We have replied to the comments in blue.

The Glaciers of the Dolomites: last 40 years of melting - Securo et al., 2024

The authors present a comprehensive overview of the state of glaciers in the Dolomites including detailed assessments of glacier volume and mass change for the main remaining glaciers in the region. They provide an informative discussion of the observed glaciological changes in the context of local climate and topography and contrast the evolution of glaciers in the Dolomites with glaciers in other European regions. As the authors point out, glacier change data from the Dolomites is sparse (by Alps standards) and this work is a valuable contribution towards a quantitative understanding of glacier change in this region over the last ~40 years.

The authors highlight the importance of local, mostly topographic factors for the evolution of very small glaciers and the need for continued monitoring to better understand the possible future trajectories of these features. I agree with this. The 3D visuals are very cool and will be valuable assets in outreach activities.

I have some questions and comments which I hope can be addressed to improve the overall clarity of the paper. My impression is that the authors probably have everything needed to do this and it is a matter of providing additional explanations or changing the way some things are presented, rather than adding to or changing the analyses. My main points are below, the following brief notes are mostly just small quibbles I had while reading. I feel like some editing for more concise language would be beneficial but this is of course somewhat subjective.

Main questions/comments:

<u>Surface change computation and treatment of errors</u>

The section in the methods dealing with this is a bit fuzzy and I find it hard to follow at times. The error in surface elevation change is stated to depend on lidar accuracy, alignment between the point clouds, and a distance uncertainty. The lidar accuracy is “not considered” (L163) because ”relative distances” are used. I am unsure what the reasoning for this is. If I understood this section correctly the authors are comparing all other data to the 2010 lidar (L158), but this does not appear to explain why the vertical accuracy of the lidar is not a relevant factor (?) Are you only looking at the horizontal accuracy? If so, why?

It's correct that we are comparing all the data to 2010 LiDAR because is the best available dataset so far. Although it is of a much smaller magnitude than the alignment error, at least in older reconstructions, it is necessary as suggested that all errors and their propagation are considered. In the revised version we will therefore consider all errors and how they combine into overall accuracy: alignment error from the point clouds manual alignment, lidar error from the surveys used as ground control points source and distance uncertainty coming from the M3C2 measurements.

I would also like more explanation of the process mentioned in L158: “Every comparison included 2010 LiDAR data and has never been done using two historical SfM-point clouds at a time, to reduce possible sources of error.” The results show surface elevation change values for various time steps before and after 2010. How were these generated if everything is compared to 2010? I do not see how comparing everything to 2010 first and then computing differences for other periods would cancel out the errors in the historical point clouds. I may have misunderstood what you did here but either way I think it requires some more explanation.

The comparisons to 2010 LiDAR only are done to have the most reliable source of data used for alignment estimation. Error is calculated outside of the glacierized area so it’s more robust if we use the best dataset as reference. The subsequent calculation for different timesteps are done just by subtraction.

Perhaps some sort of diagram showing the processing steps to arrive at surface elevation change for different time periods would help, or just a more structured explanation.

We had initially prepared a diagram showing all the processing steps which we have lately chosen to remove. Looking at the methodology now and considering both reviewer comments we think that it's better to integrate that image in the supplementary materials. See Fig. R1. Considering the current manuscript length and the suggestion coming from Anonymous Referee #2 to shorten it, we think that Fig. R1 should not be in the main manuscript.

