Review of "*Impact of biomass burning aerosols on radiation, clouds, and precipitation over the Amazon during the dry season: dependence of aerosol-cloud and aerosol-radiation interactions on aerosol loading*" authored by Liu et al.

The manuscript presents a comprehensive study of biomass burning (BB) aerosol effects on radiation, clouds, and precipitation over the Amazon, addressing both aerosol-cloud and aerosol-radiation interactions (ACI and ARI). The cloud-resolving WRF-Chem model and a suite of ground-based and satellite observations over the Amazon were employed. It is great to see that substantial efforts have been made to evaluate the model's performance in various aspects. The major findings about the distinctive effects of ACI and ARI based on the sensitivity analyses reinforce the importance of equally considering those two effects in future aerosol effect assessments. The paper is well written overall. I would recommend the publication of this study by ACP, after the following issues are addressed.

1) To assess ARI, why not contrasting the experiment PC3_EMISX and PCNR3_EMISX? The current way to obtain ARI has an underlying assumption that that the total aerosol effects are a linear combination of ACI and ARI, which may not be the case because of the complexity of the nonlinear microphysics-dynamics-thermodynamics interactions of the system. Such an uncertainty should be discussed in the paper.

2) It is unclear how the model treats the BC aging process. According to the present model description in Section 2.1, it seems the fresh BC are immediately mixed with other types of aerosols after emission. Such a simplified treatment could result in overestimation of the BC absorption and associated radiative forcing [Wang et al., 2018; Peng et al., 2016].

3) According to Fig. 6, the month-long simulations include a couple of deep convective systems with heavy precipitation (Sept. 9, 17-18). For the precipitation response analyses in Fig. 15, can the authors take a further step to assess the deep convective systems and the rest separately? Maybe a threshold of 3 mm/3hr can be applied to categorize those cases.

4) For the IWP evaluation, how are the satellite data are averaged spatially? It seems the satellite observations shown in Fig. 5 are averaged over cloud points only. I doubt ice heterogeneous nucleation scheme can explain such a huge discrepancy. Even if the ice production scheme is not a function of INP concentration in this microphysics, it should still exist (most of time as function of temperature).

5) Line 62-65, similarly, a recent study using satellite data shows nonlinear response of deep convective clouds to smoke aerosol in South America [Jiang et al., 2017].

6) Out of personal curiosity, to what extent the FDDA can reduce the meteorological biases? If the authors have the model free run available, I like to see a comparison of those two.

7) Fig. 4, what are the two dash lines in addition to the 1-to-1 line?

8) Line 326-327, it doesn't make much sense to compare a regional aerosol forcing to the global values.

9) Fig. 11 is discussed after Figs. 12 and 13. Better to reverse their order.

10) In Fig. 11 and 12, the larger updraft velocity and IWP by absorbing aerosols corroborate the thermodynamic invigoration hypothesis by Wang et al. [2013] which suggested larger CAPE above PBL due to the presence of absorbing aerosols in the lower troposphere.

11) Title is too long. Maybe remove "*dependence of aerosol-cloud and aerosol-radiation interactions on aerosol loading*".

References:

- Jiang, J., H. Su, L. Huang, Y. Wang, S. Massie, B. Zhao, Z. Wang, and O. Ali, "Contrasting Effects on Deep Convective Clouds by Different Types of Aerosols", Nat. Communications 9(3874), (2018)
- Peng, J., M. Hu, S. Guo, Z. Du, J. Zheng, D. Shang, M. Zamora, L. Zeng, M. Shao, Y. Wu, J. Zheng, Y. Wang, C. Glen, D. Collins, M.J. Molina, R. Zhang, "Markedly enhanced direct radiative forcing of black carbon particles under polluted urban environments", Proc. Natl Acad. Sci. USA, 113(16), 4266-4271 (2016)
- Wang, Y., P. Ma, J. Peng, R. Zhang, J.H. Jiang, R. Easter and Y. Yung, "Constraining Aging Processes of Black Carbon in the Community Atmosphere Model Using Environmental Chamber Measurements", J. Adv. Model. Earth Syst. 10(10), 2514-2526 (2018)