	Reviewer	Author reply
General	The author investigated the driving factors for streamflow changes during the 2022 drought in Switzerland. I enjoyed reading this paper. Glacier melting has accelerated in recent years, raising a key question: Will peak runoff arrive by the middle of this century? The author illustrated that enhanced glacier melt may not compensate for reduced glacier area, potentially leading to decreased glacier runoff in the future. The paper is well-written and well-structured, except for the results section, which could be more conclusive. My major concerns relate to data quality control. It would be valuable to include one or several basins with robust in situ observations to support the study's conclusions. I recommend minor revisions before considering publication.	We thank the reviewer for reading and carefully assessing our manuscript. We are happy to read that the reviewer enjoyed reading the manuscript. We will revise the results section, so that key findings are better highlighted and explained. We agree that data quality control is important for supporting the conclusions and are currently addressing this in the manuscript by calculating the closure of the water balance. We would like to stress that the basis of this study is indeed to use in-situ observations wherever possible. This means that all streamflow data is in-situ data, which is combined with interpolated or modelled data of glacier storage change, precipitation, SWE and evapotranspiration. No basin exists that would have in-situ observations for all water balance terms. For example, even in catchments where glacier mass balance is measured, this only represents the mass balance for that one specific glacier, whereas a catchment typically includes a handful to a lot more glaciers. Precipitation and SWE are observed locally, but that does not provide information about the catchment-wide patterns. Evapotranspiration observations are even more scarce. In summary, all robust in-situ data that are available are already included in the study. In the revised manuscript we will highlight in the various figures catchments for which both streamflow and at least one glacier is observed and which we classified as natural catchment with a closing water balance. Thank you for the detailed comments. We address them here below.
Abstract	R2.1 - Line 15: "with the difference in summer/July reflecting the extremeness of the melt conditions." This is not entirely clear to me. Could you clarify what "extremeness" refers to in this context?	With "extremeness" we refer to the anomalous meteorological conditions, which were particular extreme in July, and a bit less extreme when looking at whole summer of 2022. The more extreme (deviation from normal conditions), the more the glacier would melt, and thus being more able to offset the reduction in glacier area. Since this would use quite some space to explain, we decided to simplify the sentence. We will revise the sentence as: *Comparing 2022 to 2003-the most comparable recent extreme summer- shows a declining*

		glacier meltwater supply for 55% (36%) of the catchments during summer (July), despite more intense specific melt in 2022.
Methodology	R2.2 - Line 100: Can you explain why 25% was chosen as the threshold? "If the ratio exceeded 1 and the catchment was classified as 100% natural, we applied a uniform multiplication correction to the daily precipitation data." The bias in observed precipitation depends on gauge type and varies across seasons. If the bias primarily stems from winter under-catch, glacier accumulation could be significantly underestimated. The author briefly addressed this in Section 5.3 and the discussion. It would be interesting to include more analysis based on in-situ observations, such as comparing winter glacier mass balance (GMB) with observed winter precipitation to check if biases are consistent across years. In general, the data quality control section needs more explanation, as it directly impacts the results. A schematic illustrating this process would clarify the section.	25% was chosen, weighing off the effects of a too strict threshold resulting in few catchments remaining in the analyses, and a too high threshold including catchments that have a clear deficiency in the data that would hinder interpretation of patterns that we are after in this study. This will be added to the revised manuscript. It is correct that glacier winter balances could be used to test the biases in winter precipitation. But at the same time, these are very localized comparisons where also wind redistribution and avalanches play a role, and cannot be scaled to, for example, catchments as big as half of Switzerland. Moreover, we would like to emphasize that these precipitation values are only used to analyze precipitation deficits to describe the water balance and its anomalies. The precipitation data are not used as forcing or anything, and so the bias in precipitation does not propagate to the streamflow observations or the interpolated glacier mass balances. Indeed, the uniform multiplication factor correction of precipitation is a widely used method in hydrological studies, but misses seasonal/annual variations in the bias. In an ideal case, precipitation is corrected seasonally, annually varying and perhaps also sub-spatially (within the catchments) but information to derive such spatially and temporally varying bias corrections at the scale of Switzerland is missing. We will elaborate more in the discussion in the revised version on these data quality issues that cannot be addressed at the moment with the current data availability and within the scope of this study.
	R2.3 - Section 4.1: I like this method, but it could be described more clearly. Consider moving Figure S2 to the main text and incorporating the method or data preprocessing workflow into that figure.	We will move a revised version of Figure S2 to the main part of the paper (see Figure R2 below)
	R2.4 - Line 190: γ = 1.8. Does this value apply to all glaciers in the study region? This seems slightly high for glaciers in Switzerland.	Indeed, we used one value for all glaciers in Switzerland. This higher value for gamma resulted from the log-log plot of area and volume for Swiss glaciers in 2016 and 2022, reflecting that smaller glaciers lose their area much quicker than larger glaciers. We will add this explanation to the manuscript.

