The Cryosphere Discussions

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Reply on RC1

Dominic A. Hodgson et al.

Author comment on "Drainage and refill of an Antarctic Peninsula subglacial lake reveal an active subglacial hydrological network" by Dominic A. Hodgson et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-144-AC1, 2022

Thank you for this constructive review, and for highlighting the additional refences, which will help strengthen our paper.

1. Constraining/ inferring rapid subglacial lake drainage.

We are fortunate that the prepublication version of our paper in The Cryosphere prompted a colleague (a UK glaciologist) to examine their photographic archives of overflights of the Mars Glacier. As a result, we now have an image of the site in January 2011 which shows not only the earliest record of collapse, but also surface deformation of the downstream ice revealing the path of the subglacial drainage channel. This latter feature was subsequently infilled by snow and it not visible in later imagery. This photograph also helps address the comment on L191.

The photograph shows the ice cliffs in the process of collapse into the subglacial cavity due to loss of hydraulic support and will be included into the revised version of the paper.

We could not find earlier Landsat images of sufficient resolution to aid our interpretations.

We have compared the feature to that described by Boronina et al 2021; in that example ‘the collapse of the overlying ice was caused by drainage of supraglacial water and nearby epiglacial lakes into an englacial cavity in 2017 causing its overfill and outburst’ (lines 235-237).

2. Supraglacial meltwater inputs.

We have no data to separate meltwater inputs from the catchment, glacier surface, seepage through porous firn or a linked cavity network. However, the statement that ‘1.18 m increase in the surface elevation between 22nd and 30th December 2019 substantially exceeds the overall infill trend, confirming the seasonality of meltwater inputs, and coincides with the 32-year record-high surface melt in 2019/2020 recorded on the northern George VI Ice Shelf’ (lines 205-207), suggests that surface melt is likely dominant. We have added this to the revised version.

The Liang paper, and the Willis (2015) paper that it cites both provide useful analogues from Greenland which we will incorporate into the discussion.

3. Lake drainage trigger?

Yes – this is possible. We will include it in the revised text.

4. Wider implications.

As suggested, we will rewrite this section with a greater emphasis on surface meltwater getting to the bed of the ice sheet and influencing subglacial hydrological processes. We will also address the comment on Line 255 to better characterise the role of surface melt vs. ocean forcing.

All other minor observations addressed.