Reviewer 1

Dear authors and editor,

I appreciate the effort of the authors in addressing the issues and questions raised in the first review round. The responses are clear and the revisions have significantly improved the manuscript. I only have a couple of minor comments, which should be addressed before acceptance.

We thank the reviewer for reviewing again our article and their new comments. Please see our responses below. In addition to your suggestions, we also noticed that the numbers for total annual precipitation given in the text (Section 3.1: Field data) were incorrect. In the revised version we have corrected these numbers (they changed from 309 and 330 mm to 277 and 335 mm for water years 2019-2020 and 2020-2021, respectively). This was a textual error and did not affect the rest of the manuscript.

L144: What is La Laguna DGA? Is this at La Laguna reservoir? This full term has not been introduced previously.

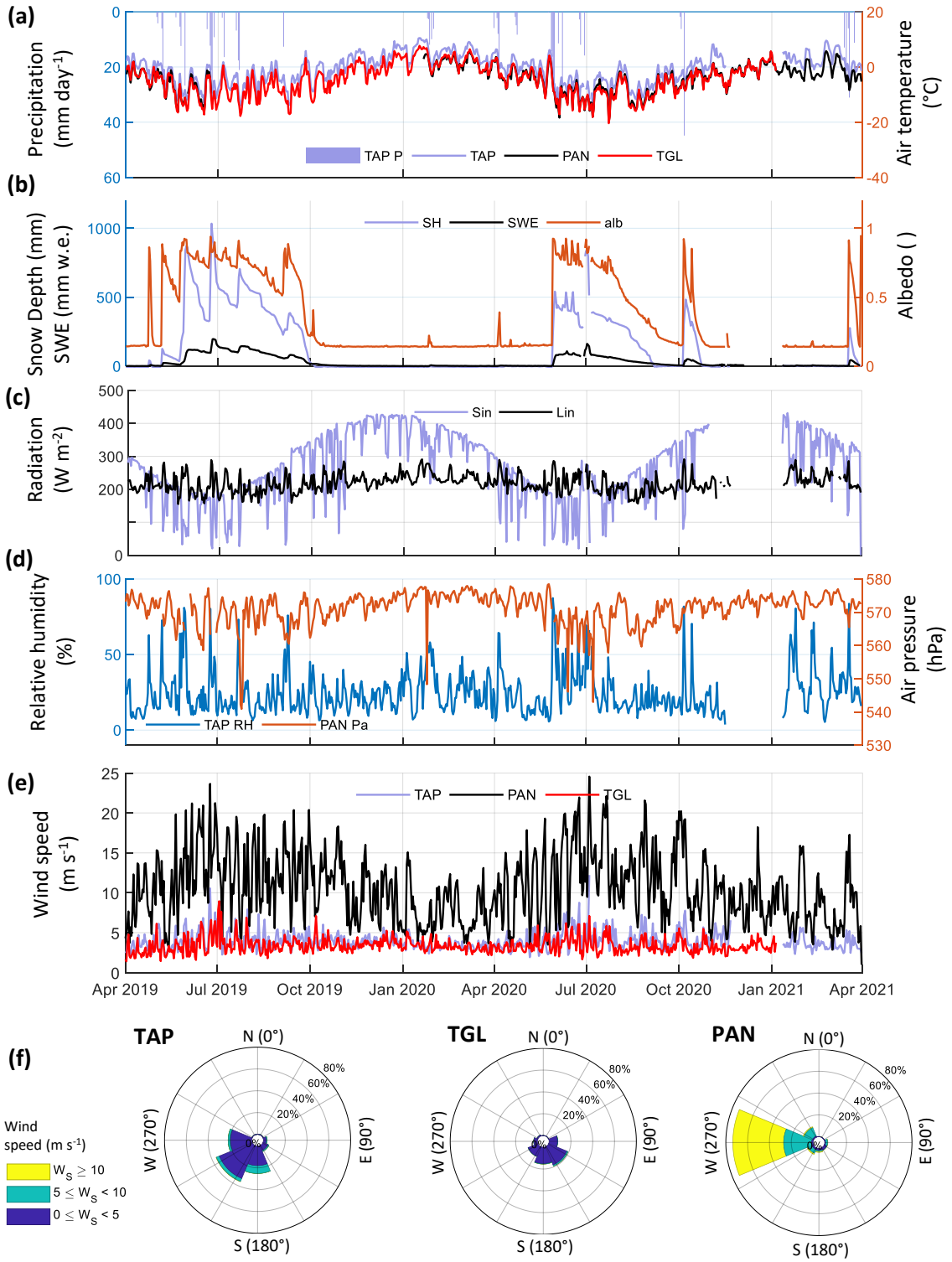
Thanks for noticing this. La Laguna DGA is a meteorological station next to the La Laguna reservoir that is maintained by the Chilean Water Directorate (Dirección General de Aguas, DGA). We briefly introduced the station in the previous version, but without using the full term "La Laguna DGA". We have introduced the term correctly in the latest version (Section 2: Study Area).

