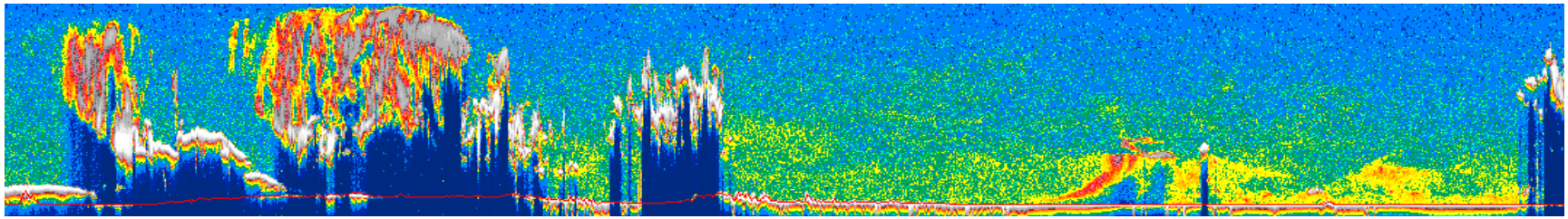
Use of Satellite Remote Sensing Data for Air Quality: The NASA Three-Dimensional Air Quality System (3D-AQS)



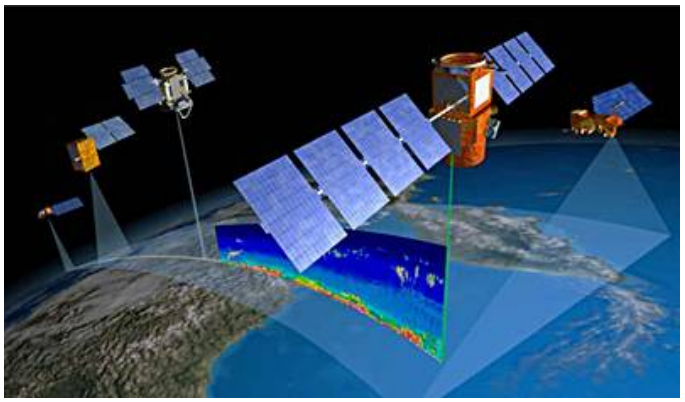
National Air Quality Conference
Portland, Oregon
9 April 2008

Jill Engel-Cox
Battelle Memorial Institute
engelcoxj@battelle.org, 703-875-2144
http://alg.umbc.edu/3D-AQS/

Ray Hoff, University of Maryland, Baltimore County

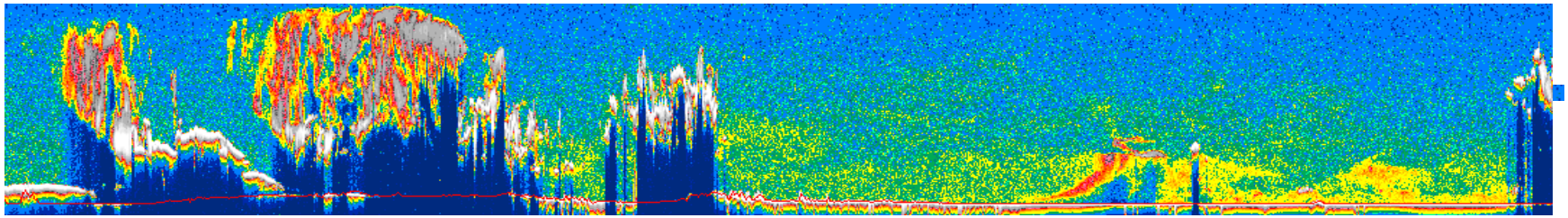
Overview of NASA 3D-AQS Project

- *Integrate* NASA satellite sensor and lidar data into EPA's air quality data systems:
  AQS/AirQuest, IDEA
- Provide greater *accessibility* and *usability* of satellite and lidar data to users of these systems
- Enable monitoring in *horizontal* and *vertical* dimensions for forecasting and retrospective analysis



Funded by NASA Applied Sciences

NASA 3D Air Quality System Project



Progress (mid-2006 - 2007)

- Formation and interaction with end user committee
- Completed benchmark report
- Determined priority datasets and sent to AirQuest
- Prepared documentation (articles)
- Transferring IDEA to operational NOAA environment and other improvements
- Started development of 3D visualization methods

Near-term Actions (2008)

- Analysis and inclusion of more datasets (based on end user input) into AirQuest
- Validate new IDEA site and continue to expand IDEA, AirQuest, Smog Blog
- Implementation of 3D visualization and data output
- Transfer weblog and possibly other tools to Central America (SERVIR-Air)

Long-term Actions (2009)

- Complete 3D data integration and visualization
- Complete data integration and transition to operations

http://alg.umbc.edu/3D-AQS/

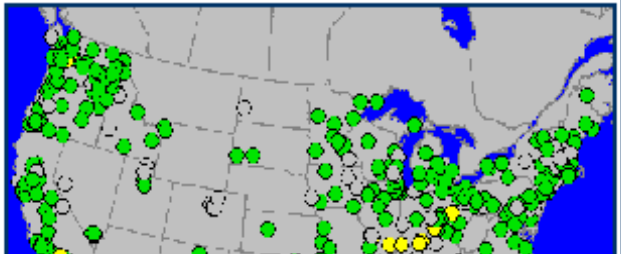
U.S. Air Quality (The Smog Blog), http://alg.umbc.edu/usaq

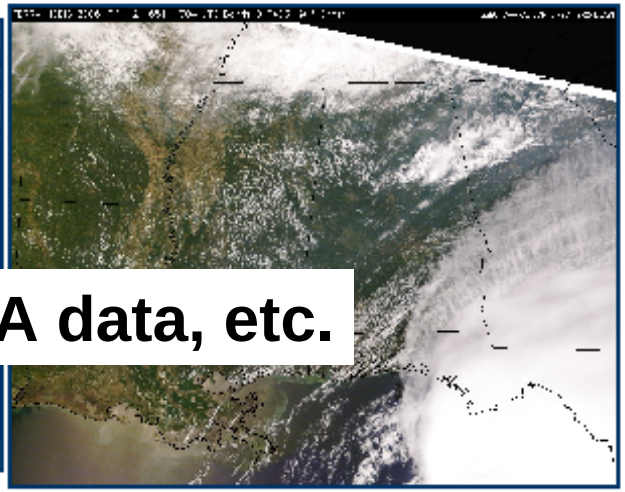
U.S. Air Quality
The Smog Blog

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 IDEA show the intensity of aerosols; AOD reached unity in some places.





Satellite images, EPA data, etc.

Daily posts for 4.5 years
~ 35,000-70,000 visitors per month, including universities, EPA, NASA, NOAA, & States, and general public

Comments now enabled!

