Comparison of the MATCH and MERRA2 Aerosol Analyses

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2016 April 27

CERES Science Team Meeting, NASA Langley, VA

Introduction

- **MATCH** aerosol distributions → **CERES SARB** SSF algorithm
- Terra and Aqua **MODIS** AOD retrievals → **MATCH** assimilation
- Terra and Aqua **MODIS** AOD retrievals → **MERRA2** assimilation

Current MATCH Work: Data Record Continuity

- **MATCH** assimilation of **MODIS** Collection 5.1 (**CERES** Edition 4)
- **MATCH** assimilation of **MODIS** Collection 6
- **MATCH** assimilation of **VIIRS MODIS**-Like Data Record

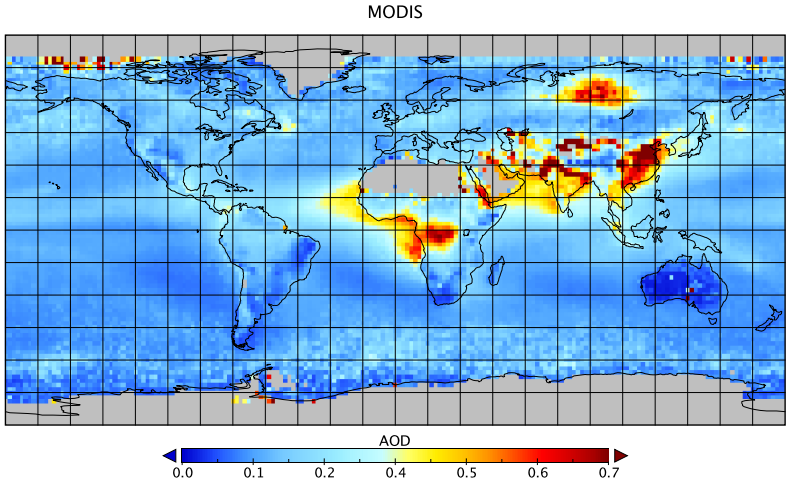
MATCH versus **MERRA2**

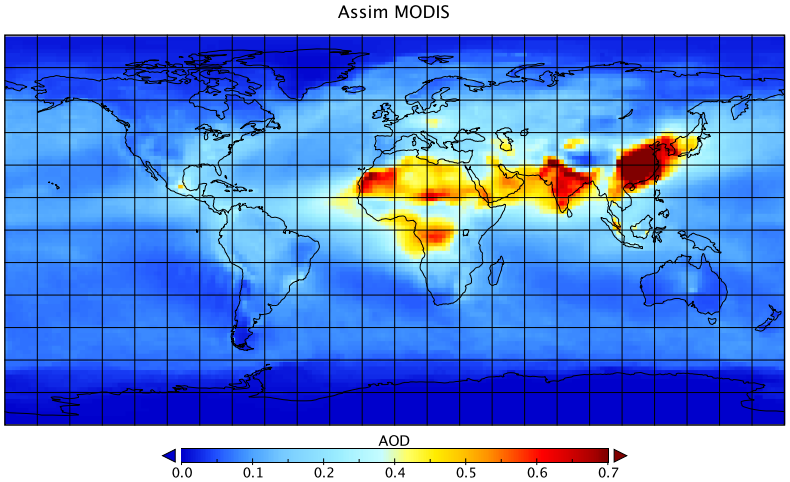
- comparison of aerosol distributions
- joint validation versus **AeroNet** surface network

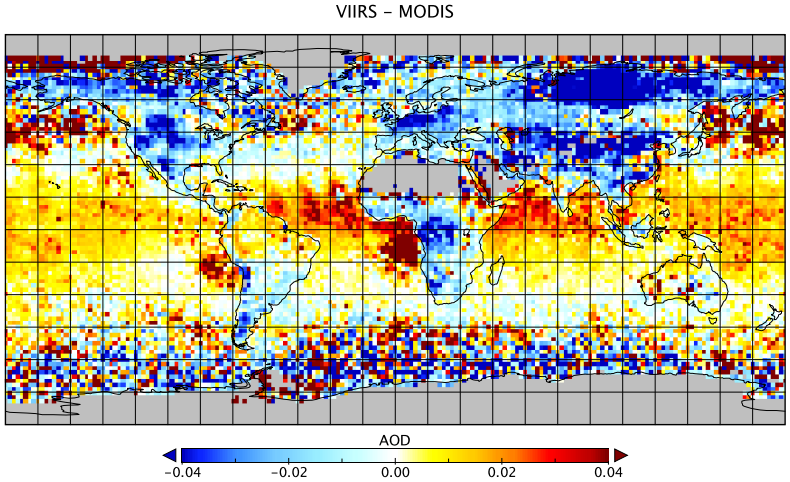
- Continuing VIIRS only MATCH assimilation
- 2014 available for SARB
- 2012 - 2015 available for SARB soon

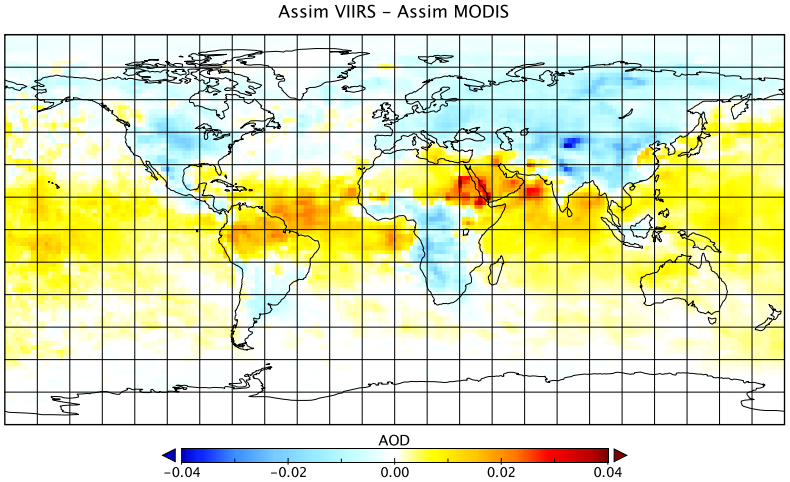
MERRA2 to supercede MATCH in Edition 5 SARB products?

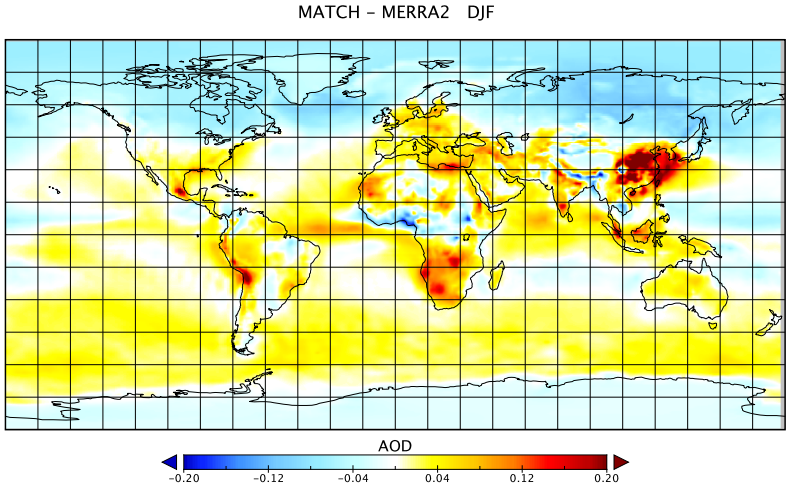
- MATCH run on AMI MERRA2 from GMAO
- CERES dataset production runs require *frozen* model/algorithms
- Aerosol Types
  Sea-Salt, Dust, Organic Carbon, Black Carbon, Sulfate
- Aerosol Optics
  MATCH optics same as SARB Fu-Liou Radiative Transfer Model
  but MERRA2 similar (based OPAC dataset)
- Temporal Resolution
  both MATCH and MERRA2 available at hourly intervals
- Spatial Resolution
  MERRA2 $\sim 0.5^\circ$ MATCH $\sim 2^\circ$
- AOD Assimilation
  MATCH Optimal Interpolation
  with "hard" correction (high MODIS weight)
  MERRA2 Local Displacement Ensemble with softer correction

