Response to Anonymous Referee #1

We thank the anonymous referee for their detailed and helpful comments on our manuscript. Below we present our point-by-point responses. The reviewer's comments are in black and our answers in blue. In addition, the anonymous referee contributed some text corrections in the report, which we followed all in the latest manuscript.

Specific comments:

L22: please re-write, shoulf the the other way arounf, bn is correlated with (dependent on) thickness

Reply: Following your suggestion, we re-wrote the sentence as follows: *"We find that the surface mass balance distribution strongly correlates with the spatial distribution of debris thickness for both glaciers (23K Glacier: r=0.88; 24K Glacier: r=0.82)".*

L23: add "on the surface of these glaciers"

Reply: Done.

L35: I suggest avoiding such phrasing, potentially dangerous is ambiguous, I suggest simply "proglacial"

Reply: We have changed the "*potentially hazardous glacial*" as "*proglacial*" in this sentence.

L40: please revise this sentence for clarity, it reads circular

Reply: Thanks for your suggestions, we split and re-wrote the sentences as follows: "*The presence of debris can influence the response of glacier to climate change. If the supraglacial debris is more than a few centimeters in thickness, it will provide a melt-buffering effect (Østrem, 1959; Nakawo et al., 1999; Nicholson and Benn, 2006; Reid and Brock, 2010; Anderson and Anderson, 2016; Yang et al., 2017)*".

L50: not clear here, you mean areas which do not contain ice cliffs and lake, please rephrase

Reply: Yes, we mean areas which do not contain ice cliffs and ponds. And we have modified the sentence as follows: " *The areas around by cliffs and ponds are characterized by high melt rates relative to surrounding debris-covered area (not containing ice cliffs and ponds) based on the differencing of high-resolution digital elevation models (DEMs) and energy-balance modelling...*".

L54: this could be rephrased. "effect..has an effect..". It is the supraglacial debris that exhibits an effect

Reply: We have rephrased the sentence as follows: "*However, some studies have found that the thicker debris cover has a larger effect on total thinning than the enhanced ice ablation from ice cliffs and supraglacial ponds area (e.g., Hambrey et al., 2008; Vincent et al., 2016; Brun et al, 2018; Anderson et al, 2021a).*"

L59: re-state which hypotheses for clarity

Reply: Thanks for your suggestions, we re-stated the hypotheses in the sentence as follows: "*These hypotheses (additional melt at hotspots area or extra thinning from reduced ice supply) therefore need to be supported with high resolution data to account for the local effects of these melt hotspots*".

L65: imagery does not provide observations of processes, it provides high res imagery which can be used to infer processes, please correct

Reply: Thanks for your suggestion, we re-wrote the sentence as follows: "*...which can infer detailed observations of local processes (e.g., Westoby et al., 2020)*".

L71: very long phase difficult to understand

Reply: Thanks for your comment, we split and re-wrote the sentences as follows: "*Compared with the use of the UAVs, in-situ observations have the shortcoming of limited spatial representation, and remote sensing data have insufficient resolution and are vulnerability to cloudy and rainy weather. Therefore, the UAV technology is widely applied in glaciological studies, including in debris-covered glacier settings*".

L82: see comment above, clarify /state the hypotheses. It is quite nice to state these as questions, for ex "are local patterns controlled by supra-glacial ponds/ice cliffs" or similar. In any case please re-state the 2 hypotheses clearly in the intro

Reply: We have re-stated two hypotheses in L59.

L86: this phrase doesn't tie here, put it at the beginning ie "The two glaciers studies are located in the S E Tibetan plateau (lat long), and are under the influence of the monsoon..etc

Reply: Based on your comment, we deleted the sentence as follows: "*The southeastern Tibetan Plateau is monsoon-influenced, and has a glacierized area of ~10,000 km^2. (L85)*" And we deleted the sentence as follows: "*This region is characterized by steep and complex topography, as well as abundant precipitation. These monsoon-dominated glaciers are characterized by high accumulation and high ablation rates (Shi et al., 2008). (L86-89)*".

We re-wrote the sentence as follows and put it at the beginning of the paragraph: "*23K (~4 km^2) and 24K (~2 km^2) Glaciers are located in the southeastern Tibetan Plateau (~29.77° N, 95.70° E; Fig. 1), and are mainly affected by two streams of humid air: the Bay of Bengal Vortex (in Spring) and the Indian Summer Monsoon system (in Summer), respectively...*".

L87: in which season?

Reply: In spring and summer. Combined with the above response, we have deleted this sentence.