Results	R2.5 - Figure 2b: For contributions of the late ending of the melt season to ΔBs, why are the bottom whiskers invisible in the Rhine, Rhone, and Po basins compared to the Danube basin? This is particularly notable since the Po and Danube basins are geologically similar.	The bottom whiskers are invisible as the 5%, 25% and 50% percentiles of the late melt contributions of the set of glaciers for those basins were 0. In these basins, many glaciers did not have a later end of the melt season than during the reference period.
	R2.6 - Figure 3: It would be interesting to include a figure with units in percentage, as the absolute values of these terms differ.	Yes, we will include the figure with relative anomalies in the SI (see Figure R1 below). The absolute values indeed differ, but we choose to display these in the main manuscript as the absolute anomalies explain the compensation effect, which is not necessarily the case for the relative ones.
	R2.7 - Line 320: "The relation between glacier melt contribution to streamflow and level of glacierization is exponential, showing a steep increase in melt contributions for catchments with 0–20% glacierization, which diminishes for catchments with more than 20% glacierization." This is interesting, but do you have an explanation for this pattern? Be cautious with this conclusion, as I don't see this trend in the reference period.	Indeed, this relationship is less clear in the reference period, but also there an exponential behavior could be identified, which is most clear if we look at the summer melt period. A possible explanation could relate to the higher glacierized catchments generally being located in the drier Rhone basin. While glacier melt increases with level of glacierization, streamflow levels off with increasing glacierization possibly due to the non-glacierized runoff/rain and snowmelt contributions getting smaller. In the revised manuscript we will add this to the discussion and note that this will need further investigation.
	R2.8 - Figure 4: The comparison of uncertainty ranges between different groups is unclear and seems unfair. Due to the logarithmic scale, the uncertainty for highly glaciated basins appears much smaller than for others.	The uncertainty range is calculated the same way for all catchments. Indeed, due to the logarithmic scale, the length of the uncertainty range does not scale with the uncertainty, i.e. it looks much smaller for the highly glacierized catchments. Without a logarithmic scale we would lose important information on the lower glacierized catchments. We will add a note in the caption that this distorts the impression of the uncertainty ranges.
	R2.9 - Line 365: Do you have any data to support this aspect?	*"Only in 16/76 catchments streamflow was higher in July 2022 than in 2003, and for three of those (two in Po basin and one in Rhine basin) that did not relate to higher glacier meltwater volumes".* The higher streamflow in 16 minus 3 catchments in July 2022 is hypothesized to relate to higher meltwater volumes, as described in the text. For the three catchments that did not show higher meltwater volumes, but did show higher streamflow volumes, there are three possible explanations: 1) it could relate to more water being released from storage (artificial or natural – e.g. wetter conditions previous month), 2) or a dominant role of ET (which was less in the Po basins in July 2022 compared to July 2003 - Fig. 7) or 3), alternatively, it relates to uncertainties such as

		a potential underestimation of the glacier area, so that actually more meltwater was generated than currently estimated. We will add these explanations to the manuscript.
	R2.10 - Line 375: Could you add a definition of “changing sensitivity”? Consider moving the sentence from Line 420 to this section.	Yes, we will add in line 378, “the sensitivity of glaciers to temperature, expressed as meltwater volume per unit of Temperature”
	R2. 11- Figure 8, Panel B: Why do glacier area changes appear almost linear after the 1970s? How was the initialization of the glacier state handled in the modeling?	Indeed, we decided to perform a linear interpolation of glacier area in between the two available inventories in 1973 and 2016. We consider this the best estimate of glacier area in between these two fixed glacier areas for every glacier. Volume-area scaling was only applied for updating glacier areas after 2016, and before 1973, respectively. This procedure will be clarified in the revised paper. Based on this approach, there is no need for an initialization of the glacier state.
	R2.12 - Section 6.2: As mentioned earlier, providing more in-situ data in the supporting information would be beneficial. This method could also be applied to other mountain regions globally.	We do not entirely understand the reviewer’s request here: We cannot print all in-situ data used in this study in the SI. The data description provides sources and references for all data that are used which should allow full reproducibility of the applied approaches.
	R2.13 - Line 450: Out of curiosity, what method was used to measure discharge in Switzerland?	The discharge data from almost 90 catchments was obtained in most cases from the Swiss federal hydrometric gauging station network, combined with stations from cantonal and private networks. Discharge at these stations is measured in a variety of ways, depending on the setting, using pressure sensors, velocity-area (radar) and weirs. The data from the authorities is provided as discharge data only, i.e. not the raw data. We will extend the data description to include this information.

