

Dear Andrea, the paper certainly improved after the review process. However, there are still several points that need to be addressed before this manuscript can be published. Please be sure to make also a very extensive and careful check of the consistency of all the formats before submitting the next revised version.

We have revised and improved all sections of the manuscript as recommended by the editor. Textual modifications are indicated in red, while changes made in the figures, although completed, are not highlighted.

Abstract:

The abstract is rather vague and does not include a clear mention on important info contained in the main text such as 1) when the isotopic signal deterioration happened and 2) to which depth (year) its effects can be observed. Part of this info can be extracted from Line 376 “We suggest that since 2015, estimated melting and percolation increased because of the evolution of the general atmospheric conditions, causing a deterioration of the climate signal preserved in the firn/ice.” and/or from Line 311 “311 Based on the model’s calculations, water percolation increased since 2014 and was able to reach deeper firn strata”.

The abstract has been improved as suggested.

Main Text:

Line 76: Please provide a clear reference for “data from Monitoring of Svalbard and Jan Mayen, mosj.no” according to the reference policy of this journal.

Understood. This is an environmental monitoring system within the Government's environmental monitoring in Norway, not a journal. The data are thoroughly validated and fully accessible through the website without any specific references indicated for their use.

Please use consistent unit of measurements of Temperature (C or K, not both; e.g. Line 87; 91-92) through the entire manuscript) and Time (e.g. Line 125 1600 - 1800 CE; Figure 2: X=year; Fig. S4 X= Date etc.). Please use also consistent direction of time/depth in ALL the figures of the manuscript and supplementary info.

We modify accordingly and all the x axis are now presented as year

Line 136 “showed a strong local response of chemical species”. Please clarify what is the strong local response.

We modify as follow “the obtained record suggests that there are local influences affecting the studied chemical species”

Line 147 “In light of the accelerated warming”. Please provide a reference as acceleration of the warming is different than amplification and is a very debated topic.

We modify the accelerated warming with Arctic Amplification

Lines 158-162. Are these lines retained or cancelled?

These lines have been cancelled

Line 225: “extensive use of satellite data”. Please be specific.

We modify by removing “extensive”

Line 245 (Figure 2). Figure 3? We correct accordingly

Line 261: “The alignment of the 2019 core with previous cores could only be done through mass balance values since the $\delta^{18}O$ values did not show the same peaks as the other records”. This implies that maximum and minimum values cannot be identified at least in the 2019 core. However, these were used for the regression analyses. To me this is still the main problem that needs to be clarified (please see also below).

At the reviewer's request, the regression analysis has been included in the main text as suggested. The statistical method's identification of maximum and minimum peaks, not aligning with the mass balance data for the 2019 and 2017 cores, serves as statistical evidence indicating the degradation of the climate signal. However, for the 2015 and 2012 cores, the peaks identified by the statistical method align quite well with the mass balance data. We have enhanced the method's description for improved clarity

Line 285: “with a slight increase (precipitations) in the most recent period (Figure 4d).” This sentence is contradicted by the graph that show the last two years (including 2019) having less precipitations. Please note that when a decrease in precipitation is combined to an increase in melting percolation, this may lead to a stronger deterioration of the signal.

The most recent shallow core was obtained in 2019, yet the firn and the data presented commence from the last summer surface, which approximately corresponds to September or October 2018. In response to the upcoming question, we found it beneficial to incorporate additional data even beyond the shallow core's coverage period. Nevertheless, we have updated all figures, retaining 2019 as the final year for displaying meteorological data.

Line 298 “The estimated annual melting at the site from 1991-2020 (Figure 4c) varied between 960 mm w.e (2020) and 117 mm w.e (2008)” Are 2020 data relevant at all for this paper? Is not the 2019 core the most recent one? Please check carefully through the paper.

Please refer to the previous answer

Line 307: “In particular, for the period 2004-2005, severe surface melt events occurred (Figure 2c and Figure S3)” Please highlight in Fig 3 the period covered by the firn core records.

We believe the editor is referring to Figure S3. In Figure S3, we will emphasize the period covered by the record by highlighting it with a light yellow rectangular shape.

Line 320: “it is evident that the seasonal signal experienced considerable changes and progressively deteriorated in the most recent cores.” Which cores? Please be specific.

We modify as follow: “it is evident that the seasonal signal for the core 2019 and 2017 experienced considerable changes and progressively deteriorated

Line 359 “The change in seasonality and, to a lesser extent, in the total amount of precipitation, might have influenced the d18O signal of the four cores.”. The “change in seasonality” of the signal? This is an effect not a cause of deterioration. Please rephrase.

We rephrase as follow “The change in the seasonal patterns of precipitation, and to a lesser degree, the overall quantity, could have influenced the $\delta^{18}\text{O}$ signal of the four cores”

Line 430 : “The data will be available upon request to the corresponding author.” I encourage the authors to put the data in a public data repository as the professional email address of the corresponding author is always temporary and data will not be accessible in the future. Please check also the policy of the journal.

We have made modifications and plan to deposit the data in the Zenodo repository once the paper is accepted. The link will be included during the proofreading stage.

Line 597 “Figure 6: Identification of the annual minimum and maximum values of $\delta^{18}\text{O}$ (red and blue points) based on the annual mass balance dating...”. The identification procedure of minimum and maxima is not clear and at this time seems inconsistent/arbitrary between different cores. Just to give one example: Panel C: the 2016 minimum would be most obviously the one at around 325 cm we depth. So in conclusion at this time I’m not convinced of this analysis and I would suggest to consider to delete entirely this min-max identification and the consequent regression analyses presented in Fig. 7.

The description of the statistical method has been enhanced for improved clarity, as previously mentioned. This statistical analysis has been incorporated into the main text based on the referee's suggestion.

Supplementary info:

In general the format of the figures presented in the SI need to be consistent with the ones in the main text, for unit of measurements, size of characters, colors (e.g. of the seasons, of the years). Please make sure that the characters are large enough to be readable (Fig. 5-6 and 7).

We've updated the figures in the Supplementary Information. Figures 5 to 7 have been generated using a different graphing software.

Paragraph 2.1 “(Errore. L'origine riferimento non è stata trovata).” Please delete.
Thanks to notice this, we remove it