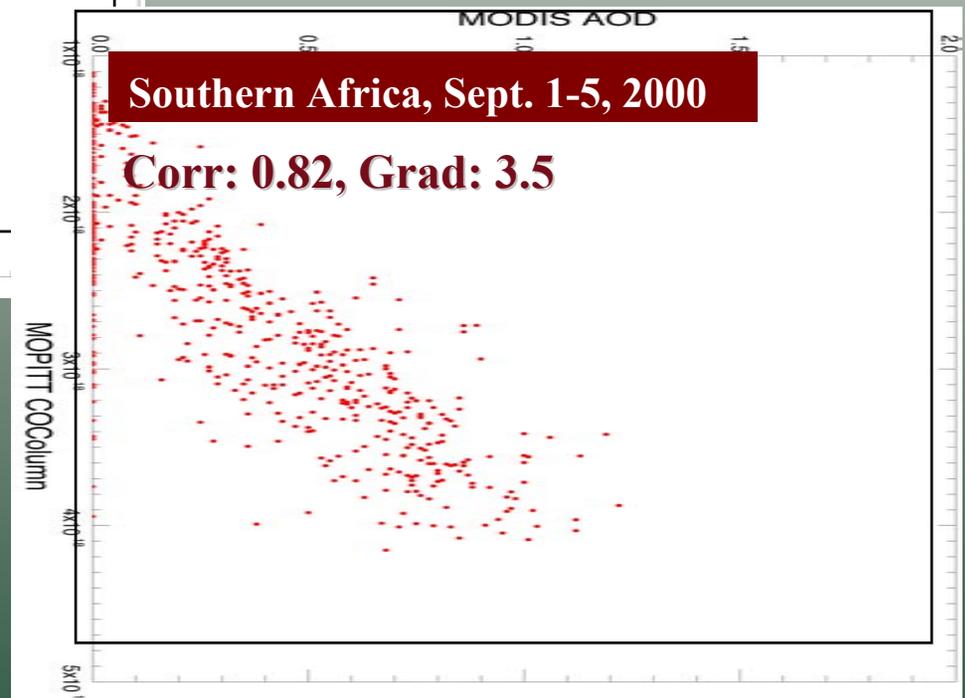
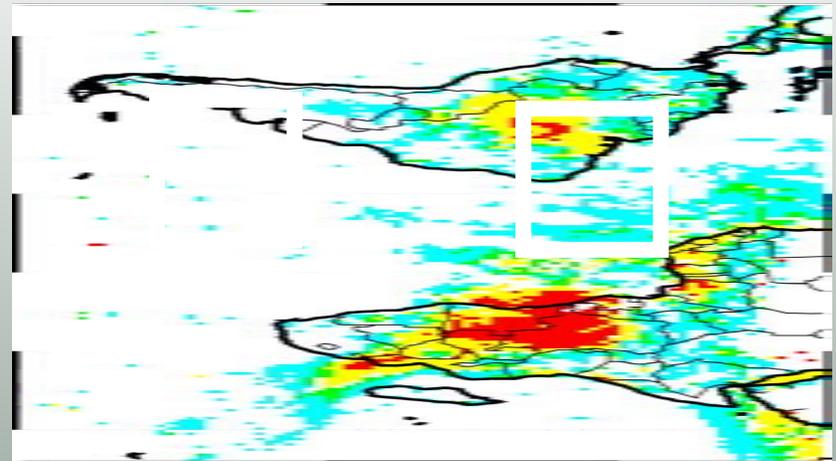
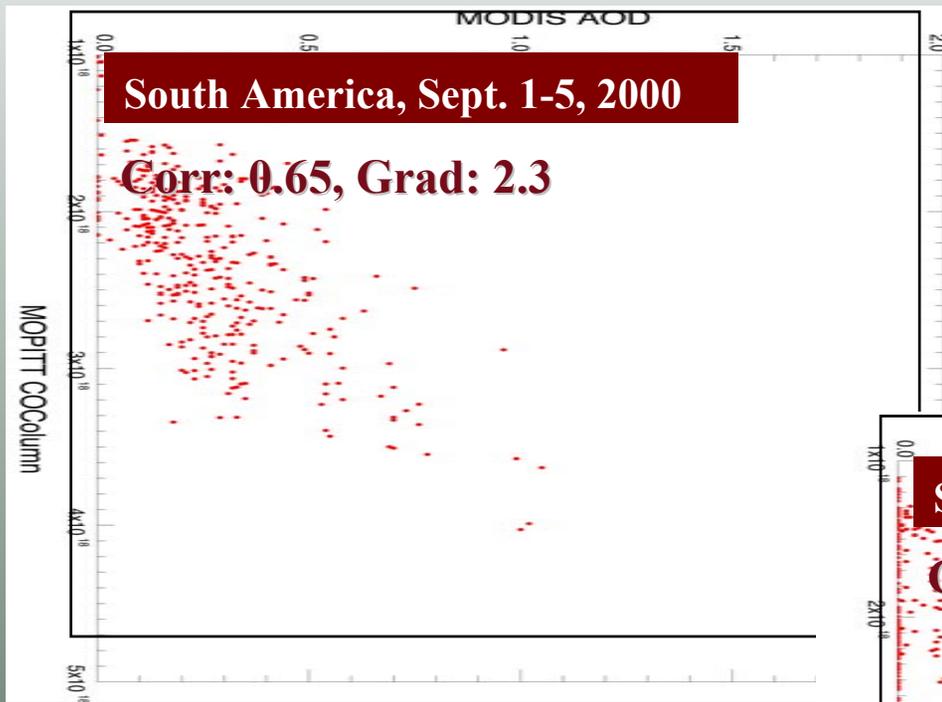


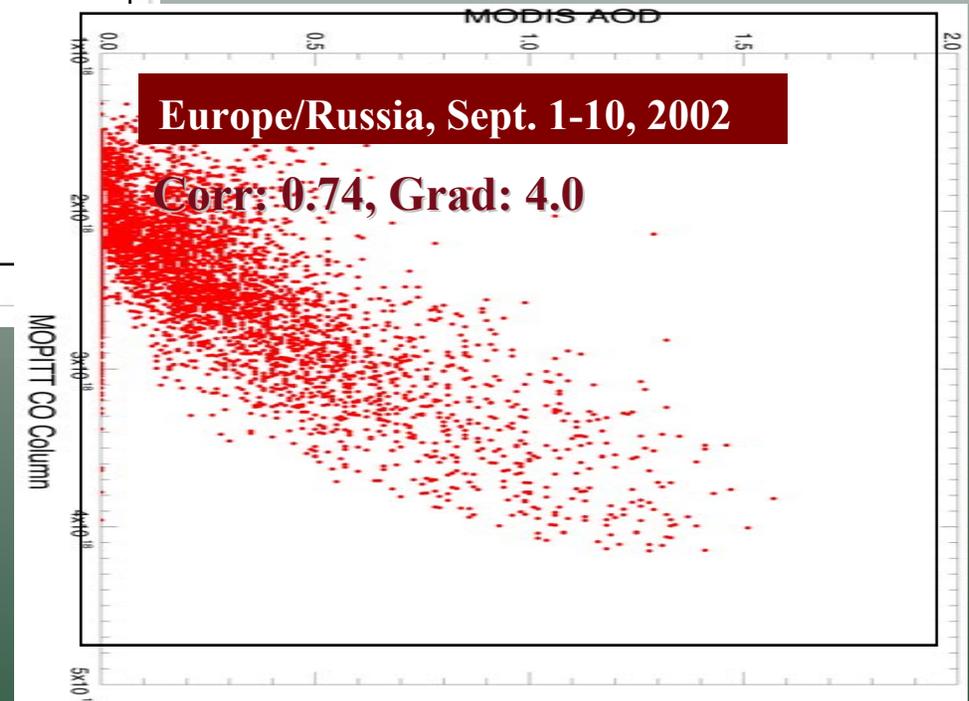
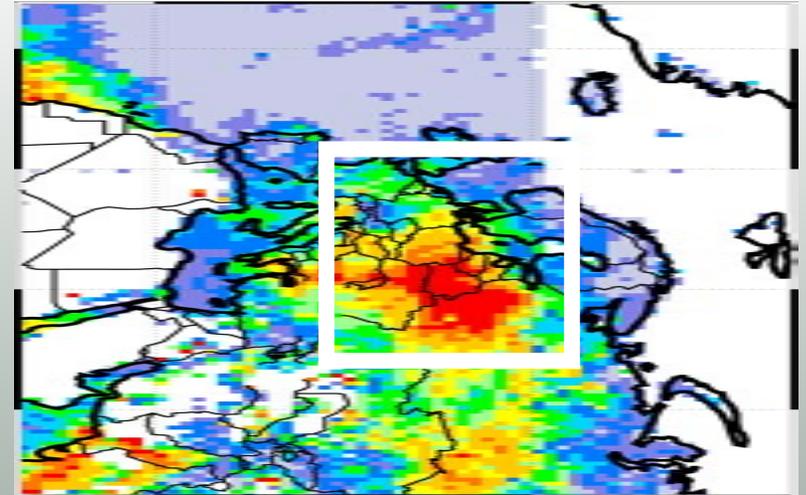
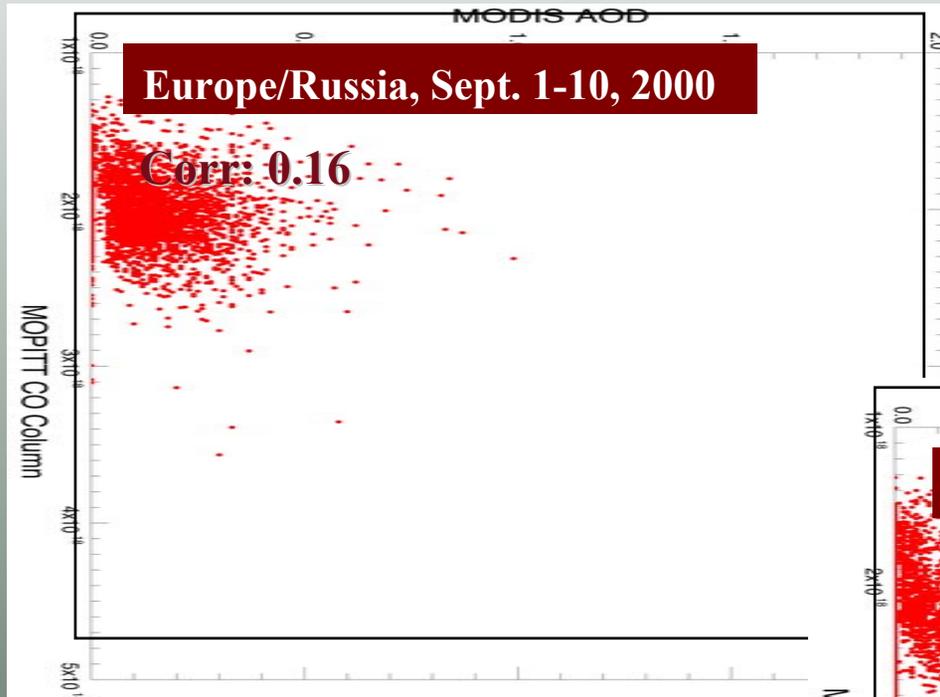
# Correlations: CO and Fine Mode AOD



