Global Assessment of OMI Aerosol Single-scattering Albedo Using Ground-based AERONET and SKYNET Inversions

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Abstract

We compare the aerosol single-scattering albedo (SSA) retrieved by the near-UV two-channel algorithm (OMAERUV) applied to the Aura/Ozone Monitoring Instrument (OMI) measurements with an equivalent inversion made by the ground-based Aerosol Robotic Network (AERONET). This work is the first comprehensive effort to globally compare the OMI-retrieved SSA with that of AERONET using all available sites spanning the regions of biomass burning, dust, and urban pollution. An analysis of the co-located retrievals over 269 sites reveals that about 46% (69%) of OMI-AERONET matchups agree within the absolute difference of ±0.03 (±0.05) for all aerosol types. The comparison improves to 52% (77%) when only 'smoke' and 'dust' aerosol types were identified by the OMAERUV algorithm. Regionally, the agreement between the two inversions was robust over the biomass burning sites of South America, Sahel, Indian subcontinent, and oceanic/coastal sites followed by a reasonable agreement over north-east Asia. Over the desert regions, OMI tends to retrieve higher SSA, particularly over the Arabian Peninsula. Globally, the OMI-AERONET matchups agree mostly within ±0.03 for the aerosol optical depth (440 nm) and UV-aerosol index larger than 0.4 and 1.0, respectively. We also compare the OMAERUV SSA against the inversion made by an independent network of ground-based radiometer called SKYNET with its operating sites in Japan, China, South-East Asia, India, and Europe. The advantage of the SKYNET database over AERONET is that it performs retrieval at near-UV wavelengths which facilitate the direct comparison of OMI retrievals with the equivalent ground-based inversion. Comparison of OMI and SKYNET over currently available sites reveals a good agreement between the two where more than 70% of matchups agree within the absolute difference of 0.05.

Datasets

- Aura/OMI newly re-processed aerosol product OMAERUV (version 1.4.2, Collection 3, Level 2) obtained from Goddard Earth Sciences (GES) Data and Information Services Center (DISC)
- Aerosol Robotic Network (AERONET) derived Level 2.0 inversion product of single-scattering albedo (440 nm)

Co-location

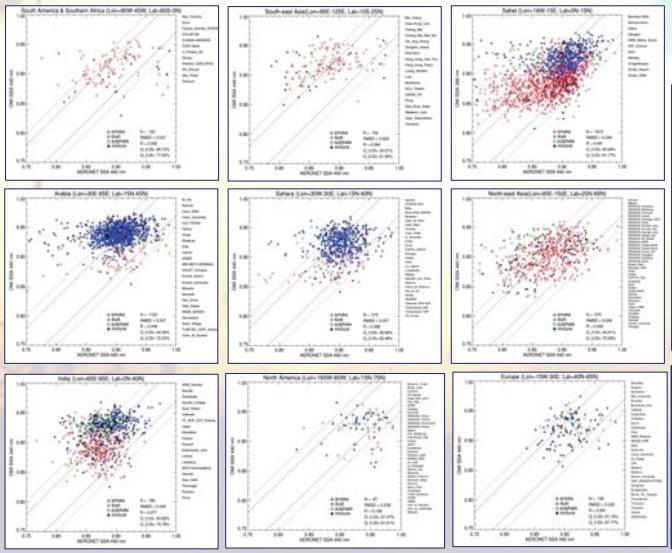
- OMAERUV retrievals (UV-AI>0.5) were spatially averaged in a 0.5 deg square box centered at the AERONET site.
- AERONET SSA inversion (AOD440>0.4) were temporally averaged within a time window of ±3 hours of OMI overpass time.

Wavelength Conversion of OMI SSA

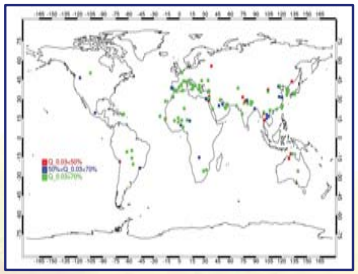
- Shortest AERONET wavelength : 440 nm
- OMI retrieval wavelength : 388 nm
- OMI SSA interpolated to 440 nm using its 388 and 500 nm retrievals

SKYNET

- An independent network of sun-sky radiometer
- Multi-year record over Japan, China, India, South-East Asia and Europe
- Availability of SSA at UV and VIS wavelengths (**340, 380, 400, 500, 675, 870, 940, 1020 nm**)



Map of AERONET sites depicted with colors where the color represents % of total OMAERUV vs. AERONET matchups that fall within the absolute difference of 0.05.



