Interactive comment on “In situ aerosol optics in Reno, NV, USA during and after the summer 2008 California wildfires and the influence of aerosol coatings” by M. Gyawali et al.

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Reply to Anonymous Referee #1 (comments for Atmos. Chem. Phys. Discuss., C2543–C2545, 2009 In situ aerosol optics in Reno, NV, USA…by Madhu Gyawali et al)

Please refer to the Author Comments for description of the added materials and for the notations AC1, AC2, etc that are used here in the reply to the particular reviewer questions.

Reviewer comments are given in bold type-face. Our replies are given in plain text.

I found this paper to be not very detailed in its content and believe there is a fundamental problem in the modeling discussion. The paper summarizes some aerosol optical properties, more specifically aerosol absorption, from 2 months of measurements in 2008. The paper shows absorption angstrom exponent and single scattering albedo measurements for a biomass burning free month and one that had significant biomass burning influence. There is very little provided in terms of data analysis, rather it simply presents the data with some very minor discussion.
Reply:
We agree with the reviewer to add the more discussion to the Simulation section, and have augmented the presentation in this section. See **AC4, AC5**, and **AC6** for revised Measurement and analysis, and Aerosol extinction variation.

An attempt is made at connecting Mie theory modeling to the observed measurements however; the authors have ignored a fundamental aspect of BC optics (see below). In its current form it requires significant changes.
Reply:
We agree with the reviewer that more discussion would help to clarify the simulation, and have revised the manuscript to address this issue. Please see **AC10.**

Specific Comments:
P14062, L9: ’ALAOC’ is not an appropriate term. If non-absorbing organic carbon is externally mixed it will not appear to absorb at all. It only enhances absorption when is surrounds an absorbing core. ’Organic’ missing when defining ’ALAOC
Reply:
ALAOC was not used as a term characterizing a specific material but the effect of a material when coating black carbon. See **AC3** for added clarification of ALAOC.

Figure 3: Add a right axis that shows % of absorption that is ALAOC

Reply:
This can’t be done as the axes won’t be linear for two wavelengths.

P14066, L14: ’becomes minimum’ should read ’is minimized
Reply: Agree and done

Section 2.5: It seems that the associated figure is not needed. This could be easily summarized in 1 sentence without the figure.
Reply:
See comment by reviewer # 5
We also believe that this figure is the key to distinguish the aerosol properties between the two months.

Section 2.6: Why use 1.55, 0.8i for the RI of BC? Many studies use values as high as 2.0, 1.0i.
Reply:
There has been a range of RI for BC in the literature depending upon the source of BC particles, the amplification factor in core and shell modeling is not very sensitive to assumed RI of BC (Bond et al., 2006), rather it is more dependent on mixing with nonabsorbing material.

P14066, L14: You have used ’Mie Theory’ and ’coated sphere calculations’ prior to this to describe ’electromagnetic theory’. Be consistent

Reply:
Agree and changed.

Figure 7. The AEA for BC is around 1, even for larger sizes because it is comprised of smaller spherules of 20 - 60nm diameter, which dictate the optics. Interactions of light with multiple spherules creates a complicated optical medium yet the absorption is still dominated by the optics of the spherules. Your modeling here ignores the fact that raw BC at large sizes is made up of these spherules rather than a solid core (as you have modeled it here). Figure 7, therefore does not represent reality.
Reply:
Quoted directly from the reviewer comment and the author reply regarding to the existence of spherules: “It is true that the spherules usually do not exist on their own, because they coagulate quickly at the high concentrations in and around flames” and “Primary spherules do exist, but not in ambient air” (see author response M. O. Andreae and A. Gelencsér, 2006, Atmos. Chem. Phys. Discuss., 6, S1974–S1985, 2006, www.atmos-chem-phys-discuss.net/6/S1974/2006/). The key point is that biomass smoke can have only a few monomers that form the BC core whereas urban BC typically has hundreds of monomers. See **AC4** and **AC10**.

Section 2.5: because you have assumed a solid spherical core of BC the baseline for Figures 8 and 9 are not valid, therefore the conclusions drawn from these figures

are not appropriate. There may well be some AEA effect that differs from traditional thinking but you haven't identified it in this manuscript. BC cores made up of spherules will collapse to be more spherical however they are still made up of spherules, even in low temperature combustion like biomass burning. If the OA coating is not wavelength dependent (which you have assumed in Figure 8) then the AEA difference is due to BC alone. The AEA differences you observe are therefore due to your treatment of the BC core, not necessarily an atmospherically relevant process. A significant amount of additional modeling and discussion would be required to ensure that the discussion here is valid.

Reply:

While the reviewer is correct that more detailed models of combustion aerosols are of interest, we maintain, as discussed in our revised Simulations and Discussion section (**AC10**), that the shell-core model is an appropriate approximation for some atmospheric aerosols.

Reference for the specific reply

Bond, T. C., Habib, G., and Bergstrom, R. W.: Limitations in the enhancement of visible light absorption due to mixing state, J. Geophys. Res., 111, D20211, doi: 10.1029/2006JD007315, 2006.