Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-790-RC2, 2020


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Local and Remote Response of Ozone to Arctic Stratospheric Circulation Extremes" *by* Hao-Jhe Hong and Thomas Reichler

**Anonymous Referee #2**

Received and published: 22 September 2020

This study analyzes ozone anomalies associated with stratospheric sudden warming, vortex intensification and final warming events based on MERRA-2 reanalysis data. Long-lasting anomalies are found both in over the Arctic and in the tropics following these extreme events. In particular, the ozone anomalies only become apparent after the QBO-related signals are removed. It is a useful exercise to document the evolution and distribution of ozone anomalies following the stratospheric circulation extremes. The paper is logically organized and clearly written. I have a few comments regarding some of the methodology and results. I recommend publication of the paper after these comments are addressed.



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Discussion paper

1. Removal of the QBO signals. It is not surprising that the SSW-related ozone anomalies are masked by the QBO-related anomalies, but it is somewhat surprising that authors tried several methods to filter out QBO and only one worked. What about the linear regression with a QBO index such as in Randel and Wu (2015 JAS)?The description of the method the authors chose ("subtract the preexisting ozone anomalies of each event from its subsequent daily ozone fields") is not clear to me. The authors cited Gomez-Ecolar et al. (2014) for the method. But what described here does not seem to agree with any of the three methods described in Gomez-Ecolar et al. (2014). It sounds like calculating the difference of ozone between different periods. Then the resulting is actually ozone tendency rather than ozone anomalies itself.

2. Why there is a persistent minimum at about 20 hPa in the QBO-related ozone anomalies shown in Fig.4a? This feature seems unrealistic and is not seen in other studies (e.g. Fig. 1 of Tweedy et al. 2017 ACP).

3. The authors show the ozone tendency due to residual mean circulation and eddy flux convergence, and the eddy convergence term contribute significantly over the Arctic. Can the authors elaborate a bit more on the physical process associated with the eddy convergence, especially what determines the sign of this term?

4. Line 118: "180-day smoothed" Do the authors mean a running mean with 180 day window?

5. Line 208-209: Why is the magnitude of the ozone anomalies associated with SSW differ so much between Hocke et al. (2015) and this study?

6. Line 225: From Fig. 2, the FW anomalies following a VI event is stronger and extends to the lower stratosphere.

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