CO and fine mode AOD  
correlations are strongest  
for intense isolated plumes

Edwards et al. (2004)

# Correlations: CO and Fine Mode AOD



Edwards et al. (2004)

# MODIS (& GOES) Observation of Particle Pollution During INTEX-NA (NEAQS/ITCT/ICARTT 2004)

Allen Chu & MODIS Aerosol Team  
University of Maryland Baltimore County/  
NASA GSFC

Chieko Kittaka, J. Al-Saddi, B. Pierce  
NASA LaRC

Shoba and Ana, NOAA GASP Team

[achu@climate.gsfc.nasa.gov](mailto:achu@climate.gsfc.nasa.gov)  
ICARTT Science Team Meeting  
University of New Hampshire  
July 24, 2004

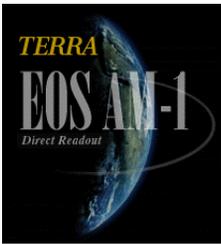
QuickTime™ and a  
Photo decompressor  
are needed to see this picture.

Aerosol optical depth: (unit: none)

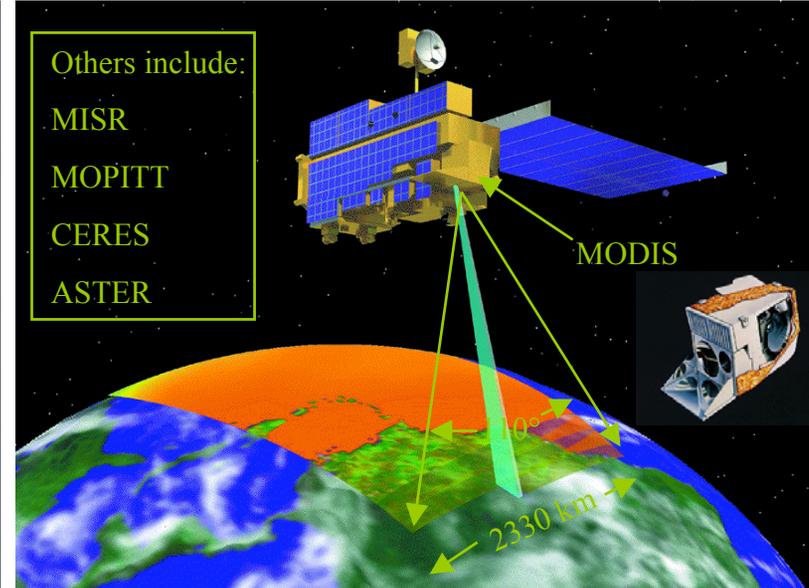
Measure of aerosol loading in atmospheric column due to extinction (scattering and absorption) of light

PM<sub>2.5</sub> : (unit:  $\mu\text{g}/\text{m}^3$ )

