Interactive comment on "Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model – Part 2: Experimental campaigns in Northern Africa" by K. Haustein et al.

Anonymous Referee #2

In this study, the performance of the new NMMB/BSC-Dust model is evaluated using data from the Saharan Mineral Dust Experiment (SAMUM) and the Bodélé Dust Experiment (BoDEx). The paper is well-written and the results of this model evaluation study provide important insight into the performance of the NMMB/BSC-Dust model.

After the following revisions are considered, I recommend this manuscript for publication in ACP.

General comments

The intercomparison between the model and the data is made rather qualitative. I would prefer to see a more quantitative intercomparison (for example by showing maps of the differences between the AOD modelled with NMMB and the AOD retrieved from the satellites, by showing scatter plots of modelled and measured dust parameters, and by specifying how much the model under-/overpredicts the measurements).

Specific comments

Abstract

p. 30275, l. 20: Please insert „of dust" after „(…) vertical distribution".

Model description

p. 30278, l. 20: Insert „NCEP-NMMB" between „the" and „model".
p. 30279, l. 26: What is the STATSGO-FAO database, and the NESDIS climatology? Could you give a little more detail?
p. 30280, l. 24: What is a dust spin-up? Could you give a little more background?
p. 30281, l. 18: Please insert the altitude of Ouarzazate: 1150 m a.s.l.

Observational data

p. 30282, l. 12: "without the presence of clouds" → outside of clouds
p. 30284, l. 14-15: repitition of p. 30283, l. 24/25
p. 30284, l. 23: "Angstroem exponent" → please indicate which Angstroem exponent (of extinction, of scattering, of absorption?) you are referring to.
p. 30284, l. 25-27: If the authors talk about background aerosols, are they referring to the vertical layering of the aerosols?
p. 30285, l. 5.: Insert "aerosol" between "vertical" and "profiles"

Results and discussion

I suggest to shorten this section (especially 4.1.2 and 4.1.2) in order to make the manuscript easier to read.
Furthermore, it is quite difficult to see the differences between the model, MODIS Deep Blue, OMI. Please provide additional plots showing the differences between the model and the various satellite products. This would it make much easier to see where the model performs well and where deficiencies are present.

p. 30286, l. 24: Why is the deviation between MODIS Deep Blue and OMI AOD so large over the Arabian Peninsula? Which product is more trustable in this case and why?

Section 4.1.2
Please provide (in addition to Figure 8 and 9) scatter plots showing the measurements of the AOD for the different stations together with the modelled AOD to evaluate the model performance.

p. 30288, l. 15: Please give more background, why (scattering?) Angstroem exponents with values larger than 0.6 indicate significant influence of fine anthropogenic aerosol.
p. 30288, l. 24: What is the reason for the overestimation of the AOD by up to a factor of 2 in Banizoumbou? Transport pathway of the dust plumes?
p. 30289, l. 24-26: Please reformulate to make clear that lidar and the radiosonde observations of the the boundary layer height are consistent while the model underestimates the boundary layer height.
p. 30293, l. 6: "Very large particles (…)" → What size range? Are the authors referring to the saltation mode?
p. 30293, l. 16-17: "(…) particles larger than 20 µm in diameter are not taken into account (…)". → I disagree with this statement. For example, measurements in the Cape Verde area showed dust particles larger than 20 µm in more than 30% of all measured cases (Weinzierl et al., 2011, SAMUM-2 special issue, Tellus 63B, 4). Other studies (e.g. Maring et al., 2003) even showed the presence of large super-micron particles in the Caribbean.
p. 30294 (and Fig. 15): Are the same averaging intervals used in the sun photometer data as used in the model?
p. 30297, l. 2: What is "alpha"?

Conclusions
p. 30299, l. 20: Insert "investigated in this study" after "SAMUM-1 period"
p. 30299, l. 24: "Inefficient dust sources are identified" → What is an ineffiecient dust source? Why is this dust source inefficient in the model? Please give more detail.

Figures
Figure 1: Please note that the Falcon research aircraft did not fly into Algeria.
For people not familiar with the location of the different countries in Africa, please indicate the names of the different countries in this figure. This would make it easier to follow the discussion in Section 4.
Figure 12: Please use height above sea level on the y-axis. Otherwise, a misleading conclusion could be drawn, if the humidity/mixing ratio data are compared with the lidar data and the reader does not know the altitude of Ouarzazate (1150 m a.s.l.)