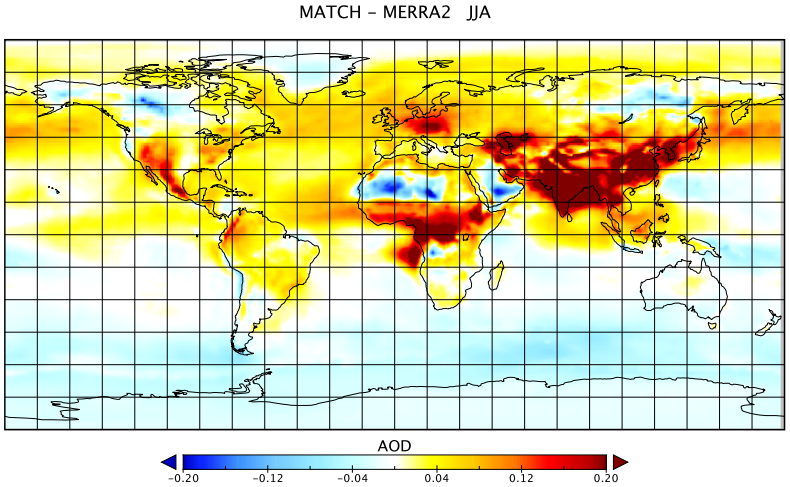

MODIS
AOD
0.0
0.1
0.2
0.4
0.5
0.6
0.7

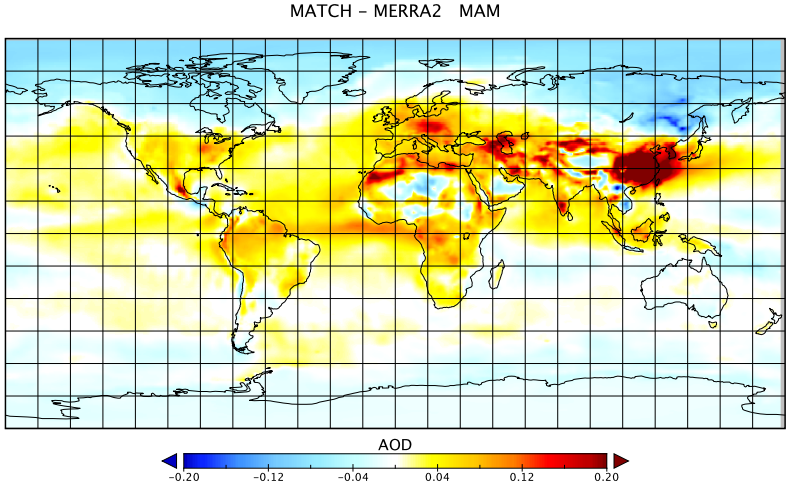

Assim MODIS
AOD
0.0
0.1
0.2
0.4
0.5
0.6
0.7

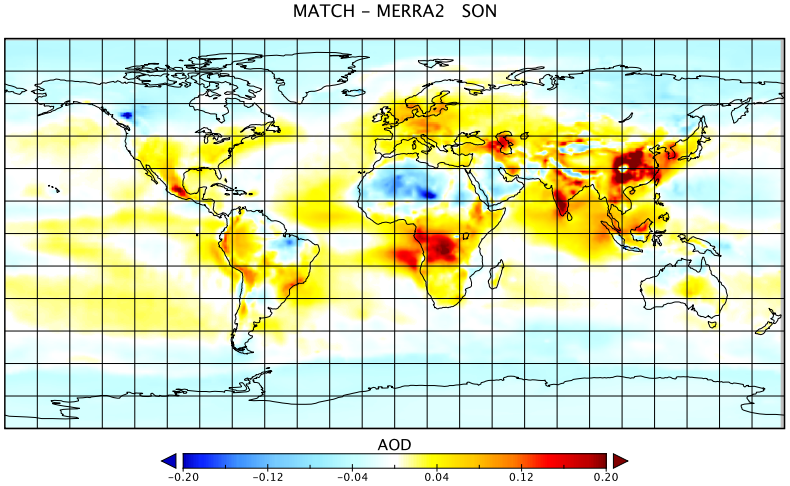

VIIRS – MODIS
AOD
−0.04
−0.02
0.00
0.02
0.04


Assim VIIRS – Assim MODIS
AOD
−0.04
−0.02
0.00
0.02
0.04

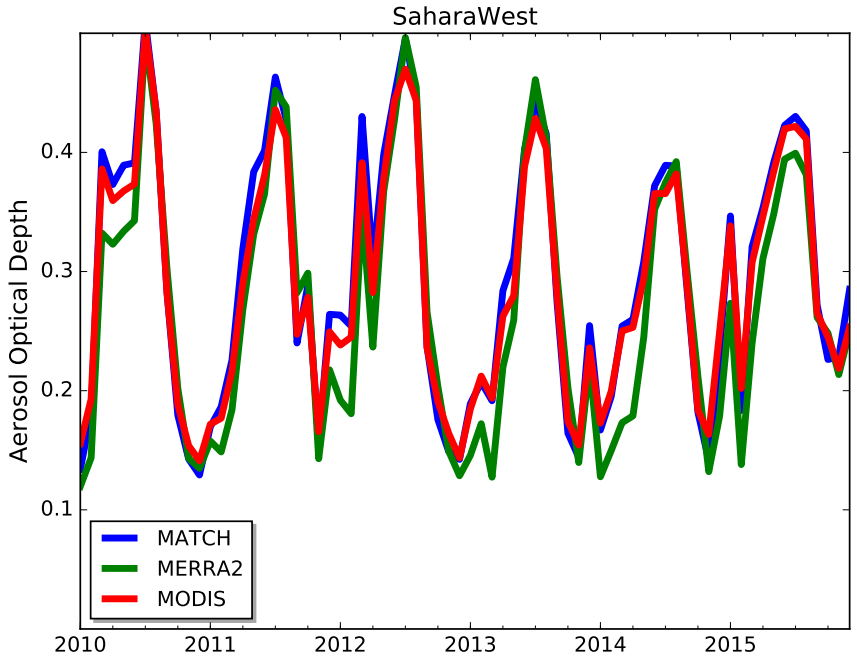

MATCH – MERRA2 DJF
AOD
−0.20
−0.12
−0.04
0.04
0.12
0.20


MATCH – MERRA2 JJA
AOD
−0.20
−0.12
−0.04
0.04
0.12
0.20

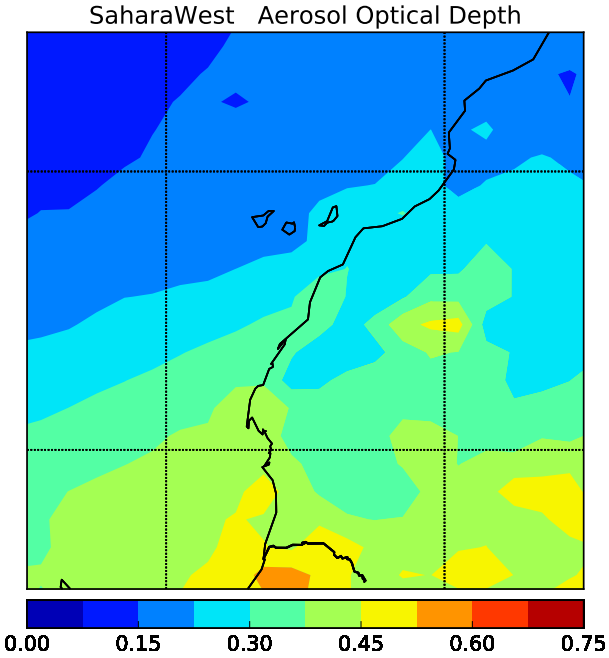

