

Interactive comment on “Antarctic grounding zone characteristics from CryoSat-2” by Geoffrey J. Dawson and Jonathan L. Bamber

Anonymous Referee #4

Received and published: 23 March 2020

In their TCD manuscript “Antarctic grounding zone characteristics from CryoSat-2” Dawson and Bamber employed CryoSat-2 data to map 41% of the main floating ice shelves and outlet glaciers of Antarctica. The used method closely follows the one described by Dawson and Bamber (2017) but uses 7.5 years of Cryosat-2 data and is applied to the whole of Antarctica. In contrast to their previous study the authors estimate the width of the grounding zone by fitting an error function to their CryoSat-2 estimate and compare their results with grounding zone estimates from Sentinel-1 DInSAR.

General remark:

Overall I find the manuscript is well written and interesting to read. I like the way how CryoSat-2 data is employed here as the proposed method is much more sophisticated

C1

than previous break-in-slope assumptions of the grounding line. However, considering the limitations of the method it is difficult to judge where the results are trustworthy and where not. I therefore suggest to include a reliability map which utilizes the combined effect of tidal range and data coverage. This should result in reasonable results at high latitudes – i.e. regions which are only sparsely covered by grounding line estimates from DInSAR due to orbital constraints. To strengthen the study I would also put more emphasizes on the latter point which should be mentioned in the abstract and conclusion. Further, I encountered several flawless mistakes which need to be corrected and are partly listed in the following. Please be consistent with the terms “grounding line” and “grounding zone”.

Specific comments:

Line 18: typo, “thefreely”.

Line 23: include “in” before grounding line location.

Line 26: remove “of”.

Line 27: I presume you mean satellite remote sensing here?

Line 29-31: maybe you could already state here that the term “grounding line” refers to point F throughout the manuscript.

Line 34: what is meant by “entire grounding zone”? Not clear.

Line 111-112: are you really referring to the grounding line (i.e point F) here? Please clarify.

Line 114: I am not sure what is meant by grounding line width? Are you referring to the grounding zone width here?

Line 120: 41% relative to what? Please state which ice shelves and outlet glaciers are defined as “main”, otherwise this number is worthless. Maybe it is more appropriate to state that you were able to map 31% of the grounding zone surrounding Antarctica (at

C2

least according to your Table 1). This also applies for the abstract.

Line 121-122: I think this is a very important point, as these are the critical areas for DInSAR estimates due to orbital constraints. Here only few coherent left looking acquisitions are available from TerraSAR-X and RADARSAT drawing a rather incomplete picture of the grounding zone. Further, break-in-slope estimates are far off due to gentle slopes in the area. It would certainly strengthen the manuscript if more emphasizes would be on this point.

Line 131: maybe you could also cite Gourmelen et al., 2017 here as their study is also based on CryoSat-2.

Line 142: I am wondering why the results are not compared to the ones from Bind-schadler et al., 2011?

Line 181: I am not sure what you mean by grounding line width? Width of the grounding zone? If so, please change here and elsewhere.

Line 201-209: this could potentially be shown in Figure 4.

Line 211: grounding zone?

Line 211: are you sure you are referring to ice thickness here?

Line 220: include "to" before "tides".

Line 224-226: true, therefore I find the section title "Grounding zone structure" a little bit misleading.

Figure 1: which grounding line is shown here? This needs to be cited in the caption as it is certainly not the one derived in this study.

Figure 4: please state in the caption that you were not able to unwrap the fringe belt at the location of profile C.

Figure 5: "Grounding line width, W " has never be mentioned in the text. I am not

C3

really convinced about the information content of this Figure and would rather move it to the appendix. Instead I would include a reliability map into the main manuscript as mentioned in my general remark.

Additional References:

Gourmelen, N., Goldberg, D. N., Snow, K., Henley, S. F., Bingham, R. G., Kimura, S., ... van de Berg, W. J. (2017). channelized melting drives thinning under a rapidly melting Antarctic ice shelf. *Geophysical Research Letters*, 44, 9796– 9804. <https://doi.org/10.1002/2017GL074929>

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-196>, 2019.

C4