Reviewer 3 comments in plain black text, author replies in *italic black text*

We appreciate the further suggestions by Reviewer 3 (F. Paul). We have incorporated all suggested changes and note where we made slightly different modifications from what the reviewer suggests.

From the reply of the authors to my earlier comments I conclude that a main point of disagreement is the ***glacier definition***. I start with this point and add details about the climatic interpretation later. As a first step, I had a detailed look at all the publications cited by the authors as well as some additional documents* that I hope would confirm their view to exclude stagnant ice from glacier mapping. Apart from the fact that the authors assign this region subjectively without using flow velocities, I have not found any evidence in the cited and additional literature that buried/stagnant ice had to be removed. If at all, it is mentioned as a possibility rather than mandatory. For example Beason et al. write on P20 (or 1) 'identifying surface velocities on glaciers at the Park to delineate active and stagnant ice'. This means they just distinguish the two types rather than removed the stagnant part and they used flow velocities for it. This is also my interpretation of the polygons marked as 'buried ice' in the inventory by Fountain et al. (2023). These polygons can be marked, but have to be included.

Also Lillquist and Walker (2006) (LW06 below) mention the separation as a possibility, but they are also not applying it. They have seemingly also not applied the rules they have listed for glacier terminus identification. I have compared the dated outlines in their publication to the aerial photography available online** and in particular the oblique 1946 images for Coe and Eliot Glacier reveal strongly down-wasted glacier tongues, basically only consisting of ice-cored lateral moraines. Still, the termini where placed at the end of this assemblage of buried or maybe dead ice remnants. I would thus not take the rules literally.

To conclude this part, I had a look at the UNESCO guidelines by Müller et al. (1977) and the GLIMS Analysis tutorial. The former states: 'Inactive ice must be included in the inventory for hydrological purposes. Marginal and terminal moraines should be included if they contain ice. The "inactive" ice aprons which are frequently to be found above bergschrunds should be regarded as part of the glacier. Glacierets and snow patches of large enough size - if perennial - should also be included in the inventory.' The latter describes under points 4 and 5:
'4. A stagnant ice mass still in contact with a glacier is part of the glacier, even if it supports an old-growth forest.' and '5. All debris-covered parts of the glacier must be included.'

Hence, to be consistent with the earlier interpretations of terminus positions, the literature cited by the authors as well as current guidelines, but also to avoid subjective assignment of glacier areas, the buried or stagnant ice has to be included. I see no way around this. As a way forward, I suggest using the outlines from Fountain et al. (2023), merge the polygons marked as 'buried ice' with the main glacier and then modify them to the 2023 extent, e.g. as visible in the very high resolution satellite image from the ESRI Basemap. Apart from the noticeable retreat of the Coe terminus, also the retreat and lateral melt of Eliot should be updated. For Ladd Glacier one has to first glue the five polygons from Fountain et al. (2023) together, but without the original images

a new interpretation of the terminus will be difficult. If the image is not available, I suggest skipping this glacier for this year from the change assessment.

We have made all of these changes and adjusted the manuscript accordingly. However, we note these changes do not alter our overall conclusions.

For glaciers that have now two or more parts (e.g. Zigzag/Sandy), all parts included in the former extent have to be summed up for calculation of area changes. I would not do a comparison of change rates when including and excluding the stagnant ice. As you do not have flow velocities, you cannot say where the stagnant ice is and related area or length changes would be arbitrary. So I would skip this stagnant ice discussion altogether. Instead, please have a discussion about the difficulties in identifying termini of down-wasting glaciers. This can be nicely illustrated and allows others to connect to this global-scale mapping problem.

We have removed discussion of stagnant ice in glacier area and length changes (removed length changes all together). We have added in a discussion of difficulties in identifying terminus area, focusing on Ladd Glacier with a new Figure 6 of the terminus in 2023 added.

However, we do retain the lowest elevation at which we identified flowing ice, which Paul does not raise questions about. In so doing, we just note the change in the lowest elevation of flowing ice found in 2003 versus 2023 following the input of Reviewer 1.

