We thank the editor and both reviewers for their helpful and constructive feedback, and we address their comments.

Below we first offer our response to the editor, followed by our comments addressed to reviewer 1, finally, to reviewer 2.

Sincerely,

Yavor Kostov, lead author

Responses to the editor

Justification (visible to authors and reviewers only):
Dear Dr Kostov and co-authors,

Thank you for your relevant, interesting and novel submission to TC / EGUsphere. I believe that it is suitable for further peer review. Below I have made note of some minor issues that I encourage you to address during the peer review process. They are mostly geared toward accessibility and clarity.

I will now send it for peer review.

Best regards,
Felicity McCormack

We are grateful to the editor for giving us the opportunity to submit our work to peer review. Our response and revisions will address both the editor's comments and the ones listed by each reviewer.

Below we also include our response to the individual issues raised by the editor.

Best regards,

Yavor Kostov, lead author

Here we respond to specific points that the editor makes.

- I suspect that the developments presented in this manuscript should have substantial impact in terms of modelling icebergs. However, the significance could be described more clearly in the introduction, discussion, and conclusion. For example, the end of the first paragraph in the introduction notes that modelling the behaviour of the largest icebergs is particularly challenging. However, the introduction does not elaborate on what those challenges are, which may make it unclear to readers less (or not at all) familiar with iceberg modelling why the developments presented in this manuscript are important. A brief overview of the limitations of previous modelling approaches -- perhaps highlighting which factors (e.g. thermodynamics, biogeochemistry, interaction with underwater infrastructure, influence on polynya activity) are likely to have the largest impact -- would help clarify the motivation and significance of this work.

We are grateful to the editor for the feedback and the recommendation that we should elaborate on the significance and impact of our new developments in the introduction, discussion, and conclusion. We will edit these sections. As suggested, we will elaborate on the challenges in modelling icebergs and on the importance of our developments.

- Line 15: should this be "iceberg acceleration"

We thank the editor, and we agree that we should specify we are referring to “iceberg acceleration” in Line 15.

- Section 3.4. In places it’s difficult to follow what is new in the berg scheme and how it differs from the previous schemes or what is commonly done in other berg schemes. It could be helpful for readers to see the updates represented schematically (e.g. some kind of flowchart), including how the bergs interact with ice shelves, or at least an itemised summary of the new processes / parameterisations implemented

We appreciate the editor’s comments about clarifying the novelty of the new grounding scheme in Section 3.4. We will specifically list the new processes that we have implemented, and which were missing from the previous grounding schemes in NEMO.

- There are some sentences that contain large whitespaces which makes me wonder whether some terms haven’t rendered in the pdf? (e.g. 204, L454)

We are grateful to the editor for pointing out that there are larger than usual whitespaces in the text (e.g., lines 204 and 454). These are typos that do not correspond to any missing text, and we will easily fix them.

- If you’ve not already done so, please check all colour maps in the coblis color blindness simulator (https://www.color-blindness.com/coblis-color-blindness-simulator/) and adapt the colour schemes as necessary

We thank the editor for reminding us to double check the figures in the colour blindness simulator one more time, and we will do so.

- The manuscript is quite long. Please consider whether you can reduce the text length for clarity and conciseness or combine some of the figures (e.g. figures 15 and 16)

We furthermore thank the editor for the suggestion to reduce the text length and to combine figures. We will indeed do our best to make the manuscript more concise, and we will merge Figures 15 and 16, as suggested.

Reviewer #1

The authors have developed the modelled dynamics of drifting and grounding/grounded icebergs, with close attention to realism, in particular the evidence from scouring. In the former instance, the pressure gradient force for drifting bergs is more correctly separated into barotropic and baroclinic parts. In the latter case, with a focus on the topographic

obstacle that is Bear Ridge in the Amundsen Sea, more extensive improvements to the NEMO-ICB model configuration are outlined. The attention to dynamical detail is impressive, most notably representation of the force balance for a grounded (and ungrounded) berg. The authors outline in considerable detail the additional forces and accelerations, based on clear fundamental physics, with just a degree of uncertainty in the coefficients of Coulomb friction.

