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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The climatology of dust aerosol over the arabian peninsula" *by* A. Shalaby et al.

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1-The title does not incorporate the second main objective of this article (dust aerosol radiative forcing estimation). Could it be that it is rephrased accordingly, without being much longer?

We have changed it to be

"The Climatology of Dust Aerosol and its Radiative forcing over the Arabian Peninsula"

2-the abstract should be rewritten after all comments are taken into account, so that it serves as a concise and complete summary of the article. line 13: the sentence is too long. It could split in two: e.g., obs and model findings (the latter in comparison to obs.,

plus clearly showing similarities and reasons for discrepancies) or which is the cycle? how the model performs and why?

We have changed the abstract to reflect all changes proposed by the reviewers

3-Introduction. In general: although I could guess that after the first two introductory paragraphs, the next two present previous studies with respect to each objective, I advise that this should be more straightforward and clear. The second paragraph, although with clear content, is not directly linked to this study, as described in the subsequent introductory paragraphs. The third paragraph, although it describes previous work on dust over the Arabian p., it does not indirectly start revealing (in conjunction to the next introductory paragraphs) the new/original contribution of the current study. Please, modify accordingly. I would suggest another thorough search in literature with respect to the appropriate references to the same/similar subject. Also, I suggest removing 'this paper focuses. . .' before this description. It is not specified in the introduction (last paragraph) how the model complements measurements (or vice versa) in the current study. Also, the term (or concept) climatology (long term study) is not at all referred in the introduction (either for this and/or the other studies).

Thank you so much for this suggestion, We rewrote the introduction to reflect the idea of the paper, added updated references which is more recent. The study objectives become clearer and consistent with the new section's structure.

4-Sect. 2.1: I would expect the authors take in mind the two short comments posted, regarding data usage. The same for the comments of Reviewer #2 on reduce/elimination of unneeded data. An idea: it would be more helpful to provide a table for each set of obs., instead of sect. 2.1.1- 2.1.4. Please, have in mind to provide all data so that the work could be reproduced by other fellow scientists. Regarding section 2.2, I would only keep the last paragraph of 2.2.1. the rest two can lie in a table in the supplement. In this table, all other schemes/model configuration information named in sect. 2.2.3 can fit, too. Again, have in mind to provide all information so that the model runs could

be reproduced by other fellow scientists. Sect. 2.2.2 can be merged into 2.2. The first paragraph of now sect. 2.2.2 should be removed, only references should occur, where one can find information on the dust uplift processes. Then, again only information related to how Regcm model incorporates already existing functions should remain. Descriptions that already exist in the source citations should be avoided. The ones found absolutely necessary to be duplicated, can be moved to an appropriate section in the supplement. Please, advice previously published supplemental material for their appropriate format/structure. All in all, subsections of 2.2 are unnecessary. After a short reference to the model, to its aerosol and dust treatment and to the table for all the incorporated processes/ modules, a short description of model period/domain and scenarios (if any) can follow and close this section.

Yes, we have considered the two shorts comments. We Updated the MODIS data set to collection 6 deep Blue and update the corresponding analysis.

I have cut all unnecessary and indirect information. All technical information about the datasets and the model specification with corresponding sources references have been provided in supplement material.

Now this section becomes Methodology with two sub sections one for the observation data set and one for Model description.

5- Sect. 3.1: It is not clear to the reader (in general in this article), why you use both the model and observations (although one can guess, this is not enough). You do not explain how the one complements the other. Also, reasons for their discrepancies are not given (eg different resolutions?? And /or known model discrepancies of the relevant modules, shown either from sensitivity tests or from previous regcm applications). From figs 2 and 3, it is evident that both obs and preds give the same information. . .thus, why coexist? Please explain /support your tools. Why both fig 2 and 3 are necessary? What information stems from the one that does not stem from the other? To my view, figure 3 is representative for this section. Figure 2 –if necessary- could be move to the

supplement. If I am incorrect, please justify. In general, I do not get the structure in the results sections 3 and 4: you mention spatial and temporal evolution, while previously you have already talked about the annual cycle and specific regions. I would advise you to have one section as 'Results' and then each subsection should represent a clear concept answering to a specific question (eg model evaluation, dust climatology etc).

