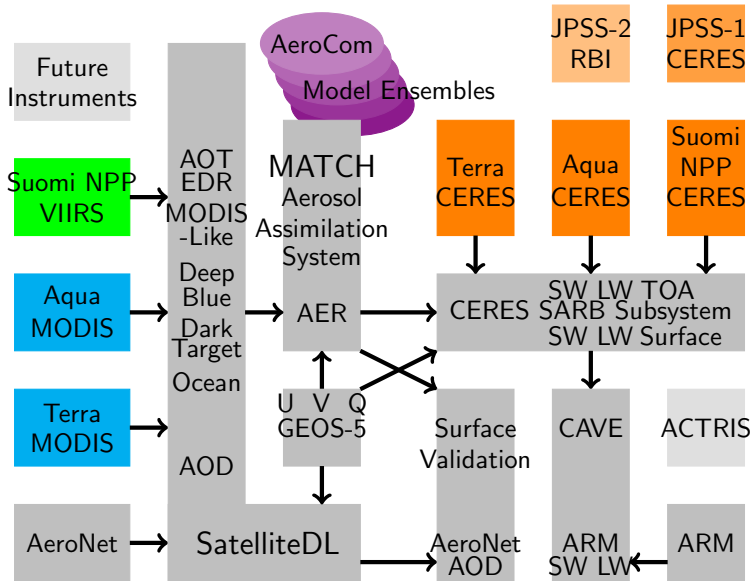


MATCH Edition 4 Aerosol Black Carbon Evaluation

David Fillmore

2014 April 23

CERES Science Team Meeting, NASA LaRC



MATCH Edition 4 Update

Final MATCH changes before June 1 code delivery:

- ▶ MODIS AOD uncertainty estimation by CERES surface types from (Petrenko and Ichoku, 2013) based on GIOVANNI ¹ coincident Terra/Aqua MODIS and AERONET statistics
- ▶ will improve assimilation observation error covariance matrices
- ▶ anthropogenic emissions of SO₂, SO₄, OC, BC from *AeroCom*, based on GEIA (Global Emissions Initiative) ² new MATCH types SO₄, OC, BC = SO_{4A}, OCA, BCA (anthro) + SO_{4N}, OCN, BCN (natural)

SARB Working Group

- ▶ MATCH Ed4 black carbon evaluation
- ▶ AERONET AAOD, BC surface observations

MATCH Ed2 in *AeroCom* black carbon study
(see Koch *et. al.*, 2009)

¹<http://disc.sci.gsfc.nasa.gov/giovanni/>

²<http://aerocom.met.no/> and <http://www.geiacenter.org/>

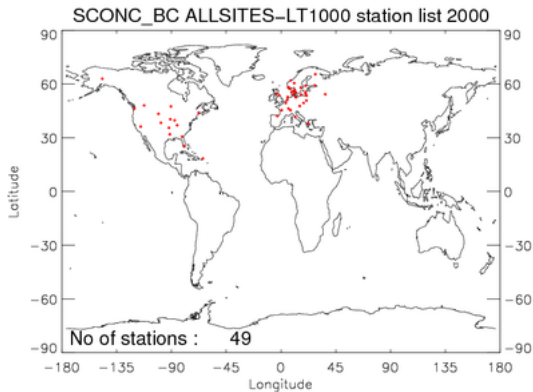


Figure 1 : Observations sites of yearly mean BC surface concentration. Observations are from the IMPROVE network over the North America and the EMEP network over Europe. See (Zhang *et. al.*, 2009) over Asia.

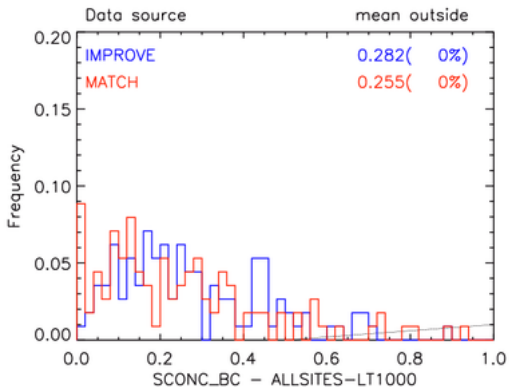


Figure 2 : MATCH versus IMPROVE over North America for BC surface concentration (1000 ng m^{-3}).

