

## **Review of ‘Repeated ice streaming on the northwest Greenland shelf since the onset of the Middle Pleistocene Transition’ by Newton et al.**

I thank the authors for addressing the major scientific issues raised by the reviewers. I find the scientific content of the article to be robust, but a number of details need to be clarified before the article can be accepted for publication. These are outlined below, note that a couple relate to points that were not fully addressed from the original review.

Kind regards,

Pippa Whitehouse  
Associate Editor, The Cryosphere

### Points not addressed from initial review

1. Please check all instances of ‘this’ and ‘these’ – it is not always clear what you are referring to. For example, line 40: ‘these studies’ (a number of studies are mentioned, but only at the end of the sentence); line 50: ‘these long-term changes’; line 180: ‘these new data’.
2. Use of brackets interrupts the text in a number of places. One example is the opening paragraph of section 2, but there are examples elsewhere.

### Points in the main text

Line 19-20: ‘ice streams continued to be active and extensive on the shelf during glacial stages’ – statement is rather vague, largely because it is not clear when the ice streams were first active

Line 20: here and elsewhere, please try to clarify that you are referring to the ‘continental shelf’ – many readers of The Cryosphere also think about ice shelves, so it is good to be clear

Line 27: temperature is not the only driver of ice sheet change; the Knutz et al. (2019) article does not make any reference to temperature as a driver of change

Line 28: word missing – ‘the future evolution...’

Line 30: the statement about needing to understand how the GrIS ‘responded to warming’ does not provide motivation for any of the research presented here, it is not relevant to this article

Line 53: ‘the mid and upper-slope’ – of what?

Line 57: ‘a number of glacial advances’ – statement is rather vague, see also lines 183-184, 271, 273

Line 76: suggest ‘show the ice stream reached’ -> ‘show that fast-flowing ice reached’ – in the original version it is ambiguous what ice stream you are referring to

Line 83: suggest ‘accumulation’ -> ‘sediment accumulation’

Line 100: ‘seafloors’ -> ‘seafloor’

Line 111: ‘the sets of MSGL’ – the landforms on the buried palaeo-seafloor surfaces are not yet identified as MSGL, this methods section just talks about identifying ‘glacial landforms’

Line 131: perhaps quote the bearing of MSGL set 1, given that you do for all other sets

Line 137: ‘The MSGL...’ – make it clear you are still talking about MSGL set 2

Line 138-139: ‘MSGL sets 3 and 4 lie in the topset strata of unit A9’ – clarify that MSGL sets 3 and 4 are located on separate surfaces, i.e. that they reflect separate glacial advances

Lines 153-154: the seismic profile in which MSGL set 5 is identified is orientated very close to the direction of the mapped MSGLs (fig. 6); perhaps comment on how this influences your ability to identify MSGL set 5 in the 2D data

Line 159: include a reference to figure 6 to help the reader identify the location of MSGL set 6

Lines 177-178: line 121 states that buried MSGLs have been observed on other margins. If some of these buried MSGLs are thought to pre-date the LGM then it would seem appropriate to clarify that the statement on line 177-178 specifically relates to the Greenland margin

Line 191-192: 'changes in depocentre migration and MSGL orientation, such as presented here, may have forced modifications in ice sheet flow...' – statement does not really make sense, how can a change in MSGL orientation force a modification in ice sheet flow? The later part of the sentence talks about accommodation space, but the logic of the early part is muddled.

Line 201-202: refer to figure 5b?

Line 206: refer to figure 6

Line 218: 'This northward' -> 'The northward'

Line 221: check use of 'subsequent' here, replace with 'successive' ?

Line 225: 'the Melville Bugt Ridge' – please label this feature on a figure

Line 227-228: please provide a brief explanation (or a reference) to support the statement that an increase in water depth would reduce erosion of the topsets

Line 242: 'IRD' – please define acronym

Line 246: suggest 'As' -> 'While' or 'Although'

Lines 259-262: I could not find any evidence in Willeit et al. (2019) to support the statement 'recent modelling ... (Willeit et al., 2019) suggests multiple ice sheet reconstructions that do not capture the ice sheet extent that has been inferred from buried landform records on many glaciated margins (e.g. Rea et al., 2018), including Melville Bugt.' Please justify this statement in your rebuttal. There is no need to edit the manuscript, but I am keen to check that this criticism of previous work is robust.

Line 270: 'anywhere' does not make sense in its current position; edit or delete

## Figures

Figure 2 caption states that units A7-A9 likely cover the middle Pleistocene (781-126 ka) and the transition into it at 1.3 Ma, but this disagrees with information on lines 131, 133, 139 and figure 6d

Figure 3b: what is the purpose of the white dashes next to the unit labels? Do the red lines identify the upper or lower boundary of each sediment unit? Caption to this figure refers to a cross-section and a profile – try to use consistent terminology

Figure 4 caption: 'Orange arrows...' – make it clear you are now talking about panels (d) to (f). Please identify which set of MSGL are shown in panels (d) to (f) and in which unit each of these palaeo-surfaces is located (reference to figure 6 may be useful). Please explicitly state what the contoured shapes represent in panels (a) to (c).

Figure 5b does not seem to be related to figure 5a. It is most closely related to the text on ice stream migration in section 5; suggest separating figure 5b and moving it to after figure 6.

Figure 6 caption: make it clear that the 'LGM record' is the same as MSGL set 6. Note that there is no compass bearing for MSGL set 5.

In general, use of outlined text in figures is difficult to read, especially for smaller figures. Please try to improve image quality where necessary.