Satellite Aerosol Validation

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Satellite Remote Sensing of Air Quality, 18-19 November 2018
Objectives

By the end of this presentation, you will learn to:

• Validate satellite derived aerosol optical depth
• List the uncertainties in the MODIS aerosol product
• Access data and tools for validating satellite aerosol products
AERONET measurements of aerosol depth are considered **ground truth** and are used to validate satellite aerosol retrievals.
Spatial and Temporal Collocation

Petenko et al., 2012
MODIS Dark Target (DT) AOD Validation

EE% = ±(0.05 + 15%)

Source: Gupta et al., 2016
AERONET Comparisons with Aqua & Terra

Includes all stations in the region (Indian Subcontinent)

Terra is biased (0.5), whereas Aqua has close to zero bias

EE% = ±(0.05 + 15%)
MODIS Dark Target AOD Validation

MODIS: Aqua for Asia

**C6, all, F3**

- $N = 9341$
- EE% = 62.29
- Bias = 0.03
- RMSE = 0.16
- R = 0.90
- M = 1.04
- I = 0.01

**U6, all, F3**

- $N = 9341$
- EE% = 64.83
- Bias = 0.02
- RMSE = 0.16
- R = 0.90
- M = 1.04
- I = -0.01
Dark Target

https://darktarget.gsfc.nasa.gov
## MODIS Dark Target AOD Uncertainties

### MODIS 10 Km Product

<table>
<thead>
<tr>
<th></th>
<th>Collection 5</th>
<th>Collection 6 (Interim Values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>+/- (0.03 + 5% of $\tau$)</td>
<td>Ocean</td>
</tr>
<tr>
<td>Land</td>
<td>+/- (0.05 + 15% of $\tau$)</td>
<td>(-0.02 - 10% of $\tau$)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(+0.04 + 10% of $\tau$)</td>
</tr>
<tr>
<td>Aqua</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+/- (0.03 + 5% of $\tau$)</td>
<td>+/- (0.05 + 15% of $\tau$)</td>
</tr>
<tr>
<td>Terra</td>
<td></td>
<td>Data not yet available</td>
</tr>
<tr>
<td></td>
<td>+/- (0.05 + 15% of $\tau$)</td>
<td>Data not yet available</td>
</tr>
</tbody>
</table>

### MODIS 3 km Product Uncertainty Values for Collection 6 (Interim Values)

<table>
<thead>
<tr>
<th></th>
<th>Ocean</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqua</td>
<td>+/- (0.04 + 5% of $\tau$)</td>
<td>+/- (0.05 + 20% of $\tau$)</td>
</tr>
<tr>
<td>Terra</td>
<td>Data not yet available</td>
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</tr>
</tbody>
</table>
Validation Maps

https://darktarget.gsfc.nasa.gov/validation/maps
Scatter Plot
Deep Blue Project

https://deepblue.gsfc.nasa.gov

Welcome to the Deep Blue aerosol project webpage

Deep Blue uses measurements made by satellite instruments orbiting the Earth to determine the amount of aerosols in the atmosphere, and the properties of those aerosols. ‘Aerosols’ is a catch-all term covering particles suspended in the atmosphere, including but not limited to desert dust, smoke, volcanic ash, industrial smog, and sea spray. Improving our understanding of aerosols is important for reasons related to Earth’s climate, human health, and ecology, as well as many others.

The Deep Blue algorithms have currently been applied to generate data products from the AVHRR, SeaWIFS, MODIS, and VIIRS spaceborne sensor series.

This website is designed to act as a single portal to provide information to both new and experienced data users about our data sets, as well as give an overview of what we do and why we do it to non-specialists. Please use the links across the top of the page to navigate, and feel free to contact us with any questions.

Recent news relating to Deep Blue, such as new data versions or publications, are listed below. You can also subscribe to our RSS feed for updates.

Current data set status and availability (updated Nov 01 2017)

See also the Data tab:

- AVHRR: Latest version is v001 (demonstration product for selected periods).
- VIIRS: Public release expected later in 2018; example data available by request.
- Above-cloud aerosol data products: Available on a case-study basis by request to Andrew Sayer.
MAPSS
Multi-sensor Aerosol Products Sampling System

- Giovanni instances
- Used to evaluate the quality of satellite retrievals
- MAPSS allows you to compare AERONET data with coincident satellite data
- Quick and effective way to evaluate the quality of the satellite retrieval at particular locations for a range of dates or seasons
- Data from MODIS & MISR
  - Satellite-AERONET Inter-Comparison: http://giovanni.gsfc.nasa.gov/mapss/
MAPSS: Multi-sensor Aerosol Products Sampling System

This user interface is used to obtain selected parameter statistics from the MAPSS database for a chosen location and time period. Time Series Plot is the available service. Plot output is rendered as a graph and is also available in ASCII format.

Select Station
Click 'Browse' button or type in comma separated names in 'Browse'.

Select Plot
Satellite Collocated with AERONET
- Time Series
- Scatter Plot

Select Measurements
Click each list below (beginning with the left-most box) to show the set of fully qualified measurements. Select a measurement and then click 'Add'. Repeat for additional measurements.

- Basic
- Advanced

- AERONET aerosols L3, ver. 2
- AERONET deconvolution L2, ver. 41
- AERONET inversion L5, ver. 2
- AERONET inversions L2, ver. 2
- CALIPSO column and layer aerosols L2, ver. 3

More...

Selected Measurements

Select Date Range
Date Picker: Seasonal Search
Date Range (UTC): from to

MAPSS Time Series

Time Period: 2005-01-01 to 2005-12-31
Mean of AOD at 440nm from AERONET_AOD_L2.5 at DBSP (a)
MAPSS Statistical Explorer

https://giovanni.gsfc.nasa.gov/mapss_explorer/
MAPSS: Further Reading


Published Validation Results


