NEMS-GFS Aerosol Component (NGAC) : aerosol verification

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Why verification :

- Monitor regular interval forecasting of different aerosol fields
- Understand and improve forecast biases/error
- Establish common matrices to compare inter-model forecasts
- Assesses impact of observation in the model

Available Datasets for aerosol verification :

- ICAP MME to compare different aerosol species (Dust, BC, Sea salt, Sulfate) against other modeling centers (GSFC, ECMWF, JMA, NRL etc.).

- Ground observing stations : AERONET locations routinely measure AOD at different wavelengths.

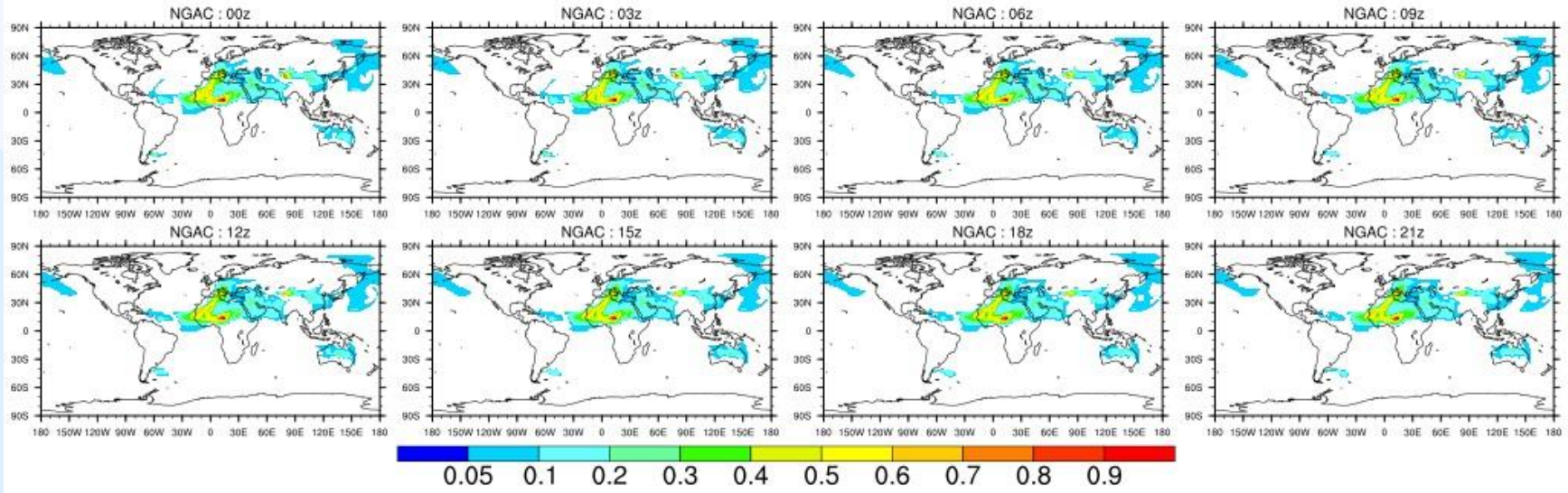
- Near-real time satellite measurements : both 2D (column integrated AOD, angstrom exponents from MODIS) and 3D fields (e.g. CALIPSO aerosol fields).

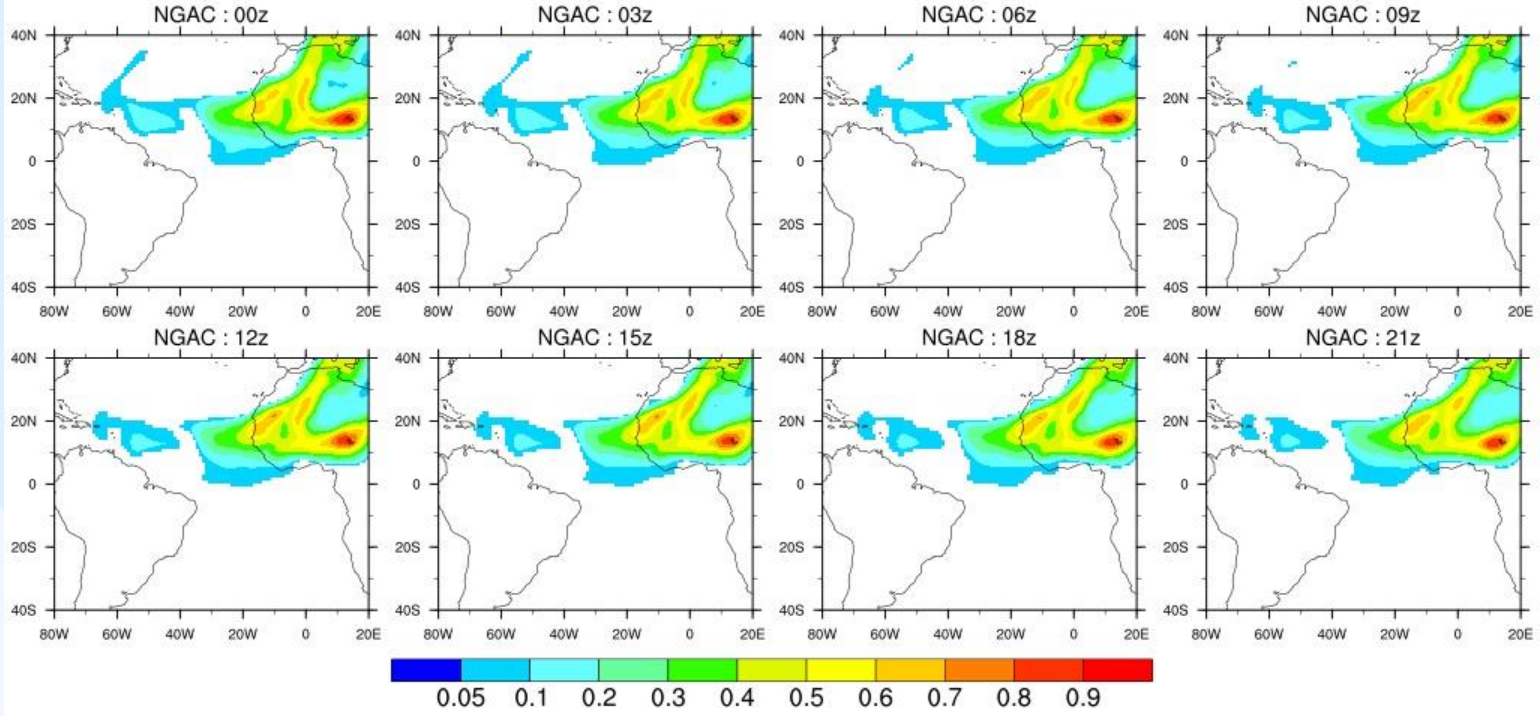
NOAA GFS Aerosol Component (NGAC, v1.0.0) data products

