

# VIIRS AOT retrieval for bright surfaces

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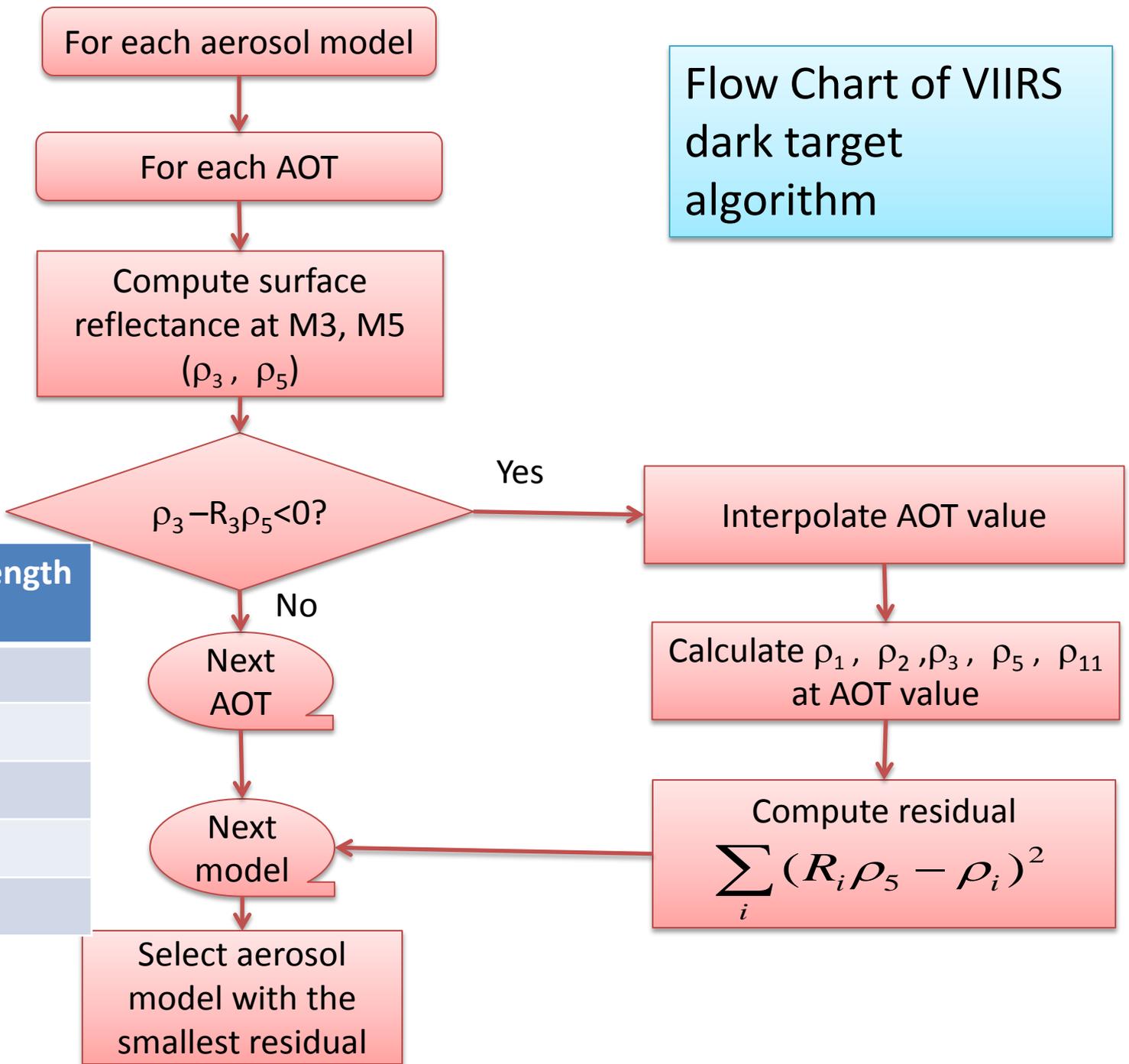
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# Introduction

- Current operational VIIRS AOT retrieval only works over dark surfaces
- We developed a new algorithm to retrieve VIIRS AOT over bright surfaces
  - The algorithm is a modified version of the VIIRS dark target algorithm.
  - **The algorithm uses surface reflectance ratios, instead of absolute surface reflectance as in deep blue algorithm, to retrieve AOT over bright surfaces**
  - The surface reflectance ratios are dependent on location and geometry.

