

We wish to thank the editor for the time dedicated to the revision of this manuscript and for the comments provided. All of the comments were integrated into the text, captions, and figures, as can be seen by the marked-up version of the manuscript. Here you will find a point by point description of the revisions made, with the editor's comments marked in blue and our response marked in black.

Abstract: 'meltwater disturbed its distribution' does not really make sense -> please try to revise so that it's more clear what process you want to emphasize here. Is it that the meltwater distribution within the the ice is more uniform?

This was changed to "the presence of meltwater affected the distribution of this radionuclide inside the ice" to make it more clear.

Figure 1: the choice of the color for the lines is very similar: can you make one color red and the other black or dark green? Please consult with the color scheme recommended for scientific papers, for example:

<https://www.simplifiedsciencepublishing.com/resources/best-color-palettes-for-scientific-figures-and-data-visualizations>

Also, make with width of both lines a bit thicker. The panels have lots of white space, which is somewhat suboptimal for the size of the figure.

Also, the standard of x-y plots with just one y-axis to have the y-axis on the left. Please correct this. Make sure to include any units in the brackets.

Add a label to x-axis, for example: Time (year)'. All axis need to have labels.

The colors were changed to red and dark green, the width of the lines was made thicker, and the y-axis was moved to the left side. The x-axis labels were changed adding "Time (Years)" and tilting the single labels, as the image was made smaller to fit into one column (width 8.3cm as suggested by the Copernicus latex format).

Figure 2: Make it smaller as the figures has too much white space and it's unnecessarily wide. Make the new figure so that it can fit one column when published (I think that is 7.5 cm in width). You can enlarge the markers for the data points in the plot. The figure capture does not provide sufficient information: state in the captions the full name of CPS and Bq/L, and include their units if there are not unit-less. Units should be written within brackets. Also, provide more information on what you included in the figure: for example, coefficient of determination (R^2) and the linear relationship between CPS and Bq/L as obtained by a linear regression model or a linear fit.

Also, you state: 'Errors on cps are 0.001'. Do you provide more details in the text on how these errors are obtained. If not, please do so. If yes, refer in the figure caption to that information in the text, for example: 'Errors calculated from XXX (see the main text) on CPS are 0.001.' Please note that some calculation cannot just randomly appear in the figure only, without it being explained or referred to in the main text.

This figure was also made smaller (8.3cm width) while enlarging the datapoints and thickening the lines. The y-axis label was changed to "Count rate (cps)". The caption was changed to: "Calibration curves calculated for the 3 three sets of tritium standards Data points are plotted as counts per second (cps) vs activity values (Bq/ml). For each set the dashed line represents the linear fit

between the data points, which is also reported in the left corner of the image together with the coefficient of determination (R^2). Errors on the count rate, calculated as the square root of each measurement divided by the count time, are 0.001 cps.”

General comments for the figure captions and main text: when you report a number smaller or equal to 10, spell the number out, so should be ‘three samples’ instead of ‘3 samples’. For numbers larger than ten, you should type them as numbers.

This was changed throughout the text and captions.

Figure 3: Caption: please make the full sentences, for example: Low resolution measurements referring to ice chips are shown in black dots, the observed activities and their error bars are shown in the histogram and their respective bars, etc.

The caption was changed to: “Tritium activity in the Adamello temperate ice core. Low-resolution measurements referring to ice chips are shown as black histograms where the width of each bar represents the actual depth covered by the sample and the height represents the Specific Activity (Bq/ml). Error bars indicate the uncertainty on the Specific Activity, calculated following the propagation of error method. Diamonds represent samples from the low-resolution dataset for which the Upper Limit was calculated instead of the Specific Activity, as detailed in the main text. High resolution measurements referring to ice core samples are shown in red.”

General comments for the figure captions: Provide enough information in the figure captions so that they can be read as a stand alone, i.e. the reader does not need to dig into the text to figure out what you are presenting in the figure. Any abbreviations need to be restated.

Figure 4: The line widths, especially in panel (b) are too thin and barely visible -please enlarge the width where possible. Also, please increase the font size in all legends, titles, and axis labels. Make sure to restate what each abbreviation represents (e.g. SDI).

Line width were enlarged in all four panels, as the font size. The two panels on the right side were made smaller to reduce the white space. The caption was changed to: “Detailed overview of the ice core in the portion where the the tritium and ^{137}Cs 1963 peaks have been observed (between 25 and 35 m deep). a) Pollen and spores concentration taken from Festi et al. (2021). Each peak of pollen and spores concentration reflects one flowering year (February–September). b) Tritium profiles. Specific activity (Bq/L) of ^3H for the ice chip low-resolution dataset is shown as black histograms while the ice core high-resolution dataset is shown in red. Error bars indicate the uncertainty on the Specific Activity, calculated following the propagation of error method. The diamonds indicate upper limits calculated for the high-resolution data set, as detailed in the main text. c) Snow Darkening Index (SDI) record, a hyperspectral index related to the impurity content of ice. d) Specific activity (Bq/L) of ^{137}Cs taken from Di Stefano et al. (2019)”

Figure 5: Again, y-axis should be shown on the left side of the graph. The panels have way too much white space, consider downsizing the figure The figure caption does not explain what the histogram represents (distribution?) and what the bars represent (error?). Make sure to restate what the abbreviations are and include all units.

Y-axis was moved to the left side and the entire figure was downsized to minimize white space. The caption was changed to: “The upper panel shows the total beta activity from the Lys ice core. Total beta values are reported here as count rate in counts per minute (cpm) with the associated uncertainty. The lower panel shows the Specific Activity (Bq/kg) of ¹³⁷Cs with the associated error, as reported in Clemenza et al. (2012). In both panels the width of each bar represents the actual depth covered by each sample.”

Comments regarding your response to the reviewer:

You responded to the comments about the linkages to the SDI dataset, but did not make any revisions in the text. I suggest you address this issue in the text and state more clearly what the motivation was for the inclusion of the SDI data in the text (something along the lines you wrote in the response: no big peak is present in the SDI dataset at the same depth as the cesium main peak indicates that the Cesium peak is not due to an abundance of dust in this layer, and this should be important information since the Cs data is not calibrated on the amount of dust present but on the volume of filtered water, despite Cs being in particulate form).

We added a paragraph at line 201 to address this issue: “the absence of any significant peak in the SDI dataset at the same depth as the main cesium peak indicates that the cesium peak is not caused by an abundance of dust in this layer. Since the impurity and the radioactive layer don’t overlap, we ruled out this possibility. This finding is significant because the cesium data is not calibrated on the amount of dust present but on the volume of filtered water, despite Cs being in particulate form. Moreover, the absence of a dust-rich layer at 32m of depth suggests that even a minimal amount of particulate matter can contribute to a substantial cesium peak.”

Line 257: Revise to: ‘While the total tritium inventory associated with the 1963 peak in the Adamello ice core generally agrees with previous findings for cold glaciers not affected by melting, we find that this is not the case for ¹³⁷Cs.’

This was revised as suggested.

Line 260: ‘that meltwater disturbed its distribution’ – as I pointed already above this phrase does not make sense.

The line was changed for more clarity to: “providing additional evidence that the position of cesium within the ice was disrupted by meltwater, leading also to partial removal through washing.”

Line 2601: ‘Such finding’ -> not clear to what finding you are referring to as this is a new paragraph. Need to restate in order to make this more clear. For example: ‘The results in this study indicate that there are possible issues ...’

Change to: ‘for a cold glacier’

This was revised as suggested.