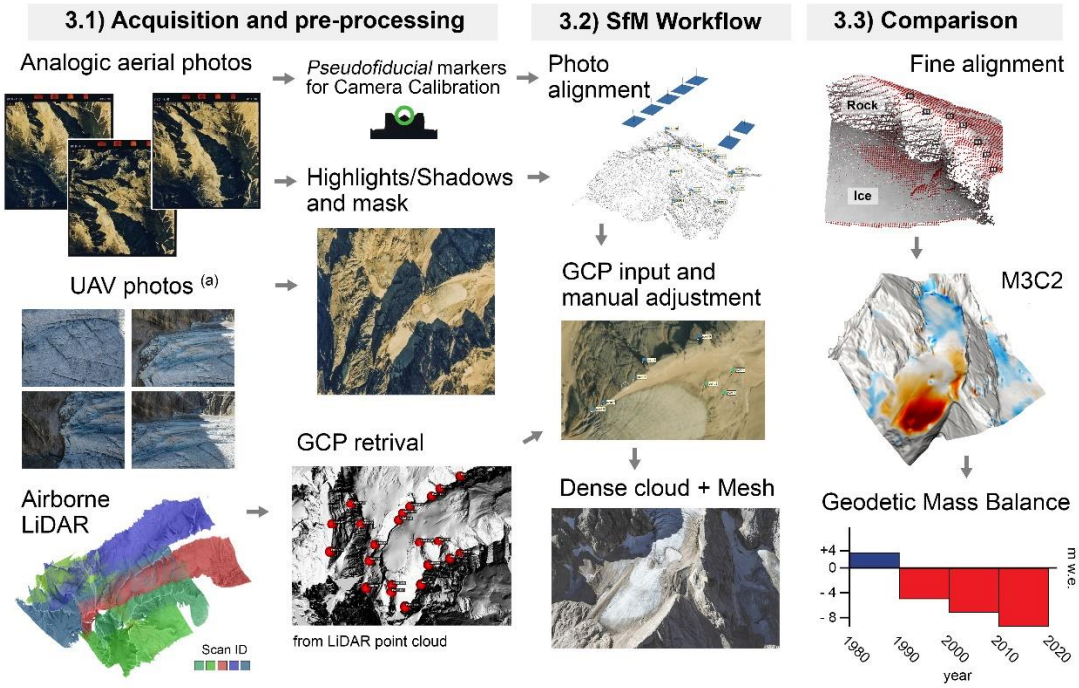

Figure R1. Summary of the data processing proposed to be integrated in the Supplementary Materials.

In the results (L206) it is stated that "Higher accuracy and precision (E_AL 0.1-0.3 m) were obtained" for the more recent years. Since the alignment error is considered the main source of uncertainty (this is my understanding based on the methods section) it would be interesting to see these values for the historical data as well and to include some more information on how this error was determined. Can you quantify the total error of the volume change data for the different time steps?

Higher accuracy and precision are reported for LiDAR-to-LiDAR comparisons (i.e., 2010-2014) and for UAV-to-LiDAR comparisons (i.e., 2010-2023) which are based on more robust data. The alignment error is visible for all comparisons in Figure 4-5. Error treatment will be implemented, see answers to comments above.

The alignment error between historical-only (i.e., analogue based) comparisons are higher, but are not included in our calculations as we compared everything with 2010 (see comment above)

Glacier area

The authors repeatedly refer to "common area" vs. "total area". It is not entirely clear to me what they mean by common area and how it differs from total area, nor did it become clear to me which year (or average) they used for computations of volume and mass change. It would be beneficial to have a clear explanation especially of "common area" early on in the manuscript (methods section). A bias related to usage of different areas is discussed later on and it is apparent that the authors are aware of the influence of glacier area on further computations, so I think i is again just a matter of improving the clarity of how this is presented.

