

***Interactive comment on* “Sensitivity of WRF-Chem model resolution in simulating particulate matter in South-East Asia” by Adedayo Rasak Adedeji et al.**

Anonymous Referee #3

Received and published: 21 April 2020

This study examined the sensitivity of the aerosol simulation in WRF-Chem to the horizontal resolutions (100km vs. 20km) in terms of meteorological fields and biomass burning emission amount in South-East Asia. The research itself is interesting, but the writing and structure need a major improvement, and so the understanding to the results.

Major comments:

1. You may need to specify “horizontal resolution” in the title. The model simulation like convection of emissions to a higher altitude and wider spatial scale largely depends on vertical resolution as well. Thus, the benefit of increasing horizontal resolution might

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be limited by keeping vertical resolution the same as done in this study.

2. To my experience, a model often works well with a (or a few) certain spatial resolution because some parameters are tuned according to this spatial resolution when this model is developed. I am wondering if it is your case. Make sure that you are aware any these kinds of implicate settings, which can better our understanding of the complicated results.

3. Does the spatial resolution of your biomass burning (BB) emission change with the model spatial resolution, 20km vs. 100km?

4. Are the meteorological fields simulated freely or nudging towards reanalysis?

5. I think that you need to have ensemble runs for a robust result.

6. Based on your figures 6-8, increasing the biomass burning emission will help to bring the PM concentration level closer to the observation at Brunei only, but overestimate PM in Singapore and overestimate the overall AOD. Thus, increasing the BB emission seemingly doesn't help much. Or the factor of 6 is too large?

7. In the end, what lesson you learned with the limitation (e.g., evaluation with only two sites in the downwind region) and what suggestion would you give to others?

8. Do you have an explanation about the differences shown in these two sites?

9. The structure needs reorganization: In the section 2, you should add a sub-section to introduce your three experiments, especially the 25kmX, which starts to appear in the Figure 3 without any introduction. The grid staggering in your Section 4.1 belongs to an individual section for the method, not the section 4 which shows your results.

10. Can you label the multiple panels in a figure as (a), (b), (c)...as you did in Figure 2? And it would be also very helpful to show a brief name in each panel, e.g., (a) WRF-Chem_100km.

Specific comments:

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- Line 22: change the 10 and 2.5 to subscript here and across the entire manuscript.
- Line 24: remove the space between “quality” and “but”; what does “prognostic” mean? You should call out the specific variable name.
- Line 38: remote sensing instruments aboard in satellite.
- Line 41: can you quantify the pollution level by giving a range of PSI?
- Line 47: remove “(Oozeer et al., 2016)”.
- Line 48: correlation coefficient of what and what?
- Line 49: remove one “(” before “Morrison”.
- Line 57-59: Clarify the meaning of this sentence “Among . . .”.
- Line 60-62: please refer this link <http://tim.thorpeallen.net/Courses/Reference/Citations.html>, or consult with your ACP editor about how to cite a reference.
- Line 67: what is PREP-CHEM-SRC? You might not mention it here but give more details in your method part.
- Line 73: change “response” to “sensitivity”.
- Line 74: clarify your purpose here?
- Line 87: Should be something like “. . .adapted from the study by Lin et al. (2009)”. Refer to the suggestion for Line 60.
- Line 92: What is your reference? (It is a good practice when preparing a manuscript, but not in a submitted version).
- Line 92: Cloud microphysics?
- Line 93-94: Clarify this sentence.
- Line 105: What kinds of aerosol species are included in your model?

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Line 121” Remove “;”

Line 122: Remove one “(”.

Line 132: What is the version of EDGAR?

Line 139: Reference?

Line 145: Based on what you described here, my understand is that your simulation was actually carried freely without nudging to reanalysis for 15-day period using the initial conditions from reanalysis at 00UTC on 15 June 2013. Right? If that is the case, you may not need to mention the restart issue. It causes confusion with the way how the daily forecast performs.

Line 174: Figure 1 – top right and bottom right (not left)?

Line 188: Should be “were used to evaluate surface parameters from simulations. . .” (The logic should be in a way that simulations are evaluated by observations).

Line 218: The 20kmX panel is not necessary to be shown in the Figure 3. Is it the same as 20km? or you need to mention it.

Line 233: What is 0.017?

Line 292: In Figure 4, what is the right column? You should introduce this experiment at the earlier stage instead of in line 313.

Line 318: How does the factor of 1.3 work? This issue goes back again to the comment on the necessity to introduce the experiments in your method section proceeding the result.

Line 327: A little bit confusion here: to my understand, easterly means that the wind blows from the east to the west. Do you mean eastward instead (blow from the west to the east in your case)? And please double check the description of your wind direction in the line 333 and throughout your manuscript.

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Line 322: In Figure 8, why do you use MERRA-2 AOD (an reanalysis) as a reference? Why you don't use AOD from any satellite observations, say MODIS or VIIRS?

Line 326: Do you have evidence on this statement? In addition, you Figure 4-5 don't include June 19.

Line 358-360: You are comparing PM concentration, instead of PM emission, right? They are quite different variables.

Line 361-362: Based on your figures 6-8. Increasing the emission will help to bring the PM concentration level closer to the observation at Brunei only, but overestimates PM in Singapore and overestimates the AOD entirely. Thus increasing the emission seemingly doesn't help much. Or the factor of 6 is too large?

Line 363: Figure 8 (not 7)?

Line 364-365: clarify this sentence. Again, PM emission is different from PM concentration. They are related but not interchangeable.

Line 368: add references here.

Line 610: Figure 6, why the observation in the third panel is different from that in other two panels? Here are suggestions to improve this figure: 1) Combine three panels into one panel by putting 4 time series in one panel; 2) Better to connect the dots into lines. It is difficult to track dots; 3) enlarge the labels in x and y axis. These suggests also apply to the Figure 7. In addition, you talked about Brunei first and then Singapore in the preceding text, then you should follow this same sequence throughout the manuscript. So please switch Figure 6 and 7.

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