Particulate matter mass concentration with diameter  $< 2.5 \mu\text{m}$



# MODIS Onboard EOS-Terra (EOS-AM) □ Satellite



## MODIS instrument Specifications:

**Bands 1-2 (0.66, 0.86  $\mu\text{m}$ ): 250 m**

**Bands 3-7 (0.47, 0.55, 1.24, 1.64, 2.13  $\mu\text{m}$ ): 500 m**

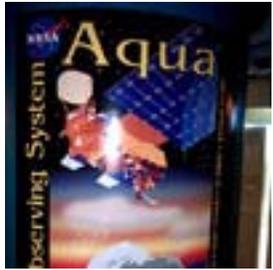
**Bands 8-36: 1 km**

**Launch date: December 18, 1999, 1:57 PT**  
Earthview door open date: February 24, 2000

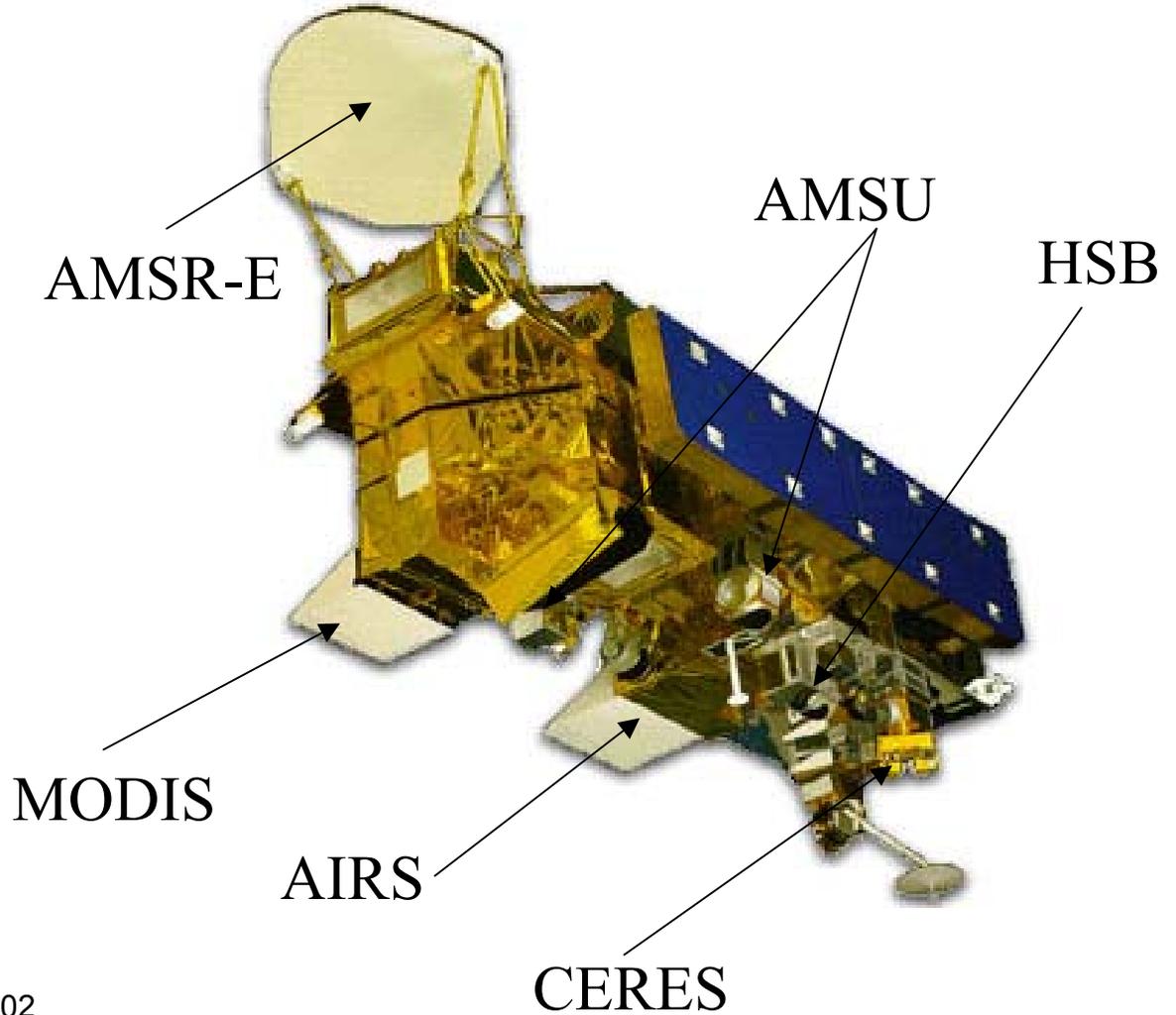
Allen Chu/NASA GSFC



# MODIS Onboard EOS-Aqua (EOS-PM) Satellite

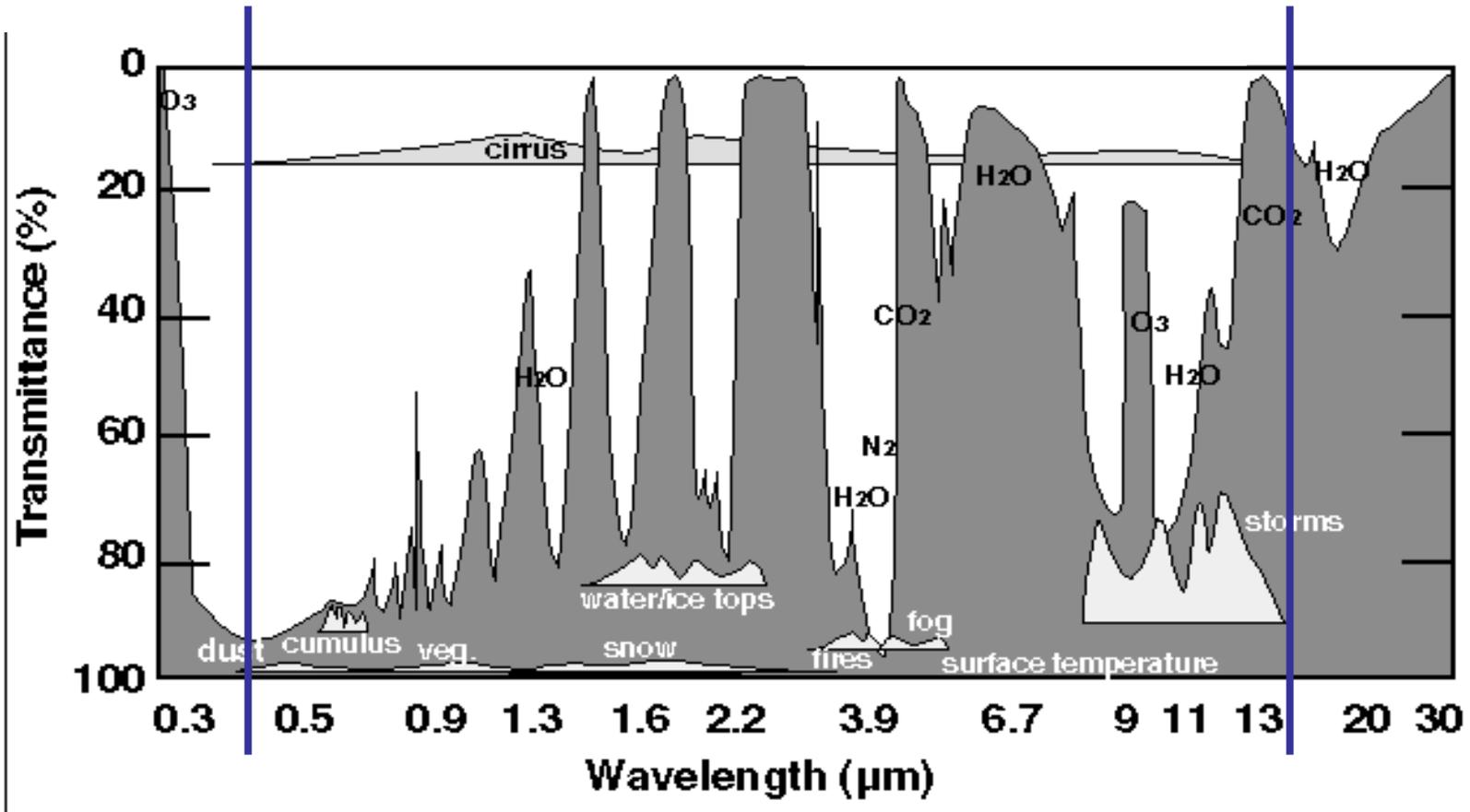


Launch date: May 4, 2002, 2:55 PDT  
Earthview door open date: June 25, 2002



# MODIS Spectral Specification

MODIS 36 channels are designed to cover from 0.41 to 14  $\mu\text{m}$





# MODIS Daily Global coverage



True Color RGB



December 1, 2000

Mark Gray/NASA GSFC

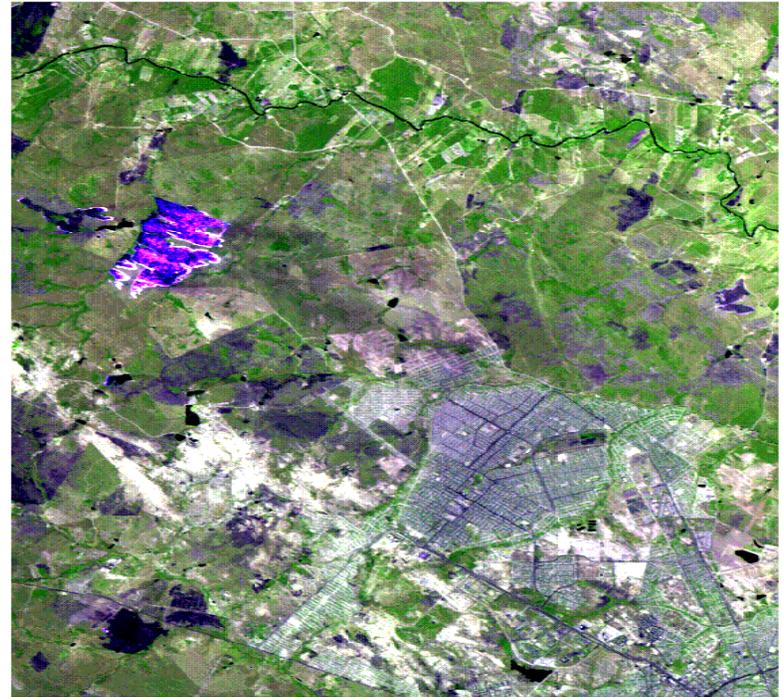
# Using Spectral contrast to Derive AOD Over Land

**ER-2, AVIRIS spectral image from SCAR-B of smoke over Cuiaba on Aug. 25, 1995**



**RGB: 0.47  $\mu\text{m}$ , 0.55  $\mu\text{m}$ , 0.66  $\mu\text{m}$**

**Heavy smoke. The image resembles human vision.**



**Near-IR RGB: 2.1  $\mu\text{m}$ , 1.2  $\mu\text{m}$ , 1.65  $\mu\text{m}$**

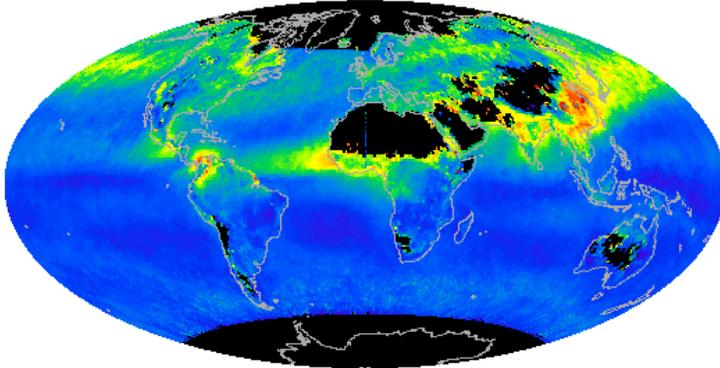
**The smoke is almost transparent in the mid-IR, surface features are visible.**

# Current Capabilities/Background

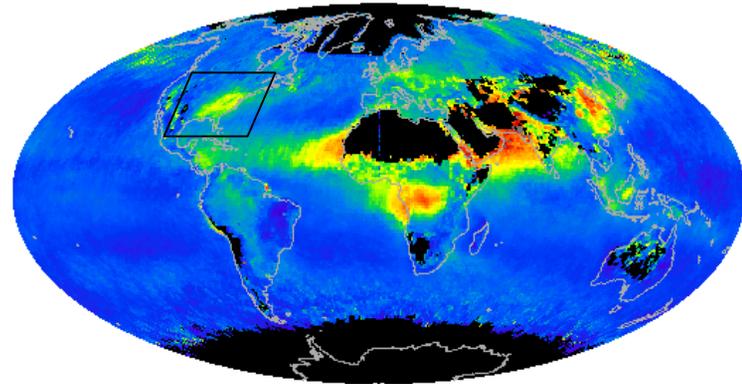
- MODIS aerosol products (10 x 10 km<sup>2</sup>) designed to observe *global* aerosol for climate applications
- Shows evolution and transport of global and regional air pollution events
- Identifies regional, international, and intercontinental transport of particulate matter
- Twice a day observations (Terra and Aqua) with direct broadcasting capability provide near real-time warning of code-red air quality
- Produces *validated* aerosol optical thickness that can be used quantitatively to correlate with PM<sub>2.5</sub> mass concentration measured at surface (as high as correlation coefficient ~0.8-0.9)
- Fills in gaps between ground-based PM<sub>2.5</sub> monitoring sites that can help the EPA create more accurate air quality assessments and forecasts, especially in rural areas.