The manuscript is succinctly written throughout. The Introduction (Sect. 1) clearly motivates the model development presented here, with a view to the wider system ice-ocean-climate system. Sect. 2 provides thorough background information on the character of seafloor and sediments, or relevance to grounding. Sect. 3 provides a detailed outline of the existing model equations and developments thereof, model configuration and experimental design. In the Results (Sect. 4), well-crafted figures convey a rich level of information, in particular the wind roses that summarise the strength and relative orientation of accelerations and forces, and the summary force balances (given typically small net accelerations). Sect. 5 provides a brief summary and discussion, pointing towards new modelling possibilities now that the basis is provided for more realistic representation of tabular bergs near Antarctica, specifically the consequences of grounding for sea ice, hydrography and even feedback on the calving process. I close with the following technical comments:

Thank you for your time in carefully reviewing our manuscript and expressing your support! We are grateful for all your comments, and we will implement your suggestions promptly.

Technical Comments:

1. **'Equations' 9, 10, 12-16 are actually terms or relations; either refer to these as such in the main text, or formally make these equations; likewise (27) is a set of proportionalities, not equations**

   Thank you for this helpful suggestion! We will turn the aforementioned relations into equations and refer to (27) as a proportionality.

2. **6 caption: typo - 'small' rather than 'smalls'**

   Thank you for pointing this out! We will correct it.

3. **Line 797: typo – 'or' not 'of'?**

   Thank you for pointing this out! We will correct the typo.

<u>Reviewer #2</u>

In this manuscript, Y Kostov and co-authors present an updated grounding representation for icebergs in the NEMO ocean model, as well as improvements to how iceberg drift is computed.

The paper is very well written and structured, clearly illustrated, and the subject matter is a natural fit for The Cryosphere. I believe this work presents substantive steps forward in the representation of icebergs in models and I am looking forward to seeing how these changes will improve future iceberg modeling efforts.

In light of this I recommend the paper for publication after revisions, with my comments detailed below. (Please note that some of these comments are musings rather than

requests for edits, arising largely because I am fascinated by this topic. Relatedly, I am keenly aware that I refer to my own papers quite a lot in my comments - which is mostly just a consequence of being most familiar with those and not a request for citations).

Thank you for your thorough and constructive comments and suggestions! We appreciate your feedback and the references to relevant papers that we will cite appropriately.

General Comments:

1) My most substantial comment is that I do wonder whether the paper may benefit from being split into 2 separate articles: one on grounding and one on drift dynamics. My reasons for suggesting this are two-fold:

i) The paper is quite long and it is at points hard to keep track of all the different pieces (see also a similar comment by the editor).
We thank you and the editor for this comment. We will shorten the paper and we are grateful that you have highlighted particular portions of the text that could be written more concisely.

ii) The paper consists of two fairly independent components: the grounding parameterization and the free drift analysis and improvements. While the grounding work is more developed in the manuscript as it stands I would argue that there is plenty of material to expand the drift analysis into its own paper (without too much extra work). Such a split could streamline the presentation in a number of ways, for example, you wouldn't have to bring in the MEDIUM icebergs at all for the grounding work. I do think a split would also help the impact of the work - other modeling groups may be more likely to pick up on the improvements in grounding when this is presented in a more focused way.

We are more inclined not to split the draft paper into two manuscripts. We think that in order to describe grounding behaviour, we have to understand how freely floating icebergs approach topographic obstacles such as Bear Ridge. In addition, the contrast between the force balance of freely floating and grounded icebergs is itself very revealing. As an alternative to splitting the paper, we will also consider building stronger bridges in the text between the passages focusing on freely floating icebergs and the ones that directly concern grounding. However, if keeping the manuscript intact will delay publication, we will adhere to the editor's advice.

Having made this case, I happily leave it to the authors and the editor what to do about it.

2) There are a few passages where I thought text could be shortened somewhat. I have highlighted those in the attached pdf.

We will go through all passages that you have highlighted and rewrite them more concisely.

3) It would be helpful to early on provide a short discussion of the types of icebergs that get stuck on Bear Ridge with typical sizes and approximate numbers. While reading the paper, I somehow assumed there would be only a handful of large tabular icebergs at a given time, until I got to Appendix A and realized you are mostly talking about ~hundreds of fairly small icebergs.

Thank you for this comment! Yes, indeed, we should point out that these are hundreds of fairly small icebergs, which may still fall into the model's largest size classes.

