Thank you for the helpful reviews, which have hopefully improved the clarity and quality of this manuscript. There are a few changes that we have made, which must be stated for both reviewers and the editor. An issue pointed out by both reviewers was that our discussion of the role of ozone depleting substances (ODSs) in the conclusion was misleading (it was). We have added text to the methods and conclusion sections to clarify that the ODS concentrations are higher in the RCP8.5 experiment (EXP2) compared to the preindustrial control experiment (EXP1) and we now discuss the implications of this on the ozone responses that we present.

Previously, since one of our experiments (EXP3) was referred to as the "RCP8.5 SST" experiment and some of our responses were referred to as "RCP8.5 SST" responses, it was unclear when we were referencing an experiment or a response to an experiment. To clear this up, now in each case when we are mentioning an experiment, the word "experiment" is used explicitly along with the label for the experiment in parentheses (see Table 1: EXP1, EXP2, or EXP3). Conversely, as we decompose the atmospheric response to full RCP8.5 forcing into contributions from RCP8.5 SSTs and RCP8.5 GHGs, we now refer to these constituent responses exclusively by saying "SSTs alone" or "GHGs alone." The figure labels and captions have been updated accordingly.

Following Figure 4, the previous version of this manuscript had a paragraph expressing that there is a duality between the stationary wave response to RCP8.5 conditions and the acceleration of the Brewer Dobson Circulation that may be inferred from our Figure 4. This paragraph has been removed. While not shown, the stationary wave response to full RCP8.5 forcing is more complex than was appreciated during the previous manuscript submission and realizing this rendered that since deleted paragraph questionable.

################################ Reviewer 2 ##################################

The paper by Elsbury et al. deals with the response of ozone STT and North Pacific jet to RCP8.5 forcing over the western North America region which is a well-known hot spot of ozone STT. This is a very interesting paper on the main mechanisms of future ozone STT over western North America. It is well written and structured, and the results are nicely presented. My only concern is the terminology of the experiments and the associated discussion which I find misleading. I would be happy to suggest publication of the manuscript in ACP once my comments below are addressed:
Comments:

1. The future SSTs mainly result from the future GHGs. What the authors present is a decomposition of the overall GHGs effect in that of SSTs and the residual of GHGs (including also the ODSs) which to my understanding is mainly the chemical effect. The EXP2 described with term RCP8.5 is the one that represents the whole GHGs effect. Therefore, using the terms "RCP8.5 SSTs" and "RCP8.5 GHGs" is somehow misleading as both constitute the overall GHGs effect (term "RCP8.5"). The same applies to the corresponding discussion.

Thank you for pointing this out. We updated our methods section to emphasize that we are decomposing the full RCP8.5 forcing (GHGs + ODSs + SSTs) into a GHG portion, which includes the ODSs, and an SST portion. We now emphasize that the SST changes are themselves induced by the GHG changes. We also now emphasize that the ODSs are part of our "response to the GHGs alone" and discuss the implications of this in the methods.

In the previous manuscript, referring to the experiments and to the anomalies using the same names, e.g., "RCP8.5 SST," was confusing. Following Oberlander et al. (2013) and Chrysanthou et al. (2022) whose experimental setups were similar to ours, we now reference the experiments as "EXP1, EXP2, and EXP3" or in some cases, as "the preindustrial control experiment" or the "RCP8.5 experiment." Throughout the result section, the cumbersome references to anomalies of "RCP8.5 SSTs" and "RCP8.5 GHGs" have been removed and are now more simply referred to as the "SSTs alone" or it's simply said "The SSTs alone do blank.."

Chrysanthou, A., Maycock, A. C., & Chipperfield, M. P. (2020). Decomposing the response of the stratospheric Brewer–Dobson circulation to an abrupt quadrupling in CO 2. *Weather and Climate Dynamics*, *1*(1), 155-174.

Oberländer, S., Langematz, U., & Meul, S. (2013). Unraveling impact factors for future changes in the Brewer‐Dobson circulation. *Journal of Geophysical Research: Atmospheres*, *118*(18), 10-296.

