Review of ESSD-2021-468: "Landsat and Sentinel-derived glacial lake dataset in the China-Pakistan Economic Corridor from 1990 to 2020"

Summary

This is my first review of the manuscript by Lesi et al., which presents a new glacial lake dataset, derived through remote sensing and semi-automated classification, over the CPEC area. The dataset is novel, well described and presented, and the manuscript is generally clear and well written. However, I have two concerns; the first relating to the content vs. scope of the article type, and the second to the discussion of errors:

1. My understanding of the scope of ESSD is that a novel dataset is presented with minimal analysis (at least none that goes beyond assessing the accuracy of the dataset) and no interpretation. While I notice that recently published data papers in ESSD vary in the amount of analysis/interpretation they contain, my view is that here, there is analysis and interpretation of the dataset that goes beyond the scope of a data description paper (e.g., a large part of the Results, and part of the Discussion – detailed below). To me, the manuscript is presented in the form of a research article rather than a data description paper, and so, if the authors wish to keep the interpretation, I am not sure that ESSD is the most suitable journal. If the authors choose to stay with ESSD, a reconsideration of the scope is necessary, in my opinion. A slight reframing of the aims could perhaps help the manuscript stay on track with presenting (rather than interpreting) a dataset, for example: 1) present an up-to-date glacial lake dataset in the CPEC in 2020 using…; 2) present two historical glacial lake datasets for the CPEC to show extent in 1990 and 2000, using… The third aim could read well as a justification for the first two aims, rather than being an aim itself.

2. The errors are presented really nicely in Figure 4, and then do not seem to be mentioned again in the Results/Discussion/Conclusions. Regardless of the type of article this ends up as, I would expect more explicit mention of the absolute errors throughout the Results and Discussion (particularly where reasons for errors are discussed) – and for these to be summarised in the Abstract and Conclusions.

Minor comments

L24: The method is threshold-based, not object-oriented classification.

L28: I think this would be clearer if you rearranged to "2234 lakes were derived from the Landsat images…" and the same for the Sentinel clause in L30.

L32: Are there no existing inventories that use imagery with a lower resolution than Landsat? If so, it would be clearer if you specified this first, and then made a comparison – at the moment, the results presented here only show that Sentinel can detect smaller lakes than Landsat, which would be expected from the differing spatial resolutions.

L47: I think a reference to the passing of peak water e.g., (Huss and Hock, 2018) would be a better phrasing than "Unsustainable glacier melt … reducing the hydrological role of glaciers"

L54: I would avoid claims such as "inevitably affected" without an appropriate reference, so recommend removing this clause.

L54: Recommend changing "The increasing…" to "An increasing…"

L58-69: This paragraph feels like it belongs in the 'Study site' section due to the amount of detail and reference to Figure 1. I would move L61-69 there (or delete if repetitive), and simply summarise the first

sentence at the end of the previous paragraph – something like: "…and highways, such as One Belt One Road Initiative (BRI) infrastructure construction projects, which aim to strength connections between countries."

L87 and throughout: I recommend specifying Sentinel-2 for clarity – for instance, there are now many studies of lakes using Sentinel-1.

L109-110: Repetition of "mainly" – recommend changing first to "generally used". I'm also not entirely sure what is meant by "respective" – do you mean individual to each study using a classification system?

Figure 1: Recommend labelling the two panels to refer to in the caption, improving legibility of coordinates (by moving outside map or using a white background as for the legend), referencing source of layers such as glacier area and population count in the caption, and perhaps consider also labelling countries in the inset.

L133-134: Are there few GLOFs because there are very few glaciers in this region? If so, perhaps specify this – if not, a reference to support this statement could be useful.

L135 and throughout: A minor point, but there is inconsistency in the use of "altitude" and "elevation". To me, "altitude" is the height of something above the land surface and "elevation" is the height of the land surface (e.g., a plane would be at 300 m altitude whether above the elevation of the sea or a high mountain). I know others interpret these two terms differently, so perhaps just use one consistently for clarity.

L155-156: "We were unable to map lakes in 2010 due to Landsat 7's scan-line corrector…" would be better than "we had to give up".

L162: Can you state how many scenes were used for each baseline year in the main text? While Figure 2 is a helpful portrayal of the temporal range of images, the spatial coverage would also be useful – how did you decide when to stop choosing scenes in each baseline year, when each lake was imaged unobscured once/twice/…? Perhaps this can also be briefly summarised – having read on, I assume that one clear image is used to delineate each lake?

L207: If the method is human-interactive, surely it cannot be automated? Indeed, having read on, I do not believe this method is fully automated and recommend changing all mentions throughout to semi-automated.

L240: Remove the "and" for clarity here.

Tables 1 and 2: Please include the source of the glacier outlines (and reference if appropriate) and a description of the yellow markers in the captions.

L299: Was the coefficient revised in the current study? If so, can you provide brief details relating to why, how, and what the original coefficient was?

Figure 4: This is a very clear and effective way of showing the errors – nice!

L358-367 (and rest of Results): For those readers without an in-depth knowledge of the mountain ranges, this paragraph would be clearer if you referred to the river basins that are labelled in Figure 9. However, this point in the text and Figure 9 onwards strikes me as data interpretation beyond the scope of this journal article type and, unfortunately, I would recommend removing most of it – unless the target journal and article type were changed. In the latter case, I would just summarise this information more succinctly, focusing on highlighting the main points in the text, and include more consideration of the mapping errors.

Figures 7 and 8: Can you label in the caption that these are for GLCS 1 and 2, respectively?

L518-527: I am a little confused by this paragraph. Even if one Sentinel scene required manual georeferencing, once that was carried out there should not have been any subsequent errors in the lake areas calculated from that scene compared to any other – if so, I would remove the reference here and briefly mention in the Methods that one scene required manual georeferencing. The only way I can see an error

propagating through to the lake areas is if the manual georeferencing was not entirely accurate – is that the case? If so, please explain in more detail here.

L531-578: I'm afraid my understanding of the journal brief is that this section is beyond the scope of this article type and should be removed.

L619: There is Landsat imagery available long before 1990 – can you specify why you put this particular year?

L623: I would be more careful in stating how accurate your dataset is – Figure 4 shows that the uncertainty in some lake areas is > ± 80%, with many > ± 50%. I expected more discussion of the absolute errors, perhaps in the Discussion, and they should certainly be acknowledged here in the Conclusions.

References

Huss, M., and Hock, R. (2018). Global-scale hydrological response to future glacier mass loss. *Nat. Clim. Chang.* 8, 135–140. doi:10.1038/s41558-017-0049-x.