We thank referee 1 for the useful comments. The referee's comments are marked in green, while our replies in black. The paper has been updated according to the referee's suggestions. Furthermore, we have fixed a small issue concerning the timescale and the 11-year cycle analysis. The changes of the main results (assessment of the method) are however minor.

Paleari et al. present a new way of measuring 10Be in polar snow/ice by using the excess of meltwater from continuous flow analysis (CFA) instead of discrete snow samples in EGRIP S6 firn core. The authors investigate the agreement with other 10Be records from Greenland measured in a "traditional" way. They also use this record to study the 11-year solar cycles as well as the short-term SEP events and stratospheric volcanic eruptions. This new way of measuring 10Be opens new opportunities for the collection of continuous records with less time-consuming sample preparation while saving an important portion of the ice cores for other measurements.

The paper is an introduction study to advertise the opportunities of using 10Be measured by CFA technic to investigate solar cycles and short-term 10Be deposition events. The analyses on the 10Be record are not very deep. On the other hand, the new measurements technic is promising. So, my two main comments, among others, are about the CFA technic that should be more highlighted and the (non-)detection of 10Be short-term events related to SEP or volcanic eruptions. I recommend major revisions before acceptance for publication in CP.

Specific comments:

- *The preparation of the CFA samples is described in section 2.1. In addition, I think it would be beneficial to add the schematic figure summarizing this preparation. Moreover, it would be interesting to know how much time is effectively won when using this technic instead of the classical extraction from ice or snow samples, as well as the quantity of ice.*

We thank the reviewer for the suggestion. For the preparation of the CFA samples we do not need the ion exchange chromatography (IEC) step. Since our equipment is able to support 12 samples at one time, this new preparation allows us to skip about 3 hours of work every 12 samples, as well as saving materials (e.g. columns and chemicals for the extraction of the radionuclides from the columns).
Concerning the suggested schematic figure for the preparation, note that only the time-consuming step of filtration through IEC has been removed from our usual procedure pertaining to Greenland ice core samples that typically are larger. A schematic figure of lab preparation of 10Be samples of small sizes with and without IEC can be found in the recently published study from Nguyen et al. (2021). We will make this clearer in the text as well as refer to the figure.

More details were added in the revised manuscript: *''This allows us to avoid the use of ion exchange chromatography (IEC), thereby saving about 3 hours of preparation per 12 samples and significant amount of materials (e.g., ion exchange columns). A schematic summarizing the preparation of 10Be samples with and without IEC at Lund University can be found in Nguyen et al. (2021).'' (lines 114-116).*

- *I am not completely convinced that 10Be from CFA can be used to detect SEP or volcanic eruptions. As the authors said, "one of the main complications of dealing with CFA systems is the possible smoothing of the signal locked in the ice" (see grey and green curves in figure 3). Moreover, is the temporal resolution of the EGRIP S6 core (yearly) enough for such detection? It should be discussed in the manuscript. Finally, the analysis can be misleading in its present form. The authors just state the years when the residual is more than 1-sigma, and it is difficult to know if these years correspond to some events or if they are due to local effects. To improve the way how are presented the analyses, I suggest replacing the histogram figures (figures 6, 7 and 8), which are not really used in the manuscript, by the standard score records shown in Supplementary Material. In these graphs, the authors could add colored dashed vertical lines corresponding to major volcanic eruptions and SEP events. In this way, it would facilitate the analyses and it would be easier for the readers to see if the standard score peaks correspond or not to these events. I would also suggest coloring the curves if the standard score curve is higher to 1-sigma, 2-sigma…, like for climatological indices.*

We thank the reviewer for contributing to present the results of our analyses more clearly.

a) On the detection of SEP events or volcanic eruptions using CFA samples:

