VALIDATION OF SUOMI NPP/VIIRS OPERATIONAL AEROSOL PRODUCTS THROUGH MULTI-SENSOR INTERCOMPARISONS

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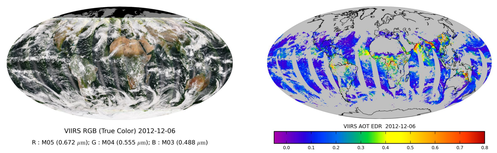
1. INTRODUCTION

The Suomi National Polar-orbiting Partnership (S-NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) provides aerosol Environment Data Records (EDRs):

- Aerosol optical thickness (AOT) (6km at nadir, Beta from 05/02/2012)
- Aerosol particle size parameter (APSP) EDR (Angstrom Exponent (AE) herein, 6km at nadir, Beta from 05/02/2012, not recommended over land)
- Suspended matter (SM) EDR (750m at nadir, not Beta yet)

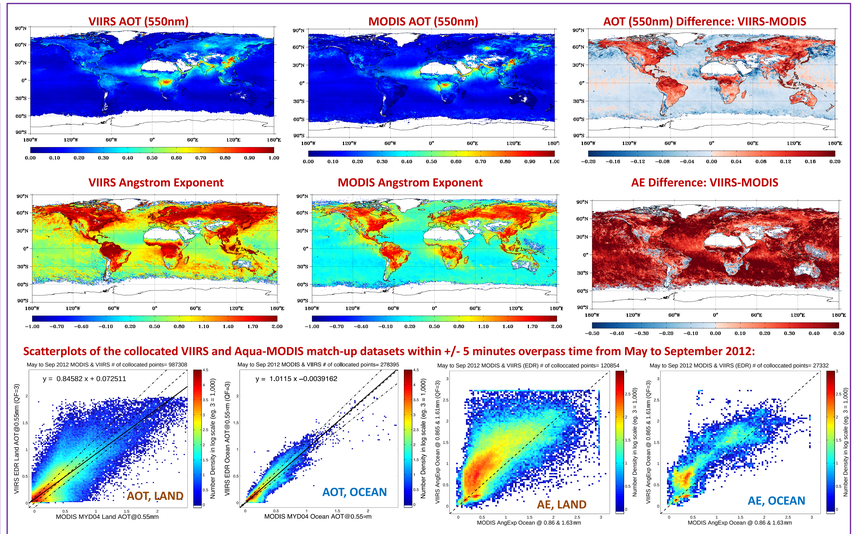
EDR validations were conducted for 05/02-10/14/2012 (noted otherwise) through multi-sensor intercomparisons.

A Beta quality product is an "*early release product with initial calibration applied. The product is minimally validated and may still contain significant errors. It is made available to allow users to gain familiarity with data formats and parameters, but the product is not appropriate as the basis for quantitative scientific publications, studies and applications.*"



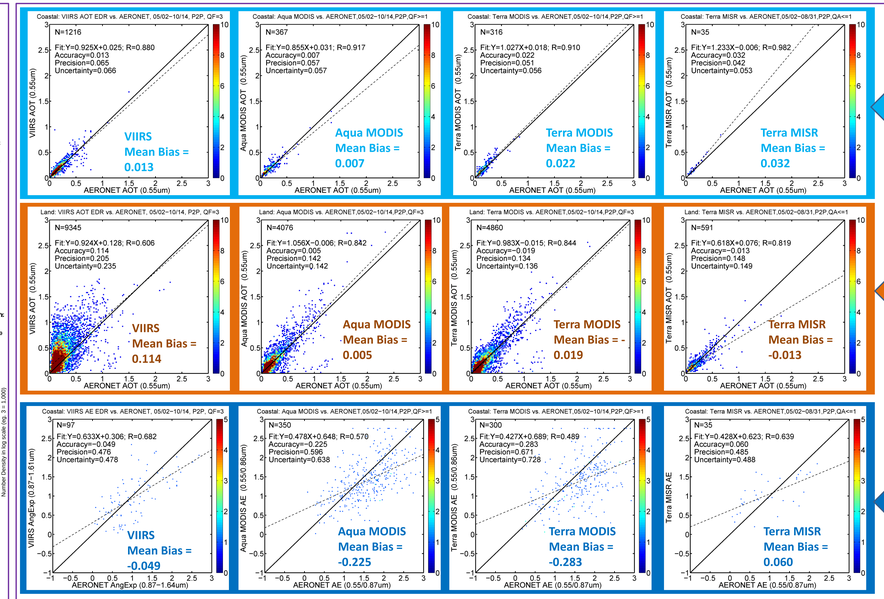
Global RGB and AOT (550nm, best QA) on 12/06/2012

2. VIIRS vs. Aqua MODIS



VIIRS and MODIS show similar spatial patterns of global aerosol distributions. However, VIIRS AOT is higher than MODIS over land but lower than MODIS over dust/smoke outflow regions over water. Similar biases over land are also seen when VIIRS are compared with the independent MODIS Deep Blue dataset. VIIRS Angstrom Exponent (AE) is also systematically higher than MODIS AE.

3. Multi-Sensor (VIIRS, Aqua MODIS, Terra MODIS, MISR) vs. AERONET (Aerosol Robotic Network)



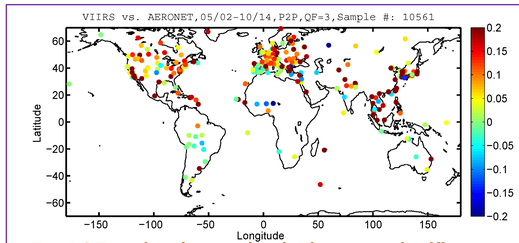
The performance of VIIRS AOT over ocean at coastal sites against AERONET is similar to the heritage satellite products (Aqua and Terra MODIS, Terra MISR).

