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Comment on acp-2022-276

Anonymous Referee #1

Referee comment on "Dynamics of ENSO-driven stratosphere-to-troposphere transport of ozone over North America" by John R. Albers et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-276-RC1, 2022

The article presents an analysis of the effects of ENSO on the ozone STT in western North America using WACCM simulations. The topic is of high interest, the simulations are very well designed, and the article is very well written. I just have a few minor comments that should be addressed before publication.

Minor comments

- I am not convinced about the implied duality BDC versus ENSO-teleconnection that is presented in the paper (e.g. L135-159, L156-159). The longitudinally-resolved ozone anomalies clearly reveal the ENSO teleconnection pattern associated with the stationary Rossby wave train (PNA). However, this does not imply that the BDC does not play a role in driving ozone anomalies, if the BDC is defined as the combined net zonal mean tracer transport by residual circulation and mixing (as is the case in this paper). In particular, the zonal anomalies combined with circulation anomalies are included in the eddy transport/mixing component of the BDC. In my opinion, the apparent duality BDC/teleconnection duality only results from the different framework (zonal mean/zonally resolved), but does not constitute a different process.

- 151-159: why focus on these high level anomalies when you are interested in STT and there are strong anomalies at lower levels? (also L268)

- L224-225 "what is important here, is that anomalies in EKE are well-correlated with anomalous STT (Shapiro 1980, Langford 1999)". I believe the two publications cited do not use EKE. Shapiro 1980 deals with turbulent/mixing fluxes and Langford 1999 actually shows the absence of correlation between monthly mean ozone and the eddy variance of meridional wind (their Fig 3d). I suggest to cite Breeden et al. 2021 instead, as they explicitly show the correlation between fold frequency and EKE, which in turn is correlated with STT (their Fig. 7).

- L93-95: Do I interpret this correctly that in your simulations there are continuously varying SST that evolve with the prescribed 2 years cycle (after one cycle ends, the next one starts)? Maybe this could be clarified.

- L96-97: but you said it was constructed averaging all events? This seems to contradict it.

- L103: since the simulations have no QBO, are there unrealistic climatological winds in the equatorial stratosphere?

- 104-105: Does this assume that El Niño and La Niña are symmetric (which they are not)? Or is it equivalent to using a climatology with zero SST anomalies (neutral ENSO)?

- 109: why is longer-timescale variability not relevant near the tropopause?

- L149: this is true at levels above 20 hPa or so, but the opposite is seen in the lwoer stratosphere! Again, I think you should focus on the dipole at lower levels.

- 198-199: yes, but the relevant information here is how this seasonal climatological behavior is modulated by ENSO, please include this information with references.

- L232-234: Writing should be more careful here: one needs to compare the ozone anomalies in Fig 4a with EKE anomalies in Fig 7a (both at 200 hPa). Then the area of enhanced ozone in the North Atlantic and that of reduced EKE overlap. In Fig 8a (800 hPa) the area of enhanced ozone is centered at lower latitudes (~30-45N), and this corresponds to enhanced, not reduced, EKE in Fig 7a.

- L232-233: "which in isolation should correspond to a reduction in tropopause fold frequency" again you could cite Breeden here.

- Fig. 1: The figure caption should include the word "anomalies"

- Fig. 5: Is this figure really needed?

Technical

- 110: not that slightly…

- L148: EXTENDING from the North Atlantic... (otherwise it is unclear)

- L174: responsible for THE high latitude…

- L214: typo: -0.5ºC (minus sign missing)

- L236: Baja CALIFORNIA

- L267: DOMINANT