

Review of ‘The demise of the world’s largest piedmont glacier: a probabilistic forecast’ by Brinkerhoff et al.

General Comments

This manuscript is interesting, novel, and well written. It includes interesting experiments related to the probable future development of Sít’ Tlein which are of interest to the cryospheric community.

However, I have several comments which I believe could help improve the manuscript:

1. How does the methodology used here impact results?

The method used in this manuscript is novel and certainly interesting/useful, but in L880 you state ‘The inclusion of time-dependent inference and uncertainty quantification is not without cost, and both of these factors lead to significantly increased computational expense relative to a time-static and deterministic inversion’. It is hard to ascertain from the manuscript whether the additional computational cost leads to a significant difference in results. It would be great if there was more explicit discussion of why and when your methodology is the best choice, or if the same future scenarios could be run from a ‘traditional’ initial state to allow for a comparison to be made. Without this, it is hard to fully assess the use of the methodology.

2. Some moving around of material may be beneficial for readability

The manuscript is long, which I realise is somewhat necessary to fully explain the methodology. However, it sometimes felt like I was swapping between two manuscripts; one on model development, and one on the future of Sít’ Tlein. It could be beneficial to move some of the material around so that the manuscript first introduces the new methodology, how it is implemented, and how it constitutes a methodological advance. Then, the case of Sít’ Tlein could be presented to demonstrate the use of the methodology (ideally with a comparison to experiments described in point 1). I think this is already the approach you have gone for, but could be more robustly applied.

Minor and technical comments

Fig.1 – Panel c appears to be missing but is referenced in the caption

L38 – Why 2344?

L108: Can you please describe your motivation for choosing a Budd law

L126: So only one vertical layer in the model?

L140: What other mesh resolutions did you try

Fig. 3 – Same colour scale for b and d? Although I realise this may make the data too difficult to see. . .

L590: Linear increase in mean air temperatures – what is the justification for this linear increase? How does this compare to e.g. different SSPs for the future?

Fig.4 : The caption refers to panels a,b and c – but this notation is not shown in the figure.

L684: Maybe it comes later, but it is interesting that there is a limited qualitative

difference between scenarios in 2073 – it would be interesting to discuss this further (e.g. how much warmer/more negative is the projected vs fixed SMB at this time point?)

Sect. 7.1.2 and 7.1.3: Have any SMB fields generated via other methods (e.g. RACMO/MAR, PDD model) been created for this region? It would be interesting to have a visual comparison

L793: I think this is a really interesting point (that you have found SMB to be the driver of retreat, but that climate forcing alone may not explain its retreat as it has behaved asynchronously to neighbouring glaciers) - maybe you can expand a bit more on this

Sect. 7.3.1 to 7.3.4 – These subsections contain very little discussion, and are more of a description of previous modelling efforts. Whilst I see that the discussion comes in sect 7.3.5, it would be beneficial to weave in discussion points alongside the description of past efforts (or move these sections to e.g. after the introduction as a background on the methods applied/developed by you?)

L874: Should this be in methods?

L880: To assess whether this computational expense is 'worth it', we ideally need to see an example of the same forward experiments run with a traditional approach

L895: It feels odd that this section comes after the discussion on model developments, when other discussion sections relating more specifically to Sít' Tlein come earlier

L910-913: Interesting!