L151-153: The gap at TAP between December 2020 and January 2021 is the same as the large data gap in summer 2021, right? Perhaps, you could use the same phrasing.

Yes, it is the same gap. To avoid confusion, we have decided to remove the second comment about the missing data.

Fig 2: The dark blue and black colored lines are quite hard to separate from each other (especially in the legend). Would it be possible to redo the figure with changing either one of these colors into another more distinct color?

Yes, we have changed the dark blue color to a lighter blue that is easier to distinguish from the black lines.



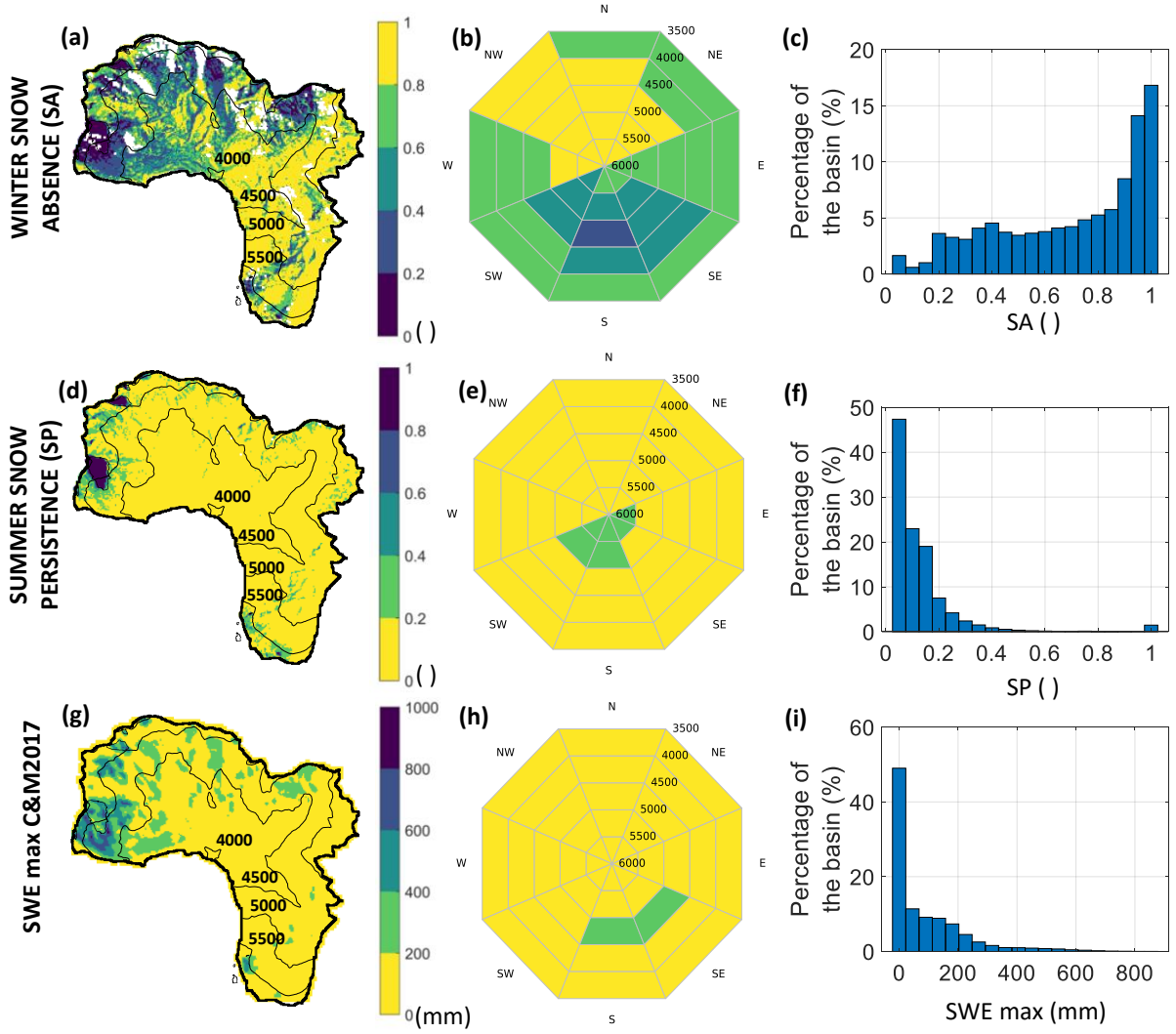
New Figure 2

L237-238: The snow surface sublimation that you extract from the turbulent latent heat flux, is that a direct output term of SnowModel or do you have to do some additional computations? If the latter, how did you compute it?

No there was no additional calculation for snow surface sublimation. SnowModel produces this variable directly. We have deleted the second parenthesis in this sentence. The new sentence reads as follows: “In our study, we analyze results for snowmelt runoff (snowmelt leaving the snowpack) and snow surface sublimation”.

L256 & 4.3: Did the windspeed input also vary with the variations in z0? Or did you use only z0 = 5 mm for the wind speed calculation and keep this constant for all ensemble runs?
We did not recalculate the 2-m height wind speed for each ensemble run. We have now added a small comment about this in the new version of the article.

Fig 3: I think Figure d and f show contrasting results. I would expect f to be exactly inversed, based on figure d. Or am I misinterpreting them? Perhaps it would be most intuitive if the colorscale of d is also inversed (similar to the previous version, but then still from 0 to 1).
Thanks for noting this. The reviewer is correct. The colorbar of Figure 3d is inverted. We have fixed this problem in the latest version. Please see the figure below.