Relatedly, I would recommend picking one of the images from the timelapse movie (ideally one with very clear sea ice differences on the two sides of the "wall of icebergs", e.g., timestamp 2:15 of the movie), annotate this, and combine it with figure 1, to provide the reader early on with a sense of the general setup. These images are rather striking.

We will combine still frame ~2:15 of the movie with Figure 1. Thank you for this suggestion!

4) The manuscript is largely focused on grounding, however, I'd argue that the subsequent ungrounding is also important. [As a side note: Reading the paper I was wondering whether ungrounding is primarily the result of melting (and potentially capsizing), or rather changes in ocean current/wind direction? This is not a focus of this work, but if you have any insight I'd be interested to hear it.]

Yes, indeed, the complete ungrounding in the model seems to be the result of melting. It is a very relevant question whether basal melting or lateral melting and capsizing dominate. We have not explored the capsizing of grounded icebergs, but we will now analyse such cases in our simulation.

In contrast, winds seem to be the main driver of motion for kinetically grounded icebergs that remain embedded in the sediment.

While I agree with the authors' choice to focus on the novel representation of the grounding process, I do think it would be helpful to also discuss ungrounding and the role of melting. Two things came to mind:
We will expand the text to discuss the mechanism behind ungrounding and the transition to free flotation in a new subsection between 4.2 and 4.3 titled Ungrounding of icebergs.

- First, as far as I know the melt model in NEMO-ICB contains a dependence of basal melt on the relative velocity between the iceberg and the ocean current at the height of the iceberg base (Merino et al, 2016, eq 2). I wonder how this plays out for grounded icebergs in the latest version?

Thank you for raising this question. We will add a clarification that in the new grounding formulation, the relative basal velocity is computed at the height of the iceberg grounding level. This formulation may not be perfect, but it allows even the statically grounded icebergs which have no velocity of their own to melt at the base.

Lines 871/872 make it sounds like this is not the case in the current model formulation?

We will clarify that lines 871/872 refer to the melting of freely floating icebergs.

The dependence on the size of the iceberg is evident as well in the Merino et al. formulation. I'm likely missing something, but maybe this paragraph could be reworded and/or clarified?

We will clarify that the melting in the Merino formulation depends on the relative velocity and directly on $L^{-0.2}$. However, we suggest that the relative velocity between the iceberg and the ocean itself depends on the inverse length scale. Hence, we expect the inverse length scale to have a much stronger net impact on the melting rate.

- Second, freely floating icebergs typically erode much faster on the side walls due to wave erosion (~1 m/d) than the base (~0.1 m/d) - see, e.g., Wagner & Eisenman (GRL, 2017, https://doi.org/10.1002/2016GL071645). In that case you might expect that icebergs shrink laterally until the aspect ratio becomes unstable and they become ungrounded by capsizing (as the authors mention). This may be particularly relevant for the smaller icebergs found all over Bear Ridge. However, since for grounded icebergs the relative basal velocity is higher, maybe the thinning is substantially faster than for freely floating ones, which might entail that capsizing isn't that important after all. Would it be easy to check how often ungrounding in the model coincides with capsizing? I appreciate that a detailed analysis of these processes is beyond the scope of this study, but I do think it would be helpful to comment on how melt is represented in the model, and to at least mention some of the considerations above.

Thank you for this comment. We will add a discussion of the relative magnitudes of the lateral and basal melting for grounded icebergs in our new subsection 4.3 Ungrounding of icebergs. Our basal melting formulation for grounded icebergs indeed allows for sustained vertical thinning. We also suspect that the wave erosion may be exaggerated in the model, and we will discuss this further in our new subsection 4.3 Ungrounding of icebergs where we will highlight melting as the dominant mechanism. We will check whether capsizing of grounded icebergs takes place and facilitates the ungrounding or whether basal melting is sufficient to detach icebergs from the bottom.

5) It was my understanding that the original NEMO-ICB used the erroneous capsizing criterion of Bigg et al (2017). We published a correction to this in Wagner et al (Ocean Modeling, 2017, https://doi.org/10.1016/j.ocemod.2017.07.003) and I discussed this briefly with Bob Marsh back then but never followed up. I just want to make sure the capsizing errors have been fixed, if there ever were any.

