

Review of "How important are cyclones for emitting Mineral dust aerosol in North Africa?" by Fiedler et al.

Manuscript ID: ACPD 13, 32483–32528, 2013

General comments:

The study constitutes an investigation on the dust emission over North Africa associated with cyclones and depressions. Although it contains some new findings, it needs substantial revisions prior to acceptance for publication.

Major Comments:

- Validity of the approach:

The study has a major problem regarding the approach used to evaluate the dust emission associated with depressions. The authors gave conclusions based on the coincidence in time and space between the presence of depressions and dust emission. But this doesn't mean that one is caused by the other. Add to this that most of the time depressions are present together with other mechanisms involved in dust emission in North Africa. I'm not sure the amount of dust emission you attribute to depressions in the paper is actually exclusively due to depressions. The majority of the results and conclusions related to the depressions part of the paper are based on this method and I have a great doubt on their representativeness and validity. The method, results and conclusions regarding this part should be revisited or you can shorten the paper to the cyclone part which is more convincing.

- Validation of some results against observations:

What one would expect from this study is to see some use of the available observations on dust emission over North Africa to validate some of the results that are driven exclusively from models and reanalyses. There is for example a great opportunity to consider the SEVIRI observations that are now available for many years and in high temporal and spatial resolution to validate the results on the climatology of the cyclones for example, but also to validate the model regarding dust emissions and many other possibilities that will give highest impact to the results described here.

- The link between wind and dust emission:

There is big assumption made here; the authors calculate the dust flux based on wind reanalyses and soil humidity, but there is a lot more that is crucial for dust emission. One of these factors for example is the availability of materials at the surface to be emitted by strong winds. How this factor is taken into account? Is the model used for dust emission was tested and validated against observations

- Missing important mechanisms for dust lofting

Many of the well-known mechanisms for dust emissions over North Africa are missing in this study (for example dust emission by the monsoon front in the intertropical discontinuity region e.g. Bou Karam et al 2008, dust emission by dry cyclones in the same region e.g. Bou Karam et al., 2009, dust emission by density currents from cold pools that migrate over the Sahara e.g. Flamant et al., 2007; Bou Karam et al., 2014, etc..). Consider mentioning them when you make the overview on the mechanisms for dust lofting in the introduction. Also, these mechanisms are present generally during summer i.e at the same time as the Heat low and associated depressions. Moreover they are often present in the same area. How the

authors can be sure that the dust flux they calculated is related to one mechanism (here depressions) and not to the others?? Again the approach used here is light and not convincing (see my first comment).

- Estimation of the error associated with the numbers you give:

The results are based on model calculations, what is the error associated with the numbers you give? How confident one should be in reading them? Is the model used was able to produce realistically dust emission associated with cyclone (validation via a case study)? Does it over or under estimate dust emission (both its localization and amount)?

Consider adding a paragraph on the estimate of the error associated with your results, it is very important for the reader to know how close to the reality are the numbers you give both on the climatology and on the dust emission mass especially that these results are based on models and it is well known how it is difficult for the current models to simulate dust emission over North Africa (e.g. the introduction of this paper).

- Appropriateness of abstract, introduction and conclusions

Since the results after revisions based on the above comments may be quite different from the current ones these parts of the manuscript need to be revisited after revisions especially the conclusions on dust emission related to depressions.

Specific Comments:

- The title doesn't say anything about depressions although great part of the paper is on this, why?

- P32484 'In summer, depressions, particularly Saharan heat lows, coincide with up to 90% of the seasonal total dust emission over wide areas of North Africa'. Coincide doesn't mean they are caused by. It is well known that dust emission is highest during summer because of many other factors than the heat low. See my main comment number 1.

- P32486 Harmattan Surge: I'm not convinced what you call Harmattan surge is a separate feature than cyclone. Although they occur a bit far from the visible cold front and cloud band of the cyclone these winds are linked to the cyclone and stop when the cyclone stops. The cyclone is mostly visible due to the cloud band which is over a much localized area, but it affects a larger area than the visible one (e.g. Bou karam et al., 2010). The paper you cited to justify this use (Knippertz and Fink, 2006) doesn't deal actually with cyclone but with an extratropical front dust emission during which Harmattan surge occurred. Consider rectification.

- P32491 You describe the method by from Schepanski and Knippertz (2011) and then you say 'The criteria from Schepanski and Knippertz (2011) used to filter tracks of Sudano-Saharan depressions are not applied here', it is confusing, describe directly what is used in the present study.

- P32493 The way you define the cyclone-affected area in my opinion is not enough to cover all the area affected by the cyclone (see also my comment regarding Harmattan surges) although the horizontal extend of the Saharan cyclones is about 10° it doesn't mean that the

wind fields beyond this area are not affected. This will lead to an underestimation of the dust emission associated with the cyclone.

- Pages 32496 and 32497 consider citing Bou Karam et al., 2009 that deals with cyclones connected to AEWs.
- P32499 Paragraph 3.5.1 is too descriptive, can be more concise.
- P32502 Paragraph 3.5.2 Consider my comment on the definition of cyclone-affected area above.
- P32505 Line 7 to 26 too long and repetitive, consider simplifying.
- P32506 Line 21. Or the difference can be due to the fact that with depressions you have the dust emission of all the other mechanisms. See my major comments number 1 and 4.
- P32507 line 7 to 9, sentence not clear.

Figures

- Figure 6: Consider improving the font size, it is very small and hard to read.
- Figure 14a: The colors used are hard to distinguish.