Atmos. Chem. Phys. Discuss., 15, C8408–C8410, 2015
www.atmos-chem-phys-discuss.net/15/C8408/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transport pathways from the Asian monsoon anticyclone to the stratosphere" *by* H. Garny and W. J. Randel

Anonymous Referee #1

Received and published: 23 October 2015

The work by Garny and Randel shows a Lagrangian analysis of the effect of the Asian summer monsoon on the UTLS region. The authors intialize trajectories in the region of the anticyclone using a combination of latitude and PV as condition for the monsoon region. They run 60 day forward calculations to study the evolution of the air mass transport pathways. Importantly they use both, kinematic and diabatic vertical velocities for the vertical motion. The authors show that trajectories are more confined at Theta = 380 K compared to 360 K. The calculations results in a budget of air parcels, which have been transported from the monsoon to other atmospheric regions. Based on these budgets the authors state that transport from the Asian monsoon via the tropical UT strongly affects the tropical LS. This pathway also contributes to the northern hemispheric lower stratosphere as well as direct mixing but to a lesser extent. How-

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ever, I'm surprised, that the authors provide no comparison e.g. with the Lagrangian cold point. This could be easily compared with observations and would give more observational evidence to their conclusions. Overall the paper is very clear, well written and provides a new look on the budget of the Asian monsoon impact on the UTLS region. Particularly the use of diabatic and kinematic vertical motions makes their results robust. I therefore recommend the manuscript for publication after considering the following comments.

Main comments: 1) Since the authors use 60 day trajectories: To get a better link to observations for verification the authors could add a plot showing the water vapour saturation mixing ratio based on the Lagrangian cold point. This should be consistent with the observed effect of the Asian monsoon on the isentropic water vapour distribution (Randel and Jensen, 2013). The authors should be able to separate in their 3D-real experiment tropical cold point from monsoon cold point air masses (p.25995, l.10 ff.). 2) They only run forward calculations initialized in the first half of the monsoon season. Therefore their fractions in Fig.13 and 15 are not valid for the whole monsoon time. Particularly during the late monsoon phase and monsoon breakup the fractions and impact on the LS can be expected to be much higher. Did the authors look at this? If not they should at least discuss this in the conclusions.

p.25985, l.18: Is the trajectory tool referenced in literature or is the tool used in this study a newly developed tool?

p.25985, l.20: What is the motivation to do the 2D isentropic calculation?

p.25987, l.20ff.: Why do trajectories, which are initialized in August in the monsoon sector, not represent the monsoon season? This seems to be inconsistent with isentropic trajectories, which cover August.

p.25992,l.13 and Fig.12: How was the tropopause crossing point determined?

Fig.17: Please indicate diabatic or kinetic case in the caption.

ACPD

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Randel, W.J., and E.J. Jensen, 2013: Physical processes in the tropical tropopause layer and their role in a changing climate. Nature Geoscience, 6, 169-176, doi:10.1038/ngeo1733

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 25981, 2015.