Compared to Wagner et al. (OM, 2017) and Bigg et al. (2017), the present capsizing criterion uses a different power law, namely:

SQRT(0.92*(KeelDepth**2) + 58.32*KeelDepth))

This makes a direct comparison with Wagner et al. (OM, 2017) formulation more difficult.

However, it stands out that in the present NEMO-ICB version, the criterion is applied as a comparison between the iceberg horizontal length and keel depth. Wagner et al. (OM, 2017) suggests that the appropriate comparison should be between the horizontal width and the full thickness rather than the horizontal length and the keel depth. The full thickness swaps with the horizontal width when the iceberg rotates. Analysing and improving the capsizing is beyond the scope of our current manuscript. However, our companion manuscript Abello et al. (2025) introduces an updated rolling criterion in NEMO that is based on the ratio between horizontal width and the full thickness while taking into account the exact issues highlighted in Wagner et al. (OM, 2017).

We will look for cases of capsizing grounded icebergs in our simulation, and if these take place, we will analyse them. We will also point the reader to our companion manuscript Abello et al. (2025), which updates the rolling criterion in NEMO.

Specific comments:

A number of mostly minor and technical comments are provided as annotations to the attached pdf.

Thank you for your detailed feedback. We have responded to these comments line by line below.

Dear authors - I am often wrong, and if you think that any of my comments are misguided please reach out to me and I'll be eager to amend my review.

Till Wagner

Line 10: not sure I'd call it ubiquitious - maybe "commonly observed"?

Line 10: Thank you, we will replace it with "commonly observed".

Lines 12-13, remove text: Strikethrough text

Lines 12-13, remove text: Thank you, we will shorten the text as suggested.

Line 27: just note that this is given as "2025" elsewhere.

Line 27: Thank you, we will change "in prep." to 2025.

Lines 30-39: This paragraph could be shortened to 1 or 2 sentences?

Lines 30-39: Thank you for this suggestion, but we think that it is important to refer the reader to broadly relevant previous literature on icebergs. This entire paragraph is composed of citations of previous publications that we prefer not to remove from our reference list.

Lines 31-32: see also: Duprat, L., Bigg, G. & Wilton, D. Enhanced Southern Ocean marine productivity due to fertilization by giant icebergs. Nature Geosci 9, 219–221 (2016). https://doi.org/10.1038/ngeo2633

Lines 31-32: Thank you, we will cite Duprat et al. (2016) here.

Line 43: there is also a body of literature that looks at iceberg scouring to shed light on paleo processes. 2 examples: Hill, J., Condron, A. Subtropical iceberg scours and meltwater routing in the deglacial western North Atlantic. Nature Geosci 7, 806–810 (2014). https://doi.org/10.1038/ngeo2267 and Starr, A., Hall, I.R., Barker, S. et al. Antarctic icebergs reorganize ocean circulation during Pleistocene glacials. Nature 589, 236–241 (2021). https://doi.org/10.1038/s41586-020-03094-7

Line 43: Thank you, we will also cite the suggested literature on iceberg scours in a paleoclimate context.

Line 44: just a note that, relatedly, Stern et al (2015) https://doi.org/10.1002/2015JC010805 found that grounded icebergs can act much like islands, in the sense that they can cause upwelling on the downwind side and increased stratification on the upwind side. Which made me wonder - how much of the differences in sea ice cover between east and west of Bear Ridge is due to icebergs mechanically blocking the sea ice advection and how much is due to the icebergs causing different ocean conditions on the two sides? Also, I found it interesting that these differences in turn impact the melt process of the iceberg itself (disclaimer - I'm an n-th author of that paper).

Line 44: Thank you for pointing us to this reference. We will cite it here in the context of modified ocean conditions sustained by grounded icebergs. We avoid speculating whether such a downwelling effect on the eastern side of Bear Ridge contributes significantly to the sea-ice dipole. Bett et al. (2020) found that representing the grounded bergs as a thin ice shelf had the same effect on sea-ice as representing them as land. This may suggest that the impact of the altered ocean conditions on sea-ice is small compared to the direct blocking of sea-ice advection.

Line 62: maybe better in quotation marks? "wall of icebergs"

Line 62: Yes, we will add quotation marks, as you suggest.

