

Replies to Editor's Comments

- 1) p2, l35: Add “with ECHAM5-HAMMOZ” to the sentence so that it reads: “Sensitivity experiments with ECHAM5-HAMMOZ for simultaneous.....” to make clear that the sensitivity experiments were performed with the model.
Reply: Above mentioned correction is added in the revised manuscript.
- 2) p2, l43-45: Something is wrong/missing in this sentence. Please correct.
Reply: Above mentioned sentence is reframed.
- 3) p2, l46: This is confusing. Lightning is a natural source. If I understand you correctly, you conclude that PAN in the UTLS must be of anthropogenic origin since it is not from lightning. This should be said more clearly.
Reply: Above mentioned sentence is reframed.
- 4) p3, l62-64: Rephrase the sentence as follows: “ A number of studies have documented that large amounts of pollution from Asia are transported across the tropopause.....”. The next sentence should be rephrase as follows: “.....and their contribution to Asia have so far got less attention.”
- 5) p4, l81: Add “of this study” so that the sentence reads “The focus of this study.....”
- 6) p4, l88: skip “the” so that it reads “We perform.....”. Please also clarify what you actually mean with NO_x and MNVOCs emission sensitivity simulations. What is changed in the simulation? This should be stated clearly in the text.
- 7) p4, l85: Although you write it later, also here the lifetime of PAN should be added.
- 8) p5, l106: “.... each support.....”. It should rather read “are responsible for.....:” or “.....account for.....”
- 9) p5, l114: Better to write “NO_x enhancements” instead of “nitrogen enhancements”?
- 10) p6, l119: Lifetime should also be given in months as it is done below or should be given both times in days.
- 11) p6, l120: rephrase, so that it reads: “figure not shown”. This information could also be skipped since nobody expects you to show figures with the lifetime.
- 12) p6, L120: The sentence should be rephrased as follows: Several studies (Tereszchuk et al., 2013, Glatthor et al., 2007, Sign et al., 1987) have reported that the lifetime of PAN varies between 2-4 months. PAN thus.....”
- 13) p6, l131: Rephrase as follows: “To our knowledge our study is the first study.....”
- 14) p6, l134: Please add a sentence what sensitivity experiments have been performed. Maybe it would be worth to start first to describe the CTRL simulation and than the sensitivity experiments.
- 15) p7, l144: “are” instead of “is”.
- 16) p7, l147: rephrase as follows: “across the various monsoon regions as well as results of the emission sensitivity.....”
- 17) p8, l154: Skip “the”.
- 18) p10, l206: Rephrase the sentence as follows: Higher acyl peroxy nitrates (MPAN) have been included in the MOZART-2 chemistry scheme, which are also formed through oxidation of NMVOCs, but their production is small compared to PAN.”
- 19) p11, l222: Add “model” so that it reads: “The model simulations.....”.
- 20) p12, l259: Ozone in small letters or better to write O₃ since for the other species also the abbreviation is given.

Reply (4 to 20): All the above suggestions are incorporated in the revised manuscript.

21) p13, l269ff: In what sense enhanced? What is the purpose of this sensitivity study. Please clarify and write in the text more precisely. Later it is written that emissions are reduced. This seems to be contradicting.

Reply: Sorry for not being careful. This sentence has been rephrased.

22) p14, l291: Rather "can be" than "will be".

23) p14, l295: Please rephrase as follows: "This is an extratropical process that likely contributes to the PAN formation..... "

24) Section 3: Such a comparison was already done in your previous paper, but here a much better analysis is used. This should be stated clearly in the text.

25) P15, l313: Rephrase the sentence as follows: "In general, the bias in PAN is ranging from -20 ppt to 80 ppt, for ozone from -2 ppb to 40ppb, for HNO₃ from -20 ppt to 75 ppt while NO_x mixing ratios show a good agreement with CAIPEEX measurements over the Indian region."

26) p16, l340: "are shown" instead of "plotted"

27) p16, l342: "underestimation" instead of "underestimate".

28) p16, l350: 8-23 km? Is that correct? In the figure 8-20 km is shown.

29) p16, l351: "at 20 km" instead of "above 20 km"? Since the figure at 20 km is shown.

30) p16, l351: "PAN" instead of "it".

Reply(22 &30): Above mentioned suggestions are incorporated.

31) p16, l351: Which anticyclone?

Reply: Sorry for not being specific. It is ASM anticyclone. This is now mentioned in the revised manuscript.

32) p17, l354-355: The given altitudes do not agree with the altitudes given in the figures.

33) p17, l366: Rephrase the sentence as follows: "These figures indicate that the model can reproduce deep convection as well as the large scale circulation."

34) p17, l372: "satellite" instead of "Satellite".

35) p17, l373: "carbon" instead of "Carbon".

36) p17, l375: Skip "and"

37) p18, l380: add " the" so that it reads ".....PAN to the UTLS.....".

38) p18, l385: A reference should be given here.

39) p20, l424: "underestimation" instead of "underestimate".

40) p20, l425: it should read ".....transport in the model.....".

41) p21, l452: "differences" instead of "difference".

42) p21, l453: It should read "latitude-altitude" and "longitude-altitude".

43) p21, l456: Rephrase the sentence as follows: "These figures show that a 10% change in Asian emissions (NO_x and NMVOCs) transports ~5-30 ppt into the UTLS over Asia and 1-7 ppt of PAN into the UTLS at Northern subtropics and mid latitudes."

44) p22, l467: skip "are".

45) p22, l471: "amounts" instead of "amount".

Reply(32-45): All the above suggestions are incorporated in the revised manuscript.

46) p22, l471: Would be worth to move figure forward so that it becomes figure 7?

Reply: This will disturb the flow of the manuscript.

47) p22, l476: It should be clearly stated if you refer to the model or to the measurements.

48) p22, l477: "PAN" instead of "it", "overestimated" instead of "over estimated".

49) p22, l480: "The figure" instead of "it".

- 50) p22, l480: “.....less than for the.....”
- 51) p23, l501: closing bracket is missing
- 52) p23, l504: add “the” so that it reads “near the equator”.
- 53) p23, l505: “simulation” instead of “simulations”.
- 54) p25, l535: Rephrase as follows: “.....differences between the reference and Asia-10%, reference and North America-10%, as well as reference and Africa-10% simulation.”
- 55) p26, l569: Rather “investigate” than “understand”.
- 56) p26, l575: “The large.....”.
- 57) p27, l585: “located in the tropics” instead of “is tropical”.
- 58) p29, l622: It should be clearly stated that you are referring to the model simulations.
- 59) p31, l668: Sentence appears twice, one is thus obsolete.
- 60) p32, l32: Once again please be more specific on what has been done. What exactly has been reduced by 10% in the simulation?
- 61) p32, l691: “This is” instead of “It”.

[Reply \(47-61\): All the above changes are incorporated in the revised version of the manuscript.](#)

- 62) p34, l725: Because it is not caused by lightning it must be from anthropogenic emissions? Please clarify and write it more precisely in the text.

[Reply: As suggested, it is made clear.](#)

- 63) p57, l1205: “km” is missing after “18”.

- 64) Figure S4 caption: “MIAPS” should read “MIPAS” and “19 km” should read “20 km”.

[Reply\(63-64\): The typos mentioned above are corrected.](#)

[We thank the Editor for reading our manuscript carefully and appreciating our scientific results.](#)