<u>**General Comments**</u>

The revised manuscript by A. Racoviteanu and co-authors 'Surface composition of debris-covered glaciers across the Himalaya using linear spectral unmixing and Landsat 8 OLI imagery' has improved a lot from its original version and I would like to congratulate the authors for all the work they put in, one can tell that this was no minor undertaking. The resulting manuscript is very nice and interesting to read, and the results come out much stronger than in the previous version. The authors have addressed all my comments, and most importantly the more general ones, in a very rigorous way. I am now convinced of the value and robustness of the method and results that the authors present.

The manuscript has undergone major changes and I still have a number of minor comments/suggestions to improve its readability. Line numbers indicated correspond to the revised manuscript (not the track-changes document):

Title

L2: 'and' -> 'applied to' or 'of'

Abstract

L22: 'eastern' -> 'central' according to Fig. 1

L25: Would be nice to specify here the proportion of debris-covered glaciers as it is the focus of the study

L26-27: Numbers do not add up to 100%

Introduction

L68: 'been' repeated

L79-85: While this is very interesting, I am not sure that it is very relevant here. I would suggest not mentioning it here but maintaining it in the discussion.

L83: 'a revised dataset'

L104: These studies are not really 'more recent' but rather just looking at smaller domains with finer resolution

L109: Zhang et al., 2021 (**https://doi.org/10.3390/rs13071313**) possibly relevant here.

L136: 'vegetation the mountain range' - something missing here

Data sources and methods

L166-167: 'selected' repeated twice

L191: Figure number missing

L197: suggest specifying 'This RapidEye scene consists of orthorectified…'

L217-218: 'numerical inversion *of* the surface'

L238: suggest specifying 'In this study the outlines in the SDC dataset…'

L244: remove 'see' before Delafontaine et al., 2009

L258: 'therefore' appears twice

L272: Sections 2.5.1 is well written and detailed. Very nice to read.

L317: refer here to section 3.1 for the actual values of these thresholds

L326-327: Unless I am mistaken, no need to spell the acronym of RMSE here (done before)

L339: 2TP + *FP* + FN

L340-342: the difference between recall and precision is not very clear here.

L347: specify that this is 6 to 7 glacier *for each site*

L358-360: Very good that you specify this here. In my experience, it is actually quite difficult to fully automate an OBIA approach…

L375 topo-climatic

Results

L379: I think here it is still missing that pixels which satisfy 2 different thresholds are categorized as 'unclassified'

L444: Add name of the lakes you refer to in corresponding figure

L475: patterns

L484: I would rather suspect (from experience of fieldwork in the region in September/October) that this is due to early snowfalls rather than late ablation season

L487-490: this belongs to the discussion

L495-498: discussion

L509-512: These are interesting results in their own way – would actually be interesting to see. You could consider adding a supplementary figure for this?

L512-515: discussion

L519, 525: Show this exponential decay in the corresponding figure along with its coefficients

L520-521: Discussion

L523-524: 'slope gradient' is wrong here, it should be slope as the gradient of the slope is actually the second derivative of the topography. There are several occurrences of this in the text, make sure to correct all of them.

L530: specify '*glacier* aspect'. Remove 'slope'.

L532-536: this is mostly discussion

Discussion

L539: A lot of this paragraph, as well as figure 13 should appear in the results. This will need to be reformulated.

L554: I do not understand this as eastern Tibet is actually in the south of the range, especially when considering a 1x1° grid

L594-595: These trends appear to be very small and I am wondering if they are really relevant…

L603-604: No need for such a justification, suggest removing this whole sentence.

L615-620: This makes sense but am not sure it is appropriate here. It reads more like a 'response to reviewers'. Suggest removing to stay concise.

L630: 'Landsat' repeated.

L639: '*square* meters'

L663: 'we are aware …' comes back several times in your discussion and I personally do not like it. I would suggest remaining objective and removing it.

L668: Here you mention that your approach can help track the changes in lake turbidity. I would also insist on the fact that it can help track the changes in pond area, which is also a great outcome.

L696: '*square* meters'

L696: some of these ice sails are actually probably large enough to encompass several Landsat pixels and could explain some of the bare ice patches.

L728: Suggest simplifying title to 'Wider applicability of the method'.

L729: 'demonstrated'

L736: can -> could

L736: remove 'we acknowledge that'

Tables

Table1: add 'Band 1' for the Landsat 8 OLI bands

Figures

Figure 1: What are the plain lines? Add reference for these regional/climatic outlines

Figure 2: Turquoise over red is difficult to see and could be a problem for color-blind readers. Nice that you shoed the ground truth points. I was wondering if there would be a way to show the different classes? It would be interesting to have a zoomed-in view of one of the glaciers to show these different classes.

Figure 6: It is hard to distinguish the LMM ponds from the OBIA ponds. Suggest taking different colors

Figure 12: This figure could be very much improved. It is currently very raw and simplistic. There is space to add additional information. For example, I suggest showing the exponential decay you mention by

fitting and exponential to your points. Since we are talking of bins, wouldn't horizontal lines or bars make more sense than points? For c), specify in figure that this is glacier aspect.

Figure 13: It is difficult to see any correlation with such plots. It could be worth increasing the size of the dots in a first step. However, if you really want to show a correlation, it would be interesting to do so in an x-y plot.