

Review of revised manuscript "Influence of temperature fluctuations on equilibrium ice sheet volume" by Troels Bøgeholm Mikkelsen, Aslak Grinsted and Peter Ditlevsen [The Cryosphere Discuss. doi:10.5194/tc-2017-47

General comments

This manuscript has improved much from previous version and the context is clearer with the new abstract and introduction. The distinction that needs to be made between the minimal model (that authors state does not apply to Greenland ice sheet) and the estimates based on the results from Robinson is still not always clear, see comments below, particularly in the abstract (1m sle vs 30 GT/y) and in the conclusion „considering minimal model of the Greenland Ice sheet“. It should be well separated and made clear when each model is applicable and what conclusions can be drawn – and what they mean. The reviewer Fettweis points out that the bias authors are pointing at is not of concern when the ice sheet models are forced with climate model output, this should also be stated in the paper so that readers will not be misled to think that there is a bias in all large scale simulations of ice sheets. I have a few minor comments that could improve the text further.

Specific comments:

Page 1

In the abstract it is not clear when authors are referring to the simple model (lines 4-7) and when to estimates based on simulations of Greenland Ice sheet (line 9) this should be clearly stated. For example by starting sentence in line 4 (We find) – by something like : By applying a simple circular symmetry model it is shown that steady state volume is biased toward a larger size if interannual temperature fluctuations are not taken into account, this can be approximately 1 m sea level equivalent for that setting. The text is confusing as it is now. The 1m sle is referring to the simple model, but the 30 GT is for Greenland, right?

Lines 4 and 7, suggest to replace "temporal" with "interannual"

Line 18 not clear what "full regional climate model" is, do you mean "high resolution"

Page 2

Line 1 add "by" before solid

Line 2, is there a reference for this statement, or is this your concern? Then state that

Line 4, suggest to replace "response from" with "response to"

Line 5 – the sentence starting in line 5 needs editing, is this a result that you are presenting here or is there a reference you can use to support this statement?

Line 10, also here is a statement that needs supporting reference or clarification

Lines 17-19 this paragraph is misplaced, maybe it can be put into the previous paragraph, as it stands it is in no context with the rest of the section.

Line 20 if something is well known you should add some reference for the reader who is interested to learn more about this well known fact.

Line 24, take the plural s off models

Line 26, missing what the bias correction is applied to

Line 32 replace "an" with "a" long-term

Line 33 suggest to replace "differs" with "differ" and "dependent" with "depending"

Page 3

Line 3 add s to "influence"

Line 5 add "be" in front of applied OR replace "applied" with "apply"

Line 6, something is missing, relationship between T and what?

Line 30, think it would be clearer to replace “mass balance” with “change in volume”

Page 4

Figure caption - the “runoff line” is not explained and in this context it is not clear what the line is

Page 5

Line 13, suggest to replace “for the model presented in Section 3” with Oer03 to clarify

Page 9

Line 11, suggest to edit “For this value it is seen” – change to something like Figure 4 shows, or it can be seen on

Line 15 “Our results indicate...” This statement needs more clarification Figure 4. Shows that for 3°C warming the temperature bias is 0.12°C, how does that translate to the 1.6°C threshold for GrIS ice loss?

Line 16 “,but it reduces the window available to avoid passing this threshold” is a strange sentence, what do you mean here? That there is less temperature change needed to reach the threshold?

Line 18 Figure 4 shows the Δ SMB with units mm SLE yr⁻¹, which here is translated to Gt/yr, suggest to use only one unit, or explain the assumption made to transfer from one to the other.

Line 31 to Page 10 line 6 - This paragraph is a strange way to start the conclusion section, suggest to move this to the discussion section

Page 11

Line 5 this sentence is misleading and in contrast to the replies to previous comments, you state there that the minimal model, Oer03, is there to show how equation 6 works and that it is not to model Greenland Ice sheet. Here, however, you state that you have considered a minimal model of the Greenland Ice sheet, suggest to edit this sentence

Line 10-11, check the reference there should not be a parenthesis around the year within the parenthesis

The supplement for the paper is not very comprehensive and would benefit from a little more text to explain better its context. The text is very minimal and in bullet point style and does not provide the information needed to support the main text. The length of the main paper is not such that it would make it impossible to add the information in the supplement to the main text, making the paper more comprehensive and readable. The other option would be to provide more context in the supplement.

Page 7

note that data is plural so line 3 should be “.. data consist of monthly means and are ...”

page 8

line 2, suggest to replace “yearly” with “annual”

line 3, parameters... are used

page 9

see comment above the figure caption does not clarify what is going on here, more text would help putting the context clearer.

Same for page 10