

Interactive comment on “Impact of coastal East Antarctic ice rises on surface mass balance: insights from observations and modeling” by Thore Kausch et al.

Anonymous Referee #2

Received and published: 27 April 2020

1 General

This paper presents data and model results for surface mass balance in the region of two East Antarctic ice rises. The authors show using ground-penetrating-radar-based estimates of SMB and results from RACMO2 and SnowModel that SMB varies on a local scale, due to erosion and redeposition by wind, and on a regional scale, due to orographic lifting. Neither of these results are surprising, but the paper argues the implications for ice-core records recovered on ice rises.

C1

2 Main issues

- In section 2.5 a number of parameters are described about the SnowModel, and it's not that clear if the 'knob-twiddling' was to match observations or actually based on a-priori information and assumptions. It would be good to make this more clear.
- It is not that clear how much the analysis from the second ice rise, TIR, really adds to the result. The SMB estimates from TIR can only be considered in a relative sense, and the GPR transects from TIR do not really capture the features that are prominently discussed for the FKIR.
- The implications of the work should be made more prominent. This work has conclusions that impact the interpretation of ice core records from ice rises, but these implications are only given a few sentences near the end of the discussion, and only just mentioned in the abstract and conclusions.

3 Small, line-by-line stuff:

- Figure 1: wind-rose plot is difficult to read at magnifications under 200%- suggest reworking that part of the plot if it's important, or eliminating it and replacing with a 'prevalent wind direction' arrow. The black dot at the summit of FKIR is not called out explicitly- presumably it is the ice core location but not clear in the caption- add it in.
- Line 27: hyphenate "inter-annual"
- Line 52, set of references: this actually goes back to Black and Budd 1964 (who King et al cite)- might be good to cite them too!

C2

Black, H. P., and W. Budd (1964), Accumulation in the region of Wilkes, Wilkes Land, Antarctica, *J. Glaciol.*, 5(37), 3–15.

- Line 62: Might as well name the ice rises before shortening them to abbreviations (I'm assuming the abbreviations are for "T" ice rise and "FK" ice rise).
- Line 70: delete comma after "rises"
- Lines 76, 77: including make and model of the (probably commercial) GPR would be of interest to GPR folks
- Figure 2: Fonts too small to read even at 135% zoom. enlarge. Also, the IRHs are challenging to see without magnification of close to 300%. Can the contrast be improved, or a different color scheme be employed?
- Line 102: Best not to start a sentence with an acronym, even if it's a common one like GPR.
- Line 104: Neither of these references establishes that the IRH is an isochron, and you really should include one (Callens in particular uses the vague "generally accepted" language that should be avoided. A good early reference for this is Spikes et. al., 2004 (see figure 2):
Spikes, Vandy B., et al. "Variability in accumulation rates from GPR profiling on the West Antarctic plateau." *Annals of Glaciology* 39 (2004): 238-244.
- Line 106: In section 2.1 you said you used 400 Mhz. Close enough that the science doesn't change, but choose one (preferably the accurate one) and be consistent (unless of course you used both!).
- Line 106: to clarify the language, suggest changing "the first 50 m of the snowpack in the vertical direction" to "the shallowest 50 m of the snowpack"

C3

- Line 121: delete "do" from the phrase "in order to do get the density"
- Line 133: Not clear if the initial layer depth mentioned here is part of an iterative procedure or simply part of an initial data analysis step. If the former, describe more fully, if the latter, delete as it's not necessary!
- Line 135: with such detail in the procedure the omission of an actual equation describing mathematically how SMB is derived seems glaring. Suggest adding here.
- Lines 138-148: This approach is fine, and using relative magnitudes of SMB is ok, but I don't think it's appropriate in that case to use absolute values on the y axes of Figures 3 D-F. instead, use some scaled value and leave units off. On line 146 you state that the absolute values should be disregarded- thus leaving them on the figure almost invites misuse of the result.
- Line 161: "it consist of" -> "it consists of"
- Line 165: "for a, in our case, single. . ." awkward. Rewrite.
- Line 191: mention Figure 3 first, and then Figure 4.
- Figure 3: Again, because the SMB estimates in panels D-F are only relative, leave units off the y-axis.
- Figure 4: make the box in panel A (denoting the location of panel B) more prominent.
- Lines 203-204: start referring to figure 5 here; will be useful.
- Figure 5: Needs A and B labels. Also, either repeat legend in panel B (there's plenty of room), or move it outside both panels. Finally, since SMB in each model is what is being directly compared to the GPR SMB, make that curve bold.

C4

- Figure 6: If a figure needs to be removed to save space, this one is a good candidate.
- Lines 238 and 265: I don't see the ice rise DIR actually named anywhere.
- Line 327: "For this ice rise the erosion at the peak. . ." This sentence is unclear- in particular the expression "ice rise wide temporal variations". I understand the idea but it is not well expressed here- suggest split to a few sentences. . .

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-66>, 2020.