The detection of SEP events using CFA samples was previously assessed in Paleari et al. (2022), where the occurrence of an extreme SEP event from 9125 years BP was detected also in CFA samples from the EGRIP core. Moreover, such extreme events were also detected in 10Be records with lower resolution, such as the GRIP and EDML records, characterized by ~5 years resolution (e.g. O'Hare et al., 2019; Paleari et al., 2022). Therefore, we are confident that the resolution of the CFA record presented in this study is suitable to detect large SEP events (e.g., extreme events detected in 775 CE or 9125 years BP). Since large stratospheric volcanic eruptions can leave a similar imprint in 10Be records in terms of magnitude (e.g. Baroni et al., 2011, 2019), we can assume that, likewise, the resolution of the CFA samples allow detection of the volcanic signal. From Paleari et al. 2022, it can be seen that CFA leads to no significant smoothing of the 10Be peak related to the 9125 years BP event. Furthermore, it was previously assessed that CFA smoothing typically leads to a smoothing of 3-4 months for ice cores with a similar accumulation rate than EGRIP (e.g., Mekhaldi et al., 2017), and therefore does not affect significantly the detectability of a peak expected to last typically 2-3 years as shown in previous studies (e.g., Mekhaldi et al., 2015; O'Hare et al., 2019; Paleari et al., 2022).

As for GLEs that are at least 2 orders of magnitude smaller than extreme paleo-events, they cannot be detected using discrete ice samples at higher resolution than the CFA 10Be record (e.g. Pedro et al., 2011; Zheng et al., 2020; Mekhaldi et al., 2021). Therefore, the paper does not suggest that CFA samples can be used to detected GLEs, but rather that CFA samples preserve a similar signal as discrete ice samples in the context of the detection of the solar 11-year cycle, of large outliers induced by stratospheric volcanic eruptions, and of extreme paleo-events.

These points have been clarified in the text: *'' This technique has already been used to collect a short record of about 40 years from the EGRIP ice core to study an extreme SEP event that hit Earth 9,125 years BP (Paleari et al., 2022), estimated to be two orders of magnitude larger than modern GLEs.'' (lines 80-82)*

b) On the residuals analysis:

As suggested by the reviewer we have replaced the histograms in the revised version with the figures included in the supplementary material. However, we think the inclusion of vertical lines corresponding to SEP events and volcanic eruptions in the figure may suggest we are making a clear correlation between residuals exceeding 1sigma and SEP events/volcanic eruptions, whereas we cannot do that with our results, and could therefore bias the readers.

- *The comparison of EGRIP S6 with other Greenland ice cores is quite convincing (figures 3 and 4), while it is not so much the case for Antarctica. I would rephrase the sentence "our results indicate that the signal measured in the CFA samples is reproducing the common radionuclide signal in Greenland and Antarctica as well as the discrete firn samples" at lines 218-219. Moreover, how the correlation is improved if instead of "global stack – no EGRIP", a Greenland stack – no EGRIP is used in Figure 5? Do the 10Be normalized records correspond to 10Be concentrations records (and not flux) for both Greenland and Antarctica? Please precise.*

We thank the reviewer for the suggestion. If we use the Greenland stack instead of the global stack, we obtain similar correlation coefficients (CFA: $r= 0.54$ ($p<0.01$); Discrete: $r=0.39$ ($p<0.01$)). In order to include this point in the discussion, we will revise Figure 4 to include a comparison with the stacks of Greenland (excluding EGRIP) and Antarctica separately. This has been added to the text (lines 225 - 228). Furthermore, we made clearer along the text and in the captions of the figures that we are using concentrations, not fluxes.

Minor comments and corrections:

- *1st sentence of the abstract: "10Be is produced by the interaction of galactic cosmic rays (GCR) or solar energetic particles (SEP) with the Earth's atmospheric constituents."*
- *Section 2.3: The authors adopted the timescale by Zheng et al., submitted. Because this paper is under review, the readers have no complete information about the timescale of EGRIP.*

A detailed assessment is included in the paper by Zheng et al. (2023).

More details on the chronology have been added to the text:
''The timescale for the EGRIP S6 core is constructed by counting the annual layers visible in the CFA dataset of the core. To constrain the annual layer count and align the EGRIP S6 age model with the main core, tie points of the EGRIP-GICC05 age scale (Mojtabavi et al., 2020) where identified in the electrolytic meltwater conductivity records at 21.53, 23.94 and 30.63 m depth and 73, 87 and 125 years b2k (before 2000 CE) respectively. In addition, the drilling year was used as an age constraint at the surface. The counting was performed using the StratiCounter algorithm (Winstrup et al., 2012).'' (lines 140-146).

