Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-227-AC1, 2017

Interactive comment on "Biomass burning CCNs enhance the dynamics of a Mesoscale Convective System over the La Plata Basin: a numerical approach" *by* Gláuber Camponogara et al.

Gláuber Camponogara et al.

glauberic@gmail.com

Received and published: 29 September 2017

We thank the referee for the criticism and suggestions that have help us improve the paper.

1. The numerical experiments are based on one set of initial and lateral boundary conditions from NCEP Reanalysis. Hence, readers can easily raise a question like how sensitive the simulated aerosol effect is to the meteorological fields? One approach to address such concern is to carry out additional ensemble simulations by reasonably perturbing initial and boundary meteorological fields. With those analyses, the authors can obtain spread of simulated aerosol signals and justify the robustness of the aerosol

effect. The similar approach has been used in the previous studies (Wang et al., 2014, Lin et al., 2016).

Thank you for the suggestion. This is an interesting idea we look forward to following this line of work in the next study. We also included this idea as future work in the paper.

2. Page 7 lines 5-9, the changes in upwelling vapor flux at cloud base are not well explained. Since the aerosol induced additional latent heat release is expected to occur well below the cloud base, the changes at the cloud base level may indicate the modification on the whole circulations in the cloud such as low level convergence.

We have improved the explanation about the upwelling vapor flux. We appreciated the suggestion.

3. Fig. 10 and 12, to better reveal the heterogeneous versus homogeneous ice nucleation, I suggest to provide 0 degree and -35 degree isothermal lines.

We added a shaded area that corresponds to the layer between 0 and -35 degree isothermal lines. Thank you for the idea.

4. Page 8 lines 20-24, more discussions are still needed to explain why CCN leads to an increase in graupel but a decrease in hail. Both hydrometeors are formed mainly by the riming processes. The authors only talk about cloud droplet size, but neglect the influence of the raindrop size. The finding about distinctive responses of graupel and hail is important, as some microphysics do not consider hail explicitly. A plot/table to show the riming efficiency is desired.

We mainly focused on the effect of CCN on cloud droplet spectra as the collision efficiencies between liquid and ice particles dramatically vary when changing the drop size within the cloud droplet range (i.e., several orders of magnitude below 40 microns in radius), compared to those coming from potential changes in raindrops. For small ice particles interacting with supercooled liquid particles the variation of collision efficiencies linked to changes in droplet size are expected to be far more important that the collision efficiencies impact within the raindrop size changes. Actually, the circulation around the falling raindrop can invert the increasing response making collision efficiencies slightly lower when increasing raindrop size. In the case of graupel/hail collecting liquid particles, changes in collision efficiencies produced by raindrop range size changes are expected to be almost negligible. Moreover, in this stage of growth, thermodynamic limits are expected to play a dominant role compared to the buck amount of liquid per unit time impacting the hail/graupel particle. We have included in the atmospheric model section (line 30-31) that the riming efficiencies are described in detail by Saleeby et al. (2008).

5. Since the latent heat release plays a central role in the aerosol invigoration effect, it is extremely valuable to display the spatial distribution of latent heat explicitly.

Thank you for the suggestion. We have added the total precipitation over the space and a figure with the ratio between convective/stratiform precipitation in order to give more detail about MCS structure.

6. References mentioned above and suggested to be discussed in the manuscript:

Thank you for suggesting the references, we have included them in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-227, 2017.