This publication may be of interest: Florentine C, Sass L, McNeil C, Baker E, O'Neel S. How to handle glacier area change in geodetic mass balance. Journal of Glaciology. Published online 2023:1-7. doi:10.1017/jog.2023.86

We refer to common area as the area in common between the two timesteps considered in each comparison; while total area is what in Florentine et al. (2023) is defined as fixed maximum glacier area. i.e., the oldest year area of each comparison. We agree with the reviewer that this needs to be specified clearly in the text adding also the proposed reference. As pointed out in Florentine et al. (2023) using temporally resolved areas in geodetic mass balance studies is more robust, as we have done for each single comparison. Unfortunately, we cannot add intermediate timesteps between the one already in use in this study because of the lack of data in between

Note that the glacier area is also related to overall uncertainties. The uncertainty in volume change is a function of the uncertainty in surface elevation change and uncertainty in the area. Neither of these factors seem to be included in the uncertainty estimate for the mass change given in the results, which appears to be based only on the uncertainty of the density conversion. I understand that it may not be possible to fully quantify the uncertainty, but it would be good to at least mention this and explain that challenges related to exact area delineation (which you mention) also affect volume and mass change estimates. Note the large impact of area on uncertainties shown e.g. in Hugonnet et al 2021. (extended data Fig 5).

We will provide a more solid error evaluation in the revised version of the manuscript, considering the error propagation and the total error also in the mass balance calculation. As per the current version it is true that the only density conversion factor is considered as source of error for mass balance calculation.

The impact of area on uncertainties is big in such large-scale studies as Hugonnet et al. (2021) but in this specific case is less impactful as we have higher resolution data and, except for debris cover, we can map with precision the area of each glacier. We anyway agree that this should be specified better in the discussion

Abstract

L 8, L 50 and elsewhere in the manuscript: unmanned aerial vehicle
Please consider using the neutral term "uncrewed aerial vehicle"

Agree and will update it, thank you

L 10: from 1980s to 2023
The 1980s and 1990s are frequently referred to as time periods throughout the text. I feel like more specific phrasing would be helpful for the reader. In the abstract and as you explain your workflow it would be good to know that, e.g. "1980s" refers to data from 1980 or 1982 as per table 2.

We agree with the proposed change, and we will integrate it with more specific periods whenever they are mentioned in the manuscript.

L10: …33% of which between 2010-2023…
Missing word? → of which occurred (?) between 2010-2023

Yes, it was a mistake, thank you

L11 negative with a smaller amplitude
Consider changing to "less negative" for clarity

Agree, we will update this throughout the text

Introduction

29: valley bottoms
I think "valley floors" is the more common term for this

Agree, it will be changed to “valley floors”

L62: providing a description of the glaciers in the Dolomites that are still active,
How do you define “active” glaciers?

Which glaciers are active in this case is taken from the last available inventory from Smiraglia et al. (2015), as mentioned in the text. e.g. L 104-109 and Fig. 1 caption

Previous studies

L69 No glacier in the area has mid or long-term mass balance dataset available
Missing “a”? (has a mid or long-term mass balance dataset…)

Correct, our mistake

L88 Results show an area variation of approximately -50% from 1910 to 2009.
Consider rephrasing for clarity: “...show an area loss of …”

We will rephrase this and other similar sentences throughout the text

L91 and following
Consider restructuring for clarity. You could move the sentence starting with “also of great significance” to the end of the paragraph so that the sentence citing Serrano et al (2021) appears directly after the first use of the term ice patch. Why is the debris cover of great significance? You might state that it is abundant without using the word significance, which is often associated with statistical parameters.

Agree to remove the use of the word significance to avoid confusion and to move the sentences as proposed. The presence of debris cover glaciers is significant because gives an insight of the geomorphic evolution of the cryosphere in the Dolomites The paragraph will be as following:

“Among the 51 glacial bodies, 13 are classified as mountain glaciers (Table 1) while 38 are considered snow or ice patches (Smiraglia et al., 2015). When we use the term ice patch, we refer to the description of ice patch of glacial origin present in Serrano et al. (2011), which is more specific and relevant to the study area compared to the definition of dead ice. The presence of debris coverage is abundant or complete on 18 of the 51 inventoried glacial bodies.”

L106 Other Dolomites massifs that still host minor ice deposits devoid of any evidence of dynamics are not included in this work.
What do you consider evidence of dynamics and how did you determine that none is present at these features compared to the nine you study?

