**Review of Tuckett et al. (2021)- The Cryosphere- Sammie Buzzard (Cardiff University)**

*This paper describes a new, mostly automated procedure for mapping the evolution of surface melt lakes on the Amery Ice Shelf. The work uses a basis of previously published methods, combined with new tools to improve estimates and processing time, suggesting that this could be scaled up to pan-Antarctic studies.*

*The main innovation is through the use of Google Earth Engine for processing, and the use of an image visibility assessment to account for cloud cover, which may have caused underestimates of lake area in previous studies.*

*This work is a useful contribution to the field and I would be pleased to see this published. The paper is generally well presented, with some particularly well put together diagrams. However there are some issues, mainly in the clarity of the writing/ presentation that need some attention before publication.*

**General comment:**

Use of RACMO data: While I absolutely appreciate that working with RACMO is a case of using the best data that's available I wasn't totally convinced by the usefulness of this part given that RACMO can't account for any lake formation/ lateral water transport and misses the influence of melt lakes on albedo, density, temperature etc. While the authors rightly state that RACMO can serve as a boundary condition (which is then limited but the accuracy of RACMO), it's compared directly with lake area here so I wasn't really sure this was a particularly informative result.

**Line by line comments:**

Line 52: Smith et al. 2020 paper not in the reference list (was hoping to look this one up, as I was unsure about the comment on the line above that most surface melt refreezes in situ and how it relates to lateral transport)

Table 1: This could probably go into the supplement as it's already published information

Figure 3: This, and Figure 2, were really well put together and really helped me to understand the process. I was a little confused by image d) however, given the size/ resolution of the image it's quite hard to distinguish between the coloured pixels (I can see black and red and maybe some blue). It may be helpful to give an indication of all the colours used, and the % of the image that each makes up?

Figure 4: This has the potential to be another really useful figure but I'm afraid I got a little lost here. Using ROI to be both the region of interest, and the % of the region of interest that's covered by the optical image is confusing. Furthermore, I wasn't sure why you were giving a value for VoI for each image, but then always dividing by 7,500- what purpose do these other VoI values serve? This could be a great visual aid with a little more clarity.

Table 2: Could these images be provided in the supplement as an example?

Section 3.4: Is all of this automated (other than the file downloading)? Could file sizes be an issue for scaling this up?

Line 259: Are these actually islands or just floating ice/ broken off ice lids? (i.e. could this be causing an underestimate in lake area?)

Line 294: How were false positives detected? What proportion of the dataset was examined for them? (Likewise for false negatives)

Line 298: I'm assuming in this paragraph you're just referring to band-thresholding techniques rather than your method as a whole?

Figure 6: Are these lakes (especially those on the floating ice shelf) as long as this image suggests, or is it a result of the same topography moving along with ice flow showing the same lake basin over several melt seasons? It would be interesting to see this image compared to e.g. the year with max lake distribution in this study to see what a single year on the ice shelf could look like.

Figure 7: Showing lake areas as a proportion of the study region area may be more useful here to spot where changes are really occurring, the low elevation changes mask anything happening as higher elevations.

Section 4.3: This section didn't seem to flow very well. I'd suggest discussing lake numbers, then lake areas, then comparing the two as this currently jumps around quite a lot.

Line 420: Is 21.0 a high or low rate? To follow on from the previous sentence it would suggest that it's not particularly high in comparison to other years, but line 415 suggests it is high. Perhaps this data could also be presented?

Line 431: Are 'accumulations of surface meltwater' lakes, or is RACMO data still included here?

Line 480: I really hate to be "that" reviewer and point you to my own work, but I think it's worth mentioning here that this has also been modelled and shown to have very important feedback for lake formation and development over multiple melt seasons (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017MS001155 for a general case, and https://tc.copernicus.org/articles/12/3565/2018/ for Larsen C specifically as with the Hubbard paper).

Line 491: There are few papers that deal specifically with foehn winds over ice shelves (e.g. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020JD032463)

Line 546: It seems a little odd to say that the index has an effect- it's just an index. Maybe better to say they are linked/ correlated?

Line 568: Was this event in the RACMO data?

Line 600: I'd say likely rather than possible but I may be biased!