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***Interactive comment on* “The regime of desert dust episodes in the Mediterranean based on contemporary satellite observations and ground measurements” by A. Gkikas et al.**

Anonymous Referee #4

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This paper analyzes the mineral dust transport events above the Mediterranean area and using measurements. The results show the frequency of occurrence of dust aerosols as a function of geographical area (western or eastern part of the Mediterranean region) and the season. The analysis covers seven years. The authors conclude that they have characterized a decreasing trend of dust episodes over the years due to the NAO index decrease.

In general, the article is too long compared to the amount of reported results. Figures and tables should be reprocessed as often difficult to read. The last section on the backtrajectories provides little information. The "new algorithm" is a combination of

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threshold, already known and used in the literature. A novelty could be to calculate distribution for each criterion in order to take into account the uncertainties attached to each parameter used. A key point of the study is presented in section 3.1: this is not possible to directly correlate surface PM₁₀ measurements (even if this is "background" stations) and long-range transport of mineral dust plumes, coming from Sahara and crossing the Mediterranean area at altitudes often between 2000 et 5000m. The authors cite articles clearly showing there is no obvious between these two quantities. However, they used this assumption to validate their algorithm. Another weak point is the number of data used: there is more available PM and AOD surface measurements, especially in the eastern part of the Mediterranean area. Why the authors did not use all these data? This is a crucial point in case of a statistical study, searching for trends. With the low amount of data used here, the validation of the multi-threshold algorithm is not ensured and the trends results are thus certainly not statistically representative.

For the moment, this article is not acceptable for publication in ACP and needs a lot of improvements.

The abstract is very long and not represents really a synthesis of the results. The classification of the dust episodes needs some clarification: a common episode lasts 1 day, a strong episode 6 days and an extreme one 4 days: how do the authors use the words "strong" and "extreme"? The introduction is very complete and clearly presents the state of the art in this domain. The authors claim that "the novelty of the paper lies in its complete coverage of the region". This is probably true, but not sure: the bibliography on the dust studies in the Mediterranean area is huge and this is always risky to say that we are the first. Even if this is the case, a spatial coverage extension is not really sufficient to justify the publication of a scientific paper in a peer-reviewed journal. I encourage the authors to delete this statement and to more focus on real and important results in the abstract. The others sections are, in general very long and contains a lot of bibliography: they could be certainly shortened to go directly to the novelties of this work. The conclusions are already well known and review papers exist

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showing all these results (see for example Scheeren et al., 2003, ACP; Millan et al., 2005, J. of Climate; Rodriguez et al., 2007, Environ. Chem. Lett.; Kulmala et al., 2011, ACP; among others).

The table and figures need some work to be readable and useful. The colors in the table are not very useful. It could be better if the authors provide directly in the caption the thresholds used to segregate the events. The figure 1 is not very useful as it: there is no need to have a picture but just informations on the map. This map clearly shows there is no data used in the eastern part of the domain. The flowchart in figure 2 is not very useful, since only one two lines are different, depending on strong or extreme episodes, and 'land' and 'sea'. The authors can remove this figure and just write: "over the sea, the additional criterion of $r_{\text{eff}} > 0.6$ is applied" (to add line 288). The map in figure 3 is difficult to read: difficult to link the size of the circles to the values. Try another way to express this result. The scatter-plot is not readable: even if point exist for high concentrations/high AOD they are not numerous and are masking the real informations for $\text{AOD} < 1.5$ and $\text{PM} < 200 \text{ ug/m}^3$ (and not ugr/m^3). Figure 5, 6 and 7 are certainly done with a basic plot software: the trinagles are completely unrealistic and this is not possible to publish results like this. The graphical software interpolate all results and clearly show the lack of data. Use square to plot values only where data are available, as in Figure 8. The Figure 10 has no interest: the trajectories are covering the whole region and we can see nothing.

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