Review of AMTD manuscript 2016-237 by Wang et al.

This paper attempts to quantify brown carbon absorption using the AERONET data base of aerosol extinction optical depth and single scattering albedo as well as aethalometer measurements at a number of stations. The approach used in this analysis has been used in previous studies [Schuster et al., 2005; Russell et al., 2010, to mention a few], strangely ignored in the literature review. An innovative component of this work is the combined use of surface and space based AAOD retrievals for the estimation of aerosol absorption exponent. There are several issues in the paper that need to be addressed.

The use of annual average AAOD values in Figure 2, ignores the seasonal variability of aerosol type. It would be more illustrative to plot instead seasonally averaged data and identify in a table the sites used in the analysis. I suspect the analysis presented in section 2 will change substantially if seasonal AAOD data is used.

The seasonal maps showing the 10-year average of seasonal mean BrC-AAOD (as indicated in the caption of Figure 3) look very strange to me. I wonder if that is really what is being plotted. I am very surprised by the number of AERONET sites having 10 years of observations over the 2005-2014 period. Most sites shown on those maps do not have a continuous ten year record. Surprisingly the seasonal maps of derived BrC-AAOD based on AERONET observations do not show the expected AAOD hot spots in the Sahel (DJF), Southern Africa (JJA, SON), and Amazon Basin (SON). The only known hot-spot correctly showing is the Southeast Asia (MAM). I suspect these maps are more a representation of the geographical and temporal bias of AERONET observations over the 2005-2014 period than an actual representation of the AAOD load as intended by the authors. The number of sites in SE Asia and China has increased significantly over the last ten years. On the other hand, the coverage over Southern Africa has gone down significantly. A better description and explanation of this map is needed. I suggest to re-do these maps using a more careful selection of sites making sure that the temporal coverage is similar for all used stations.

Other comments:

Page 6, line 24. Abundant biomass burning also takes place in Northern South-America and the Sahel during NH winter. Also in the NH Spring there is intense biomass burning in Southeast Asia and Central America.

Page 9, line 1. Add the Torres et al [2014] reference that describes the latest algorithm upgrades.

Page 9, line 8. Nowhere in the quoted references, is it said that OMI and AERONET AAOD have a correlation > 0.8 as stated by the authors. They incorrectly imply that OMI and AERONET AAOD have been directly compared citing papers that refer to AOD validation. Both OMI AOD [Ahn et al. 2014] and SSA [Jethva et al, 2014] have been compared to AERONET produced values. The authors need to read the papers and correctly quote them.

The title of the paper is confusing because both AERONET and aethalometer data are obtained by means of surface observations. The title should also reflect the fact that OMI observations are used in the estimation of the reported results. Suggest changing title to 'Deriving brown carbon absorption from multi-wavelength absorption measurements: Method and applications to AERONET, OMI and Aethalometer observations'

References:

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Schuster, G. L., *O. Dubovik*, *B. N. Holben*, and *E. E. Clothiaux* (*2005*), *Inferring black carbon content and specific absorption from Aerosol Robotic Network (AERONET) aerosol retrievals*, *J. Geophys. Res.*, *110*, D10S17, doi:*10.1029/2004JD004548*.

Torres, O., Ahn, C., and Chen, Z.: Improvements to the OMI near UV aerosol algorithm using A-train CALIOP and AIRS observations, Atmos. Meas. Tech., 6, 5621-5652, doi:10.5194/amtd-6-5621-2013, 2013.

Jethva, H., O. Torres, and C. Ahn (2014), Global assessment of OMI aerosol single-scattering albedo using ground-based AERONET inversion, J. Geophys. Res. Atmos., 119, doi:10.1002/2014JD021672.