

Interactive comment on “Radar diagnosis of the subglacial conditions in Dronning Maud Land, East Antarctica” by S. Fujita et al.

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General Comments

This paper presents bed reflection strength analysis of a combination of ice penetrating radar datasets from the Dronning Maud Land/Dome Fuji area of East Antarctica. The basic observation reported is that beyond a critical ice thickness the magnitude of the radar returned power is controlled by factors other than the englacial absorption of the radar energy, which appears to be the dominant factor at lesser thicknesses.

I found the results of the paper very interesting, especially as they parallel closely our observations from the Byrd and Totten catchments in East Antarctica. Although this paper is likely to be of interest to others there are several weaknesses which should be

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addressed before publication:

1. Roughness – The authors assert that, while the basal reflectivity is sensitive to basal roughness at the scale of the radar wavelengths, this can be rejected as an explanation for their results because the same pattern is found with both of the radar frequencies. The wavelengths of the two radars compared in this study, however, (0.94 m and 2.40 m) are sufficiently similar that a transition from sediment to bedrock might easily affect roughness at both these length scales. The presence of basal water may be the correct explanation for their observations, but I am not sure that roughness can be rejected so easily. Some analysis of the basal roughness should be included to demonstrate that both radars would not be affected equally by the magnitude of the roughness changes observed.

2. Diagnosis of wet or dry bed – I found it very difficult from reading the manuscript to identify what the exact criteria were that were used to classify the bed as wet or dry. Presumably a reflection of some value of dB greater than would be predicted by using the linear trend from the upper part of the ice column to account for englacial absorption was used? I could not find this stated clearly anywhere in the manuscript. The method of classification needs to be described much more clearly.

3. The structure of the paper does not help the reader. The long sections 3 and 4.2, which discuss each of the survey tracks in turn, contain significant repetition and a level of detail that is unlikely to be of interest to anyone not directly concerned with work on this particular survey. The results should be described and discussed in a more concise way, probably through more consideration of the dataset as a whole rather than the dissection of each individual element.

Specific Comments

(1785,7) – should it be primarily instead of primary?

(1785,17-19) - "For the majority of the investigated locations, we were able to infer bed

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conditions. The possible error was estimated to be within several percent" – several percent of what? Basal conditions are not estimated quantitatively (e.g. basal temperature) so how can a percentage error be given? In any case a summary of the results is probably out of place in the introduction.

(1786,19) – should be diagnose not diagnosis

(1786,20) – missing A before Continental

Equation 1 – Since all the quantities are expressed in units of dB are the cumbersome square brackets and subscripts necessary? A line stating that all quantities are in logarithmic units might be more elegant.

(1787,15) – should be ice/bedrock or ice/rock not ice rock, also unnecessary by on this line.

(1789,12-15) – This sentence is over-complicated and confusing, it should be stated much more concisely.

(1792,21) – This sentence should be made more precise e.g. The depth of this reflector at the Dome Fuji site. . .

(1793,12) - An important feature of Fig. 3b, d is that we adjusted the scales of the left-hand and right-hand axes using the gradient of a regression line found in the region of thinner ice (< 2800m) of the H-P plot, as indicated by the red lines in Fig. 3a, c.

I didn't really find this description quite sufficient. It sounds like you have corrected the reflection strengths in figs 3 b and d for englacial absorption using a linear fit to the part of the H-P plot between H=2200m and H=2600m. If so this sentence, as well as the figure caption, should be re-written to make this clear.

(1794,5-10) – The end of this paragraph becomes a bit long winded. It would be neater just to reference Fig. 4 b and c in the previous sentence and omit the sentence beginning at line 5 as this is covered by the figure caption.

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(1795,14) – should be differences

(1796,20-24) – Figure 6d, f show the X-PH plots for these regression lines, which clearly indicate the x locations at which the profiles of [P c bed]dB and H agree or disagree. In leg E1, disagreement occurred at locations at which the traverse route crossed the Veststraumen ice stream (NÁslund et al., 2000) ($2625\text{km} < x < 2725\text{km}$) and another ice stream at $x = 2560\text{km}$.

It may not be immediately clear what is meant by 'agree' and disagree' here, in fact, if this is after a correction has been applied for englacial attenuation, I'm not sure I understand at all?

(1798,12-14) – Point (ii) does not make sense as it is, I think I can gather what you are trying to say but it really needs re-writing.

(1799,1-3) – Similarly in point (vii) it is unclear which gradient is being referred to and how it would be different if a different depth range were taken. These bullet points are a good idea to sum-up the results but they should stand independently as complete sentences.

(1808,9-19) – Not all ice-stream/tributary locations are controlled entirely by the substrate, topography can have a very great influence. This work shows warm conditions beneath some ice streams, but that could be the result of increased frictional heat generation due to fast flow caused by high driving stresses. It is quite a jump between wet basal conditions and an ice stream location controlled by the condition of the substrate. This point probably needs to be backed up with further evidence or the reasoning of the authors needs to be stated more clearly.

(1808,27) – The word year is missing after million.

(1809,25) – Should be On both sides. . . rather than In both sides. . .

(1810,12) – Should be ponded instead of pounded

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(1812,6) – Should the below here be at ?

Interactive comment on The Cryosphere Discuss., 6, 1781, 2012.

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