

Interactive comment on “Modulation of Saharan dust export by the North African dipole” by S. Rodríguez et al.

Anonymous Referee #2

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The authors examine the summer interannual variability in African dust transport and identify a relationship between this summer transport and large-scale meteorology in western North Africa. Combined analysis of surface dust concentrations at the high altitude Izaña station for the years 1987-2012 together with satellite data and NCEP/NCAR meteorological data revealed that the African dust transport over the north Atlantic is linked to the gradient in geopotential height between the subtropical Sahara and the tropics. An index (called North African Dipole Index in the text, NAFDI) quantifying this gradient was defined as the difference of the 700 hPa geopotential height anomalies averaged over Morocco and over Bamako. The authors find that for summer with high NAFDI the dust transport is enhanced associated to stronger easterlies compared to summers with low NAFDI with lower dust concentrations at

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Izaña due to weaker zonal winds. The research presented is interesting, the paper is well written and the results contribution to further understand the interannual variability of African dust transport over the North Atlantic. I recommend this paper to be published in ACP but I have several comments, suggestions and questions that I would recommend to be addressed before its publication.

General comments

1. Although the authors provide additional information of the dust surface concentrations in the supplement I consider that important information should be provided in the text. The authors mention daily data in the text but the analysis is done in terms of monthly data. How is the monthly average computed, more specifically how is the NAFDI computed, taking only days with surface concentration data or taking all days? Same is valid with respect to the satellite data. Furthermore, the authors mention that two databases of dust surface concentration exist for the analyzed period, which one was used for the study? This should be clarified.

2. Although the high and low NAFDI summers are defined in caption of Figure 2, this should be made explicit in the text. In addition, the authors should explain why the define high and low NAFDI summers only taking 3 years. Why were the years 1994 (high NAFDI) and 2002 (low NAFDI) excluded?

3. Section 2.3 mentions that back trajectories were analyzed but no mention is made of this analysis neither in section 4 presenting the results nor in the conclusions. Either include some of the results in the text or remove this analysis completely from the manuscript. The supplement is made to provide additional information or to support the results presented in the study. If the back trajectories is not linked somehow to the results and is not even mentioned then I don't see the point of having it in the supplement at al.

4. Section 2.4 describes how the dust surface concentrations are processed. I suggest moving this paragraph to section 2.1 where the surface concentrations are presented.

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5. The authors make references to the supplement throughout the text but without specifying which figure, table and/or section they refer. The authors should facilitate the task to search the information in the supplement to the reader and specify which part is meant each time the supplement is referenced.

6. Figure 4 presents correlations between the NAFD with different parameters (zonal wind, MDAF and precipitation). Is this done for all summers, high NAFDI summers or Low NAFDI summers? I'm surprised by the negative correlations over ocean and continent in the subtropical band. From Figure 2 we see that low NAFDI summers we have weaker winds than summers with high NAFDI, shouldn't that give a positive correlation? A negative correlation between NAFDI and zonal wind tells me that while one increases the other one decreases. Doesn't a negative correlation contradict the result that enhanced dust transport is linked to the NAFDI and is associated to stronger easterly zonal winds? Please clarify. How exactly is this figure produced?

7. The results show that in general, enhanced dust surface concentrations in the summer coincide with and increase in the NAFDI. This is illustrate in Figure 5a and is seen for most of the years in Figure 1a. The authors then analyze the meteorological large-scale condition and link the enhanced surface concentration to increase of zonal wind in the subtropics. Only three summers are used to define the high NAFDI summers and three for the low NAFDI summers. Yet, years exists where low dust surface concentration is not matched with low NAFDI (1991 and 1994), in particular for the year 1994 with a NAFDI equivalent to the year 1987. The latter was defined as a high NAFDI year and used in the analysis. The authors should explain or at least discuss why these years the link high NAFDI and high dust surface concentration does not apply.

Specific comments

Page 26691, lines 15-18: I suggest reformulating these lines with parenthesis within parenthesis.

Page 26693, lines 10-16: I suggested reformulating these lines, too long and unclear.

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Page 26693, line 18: remove “the” in “in the summertime”.

Page 26696, line 6: include “the” after “studying”.

Page 26699, Eq 1: why is there a 0.1 in the equation? Please clarify.

Page 26704, line 6: replace “latutudes” with “latitudes”.

Page 26715, Figure 2: Although the latitudes are provided in Figure 2d, please include them again in Figure 2a and 2b, it makes it easier to read them.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 26689, 2014.

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