Comparison of NOAA VIIRS and NASA MODIS Aerosol Products
Lorraine A. Remer\textsuperscript{1}, Jennifer Christhilf\textsuperscript{1,2}, Robert C. Levy\textsuperscript{2}
\textsuperscript{1}UMBC, \textsuperscript{2}NASA/GSFC

20170813 0.25°x0.25° Gridded High Quality EDR AOT\textsubscript{550nm}

NOAA VIIRS (IDPS) 13 August 2017
VIIRS MODIS IDPS Daily 0.25 deg Gridded From 6 km High QA

IDPS Daily 0.25 deg Gridded From 6 km High QA

Aerosol Optical Depth Land Ocean Mean

13Aug2017

MODIS/Aqua MYD08_D3.A2017225.006.2017226175038.hdf none
Real color imagery and native resolution AOD
13 August 2017

MODIS Aqua AOD and imagery
Wavelength differences
Swath differences
Orbit differences
Spatial resolution differences
Calibration differences

Algorithm differences

>>>>> Sampling differences
>>>>> Retrieval differences

>>>>> Differences in means
A & B are identical algorithms

Seasonal (MAM) mean AOD at 550 nm

E is difference between identical algorithms applied to different sensors (B-A)

Levy et al., 2015
A calibration investigation using “match files” (Sayer et al., 2017)

From SIPS:
MCST MODIS Aqua Collection 6 data (at 1 km pixel size, the MYD021KM product)
VCST VIIRS Version 1.1 data with Version 1.0.1 calibration (the VL1BM product).
Red box outlines the difference between using the SIPS MODIS input and the operational MODIS product.

Levy et al. (2013)
Sayer et al., 2017

VIIRS Vicarious Gain

Sayer et al., 2017
AOD validation at 6 AERONET island sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude, °</th>
<th>Longitude, °</th>
<th>Number of matchups</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM Graciosa</td>
<td>39.091</td>
<td>-28.029</td>
<td>149</td>
</tr>
<tr>
<td>Ascension Island</td>
<td>-7.976</td>
<td>-14.415</td>
<td>414</td>
</tr>
<tr>
<td>Ersa</td>
<td>43.004</td>
<td>9.359</td>
<td>624</td>
</tr>
<tr>
<td>Manus</td>
<td>-2.060</td>
<td>147.425</td>
<td>105</td>
</tr>
<tr>
<td>MCO Hanimadhoo</td>
<td>6.776</td>
<td>73.183</td>
<td>268</td>
</tr>
<tr>
<td>Midway Island</td>
<td>28.210</td>
<td>-177.378</td>
<td>89</td>
</tr>
</tbody>
</table>

Standard

(a) Standard L1 calibration

Bias = 0.0313

With vicarious corrections

Bias = 0.0149

Sayer et al., 2017
Characterizing MODIS – VIIRS differences

- MODIS Collection 6 Level 3 AOD 550,
- DT land and ocean,
- 1 degree gridded

- VIIRS IDPS AOD550
- 0.25 degree gridded (from VIIRS team web page).
- Aggregated up to 1 degree (if any one of the 0.25 deg squares is populated, the 1 deg square will have a value

- 8-day means created from each.
- Sync-ed
- Start 25 January 2013
- End 24 January 2017
Each ordered pair is an 8-day mean of a 1-degree grid box.

Red line is 1:1 line.
MODIS - VIIRS
2013-2017

AOD 550 differences

Difference of 4-year means
VIIRS count is the number of 0.25 deg squares in each 1 degree box for the entire period. (5840 max for 1 year).

Shown are 2016 counts and differences.
The graph shows the global mean AOD ( Aerosol Optical Depth) over a period from 2013 to 2017. The data is divided into three categories: MODIS global, VIIRS global, and global diff. The MODIS global data is represented by blue lines, the VIIRS global data by orange lines, and the global diff by black lines.

- MODIS global: AOD values fluctuate significantly from 2013 to 2017, with peaks and troughs evident in the data.
- VIIRS global: Similar to MODIS global, but with less pronounced peaks and troughs.
- Global diff: The graph indicates a gradual decrease in AOD over the years, with a linear trend line labeled "slope = 0.0028 per year".

The x-axis represents the date, ranging from 2013 to 2017, while the y-axis represents the global mean AOD at 550 nm waveband.
MODIS AOD slope = essentially zero
VIIRS AOD slope = -0.01 per year
Something happened to VIIRS in 2015 that caused land AODs to decrease.

Translates to 0.01 per year, but is really a jump, not linear.

Result over all is to bring VIIRS closer to MODIS.

But not in India, and other land locations where VIIRS is higher than MODIS.

No temporal change to ocean AODs.

VIIRS background ocean AOD still 0.005 higher than MODIS.
Each ordered pair is 8-day mean

Averaging interval

Each ordered pair is a 4-year mean

Global 4 Years, Slope