Second review to Ershardi et al. 2021,

The authors' have given extensive feedback to my review comments, and implemented changes where appropriate. I appreciate that the other reviewer found the MS to be overtly technical/equation dense. However - the MS is broadly in-line with other respected polarimetry/ice fabric papers (e.g. those by Matusoka and Fujita). Some new technical developments were made, hence justifying the level of detail of the presentation. Additionally, both the introduction and discussion are now improved, so I think general TC readers could enjoy those sections without needing to fully understand the whole paper. In summary - I think the re-submitted MS is considerably tighter than before, and I recommend publication subject to a few final comments.

Tom Jordan, Plymouth Marine Laboratory, 24/10/2021

Feedback on specific points from last review

1. *Anisotropic scattering parameter.* This has now been implemented by taking the positive square-route of the intensity ratio (eq. 19). I agree this is an improvement from before, as the scattering parameter is now linear w.r.t. the eigenvalue difference, and is therefore consistent with the matrix model scaling relationship. I am also happy to see that the suggested change did not have an adverse effect on the previous conclusions. *However, notation-wise I still think eq. (6) (where r is complex number) an eq. (19) (where r is a scalar) are inconsistent*. My recommendation would be to use |r| instead of r in eq. (19) (and all subsequent usage) and be clearer throughout the MS that it represents a magnitude.

8. Significance of recovering the vertical eigenvalue for ice-flow modeling. I think this could be made more explicit, as this is a key step forward for what the radar can provide to ice-sheet models (and it is considerably more useful than the `horizontal eigenvalue difference' in constraining rheology). Ice-sheet modelers' will be interested in this result, as the strength of the vertical eigenvalue is a strong control on how soft ice is to shearing within the ice column - e.g. see: Azuma 1996 - https://www.cambridge.org/core/journals/annals-of-glaciology/article/an-anisotropic-flow-law-for-icesheet-ice-and-its-implications/A9AC75ED14AD578C809CCF9752BF1D20

All other comments look well implemented (or justified) to me - good job!

Additional comments

L68 – Maybe `parameterization of an anisotropic flow law' works better than `further developments of…'?

Fig. 5 caption – it looks like some formatting errors are present

L 522 `Since polarimetric radar is insensitive to the vertical component of ice fabric, it is only possible to estimate its horizontal anisotropy (Sect. 3.3).' I think the readers may find this line confusing as the paper obviously developed the inversion method to solve for all 3 eigenvalues. Maybe – add `… its horizontal anisotropy from the matrix model alone'