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 this site:

Search

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

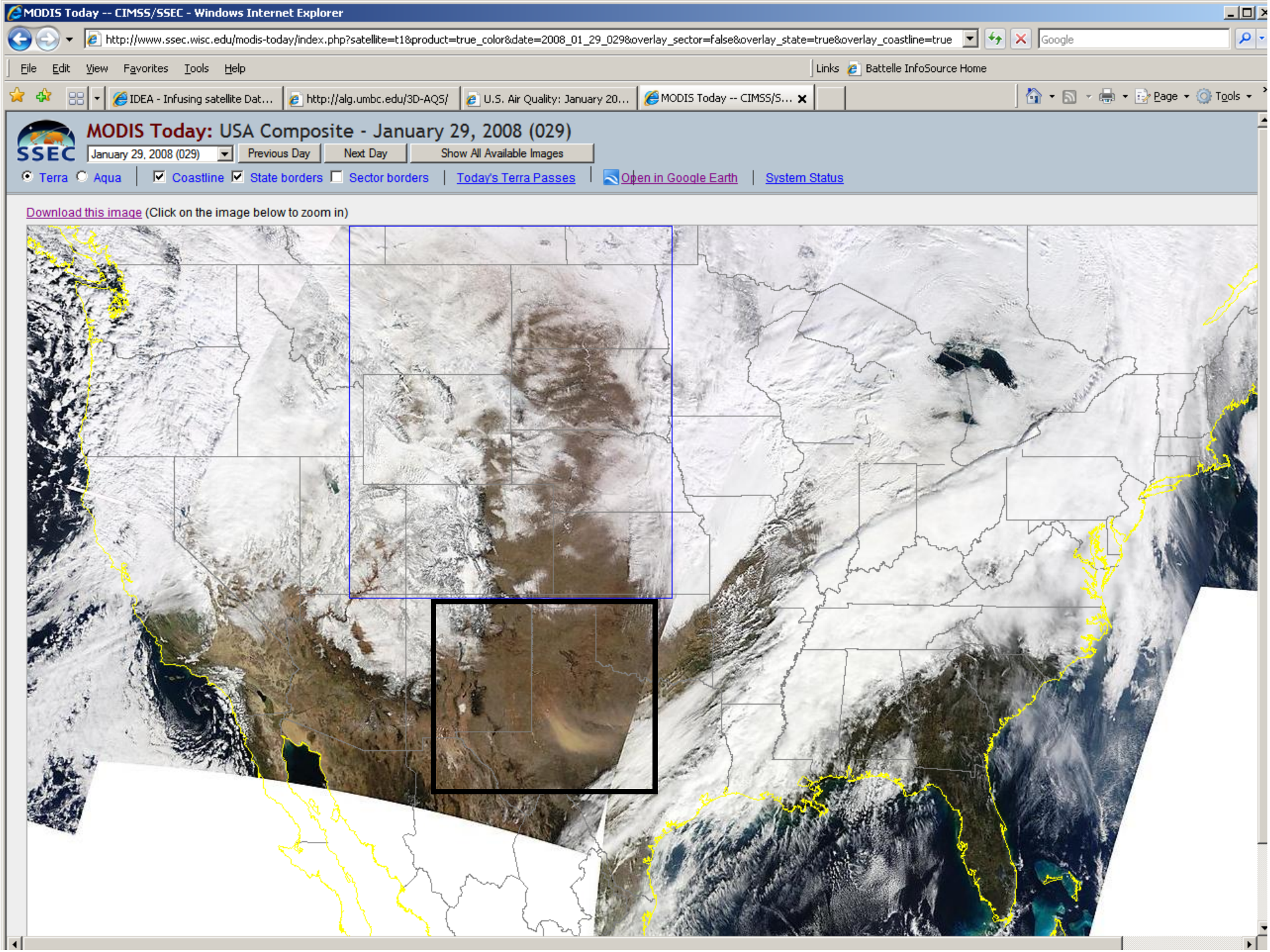
Main Data Sources

- UW MODIS Direct
- NASA MODIS Rapidfire Browse / Subsets
- EPA AirNow / ParticlesNow
- NASA/EPA/NOAA/UW IDEA
- NOAA NESDIS GASP
- NASA OMI 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 (IDEA)
- GOES Aerosol/Smoke Product (GASP)
- ine Particles (AQI PM2.5)
- stem Fire and Smoke Product (HMS)
- OAR Product