- NGAC uses Goddard aerosol model (GOCART) and NEMS-GFS meteorological fields for dust-only simulations (at present)
- NGAC provides 1x1 degree products in GRIB2 format once per day (at 00z) with 3-hour intervals up to 120 hours
- AOD fields at specified wavelengths (340nm, 440nm, 550nm, 660nm, 860nm, 1.63μm and 11.1μm) for 0-120 hour.
- Also provides dust emission, sedimentation, dry and wet deposition fluxes, dust size mode dust concentration and column mass density (all at 550nm)
- Dust mixing ratio at different model levels for all size bins

Out of so many data products, we do aerosol verification using AOD and PM2.5

NGAC DUST AOD : 13th October, 2014





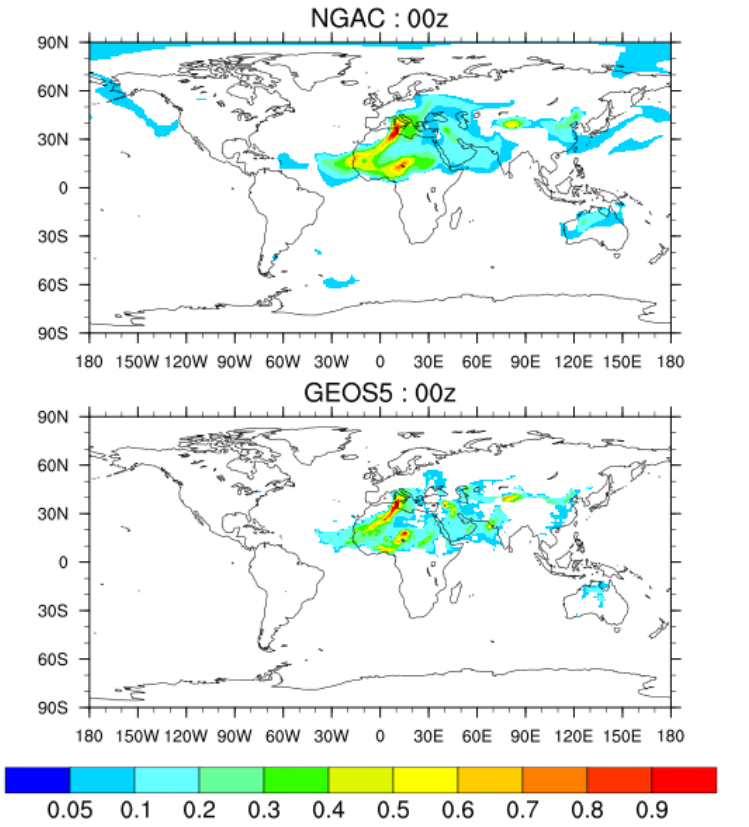
NGAC current verification efforts :

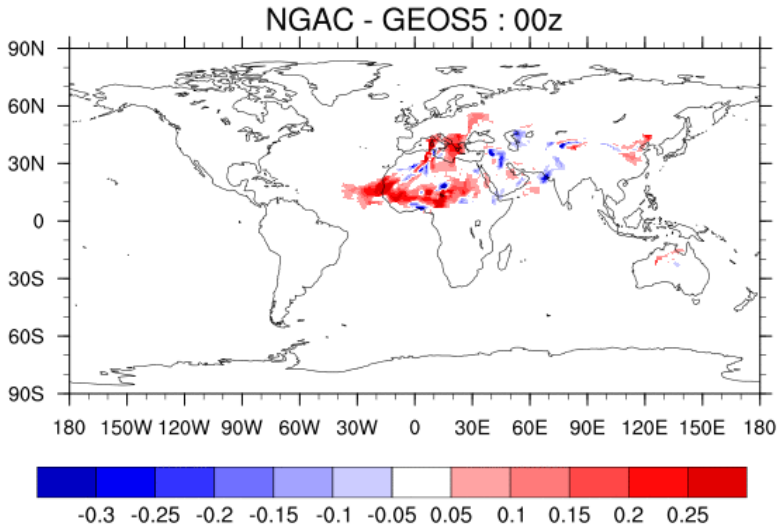
- Simple difference plots for Dust AOD and PM2.5 between NGAC and GEOS-5 (re-gridded to 1 degree resolution) over entire globe and selected regions (like, Africa). Started from September 6th, 2014 and near real-time.