These are the crucial points, in the introduction and Methodology section, we emphasized on the role of the model. Along the manuscripts we try to explain, what the sources of uncertainties are, in the model simulation.

We moved figure 2 to the supplement and kept figure 3 for the zonally averaged annual cycle instead.

We restructured the manuscripts to have in one section, namely Results, the AOD climatology, radiative forcing, model validation and atmospheric circulation.

6-Section 5: again, it is not clear why you use both model and obs. You mention 'comparisons' but what do they serve existing throughout the article? To my view, the question is 'dust radiative forcing' and the answer should be given with the main tool of this study. Assuming this is the model (which should be mentioned explicitly if true), then measurements only serve as evaluation tools. But, if observations can answer the same question, then why use the model? An obvious advantage of predictions vs. obs is the extended spatial distribution of the radiative forcing. But if I am not mistaken, it is not shown here. Shouldn't figure 11 and the respective paragraph describing it be among the first results of this study? These are the emissions that are then advected through the atmosphere. Or, in case it is only used to explain the main results, it should be placed in the supplement. There is the potential to provide substantial conclusions, although currently the respective section needs rewriting

This section of radiative forcing has been combined with the section 3 as described in the previous point. Also we added a new figure that shows the spatial distribution of the radiative forcing.

7-Specific notes on parts of the paper (text, figures, tables) which should be reduced, combined, or eliminated are given here and in the attached pdf. The amount and quality of supplementary material should be modified as advised in the relevant comments The language is quite fluent and precise. Where appropriate, specific directions are given. Please do a thorough check on the correct definition and use of the symbols, abbreviations, and units.

We have checked all notes and changed correspondingly according to the new structure.

8-Technical corrections: they are provided in the attached pdf Please also note the supplement to this comment

1-Abstract

Abstract has been shortened and concentrated on main results

2-Page 3 line 10: “About 2000 Mt is emitted”

About 2000 Mt of dust is emitted

3-Page 3 line 13 “also it acts”

Indirectly, they act

4-Page 7 line 13:

The description of the each station feature is removed to Section 3.2

5-Page 12 line 19: “The stars indicate the locatin of the AERONET stations that will be used for model validation”, only these data are used for validation

The chosen three stations (Kuwait university, Solar-Village and Mezair) has the longest data record compared to the other AERONET stations in the Arabian Peninsula. That why we chose these stations. This has been explained in section 2.

5-Page 13 The whole manuscripts has been restructured as the following:

1-Inroduction 2-Methodology 2.1 observation dataset 2.2 simulation design 3-Results 3.1 AOD annual cycle 3.2 model comparison with AERONET and Satellite 3.2.1 Kuwait University 3.2.2 Solar-village 3.2.3 Mezaira 3.3 Dust aerosol radiative forcing 3.4 Atmospheric circulation and Land-surface response 3.4.1 Spring season 3.4.2 Summer season 4-Summary and Conclusions

6-Page 13, line 1: start with what tools you use in this section and why you select them instead of the others for this specific analysis.

This is considered in the revised manuscript

7-Page 15 line 1+: This line has been deleted

8-Page 16 line 1+: the first sentence of each 3.2 subsection is maybe better placed before subsections, so that one reads the reasons for examining regions separately.

This done by putting the all sites description in the last paragraph in section 3.2

8-Page 17 line 11: “(Table 3)” has been corrected to be Table 1

9-Page 22 line 15: this and the next paragraph, are not results. please remove. the necessary info should be placed/merged with the relevant one in the introduction.

This is done be moving what is relevant to the introduction

10-Page 23 line 6: please inverse (sect 5.1 is boarf not toarf). in general, try to be consistent with the order of appearance of the parameters/goals etc. throughout text.

The two sections have been rewritten in section 3.3 in the revised manuscript

11-Page 23 line 15:”TOARF”, full expression and abbr. in parenthesis

Has been considered in the new subsection 3.3

12-Page 23 line 17:”(BOARF)”, no parenthesis

Has been corrected

13-Page 25 line 14: very long sentence, focusing to the comparison rather than the actual findings. please split and focus on the questions/answers you aim at.

We have rewrite the conclusion to be more concise

14-Page 41: Figure 5 and Figure 6 captions have been modified

15-Page 45 and 46: Figures captions have been modified

16-Page 49 : Figure 13 caption has been modified

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 1523, 2015.