We'd like to thank both reviewers for their very valuable inputs and thorough reviews. Our answers to each comment are indicated in blue below.

Reviewer 1

In this paper the authors compare the distributed SMB of well-studied Argentière Glacier calculated (1) by inverting an ice flow model and (2) using an enhanced temperature-index (ETI) mass balance model. With method (1) they find a higher spatial variability of SMB, especially higher accumulation rates at the orographic left side of the glacier, which they attribute mainly to regular avalanching from adjacent steep headwalls. This is supported by the indication of avalanches in radar images and a conceptual snow redistribution scheme. To better describe the spatial variability of the SMB and especially account for the total effect of snow redistribution – in which avalanches are shown to be an important factor - the authors come up with zonal precipitation correction factors. Using these correction factors in the ETI-SMB model they find that the projected glacier volume by 2100 based on RCP 4.5 is higher than without including this effect and that more mass is conserved in the zones below the steep headwalls. Finally they conclude that SMB inversions have a high potential in deriving the spatial variability of the SMB.

We would like to thank Reviewer 1 for their high-quality review, and their very relevant and constructive comments.

General comment:

This is a very interesting study, which is building up on a lot of previous work, taking advantage of the solid data base of Argentière Glacier and advanced glacier modelling. The authors take an impressive modelling effort to calculate the distributed mass balance of Argentiére Glacier and to better constrain the effect of avalanches on the mass balance. Especially the uncertainty analysis using three different ice thickness distributions and their effect on the inverted surface mass balance is very interesting. This study is an important contribution to better quantify the spatial variability of surface mass balance on a glacier and to attribute the observed variability to individual processes.

The paper is well written, well structured and generelly pleasant to read. Methods and results are described in a comprehensible manner, holding a good balance between detailness and readability. The supplement is very usefull in following the details of the analysis and the results. The authors discuss uncertainties and limitations of their study extensively and also put their findings in relation to the relevant literature.

I have only some minor comments on the manuscript.

Minor comments:

L27: you could add the 20% of total mass input for the whole glacier as you did in the conclusions, as this is also a main quantitative finding.

True, we will add this here:

‘indicating an additional 60% mass input relative to the accumulation from solid precipitation at these specific locations, which was equivalent to an additional 20% mass accumulation at the scale of Argentière Glacier without its two smaller tributaries’

L118: What do you gain by using 13 DEMs (of every year) and not just the DEMs of the beginning and end of the study period? Signal to noise ration should be best by using those two only. Could you add a line to explain why you are doing that.

The goal here was mainly to reduce the number of gaps in the accumulation area, especially at steep locations or areas affected by shadows (which is the case for a large area at the base of the headwalls, where the avalanche deposits are mostly located). This approach also has the advantage of smoothing out the signal of individual avalanches (or crevasses, or any local process), which could introduce a local bias in one of the DEMs and therefore create an artefact in the dh maps. We will specify this in the corresponding paragraph:

‘This approach helps reduce the proportion of gaps in steep locations or areas affected by shadows, and smooths out the signal from individual avalanche deposits.’

L141: As I understand it, only two of the three different ice thickness modelling approaches are constrained by measurements at Argentière Glacier, while the Farinotti (2019) model is contrained by data from a also lot of other glaciers? Maybe you can be more specific here. Besides it would also be interesting to add a line, what was the intention to choose these 3 approaches? I guess to cover the uncertainty, that is introduced by the uncertainty in ice thickness distribution, but maybe there was also the idea to have different model complexities or applicability for glaciers without GPR measuements?

Yes, the F2019 approach does not use the Argentière GPR data but rather has been calibrated with lots of other measurements from all around the world. In this sense the first sentence of this paragraph can be confusing - the intention here was also to say that the SGSs applied to the F2019 were using the Argentière in situ data. We will change this, by mentioning that only 2 of the modelling approaches are constrained by the *in situ* GPR data:

‘We used distributed ice thicknesses obtained from three different modelling approaches, two of which are constrained by *in situ* ice thickness observations.’

We will also specify that for the F2019 consensus model, these were calibrated with data from many different sites:

‘***The F2019 thickness*** estimate from the global product by Farinotti et al. (2019) which was originally derived from five different estimates of various sources, constrained by a large amount of GPR data from all around the world. This is a reference product that is available for all mountain glaciers in the world, and which did not use the GPR measurements made on Argentière.’

The primary goal of using these three different products was indeed to cover the uncertainty coming from different scenarios of thickness distribution. And indeed, this

also enabled us to test thicknesses from different model complexities for a possible transferability to the larger scale. We will add this sentence:

'These three approaches were chosen to encompass the uncertainty in ice thickness as well as to test the influence of model complexity.'

L373 – L376 Here you refer to different locations on the glacier by giving altitudes. Please label some contour lines in Fig.5, so that these locations can be identified faster by the reader.

Good point, we will add these in Figure 5.

L456 Here you write "46% less volume by the end of the century than for the corrected scenario". In L 459 (and also in L585) you write 71% lower in volume, obviously both values without the Tour Noir. This seems inconsistant to me. In the conclusion L620 you write: "twice as much mass being conserved by 2100", which seems to be constitant with the 46% of L456. Maybe try to use the same measures throughout the paper.

Thanks for pointing that out. The 46% actually include the Tour Noir tributaries, while 71% stands for the difference without these. To avoid any confusion, we will rephrase this sentence:

'This leads to a faster retreat of the Argentière main glacier trunk and 46% less volume by the end of the century (with Tour Noir) than for the corrected scenario (Fig. 9, S14b).'

L546 I guess text refers to Fig. S1 and not Fig. S10

Good catch, this should actually be Fig. S8. We will change it accordingly.

L612 This location… perhaps say "this area"

Will be changed as suggested.

L615 "this" perhaps say "this process" or "avalanches"

We will change 'this' to 'avalanches'

Fig.3: For a faster readability perhaps add to the legend: 2020 and 2012 glacier outlines and stable terrain. Consider a color scheme that shows more details, especially in the elevation changes (a).

We will move these elements from the caption to the legend. We will use an asymmetrical colormap to make the positive changes in the elevation change more visible.

Fig S16(d): the distance along centerline is oriented from the snout upwards I guess. Please specify that in the x-axis label or in the Figure Caption.

Indeed, we will modify the x-axis label accordingly.

Fig. 3,5,7,9 and also some Figs in the supplement: Maybe you can avoid repeating the phrase “The black outines indicate the glacier ourlines manually dreived from the … Pléiades..” by just stating the year of the glacier outline in the legend of the figures.

Agreed. Will be modified as suggested.

Maybe I missed it: Which ice thickness distribution did you use for the foreward modelling?

For the forward modelling we used the same thickness distribution as Gilbert et al. (2023), which is an inversion applied with Elmer-Ice and constrained by the GPR measurements. We will specify this: ‘The thickness inversion for the forward modelling uses Elmer/Ice, as in Gilbert et al. (2023). ‘