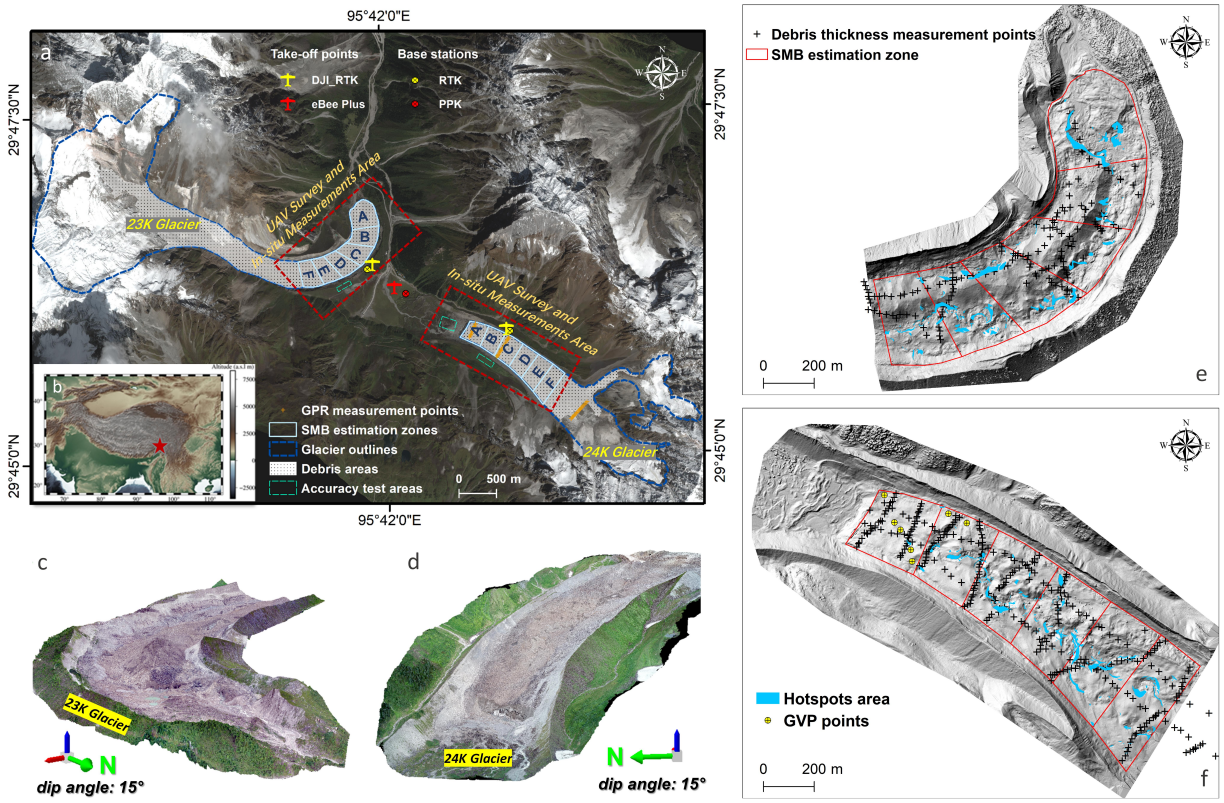
L93: not clear, which part? clarify here., They are under the monsoon but are not of summer-accumulation type? it contradicts the papers cited

Reply: Thanks for your comment. Combined with the above response, we

have deleted the sentence as follows: "*These monsoon-dominated glaciers are characterized by high accumulation and high ablation rates (Shi et al., 2008)...*". The latest version removes this ambiguity.

L110: please fix text in legend in 1e which overlaps with figure. legend can be put/split between 1 e and 1f

Reply: We have revised the figure based on your comment.



L142: not obvious - you mean area is marked in fig 1 a? figure is quite busy so rather put this info in the figure caption-

Reply: We have added this information in figure caption as follows: "*(a) Overview of the 23K Glacier and 24K Glacier basin including the UAV survey area, accuracy test areas, ...*".

L201: revise this as all sentences have no subject, should be..."where, us

is..., we is ...and l is...", si they should al be separated by comma, :where"should be removed

Reply: Done.

L233: please re-write this for clarity, "The uncertainties in the UAV measurements , reported as mean absolute deviation,were etc etc..

Reply: Thanks for your suggestion, we re-wrote the sentence as follows: "*The uncertainties in the UAV measurements , reported as mean absolute deviation in the X, Y and Z directions are 0.14 ± 0.11 m, 0.09 ± 0.11 m, and 0.24 ± 0.18 m respectively (Table 2).*"

L248: not sure what you mean by resp. 24K, please re-write as "the average thinning over 23K and 24K was -1.5 and 0.2, respectively. This is the correct way gramatically

Reply: Thanks for your suggestion, we re-wrote the sentence as follows: "*the average thinning over 23K and 24K Glacier survey area were -1.5 ± 0.1 m and -0.2 ± 0.1 m, with an average daily thinning of -0.5 ± 0.03 cm* d^{-1} *and -0.1 ± 0.03 cm* d^{-1}*, respectively (Fig. 2b, 2e)*".

We also re-wrote the sentence (L249-251) as follows: "*During the warm period (August 2020-October 2020), the magnitude of the thinning of both glaciers was very similar; 23K and 24K Glacier were -0.7 ± 0.1 m and -1.0 ± 0.1 m, with an average daily thinning of -1.2 ± 0.03 cm* d^{-1} *and -1.6 ± 0.03 cm* d^{-1}*, respectively (Fig. 2c, 2f)*".

L257: I suggest re-writing this as separate sentence for clarity: Upper row

refers to 23K Glacier and bottom row refers to 24K Glacier

Reply: Thanks for your suggestion, we have added this sentence (*Upper panels refer to 23K Glacier and bottom panels refer to 24K Glacier*) in the caption.

