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Solid Earth Discussions

Interactive comment on "Characterizing a decametre-scale granitic reservoir using GPR and seismic methods – A case study for preparing hydraulic stimulations" *by* Joseph Doetsch et al.

Joseph Doetsch et al.

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Reviewer: Fig 1: use (); Change height axis; delete AU Gallery; two times b) Boreholes Answer: We changed this in the figure. Reviewer: Fig 3:move text into white background Answer: We changed this in the figure. Reviewer: line 360, 366, 376: GPR? Answer: Yes. We corrected it. Reviewer: line 363, 367: the use of (in the text? Answer: The parentheses are correct. By accident the whole figure caption was written in the manscript, instead of the figure number only. Reviewer: Fig 9: error bars instead dots? Answer: We agree that error bars could be added to each data point. However, we decided not to show error bars, as the figure is already crowded with >10.000 data

points. Adding 10.050 error bars would make it practically impossible to distinguish individual data points. As mentioned by the reviewer, the conclusion of the figure would not change. Reviewer: Fig 10c: exception of correlation at profile meter 20+45? Answer: We argue that this is because of the velocity not only depending on the fracture density, but also the stress state (i.e. volumetric compression). As described by Krietsch et al. (2018), the in-situ stress state is very heterogenous throughout the volume. Thus, the correlation between fracture density and velocity does not perfectly fit. Reviewer: line 521: "lalso ed" ? Answer: This is supposed to mean "also led". It's corrected in the manuscript. Reviewer: In Fig. 6+7 the first 25 ns in the sections are shielded with grey color. It is better to show this part too and explain the disturbances and influences on that signals. Answer: We are performing the top mute up to 25 ns, in order to remove the direct wave as well as signals from the direct vicinity of the antennas and the tunnel. There are quite a few signals/disturbances from installations on the tunnel walls, which are not of geological origin and distract from the signals from the shear zones that we are interested in. We thus prefer to remove these signals to enhance the clarity of the figures. Reviewer: The sections in Fig. 6 and 7 show results from different profiles with different processing steps. For better comparability, both sections should be presented migrated and unmigrated as well. Are destructive migrated parts of the signal (Fig. 7) reflections received from installations inside the tunnel system? Answer: We agree with this comment and added the suggested two extra figures in the supplementary material. The shear zones are reflecting electro-magntic energy significantly. The shear zones S1 and S3 are representing different strike directions. The orientation of the antennae during the measurement affects the backscattering. In this case only one shear zone was detected. Maybe it would be possible to detect the other shear zone by rotating the antennae 90âÚę. Answer: This is a very good comment. We agree that measurements at different (90°) angles would be very beneficial. However, these measurements are not available to us and cannot be conducted now (we don't have access to the test side any longer). Nevertheless, we do have GPR measurements that image the S3 shear zones in detail, recorded from boreholes running sub-parallel

to the shear zones. These data are shown in Figure 3a of Giertzuch, P. L., Doetsch, J., Jalali, M., Shakas, A., Schmelzbach, C., & Maurer, H. (2020). Time-Lapse GPR Difference Reflection Imaging of Saline Tracer Flow in Fractured Rock. Geophysics, 85(3), 1-47. This info has also been added to the manuscript. Reviewer: The distribution of the shear zones is shown in Fig. 10a and 11. It would be nice to show these lines in all the other pictures from seismic results too. Answer: We tried to visualize the shear zones as often as possible. However, we had the feeling that the figures were getting to busy and loosing information, if the shear zones were visualized more often. Reviewer: Does it make sense to show GPR and seismic results in a common picture? Answer: We tried to combine these data visually in a figure, but for the sake of clarity, we did not merge them into one figure in the manuscript.

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