The previous sentence is based on Smiraglia et al. (2015) inventory work, a proper analysis of this is not included in this work.

We will specify and add Smiraglia et al. (2015) citation in the text

Table 1: state in the caption or in the table for which year the area value is valid. Same year as the cited publication?
Caption: Smiraglia and DIolaiuti → typo

The area for the Dolomites is valid for 2009, despite the work is from 2015. Also, the correct citation is Smiraglia et al. (2015) and not Smiraglia and Diolaiuti, our mistake. We will add the year and correct this

Data and methods

Table 2: 2010 and 2012 photos have been used only for visual reference and not for mass balance reconstructions.
Would this be an opportunity to compare results using the 2010 photo vs. the 2010 lidar and assess the difference in elevation change between the different methods/data sources?

Even if this would be an interesting proposal, the problem is that 2010 surveys do not match in date and we have these kind of data only for one location (Mt. Antelao). Our proposal is therefore to improve the error and uncertainties section (see general comments) without including this comparison in the work.

L157: …using common area with regards to different years.
Unsure how to interpret this - does this mean you used the same area value for all computations of geodetic mass balance? Which area value (from which year) did you use?

We did not use the same area, but the common glacier area between each period. E.g. if the comparison is 2010-2014, we used their common area. Note that we have still reported both common and total area in the surface elevation change in Fig. 4 and Fig. 5

L157:
Every comparison included 2010 LiDAR data and has never been done using two historical SfM-point clouds at a time, to reduce possible sources of error. Does this mean you compared every other year to 2010? See general comment above.

Yes, we compared every other year to 2010. See comments above.

L163: ±0.12m I am assuming this refers to vertical accuracy? Consider clarifying In this study, our comparisons were done using relative distances; therefore, it may not be considered.
I don't understand what you mean here. Are you saying uncertainties in the lidar measurements are not considered? Please clarify why not.

It was unclear and as mentioned above this part will be implemented with a more robust accuracy estimation. All errors and their propagation will be now considered in the revised version of the manuscript

EM3C2 was available as a direct output of the algorithm (i.e., distance uncertainty), and considering our dataset was negligible compared to the E_{AL}.
So E_{AL} was the main error source? Can you quantify the relative contribution of the different errors?

Yes, E_{AL} was the main error source. As commented above we will provide a much more comprehensive evaluation of all errors and error propagation. We will also quantify the relative contribution of the errors

L170 imageries → imagery

Our mistake, will change it to imagery

Weather station network

L180 Additionally, years with missing data exceeding 5% of the accumulation (November to April) or ablation (June to August) season. Unusual definition of accumulation and ablation season, please explain the reasoning behind this. What happens in the missing months? (May, September, October)

Please, see comment "L199-L202"

L182 This was implemented at the level of individual AWSs, ensuring the availability of data for each year after averaging across all stations

Why average over all of them? If the goal is to get one T&P time series for the region, consider leading with that.

The study area is small and individual stations do not show diverging trends among each other. While, averaging among the stations allow us to have a more complete regional timeseries

L183 All the time series begin between 1985 and 2001 and end between 2020 and 2022 Does this mean that none of the time series extend beyond 2022?

Yes they do, but when preparing the manuscript we stop to 2022 because more recent data were still not available from the regional environmental agency. Furthermore, the study area is small and individual stations do not show diverging trends among each other. Averaging among the stations allow us to have a more complete regional timeseries

L189 where xa is either the total precipitation during the accumulation season (for the precipitation SAI, Pr SAI), and the mean… Should this be "or the mean" ?

Yes, it is "or". Thank you

L191: The accumulation and ablation seasons were defined according to local climatology
Please specify what this means.

(Reply here refers also to comment to L180)

Nov-Apr is the time during which snow monitoring stations show increasing snow on the ground. From May the mean snow on the ground start decreasing in all the snow monitoring stations. Dolomite glaciers are located at lower altitudes compared to the Alpine average; therefore we used a shorter accumulation season.

