

GENERAL REMARKS

The study investigates the size distributions of mineral dust from North Africa after long-range transport across the Atlantic to Miami, Florida. Data stem from remote sensing instrumentation (MODIS, AERONET and MPL), in-situ data from impactor samples, reanalysis data (MERRA-2) and forward processing product GEOS-5 FP, and span over three dust seasons from June to August in 2014, 2015, and 2016.

The key finding of the study is that the surface mass concentrations of mineral dust provided by the reanalysis products overestimate the values from surface sampling slightly. Furthermore, the dust represented in the models is of finer granularity than reported from in-situ observations. Overall, the presented results suggest that model mean dust sizes by mass are too large with too much dust mass placed in the boundary layer. These conclusions are of interest for the scientific community and deserve publication in ACP.

The manuscript is clearly structured and in general terms well written. In few sections it lacks quantification of results, which requires modification. The manuscript can be accepted for publication in ACP after major revisions have been considered which are specified in the following. Revisions are classified major since the adjustment of diameters to either volume equivalent or aerodynamic equivalent may alter the main conclusions.

SPECIFIC COMMENTS

1. The abstract contains the conclusion “Measured near-surface dust mass concentrations slightly exceed model values, with most of the modelled dust mass in diameters between 2-6 μm .” The data shown in Fig. 6 show the opposite behaviour. Please clarify.

2. The results presented graphically in Figs. 5 -7 are described in the text only qualitatively as “robust correlation” (page 4, line 13), “slight underestimation” (page 7, line 22) or “clear correlation” (page 8, line 13). In all cases the results from a linear correlation analysis should be presented and discussed in the text.

3. The presentation and discussion of dust particle sizes lacks clarity. Size distributions were measured by a cascade impactor which sorts particles according to their Stokes number and thus aerodynamic equivalent diameter which assumes unit density (1 g cm^{-3}). The models use spheroidal particles to describe dust particles with given densities. All values are listed in Table 1, but there is a conversion missing from aerodynamic equivalent diameter with density 1 g cm^{-3} volume equivalent diameter with densities 2.5 to 2.65 g cm^{-3} . However, this conversion is essential for the comparison of the results and needs to be included. Furthermore, the title of column 4 should be modified from “Miami” to, e.g., “Miami impactor cut-off diameter”.

Figure 9 showing the results from the size distribution comparison need to be adjusted to the respective size classes after the diameters have been converted to one type (either volume

equivalent or aerodynamic equivalent). Besides adjusting the diameters of one data set to the other, no matter which serves as reference, the size distributions need to be presented as $dM/d\ln D$ or $dM/d\log D$, or dM/dD , whatever is preferred. Otherwise the size distributions cannot be compared.

Finally, Fig. 12 lacks explanation. To my understanding, it shows the vertical profiles of mass mixing ratios for the 5 size classes of GEOS-5 FP, and thus the vertical distribution of the total dust mass mixing ratio in the model would be the sum of the five classes. If this is correct, what is then the “Average”? Here, some explanation is requested.

MINOR ISSUES

Page 2, line 32: blank space between “a” and “MPL”.

Page 4, line 31: It might be easier to read if the equations are presented on a separate line.

Page 6, line 25: The Chapter title “Overview” is misleading. The title should contain an indication that here the presentation of results starts, e.g., “Overview of dust seasons from 2014 to 2016”.

Section 4.4: Figure 10 seems to be introduced before Figure 9, please check.

Page 9, line 35: use lower –case letter after comma.

Page 11, line 8: the term “ $\tau_{aer}s$ ” is confusing, since it also may refer to the product of aerosol optical depth τ_{aer} and a property s . Please rephrase.

Page 22, Figure 2: please remove the points from the plot where no data are available. The current plot is heavily misleading.

Page 28, Figure 8: it would be of high relevance to the variability range of the average frequencies connected to the respective mass concentration bins. Please show $\pm 1\sigma$ as error bars.