# Seasonal Variation of MODIS-derived $\tau_a$

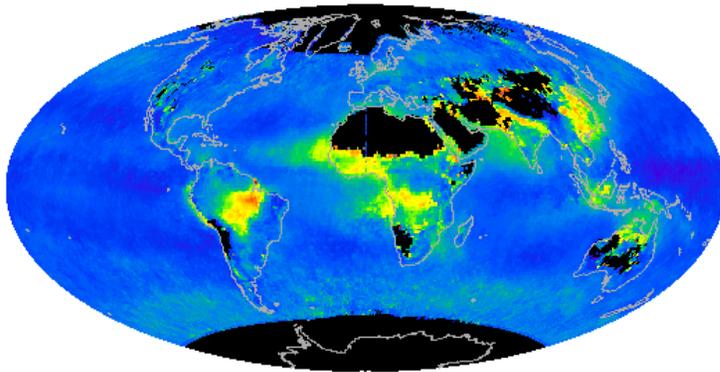
Spring



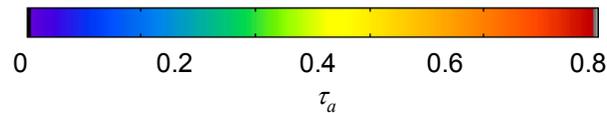
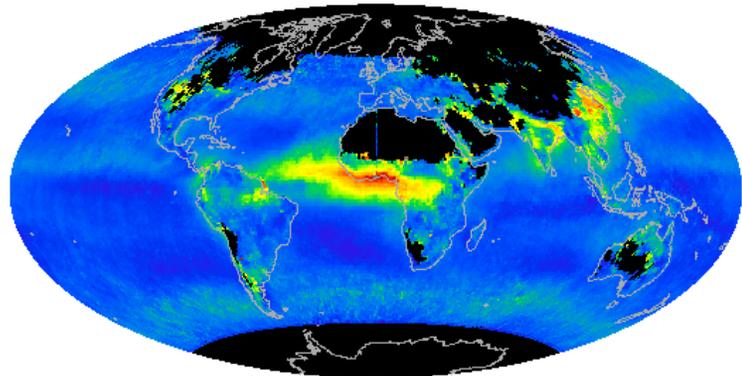
Summer



Autumn



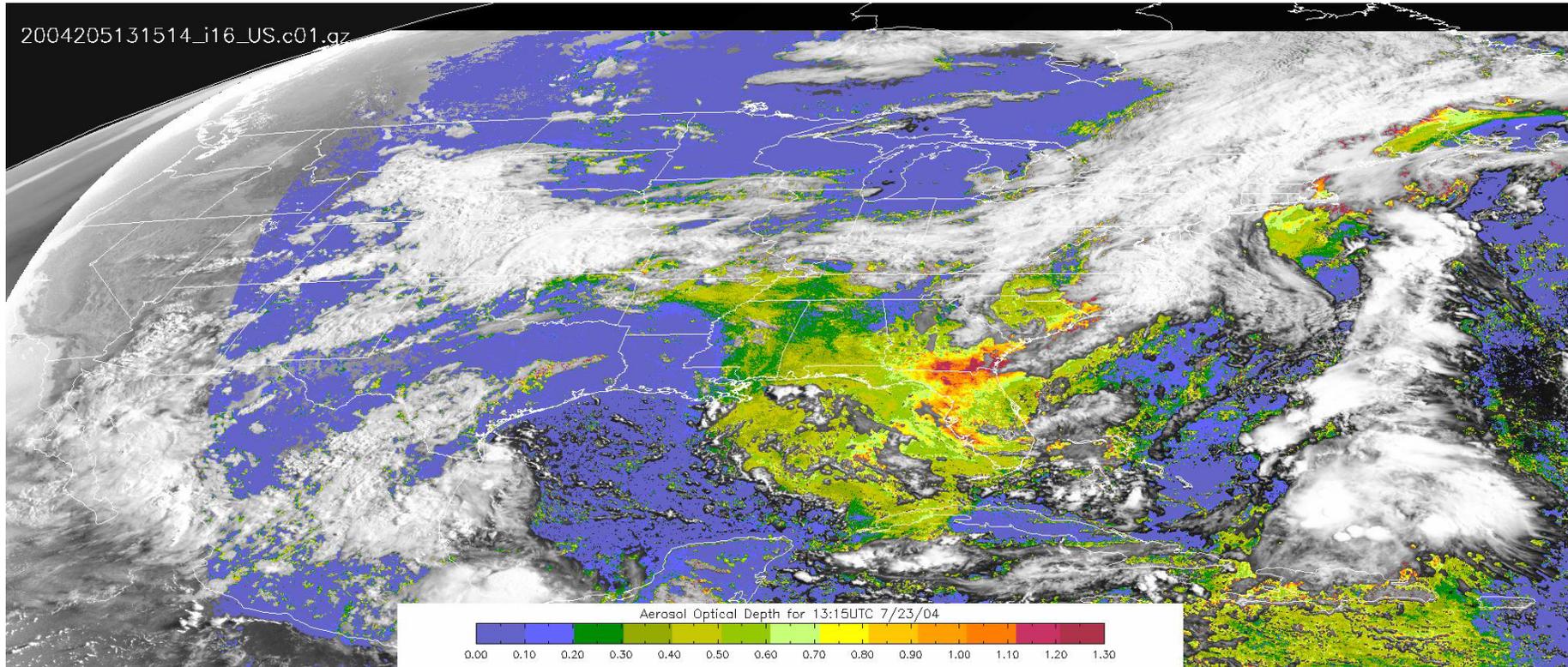
Winter



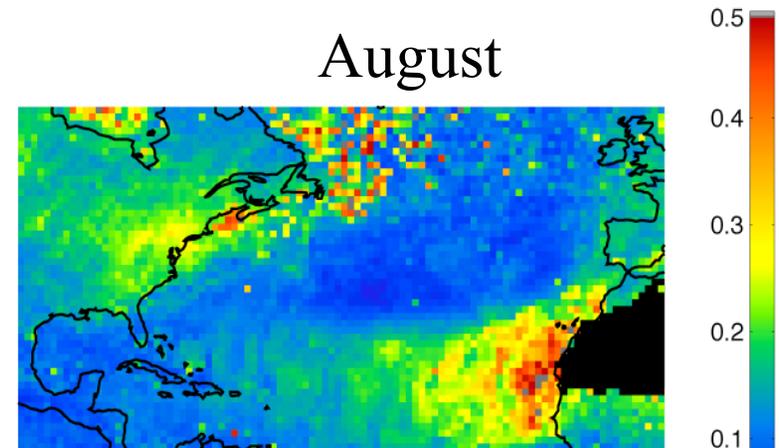
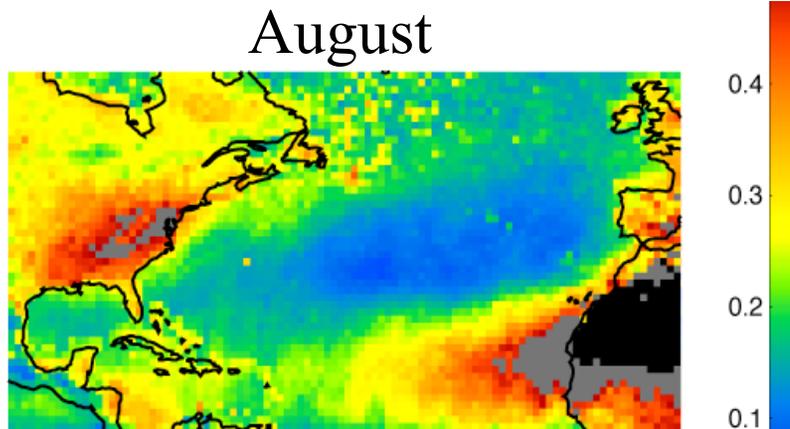
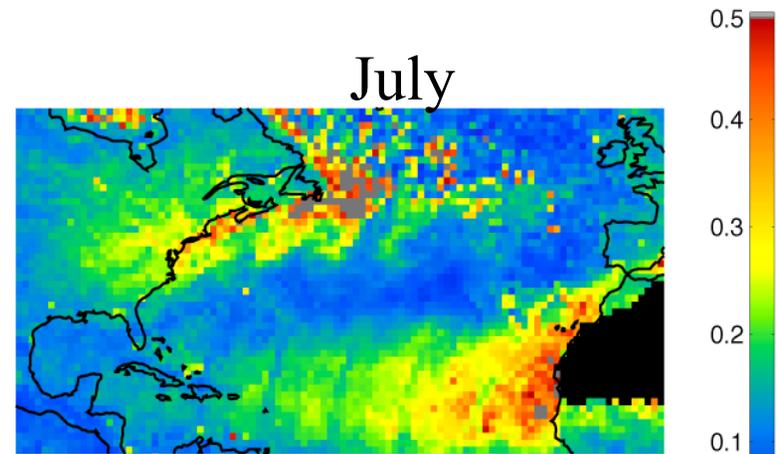
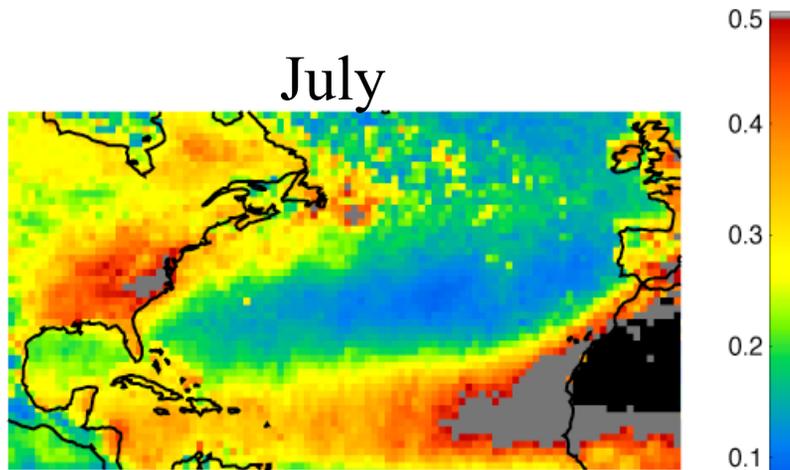
Images of seasonal means of MODIS-derived  $\tau_a$  for spring (March - May 2001), summer (June - August 2001), and autumn (September - November 2001), and winter (December 2000 - February 2001).