- Time series of NGAC and GEOS5 dust AOD against few selected AERONET observed total AOD.

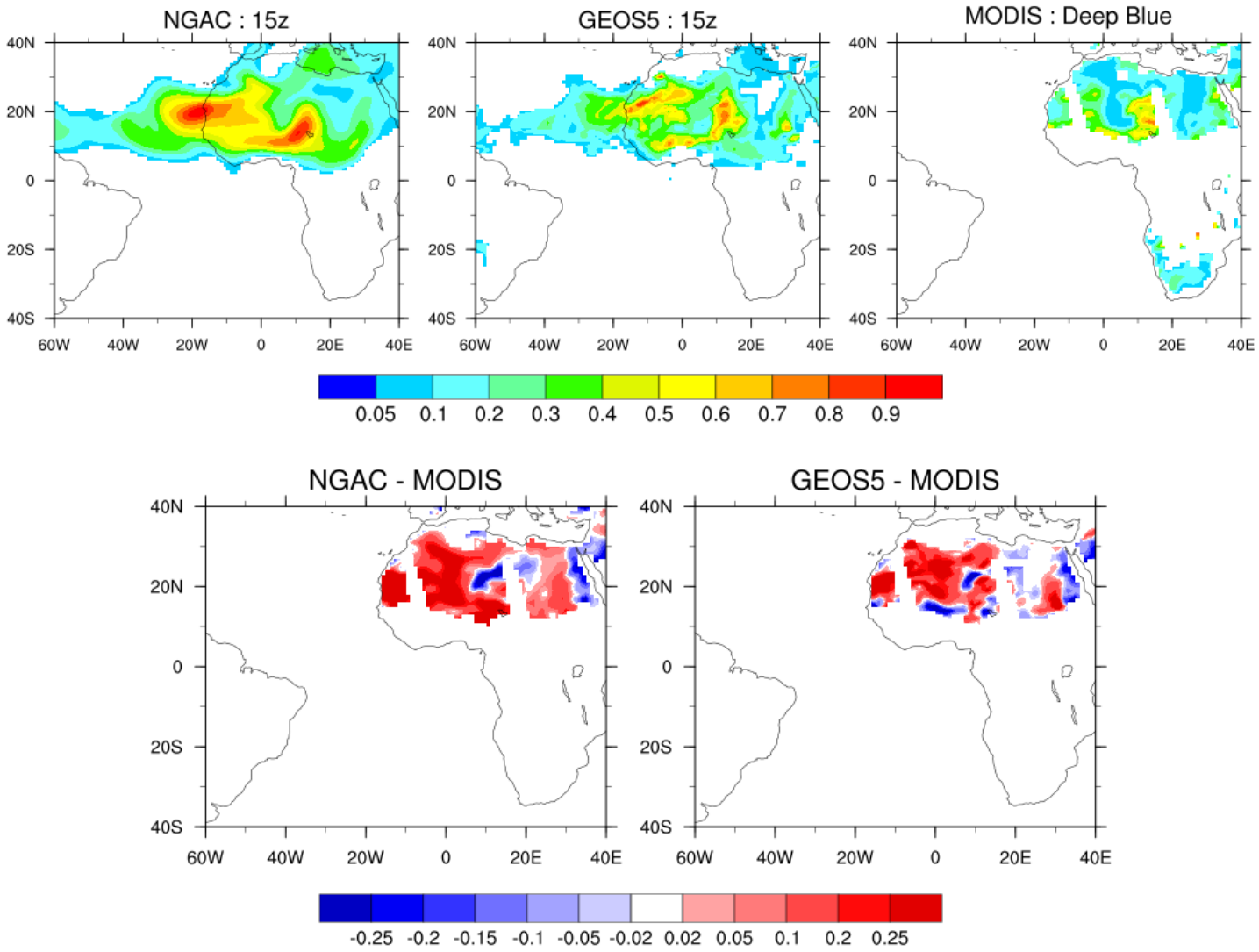
- Compare with MODIS (Aqua, deep blue) observed AOD against NGAC and GEOS5.