References

Torres, O., C. Ahn, and Z. Chen (2013), Improvements to the OMI near-UV aerosol algorithm using A-train CALIOP and AIRS observations, *Atmos. Meas. Tech.*, 6, 3257-3270, doi:10.5194/amt-6-3257-2013

Jethva, H. O. Torres, C. Ahn (2014), "Global Assessment of OMI Aerosol Single-scattering Albedo using Ground-based AERONET Inversion, *J. Geophys. Res.*, Accepted

Ahn, C., O. Torres, and H. Jethva (2014), Assessment of OMI near-UV aerosol optical depth over land, *J. Geophys. Res. Atmos.*, 119, doi:10.1002/2013JD020188.

Updated OMI/OMAERUV Algorithm (V1.4.2)

Torres et al. (2013)

New Carbonaceous Aerosol Models

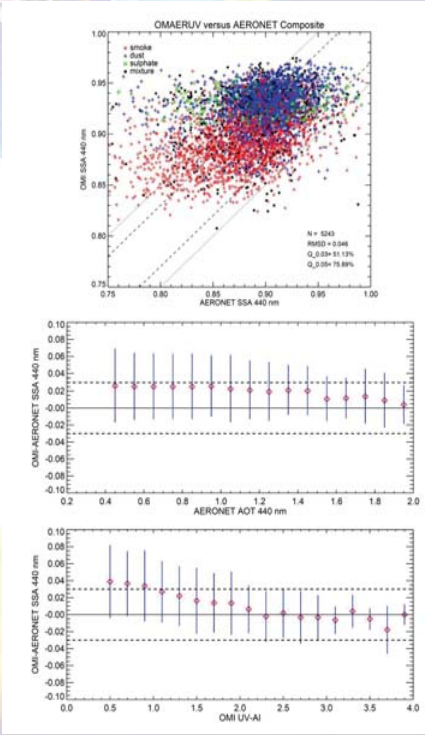
- accounting the presence of organics in biomass burning aerosols

Use of AIRS CO in conjunction with UV-AI

- robust discrimination of SMOKE from DUST

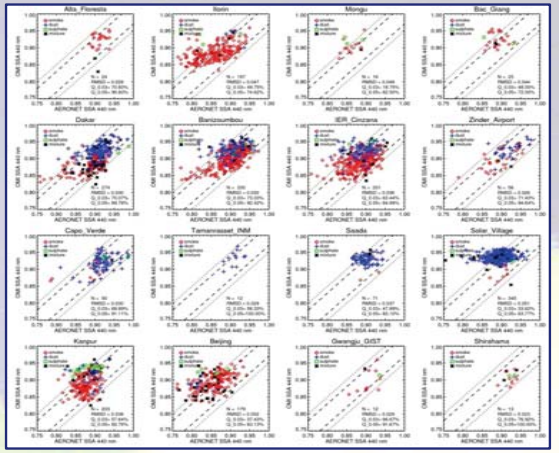
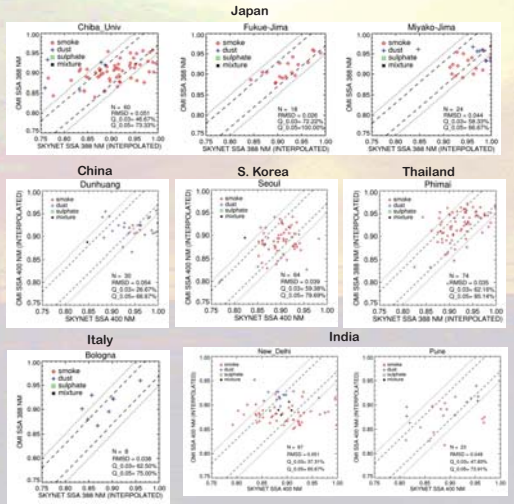
Determination of mean aerosol layer height using CALIOP-based climatology

OMI-AERONET Differences as f(AOD, UV-AI)



Both inversions converge to similar solutions at higher AODs and UV-AIs

- *A comparison between AERONET/SKYNET and OMAERUV SSA measurements does not constitute a validation analysis since both measuring techniques are based on inversion algorithms that rely on assumptions. The resulting level of agreement can only be interpreted as a measure of consistency (or lack thereof) in the measurement of the same physical parameter by fundamentally different remote sensing approaches.*
- First comprehensive effort to compare the OMI-retrieved SSA against that of AERONET globally using all available sites spanning the regions of biomass burning, dust, and urban pollution.



OMAERUV versus SKYNET