

Comments of Anonymous Referee #1

General comments of Reviewer 1

The authors have made substantial improvements to the manuscript, and I therefore recommend this work be accepted following some minor modifications, which I list below.

Some typos still exist within the manuscript – a couple are listed below but a thorough proof-read by the authors is necessary.

There is still too much detail included in the majority of figure captions that should be located within the text instead (or already is, but is repeated in the captions).

We thank the reviewer once again for their helpful suggestions and constructive remarks.

Following their new suggestions, we have subjected the attached version to a thorough proofread by the authors. We have also made slight modifications to the figure captions in an attempt to improve their clarity and conciseness.

Specific suggestions of Reviewer 1

Lines 19-20: This is a long sentence that would benefit from at least a comma somewhere.

Line 88-9: Technically NSIDC terms their SIC as a percentage (i.e. 0-100, see documentation of NSIDC data) rather than area fraction (0-1), so maybe use 15% here rather than 0.15.

Line 101 and elsewhere in Data/Methods: add an “S” after the degrees symbols for clarity.

Line 122: This makes it look like the record was reached on 21 February in both years, may want to rephrase to make this clearer.

Line 159: This new addition requires some finesse. The first line “This enhanced variability appears to be related to swift changes in the tropospheric westerly winds” is basically a direct repeat of a sentence in the introduction (see lines 45-47) but without the references. Are you intending an “as mentioned above”, or is this based on your results. If the latter, how does the enhanced variability “appear” to be related to the westerlies? Your measure of variability spans much further than the SAM average in Figure 3. Figure 1 doesn’t show the link either, so this statement either needs a (very) brief explanation and references or to be reworded to more clearly link to whichever of the plots/Supplementary Material shows this to be the case.

Line 198: “index” appears here twice.

Line 208: This sentence needs a reference.

Line 209: Is the feedback loop between the vortex and ozone hole, or the other way around? The way the following sentence is written, the loop commences from the ozone – is that what you intend to say? This begs some clarification.

Line 246: “comparable”, not “camparable”.

We have made modifications to the text in accordance with each of the minor suggestions mentioned above. In the specific cases of lines 159, 208, and 209, we have slightly modified the text and included additional references that further explore some of the interesting points raised by the reviewer.

Additional Suggestions of Reviewer 1

Figure 4: It would be far easier for the reader to understand the links between the text and the figure if the axis titles were the same as what is being described in the text. Instead of “45-75°S Zonal Wind Anomaly (m/s)” etc, consider simply titling the axes as “stratospheric jet stream” and “tropospheric westerly winds”, with the more technical description in data/methods or within the relevant results section in the body of the manuscript.

Figure 5: This is a welcome modification, but I'm curious why you don't just show the Spring 2022/2017 anomalies, relative to the 1981-2010 mean. Wouldn't that be easier to interpret relative to the temperature anomalies shown in (c)? This is done in Figure S3 for 2022, but is stuck in the supplementary material.

According to these suggestions, we have slightly modified the captions of Figs. 4 and 5. In addition and as requested by the reviewer, we have modified Fig. S3 adding the sea ice anomalies for 2017.

We thank the reviewer once again for his/her helpful suggestions and constructive remarks. We believe these revisions have greatly improve our manuscript.

Best regards,

The authors.

Final author comments (ACs); manuscript tc-2023-59

Comments of Referee #3

General Suggestions of Reviewer 3

The authors study the links between sea ice variations and general atmospheric circulation, in particular what happens in the stratosphere. I find the paper rather well constructed with more than useful revisions. The work between the two versions seems to me to respond perfectly to the reviewers' remarks.

The introduction is a bit long, but clear and complete. It gives readers from different backgrounds a good understanding of how atmospheric circulation works and what we (don't) know today. Numerous additions in the latest version answer questions I had while reading (e.g. why use ERA5 and MERRA2, mentioning the opposite role of SAM according to season explicitly). I also found very interesting the last paragraph before the conclusion, which puts into perspective what we are currently observing over a longer period. The authors are particularly honest about what they have found and what we can conclude from it.

We thank the reviewer for his helpful comments and constructive remarks. We agree with the reviewer that previous revisions greatly improved the clarity of our manuscript. As highlighted by the reviewer, we have attempted to be transparent regarding both the scope and limitations of our work.

Specific Suggestions of Reviewer 3

My only minor/technical concern is about Figure 5. The caption says there is a link between large-scale stratospheric flow and sea ice variation, but shows 700hPa temperature which is the troposphere. Following the paper, I have no doubt there is a link but maybe this level is not the more adequate with the caption.

According to these suggestions, we have slightly modified the caption clarifying that Fig. 5b shows anomalies in the *stratospheric* flow, while Fig. 5c shows anomalies in the *tropospheric* air temperature.

We thank the reviewer once again for his helpful suggestions and constructive remarks.

Best regards,

The authors.