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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A modelling study of moisture redistribution by thin cirrus clouds" *by* T. Dinh et al.

Anonymous Referee #1

Received and published: 7 August 2014

General Comments: This manuscript describes idealized simulations of cirrus clouds to understand moisture redistribution in the TTL. The simulations are performed with full microphysical processes, and then highly idealized cases that are designed to understand the response of specific processes (such as radiative feedbacks and sedimentation). Their results indicate that water vapor is transported upwards when the cloudy air is moister than the surrounding air, and is transported downwards when the opposite is true. In addition, the show that air parcels that pass upwards through these cold thin cirrus are indeed dehydrated regardless of the moisture scenario. While these results are interesting, the different scenarios simulated are quite sensitive to initial conditions and so it is difficult to draw specific conclusions, which is somewhat disappointing. Nevertheless, the study does provide new insight into specific processes that occur in thin

cirrus that contribute to the dehydration of air in the TTL. The simulations and approach are well thought out, the model and microphysical representations are sufficient to do the job, and the manuscript is very well written and organized. For these reasons I am inclined to accept this manuscript with very minor revisions as detailed below.

Specific Comments:

1) Suggest adding either "cold cirrus clouds" or "Tropical Tropopause Layer" to the title because these simulations/conclusions do not necessarily hold true for warm cirrus clouds.

2) P. 13304, Line 19: intepretations -> interpretations

3) P. 13311, Lines 7-10 (Rather, of interest. . ..): What observations are you referring to in this sentence? Are there any observations to support your model simulations and conclusions? Although this is a theoretical study, quite a bit of observational work has been done to study these TTL processes. Can you link your results to these studies?

4) Figure 3: The q_v is averaged over the domain (correct?). What is the average cloud base/top height relative to the location of the hydrated/dehydrated layer for each scenario? In the text you mention that air passes through the cloud base is hydrated and the air that passes through the top is dehydrated. But in Fig. 3b for the all-phys dry case, the layer is hydrated at the top of the domain. I would be interested to see where the cloud top is relative to these simulations.

5) Figure 4: Is the conversion from ice to vapor or vapor to ice? Please clarify in the figure caption.

6) P. 13316, Lines10-11 ("Of more interest. . .."): I don't think I understand how you drew this conclusion. From your discussion, I thought that the inf-sed scenario did not produce much nucleation. Can you refer to the figure(s) to help make this statement more clear?

7) P. 13316, Line 20: Figure 6c refers to the moist scenario. I think you mean Fig 6b

(not 6c).

8) Figure 6: The scale is not defined for the histogram color bar, but I imagine it is number or counts. Please define in the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 13301, 2014.