GOES Aerosol and Smoke Products (GASP) derived by a single channel ( $0.67 \mu\text{m}$ ) retrieval algorithm, which provide hourly aerosol optical depth image over the US at 4 km resolution, most suitable for flight planning.

<http://www.gis.ssd.nesdis.noaa.gov/GASP/viewer.htm>



# MODIS 4-Year (2000-2003) Mean $\tau_a$ & std



Mean

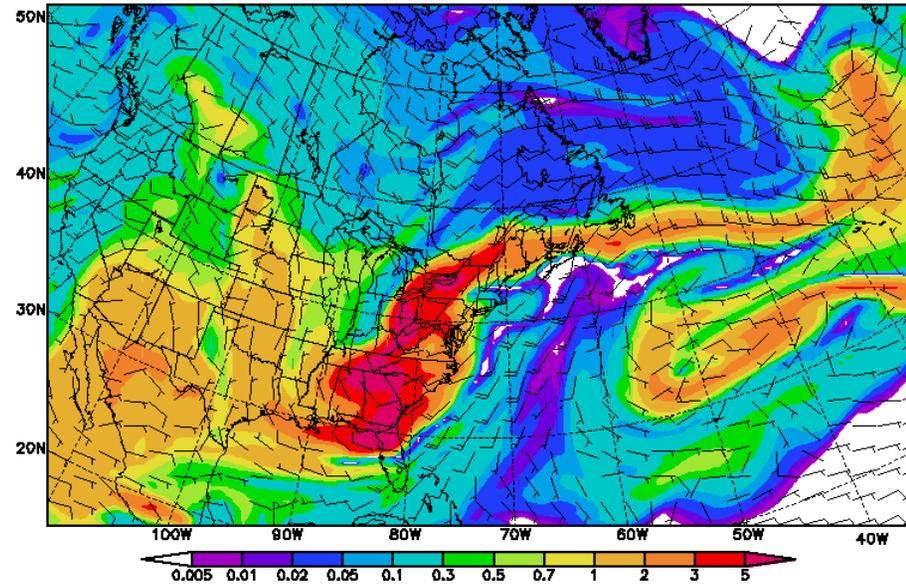
Standard Deviation



QuickTime™ and a  
LZW decompressor  
are needed to see this picture

CGRER, University of Iowa

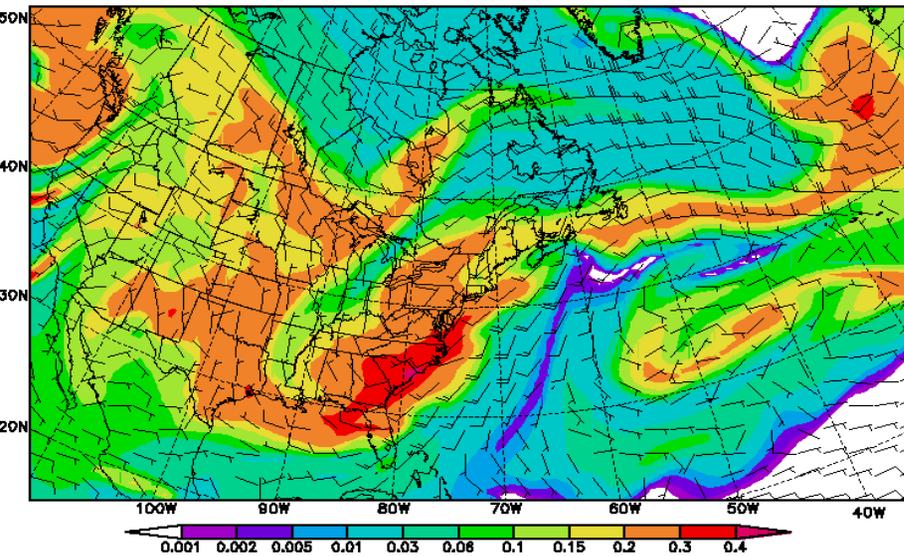
Simulated Sulfate ( $\mu\text{g}/\text{m}^3$ ) in the 3km layer  
at 18GMT, 07/19/2004



Terra & Aqua MODIS  $1^\circ \times 1^\circ$  mean AOD July 18 - 20, 2004.

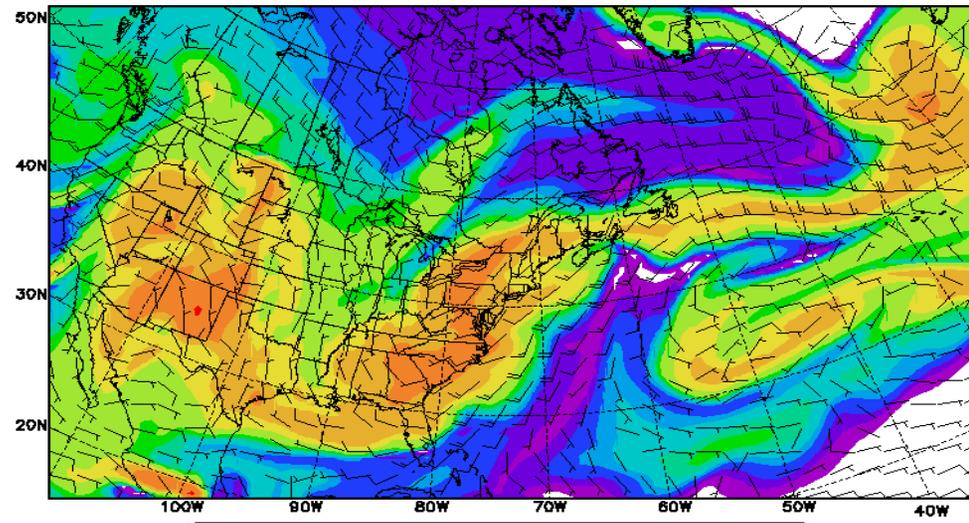
CGRER, University of Iowa

Simulated BC ( $\mu\text{g}/\text{m}^3$ ) in the 3km layer  
at 18GMT, 07/19/2004



