

Interactive comment on “Vertical profiles of aerosol optical properties over Central Illinois and comparison with surface and satellite measurements” by P. J. Sheridan et al.

Anonymous Referee #3

Received and published: 12 September 2012

Airborne measurements are important for comparing radiative properties of particles derived from in situ and remote sensing techniques. The article provides a unique dataset with regard to the number of flights, overall duration of the time series and the used instrumentation.

The paper is well written and clearly structured. The data evaluation and conclusions are sound. I recommend the paper for publication in ACP after addressing following comments.

General comments:

In-situ measurements are often conducted at low relative humidity. For comparison of
C6851

data from in-situ measurements with data from remote sensing measurements have to be conducted at ambient or at controlled relative humidity. The reviewer thinks that it is worth to explicitly mention in the abstract and introduction that results for in-situ measurements were conducted at dry conditions and at controlled humidity.

Specific comments:

page 17189, lines 16 to 24: In-situ measurements are often conducted at low humidity. To avoid confusion the authors should state that the aerosol optical properties of interest are given for ambient condition.

page 17190 line 6: ‘Covert et al. 1972’ is a laboratory study investigating the hygroscopic growth of pure materials. The reviewer thinks that it is not a reference for atmospheric processing for different types of aerosols.

page 17195, line 18: The loss processes are not listed correctly. Gravitational settling, inertial and diffusion losses can be calculated for different flow regimes, laminar and turbulent flows, respectively.

page 17195, line 21: The authors should quantify how much the inlet line losses for the racks A,B and C are higher compared to the inlet losses for the nephelometer rack. This is important for showing that the single scattering albedo is not affected by different transportation losses.

page 17196, lines 9 to 14: The correction for the TSI nephelometer was mentioned few lines before. The reviewer thinks that this correction is for the so-called truncation error. The readers are left in the dark if the 1-wavelength nephelometers were corrected for truncation.

page 17196, line 27: The influence of changing humidity on PSAP measurements is still under debate and not much is published concerning this issue. What is the relative humidity in the PSAP. Was the humidity controlled or measured?

page 17198, lines 11 to 14: The backscatter fraction was used to calculate the asym-

metry parameter and the up scatter fraction using parameterizations given in Andrews et al 2006 and Grams 1976, respectively. Both parameterizations are limited in their use to special conditions and aerosol types. The authors should mention the limitations. Does this affect the calculated radiative forcing efficiency?

page 17198, lines 15ff: If scattering data of the 1-wavelength nephelometer have not been corrected for the truncation error, then the resulting growth factors $f(\text{RH})$ might be affected by instrumental artefacts since the truncation changes with particle size and thus with relative humidity. This could be important when comparing gamma values of different studies (page 17209 lines 27ff). Can the authors comment on that?

page 17198, lines 16 to 25: Because of the hysteresis effect the scattering hygroscopic growth factor might depend on the direction in which the humidity changes, i.e. the aerosol is dried first and then humidified or vice versa (see Fierz-Schmidhauser et al. 2010). In the present study the aerosol is dried and afterwards humidified. Is this practice appropriate for investigating atmospheric processes?

page 17210, lines 11-13: A mean gamma value of 0.51 was chosen but Fig. 10 suggests that the gamma value depends on the altitude. How large is the effect in relation to the differences between AAO and CALIPSO shown in Figure 12.

page 17227, table 2: Equation for absorption Angström incomplete; $"/\log(\lambda_1/\lambda_2)"$ is missing

page 17230, Fig2: The title "Cessna 206 Inlet penetration" is misleading since the efficiency of the 'main inlet' is not included in the figure.

pages 17233 and 17234: Figure captions: subscript "0" missing in "(d) ω for total. . ."

Page 17241: The authors should explain the x-axis label " $f(\text{RH})$ (85%/40%)"

References:

Fierz-Schmidhauser, R., P. Zieger, G. Wehrle, A. Jefferson, J. A. Ogren, U. Bal-

C6853

tensperger and E. Weingartner "Measurement of relative humidity dependent light scattering of aerosols." *Atmos. Meas. Tech.* 3(1): 39-50.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 17187, 2012.

C6854