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Comment

Interactive comment on “The imbalance of glaciers after disintegration of Larsen B ice shelf, Antarctic Peninsula” by H. Rott et al.

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In the full review and interactive discussion the referees and other interested members of the scientific community are asked to take into account all of the following aspects:

1. Does the paper address relevant scientific questions within the scope of TC? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes (data)
3. Are substantial conclusions reached? Yes
4. Are the scientific methods and assumptions valid and clearly outlined? Mostly, yes
5. Are the results sufficient to support the interpretations and conclusions? Yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Mostly, yes
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
8. Does the title clearly

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reflect the contents of the paper? Yes 9. Does the abstract provide a concise and complete summary? Yes 10. Is the overall presentation well structured and clear? For the most part, yes 11. Is the language fluent and precise? Mostly, yes 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Clarified, yes (see below) 14. Are the number and quality of references appropriate? Yes 15. Is the amount and quality of supplementary material appropriate? N/A

General Comments

This is a well conceived study which makes a significant contribution to our knowledge of the response of Antarctic Peninsula glaciers to the loss of their floating ice shelves. Of particular interest is the use of TerraSAR-X data for generation of ice velocity measurements. This sensor collects high spatial resolution data, yet also permits high temporal resolution. Therefore, a notable feature of this work is its analysis of seasonal variations in flow velocity. The authors explain their datasets, methodology and results well, and their stated conclusions are fully supported by their experiments and interpretation. However, I do have some suggestions and corrections which I feel will help to clarify various points in the manuscript and increase the traceability of the work. These comments principally relate to calculation, description and presentation of errors, and to acknowledgment of the limitations of the datasets presented. The points are detailed in full below. Should the authors make the following corrections / revisions I recommend that the manuscript be accepted for publication in The Cryosphere.

Specific Comments

1609.28 / Figure 1: An inset location map might help to orient the reader given that theres not much of a location scale in this figure.

1611.7: You state here that glacier motion was mapped ‘.in the years 2007-2009’. However, I do not see any image pairs from 2007 listed in Table 2, nor any velocity

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data from 2007 within Figures 4, 5, or 7. If there is no data from 2007 then it should say '2008-2009' here and elsewhere in the manuscript (e.g. 1609.4).

1611.8: 'HH' (and any other) acronyms used here for the first time should be fully defined.

1611.9/10: There's a variety of different decimal places quoted in these numbers. Its easier to read (and neater) with the same number of decimal places. 1 is fine for these values (2.1 m, 0.9 m, etc).

1611.13-15: I don't understand this sentence, re-write (particularly the '..size of 48 x 48 pixels after 2 x 2 looks pre-filtering..' part. What does this mean?

1611.19: If the matching output is corrected for terrain distortion, presumably this requires a DEM? Detail how (and with which DEM) this was done.

1611.23: '..subsidence rate..' seems a strange phrase when talking about ice surface elevation change. Why not 'thinning'?

1611.27: The units 'm/yr' are used here whereas elsewhere in the manuscript you use m a-1. Choose one and be consistent throughout (I prefer m a-1).

1612.15 / Figure 2 / Table 2: Figure 2 specifies flux gates H1 and G1, however there is no gate labelled G1 in Table 2. Either change Figure 2 to H1 and H2, or Table 2 to H1 and G1. Also Table 2 lists a gate 'PU1' which isn't labelled in any of the figures. Include this label where appropriate in Figure 1, 2 or 3.

1612.17 (and elsewhere): You mention for the first time here a drainage basin area. None of these areas are delineated in the figure images. It would be useful for the reader to be able to see the extent of your defined drainage basins. Also, explain in the text how you delineated these basins. Outlines could easily be added to Figure 1.

1613.22 / Figures 4, 5, 7: I find the figure caption a little difficult to read as you've ordered the velocity profiles by date but not alphabetically by letter. It would be better

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to order them by date, and alphabetically, so that a) is 1995, b) 1999, c-f) later dates of TerraSAR-X data.