- *Table 1: highlight in color the years corresponding to SEP or volcanic events. 11-year cycle: I suggest doing some spectral analyses, too.*

We thank the reviewer for the suggestions:

a) Although it could guide the reader, we think that highlighting the years corresponding to SEP or volcanic events could bias the reader. Since we are not able to make a clear correlation between residuals and events, we decided to not modify the table.

b) We have included a new figure (figure 9, see below) in the revised version showing a wavelet analysis of the CFA and discrete data, and of the global stack (excluding the EGRIP S6 10Be records) to better assess the presence of the 11-year cycle in the data. The spectral analysis of the records highlights the presence of the 11-year cycle in the S6 records, especially so in the period 1900-1960, whereas it shows that by stacking several records it is, as expected, possible to increase the signal to noise ratio and to better detect the 11-year solar cycle.

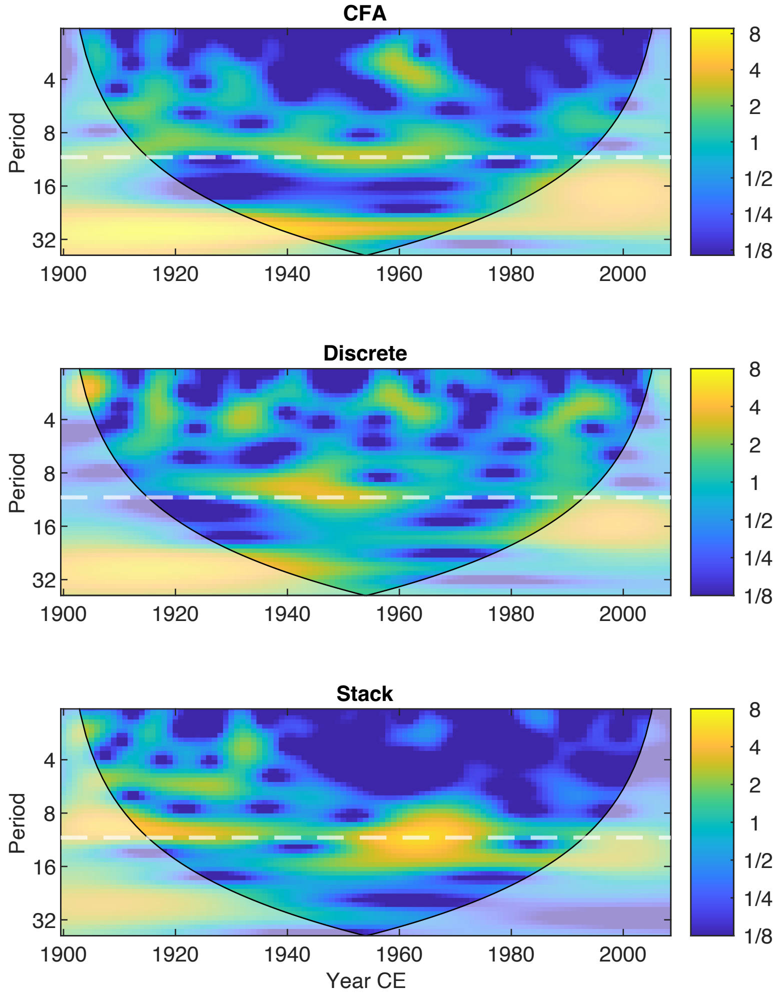

Figure 9. Continuous wavelet power spectrum (Grinsted et al., 2004) of the ^{10}Be concentration records from CFA samples (top panel) and discrete samples (middle panel) from EGRIP S6, and of the global stack (bottom panel) calculated including the records from NGRIP,NEEM, Dye 3, Renland, Das2 , DML, DSS, Vostok and Concordia. The white dashed line denotes the frequency of the 11-year cycle.

- *Figures in Supplementary Material are not referenced in the main manuscript while they are useful. I suggest replacing the histograms by these figures (see general comment). The histograms can go in supplementary material if the authors want to keep them.*

As suggested by the referee, the histograms have been replaced with the supplementary figures in the revised manuscript.

