

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 #1

Received and published: 7 August 2016

Summary

The paper summarizes the physical and optical properties of aerosols from biomass smoke from regional to continental scale events. The paper is appropriate, well-focused and should eventually be publishable in ACP. I recommend the following minor modifications and additional analysis prior to publication.

Technical Comments

Techniques and analysis seem sound. The criteria for smoke impacts and differentiating LRT and regional smoke events with water vapor seems well-thought out.

Certainly the trend is consistent of lower SSA for the Siberian fires and thus a flaming,

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higher MCE fire. However, all the SSA values are all relatively high suggesting an MCE on the lower end of the range (mixed to smoldering combustion). This is worth commenting. For reference see the Liu paper below.

The analysis brought to mind a recent paper by the CSU group examining emitted and aged biomass smoke sizing and radiative properties paper referenced below which may provide a useful intercomparison and context.

Table 1 is useful, however would be more useful with the following additions:

- o A summary mean +/- s.d. for the regional versus Siberian events, maybe 2 lines at the bottom
- o Adding in your rough estimate of the age of the plume for each case which was stated as a range elsewhere. Do the size distributions with Aitken modes correspond to the younger plumes? Are there any other conclusions to be drawn?

Figure 4. I'm not sure how the percentiles are done with such small numbers of samples, symbol with whiskers showing the range seems more appropriate. You're really comparing the Siberian to regional fires, why separate into 3 groups? I could only see one small outlier symbol on the chart.

Figure 5. Meaning of this? The events symbols are not distinguishable; I would simply delineate Siberian vs. regional with different symbols and colors. With the exception of CO, these parameters are by definition or calculation interdependent. Is the take home message something along the lines of, “Biomass smoke events as indicated by elevated CO concentrations featured shifts to larger sizes driving higher PM mass concentration, light scattering coefficients, and the highest overall mass scattering efficiencies.”

Mechanics and Presentation

The presentation is appropriate in terms of length, style and diction. Figures are appropriate.

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Why put the hysplit trajectories plot in supplementary material though? The CALISPO images are appropriately in the supplement. However, the paper is short enough it can accommodate the additional figure rather than the annoyance of looking elsewhere.

I noted a few inconsistencies (line 158 and 196 for example) in variable, citation, and subscript italics, check throughout.

Line 109 "was located prior to any. . ." Aerosol instrumentation?

Line 133, I recommend breaking out as an equation rather than inline.

Line 192, I believe you mean Period 2.

Line 209, "ascended from the boundary layer (BL) to. . ." MBO?

Line 242 superscript missing

Line 280 "hygroscopy" replace with hygroscopicity

Line 299 "Mei" replace with Mie

Line 375 "preformed" replace with performed

Liu, S., et al. (2014), Aerosol single scattering albedo dependence on biomass combustion efficiency: Laboratory and field studies, *Geophys. Res. Lett.*, 41, 742–748, doi:10.1002/2013GL058392.

Rapidly evolving ultrafine and fine mode biomass smoke physical properties: Comparing laboratory and field results, *JOURNAL OF GEOPHYSICAL RESEARCH: ATMOSPHERES*, Volume 121, Issue 10, 27 May 2016, Pages: 5750–5768

Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-518, 2016.