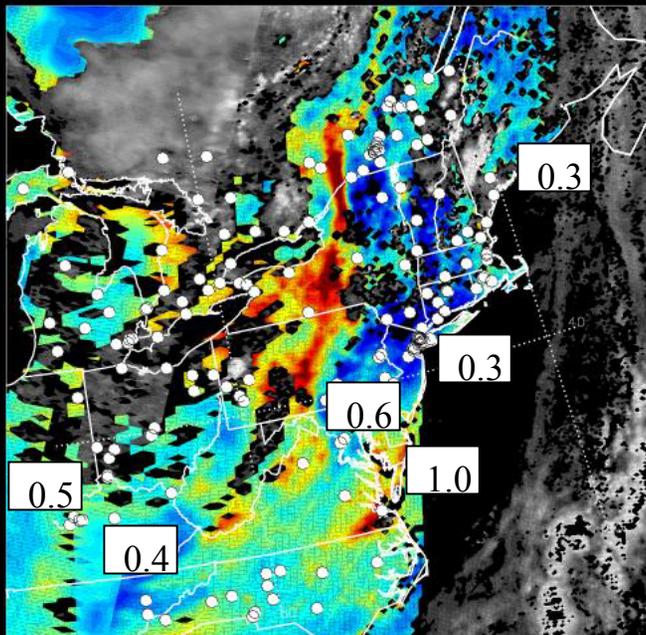
CGRER, University of Iowa

Simulated Anthropogenic CO (ppbv) in the 3km layer  
at 18GMT, 07/19/2004



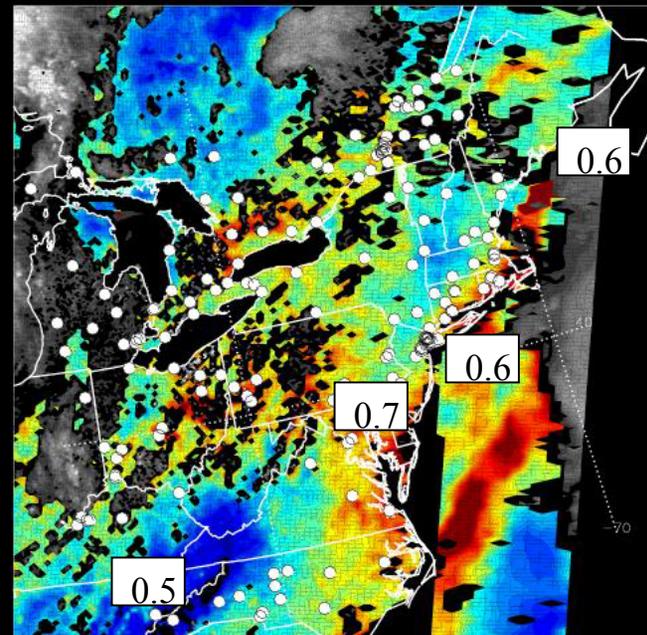
Model simulation by Dr. Greg Carmichael

MODIS Aerosol Optical Depth 2004 07 20 EPA Region 1-3

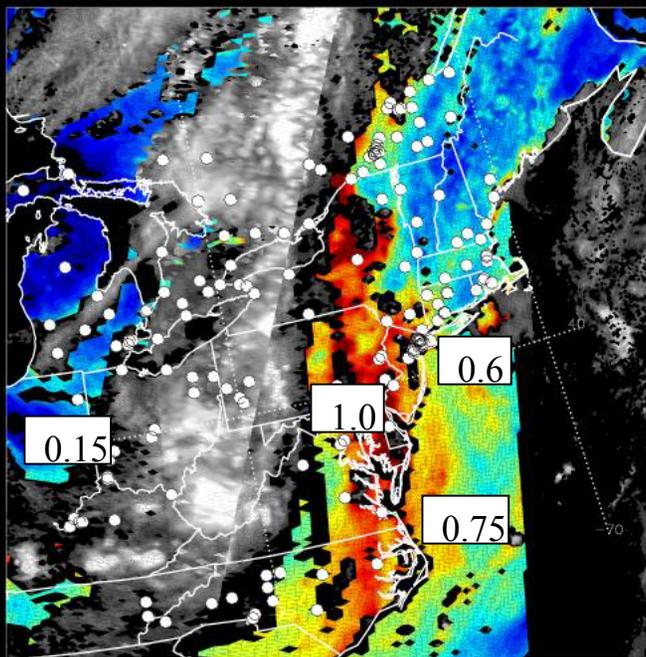


AERONET

MODIS Aerosol Optical Depth 2004 07 21 EPA Region 1-3

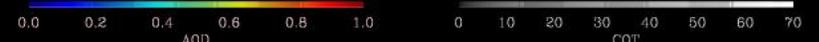
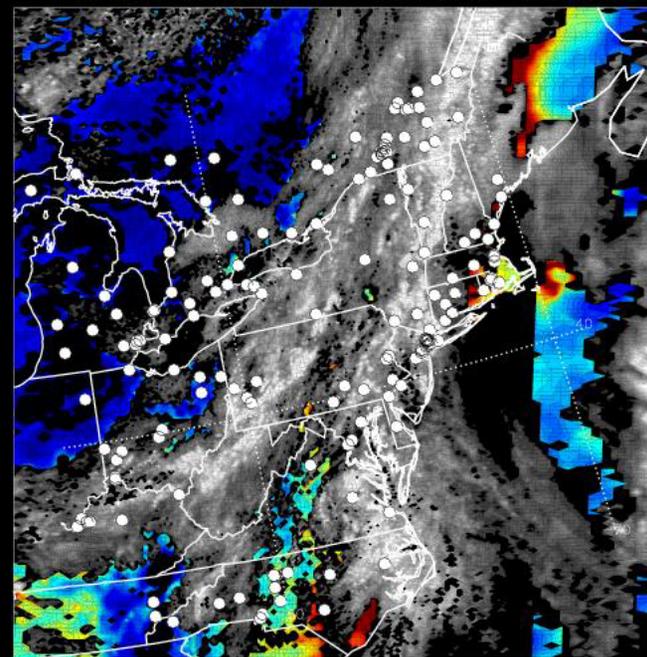


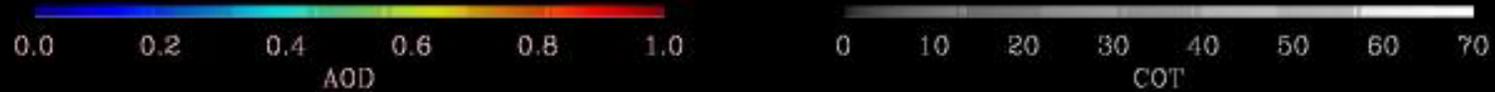
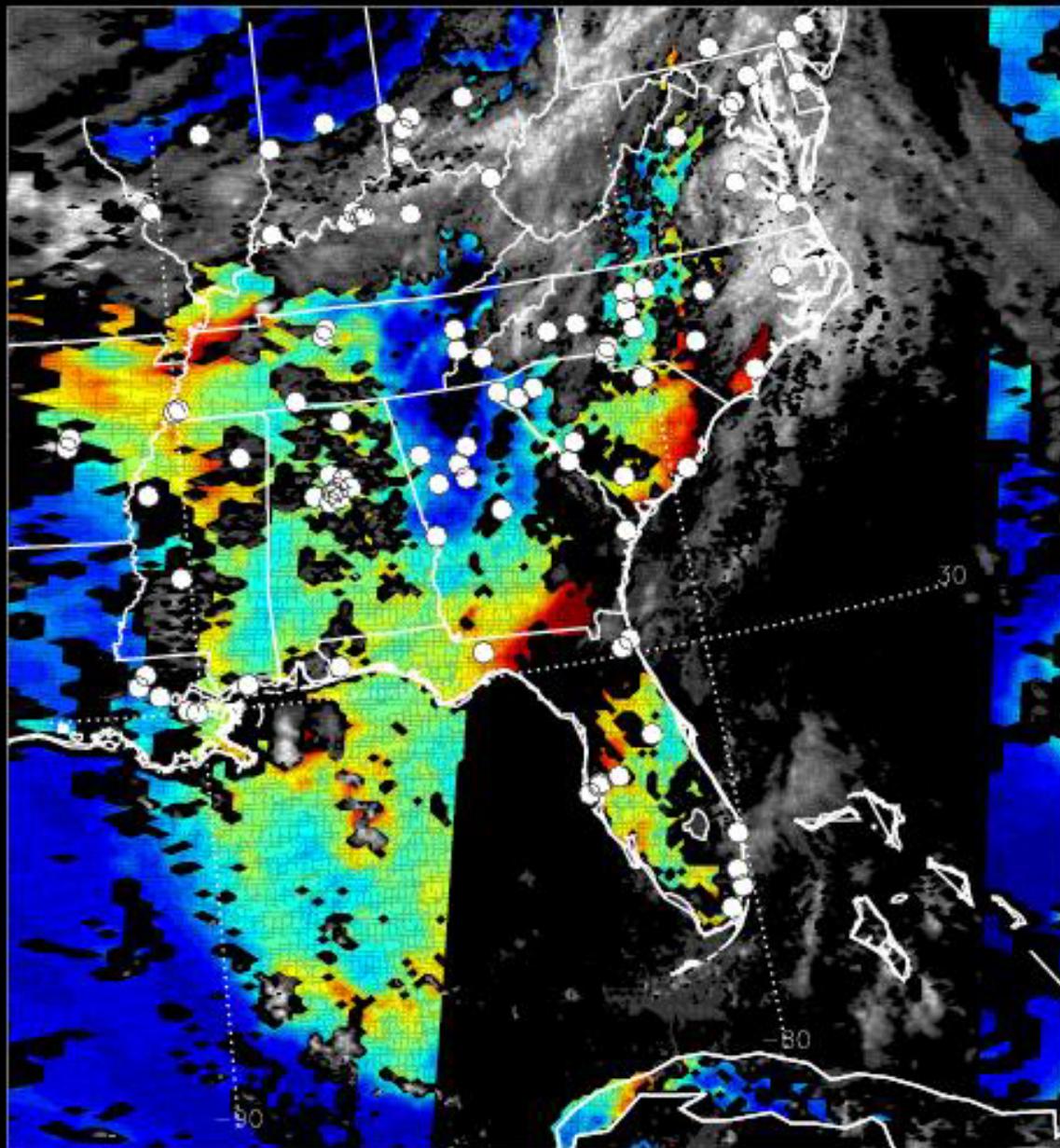
MODIS Aerosol Optical Depth 2004 07 22 EPA Region 1-3