Lines 65-67: I would argue that there were important efforts quite a bit earlier - e.g., Mountain (1980) https://doi.org/10.1016/0165-232X(80)90055-5 and Smith and Banke (1983) https://doi.org/10.1016/0165-232X(83)90045-9

Maybe it would be more accurate to say that most currently used iceberg models can be traced back to Bigg et al (1997) and Gladstone et al (2001).

Lines 65-67: Thank you for pointing us to these references. We will cite them here and rephrase the statement about Bigg et al. (1997) and Gladstone et al. (2001).

Interestingly, Mountain (1980) actually assumes that Ekman currents play an important role in driving iceberg motion. So we will also cite this in our Section 4.1 when discussing the ageostrophic contribution to the ocean dynamics around icebergs.

Lines 99-106: paragraph could maybe be shortened

Lines 99-106: Yes, we will shorten this paragraph, as you suggest.

Line 112: Shoal

Line 112: Thank you. We will replace "shallow" with "shoal," as you suggest.

Line 132: in my experience "capsizing" is used more typically in the literature

Line 132: Thank you. We will replace "toppled" with "capsized," as you suggest.

Line 132: note that the standard capsizing criterion that was used by Bigg et al (1997) and most subsequent iceberg modeling studies dated back to Weeks and Mellor (1978) https://doi.org/10.1016/B978-0-08-022916-4.50015-7 and featured some errors that led to icebergs continually capsizing among other things (see also my general comment 5).

However, it stands out that in the present NEMO-ICB version, the criterion is applied as a comparison between the iceberg horizontal length and keel depth. Wagner et al. (OM, 2017) suggests that the appropriate comparison should be between the width and the full thickness rather than the length and the keel depth. The full thickness swaps with the horizontal width when the iceberg rotates. Analysing and improving the capsizing is beyond the scope of our current manuscript. However, our companion manuscript Abello et al. (2025) introduce an updated rolling criterion in NEMO that is based on the ratio between horizontal width and the full thickness while taking into account the exact issues highlighted in Wagner et al. (OM, 2017). We have already cited Abello et al. (2025), but we will also refer to it when discussing the capsizing criterion and its update in NEMO.

Figure 2: Instead of using a schematic for panel (c), could you take an actual representative cross-section example - and you could mark that cross-section on the map of panel a or b?

Figure 2: Thank you for this suggestion, which we have carefully considered. However, individual sections do not necessarily provide a clearer picture compared to this schematic, which is very representative of typical scour shapes.

Line 155: could you mention in this paragraph briefly why you're interested in WBD and shear strength - I was wondering about it until I got quite a bit further down.

Line 155: Thank you, yes we will mention that WBD and shear strength determine the sediment resistance forces acting on grounded icebergs.

Line 167: Strikethrough text

Line 167: Thank you for suggesting this correction. We will remove the "s."

Figure 3: It's not clear to me exactly how the partition of the 3 layers plays out in this plot - maybe you could color the markers accordingly or draw approximate boxes around them.

I was also wondering whether different colors (or using different markers) for different cores may be insightful?

Figure 3: Yes, we will make sure that the three layers are differentiated in this figure by drawing boxes around the data markers while using distinct color and line types for the box contours.

Lines 200-201: are these two sentences needed?

Lines 200-201: In order to make the text more concise, we will remove these sentences.

Line 204: Strikethrough text

Line 204: Thank you for pointing out this typo. We will correct it.

Line 204: And

Line 204: Thank you for pointing out this typo. We will correct it.

Line 208: Martin and Adcroft (2010) distinguished between form drag and skin drag. How does NEMO-ICB deal with this?

[As a sidenote: we looked in some detail at the relative importance of form vs skin drag and found that this varies substantially depending on whether you have a high length-to-height ratio or one that is O(1) - take a look if you're interested: https://doi.org/10.1175/JPO-D-20-0275.1

See also a further comment on C_drag below.

Line 208: Here we will clarify that NEMO-ICB assumes form drag, and we will cite Martin and Adcroft (2010), as well as Wagner et al. (2022).

Line 239: Maybe a short paragraph on the melt representation in NEMO-ICB following here?

Line 239: You suggest adding a short paragraph on the melt representation here. We think this might be more appropriate after Line 365, and we will add it there.