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Zheng, M., Adolphi, F., Paleari, C., Tao, Q., Erhardt, T., Christl, M., Wu, M., Lu, Z., Hörhold, M., Chen, P., and Muscheler, R.: Solar, Atmospheric, and Volcanic Impacts on 10Be Depositions in Greenland and Antarctica During the Last 100 Years, J. Geophys. Res. Atmos., 128, e2022JD038392, https://doi.org/10.1029/2022JD038392, 2023.

We thank referee 2 for the useful comments. The referee's comments are marked in green, while our replies in black. The paper has been updated according to the referee's suggestions. Furthermore, we have fixed a small issue concerning the timescale and the 11-year cycle analysis. The changes of the main results (assessment of the method) are however minor.

General comments:

Paleari et al. present a new method, continuous flow analysis (CGA), for the extraction of beryllium-10 from ice that greatly reduces the labour and sample size associated with discrete sampling. Through this study of a Greenland firn core, the authors show that the CFA method is capable of reconstructing galactic cosmic ray (GCR) variation during the 20th century and 11-year solar cycles that compares well to previous studies using discrete sampling.

As this is an initial study, I would like to see a better estimate of the associated depth errors when compared to discrete sampling to ascertain the inherent bias introduced by the CFA method. Also, filtering the background noise and extracting the 11-year cycle could provide a better way to compare between sites in Greenland and Antarctica. These revisions should be relatively minor.

Specific comments:

1. *The CFA method combines samples to obtain enough ^{10}Be for measurement. This essentially "smooths" the data when compared to discrete sampling. A rough estimate of the depth attribution is provided in section 2.2, but more statistical approaches are available. I recommend using a Bayesian approach for samples with inherent depth uncertainty to determine the age model under both the discrete (Zheng et al.) and CFA (this study) sampling. They can then be directly compared to constrain the additional depth uncertainty introduced by your CFA method. The freely available software Undatable (Lougheed and Obrochta, 2019) has been developed for radiocarbon dating but can be adjusted for the tie points, i.e., ash layers and annual bands, used here. Other Bayesian approaches are available e.g., Parnell et al., 2008.*

We thank the reviewer for the suggestion. Because of the high resolution of the samples, we obtain good results with the method explained in the paper. The same approach was used in Paleari et al. (2022), where we also obtained good results in the depth attribution of the samples. We then assigned the age to the samples by using the same age-depth model as the one presented by Zheng et al. (2023).10Be concentrations are known to be seasonal (e.g. Zheng et al., 2020) and thus, we believe that the main uncertainty is caused by comparing samples that cover somewhat different depth spans, for which we cannot provide a reliable assessment.

Although we appreciate the reviewer's suggestions of many excellent Bayesian approaches, we believe that using this more convoluted method would not significantly improve the depth assignment and distract readers from the aim and scope of our study which is to assess the suitability of CFA meltwater for the measurement of radionuclides. Furthermore, it can be seen visually from the figures (e.g. Figure 2 and 3) that the depth assignment uncertainty is negligible, as the discrete and CFA records agree very well with no systematic apparent lead/lag.

2. *Sampling and environmental factors introduce background noise that obscures GCR variability in the Greenland and Antarctic records presented in Fig. 3. This leads to relatively low, albeit statistically significant, correlation between EGRIP and other cores. If the main purpose of ^{10}Be analysis in ice cores is to reconstruct the 11-year solar cycles, would it not be better to first filter out the background noise to isolate the 11-year cycles and then compare? A simple bandpass or high pass filter, provided by MATLAB, R, python etc., could achieve this. The cycles can then be directly compared using coherency and cross-phase spectral analysis (although this part is not essential). This can also help assess the nature of odd and even cycles.*

We thank the reviewer for the useful suggestions. The 10Be data, as highlighted by the reviewer, is characterized by background noise. As suggested by the referee, we have included a new figure (figure 9, see below) in the revised version of the manuscript showing a continuous wavelet power spectrum of the CFA and discrete records and the global stack (excluding the EGRIP S6 records) to better analyze the presence of the 11-year cycle in the data. The spectral analysis of the records highlights the presence of the 11-year cycle in the S6 records, especially so in the period 1900-1960, whereas it shows that by stacking several records it is possible to increase the signal to noise ratio and to better detect the 11-year solar cycle.

