



January 27th, 2015

RE: Response to the P. O'Brian referee interactive comments

In response to the referee's comment, we provide a point-by-point response, summarizing how we have addressed the concerns. We wish to thank P. O'Brian for his insightful and constructive review. We hope that our replies are considered satisfactory.

Yours sincerely,

Caroline Lavoie and Eugene Domack on behalf of the contributing authors

Reviewer's comments:

There are several points of discussion that should be considered: Page 6 Lines 22-24. The authors assume that the flow lines and the lineations on hard substrates are LGM or older. It would be good for there to be some discussion given to potential changes in flow during deglaciation or inheritance of older features. E.g. Was deglaciation so rapid that the ice pattern of features most likely reflects LGM flows? You are right when pointed out the importance to assume that the flow lines and the lineations on hard substrates are LGM or older. We added text to be more specific 'While it is possible that the preserved flow line features we examine are representative of the "death mask" state of the APIS (i.e., Wellner et al., 2006) rather than the mature LGM stage of the system, we suggest that this in general is not the case. We base our assertion upon specific observations and assumptions that include:

- only slight modification of flow trajectory as preserved along recessional grounding zones (i.e. Evans et al., 2005; Fig. 7, pg. 752), and such flow relationships are easily resolved;
- clear association of converging flow paths from areas that would have provided divergent flow during stages of retreat (i.e. as from shelf domes, see below);
- a general shelf slope that does not, except very locally, provide significant reversal in relief to have influenced evolving flow paths as ice would have thinned (drawn-down) and receded toward the coast.

Major reorganizations of flow during an ice mass recession are well documented from the southern margins of the Laurentide Ice Sheet and elsewhere. But these nearly-90 degree reorientations are when a large ice mass is thinning across major mountains and valleys, such as the SE margin of the Laurentide across the Adirondack Mtns. and Mohawk Valley. The general relief of the continental shelf does not provide the same character of topography that would have allowed such major flow reorientations. This is because the major source of ice was the AP whose elevation and proximity did not provide a low profile ice sheet derived from distant sources and subject to changes in emergent relief (as was the case for the large ice sheets of the past). We do recognize that some flow lines may be altered slightly and we have pointed out in the literature where this might be the case. We also recognize that



overprinting can take place, but we see no major evidence for this in our data. Rather it seems the “death mask” of the system was pretty much representative of the mature or vital extent and character of the APIS. We feel that this has to be the working hypothesis until good 3-D seismic is available over vast areas—something which might be a long way off in the future.

Figure 6: The figure shows NE flow along Bransfield Strait then major divergence of flow to the Powell Basin and between King George and Elephant Island yet still major palaeoflow lines continue NE well past Elephant Island. This looks strange to me. Given the bathymetry, would it not be more likely that there was a small ice dome on Elephant Island? To have definite flow direction as shown there must be some evidence from the sea floor though the area is off the NE corner of figures 1 and 5. It doesn't detract from the main part thrust of the paper but it would be good to tidy up this end of the region. We also believe that it is likely that there was a small accumulation center on Elephant Island providing a plug to the NE flowing Bransfield Ice Shelf system. The text and Fig. 6 have been clarified. On the figure we deleted the flow line NE past Elephant Island to avoid any confusion.

Presentation: The descriptions and arguments rely heavily on place names in the Antarctic Peninsula. Therefore, all place names need to be present on figures and large enough to be read easily. As someone who has never worked in the Peninsula, I regularly found myself lost in the geography, making it harder to evaluate details of the discussion: We agree and to answer your comment, we reviewed the text carefully to add the place names missing (Biscoe Trough, Trinity Peninsula, Maxwell and Admiralty fjords, Lafond, Laclavere and Mott Snowfield troughs, Hugo Island Trough) and put the labelling larger in Figures 1, 2, 6 and 7 adding 2 pt (size).

The paper is quite well written but has some minor issues in places, particularly in clarity of expression. I list them below.

Page 9, Line 7: “more a more” needs rewording: The text has been modified... By using a more detailed analysis...

What do you mean by flow indices? Do you mean flow indicators? Indices would suggest a derived numerical parameter of some sort. Indices is plural of index, not indicators. Yes, we mean flow indicators. The text has been modified..... of flow indicators available..... Also Page 10, Line 2.

Page 9, Line 14: “an indistinct tributary confluence” I'm not really sure what this means, even after looking closely at the maps. We mean fed by small tributary confluence not clearly identifiable today. The text has been modified..... and was probably fed by small tributary confluence.

Page 9, line 27: do you mean “offshore of”? Yes, the text has been modified.

Page 10, Line 2: What are marine flow indices? Do you mean flow indicators in which case you are saying flow of marine currents? Alternatively, do you mean ice flow indicators further offshore (delete “marine”). Yes, we mean flow indicators. The text has been modified..... that parallel flow indicators found directly further offshore.



Page 10, line 6: What does “and inward the shipboard surveys” mean? Do you mean “adjacent to the areas surveyed by ship”? No, our mistake. We rephrased for Recent seismic reflection soundings close to the northern ice shelf front and inward show a uniform....

Page 10, Line 11: Do you mean “the evidence is for the establishment: : :”? Yes, the text has been modified.

Page 11, Line 1: Should not this be in past tense? Do you mean Crossed rather than crosses? “May only have” rather than “may only be”: : :?” Yes, the text has been modified.

Page 11, Line 23: What do you mean by “fans”? This the first a fan has been mentioned. What sort of fan? Alluvial, submarine????? Please explain. We mean trough-mouth fans (grounding zone fans) (see Simms et al. 2011). The text has been modified.... surface of the grounding zone fans (i.e. mouths of both Maxwell and Admiralty fjords)....

Page 12, line 7: “structure 100 km long” is correct, delete “of”. The text has been modified.

Page 15, line 22: “flows into the northern outlet glaciers: : :.” The text has been modified.

Page 15, line 24: “a topographic obstacle about 400 m high”: : :Don’t need “of”. The text has been modified.

Page 17, line 5: “conditions change: : :” The text has been modified.

The reviewed version of the paper will be closely read for the Grammar (also suggested by Dr. Bentley).