

Introduction to Satellite Air Quality Products

Dr. Ana I. Prados
University of Maryland Baltimore County /JCET, Baltimore, MD
NASA Goddard Space Flight Center, Greenbelt, MD

CMAS NASA Satellite Training, October 14-16th, 2009



Accessing NASA Air Quality Data Products

- NASA satellite data products are **FREE**
- Many web-based applications are available for downloading data and imagery
- Tools for visualization and analysis of satellite imagery are also available



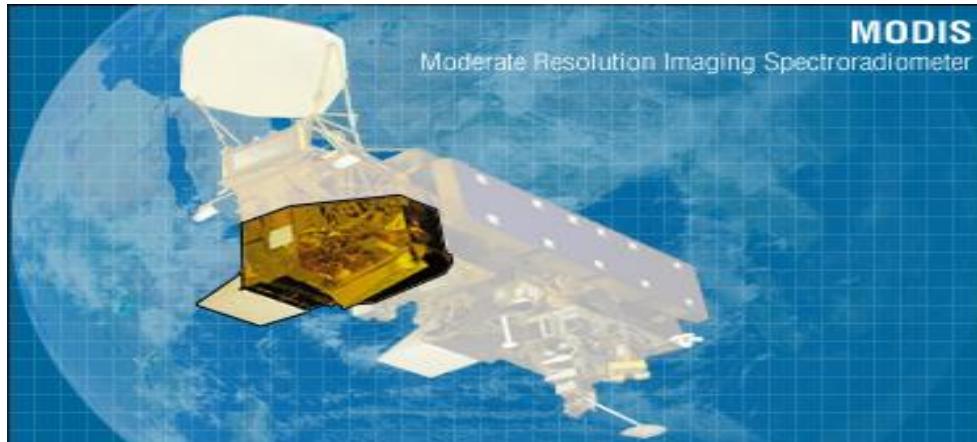
NASA Satellite Products for Air Quality Applications

- Particulate Pollution (dust, haze, smoke)
 - True Color Imagery (MODIS)
 - Aerosol Optical Depth (MODIS and OMI)
 - Aerosol Index (OMI)
 - Vertical Aerosol Extinction Profiles – satellite based Lidars (CALIPSO)
- Nitrogen Dioxide, Sulfur Dioxide, formaldehyde (OMI)
- CO, CO₂, Methane (AIRS)

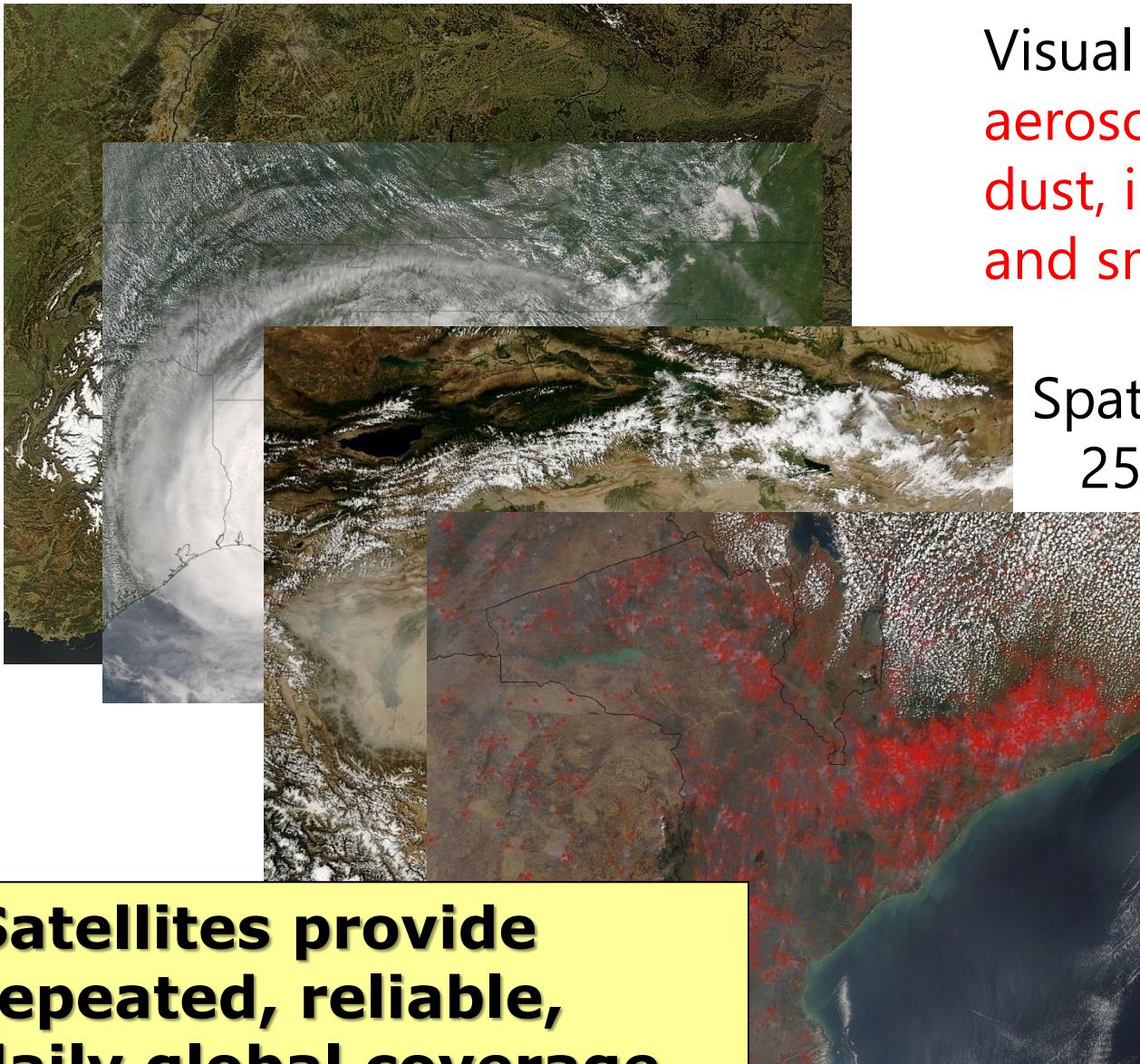


MODerate Resolution Imaging Spectroradiometer (MODIS)

- 36 spectral bands ranging from 0.41 to 14.385 microns.
- Many applications, including air, water, vegetation
- Available in various resolution (depends on product)
- MODIS is on NASA's **Terra** and **Aqua** satellites



True Color Imagery

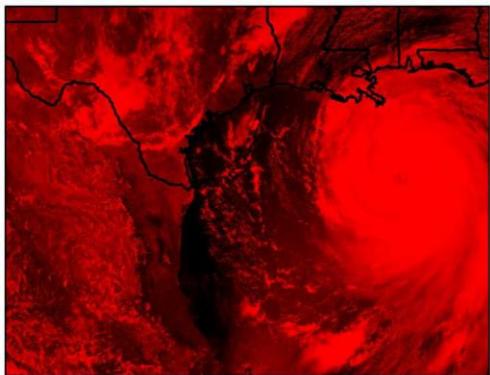


Visual qualitative aerosol representation of dust, industrial pollution, and smoke

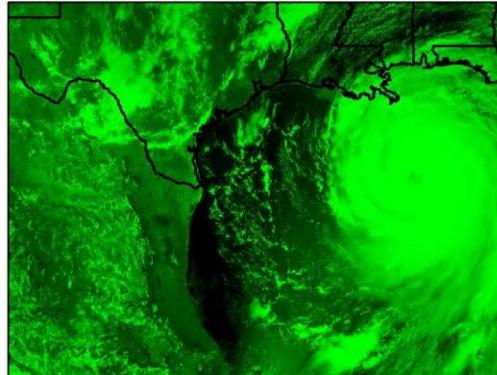
Spatial resolution:
250 m, 500 m, 1 km

MODIS True Color Image

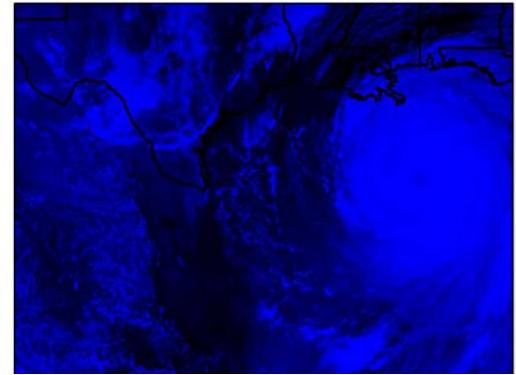
- A true color image is NOT a picture!
- It is made from a combination of the **red** (band 1), **green** (band 4), and **blue** (band 3) bands of MODIS



+



+



=



Haze and Smoke: white/gray
Clouds and Snow: deep white

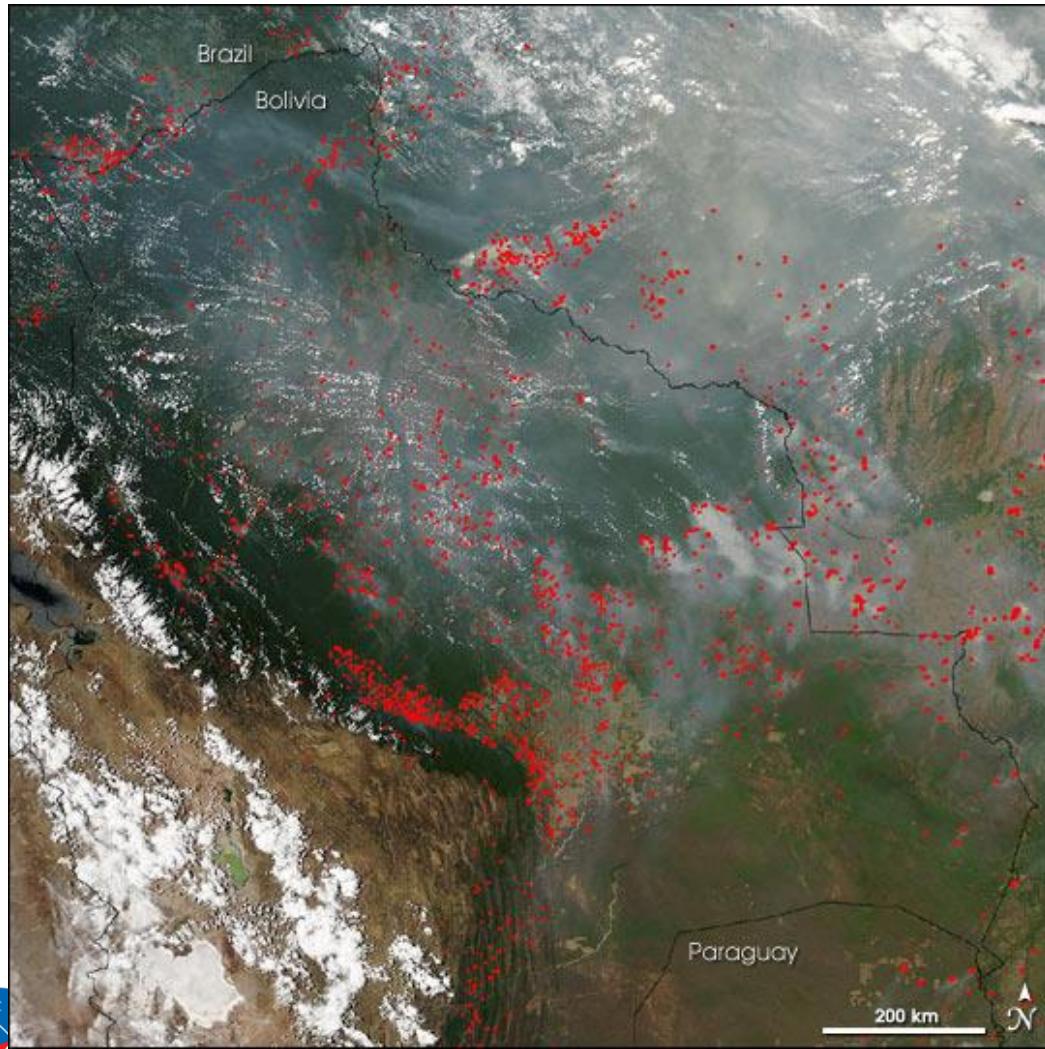


Smoke Over Florida

May 2, 2007.