Lines 241-243: Maybe it's worth mentioning that you envisage the icebergs to plough a triangular (v-shaped) trench into the sediment, however, the motion of the iceberg is computed using a perfectly rectangular iceberg. (I've always assumed that these icebergs are approximately flat at the bottom, which makes me think: how do they leave v-shaped scours? Am I missing something obvious?)

Lines 241-243: Thank you! Yes, we will mention that guided by observations, we assume that iceberg keels plough v-shaped trenches into the sediment. Even tabular icebergs are not flat at the bottom but rough.

Line 256 and Section 2.2: is this the same as WBD ? maybe clarify ?

Line 256 and Section 2.2: Yes, thank you for pointing out the inconsistent use of terminology which we will fix. We assume fully saturated sediment, so in our case WBD is the same as saturated density.

Line 267, Eq. 11: could move this term in front of the curly bracket, since it's the same for the two cases?

Line 267, Eq. 11: Yes, we will move the common factor outside the curly brackets.

Lines 274-277: maybe this should be moved to near line 170 ?

Lines 274-277: Yes, as you suggest, we will move these sentences right after Line 170.

Line 299: you provide a reference and more discussion for this later- I would move it up here and shorten

Line 299: Thank you! We will move the sentences and the Veldhuijsen et al. reference from Lines 449-451 to this part of the text.

Line 321: Strikethrough text

Line 321: We will fix the mistyped sentence, as you suggest.

Line 321: of motion

Line 321: We will fix the mistyped sentence, as you suggest.

Line 321: Strikethrough text

Line 321: We will fix the mistyped sentence, as you suggest.

Line 321: capped?

Line 321: Yes, we will rephrase "limited" to "capped."

Lines 329-330: maybe discuss briefly here what range you tested and that the results are fairly insensitive to this exact value. Looking at Appendix B it seems to me that the effect of mu is saturated once you exceed 0.002, and the main differences arise somewhere in the range mu = [0,0.002]. Did you look at smaller values as well?

Lines 329-330: Thank you for pointing out that we should discuss the Appendix B results here in more detail. We will state that we have done tests with values higher and lower than 0.002, including a case with no Coulomb friction that still includes sediment resistance and gravity. We will refer the reader to Appendix B.

Line 339 and equation 18: d

Line 339 and equation 18: Thank you! We will fix the typo.

Line 341: force

Line 341: Thank you! We will add the missing word "force," as you point out.

Lines 344-361: I wonder whether this paragraph could be cut/shortened/moved to the appendix?

Lines 344-361: Thank you for this suggestion, we will mention the curvarture term here, and move most of this paragraph to Appendix B.

Lines 407-419: This paragraph could maybe be summarized in a sentence or two?

Lines 407-419: Thank you for this suggestion. We will shorten this paragraph.

Lines 449-451: move this density discussion up (see earlier comment).

Lines 449-451: Yes, we will move this discussion to Line 299.

Line 471: maybe mention here somewhere how melt and ungrounding happens (+capsizing?) - see my general comment 4.

Line 471: Thank you for this suggestion. Here we will point out that complete un-grounding and the resumption of free flotation is due to the melting process and compare the relative roles of basal melting versus lateral melting and capsizing.

Section 4.1: The following analysis is a really interesting step forward! I've always felt a little uneasy about our approximation ignoring the ageostrophic currents.

I will say that I struggled a bit to follow the argument of the next few pages in detail, I guess at least in part because I'm used to thinking of it in terms of the force balance equations, rather than just the accelerations. And since I think of the drags, for example, as "surface forces" acting on cross-sectional areas and Coriolis and gravity as "body forces" acting on the mass of the iceberg, I found myself doing some cognitive aerobics reconciling the two frameworks. I am not suggesting you recast the whole argument in terms of forces, but maybe you can go over the text once more with a critical eye to make it as clear as possible?

Section 4.1: Thank you for your feedback! We will rephrase this part of the text to make it clearer. For example, when discussing the potential sources of acceleration on grounded icebergs, we will refer to them as "forces per unit mass" in the case of static grounding.

Line 542, Eq. 22: this reminds me of the discussion in Bigg et al (1996) - see their eq (4)

Line 542, Eq. 22: Thank you for pointing this out. We have cited Bigg et al. (1996) elsewhere, and we will also cite that reference here. We will point the reader to eq (4) in Bigg et al. (1996).

Lines 590-599: this may speak to my confusio (see comment above) - how exactly is C_drag obtained here?