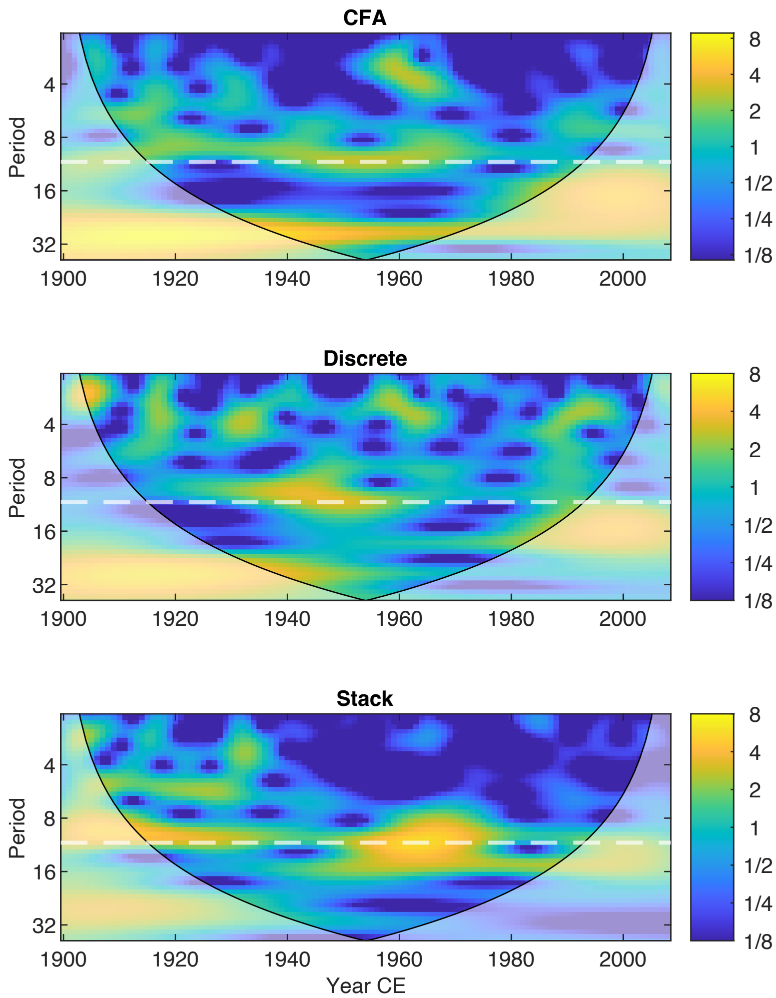

Figure 9. Continuous wavelet power spectrum (Grinsted et al., 2004) of the ^{10}Be concentration records from CFA samples (top panel) and discrete samples (middle panel) from EGRIP S6, and of the global stack (bottom panel) calculated including the records from NGRIP,NEEM, Dye 3, Renland, Das2 , DML, DSS, Vostok and Concordia. The white dashed line denotes the frequency of the 11-year cycle.

Minor comments:

Line 109: Please provide more details of your chosen carrier e.g., brand, concentration etc.

The carrier used is from Scharlau (1000mg/l; $Be_4O(C_2H_3O_2)_6$ in HCl 2%). This has been added in the main text (line 111).

Line 110: Are the samples filtered for dust? This could also influence your results due to scavenging and deposition of 10Be. This can be easily done using a syringe and 20-30 µm mesh.

The samples were not filtered for dust. As previously shown by Baumgartner et al. (1997), dust during the Holocene does not represent a problem for 10Be measurements in polar ice cores, as it is usually less than 5% of the total 10Be content of the ice.

Line 139: It is hard to access the age model as it is not published so it might be good to present the CFA and discrete sampling age models here for comparison. This can be done using Undatable.