L191: Finally, SAI values were spatially averaged, providing unique Pr and T SAI values for the entire region
Does "spatially averaged" mean you produced some kind of gridded data set or is this simply one averaged time series over all the weather station data? Please clarify

It is the second one. "Finally, SAI values were averaged across all weather stations, resulting in unique Pr and T SAI time series representing the entire region."

L193: The pre-processing applied to AWS data may result in an underestimation of total precipitation and therefore of the Pr SAI.
Why? What part of the preprocessing leads to underestimation?

Due to the presence of missing data and the fact that years with more than 5% of missing data during the accumulation or ablation season were excluded from the analysis.

L198 collect a datum
Consider rephrasing → record a value

OK, thank you. We will change it to "record a value"

L200: Using this data, we reconstructed the October to June snow depth on the ground for the most relevant years of our study (1982, 1992, 2010, 2014, 2023).
Reconstructed as in you averaged over October to June for the given years? Or does the reconstruction involve something more complex?

We have changed "reconstructed" with "show". The data we present here are daily snow on the ground as recorded by the snow monitoring stations.

L202: Additionally, we calculated the October to June snow depth on the ground averaged over the whole time frame for each station as well as the total annual snow accumulation.
Could you explain your reasoning for using October to June average snow depth? Wouldn't the snow depth at the end of the accumulation season (late spring) be a more relevant metric?

We show the Oct to Jun (data are every 30 min or day according to the station) trend. In this way it is possible to see the snow at the end of the accumulation season as well as the whole of annual trend. We rephrase the sentence to make it clearer: "Additionally, we calculated the October to June snow depth on the ground averaged over the five reference years for each station, as well as the total annual snow accumulation from 1980s to 2023."

Results

L206: Higher accuracy and precision (EAL 0.1-0.3 m) were obtained…
What does the EAL 0.1-0.3 m value represent? (accuracy or precision? Which years? What are the values in the years where lower accuracy(?) was obtained?)

We will specify the highest and lowest accuracy and also the period considered in the revised version of the manuscript. These 0.1-0.3m E_{AL} values are referred to the recent comparisons (2010-2023) that do not include analogue imagery. See also updates listed in the general comments answers.

L207 Out of the 9 glaciers analysed, Sorapiss Occidentale, Antelao, Marmolada and Pale di San Martino areas were reconstructed starting from the 1980s while Popera and Cristallo reconstruction begins in the 1990s
State the exact years, 1980s and 1990s is vague

Agree, we will state the exact periods.

L214:
In 1980s and 1990s the Dolomites glaciers were larger in number, with several of them that have now completely melted, turned into permanent ice patches without apparent ice dynamics and heavily buried by debris.
Consider rephrasing for clarity. Something like: In the 1980s and 1990s, there were more glaciers in the Dolomites, some of which have completely melted or turned into debris covered permanent ice patches without apparent ice dynamics.

Agree, thanks for the feedback.

L217 Relative area reductions are not similar across all glaciers
State min max range of area reduction to show variation?

Agree, it's useful to present quantitative insights. Smallest area reduction is 9.1% in Popera Alto glacier while largest is 88.9% in Fradusta glacier. Areas are also shown for all timesteps available in Table S2.

L219: topographic bounding
Consider explaining this term

Instead of using this term we will use "bounded by steep topography" to be clearer

L226: for common and total glacier area
Please explain what you mean by common and total area. Is this stated somewhere?

See general comment "Glacier Area". We will add a specific explanation that was now missing.

