Atmospheric
Chemistry
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Discussions

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Interactive
comment

*Interactive comment on* "North African mineral dust sources: new insights from a combined analysis based on 3D dust aerosols distributions, surface winds and ancillary soil parameters" *by* Sophie Vandenbussche et al.

**Anonymous Referee #3**

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General comments

The analysis gives compelling new evidence on dust emission sources year-round and is an important contribution to the dust source literature for North Africa, with some especially interesting insights on the role of the Sahel. The methodology is well described and the analysis is focused. My main concern relates to the distinction of morning and evening emission events and their link to mesoscale meteorological emission mechanisms, as well as the use of reanalysis winds. One more minor comment is a suggestion to improve the introduction. See below for all comments.

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Discussion paper

Major comments

1. The results have some interesting implications in the debate on the role of meteo-rological emission mechanisms and in this paper it's suggested that morning (09:30) dust is linked to LLJ breakdown. I feel if this is link is going to be explicitly made in the paper, the following questions arise in the context of summertime: a. 09:30 is close to the timing of LLJ emission, but during summer isn't it plausible that most observable dust at this time is still due to cold pool outflow (CPO) activity from the night before, especially if the CBL hasn't developed to mix it out of the bottom 1km? See Allen et al. (2013) for issues with using emission timing to infer emission mechanisms. At a glance, SEVIRI also shows much more dust at 09:00 compared to 21:00, but based on Caton Harrison et al. (2019) this appears to be mostly residual CPO dust. b. Can these results be reconciled with evidence from the literature that CPOs are the primary driver of dust emission during summer?

2. I am not aware of any evidence that ERA5 is capable of representing winds as-sociated with CPO activity. Could this algorithm risk unfairly excluding many of those events with high CPO winds that are severely underrepresented in ERA5?

3. For the introduction: please consider discussing more the challenges and oppor-tunities associated with satellite dust source detection/analysis? Maybe less space could be devoted e.g. to the microscale details of dust emission to accommodate this. I feel it would be beneficial to explicitly justify the current research in the context of the literature, other than just providing 'still another approach'. How has dust source de-tection been accomplished and what exactly is missing that this work addresses? If it's the vertical component, please also compare with previous attempts at this, e.g. Todd and Cavazos-Guerra (2016). See also Bakker et al. (2019) for a recent dust source analysis in ACP. A preprint article by Chédin et al. (2019) on IASI dust observations (https://www.essoar.org/doi/10.1002/essoar.10501119.1) may also be of interest.

4. Surface and soil moisture thresholds (algorithm steps 5 and 6): is there any way you

could give a sense of what proportion of pixels which would have otherwise passed were filtered out by this step? It looks from Figure 4 like mainly the Sahel region will be affected. As you identify later this is a crucial factor as our understanding of Sahel dust sources is limited.

5. Figure 5: The Tademait Plateau itself seems quite unlikely to be a dust source, compared to the large array of sebkhas in the Tidihelt basin directly south (e.g. see Ashpole and Washington, 2013) – please double check whether the plateau is actually collocated with your results?

Technical corrections

A few small grammatical/language issues need addressing but don't affect general readability. Some examples are "estimate on" rather than "estimate of", sentence starting "The Angstrom exponent..." on L124, L191 "that data set" instead of "this data set", L308 "All area"...One repeated error is the use of "allows to" or "allowing to".

L25: "Saharan"

L90: The Ashpole and Washington scheme temporal sample is 2004-2010, which is long but only applied for summer, and the geographical area is the western Sahara which is not complete but does not seem small?

L103: "This eventually..." sentence unclear, please rephrase

L105 ", and," remove first comma

L116 "allows to gain" rephrase

L118: "estimate on" -> "estimate of"

L128 "by contrast" more appropriate than "on the contrary"

L134 "provide very good prerequisites" unclear – perhaps a "good basis"?

L135 Minor but the first point is stated here for the first time whereas 'in a nutshell'

implies it isn't.

Paragraph 1 of section 2.1 would make more sense at the start of section 2

L187 "scares" -> "scars"

L200 "a hint to..." I'm not sure what this means. Perhaps you mean that the corresponding figure is referenced in the schematics?

Figure 2: a discrete colour bar would be much easier to read than a continuous one. The same applies to all other map figures.

L236 Not clear what "those" refers to

Section 4.1 please refer to the label numbers in Fig 5 as you discuss geographical locations.

Section 5.1 please continue referring to label numbers in Fig 5 where possible.

L402 should be "two pieces of evidence"

L451 "emissions do..." unclear, please rephrase

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