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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quantifying the single scattering albedo for the January 2017 Chile wildfires from simulations of the OMI absorbing aerosol index" *by* Jiyunting Sun et al.

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Thank you very much for your advice! Please find our responses to your comments in supplement file. Thank you very much!

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2018-40/amt-2018-40-AC3-supplement.pdf

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-40, 2018.

This document contains the responses to the editor's comment on the manuscript version 2, followed by a version 3 manuscript (starts in page 8). The reviewers' comments and questions are in bold. For each comment / question, the authors' reply / answer is in black, and the corresponding modifications in the manuscript version 3 are marked in blue color.

Author's response to the editor

Thank you very much for your comments on our manuscript. In the followings please find responses to your comments.

Your manuscript # amt-2018-40 has received comments and suggestions from two anonymous reviews for which you have just submitted a response addressing their concerns. Thank you. Along the review process, I have read your paper and gave some thoughts on the research content. As I understood, the concept of the retrieving aerosol SSA in the near-UV region by constraining AOD quite resembles to the methods presented in Satheesh et al. (2008) and Gassó and Torres (2016). Both earlier studies, and the results of your own paper demonstrate that it is possible to retrieve aerosol SSA and layer height from the color ratio information (UVAI) in the near-UV given the AOD as an a priori and a pre-defined aerosol model. It was a surprise that your paper completely misses to discuss and cite these two papers relevant to the present study.

We have read the two research papers we missed out upon that you mention in the comment. We appreciate the studies you suggested here (the publication of Satheesh et al. was actually published in 2009). From our view, the goals and / or the methods of these two studies do not resemble to ours. Satheesh et al. (2009) provided a hybrid retrieval method by combing OMI and MODIS measurements, and Gassó and Torres (2016) aimed to discuss the discrepancy between OMAERUV AOD and other independent measurements. But both studies did discuss the relation among aerosol layer height, aerosol concentration, and aerosol absorption, thus we have included them in the introduction part.

Satheesh et al. (2009) used a hybrid approach to retrieve aerosol layer height (ALH) and aerosol single scattering albedo (SSA). They combined the OMI aerosol product (OMAERUV), which is sensitive to ALH and aerosol absorption, with MODIS's accurate aerosol optical depth (AOD), which is insensitive to ALH. Their study has a similar object as ours, that is to retrieve SSA from satellite measurements, but the method is not the same. Both studies retrieve ALH and SSA from given a priori aerosol models. Satheesh et al. used MODIS AOD as the parameter to constrain the operational OMAERUV retrieval, while we use the absorbing aerosol index (AAI). The role of AAI used in Satheesh et al. (2009) is a qualitive parameter to distinguish absorbing aerosols from non-absorbing ones.

Specifically, Satheesh et al. (2008) extrapolated MODIS AOD to the near UV band. Using this MODIS-produced AOD to constrain the standard OMI AOD inversion procedure (OMAERUV) allows to derive improved ALH and SSA (that specified in the LUT). In our study, we used MODIS standard AOD at 550 nm to constrain the radiative transfer calculation in the forward simulation, and used OMI measured AAI to constrain the backward retrieval of ALH and SSA. Furthermore, Satheesh et al. (2009) only compared the SSA retrieved with the hybrid-algorithm with that retrieved with the standard OMI algorithm SSA. They did not validate it with measurements from other instruments such as AERONET.

Satheesh et al. mentioned the difficulty of extrapolating MODIS AOD from visible band to 388 nm where OMI requires the AOD information for retrieval (especially difficult for small particles, e.g. biomass burning aerosols). They first applied a linear least square fitting (log-log scale) for AOD as a function of wavelength, then they improved the method by including information on the AOD spectral curvature. The relation between UV and visible AOD may provide some clues to determine the relation between UV and visible SSA and refractive index, and it is worth to study in a separated research. Satheesh et al. also mentioned that measurements of aerosol absorption in the UV spectral range are rare, which makes it difficult to validate the retrieval results. We met similar difficulties in determining the spectral dependence of aerosol properties from

Fig. 1.