L226: Due to the impossibility of retrieving enough data for years 1999 and 2001, we considered the period from 1990s to 2010 as a unique time frame, instead of calculating the metrics at a decadal frequency. The

average cumulative surface elevation change (Table 3) was calculated for three periods: 1980s with -5.21 m, 1990s-2010s with -14.09 m and 2010s with -9.31 m.
Does “unique time frame” just mean you used a longer time step? I think rephrasing would help clarify this, something like: “The average cumulative surface elevation change (Table 3) was calculated for three periods: 1980s with -5.21 m, 1990s-2010s with -14.09 m and 2010s with -9.31 m. Due to lack of data in 1999 and 2001 it was not possible to resolve the 1990s-2010 period at decadal frequency.”

We agree with the proposed rephrasing that avoids potential misunderstanding.

L241 The highest absolute losses, corresponding to almost 35 m, are reached in the area involved in the ice avalanche that happened in a detached part of Marmolada Principale, on 3rd July 2022, as shown by the Kernel Density plots of surface elevation loss (Fig. 5b)
Can you mark this in the figure? I am unsure where I can see this in Fig 5b.

As this is under “Marmolada Collapse” label in Fig. 5b, we will add a reference to it in the text to help the readers finding it in the figure. The same label is present also in the map (Fig. 5a) so it should be easy to find it.

L243 The Fradusta Inferiore Glacier was not included in the common area measurements as it had already disappeared before 2023 surveys took place.
Again, what exactly is common area?

See comments above on Glacier Area. More explanations will be added in the methods.

L246 On that glacier a rise of more than 10 m has been observed close to a wide serac whose presence is possibly related to a small surge induced by a recent rockfall (Fig. 5a) in the accumulation area as well as by internal glacier dynamics
Interesting! If possible, consider marking this feature in the figure

This feature is already shown in Fig. 8a, b and more text is present in the Discussion section.

L248 This is well visible in Fig. 6a,
Should this be Fig 5a?

You are correct, our mistake

L251 ff and Table 4:
Do these uncertainties refer only to the uncertainty originating from the density conversion, or does this also include uncertainties in area and volume?

Uncertainties in area and volume were not present and will be updated in the revised version of the manuscript. See general comment on “Surface change computation and treatment of errors”.

L256 Our results show that the use of a fixed maximum glacier area in the geodetic mass balance leads to an underestimation of the m. w.e. loss when compared to common area calculations. In our case the bias introduced by total area is between -1% and -31% of the common area mass balance, depending on the site and considered period. There are some cases of decadal comparison (1980s-2010 in Cristallo, Antelao Inferiore and Marmolada) where total glacier area produced larger mass balance losses than calculations using common area.
I am still unsure about the differences between “fixed maximum glacier area” (this term is used for the first time here), common area, and total area.

See comments above on Glacier Area. More explanations will be added in the methods.

Table 4: (a) Sorapiss Occidentale values have been corrected removing the positive elevation gain portion for 2010-2023.

Why did this need to be corrected? Did you simply delete all positive values or was there some other correction? You measured the positive elevation change and suggested that this was due to a rockfall/surge process - what is the argument for removing the elevation gain when that is what your analysis shows?

We have removed the positive elevation change values (simply removing values > 0) from Sorapiss glacier to try to get a more realistic estimation of the mass balance rate. Although this is not the most precise evaluation, we think is still better than showing the mass balance rates including that positive values.

We agree that the positive change (in surface elevation change) measured should be shown, and that is why in Table 3 we did not apply any correction.

Climate data

L266. Among the ten highest events, seven have occurred in the last 15 years (2007-2022).
Consider rephrasing for clarity? highest → warmest

We would prefer to use "high-low" as we are actually writing about SAI and not T, even if high SAI means warmer T.

L269 The maximum Pr SAI has been calculated for 2014 with a value > 2, while 1996 is marked by the minimum value at -1.22.
Consider rephrasing for clarity, e.g.: Pr SAI was greatest in 2014 with 2.x and lowest in 1996 with -1.22.

Ok, thank you. We'll rephrase. "Pr SAI was greatest in 2014 with a value > 2 and lowest in 1996 with -1.22."

