



EGUsphere, referee comment RC2
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Comment on egusphere-2022-805

Surui Xie (Referee)

Referee comment on "The control of short-term ice mélange weakening episodes on calving activity at major Greenland outlet glaciers" by Adrien Wehrlé et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-805-RC2>, 2022

Summary: This manuscript presented multi-summer and fall observations of ice mélange weakening episodes in front of three large outlet glaciers in Greenland, and developed a model using random-walk plus a down-fjord trend to simulate mélange motion. The carefully designed model makes the results unsurprising. However, this is a good effort in modeling the often complex processes occurring at the ocean-glacier boundary.

Comments:

Observations:

The observed timing and transition of IMW to iceberg calving process do not appear to follow a certain pattern. Apart from the description of some IMW episodes, the process can hardly be replicated in other fjords, nor in the BRIMM model described in this manuscript. Do we have sufficient data to quantitatively characterizing the IMW and calving processes and their possible feedback? If not, what are needed?

The IMW front propagation speed (Figure 6c and in the manuscript text) is probably not a useful variable in describing the short-term IMW episodes, as mélange break-up or collapse often behave like transient events.

Modeling:

Shouldn't the bias added to the model be equal or similar to the advance rate of the glacier terminus?

Meltwater plume or iceberg break-up can perhaps produce the two criteria implemented in the model, though calving is not necessarily to happen during or shortly after plume or iceberg break-up events.

Line 35: remain -- > remains

Lines 47-48: This could confuse readers. Large calving events are more likely to occur when the mélange is un-jammed, or the mass/extent of the jammed mélange has decreased to a critical level.

Lines 86, 87 and a few other places: It is perhaps better to explain the terminology "solid ice" when first referred -- if the authors would like to keep the term -- I thought ice could only be solid in the nature environment.

Lines 78-179: Does "constant" mean fixed-coordinate in Eulerian frame?

Lines 208-209: It may be true that the mélange strength and density contribute more at HG than at KG on some aspects of the mélange dynamics (in a relative sense), but how could the comparison of HG and KG's fjord geometry lead to a conclusion that mélange's strength & density are more important than fjord geometry in affecting mélange dynamics?

Line 322: Red -- > Black

Lines 324-325: In figure 9a, under what circumstances would the terminus be stable? When the average advance rate of the calving front is 0 (white color)? Did the authors implied that the average advance rate of calving front needed to be a large negative value (towards -20 m/d) for the glacier to have a stable terminus position – "either the random motion or the bias has to be large"?

Line 326: What are the conclusions, could the authors elaborate?

Line 352: How about ice blocks with high length-to-height ratio? I don't feel they will increase the mélange by smaller areas.

Lines 356-361: The first sentence stated that calving could increase the density of mélange, whereas the latter example suggests that calving can break the cohesion and perhaps reduce the density. They seem to be controversial. Some rewording is needed.

Line 389: HH -- > HG.

Line 418: So, the bias implanted in the model was caused by ocean currents? Please clarify this in the model set-up section.

Line 427: It is perhaps difficult, if not impossible for the glacier terminus to reach the fjord mouth. Under the scenario suggested by the authors, pro-glacial mélange should have some length to suppress calving and allow glacier advances.

Line 450: Where is Appendix A?

Figure 2: Some details about the IMW front detection should be provided in the caption or in the text of the manuscript. For example, the extent of mélange in panels a and b appears to be beyond the range of the colored lines, and the SAR images don't show significant contrast between strong & weak mélange (particularly for panel b). Besides that, it would be good to add the reference line (for computing distances) onto the maps – for this and other similar figures.

Figure 5: There are a few jumps/discontinuities in IMW distances to the reference point without calving activities (e.g., in late June and early October 2019, and late November 2020). Please provide some details about these jumps, otherwise it is difficult for the readers to interpret the figure.

Figure 6 caption, first sentence: "at KG, HG, and JI"?