

**How can NASA satellite data (and models) can be used to improve NASA's operational air quality forecasting?**

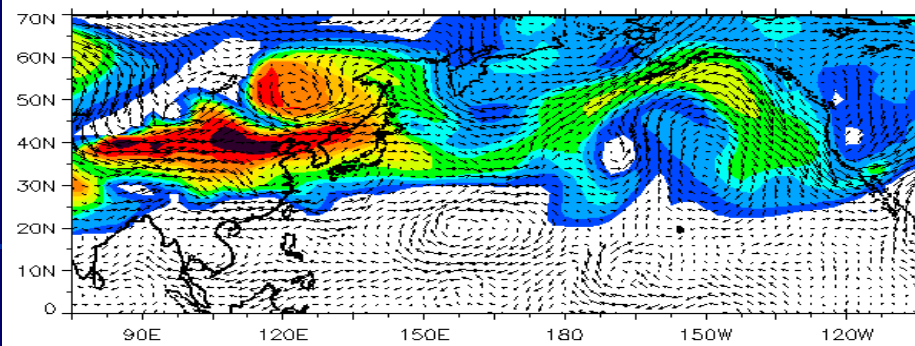
**Mian Chin NASA GSFC**

# The quality of air quality forecasts depends on

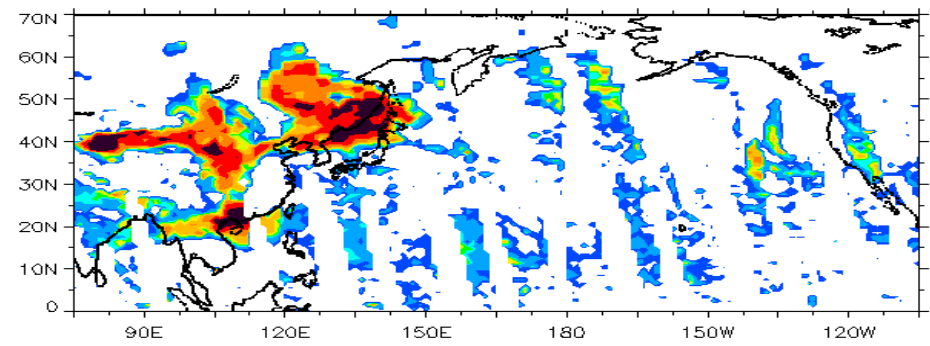
- The accuracy of emission, chemistry, physical processes in the regional forecast model
- The adequate lateral and initial conditions for the regional forecast model that take into account for the long-range transport of material from outside of the model domain

# Dust Evolution and Trans-Pacific Transport 4/8 – 4/14/01

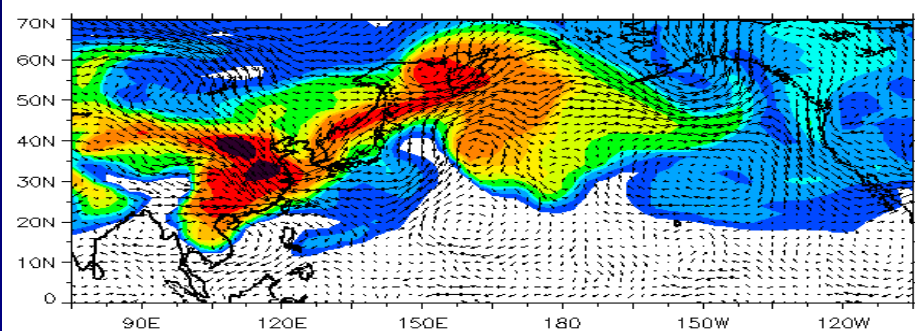
Dust AOT April 8, 2001 GOCART



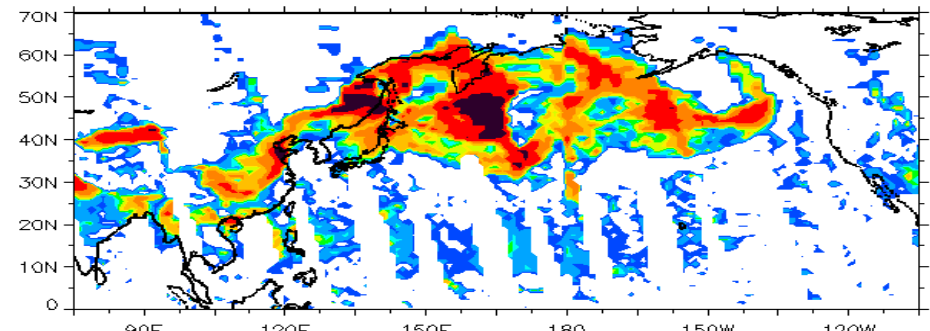
TOMS AI April 8, 2001



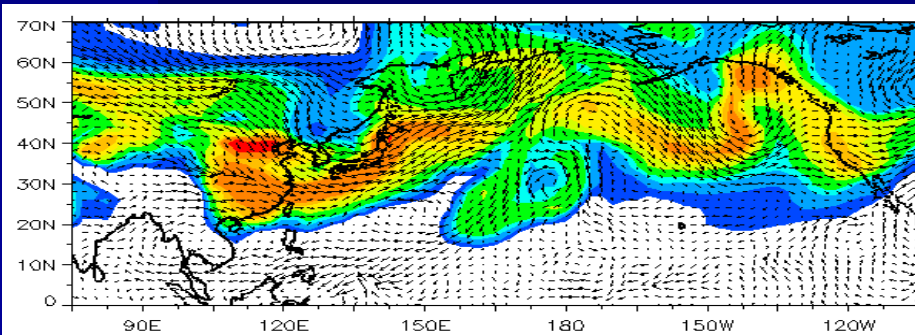
Dust AOT April 11, 2001 GOCART



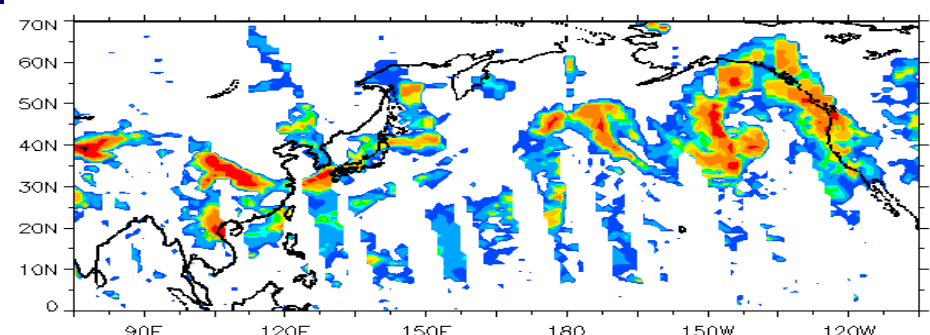
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Dust AOT April 14, 2001 GOCART