Flow Chart of VIIRS dark target algorithm



Bands	Wavelength (μm)
M1	0.412
M2	0.445
M3	0.488
M5	0.672
M11	2.25

# Modifications of the algorithm over bright surfaces

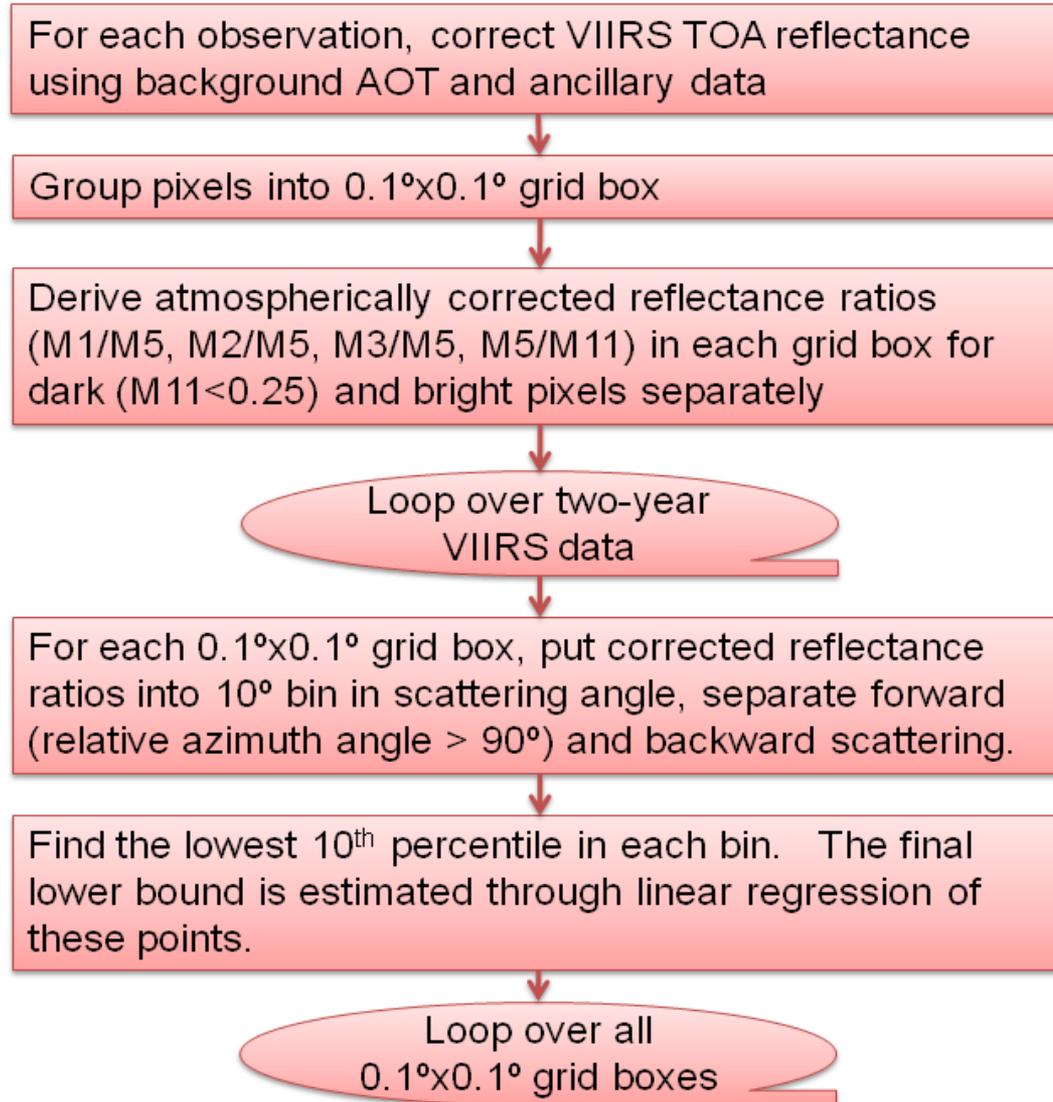
	Dark target algorithm	Bright surface algorithm
Bands used	M1,M2,M3,M5,M11	M1,M2,M3,M5
Surface reflectance ratios	Global fixed ratios	Global reflectance ratio database
Bands used for AOT retrieval	M3, M5	M3,M5 for North Africa/Arabian Peninsula M1,M5 for the other regions
Aerosol model selection	Select aerosol model using residuals	Fixed dust model for North Africa/Arabian Peninsula Select aerosol model over the other regions

