliegend at 4200 m depth in the vicinity of the boreholes with higher resolution in three dimensions. The imaging of structures in the target reservoir interval is a special challenge, (...)”

Line 62 >> “For this wireline deployment method nevertheless only very few experiences exist until now” – I think the phrasing is slightly off, consider rewriting

Response: We think that that our statement, that only very few experiences for wireline deployments of fiber-optic sensor cables (sensu stricto) exist until now is justified, given the handful of existing publications on the subject (most of them cited in our manuscript), and would prefer to leave the formulation as it is.

Line 67 >> I think “as well” should be “and” because of the comma preceding it

Response: We have changed “as well” to “and”.

Line 95 (and others) >> I think that “DAS data were” is better than “DAS data was”

Response: Historically, the use of plural with “data” is correct. But today the usage of “data” as a mass noun with singular verb is widely accepted, see e.g. Oxford Dictionary of English.

Line 114 >> “mainly data for well GrSk3 could only be recorded during this time.” – remove “only” or rephrase

Response: We have rephrased this to “mainly only data for well GrSk3 could be recorded during this time.”

Line 127 >> “signal-to-noise ratio, while keeping” – unnecessary comma

Response: We have deleted the comma.

Line 131 >> Emphasize that it is the apparent velocity (ZO case)

Response: We have changed “velocity” to “(apparent) velocity”.

Line 174 >> “to be distinguished” -> to distinguish

Response: We think that both formulations are possible in this case, and we prefer to keep “to be distinguished”.

Line 186 >> “acoustic receivers” is ambiguous, maybe “recording elements” instead?

Response: We have changed “(...) the ringing noise in the DAS data is related to the different deployment methods of the acoustic receivers.” to “(...) the ringing noise in the DAS data is related to the deployment method of the DAS sensor cable.”

Line 225 >> “The energy of signal and noise was computed” – should be in plural form

Response: We have changed “energy” to plural: “The energies of signal and noise were computed (...)”.

Line 282 >> “and correlated are at or close to” – the “are” is redundant

Response: No, this is not correct, "are" is the predicate of the sentence and is required.

Line 331 >> "Based on this survey, several important new experiences" – maybe "lessons" works better?

Response: This would be an alternative formulation as well, but we prefer to keep "experiences".

Line 365 >> can therefore not -> can not therefore

Response: The proposed formulation seems strange. We prefer to keep the original one.