Figure 5 and 7: Velocity profile labels (a to f) should be defined in the captions of each of these figures (unless the figures will be directly next to each other).

1614.3: Strictly speaking this isn't '..InSAR data of 1995 to 1999..', but InSAR data from 1995 and 1999. Change.

1614.12: Figure 4 appears to show that the April 2009 velocity affected the lower 7-8 km of the glacier, rather than just the lower 4 km? Does this affect your conclusion that stresses at the terminus are more important than basal sliding? Perhaps mention that the velocity increase is greatest at the terminus and reduces further upstream (to ~7-8 km).

1614.15-20: How do these images provide evidence for such change? I do not understand this paragraph. If it cannot be clearly explained then remove the paragraph, and figure 6.

1614.25: What does 'orographically left' mean? Given that this glacier is roughly east-west oriented, how about the 'northern' or 'southern' margin?

1615.8: Again 'cm d-1' rather than '/d' as before. Make sure these units are consistent throughout.

1616.7: Again, I don't think 3 decimal places are required here. I would say that 2 is plenty. This also applies to Table 2 which would read a bit easier with 2 rather than 3 decimal places for the discharge measurements.

1616.10: As far as I can tell there is no way of knowing how you derived an uncertainty of 15% for your flux gate cross-sectional area. This seems to be the largest error source in your mass budget calculations and therefore needs to be explained fully. From an earlier paragraph you have assumed a trapezoidal cross-section using just one point measurement of ice thickness (and compared this to a fully v-shaped cross section).

Perhaps you should detail the equation used to generate this cross-section. Please describe exactly how you calculated the 15% uncertainty for your cross-sectional area.

1616:14-17: Field measurements of accumulation may not exist close to these drainage basins, but maps of accumulation do, from interpolation of field measurements forced with passive microwave data (Arthern et al., 2006 JGR, doi:10.1029/2004JD005667), and RACMO regional climate model output (van den Berg et al., 2006 JGR, doi:10.1029/2005JD006495). Would your estimates of accumulation be any different using these datasets (which are readily available)?

1616.28 / Figure 4: e) and f) InSAR velocity profiles appear to be truncated at the edges (marked by dotted lines). This isn't mentioned in the main text or the figure caption. Perhaps it should be explained what this means, if these data are extrapolated, and if so, how?

1617.5 / Table 2: Reduce to two decimal places. Also, include all error bounds in the discharge column of Table 2 (including discharge change / mass imbalance).

1617.20: Perhaps worth mentioning here that velocity increases are sustained along the length of the profile for which you have measurements, and therefore are likely to continue for some distance upstream. How long is the glacier? How much of the glacier does your 25 km of data cover?

1618.17-18: Again, these mapped glacier areas would be useful to see, perhaps in Figure 1?

1649.11 / Table 2: As the other Larsen B glaciers than Crane have no known ice thicknesses, and their accumulation has been assumed the same (or -20%) of Crane, then it is essential that the derivation of their mass budget errors are well described in the paper. The total uncertainty of each individual discharge measurement (and change) should also be included in Table 2.

1619.13: The cross-section area uncertainty for glaciers other than Crane is given as

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30% (twice that of Crane). Again, it is unclear where this value comes from and how it was derived. Please explain.

1620.25 Two paragraphs starting here: it seems strange to introduce these new results (from Larsen A and PGC outlet glaciers) in the conclusions section. Shouldn't these be introduced in the discussion section, i.e. before the conclusions?

Technical / Textual Corrections

1609.5: ‘..draining into Larsen B...’ 1609.6/7 and .14: earliest references first (e.g. 2004 before 2008) 1609.23: ‘Between June 2007 - January 2010..’ 1609.25: ‘..dataset..’ 1609.26: ‘..draining into the Larsen A and Larsen B embayments..’ 1609.27: ‘..focus on..’ 1610.11: ‘Database..’ 1612.13: ‘We select gates..’ Here and elsewhere, use past rather than present tense? 1613.8: ‘Paterson’ 1620.14: ‘..basal shear stress..’?

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