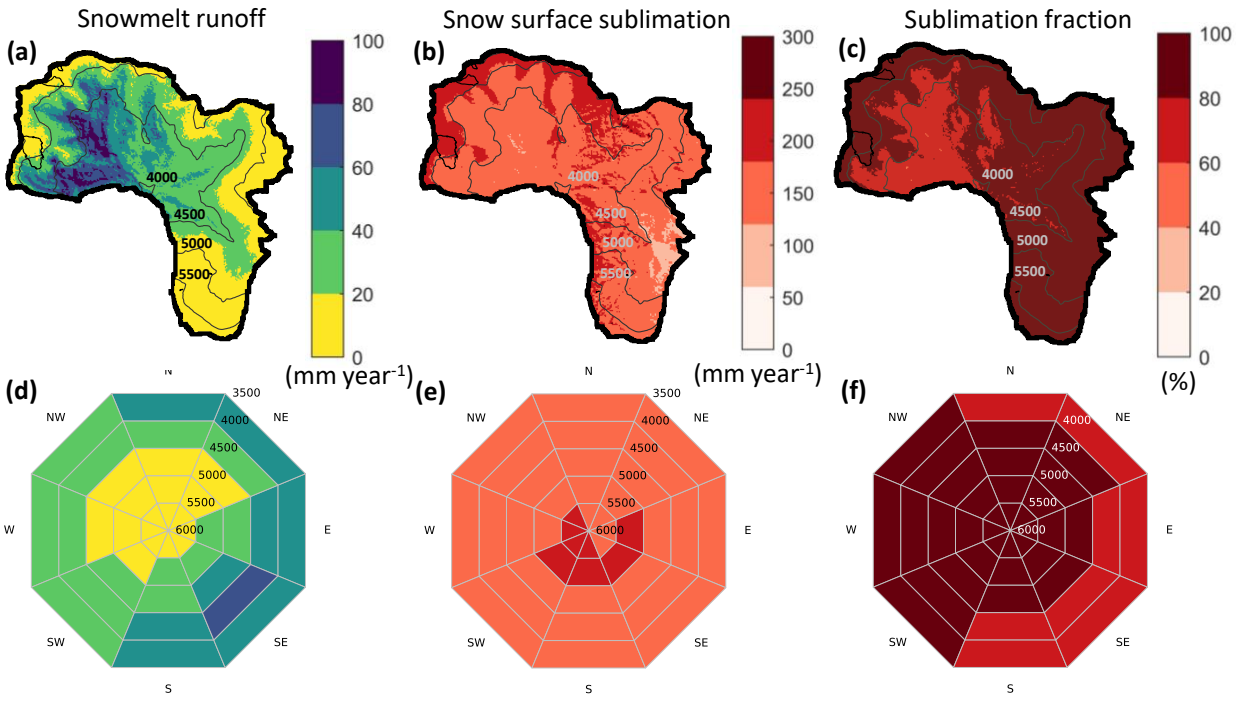


L384: “at the border with Argentina” might not be clear to the reader.

We have deleted that sentence.

Fig 8b&c: These figures are a bit hard to understand due to the selected colorscales, and make it difficult for the reader to observe themselves what you state in the preceding text in L390-400.
We agree with the reviewer that the patterns described in the text were difficult to follow in the figure. We think that it was difficult to understand because some descriptions were not clear and therefore we have modified the text slightly to make it more consistent with the figure. We prefer to keep the colormap as it was chosen (red colors and starting from 0) to distinguish sublimation processes that decrease the water availability of the catchment with red colors from snowmelt runoff with blue or green colors. Also, we chose the red colormap starting from 0 to highlight the overall high values of both, snow surface sublimation and sublimation fraction. Please see the revised text and the figure below:

“Once snow starts to metamorphose in response to internal exchanges of energy and vapor, wind transport is reduced, and the snowpack is more favorable to surface sublimation and snowmelt runoff. We find that surface sublimation was the biggest loss of snow mass, showing large values at the north-western edges of the catchment (Figure 8b). Snowmelt runoff shows a heterogeneous distribution with large values at wind-protected valleys in the north-west section of the catchment and very low values to the east (Figure 8a). On average, the elevation band with the largest values of snowmelt runoff was that between 4000 and 4500 m a.s.l. with a SE aspect (Figure 8d). The sublimation fraction is above 60% across the entire domain, and above 80% at the high-elevation north-western edge of the catchment, where surface sublimation is very large (Figure 8b), and to the eastern areas of the catchment, where snowmelt runoff is almost zero (Figure 8c). Glaciers occur in sites dominated by snow surface sublimation with a sublimation fraction larger than 80% (Figure 8c). However, in terms of runoff volume, we find that ice melt corresponds to 60% of the runoff contribution from the cryosphere (snowmelt and ice melt), which is equivalent to 55 mm a-1 (or 4.3 Mm3 a−1, about 10% of the maximum capacity of La Laguna reservoir).”


Snowmelt runoff
(a)
4000
4500
5000
5500
100
80
60
40
20
0
(mm year-1)
Snow surface sublimation
(b)
4000
4500
5000
5500
300
250
200
150
100
50
0
(mm year-1)
Sublimation fraction
(c)
4000
4500
5000
5500
100
80
60
40
20
0
(%)
(d)
N
NE
E
SE
S
SW
W
NW
3500
4000
4500
5000
5500
6000
(e)
N
NE
E
SE
S
SW
W
NW
3500
4000
4500
5000
5500
6000
(f)
N
NE
E
SE
S
SW
W
NW
4000
4500
5000
5500
6000

