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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Absorbing aerosols at high relative humidity: closure between hygroscopic growth and optical properties" *by* J. M. Flores et al.

Anonymous Referee #2

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The authors present a very interesting laboratory study on CRD extinction measurements for size-selected aerosols at different humidities using Mie theory to retrieve complex refractive indices. Then they use the results to discuss aerosol optical properties near clouds.

First let me comment that this manuscript was very difficult to review due the absolute mess involving table and figure captions and the references to figures in the text.

For example:

The caption for Table 1 states "The dashed line shows the exponential fit..."; this is obviously a figure caption.

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Fig. 4: The text (p. 1030, l. 6-7) states “Figure 4 shows two examples of the results of the complex RI derivation and comparison performed.” The figure shows plots of Qext as function of size parameter, the figure caption discusses “extinction as a function of distance from the nearest cloud”.

Fig. 5 plots Qext_core-shell divided by Qext_homogenous as function of size parameter. The caption states “Single scattering albedo as a function of distance from the nearest cloud”

Fig. 6 plots extinction as function of distance from nearest cloud, the caption states” Asymmetry parameter as a function of distance from the nearest cloud”

And so on!

The authors first need to sort out all these mix-ups before they can expect a meaningful review.

However, here are a few additional comments:

1) The discussion of aerosol optical parameters near clouds should not be part of this manuscript and cannot be based on the laboratory measurements presented in the first part. Strongly absorbing aerosols are generally black carbon based and nigrosin is not a good model of their complex behavior upon humidification. Black carbon aerosols are generally emitted as fractal-like chain aggregates which upon humidification may collapse, irreversibly changing their optical properties (for example, see Lewis et al., 2009). In general, the discussion of aerosol optical parameters near clouds seems to be somewhat of an afterthought as it is not mentioned in the title and only very briefly in the abstract.

2) p. 1026 l. 10-11: “If the final dry measurements differed more than 5% from the initial, the measurements of that substance were repeated.” And I assume the original measurements were not used. This excludes, by definition, any irreversible changes of aerosol optics upon humidification, a very unscientific procedure. At the very least, the

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authors need to discuss how often this happened and what the excluded data show.

3) p. 1030, l. 23-26: “Figure 3 shows, in general good qualitative agreement between measurements and theoretical calculations. . .”. This is not what I see in Fig. 3! I see large, systematic looking discrepancies, especially for absorbing aerosols. These discrepancies need to be discussed!

4) Error bars need to be included in all figures!

5) The derivation of the imaginary part of the refractive index from extinction measurements is, at best, very challenging. Even the authors state (p. 1033, l. 22-23) “In Fig. 6, we observe that the extinction is practically independent from the imaginary component of the complex refractive index. . .”. So, how can one retrieve the imaginary component from extinction measurements? At the very least, the authors need to include a detailed error analysis for the imaginary part and in table 1, a comparison of retrieved values with literature values. The error analysis also needs to extend to the calculation of the single scattering albedo, which is crucial for cloud effects.

References:

Lewis, K. A., W. P. Arnott, H. Moosmuller, R. K. Chakrabarty, C. M. Carrico, S. M. Kreidenweis, D. E. Day, W. C. Malm, A. Laskin, J. L. Jimenez, I. M. Ulbrich, J. A. Huffman, T. B. Onasch, A. Trimborn, L. Lui, and M. I. Mishchenko (2009). Reduction in Biomass Burning Aerosol Light Absorption upon Humidification: Roles of Inorganically-Induced Hygroscopicity, Particle Collapse, and Photoacoustic Heat and Mass Transfer. Atm. Chem. Phys., 9, 8949-8966.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1019, 2012.