Haze and Smoke: white/gray
Clouds and Snow: deep white



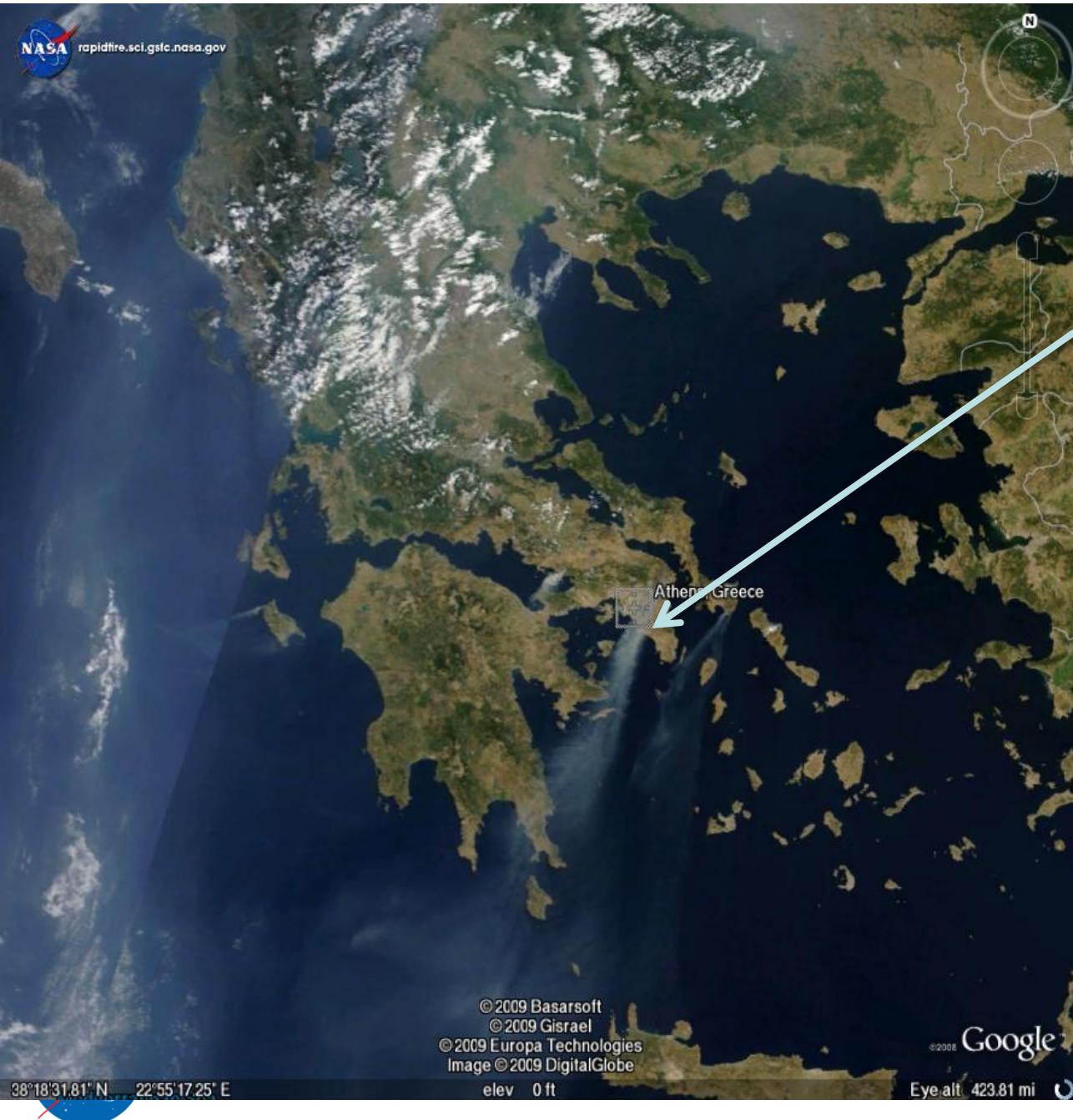
Fire Smoke in
Bolivia

Red Dots indicate
fire locations

MODIS Aqua

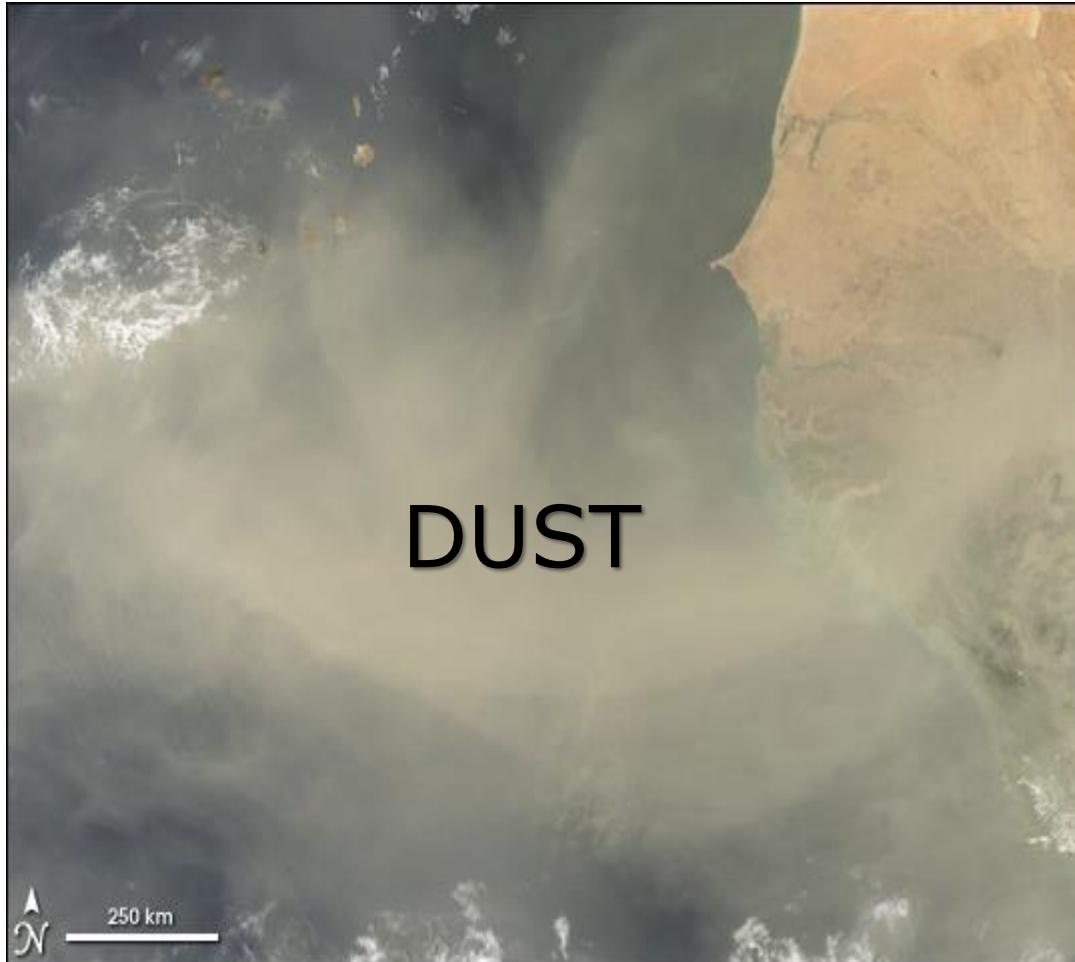
October 7, 2004





- Fire Smoke Plumes in Greece (near Athens)
- MODIS Terra
- August 23rd, 2009

Dust off the West Coast of Africa



MODIS Aqua

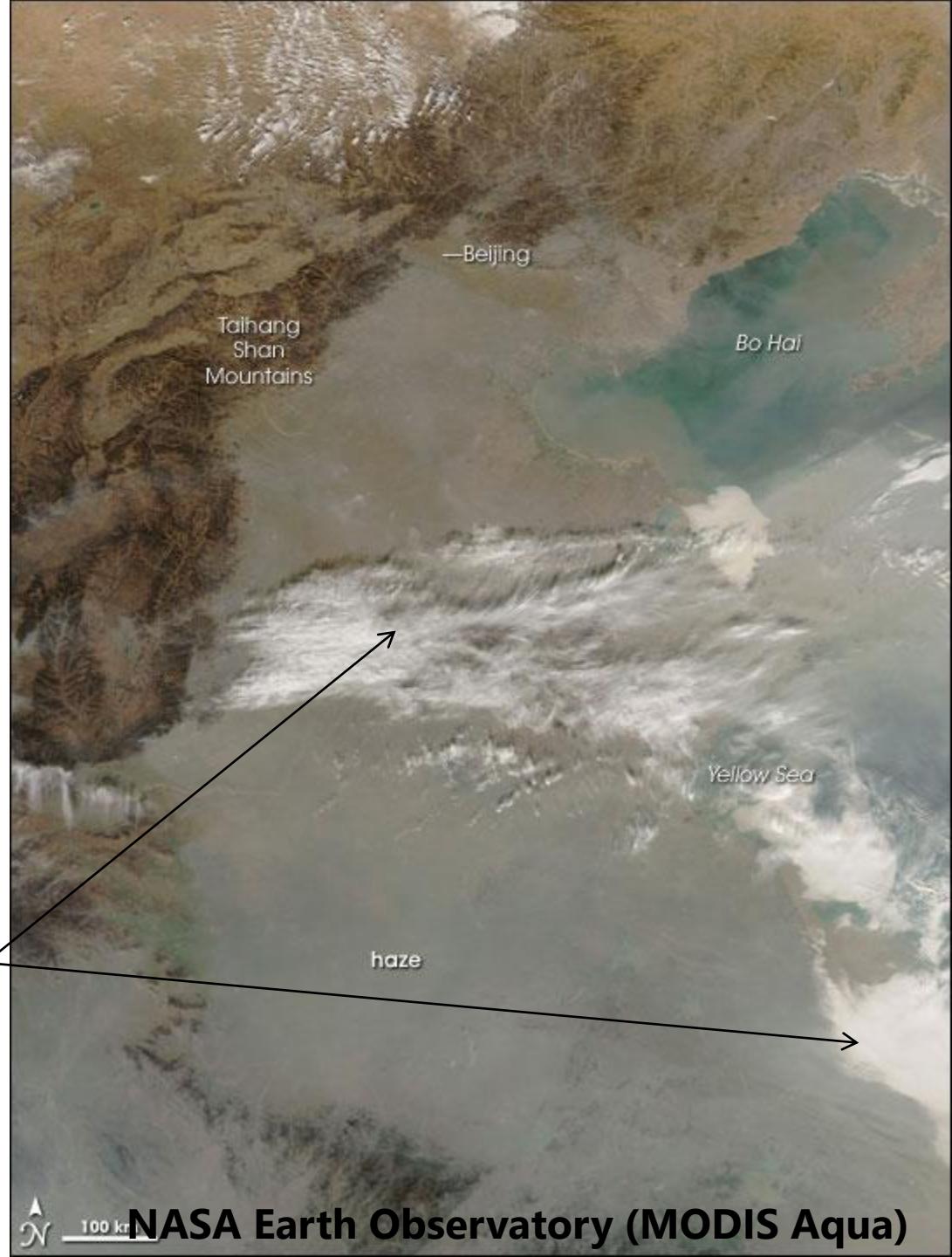
Dust often
has as a
brown-ish
color

March 12th,
2006

NASA Earth Observatory (MODIS Aqua)

- Haze over eastern China
- MODIS Aqua
- January 7th, 2008

Clouds



100 km

NASA Earth Observatory (MODIS Aqua)

MODIS Rapid Response System: Subsets

Global Near Real-Time Terra and Aqua MODIS True Color Images

<http://rapidfire.sci.gsfc.nasa.gov/subsets/>

USA6 Subsets

◀ prev

USA6 Subset - Terra 1km True Color image for 2009/060 (03/01/09)

Vectors selected: none

Change vector options: submit

View alternate pixel size: [2km](#) | [500m](#) | [250m](#) |

View alternate band combination: [Bands 7-2-1](#) | [NDVI](#) |

[View Aqua image](#) | [See all images available for this area this day](#) |

[Display metadata \(including time of input data\)](#)

[Display worldfile](#) | [Display projection file](#)

[Download JPG image with ancillary files \(.zip\)](#)

[Download KMZ file for GoogleEarth](#)

[Download GeoTIFF file](#)

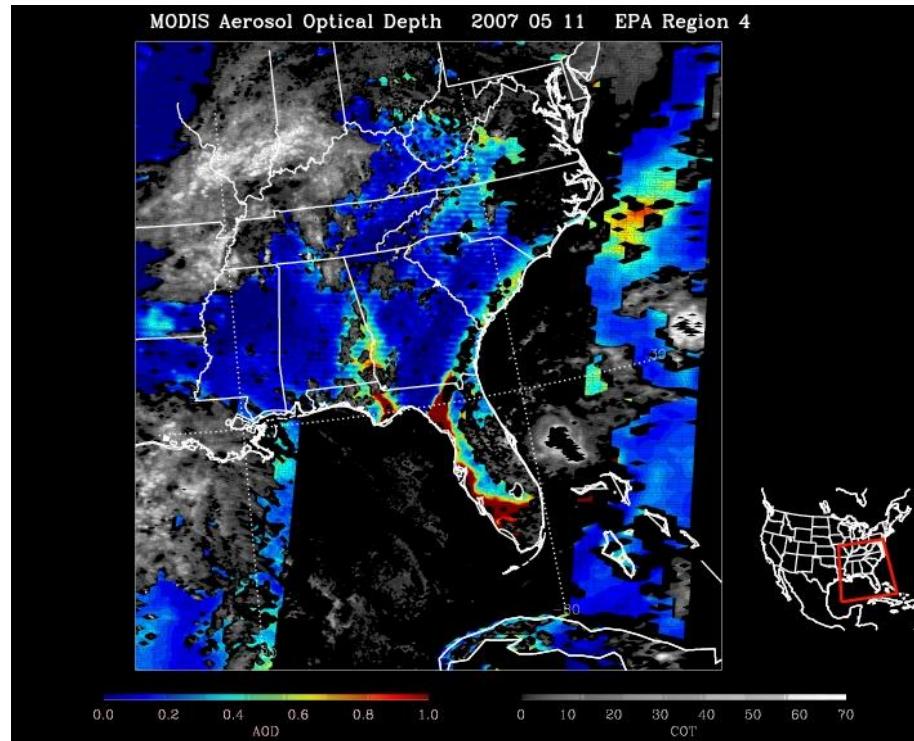
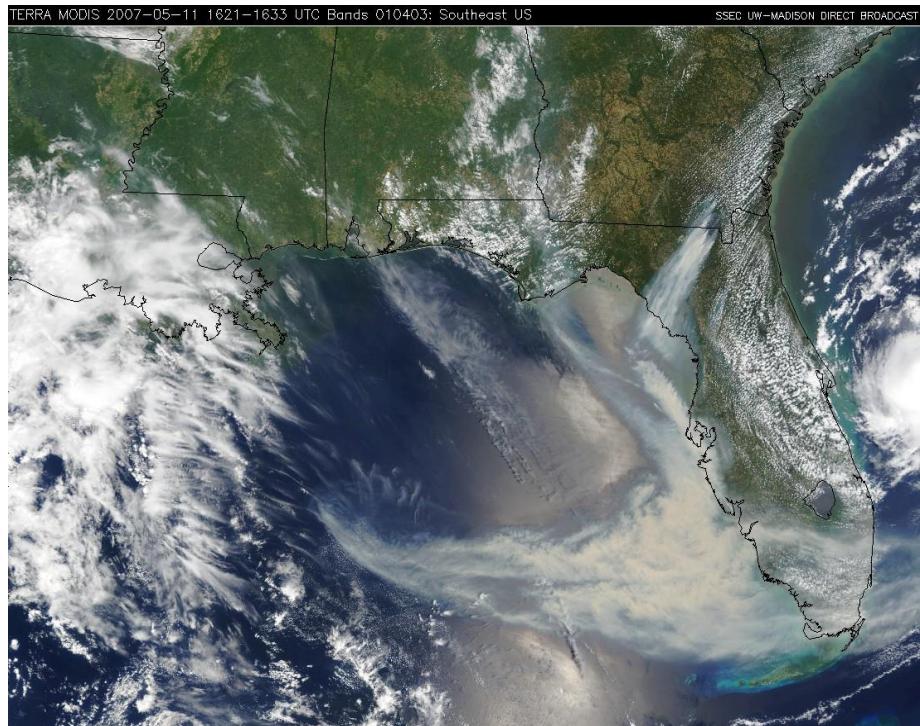
Available in KMZ for Google Earth
Visualization



MODIS Aerosol Optical Depth



Wildfires in Florida: May 11, 2007



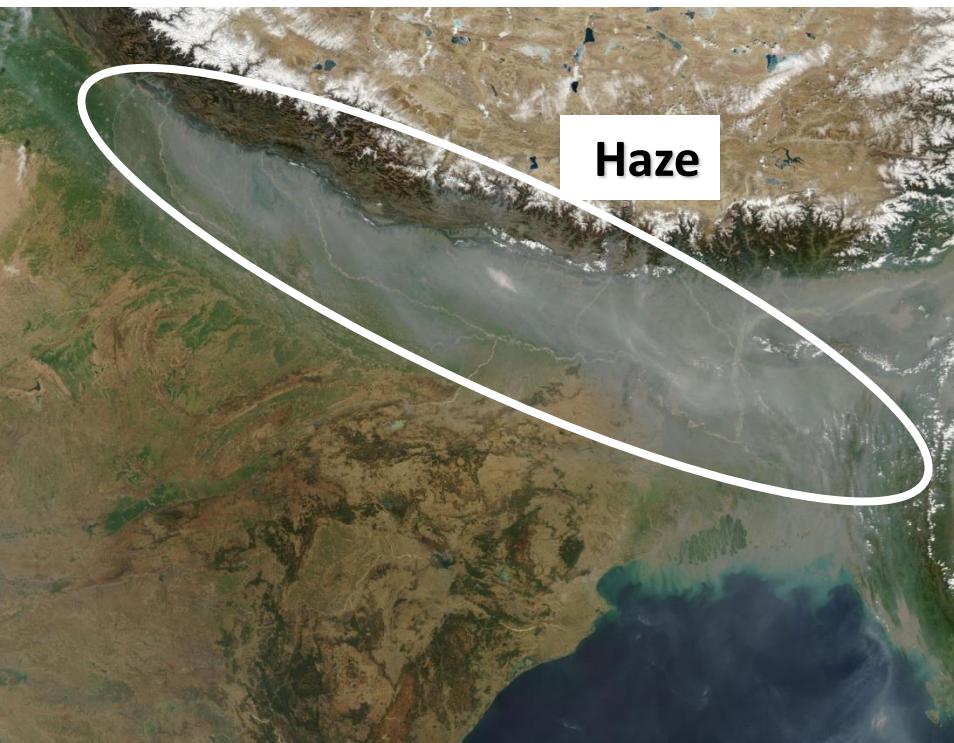
MODIS Terra True Color Image

MODIS AOD (L2)

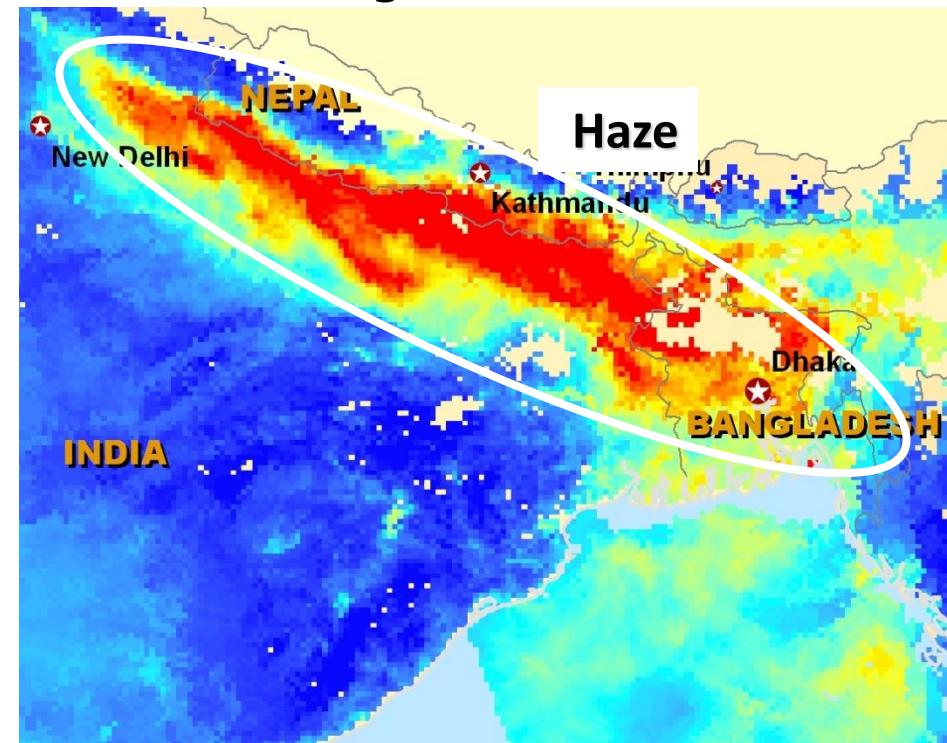


Northern India, Nepal, and Bangladesh MODIS True Color and AOD Images

True Color Image



AOD Image



MODIS Terra
February 5, 2006



Access to MODIS AOD

- NASA LAADS L2 Web Browser: Access to high resolution MODIS RGB and AOD
 - Giovanni - webtool for imagery visualization and analysis
 - DataFed - webtool for imagery visualization and analysis
- and others.....

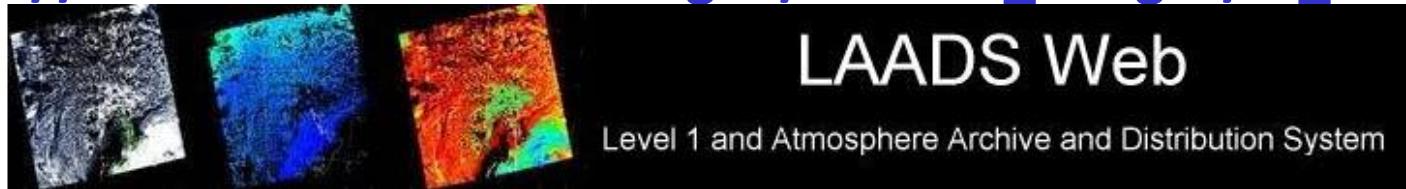
Presentation available --- visually Exploring the Earth with NASA Satellite Data

<http://aerocenter.gsfc.nasa.gov/asrs/materials/>



NASA LAADS Web Level 2 Browser

http://ladsweb.nascom.nasa.gov/browse_images/l2_browser.html



Level 2 Browser

Satellite: Terra
Date: September 3, 2008
Parameter: RGB
Collection: 5

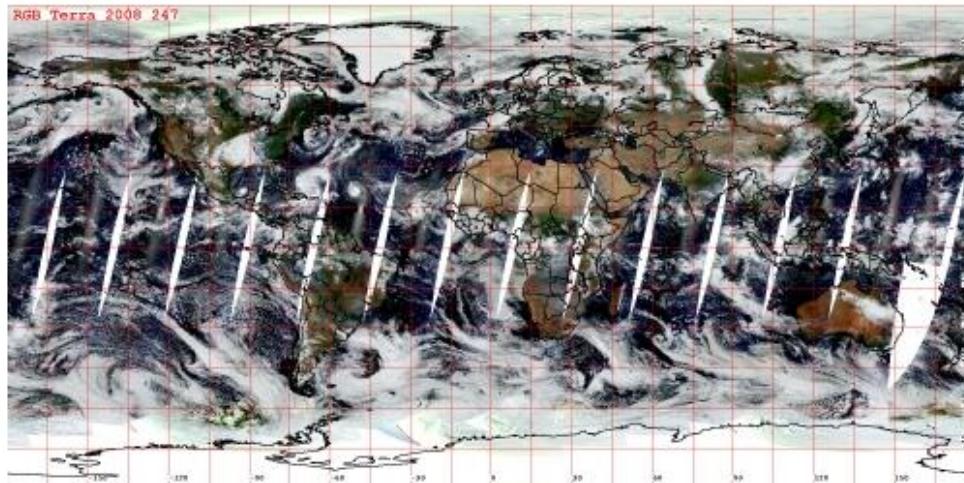
Satellite: Terra Aqua Combined
Month: Sep Day: 03 Year: 2008
Parameter: **RGB**
Collection: 5 - Coll 5 AQUA/TERRA Forward and Reprocessing