L272 Temperatures have risen by 0.4-0.6 °C per decade since 1985, while precipitation showed an increase that lasted about 15 years from 1995, culminating in the extremely snowy year of 2014 (Fig. 6b). Fedaia station, the only one providing data since 1980, does not show any trend for the total snow accumulation (p-value = 0.61; Fig. 6c), however, increased extreme events can be observed in the last decade of its time frame. The other three snow monitoring stations exhibit slightly different patterns, demonstrating a higher frequency of snowy winters also in previous decades. Did you also look at station variability for T and P? How do you identify extreme events in the snow time series?

P and T trends among stations were similar. Furthermore, since the study area is quite small and none of the stations is on/adjacent a/to a glacier we preferred to use regional mean values. Extreme events are considered those events falling above the 95th percentile.

We will modify the text consequently: "The snow monitoring stations, do not show any trend for the total snow accumulation (p-values = 0.54-0.95; Fig. 6c), however, extreme events (above 95th percentile) were observed in 2013 and 2014 for all the stations. "

Fig 6b: The dotted line is hard to see. I'm assuming the lines refer to hydrological year, i.e. 2023 refers to the 2022/23 winter season. Consider stating this in the caption or legend.

We will modify the caption: "…for the same snow monitoring stations (c). The years shown in the plot refer to hydrological years, e.g. 2023 refers to 2022-23".

Discussion

L295 In the Dolomites, a slight increase in winter snowfall has been observed at some high-altitude stations, such as Ra Vales site at 2620 m (Fig. 6)
How do you determine this increase? It is not really obvious from Fig 6c and there is no mention of this in the results.

This slight increase has been determined since 1993 using linear regression and is present in all the 4 stations, but more evident for the highest one (2620 m a.s.l.). Extending the linear regression from the beginning of the time series (i.e., 1980 and 1987) bring slightly different results, even with slightly negative values. We will add this to the result as it was absent and implement this part also in the discussion.

L296 unfavourable years conditions for glaciation prevailed
Extra word? Delete “years”

Yes, it was a mistake

L302 Within Alpine mass balance records, the ablation season of 2022 results unprecedented.
Missing word? (...results were unprecedented…)

Yes, we will correct it adding “were”

L305 According to such climatic evolution, the Dolomites are rapidly turning from being mountains hosting sites favourable to local glaciation, to areas where peri-glacial processes will progressively gaining importance.
→ gain importance

Agree, thank you for the correction

L317 Dolomites glaciers mass balance rates are half of the average RGs rate during the last 13 years
Interesting!

L334 stabilise the dynamic of some glaciers of the Dolomites
Do you actually mean dynamic as in movement or something else? Consider rephrasing

We meant that extremely snow winters like 2014 can stabilize the mass balance of the Dolomites, as glaciers, as shown in the 2010-2014 comparisons. The sentence needs to be rephrased to avoid confusion.

“The occurrence of extremely snowy winters can still result in an increase of volume for some glaciers in the Dolomites. This is evidenced by our data from at the end of summer of 2014, when 5 glaciers of the Dolomites (Popera, Sorapiss, Antelao Inferiore, Marmolada) have recorded a positive cumulative mass balance since 2010.”

Fig 7: Cool figure! I’d be interested in seeing how the WGMS annual product compares to your values for the Dolomiti glaciers (just an idea, the figure is informative as is and this is not needed for the manuscript)

https://cds.climate.copernicus.eu/cdsapp#!/dataset/derived-gridded-glacier-mass-change?tab=overview

We have tried to compare the values we had with WGMS annual product (see Fig. R2). 2023 is missing from the available WGMS annual gridded products and we don’t think that considering the high local variability of our very small glaciers it is worth adding it to the figure or the paper.

Fradusta (-12.8 m w.e.), Travignolo (-8.5 m w.e.) and Marmolada (ranges between -14.5 and -8.4 m w.e.) are in a WGMS cell of -6.76 m w.e.

