

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2022-159

Anonymous Referee #3

Referee comment on "The impact of improved spatial and temporal resolution of reanalysis data on Lagrangian studies of the tropical tropopause layer" by Stephen Bourquet and Marianna Linz, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-159-RC3>, 2022

This manuscript adopted the backward kinematic Lagrangian trajectory model to investigate the impact of spatial and temporal resolution of input meteorological fields on cold point temperature (CPT) simulations, therefore the impact on water vapor mixing ratio at entry into the stratosphere. The quantitative evaluation results provide an important value on the simulations of troposphere to stratosphere transport and moisture distribution. I suggest to consider publication after the authors appropriately address the comments.

General points:

- The manuscript assessed the simulation of CPT with trajectory model and mentioned in the text the corresponding water vapor changes (e.g., 26% in summary part). It is certainly worth showing the distribution of water vapor at cold point level and comparing with observations.
- The setup for the LAGRANTO runs are not clear.
 - In sec 2.2, the authors mentioned that the trajectories were calculated backwards for 3 months from the end of February to the beginning of December. Is this time at the release points or when the CPT was found along the trajectory?
 - Lines 131-135, the release of parcels are not clear to me. "At the end of each day for 5 consecutive days". How many days in total per experiment from the end of February to the beginning of December? How to choose the 5 consecutive days? The figure S4 shows the PDF comparisons for two latitude ranges. How about the PDF of the cold point latitude?
 - Lines 147-152, the trajectories tracked below 340 K were used for cold point analysis. What's the percentage of the trajectories used in this analysis compared to total initialized? For "the fraction of trajectories traced below 340 K at each timestep", is the black contours in figs 2-4 a&b related the fraction here? Or how was the fractions shown as black contours in figs 2-4 calculated?
- Figures 2-4

- In 2d, the PDF for 1.0 is missing; in 4d, the PDF for 3 hour is missing.
- In 3, given the cold point pressure and potential temperature show a bimodal distribution, I suggest to check the same PDFs separately in three main regions: west Pacific Ocean, South America and central Africa to discuss the possible reason for the bimodal structure.
- Lines 216-219, is this related to the limitation of interpolation in lower vertical resolution grid?

Minor comments:

- The saturation mixing ratio should add "relative to ice" .
- Line 221, it is 0.35 K in original reference.
- Consider add the calculated water vapor mixing ratio in text, beside the difference or percentage, such as lines 231 and 240.
- Lines 229-230 mentioned the difference first and later lines 241 gave the values. Consider put together or mention the mean values early.
- Line 248, are these values the calculated water vapor or the differences?
- Lines 249-255, is the horizontal coverage of the cold point sampled every 6 hours different from the 1 hour trajectories? Were the "edge" cold points still there?
- The summary part is not quite corresponding to the order of the results part. Such as summarized the variance in displacement first. Put discuss on temporal resolution ahead of vertical resolution and talk about temporal resolution again from line 327.