Update

+ Previous

+ Next

+ View Help



Specify Bounding Box Coordinates as:
North, West, East, South

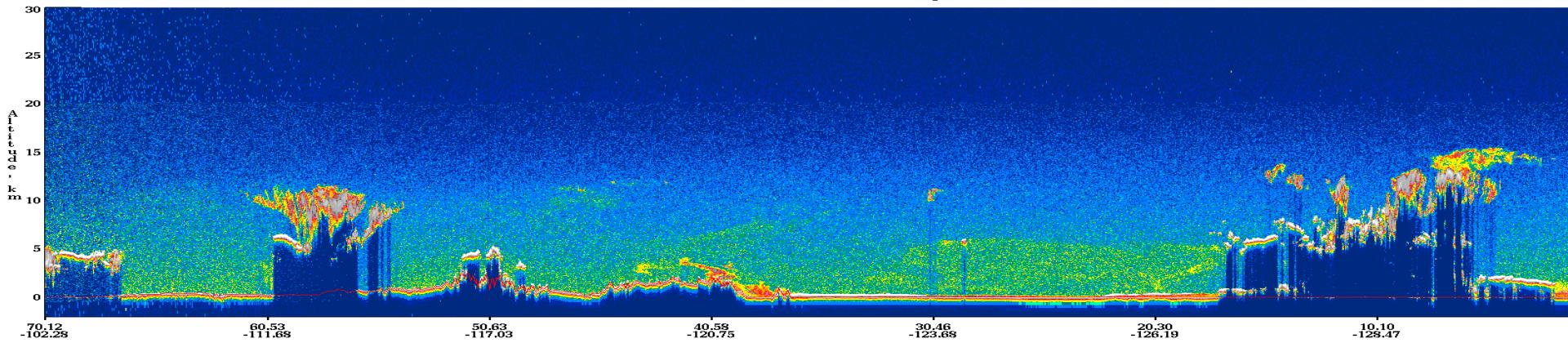
North: **10**

West: **-10** East: **10**

South: **-10**

Get Granule Images



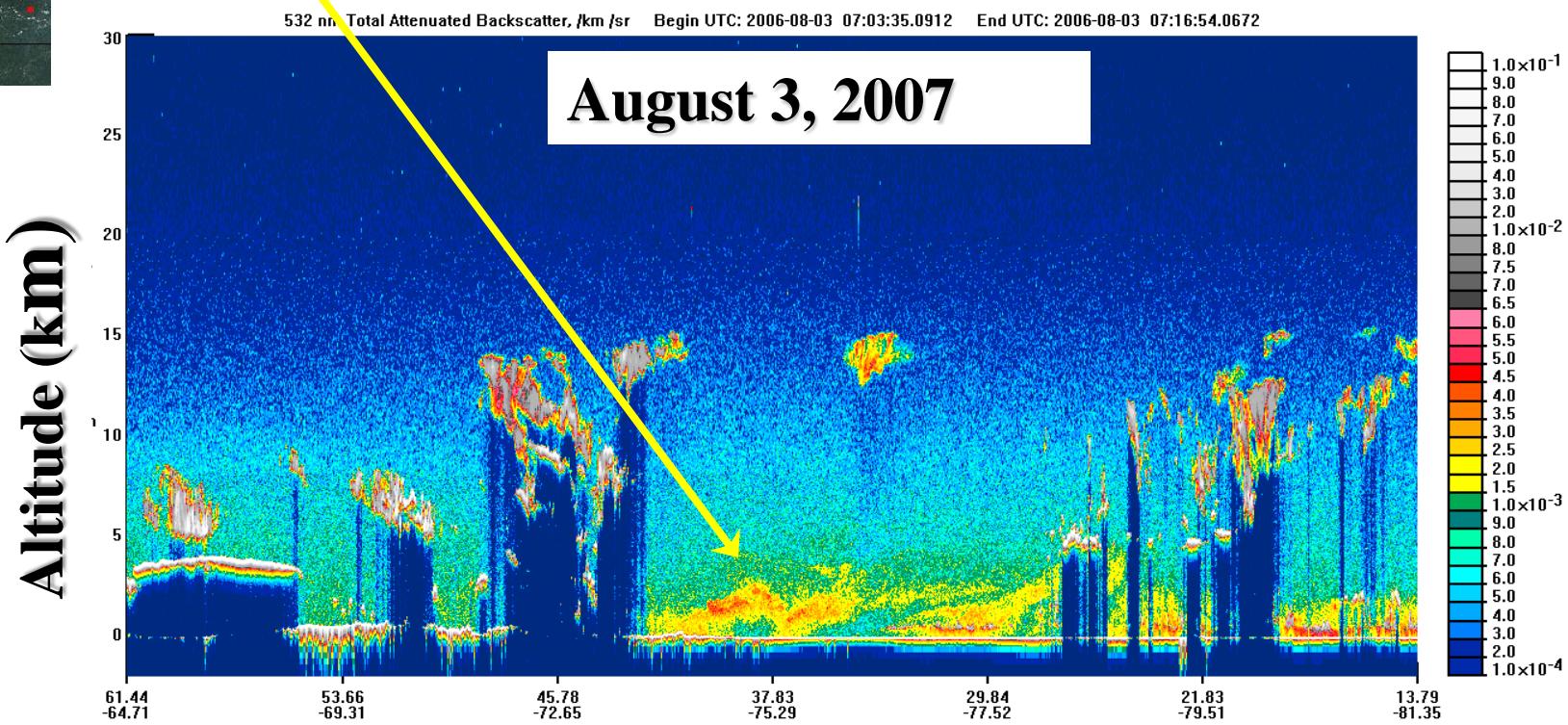
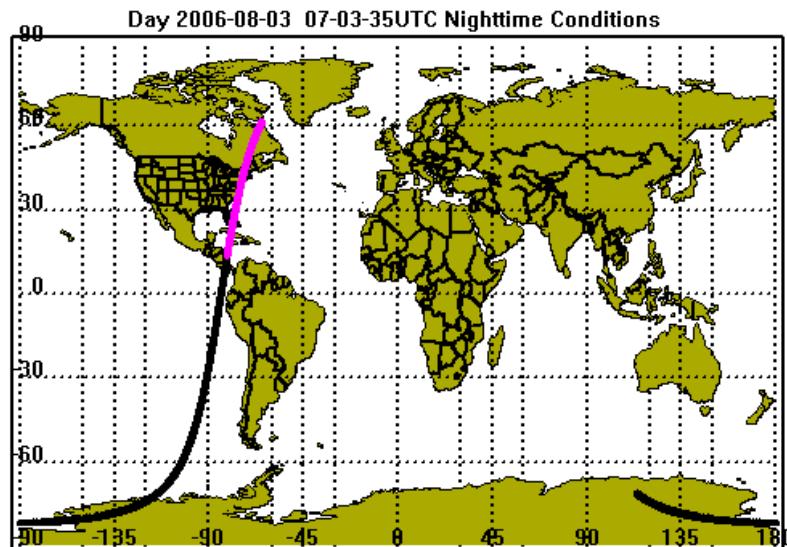
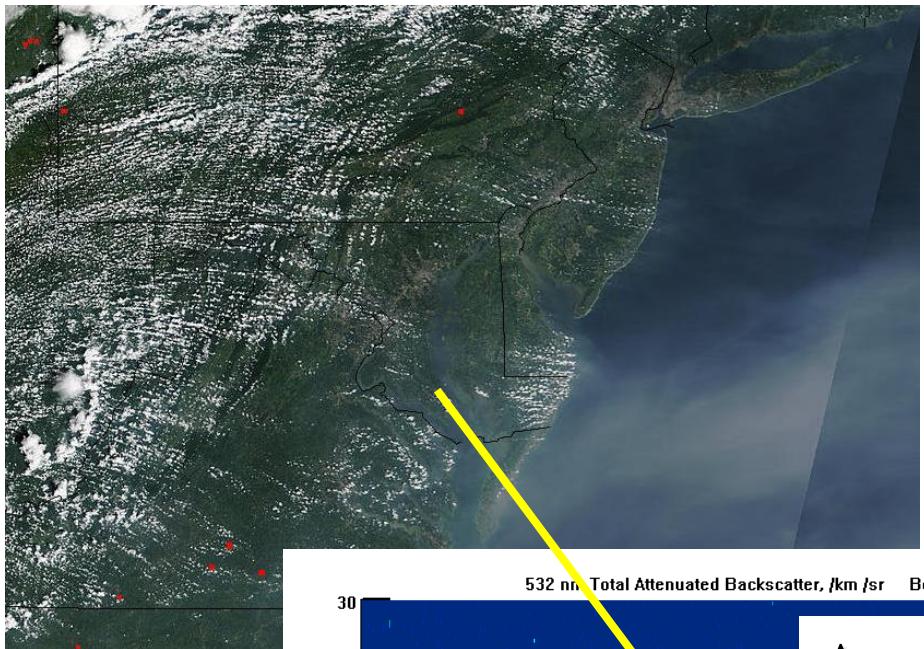


Cloud-Aerosol Lidar and Infra-Red Pathfinder **Satellite Observation (CALIPSO)** **3D Visualization of Air Pollution**

- CALIPSO has a lidar that provides information about the *vertical distribution* of particles
- Useful in conjunction with column AOD
- Spatial resolution (vertical): 30 – 60 m
- Temporal resolution: 16 days \pm 20 – 50 km



CALIPSO Aerosol Profiles



Access to CALIPSO Data and Imagery

Information and data (Extinction and Backscatter profiles)

http://eosweb.larc.nasa.gov/PRODOCS/calipso/table_calipso.html

Lidar Browse images of Total Attenuated Backscatter and Feature Mask (also available in KMZ for version 2 only)

http://www-calipso.larc.nasa.gov/products/lidar/browse_images

Giovanni A-Train Instance - Feature Mask (also available in KMZ)

<http://giovanni.gsfc.nasa.gov>

The easiest way to visualize CALIPSO data is through Google Earth (use KMZ format)



Ozone Monitoring Instrument (OMI)

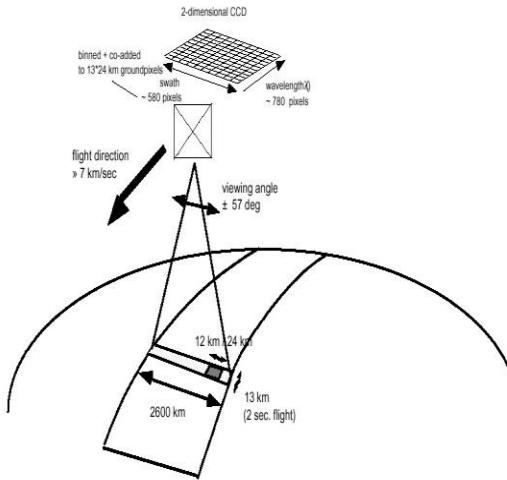
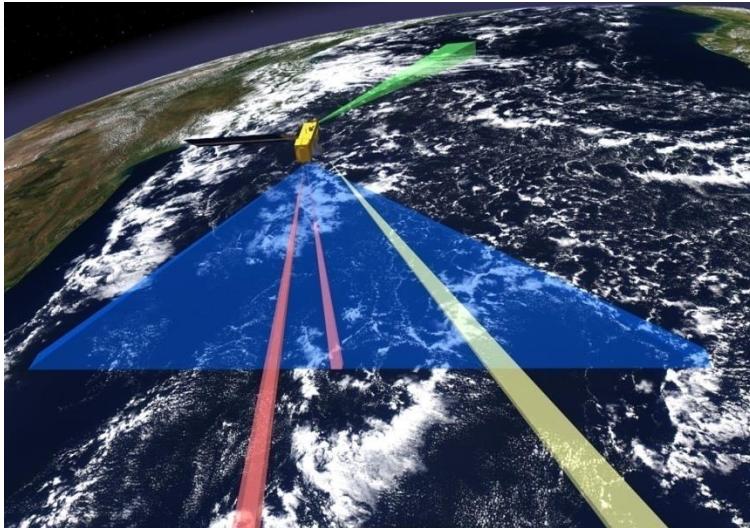


Figure 2.1 Measurement principle of OMI.

Courtesy of Fokker Space

One of four sensors on the EOS-Aura platform (OMI, MLS, TES, HIRDLS)

An international project: Holland, USA, Finland

Launched on 07-15-04

Instrument Characteristics

- Nadir solar backscatter spectrometer
- Spectral range 270-500 nm (resolution~1nm)
- Spatial resolution: 13X24 km footprint
- Swath width: 2600 km (global daily coverage)
- 13:45 (+/- 15 min) Local equator crossing time (ascending node)



Retrieval Products

Column Amounts

- Ozone (O_3)
- Nitrogen Dioxide (NO_2)
- Sulfur Dioxide: (SO_2)
- Others

Aerosols

Courtesy of OMAR Torres

OMI Near UV Aerosol Products (388 nm)

Aerosol Index (AI)

Qualitative Indicator of the presence of absorbing aerosols: smoke, desert dust, volcanic ash. It is calculated using observations at two wavelengths in the range 330-390 nm.

Extinction Optical Depth, AOD

A measure of the aerosol capacity to extinguish radiation by scattering and absorption. It is related to the total column amount of aerosol particles in the atmosphere.

Single Scattering Albedo, SSA

A measure of the fractional extinction due to scattering of incident solar radiation.

Varies between 0 (all absorption, no scattering) and 1 (all scattering, no absorption). Typical variability range (0.6 to 1.0)

Absorption Optical Depth, AAOD

The actual optical depth resulting from the absorption process. It is easily calculated as

$$\text{AAOD} = \text{AOD} \times (1.0 - \text{SSA})$$



OMI UV Aerosol Index

$$\text{Aerosol Index} = 100 \times \log \left(\frac{\text{Measured Radiance (354 nm)}}{\text{Calc. Rayleigh Radiance (354 nm)}} \right)$$

Positive values for UV-absorbing particles: desert dust, smoke, volcanic ash

Negative values for small size (less than 0.2 microns) non-absorbing particles. In practice, it is difficult to separate aerosol effects from other non-aerosol effects that also produce negative AI values. Aerosol Index yields near-zero values for clouds.

Magnitude of positive AI depends mainly on aerosol absorption optical depth and height of aerosol layer. Also depends on aerosol microphysical properties.



Properties of the OMI UV Aerosol Index

Detects absorbing aerosols over all surface types: ocean, vegetated surfaces, deserts, snow/ice, etc

Detects absorbing aerosols under partial cloudiness conditions and above clouds

Aerosol Index is insensitive to carbonaceous aerosols (smoke) below ~ 2km

Larger sensitivity to low altitude desert aerosols (~ 0.5 km)

Aerosol Index signal meaningful for values larger than 0.5

Direct conversion of AI to any physically meaningful parameter is not possible because of multiple dependencies (AOD, SSA, height, etc).



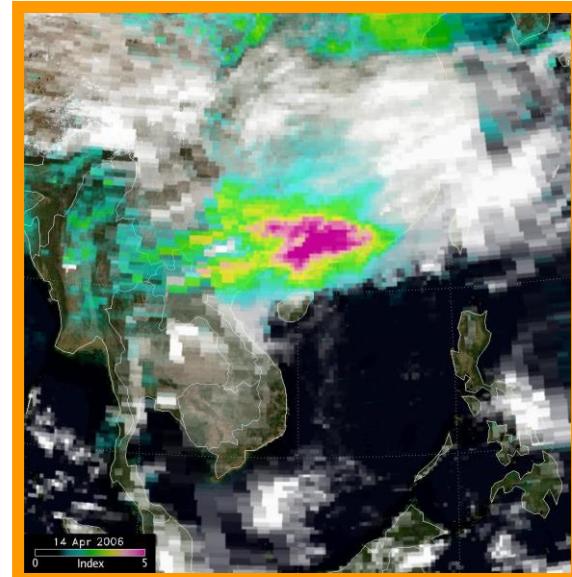
Trans-oceanic Aerosol Transport as seen by the OMI Aerosol Index



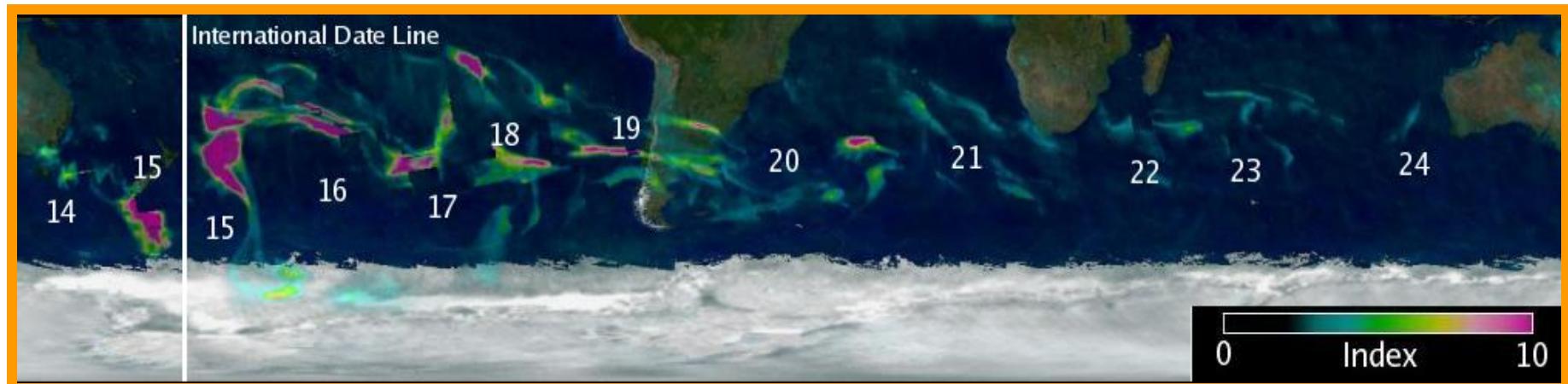
Courtesy of OMAR Torres

Air Quality Applications of the Aerosol Index

- Validation tool for transport models
- Separation of carbonaceous from sulfate aerosols
- Identification of aerosols above PBL (i.e., PBL aerosols are not detectable by AI)
- Tracking of aerosol plumes above clouds and over ice/snow
- Detection of UTLS (upper troposphere/lower stratosphere) aerosols



Aerosols over clouds: April 14, 2006



Courtesy of OMAR Torres

Transport around the globe of a high altitude smoke layer generated by the Australian fires in December 2006. Numbers indicate the day of the month.