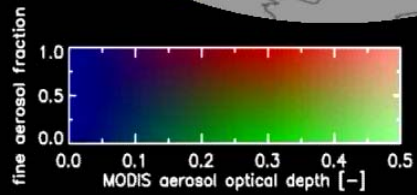
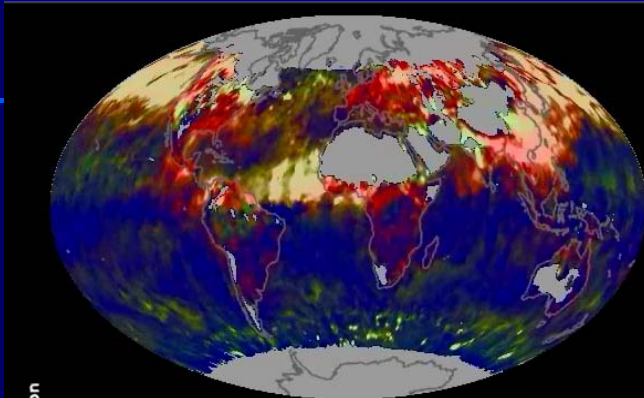
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# Global aerosol distributions

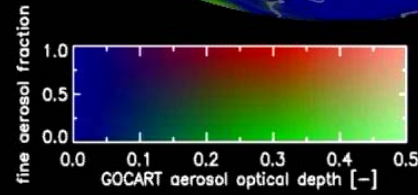
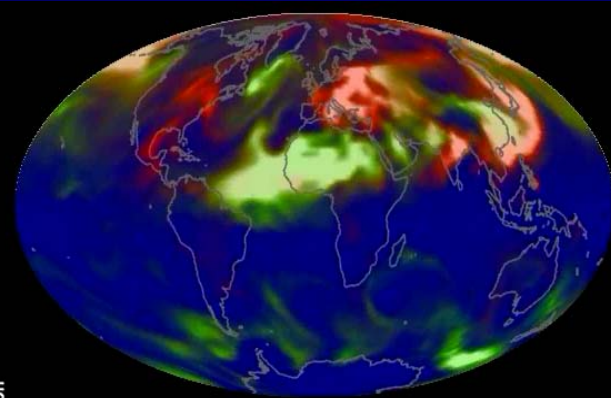
4/13/2001

MODIS



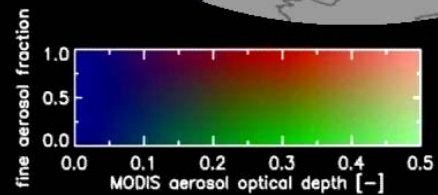
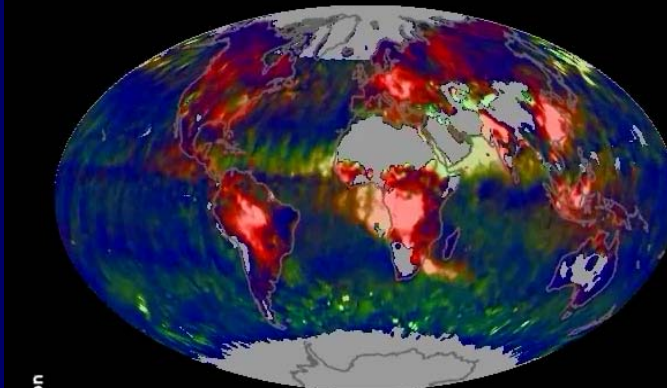
13 APR 2001

GOCART

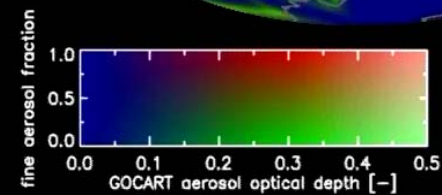
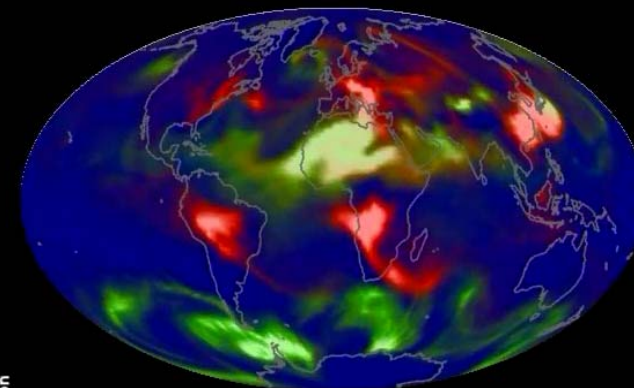


13 APR 2001

8/22/2001



22 AUG 2001



22 AUG 2001

# What can we (NASA) do in partnership with NOAA/EPA to improve AQF (for aerosol)?

- Satellite fire data for biomass burning emissions
- An optimal global dataset that integrate satellite data and global model to provide lateral boundary conditions for AQF model

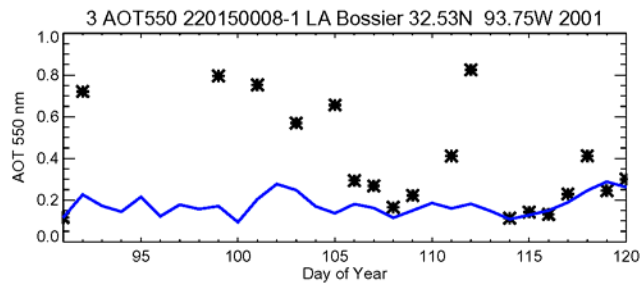
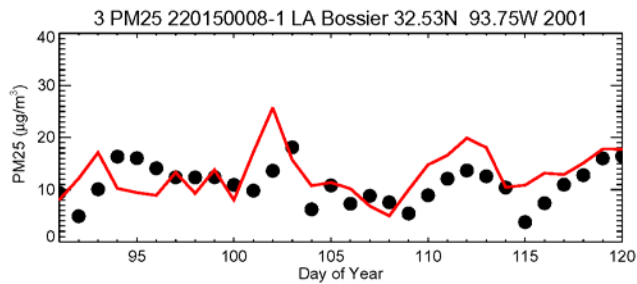
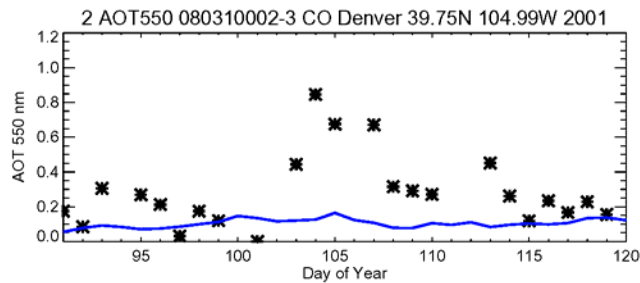
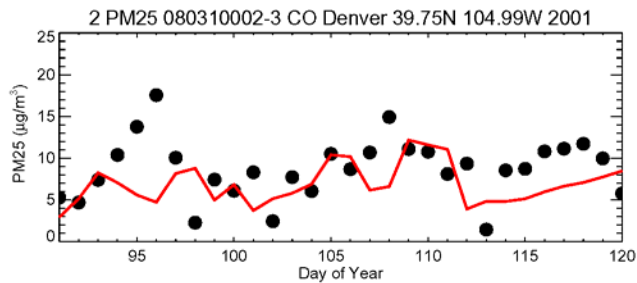
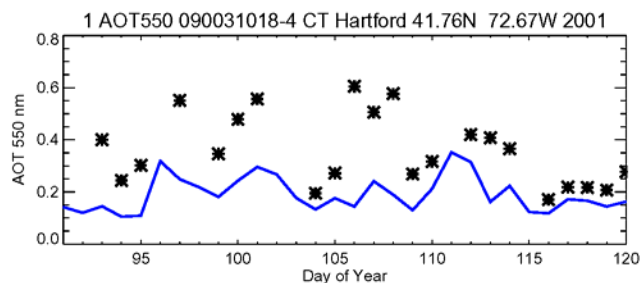
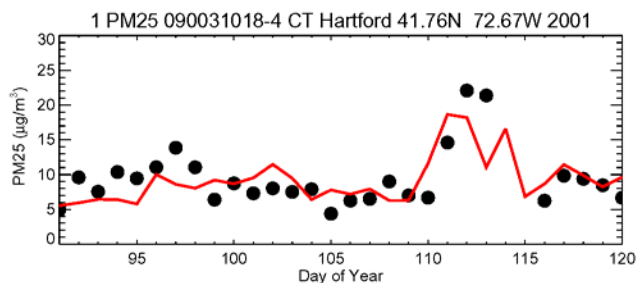
## GOCART vs EPA PM2.5

