Review of the *revised* (v3) manuscript

Seasonality of the Quasi-biennial Oscillation signal in water vapor in the tropical stratosphere

submitted to EGUsphere by Qian Lu et al.

Reviewer Comment, November 2025

General Comment

The authors clarified that the added value of the ERA5 SWV does not lie in direct observational constraints (as there are none) but simply in the indirect constraints brought by realistic dynamics. Hence their comparison of the seasonalities of QBO signal, between ERA5 SWV and CMIP6 SWV, is similar to a comparison between GCCM with specified dynamics and unspecified dynamics. In this sense, the QBO signal in ERA5 SWV is indeed expected to be more realistic than in the CMIP6 SWV.

Major Comments

1. A very simple comparison between climatological SWV in SWOOSH and ERA5 (new Fig. 1) leads the study to focus on pressure levels below 10 hPa. But Fig. 2 shows that the signal in ERA5 is not realistic above 30 hPa as it quickly becomes much weaker than in SWOOSH. This is noted by the authors in their response: "*We noticed that the WV anomalies above 30 hPa are weaker in ERA5 than in SWOOSH. We mainly focus on the WV below 30 hPa (especially in Figure 5)*." Yet this is not mentioned explicitly in the revised manuscript, which keeps a very high top (1 hPa) for Figures 6, 8, 9 and still computes ERA5-CMIP6 correlations over the whole 100-1 hPa pressure range (Table 1).
   Figure 2 clearly shows that the QBO signal in SWV can not be studied with ERA5 in the middle stratosphere (30-10 hPa). Figure S2 does show some signal with ERA5 in the upper stratosphere (10-1 hPa) but still much weaker than SWOOSH. Hence the paper should
   - improve Fig. 2 and S2 by the addition of a vertical profile showing, as a function of pressure, the overall agreement between the QBO signals in SWOOSH SWV et ERA5 SWV. This could be simply, at each pressure level, the normalized standard deviation of the differences between both time series.
   - clearly state that the QBO signal in ERA5 SWV can not be trusted above 30 hPa.
   - limit the vertical range of Figures 6, 8, 9 to the 100-10 hPa pressure range. This would also allow Fig. 6 and 9 to show more details (finer color bars) and Fig. 8 would become clearer.
   - focus all discussions in sections 4 and 5 on the lower stratosphere (i.e. the 100-30 hPa pressure range).
   - re-calculate the the correlations of Table 1 using only the 100-30 hPa pressure range.

2. While this is not mentioned in either version of the manuscript, it appears that an asset was actually uploaded with the manuscript: https://doi.org/10.5281/zenodo.14999285. It is a collection NCL codes, probably to generate the figures. In its present form, this asset is useless. Four improvements are necessary:
   - Mention the existence of this asset, and reference it properly, in a dedicated section at the end of the mansucript (as is standard in Copernicus journals).
   - Update the NCL files: the recorded date for this asset is March 2025, i.e. before the revision of the paper.
   - Rename the NCL files according to the figures which they generated.
   - Include the datasets which are plotted, e.g. "/nuist/scratch/raojian/luqian/water/u.nc" which is read by "bd.ncl"

Minor comments

1. Lines 114-115: "*Figure 1 shows the evolution of the annual mean, summer mean, and winter mean of the WV mixing ratio in the troposphere during SWOOSH satellite data and ERA5 reanalysis from 1992 to 2019*".
   Please revise this sentence: this figure shows climatological means of SWV over 1992-2019, not its evolution over that period. It shows WV in the stratosphere, not in the troposphere.

2. Lines 173-174: "*The WV QBO from SWOOSH is consistent with ERA5 reanalysis, but the amplitude is stronger, and the strong WV QBO in SWOOSH propagates upward at a higher level. (Fig. 2b)*".
   In this comparison SWOOSH is the observational (i.e. reference) dataset. So the comparison should be formulated the other way around, e.g. "**The WV QBO from ERA5 is consistent with SWOOSH but it does not propagate as high, with a much too weak amplitude above the 30 hPa pressure level.**" This is also the right place to draw the consequence about the vertical extent of the study (see Major Comment 2).

3. Figure 5: it is difficult to distinguish the different shadings due to the dots. You should either reduce the density of these dots, or decrease their size. Also, their meaning must be explained in the caption (confidence level).

4. Figures 10 and Figure 2: must have exactly the same color bar and shadings, to enable visual comparisons. In Figure 10, the labels of the color bar are not complete (dot missing, e.g. "-0 25" → "-0.25")