MATCH – MERRA2 MAM
AOD
−0.20
−0.12
−0.04
0.04
0.12
0.20


MATCH – MERRA2 SON
AOD
−0.20
−0.12
−0.04
0.04
0.12
0.20

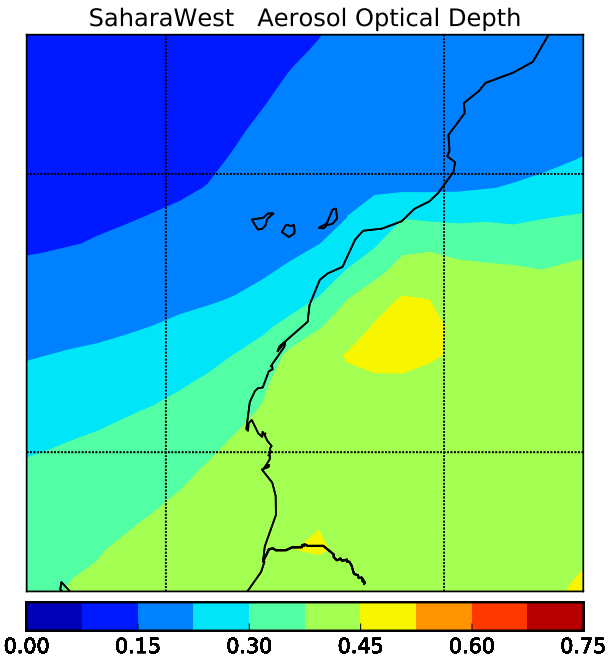
Western Sahara AOD 2010 - 2015



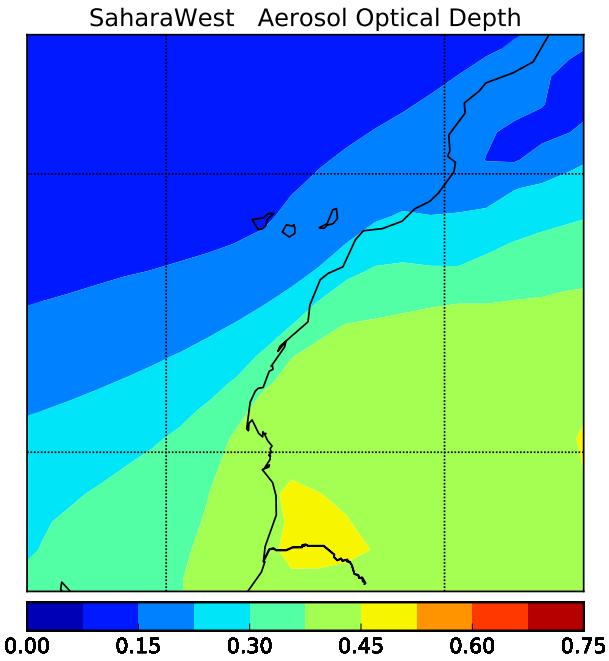
MODIS



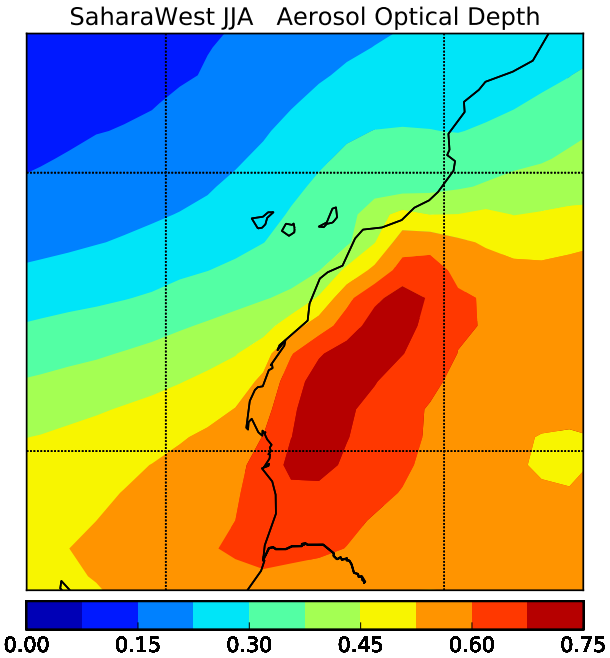
MATCH



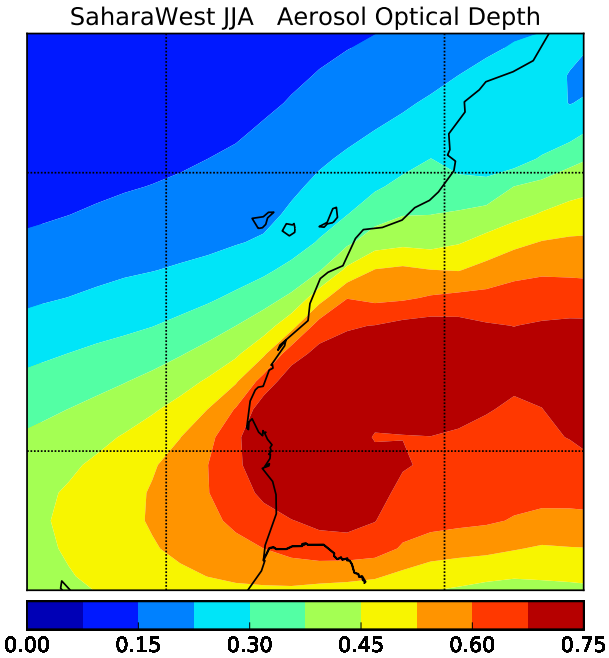
MERRA2



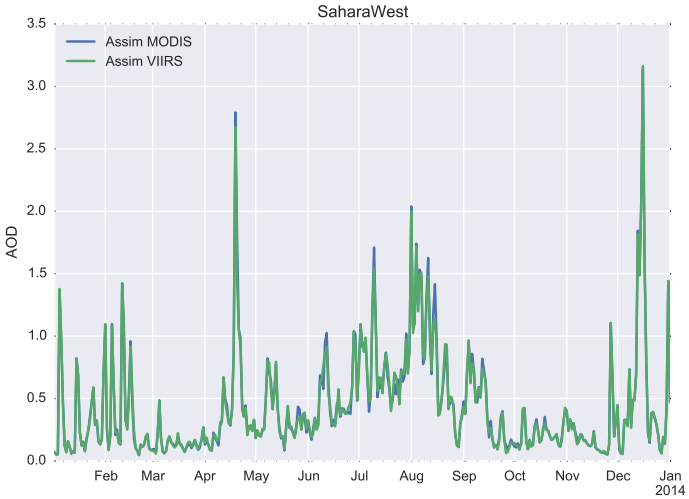
MATCH

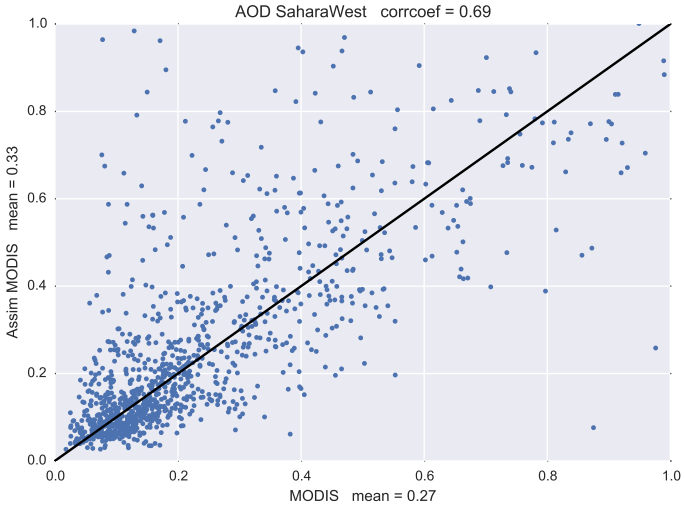


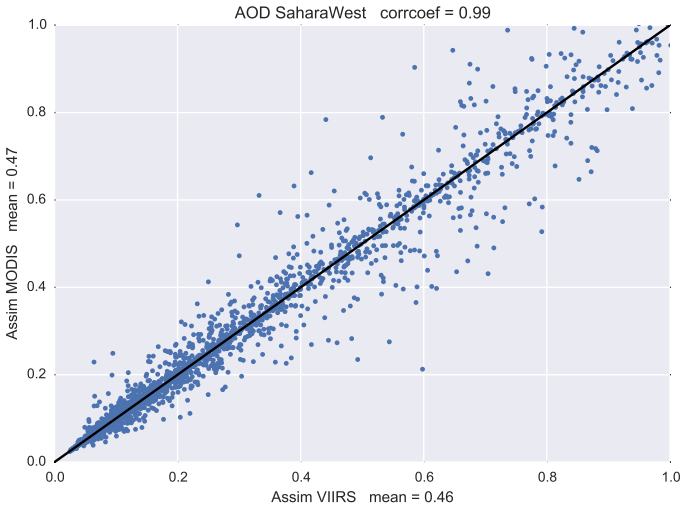
MERRA2

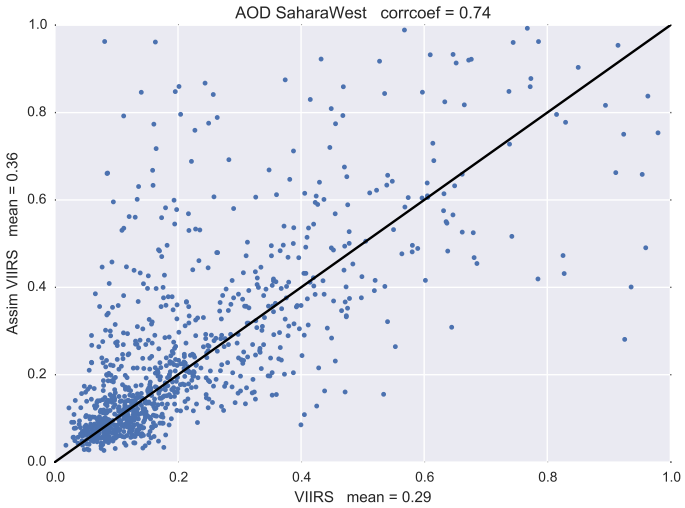


