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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dust size parameterization in RegCM4: Impact on aerosol burden and radiative forcing" *by* Athanasios Tsikerdekis et al.

Anonymous Referee #3

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Review on the "Dust size parameterization in RegCM4: Impact on aerosol burden and radiative forcing" by Tsikerdekis et al.

Authors of the manuscript present an interesting analyzis of which processes control the dust aerosol load over the Sahara and surrounding region by 1) performing a detailed validation againts available aerosol observational products and 2) by performing sensitivity test of the model performance on the choice of the aerosol size distribution discretization method. Although the amount of work done is rather small (validation of the default model configuration and a comparison to a more complex parameterization), the results are discussed in very detailed way with lots of aspects

considered. In this view, it represents a valuable contribution to the aerosol science and to modeling communities focusing to aerosol regional transport and its model representation. Thus I recommend it to publication in ACP after considering the following comments:

General comments:

In principle, the authors present and compare three datasets: observation and two model realizations. I suggest to join all three datasets in the validation part. It makes the reader easier to see the difference between the two aerosol size bin discretization schemes in the view of the reference observational data. Of course, this holds only for those quantities, where observations are available.

The presented changes caused by the introduction of new aerosol size bin scheme are rather small. I agree with the other reviewer, that this requires a statistical significance test of the differences.

Specific comments and corrections:

Pg 1, line 14 (Abstract): It is not the sensitivity of the parameterization, but the sensitivity of the model representation of aerosol on the choice of the parameterization. Rephrase, please.
Pg 1, line 20: Change 'minimize' to 'reduces'.
Pg 1, line 31: change 'taking' to 'taken'.
Pg 3, lines 15-16: This statement is true, however please add 1-2 sentences on how this number affects the modeling of aerosols, at least in theory.
Pg 4, line 19: change 'to improve radiation processes' to 'to improve the model representation of the radiation processes...'
Pg 4, line 23: use rather 'driven by RegCM4 meteorology, while ...'

Pg 5, line 8: remove ‘is’ (‘used’ only, not ‘is used’)
Pg 5, lines 25-26: So aerosols cannot move from one bin to another meaning that there is no aerosol fragmentation or aerosol coagulation?
Pg 6, lines 5-7: I would be interesting to compare the presented optical properties with those obtained by using only one effective diameter – i.e. the one that describes the bin (the center of it).
Pg 9, line 7: correct ‘buns’ to ‘bins’
Pg 16,line 8: correct ‘Thus is exhibits’ to ‘Thus it exhibits..’
Pg 17, line 2: ..on emissions? I missed something in the manuscript? At this point, I would recommend to present an emission figure to gain some idea about its spatial distribution.
Pg 18, line 14: The use of word ‘underestimates’ is not correct, as we have no comparison of RF figures with observation: there is no information on the reference values of the RF, so it can possibly be that the 4 bin approach is closer to the reality.

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