The two records arise from the same core and are thus on the same age-depth model, described in the paper by Zheng et al. and summarized in the Methods section. More details on the age-depth model have been to the text:'' *''The timescale for the EGRIP S6 core is constructed by counting the annual layers visible in the CFA dataset of the core. To constrain the annual layer count and align the EGRIP S6 age model with the main core, tie points of the EGRIP-GICC05 age scale (Mojtabavi et al., 2020) where identified in the electrolytic meltwater conductivity records at 21.53, 23.94 and 30.63 m depth and 73, 87 and 125 years b2k (before 2000 CE) respectively. In addition, the drilling year was used as an age constraint at the surface. The counting was performed using the StratiCounter algorithm (Winstrup et al., 2012).'' (lines 140-146).*

Line 171: It would be good to see this relationship visually (scatter plot) and compared to the relationship between the two data sets before interpolation.

We thank the reviewer for the suggestion. However, since the datasets are characterized by different resolution and number of samples, the only way to obtain a correlation coefficient between them is to interpolate. Since the current manuscript include already many figures in the main text and supplementary, we decided against adding a scatter plot as the correlation coefficient is high ($r = 0.77$), significant ($p < 0.01$), and based on many points ($n=109$).

Line 173 and 185: There is also less variability in the discrete samples between 4 and 8 m which will therefore provide a better correlation to the smoothed CFA. In other words, there is less variability to smooth.

We agree and clarified the main text: *'' It can, however, be pointed out that the first ~8 m of the CFA excess water record (between ~4 and ~12m of depth) is seemingly more autocorrelated compared to the deeper part of the record and relative to the discrete 10Be record, the latter also smoother in the first ~8m of the record compared to the deeper part. ''* (lines 171-173).

Line 292: Space between no. and number e.g., no. 05. Please apply throughout the manuscript.

Changed in the main text.

Line 300: relative, not relatively.

Changed in the main text.

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During the Last 100 Years, J. Geophys. Res. Atmos., 128, e2022JD038392,
https://doi.org/10.1029/2022JD038392, 2023.

We thank referee 3 for the useful comments. The referee's comments are marked in green, while our replies in black. The paper has been updated according to the referee's suggestions. Furthermore, we have fixed a small issue concerning the timescale and the 11-year cycle analysis. The changes of the main results (assessment of the method) are however minor.

General Comments:

This paper from Paleari et al. details a new beryllium-10 sampling technique and assesses the suitability of the technique for making high-resolution measurements for investigating short term signals from Solar Energetic Proton Events, the 11-year solar cycle and possible 10Be signals linked to volcanic activity. The authors compare results obtained from ice core continuous flow analysis (CFA) and traditional sampling methods, and compare their results with other published records. Using the CFA waste stream makes good and efficient use of limited ice core resources, and their results indicate that the technique works quite well and delivers a reproducible record. The paper is a valuable contribution to the field for this reason.

Overall, I believe their work to be sound, however, there are sections that are lacking in detail, or require a higher level of assumed knowledge to properly understand. In my view the paper may be suitable for publication in CP after clarifications/corrections to address the points raised below.

Major Comments:

The derivation of the depth scale should be explained in more detail. The authors discuss the uncertainty induced by crossover between 1 m ice sections, but they should state clearly how sample depth is attributed and how the depth uncertainty is estimated.

We thank the reviewer for the useful comment. The primary source of uncertainty is given by the time it takes for the meltwater to travel from the melthead to the centrifuge tube. To address this, flow time (usually around 20-30 seconds) was calculated at the beginning of each melting sessions and used it to pinpoint in which centrifuge tube the ice core sections begin and end. We added this in the revised text:

'Taking also into account the time needed for the meltwater to flow from the melthead to the centrifuge tubes (usually 20-30 seconds), and that was calculated at the beginning of each melting session, we assume the uncertainty related to the depth attribution to be <6 cm (3-4 months on average). We thus consider this to not affect significantly our results (see Section 3)'' (line 134-138).

I would like to see a proper explanation of how the S6 timescale was developed and its associated errors. I see there is a submitted paper, but I think it is important for this paper dealing with annual timings of SEPs, volcanics and comparisons with other records that any uncertainty in dating be acknowledged and its implications for interpretations be addressed.

