

Interactive comment on “Brief communication: Improved simulation of the present-day Greenland firn layer (1960–2016)” by Stefan R. M. Ligtenberg et al.

Anonymous Referee #1

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The study presents the results of the IMAU-FDM firn densification model forced with an updated set of boundary conditions, namely the RACMO2.3p2. As a result mainly increased snowfall inland and decreased surface melt in the input fields, FDM-simulated density profiles, subsurface temperatures and integrated firn air content are improved considerably compared to those driven by the previous version of RACMO2. While the study does not have groundbreaking results, it is nevertheless an important documentation of a widely used firn product across the disciplines. It also provides a useful illustration of the importance of weather forcing, and the potential perils of tuning a firn model to observed quantities if the problem lies in the weather forcing.

C1

The manuscript is concise and well-written and the figures and analyses nicely support the conclusions. I suggest to accept with only minor revisions.

MINOR POINTS ## P2L26-28: You discuss the downscaling to 1 km by Noël et al (2017) but do you use this in this paper? I cannot see that you do, and to avoid confusion, I suggest to leave this sentence out.

P3L13-14+Fig 1: You discuss the three categories of the melt-accumulation ratio and Figure 1 has this quantity color-coded. But it is tricky to read off the colorbar. I suggest you choose a colorbar with three color-sets (eg. greens, blues and reds) that shifts exactly with the three categories.

P3L22-26: You list two reasons for improvement in the firn air content – reduced melt and fix of an artefact in the densification parameterization. You point to the former as the main reason, but how have you separated the two?

P4L5: downslope

P4L29: You mention that the extent of the firn aquifer is greatly improved, but you do not show or document this here, do you?

P4L34: You talk of higher temperatures in the ablation zone caused by shorter bare-ice duration and mention less insulating effect of a snow layer. I don't understand this – won't a shorter bare-ice duration (with an accompanying longer snow cover duration) lead to an increased insulating effect? Please review this sentence.

Fig 1 caption: Note that modeled profiles are taken at same time as the cores were drilled. Perhaps indicate on the profiles when this is.

Fig 2 caption: “firn layer (FL)” -> “firn line (FL)”

Fig 3 caption: “Difference between” can sometimes be a bit unclear. Please indicate exactly what is subtracted from what.

C2

