Thank you to the authors for revising the manuscript. The overall structure and presentation have improved, and the updates have addressed several of the issues raised previously. However, I still have some concerns regarding the physical interpretation of several relationships between the annual climate variability indices and the ice core records. I believe further analysis, clarification and discussion would strengthen the manuscript and provide greater confidence in the interpretations.

Major revisions

Data selection requiring further clarification

1) SST-SEIO index

The manuscript currently links SST-SEIO to the Dipole Mode Index (DMI), which is the index commonly used to represent the Indian Ocean Dipole (IOD) (line 128). Suggest revisiting this to ensure the correct dataset is referenced. It would also be helpful to provide the latitude and longitude bounds used to define this index. More generally, a figure showing the regions associated with all climate indices used in the study would improve clarity for readers.

2) Use of ERA5 in the Southern Ocean

The use of ERA5 over the longer analysis period to identify moisture source regions is understandable. However, given the sparse observational coverage in the Southern Ocean prior to the satellite era, it would be beneficial to include some discussion of ERA5 performance in this region and period. While a full evaluation is beyond the scope of this study, references that assess ERA5 skill in data-sparse Southern Ocean environments would help readers interpret the results appropriately.

a. Selection of ERA5 results

The manuscript presents selected seasonal and spatial correlation results from ERA5. It would be useful to clarify what additional variables and seasons were examined but not shown. As currently presented, it is difficult to determine whether the selected results provide a comprehensive picture or primarily highlight relationships that exhibit stronger correlations. Some discussion of the full analysis would help reduce the potential for perceived selection bias and strengthen confidence in the interpretation.

3) Description of datasets spanning 1872–2013

Additional information is needed regarding all datasets used in the long-term comparison period. For example, no reference or description is provided for the Niño3.4 dataset. It would be helpful to clarify whether this record is derived from reconstructions, ship-based observations, blended datasets, or another source, and to provide appropriate citations.

Additional analysis and/or clarification to discussion points

4) Annual layer identification and snowfall seasonality

Please clarify whether the summer snowfall maximum could influence the identification of annual layers using isotopes. For example, could large snowfall events associated with atmospheric rivers influence the positioning of annual isotope peaks from year to year? If so, it would be useful to discuss whether this could affect the derived interannual variability.

5) Stability of correlations through time

The correlation analysis is conducted over 1957–2013. However, relationships between East Antarctic climate and large-scale modes of climate variability are known to vary through time. The d-excess results shown here appear broadly consistent with previously documented shifts in Antarctic temperature–SAM observed in Antarctic wide study using station data: Turner et al 2020 https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.6378 and Law Dome ice core study: Udy et al 2026 https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2025JD045013. Recommend assessing the stationarity of the reported correlations or, at minimum, discussing this limitation.

6) Annual means for ENSO and IOD indices

The response to reviewers acknowledges concerns raised regarding the use of annual ENSO and IOD indices, but these limitations are not clearly reflected in the revised manuscript (Section 2.3). As a result, readers may not fully appreciate the challenges associated with interpreting annual-average values for climate modes that have strong seasonal characteristics and have events split by the January-December year.

For example, the relationship reported in line 248 is based on annual IOD values, yet the physical relevance of annual averaging for this mode is unclear in the manuscript. While annual indices can be calculated, their interpretation unlikely reflects the known IOD dynamics and teleconnections. At minimum, the manuscript should explicitly discuss these limitations. My preference would be to see the analysis revised to better account for the seasonality of the relevant climate mechanisms and the way signals are recorded in the ice core. This issue is particularly important given that the ERA5 results presented in Section 3.2 demonstrate clear seasonal dependencies. Crockart et al. (2021) - CP - El Niño–Southern Oscillation signal in a new East Antarctic ice core, Mount Brown South may provide a useful example of an approach that considers both seasonal climate variability and annual ice-core records.

7) Interpretation of climate-index phases

In the paragraph beginning at line 260, I recommend referring explicitly to the phases of the climate modes rather than their associated variables. For example:

- Lower SSTs in Niño3.4: is this referring to an anomaly and La Nina conditions?
- Strong westerlies associated with SAM: which SAM phase is being referenced? Positive SAM?
- The negative correlation between accumulation and SST-SEIO is described as "ambiguous." If this relationship differs from expectations based on previous studies, it would be helpful to state this more directly and explain why.

8) Physical interpretation of the 3-year smoothing

The manuscript would benefit from further discussion of the physical meaning of the 3-year smoothing applied to the data. While smoothing is commonly used in ice-core studies to reduce noise and often increases correlation strength, it is not always clear what climatological process the smoothed signal represents when applying to modes of climate variability that have a strong seasonal influence.

For example, Table 6 shows cases where no significant annual correlation is present, yet significance emerges after applying a 3-year running mean. It would be helpful to discuss how such results should be interpreted from a climate perspective and whether they imply persistence, low-frequency variability, or another process.

9) Interpretation of Figure 5

The d-excess correlations with SST shown in Figure 5 do not appear to exhibit strong anomaly patterns associated with major Pacific or Indian Ocean climate modes. I recommend expanding the discussion of this result and considering its implications for the proposed mechanisms and links with the correlation findings of this study.

10) Discussion of warm intrusions (line 344)

It would be helpful to clarify how the warm intrusions discussed are linked to the climate modes identified in the analysis. In addition, some discussion statements (e.g., lines 344 and 351) would benefit from explicit figure references so that readers can more easily connect the discussion to the presented results.

11) Significance of the ice-core record

The concluding paragraph at the end of Section 3.4 would benefit from additional emphasis on the broader significance of this ice-core record for climate research. At present, the section reads primarily as a summary of existing literature. Expanding the discussion of the unique contribution of this record would strengthen the overall conclusions.

Minor revisions

1. In the study area description, please clarify what is meant by "relatively high snowfall" by providing quantitative values in the text. These values are currently available in Table 3 but would be useful to include in the main text.
2. In all figure and table captions, please define acronyms in full (e.g., Southern Annular Mode (SAM)) to improve accessibility for readers.
3. For Figure 2, please explain why a 5-year smoothing is applied, whereas 3-year smoothing is used in the correlation analyses.
4. Ensure all result statements include reference to relevant figures. E.g. paragraph beginning at line 232 - please include references to the relevant figures from this study where appropriate to assist with cross-referencing and clarity.
5. Please clarify the meaning of "transport pathways." I assume this refers to moisture transport pathways, but more consistent language would improve clarity.
6. In Section 3.4, "atmospheric river events" and "atmospheric rivers" appear to be used interchangeably. Consider using a single consistent term throughout.