Summary of major changes

Figure 1 and 2. The *m* and *r* have been added to each panel, in addition RACMO2.3 and CESM1.0 in text are annotated to the first figure in colors corresponding to their scatter and lines. Y-axis is changed to show the same range for the same units.
Figure 2. Added an additional panel containing snowfall.
Figure 3. Added an additional row with SMB vs elevation for each of the lapse rates.
Figure 4. Added a spatial map of the RACMO2.3 reference data. Changed panel (b) to show EC-1K minus EC-6K.
Supplementary figure. A supplementary figure similar to Figure 1 has been added showing the incoming and outgoing solar and longwave components.

Reviewers comments in black
Author's response in red

Reviewer #3:

General synopsis This is a useful contribution about the novel application of using Earth System Models (ESM) with downscaling, via sub-gridcell elevation classes, to simulate Greenland Ice Sheet surface mass balance. Although it is fairly model-specific (based on the CESM1.0 ESM), this paper should be of broad interest to the GrIS SMB modelling and Greenland climate communities.

Some previous highly relevant literature is missing or can be better acknowledged (see comments below).

I wonder whether the CESM results can be compared with MAR as well as RACMO, for an independent RCM model check (and since MAR is the main alternative RCM currently used for Greenland)?

Specific comments

Page 1, lines 15-16 re. strong Arctic warming: Please add the following reference to those cited: Overland, J.E. and Hanna, Edward and Hanssen-Bauer, I. and Kim, S.-J. and Walsh, J.E. and Wang, M. and Bhatt, U.S. and Thoman, R.L. (2018) Surface air temperature. Arctic Report Card , NOAA.
https://www.arctic.noaa.gov/ReportCard/Report-Card-2018/ArtMID/7878/ArticleID/783/Surface-Air-Temperature

We will add this reference.

P1, L21 re. "GrIS is losing mass at an accelerated rate": please add the following highly relevant references to those cited: Edward Hanna, Francisco J Navarro, Frank Pattyn, Catia M Domingues, Xavier Fettweis, Erik R Ivins, Robert J Nicholls, Catherine Ritz, Ben Smith, Slawek Tulaczyk, Pippa L Whitehouse, H Jay Zwally (2013) Ice sheet mass balance and climate change. Nature 498, 51-59. Bamber, JL et al. (2018): The land ice contribution to sea level during the satellite era. Environmental Research Letters, 13(6), 063008,

This reference is added.

P2, L8: should also add there is a significant disparity between different model estimates of GrIS SMB (Fettweis 2018): Fettweis, X. (2018) The SMB Model Intercomparison (SMBMIP) over Greenland: first rlts. AGU Fall Meeting talk archived at: https://orbi.uliege.be/handle/2268/232923.

Reference for the SMBMIP is added.

P2, L19: re. statistical downscaling please add the following highly relevant references: Hanna et al. (2011) AND Wilton et al. (2017) DJ Wilton, A Jowett, E Hanna, GR Bigg, MR Van Den Broeke, X Fettweis, ...(2017) High resolution (1 km) positive degree-day modelling of Greenland ice sheet surface mass balance, 1870–2012 using reanalysis data. Journal of Glaciology 63 (237), 176-193

This reference is added.

E Hanna, P Huybrechts, J Cappelen, K Steffen, RC Bales, E Burgess, ...(2011) Greenland Ice Sheet surface mass balance 1870 to 2010 based on Twentieth Century Reanalysis, and links with global climate forcing. Journal of Geophysical Research: Atmospheres 116 (D24)

This reference is added.

P2, L32: While the motivation for the study is good as stated, can you make it clear in this sentence/paragraph whether you investigated precipitation downscaling as well as temperature downscaling?

Yes, we will make it clear by adding "it must be noted that our model does not downscale precipitation"

P3, L26: How was this number of elevation classes chosen? Would having a greater number of classes improve the results?

The choice was motivated by a compromise between computing time and increased (vertical) resolution. Offline test showed this number is appropriate, and is the default for CESM1.0. We will add this to the revised manuscript.

P3, L34 "Incoming radiation, precipitation and wind are kept constant across all ECs" - Is this a potential limitation of this study or could improvements be made here?

This is discussed in detail in section 4 (p.11, l1-11)

P5, L8 "snow when near-surface temperatures are between -7ˆoC and -1ˆoC" – the latter value (-1C) seems quite a low upper threshold for snow?

This is the limit of where precipitation falls as snow only, mixed precipitation can occur at higher temperatures. This will be added to the revised manuscript.

P10, LL4-5 "the first time the EC method for downscaling from a global climate model of ~100 km to the much higher resolution (5 km) of an ice sheet model" – point out that this kind and magnitude of statistical downscaling has been previously successfully used in downscaling meteorological reanalysis data from ~100-km resolution to 5-km resolution (Hanna et al. 2005 & 2011, Wilton et al. 2017). E Hanna, P Huybrechts, I Janssens, J Cappelen, K Steffen, A Stephens (2005) Runoff and mass balance of the Greenland ice sheet: 1958–2003. Journal of Geophysical Research: Atmospheres 110 (D13) (Other two references details are above.)

This reference is added.

P11, LL9-11: The recommended implementation of a precipitation phase downscaling scheme doesn't really solve the great challenge of overall elevation correction for precipitation. This paragraph therefore sounds a little weak as currently stated – can the authors strengthen their argument here?

Yes, this wouldn't solve the difficulty of resolving the complex spatial patterns of precipitation over the GrIS. However, we do believe that changing the phase could improve the SMB as it would not allow for e.g., unrealistic rain at higher elevations.

P12, L4 "Our sensitivity experiments reveal that a larger lapse rate for the temperature correction results in higher melt energy gradients" – isn't this rather an obvious and unsurprising result? – perhaps rephrase?

We will rephrase to: "our sensitivity experiment show that a larger lapse rate for the temperature correction results in higher melt energy gradients, as expected."