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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Saharan dust transport and deposition towards the Tropical Northern Atlantic" *by* K. Schepanski et al.

Anonymous Referee #1

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Review on "Saharan dust transport and deposition towards the Tropical Northern Atlantic" by Schepanski et al

The need for a good aerosol transport models for climate studies is great. In particulars dust transport models that can reproduce realistic dust fluxes and depositions and help to estimate the true atmospheric dust loading. In this paper the authors describe a study of Saharan dust transport toward the Atlantic Ocean during the spring and summer of 2006 and the winter of 2006-2007.

In this paper two types of information are provided:

1) The model results and the possible explanation for the patterns in the different seasons, and

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2) The validations and comparison to remote sensing measurements (from space and surface).

The results presented here can be of interest providing that the authors will discuss the limitation of the model in depth. The validation and comparison to measurements part is weak. The authors do not provide sufficient explanations to the nature of remote sensing, to the physical advantages and disadvantages of the measurements from the surface and space, and some of the statements and explanations are wrong (listed below).

In most cases when there was disagreement between the measurements and the model the authors explain why the measurements are limited or wrong. I would suggest considering more the likelihood for problems in the model.

A key point that is missed in the paper: Dust models rely heavily on the accuracy of the winds and in particular the surface winds for source activation (threshold wind). After the source is activated and dust is emitted, the whole fate of the dust (transport, flux pattern and deposition) depends on the wind direction, speed and derivatives. The authors do not discuss the accuracy and the limitations of the wind properties in the model. Given the fact that the Sahara is not dense with ground measurements and meteorological stations that can provide profiles of the upper atmosphere regularly, the author should explain why they expect to have an accurate dust fluxes on a daily basis. Can this be part of the disagreement with the measurements?

More specific points:

1) Why Cape Verde in the winter? In the summer this station is located in the heart of the average dust plume, however the winter flux pattern is shifted southward and Cape Verde seats on the Northern Border of the plumes. The noise and sensitivity to small changes and to the model accuracy would be much greater then.

2) The measured AOD in the summers is mostly dust with contribution of marine

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8, S8159–S8161, 2008

Interactive Comment

aerosol and in the winter contains significant contribution of smoke. The authors should consider that when comparing the results.

3) Dust is not spherical - Why calculating the AOD as spherical (and not spheroids like in the AERONET retrieval). Currently MODIS can not consider non-spherical aerosol (due to limitation of the inversion) and therefore assumes spherical particles and retrieve the optical properties (AOD and fine-fraction). This is not symmetric to the model calculations. Having the dust loading and estimating the AOD of spherical particles can introduce significant differences to the measurements.

4) Linking AOD to mass: there are several insitu measurements showing numbers similar to the ones in Kaufman's paper. Based on the comments above the authors should re-estimate their constant and explain why it is so different form the insitu measurements.

7) The authors should use the CALIPSO retrievals of the dust vertical profiles for model validations.

8) Emissions and patterns of the Bodele are especially sensitive to the accuracy of the surface winds and to the model translation of the wind to dust fluxes. How accurate the model winds there? Isn't the Bodele too far from any meteorological station? Can the model be trusted on a daily resolution (in figure 8).

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16061, 2008.