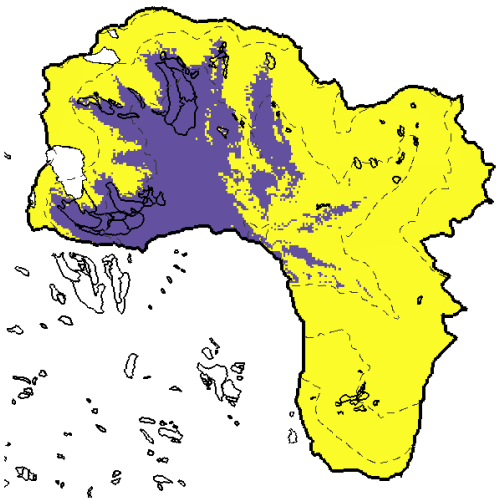
Reviewer 2

I think the manuscript has greatly improved. The structure of the results and discussion session reads much better now and the figures have also been cleaned up and are therefore more clear.
We thank the reviewer for taking the time to review our article again and their positive comments. Please see our responses below. In addition to your suggestions, we also noticed that the numbers for total annual precipitation given in the text (Section 3.1: Field data) were incorrect. In the revised version we have corrected these numbers (they changed from 309 and 330 mm to 277 and 335 mm for water years 2019-2020 and 2020-2021, respectively). This was a textual error and did not affect the rest of the manuscript.

I have a few more small comments:
- In the abstract, the fifth sentences reads a bit difficult, “permit,xxxx, limited removal” – consider rewording
We have simplified this sentence to: “In this study, we suggest that most of the snowmelt runoff originates from specific areas with topographic and meteorological features that allow large snow accumulation and limited mass removal due to high sublimation fraction”.

- L18 (Track change version) – winter snow and summer snow? Instead of snow winter absence?
Thanks for this suggestion. We have changed “snow winter absence” and “snow summer persistence” by “winter snow absence” and “summer snow persistence”, respectively throughout the entire document.

- L25 – “rock glaciers” – although there is some explanation how snowmelt hotspots could be related to rock glaciers in the discussion, I was a bit confused about it for this manuscript, as the snowmelt hotspots seem not to be in areas where rock glaciers occur. Could this also be left out in the abstract and conclusion for this paper as this has not been explicitly shown?
We thank the reviewer for this comment as it gives us the opportunity to show an additional figure that is not included in the article. We found that there are several rock glaciers in the areas identified as snowmelt hotspots. In the figure below we show the outlines of rock glaciers that have been previously identified in this region (CEAZA, 2020). Clean glaciers in the catchment are shown in white. This confirms our ideas of snowmelt playing an important role in the internal water paths of rock glaciers. We added this figure to the Supplementary Material (Figure S8).



- L80 – “Runoff generation processes” – what is meant here? Still no hydrological model is used and no streamflow is simulated. Would “snowmelt processes” not be a better word?
We have reworded this sentence to: “Given that snowmelt explains 85% of streamflow variability in semiarid catchments (Masiokas et al., 2006) and is a useful predictor of streamflow (Sproles et al., 2016), it is of vital importance to properly understand snow processes and quantify snowmelt volumes in their full complexity and spatial variability.”

- L81-L86 – here I read two times a very similar sentence. I think it could be shortened into one sentence
We have merged both sentences to: “In this work, we hypothesize that the meteorological and topographical conditions of the semiarid Andes result in large areas where snow surface sublimation losses dominate over snowmelt, thus delimiting relatively small areas from where most of the snowmelt runoff is generated, and further increasing the typically large spatial variability of snowmelt in mountain terrain.”

- L151 – I was a bit confused to read here that precipitation amounts were increased by 30%, but later on I read that the precipitation correction factor was set to 0.7. Are these two options not cancelling each other out?
Yes, that is correct, both factors cancel each other in the ensemble runs with a precipitation factor of 0.7. This is because the factors used in the ensemble runs were chosen as an uncertainty range for snow undercatch, i.e. from 0 to 60%.