2. I find the term "RCP8.5 GHGs" misleading, as this also includes the ODSs impact on future ozone STT. Although, the authors nicely discuss the limitations of their approach in the conclusions, I feel that the term "RCP8.5 GHGs" gives the impression that ODSs are not included, and someone must specifically find that information (that are included) in the text.

This is an important point and we have added text to methods and to the conclusions to explicitly state that the ODSs are included as part of the GHG response. The implications of binning the CH4, CO2, N2O, and ODS responses together is now discussed as well.

3. Moreover, I am a bit puzzled with how ODSs are treated in the simulations. The authors state (P4, L105-107) "There are also increased concentrations of ozone-depleting substances (ODS; e.g., chlorofluorocarbons) relative to the preindustrial experiment, due to the long lifetimes of these substances, which were emitted prior to the Montreal Protocol.", but in the Conclusions they attribute higher ozone concentrations also "…from reduced ODSs" (P19, L437). Is the latter statement referring to a comparison with respect to the present period? If yes, the comparison presented is relative to the preindustrial period. Please clarify this.

Thank you for spotting this contradiction. This sentence, which was previously in the conclusion, was referencing the results of Dietmuller et al. (2021), whose study focuses on 1990s-2100. However, this was misleading because as you point out, our study focuses on preindustrial vs. late 21st century. Following this comment and a similar comment from the

other reviewer, we have added text to the methods section and to the conclusion to better clarify the role of ODSs in these simulations.

Dietmüller, S., Garny, H., Eichinger, R., & Ball, W. T. (2021). Analysis of recent lower-stratospheric ozone trends in chemistry climate models. *Atmospheric Chemistry and Physics*, *21*(9), 6811-6837.

Minor Comments:

L32-L33: Recently Zanis et al. (2022) studied the climate change penalty and benefit on ozone air-quality using simulations from CMIP6 ESMs. I believe this reference can be included here.

Added!

L82: What is the resolution of WACCM model near the tropopause?

Horizontally, 1.9 degrees latitude by 2.5 degrees longitude. If you are referencing the vertical resolution, it ranges between 1.1 and 1.4 kilometers throughout the lower stratosphere. In a sense, the vertical resolution near the tropopause is much finer. The finite volume dynamical core uses fluctuating vertical coordinates: the material surfaces that bound the finite volumes, which contain some amount of tracer, can be compressed or spread apart (Neale et al. 2010). The material surfaces are then remapped back to the predefined model levels, and transport proceeds by considering the pressure difference between the current (fluctuating material surfaces) finite volume and the predefined (fixed vertical coordinate) finite volume (Abalos et al. 2013).

Neale, R. B., Chen, C. C., Gettelman, A., Lauritzen, P. H., Park, S., Williamson, D. L., ... & Taylor, M. A. (2010). Description of the NCAR community atmosphere model (CAM 5.0). *NCAR Tech. Note NCAR/TN-486+ STR*, *1*(1), 1-12.

Abalos, M., Randel, W. J., Kinnison, D. E., & Serrano, E. (2013). Quantifying tracer transport in the tropical lower stratosphere using WACCM. *Atmospheric Chemistry and Physics*, *13*(21), 10591-10607.

L88: How is tropopause defined in WACCM?

WACCM uses the lapse rate tropopause. At high latitudes (>55 degrees), in the event that the tropopause cannot be found, the model will use the climatological tropopause.

L218: Please include degree symbols (and where else applicable).

Added!

L271: Maybe “The 200 hPa O3S”.

Added!

References

Zanis, P., D. Akritidis, S. Turnock, V. Naik, S. Szopa, A.K. Georgoulias, S.E. Bauer, M. Deushi, L.W Horowitz, J. Keeble, P. Le Sager, F.M. O'Connor, N. Oshima, K. Tsigaridis, and T. van Noije, 2022: Climate change penalty and benefit on surface ozone: A global perspective based on CMIP6 earth system models. Environ. Res. Lett., 17, no. 2, 024014, doi:10.1088/1748-9326/ac4a34.