JJA 2010 - 2015

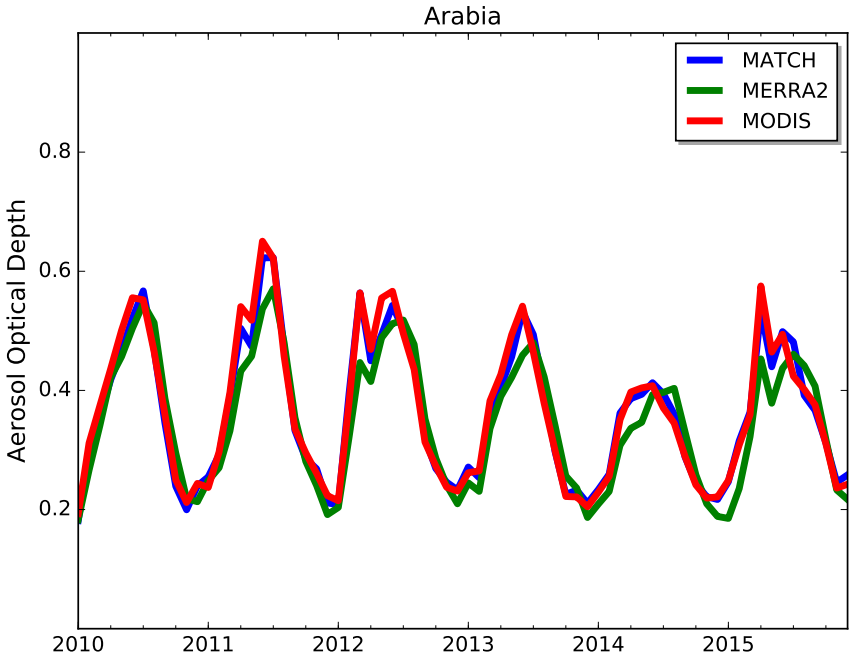

SaharaWest
Assim MODIS
Assim VIIRS
AOD
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
2014


AOD SaharaWest corrcoef = 0.69
Assim MODIS mean = 0.33
MODIS mean = 0.27
0.0
0.2
0.4
0.6
0.8
1.0

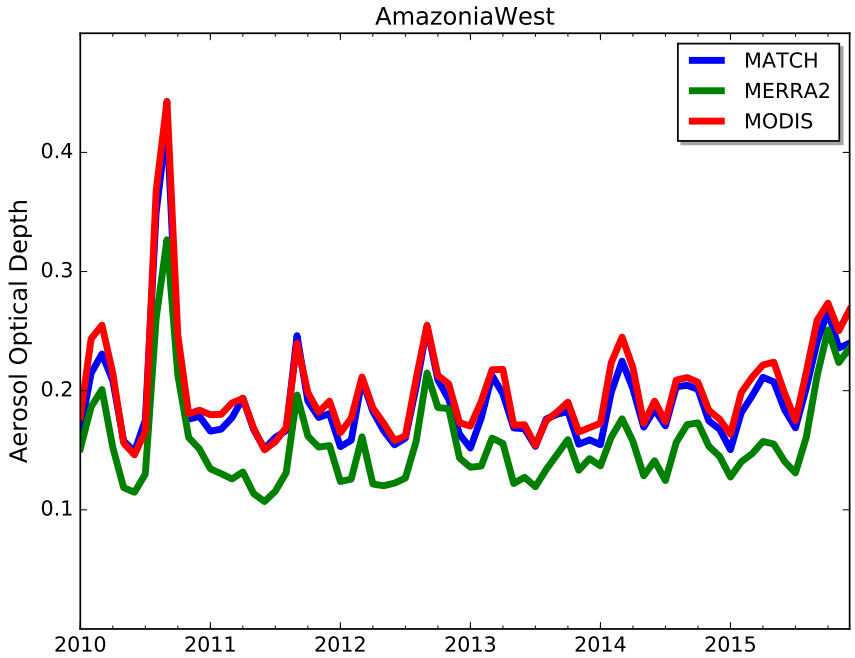

AOD SaharaWest corrcoef = 0.99
Assim MODIS mean = 0.47
Assim VIIRS mean = 0.46
0.0
0.2
0.4
0.6
0.8
1.0


AOD SaharaWest corrcoef = 0.74
Assim VIIRS mean = 0.36
VIIRS mean = 0.29
0.0
0.2
0.4
0.6
0.8
1.0