15th October, 2014

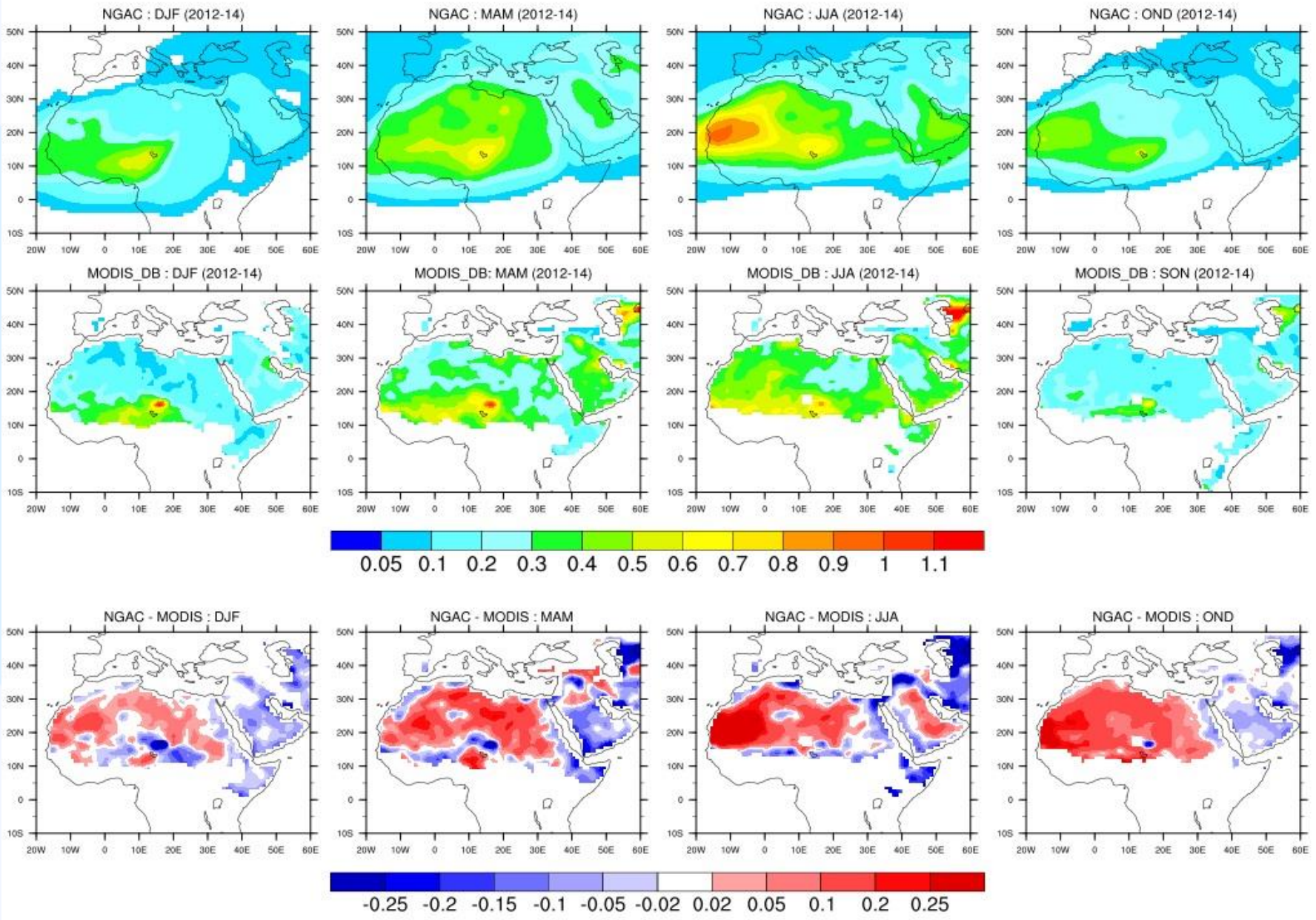


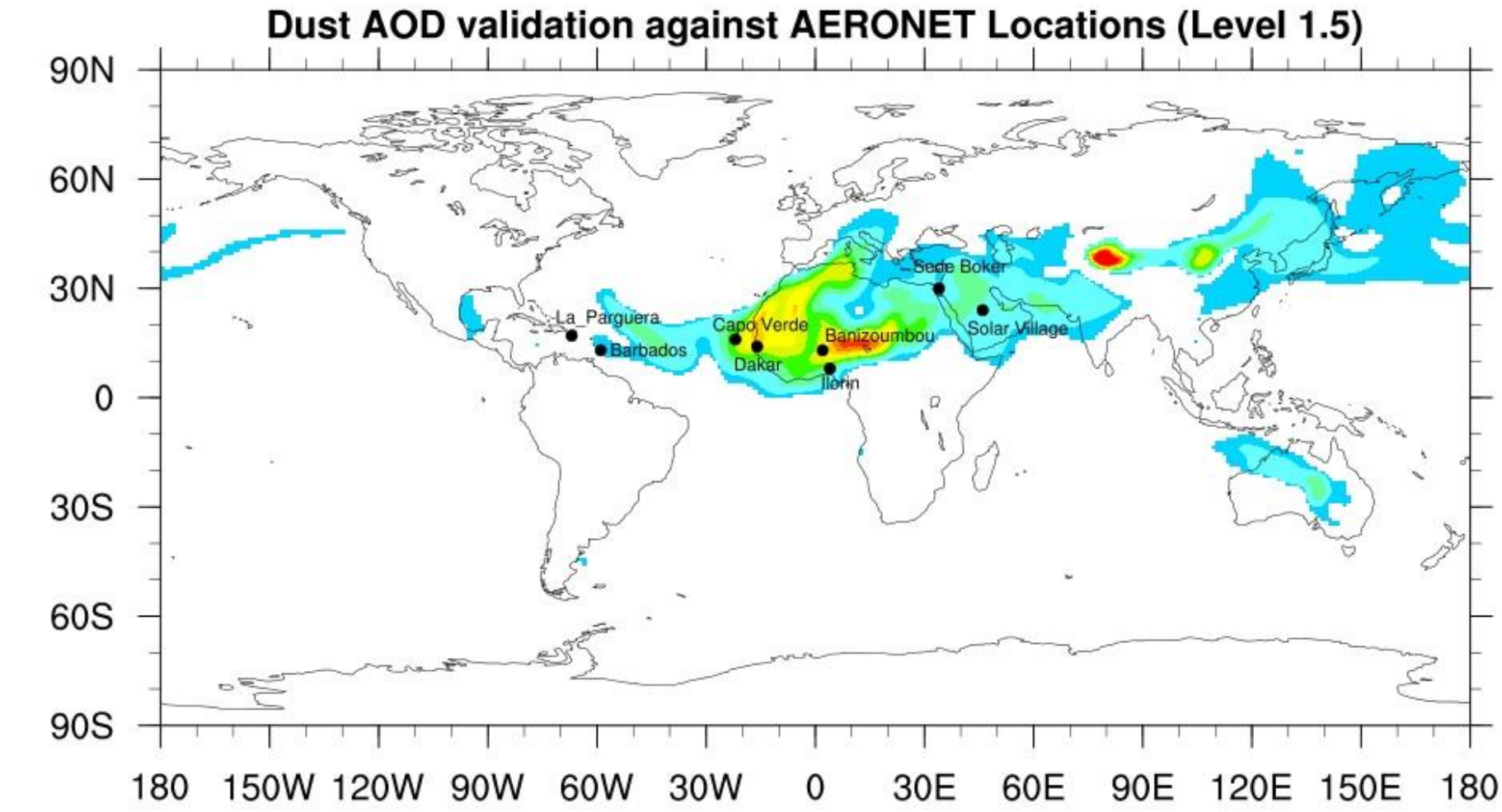


MODIS deep blue AOD (over