Other Links


MODIS Today -- CIMSS/SSEC - Windows Internet Explorer
http://www.ssec.wisc.edu/modis-today/index.php?satellite=t1&product=true_color&date=2008_01_29_029&overlay_sector=false&overlay_state=true&overlay_coastline=true
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http://alg.umbc.edu/3D-AQS/
U.S. Air Quality: January 20...
MODIS Today -- CIMSS/S...
Page Tools
SSEC
MODIS Today: USA Composite - January 29, 2008 (029)
January 29, 2008 (029)
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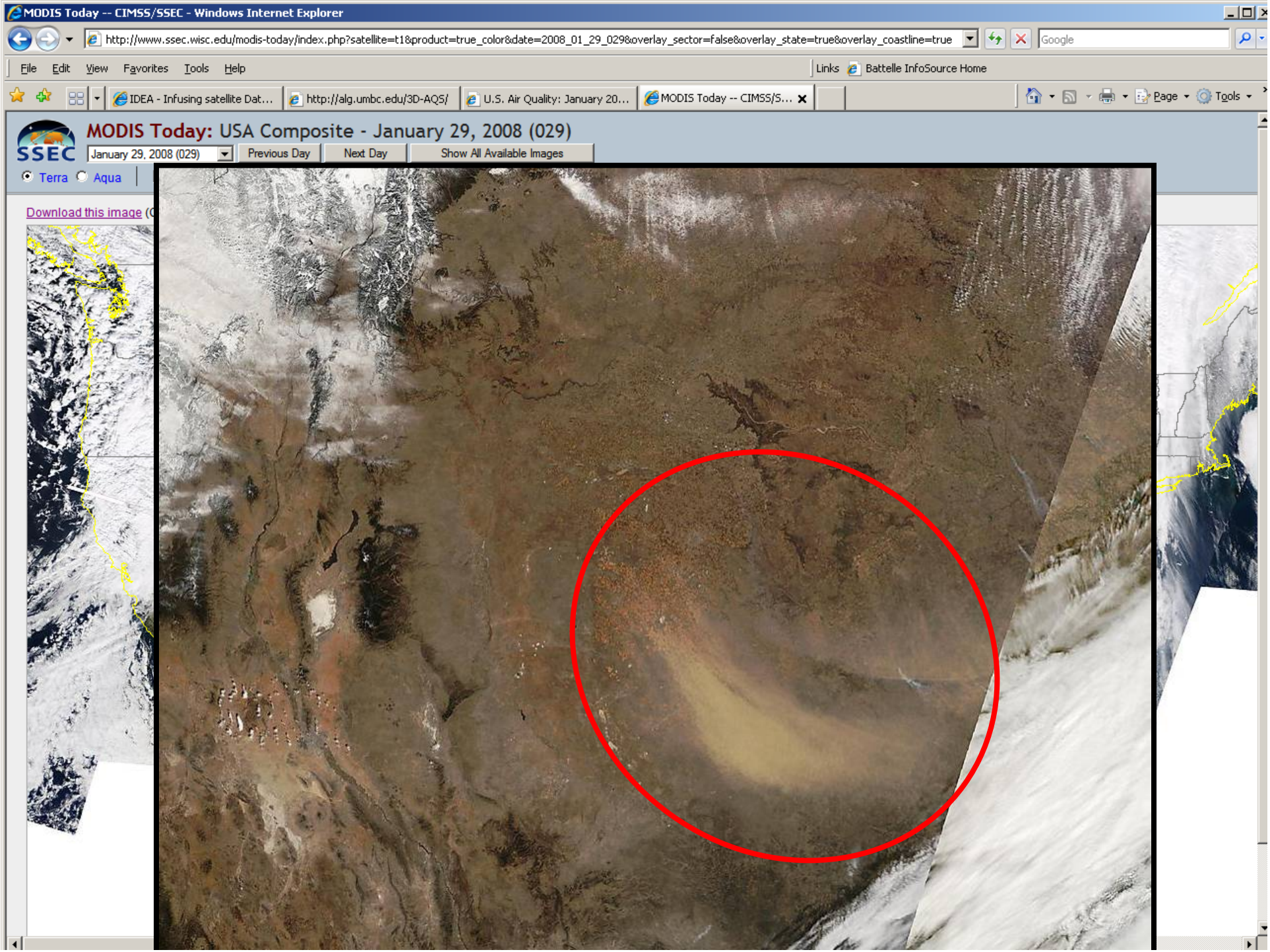
MODIS Today -- CIMSS/SSEC - Windows Internet Explorer
http://www.ssec.wisc.edu/modis-today/index.php?satellite=t1&product=true_color&date=2008_01_29_029&overlay_sector=false&overlay_state=true&overlay_coastline=true
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http://alg.umbc.edu/3D-AQS/
U.S. Air Quality: January 20...
MODIS Today -- CIMSS/S...
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SSEC
MODIS Today: USA Composite - January 29, 2008 (029)
January 29, 2008 (029)
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Next Day
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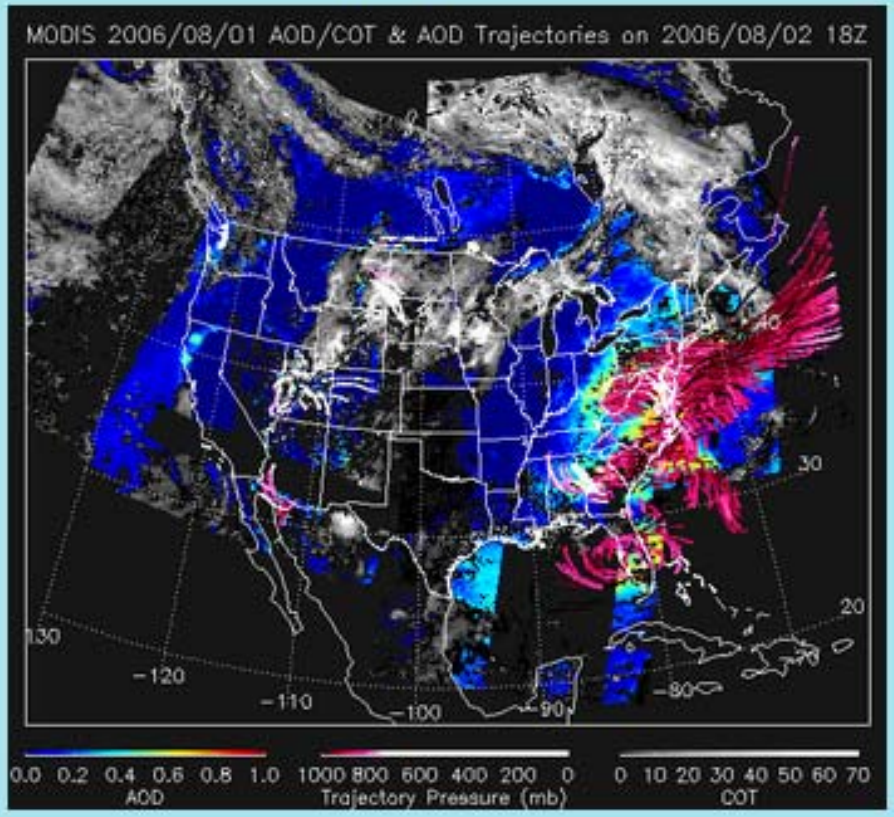
IDEA

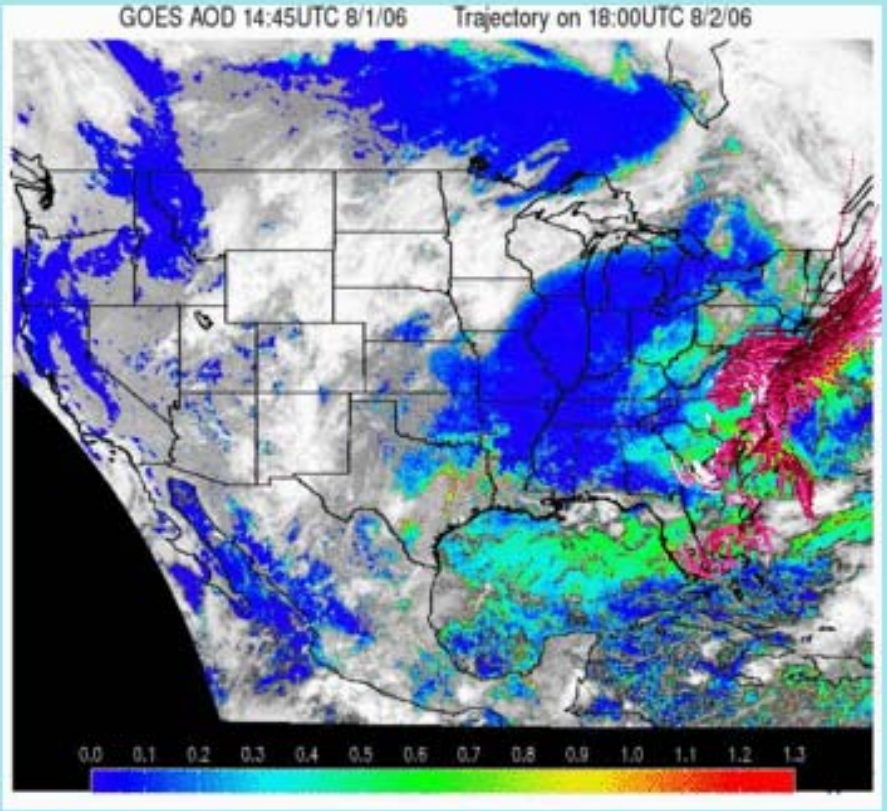
Infusing satellite Data into Environmental Applications

We value your feedback! Please send any comments, problems and suggestions to the IDEA Team.

