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Interactive comment on "Quantifying meltwater refreezing along a transect of sites on the Greenland Icesheet" *by* C. Cox et al.

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This paper discusses and innovative new method to quantify refreezing meltwater in firn using a thermistor string placed over the melt season. The paper is well organized, written fairly well, and relevant to this journal. I do have quite a few comments, some may involve substantial textual changes but all should be easy to address.

p5486 L 20 Need to mention SMB estimates

p5487L0-3 Passive voice hard to follow

p5487l18 There are 7 prepositional phrases in this sentence, need to clean up

p5489l8-10 Don't understand what you are talking about here

p 5489l2 Best to use variables and identify variables in the text.

p 5491l11 Indeed it will break down. Implications? Seems to me that if you know the starting density and the latent heat, then you should know the volume of water that has refrozen and hence you could adjust the density?

p5491p20 Need to state K is conductivity here. And mention how you calculate k here or at least cite the appendix. I'm not sure if this is a concern but do we need to worry about how k c would hange for dry firn, saturated firn or ice. Also what assumptions are we making with respect to this issue?

p5492l6 Can you give context? Out of how much melt annually? It seems to me that while this is a cool validation method, in winter you would be more confident of your thermal conductivity since you don't have changing density and liquid water in the mix. Might your summer uncertainties be higher?

p5492l7 Is this not contradictory to your previous sentence?

p5492l16 Increased from what?

p5494l25 Analyses

p5494l2 Spell out CP

p5498 Not fully convinced by your interpretation of H2,H3,H165. Lateral migration of meltwater might occur at one site but this peak is occurring at 3, indicating that water was migrating towards all three sites. Were the holes unfilled and therefore a conveyance for water? Also not convinced that the pdd model is in error. At higher elevations and lower elevations the pdd model makes sense wrt refreezing. Unless the DDF is higher in a band at that elevation, I don't see how that justifies the peak in refreezing. As you say this is a key transition zone, different from areas above or below. Could the thermal conductivity assumptions or something else make your method less effective in these conditions?

Also given the issues with missing the top 1 meter of firn, in the intro it would be good to prepare the reader for this problem. Fully elucidate the extra difficulties in dealing with the energy balance at the surface and why it was not feasible to deal with that here.

Results General I interpret your tone here as you feel your results aren't as good as MAR refreezing. Seems to me your observations are far more reliable than the MAR model and thus discussion on why MAR may be off is entirely valid here (if you have ideas).

p5499l23 This paper covers refreezing but I don't really feel like it shows specifically that "piping complicates refreezing". Please clarify.

Figure 2 it would be nice to see the density profiles just so we have a sense of what kind of of firn we are dealing with. Also it would be valuable to state where pore close of might be, not necessarily in the figure, but where appropriate in the paper.

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Interactive comment on The Cryosphere Discuss., 8, 5485, 2014.