

Interactive comment on “Aerosol observations and growth rates in the tropical tropopause layer” by D. A. Waddicor et al.

Anonymous Referee #2

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GENERAL REMARKS

The manuscript presents results from a case study on new particle formation in the TTL regions close to the anvils of deep tropical thunderstorms. The concept of the study is scientifically sound and the presentation of the observational results is convincing. Theoretical studies of particle nucleation from sulphuric acid are compared to the observations but significant differences are found. The weakness of the presented study is related to the missing link between model studies and observations. The presented material deserves publication in APC after major revisions which are discussed in the following.

Before going into detail I want to make four more general points:

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1. Throughout the text particle number concentrations are sometimes reported for standard temperature and pressure, sometimes they are not. Please make a clear statement at the beginning how particle number concentrations are reported. Furthermore, I suggest to adjusting the figure axis titles where particle number concentrations are given in 1/cc instead of 1/cm³. Please use a consistent unit in the manuscript. You should also explain STP in the text.

2. Number concentrations of Aitken mode particles are derived from the difference between two condensation particle counters with one being equipped with diffusion screens. However, diffusion screens never allow a 100% transmission efficiency as can be taken from Feldpausch et al. (2006). Please state in the text whether you considered the full transfer function for diffusion screens in your data analysis. This is a crucial point because it has a significant impact on the comparison of model data and observations. Actually the manuscript only mentions corrections for low pressure operation.

3. Intercomparison of model results and observations is performed on the basis of integral number concentrations for the size range 10–100 nm and 100–1000 nm, see Figure 10. The presented results are not discussed with sufficient detail because Aitken mode number concentrations vary over one order of magnitude for almost similar time out of cloud. On the other hand accumulation mode number concentrations also show two clusters of data, one with number concentrations close to 0 particles per cm³, and another cluster with values above approx. 10 particles per cm³. It is strongly recommended to discuss whether or not there is a link between high number concentrations in the Aitken mode and low number concentrations in the accumulation mode. A map of states of tropospheric aerosol was introduced by Schröder et al. (2002). Although this data were obtained in mid-latitudes the overall scheme is also valid for the TTL regions. I strongly recommend to discuss Fig. 10 in relation to Schröder et al. (2002). You may also try to plot data in a similar way as Schröder et al.

4. The presentation of the material requires improvement. It is surprising that the

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results section is only half a page long. I suggest renaming section 4 as results section and move the current section 5 into section 4. I would also like to see results from the modelling study being presented in the results section because the model runs were performed for the specific observations conditions (I assume).

SPECIFIC COMMENTS

1. The title should be more specific and make a clear statement that the presented results arise from a case study.

2. Page 2361, line 2; please use the unit K for the temperature difference.

3. Page 2371, line 22. What means a standard deviation of 1.237 nm for a log-normal size distribution?

4. References: please check the references, currently they are not in line with ACP requirements. Each reference ends with a 4 digit number after the year of publication.

5. References:

Feldpausch et al: Please delete the "A" in the title of the paper.

Möhler et al.: Please correct the name of the lead author.

6. Figures:

Figure 5. Correct the y-axis title to "particle number conc. [> 100 nm].

Figure 8: Add the range of numbers to the colour bar for aerosol number concentrations.

REFERENCES

Feldpausch, P., et al.: Measurement of ultrafine aerosol size distributions by a combination of diffusion screen separators and condensation particle counters, *J. Aerosol Sci.*, 37, 577-597, 10.1016/j.jaerosci.2005.04.009, 2006.

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Schröder, F., et al.: Aerosol states in the free troposphere at northern midlatitudes, *J. Geophys. Res.*, 107, 8126, 10.1029/2000jd000194, 2002.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 2355, 2012.

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