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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of dust storms on the Arabian Peninsula and the Red Sea" *by* P. Jish Prakash et al.

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Review 2 – RESPONSE

>This study presents a case study of dust event that occurred during 18-29 March 2012 over Arabian Peninsular using WRF-chem model with the GOCART aerosol option. Their model simulation successfully captures the strong dust event over the Arabian peninsular during the period also captured by the Satellite and AERONET remote sensing observations. They also estimated the radiative effect of dust event at surface is -10W/m2. In general the study may contribute to better understand the role of the dust storm over the region, but the paper still needs some major issues to be considered for publication.

We have used the WRF-CHEM model with the GOCART dust emission scheme. For calculating aerosol microphysics in this study we have used the Modal Aerosol Dynamics Model for Europe (MADE). In this case-study we have aimed at quantifying dust aerosol impacts associated with aerosol mass generated during the dust storm, dust transport and deposition. These characteristics are not measured in this region and are not well known.

>The validation of the dust AOD is shown in Figure 8 and 9. How about emission, deposition, mass concentration? Are MODIS and AERONE the only available observations for the time and region? Evaluation of simulated dust would be the most challenging part of modeling study, however authors should put more effort on validation and they need to add more discussion about the uncertainly of the model results.

The validation of model results is challenging over the Arabian Peninsula because of insufficient observations. This was discussed in the introduction. Moderate-Resolution Imaging Spectroradiometer (MODIS) is the most trusted aerosol sensor on the NASA Terra and Aqua satellites that provides aerosol optical depth. Aerosol Robotic Network (AERONET) is a global network of ground based CIMEL robotic sunphotometers that retrieves aerosol optical depth for multiple wave-lengths and is the most reliable ground-based aerosol network. As AERONET sites are sparse over the Arabian Peninsula, we have established our own AERONET site, which is the only one at the Arabian west coast, and used those observations in this study. The direct observations of dust emission and deposition in this area are not available. However, the aerosol optical depth provides a reliable constrain to aerosol amount as it could be converted to aerosol loading provided we know aerosol specific extinction coefficient.

>They compare WRF meteorological field with ERA-I reanalysis. It seems model generally capture the reanalysis, but I noticed that the WRF strongly overestimates the surface pressure on May 19 (Fig. 2e-f). The discrepancy is important since the differenceshall influences the dust emission, deposition, and loading in Figure 3,5, and 9. It should be improved and discussed in the manuscript.

Figure 2 compares sea-level pressure from simulations (left column) and from reanalysis (right column) for March 17-19. It shows propagation of the cold front from the Eastern Mediterranean that was captured well in the model simulations. Figure 2f from reanalysis for March 19 was erroneously substituted by the field for March 17. We corrected this (see figure below). In new Figure 2 simulations compare with observations extremely well.

>The text is lengthy and it needs to be greatly improved. First, the 6-page long introduction provides wide review of dust modeling, but many of them are not necessary for this study, rather they may distract the focus of this paper. These redundant texts appear in many other places especially in results sections. Although improving manuscript is the authors' responsibility, I will give some example as follow: 1. P19198, L15-22: The case in this sentence is for the Asian dust. What's the purpose of comparison with yours?

Here we compared dust deposition calculated in the different studies with our results and show that our simulations give similar dust deposition mass as in other studies.

>2. P19199,L15-P19200,L4: This is not result. Suggesting remove it.

Here we estimated the amount of dust deposited to the Red Sea annually. We consider this an important result, as this is the first estimate of dust input to the sea drastically needed for biological studies. We believe we have to report this result.

>3. P19201,L8-P19201,L11: This senstence is not relevant.

This is the acknowledgement of the previous process study.

>4. P19201,L13-P19202,L5: This sentence is not result. It could be removed.

This is a discussion of processes responsible for vertical distribution of dust that affects the dust long-range transport.

>5. P19202,L15-P19202,L19: Same. Not relevant for result section.

Removed

>6. Same for Section 3.4: The entire section can be greatly improved by removing text that discusses previous studies.

We agree that the text has to be improved and shortened, and the results section has to be cleaned. However, we believe that in some cases it is necessary to compare our results with those from the other studies, so we have to retain some discussion in the results section. We hope the reviewer will agree with this compromise.

>Yong-Seung and Ma-Beong (1996) should be Chung and Yoon (1996)?

Thanks, changed.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 19181, 2014.

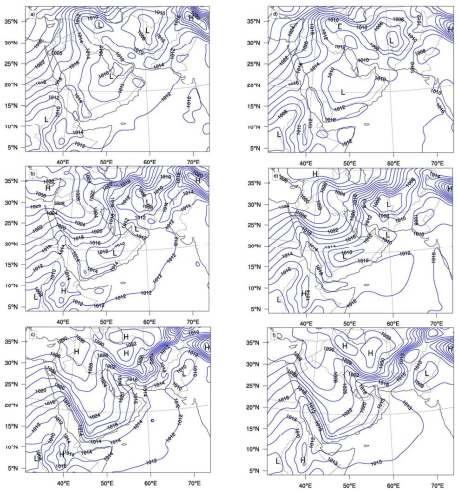

Fig. 1.