

Interactive comment on “The internal structure of the Brunt Ice Shelf from ice-penetrating radar analysis and implications for ice shelf fracture” by Edward C. King et al.

Anonymous Referee #1

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Review: “The internal structure of the Brunt Ice Shelf from ice-penetrating radar analysis and implications for ice shelf fracture” by King et al.

The authors present samples of GPR data from studies on the Brunt ice shelf in the vicinity of Halley Station, giving insights into the complicated composition of the ice shelf, and interpreting its role for fracture propagation. The paper is very well written and neatly structured, and it is a valuable contribution to research into ice shelf stability. It presents a combination of data from lots of different sources, but unfortunately only shows very little data of the long radar profiles. I have some comments and suggestions for the authors which I think should be considered before publication:

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The authors present three short sections of GPR data, of which two are part of long profiles along flow direction of the ice shelf. It is a bit disappointing that only so little of the data is shown. Especially as the positions of the shown profiles is quite far downstream. Showing a profile from further upstream could give an indication about the temporal evolution of the ice shelf interior structures. This is not discussed at all here, but would strengthen the paper. Additionally it would be interesting to discuss the accumulation of snow respectively to the time since the ice came over the grounding line. Does this give any hints about how much sea-water infiltrated ice there is? What about the hydrostatic equilibrium? As there is a very good surface elevation model this could be easily discussed and shown?

How is the flow velocity varying along the flow line of the radar profiles? Looking at flow velocity maps of the Brunt it seems to me that that velocity is not necessarily steadily increasing along flow. Is it possible that the bending of the layers in the firn, and also the bending of the brine infiltration layer is due to shortening along flow? Is the wavelength of the surface undulations changing along flow?

Looking at Figure 2, there seems to be a rather sharp transition between the first part of the profile, from which no radar data is shown, where there are rather deep valleys between the “Railway sleepers”, and the second part, where the height difference seems to level out. Is this due to the local variations of accumulation? Or might this be also due to a change in the flow regime? This would be interesting to discuss.

Is it possible from the radar data to determine the timing of the last brine infiltration by comparing the radar layers on top of the meteoric ice blocks and within the troughs? In figure 5 it looks like as if the bending brine infiltration layer to the right of the block is more or less the same isochrones as the first smooth layer on top of the block.

Are the secondary infiltration events limited to the ice between the “Railway Tracks”? This would be interesting to discuss.

The overall structure of the manuscript is very clear, but I do not understand why the

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authors present the sentinel data in the last part of the discussion instead of in the observation section.

As there are a lot of figures, I am not sure whether figure 8 is really necessary. The point could be made by referring to figure 2.

The labels of the lower panels in figure 2 are hardly readable, maybe this should be changed.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-13>, 2018.