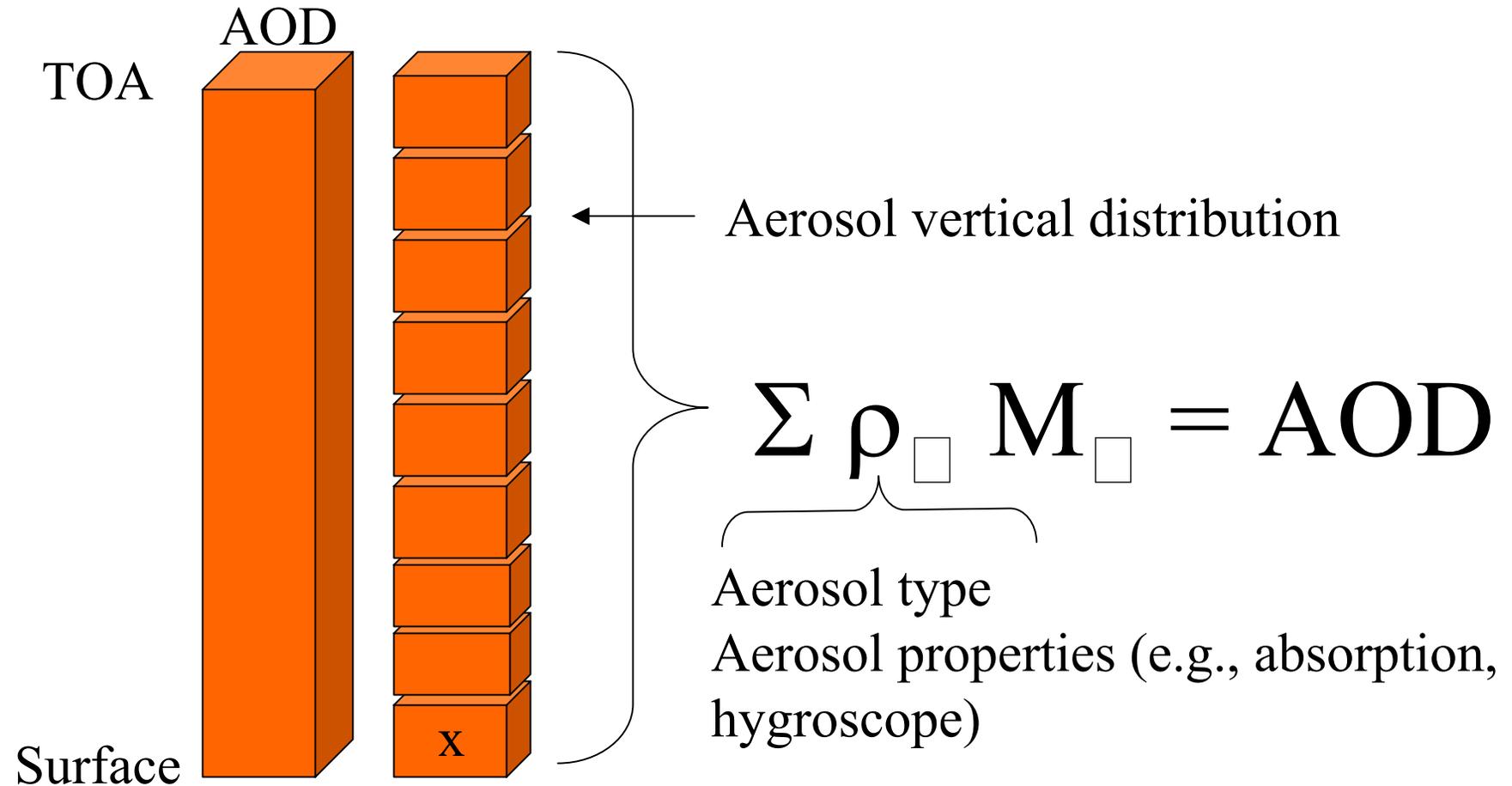
[http://  
idea.s  
sec.wi  
sc.edu](http://idea.ssec.wisc.edu)

MODIS Aerosol Optical Depth 2004 07 23 EPA Region 1-3



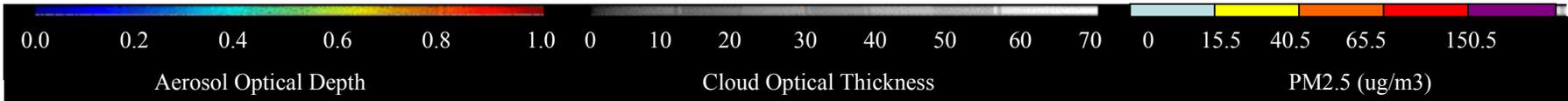
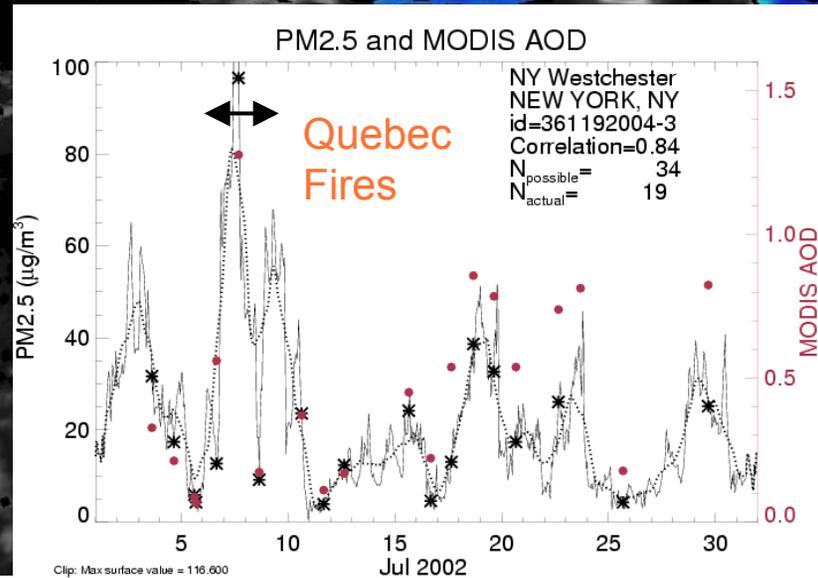
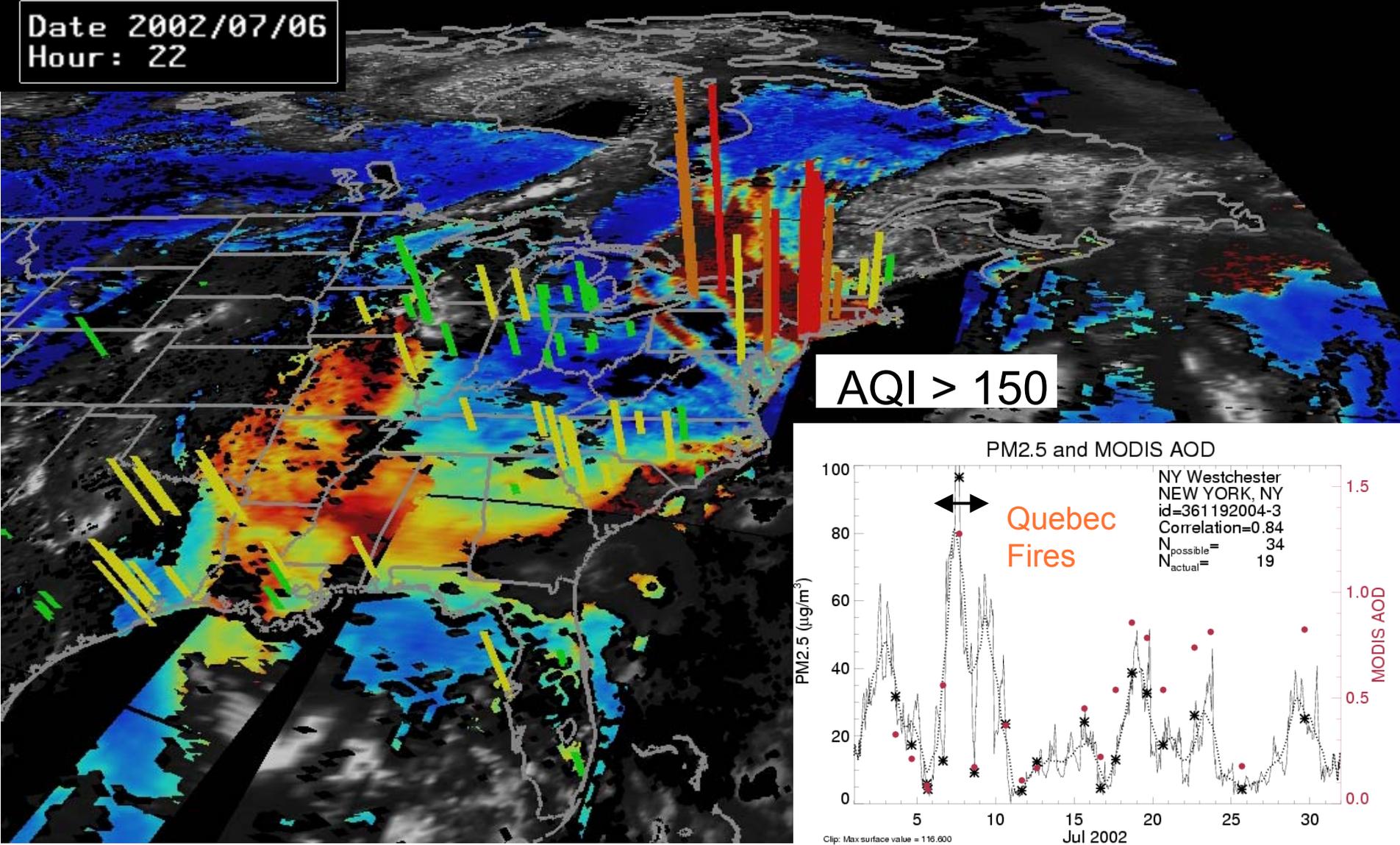


