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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of geographic variations of convective and dehydration center on stratospheric water vapor over the Asian monsoon region" *by* K. Zhang et al.

Anonymous Referee #1

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Review of Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-21, 2016
Title: Impact of geographic variations of convective and dehydration center on stratospheric water vapor over the Asian monsoon region

General comments:

This paper discussed the contribution of the geographic variation of convection and the associated geographic variation of dehydration locations to the water vapor

over Asian monsoon region in the lower stratosphere during boreal summer. The trajectory model simulation provided clear proof of the east-to-west shift of the dehydration location at the intra-seasonal time scale. Further SVD analysis confirms the connection between the convection pattern and the water vapor anomalies.

The main concern from my perspective is the statements in many places of the paper like 'warmer tropopause temperature in the west of Asian monsoon region', e.g. Page 1 line 20-24, Page 6 line 16-17 and Page 8 Line 25-26. It seems to me that the author is comparing the tropopause temperature in the west side to that in the east side. However, it is not clear in which region, which latitude or which period it is compared.

The author divided the east side and west side of Asian monsoon region by 80-90°E according to the caption of Figure 3. However, from the tropopause temperature shown in Figure 2, the differences of the tropopause temperature between the east side and the west side are not significant. And the author also pointed out that the convection increases over the west side of Asian monsoon region which increases the local diabatic heating. From my understanding, the anomalous convection over the west Asian monsoon region should lead to stronger upwelling and relatively cold temperature in the tropopause layer, which controls the dehydration. Actually, the pattern of dehydration location and of the tropopause temperature is associated with each other. That means when the convection increases over western side of Asian monsoon region, the cold point temperature should correspondingly decreases to some degree. I suggest author gives a direct comparison of the tropopause temperature of east side and west side to clarify this point.

Furthermore, Figure 1 shows the variation of tropopause temperature is not able to fully explain the variation of seasonal water vapor variation, which is the motivation of the work. I have some questions concerning the domain and the magnitude of interannual variabilities, which are specified in the following part.

The paper describes interesting result, which contributes to complete the picture of moisture center over Asian summer monsoon region. Overall, the paper is nicely structured and presented. I suggest it is published after clarifying the questions above.

Specific comments:

- *Pg. 2, line 21: A recent paper (Ploeger et al. 2015, ACP) intensively discussed the variability of a PV-based transport barrier of Asian monsoon anticyclone. This study is highly related here and I recommend to cite this study. doi:10.5194/acp-15-13145-2015*

- *Pg. 3 , line 28: I suppose the OLR data is also daily anomalies according to the section 3.2. So add 'of' after 'water vapor and' in order to avoid the misunderstanding.*

- *Pg. 4, line 29: Is the weighting functions the weighting matrix of MLS averaging kernels? If yes, please clarify here.*

- *Figure 1: First, this figure shows the 9-year climatology of water vapor and tropopause temperature. The intra-seasonal variations are usually can be 'offset' by averaging over several years. Can you comment on how large is the interannual variability of temperature? Does this strong intra-seasonal variations of temperature attribute to some particular year or is it a common feature for this domain during boreal summer? Perhaps it worth to add the standard deviation to the tropopause temperature.*

- *Figure 1: Second, you mention that the same domain used for area-averaging the tropopause temperatures as R15, which is 15-32° N, 70-120° E. However, I checked R15 and the domain 15-30° N, 70-120° E is used. Besides, you also use 15-30° N in Figure 4 of averaging the diabatic heating rate. From Figure 2, it is seen that the gradient of tropopause temperature around 30° N is very large and the 2 degrees could influence the variation of temperature shown in this plot. I suggest to show the tropopause temperature averaged over 15-30° N, 70-120° E. Otherwise the author could compare the results between the 2 domains and clarify the results stays the same.*

- *Figure 2 and 3: I suggest to add boxes in Figure 2 to show the domains of west side and east side mentioned in the caption of Figure 3.*

- *Figure 5: the subfigures are too small. It is better to enlarge the figure, especially those color bars.*
- *Pg. 8, line 10: it should be '(Fig.1 and Fig.6a-b)'*