

## Review of Bradley et al, 2017, CPD

This study investigates the effect of sub-ice shelf melt parameterizations and (relative) sea level forcing on the evolution of the Greenland ice sheet over the last two glacial cycles. This is an interesting topic and the notion that ice sheet models should account for changes in sub-ice shelf melt and sea level over glacial-interglacial time scales is very relevant.

However, unfortunately the manuscript lacks essential information in some places, and is too lengthy and unclear in other parts. Not crucial, but very disturbing for a reviewer, are the many editing issues. I have listed some of the most frequent issues, and suggest a very thorough typesetting process after the scientific content is sufficiently revised.

### GENERAL COMMENTS

1. On the climate forcing: I understand that the focus of this study is on testing the sub-ice shelf melt parameterizations and the effect of sea level forcing on ice sheet evolution. However, the climate forcing the ice sheet model simulation over the last two glacial cycles is important, and will likely largely affect the simulated spatial and temporal extent. The SAT forcing is taken from Helsen et al. (2013), but this forcing is not discussed. Is this forcing really representative for the entire model domain? How is the SMB calculated from the SAT forcing? The timing and extent of the simulated Greenland ice sheet will depend on the SMB evolution.
2. Related to this: Page 12, lines 425-457 discusses spatial variability of the simulations and links this to the SAT. However, my understanding of the SAT forcing is that it only varies over time, not spatially, which would mean that this discussion over-interprets the results.
3. PD ice sheet: Yes, indeed a common feature of SIA models is the overestimation of ice on the margin of the ice sheet (p. 6, lines 199-200). However, studies using these models focus mostly only on grounded ice, while this study investigates the ice shelves. How will the overestimation of marginal ice effect your ice shelves (thickness, dynamics, ...)?
4. Why focus on 2 glacial cycles? Many of the inputs/forcings are only available for the last glacial cycle, as are the data observations to compare the model results to. What is the added value of including the earlier glacial cycle, apart from model spin-up?
5. The set-up of the sea level/water depth forcing is not clear to me. In the ESL method global mean sea level change is used as forcing, but local changes in the solid earth field are also included. Correct? In the RSL method, local and non-local geoid and solid earth changes are included, but they seem to not be consistent, and are calculated from different (not necessarily compatible) models. Especially the comparison of the total water depth from the different methods (page 8, lines 290-298) is very confusing. Please clarify this section. Note that it is also confusing to call the first method "ESL", as the text also uses "ESL" as unit for global mean sea level change.

6. In my opinion, the use of supplements in a CP publication should not be necessary. It is difficult as reviewer to find your way through the different texts, tables and figures. This will therefore be very confusing for the reader.
7. Related to this: the present manuscript contains too much information. What is the main message of the manuscript? And what information is needed to verify and understand that message?  
For example, I think that methods 1-3 of the SSM parameterization are not essential, and could be omitted. Similarly, is it really necessary to include the ESL forcing method? Maybe better to only focus on explaining the RSL method and present those results more clearly?

### **SPECIFIC COMMENTS**

Page 6, lines 196-200: This tuning of the PD ice sheet should be explained in a separate section, or included in Sect. 4.

Abstract, lines 14-16; and Conclusions, line 512: Make clear that only the solid Earth influence of the LIS and IIS on GrIS was explored. How changes in atmospheric circulation due to the vicinity of these large ice sheets affect the GrIS is not discussed.

### **TECHNICAL COMMENTS**

1. Order of references: this seems random, please change to chronological or alphabetical, and be consistent.
2. References in the text need to be formatted to: ... Name et al. (year) ...
3. Use spaces between Table of Fig. and number (i.e. Table 1 instead of Table1).
4. Please check all apostrophes (e.g. forcings instead of forcing's for plural)
5. "sheet-only" should be "ice sheet only", similarly "shelves" should be "ice shelves"
6. "on Table" should be "in Table"