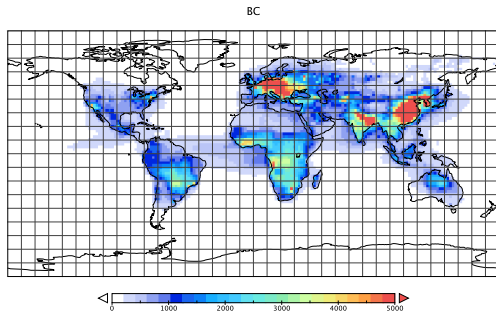


Figure 3 : MATCH yearly mean BC surface concentration (ng m^{-3}).

BC Regional Tendencies

- ▶ High Latitudes 10 - 100 ng m⁻³
- ▶ North America 100 - 500 ng m⁻³
- ▶ Europe 500 - 5000 ng m⁻³
- ▶ Asia 1000 - 15000 ng m⁻³

BC Surface Concentration Summary

Average model to obs ratio from (Koch *et. al.* 2009).

Model	N. America	Europe	Asia
MATCH Ed2	1.3	3.0	0.25
MATCH Ed4	1.1	2.5	0.50
SPRINTARS	7.7	9.7	1.0
GOCART	1.2	2.1	0.48
<i>AeroCom</i> Average	1.6	2.6	0.50
<i>AeroCom</i> Median	1.2	2.2	0.43

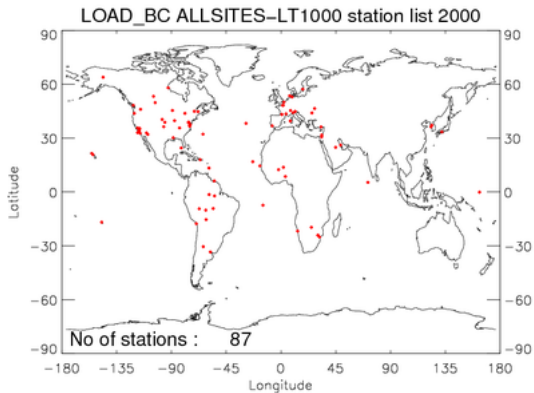


Figure 4 : AERONET Surface Sites for Aerosol Absorption Optical Depth at 550 nm.

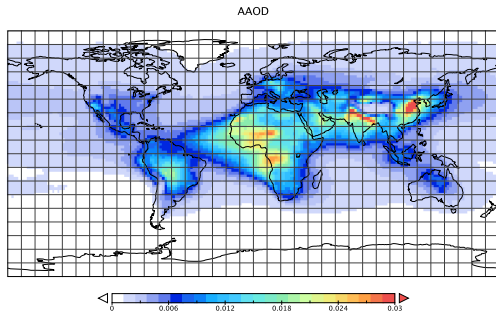


Figure 5 : MATCH Aerosol Absorption Optical Depth at 550 nm. Primarily BC and DUST.

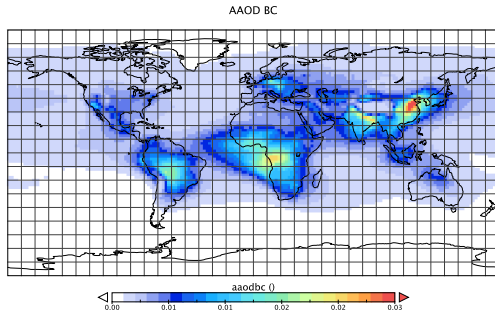
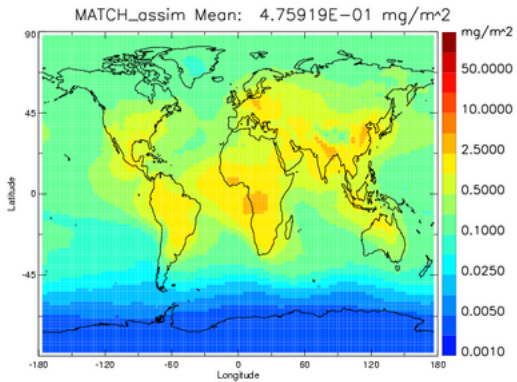


