

## ***Interactive comment on “Simultaneous retrieval of effective refractive index and density from size distribution and light scattering data: weakly absorbing aerosol” by E. Kassianov et al.***

**Anonymous Referee #1**

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This manuscript introduced a method to simultaneously retrieve effective refractive index and density from size distribution and light scattering measurements. The method is useful and simple for air quality and climate related studies. The major uncertainties of the method are analyzed and the authors demonstrated the method with a real case study. I have several major concerns regarding the retrieval method and the treatment of relative humidity adjustment in the case study, detailed below. I suggest major revision of the manuscript.

Major Comments:

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1. Treatment of truncation error of TSI 3563 nephelometer in the retrieval process is not clearly described. The authors only mentioned that the optical closure was done according to Liu and Daum, 2000 and Mack et al. 2010. In Mack et al. 2010, the measured optical properties by TSI 3563 nephelometer were corrected according to the empirical parameterization by Andsen and Ogren (1998), assuming only submicron particles were present. The uncertainties of size distribution, density, and refractive index etc. have been introduced by this correction to the observed optical properties. I would suggest the authors to correct the angular non-idealism according to the measured truncation error of TSI 3563 nephelometer (Anderson et al. 1996) in the MIE calculation in order to simulate the nephelometer output optical properties, instead of correcting the measured optical properties directly.

2. Comparison with the alignment method (1) On P. 4954 L. 10, the authors mentioned that the size range of TSI SMPS is 0.01–0.48  $\mu\text{m}$ . What type model of SMPS was used in this study? What is the full size range of this SMPS? (2) If the full size range of SMPS is greater than 480 nm and overlaps with APS size range (0.52–19.8  $\mu\text{m}$ ), how does the APS size distribution match the SMPS size distribution in the overlapping geometric size range when applied with the retrieved time dependent densities from this study? (3) In Sect. 4.3, the authors indicated that by visual inspection, there are no major alignment problems in the overlap region. Would it be possible to statistically compare the retrieved densities and the densities calculated by the alignment method as in Hand and Kreidenweis (2002) and Khlystov et al. (2004)?

3. RH adjustment and uncertainties The authors estimated the uncertainties of the method with an ideal case. How about the uncertainties introduced by the RH adjustment into the real case? Since the major chemical composition were measured during the campaign, would it be possible to justify the empirical parameterizations used in the RH adjustment?