Symbol: data Line: model

## GOCART vs MODIS AOT

Symbol: data Line: model

PM2.5



AOT

April 2001

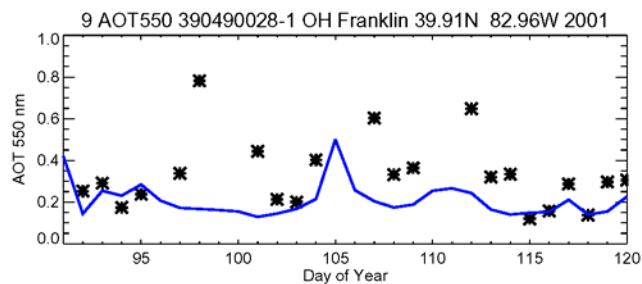
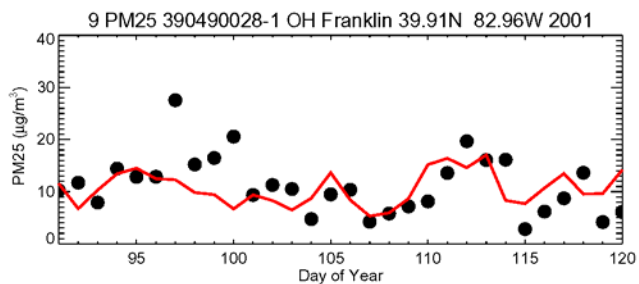
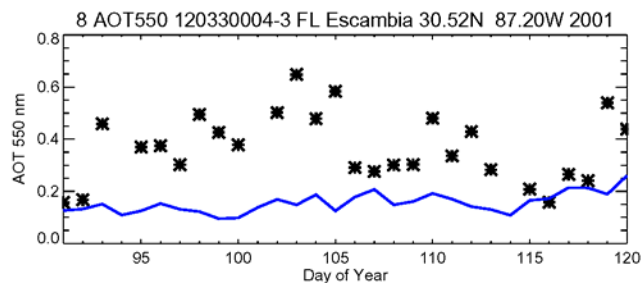
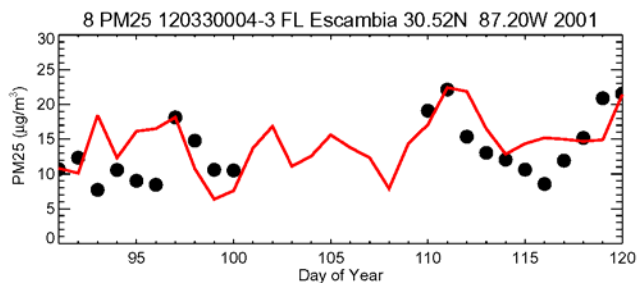
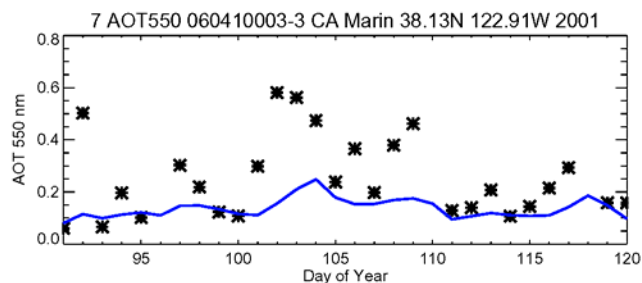
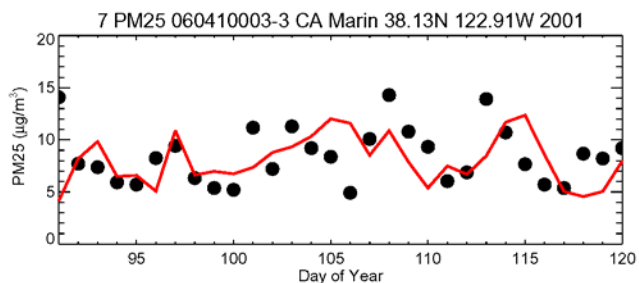
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April 2001