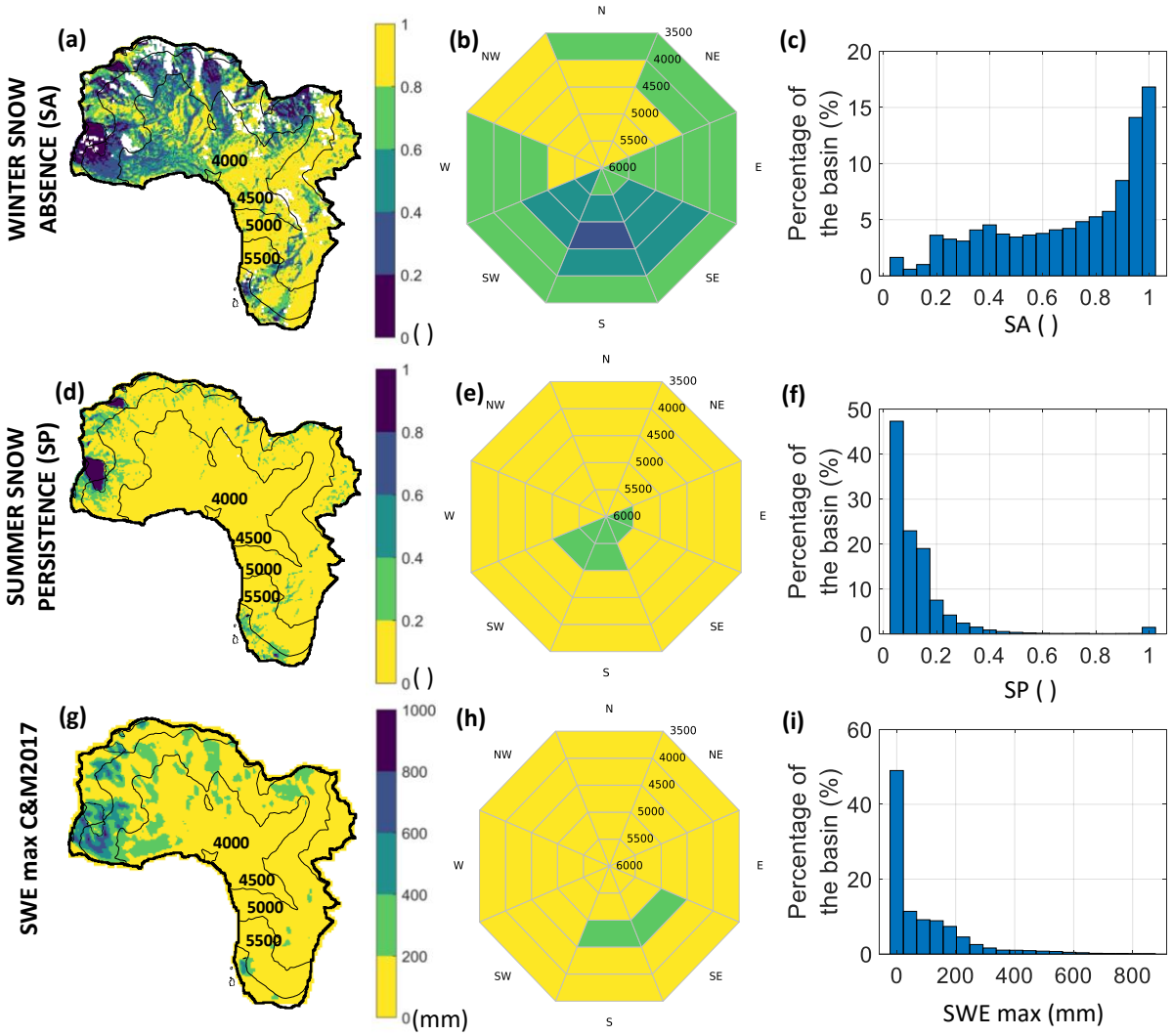
- L178 – Could you add “at a monthly resolution”?
Done.

- L206 – Maybe change “finally” into “third”, to be consistent

Done.

- In Section 5.1 where does the 0.6 Threshold come from?
This number was used only to help in the description of the figure. In the revised version, we have only kept the first use of the number and replaced the rest by other numbers that are more intuitive, such as SA=0.5 (half the wintertime).

- Figure 3 – I still have a bit trouble with the color bars for SA and SP. For SA, a high number (yellow) means that most of the time snow is absent. That same color means for SP that snow is present (in almost the whole basin?). Could one of the bars not be flipped?
Thanks for noting this. Indeed, the colorbar in Figure 3d was flipped. We have fixed this in the revised version.



