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Atmospheric Measurement Techniques Discussions

Interactive comment on "Spatial distribution analysis of the OMI aerosol layer height: a pixel-by-pixel comparison to CALIOP observations" *by* Julien Chimot et al.

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The paper presents the retrievals of aerosol layer height from OMI O2-O2 absorbing band and evaluate the retrievals with CALIOP. The retrieval method was published already, which is based on neutral network algorithm trained with data from radiative transfer calculation. Overall, the paper is interesting, and I recommend it be published after the following comments are addressed.

1) The introduction part discussed pros and cons O2 A band. how about O2 B? Both Xu et al. (2017, cited already) and Ding et al. (2016, see below) showed from real data and theoretical calculation that O2 A and B are complimentary to each other for retrieving ALH at different altitude. This is because their combination provides a wider

range of different O2 optical depth, thereby allowing to characterize aerosol layer at different altitude. I recommend that both Xu's paper and Ding's paper should be added in the introduction to talk about O2 B band.

Ding, S. et al., 2016, Polarimetric remote sensing in O2 A and B bands: Sensitivity study and information content analysis for vertical profile of aerosols, Atmospheric Measurement Techniques, 9, 2077-2092, doi:10.5194/amt-9-2077-2016.

2) Equation 1. Comparing ALH with CALIPO. Xu et al. (2017) used the same method to evaluate ALH retrieved EPIC/DSCOVR, and their better found a better statistics, although their analysis over the over ocean. In case of O2-O2 method, this reviewer is curious how well the final results (using AHL and AOD for forward calculating) can agree with OMI spectra in O2-O2? Because O2-O2 absorption optical depth is small, it has the disadvantages to retrieve high altitude aerosol layer. Is there any limit where retrieval uncertainty is too large? Regardless, some discussion on how the results compare with some existing techniques can be more helpful to the readers.

3) How the shape of aerosol profile is defined? Is it Gaussian distribution, and how the width of profile is assumed? In Xu et al. (2017), the assumption of the width is based on field data. Globally, will the width have any effect on retrieval?

4) In several plots, the retrieved AHL appears to be for aerosols above clouds (such as Figure 7 -14 - -12 degree). In such cases, how AHL from CALIOP is computed? Cloud contamination seems very high in all cases showed.

5) Non-spherical dust phase function. It is surely important, but in many cases, especially in Asia, dust and spherical particles can co-exist, and only consider non-spherical particles are not sufficient as shown in the following paper. Does the difference bewteen AHL vs. CALIOP counterparts as a function of scatting albedo show any indication of dust non-spherical effect? It will be interesting to see if the difference as scattering angle is flat or random for smoke particles.

Wang, J. et al., 2003, The effects of non-sphericity on geostationary satellite retrievals of dust aerosols, Geophys. Res. Lett., 30, 2293.

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