# Surface reflectance ratio database

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- Derived from two-year VIIRS SDR data (May, 2012-Apr, 2014)
- $0.1^\circ \times 0.1^\circ$  spatial resolution
- Background AOT at AERONET sites and interpolated globally for atmospheric correction
- Lower bounds of the two year atmospheric corrected reflectance ratios

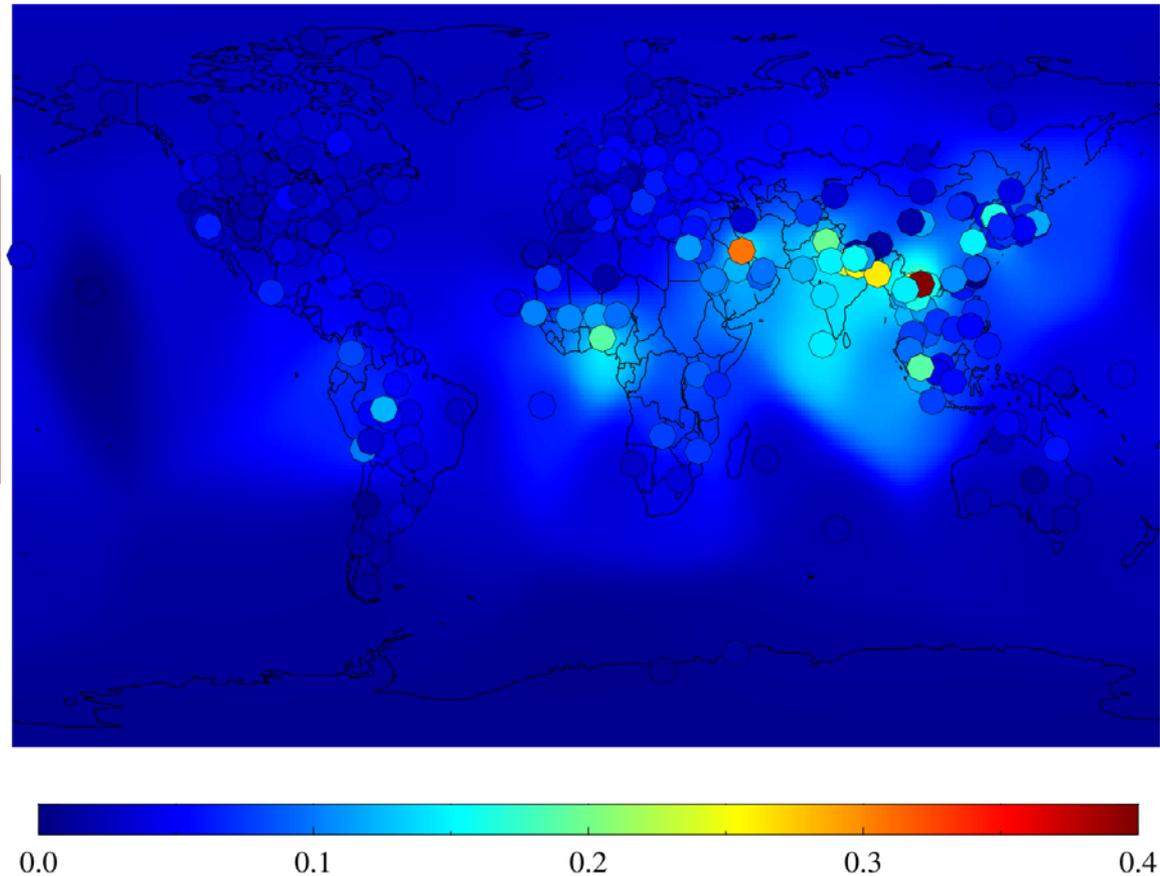
# Surface reflectance ratio database derivation flow chart