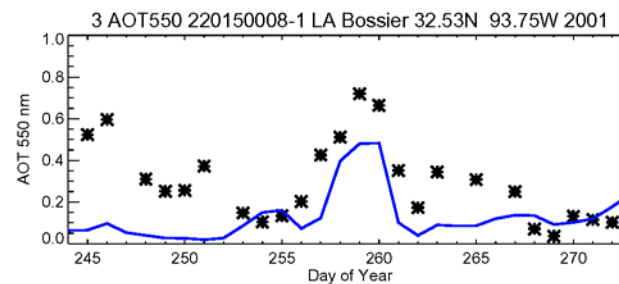
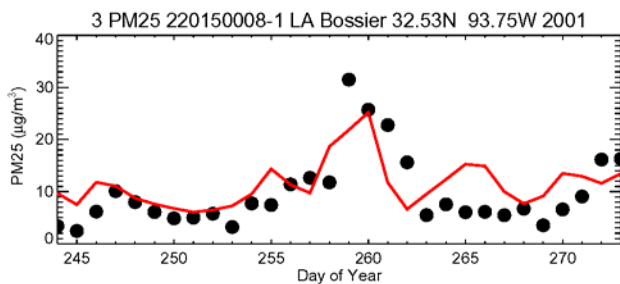
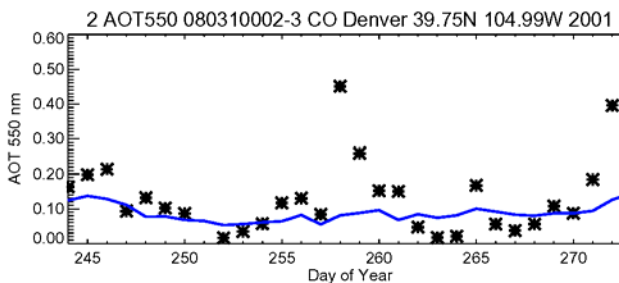
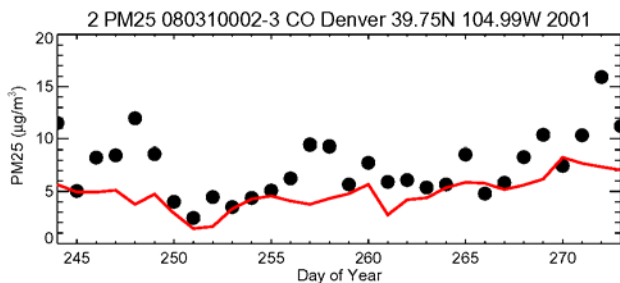
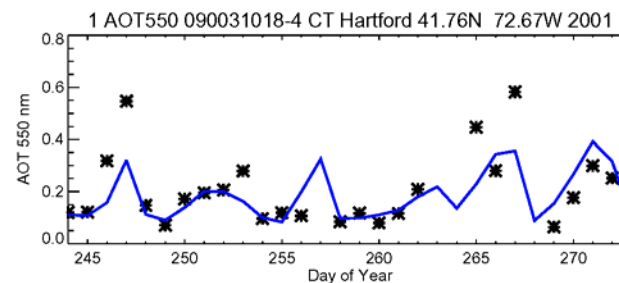
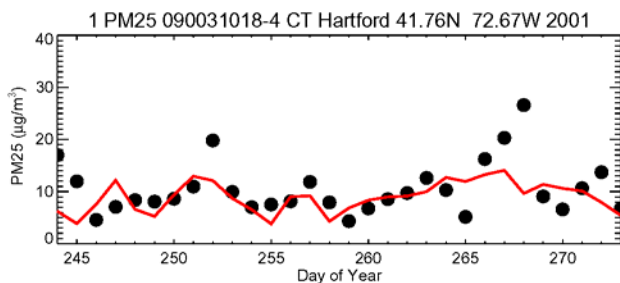
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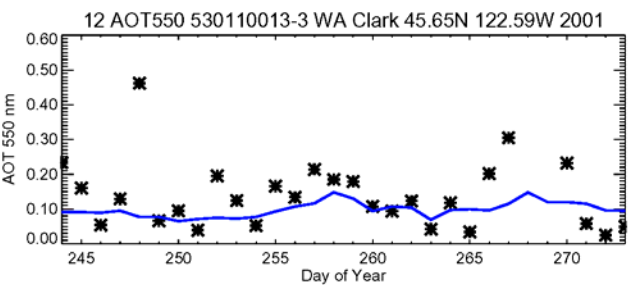
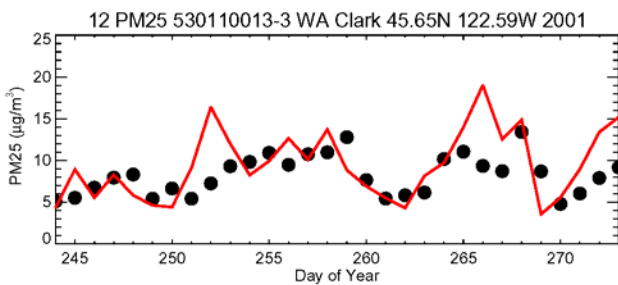
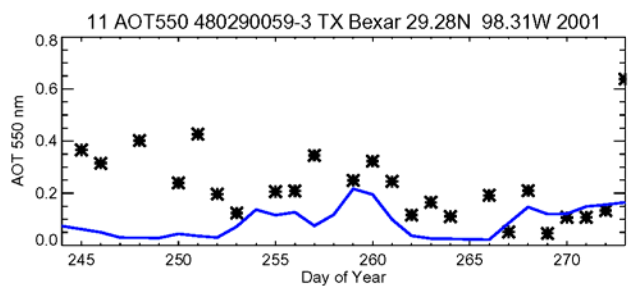
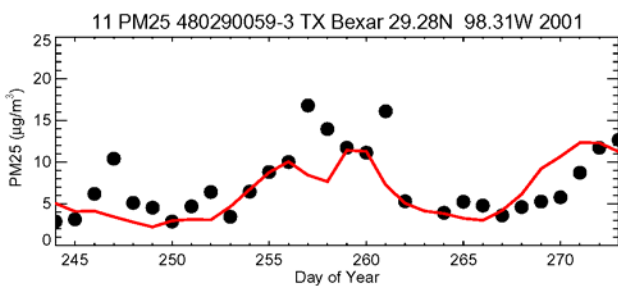
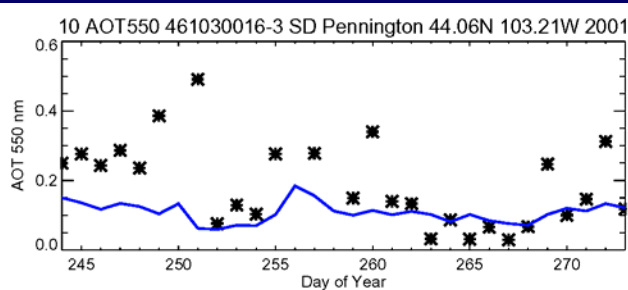
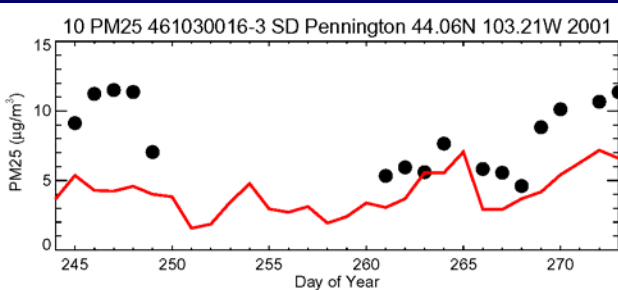
AOT

