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Interactive comment on "Effects of Near-Source Coagulation of Biomass Burning Aerosols on Global Predictions of Aerosol Size Distributions and Implications for Aerosol Radiative Effects" *by* Emily Ramnarine et al.

Anonymous Referee #2

Received and published: 4 March 2019

The paper reports a study of the impacts of coagulation of particles in biomass burning plumes on the climate impacts of biomass burning aerosol. The study finds that this process, that is not usually included in atmospheric or climate models, reduces the number of cloud droplet forming particles produced by biomass burning by 37% globally. Overall, the study finds that including coagulation of particles in biomass burning plumes reduces the cooling impact of biomass burning aerosol through the aerosol indirect effect, but increases the cooling impact through the direct radiative effect.

This is an important study. The paper is well-written. The model experiments are

clearly described and the authors have tested a range of assumptions and datasets. I recommend publication after any minor comments have been addressed.

Minor comments

Section 2.1. What new particle formation scheme and SOA formation did you include in the model? These will control the baseline particle number and the growth rates of particles and so are important for your study.

Figure 6. Do you report the values averaged over all size distributions? From the figure it looks like the impact of coagulation on the average DRE value is greater than the 4% in the Abstract?

Section 2.2 How would your results depend on parameter uncertainty in equations (1) and (2) on Page 6. The authors should be commended for exploring the uncertainty in the global model inputs/datasets. It is probably beyond scope to explore the impact of uncertainty in these equations, but a short discussion would be useful.

Section 2.2 Do you have information on the values of Dpm and model width calculated from equations (1) and (2)? It would be interesting to know the mean values used as input to GEOS-chem as well as spatial and temporal variability.

An important point is to what extent the emitted size distribution in the model represents fresh or aged smoke. This is mentioned by the authors in Section 2.2. Could the treatment of in-plume coagulation simply be captured by assuming a larger emitted size? Or does the in-plume calculations allow treatment of important spatial and temporal variability that would be ignored by using a globally uniform value?

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