

Interactive comment on “Quantifying pollution transport from the Asian monsoon anticyclone into the lower stratosphere” by Felix Ploeger et al.

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We thank the Reviewer for her/his careful consideration of the manuscript and are encouraged by her/his very positive rating of the manuscript. All minor points raised are addressed in the revised version, as described below (Reviewer's comments in *italics*). Text changes in the manuscript are highlighted in color (except minor wording changes).

Minor remarks:

p.5, l.31: *What is meant with “direct pathway”? I guess quasihorizontal roughly along isentropes from 380K-400K into the tropical tropopause region?*

We agree that our wording here was somewhat too loose. However, to our under-

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standing also Garny and Randel (2016) are not totally clear about the details of their main pathway from the anticyclone to the stratosphere. They write that “the preferred pathway of trajectories is to travel from within the upper-tropospheric anticyclone region to the tropical lower stratosphere (32% of all trajectories). Another 14% are first mixed outside of the anticyclone into the tropical upper troposphere and are subsequently transported upward into the tropical lower stratosphere.” As the analysis is neither done in potential temperature nor in tropopause based coordinates, it is difficult to exactly conclude where isentropic mixing occurs. Furthermore, their definition of the tropics covers 30S–45N, such that the anticyclone belongs to the tropics, whereas we differentiate between deep tropics and subtropics (to which we assign the anticyclone). In this sense, our findings regarding cross-tropopause transport in the Asian monsoon are a refinement of Garny and Randel (2016). In the revised verison, we changed the wording to: “Garny and Randel (2016) concluded from 60 day backward trajectory ensembles that the preferred pathway of air masses is to travel from within the upper-tropospheric anticyclone region to the tropical lower stratosphere, but they did not further investigate where (relative to the tropopause) horizontal mixing from the monsoon region to low and high latitudes occurs”.

p.5, l.33: *Similarly: “....transported upwards in the monsoon and reaches the extratropical tropopause within a few days...”: The monsoon tropopause is meant here with extratropical, please clarify.*

Orbe et al. (2015) state that “Asian air reaches the extratropical tropopause within a few days of leaving the boundary layer and is quasi-horizontally transported into the tropical lower stratosphere...”, implying that the monsoon tropopause is considered to be extratropical. Their Fig. 4 shows that the use of pressure as vertical coordinate favors the interpretation of tracer transport from the monsoon towards the NH extratropics, as tracer contours are slanted towards high latitudes. Using potential temperature as vertical coordinate clearly shows cross-tropopause transport in the vertical direction (see our Figs. 3 & 4). Hence, in our opinion considering the monsoon tropopause as

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extratropical is arising from the use of pressure as vertical coordinate.

p.5, l.27: *equator wards* → *equatorwards*

Changed.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/acp-2017-86/acp-2017-86-AC2-supplement.pdf>

Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2017-86, 2017.

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