Response to the Dr. Etienne Berthier

We thank the editor for his 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 editor contributed some text corrections in the report, which we followed all in the latest manuscript.

The co-authors also worked together to check this paper. We found some points for correction/improvement outside the scope of this comment. E.g., we revised and replaced Fig. 2-Fig. 9 in the manuscript (to harmonize the style and comply with the formatting requirements of the TC), and some other parts. The modifications are remained in the "with track" pdf file. Here, we explain and illustrate this.

Manuscript:

L17: I suggest to write "with four unpiloted aerial vehicle repeat surveys" (otherwise a reader can think that only 2 surveys are available)

Reply: Done.

L18: The exact days of the surveys are not important for the abstract.

Reply: We have deleted the "*(13th Aug. 2019 - 20th Oct. 2020)*" in the sentence.

L39: no cap letter

Reply: We have changed the "*I*" as "*i*".

L49: English not OK here.

Reply: Thanks for your reminder. We have re-wrote the sentence as: "*The area influenced by cliffs and ponds are characterized by high melt rates relative to...*".

L85: Bo cap letter for glaciers here

Reply: We have changed all "*23K and 24K Glaciers*" as "*23K and 24K glaciers*" in the manuscript.

L91: As far as I remember I do not think Yao et al., 2012 is based on geodetic measurements. Can authors double check?

Reply: This paper's mass balance results are not based on *geodetic* measurements data. So we deleted "Yao et al., 2012" here.

L106: strange typography

Reply: We have changed the "、" as ",".

L201: a small word missing

Reply: We have added "*from*" here.

L221: Ambiguous. Do you mean "surface elevation change"?

Reply: We mean the the surface elevation and mass balance changes at these locations. We have re-wrote the sentence as: "*In this way, we could effectively measure the surface elevation and mass balance changes at these locations, thereby providing us with an upper-bound estimate of the total contribution of ice cliffs and ponds to the surface mass balance...*".

L224: I propose to remove this and keep the phrasing more simple. Otherwise the sentence is hard to read.

Reply: Done. We have re-wrote the sentence as: "*We also defined the hotspots area enhancement factor as the ratio of melt rate of the ice cliffs and supraglacial ponds area to the sub-debris area melt rate (Miles et al., 2022)*".

L249: minus sign is missing here!

Reply: Thanks for your reminder. We have added the "-".

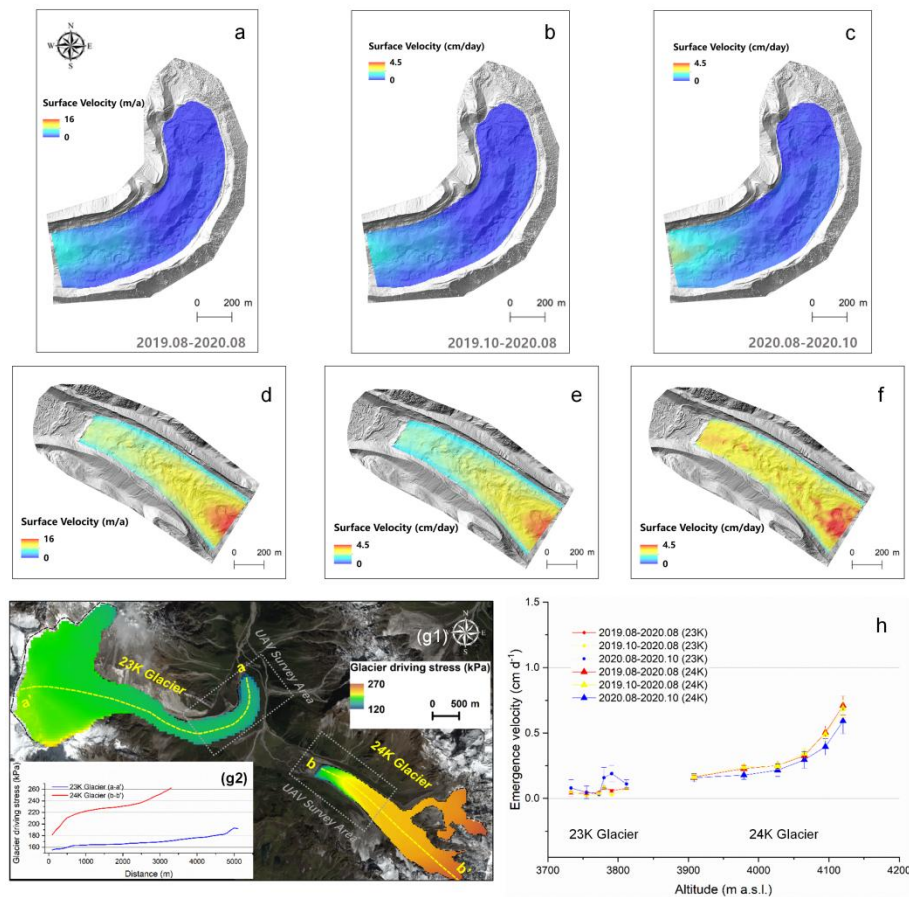
L274: Should be in unit of m a-1 (here and elsewhere)

Reply: We have changed the "m" as "m a^{-1}" here and elsewhere.

