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Felicity Holmes
Department of Physical Geography
Stockholm University
106 91 Stockholm
felicity.holmes@natgeo.su.se

Response to reviewer one

The authors are grateful for all your comments on the manuscript, and have made many changes which we believe have led to considerable improvements. Please see below for responses to the comments.

The main changes in response to the comments are:

- New style for Figs. 4 and 5 (removal of 'polar plots' in preference of bar chats), which we believe are much easier to read
- New style for Fig. 7, with modelled undercuts shown on a line graph. We believe that this makes the size of the modelled undercuts much clearer

Specific changes made in response to your comments are detailed below, with the comments written in bold, and the changes made in normal typeface.

In addition, we have run three additional simulations to allow exploration of the impact of a different sliding law, the impact of a more gradual undercut geometry, and the impact of having no tidal fluctuations in the model.

We hope you find the alterations satisfactory,

Yours Sincerely,

Felicity Holmes, on behalf of all authors

Line comments

L15: Maybe Svalbard should also be mentioned here, as the paper is about Svalbard.

It has been clarified that 'glaciers non-peripheral to Greenland and Antarctica' includes Svalbard.

L19f: Strictly spoken, "frontal ablation" also contains subaerial melt and sublimation at the calving front and should be mentioned for clarity (see Cogley et al. 2011, Glossary of Glacier Mass Balance, for details).

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The definition of frontal ablation in the manuscript has been expanded to explicitly include subaerial melt and sublimation.

L24ff: Maybe it would be worth adding Svalbard's tidewater glaciers that have shown retreat over recent decades, which implies substantial calving (e.g. Braun et al. 2011, doi:10.1111/j.1468-0459.2011.00437.x).

This point has been added in, alongside a reference to Braun et al. (2011).

L64: "supra-glacial melt" is rather odd, "surface melt" would be the right term (also to be corrected in the following)

All instances of supra-glacial melt have been changed to ‘surface melt’.

Fig. 1: left panel: name the most important currents in the map; right panel: no needs for three decimals (one is enough)

The suggested changes have been made to the figure, with both the West Spitsbergen Current and the Sørkapp current explicitly labelled on the map. Only one decimal place is shown for the right panel.

L105: I'm not sure if this is the right location, but in any case it needs to be noted that you do not consider subaerial frontal melt/sublimation in your modelling.

This has been clarified in the ‘Model Inputs’ section, where the forcings (e.g. submarine melt) are discussed.

L106-109: Additional information about e.g. mean velocities and errors/uncertainties of the calculated velocities must be presented here. Given the nature of the study, velocities at the front should be given special attention.

Additional details have been given relating to the velocity fields, for example the estimation of the errors for frontal velocity.

L179ff: The position should be mentioned from where the profiles were measured (maybe also indicate them in Figure 1).

Information on the location from which the profiles are measured has been added in to the Methods section. The multibeam data was taken from a research vessel in Kongsfjorden, and the LiDAR data was taken from the shore at 78°52’04.1"N 12°29’06.7"E.

Table 2: The term "Large icebergs" should be quantified somehow in the caption so that it can directly be distinguished from "All icebergs".

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The definition of large icebergs has been added to the caption for Table 2

Fig. 4b/c: I find it very hard to distinguish between "All size" and "Large" in those figures. The presentation of the data should somehow be changed so that a straightforward differentiation is possible. I also think that this kind of plot is inadequate to visualize the results, as +80 and â€ ‘ 80 cm are located in direct vicinity. A linear bar plot would be correct instead (it would also solve the problem that lines overlap frequently for small numbers of icebergs, which is in parts responsible for the problematic readability of the graphs).