land) ; 3rd October, 2014

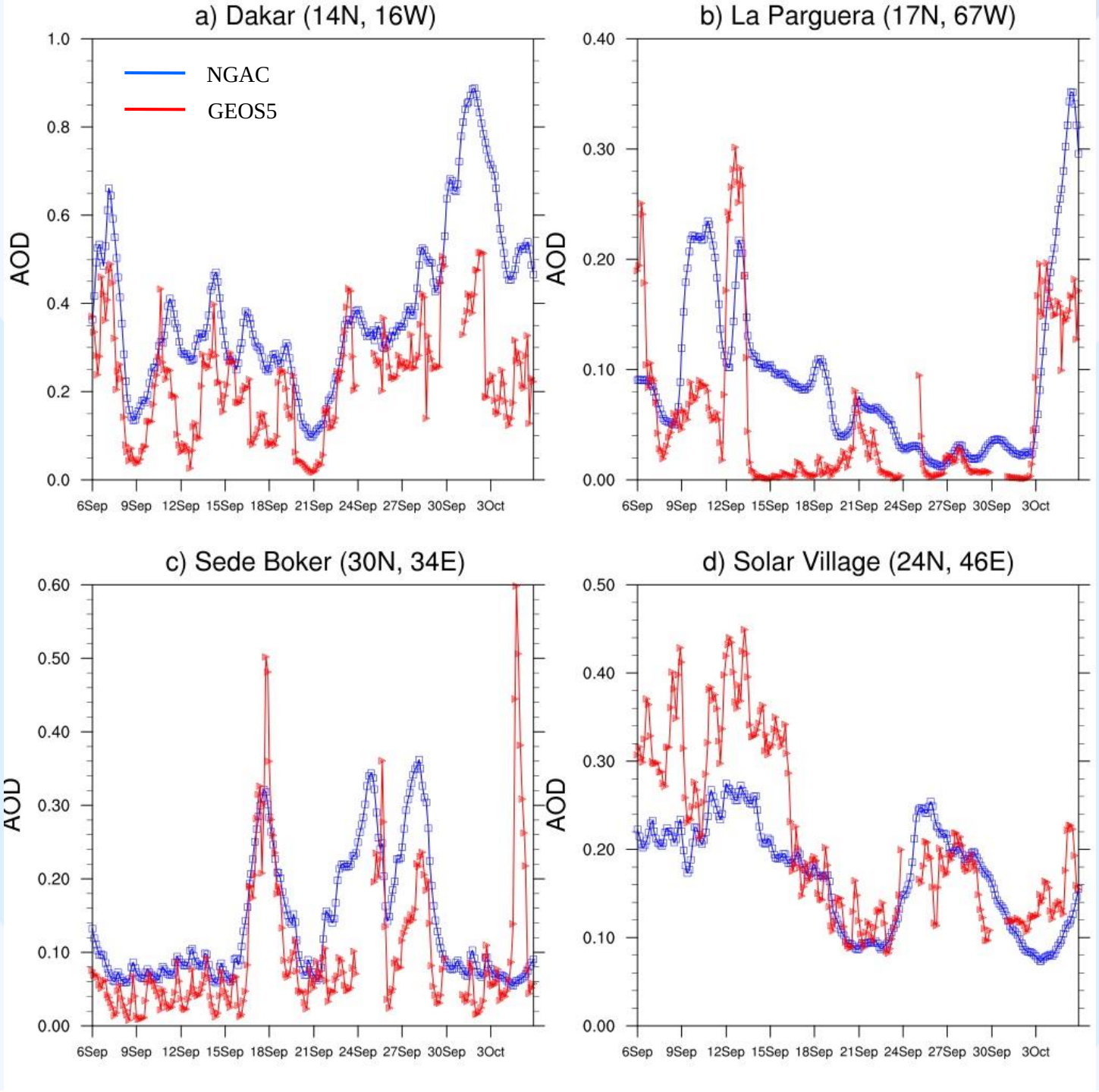


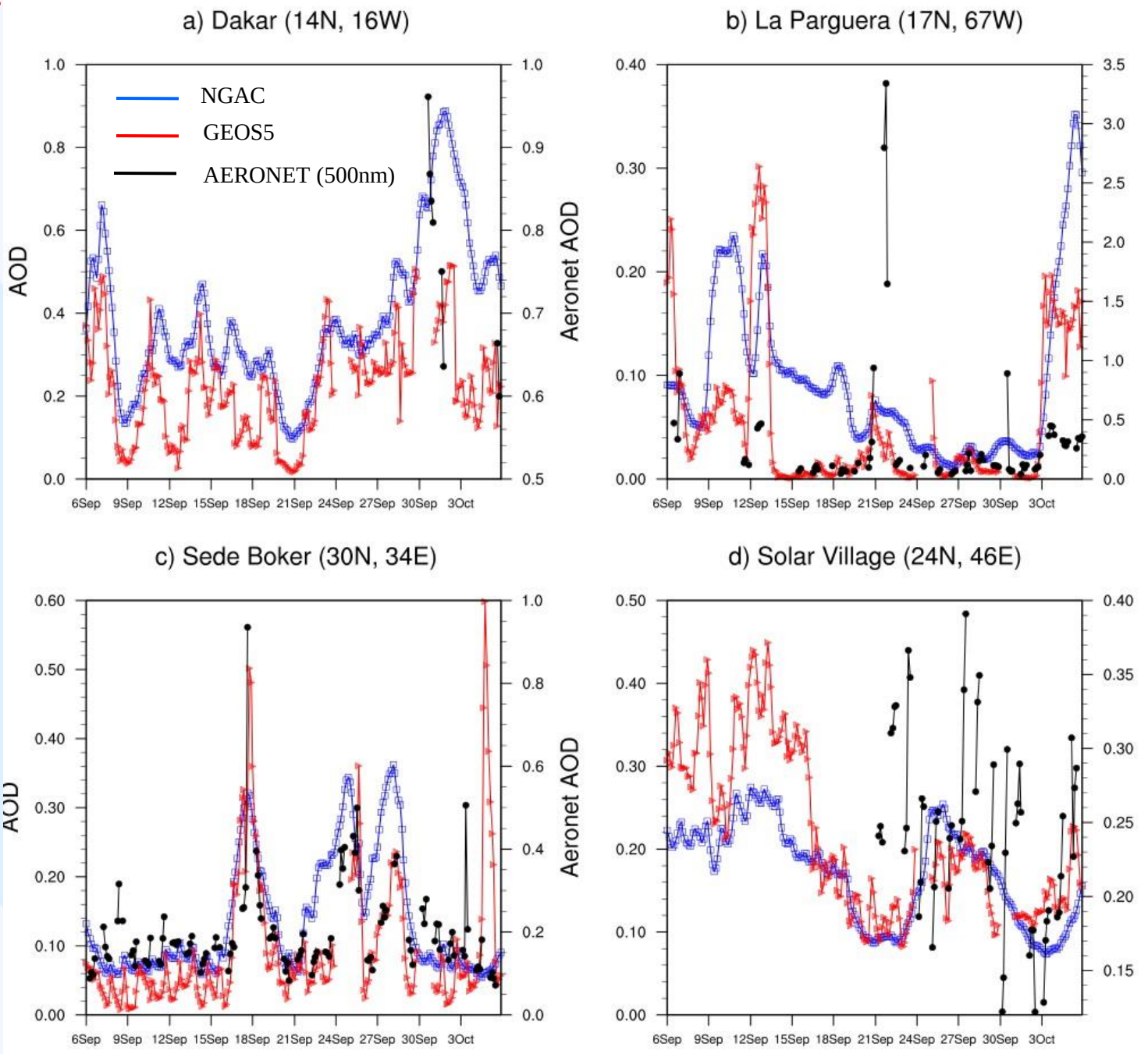
Seasonal variability of NGAC dust AOD (Sept, 2012 – Sept, 2014)





- AERONET provides total AOD at (340, 380, 440, 500, 675, 870, 1020 and 1640 nm) wavelengths