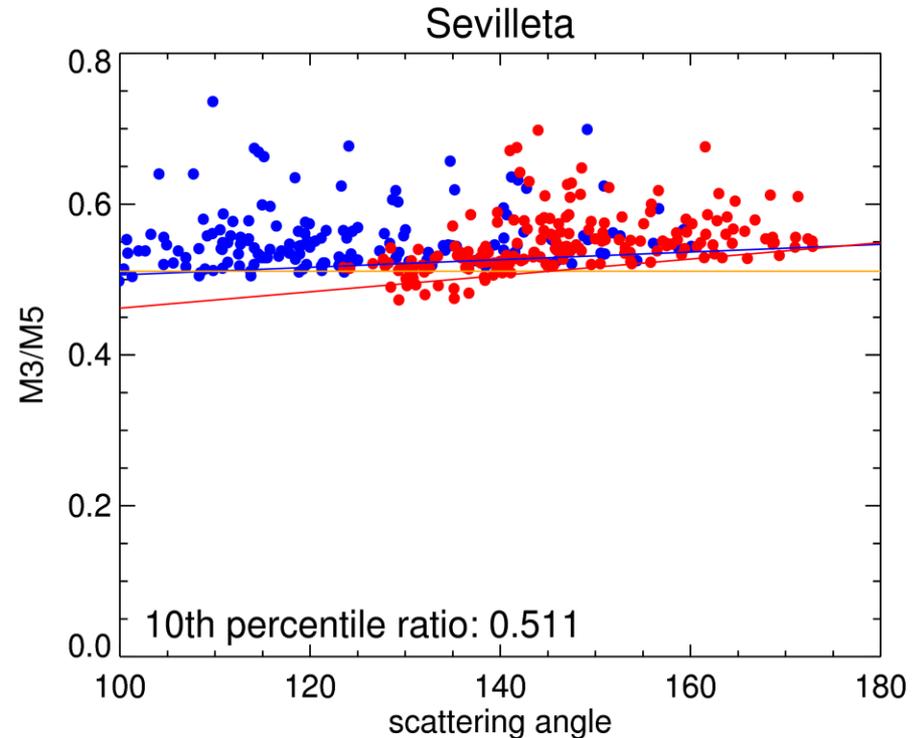
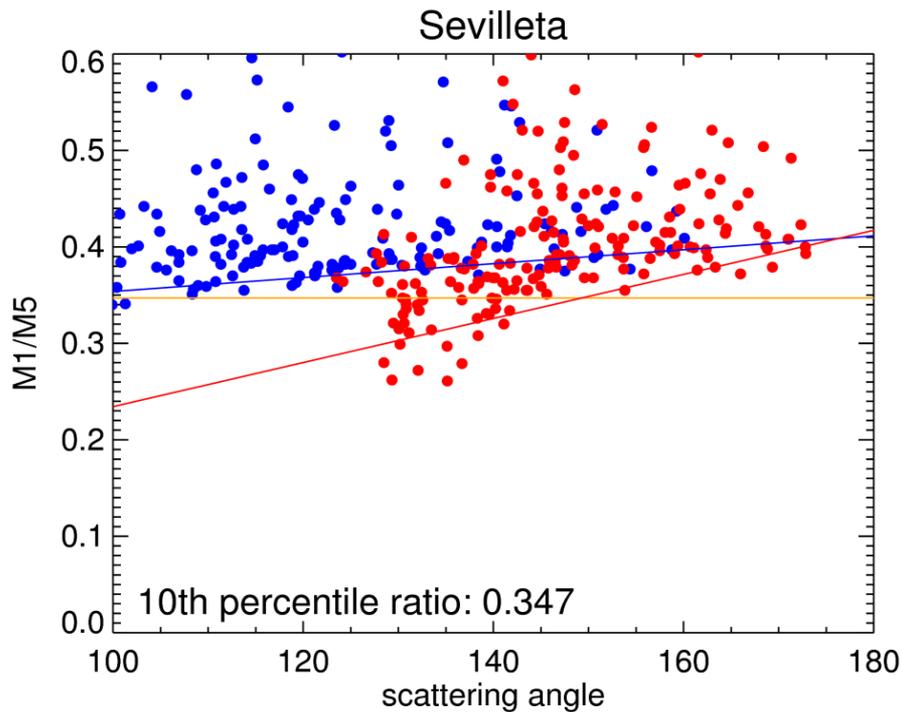
# Background AOT for deriving surface reflectance ratios

AERONET and interpolated background AOT

- Two-year AERONET data
- Bottom 5<sup>th</sup> percentile at each AERONET site
- Spatially interpolated to other areas



