Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-227-RC1, 2017

Atmospheric Chemistry and Physics Discussions

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.

Anonymous Referee #1

Received and published: 1 June 2017

This study simulates the effect of biomass burning aerosols as cloud condensation nuclei on a deep convective cloud system over the Amazon using a cloud-resolving model with a two-moment bulk cloud microphysics. The finding about the aerosol invigoration effect essentially agrees with previous modeling studies (Khain et al., 2005; Li et al., 2009; Wang et al., 2011; Fan et al., 2016) with the similar topics. Considering there are abundant observations emerging from recent field campaigns over Amazon, a modeling study like this one would be of interest to the community. The paper can be accepted by ACP after authors can prove the robustness of the simulated aerosol effect and better illustrate some critical microphysical processes following the CCN perturbations.

Printer-friendly version

Discussion 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)

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.

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.

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.

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.

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

Fan, J., et al. "Review of Aerosol-Cloud Interactions: Mechanisms, Significance, and Challenges", J. Atmo. Sci. 73 (11), 4221-4252 (2016)

Khain, A., et al. "Aerosol impact on the dynamics and microphysics of deep convective

Printer-friendly version

Discussion paper

clouds", Q. J. Royal Meteo. Soc. 131(611), 2639-2663 (2005)

Li, G., et al. "The effects of aerosols on development and precipitation of a mesoscale squall line", J. Geophys. Res. Atmos., 114, D17205, (2009)

Lin, Y., et al. "Distinct Impacts of Aerosols on an Evolving Continental Cloud Complex during the RACORO Field Campaign", J. Atmo. Sci. 73(9), 3681-3700 (2016)

Wang, Y., et al. "Long-term impacts of aerosols on precipitation and lightning over the Pearl River Delta megacity area in China", Atmo. Chem. Phys., 11(23), 12421-12436, (2011)

Wang, Y., et al. "Distinct Effects of Anthropogenic Aerosols on Tropical Cyclones", Nature. Clim. Change, 4, 368–373 (2014)

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