- L432 – “Rainfall was much lower than snowfall”, but later it is stated that “snowmelt and icemelt played a secondary role at the annual level”. How does this work?
Yes, this was not fully clear. The second statement is in comparison with the other mass losses, mainly surface sublimation. We have now made this more explicit in the full sentence: “Snow

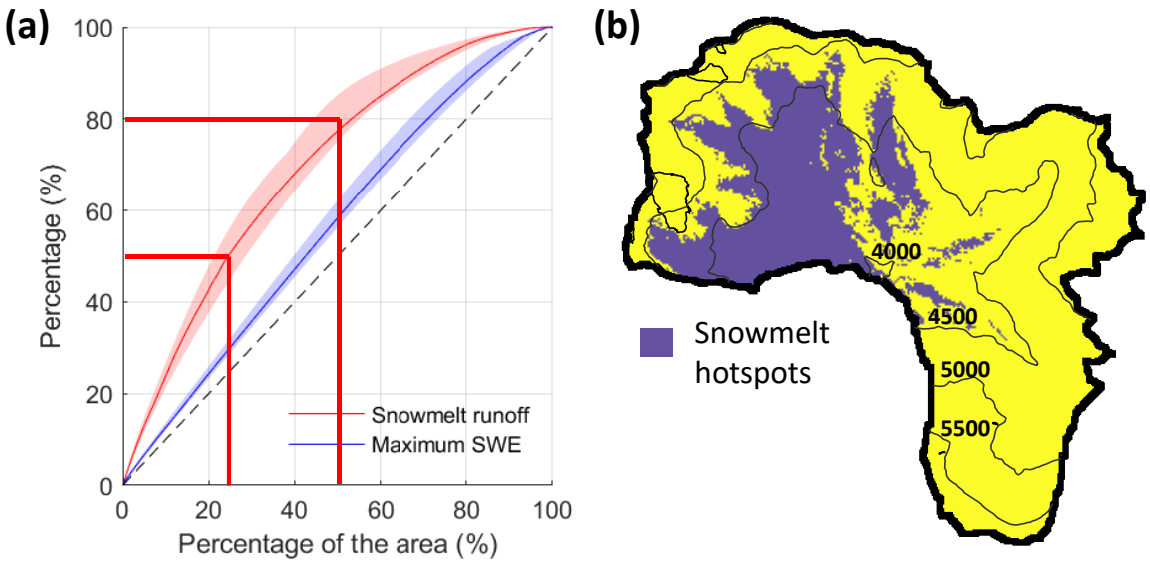
surface sublimation was the process that removed most of the snow mass and dominated ablation during winter and spring. In comparison, snowmelt runoff and ice melt played a secondary role at the annual level, but their relative importance increased in spring and summer."

- I think Figure 6 is very interesting. Would it be possible to say something about the flow during winter? Do these amount match with monthly precipitation/rainfall inputs for the station further downstream? Maybe it could also be mentioned that almost all of the flow into the reservoir in summer comes from the upstream catchment
Thanks for this comment. This is an interesting subject. We have isotopic analyses (unfortunately not yet published) showing that the winter base flow is sustained by groundwater that originates from previous melt seasons ("old water"). This base flow is occasionally interrupted by snowmelt originating from elevations below 4000 m.a.s.l. Since the 0°C isotherm during precipitation events is typically below 3000 m a.s.l., we do not expect large contributions from rainfall.
We prefer to not to comment on the second suggestion as the contribution from lateral sub-catchments may be important occasionally depending on the amount of accumulated snow.

- L526-528: "For this xxxx snowmelt runoff" – this is already in the methods
Removed.

- L533 "Interestingly" – I found this confusing since it was just explained above that almost all snow sublimates at the glacier surface
Removed.

- Figure 10 – Indicate the threshold of 50% also in the figure, otherwise it is not understandable without reading the text
Done



- L585 – ExplainS
Corrected.

- L593 “General spatial trends” – I wondered if it would be possible to provide somewhere a map where model simulations of SWE/SA/SP and observations could be compared?.
Yes. We have added a new figure to the SI with the maps (also here below). The maps show the same conclusions derived from Figure 5, i.e. there is a general agreement in the spatial trends, but the exact values do not match completely, with the differences discussed in the main text. Small-scale variability is also difficult to reproduce.