L265: should be "surface elevation change rate", in caption and label

Reply: We have revised the figure and caption based on your comment.

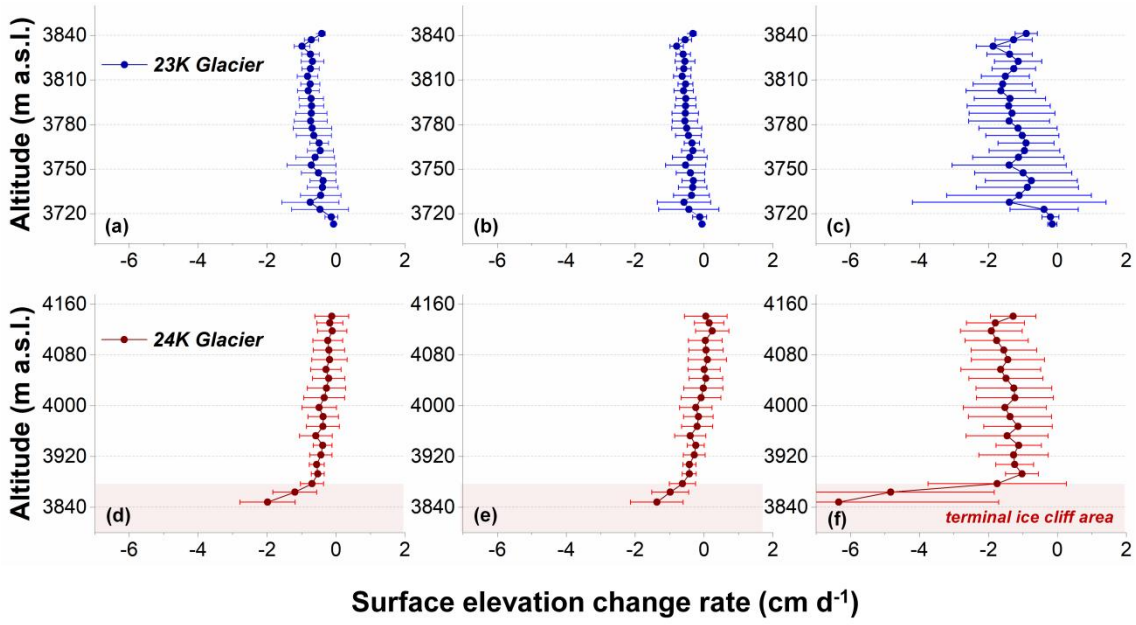


Figure 3: Annual average glacier surface elevation change rates within 5-m (23K Glacier)/15-m (24K) elevation bands (dots) with the corresponding standard deviations (horizontal error bar) for August 2019-August 2020 (a, d), the cold period (b, e) and the warm period (c, f) across the monitoring area of the two glaciers. The red shadowed sections represent the terminal ice cliff at of the 24K Glacier.

L301: see comment above about this phrasing (resp.), plus there is repetition as "respectivelyïs added at the end

Reply: Thanks for your suggestions, we re-wrote the sentence as follows: "*The ratio of annual emergence velocity and annual surface mass balance for 23K and 24K Glacier are -0.09 and -0.49, respectively*".

L333: put this after the p-value, eg p-value at 0.02 at 95 % confidence

level

Reply: Done.

L334: need to specify if negative or positive correlation. I am confuxed here as results show pisitice correlation, ie thicker debris = more melt while it should be negative (thinner debris = increased melt, thicker = reduced or suppressed). please check the sign of the correlation

Reply: Thanks for your suggestions. In this part, we demonstrate the surface mass balance rather than the magnitude of melt. The surface mass balance is negative at the ablation status (ie., thicker debris = more melt = more negative surface mass balance).

L337: same here- positive or negative?

Reply: Thanks for your suggestions, we have explained this in the above response.

L338: this is opposite to what we expect, ie more ice cliffs and ponds, less melt - please comment or check

Reply: This is the same explanation as the two responses above. We demonstrate the surface mass balance rather than the magnitude of melt.

L352: please rephrase this, phrase is confusing- you present trends from Dehecq et al but you say "we explore changes", please rephrase ato say you are comparing your work with Dehecq et al

Reply: Thanks for your suggestions, we re-wrote the sentence as follows: "*Combined with our work and Dehecq et al (2015), we explore changes*

in the glaciers' dynamic state by analysing the surface velocities over the last two decades (Fig. 10)".

L440: but on the previous pages you showed a negative correlation

Reply: For 23K Glacier, the correlation coefficient (r) between the "hotspots" area percentage and the surface mass balance is -0.29 (p-value is 0.58 at 95% confidence level). For 24K Glacier, the correlation coefficient (r) between the "hotspots" area percentage and the surface mass balance is -0.48 (p-value is 0.36 at 95% confidence level).

Based on all r ($r^2 << 1$) and p-value (p-value >> 0.05) results, we consider that there is no significant correlation between the two glaciers' "hotspots" area percentage and the surface mass balance.