Inversion Procedure

Observations

Measured radiances at 354 and 388 nm

Aerosol Models

Three aerosol types:

- Desert dust aerosols
- Carbonaceous aerosols
- Non absorbing aerosols

Assumed properties:

- Particle size distribution
- Refractive index

Ancillary Input

- Surface Albedo
- Aerosol Type
- Vertical Distribution

Retrieval Algorithm

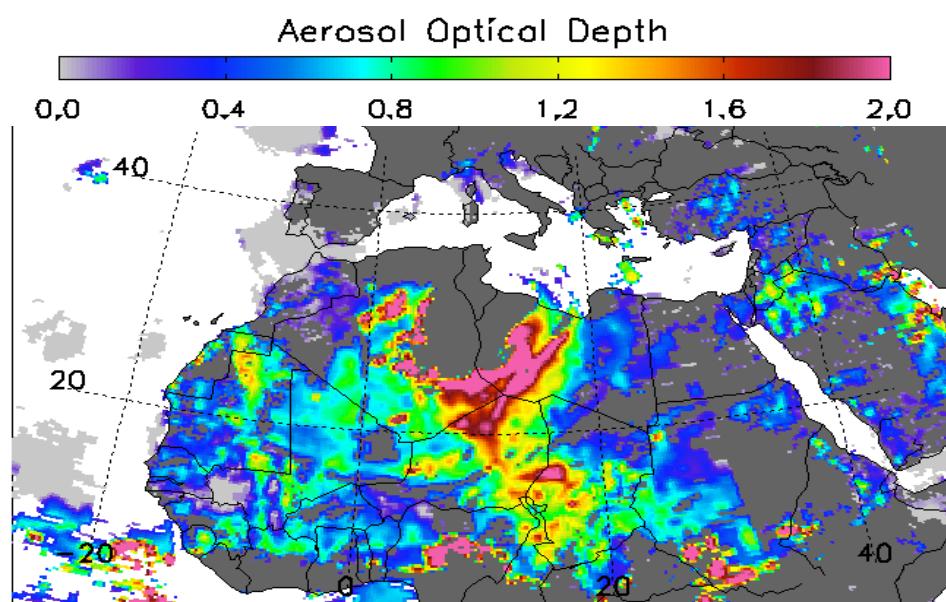
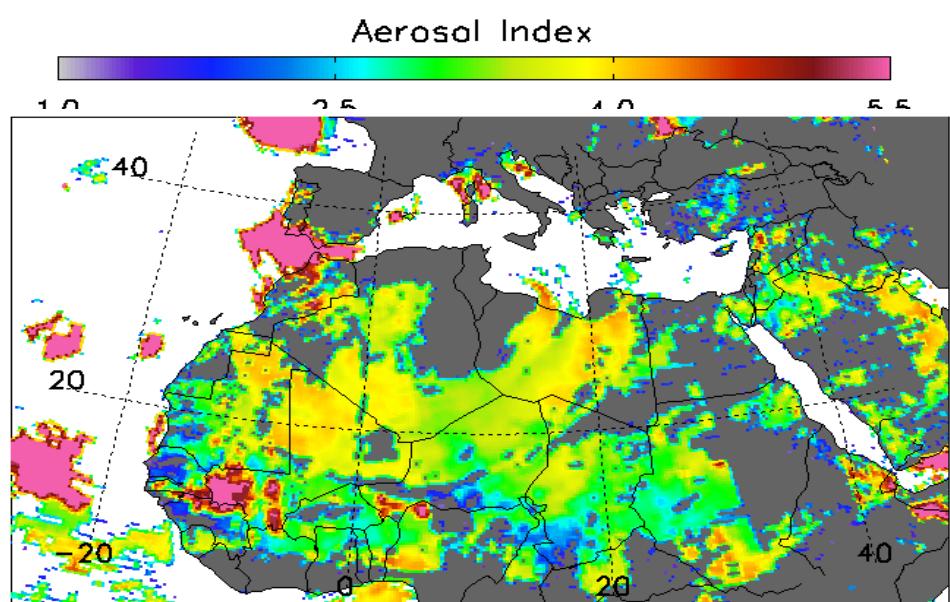
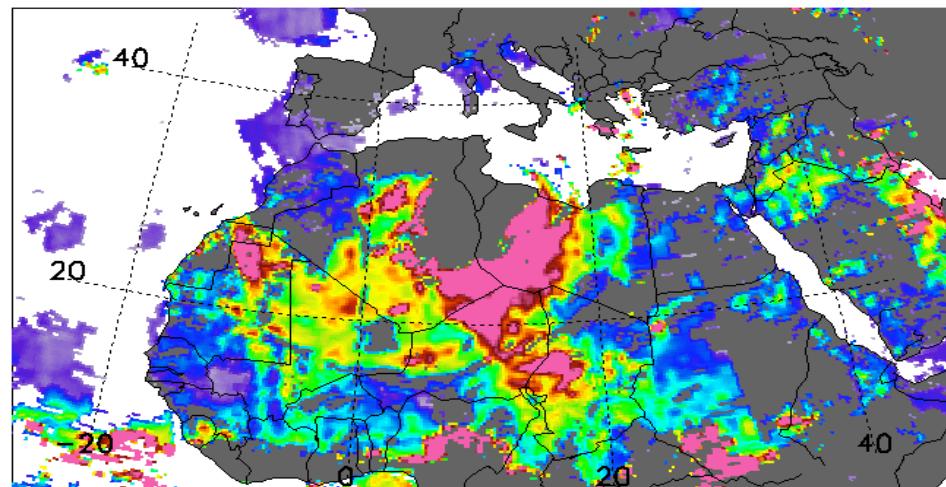
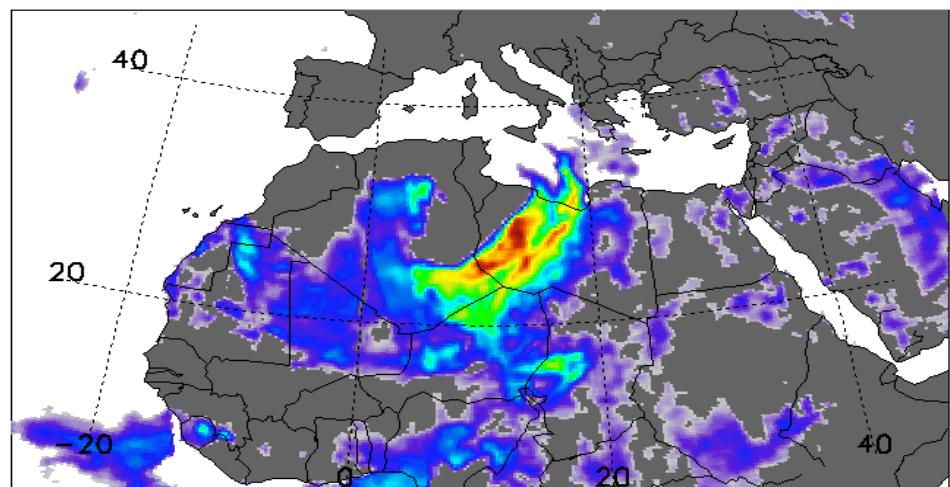
Extinction optical depth, AOD
Single Scattering Albedo, SSA
Absorption optical depth, AAOD
(354, 388)

Derived Parameters



Courtesy of OMAR Torres

OMI Retrieved Dust Properties (March 9-2007)



Single Scattering Albedo

0.75 0.80 0.85 0.90 0.95 1.00

Aerosol Abs. Optical Depth

0,0 0,1 0,2 0,3

Advantages of near UV retrieved products (AOD/SSA)

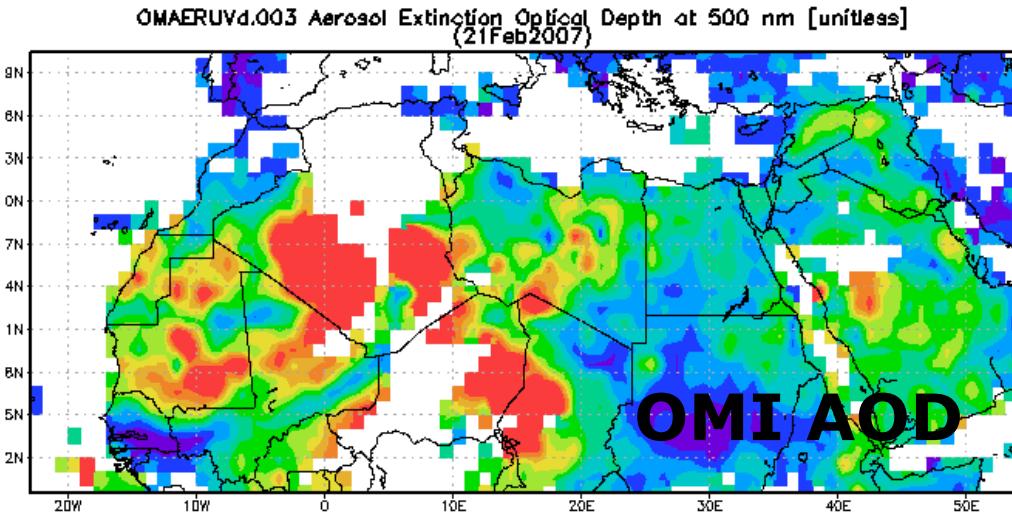
- Retrieval capability over deserts where traditional visible and near IR methods fail.
- Retrieval capability of aerosol single scattering albedo.

Current Limitations

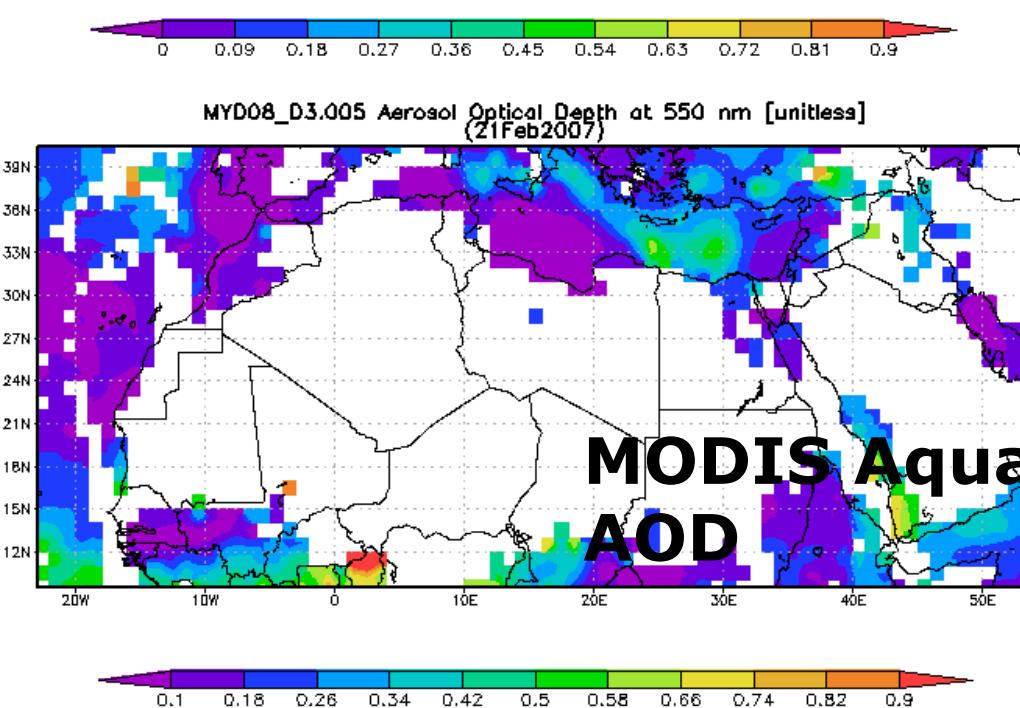
- Sensitivity to aerosol layer height
- Sub-pixel cloud contamination associated with large footprint (instrument limitation)
- Works best under conditions of minimum cloud contamination and large scale aerosol events (desert dust and smoke plumes)
- Small horizontal scale events (non-absorbing aerosols) are difficult to detect because of sub-pixel cloud contamination.



Advantages of near UV retrieved products (AOD/SSA)



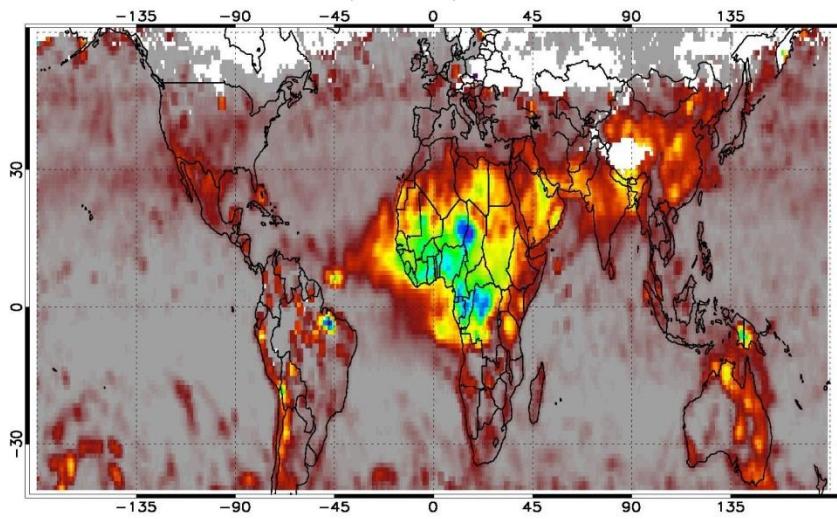
Mostly sensitive to UV absorbing aerosols in the free troposphere (smoke, dust)



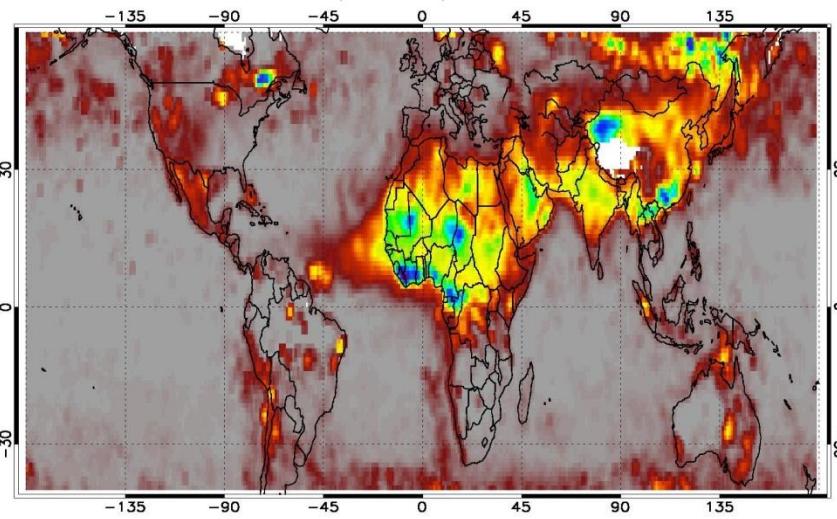
Greater coverage over bright surfaces (desert, snow) than MODIS

Global Climatology Aerosol Absorption Optical Depth

Aerosol Abs. Optical Depth at 388nm for DJF–2006



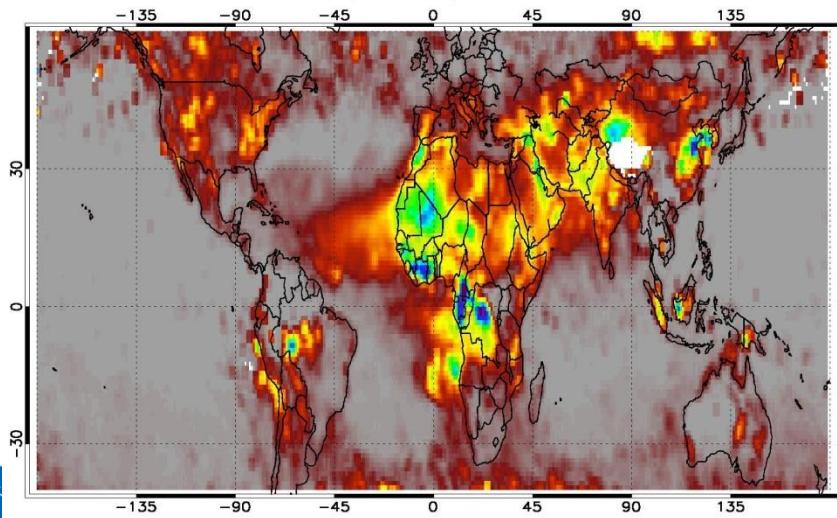
Aerosol Abs. Optical Depth at 388nm for MAM–2006



Aerosol Abs. Optical Depth at 388nm

0.00 0.04 0.08 0.12 0.16 0.20

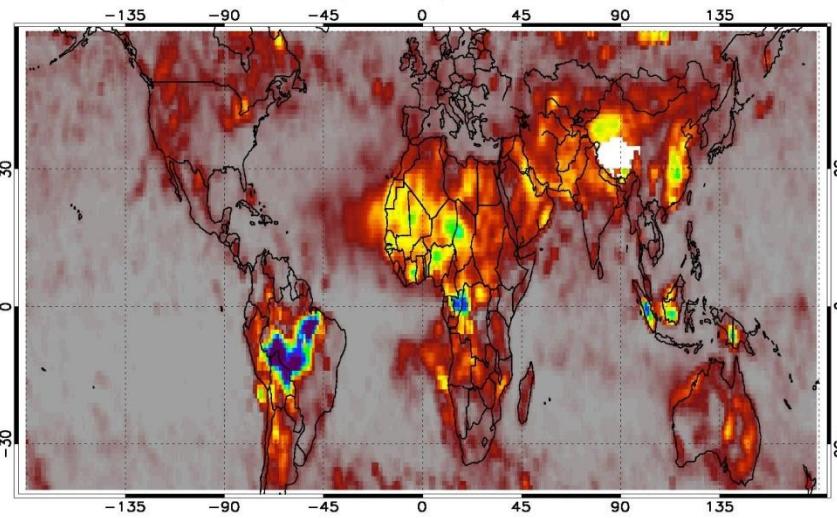
Aerosol Abs. Optical Depth at 388nm for JJA–2006



Aerosol Abs. Optical Depth at 388nm

0.00 0.04 0.08 0.12 0.16 0.20

Aerosol Abs. Optical Depth at 388nm for SON–2006



Aerosol Abs. Optical Depth at 388nm

0.00 0.04 0.08 0.12 0.16 0.20

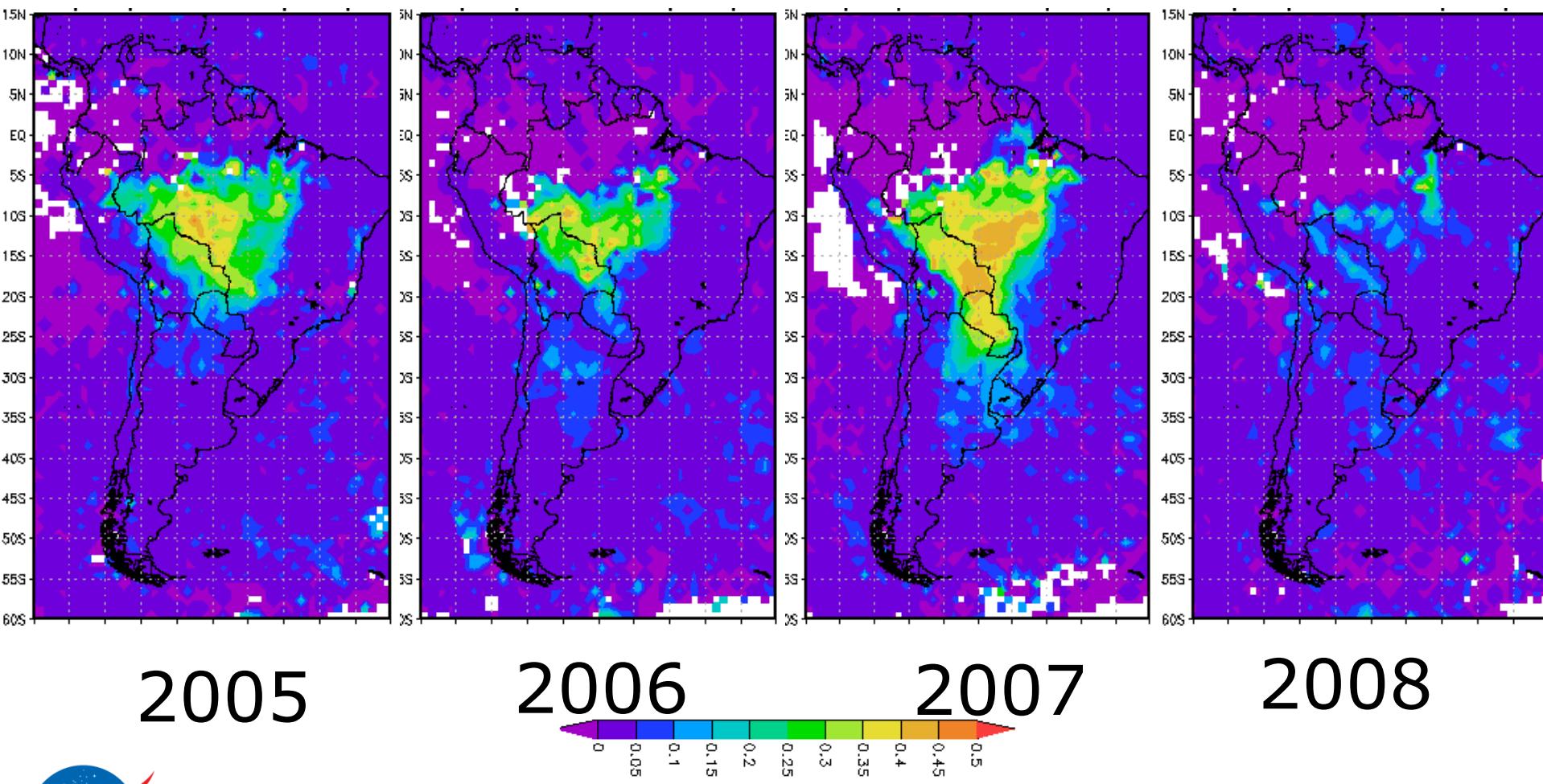
Aerosol Abs. Optical Depth at 388nm

0.00 0.04 0.08 0.12 0.16 0.20

Courtesy of
OMAR Torres



September Average Aerosol Absorption Optical Depth (388 nm)