# Relationship between aerosol optical depth and mass concentration measured at surface



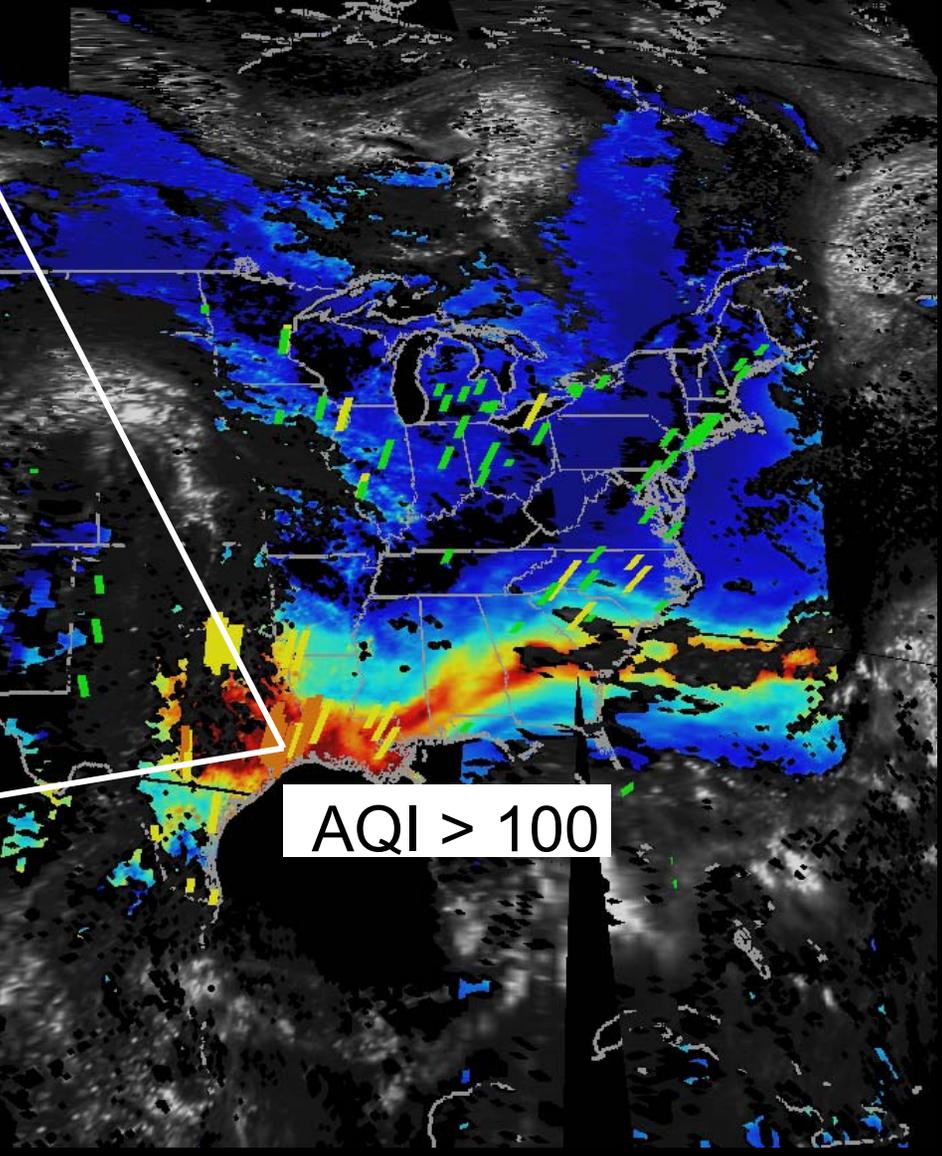
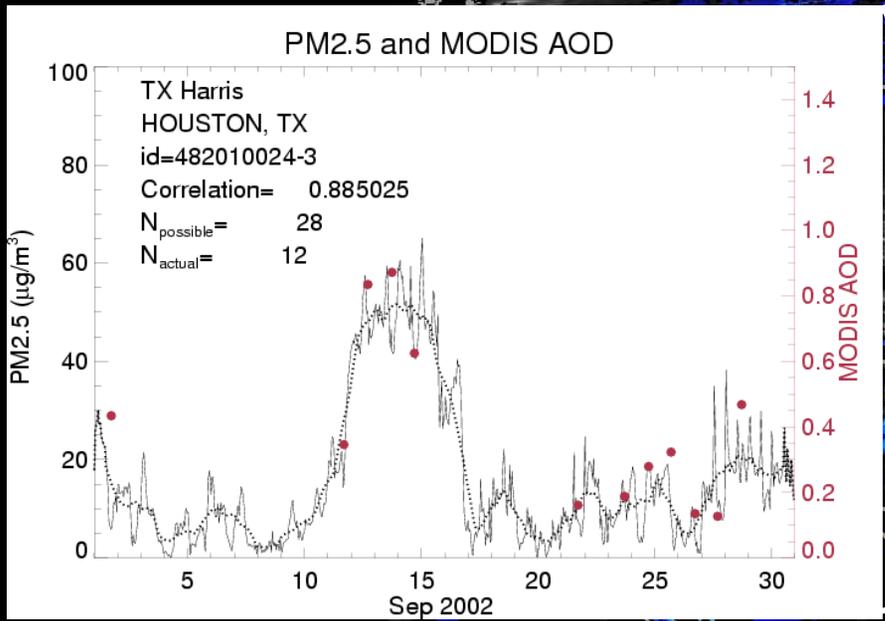
# 6 July 2002-The high AOD from MODIS in New York City is seen due to smoke transported from Quebec Fires

Date 2002/07/06  
Hour: 22



12 Sept. 2002-The high AOD from MODIS is seen stretching along the entire Gulf Coast and extending out into the Atlantic Ocean. This transport was caused by T.S. Gustav pulling off into the North Atlantic and the development of T.S. Hanna in the Gulf.

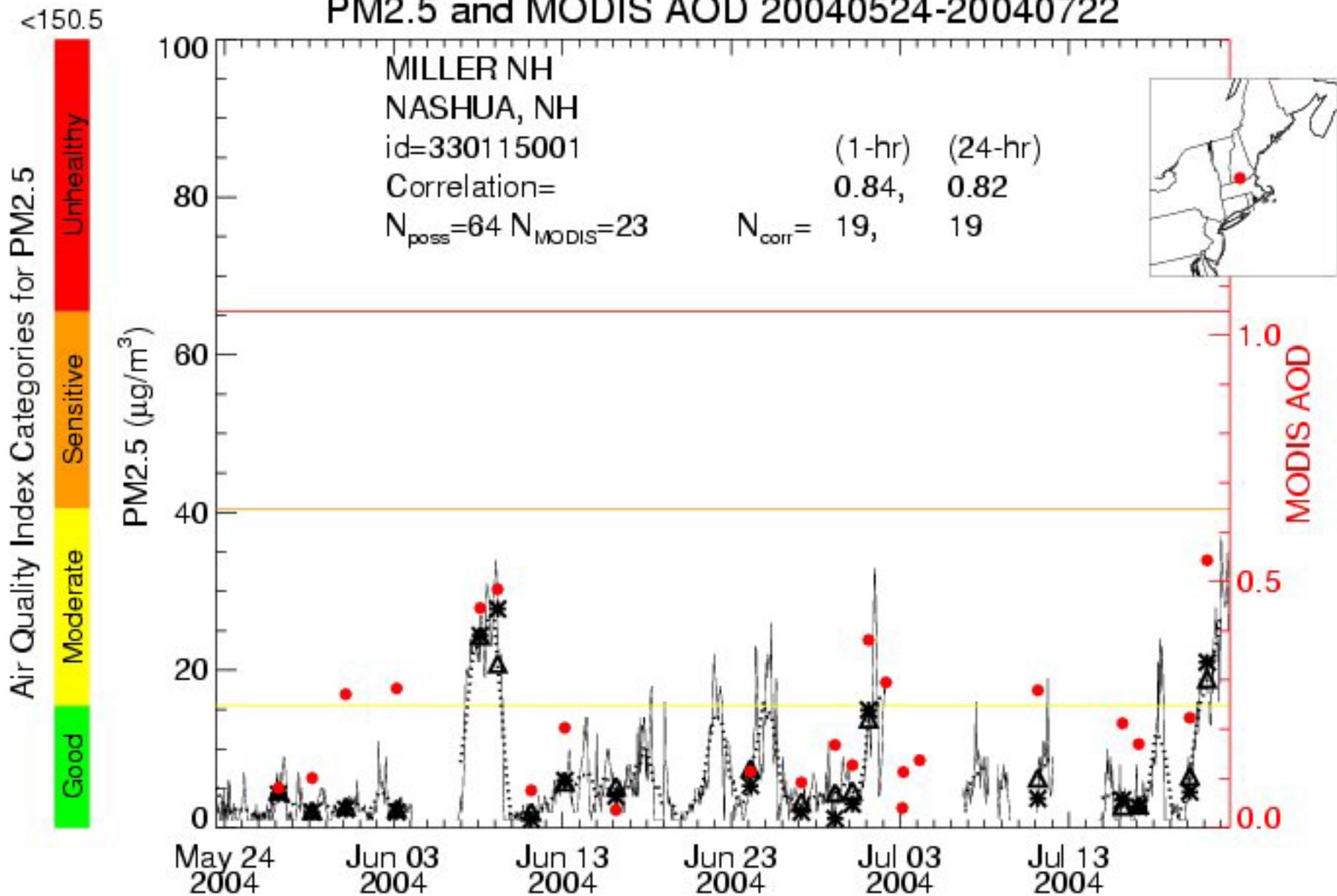
Date: 2002/09/12  
Hour: 22



**AQI > 100**



# PM2.5 and MODIS AOD 20040524-20040722



# Contribution of Asian Pollution ?

