

Editor comments on 2nd revision

Specific comments:

P1, L7: The statement: "Latent heat released during cloud formation drives the ascent of air masses." is not correct. I guess you mean that the latent heat release causes a cooling that can lead to further ascending of air masses. However, if an air mass ascends or not is driven by the stability of the atmosphere. Latent heating has (if there is an impact) only a minor impact.

P1, L8: "A case study in December" -> could that be rephrased as well. You are doing a case study, but the measurements are available not only for December 2018.

P2, L32-33: "These cold temperatures significantly modify the pathways of air masses by dehydrating air and by the release of latent heat" -> they do not modify the pathways it is rather the amount of clouds or cirrus that are formed.

P2, L34 and throughout the manuscript: The term "dehydration" is misused. Dehydration is usually caused by sedimenting ice particles. Either you have to write this more clearly or you should omit the term dehydration here and at some other places in the manuscript. Note, while reading your paper and checking again on this processes in the TTL, I realized that the term that is missing here is "freeze-drying". This is the process that causes the dehydration in the TTL (see e.g. Uemura et al., <https://doi.org/10.1002/2013JD021381>, 2014).

P3, L58: here you should replace "dehydration" rather by cloud formation processes. Using CALIOP cloud observations you observe when and where clouds occurred and in combination with models you are able to investigate the formation processes. You could also write "cloud formation and related processes as dehydration".

P5, L124: ".....potentially leading to associated dehydration of air masses through the removal of water vapor by ice particle formation." Add "and subsequent sedimentation of the ice particles" since there will be no dehydration of the air mass if the ice particles haven't sedimented. Note, same here as for P2, L34 while reading your paper and checking again on this processes in the TTL, I realized that the term that is missing here is "freeze-drying". This is the process that causes the dehydration in the TTL (see e.g. Uemura et al., <https://doi.org/10.1002/2013JD021381>, 2014) .

P5, L129-130: ".....with a hybrid vertical coordinate within the TTL changing from kinematic to diabatic." I hope you compare the kinematic versions of the model and use the diabatic version for further analysis. Could you rephrase the sentence as well to be more precise which versions of the models you actually compare?

P8, L167: "....air mass to release latent heat and subsequently rise into the stratosphere" you mean from deep convective clouds? Here of course the latent heat may have a higher impact and may have an influence on the ascent of air masses.

P8, L167-169: "This supersaturated and cold environment near the CPT suggests a condition that led to further dehydration of the air mass flow in the altitude range above 14 km up to the CPT." If the process of freeze-drying is explained somewhere before in the manuscript, this sentence may ok as it is now, but otherwise it should be improved as well.

P9, L195-196: "We have compared and validated the HYSPLIT results with those of ATLAS shown in Appendix A." This sentence is obsolete since you have mentioned this already several times before

and a few lines later you write again “The comparison between the two model results is described in detail in Appendix A.” This paragraph should be improved.

P11, L236: “.....dispersion of the vertical coordinates of stratospheric kinematics.” Sentence not clear, please rephrase.

P11, L237: “The comparison details between the results of the two models are in Appendix A.” Obsolete here since this has been mentioned several times, just add “see Appendix A” in parenthesis.

P18, L378-379: “ bringing high concentrations of species related to human activities, such as O₃, CO, and NO_x.” Text part uncomplete. Add something like “ to this/other region”. Not clear what you actually mean here, if the pollutants are coming to Southeast Asia or transported away from there.

P19, L398: What is meant with “consistent with other studies”? Same type of study or deriving the same/similar results? Please rephrase the sentence.

P19, L415: “Latent heat can be released due to the condensation of water vapor, resulting in the dominant ascent of air in this region.” Please improve this sentence and make clear that you mean latent heat release in connection with deep convection.

P22, L455-456: “All trajectories within a cirrus cloud are initiated simultaneously every hour during the time of the lidar observation.” Do you really start every hour new trajectories or do you use an hourly output for the trajectories? Please add this information as well. In the former case, over how many hours are trajectories started and how many trajectories have you calculated in total? In the latter case, please rephrase the sentence to be more clear.

P22, L456ff: You are comparing two trajectory models with different vertical coordinates for trajectory calculation. However, both consider diabatic processes. Nevertheless, due to the different approaches differences occur. What I miss in your manuscript is a clear statement what you want to achieve with comparing these two models. Do you want to investigate which method produced the more reliable results? Since the calculations are also based on different reanalysis this makes an assessment quite difficult.

Technical corrections:

P9, L186: cold traps -> cold trap

P9, Figure 2 caption: Add “for” so that it reads “Lidar and radiosonde observations **for** a typical case of cirrus cloud measurements on 13 December 2018.”

P9, Figure 2 caption: remove second full stop after “marked” and Section 2 -> Sect 2.

P11, L218 : “this case” -> which case? Please be more precise.

P11, L240: “Case 2” a bit lost year. Either put this in parentheses with the reference to Fig 4 or include this in the sentence.

P11, L248: Since you mean “an extremely cold ‘cold trap’ you should write it also like this.

P13, L259: “capture variations” variations of what? Please be more precise.

P13, L259: “Although trajectories were calculated hourly” Not the trajectories are calculated hourly, you calculate these with an hourly output time step. Please rephrase the sentence to be more clear.

P14, Figure 6 caption: cloud layer -> cirrus cloud layer

P14, L287: Remove parenthesis around the reference of "Sun et al., 2023a".

P15, L295: "the ascending air masses higher than the 400 K level account....." you mean the air masses "that" ascend higher than the 400 K level? Please correct the sentence.

P15, L299: "....., enhancing tropical stratospheric entry." This sentence part feels uncomplete.

P18, L368: dynamics -> dynamical processes

P18, L373: Research -> Recent research studies(e.g. Rao et al.) if there are several studies or A recent research study(Rao et al.) if this is only discussed in Rao et al.

P18, L383: vast -> west (?)