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Comment

## ***Interactive comment on “Aerosols optical and physical characteristics and direct radiative forcing during a “Shamal” dust storm, a case study” by T. M. Saeed et al.***

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Aerosols optical and physical characteristics and direct radiative forcing during a “Shamal” dust storm, a case study Saeed et al. Received: 28 May 2013 – Accepted: 19 August 2013 tm.saeed@paaet.edu.kw

Response to interactive comment posted by A.M. Sayer on 19 September 2013.

We thank Dr. Sayer for his valuable comments, for guiding us through MODIS products and for providing us with a reference list. Here is a detailed response to the comment. For the sake of clarity the commentator’s paragraph have been pasted between

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parenthesis while the response is stated below each paragraph.

“The authors state (p.23904, lines 24-26) that the limited data coverage is “most likely due to the over bright signal of dust retrieved by MODIS which was discarded by the applied algorithm as it was confused by the bright signal of clouds.” This is not the case. In fact, the algorithm for the land part of the dataset the authors appear to be using (MODIS Dark Target) is specifically designed not to perform retrievals over bright land surfaces (e.g. deserts, snow) as the assumptions built into the retrieval algorithm are not appropriate for these cases. This was one of the motivations for the original development of the Deep Blue algorithm, provided in the same MODIS product files, which does provide retrievals over some of these surfaces, and so is able to fill in some of the gaps in Dark Target coverage in these regions. The authors may therefore wish to look at the Deep Blue data for additional insight into aerosol loading over the Arabian Peninsula. Deep Blue is also available through the Giovanni portal, and, having just checked, happily there is some coverage on those days. Unfortunately the present version of Giovanni does not, to my knowledge, allow a ‘fusion’ of Deep Blue and Dark Target/ocean data directly, so you’d have to go back to the source data files to create one (rather than use Giovanni).”

Chapter 4 has been modified accordingly. Aerosol optical thickness product from Aqua and Terra MODIS level 3 collection 5 Deep Blue algorithm have been obtained and are presented in the revised manuscript.

“Additionally, the mass concentration product in Figure 9 is not validated and is probably not quantitatively reliable (I believe it will be removed in the next MODIS version), so I would suggest the authors remove it. The only quantitative aerosol property retrieved in this version of the datasets is the AOD, and (in some cases over ocean) the Angstrom exponent, so I would suggest that sticking to AOD only is probably the most sensibly.”

We thank the reviewer for the suggestion. The mass concentration product has been

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removed and since our interest is in dust aerosol properties over land only, Angstrom exponent product has been removed as well.

“It looks like this figure is more illustrative for the paper than crucial to the main analysis, but I thought these points worth mentioning, to aid the authors in this and future studies, and avoid possible over interpretation of/misconceptions about the data. Here are some recommended key references for the current and forthcoming MODIS aerosol products: Hsu, N. C., S. C. Tsay, M. D. King, and J. R. Herman (2004), Aerosol properties over bright-reflecting source regions, *IEEE Trans. Geosci. Remote Sens.*, 42, 557–569. Hsu, N. C., M.-J. Jeong, C. Bettenhausen, A. M. Sayer, R. Hansell, C. S. Seftor, J. Huang, and S.-C. Tsay (2013), Enhanced Deep Blue aerosol retrieval algorithm: The second generation, *J. Geophys. Res. Atmos.*, 118, 9296–9315, doi:10.1002/jgrd.50712. Levy, R. C., L. A. Remer, S. Mattoo, E. F. Vermote, and Y. J. Kaufman (2007), Secondgeneration operational algorithm: Retrieval of aerosol properties over land from inversion of Moderate Resolution Imaging Spectroradiometer spectral reflectance, *J. Geophys. Res.*, 112, D13211, doi:10.1029/2006JD007811. Levy, R. C., Remer, L. A., Kleidman, R. G., Mattoo, S., Ichoku, C., Kahn, R., and Eck, T. F.: Global evaluation of the Collection 5 MODIS dark-target aerosol products over land, *Atmos. Chem. Phys.*, 10, 10399-10420, doi:10.5194/acp-10-10399-2010, 2010. Levy, R. C., Mattoo, S., Munchak, L. A., Remer, L. A., Sayer, A. M., and Hsu, N. C.: The Collection 6 MODIS aerosol products over land and ocean, *Atmos. Meas. Tech. Discuss.*, 6, 159-259, doi:10.5194/amtd-6-159-2013, 2013. Remer, L. A., and Coauthors, 2005: The MODIS Aerosol Algorithm, Products, and Validation. *J. Atmos. Sci.*, 62, 947–973. doi: <http://dx.doi.org/10.1175/JAS3385.1>”

The references have been included in the paper.

Response to the second comment poster by A. M. Sayer on 7 October 2013.

We would like to thank Dr. Sayer for his follow up and interest in the discussion.

“The reviewer’s comments suggest the additional consideration of MISR data as a

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source of AOD/Angstrom exponent information. I would agree in suggesting that they look into this. MISR is quite a powerful tool for this purpose although compared to some other sensors, has the disadvantage of a narrower swath width, limiting the spatial completeness of sampling. However, happily, I believe MISR does provide some coverage over the authors' region of interest during this period."

Due to the narrow swath of MISR, it did not adequately cover our region and days of interest and therefore it is dismissed.

"The reviewer also refers to Ashpole and Washington and Ginoux et al, and several other papers later, for dust source maps. I concur that these are valuable studies, and also wish to thank the reviewer on a personal note, as I had been unaware of one or two which were mentioned."

The references provided have been included into dust source discussion.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 23895, 2013.

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