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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Response of Arctic ozone to sudden stratospheric warmings" *by* Alvaro de la Cámara et al.

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General comments

The paper analyzed the polar ozone evolutions during the SSWs using the WACCM 240-year simulation, which is also shown a fair agreement with the ERA-Interim, MLS and SWOOSH ozone. Then, the contribution from relevant dynamical (e.g. isentropic mean advection, isentropic eddy transport, cross-isentropic advective transport, cross-isentropic eddy trasnport) and chemical processes are quantitively diagnosed.

One highlight of this work is to provide statistical analysis of ozone changed during PJO-SSW and nPJO-SSW based on the long-term WACCM run. The result shows that the polar ozone anomalies are stronger and longer during PJO-SSW than nPJO-

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SSW, which is found related to the irreversible mixing and cross-isentropic advection.

Another highlight is that the authors particularly used equivalent length for ozone to quantify the irreversible mixing and make a note of the difference between the irreversible mixing and eddy transport. The differences between the 'Lagrangian' and 'Eulerian' perspective deepen the understanding of the roles of these processes.

The paper is well-written with valid methods, a clear structure and appropriate figures. The topic of the study meets the scope of ACP well. The flow of the whole paper is very clear and brief. The conclusions are sufficiently supported by the materials. In general, this paper has a good scientific quality and I recommend it to be published on ACP. I only have a few suggestions to authors, which can potentially improve the presentation of the paper.

Specific comments

1. Page 5, line15-20: please specified which temperature and wind are used for the SSW identification for MLS and SWOOSH.

2. The statements about Figure 1: better to mention the climatological seasonality is based on different length of climatology, i.e. 1980-2017 for SWOOSH, 2004-2012 for MLS, 1979-2012 for ERA-I and 240-year for WACCM, either in the text or in the caption of the figure.

3. Page 6, line 8 and line 21, please check the writing of the citation: Brasseur, Guy P. and Susan Solomon.ÂăAlso that in the reference list.

4. A suggestion for Fig. 4 and 8: to add the physical interpretations for each mathematics terms are helpful to readers. I would add the physical interpretations like what is done in Fig.2 also in this two figures.

5. Also a suggestion to easier go back and forward from text to figure: add some brackets with the color of the corresponding lines after the physical interpretations in the last paragraph of page 9, e.g. 'isentropic eddy transport (red line)' or 'vertical

advection of ozone (dark blue line)'.

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