

Manuscript: Evolution of ice-shelf channels in Antarctic ice shelves

Response to reviewer's comment RC C356

Thank you for your constructive comments which helped to improve the current version of the manuscript, particularly by making it more accessible for readers. Virtually all of the proposed points have been implemented in the revised version. Attached is a point-by-point response. Reviewer's comments are marked italic, responses are marked in bold. In the revised manuscript changes are marked in bold.

Reinhard Drews,
Laboratoire de Glaciologie,
Université Libre de Bruxelles,
Brussels Belgium

The paper presents results from observations and modelling of ice shelf channels, which is a topic of interest to a number of communities. I echo the sentiments of previous reviewers that the results aren't hugely original, but there is merit to the approach which utilises both field observations and modelling. The paper could be improved by making it slightly easier for the reader to compare the field and modelling results - especially by making Fig. 4 more user-friendly. A couple of extra references should be included, firstly the discussion of stabilisation of ice shelves (p1605) should include Khazander et al. (2009). The reader would also benefit from a short description of the role of plumes in forming the channels, and the suggested cause of basal accretion in filling in the channel downstream of the melting. The author assumes a large amount of contextual knowledge in some of the statements (e.g. p1615, line 7). Jenkins (2011) should be included in this description, and also on p1611, line 16: ". . .following the suggestions of Jenkins (2011) and Le Brocq et al. (2013)."

Ok, implemented. The figures have been revised (see new Figures 4-7) and the suggested references are included (plus some additional ones) in section 1. The basis of the plume model has been inserted in the revised version of section 1.

The purpose of the 5 experiments aren't well described – the reason for them becomes clear later, but a description at the end of page 1611 before the results section would help. Figure 4 could be greatly improved to help the comparison of the field & modelling evidence. Fig 4b and 4f are the comparison between the modelling result and the field evidence, and as such, they should be presented in as similar a way as possible. Show either lower surface OR ice thickness in both plots, at the moment it is very hard to compare. Also the effective meaning of the blue and red lines are switched in the two plots. Further, the inconsistent scaling of the x-axis makes it very hard to compare channel widths.

Ok, implemented. The different experiments are now better motivated at the end of section 2.4. Figures 4—7 have been revised, also in-line with comments of Reviewer 1.

Further, the discrepancy of hydrostatic thickness and radar thickness in "non-channel" ice shelf in Fig 4f suggests that you could improve the values/parameters which you use to derive hydrostatic thickness – this would make it easier to see when a channel isn't in hydrostatic equilibrium. At first I wasn't sure why you needed the non-channel part of the radargram, but it does help to see what the discrepancy is in non-channel areas. A section on how the model could be extended to answer more complex questions to do with the "evolution" of the channels would also be useful. The paper has looked at fairly basic scenarios, more complex scenarios such as why the channels "meander" across the overall ice shelf flow direction would be an interesting question for example.

Ok. Using 918 kg m⁻³ instead of 900 kg m⁻³ (also see comment of Reviewer 1) removed the unphysical negativ bias between hydrostatic- and radar-thickness. Section 4 has been revised, it now includes an outlook at the end on how the model and the observations can be further extended.

p1617, line 12: should this be "local maximum of the effective" rather than "off"?
Ok corrected.

P1618, line 17: should be trough rather than through?
Ok corrected.