More details on the development of the timescale of the EGRIP S6 core were added to the main text:

''The timescale for the EGRIP S6 core is constructed by counting the annual layers visible in the CFA dataset of the core. To constrain the annual layer count and align the EGRIP S6 age model with the main core, tie points of the EGRIP-GICC05 age scale (Mojtabavi et al., 2020) where identified in the electrolytic meltwater conductivity records at 21.53, 23.94 and 30.63 m depth and 73, 87 and 125 years b2k (before 2000 CE) respectively. In addition, the drilling year was used as an age constraint at the surface. The counting was performed using the StratiCounter algorithm (Winstrup et al., 2012).'' (lines 140-146).

As the S6 discrete analytical method is not currently published, can you give details about the discrete sampling (e.g. sample sizes etc.) so the readers can appreciate the value of this method in time and ice material savings?

The S6 firn core in the study by Zheng et al. (2023) was sampled at a 1-year resolution and the samples are on average 140g in weight, compared to 100g for the CFA record. In the case of the S6 discrete record, due to the large sample size, the use of ion exchange chromatography was required, adding a few hours of preparation, as well as materials (e.g. columns and chemicals for the extraction of the radionuclide).

The weight comparison between the discrete and CFA samples has been added to the text (line 146), and more details on the preparation were added in section 2: *'"This allows us to avoid the use of ion exchange chromatography (IEC), thereby saving about 3 hours of preparation per 12 samples and significant amount of materials (e.g., ion exchange columns). A schematic summarizing the preparation of 10Be samples with and without IEC at Lund University can be found in Nguyen et al. (2021).'' (lines 114-116).*

How much does site accumulation rate affect the interpretation of the record? What resolution is required for CFA to produce a record capable of detecting SEP events? Does the smoothed nature of CFA signals present a problem in determining rapid events compared to discrete methods?

We thank the referee for the comment.

a) Since we mainly compare two records from the same site, accumulation rate is not a concern. This holds particularly true considering that the accumulation rate at the EGRIP site is high enough to ensure that the annual production rate is well preserved, allowing us to extract the signal of 11-year cycle. It was also previously shown that the signal of extreme solar paleo-events can be preserved (Paleari et al., 2022).

b) Paleari et al. (2022) showed a 10Be record from CFA samples from the EGRIP core confirming the presence of the 9125 years BP SEP event. The 10Be record, characterized by sub-annual resolution (0.85 years on average), showed that CFA samples can be used for the detection of extreme SEP events. These extreme events can, however, be detected also in lower resolution records such as the GRIP and EDML records, characterized by resolution of ~5 years (e.g. O'Hare et al., 2019; Paleari et al., 2022). On the other hand, it has been shown in several studies (e.g. Pedro et al., 2011; Mekhaldi et al., 2021) that annual 10Be data is not able to resolve the signal left by GLEs, which cannot be unambiguously detected even in records with seasonal (e. g., Pedro et al., 2011; Zheng et al., 2020) resolutions.

c) As shown by Paleari et al. (2022), the CFA smoothing does not compromise the suitability of the CFA samples of preserving the signal given by large SEP events.

I see the primary value of the paper is its convincing demonstration of the veracity of a CFA sampled 10Be record. As such the paper is primarily a methods paper and the methods therefore should be presented with some more detail. The current methods sections are extremely brief, some points where more detail would help are noted further below.

Specific Comments:

Line 81: The authors state it was "not possible to analyze in depth and ultimately quantify the uncertainties related to this method". Could the authors clarify what is meant by this comment?

That is because the different locations are characterized by different climate and weather conditions, that can affect the 10Be records.

This point has been clarified in the text : *'While suitable for the assessment of the existence of the peak in 10Be concentrations, it was not possible to analyze in depth and ultimately quantify the uncertainties related to this method. That is because the record was only compared to ice core records from other locations from Greenland and Antarctica, therefore characterized by different climate and weather conditions.''* (lines 82-85).

Line 109: What carrier was used? How was the sample water captured in the centrifuge tubes? E.g. by fraction collector, or manually? What was the length and type of the tubing between the melthead and the centrifuge tube – this is relevant given the potential risks of adsorption of 10Be to surfaces prior to the centrifuge tube. Please clarify with answers in the main text.