The second main point I want to make is on the ***climatic interpretation***. As mentioned before, most of the glaciers in the study region can hardly be used for a climatic interpretation, as they are either heavily debris covered (e.g. Ladd, Coe, Eliot) or calving (Reid, Newton- Clark). This decouples their responses to climate change and makes calculation of response times challenging. On the other hand, a closer look at the Mt. Hood glacier images available online** combined with the accumulation season precipitation and cumulative length change plots presented by LW06, reveals a fast response of the glaciers to related fluctuations (e.g. advances following increased precipitation). This fast response can likely also be expected from the steepness of the terrain. So, if the authors wish to keep some climatic interpretation, I suggest stripping it down to the basics and continue the time series presented by LW06. This means:
-add a note on the difficulties to interpret glacier fluctuations in this region in climatic terms
-continue the analysis by LW06, showing only curves for winter accumulation and summer ablation without an artificial delay or averaged values
-use cumulative length changes rather than normalized length
-discuss the obviously fast/sensitive reaction to precipitation changes in the past and contrast this with the now dominating retreat/down-wasting due to increasing temperatures (and all the problems related to it for glacier extent mapping).

We have greatly reduced our discussion of glacier-climate linkages as the reviewer suggests. In our original manuscript, we already noted the prior issues with glacier fluctuations and climate change in our introduction. In our further revised manuscript, we now just compare the rate of glacier area change (total area, per above reviewer comments) and the change in temperature and precipitation. In so doing, we focus only on the unprecedented 21st century rate of retreat and its correspondence with unprecedented warmth, whereas precipitation is non-unique. We

chose to use this approach because it 1) included the records of more glaciers (7 for the period of 1907-2023 and 10 for 1981-2023) and 2) partly avoids issues of down wasting versus length change as contraction of the lateral margins are included, which can occur as the ice thins. We also chose not to continue the length records of Lillquist and Walker (2006) due to the issues identified above in their mapping terminus location. Mainly, Lillquist and Walker (2006) set out to map actively flowing ice but then did not do so, or only partly did so (e.g., for Eliot Glacier they explicitly note in their Figure 3A separation between the 2000 glacier terminus and the lowest extent of debris covered ice in 2000 that would be included in the glacier length/area following Müller et al. (1977)), for the interval where they used only archived photographs according to Review 3's (F. Paul's) investigation. Given this ambiguity, we feel using the glacier area records, which also then includes more glaciers that partly addresses issues of varying climate sensitivity, is a more robust approach. We believe this satisfies the reviewer's concerns even further than the suggested revisions provide above.

We have removed the mean annual temperature and total annual precipitation and present the final records with a simple 11-year box-car smoothing that is based on the fastest response time for such glaciers of 11 years (Pelto, 2016). We include this smoothing as our goal is to show how the rate of glacier retreat has changed in accord with climate change, which is an average over a given number of years versus any given year's temperature or precipitation. In the Pacific Northwest, temperature and precipitation have significant year-to-year variability in response to eastern tropical Pacific sea surface temperature fluctuations (i.e., ENSO), which we remove with the 11-year box-car smoothing.

We have added a discussion on how past changes in the rate of glacier area change relate to changes in summer temperature and winter precipitation. This includes the overall period of glacier stability and individual glacier advance in the mid 1900s.

Regarding the suggested text changes describing the importance of flow for an ice body to be named a glacier, I also suggest to not present it. First, the authors do not use or have flow velocities to apply the definition and second, the cited definition by NSIDC as well as the one by Cogley (2011) says 'evidence of *past* or present movement/flow'. So even if the 'stagnant ice' does not flow today, there is multiple evidence that it has done so in the past. In other words, also these definitions do not allow removing possibly stagnant ice from the area.

We have removed this section.

I hope the above explanations help clarifying my objections and the authors can revise their ms accordingly. Most of the points in their reply will likely settle when we agree on these main points. As a note, the comments from my earlier reviews are still valid and should thus be considered as well. I have not repeated them here.

We have made these changes (e.g., only include the photos of Ladd that have slight snow cover in 2003 in the supplement).