

## ***Interactive comment on “A Decade of Variability on Jakobshavn Isbrae: Ocean Temperatures Pace Speed Through Influence on Mélange Rigidity” by Ian Joughin et al.***

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This paper presents a comprehensive set of data describing the behaviour of Jakobshavn Isbrae over the last decade. Surface velocities, DEMs, terminus position and ocean temperatures are examined together to investigate recent variability, the role of water temperature and ice-mélange on calving, and the potential for the ‘ice-cliff instability’ to be operating in this location.

I find this paper to be very well presented and written, to make good use of the novel, high quality and comprehensive datasets presented, and to provide a valuable contribution to the literature around calving and outlet glacier stability. The figures are

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especially well conceived. I recommend that it be published subject to some minor corrections below.

1) The volume of papers being published in this scientific area has grown very quickly in recent years, so the authors should be forgiven for overlooking some highly relevant works or for missing important citations. Nevertheless, because it directly addresses the issue of melange rigidity on calving, is generally in agreement on the issue, and is also published recently in *The Cryosphere*, I feel that the recent article by Bevan, myself and others (<https://www.the-cryosphere.net/13/2303/2019/>), should be mentioned and cited through the text. The authors may also like to consider looking at <https://doi.org/10.1016/j.epsl.2015.01.031> which is highly relevant to parts of the discussion on seasonal thinning/thickening.

2) I find the phrase “correct velocity is reported at the wrong location” (page 3 paragraph 1, used twice) to be rather confusing. The issue is important, valid and usually insurmountable, but the way it is described could be clearer. I suggest something like “...so that the .. true geographic location for the retrieved velocity can be displaced by up to 50m from the selected image location leading to a bias in velocity which depends on the velocity gradient” (I’m sure you can do better).

3) Line 109: adding constant → adding a constant

4) Line 155: “there appear to be few, if any, instances of missed detections”. This seems unnecessarily vague. Either rigid melange was detected (using the proposed method) or it wasn’t - “appear” and “few, if any” make this whole process sound too hit-and-miss (which I don’t believe it is).

5) Line 163: “Melange was particularly sparse”. I think this needs clarifying since up to now the discussion has been about absence/presence and rigid/non-rigid. What do you mean by sparse (time/space)??. Does the Jakobshavn fjord ever really have open water in it?

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6) Line 164: “melange-free”. As above. I don’t think you mean free of melange, but you probably mean free of rigid melange. I suggest that you make the language a bit tighter here, because it is important.

7) Line 194: meter → meters

8) Line 228: Rather than referring to a “closed white contour” (of which there are several in different panels), I recommend labelling exactly the features you are discussing.

9) Line 415: “more than 130m”. This is the first mention of critical cliff heights. I suggest that you refer to a figure here to show that such high cliffs are clearly present in your data.

10) Line 470: “correlate well with . . . AMO”. This seemed to be the first mention of such a comparison, so should be in the results or discussion, not left until the conclusion.

Otherwise, great job!

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-197>, 2019.

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