Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-632-RC3, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Impacts of Biomass Burning Activities on Convective Systems in the Maritime Continent" *by* Hsiang-He Lee and Chien Wang

Anonymous Referee #1

Received and published: 20 September 2019

This study investigates the impact of biomass burning aerosols on convective systems in the Sumatra and Borneo regions of Southeast Asia using the WRF-Chem model. Considering the large uncertainty in the interactions between aerosols, particularly those from biomass burning, and convective clouds, this study advances our understanding of the complicated and competing physical processes that governs the net effect of biomass-burning aerosols. The manuscript is generally well written. I think it can be considered for publication after the author addresses the following comments and suggestions. 1. Abstract: The descriptions after Line 45 are much too general. The author mentioned several times that fire aerosols have "significant/substantial impacts" on convection. What exactly are these impacts? I believe the author should summa-

Printer-friendly version

Discussion paper

rize their main findings here so that the abstract can be more informative. 2. Line 173-175: How did you treat emissions from the flaming vs smoldering phases when calculating plume rise? A previous study (Shi et al., 2019, JGR-Atmospheres, DOI 10.1029/2019JD030472) has shown that the fraction of smoldering-phase emissions has a large impact on plume rise and fire-induced aerosol concentrations. 3. Line 185-186: I think it's not accurate to use "fossil fuel emissions" here. "Anthropogenic emissions" may be a better term. Many anthropogenic emissions do not originate from fossil fuels, such as VOC emissions from solvent use, NH3 emissions from agricultural activities, and emissions from household biomass fuels. 4. Line 191-193: This is an important point. You may want to show the data in SI. 5. Section 3.1.2: Since fire emissions have a large day-to-day variability, I think the monthly mean AOD may not be suitable for evaluating the model performance. I suggest to use daily product (MOD08_D3) instead. Also, the author argues that the higher simulated AOD than observations is because "a high spatiotemporal resolution in our simulation enables the model to capture episodic fire events better". I think comparing with daily AOD observations could help to confirm whether this argument is true or not. 6. Line 303: but smaller number? 7. Line 307-308: Why do the mass concentration of snow and graupel increase significantly? Due to the aerosol invigoration effect? You need to explain. 8. Line 317-321, 351-353: Why do the aerosol impacts on stronger and weaker convective systems quite different? You should explain briefly here since the discussions in Sections 3.3 and 3.4 are far away. I think your finding that fire aerosols tend to invigorate weak convection but suppress deep convection is generally consistent with and could be better supported by previous observation-based studies (e.g., Jiang et al., 2018, Nature Communications, DOI 10.1038/s41467-018-06280-4; Zhao et al., 2018, GRL, DOI 10.1002/2018GL077261), which showed that smoke aerosols generally suppress deep convection and convection-generated ice clouds. 9. Line 381-408: This part is difficult to follow and should be better organized. The author intends to investigate the dependency of the aerosol impact on convective strength (Line 381-382). This question is discussed for r1, but not clearly for r2. From the current text, I am

not sure how the aerosol impacts differ for convective systems with different strength in r2. The same problem exists in the conclusion section. Also, why do you introduce daily maximum and minimum rainfall? A few transitional sentences are needed. Line 391-392: Better to mention clearly that this refers to r1. 10. Figures 5, 6: Some texts in the figures are too small to be visible.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-632, 2019.

Printer-friendly version

Discussion paper