The figure has been re-made so as to aid readability, with an example of the results from the ALL simulation shown below:

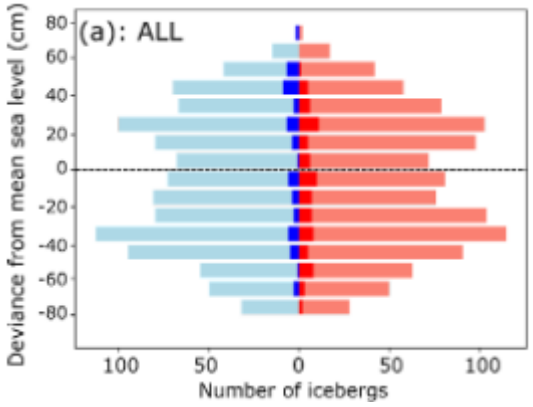

Fig. 5: Same comments as for Figure 4. This needs to be changed here, too.

The plots in Fig. 5 have been changed in the same way as has been done for Fig. 4.

L264: correct to "... an impact ..."

The correction has been made.

Discussion section: It might be worth taking a look at another study that analyzed calving at Kronebreen (Sund et al. 2011, TCD, https://tc.copernicus.org/preprints/tc-2010-104/), even if the paper was not accepted for final publication. Maybe it gives some additional insights into the discussion.

Thank you for this suggestion and link to the article

Fig. 7: I have some problems with this figure, too: While I like the idea of showing the profiles in perspective, I think this makes visual comparison of the undercut sizes almost impossible. In (a) sizes are given for profiles 2 and 3. It appears that the undercut in

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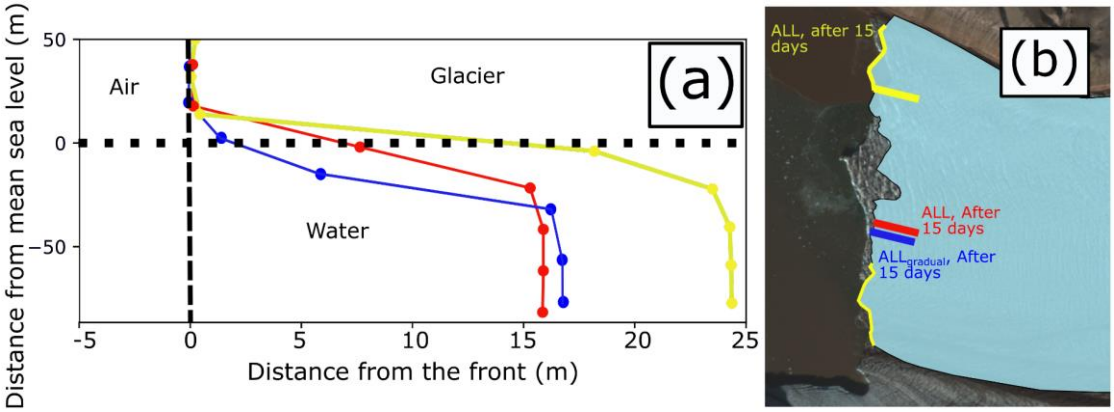
profile 2 is about four to five times as large as thin in profile 3, but this is by no means supported by the values given. Moreover, it is strange that profiles 1 and 4 are shown with their numbers, while undercut values are given for profiles 2 and 3. I suggest to change the presentation of the profiles in (a) to individual x (distance from calving front) vs. y (depth) line graphs. This would allow the reader to get the right idea of the sizes of the undercuts.

The figure has been edited so that it is now a line graph, which we believe makes it much easier to see the sizes of the undercuts, as well as to compare them to the observed undercuts. Undercuts are shown from a plume location (midway point of the simulation), and a non-plume location (midway point of the simulation). Additionally, an undercut from the new 'ALLgradual' sim is shown, where a less angular undercut is modelled. The updated figure is shown below:



L345 "We note..." instead of "The authors of this paper note..." ?

Here, we refer to the authors of Vallot et al., rather than to ourselves. This is not clear in the original text and we have changed it to read: 'However, Vallot et al. (2018) note…'

L390: It needs to be discussed to which extent the fact that subaerial frontal melt was not considered in the model (only one single simplified overall frontal melt), has an impact on the results. I mean, frontal melt rates are different below and above the water line, which clearly also impacts the creation of undercuts.

We have added in some discussion about the lack of subaerial melt/sublimation in the model set up, and how this may impact modelled undercut sizes.