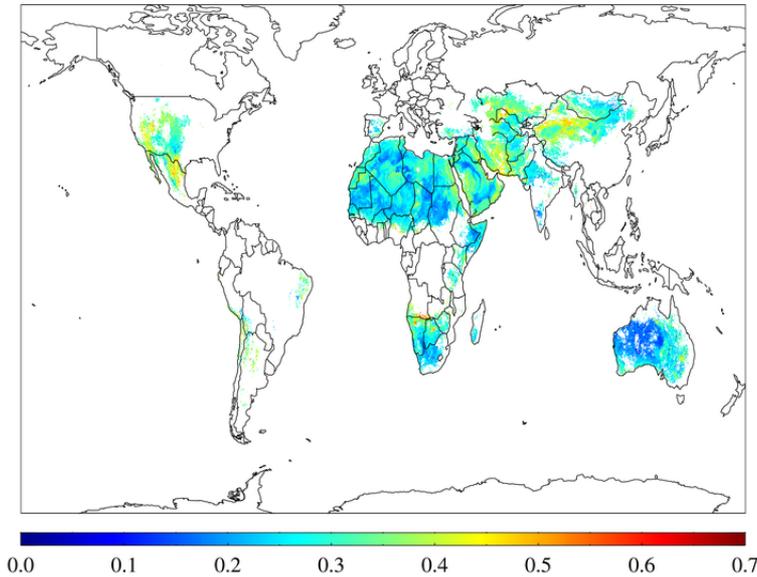
# Example of atmospheric corrected reflectance ratios



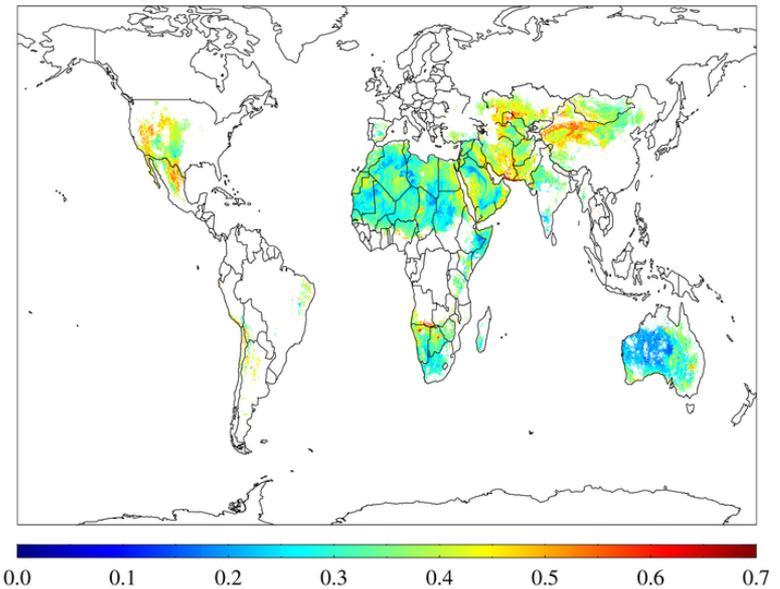
- Two-year corrected reflectance ratios at Sevilleta (a western US site)
- Blue: forward reflectance; Red: backward reflectance
- Linear model for the lower bounds (10<sup>th</sup> percentile)

# Surface reflectance ratio database over bright surfaces

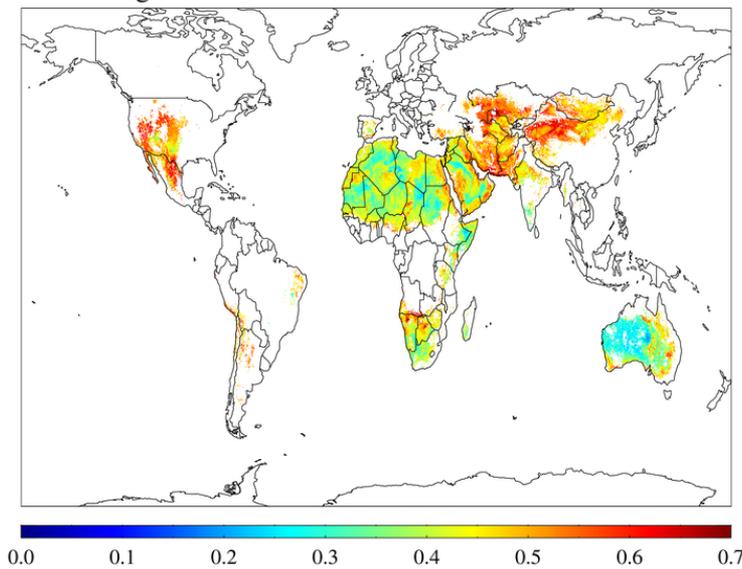
VIIRS bright surface reflectance ratio M1/M5



