

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

Anonymous Referee #1

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The paper presents an analysis of stratospheric ozone anomalies associated with sudden stratospheric warmings (SSW), vortex intensification events (VI), as well as FW events at the end of the corresponding winters. MERRA-2 data is used and both the Arctic and the Tropics are examined. The transport mechanisms are examined using the Transformed Eulerian Mean formalism. The paper is very well written, the methods are valid and the interpretation of the results is correct. I only have minor comments that should be addressed before publication.

Minor comments

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- General: I find interesting the approach of interpolating the time axis in order to get common composited times for the SSW/VI event and for the FW. It helps bring out the outstanding ozone feature during the FW following VI events. However, I am not convinced by the terminology “the event’s duration” referring to the lapse time between the event’s central date and the FW. The final warming terminates the winter season, and while this indeed terminates the VI events, the SSW ends when the vortex recovers, not when it breaks down.
- L134-138: I understand that S does not provide information on the photochemical changes as it is obtained as a residual and there are likely important numerical errors that prevent closing the budget, especially in a reanalysis system, where assimilation increments are included. However, you could check if the expected behavior is found in the S anomalies when referring to changes in photochemistry, e.g. for VI events in the polar region (L252-254) and in the tropics (L325-326).
- Sections 3.1 and 4.1. Several of the features described in these sections have been previously shown in the article of de la Cámara et al. 2018 JGR (<https://doi.org/10.1002/2017JD028007>), such as the tropical upwelling or the wave activity for SSW composites, in both reanalysis and model data.
- L157: “one-tailed t-Student test”. This should be a two-tailed test, since the sample anomalies could be overestimating or underestimating the population anomalies (i.e. the null hypothesis is $\mu = 0$, not $\mu \leq 0$). This is important since for a 95% confidence level for the 8 VI events, $t_{0.025,7} = 2.365$ should be used instead of $t_{0.050,7} = 1.895$.
- L241-242: The small role of photochemical effects hypothesized here against the findings of Sagi et al. (2017) is consistent with the photochemical term shown in

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de la Cámara et al. (2018) ACP. Note that this paper does show the transport and chemistry relative contributions referred to L353-355 in a CCM, and that these CCM transport results are overall consistent with your reanalysis results.

- L304: These values are much lower than their Arctic counterparts, what is the relative TOC change?

Technical

- L35 onward: Consider changing “transports” to “transport” throughout the paper?
- L125: change "p-coordinates" to "pressure coordinates"
- L341: "spectacular" Perhaps a more scientific term could be used (sudden/abrupt)?

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