

## ***Interactive comment on “Physical and Optical Properties of Aged Biomass Burning Aerosol from Wildfires in Siberia and the Western US at the Mt. Bachelor Observatory” by James R. Laing et al.***

**Anonymous Referee #2**

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This manuscript characterizes the physical and optical properties of biomass burning aerosols transported over the Mt. Bachelor Observatory during the summer 2015. This is an important dataset and deserves to be published. This being said, I feel the analysis of the measurement data could have been better processed with appropriate uncertainty values assigned. Hence, I would recommend publication of this manuscript after mandatory revision. Below are my major comments: 1) The fact that the authors observe a low single scattering albedo and Absorption Angstrom exponent implies majority of the aerosols were black carbon (BC) and not Brown Carbon. This is corroborated by higher MCE values indicating flaming phase of combustion. So, my question is: why are the authors surprised at lack of BrC aerosols? BrC aerosols are generated

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from smoldering fire phase, mostly associated with peat burning. Smoldering phase is associated with very low MCE, which was not observed in this study. What the authors observed were over crown forest fires (flaming phase). This concept has to be made clear in the text and the abstract. Otherwise, the confusion that only BC is generated from Siberian forest fires would propagate in the community. 2) The abstract and the text says “aerosol light scattering and absorption” were measured. Please specify what parameters were measured—scattering and absorption cross-sections or coefficients? I am assuming the authors measure coefficients. 3) The scattering and absorption coefficients were adjusted to desired wavelengths using Angstrom exponents calculated by other studies. Could the authors specify the values used to extrapolate? 4) Reading Fisher et al (2010), it seems the SAE values ranged between 2-2.8? What’s the rationale behind using this range? Why not use 4 instead? Since all particles are in Rayleigh regime (sub-micron), their scattering cross-sections decrease in power-law exponents of 4 with increasing wavelength. So, why did the authors adopt SAE of ~2.4 and not 4? 5) Figure 5 doesn’t make any sense to me. Could the authors provide any physical explanation behind the correlations? Scattering in the Rayleigh regime goes as square of particle volume, which probably explains the poor correlation. But what about the others. If one cannot explain or even hypothesize the reason behind a plot, why put it. I suggest the authors to remove this unnecessary plot from the main manuscript or move it to Supplementary Materials. 6) Please provide an error analysis of the techniques used to measure absorption and scattering coefficients. Uncertainties involved during calculation of SAE, AAE using previously published data should be mentioned. A paragraph on error analysis is a must for this kind of study. I would further suggest to propagate these values to the error bars in figure 4. 7) The manuscript has grammatical and typographical errors. I suggest a thorough editing done to the contents during its revision.

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