

Summary:

This manuscript investigates the sensitivity of ice loss in the Amundsen Sea Embayment (ASE), West Antarctica, to prescribed calving front retreat rates using the Úa ice-flow model. The authors systematically apply constant retreat rates from 0.1 to 1 km/year along the calving fronts of major glaciers, including Pine Island, Thwaites and Crosson/Dotson. They quantify the additional sea-level rise (SLR) contributions caused by these retreat rates, comparing their impact with that of ocean-induced melt variability from ISMIP6 ocean forcing scenarios. They find that calving processes have an impact comparable to ocean forcing, highlighting the necessity of better representation of calving in future ice sheet models.

This manuscript addresses a crucial gap in understanding the dynamics of Antarctic ice shelves, specifically the sensitivity of future ice loss projections to calving front retreat. The study is timely and of high relevance, given the uncertainties associated with calving dynamics and their impact on global sea-level rise. However, parts of the results and discussion lacks clarity. This overall issue is address in more detail in the specific comments below. Several aspects would benefit from additional clarifications and expansions to enhance the robustness and readability of the paper.

Specific comments:

L17-18: Please add references.

L21: Does this mean that it is easier to implement continuous calving rate rather than modeling small-scale individual calving events? Please clarify.

L31: "...reproducing *observed grounding lines* consistently..." => reproducing observed calving front

L32: More numerical models now include calving capability, as mentioned in the Discussion section. Therefore, it may be more appropriate to specify "for real glacier simulations?". Also please add some supporting references.

L47: "raise sea levels by over a metre." : Please add references.

L62-69: This should move to the Methods section.

L67: What ocean domain is referred to here? I assume it means the surface area of the entire global ocean — please clarify.

L76: Why was it necessary to lower the bed topography when forcing the retreat? By how much was it lowered? How does the model behavior differ if this step is included?

L107: “The repeated forcing... between 2100 and 2300.”: Could you clarify this? Was the forcing from 2080–2100 repeated uniformly across the 2100–2300 period?

L103-108: It would be helpful to include a table summarizing the experiments described here or in Section 2.3. For the ocean forcing scenarios, please clarify which models provide extension to 2300 and which provide data only for a partial period and should be extended with repeated forcing.

L114: ‘Ocean_RR#’ this format is not used later in the text, which make it difficult to follow the experiment descriptions in the Results and Discussion sections.

L128: “... at various points during the simulation”: ... at various points *in time* during the simulation.

L141: a significantly different *compared to Control_RR0*?

L142: until later: Please specify the year or time range.

L146: “as contact is lost with pinning points”: Please specify the year after which contact is lost with pinning points.

L170: ... SLR for RR0 and RR0.5, *respectively*.

L170: “Comparing these ranges to Figure 3(b)...” Consider rewriting this sentence to clarify what is being compared here. What’s the range of RR0 to RR0.5 or RR0.7 to RR1?

L173-178: This paragraph is unclear. For example, “ $-\Delta VAF_{add}$ follows a similar trajectory for each RR0.5 and each RR1 ocean forcing case.” Does this mean “ $-\Delta VAF_{add}$ of Control_RR1 falls within the upper bound of the RR0.5 ensemble across ocean forcings”? Please rephrase for clarity.

L181: “Our results show that for a given ... without retreat.”: Could you give a figure or table including $-\Delta VAF$ and $-\Delta VAF_{add}$ for each ocean forcing scenario to strengthen this statement?

L186: I think this sentence makes too strong a generalization. Perhaps, I suggest something like “While our findings demonstrate that prescribed calving front retreat rates drive comparable ice loss across a range of ISMIP6-2300 ocean forcings within the ASE, caution should be taken in generalizing these results to the entire Antarctic Ice Sheet.”

L204: Refer to Figure 2(c) and (d)

L229: RR0.4

L229: “However, the curve for..”: can you comment more on this?

L229-L240: Consider moving this part to the Results section.

L241: Can you comment more on “some interactions”?

L246-L247 “In our case, the additional VAF loss when retreating...” Please quantify the additional VAF until 2050 or 2100 (early stages).

L255: Could the post 2100 results be influenced by the repeated ocean forcing scenarios? If so, it may be worth discussing this.