Dear Hubertus,

Thank you for your detailed review or our revised manuscript. We have made the changes you requested – in most cases directly following your suggestions. Please find detailed comments below.

All the best,

Christo, on behalf of the authors

additional points:

The wording of the abstract does not fully reflect the tentative character of your conclusions and the detailed discussion of the proxy in the manuscript (see also several comments by referee #1). I would suggest the following wording changes to the abstract:

line 36 of your track changes version: "The 86Krxs may therefore reflect the time averaged..., but may not record individual synoptic events."
line 43 of your track changes version: "We show that Antarctic 86Krxs appears to be linked to the ..."
line 46 of your track changes version: "... from the WAIS Divide ice core. Based on the empirical spatial correlation of synoptic activity and 86Krxs at various Antarctic sites, we interpret this record to show that synoptic Activity is slightly below..."

We have made these suggested changes, with minor changes from the suggested wording for the first point.

line 121 of your track changes version: "... and T temperature in Kelvin."
Done

The discussion of the effusion effect in line 132 is a bit unconnected to the rest of the text and should be backed up at best by a calculation of the air flow or at least the respective references should be provided. I would suggest to write at line 132 of your track changes version: "Note that also a upward air movement exists in the firn column relative to the overall downward advection of the ice, which is caused by the slow reduction of porosity with depth. However, this upward air flow..."
Following this sentence I would recommend to give a back of the envelope calculation here for the speeds of the air movements.

The calculations came from Buizert and Severinghaus (2016, page 2103). That paper had been cited on the previous line – which is why we did not repeat the citation again. We now have expanded this following your suggestion:

“Note that also an upward air movement exists in the firn column relative to the overall downward advection of the ice, which is caused by the slow reduction of porosity with depth (Rommelaere et al., 1997). This upward air flow due to gradual pore closure (around 10^{-9} to 10^{-8} m s^{-1}) is orders of magnitude smaller than the flows driven via barometric pumping (around 10^{-6} m s^{-1}), and therefore neglected here (Buizert and Severinghaus, 2016). “

line 290 of your track changes version: Please provide a reference for the timescale of pressure equilibration or some argumentation why it is about one hour

That calculation is again from Buizert and Severinghaus (2016). We added the citation.

line 389 of your track changes version: "...in the absence of a gradient DeltaT in mean annual temperature (Morgan et al., 2022)."

Agreed. This is an important addition.

line 395 of your track changes version. "... an unexpected positive DeltaT..."

Done

line 558 ff of your track changes version: I assume you use the mean of the next neighbor residuals to assess the significance of the offset between campaign 1 and 2. Each residual contains the analytical uncertainty of 2 individual measurements (uncertainty is larger), but at the same time you need to show that the standard error of the mean of all residuals is not significantly from zero (uncertainty becomes smaller). Please expand the discussion of the uncertainty in this paragraph accordingly.

The measurement offsets between the five campaigns are easily visible by eye, and we just wanted to provide a simple way to estimate these offsets. We did not explain very carefully how we performed the linear interpolation, so we added some clarification to this section of the manuscript.

line 627 ff of your track changes version: This paragraph is somewhat disconnected to the rest. Please extend a bit to explain.

For more context, we added:

“Understanding the cause of this relatively high scatter in the $^{86}Kr_{xs}$ records will require more work, in particular the measurements of several high resolution $^{86}Kr_{xs}$ records in various sectors of Antarctica.”

line 694 of your track changes version. "... a statistically significant impact at WDC..."

Thanks. Corrected.

libe 768 of your track changes version: I would delete ", demonstrating the validity of the new proxy."

Agreed. The reader can decide for themselves whether the proxy is valid or not.

caption Figure 3 line 1251 of your track changes version: "15N excess"
Done

Figure 8: Are the data points in this figure corrected for gas loss and thermal fractionation or not? Please add this information to the caption. Moreover the spline in this figure shows a peak at around 17 kyr BP which is not backed up by a data point in campaign 1 or 2 (i.e. the peak in the spline is higher than all the data points). Please double check or explain, why this peak appears.

There is no Figure 8, and we are not sure whether you refer to fig 6 or 7 here.

Thanks for catching the difference between the spline and data! We had to dive back into the code to find the origin of this issue, which was an error in our previous submission. We had inconsistently applied the gas loss correction to the data and the spline.

For campaigns 4 and 5 we do not have $\delta O_2/N_2$ or $\delta Ar/N_2$ data, which makes it impossible to apply the gas loss correction. To compare campaigns 1-5, we had NOT applied the gas loss correction to any of the data in the old figure 6. However, the gas loss correction WAS being applied to the spline (which was based on campaigns 1 and 2 only).

We have made the following changes:

- We have made a 3rd order polynomial fit to the WDC $\delta O_2/N_2$ or $\delta Ar/N_2$ data from campaigns 1-3, which allows us to make a systematic gas loss correction to all campaigns.
- We have added this fit to figure A5.
- We have updated figures 6 and 7 with data and splines consistently corrected for gas loss and thermal fractionation

We added the following text to appendix A1 on the gas loss correction:

"In order to provide a consistent gas loss correction to the five measurement campaigns, including campaigns 4 and 5 for which no $\delta O_2/N_2$ or $\delta Ar/N_2$ data are available, we fit a third-order polynomial to all available gravitationally-corrected WDC $\delta O_2/N_2$ - $\delta Ar/N_2$ data (Fig. A5A). We can then calculate the expected WDC $\delta O_2/N_2$ - $\delta Ar/N_2$ at any given age, also in the absence of $\delta O_2/N_2$ and $\delta Ar/N_2$ data. For consistency, we use this correction method for all data seen in Fig. 6. Note that the WDC $\delta O_2/N_2$ - $\delta Ar/N_2$ values are small for all ages, and that therefore the gas loss correction is small for this site."