September 2001

### GOCART vs EPA PM2.5 Symbol: data Line: model

### GOCART vs MODIS AOT Symbol: data Line: model

PM2.5

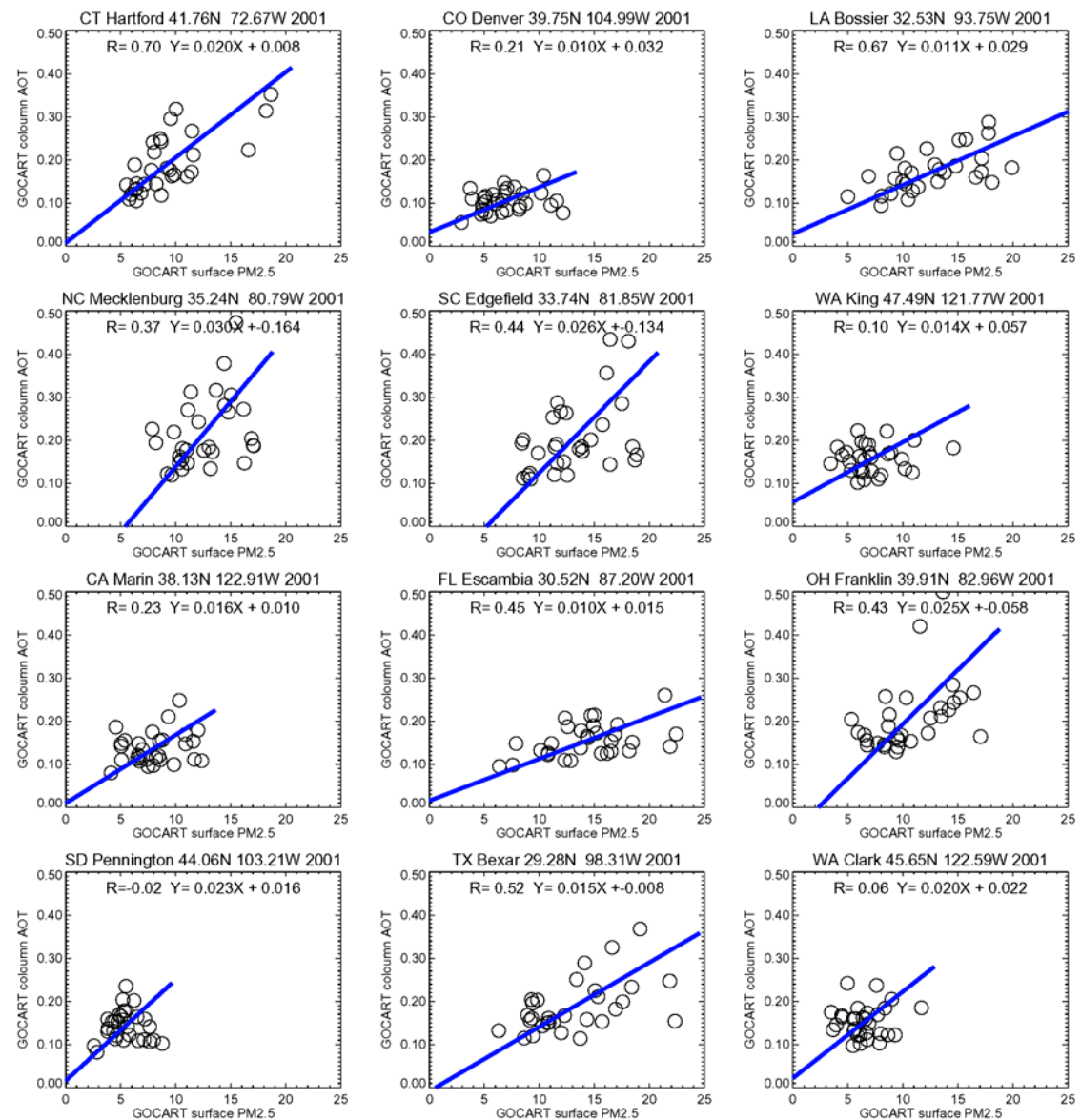


AOT

September 2001

# Relationship between AOD and PM2.5 in GOCART model 200104

AOT

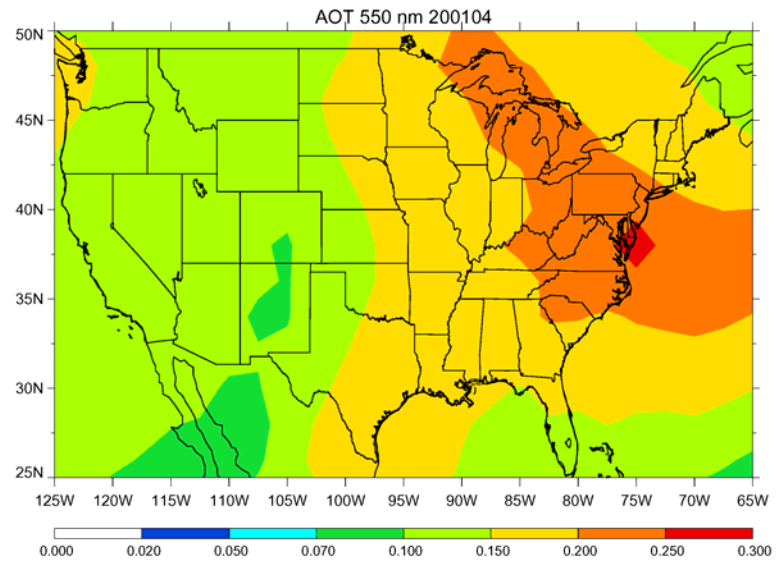
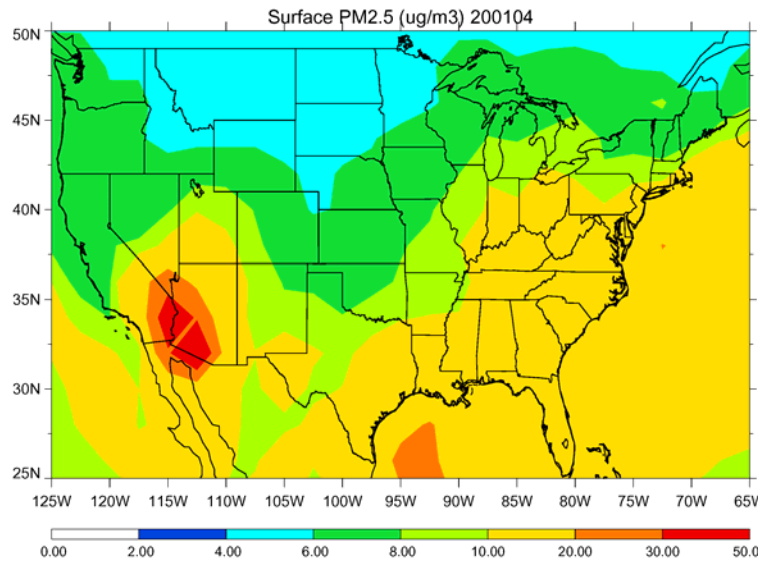


PM2.5

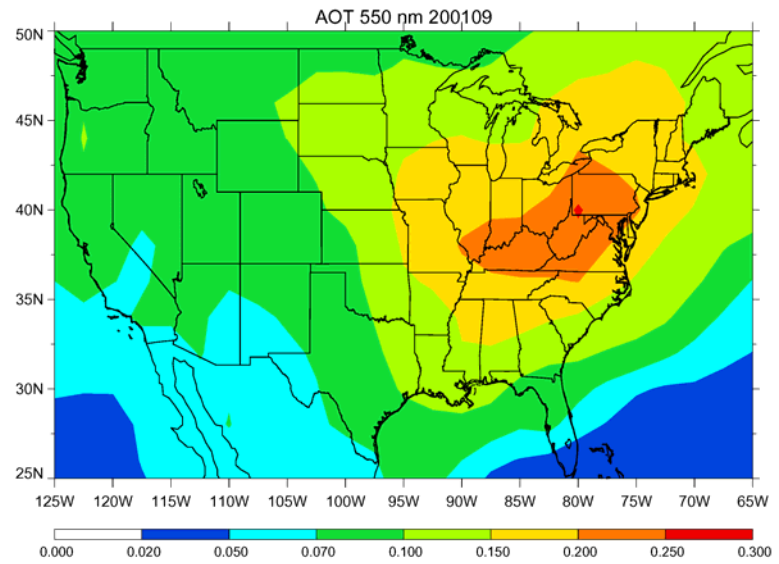
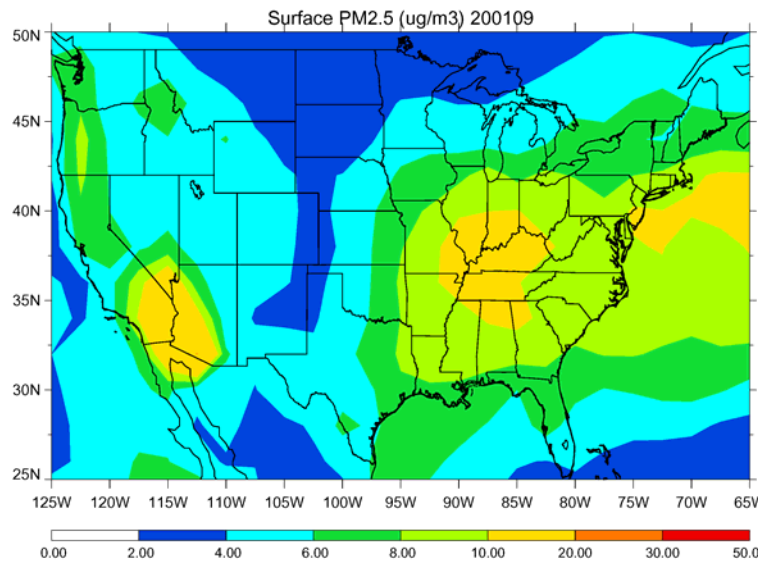
# PM2.5