a) Dakar (14N, 16W)
b) La Parguera (17N, 67W)
c) Sede Boker (30N, 34E)
d) Solar Village (24N, 46E)
NGAC
GEOS5
AOD
6Sep 9Sep 12Sep 15Sep 18Sep 21Sep 24Sep 27Sep 30Sep 3Oct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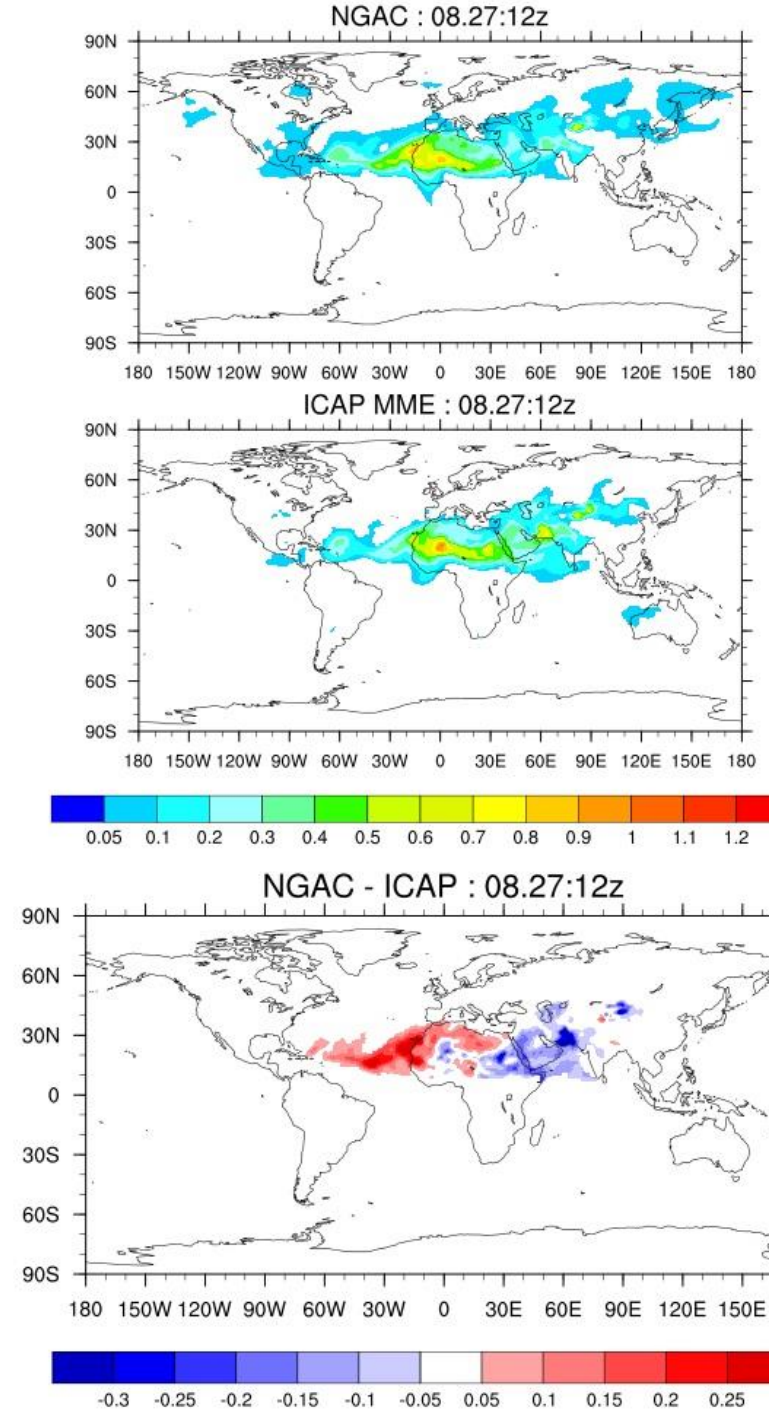
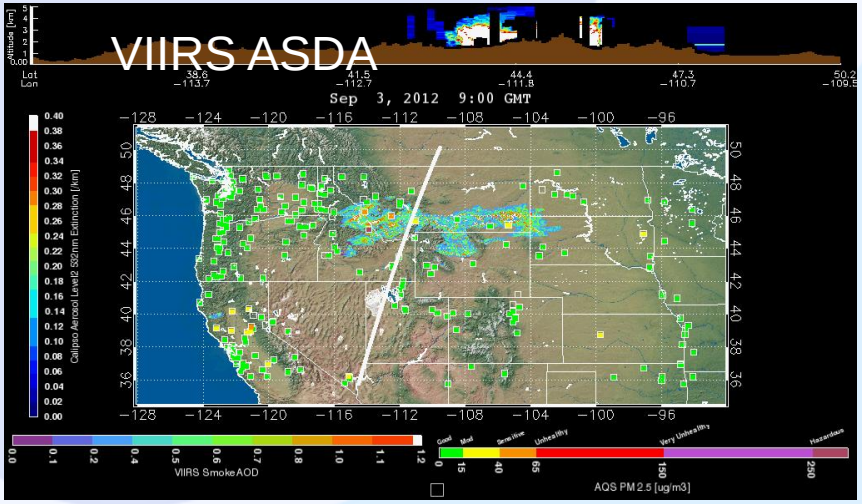
b) La Parguera (17N, 67W)
c) Sede Boker (30N, 34E)
d) Solar Village (24N, 46E)
NGAC
GEOS5
AERONET (500nm)
AOD
Aeronet AOD
6Sep 9Sep 12Sep 15Sep 18Sep 21Sep 24Sep 27Sep 30Sep 3Oct

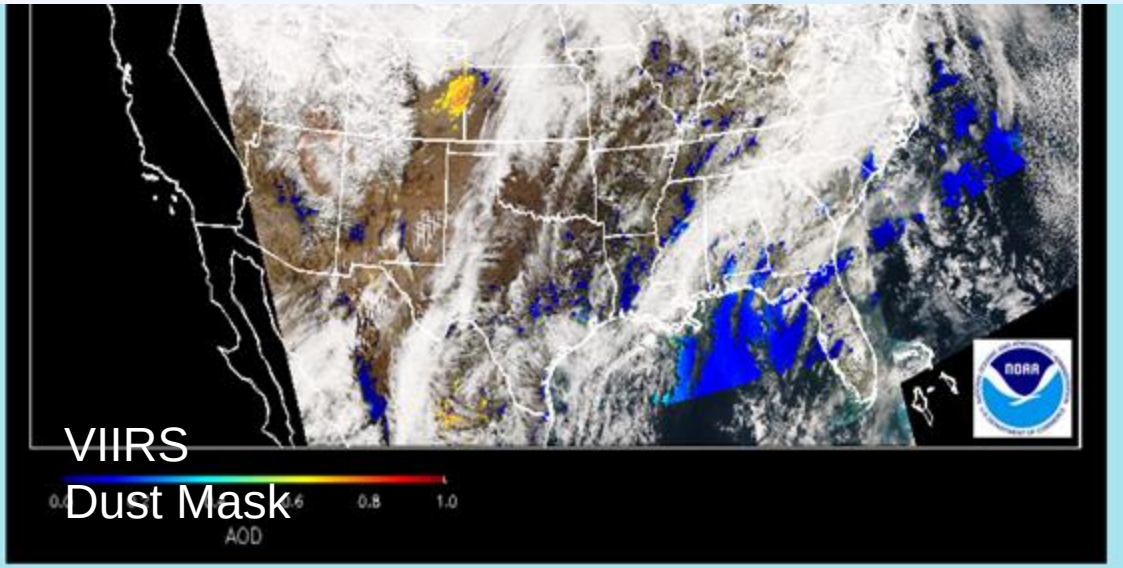


ICAP MME test data provided by Dr. Peng and Dr. Reid (NRL)