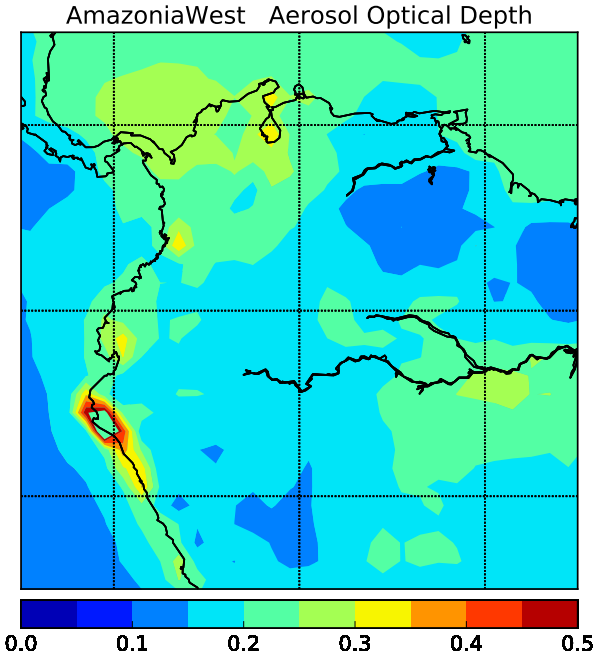
Arabian Peninsula AOD 2010 - 2015



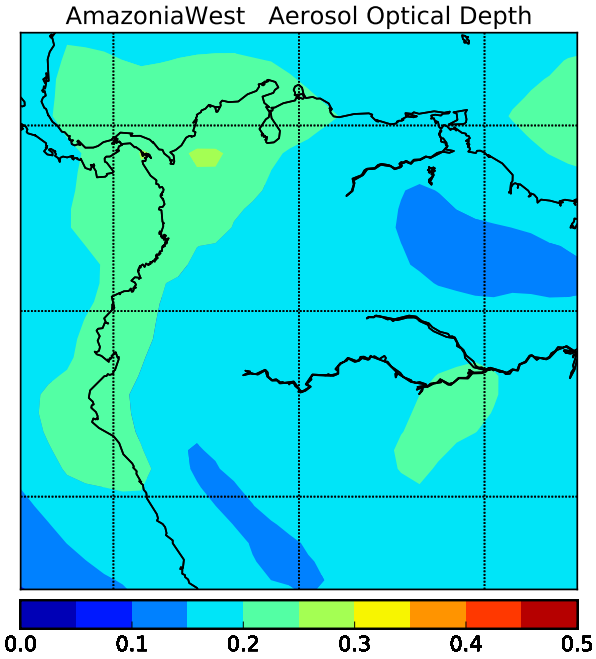
Western Amazon AOD 2010 - 2015



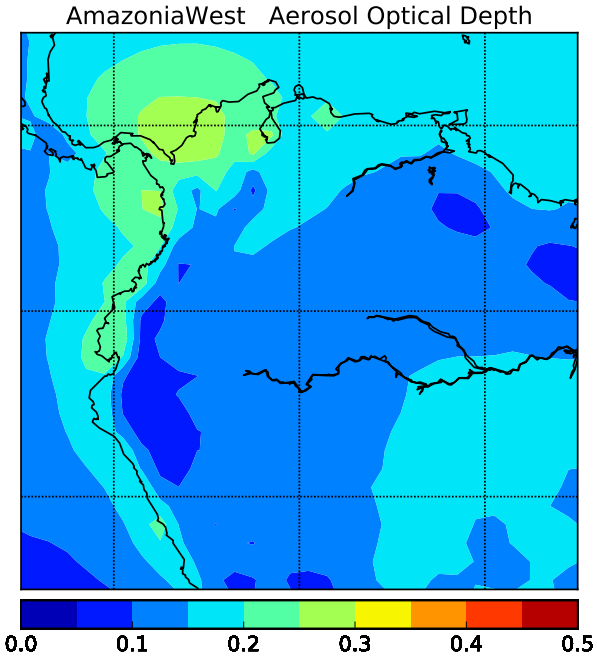
MODIS



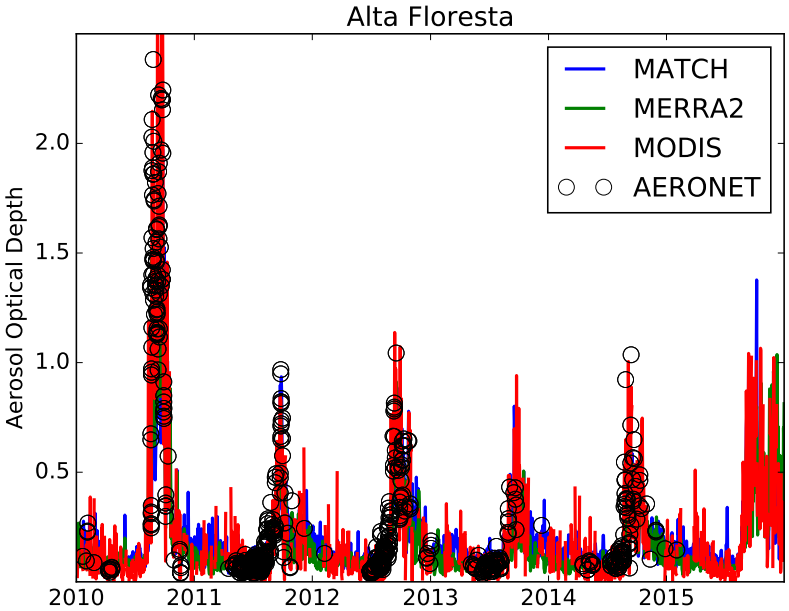
MATCH

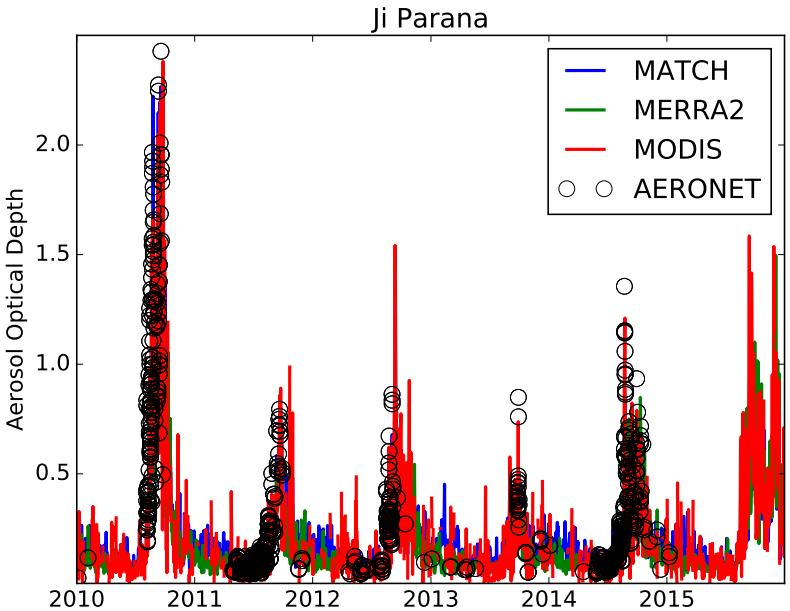


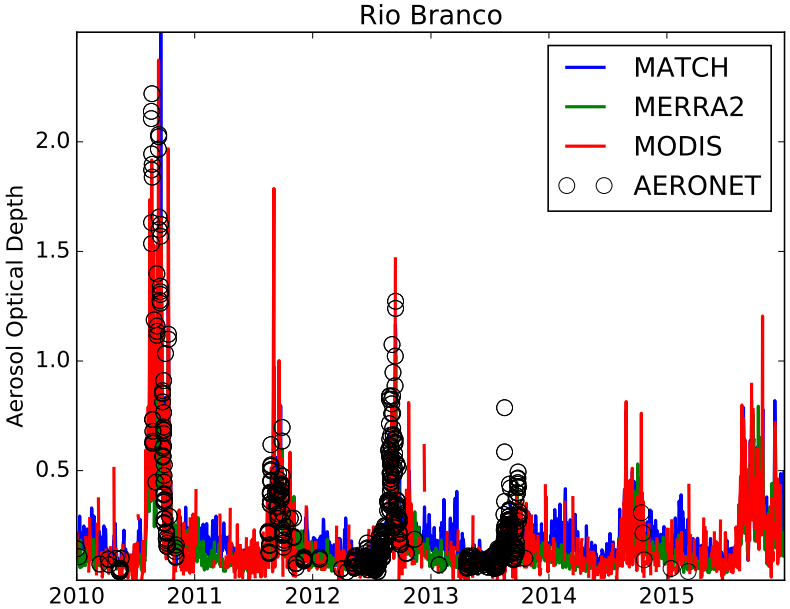
MERRA2

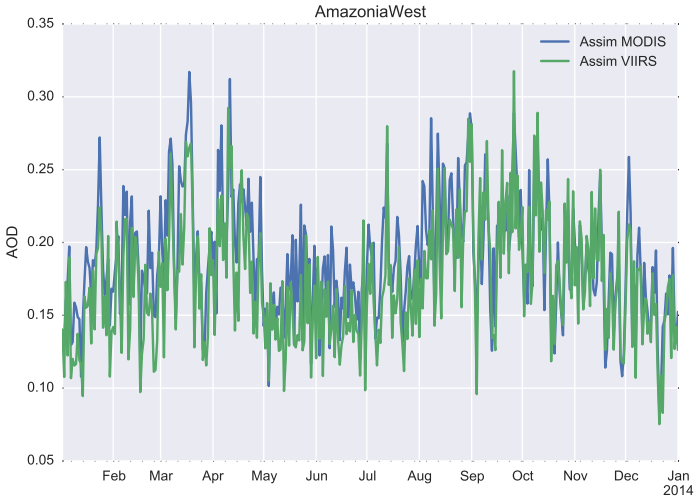


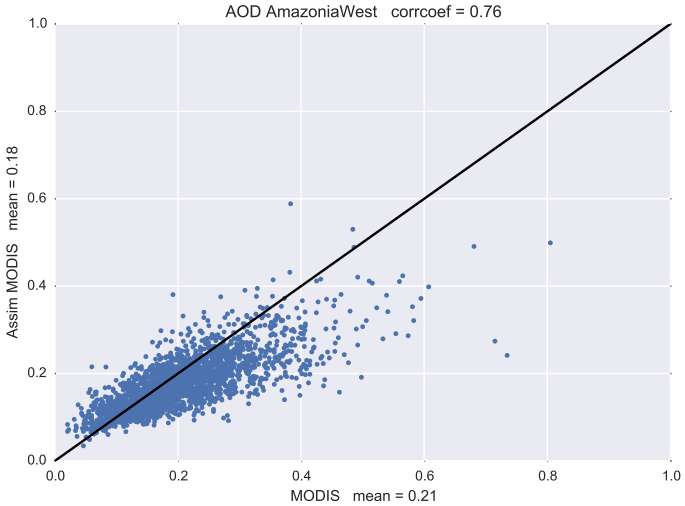
Amazon AERONET Sites

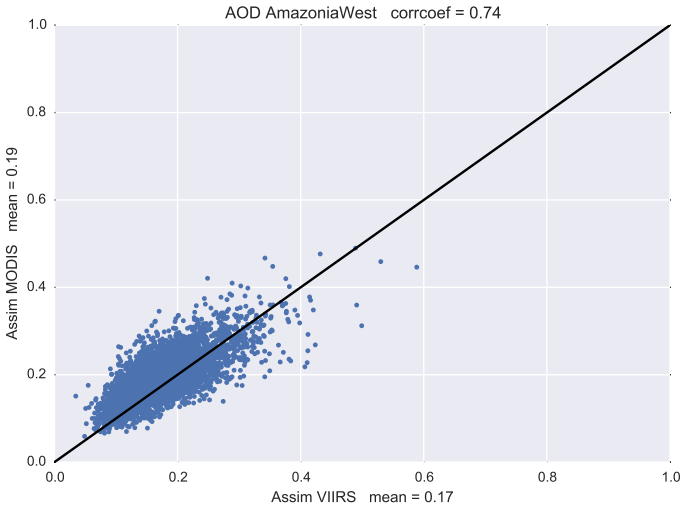


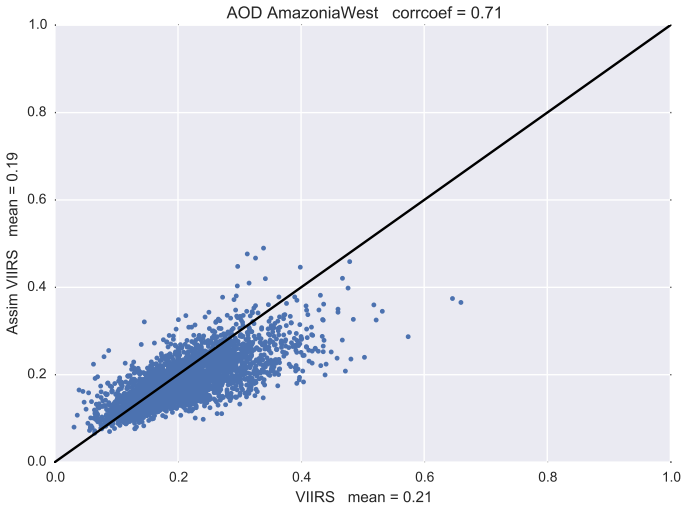




