

## ***Interactive comment on “Changes in the firn structure of the Greenland Ice Sheet caused by recent warming” by S. de la Pe na et al.***

**L. Koenig (Referee)**

lora.koenig@colorado.edu

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General Comments: This paper analyzes in situ, airborne and modeled data to quantify the changes in the firn structure in West Greenland. It is a well written paper that contributes to the field by quantifying on the rapidly changing near-surface firn in Greenland, its effects on densification and the implications for lidar remote sensing. This paper should be published with minor revisions.

Scientific Comments: The title of this paper should be change to “Changes in the firn structure of the Western Greenland Ice Sheet. . .” The data presented is from the Western sector of the ice sheet and it is clear that different percolation processes are occurring on the Eastern portion of the ice sheet (see Forster et al., 2013)

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The selection of the 2011 IceBridge line needs further justification as well as the exclusion of other Snow Radar data in the area. Additional information should also be provided on what causes the tracking algorithm to stop at ~2500 m. Figure 4 seems to show the strong reflection going up to higher elevations in the radar data. What determined the high elevation stopping point of the ice layer? This information should be included on page 549 for clarity.

The statement on page 551 line 20 that if melt continues to exceed total accumulation is likely to lead to lateral transport needs further references or explanation. The processes that lead to meltwater pathways and ponding versus percolation are still unknown and this statement needs further justification if included.

Detailed comments: Page 543 line 7 “firn ice” change to firn-ice content.

Page 543 line 17 “mass gain” This is a bit confusing because melt and refreezing alone would not lead to mass gain in the region unless it was transported/routed from some other area of the ice sheet. The mass gain is still from snow fall but perhaps you are referring to melt water routing into the region. Please clarify.

Page 545 line 1 consider adding temporary buffer.

Page 545 line 1 Careful with terminology firn ice throughout. There is either ice or firn or firn-ice content.

Page 545 line 25 provide approximate snowpit depths to define near-surface.

Page 546 Line 21 provide frequency range of Snow Radar as opposed to bands as it is easier for most readers to interrupt. Also provide the vertical resolution which is important for understanding the ice lenses that can be resolved. Add citation to Panzer et al., 2013 (J. Glac) on Snow Radar.

Page 547 first paragraph please add an additional sentence on if there is a routing scheme for meltwater/percolation implemented in the model and how this relates to the statement about mass gain from the abstract.

Page 548 line 22 you switch units here from giving ice amounts in layer thickness to mass kg/m<sup>2</sup>. Please make consistent by providing the thickness as well for the J sites for easier comparison.

Page 550 line 14 each site is redundant and can be removed.

Page 551 line 17 suggests is redundant.

Page 551 line 24 with predicted positive SMB in which year? Average 1958-1999? Please clarify.

Page 551 line 28 it would be more informative/easier to read if km<sup>2</sup> was changed to a percentage of the area.

Figure 1- increase font size on PARCA, T and J labels and add flight line to zoomed image. It appears to be just outside of the zoomed in box.

Figure 4- insert should show tracked layer.

Figure 5- A bit difficult to read with all the data presented. Consider smoothing along track.

Figure 6- Unclear from the caption and x-axis if the time series ends in 2012 or 2013. Extend time series through at least 2013 to match in situ data.

Figure 7- Show the outline of Greenland on this figure and the ice sheet outline for context.

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Interactive comment on The Cryosphere Discuss., 9, 541, 2015.

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