Atmos. Chem. Phys. Discuss., 12, C3439–C3441, 2012
www.atmos-chem-phys-discuss.net/12/C3439/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cirrus and water vapor transport in the tropical tropopause layer: a modeling study" *by* T. Dinh et al.

Anonymous Referee #1

Received and published: 10 June 2012

Summary:

This is a well-done and well-written paper. To borrow from the abstract, this manuscript argues that, "even under the influence of the large-scale wave, the radiatively induced mesoscale dynamics in TTL cirrus actively contributes to transport of water vapor in the vertical direction." The supporting evidence is a cloud-resolving simulation of a Kelvin wave in the TTL, into which a humid patch has been inserted. The radiatively driven circulation causes water to be transported upwards despite the tendency of ice free fall to move water downards. This provides a counterweight to the results of Jensen et al. (2011), which suggest that wind shear blows apart the incipient TTL cirrus before a radiatively driven circulation can develop.

General comments:

It seems like one of the key differences between Jensen et al. (2011) and this work is the treatment of shear: it is smaller in this study (and generated entirely by the Kelvin wave) than in Jensen et al., and this may explain the different conclusions. What observations are there to support one value of shear over another? Since the shear in this study is set by the amplitude of the Kelvin wave, how was the amplitude of the Kelvin wave chosen? I think the paper should include some discussion of this.

Although the point of this paper is to establish a proof of concept (i.e., that radiatively drive ascent can out-compete free fall), I think it would be helpful to include some discussion as to the generality of these conclusions. If the simulation is run for longer than 12 days (two wave periods), does the water continue to rise? What real-world scenario would have created the initial supersaturated patch of vapor? And, along the lines of my other comment, how sensitive is this to the magnitude and period of the Kelvin wave?

Specific comments:

p.10735,l.6-7: Is the background aerosol concentration and radius kept fixed throughout the simulation, or is this just the initial condition and the aerosol distribution is prognostic?

p.10738,l.9: k should be 1.047e-6 1/m here.

p.10749,l.20: Swap RAI and RAV.

p.10749,l.26-28: Please explain what terms in the equations are being removed in each of these experiments.

References:

Jensen, E. J., Pfister, L., and Toon, O. B.: Impact of radiative heating, wind shear, temperature variability, and microphysical processes on the structure and evolution of thin cirrus in the tropical tropopause layer, J. Geophys. Res., 116, D12209, doi:10.1029/2010JD015417, 2011.

ACPD
12, C3439–C3441, 2012

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 10729, 2012.

ACPD

12, C3439–C3441, 2012

Interactive Comment