MODIS aerosol optical depth, with aerosol trajectory forecast



GOES aerosol optical depth, with aerosol trajectory forecast



IDEA

Infusing satellite Data into Environmental Applications

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View RGB

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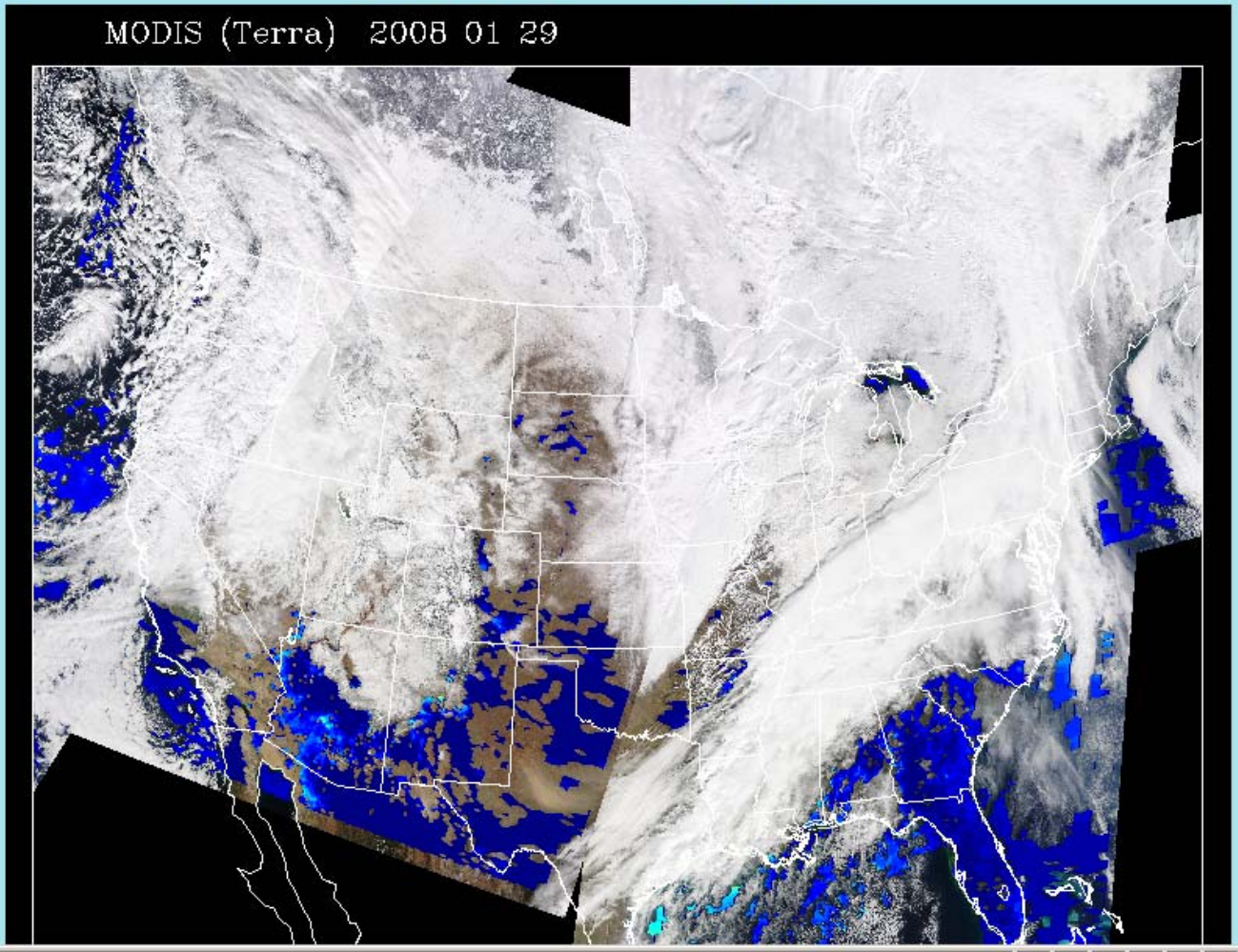
View AOD

Download U.S. AOD Image



IDEA

Infusing satellite Data into Environmental Applications

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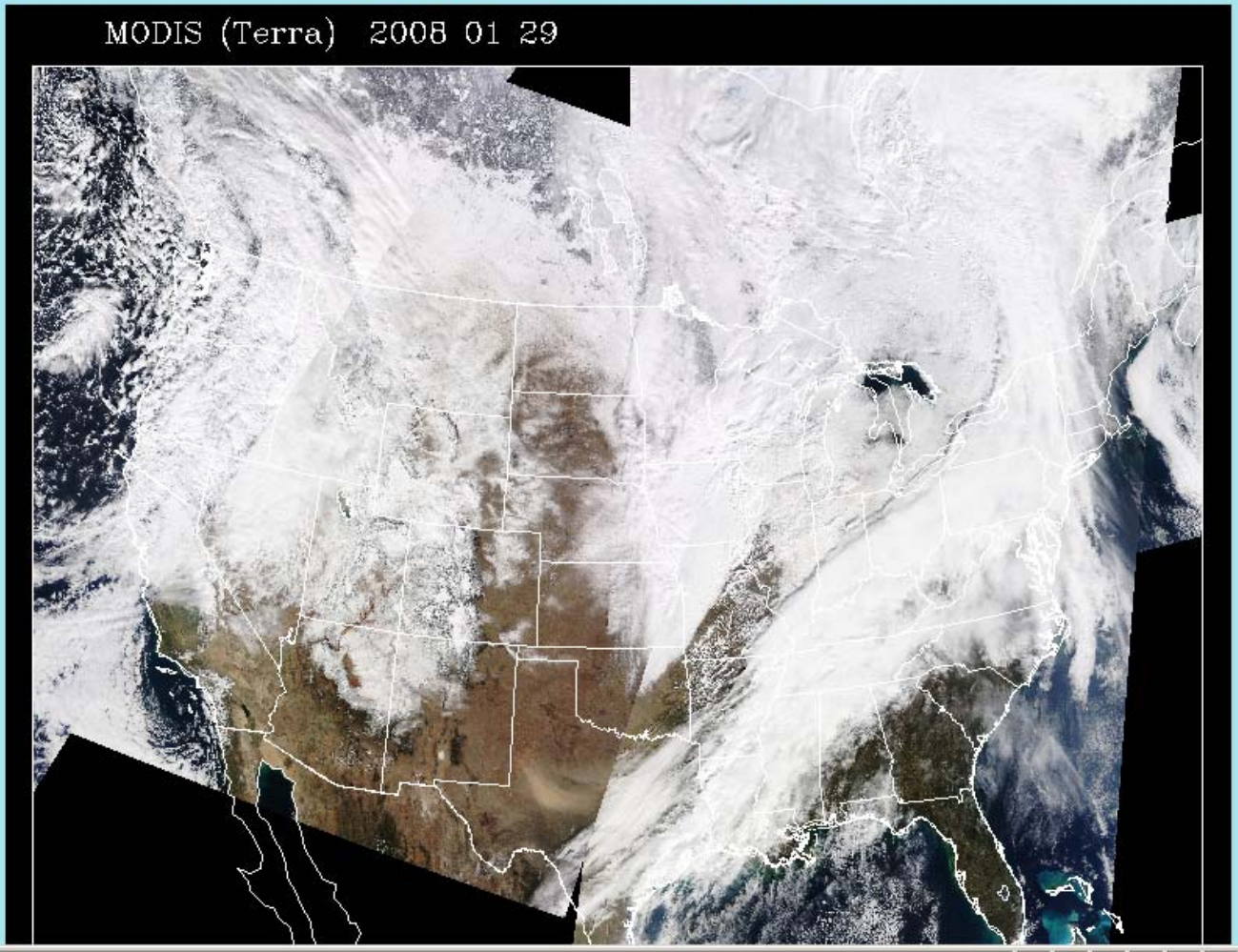
View AOD