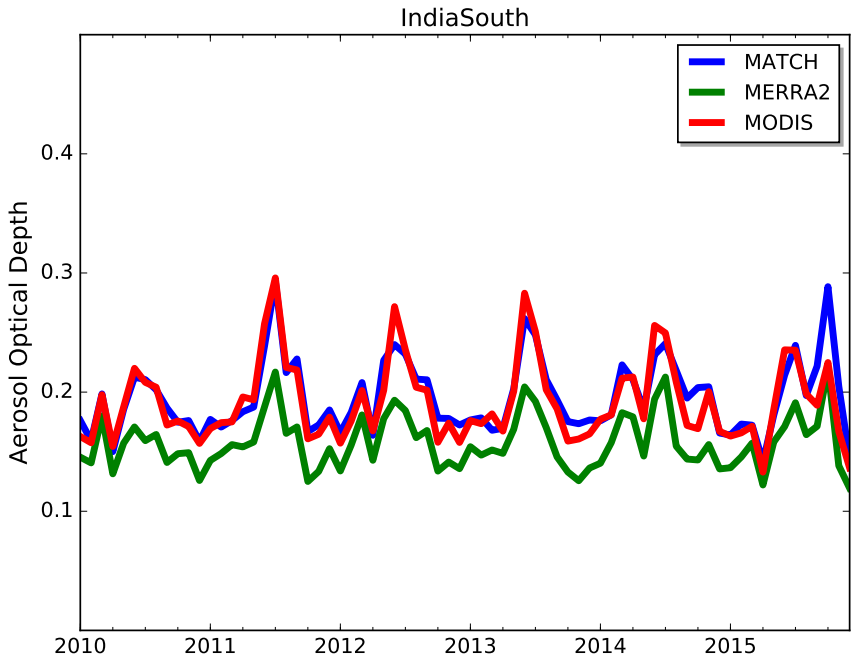

AmazoniaWest
Assim MODIS
Assim VIIRS
AOD
0.35
0.30
0.25
0.20
0.15
0.10
0.05
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
2014


AOD AmazoniaWest corrcoef = 0.76
Assim MODIS mean = 0.18
MODIS mean = 0.21
0.0
0.2
0.4
0.6
0.8
1.0

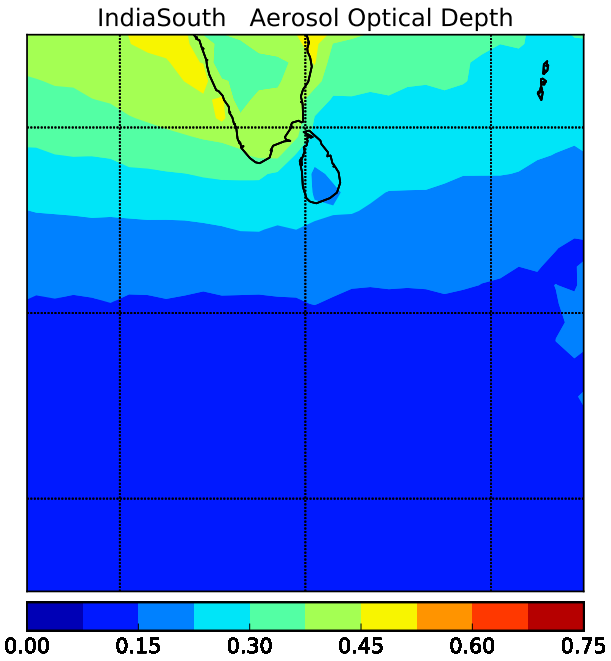

AOD AmazoniaWest corrcoef = 0.74
Assim MODIS mean = 0.19
Assim VIIRS mean = 0.17
0.0
0.2
0.4
0.6
0.8
1.0


AOD AmazoniaWest corrcoef = 0.71
Assim VIIRS mean = 0.19
VIIRS mean = 0.21
0.0
0.2
0.4
0.6
0.8
1.0

