

Interactive comment on “Comparison of three aerosol representations of NHM-Chem (v1.0) for the simulations of air quality and climate-relevant variables” by Mizuo Kajino et al.

Anonymous Referee #2

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The paper of Kajino et al. compares the three aerosol representations (bulk, 3-category, 5-category) which are available in the regional CTM NHM-Chem. The results of air quality related variables (O₃, NO₂ etc) are compared with observations. Further, CCNs and AOT etc. are compared between the three aerosol representations. The paper is a re-submission of a paper which was rejected earlier in GMD.

I already reviewed the rejected earlier submission of the paper. The focus has now changed from a model description paper to an model evaluation paper. The manuscript fits well into the scope of the journal. The paper is very long and parts of it could be shortened, while some parts could be improved with adding some more discussion.

C1

Further, to my opinion the language should be improved at some points. In general, the paper needs some larger revisions before it can be accepted for publication.

Major comments:

To my opinion the figures are partly confusing. Some of the figures show Bulk/5-cat, 3-cat/5-cat, 5-cat, other show 3-cat, 5-cat, 3-ca/5-cat. An example are Fig. 3 and Fig.4. To add a little bit of confusion the caption of Fig 4 says (same as Fig. 3). I think it would be much easier if all figures would have the same design. Similar for example Fig 8 and 6/7 or Fig 9 and Fig 10.

Currently, there is no coupling of meteorological variables and aerosol, which is a major shortcoming of the study. This should be clearly mentioned and discussed (see also Reviewer 1).

The authors included a lot of information to the supplement, but sometimes discuss this supplementary material very detailed. As an example see page 20 15ff. Either this are supplementary information (what is fine) or this are no supplementary information. If this are no supplementary information the figures should be included into the manuscript. If this are supplementary information the long description should be moved to the supplement to shorten the paper a little bit.

Generally, the paper offers a lot of analyses and information, but the results are of course only valid for the NHM-CHEM model. Therefore, I ask the authors to shorten parts of the general description of the results a little bit and put more empathize on the following points:

- 1) why are these variables important (see reviewer 1)
- 2) Discuss similarities /differences of the aerosol representations available in NMHC-Chem with aerosol representations available in other models
- 3) Discuss which findings most important for other aerosol models

Minor comments:

C2

P4|20ff: The discussion about what schemes/couplings have been used in which publications is where long and could be removed without losing important information for the paper

The description in p12|5ff about the temporal length of the simulations is very confusing and should be rephrased

The sentence 'We applied the monthly mean values of GFED3 without temporal variations' is unclear (the same monthly means in each month?)

The part in the conclusion: 'The initial and boundary conditions should be improved before model formulation. The difference in PM_{2.5} was large, i.e., up to 20-100%. Improving the model formulation, as well as its initial and boundary conditions, is needed.' is unclear. What exactly and why should initial and boundary information be improved?

I suggest to rename the conclusion into 'conclusion & Discussion'

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-229>, 2020.