The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2019-196-RC2, 2019

The Cryosphere Discussions
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EGU

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

Anonymous Referee #2

Received and published: 26 November 2019

This paper uses Cryosat-2 data to map Antarctic grounding lines and tries to obtain additional information about the structure of the grounding zone. A large part of the paper describes the previous work, mapping methodology and results. This in itself is not novel (in fact it is well described already in Dawson & Bamber, 2017, GRL) and while the results are extended, and reasonable agreement is shown with previous studies, the mapping does not seem to be an improvement over previous maps.

The conclusion that 'this method has the potential to monitor grounding line retreat and change in its structure', while highly valuable if true, is not supported by the results. There is no demonstration of the ability to monitor change in grounding line position or grounding zone structure over the Cryosat-2 period, nor is it clear if the confidence in these results is high enough to establish change over longer periods by comparison

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Discussion paper

with other sensors.

The title suggests the manuscript provides a method to obtain information on other grounding zone characteristics (besides position which is reasonably well known), but there are no substantial conclusions in this area. Is there any statistical significance between deviation from the grounding line width - thickness relationship and the other variables that influence ice response to tides in the grounding zone, such as plan-view curvature (i.e. concave - convex) or strain rate? These 'grounding zone characteristics' could be obtained from the results themselves, or from auxiliary datasets and could lead to interesting findings. The observation of a correlation between grounding zone width and ice thickness in-line with elastic beam theory has been shown before. In fact it is already discussed in a very similar way in Bindschadler et al., 2011.

Whilst the presentation is clear and concise, at present I feel this manuscript does not meet the standard for originality or significance required for publication in The Cryosphere. The main conclusion appears to be that Cryosat-2 tidal grounding line mapping agrees to some extent with previous studies, but does not increase accuracy, coverage or ability to monitor change. If the manuscript could be adapted to include any substantial new conclusions about grounding zone characteristics, structure or temporal or spatial change in position then it could still be a valuable contribution to the journal.

Specific comments:

L18: 'the freely'

L33: you suggest that 'DInSAR and ICESat do not have sufficient spatial or temporal coverage to monitor change across the entire grounding zone', but the method presented here also only maps 41% of the grounding zone. It is not clear what point is trying to be made and it is not clear that Cryosat-2 provides any improvement over these techniques.

L39: How can you ‘characterise’ a stress gradient using tidal flexure information?

L50: This is not correct. Bindschadler et al., 2011 conducted a very similar analysis to yours for the entire continent.

L84: ‘closely follows’ the technique in Dawson & Bamber, 2017 or is the same? If there are minor differences it would help to say what these are, or if there are no differences, say so.

L116: What is the justification for the 10km along track smoothing? Does this modify the positions significantly? What is meant by ‘along track’ in this context?

L138: It seems fairly arbitrary to say you would ‘lose the resolution needed to map the grounding zone accurately’. What does ’accurately’ mean here? How accurately is the grounding zone being mapped with the 2 km cells?

L149: A standard deviation of 1.7 km does not seem low (in comparison to your whole of Antarctica data).

Tab1: I assume ‘M’ means MEaSUREs and ‘E’ means ESA CCI. Please specify in the caption.

L172 / Fig 3: If there is no usable data from cross section C, just leave it out.

L179: Isn’t the 10 km upper limit is self-imposed in the method? If you find grounding zones the full width then perhaps you need to expand the search region?

Fig 5: Bedmap-2

L185: ‘Poisson’s ratio is generally denoted as ‘nu’ not ‘mu’.

L189: Rutford not Rutherford.

L199: An attempt should be made to quantify these factors.

L201-209: This is a valuable analysis. Can this be done for the whole dataset?

L219-222: How does this translate to variation in effective Young's Modulus? Is this factor actually related to change in ice properties or just to change in ability to monitor grounding zone width due to higher amplitude tides? Is there a difference between areas of semi-diurnal and diurnal tides?

L244: Cryosat & DInSAR

L246: If this is the case it needs to be shown in the paper.

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