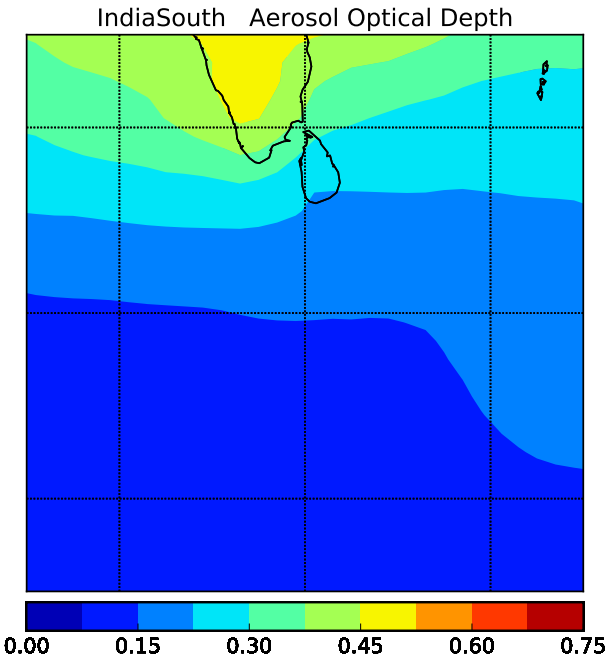
Southern India AOD 2010 - 2015



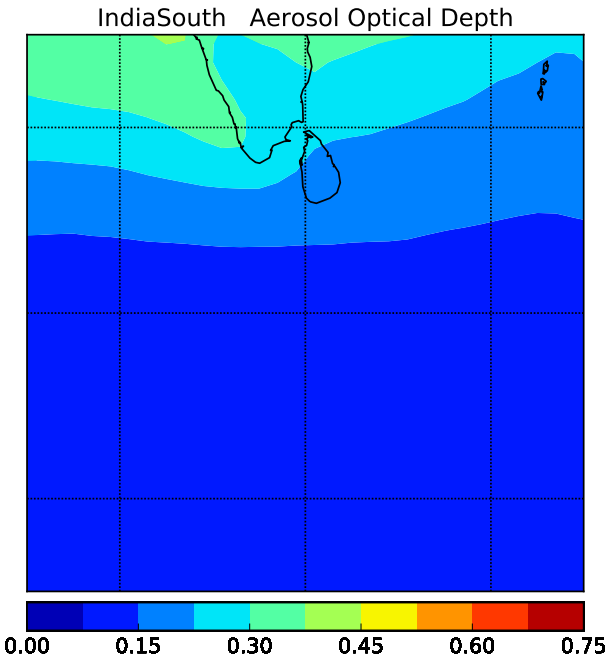
MODIS



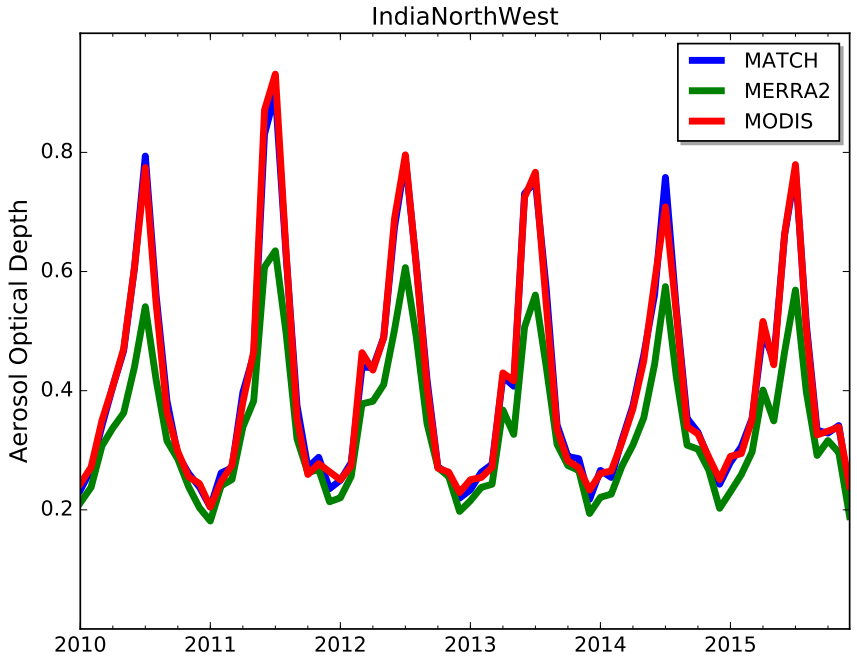
MATCH



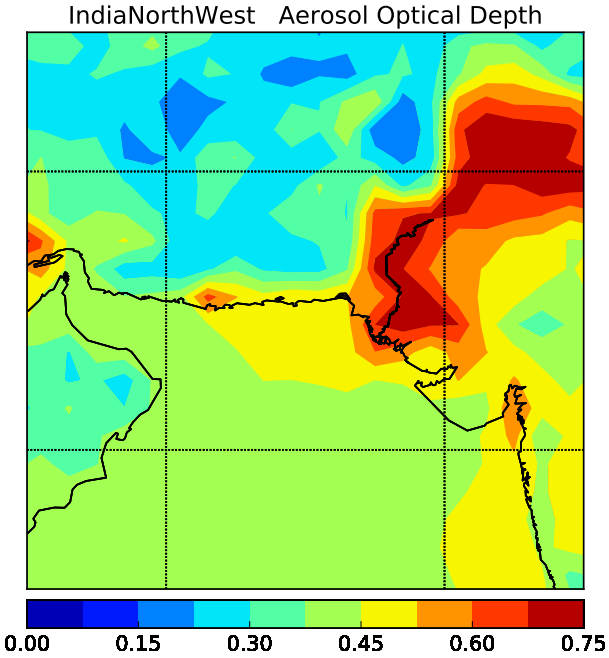
MERRA2



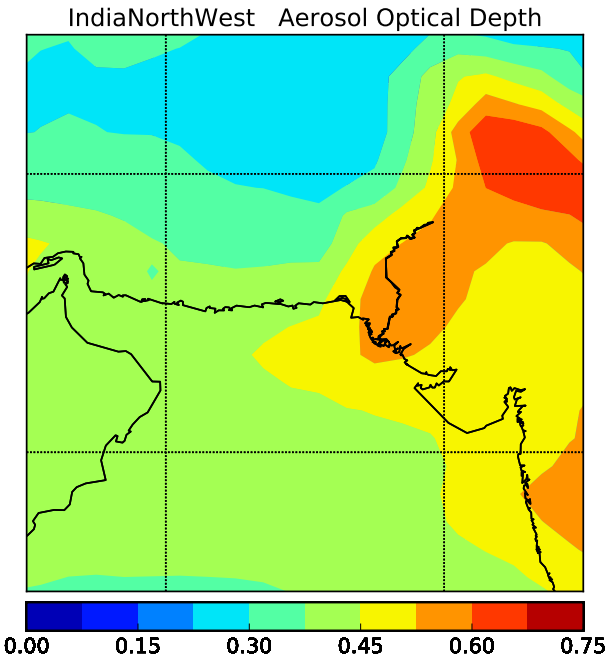
North Western India AOD 2010 - 2015



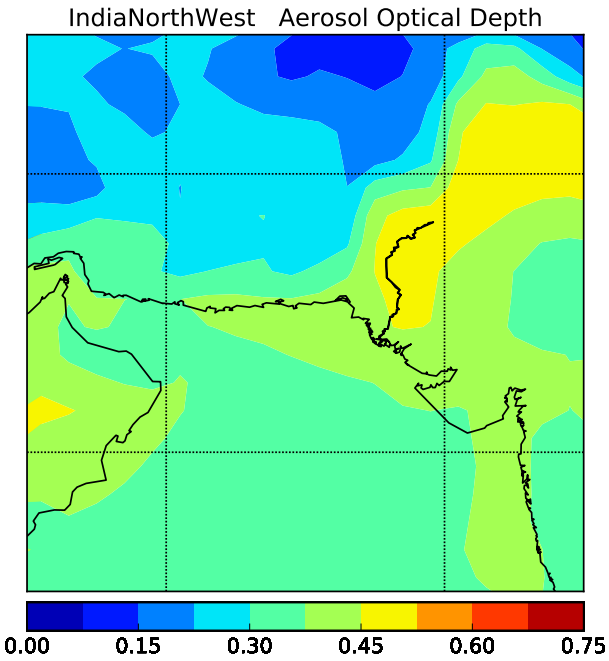
MODIS



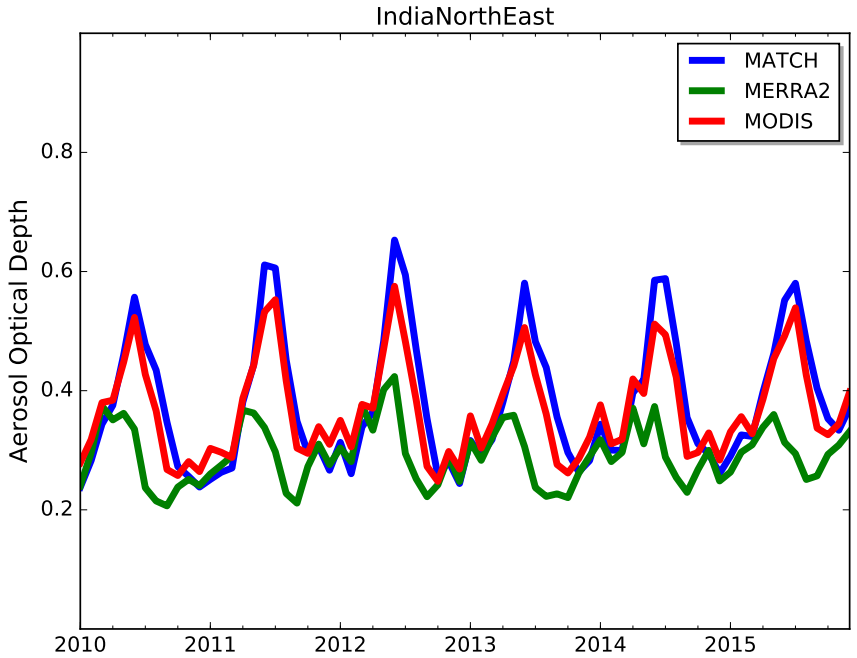
MATCH



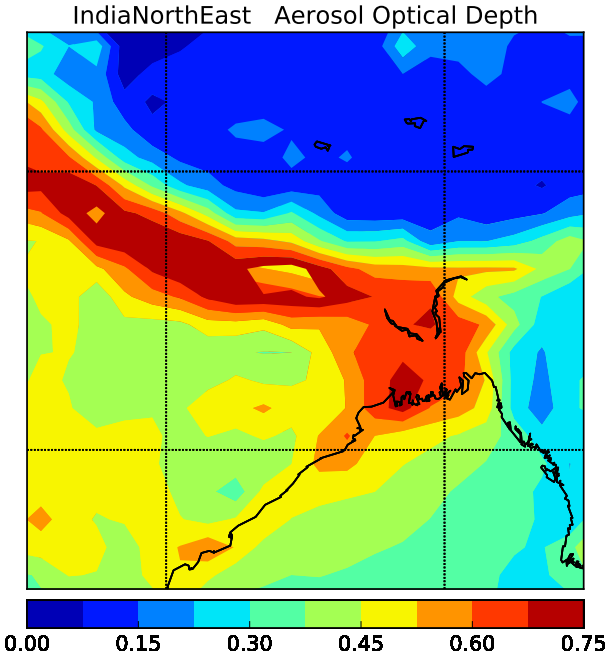
