Response to Anonymous Referee #1 ’s Comments,

1 General comments:

Thank the authors revising the manuscript based on the comments addressed before. Most of the comments are answered properly. However, there are a few minor points that I would like to see clarified before the manuscript is published.

We would like to sincerely thank the referee for the constructive comments and suggestions. Following the reviewer’s suggestion, we have substantially revised the manuscript. Please note that the manuscript is also altered according to the other reviewer’s comments and suggestions. More details can be found in the point-by-point responses as shown below.

2 Specific comments:

– L140-L141: The UTLS SAO signal is significant in the regions of 22.5°-42.5° in both hemispheres. The results are based on the regions of 32.5°-42.5° Some connection needs to be built before L148 "We then mainly focus on the SAO..."

Thank you very much for the very helpful comment. We haved added the connection before the sentence.

– L162-L166: Figure S3 and S4 do not help to explain the strong SAO signal over Asia and Australia. Compared to the regions with strong SAO signal in Figure 2, the regions with larger water vapor and strong upwelling are shifted toward the equator, where the SAO signal is weak. Perhaps the water vapor anomaly with zonal mean removed might show better agreement.

Thank you very much. We have made the water vapor anomaly with zonal mean removed as new Figure S3 in the supplement.

– L267-L268: "Such reduction of ..... than tropics." The SAO in tropics is located in the altitude between 400 hPa and 225 hPa. Figure R6 shows that the relative difference of SAO PSD in tropics (400-225 hPa) is larger than that in SHM/NHM UTLS (250-175 hPa). It might be better to change as "Such reduction of SAO PSD caused by removing SST-SAO is larger in the SHM and NHM than that in the tropics"

Thank you very much. We have corrected the sentence.

– L284-L285: "In October, the negative values .....reduced radiative cooling." The total heating rate is reduced only for the sensitivity simulation of rmSAO in October (Figure 9a)

Thank you for your suggestions. We have modified the sentence.

– L289: In winter –> In austral winter

Corrected.

– L289-L290: "In April, the negative values.....reduced radiative cooling." The total heating rate is reduced only for the sensitivity simulation of rmSAO-TP in April (Figure 9b)

Thank you very much for the reminder. We have changed the sentence in the manuscript.

– L306: in summer –> in austral summer or in February

Corrected.

– L307-L308: "The further energy ..... in the summer season" This conclusion applies in the NHM SAO. The peak of temperature for SHM in summer is not stronger than that in winter (Figure 3d and Figure 8b). It might be better to summarize it more precisely.

Yes, we have added the NHM in the sentence.

Response to Anonymous Referee #2 's Comments,

In the revised paper "The semi-annual oscillation (SAO) in the upper troposphere and lower stratosphere (UTLS)" by Shangguan and Wang my suggested changes were satisfactorily addressed. The paper is now almost ready for publication in ACP. There are just a few remaining very minor comments as detailed below.

We would like to sincerely thank the referee for the constructive comments and suggestions which helps to improve the manuscript significantly. Following the reviewer's comments/suggestions, we have revised the manuscript substantially. Please note that the manuscript is also altered according to the other 1 reviewer's comments and suggestions. More details can be found in the point-by-point responses as shown below.

l.87: please include the ERA5 reference paper Hersbach et al. (2020)

Hersbach, H., Bell, B., Berrisford, P., Hirahara, S., Horanyi, A., Munoz-Sabater, J., Nicolas, J., Peubey, C., Radu, R., Schepers, D., Simmons, A., Soci, C., Abdalla, S., Abellan, X., Balsamo, G., Bechtold, P., Biavati, G., Bidlot, J., Bonavita, M., de Chiara, G., Dahlgren, P., Dee, D., Diamantakis, M., Dragani, R., Flemming, J., Forbes, R., Fuentes, M., Geer, A., Haimberger, L., Healy, S., Hogan, R. J., Holm, E., Janiskova, M., Keeley, S., Laloyaux, P., Lopez, P., Lupu, C., Radnoti, G., de Rosnay, P., Rozum, I., Vamborg, F., Villaume, S., and Thepaut, J.-N.: The ERA5 Global Reanalysis, Q. J. Roy. Meteor. Soc., 146, 1999-2049, https://doi.org/10.1002/qj.3803, 2020.

Thank you for your suggestion. We have added the reference in the manuscript.

The caption of Fig. S4 is not correct. It should address vertical velocity rather than water vapor.

Thank you very much for your suggestion. We have modified the caption of Fig. S4.

Caption of Fig.S9: panel (c) is not introduced

Thank you for the reminder. We have added it in the caption of Fig. S9.