

## ***Interactive comment on “Longitudinal surface structures (flowstripes) on Antarctic glaciers” by N. F. Glasser and G. H. Gudmundsson***

**Anonymous Referee #2**

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This paper introduces longitudinal surface structure maps for a small number of ice streams and isolated valley glaciers in four regions of Antarctica. The paper presents hand digitized maps of flow stripes from a series of Landsat and Terra Aster images. After a rather convoluted introduction the maps are presented in turn before key observations are presented.

The lines drawn on the maps show, in places, dendritic like patterns of flow convergence, with in other areas significant flow divergence and widening stripes. It is not possible to indicate exactly where these occur as there are no lat/long coordinates on any of the maps and images. However, the patterns shown are more complex than the text suggests, casting some doubt on the observations.

I am surprised that manually digitizing these stripes is either the quickest or most accurate way to make interpretations. Is there no pattern recognition software that would allow this to be done, quickly, easily and without human interpretation? Such an approach would also allow quantification of stripe widths and lengths.

I am also surprised that no modelling is presented. The 2nd author has conducted more rigorous modelling studies of similar features. The models presented are simple cartoons.

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Specific comments:

Page 3086, Line 25-27: be specific about the glaciers – you name the Lambert Glacier but not the Ferrar.

Page 3087, Line 1-6: This is somewhat strange to read – the material is repetitious of the abstract and somewhat out of place.

Page 3087, Line 21-22: Sentence lacks context and detail.

Page 3087, Line 27: This discussion of possible cause seems out of place. The previous part of the paragraph does not state that these structures form in any particular way.

Page 3087, Line 28: Why not use the continuum mechanics phrase?

Page 3088, Line 6: This line starts the discussion of cause/explanation – move comments in paragraph above down to here.

Page 3088, Line 4-16: This section seems under-developed. More needs to be made of current theories of formation.

Page 3088, Line 17: Back to description here, before causal discussion at the end of the paragraph.

Page 3089, Line 2-21: Back to explanation here with a summary of the theories put forward earlier in the introduction.

Page 3089, Line 6-7: This could be interpreted in many ways – to suggest folding as the only mechanism goes against the discussion of the ‘streakline’ from earlier in the introduction. I do not believe that the assertion of folding is warranted or substantiated in this context.

Overall the introductory paragraphs are poorly constructed. There is a feeling that they are rushed and not really ready for submission. The authors should revisit them and order them so that description and possible process are in separate paragraphs and follow logically from each other.

Page 3090, from Line 11: Again, structural comments – why are we getting a description of field sites mixed in with the results?

Page 3090, Line 18-20: There is a discussion of shadows here. What is the sun angle and sun direction on the images? The lines on the maps do not run at a consistent angle, so the amount of shadow is not a good indication of vertical dimension. Do the authors have 2 or more images of the same area with different sun angles and elevations to explore shadowing further? The authors may end up mapping a very different set of features if different sun angles highlight different features.

Page 3090, Line 21: All elevations need to be better justified. The authors do not present a DEM so these numbers are not well justified or field truthed.

Page 3092, Line 4: Remove word ubiquitous – you present a limited sample of glaciers and ice streams here.

Page 3092, Line 9: Define what is meant by a hierarchical network.

Page 3092, Line 14-16: There is a discussion regarding flow stripe preservation through ice falls. Do the crevasses extend through the ice thickness (a true ice fall) or is this just a zone of extensional flow with crevassing in the surface ice. If the former I might expect horizontal displacement between ice blocks, so the potential for flow stripe blocks to be offset and upon compression incorporated into other flow stripes.

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Such conditions would not meet the criteria for streaklines.

Page 3093, Line 5: No evidence at the scale of the imagery presented (with 15 m grid cells).

Page 3093, Line 21: Remove ‘it is clear that’. Also why not show this – there must be velocity data available for many of the glaciers and ice streams here. SAR imagery would indicate broad compressional/extensional regimes of flow.

Page 3094, Line 9-11: There is some contradiction here with the folding mechanism proposed in the introduction. I am more convinced by this argument than the folding one.

Page 3095, Line 20-30: This is introductory material that should be in the causal mechanisms section of the introduction.

Table 1 is largely in the introduction – I am not convinced it is required here.

Table 2 is redundant. The two x’s could be explained in a short line of text.

The most disappointing aspect of this paper is that little is inferred about any changes in the causal mechanisms that might be inferred from the data. If velocity changes through time then patterns and structure might be expected to change. Are any changes detected that cannot be easily explained? These stripes are a palaeo record of flow. It is likely that in order to explore this and make full use of the study a more rigorous way of pattern recognizing the stripes would be required to quantify the process.

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Interactive comment on The Cryosphere Discuss., 5, 3085, 2011.

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