Download U.S. AOD Image



http://www.star.nesdis.noaa.gov/smcd/spb/aq/index.php

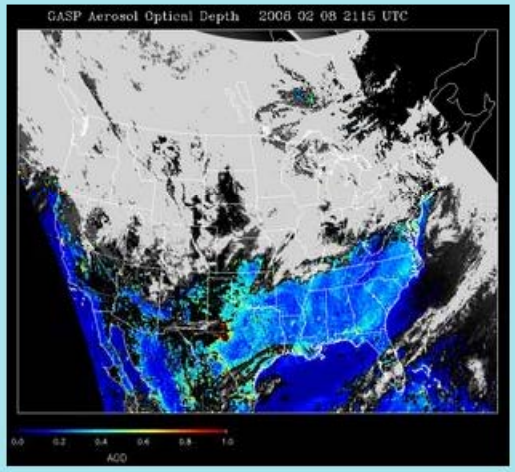
IDEA - Infusing satellite Data into Environmental Appli...

IDEA Infusing satellite Data into Environmental Applications

We value your feedback! Please send any comments, problems and suggestions to the IDEA Team.

MODIS | GASP

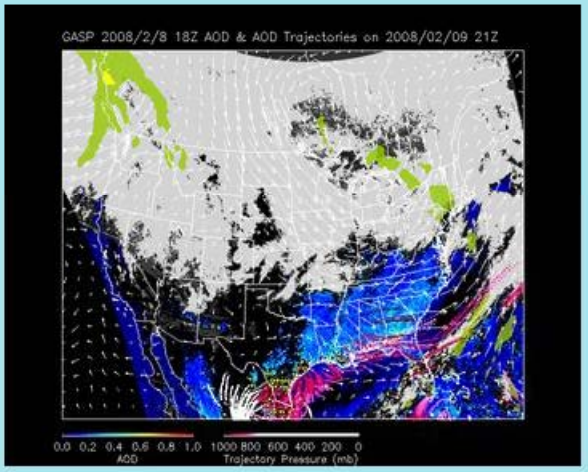
Regional plots of GASP aerosol optical depth (AOD)



Select Region

Product description

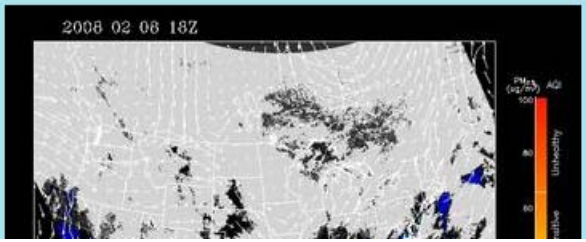
48-hour aerosol trajectory forecast, with model winds and precipitation