# AOT

April

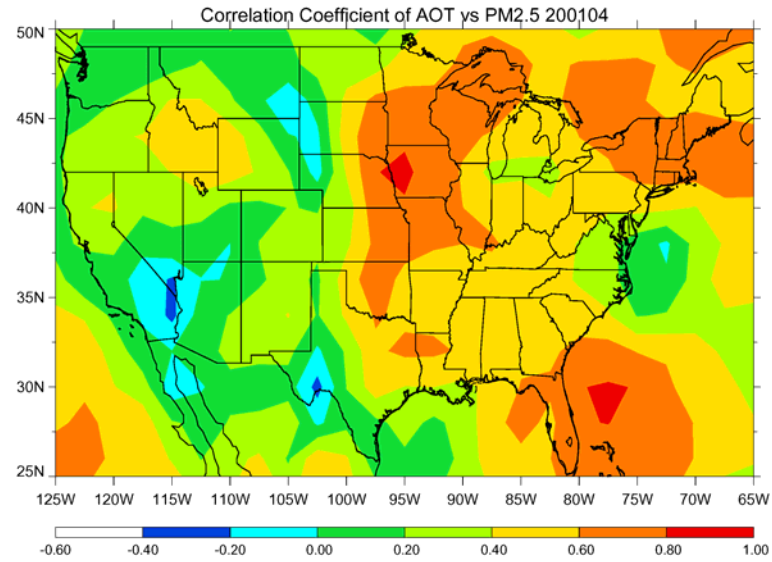


September

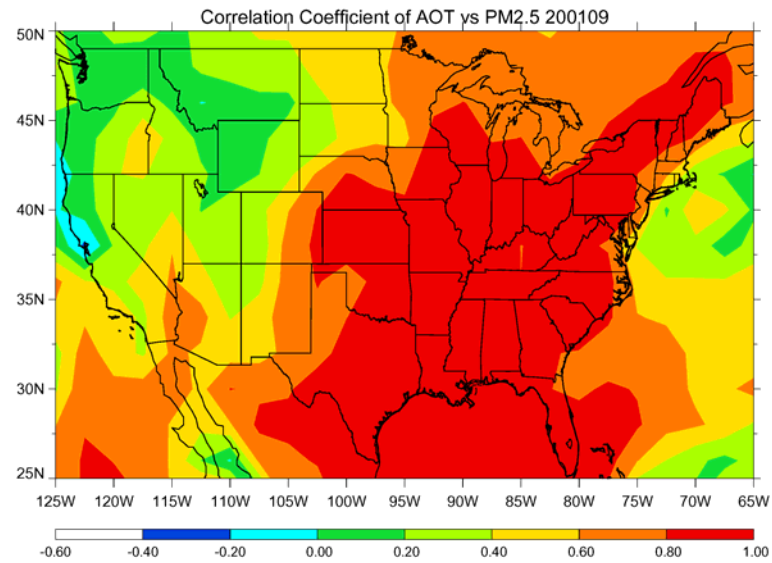


# Correlation Coefficient between AOT and PM2.5

April

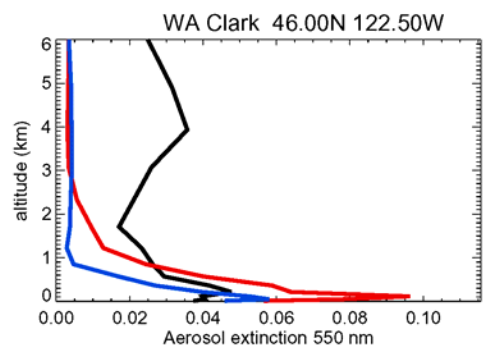
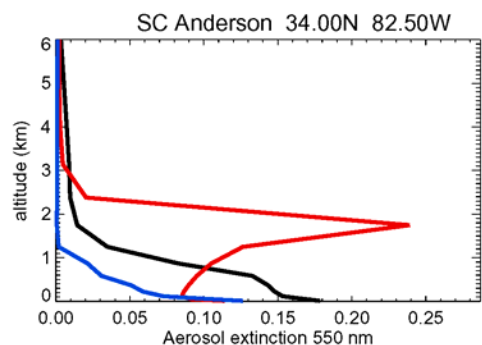
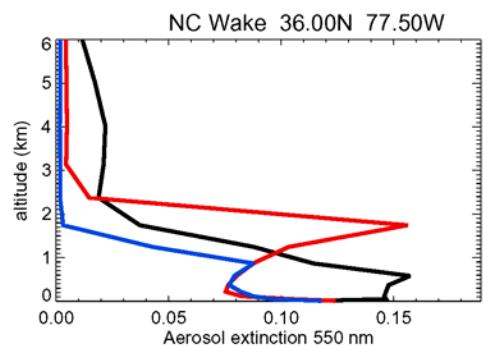
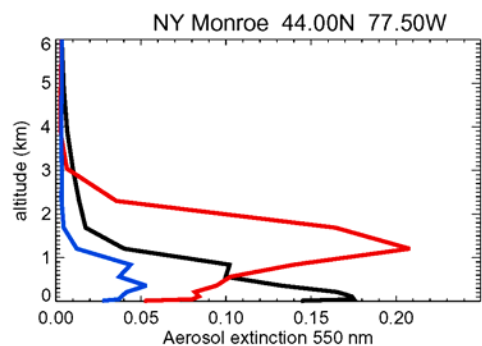
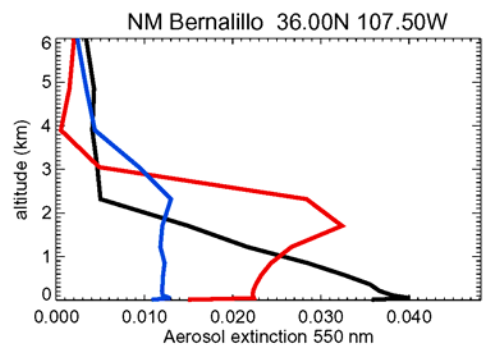
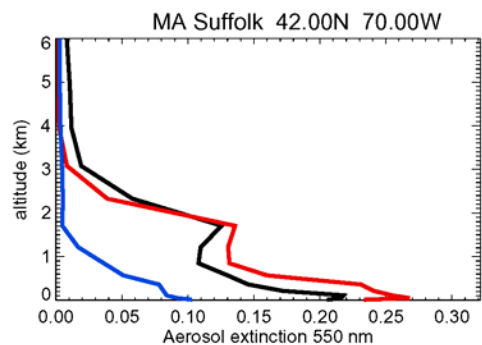
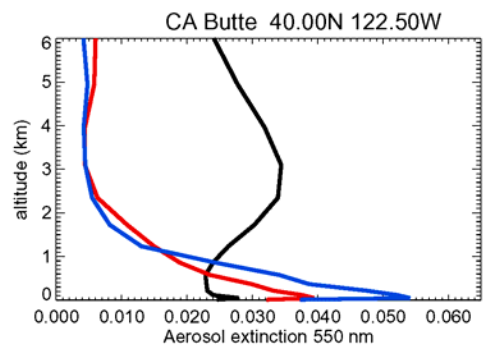
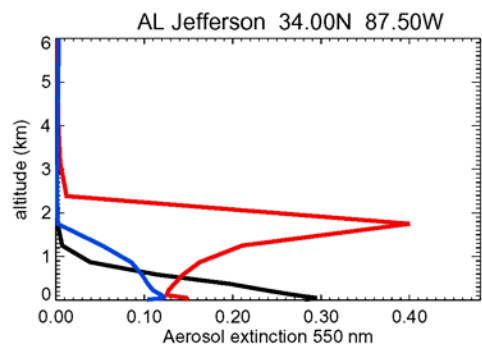


