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Interactive comment on “Constraining the recent mass balance of Pine Island and Thwaites glaciers, West Antarctica with airborne observations of snow accumulation” by B. Medley et al.

Anonymous Referee #1

Received and published: 28 February 2014

General Comments This paper presents a better understanding of the mass balance of Pine Island and Thwaites glacier using radar-derived accumulation rates and flux gate analysis. It is a very well written and relevant paper introducing a new grid of recent accumulation (1985–2009) over the Pine Island Thwaites region. This research uses cutting edge technologies and sound methodologies. The paper also presents a very well laid out comparison of the new accumulation map to reanalysis and modeled data. This paper should be published with minor revisions.

Specific Comments I have only one major scientific issue with this paper, the assump-

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tion that manual digitization of a layer can be ± 1 range bin. This should be increase to at least 3 bins or further, substantial justification needs to be given for the ± 1 range bin. In the end it is likely that this does not matter in the final result because the 25 km smoothing would take out this noise assuming picked layers oscillate horizontally by more than 3 range bins over 25 km which is likely. Nonetheless the ± 1 range bin is too small of an error on a manual pick. If a new error is selected it should be used to recreate the final error map in Figure 7C.

A minor issue is the use of a constant density profile for the entire catchment. Previous studies (Spike et al., 2004) use a linear interpolation of density along radar transects. Please justify why the ± 1 standard deviation was chosen as opposed to a linear interpolation. A one sentence justification in the paper should address this.

Page 958 Line 4- Need to add a reference to the Burgener et al., 2013 paper and include additional comments on the slightly negative trend observed in these cores.

Page 959 Line 17- epsilon should be used for Dielectric permittivity.

Page 959 second paragraph- clarify if reflection and/or refraction is accounted for in depth conversion.

Page 959 line 21- Are the 9 cores from the same time period? Add a sentence on how the cores from the early and late 2000's compare given the suggested change in accumulation from H1 and H2.

Figure 1 Caption- Change to radar-derived accumulation measurements were taken from Medley et al. (2013).

Page 960 line 1- Sentence beginning with Tracking is unclear. What is meant by steepened, do you mean dynamical processes or surface redistribution? Please clarify.

Page 963 line 16- 500 m do you mean ~ 500 m given changes in aircraft speed or did you grid along the flight line. Please clarify. Also with OIB snow radar data along track should be 10's of m along track. Please clarify.

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Page 963 line 19- the sentence including accumulation was not appropriately sampled. . . is confusing. It is certainly appropriately sampled along track. Please clarify what this is in reference too i.e. the grid spacing of the flight lines/distance between flight lines. (This is nicely stated in the conclusion). Perhaps just deleting the section after the semicolon will get the point across.

Technical Corrections

Throughout the paper Greek letters should be double checked. Likely this was just a conversion issue.

Page 957 line 19 and 20 Make asl and $a.s.l.$ consistent.

Page 962 Tao should be σ .

Page 967 Line 8-fromating issue with parentheses.

Page 967 line 23- Tau to σ .

Page 968 line 3- Tau to σ .

Maps should have latitude and longitudes on axes.

Figure 1- The resolution of this figure needs to be increased. Legend text is not readable. Additionally the flightlines and catchments are difficult to distinguish with color scheme and elevation contours confusing. I suggest reducing line width slightly on flightlines(layer picks), using a red line for the catchments for distinction and a thin dashed line for contours.

Figure 2 Caption- Are the sub basins labeled in Figure 1? With the resolution difficult to tell please make clearer.

Figure 3 Caption- change deviation to the ± 1 standard deviation for clarity.

Figure 3 Caption-Depth equation is incorrect. Change to same as page 959.

Figure 4 Caption- second line, delete the

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Figure 6 and 7-Again the catchment lines at this resolution are difficult to see. Consider a red solid line.

Figure 9 add full caption from 8 or combine the figures.

Interactive comment on The Cryosphere Discuss., 8, 953, 2014.

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