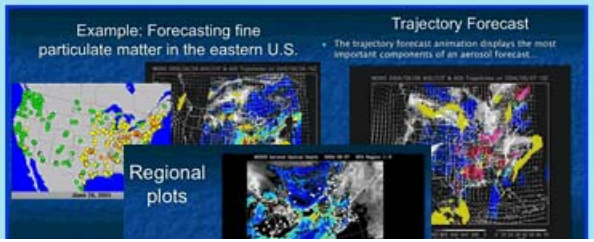
View latest

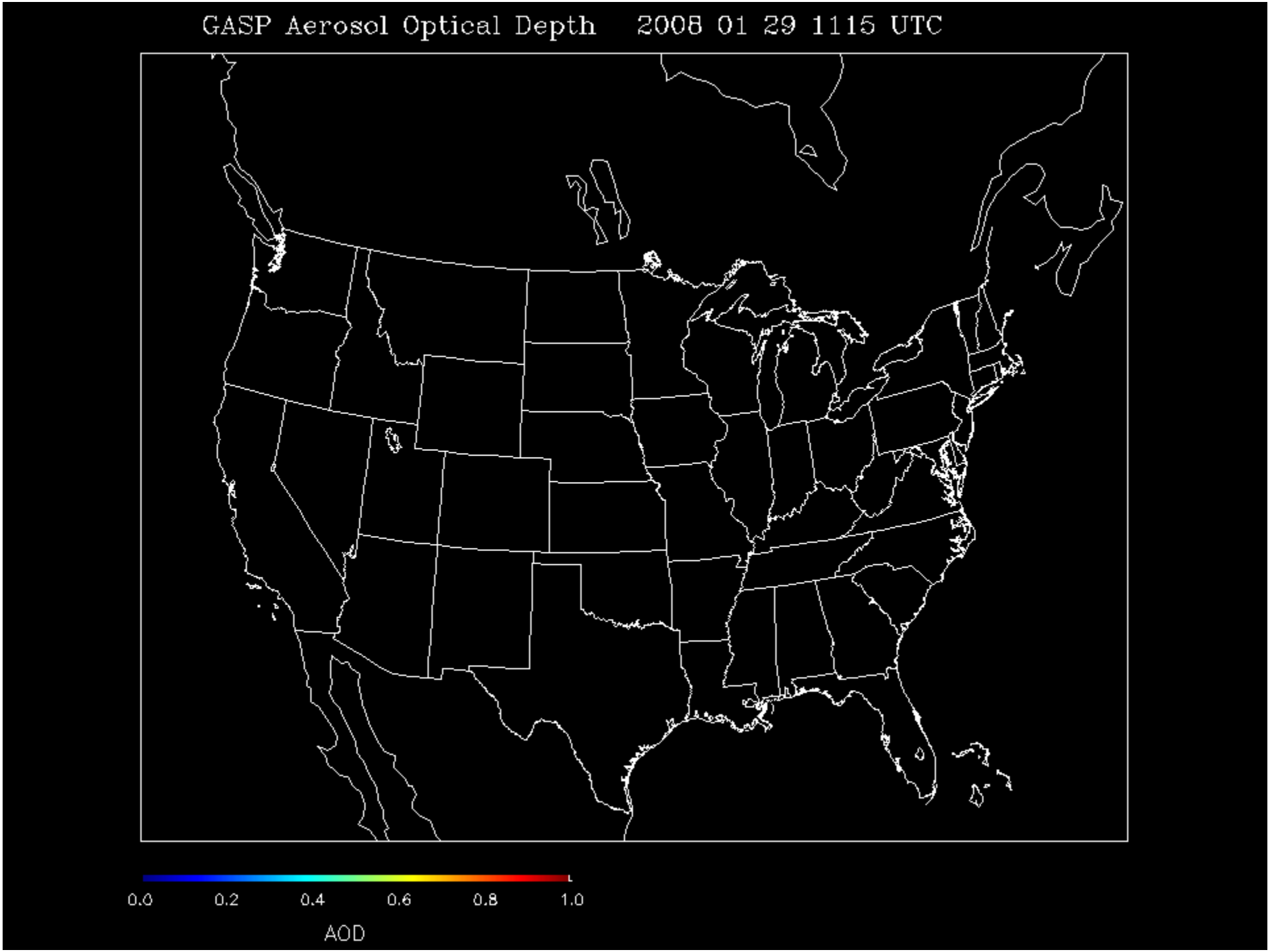
Product description

3-day composite history*



Tutorials for interpreting the IDEA products




GASP Aerosol Optical Depth 2008 01 29 1115 UTC
0.0
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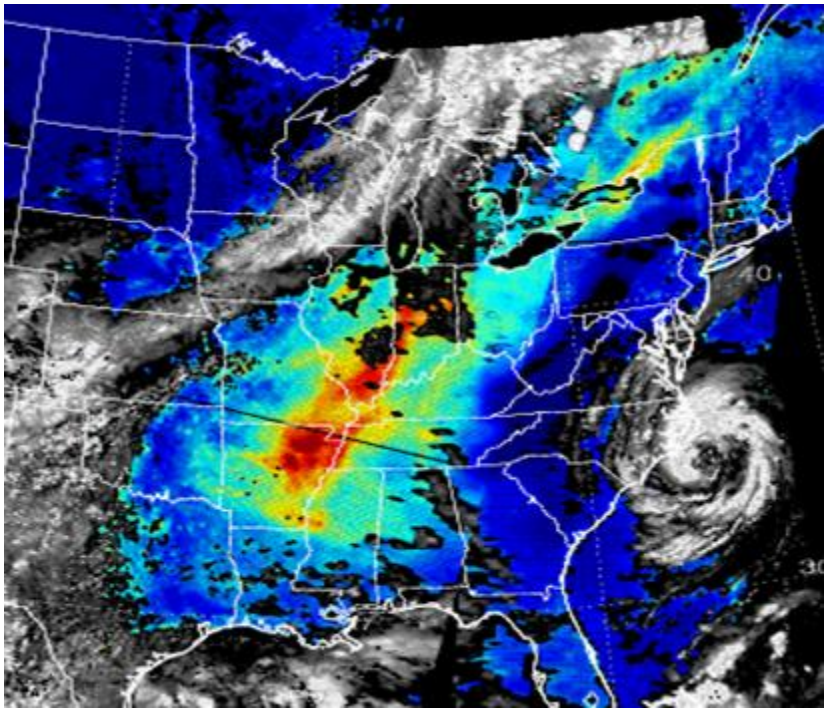
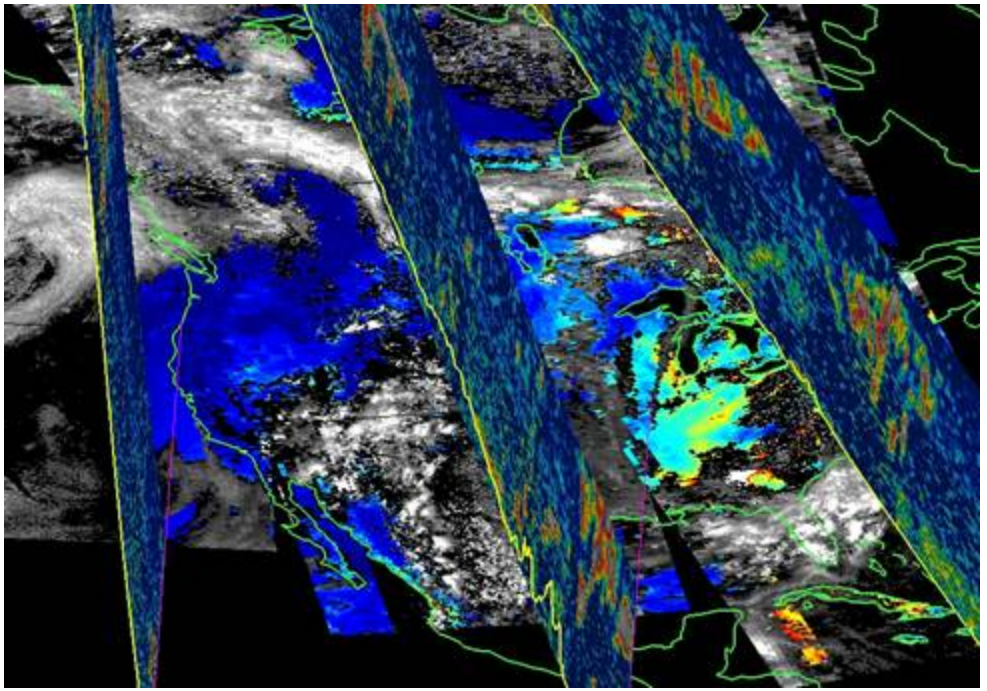
1.0
AOD