September



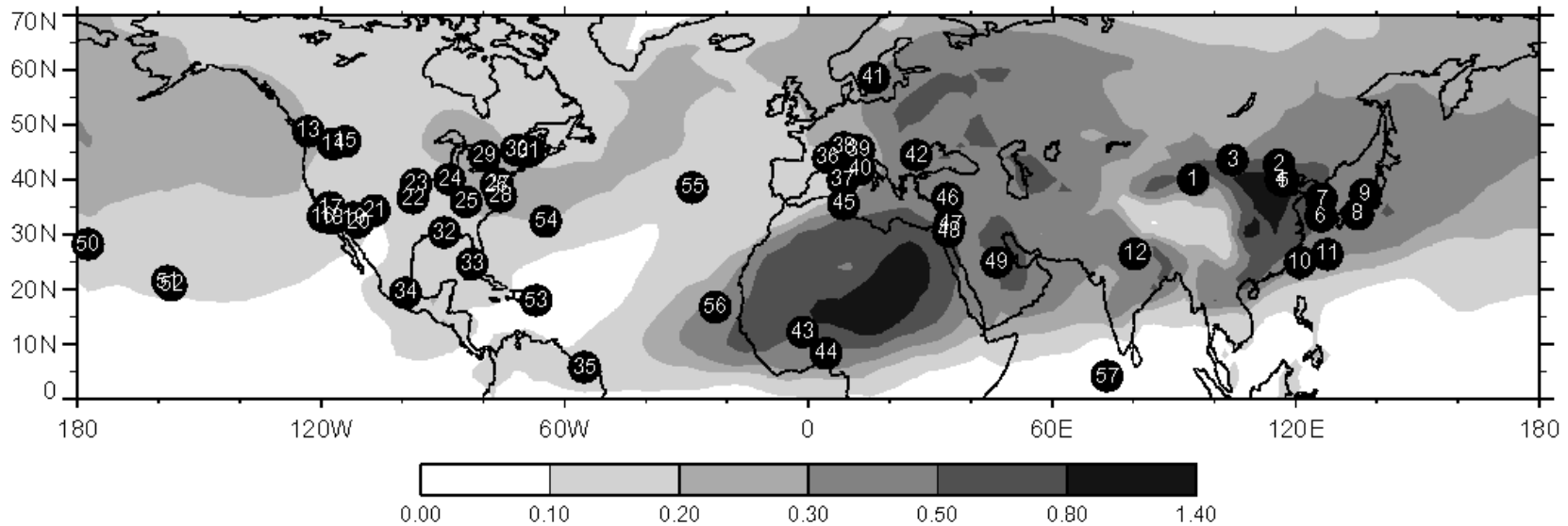
# Aerosol Vertical Distributions

Altitude (km)



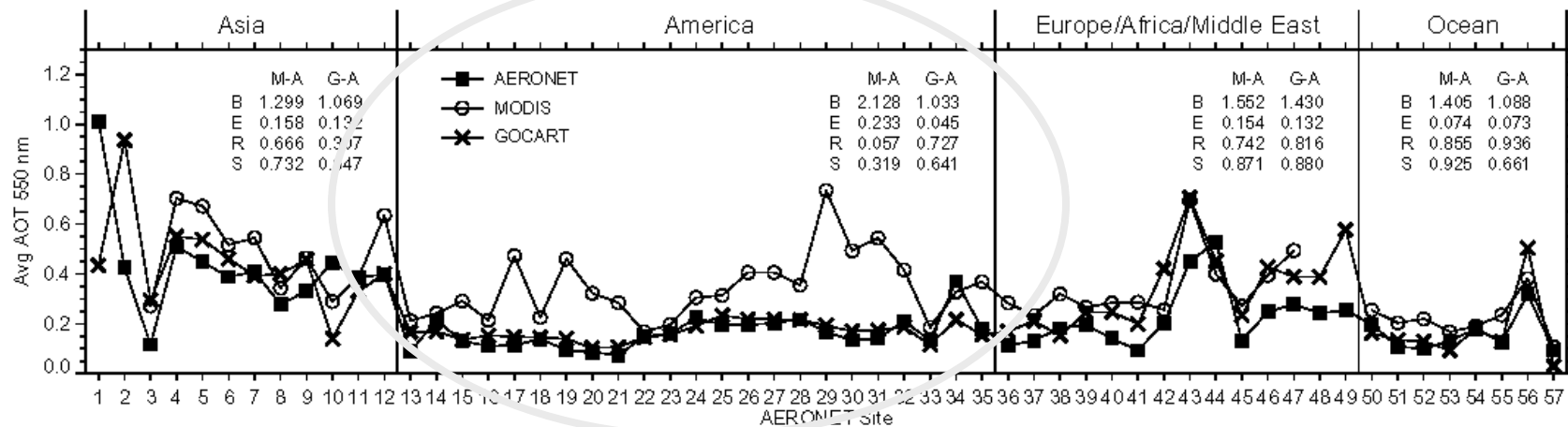
April  
July  
September

# Comparisons with AERONET direct AOT measurements 200104



- Sites 1-12: Asia
- Sites 13-36: North America and Surinam (South America)
- Sites 37-49: Europe, Africa, Middle East
- Sites 50-57: Oceans

