

Comments on Mokhtari et al.:

General remarks:

The present manuscript search to quantify the dust emission and deposition over North Africa and establish a climatology of optical properties over the region using a 5-year simulation (2006-2010) of the ALADIN model which is coupled to the surface me SURFEX. The model results are compared against MODIS, CALIPSO and AERONET observations showing the ability of the model to reproduce the main dust patterns observed over North Africa.

While the results of the study are interesting to be published, their presentation and discussion are not yet sufficient enough to be published at Atmospheric Chemistry and Physics in the current form. The present manuscript is focusing on the model evaluation more than in the analysis of the processes associated to dust cycle or differences along the simulated period that can be affect the model results as changes in the land surface properties, for example. Therefore, I would suggest to the authors to resubmit the manuscript to Geoscientific Model Development (GMD).

General comments:

The manuscript demonstrate the ability of the ALADIN model to reproduce the main dust patterns observed over North Africa for the period 2006-2010. The authors include a set of observational datasets that focus to provide a database of dust optical properties, however only the aerosol extinction (AOT and extinction) is discussed.

In the current form, the present work is showing a model evaluation results and it would need to include to answer a particular question. Any sensitivity analysis to differences on the refractive index, single scattering albedo or size distribution is considered. Furthermore, an analysis of the processes associated to dust cycle or differences along the simulated period that can be affect the model results as changes in the land surface properties should be included in the manuscript. Also, if there is any new model development included in the present model configuration should be emphasized in the manuscript or a discussion that emphasize the improvement that represents to use a dust climatology based on a regional model instead to a global model.

Discussions of the results would be easier to follow if some statistics were included in the AERONET and MODIS comparison. Also, I would suggest to include a new sub-section in Sect. 2 with the description of the different observational datasets used in the model comparison. This new section will include a description of the different AERONET sites and satellite aerosol products used and their limitations in the dust model comparison as other possible aerosol species that can affect the discussion of the results or the temporal and spatial resolution of these products.

Minor errors:

Introduction Sect. should be updated with a more recent publications. For example, the latest IPCC report (IPCC, 2013) or the reference of the dust AEROCOM intercomparison (i.e. Huneus et al., 2010) are missing.

Page 5755 Line 18-19: The reference to the SDS-WAS is not well justify in the text.

Page 5757 Line 18-23: The calculation of aerosol optical properties should be described in more

Details because the optical properties is the focus of the present study.

Page 5759 Sect. 2.3: The model simulation begins 1 January 2006, or is there a spin-up period for dust concentration?

Page 5759 Line 14: Indicate the coordinate of the vertical layer (sigma?).

Page 5760 Line 13: In the comparison of ALADIN with the rest of the model results (global and regional), ALADIN is the model that provides highest emissions between the regional models meanwhile it is lower with the global. This should be better discussed in the text.

Page 5761 Line 14: Again, the authors are compared the results of the regional ALADIN model with a global model results from Tanaka and Chiba (2005). I would be desirable to include a discussion about the possible improvement that represents to use a regional model at 20km x 20km in comparison with a global model.

Page 5762 Line 21-22: the authors indicates “we show that the use of a three dimensional NWP model such as ALADIN significantly improves the climatology of wet deposition of dust aerosols”. This sentence needs to be better justified with the comparison with other model studies.

Page 5763 Line 3: In Fig. 5, Bodélé is not the region with the maximum deposition, only in winter we find maximum deposition in this region. This is consequence to low level dust transport during this period. This should be emphasized in the text.

Page 5764 Line 2: the climatology shown in Nabat et al. (2013), does it include the years analysed in the present study? It would be interesting that the authors would include it.

Page 5767 Line 16: There isn't any Soroa AERONET site in the AERONET website (http://aeronet.gsfc.nasa.gov/cgi-bin/type_piece_of_map_opera_v2_new). Could the authors check it?

Page 5769 Line 22: The model underestimations observed during summer are associated to convective dust storms (haboobs) that the models are not capable to reproduce (see Knippertz and Todd, 2012).

Page 5770 Line 6: “March” instead “Mars”

Page 5770 Line 10: There is also a model overestimation during July.