Direction of changes to the website

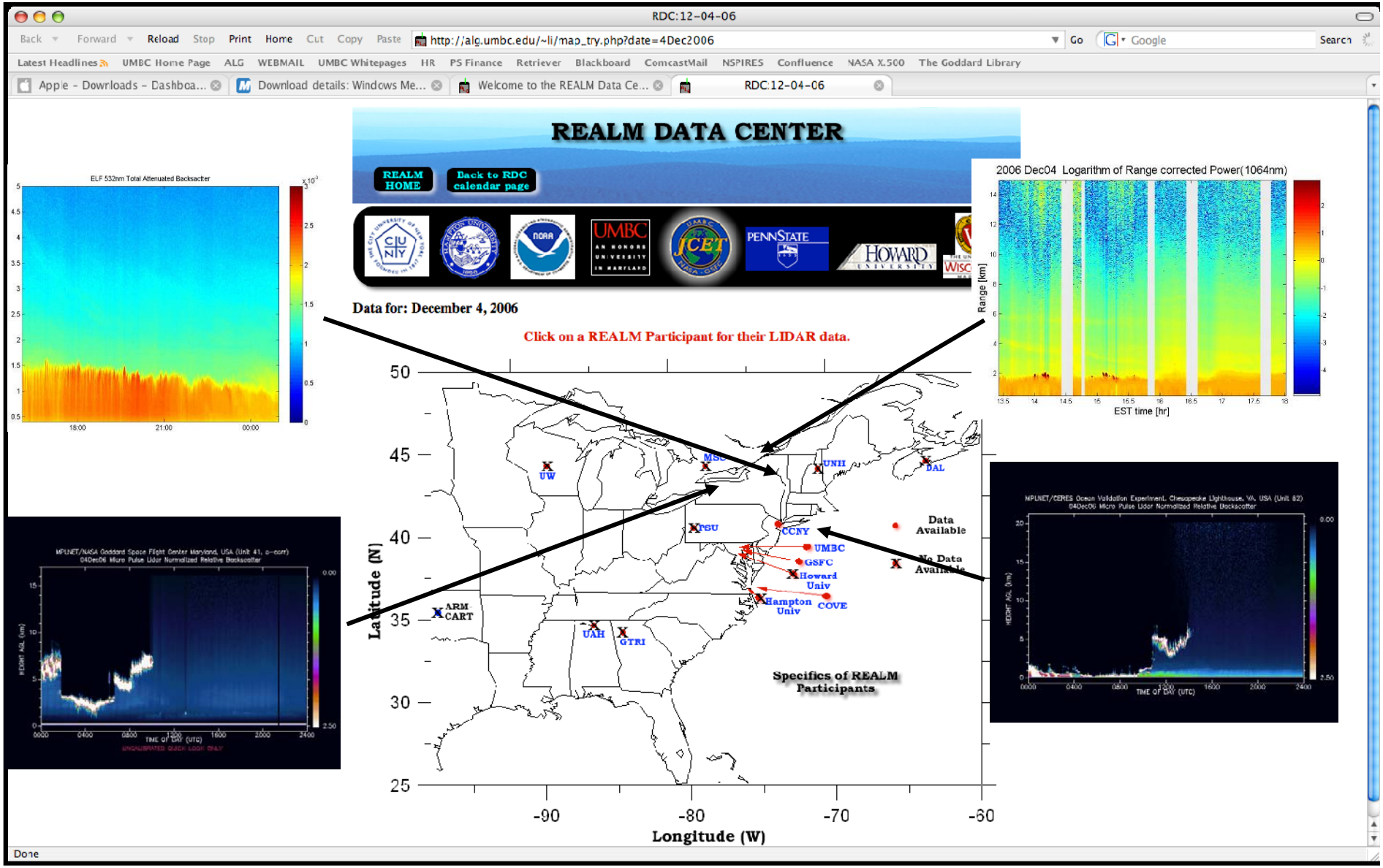
IDEA* ⟶ “3D-IDEA”





* Infusing satellite Data into Environmental Applications

http://alg.umbc.edu/REALM



NASA 3D-AQS Project: Datasets into air quality relevant formats

Completed datasets to AirQuest:

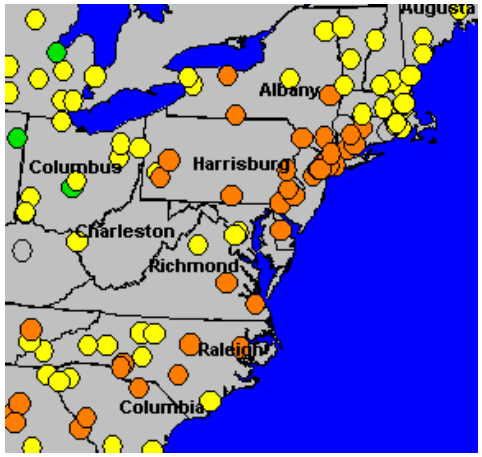
- MODIS, GOES, and MISR AOD matched to surface $PM_{2.5}$ monitor data
- MODIS AOD matched to CMAQ 12×12 and 36×36 km^2 grids

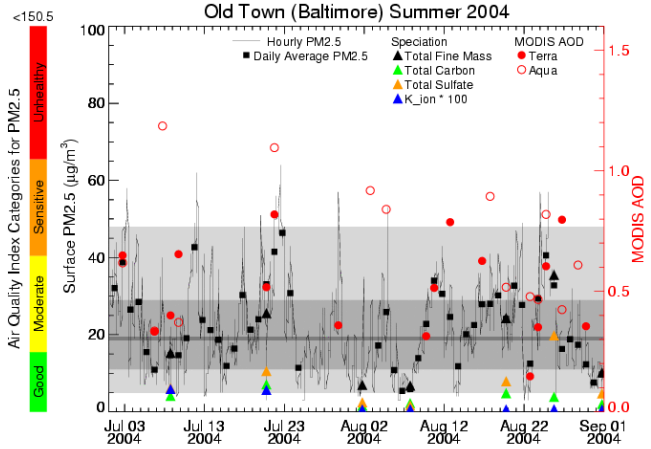
3D-AQS End User Rankings of Remote Sensing Datasets

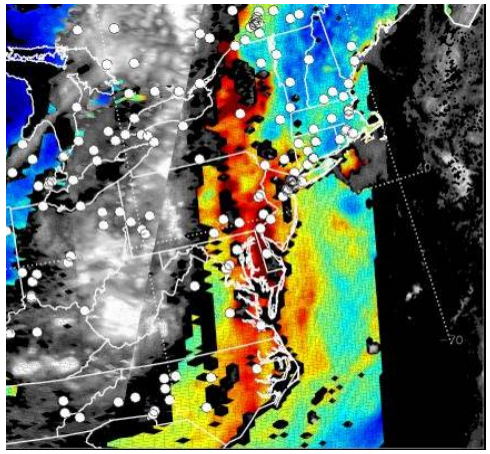
Ranking	Pollutant	Sensor
1	**Particulate Matter ($PM_{2.5}$)**	**ground-based LIDAR**
2	**Nitrogen Dioxide (NO_2)**	**OMI**
3	**Tropospheric Ozone (O_3)**	**OMI-derived**
4	**Particulate Matter ($PM_{2.5}$)**	**CALIOP**
5	Sulfur Dioxide (SO_2)	OMI
6	**Particulate Matter ($PM_{2.5}$)**	**MISR**
7	Carbon Monoxide (CO)	AIRS
8	Carbon Monoxide (CO)	MOPITT