For this project we used a Beryllium carrier from Scharlau (1000mg/l; $Be_4O(C_2H_3O_2)_6$ in HCl 2%). The samples were collected manually. The melthead was connected to the centrifuge tube via a 3m long tube in Teflon. These points were added to the manuscript: *''The melthead is designed to only inject meltwater from the inner part of the core for measurement (26x26 mm, e.g. Erhardt et al., 2022), while the meltwater from the outer part of the core, otherwise discarded, is pumped towards centrifuge tubes for continuous 10Be sampling through a 3m long tube in Teflon. To collect the water, we used 50ml centrifuge tubes where 0.1 mg 9Be carrier (from Scharlau (1000mg/l; Be4O(C2H3O2)6 in HCl 2%) was previously injected.''* (lines 107-111).

Section 2.2: This is difficult to follow. For starters, specify in the text the target resolution you were aiming for. It is not clear from this section if it was 1 sample per core or a much larger number of samples per core. I see the answer comes later around L161, but bring that information also into Sect 2.2 to help the reader.

We thank the reviewer for the useful comment. We initially aimed for a target resolution of 50g samples, corresponding to the weight of a full 50 ml centrifuge tube. However, the age-depth model of the S6 firn core then showed that combining two tubes for 100g samples would result in i) high-resolution of ca. 1 year and ii) more time- and cost-effective measurements. This corresponds to firn segments of about 25cm (on average). More details were added in the text: ''*The resulting samples have an average length of 25 cm, corresponding to an average time resolution of 1.2 years, with a minimum of 0.7 years and maximum of 2 years, depending on annual layer thickness and firn density.''* (lines 118-120).

Line 171: Two sided or one sided t test?

Two-sided.

Line 178: Also on STE cite Heikkilä et al., 2013 (doi:10.1002/jgrd.50217) and Pedro et al., 2011 (doi:10.1029/2011JD016530).

We thank the reviewer for the suggestions. The references were added to the text.

Line 180: Hence give more detail on the materials and lengths that were used.

The tubing is Teflon and the length is 3m. More details were added to the manuscript (line 110).

Figure 3: Congratulations, the CFA S6 versus discrete S6 plot is convincing

Thank you!

Figure 3. The reference for DSS should be Pedro et al., 2012.

Thank you, fixed.

Lines 221-223: Das2 written instead of Das 2 as in the rest of the manuscript.

Corrected.

Line 260: For clarity, it may be worth stating the 1951 start date is determined by Mekhaldi et al., not just a time period you chose.

We thank the reviewer for the useful comment. This was clarified in the manuscript (line 258-259).

Figure 6. Consider moving this figure to supplementary material.

We thank the reviewer for the suggestion. The histograms have been replaced by the supplementary figures of the residuals.

Line 275: These two paragraphs in particular are difficult to follow. Table 1 already summarises much of this information in a more concise and easier to comprehend way. Rather than list every 1 sigma or greater year, the authors might consider revising Table 1 with colors or bold font to indicate volcanics and GLEs, or create a table specifically to highlight where these intersect with above average 10Be concentrations.

We thank the reviewer for the suggestion. We have simplified the paragraphs in the revised version so that they are easier to follow. Although we agree that highlighting years characterized by volcanic eruptions and SEP events may guide the reader, we think that it may suggest we are making a clear correlation between residuals exceeding 1sigma and SEP events/volcanic eruptions, whereas we cannot do that with our results, and could therefore bias the readers.

Line 404: formatting of 10Be.

Fixed.

Conclusions: The paper is overly shy in drawing a conclusion on detection of SEPs/GLEs and volcanic events. A clearer statement would be that volcanic and SEP/GLE events are not clearly distinguishable from the level of internal variability in annually-resolved 10Be signals.

We thank the reviewer for the suggestion. This has been clarified in the Conclusions in the revised version. ''*This study shows that presently volcanic eruptions and GLEs influences cannot be unambiguously distinguished from the internal variability in annually-resolved 10Be records, in agreement with previous studies (e.g. Pedro et al., 2012; Mekhaldi et al, 2021).*'' (lines 402-404).

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