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Atmospheric Measurement Techniques Discussions

Interactive comment on "Critical evaluation of the MODIS Deep Blue aerosol optical depth product for data assimilation over North Africa" *by* Y. Shi et al.

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The manuscript provides an extensive evaluation of MODIS collection 5 and selected samples of collection 6 Deep Blue (DB) aerosol products with the goal of identifying and quantifying product uncertainties for potential usage of the DB products in model aerosol assimilation. Based on their data uncertainty evaluation the authors develop new quality assured DB level 3 AOD products.

The paper brings up the important topic of satellite data uncertainty requirements for aerosol product usage in model assimilation, and it builds on the previous work done

by the group. The paper is well written, the motivations are clear, and it is relevant for AMT. The authors demonstrate deep understanding of satellite data (that is not trivial in the case of the DB algorithm) and potential retrieval artifacts. The methods and the product developed in this study are useful for the wider modeling community.

I have only a few general comments that mainly concern the analysis of the satellite data. The technical comments are very well summarized in the review by Dr. Colarco.

1. The authors claim that the regional dependence of the DB retrieval performance is suggestive of microphysical biases. It is not clear why that is the main reason. The major limitation of MODIS Deep Blue Collection 5 is that the surface reflectance database is static (it is essentially the minimum reflectance observed over the length of the MODIS mission, with a few adjustments, for a given season). I suspect that this may also be an important source of regionally/seasonally-dependent error.

2. The potential sources of uncertainty are identified in this work as angular dependence, aerosol microphysics, surface albedo, and cloud contamination. The authors do not consider another important source of uncertainty, which is the surface elevation. The retrievals at UV and "deep-blue" wavelengths are very sensitive to the height of aerosol and surface because the Rayleigh contribution to the radiance is large at short wavelengths. Elevated terrain is expected to lead to biases as pressure is not accounted for explicitly (only via the observed reflectance from the database), nor is aerosol elevation.

3. The DB Angstrom exponent is pre-defined by the aerosol models contained in the look up table. Therefore the DB Angstrom exponent will not necessarily relate to the AERONET fine mode fraction.

I strongly recommend this paper for the publication after addressing above comments, and those that were pointed out by Dr. Colarco.

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