

Interactive comment on “Aerosol particle properties in the tropical free troposphere observed at Pico Espejo (4765 m a.s.l.), Venezuela” by T. Schmeißner et al.

Anonymous Referee #1

Received and published: 20 January 2011

General comments: This paper presents a unique set of aerosol size distribution measurements collected at high altitude site in the tropical free troposphere during almost two years. Aerosol size distribution measurements at this location type are still rather scarce but provide very important input for the assessment both of the aerosol radiative properties as well as of aerosol-cloud interactions taking place in the lower free troposphere above the tropics. In this sense, I believe the presented 2-years DMPS data set is very interesting to be shared with the scientific community. As shown in the specific comments below, the manuscript however in my opinion needs major revisions before publication in ACP.

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Structure of the manuscript: I find the manuscript rather hard to read. Most of the Result section (Section 3) remains entirely descriptive. Features of the observed data series are described in very detail, but their interpretation is then only given in Section 4. The reader-friendliness of the entire manuscript will in my opinion be strongly improved by discussing the data at the same time as the data are presented. Therefore I strongly suggest combining Sections 3 and 4.

Data included in the study: It is mentioned that also an aethalometer was operated at the site (and maybe also further aerosol instruments?). I understand that this manuscript focuses on particle number measurements. Since an influence of biomass burning on the measured size distributions is discussed in the manuscript, any additional information gained from the aethalometer should however be presented here as well.

Specific comments:

Sampling conditions: The authors state that under cloudy conditions, the examined aerosol consisted of the interstitial aerosol plus an undefined number of cloud drop residuals. Although data with $RH > 95\%$ were excluded (used as cloud criterion, see also next comment), at least an estimate of the inlet cut-off would improve the data quality assurance (size-dependent losses etc. see e.g. tool by MPI Mainz, <http://www.atmos-meas-tech.net/2/479/2009/amt-2-479-2009.html>). Furthermore, to what extent do these residual cloud droplets dry off in the inlet?

Cloud definition: In the presence of a patchy cloud, I would expect a variability between 90 and 100 % RH during an individual DMPS scan (15 min), which would a) influence the performed categorization of this size distribution (cloud/no cloud) and b) the size distribution itself. Do the authors have any idea on the density of the clouds which were usually present at the site? In case of frequent patchy clouds, the above effect may influence the results. This needs to be addressed.

Section 3.1: The season-dependent average number concentrations (plus standard

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deviations) are given both in the text and in Table 3. This is redundant, I suggest skipping the Table. Also, Figures 2 and 3 basically show the same information. I suggest showing only Figure 3 (the box plots). The average concentrations plus standard deviations are also prominently listed in the Abstract. Based on the large standard deviations the question may arise while reading the abstract whether the reported differences are significantly different at all on a statistical basis. Although the box plot in Figure 3 nicely shows the differences, this issue should be taken into account to avoid confusion.

Section 3.2 / Data base: Size distribution analysis is only shown for 2008. What about the data from the rest of the measuring period?

Section 3.2 /Distribution fitting: I see a general problem with the automatic fitting of three modes into every individual size distribution. While the fitting program will always return a mode diameter value for all three modes, these numbers do not physically make sense in cases where only a monomodal or a bimodal size distribution was present (which according to Figures 4 and 7 was the case quite often). This is even visible by eye when looking at Figure 7. Therefore a more specific approach for the fits should be applied. For example, the authors could apply a trimodal fit only for cases where the fit quality of a bimodal fit decreases (and where a third mode or shoulder is at least recognizable).

Section 3.2 / Nucleation mode particles : An analysis of the difference between the CPC number concentration ($N > 10$) and the integrated DMPS number concentration (N20-470) would provide important information on the occurrence of nucleation mode particles.

Details:

Title: I suggest to be more specific, e.g. "Aerosol number size distributions."

Page 29159 /lines 22 ff: How was the DMPS calibrated?

Section 2.2: This section presents data and should be moved to the Result section.

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Page 29163, line 26: Replace "aerosol densities" with "aerosol number concentrations".

Page 29164, lines 15 ff: I do not understand/agree with this interpretation. In case of an approximately normal distribution of the values, a lower number of data points will increase the standard deviation but not significantly change the average. Most likely the few remaining data points were just not representative enough.

Figure 6: I do still get the wrong Figure 6 when downloading the manuscript from the ACPD website.

Page 29165, lines 18/19: "Obviously, the dry FT aerosol goes always together with lower specific humidity values compared to the wet FT aerosol". What do the authors want to conclude from this statement? Isn't this a circular statement?

Page 29166.line 18: Replace "die" by "stop".

Page 29166.line 19: Add "since particles transported to the site experience.".

Summary and conclusions Section / last sentence: This statement on the relevance of the work seems too short to me. I think the authors should be more convincing here, since they indeed have an important and interesting set of data!

Table 1: Please check the significant number of digits.

Table 3: Please remove the decimal digits, they are not significant at all.

Table 4: Please specify the units.

Figure 1: In some cases you draw lines between gaps, in other cases you don't. Please check.

Figure 4: Please specify the year of the measurements.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29153, 2010.

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