Aerosol Remote Sensing from OMI Observations: An Overview

Omar Torres  
*NASA GSFC*  
Changwoo Ahn  
*SSAI*  
Hiren Jethva  
*GESTAR-USRA*

*15-18 September 2014, College Park, MD*
OMI Near-UV Aerosol Algorithm (OMAERUV)

**Purpose:** Retrieval of Aerosol Single Scattering Albedo and Absorption Optical Depth

**Measurements:** Radiances at 354 and 388 nm.

**Physical Basis:** Radiative interaction between particle absorption and molecular scattering in the UV.

---

**Retrieval Products:**
- AOD and SSA (388 nm)
- Absorbing Aerosol Index

**Inversion Scheme:**
For a given aerosol type and ALH, satellite measured radiances at 354 and 388 nm are associated with a set of AOD and SSA values.

---

*In spite the sensor’s coarse resolution for aerosol retrieval, valuable information on particle absorption can be derived from OMI near UV observations.*

---

Combined use of OMI, CALIOP and AIRS observations in OMAERUV Aerosol Retrieval

OMAERUV uses a CALIOP-based Aerosol Layer Height Climatology and real-time AIRS carbon monoxide data for aerosol type identification [Torres et al., 2013]

The combined use of Al and CO allows the identification of smoke layers over arid areas.

AIRS CO allows the identification of heavy aerosol loads over China, and other regions, otherwise undistinguishable from cloud contamination.

Torres, O., C. Ahn, and Z. Chen, Improvements to the OMI Near UV aerosol algorithm using A-train CALIOP and AIRS observations, Atmos. Meas. Tech., 6, 3257-3270, 2013
The Global Picture

y-intercept = 0.10
Slope = 0.79
Q = 64.93

Number of pairs per 0.02 AOD bin. Maximum pair density (50 to 110) shown in pink.

OMAERUV SSA assessment: Comparison at selected AERONET sites

51% (75%) of matched pairs agree within 0.03 (0.05)

• OMI and AERONET are within their expected uncertainties (±0.03) for AOD>0.4 and UV-AI>1.0
• Closer agreement for larger aerosol loading
2007 AAOD Global Seasonal Average Maps

WINTER

SPRING

SUMMER

AUTUMN
Validated long-term record of OMAERUV Aerosol Optical Depth and Single Scattering Albedo

OMI-AERONET comparison of monthly mean values of AOD and SSA over nine years

DAKAR, SENEGAL (14.4N, 17W)

[Graph showing time series of Aerosol Optical Depth and Single Scattering Albedo for OMAERUV and AERONET data from 2005 to 2014.]

[Inset graphs showing scatter plots for comparison of OMAERUV SSA (440) with AERONET SSA (440) and OMAERUV AOD (440) with AERONET AOD (440).]

N = 83, Q = 75.90%, 90.36%
RMSD = 0.027
R = 0.69

N = 84, S = 0.90
RMSE = 0.10, I = 0.08
R = 0.82
Nine-year Global record of OMI Aerosol Absorption Optical Depth

OMAERUV AAOD388 ZONAL AVERAGE

Latitude

EQ

60S 30S 30N 60N 90N

Time

2005 2006 2007 2008 2009 2010 2011 2012 2013

0 0.02 0.04 0.06 0.08 0.1
An AAOD increase (~ 0.01/year) is apparent in Southern Africa.

AAOD = AOD(1-SSA)

Is AOD increasing or SSA decreasing?
AOD and SSA time series over SH biomass burning regions

A decrease in the water-content of fuel can produce more absorbing particles

Time series of monthly accumulated rain (TRMM)

May-Oct. Precipitation Anomaly (%)
The observed high latitude NH increase in AAOD is likely associated with increased boreal fire activity in Canada.
Simultaneous Retrieval of Cloud (COD) and Aerosol (AOD) Optical Depth

Inversion Scheme

August 4-2007

Summary

Significant progress on the quantification of aerosol absorption has been achieved during the first decade of OMI operation.

- A ten year data set of 388 nm AOD and SSA has been derived from OMI observations.

- The capability of retrieving aerosols above clouds using UV/VIS observations has been developed.

The decadal OMI AOD and SSA records have been evaluated by direct comparison to independent ground-based AERONET observations.

The OMI SSA and AAOD data sets are the first ever quantitative multi-year records on aerosol absorption from satellite-based observations.

Continuation of the OMI record on aerosol absorption is required for conclusive analyses of global/regional trends.