L276: above velocity for the cold/warm period were provided in cm / day. Why a different unit here? To be homogonized for comparability

Reply: Thanks for your suggestions. We have changed all in "cm d^{-1}" for L276-277.

L279: Is the unit in m? m/a ? or cm/d? If you do not show "rates", the different periods (of very different durations) can not be compared . The title of the X-axis is not correct.

Reply: We have changed the figure as follows:

L282: why b1 here? Not clear (and ambiguous)

Reply: We have deleted.

L313: Phrasing a bit confusing. Was difficult for me to find which numbers are annual/warm/cold period.

Reply: We re-wrote the sentence as: "*They are significantly higher in the warm period (23K: ~4.4; 24K: ~2.6) than at the annual scale (23K: ~2.2; 24K: ~1.6) or during the cold period (23K: ~2.6; 24K: ~1.7), indicating that the hotspots effect is more pronounced during the ablation period.*" in the manuscript.

L341: need to clarify between which period and which period exactly.

Reply: We changed the "*over this time period*" as "*between the*

2000-2004 and 2015-2019 periods".

L347: Is it 2015 or 2019? Can author double check?

Reply: We have checked. We use the "1999-2003" and "2013-2015" surface velocities from Dehecq et al (2015).
(https://zenodo.org/record/2578187; https://zenodo.org/record/2578199)

L349: unclear wording.

Reply: We re-wrote the sentences as: "*The velocity magnitude and pattern obtained by Dehecq et al. (2015) for the period 2013-2015 correspond well with our UAV results*".

L353: These statements do not really fit in the "result" section of the article.

Reply: We deleted this part.

L356: clarify that these numbers are averages for the UAV areas. do authors mean less negative here? Important to make it correct.

Reply: We re-wrote the sentence as: "*A prior study analyzed the mean surface mass balance from 2000-2016 based on regionally-available datasets (Miles et al., 2021), with values of -1.5 $\pm$ 0.7 m w.e. a^{-1} for the UAV survey domain of 23K Glacier and -1.6 $\pm$ 1.1 m w.e. a^{-1} for the UAV survey domain of 24K Glacier.*"

We mean the less negative here, and we re-wrote the sentence as: "*These melt values for the period 2000-2016 are less negative than our results for the period 2019-2020, which might be attributed to warming or to changes in precipitation phase in the southeast Tibetan Plateau (e.g.,*

Jouberton et al., 2022)".

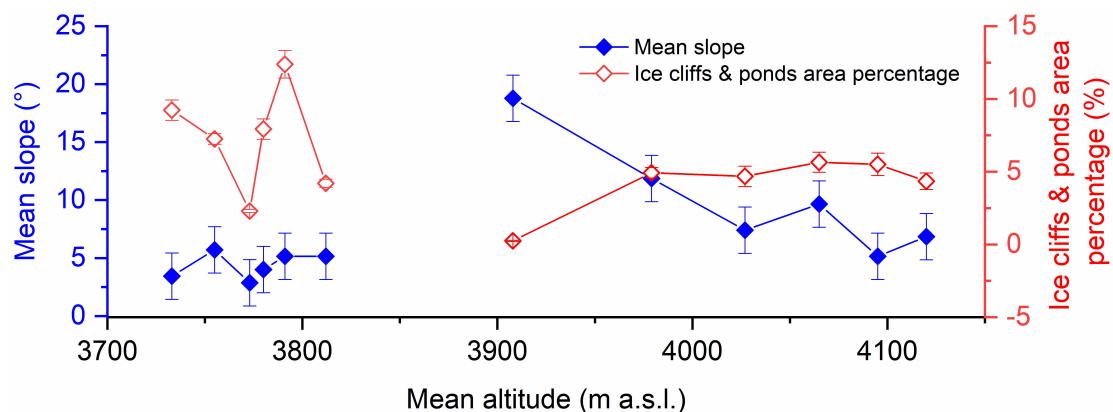
L359: Given the errors bars for the 2000-2016 SMB, can authors really make a statement like this? Seems hazardous.