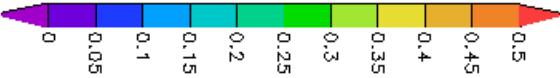


2005

2006

2007

2008



Courtesy of OMAR Torres

OMI NO₂

- **Data Products** (NO₂ Column Densities)
 - Total and Stratospheric Column
 - Tropospheric Column
- **Two Separate Algorithms**
 - NASA/GSFC
 - KNMI “Real Time”
- **Sensitive to pollution in the PBL**
- OMI “can’t see” below clouds. Retrievals (L3) only available for less than 30% cloud cover

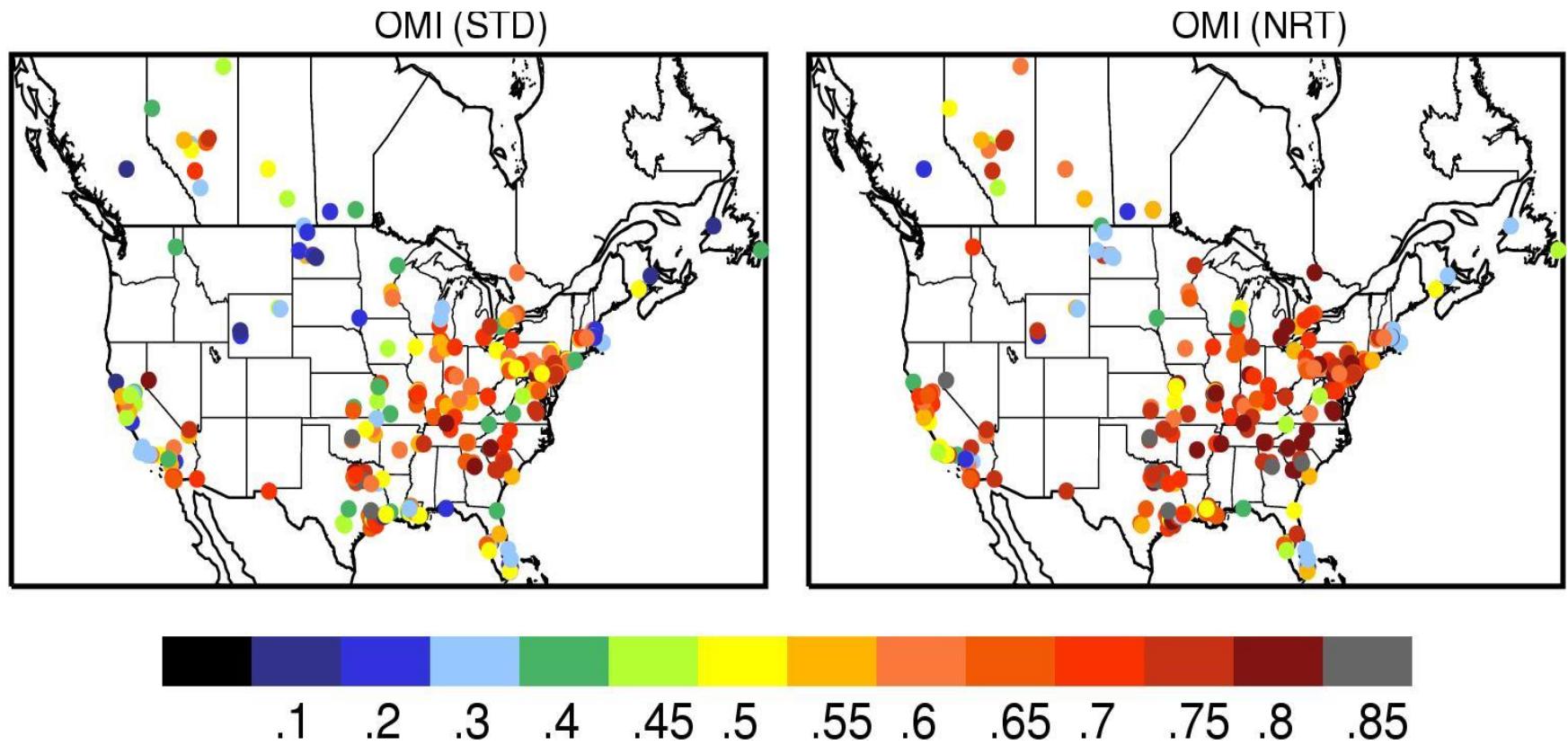


OMI Column NO₂ Density Retrievals (NASA GSFC)

- **Step 1- Obtain Slant Column Densities** from a spectral fit to the OMI measured Albedo and calculate **initial Vertical Column Density** (assumes clean tropospheric profile)
- **Step 2 – Calculate Air Mass Factors** for cloud/cloud-free/polluted/unpolluted profile shapes
- **Step 3 – Stratosphere - Troposphere Separation** calculate “background” NO₂ and re-compute Vertical Column Density with new AMFs if pollution is present



OMI NO₂/Surface Correlations



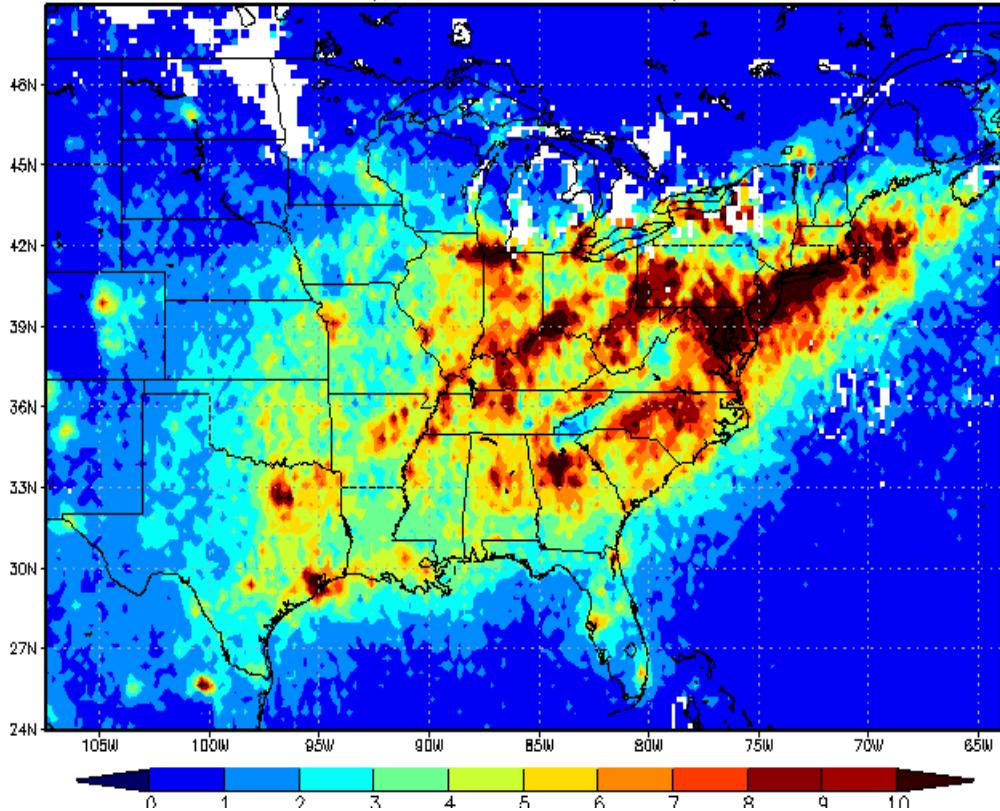
Lok et al., GEO Cape Workshop, 2008



OMI Tropospheric NO₂ Column

February 2006

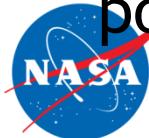
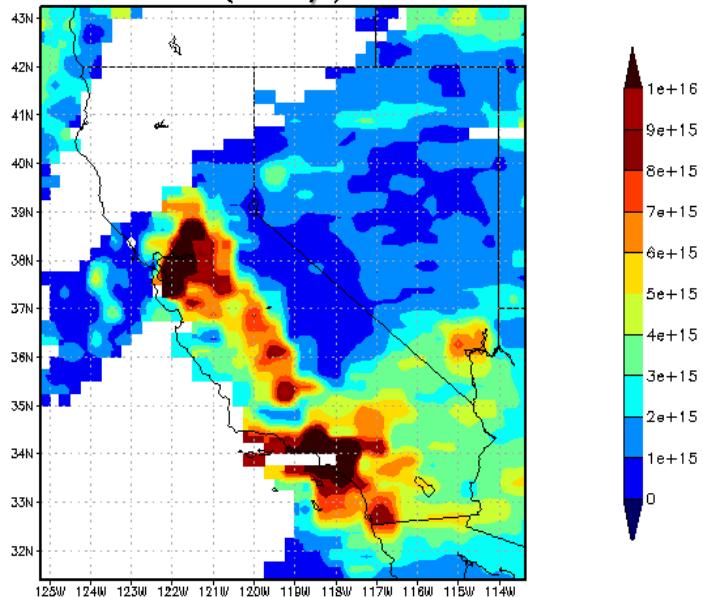
OMNO2G.003 NO₂ Tropospheric Column Amount (Clear, 0–30% Cloud) [10¹⁵ molec/cm²]
(01Feb2006 – 27Feb2006)



Sensitive to Boundary layer pollution

Good qualitative agreement for urban areas and large point sources (e.g. EGUs)

October 25th, 2007



OMI Tropospheric NO₂

Global Near Real-Time OMI NO₂ Tropospheric Column from KNMI

http://www.temis.nl/airpollution/no2col/no2reaioomi_col3.php

Regional Tropospheric NO₂ columns from OMI



[Tropospheric NO₂](#)

Re

NO₂ observation for:

NO₂ (Region: World)

Year: 2009

Region: Month: February

Year: Day: 19

Month:

Day:

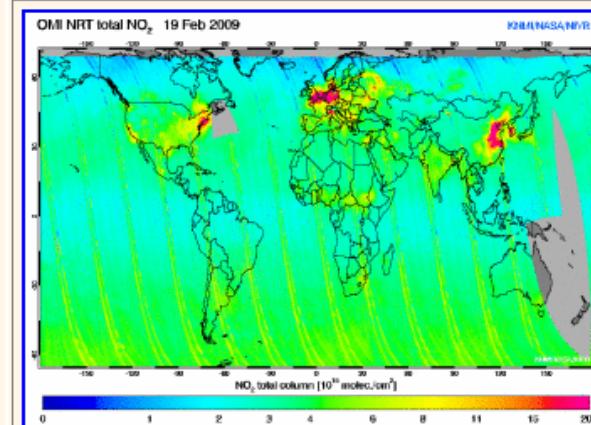
[<- previous day](#)

[<- previous month](#)

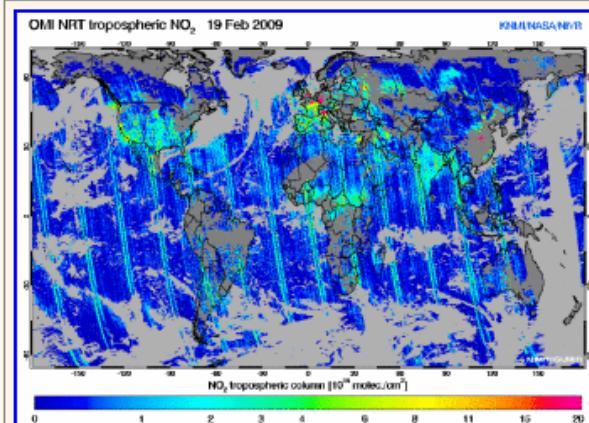
[next day -->](#)

[next month -->](#)

Regional NO₂ of 19 February 2009



Total column



Tropospheric column

[NO₂ data file](#)

Profile data is not available

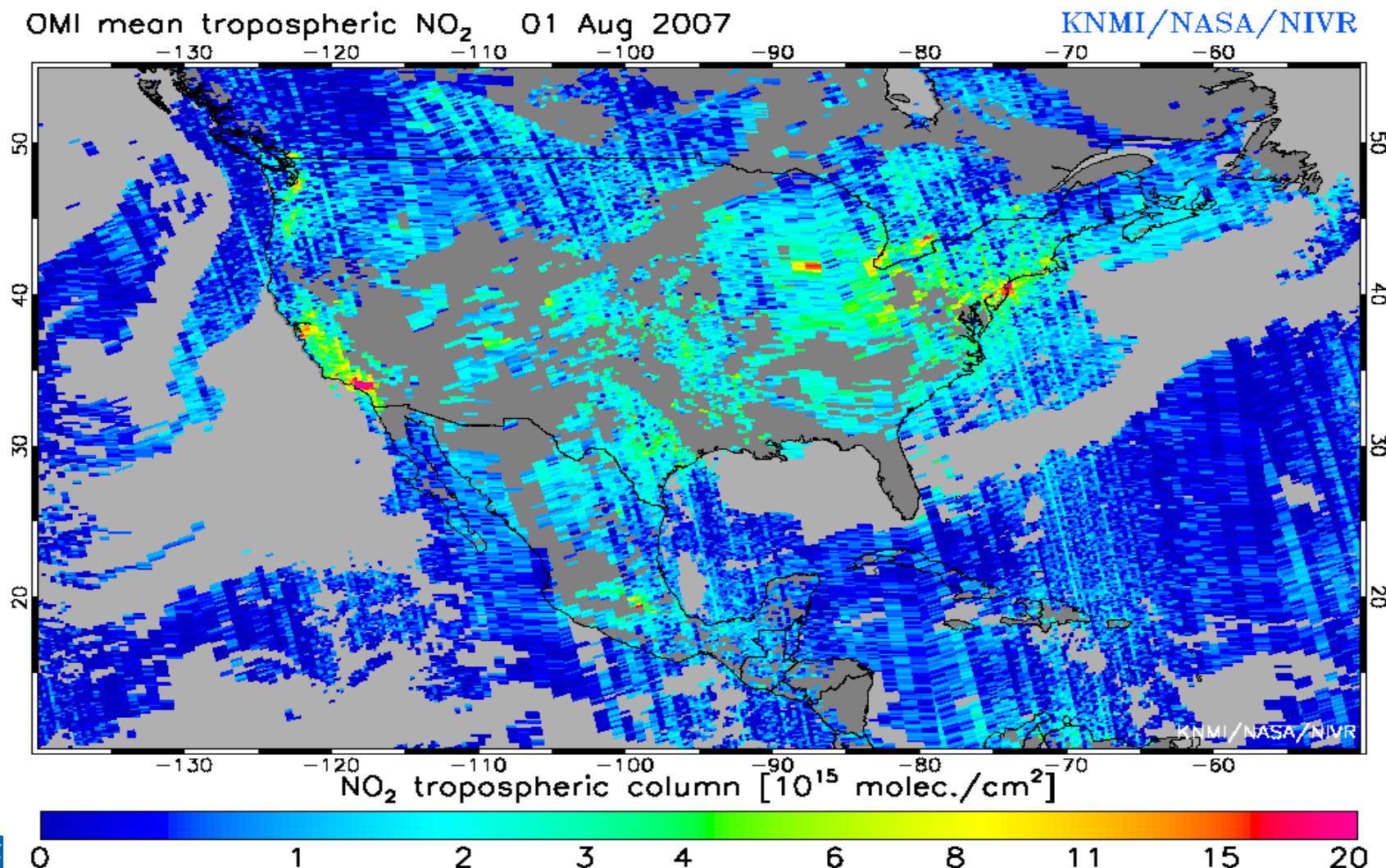
[Data file archive](#)

[Image in Google Earth](#)

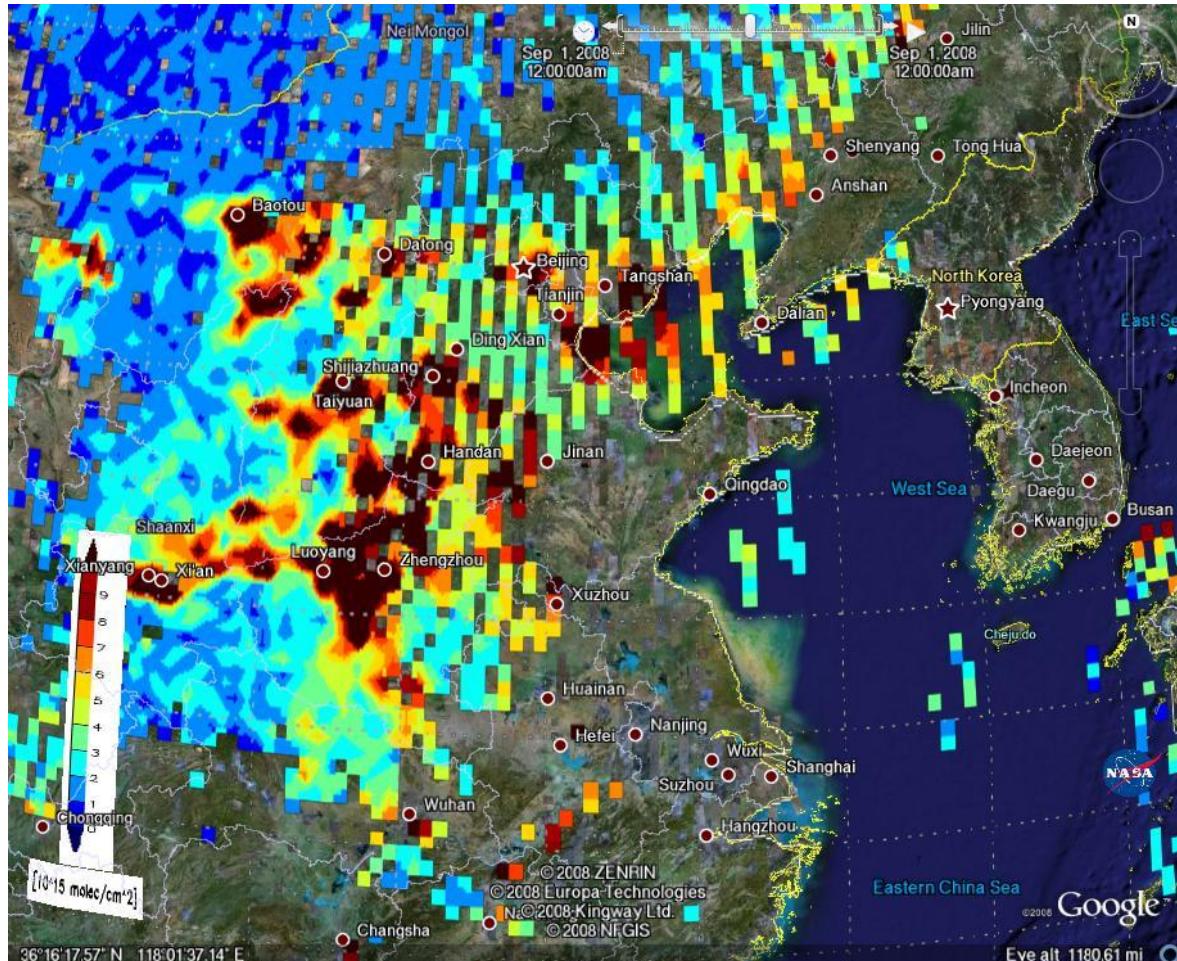


OMI KNMI Tropospheric NO₂ Column

http://www.temis.nl/airpollution/no2col/no2regioomi_col3.php



NASA GSFC Tropospheric NO₂ over Eastern China



0.25x0.25 degree
L2G OMI NO₂

KMZ data format.
Eastern China
(image saved
from Google
Earth).