Current Datasets Sent to AirQuest

- MODIS, GOES, and MISR AOD matched to ground-based $PM_{2.5}$ monitors
  - MODIS – fully incorporated
  - GOES/GASP – fully incorporated
  - MISR – dataset created by NASA JPL and being incorporated

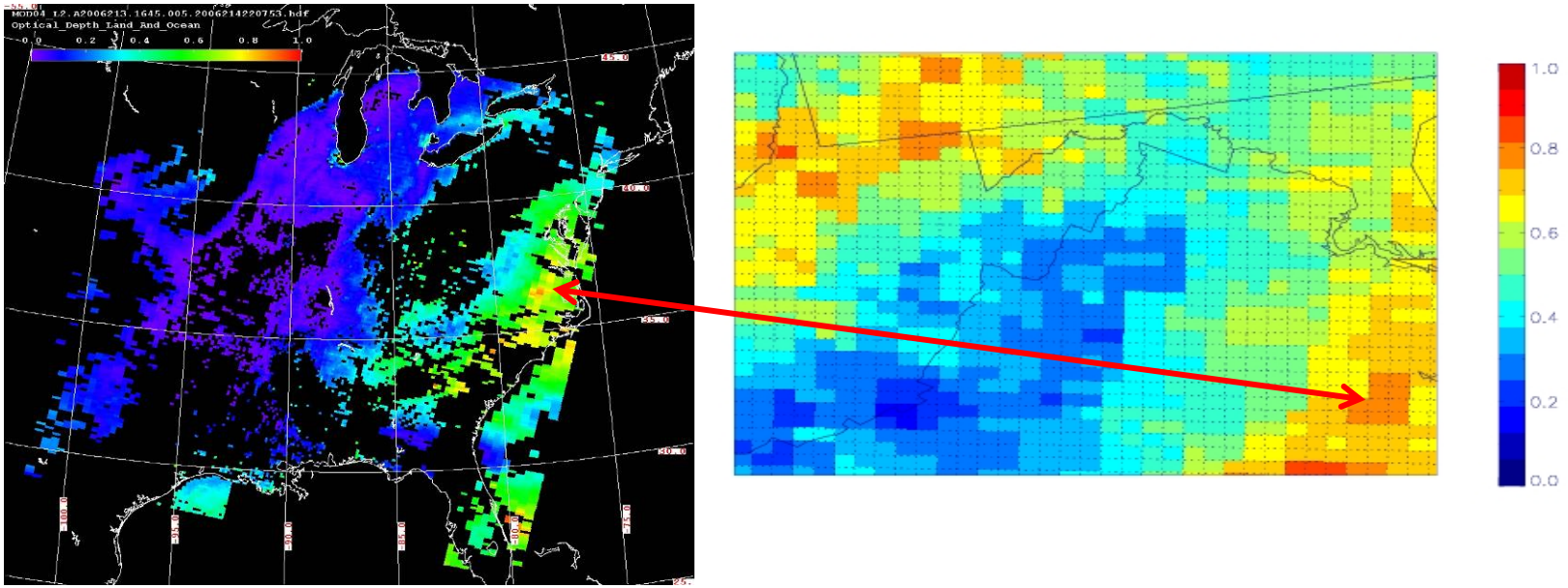






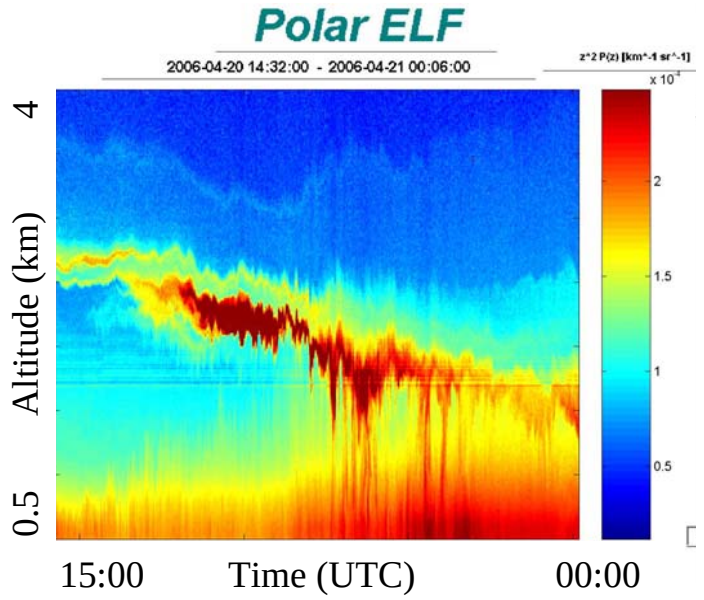
Datasets to AirQuest

- MODIS AOD matched to 12 km^2 and 36 km^2 CMAQ grids
  - Dataset created and in process of being incorporated into AirQuest

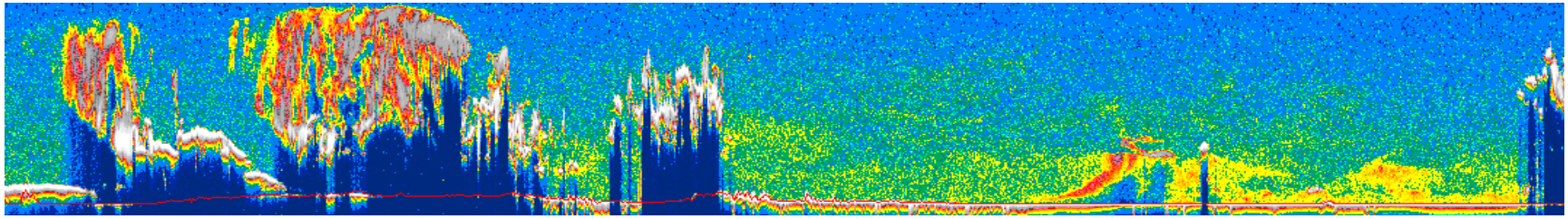


Datasets to AirQuest

- Ground-based LIDAR data
  - Test dataset being developed in CMAQ relevant layers
- OMI NO_2
  - Test dataset being prepared and being validated compared to ground-based NO_2 data
- OMI tropospheric ozone
  - Experimental data being evaluated compared to ground-based ozone data
- CALIPSO
  - Waiting for NASA to reprocess CALIPSO dataset



3D-AQS Remote Sensing Data: Conclusions



- Satellite aerosol optical depth data matched to monitors and on CMAQ grid now available in AirQuest
- New datasets available over next 18 months
- Applications include:
  - Location specific evaluation of satellite data versus EPA monitored data
  - Supplemental monitoring at increased spatial and temporal scales
  - Air quality model evaluation
  - Back trajectory studies to evaluate pollutant transport for CAIR
  - Improved tools for air quality forecasting

Questions?

MODIS, 5 March 2008
Data from NASA GSFC Rapidfire