VIIRS bright surface reflectance ratio M2/M5

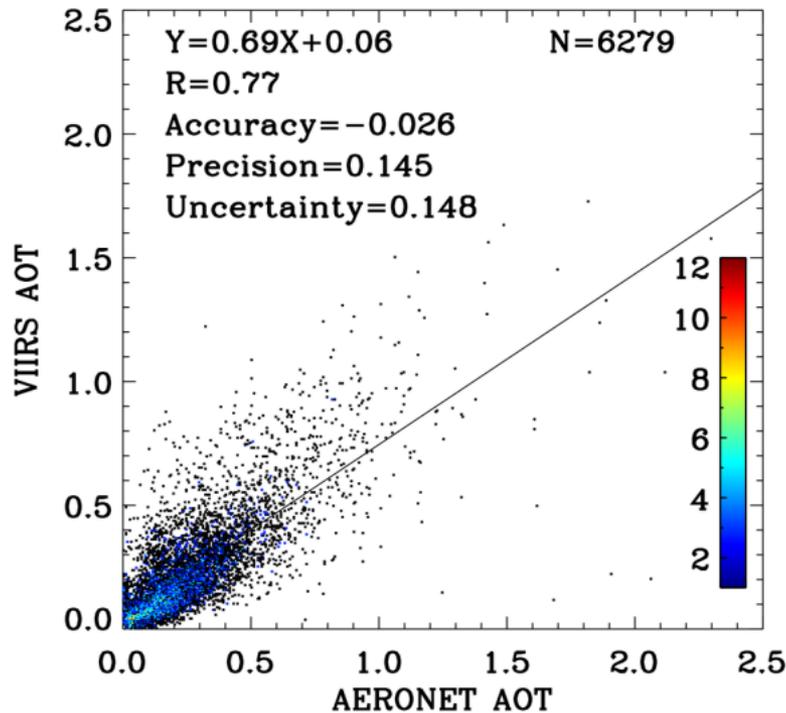


VIIRS bright surface reflectance ratio M3/M5

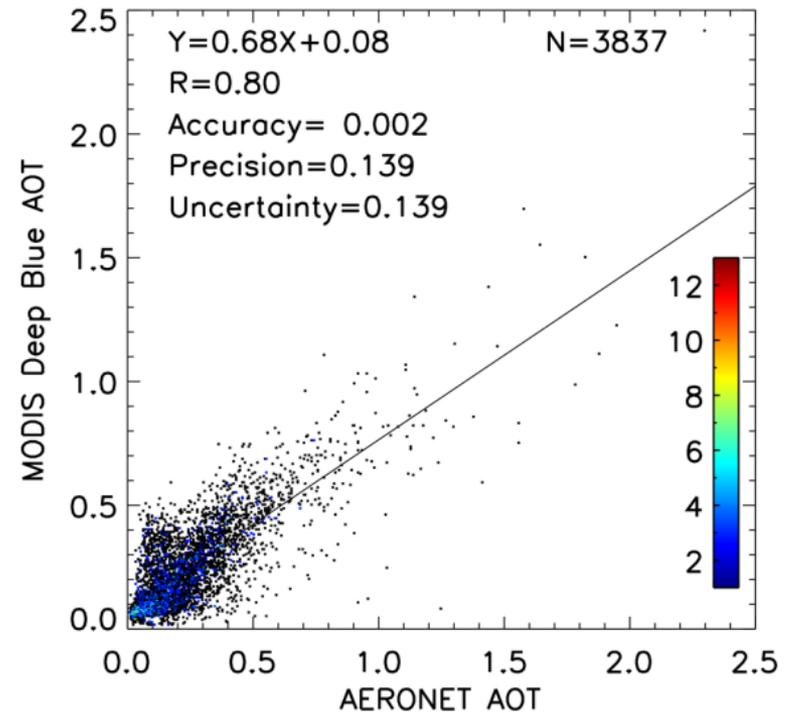


- M1/M5, M2/M5, M3/M5
- Linear dependence on scattering angle
- Separate forward and backward reflectance geometry
- The plots are in backward reflectance geometry with scattering angle  $140^\circ$