Using Satellite Data to Improve Operational Air Quality Forecasting Capabilities

- Routine use of NESDIS smoke and dust product by NWS to verify operational forecasts:
  - ASDA work started in 2005. GOES-E product became operational in 2008 and GOES-W in 2009.
  - Aqua MODIS dust mask work started in 2008. Product became operational in 2012.
- NESDIS continuing to refine the dust mask algorithm and applying it to SNPP VIIRS





Shobha Kondragunta (NESDIS/STAR)

Ongoing work :

- Introducing statistical verification package (MET-5, from DTC) into near-real time NGAC verification.

- Explore additional fields (angstrom exponent, PM2.5) for dust and other aerosols for verification

- Compare against ICAP MME models for dust and other species

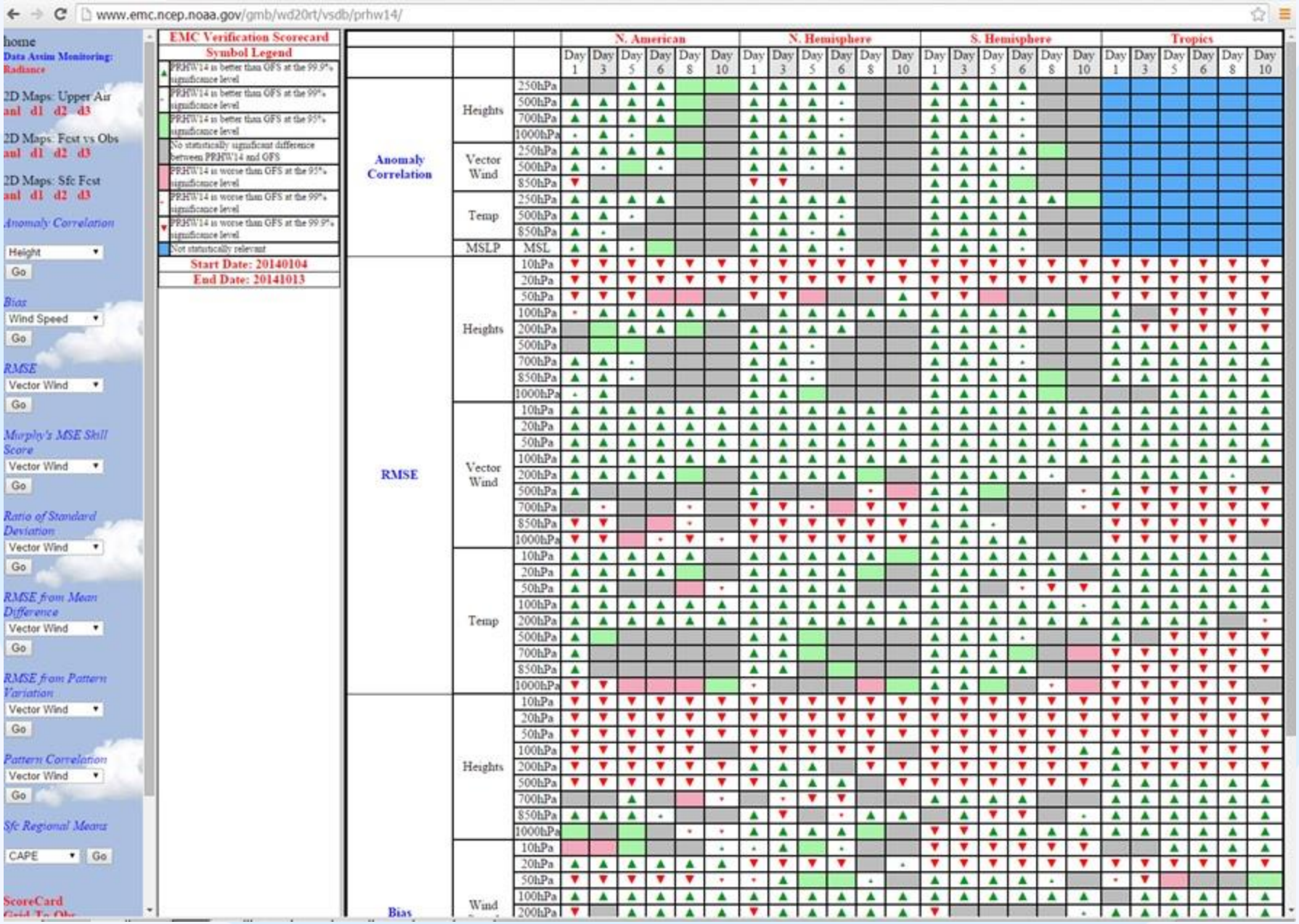
- Using other satellite observations (like CALIPSO 3D fields) to verify (for example, dust extent) vertically.

Some key issues :

✓Resolution (both spatial and temporal)

✓ Data format (grib2/ascii/netcdf/hdf) and suitable software to visualize

NCEP emphasis on improving model performance metrics



Courtesy : Fanglin Yang (NCEP/EMC)