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Interactive comment on "Satellite retrievals of dust aerosol over the Red Sea, 2005–2015" *by* Jamie R. Banks et al.

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We thank the reviewer for their helpful comments, and we include our responses below:

1) "Page 4, line 4: The MODIS 'Dark Target' algorithm typically refers to the dark target algorithm over land not ocean. It is important to make it clear that the retrieval over ocean is different and distinct to the dark target retrieval over land."

As with point 3 made by Andrew Sayer, we agree that this is a very relevant point. We have amended the text accordingly.

2) "Page 4, line 8: MODIS is 250 m, 512 m and 1 km (depending on band), not 10 km."

It is true that the MODIS measurements are made at spatial resolutions of 250 m, 512 m, and 1 km, and this is stated in the text. It is the AOD derived products which have a resolution of 10 km: for clarity we have included the statement that this is the resolution of the AOD data within the L2 products.

3) "Page 10, line 8: The SEVIRI retrieval uses measurements over a smaller spectral range (630–1610 nm) than that of the MODIS retrieval (550–2110 nm). Is it possible that the larger wavelength at 2110 nm provides additional sensitivity to large dust particles for the MODIS retrieval compared to the SEVIRI retrieval? Likewise the measurements used for the MISR retrieval have even a smaller maximum wavelength and likewise the MODIS AODs are positively biased relative to the MISR AODs."

We agree that the spectral ranges are an important point when considering the capabilites of the retrievals, and to the discussion on page 11 (Section 5) on possible explanations for the SEVIRI/MODIS discrepancy we add the sentence: "Similarly, another contributor to the discrepancy may be the different spectral ranges used by the retrievals: while SEVIRI only uses the 630 nm channel for this AOD dataset, the MODIS ocean AODs are retrieved using a combination of six of the MODIS channels between 550 and 2110 nm, which may increase the information content of the MODIS retrieval and hence the MODIS retrieval may be more sensitive to high loadings of large desert dust particles."

4) "Page 11, line 4: Maybe say "Taking MISR retrieved AODs" or in some other way make it clear that MISR is still just another retrieval and should not be taken as truth."

'Taking MISR AOD retrievals as our reference' is now our introduction to this paragraph (was Page 11, line 4), to remind the reader that MISR AODs are also retrievals and not the absolute truth.

5) "Page 11, line 10: In addition to the non-spherical dust analogues present in the MISR retrieval, as pointed out by the author, MISR makes measurements at multiple view angles which will help resolve a larger range of the single scattering phase function than possible with either SEVIRI or MODIS. This should be taken into account if further discussion of the implication of the sphericity assumption is added."

Indeed, MISR's observations at multiple viewing angles should help provide the MISR retrieval with more information about the aerosol particle scattering. We now include in this paragraph the sentence: "Moreover, the fact that MISR measurements are made at multiple viewing angles allows for increased resolution of the observed aerosol particle scattering, and hence a more constrained knowledge of the phase function."

6) "Page 11, line 10: It may be instructive to compare plots of phase functions for dust particles with and without the spherical assumption for this discussion."

In the third paragraph from the end of Section 5, where we discuss Figure 10, we also describe the spherical and non-spherical dust phase functions analysed by three previous authors.

7) "Page 19, figure 1, line 3: A new sentence should start between "contour" and "note"."

There is a full stop between 'contour' and 'Note'.

8) "The tendency for the MODIS AODs to be positively biased against both the ship borne measurements and SEVIRI AODs may have something to do with the Ångström exponent due to its use to scale the AOD at 550 nm to that at 675 nm and 630 nm, respectively. It may be useful to compare the MODIS Ångström exponent to the AERONET retrieved exponent at the KAUST AERONET site or to that of the SEVIRI

retrieval."

It is worthwhile to explore the Ångström coefficient in more detail, we agree, and so as the penultimate paragraph of Section 5 we include MODIS/AERONET comparisons of the retrieved Ångström coefficient over both KAUST Campus and Abu Al Bukhoosh. We do not include SEVIRI in this analysis due to the fact that the inferrence of the Ångström coefficient is not a validated product. MODIS Ångström coefficient values seem to be biased high aginst the AERONET values, consistent with what has been reported before by Levy et al. (2003, JGR). MODIS Ångström coefficient values are greater over Abu Al Bukhoosh than over KAUST, indicative of the more industrial environment of the Abu Al Bukhoosh site on an oil platform. The MODIS positive bias is not however due to its overestimate of the Ångström coefficient, since the AOD-scaling using the Ångström coefficient is negligibly different between the MODIS and AERONET values. In fact the MODIS overestimate of Ångström coefficient actually implies an underestimate of the scaled-AOD at 630 nm.

9) "It might be instructive to compare the Ångström exponent of dust over the Red Sea from east and west sources. Likewise, it may be useful to do the same thing when comparing dust over the Red Sea with that over the Persian Gulf."

In the final paragraph of Section 6 we now compare the Ångström coefficients at the basin-scale between the Red Sea and the Persian Gulf. Interestingly, while the mean Ångström coefficient over the Red Sea is 0.67, over the Persian Gulf it is distinctly higher, at 0.96. This is a signifier of the more heavily polluted urban-industrial environment of the Persian Gulf, a major centre for global oil extraction.

10) "The fonts on some of the plots are a bit small and should be increased in size."

The font sizes on several of the plots have now been increased by a couple of points.

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