Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-232

Anonymous Referee #1

Referee comment on "Robustness of simulating aerosol climatic impacts using regional model (WRF-Chem v3.6): the sensitivity to domain size" by Xiaodong Wang et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-232-RC1, 2021

General comments:

This study investigates the impacts of domain size on the modeling of aerosol impacts on East Asian summer monsoon using the updated regional model WRF-Chem. The authors compare the simulation results with small and large domain size. The consistent side in different domain size simulations is that aerosols lead to the cooling of lower troposphere and thus the anti-cyclone circulation anomalies and the weakening of EASM moisture transport. The results also demonstrate that domain size has a great influence on the simulated meteorological fields which leads to the difference of simulated strength and area extent of aerosol-induced changes of lower-tropospheric temperature and pressure, which further results in different locations of circulation and precipitation anomalies. This study gives a highlight to understand the importance of domain size and proper modeling of meteorological fields in the study of aerosol impacts on circulation and precipitation and has a good guiding significance for similar research. There are a few questions needed to be revised.

Specific comments:

- In the description of figure 3 and 4, there are some information about the results from CLEAN-L, such as that at Line 303-305. I suggest the author to revise figure 3 and 4 by adding the results from ERA5 and CLEAN-L, and then figure S2 and S3 can be removed.
- In figure 4 and S3, are the temperature and wind averaged for June and July? Please clarify it.
- At line 348-349, the author claimed that "At 32°N-36°N, CTRL-L simulates lower aerosol mass concentration near the surface and higher above 850 hPa.". Is there any explanation for this?
- At line 382-384, I think the description "aerosol-cloud interaction also increases cloud amounts over Northeast China and its adjacent ocean (Fig. S6a) and thus reduces the lower tropospheric temperature and increases the surface pressure over the area." is not accuracy. The cloud amount increases not only over Northeast China and its adjacent ocean but also the north of Hebei province while the temperature increases over part of Northeast China and Bohai sea.
- At Line 384-386, what is the reason for the aerosol-cloud interaction-induced the

reduction of cloud amounts and the increase of lower tropospheric temperature over the Yellow River Basin?

Technical corrections:

- Please check the caption of Figure 4. I think it should be "(a)The cross-section of meridional temperature anomalies and wind averaged for 105°E and 122°E from the CLEAN-S simulation, and (b) the difference of temperature (not meridional temperature anomalies) and wind between CLEAN-L and CLEAN-S. The meridional temperature anomalies are calculated by subtracting the mean temperature in this latitude range at each pressure level."
- At Line 376, "the spatial distribution the impacts of aerosol-cloud" should be "the spatial distribution of the impacts of aerosol-cloud".