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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification of water vapour transport from the Asian monsoon to the stratosphere" *by* Matthias Nützel et al.

Anonymous Referee #3

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This paper investigates the water vapor transport from the Asian monsoon region to the stratosphere using the ClaMS model with tagging method. The results are noteworthy, paper is well written, and figures are nicely generated. I recommend publication in ACP with minor revisions.

(1) In general, I was somewhat alarmed by the relatively dry NM at 83 hPa in the model compared to MLS (Fig. 2). The caveat is there so I am not suggesting any specific changes to the text, but the relative contributions of water vapor from AM and NM to the stratosphere, which are the key results of this study, have certain degree of uncertainty that is difficult to quantify.

(2) Comparison with Bannister et al. (2004) and Wright et al. (2011) studies is very nice. When reading the Introduction (specifically second paragraph of p. 3), I was also

reminded about the conclusion by Ueyama et al. (2018) that showed the importance of convection in explaining the water vapor maximum in AM at 100 hPa? Is this study not relevant for this paper because of its focus on the 100 hPa level? [Ueyama, R., Jensen, E. J., and Pfister, L. (2018). Convective influence on the humidity and clouds in the tropical tropopause layer during boreal summer. JGR, 123, 7576-7593.]

(3) I am slightly confused as to how the mixing scheme in CLaMS (i.e., merging of parcels and insertion of new parcels) affects the source identification through the tagging method. For example, if two parcels merge into one, does the merged parcel have two sources (if the two parcels have different sources)?

(4) Table 1: It may be helpful to spell out the acronyms (e.g., AM, NM) in the title.

(5) p. 9, line 13: I agree that the agreement is good, but the seasonal cycle amplitudes appear to be weaker in CLaMS compared to MLS. Any thoughts?

(6) p. 14, line 10: Why did you choose to show the time series at 400 K for the NH extratropics (Fig. 7) instead of at 450 K as for the tropics (Fig. 6)? It may be helpful to add "Tropics" and "NH extratropics" label in these two figures.

(7) p. 13, line 26: Should this be "14%" consistent with the Abstract (line 12) and Conclusions (line 11)?

(8) Table 2: The average peak mass and water vapor contributions from NM at 400 K and 450 K are very similar. I would have expected lower contributions at 450 K as for AM. Do you have an explanation?

(9) p. 24, line 8-9: This phrase, " Hence, water vapor from the UT in the Asian monsoon region is mostly determined by the transport pathways of air masses from the UT in the Asian monsoon", is unclear.

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