Lines 590-599: Thank you for pointing out the need for greater clarity! We will specify that this is form drag, which is calculated as a function of the fluid density and iceberg geometry. We will specify that the values cited here are output directly by the model during the respective simulations.

Lines 590-599: following up on an earlier comment, it appears that C_drag represents the form drag only? (For skin drag in the limit of thin icebergs the atmospheric and oceanic drag coefficients are comparable - see Wagner et al (2022)). Might be helpful to clarify what C_drag represents.

Lines 590-599: Thank you once again for your feedback! We will clarify that this is form drag, which is calculated as a function of the fluid density and iceberg geometry. We will cite Wagner et al (2022). We will specify that the values cited here are output directly by the model during the respective simulations.

Lines 710-711: this is largely a repeat of l 696/697. Also, maybe make it clear when you first introduce MEDIUM icebergs that these do not feature in the grounding discussion?

Lines 710-711: We agree that we should remove these lines because re-stating this information here is redundant to Lines 696-697. Moreover, as you suggest, we will point out earlier, in Lines 451-452, that MEDIUM icebergs do not feature in the grounding analysis.

Line 754: Strikethrough text

Line 754: Thank you! We will move the quotation marks outside the word "kinetic".

Line 754: "

Line 754: Thank you! We will move the quotation marks outside the word "kinetic".

Line 766: Strikethrough text

Line 766: We will move the word "only," as you suggest, and we will delete the phrase "the course of."

Line 766: Strikethrough text

Line 766: We will move the word "only," as you suggest, and we will delete the phrase "the course of."

Line 766: only

Line 766: We will move the word "only," as you suggest, and we will delete the phrase "the course of."

Line 785, Figure 13 caption: cut?

Line 785, Figure 13 caption: We will delete the mistyped word "and," as you suggest.

Lines 797-798: something went wrong here - revise?

Lines 797-798: Yes, we apologize for accidentally pasting the unnecessary words at the end of the sentence. We will delete them.

Lines 797-798: Strikethrough text

Lines 797-798: Yes, we apologize for accidentally pasting the unnecessary words at the end of the sentence. We will delete them.

Lines 812-813: Maybe this can be combined with the first discussion of mu on l 329? See also my comment there.

Lines 812-813: Thank you, we will indeed move that to the earlier discussion of mu on Line 329.

Figure 15: I'm missing something here, sorry - how do you have acceleration in the case of "statically grounded" ? Could this be rephrased?

Figure 15: We accept your suggestion. In the case of statically grounded icebergs, we will rephrase "acceleration" to "force per unit mass."

Lines 854-896 on page 32: I feel like this page could be shortened?

Lines 854-896 on page 32: We will do our best to make this text more concise.

Lines 867-869: note that this was studied (and indeed found to be the case) in England et al (2022) https://doi.org/10.1126/sciadv.abd1273 (disclaimer: I'm a co-author) and breakup was implemented in the GFDL model in Huth et al (2023) https://doi.org/10.1029/2021MS002869

In my experience, breakup is a first-order process for large icebergs. I'd be excited to talk more if you're interested in adding something like this to NEMO ?

Lines 867-869: Thank you for pointing us to these references, which we will cite here. It is noteworthy that England et al (2022) demonstrate the potential for iceberg fragments to move at a different angle relative to parent icebergs. In England et al. (2022) the Wagner et al. (2017) analytical model is directly imposed on icebergs. At the same time, it would be interesting if a future study explores whether this motion of iceberg fragments appears as an emergent phenomenon when all model forces are applied to the iceberg momentum budget. There is also indeed potential room to improve the iceberg representation in NEMO by introducing fragmentation.

Lines 872-873: I think it does, and I think the NEMO model accounts for that (?) see my comment earlier.

Lines 872-873: Yes, we will add a clarification that the melting in NEMO is indeed a function of the relative velocity and the geometry. Our results imply that the iceberg lengthscale impacts the rate of melting not only by changing the geometry of the icebergs but via an impact on the relative velocity. This impact on melting via the relative velocity is an interesting new avenue for exploration in a future study, especially if it naturally emerges from the full set of dynamical and thermodynamical forcing factors applied to simulated icebergs.

Line 1134: Strikethrough text

Line 1134: Thank you. We will delete the typo.