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Interactive comment on “The physical basis for gas transport through polar firn: a case study at Summit, Greenland” by A. C. Adolph and M. R. Albert

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Received and published: 13 September 2013

Short Comment:

I enjoyed your TCD paper. Firn structure is of interest to the cryospheric community for a variety of reasons. While it is of paramount importance in interpreting depositional and post-depositional effects on ice core gas and aerosol species, there is also a growing interest in the influence of firn structure on meltwater retention. I would like, however, to draw attention to the following concluding sentence: “[Summit] is a site where the climate has not experienced a lot of change in recent decades, so that the firn has a fairly consistent layering pattern, and there were no melt layers in the firn.”

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I must protest at this characterization of Summit as an unchanging “pole” that has escaped contemporary climate change. While there were no melt layers during your 2007 field campaign, Nghiem et al. (2012) demonstrate at least two distinct melt layers were generated in 2012, and McGrath et al. (2013) suggest that the 0.09 C/a warming rate observed at Summit over the 1982–2011 period places it in the 99th percentile of all globally observed temperature trends. So the climate at Summit is indeed changing very rapidly. It is now an open question how much longer Summit will remain a “dry” snow zone. Perhaps the rapidity of Summit’s climate change may serve as further impetus to best characterize its firn structure before it is eclipsed by the “percolation” zone with its more complex firn stratigraphy. Nghiem, S.; Hall, D.; Mote, T.; Tedesco, M.; Albert, M.; Keegan, K.; Shuman, C.; DiGirolamo, N. and Neumann, G. 2012. The extreme melt across the Greenland ice sheet in 2012. *Geophysical Research Letters*. 39, L20502. McGrath, D.; Colgan, W.; Bayou, N.; Muto, A. and Steffen, K. 2013. Recent warming at Summit, Greenland: Global context and implications. *Geophysical Research Letters*.

Author Response:

We highlighted this aspect by including a brief description of Summit to reflect the rapidly changing climate and the potential implications of increased melt layers in the conclusion section of the paper.

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