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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of aerosol-radiation interaction on precipitation during biomass-burning season in East China" *by* Xin Huang et al.

Anonymous Referee #1

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General Comments: This is a very interesting study to investigate the impacts of agriculture fire emissions on temperature, precipitation, and clouds over East China. The study selected a typical event around June 10 2012 and conducted model simulations using WRF-Chem to examine the impacts. The results show that the absorbing aerosols emitted from the agriculture fire interacted with radiation and changed the meteorological conditions. This redistributes the precipitation over the downwind areas of the burning plumes. The results are well presented, and the topic is suitable for publication in ACP after addressing some specific comments listed below.

Specific Comments: 1. Since this study investigated the impacts of fire emissions on meteorological fields, more discussion about the fire emission inventory may be

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needed. In Section 2.1, please state what's the spatial and temporal resolution of the fire emission inventory used in this study. Section 3.4 discussed about the uncertainties that are partly from the fire emission spatial and vertical distributions. Did you compare your emission inventory with the FINN fire emission data (Wiedinmyer et al., 2011) that are with hourly temporal and 1x1 km2 horizontal resolutions? In terms of vertical distribution of fire emissions, did you use the plumerise scheme in WRF-Chem or prescribe distribution profile? Please clarify.

Wiedinmyer, C., Akagi, S. K., Yokelson, R. J., Emmons, L. K., Al-Saadi, J. A., Orlando, J. J., and Soja, A. J.: The Fire INventory from NCAR (FINN): a high resolution global model to estimate the emissions from open burning, Geosci. Model Dev., 4, 625-641, doi:10.5194/gmd-4-625-2011, 2011.

2. In Section 2.2, the simulation was conducted from May 20 to June 15, but the analysis was only for June 9-11. This is confused. I would suggest just mentioning that you have a simulation period for spin-up the chemistry initial condition. More importantly, please state what's the meteorological initializing date for the event of June 9-11. The different initializing date may change the results of impacts. Did you try different initializing date to see whether the results changed?

3. In line 175 of page 6, I am not convinced that the ACI should be disabled for investigating ARI effect. Please explain why ACI should be disabled in this study? I think it will be more interesting to compare both ACI and ARI. Although authors pointed that previous studies found ARI sometimes is more important, this is not always the case (e.g., Zhong et al., 2015). Another critical issue of turning off ACI in WRF-Chem is about aerosol wet removal. In WRF-Chem, aerosol wet removal is linked with ACI. With turning off ACI, please clarify how you treat the wet removal of aerosols in your simulations since your event (Fig. 8) shows significant amounts of precipitation.

Zhong, S., Y. Qian, C. Zhao, R. Leung, and X.-Q. Yang (2015), A case study of urbanization impact on summer precipita-tion in the Greater Beijing MetropolitanArea: Ur-

ban heat island versus aerosoleffects, J. Geophys. Res. Atmos., 120,10,903–10,914, doi:10.1002/2015JD023753.

4. This study highlighted the impacts of fire emissions, however, the experiments were only designed with CTL and ARI. Based on these two experiments, it's hard to disentangle the biomass burning effect from the effects of anthropogenic aerosols. One experiment without biomass burning emissions is needed if the purpose is to investigate the impacts of agriculture fire.

5. In lines 219-221 of page 8, please provide the corresponding simulated values as well.

6. In Fig. 3, do you have hourly observations? If not, why not also put daily mean of simulated values for a direct comparison?

7. In Fig. 4, why not show the simulated SSA?

8. Section 3.3, Fig. 8, it seems to me that model has large biases in capturing spatial distributions of TRMM precipitation. Can you try another precipitation dataset (CMORPH) for comparison? CMORPH provides 8 km resolution data. Is this poor comparison between model and TRMM due to the initial condition? Did you try different initial meteorological conditions? In addition, this may be also partly due to the missing of aerosol-cloud interaction? Strong suggestion to test this case with aerosol-cloud interaction.

9. I don't see the necessity to include the paragraph of Line 331-337 of page 12.

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