

Interactive comment on “Melting and fragmentation laws from the evolution of two large southern ocean icebergs” by Nicolas Bouhier et al.

Anonymous Referee #2

Received and published: 20 December 2017

This paper presents an assessment of two different melting model approaches for icebergs during their drift and introduces an empirical fragmentation law developed from observations for the fracturing processes during iceberg drift. In principle, this is an interesting story with potential for improving models of freshwater input into the Southern Ocean by iceberg melting. However, the manuscript needs some work before publishing. A main problem is a lack of structure, which makes the line of thought hard to follow for the reader.

The manuscript contains a lot of different types of observational data, models, model results, so that it might have been better to divide the story into two manuscripts. The introduction is rather long and detailed, but at the same time is lacking a clear line of thought. It should be more concise, and more importantly make the contribution or the

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potential of the presented approach to larger research goals more clear. The rest of the manuscript does not follow the usual methods/ results/ discussions structure. After the introduction a “data” section follows, after which already the results from the ice-berg observations are presented. Then one melt model is introduced, and the results presented, before the second model approach is described. This is not good for the reading flow. My suggestion for a better structure would be to clearly divide the paper in two parts, 1. Melting, 2. Fragmentation, and follow a classic methods/ result / discussion structure in each of the separate parts. The introduction and an additional joint discussion then should make it clear how these parts belong together. In the first part you could have a “methods” chapter where the remote sensing data and their analysis is described, and the two melt approaches as well as the explanation that you are assessing and comparing their performance. Then present the melt results from observations, and the model results. Followed by a discussion of all three results. In a second part the fragmentation model could be explained. In this way the paper could be made more concise and clearer. The summary is too long and repetitive, and contains parts which should be mentioned before in a discussion. In my view it would be necessary to thoroughly rework the structure of the paper in order to communicate the actual value of the study.

Language: There are problems with punctuation, grammar and expressions in some places, which need a revision and maybe a read-through by a native speaker.

Figures: The labels on the axes should appear as the same font size, and should not overlap as in figure 4. I would suggest including a table with the fitting parameters for the fragmentation law, instead of printing the equations into the figure. Where possible I would place the panel labels outside of the main plot area and without a frame.

Specific comments: Title: the title is not an adequate description of the content, as previously established melt models are being assessed, and a new empirical law for fragmentation is presented. Southern Ocean is a name and should be written with capital letters.

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Page 1, line16: “melting accounts for less than 20 % of their mass loss” This is only true for the final stages of decay, as most large tabular icebergs keep their shape quite well during drift. This expression is also a bit misleading, as in the end all mass is lost due to melting, as also the smaller icebergs do melt.

Page 3, line 13: please insert the web-address of the BYU data base as a reference.

Page 5, line 15: insert “Here,” in front of the second sentence to make it clear that now you are talking about your study and no longer about the BYU data.

Page 5, line 37: “Due to lack of a better alternative. . .SST is used”: I understand that the ocean temperature at the base of the iceberg, i.e. in about 300m depth, is not easy to obtain, but it would be necessary to at least discuss this as an error source and get some data from models to estimate the difference possible between the temperature at the surface and at depth.

Page 6, line 9: I think SI units are standard for TC.

Page 7, first paragraph: Something that is completely missing here is the influence of firn compaction or changes in density along drift. This can have a substantial effect on the freeboard of an iceberg, while no mass is lost. This should be explained and an error should be estimated for this. There is also no information about which mean density has been assumed and why. The units in this and the following paragraphs are not displayed correctly in the pdf.

Page 10, line 16: “melt rate”

Page 10, last paragraph: here methods, results and discussion are all mixed up in one single paragraph.

Page 11, line 18: “melt rate”

Page 12, first paragraph: here also all in one paragraph: first discussion and interpretation of results (“highest correlation is obtained for. . .), and only after this a reference

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to the figure where the data is shown. This is confusing to read. First describe the results, then interpret and discuss them

Page 12, line 17-19: This paragraph is unclear, are there words missing? (“volume loss depending”?)

Page 13, first paragraph: As the model is derived by fitting the observations, it should not be a surprise that there is a good correlation. It would have been interesting to discuss the meaning of the fit parameters, and why they are different for the two icebergs. In my view a useful empirical model should be able to reproduce the fragmentation of different icebergs with the same parameters.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-208>, 2017.

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