We thank referee 2 for the useful comments. The referee's comments are marked in green, while our replies in black.

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. (in review). 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. In particular, the EGRIP records are particularly noisy in the period 1960-2010, as highlighted by the lower correlation coefficients described in section 4.

As suggested by the referee, we will include a new figure 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 (see Fig. 1 below). 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.

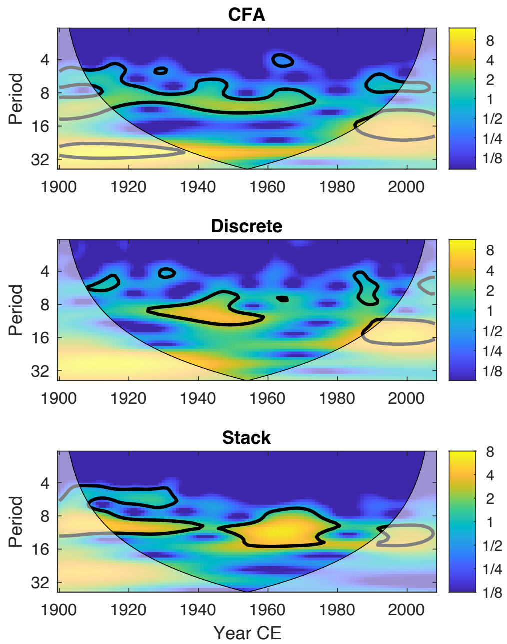

Figure 1. Continuous wavelet power spectrum (Grinsted et al., 2004) of the 10Be concentration records from CFA samples (top panel) and discrete samples (middle panel) from EGRIP S6, and of the global stack (bottom panel) calculated including the records from NGRIP,NEEM, Dye 3, Renland, Das2 , DML, DSS, Vostok and Concordia. The records were smoothed (3-year moving average). The black line denotes 5% significance.

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 will be added in the main text.

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. The paper is currently under review and more details will be available at the time of publication. More details on the age-depth model will be added in the revised manuscript.

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.

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 maint text.

References

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Grinsted, A., Moore, J. C., and Jevrejeva, S.: Application of the cross wavelet transform and wavelet coherence to geophysical time series A., Nonlinear Process. Geophys., 11, 515–533, https://doi.org/10.5194/npg-11-515-2004, 2004.

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