September 1st,
2008

Source: NASA Giovanni

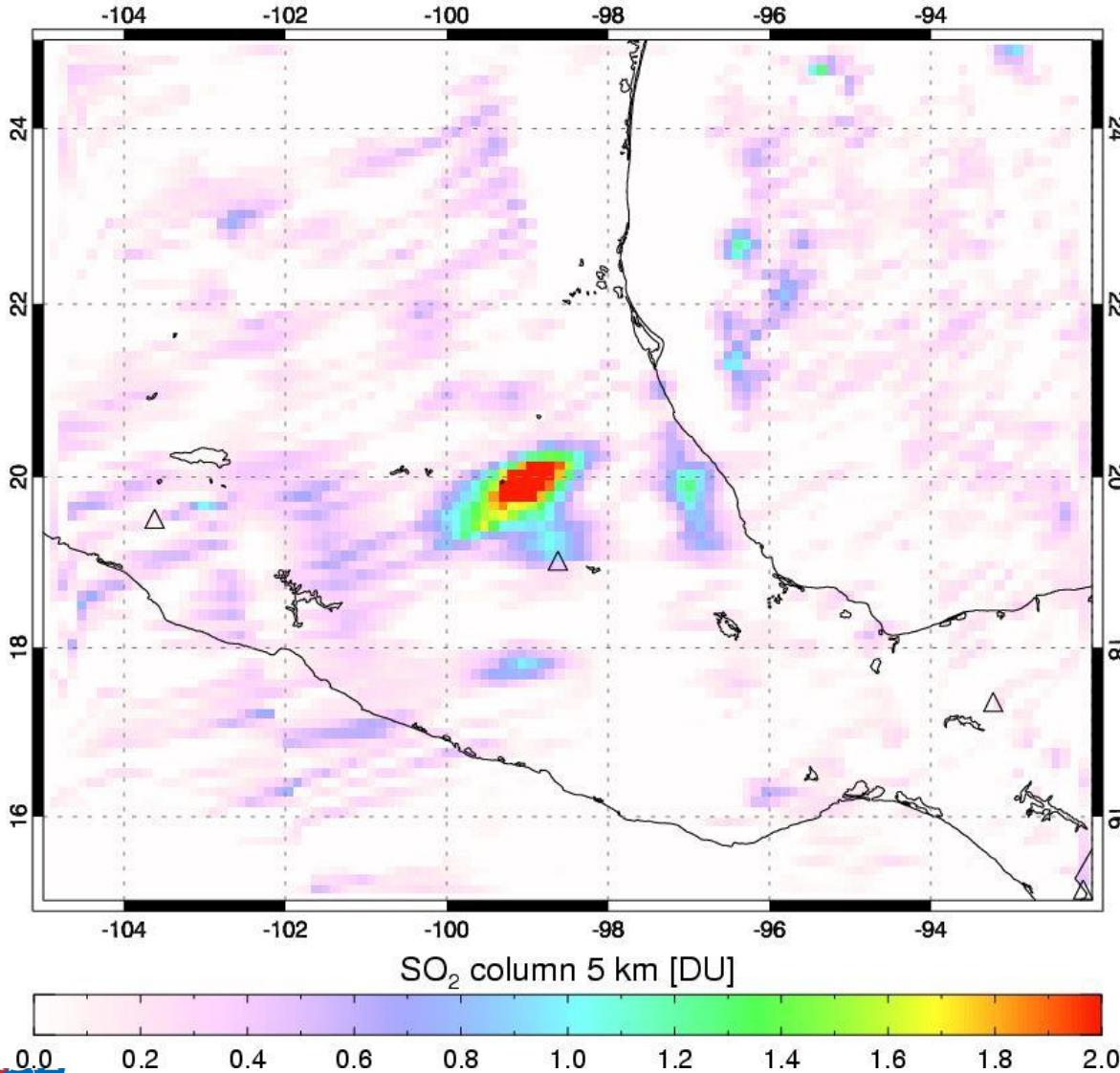


OMI Tropospheric SO₂ Column

Aura/OMI - 07/18/2007 19:31-21:13 UT

Mass: 0.596 kt; Area: 13652 km²; SO₂ max: 3.04 DU at lon: -98.90 lat: 20.00 ; 19:33UTC

Contact: Simon Carn (scarn@umiacs.edu)



- Daily observations at ~1:30 PM LST
- Day to day variability for large sources only (e.g. volcanoes)
- Sensitivity difficult at ground level
- Algorithm development in progress (NASA/GSFC) to improve ground level sensitivity



Model Forecast Data



NAAPS MODEL Data

http://www.nrlmry.navy.mil/aerosol/index_frame.html

Welcome to the NRL/Monterey Aerosol Page. This site is an official U.S. Navy site.

Choose a Region: [World](#) [Sahara](#) [Med](#) [Europe](#) [S Africa](#) [SW Asia](#) [SW Asia \(Secure\)](#) [Ind/Ind Ocean](#) [Indonesia](#) [SE Asia](#) [Austr](#) [E Asia](#)

[NPMOC](#) [N Amer](#) [S Amer](#) [Trop Atl](#) [Carib](#) [CentAm](#)

or Choose a Format: [Home/README](#) ["The Big Table"](#) [Restricted](#) [Links](#) [Case Studies](#) Last updated 3 September, 2004 [Disclaimer](#)
[Site Status](#)

Product:

[Sfc. Obs.](#)
[Current](#)
[Loop](#)
[Archive](#)

[AERONET 1.5](#)

[NAAPS](#)
[5-d Fcst](#)
[Loop](#)
[Current](#)
[Archive](#)
[Time-sections](#)

[NAAPS/SAT](#)
[Current](#)

[5-d Loop](#)
[Archive](#)

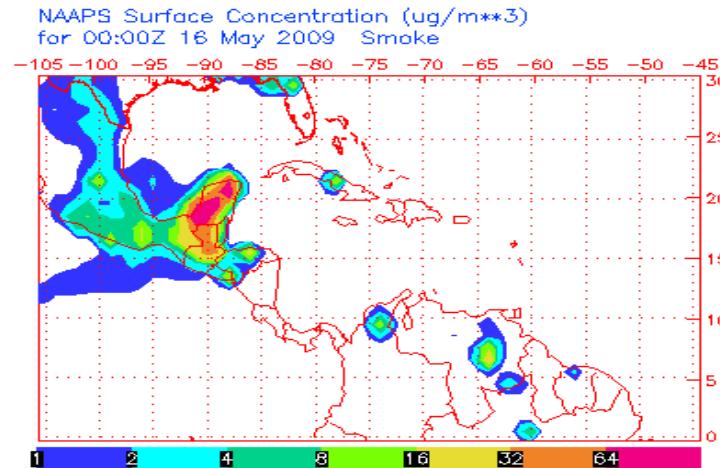
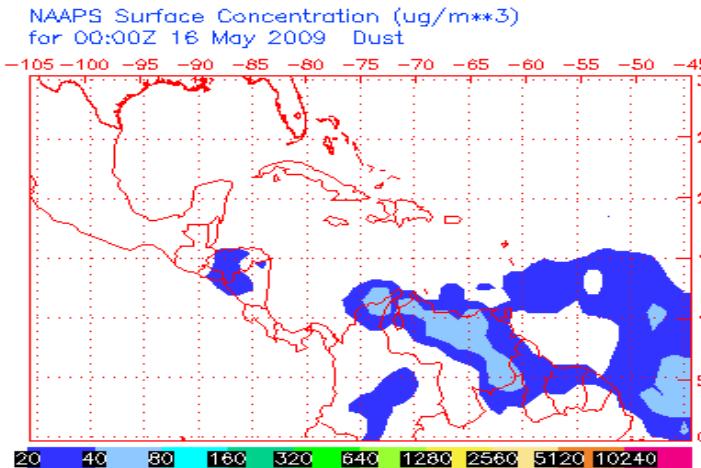
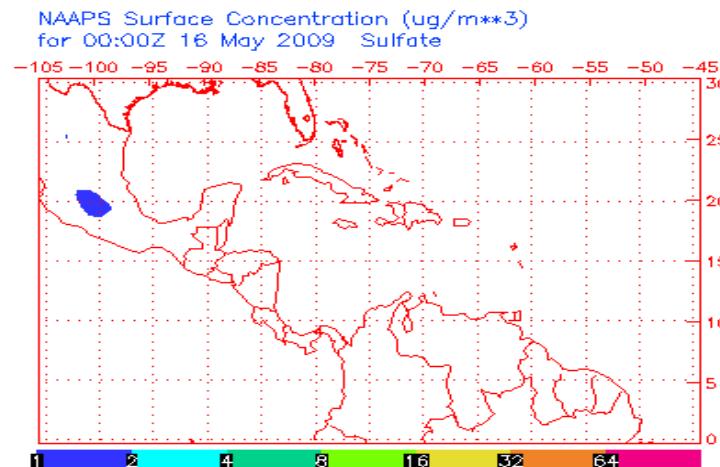
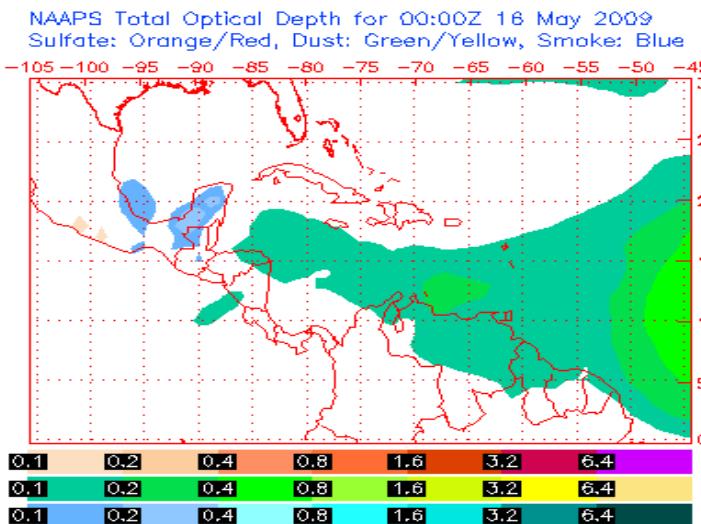
[SeaWiFS](#)
[Current](#)

[5-d Loop](#)
[Archive](#)

[MODIS](#)
[Current](#)
[Loop](#)
[Archive](#)

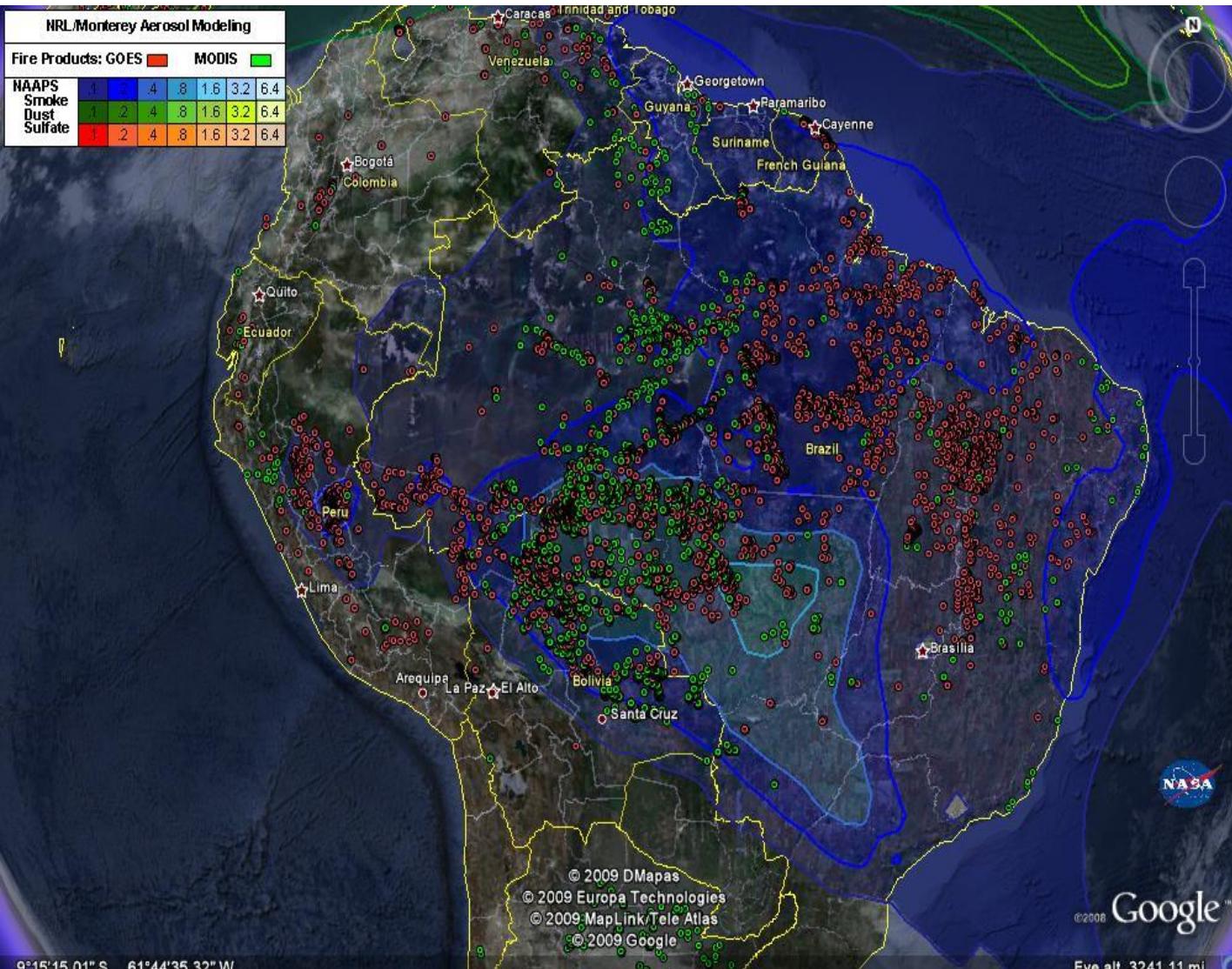
[NPS/NRL AOD](#)

Current: [N](#)
[G](#)
[4-d N Loop](#)
[4-h G Loop](#)
[Aerosol](#)



Flambe: Easy Access to Satellite and Model Data via Google Earth

<http://www.nrlmry.navy.mil/flambe/>

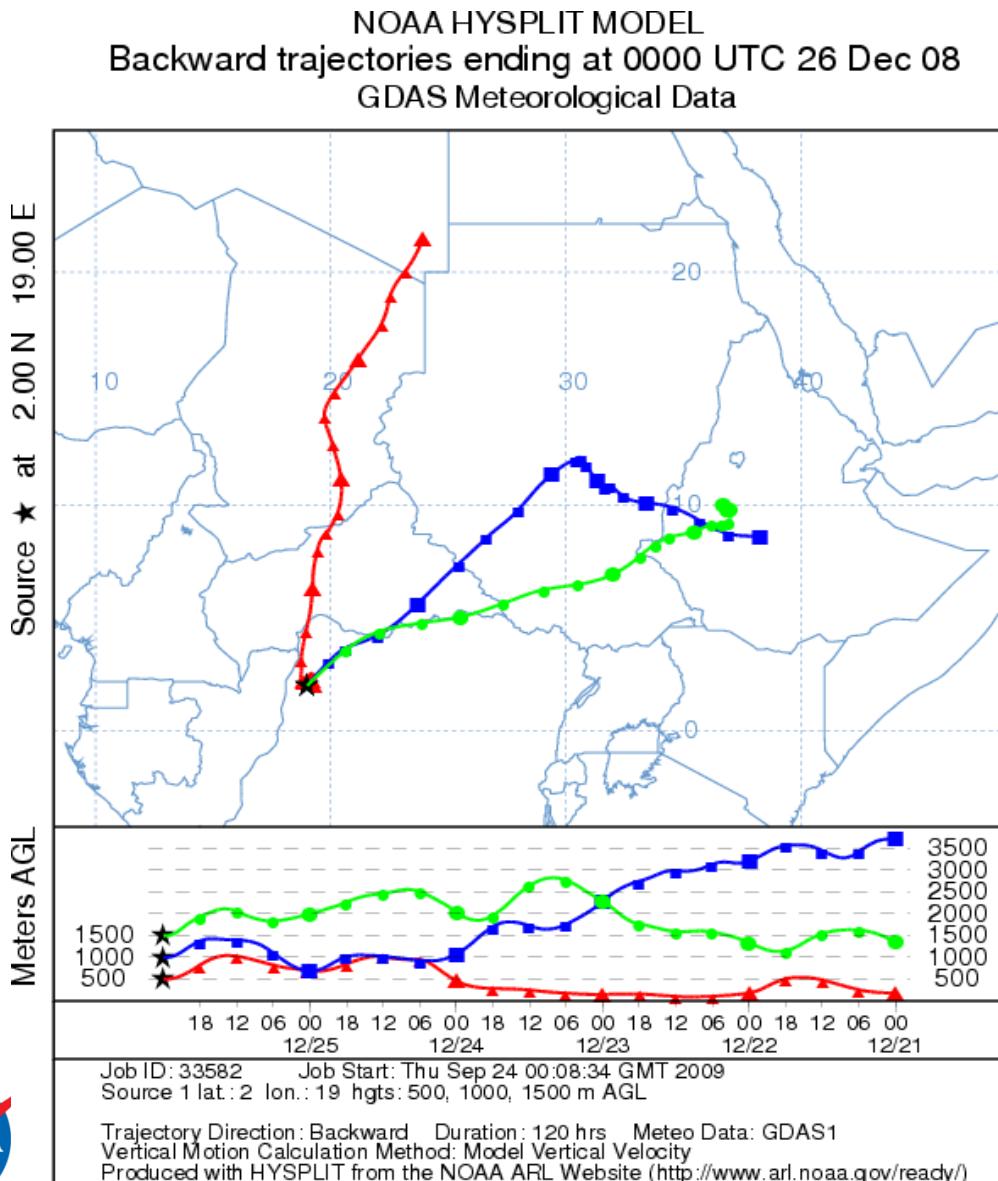


Contours of model predicted aerosol types (smoke, sulfate, dust)