Antelao Superiore (-10.0 m w.e.) and Inferiore (-6.4 m w.e.) are in a WGMS cell of -4.27 m w.e.

Sorapiss (-3.8 m w.e., with correction, see comments above), Cristallo (-8.6 m w.e.), Popera Alto (-7.4 m w.e.) and Pensile (-5.8 m w.e.) are in a WGMS cell of -10.85 m w.e.

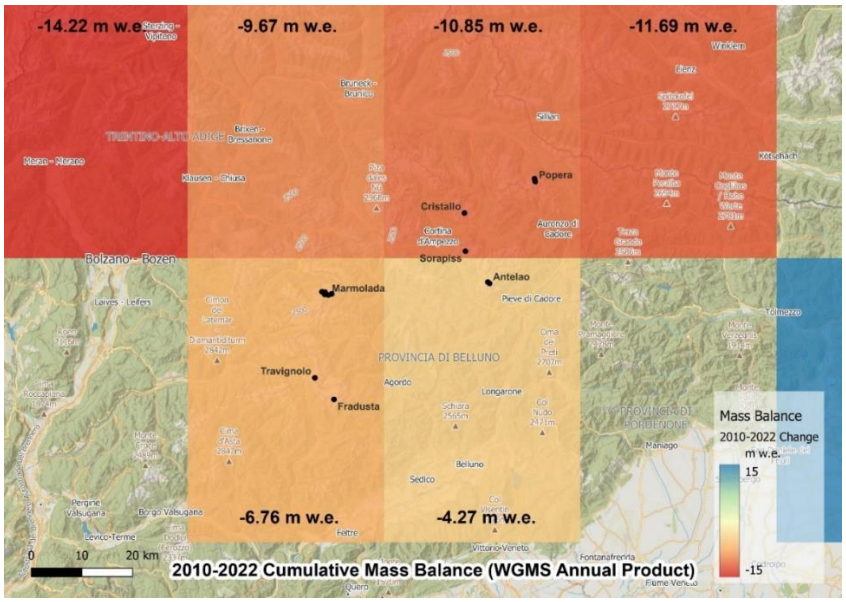

Figure R2. WGMS Annual Product Grid sum from 2010 to 2022 and position of the analyzed glaciers.

L360 most representative
If it is the largest it is not the most representative in terms of size. Consider removing this.

Correct, we will remove the "… and most representative …" as it's not correct. We meant it's the most representative for Alpine scale or WGMS comparisons and of course in eventual weighted means.

L374 In this study we used the surface lowering observed during the last 13 years and direct observations on site to assess the glaciers end.
I would like to read this earlier, e.g. in the methods.

Agree, this sentence will be put in the methods at L141 and slightly modified to fit in the paragraph. We will add also a sentence to specify how glaciers area have been mapped as also requested by R2. As per now is only mentioned in L141.

L397 In the late 1950's the Dolomites were hosting 33 glaciers, of which only 9 are still active;
Define somewhere what you mean by active

As mentioned in the comments above here we refer to Smiraglia et al. (2015) Italian inventory. We will specify this "… of which only 9 are still considered mountain glaciers (Smiraglia et al., 2015).

L402 A few glacial bodies may eventually shift from glacial to periglacial, thus becoming more resilient in a warming climate.
There seems to be an ongoing discussion about how and whether glacial features can turn into periglacial features (e.g. discussion comments here: https://tc.copernicus.org/articles/18/1669/2024/tc-18-1669-2024-discussion.html). Perhaps rephrase this sentence to avoid ambiguity. You could focus on the processes that would make the ice features more resilient without classifying them as glacial or periglacial.

We partly agree on this, despite in the Dolomites region these glacial-periglacial shift appears as an ongoing phenomenon (see e.g Seppi et al., 2014). It is anyway a good idea to rephrase the sentence to avoid ambiguity