

## ***Interactive comment on “Pivotal role of the North African Dipole Intensity (NAFDI) on alternate Saharan dust export over the North Atlantic and the Mediterranean, and relationship with the Saharan Heat Low and mid-latitude Rossby waves” by E. Cuevas et al.***

**Anonymous Referee #2**

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General Comments I state at the outset that I am not a meteorologist although I am quite familiar with aspects of African meteorology related to dust events and much of the literature related to dust and meteorological forcing. So my review is as an informed “user” of meteorology in this field of research. That said, there are aspects of this paper which I do not fully understand – but this may be because of my limited background.

This paper builds on an earlier paper (Rodriguez et al., ACP, 2015) where they introduced the concept of the North African Dipole (NAFD). They developed an index

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(NAFDI) that was defined by the relationship of high pressure over the Sahara and low pressures over the tropics. They showed that the large interannual variability in long-term (1987 to 2014) dust concentrations measured at Izaña Observatory (on Tenerife, Canary Islands) could be explained by variations the intensity of the NAFD over the period and that dust export could be related to changes in rainfall patterns and wind fields linked to NAFD. The present paper further examines the role of the NAFD by bringing in a broader range of satellite and meteorological products and by extending the time period of the study. As a result they revise the index that quantifies the North African Dipole Intensity (NAFDI) and show that the Saharan Heat Low (SHL) and mid-latitude Rossby waves play a role in the NAFDI.

The paper addresses an important topic - the factors driving the variability of dust transport out of North Africa. There are interesting aspects to this paper especially as they could eventually be linked to climate variability over time. However the paper is difficult to read. It is too long and detailed. I became lost in the many facets of the discussion. This could be due to the fact that I am not a research meteorologist. There are many aspects of the paper that make sense to me but there are others that I do not understand in the context of the topic.

My recommendation is that this paper has the potential to make a significant contribution to the field but it will require substantial revisions before it is suitable for publication.

MAJOR COMMENTS 1. Length: Aside from the readability problems that might be due to my limitations, there is clearly a tendency in this paper to ramble on. An example is the abstract which is far too long and far too detailed. It would discourage many readers before they reached the body of the paper.

2, Objectives: The background and the objective of the study are not clearly stated. Nor are the conclusions. It should start with the statement of the problem (i.e., the role of dust in climate, the need to understand the response of sources to meteorology and the variability thereof). Then a sentence on the old definition of NAFDI and then

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address the effort to revise it and why. The section on p 4, line 25 is a more clear statement of what is done. It could be paraphrased in the abstract. The abstract would end with a discussion of results but much simplified from the present discussion which is too detailed and not understandable by the reader without having read the paper.

3. Significance: In general, it is difficult to relate the NAFDI to real-world results. How does the NAFDI approach relate to other efforts in this field? Many papers address specific meteorological systems that seem to drive dust events. How does the NAFDI relate to these other approaches? There is much reference to statistical metrics to show that the new NAFDI improves on the old. But it is not clear if the improved statistical significance is of practical "significance". For example, on page 29, line 14: "As a result, the total dust concentrations measured at the Izaña Atmospheric Observatory in August months (from 1987 to 2014) and the NAFDI time series for that period show a better Pearson correlation coefficient between them when using the improved NAFDI (0.72 instead of the value 0.67 that is obtained when using the original NAFDI definition)." It is not obvious how this improvement is manifested in a larger sense and how this compares with other efforts to characterize dust export. To me, figures such as Fig. 1, 2, 3, 4, 8, 9, etc. are more persuasive than Fig. 11 and 12 for example.

4. Conclusions. This section provides some interesting insights. But there is a lot of discussion in this section that should not be a part of "conclusions". Many of the insights are lost in the very long and convoluted text.

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