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

Anonymous Referee #3
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This manuscript shows the dynamical features of SSW and VIs from the boreal early winter to late spring in both region, Arctic and Tropics. The present study found new aspect on the dynamical impact of the final warming at the case of Vis winter. Further, there are descriptions of ozone fields at Arctic and tropics on SSW and Vis winters. The manuscript was well written, the present manuscript will be published after modifying some minor corrections and/or answer to the reviewer comments.

Minor comments:

Abstract: It is interesting points that should be described in the Abstract, that is the quantitative discussion of ozone change (Figs.2 (a,b) and Figs.5 (a,b)). The ozone change was large at both case of SSW and Vis with FW in the Arctic, on the other hand, the ozone change was small but same amount for both case in the tropics.

We revised the abstract by adding specific numbers for the changes in column ozone in the following way:

L15-17: *"Over the Arctic and during sudden warmings, ozone undergoes a rapid and long-lasting increase of up to ~50 DU, which only gradually…. In contrast, vortex intensifications are passive events, associated with gradual decreases in Arctic ozone that reach ~40 DU during late winter and decay thereafter."*

L20-21: *"After controlling for this effect, small but coherent reductions in tropical ozone can be seen during the onset of sudden warmings (~2.5 DU), and also during the final warmings that follow vortex intensifications (~2 DU)."*

Line 41 "become easterly": The major warming event accepts the reversal of zonal wind direction from westerly to easterly, however the warming event does not always reverse the wind direction, like for the minor warming.

We now revised the manuscript as follows:

L37-38: *"At times, the bursts of waves and their interaction with the polar vortex are strong enough to create so-called major Stratospheric Sudden Warming Events (SSWs)…"*

Line 253-255 "In contrast, the negative anomalies. . .": Figs.2 (c, d) : Do Figs.2 (c,d) show the anomaly from climatology? If so, the authors should add the description of the anomaly from what.

Yes, Figs. 2c and 2d are daily ozone anomalies, and we corrected the caption of figure 2 to makes this clearer:

Caption 2: *"Figure 2. Arctic ozone …. Remaining panels are anomalous time-height cross-sections of …".*

The calculation of daily ozone anomaly is already described in section 2.1, where we write:

L96-99: *"We compute daily climatologies from MERRA-2 by averaging each day of the year over the entire record and smoothing over the seasonal cycle using 10-day running means. Daily anomalies are obtained by subtracting the climatologies from the daily data."*

Line 264 "the variations of w (Fig.3a)": If the QBO variation remains in the residual vertical velocity and temperature fields, the authors should note the fact.

Yes, the QBO variations are still contained in the diagnostic of the dynamical quantities. To make this clearer, we now add one sentence after line 263:

"Note that no filtering has been applied to this figure and that the shown changes are due to both the remote impacts from the Arctic circulation events and the local effects from events like the QBO."

Line 278 Fig4b: The year of 2016 for Vis case is absent.

As described in section 2.2, we did not include the anomalous 2015-2016 QBO event in our analysis. We revised the caption of Fig. 4 as follows:

Caption 4: "Figure 4. Composites for QBO events …; S and V on the right axis is the mean UEQ30 of all SSWs and all VIs (except 2016), respectively. The 2015-2016 QBO event has been purposefully excluded from this analysis due to the anomalous nature of this event.