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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical note: Measurement of chemically-resolved volume equivalent diameter and effective density of particles by AAC-SPAMS" *by* Long Peng et al.

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Review to "Measurement of chemically resolved volume equivalent diameter and effective density of particles by AAC - SPAMS" by Peng et al, submitted as technical note to ACP

This manuscript presents an interesting application of an aerodynamic aerosol classifier (AAC) and a single particle mass spectrometer (SPMS) to obtain particle properties like effective density and shape.

The idea of using aerosol mass spectrometers that measure the vacuum aerodynamic

diameter in combination with other size measurements to obtain shape and density of aerosol particles is not new. In 2006, two papers where published on this topic: one by Zelenyuk et al. (ZEL2006), the other by my group, Schneider et al., 2006 (SCH2006). While the authors of the present manuscript reference ZEL2006, they may have overlooked our paper, because we used an Aerodyne AMS and not a laser ablation SPMS.

Both ZEL2006 and SCH2006 used the mobility diameter measured by a differential mobility analyzer (DMA) and not the AAC that measures the aerodynamic diameter, but the basic idea is the same. In SCH2006, we already presented the equation for rho_eff_II (your Equ. 8). Thus, please give proper credit to our work.

In general, this technical note is appropriate for ACP. The combination of single particle results (via the clustering algorithms), effective density and shape factors is interesting and is worth to be exploited further.

However, I have some further important comments that have to be addressed before this paper can be published:

Lines 68-76: You rely here on DeCarlo et al., 2004, but the numbering of the effective density is different. rho_e_I is the same, but you changed rho_e_II and rho_e_III compared to deCarlo et al. Please use the same numbering to avoid confusion. Please also refer to Hand et al., 2002 who introduced your rho_e_III (which in de Carlo et al. is termed rho_eff_II).

Line 80, equation 8: rho_0 is wrong here, needs to be deleted to get the units right.

Line 81: "The detailed derivation will be presented in a separate paper". The derivation of Equ. 8 was given in deCarlo et al., 2004, and also in SCH2006, so please give proper reference here, and for completeness, give the derivation of Equ. 7 here as well.

Line 157, Equ 11: To calculate D_ve, you need the Cunningham slip correction values here. How are they obtained? The differences between D_ve and D_a (e.g. Fig. S2) are rather large, so the Cunningham correction can not be neglected.

Line 161: I think that Equ. 12 results from combining Equ. 3 and Equ. 6. Correct?

Line 176: Please state clearly how D_ve,th was calculated. I would assume that again the Cunningham correction is needed to do this?

Line 180 – 182: Please clarify that for spherical particles like PSL, rho_e = rho (see deCarlo et al., Equ [43] and thereafter).

Line 206-209: If different definitions of the effective densities are used, the statement "This pattern is divergent with the previous studies, which showed that effective density decreased as the size increasing" has to be removed or at least reworded.

Line 259-260: Please refer to the respective Figures in the Supporting Information.

Line 275-280: rho_e = rho_p / shape factor (Equ. 6). Thus, either the density of the particle material is a function of size, or the particle shape factor (or both). I think you can not rule out that the material density changes with size. SPMS is not quantitative, so particles of the same cluster type may have different quantitative composition (e.g. the ratio OC/EC or organic/inorganic). Thus, you can't tell whether the changing rho_e with size is an effect of shape or composition.

Supplement: Fig. S2b) is missing.

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