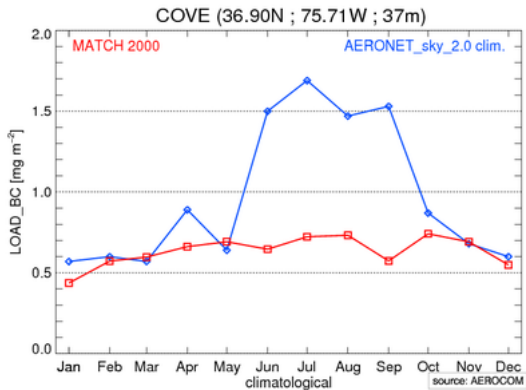
Figure 6 : MATCH BC Aerosol Absorption Optical Depth at 550 nm.

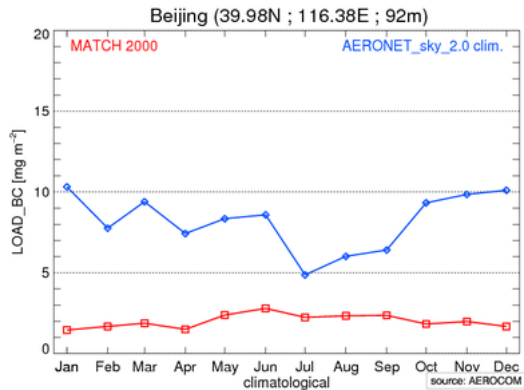
AAOD Summary

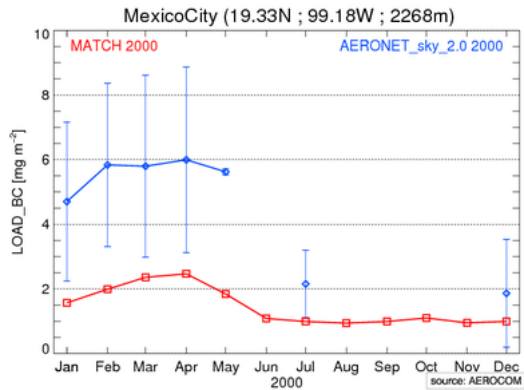
Average model to obs ratio.

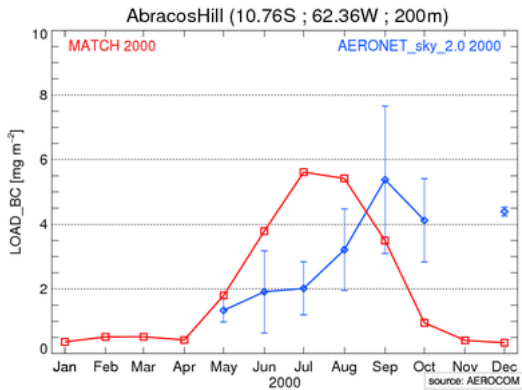
Model	N. America	Europe	Asia	S. America	Africa
MATCH Ed2	0.65	0.71	0.67	0.65	0.59
MATCH Ed4	0.75	0.80	0.72	0.73	0.63
SPRINTARS	1.4	0.48	0.44	1.8	1.2
GOCART	1.4	1.5	1.4	0.72	0.79
<i>AeroCom</i> Average	0.86	0.81	0.67	0.68	0.53











BC Column Mass Summary

Average model to obs ratio.

Model	N. America	Europe	Asia	S. America	Africa
MATCH Ed2	0.34	0.44	0.39	0.61	0.50
MATCH Ed4	0.40	0.53	0.57	0.69	0.61
SPRINTARS	1.2	1.3	0.91	0.63	2.2
GOCART	0.53	0.73	0.80	0.48	0.75
<i>AeroCom</i> Average	0.42	0.58	0.64	0.42	0.64

- ▶ BC a major component of clear-sky SW absorption, but not well constrained by satellite observations (but MISR and OMI have AAOD products)
- ▶ Further BC *AeroCom* activity planned with HIPPO ³ aircraft campaigns
- ▶ New ACTRIS ⁴ portal consolidates many in-situ aerosol datasets from networks and field campaigns

³<http://hippo.ornl.gov/>

⁴<http://actris.nilu.no/>