Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-801-SC1, 2020


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Influence of ENSO on entry stratospheric water vapor in coupled chemistry-ocean CCMI and CMIP6 models" *by* Chaim Israel Garfinkel et al.

**Mohamadou Diallo**

m.diallo@fz-juelich.de

Received and published: 11 November 2020

Dear Chaim,

The manuscript presents an interest results but I think that some important points are still not clearly addressed in the manuscript. Please find below my comments and questions regarding these aspects. I am sure addressing these points will help improve the paper.

Kind regards,

Mohamadou



Printer-friendly version

Discussion paper

Major points:

1. Among the climate models used here some have interactive QBO (WACCM, HadGEM, ...) and other have nudged QBO. This will lead to different modulations of the water vapor entry (tape recorder). Therefore, it is important to remove the QBO signal adequately in order to attribute properly the remaining variability to ENSO. However, this does not seem to be the case here or at least the description is not clear. Therefore, I have these questions:

a. Is the QBO proxy used in the MLR for all analyses calculated using the each model winds for the REF-C1 simulations?

b. Is the QBO proxy used in the MLR for all analyses coming from the observation (Berlin QBO or NASA)?

c. Is the QBO proxy used in the MLR for all analyses a combination of both a) for auto-generating QBO models and b) for nudged model?

If you have used the method a) or b) the results will seriously be questionable because of the time of the QBO modulation in the models, which auto-generate the QBO is different with the observed QBO signal,leading to bias results.

2. Regarding the Fig.1 where the non-linear response of water vapor induced by ENSO is claimed, it would be very interesting to see the QBO nudged models like (EMAC) regarding this non-linearity. Does ERA5 also show this non-linearity in Fig 1? The QBO contributes the most in the entry of water vapor anomalies via its modulation of the cold point temperature (Brinkop et al 2016; Diallo et al., 2018; Tao et al. 2019), therefore, it's important to handled it properly, which is seems to not be the case here.

3. It would be also very interesting show the tape recorder of each climate model simulation compared to ERA5. According to Hardiman et al. 2017, Figure 8, the HadGEM REF-C1 simulation compares very poorly with the SWOOSH observations, therefore, it would be interesting to see these models performance of tape recorder.

4. Thank you for adding the Tao et al, 2019 and Diallo et al 2018 into the discussion regarding the different contribution and modulation of the stratospheric water vapor and its entry by ENSO, QBO and seasonal cycle from observations (MLS, SWOOSH) and reanalyses.

References:

1) Hardiman, S. C., Butchart, N., O'Connor, F. M., and Rumbold, S. T.: The Met Office HadGEM3-ES chemistry–climate model: evaluation of stratospheric dynamics and its impact on ozone, Geosci. Model Dev., 10, 1209–1232, https://doi.org/10.5194/gmd-10-1209-2017, 2017.

2) Brinkop, S., Dameris, M., Jöckel, P., Garny, H., Lossow, S., andStiller, G.: The millennium water vapour drop in chemistry–climate model simulations, Atmos. Chem. Phys., 16, 8125–8140,https://doi.org/10.5194/acp-16-8125-2016, 2016.

3) Tao, M., Konopka, P., Ploeger, F., Yan, X., Wright, J. S., Diallo, M., Fueglistaler, S., and Riese, M.: Multitimescale variations in modeled stratospheric water vapor derived from three modern reanalysis products, Atmos. Chem. Phys., 19, 6509–6534, https://doi.org/10.5194/acp-19-6509-2019, 2019.

4) Diallo, M., Riese, M., Birner, T., Konopka, P., Müller, R., Hegglin, M. I., Santee, M. L., Baldwin, M., Legras, B., and Ploeger, F.: Response of stratospheric water vapor and ozone to the unusual timing of El Niño and the QBO disruption in 2015–2016, Atmos. Chem. Phys., 18, 13055–13073, https://doi.org/10.5194/acp-18-13055-2018, 2018.

---

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-801, 2020.



Printer-friendly version

Discussion paper