VIIRS AOT (550nm) retrievals over land are biased high, compared to AERONET. Heritage satellite products do not show such high biases.

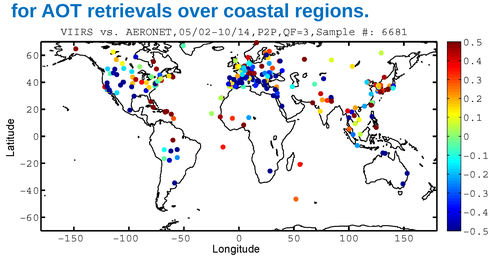
VIIRS AE retrievals over ocean at coastal sites compares well to AERONET similar to the heritage satellite products.

In the statistics: **accuracy** = mean bias, **precision** = standard deviation of biases, **uncertainty** = root mean square error. Multi-sensor matching up were performed by MAPSS (Multi-sensor Aerosol Products Sampling System).

4. VIIRS vs. AERONET (Global View)

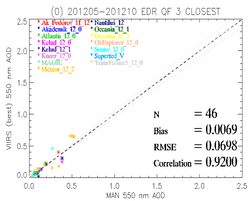


For AOT retrievals over land, There are significant regional dependence in the biases between VIIRS and AERONET: high bias over East Asia, Europe, US coasts, but low bias over Amazon and Sahel. There are no significant regional dependence in the biases for AOT retrievals over coastal regions.



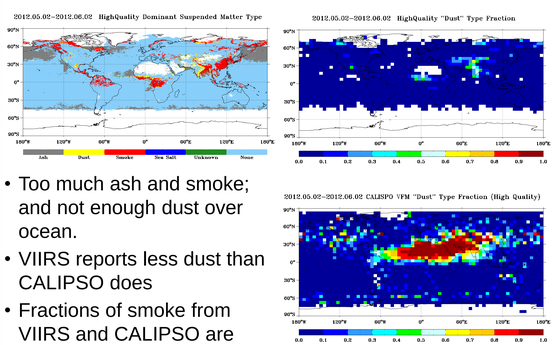
Although AE retrievals over land have no skills so far, there are regional dependences between VIIRS and AERONET: i.e. low biases over western US and Europe.

5. VIIRS vs. MAN (Maritime Aerosol Network)



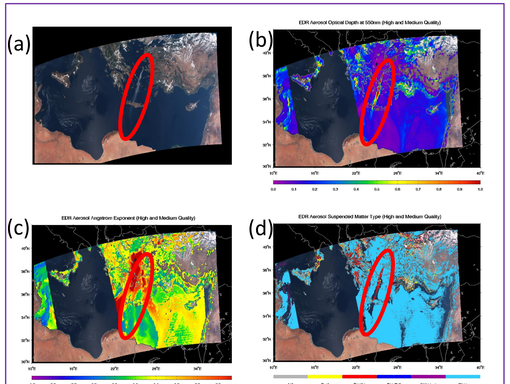
VIIRS AOT (550nm) best quality retrievals over ocean correlate well with MAN cruise observations with mean bias of 0.007 and RMSE of 0.07, further evident the outstanding performance of VIIRS AOT retrievals over ocean.

6. VIIRS vs. CALIPSO



- Too much ash and smoke; and not enough dust over ocean.
- VIIRS reports less dust than CALIPSO does
- Fractions of smoke from VIIRS and CALIPSO are also quite different (not shown).

7. Event Monitoring



Wildfire broke out on the Greek island of Chios in mid-August, sending a thick plume of smoke southward toward the island of Crete (Kriti), was well observed by VIIRS aerosol products: (a) RGB; (b) AOT 550 nm; (c) Angstrom Exponent; and (d) Suspended Matter type, on 08/18/2012. The heavy smoke plume was characterized by elevated AOT (550 nm) for more aerosol loading, increased AE for more fine mode particles, and properly assigned aerosol type of smoke as suspended mater type.

8. SUMMARY

- VIIRS Aerosol EDRs provide similar global aerosol distributions showing potential for continuing their heritage satellite products from MODIS and MISR.
- With better spatial resolution over a wide spectral range and increased daily spatial coverage, VIIRS Aerosol EDRs demonstrate great capability and potential for global aerosol event monitoring.
- VIIRS AOT over land is biased high against comparable products in a global sense. Algorithm improvements by adjusting spectral surface reflectance ratios are enacted to lower the biases.
- VIIRS AOT over ocean agrees well with MODIS and AERONET.
- VIIRS APSP EDR over ocean correlates well with MODIS and AERONET, but is biased high against MODIS AE in a global sense.
- VIIRS APSP EDR over land has no skill at this time.
- VIIRS SM EDR is of limited scientific value at this time, and is not at Beta level yet.
- Filtering the VIIRS Aerosol EDRs with the extensive quality flags available is highly recommended. Best quality assured data usage is preferred.

- The VIIRS aerosol EDRs are available form NOAA's Comprehensive Large Array-data Stewardship System (http://www.class.ngdc.noaa.gov). (Note: Data between 10/15-11/27 2012 have errors and should not be used.)
- VIIRS Aerosol Products Users' guide is available at:
- http://www.star.nesdis.noaa.gov/jpss/ATBD.php#S126472
- VIIRS Aerosol Products README file is under "VIIRS Aerosol" at:
- http://www.nsof.class.noaa.gov/saa/products/welcome
- Other documents are available at: http://npp.gsfc.nasa.gov/science/documents.html

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