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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Relative Importance of Black Carbon, Brown Carbon and Absorption Enhancement from Clear Coatings in Biomass Burning Emissions" *by* Rudra P. Pokhrel et al.

Anonymous Referee #2

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This manuscript presents a study of relative role of BC, BrC and absorption enhancement from clear coatings in biomass burning emissions. Various types of biomass fuels which representing globally significant sources of biomass burning aerosol emissions were burned in 22 individual burns in the experiment introduced in this work. The manuscript is outlined logically and written clearly. The results provide some insights into the relative importance of BC, BrC and lensing effect to total absorption coefficients in biomass burning emissions. This work may help for parameterization of BrC absorption used in models. However, more in-depth discussions are needed in the text before jumping into quantitatively conclusions. I suggest that his manuscript can be accepted for publication in this journal after my following comments are addressed.

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Major comments:

1. Several assumptions are used when estimating the contributions of BC, BrC and lensing effect to total absorption coefficients. One of the assumptions is that the absorption enhancement from lensing is constant at all wavelengths, and this assumption is used in Approach 1 and 2. Another assumption is that clear coated BC has an AAE of 1.6, and this assumption is used in approach 3. According to references introduced by authors, these two assumptions are based on Mie calculation when all BC are core-shell mixed with other aerosol components. However, the mixing state of BC in this study is unknown. Obviously, the mixing state of BC will exert significant influences on the calculated contributions of BC, BrC and lensing effect. More analysis and discussions are needed to address the possible mixing the state of BC. I suggest that the authors estimate the influences of mixing state based on calculations in this study.

2. Results of parallel runs of thermally denuded channel and dry channel demonstrate that significant discrepancy exist (larger than 50 % which is at the outer limits of the Gaussian error curce) between measured absorption coefficients at 405 nm from two different photoacoustic absorption spectrometers. Though results of added experiments show that the dry 405 channel is better and absorption coefficient of the denuded channel is corrected according results of parallel runs, large bias still exist in measured absorption coefficient at 405 nm and this error will propagate into the calculation of AAE and influences the analytical results introduced in this research. Hence, uncertainty analysis about calculated AAE should be given in the text to acknowledge the awareness of this problem.

Specific comments:

3. Title of table 1, " at 405 nm estimated from four different approaches", it should be three approaches.

4. Caption of Figure 2, the unit of absorption coefficient should be included.

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