The Cryosphere Discussions

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Comment on tc-2022-144: "Drainage and refill of an Antarctic Peninsula subglacial lake reveals an active subglacial hydrological network" by Hodgson et al.

Anonymous Referee #2

Referee 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-RC2, 2022

In their TCD manuscript "Drainage and refill of an Antarctic Peninsula subglacial lake reveals an active subglacial hydrological network" Hodgson et al. combine airborne LiDAR data with time stamped elevation data of the Reference Model of Antarctica (REMA) to investigate surface elevation changes over a potential subglacial lake location on the Antarctic Peninsula. The authors further employ airborne accumulation radar data to investigate the structure of the subglacial bed in the study region. With the help of additional remote sensing data, they broaden the study to other potential subglacial lake locations on the Antarctic Peninsula and discuss their results in a wider context. The paper is interesting to read and presents some new findings about subglacial lakes on the Antarctic Peninsula. In the following, I have two general remarks and a couple of specific comments. However, overall I think this is a nice contribution that is worth to be published after some revisions have been made.

General remarks:

1) Are there any accessible datasets which could be used to investigate the actual lake drainage prior to 2013? Here I am thinking of ICESat-1 data (you need to be lucky), the Antarctic Peninsula DEM derived from ASTER data or any Landsat-7 or ASTER acquisitions? This would certainly strengthen the study.

2) The Authors state that a southerly shift of subglacial lake appearance can be related to a changing glacier regime on the Antarctic Peninsula. This might be true, however, how can the Authors be sure that no subglacial lakes exist in these areas prior to 2013?

Specific comments:

L6-L7: I am not so sure if this is really well understood… please rework this statement.

L21: subglacial water activity has also been monitored by Synthetic Aperture Radar (SAR) satellite data. See for example Joughin et al., 2016, Gray et al., 2005, Neckel et al., 2021.

L23-26: good point. By the way, Capps et al. 2010 also used SAR data to investigate subglacial lakes. I also think many small subglacial lakes are still hidden underneath the East and West Antarctic Ice Sheets (see for example Livingstone et al., 2013).

L46-49: this is an interesting and important point but I am rather skeptical if this canbe answered concerning the limited data situation.

L87: typo: speed.

L100-103: are there any rock outcrops covered by the LiDAR and/or DEM data that can be used for vertical and horizontal alignment and/or validation of the datasets?

L166: according to the oxford dictionary, a catastrophe is defined as: "an event that causes one person or a group of people to suffer, or that makes difficulties" which is not the case here. Please rephrase the term 'catastrophic' here and elsewhere in the text.

L200-201: why? Can the authors be sure that the lake was empty in 2013? Or could not have the sealing occurred some time before when no data were available? Not clear from the sentence.

L260-262: I suggest to rethink this statement as active hydrological networks are also common in other parts of Antarctica where surface melt processes are only minor, meaning that surface melt might not the only reason for subglacial water activity (e.g. Ashmore et al., 2014).

Figures

Fig. 1: thin white lines in panel b are rather hard to see. I recommend to zoom in on the study area.

Fig. 5: I think consecutive DEM differences would be more interesting than the single time steps shown here. Are the REMA strips covering the hydrological catchment? If so it might be worth to show it. Also analyzing the DEM differences in the surrounding might be interesting regarding processing biases and/or the detection of actual surface lowering (see for example Palmer et al., 2015).

Fig. 7: please indicate the locations of these profiles in Figure 5. How about combining Figs. 5 and 7?

Additional References

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