Reply: Thanks for your suggestions. We deleted this sentence (L358-360) in the manuscript.

L362: source for the velocity data to be given in the figure legend.

Reply: We have changed the caption as: "*Figure 9. Annual surface velocity (Dehecq et al., 2015) for 1999-2003 (a)...*". We also changed in Figure 8.

L378: gradient of what quantity?

Reply: Actually, We would like to express the "slope". And we have changed the "*longitudinal gradient*" as "*slope*". In order to express the results more directly, we have converted the tangent results $(\tan(\alpha_m))$ to be the slope angle (α_m; in L379) in the text, and the image in the appendix section (Fig. S4) has been modified to be the slope angle accordingly. The modified figure as follows:

L383: the reader has no mean to know what this value is (currently reads

as if this was "ice supply"...). Also you compare numbers of different signs (SMB is negative, emergence velocity is positive) so the current wording does not really make sense.

Reply: Thanks for your suggestions. We change the SMB (negative) to melt (positive). And we re-wrote the sentences as: "*Using the ratio of ice emergence to melt, we can identify, for each season, whether ice resupply or melt is the main factor leading to the thinning rates. In Table 5, we clearly see that at 23K Glacier, the ice supply is considerably smaller than the absolute value of melt for all periods, indicating that the melt is directly responsible for contemporary thinning patterns. 24K Glacier also exhibits a strong imbalance between ice emergence and melt over the warm period (0.15), but ice emergence nearly compensates for melt during the cold period (0.87). Thus, 24K Glacier exhibits a relative healthier cold-season and annual balance than 23K Glacier*".

L432: This sentence has such a complexe structure that I could not understand it. Clarify what these mean residuals are.

Reply: In this paragraph we attempt to discuss the influence of ice cliffs and supraglacial ponds on glacier ablation/surface mass balance patterns and compare them with similar studies. For the mean residuals, we currently consider that this method lacks enough research references and the experience of rigorous application in ice cliffs and supraglacial ponds studies. In addition, the current results (ablation contributions,

enhancement factors, etc.) are sufficient to support our discussion, and therefore we chose to remove this section. For your comment on this sentence (L432), we also chose to remove the sentence in this paragraph. We have reorganized the paragraph: "*The role of ice cliffs and supraglacial ponds area is not negligible, as ablation in the survey areas would be underestimated by 24.5 ± 1.7% (23K Glacier) and 7.0 ± 0.7% (24K Glacier), respectively, if the ice cliffs and supraglacial ponds area were not taken into account. Other studies have observed and simulated the contributions of ice cliffs to be 17-26% of the total ablation for different glaciers, which is in agreement with our results (Brun et al., 2018; Anderson et al., 2021a; Buri et al., 2021). The combination of ice cliffs and supraglacial ponds densities (23K Glacier: 7.2 ± 0.5 %, 24K Glacier: 4.4 ± 0.5 %; Fig. 6a, b) and their enhancement factors (23K Glacier: 4.4, 24K Glacier: 2.6; Table 6) shape the ablation contribution patterns of ice cliffs and supraglacial ponds together. Based on UAV and time-lapse camera observations, Kneib et al. (2022) carried out high-precision observations of a single ice cliff on 24K Glacier and measured the daily cliff melt during the ablation period at 3.9-5.1 cm d^{-1}. In this study, the daily melt rate of the 24K Glacier ice cliffs and supraglacial ponds area during the warm period was estimated to be 4.4 ± 0.2 cm w.e. d^{-1} (~4.9 cm d^{-1}), which is similar to the observed value for a single ice cliff. We note that in this study, the outlines of ice cliffs and*

supraglacial ponds area as digitized for warm periods were based on the union of the cliffs and supraglacial ponds' outlines (Brun et al., 2018), which may lead to an overestimation of the extent of the ice cliffs and supraglacial ponds area (Kneib et al., 2022)......".

L447: I did not understand, it seems that two opposite statement are made her in the same sentence. Clarify.

Reply: We have deleted the sentence.

L481: It seems to me that this should not be a last bullet point but rather a concluding statement for the article. Hence I suggest deleting "4) "

Reply: Done.

SI:

Fig S1: Resolution of the images is rather low.

We have changed the figure as follows.

Fig S1: space missing

Reply: Done.

Fig S6: I cannot really see a background image here and also in Figure S7

Reply: For Fig. S6 and Fig. S7, this sentence in the caption is an error writing. In addition, we found that these two figures are duplicated with Fig. 2 and Fig. 4 in the manuscript by our checks, and these two figures are not cited in the manuscript too, so we removed these two figures in the appendix. Similarly, we removed Fig. S9