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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reduction in biomass burning aerosol light absorption upon humidification: roles of inorganically-induced hygroscopicity, particle collapse, and photoacoustic heat and mass transfer" *by* K. A. Lewis et al.

Anonymous Referee #1

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This paper shows some interesting results of light absorption response to humidification, for biomass burning particles. The measurement is certainly unique and enlightening to the community and should be published. It seems as though there is the potential for this paper to better quantify the contribution of each potential mechanism involved in the observed result. The authors have done a good job in looking into heat and mass transfer, however the contribution of fractal collapse comes from the work of others with figures reproduced in this paper and the potential for absorption enhancement due to coating is not really addressed.

General Comments:

* There are a lot of figures! These can easily be consolidated into a form that is easier to digest. See comments below.

* There are 3 competing mechanisms for these results. Absorption enhancement, fractal collapse and PAS mass transfer. I feel like you should summarize the potential increases or decreases in absorption for each effect and then relate this back to what you see. Some effort at quantifying the impact of each would be very helpful. For example, P15266 L4-14 seems to discusses the fact that fractal collapse is not contributing to the observed absorption RH response, however the first 3 panels in Figure 14 suggest some amount of absorption reduction could be due to collapse. The PAS mass transfer effect is presented in a long section. P15271 L2 "The model predicts a reduction in measured light absorption cross section"..... why don't you show what the model predicts? Can you model the potential absorption enhancement based on size distributions and non-BC mass contribution?

* Murphy (2009) recently published a discussion on PAS mass transfer extending the calculations of Raspet into more appropriate flow regimes. What are the size distributions of these particles? Are the results affected by using the Raspet limitation of continuum flow?

* Can you please address measurement uncertainties on figures! Figure 4 is an important figure with important data but what is the uncertainty on this? Please add uncertainty bars.

* Discuss in more detail the usefulness of the calculated 'salt surface fraction'. This is an interesting result however how can it be applied elsewhere?

P15249 L25: Dust also absorbs light but is not from incomplete combustion.

P15250 L10: The variability in radiative impact is due to a lot of factors that should be

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discussed in the introduction. These include combustion temperature, fractal dimension, fractal collapse, coating enhancement etc.

P15254 L23: base line should be baseline.

P15260 L 25: Does this indicate external mixing or could it indicate uneven internal mixing?

P15272 L8: Why use a polynomial fit? What meaning does a polynomial have over just drawing a line?

P15272 L9: Any distribution around the polynomial assumes that the polynomial is physically meaningful. Attributing scatter around the polynomial to any uncertainties is surely not appropriate. Also, are the 'inaccuracies' in the measurement of RH or the measurement of absorption at different RHs?

P15272 L15: Different salts will have different deliquescence points. Might the shape of the lines be due to multiple salts responding at different RH levels?

Figures 1 and 3 should be combined into 1 figure. I don't think it is necessary to show a panel for each fuel type. Select 1 scattering panel and 1 absorption panel and combine the two as an example and reference the other fuel types in the text.

Figure 2: Add fRH = 1 line for visual reference.

Figure 4: Add a key so the reader can see which points relate to which fuel type. Also please add uncertainties for each point. This is essential in understanding the observed variability.

Figure 5. Add % of mass for each section in the pie charts.

Figure 6 and 7. Combine 6a and 7b into 1 figure the rest is unnecessary.

Figure 9: This image needs to be enhanced to observe the details of the BC. Not all the particles in that image need to be shown! Zoom it in.

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Interactive Comment

Figures 8 and 10: Make a 6 panel figure so readers can easily compare. Add a very obvious title of the fuel type above each column rather than buried in the SEM image.

Figure 11: Add a gRH = 1 line.

Figure 13. To make this meaningful to the reader you need to extract out the values from this figure and re-plot them at a ratio between 100% and 10% RH as a function of soot mass concentration. Either get the raw data or extract it from the figure you have using a data extracting software tool.

Figure 15: Y Axis label… is this 'salt surface fraction' or 'aqueous solution fraction? The way you have it labeled is confusing. Is it really the fraction of the particle surface that is covered in a salt (dry?) or is it the surface are of BC that is covered in a scattering layer of aqueous material?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 15247, 2009.