

## ***Interactive comment on “Rapid Evolution of Aerosol Particles and their Optical Properties Downwind of Wildfires in the Western U.S.” by Lawrence I. Kleinman et al.***

### **Anonymous Referee #4**

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Review of Rapid Evolution of Aerosol Particles and their Optical Properties Downwind of Wildfires in the Western U.S. by Kleinman et al., 2020, submitted to ACP

Kleinman et al. presented analysis on aging of biomass burning (BB) particles measured from BBOP field campaign (phase 1 mostly). The authors reported increasing mass scattering efficiencies and particle size with photochemical age downwind of the fire emissions. The authors concluded in the original manuscript that coagulation is the main mechanism for growing particles' size with aging. However, in the response to Review #3, the authors found mistake in the original manuscript and concluded that other mechanisms are responsible for the size change. It would be easier to review and com-

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ment the revised manuscript. In general, the paper is well written and presents valuable datasets for the community to study BB particles. I find the manuscript suitable for ACP. Some concerns are attached below.

Line 16, one would think absorption by Brown carbon decays with time. SSA is quite sensitive to absorption instead of scattering. Some discussions and quantifications are needed to justify this statement.

After reading the review notes from Reviewer#3 and the authors' response, I am concerned with the calculation of coagulation vs. other microphysical processes in the paper. Seems the new calculation (not available to us yet) suggests that coagulation is not the primary contributor to growing size, then what are the primary mechanism(s)? Condensation? Aging? I understand the authors claimed in the response to Reviewer#3 that observations size limit is only up to 260 nm, thus difficult to tell exactly. However, seems the paper is incomplete without explaining the growing size, which leads to the increasing MSE (shift from 0 to cooling effect, the major finding of the paper in my point of view). If observation-based calculation is not easy, maybe some box model, regional model or theoretical calculations can help.

Coagulation is mainly responsible for the size change from Aiken to Accumulation mode. How much does MSE change in response to the coagulation?

Any change in particle shape with aging available from BBOP? Need to consider (at least discuss) the non-spherical shape and its impact on scattering/absorption (SSA)?

Minor: a. Figure 4, labels of the left/right Y-axes should be in different colors

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Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-239, 2020.

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