# Average AOT 200104

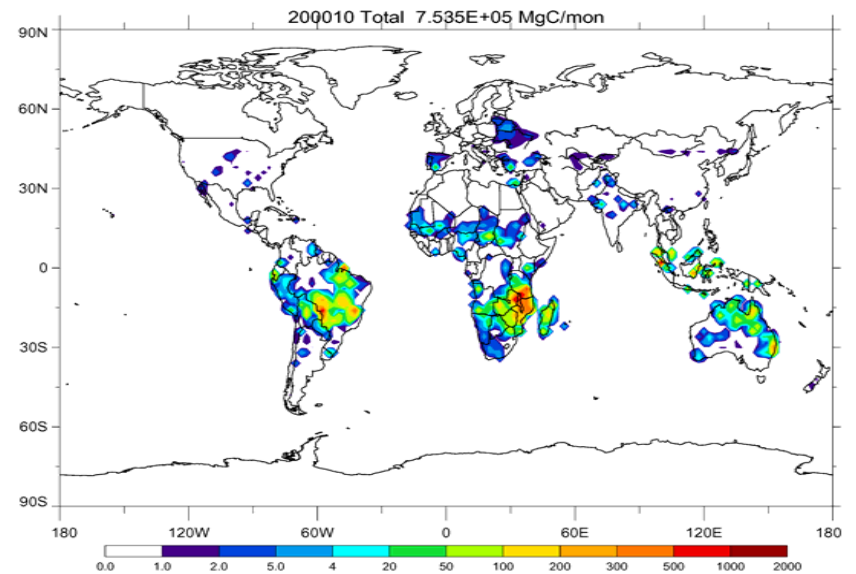
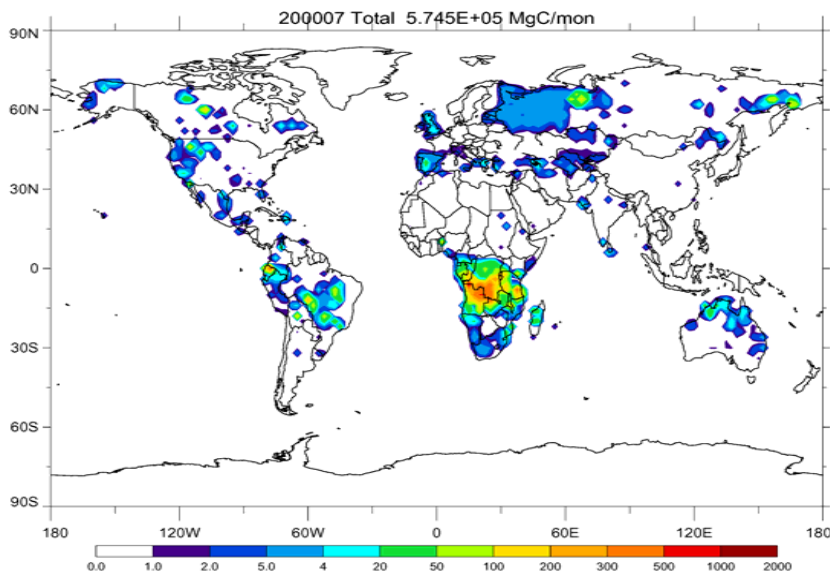
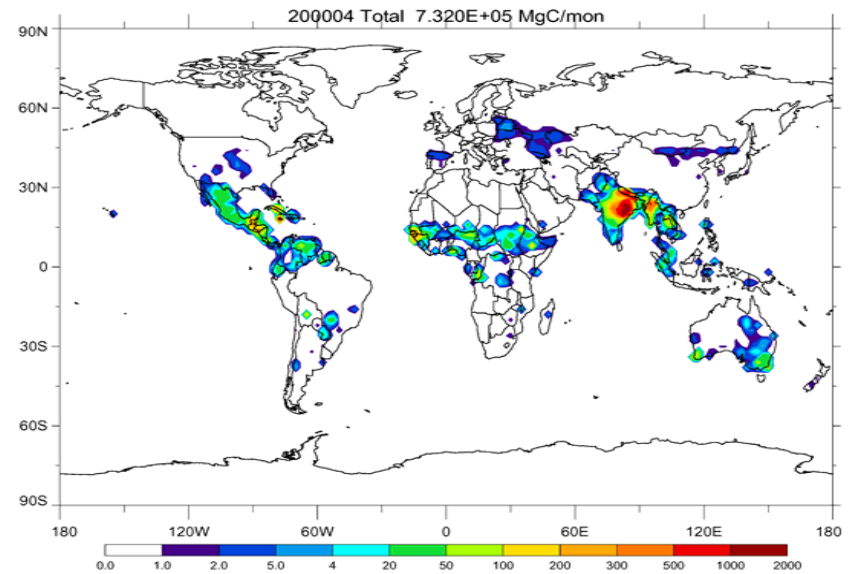
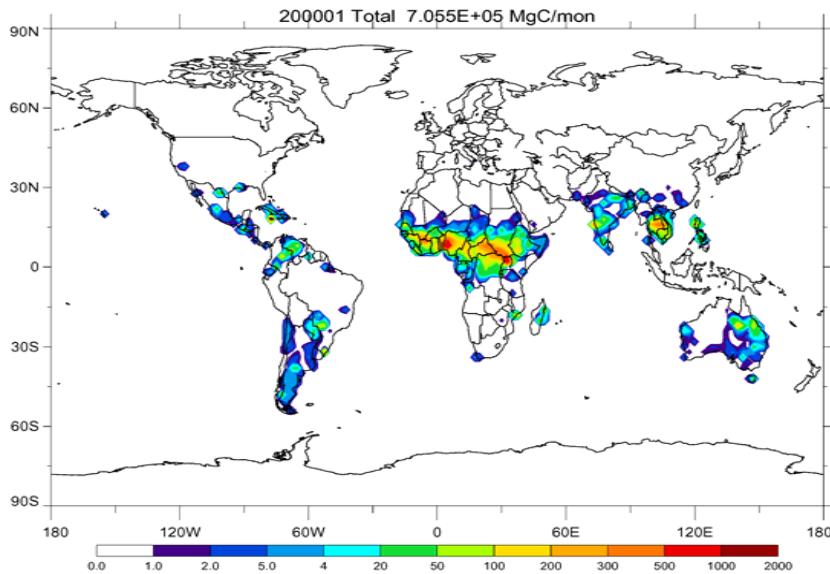


All sites - M-A: B=1.642 E=0.185 R=0.596 S=0.765 G-A: B=1.145 E=0.094 R=0.783 S=0.869

# Example: Global aerosol distributions from MODIS-MISR-GOCART integration

- Such an integrated product agrees better with AERONET sunphotometer measurements of aerosol optical depth than MODIS, MISR, or GOCART alone
- This integrated product can be used to correct the 4-D mass concentrations of individual aerosol types (sulfate, OC, BC, dust, etc) from the GOCART model for use in the regional model

# Biomass burning emission of BC in 2000 (based on Duncan et al. 2003)



**We need to verify the results and quantify the effectiveness of using the global products for PM2.5 forecasts!**

- To use or not to use:
  - Using the global aerosol as boundary conditions vs. not using it
- To assimilate or not to assimilate:
  - Boundary conditions from the global model only vs. from the satellite data + model integrated products