Reviewer 1:

General comments:

As I understand it, the phenomena studied by the authors have not been looked in detail hitherto. This makes this study novel; however, the results themselves do not seem to me to be very surprising – they are basically associated with the well-known wintertime flow around the Aleutian High. The pitfalls of zonal averaging are also well-known. The results of the trends provide interesting information regarding changes in atmospheric conditions over the last 40 years or so; however, as written in Sect. 4, these results seem like an afterthought. Perhaps the authors could refocus the paper, spending more time on the trends and using the other results to argue for the robustness of their results?

A: We understand that the problem of zonal averaging is well known. But it is still used a lot in various studies and it should be mentioned that this problem could affect the results. The second reviewer strongly requested to start with and to focus mainly on the two-core part of our paper and to simplify the trend analysis. We are sorry. Moreover, we have added a new table with trends for all years. It confirms the previous main results (change of trends and significant trend only for sectors affected by two-core structure). There are some difference between all years trends and other groups and the short discussion is now in the text.

In general, although the authors have made an effort to improve their paper, it is still difficult to follow their arguments in many places. This is chiefly because the English still needs some work. An example is the lack of use of the definite article “the” in many occasions. There are other instances where the English could be improved. I would suggest that either the authors do a concerted effort to improve matters, or the English language services of ACP are used.

The above comments as well as the specific comments below should be addressed before the paper is suitable for publication in ACP.

A: The article was read by native speaker even not physicist. We hope that English is better now (especially the definite article).

Specific comments (not all instances where the English could be improved are identified):

L. 15: It is "National Centers for…".

A: It was corrected in the text.

L. 68: I suggest "understood" instead of "believed". Understanding is more appropriate to science than belief.

A: We have used accepted instead of believed.

L. 78: What impacts were found on stratospheric ozone and water vapour?

A: The changes in geographical distribution and concentration.

L. 83: Avoid subjective statements, such as stating your study is "substantial".

A: *Might be* is changed to *is.*

L. 86: Words missing after "at"?

A: It is corrected in the text.

L. 108: I do not know what you mean by "supported".

A: It was changed to *confirmed*.

L. 137: "…start of satellite data…".

A: It was changed to start *of satellite data*

L. 171: Identify the u component (i.e., as the zonal component).

A: It is added and identified in the text now.

L. 199: Identify the 5-core structure – I see this at both 50N and 20N.

A: It is corrected in the text.

L. 203: Indicate that the 5 hPa results are not shown.

A: It is noted in the text.

L. 216: Use different terms than “front side” and “backside”. Perhaps use “westward” and “eastward”.

A: In meteorological literature the term front-side and back-side have predominantly been used.

L. 217: Avoid hyperbole like “massive”.

A: It is changed to the strong.

L. 237: What reanalyses are used to compute the trends?

A: NCEP/NCAR reanalysis. It is now in the text.

L. 244-245: Identify these sectors.

A: The sectors are identified in the text.

L. 256: Indicate that the bottom panel is in Table 2.

A: It is now in the text.

L. 260: Do you show this analysis?

A: Not shown in the text.

L. 559: ration -> ratio.

A: Corrected in the text.

Reviewer 2:

The authors have made many improvements to their manuscripts:
- the introduction is much improved;
- the structure of the manuscript is more coherent: the analysis of the climatology and the identification of a di-core pattern (the main finding of the study) comes first; the analysis of the trends in light of the di-core pattern comes second.
- the discussion of the results is improved as well, with some analysis to tie the results to temperature and ozone.

A: Thank you for your previous comments.

There remains however one major issue concerning the trend analysis. As it stands, it is not very useful as it only looks at the impact of QBO, SSW, and solar cycle without even presenting the trends themselves, no influence included. It would be greatly beneficial to add to the trend analysis a simple table with the trends, no influences accounted for. It needs to be analyzed in the context of the di-core pattern, providing a description of how this pattern has been changing over the last 50 years.

A: We have added a new table with trends for all years. It confirms the previous main results (change of trends and significant trend only for sectors affected by two-core structure). There are some difference between all years trends and other groups and the short discussion is now in the text.

I also believe that the level of English is not good enough for publication as the manuscript stands. Several sentences, such as "Further analysis, which has been done, is comparison between years in the solar cycle 230 maximum and minimum in different QBO phases and trends in different dynamics situations 231 (SSW or no SSW years, east or west QBO years)" are not well written and for this reason, the manuscript needs further work. I would suggest spending a bit more time improving this aspect of the article.

A: The article was read by native speaker even not physicist. We hope that the English is better now.

Overall, I believe that the authors have made substantial improvements to their manuscript, although very slowly and through too many iterations. As a result, I believe that the authors are close to having a manuscript that would be suitable to publication in ACP, if they address the two major issues I have listed above.