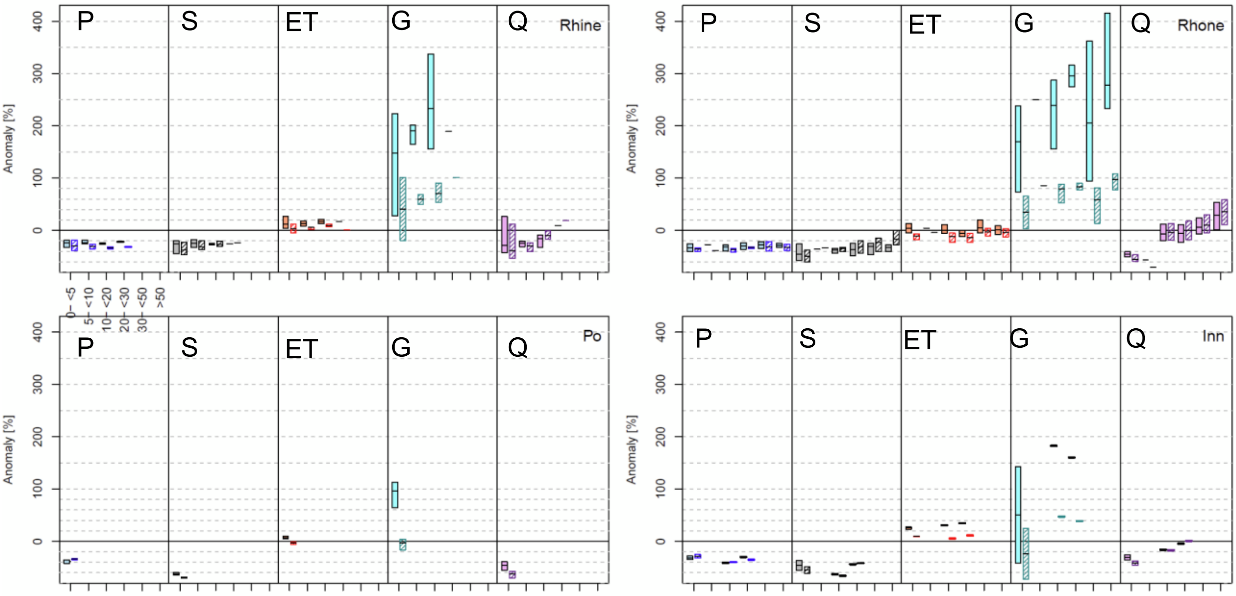

Figure R1 – Relative anomaly version of Figure 3 of the manuscript. The solid bars represent annual anomalies, and the dashed one the summer anomalies. The bars indicate the min-max and the mean of the various catchment groups (categorized by glacierization).

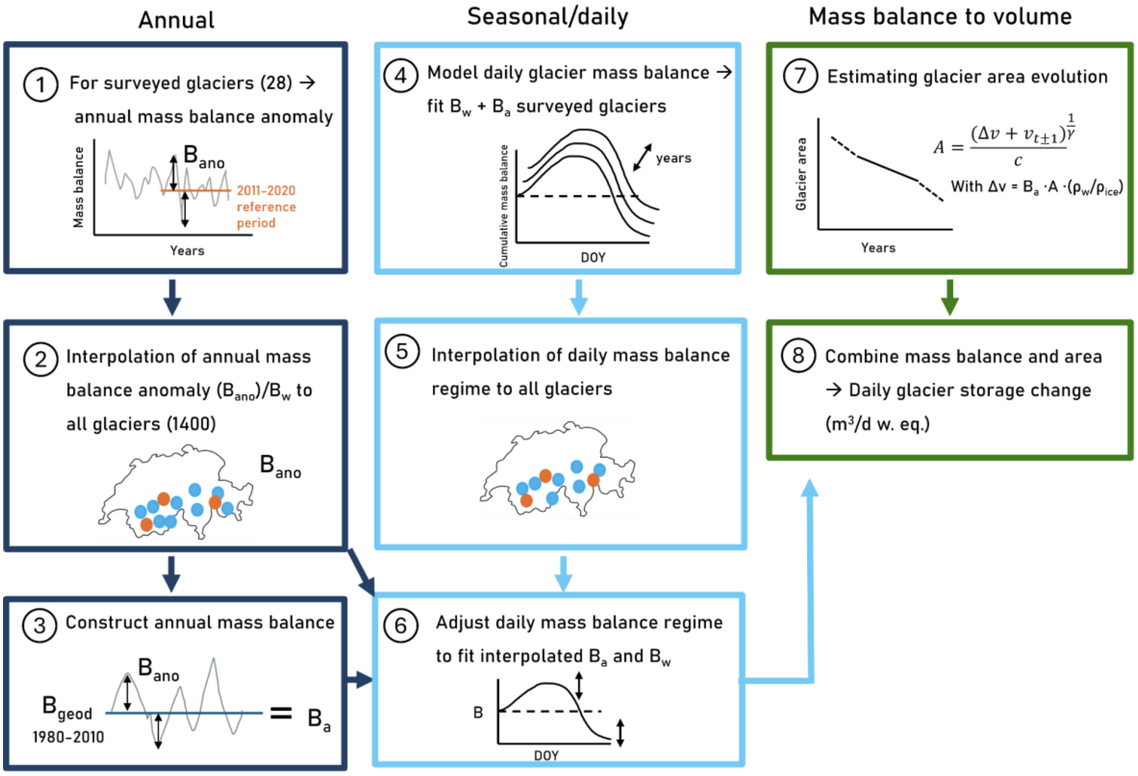

Figure R2 – Flowchart for deriving the daily glacier mass balance and glacier storage change estimates for all glaciers in Switzerland. This figure will be added in the methods part of the paper.