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Atmospheric Chemistry and Physics Discussions

Interactive comment on "How important are cyclones for emitting mineral dust aerosol in North Africa?" *by* S. Fiedler et al.

Anonymous Referee #1

Received and published: 11 February 2014

Review of the paper 'How important are cyclones for emitting mineral dust aerosol in North AfricaÂă?' by S. Fiedler et al.

This paper presents a very interesting study on the contribution of depressions and cyclones in mineral dust emissions over North Africa. In the first part of the study, depressions and cyclones are identified and analyzed. This part is clear, well documented and minor revisions are requested. I am less convinced by the second part of the study, when the impacts of these atmospheric components in the dust emissions are discussed. Here, results should be presented differently and this part suffers to a lack of additional studies to better assess the role and the impacts of the atmospheric forcing on dust emissions.

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My main concern is the too simple attribution of the dust emissions to a depression or cyclone without deeper analysis of the intensity of these components. In this study the authors consider the simultaneous presence of dust emissions and synoptic component as a causal relationship. AEWs and HL present a large temporal variability of intensity that could influence differently the 10m wind field and so the dust emissions. Also, the contribution of the convection is not enough taken into account. The large scale components (and more specifically the cyclones) could be decomposed in two different classes following if they are associated or not with convection and with cold pools. The authors should also present the contribution and mechanisms involved with dust emissions not associated with depression or cyclone.

Also, before to analyze the contribution of each component on dust emissions, the authors should discussed the impacts of these components on the 10m wind speed distribution.

Finally, reanalysis are less good to represent fine scale processes, especially cold pool, this tends to promote large scale origins of dust emissions. This also should be discussed.

Detailed commentsÂă:

p32488 l9Âă: I am not sure that the reference (Todd et al) is well adapted here.

P32488 l29Âă: Please add this reference about the origins of AEWsÂă: Leroux, Stephanie, Nicholas M. J. Hall, George N. Kiladis, 2011: Intermittent African Easterly Wave Activity in a Dry Atmospheric Model: Influence of the Extratropics. J. Climate, 24, 5378–5396.

p32491 l23Âă: About the point 3. I am not convince by the method to exclude heat lows. A decreasing core pressure could be also associated with heat low.

P32494 l4Âă: In figure 2 and in the text '... with 40-100 events in the 20-yr period ...', the authors should present the results in term of occurrence probability instead of

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number. That takes into account the duration of the events and will be more useful when the impacts of these events on dust emissions will be discussed.

P32495 l10ÂÃ: How do the authors explain the presence of depression in the Senegal coastÂÃ?

P32498 l10ÂÃ: The authors should show the occurrence probability of the depression over the Sahara during the year and for each season. The heat low is always detected over Sahara in summer. That means that the authors consider all dust emissions are associated with the heat low during this summer periodÂÃ? The authors should use the intensity of the depression and analyze the influence of the hl activity on the 10 m wind field then the contribution on dust emissions.

p32499 The section on seasonal climatology is too descriptive. Please reduce this subsection and clarify the most important results.

P32501 l29ÂÃ: 'This results gives evidence ...' Please compare these results with the occurrence probability of each component. The heat low is present all year long. It is statistically evident to find a contribution larger than an another rarer component. The comparison between the ratio of dust emission contribution vs. the occurrence probability should be done.

P32503 l5ÂÃ: Could the authors clarify the method to distinguish each quadrant. Maybe these quadrants should be relative to the cyclone displacement instead of East/West.

P32505 l7ÂÃ: 'The diurnal ...' it is difficult to interpret this figure since these emissions occurred at different places following the season.

P32506 l21ÂÃ: Where does the soil moisture data come fromÂÃ?

P32506 l26ÂÃ: This paragraph is not clear. Could the authors clarified the method used to assess the soil moisture impactsÂÃ?

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Figure 5Âă: Please simplify the orography.

Figure 7Âă: Please add the annual occurrence probability of depressions (and its radius of influence).

Figure 8Âă: As previously, the occurrence probability of depressions should be added.

Figure 10 and 11, same as previously. Ratio of dust emissions should be compared with the occurrence probability.

Figure 14Âă: The authors should compare these distribution with dust emissions that occurred without cyclone. Without this kind of comparison, I am not sure to understand the interest of this figure.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 32483, 2013.