Authors point-to-point response on Editor Comment #1 to tc-2022-200

Dear Editor, dear Joe MacGregor,

We thank you for your two important and helpful comments. Please find our answers below in green.

1. *The statement of "an almost perfect agreement" in the abstract yet the lack of a direct quantification of the relation between the radar and ice-core fabric measurements is not satisfactory. This needs to be quantified, whether by a simple correlation coefficient, rms difference or some other suitable metric. I recognize that the relevant eigenvalue difference varies with depth, so perhaps a depth subset is appropriate/simpler, but the present situation is dissonant for what is an other quantitatively rigorous MS.*

   Thanks for raising this point. We had a short statement about the mean difference in the results section. Now, we calculated the root-mean-square of the differences of both methods (radar and ice core analysis) by one subset between 120 m and 250 m depth for the difference of the Eigenvalues 1 & 2 and and a second subset below for the difference of the Eigenvalues 1 & 3.

   We improved and moved the following section to the discussion (l. 166 - 171):

   "*The horizontal fabric asymmetry derived from the polarimetric cross-correlation of the pRES measurements and the difference of the weighted horizontal eigenvalues from the ice core analysis (λ2–λ1 between 120 and 250 m and λ3–λ1 between 250 and 1400 m) show almost perfect agreement with a root-mean-square difference of the result of both methods of only 0.03. This value corresponds to the uncertainty of the ice core analysis and thus represents the lowest possible value in the difference. However, the root-mean-square value of the difference of the unweighted horizontal eigenvalue is 0.06 and thus higher, which is a result compatible to analyses of seismic waves by Kerch et al. (2018).*"

2. What is the ice thickness at both the study sites, and for what fraction of the ice column is the S/N high enough to analysis? There are several paths here. First, the ice thicknesses ought to be given in the text. Second, in Figures 2 and 3 either show the complete radar dataset down to the bed (or the noise floor, whichever is first), or show an additional vertical axis that is the fraction of the ice thickness rather than absolute depth. Otherwise, the casual reader could be left with the impression that you've measured fabric through the entire ice column, rather than what I suspect is closer to half of it. Still a big improvement over earlier methods, but a more sober representation of the outcome. Related to this, it could be worth discussing how we might eventually be able to detect bulk fabric changes all the way to bed.

You are absolutely right, we have missed stating the ice thickness, which is roughly 2668m at the EastGRIP drill site. In the revised version, we state this in the Data section. We added a second y-axis to Fig. 3 with the fraction of ice thickness and mentioned these fractions for certain depths in the result section. We also added the following section to the discussion (l. 192 – 197):

"Noise limits the evaluation of fabric asymmetry for deeper layers. At the EastGRIP drill site, this limit is about half the ice thickness of the ice with current systems. Determining the fabric for deeper layers from radar measurements, eventually over the whole ice sheet thickness, requires further reduction of the signal-to-noise ratio in more powerful phase-sensitive radar system that can perform co- or quad-polarized measurements. The applicability of the polarimetric cross-correlation method needs first to be demonstrated for such radar systems."

We have improved the manuscript according to the responses to the reviewers.

Many thanks for your efforts to improve our manuscript!

Best regards,

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