# VIIRS AOT retrievals over bright surfaces at AERONET sites



VIIRS

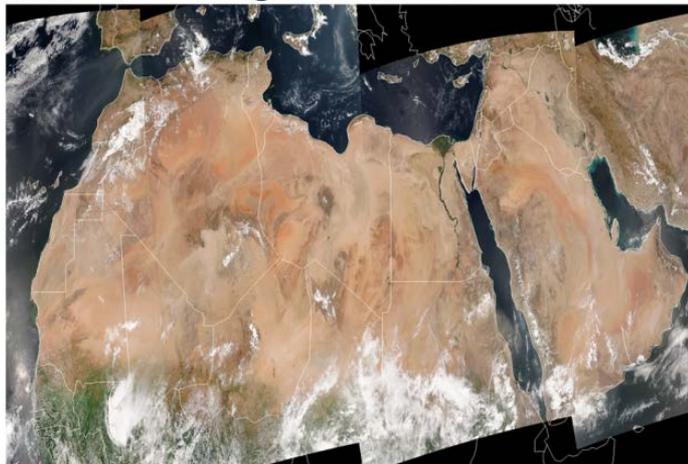


MODIS deep blue

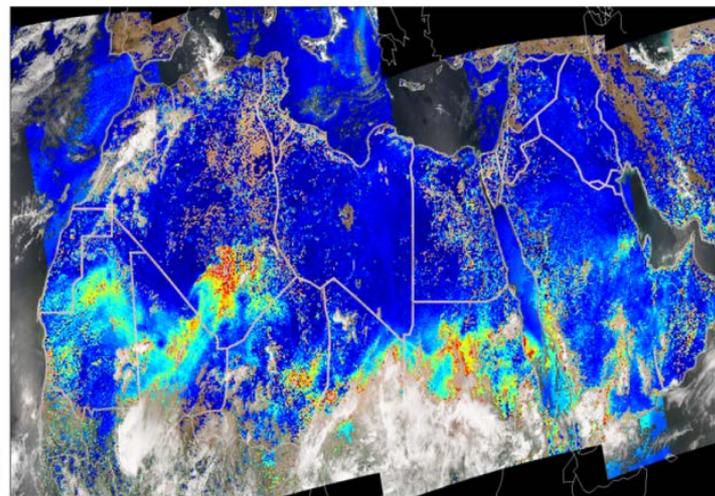
- Two-year AOT retrievals (May 2012- Apr 2014)
- Most of the sites are located in North Africa, Arabian Peninsula, and western CONUS

# An example of AOT retrieval over north Africa and Arabian Peninsula

VIIRS RGB image 20130823

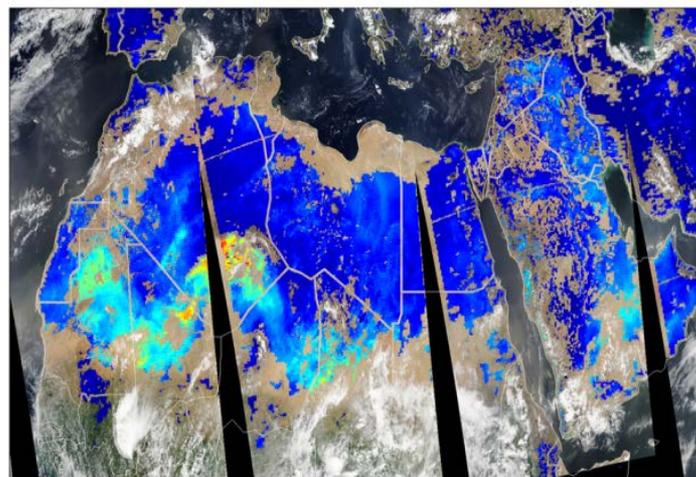


VIIRS AOT 20130823



0.00 0.40 0.80 1.20 1.60 2.00

MODIS deep blue AOT 20130823



0.00 0.40 0.80 1.20 1.60 2.00

- VIIRS AOT retrievals are in agreement with MODIS deep blue AOT retrievals in most areas:
  - Both show dust storm in the west
  - Low AOT regions agree mostly
- Differences:
  - Some high AOT regions in VIIRS are not seen in MODIS deep blue
  - Less coverage in MODIS deep blue

# Conclusions

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- We developed an AOT retrieval algorithm for bright surface using global surface reflectance ratio database
- The AOT retrievals compare well with AERONET and MODIS deep blue AOT
- The algorithm will be implemented in the NDE system