MERRA2



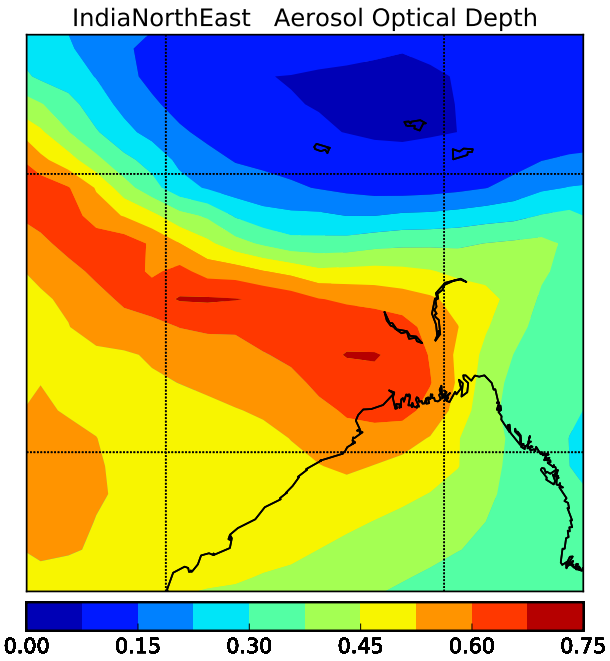
North Eastern India AOD 2010 - 2015



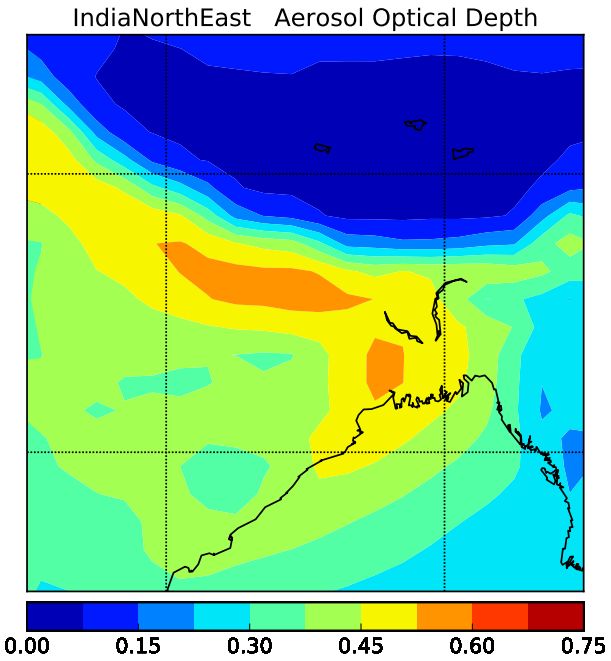
MODIS



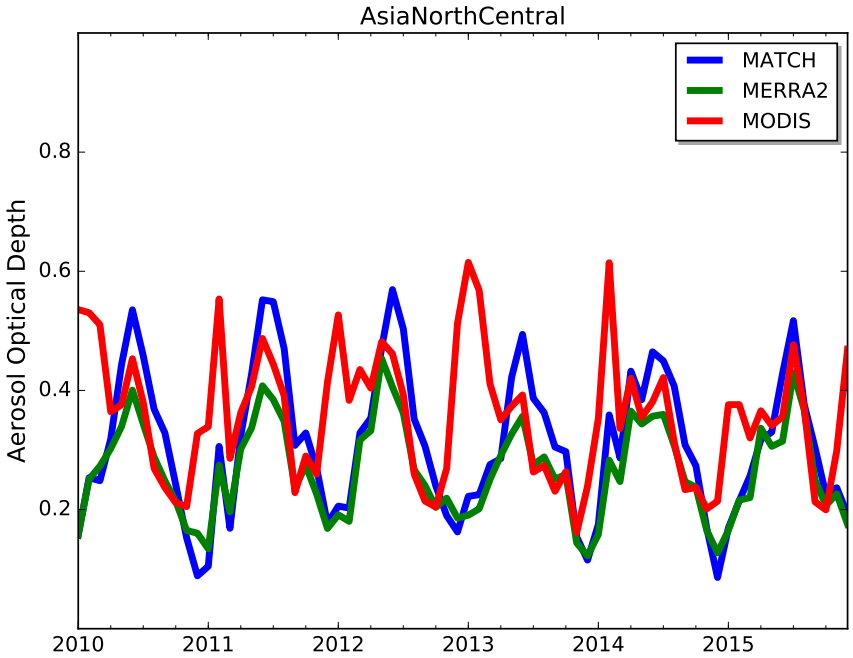
MATCH



MERRA2



China AOD 2010 - 2015



Conclusions

- MATCH tracks MODIS more closely than MERRA2 (by design)
- no large AOD discontinuities in MODIS to VIIRS
- large MATCH and MERRA2 differences over India and Asia
- will create a SARB compatible MERRA2 aerosol dataset