True Color Image (low resolution)

Fire locations from MODIS and GOES

Model Trajectories (NOAA product)



Information on where the air is coming from (backtrajectories) or going (forward trajectories)

Also provides the altitude of the air parcels

Fire Products



NOAA Hazard Mapping System Fire and Smoke Product

Fire Information from MODIS and GOES, Complied by NOAA

<http://www.ssd.noaa.gov/PS/FIRE/hms.html>

HMS Keyhole Markup Language (KML) Files

The HMS
the Sate
polar (A
(MODIS
quality o

Last Update Thu Feb 26 15:17:07 UTC 2009

The m
through

Most Recent

Related
HMS KML
Files:

- S 24 Feb 2009 -- [FIRE SMOKE](#)
- N 23 Feb 2009 -- [FIRE SMOKE](#)

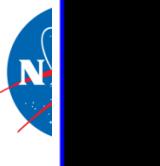
The mo

Analysis
Fires a
Smoke, w

For the m
smoke ex
Nacional)
the other
analyze s
MODIS w

26 Feb 2009 -- [FIRE SMOKE](#)
25 Feb 2009 -- [FIRE SMOKE](#)

22 Feb 2009 -- [FIRE SMOKE](#)
21 Feb 2009 -- [FIRE SMOKE](#)
20 Feb 2009 -- [FIRE SMOKE](#)
19 Feb 2009 -- [FIRE SMOKE](#)
18 Feb 2009 -- [FIRE SMOKE](#)
17 Feb 2009 -- [FIRE SMOKE](#)
16 Feb 2009 -- [FIRE SMOKE](#)
15 Feb 2009 -- [FIRE SMOKE](#)
14 Feb 2009 -- [FIRE SMOKE](#)
13 Feb 2009 -- [FIRE SMOKE](#)
12 Feb 2009 -- [FIRE SMOKE](#)
11 Feb 2009 -- [FIRE SMOKE](#)
10 Feb 2009 -- [FIRE SMOKE](#)
09 Feb 2009 -- [FIRE SMOKE](#)
08 Feb 2009 -- [FIRE SMOKE](#)
07 Feb 2009 -- [FIRE SMOKE](#)
06 Feb 2009 -- [FIRE SMOKE](#)
05 Feb 2009 -- [FIRE SMOKE](#)



▼ Search

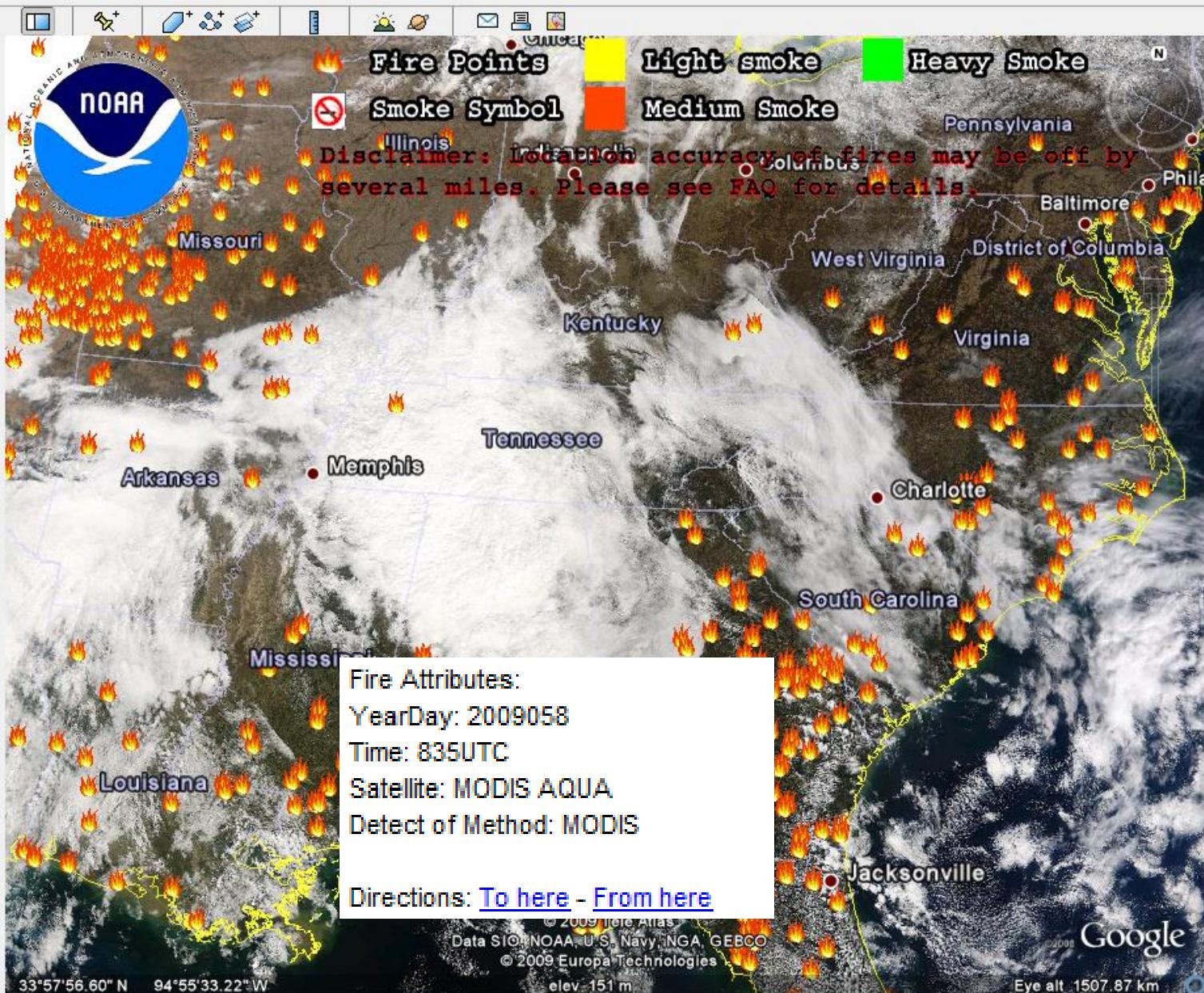
Fly To Find Businesses Directions

Fly to e.g., Reservoir Rd. Clayville, NY

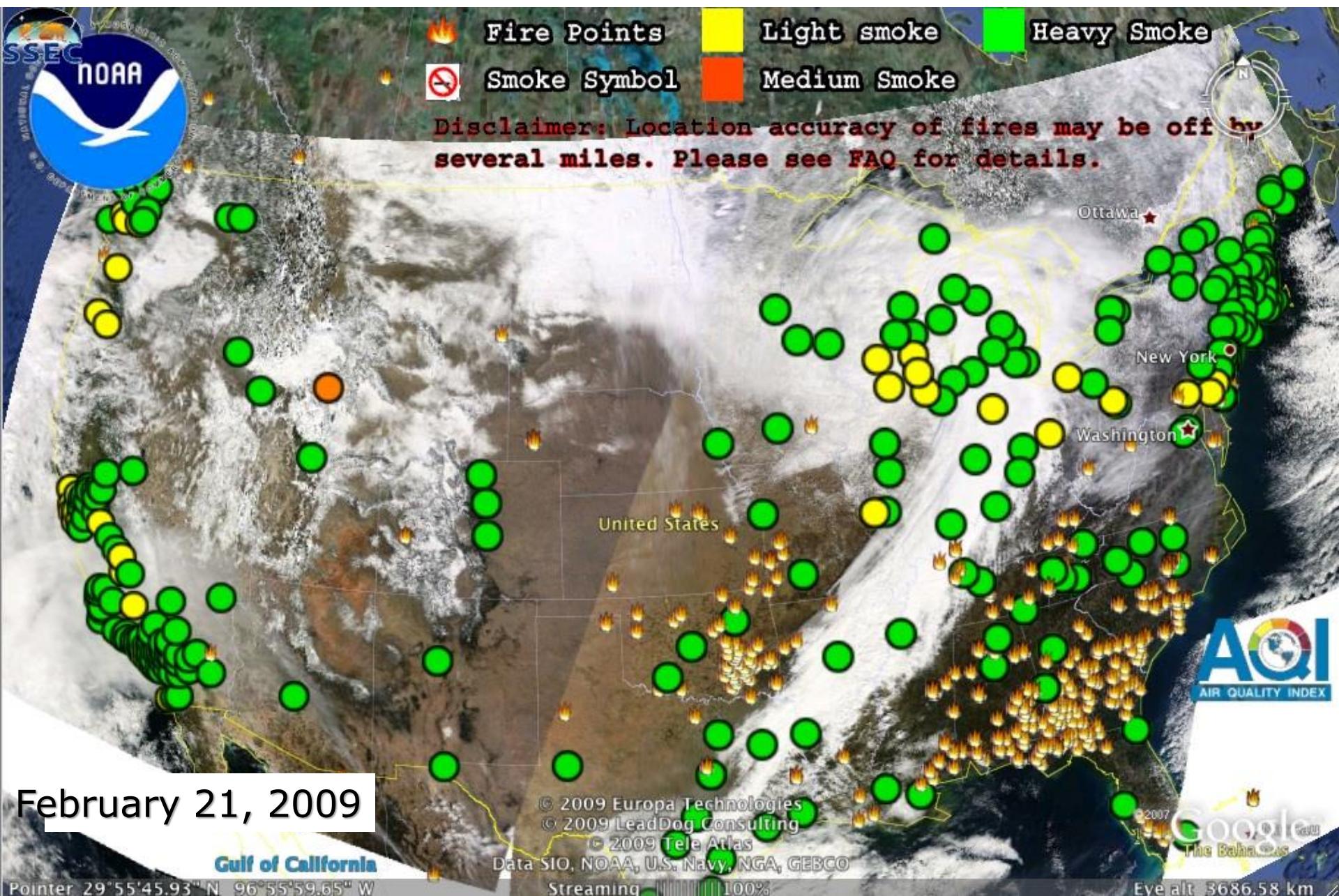
▼ Places Add Content

- Today's Forecast
- Tomorrow's Forecast
- Temporary Places
 - terra_today.kml
 - MODIS REALTIME IMAGERY
 - Terra MODIS real-time imagery from SSEC, UW-Madison
- latestfire.kml
- latestsmoke.kml
- fire20090225.kml
- smoke20090225.kml

- ▼ Layers
- Primary Database
 - Geographic Web
 - Roads
 - 3D Buildings
 - Street View
 - Borders and Labels
 - Traffic
 - Weather
 - Gallery
 - Global Awareness
 - Places of Interest
 - More
 - Terrain



MODIS Aqua True Color, AQIs, HMS Fire Data



National Weather Service Data

Current, Past, Fire, and Forecasted Weather Files from NWS

<http://www.srh.noaa.gov/gis/kml/>

Current Weather	Forecasts	Past Weather
Watches & Warnings Current Weather Warnings Flash Flooding - Basins and Streams	Your Local Weather Forecast Your Local Weather Graphical Forecast	Doppler Radar NWS Radar archive data
Doppler Radar Real Time Radar Radar Locations	MOS Guidance GFS Meteograms	Normals, Means, Extremes NCDC Climate Atlas of the United States NCDC GIS Portal
Surface Observations Metar Obs RAWS Obs APRSWXNET Obs MesoWest Obs Other Surface Obs	GOES Sounding Skew-T Tulsa area: Max Min POP River Gage Forecasts	Severe Weather Storm Reports: Tornado, Wind and Hail 1950-2006 Database of Tornado, Large Hail, and Damaging Wind Reports
Satellite Infrared Loop Visible Loop Water Vapor Loop		Rain/Snowfall CoCoRaHS Observations NOHRSC Snow Data
Remote Gages River Gages: Observed Snow Gages: w/ labels w/o labels	Fire Weather Current Spot Forecast Sites Fire Weather Categorized Observations	Hurricanes Past Atlantic Storm Tracks Past East Pacific Storm Tracks
Great Lakes Wave Height Ice Water Temperature	MODIS fires IMET Locations	Additional Info Coastal Estuarine Bathymetry nowCOAST web mapping portal
Surface Fronts Past and Present Synoptic Features	Not working	

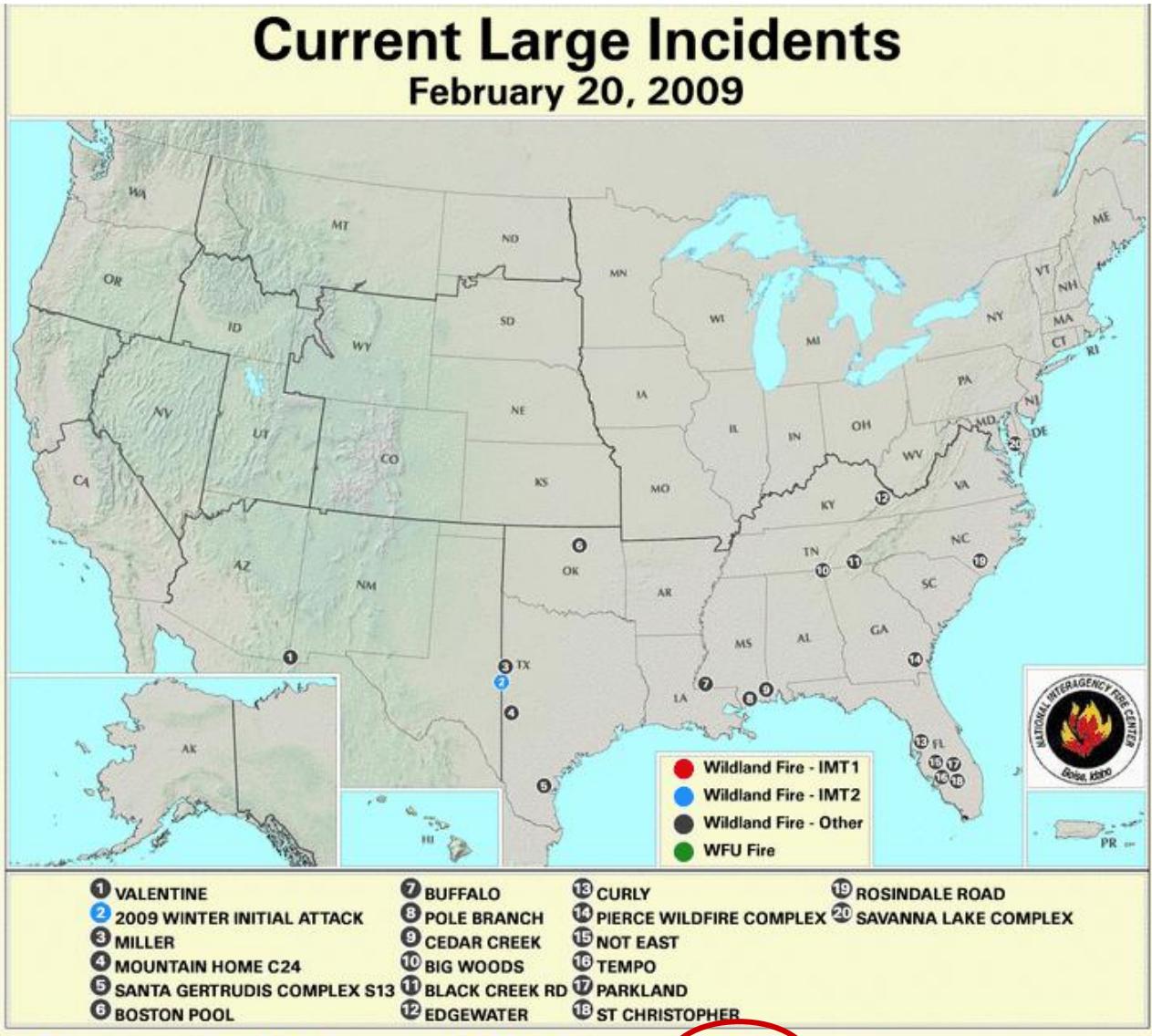


MODIS Active Fire Mapping Program

Fire Information from MODIS Complied by USDA

<http://activefiremaps.fs.fed.us/>

- Contact Us
- Programs and Services
- BAER
- Active Fire Maps
 - Current Large Fires
 - [United States](#)
 - [Canada](#)
 - Regional Maps
 - [United States](#)
 - [Canada](#)
 - ArcIMS Maps
 - [CONUS](#)
 - [Alaska](#)
 - [Hawaii](#)
 - [Canada](#)
 - MODIS Images
 - [United States](#)
 - [Canada](#)
 - Fire GIS Data
 - Google Earth and WMS Maps
 - Current Detections
 - [United States](#)
 - [Canada](#)
 - Other MODIS Products
- Information
 - [FAQs](#)
 - [NASA](#)
 - [MODIS](#)
- Related Links
 - Project Cooperators
 - [RSAC](#)
 - [NASA GSFC RR](#)
 - [NASA GSFC DRL](#)
 - [NIFC](#)
 - [UMD](#)
 - [SSEC](#)
 - [GINA](#)
 - [CONABIO](#)



[View
Printable Map](#)

[View High
Resolution Map](#)

[Definition of
Map Terms](#)

[Download
KMZ File](#)

Select a Fire ▾

▼ Search**Fly To** Find Businesses Directions

Fly to e.g., Hotels near JFK

**▼ Places**

Add Content

 t1.09057 a1.09057 CONUS MODIS Fire Detections

This KML displays the following:

- Legend and Logos
- Current Incident Locations
- MODIS MOD14 1km Fire ...
- MODIS MOD14 1km Fire ...
- MODIS MOD14 1km Fire ...

