We thank referee 3 for the useful comments. The referee's comments are marked in green, while our replies in black.

***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 will add more details on the uncertainty related to the depth assignment in the revised version of the manuscript.

*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.*

The timescale for the EGRIP S6 core is constructed by counting the annual layers visible in the CFA dataset of the core using the StratiCounter algorithm (Winstrup et al., 2012). 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) were identified in the electrolytic meltwater conductivity records at 21.53, 23.94 and 30.63 m depth and 73, 87 and 125 yrs b2k respectively. As explained in the manuscript, Zheng et al. (in review) proposed adjustments of the chronology based on the correlation between the 10Be record from the S6 core and other 10Be records from Greenland and the theoretical 10Be production rate modeled from neutron monitor data. More details will be added in the revised manuscript.

*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. 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). More details will be added to the revised manuscript.

*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 will be addressed and clarified in the revised version of the manuscript.

*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. We will add more details in the revised manuscript.

*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 will be added to Section 2 in the revised version of the manuscript.

*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 will be 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 will be added to the revised manuscript.

*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.*

The typos will be corrected in the revised version.

*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 will be clarified in the revised version.

*Figure 6. Consider moving this figure to supplementary material.*

We thank the reviewer for the suggestion. The histograms will be 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 will clarify these 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 will be clarified in the Conclusions in the revised version.

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