

Dear Authors,

thank you for another revision of this manuscript. Fortunately, we now have a positive review that suggests publication with minor revisions. I concur with this assessment and added some additional remarks which you should address prior to typesetting. This paper has had an usually long review history, but I believe in the end this has improved the paper to the degree required. I hope you feel the same way in spite of all the criticism that was raised.

We can now essentially move on with publishing this paper in The Cryosphere. Congratulations!
-- Reinhard Drews

Many thanks for all of your work to help with this manuscript. We have addressed the comments below as indicated by our responses in italics.

I 18 missing comma "ice shelf draft, the cause and ..."

Addressed

I 24 "The combination of thinner ice" this is a long sentence which I found hard to digest. Split in two sentences? Also, can you find a better word than "complex" strain rates and "complex" morphology? I believe in terms of morphology you mean that it is "spatially variable on sub-kilometer scales". In terms of strain rates, do you refer to the "along-flow banding" seen in Fig 4b? I don't think I found the best words either, but "complex" by itself doesn't really contain useful information.

We have changed the sentence to say:

"Enhanced melt rates near the ice shelf terminus and in steep regions of the channelized suture zone, along with relatively thin ice in the suture zone, appear to represent vulnerable areas in the NIS. This morphology, combined with ice dynamics, induce strain that has led to the formation of transverse fractures within the suture zone, resulting in large-scale calving events."

We have also removed/replaced the word 'complex' in all instances in the abstract.

I 55 "thinning rates .."

Addressed

I 62 to you mean "topography" or "thickness"? My guess is the latter.

Following the comment from the reviewer we have changed to: "how does basal morphology relate to surface topography and influence the distribution of marine and meteoric ice?"

I 99 "bed reflection" do you mean "reflection from the ice-ocean interface" or "ice base". Bed suggests sediments/bedrock to me.

Good point – we have changed to 'ice base'

I 144 "demonstrate consistency" what does the "I" do in there ?

Addressed

I 201 I don't think "if" is the right wording but "how".

Addressed

I 205 "horizontal compression" --> "transverse compression" to be consistent with what is described in the legend of Fig. 4.

Addressed

eq (3) make sure that that the divergence is adequately done in typesetting. Currently it is not.

We will make sure this is correct in the final version – it looks fine in our word version.

I 263 "from horizontal" incomplete sentence

Changed to 'horizontal flow'

Please check the possibility of one column vs. two column Figures. Some Figs (e.g. Fig 3,7) are somehow in-between both options.

All figures are now sized correctly for 1 vs. 2 columns (3,6 and 7 are now 1 column for example).

REVIEWER 1

The authors describe and interpret new ice thickness transects from the Nansen Ice Shelf in combination with satellite datasets and oceanographic glider data to infer the quality of satellite-derived estimates of thickness. They estimate the distribution of basal melting and comment on the origin and evolution of basal fractures on the ice shelf.

The paper is clearly structured and interpretations are largely supported by the data. Parts of the abstract are difficult to follow, but in general I would recommend publication subject to some minor, largely typographical corrections, listed below:

Thank you for your review. We have addressed your comments as shown below.

Line 15: "...ability of the ice shelf to buttress..."

Addressed

Line 18: "...variations in ice shelf draft, the cause and effect..."

Addressed

Line 19: The phrase "near the onset of floating ice convergence in the suture zone" is slightly confusing. Does this mean at the grounding line? I suggest a rephrase.

Addressed: "We find that the Nansen Ice Shelf has a highly variable basal morphology driven primarily by the formation of basal fractures near the onset of the ice shelf suture zone".

Line 23: This sentence implies vertical variability in thickness, which doesn't make sense.

We have removed this reference to vertical variability.

Line 33: I would use "under" instead of "undergoing"

Addressed

Line 42: "...(e.g. the Global Land Ice...)"

Addressed

Line 50: Consider splitting into two sentences.

We have now split the sentence.

Line 61: The research questions listed here are quite vague. In particular 'What morphology does the ice shelf have' is somewhat unscientific. I would suggest rewording to something like 'how does basal morphology relate to surface topography and influence the distribution of marine and meteoric ice'

We have changed as suggested

Line 79: "...a supraglacial river..."

Addressed

Line 85: "...winds, which also strip the NIS..."

Addressed

Fig 1c: The fact that all sites are coloured the same colour slightly confusing, but I admit this may be a bit picky.

We have kept as the same colour because of difficulty differentiating the colours on the satellite image if we changed them (plus problems fitting it all into the legend)

Fig 2: I would avoid using black lines to denote both the transects and the fracture.

We have changed the color of the fracture.

Line 144: "...demonstrate consistency..."

Addressed

Fig 4: The blue-red colour scale here seems backwards to me (red normally implies positive values?), although this is clearly just a personal preference as there are other examples where red is negative.

It's fairly standard to have red as compression even though we agree it's a bit counter intuitive, but we have retained as is to stay with convention.

Line 259: Given that these cited surface ablation measurements are used extensively for calculation of basal melt, it would be valuable to discuss a bit about the potential uncertainty and what this would do to your overall conclusions.

We have added in the following: "good correspondence between the estimated cumulative thinning rate and the measured thinning, particularly at the northern margin of the suture zone, suggesting this higher surface ablation rate is the more accurate estimate when averaged over time." Since we use two different estimates and plot the outputs in Figure 6 we think this demonstrates the uncertainty in surface ablation relative to the basal melt rates and strain thinning. Compared with our radar thickness change and other calculations, the higher ablation rate appears fairly accurate over time. Without past data on ablation rates its not possible to be more exact within the framework of this manuscript.

Line 271 & 246: The time to travel between sites is inconsistent between these two lines.

We have corrected the second time to the more accurate one of 123 years.

Line 284: "Thickness change due to strain thinning reaches a maximum of 13 m between Site 1 and Site 3."

Addressed

Line 302: I would split this sentence for readability.

Addressed

Line 504: "Here, the limited width of the..."

Addressed

Fig C1 caption: "(d) Temperature profiles from the..."

Addressed