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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transport timescales and tracer properties in the extratropical UTLS" *by* P. Hoor et al.

Anonymous Referee #1

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Review of "Transport timescales and tracer properties in the extratropical UTLS" By Hoor et al

General:

This manuscript uses trajectories to investigate transport times in the extratropical lowermost stratosphere. It is well written, and should be suitable for publication in ACP subject to several important revisions.

Generally I have only a few comments:

1. The conclusions could be sharpened a bit. What is the main point of this paper? To define timescales? What feature should the reader take away.

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2. It would be nice to also show a scatter plot of H2O_LCPsat v. t_TST that would correpond to a H2O v. CO scatterplot from observations.

3. There are some aspects of the figures that could be improved, and a few points that need to be clarified as I outline below.

Specific:

Abstract: define TST please Abstract, last line: "encountered TST" is probably not the right english verb. "encountered the tropopause" would work.

Pg 1, last paragraph, first sentence: "Trajectory experiments that have investigated .... have mostly focused on distinct processes and regions..."

Put a tropopause on figure 1?

Pg2, column 2, 2nd paragraph, 1st sentence is awkward. How about: "investigate, using a Lagrangian approach, the relation between transport time and temperature. Both transport time and temperature affect CO and H2O in the stratosphere.

pg2, section2 (set up): what is the impact of using a different year? Can you estimate some how or provide a reference? How sensitive are your results to interannual variability?

pg3, column 2: how do you know that vertical dispersion will have only a minor effect? Can you provide a reference? Has anyone used this analysis before?

pg5, column1, 2nd paragraph: you mention a tropopaus following layer in Figure 3, but there is no reference to the tropopause on the plot. Could you show the mean (and std deviation in lines maybe) of the tropopause in theta-latitude space on these two plots. That would prove your point better.

Figure 5: Units are labeled as 'K' but units are deg C. I suggest changing the legend to K.

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pg 8, column1, 3rd para (Fig7): It would be good to note that the positive skewness in Figure 7 indicates (if I read the difference correctly) that the parcels undergo their last saturation (T_LCP) in the troposphere before crossing the tropopause. It might be worth mentioning the fraction of parcels that are dehydrated in the tropopshere.

pg 8, section 4.1: The statement "Since the max H2O in an air parcel.... rather than an enhancement." I do not think is true: THe background water vapor of parcels that do not undergo TST (and come from the 'overworld' is likely lower (since it may have come from the colder tropical tropopause), so even parcels with T_LCP of -73C (200K) in the extratropical LMS will be increasing H2O. Please rephrase.

pg 8, column 2, apra 2: "maximum for dehydration": see comment above. I do not think this is necesarily dehydration. H2OLCP sat is about 7-10ppmv which would be an enrichment over the overworld.

Pg 11, 2nd column, 2nd to last paragraph: The 90 day limit might still be a cutoff because you are only looking at trajectories with TST: there might be more if you run longer, but in general I think the interpretation is correct.

Pg12, 1st paragraph: what about the seasonality of the 'kink' in CO or t_tst? Is the layer thicker or thinner? Do the gradients change? Could you plot the slope points for summer?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 12953, 2010.