▼ Layers Primary Database Geographic Web Roads 3D Buildings Street View Borders and Labels Traffic Weather Gallery Global Awareness Places of Interest More

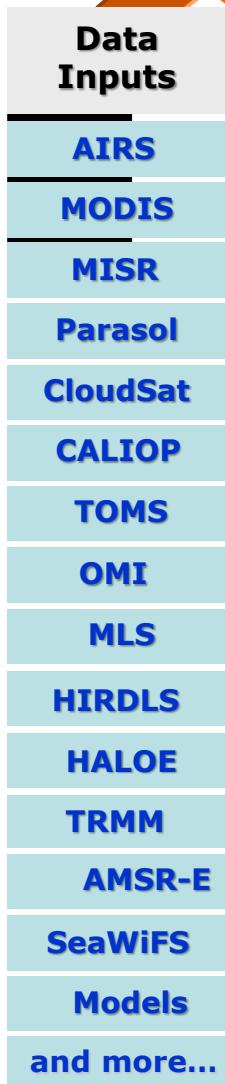
What is Giovanni ?

- Giovanni is a Web-based application developed by the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC).
- Giovanni provides a simple and easy way to explore, visualize, analyze, and access vast amounts of Earth science remote sensing and model data.
- *Giovanni is NOT a near real time tool (data generally available within 1-3 days)*

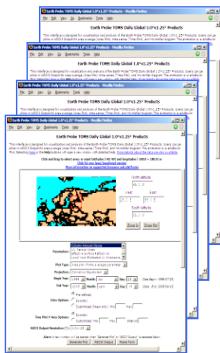
<http://giovanni.gsfc.nasa.gov/>



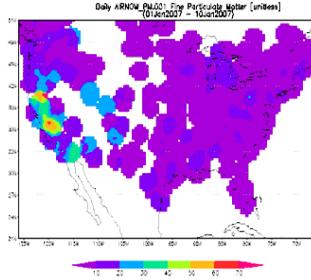
Giovanni Data



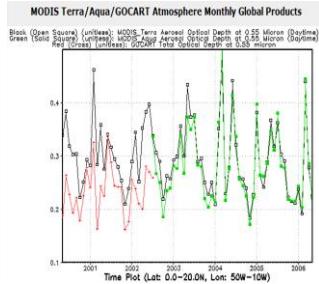
Giovanni Instances



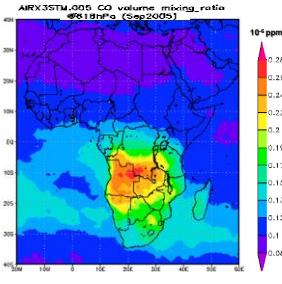
Giovanni Tools



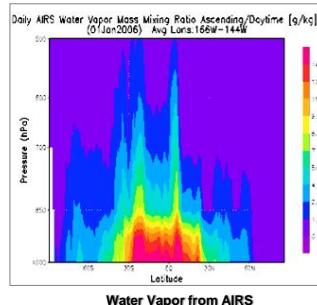
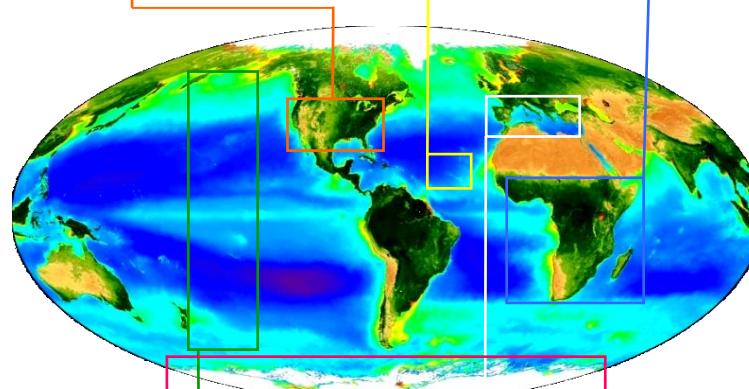
Particulate Matter (PM 2.5) from AIRNow



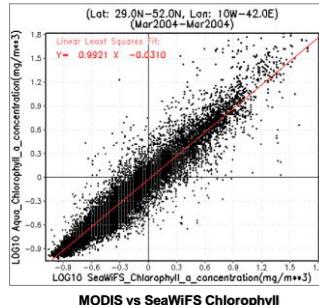
Aerosol from MODIS and GOCART model



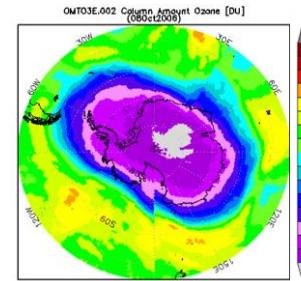
Carbon Monoxide from AIRS



Water Vapor from AIRS



MODIS vs SeaWiFS Chlorophyll



Ozone Hole from OMI



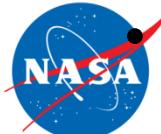
Giovanni Air Quality Datasets

Particulate Air Quality

- **PM_{2.5} station data** - Acquired at DataFed from EPA AIRNow and then via WCS into Giovanni
- **MODIS TERRA and AQUA** total and fine mode **Aerosol Optical Depth (AOD)**
- **MISR AOD**
- **CALIOP Aerosol Feature Mask** *vertical curtain plots*
- **OMI AOD and UV Aerosol Index**
- **GOCART Model data** – AOD speciation (2x2.5 degree)

Trace Gases

- **OMI NO₂** Tropospheric column (0.25x0.25 degree)
- **AIRS CO and methane** (profile data)



Giovanni: Tools for Air Quality Applications

- Temporal and geographical selection of data products
 - Lat/lon maps with overlay option, time series, and Hovmoller plots for ***customized visualization of air quality events***
- Combined surface monitor and satellite data -
 - AOD/ PM_{2.5} scatter plots, correlation maps, time series and difference plots for ***analysis and source attribution of pollution events***
- Temporal Animation plots of air quality data products for examining ***long range transport of pollutants***



Giovanni Air Quality

<http://giovanni.gsfc.nasa.gov/>

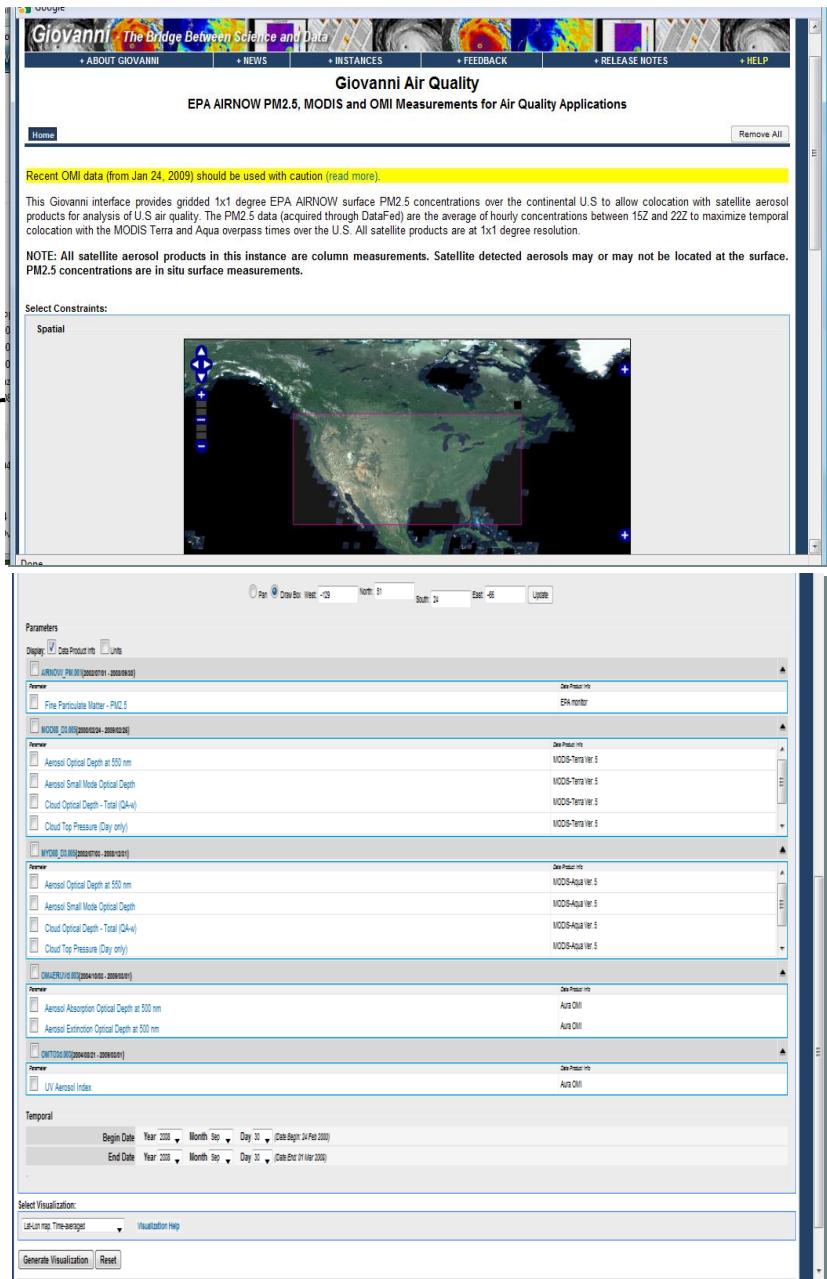
➤ ***Web-based application***

Developed by the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC)

➤ ***Easy to use***

No need to learn data formats, programming or download large amounts of data

➤ ***Customized data analyses and visualizations*** with only a few mouse clicks...



Giovanni Instance Page - Gridded data

Description →

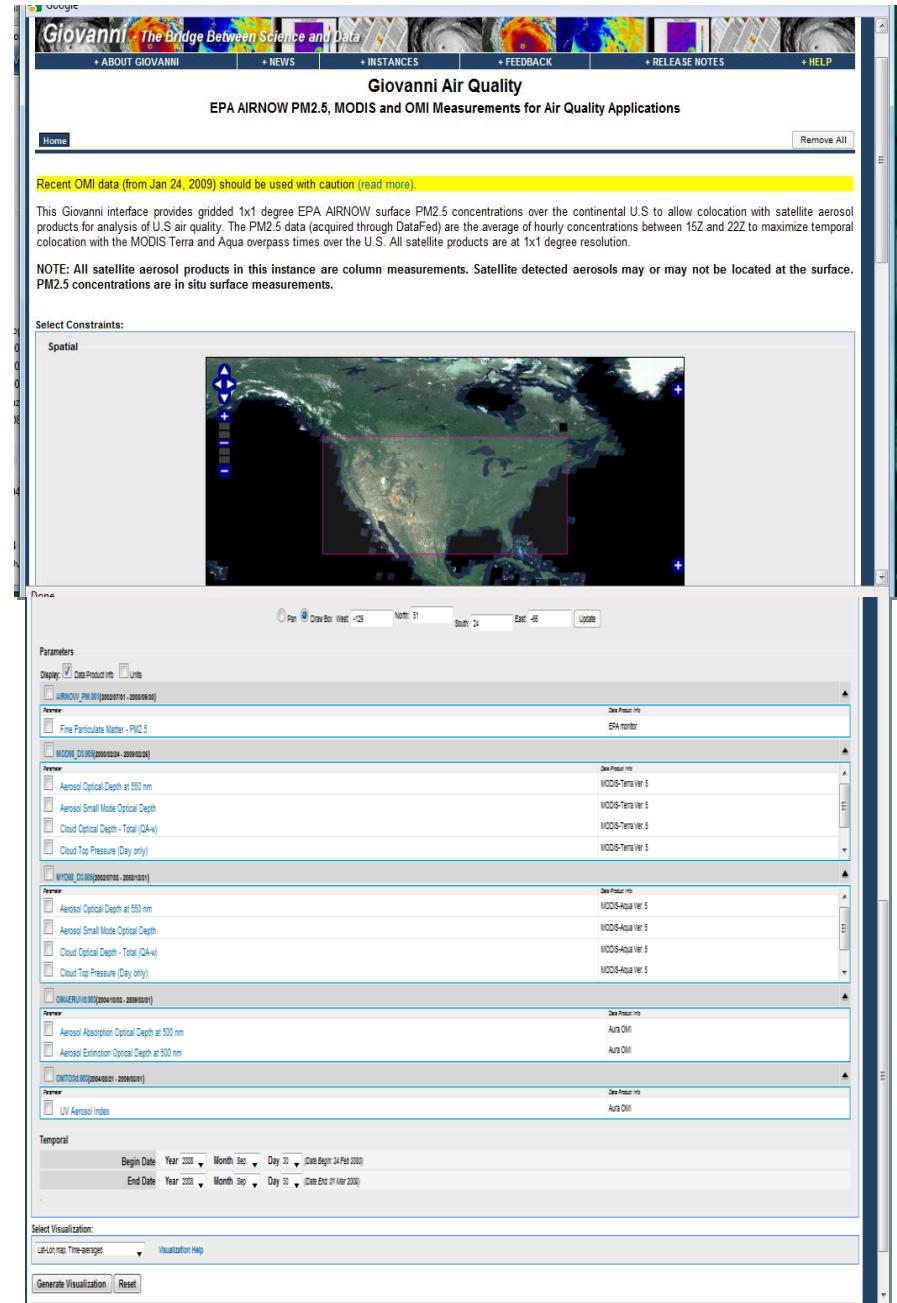
Spatial Selection →

Some instances have vertical or wavelength selection

Parameter Selection →

Temporal Selection →

Visualization Selection →



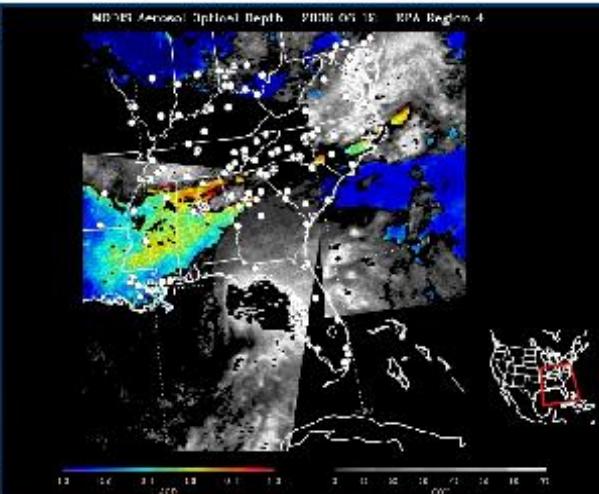
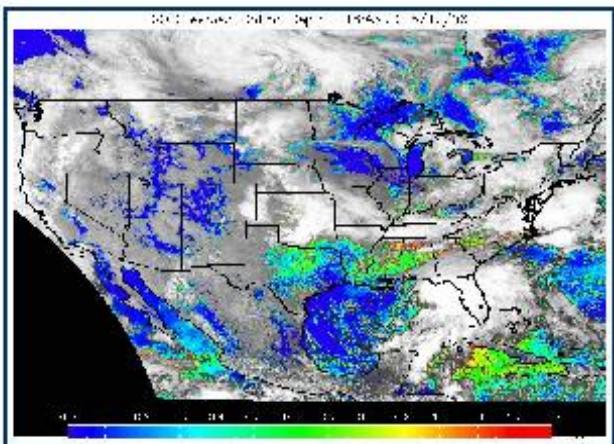
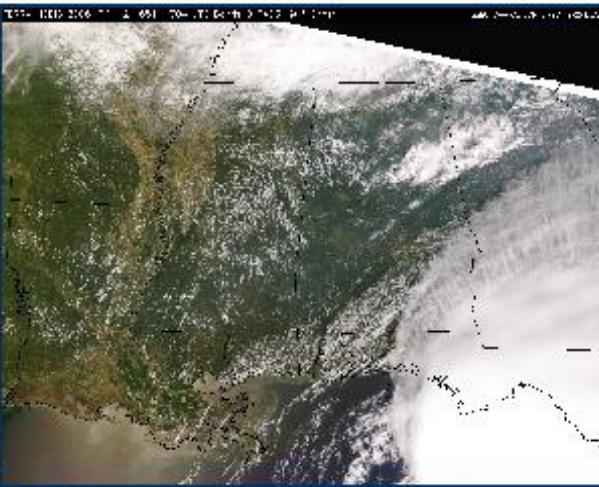
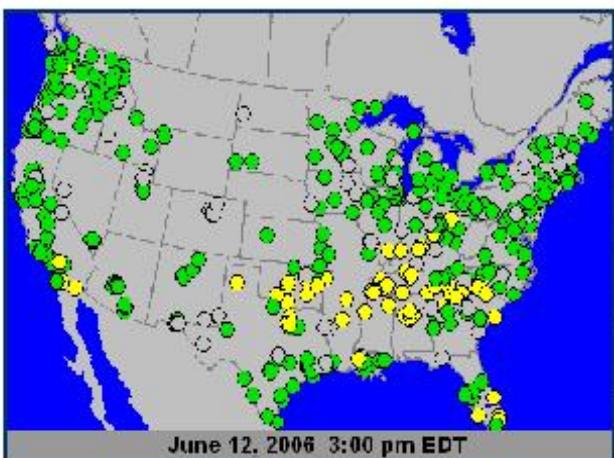
Useful Resources for use and interpretation of Satellite Datasets



June 12, 2006

Moderate AQI in the South

Particulate Matter measurements remain moderate (AQI is code yellow) in the South. [Tropical Storm Alberto \(source: NOAA OSEI\)](#) is also visible in today's satellite images, which is likely contributing to the aerosol load over the south (also mentioned by Jill in [yesterday's post](#)). Both GASP and IDEAS show the intensity of aerosols; AOD reached unity in some places.



About U.S. Air Quality

USAQ is a daily diary of air quality in the U.S., using information from NASA satellites, ground-based lidar, EPA monitoring networks, and other monitors. Interpretation and analysis is provided by the staff of the University of Maryland, Baltimore County Atmospheric Lidar Group.

Search

Search on site:

Recent Entries

- [Moderate AQI in the South](#)
- [Southern haze and Alberto, the first named Atlantic storm](#)
- [Hazy in Louisiana](#)
- [CALIPSO comes alive!](#)
- [Still hazy in the east](#)
- [Moderate AQI Continues...](#)
- [Moderate AQI in the East](#)

Index & Links

Main Data Sources

- [UW MODIS Direct](#)
- [NASA MODIS Rapidfire Browse / Subsets](#)
- [EPA AirNow / ParticlesNow](#)
- [NASA/EPA/NOAA/UW IDEAS](#)
- [NOAA NESDIS GASP](#)
- [NASA OM3 Ozone and Aerosol](#)
- [NOAA Hazard Mapping System Fire and Smoke Product](#)
- [Baltimore-DC Air-Watch.net](#)

Image Interpretation Help Files

- [MODIS Red Green Blue Image \[MODIS Direct\]](#)
- [MODIS Red Green Blue Image \[Rapidfire\]](#)
- [MODIS Aerosol Optical Depth \[IDEAS\]](#)
- [GOES Aerosol/Smoke Product \[GASP\]](#)
- [Air Quality Index Fine Particles \[AQI PM2.5\]](#)
- [Hazard Mapping System Fire and Smoke Product \[HMS\]](#)
- [UMBC Polar LIDAR Product](#)

Other Links

NASA Satellite Trainings and Resources

- <http://arset.gsfc.nasa.gov/>
 - Find out about upcoming workshops on use of NASA Earth Science data sets and tools
 - Access to training materials from previous workshops
 - Links to other satellite resources
- Further info: Ana.l.Prados@nasa.gov

