Anonymous Review of 'Changes in Supraglacial Lakes on George VI Ice Shelf, Antarctic Peninsula: 1973-2020'. Barnes et al. (2021)

Overview

This manuscript presents a record of surface melt area on George VI Ice Shelf between 1973 and 2020. It identifies high melt years in 2020, 1990, and 1989. The authors map lake areas using an NDWI green and infrared method, alongside manual delineation of some scenes, and heavy manual post-processing. They then consider the patterns in surface meltwater areas in the context of climate and firn data, in addition to using CMIP to consider how GVI Ice Shelf's meltwater system may evolve into the future.

Overall, it is clear that a lot of work, comprising many data sets, has been put into this manuscript. However, the methodological steps are hard to follow, and the significance of the findings are therefore hard to evaluate with certainty. I recommend that the author's re-write the paper in many areas, and focus on presenting the methods and results with greater clarity, taking into account my suggestions below.

Novelty

Whilst other work (e.g. Banwell et al., 2021) has discussed melt extents on the GVIIS, this work adds some new insights through the use of climate (MAR) and FAC data. However, these additions need to be presented more clearly for the novelty to be fully conveyed.

Scientific Quality

The main text fails to clearly communicate the methodological steps taken, and does not account for error, particularly when delineating lake areas using both NDWI and manual methods. This needs to be improved.

Significance

The colloquial tone of the manuscript makes the significance of the work hard to assess, and the science is not yet fully convincing. This needs to be addressed. However, the discussions on firn air content and future climate modelling of GVIIS is very interesting, and if the paper can be re-written to a higher standard, these points may be better conveyed.

Presentation Quality

The presentation quality needs to be addressed in order for this paper to be published. The paper often has a very colloquial tone, which rambles, and therefore much of the text is

hard to follow. The methods need to be clearer throughout, and justification for methodological decisions should be provided. Generally, figures are ok, but please make sure figure labels etc are legible.

Main Comments

The abstract of the text needs to be re-written. When compared to the introduction it is of a lower standard of writing, and it doesn't convey the key findings well.

When describing George VI Shelf (Lines 47-55), the authors need to do some wider reading of literature. For example, they should use past work here to describe the different glaciological settings of the north and south GVIIS. A study area figure is also required.

It makes little sense to me to use the NDWI Green and Near Infrared method over the NDWI blue and red method, given that the majority of literature would use the latter, and this has been well justified in many previous papers. I am not convinced as to why the authors chose to use this alternative thresholding method, and the text in S2 still does little to convince me. It would be interesting to see some maps showing the differences between the two thresholding approaches.

The lakes in some imagery were manually delineated, yet there is no mention of the error that should be considered when comparing these manually delineated lakes to lakes found using the thresholding method. Overall, the authors should consider the errors associated with all methods, and reference these where appropriate.

The authors state that they use a different threshold for Landsat 1 because the bands do not correlate with the other Landsat instruments. But I question whether the Sentinel-2 bands correlate? If not, why did you not use a different threshold for that too?

Is there full ice shelf coverage for every data point investigated? If not, how much of the ice shelf is 'missing'?

The authors only show satellite imagery of GVIIS in maximum melt years, however they comment (Line 167) on the spatial organisation of surface meltwater in low melt years too. It would be useful to see some figures showing this, to allow the reader to see the changes that occur over time.

The authors suggest that they convert the areas for all data that wasn't affected by the Landsat-7 scan line failure, ultimately reducing the areas? This is a questionable decision as it broadly means the data presented is not representative of the true area of melt on GVIIS,

which is an important statistic to have. I suggest the authors present both the converted and unconverted data.

Line by Line Comments

Line 33-35: Sentence does not read well, colloquial tone.

Line 36: Change to Larsen B Ice Shelf (LBIS) and Wilkins Ice Shelf (WIS).

Line 37: Reference here (and elsewhere) is surely an example of one applicable piece of literature? If so use (e.g. ref) as opposed to just (ref).

Line 67: 'Landsat-1-8' Remove hyphens. Landsat 8 should not be hyphenated, and Sentinel-2 should be.

Line 73: 'Where multiple low cloud images'. How did you quantify low cloud images?

Line 73: How did you mosaic? Did you simply put any image preferably on top? Or the most recent image? Please specify.

Line 74: 'Remedied' is an odd word to use – change.

Line 74: If you focussed on the Northern sector then show the readers how you define this area in a study area map.

Line 129: change 'most non-significant' to least-significant

Line 135: Extra '.' – remove

Line 148: Ref for compressive flow regime?

Line 155: How was the study area extent decided? Manually? Specify in the methods.

Line 166: In this context, what do you mean by regional and local?

Line 184: Double use of 'respectively'.

Lines 203-207: This section doesn't read very well and feels repetitive. Try and condense

Line 208: ‘It is also unsurprising’ – too colloquial

Line 208-209: ‘having the correlates’ – I assume this is a typo?

Line 274: Insert comma after ‘Generally’

Figures

Figure 1: If e isn’t a true color composite, then what is it?

Figure 3: Put units in brackets

Figure 4: Put units in brackets.

Move X axis label ‘Year’ below the years.

For plots c, d, e make colour bar label font size larger.

Supplements

Table S1:
Table heading required – despite it being in the other supplementary document

Why are two Landsat 5 images highlighted in red?

If the authors have the AOI coverage for each image, they could add this information

Text S2: Much of this should be explained in the main text.

Text S3: Again, much of this should be explained in the main text.

Figure S7: Put units in brackets.

References:

Banwell, A.F., Datta, R.T., Dell, R.L., Moussavi, M., Brucker, L., Picard, G., Shuman, C.A. and Stevens, L.A., 2021. The 32-year record-high surface melt in 2019/2020 on the northern George VI Ice Shelf, Antarctic Peninsula. *The Cryosphere*, *15*(2), pp.909-925.