

Interactive comment on “An observationally-constrained estimate of global dust aerosol optical depth” by David A. Ridley et al.

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This is a very nice work, which will provide a better constrained mean dust load and optical depth. Still, I wonder about some biases related to satellite data in general, and MODIS Deep Blue in particular. The authors note a lack of bias in MODIS AOD based on the scatter plot of daily values at AERONET sites. However, these sites are characterized by different aerosol environments and surface albedo. Uncertainties related to satellite retrieved AOD between sites will be different. In Figure 3 of Ginoux et al. (Rev. Geophys., 2012), you will notice very different biases between regions. For example Australia is biased high, while Africa is slightly biased low. Although this study was done with Collection 5.1, similar results are obtained with Collection 6, but with

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much more reduced bias in Australia. My point is that there is very little information we can extract from your Figure 2. A better approach would be to also plot seasonal variation at dusty sites (e.g. Tamanrasset, Birdsville, Solar Village, Dunhuang, etc.). I am also concerned about your method of temporal average of observations. If you consider only days with retrievals you will have a high bias, as you discard all days with dust being washout and rainout (low dust). This will be also true for AERONET data. But, it is unclear which method you are using. None of the models simulate dust from agricultural regions or with dynamic vegetation. Their contribution is highly uncertain but may affect your results regionally. Finally, you are most likely using MODIS quality flag 3 (QA=3) aerosol products, as advised by Sayer et al. (2013). However, it is not a good choice over dust sources as clearly shown in Figure 1 of Baddock et al. (Geophys. res. Lett., 2015). This choice of QA=3 may induce a low bias, if you use all days rather than just days with QA=3. On the other hand, if you divide the sum of all valid AOD by the number of days with QA=3, you will again create a high bias. In fact, it may be very high in some areas. Take a look at the factor 10 difference of frequencies between QA=1 and QA=3 in Figure 1 of Baddock et al. (2015).

Hopefully this will help improve your results.

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