Response to Reviewers
Manuscript Number : AMT-2014-41
Manuscript Title : Development of a cavity enhanced aerosol albedometer

We thank the reviewers for their thoughtful and thorough reviews. Point-by-point responses to the reviewers' comments are attached below.

Response to Reviewer #1 comments

This manuscript presents excellent work showing substantial progress from previously published work. It should be published in AMT after minor revision taking the following comments into account.

1) The discussion of the influence of particle losses on instrument performance is insufficient. Note that most particle loss mechanisms are size dependent and that the particle SSA is often also size dependent. Therefore, the statement on page 2994, lines 5-7 "Since the scattering and extinction coefficients were measured on the exact same volume, the uncertainty [of SSA] due to particle losses could be ignored.". For example should the atmosphere contain a bimodal size distribution of sub-micron black carbon particles (low SSA) and supermicron mineral dust particles (high SSA) with supermicron particles experience large inlet losses due to gravitational settling and/or impactions, the SSA measured could be much smaller than the ambient SSA. Therefore, a particle size dependent discussion of particle losses is of the essence.

We totally agree with the reviewer's comment: "*Most particle loss mechanisms are size dependent and that the particle SSA is often also size dependent.*". The particle loss would result in over- or under-estimating (depending on the particle concentration that was measured at the entrance or the exit of the cavity) the aerosol extinction and scattering cross-section, calculated from the experimental data. In our case of study of monodispersed particle, as the SSA is determined by the ratio of scattering coefficient to total extinction coefficient, and the particle numbers were the same for both coefficient measurements, the particle loss would not affect the SSA value for monodispersed particle.

We have modified the corresponding statement: "*Since the scattering and extinction coefficients were measured on the exact same volume, the uncertainty of SSA for monodispersed aerosol due to particle losses could be ignored.*"

2) A discussion of the time response of the instrument is missing. The time response is likely to be limited by the time needed to exchange the sample volume inside of the instrument. Such a discussion is important to be able to evaluate potential use of the instrument for characterizing particle optics in quickly varying environments.

The time response of the instrument is evaluated using laboratory generated monodispersed PSL particles with diameter of 240 nm. The following figure shows the time responses for the measurements of the particle concentration (using a CPC) inside the integrating sphere and the measurements of the corresponding scattering and extinction coefficients using the cavity enhanced albedometer. The rise time (from zero to its final stable value) for the variation of particle concentration from 0 to 393 particle/cm^3 was about 190 s and the rise time for the scattering and extinction coefficient (37 Mm^{-1}) measurements was about 206 s.

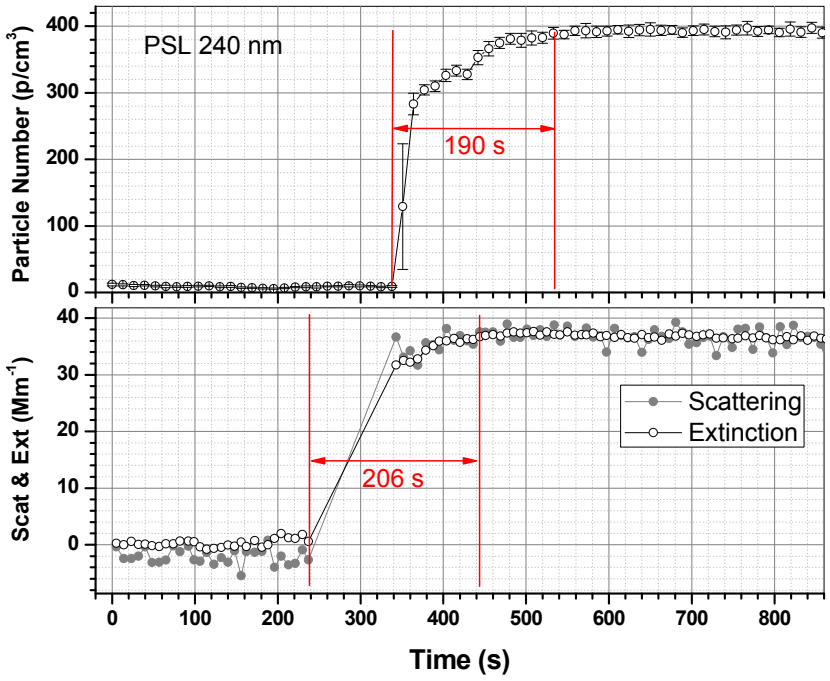

Figure Caption: Time response of the developed cavity enhanced albedometer to a variation of particle number from 0 to 393 particles/cm^3(evaluated with monodispersed PSL particles with diameter of 240 nm). Upper panel: rise time for the measurements of particle number concentration inside the albedometer with a TSI CPC 3776. Lower panel: the time response for the measurements of scattering and extinction coefficients.

3) P. 2983, lines 9-12: "the commonly used method for the measurement of SSA is to separately measure the aerosol scattering, absorption, and extinction coefficients with different instruments.". Commonly, only two of these three coefficients are measured to determine SSA and this should be stated here.

DONE. The sentence was modified as : "the commonly used method for determination of SSA is to separately measure two of the three optical parameters: absorption, scattering and extinction coefficients with different instruments."

4) The English language is much improved from the initial submission but there are still some minor issues such as p. 2999, line 8 which should read "controllers are usually used", instead of "controllers is usually used". Additional proof reading is recommended.

We have carefully checked the English usage.