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# BAMS



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*IRIDESCENT MOUNTAIN WAVES*

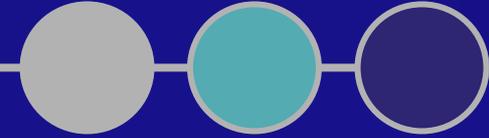
*EVALUATING MODEL CLOUDS*

*CHESAPEAKE BAY PLUMES*

## Regional Prediction

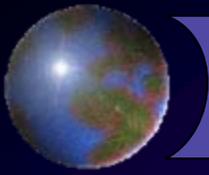
THE PACIFIC NORTHWEST FORGES AHEAD

NASA AQ Team Meeting  
Jun 18-20, 2007



# *A Comprehensive Regional Air Quality Decision Support System in the Pacific Northwest*

*Washington State University  
University of Washington  
NCAR, & Pasayten Consulting  
in collaboration with the  
USDA/FS AirFire group &  
Sonoma Technology, Inc.*



# *Topics*

- NW-AIRQUEST
- AQ DSS: AIRPACT and ClearSky
- NASA-funded DSS enhancement
- BlueSky-AIRPACT wildfire treatment
- OMI Tropospheric Column NO<sub>2</sub>



# *NW-AIRQUEST : The Northwest International Air Quality Environmental Science and Technology Consortium*

- NW AIRQUEST seeks to develop, maintain, and enhance a sound scientific basis for air quality management decision-making in the Pacific Western Region of North America (encompassing the states of Washington, Oregon, Idaho, Montana, and Alaska in the United States, and the provinces of British Columbia and Alberta in Canada.)
- <http://lar.wsu.edu/nw-airquest/>

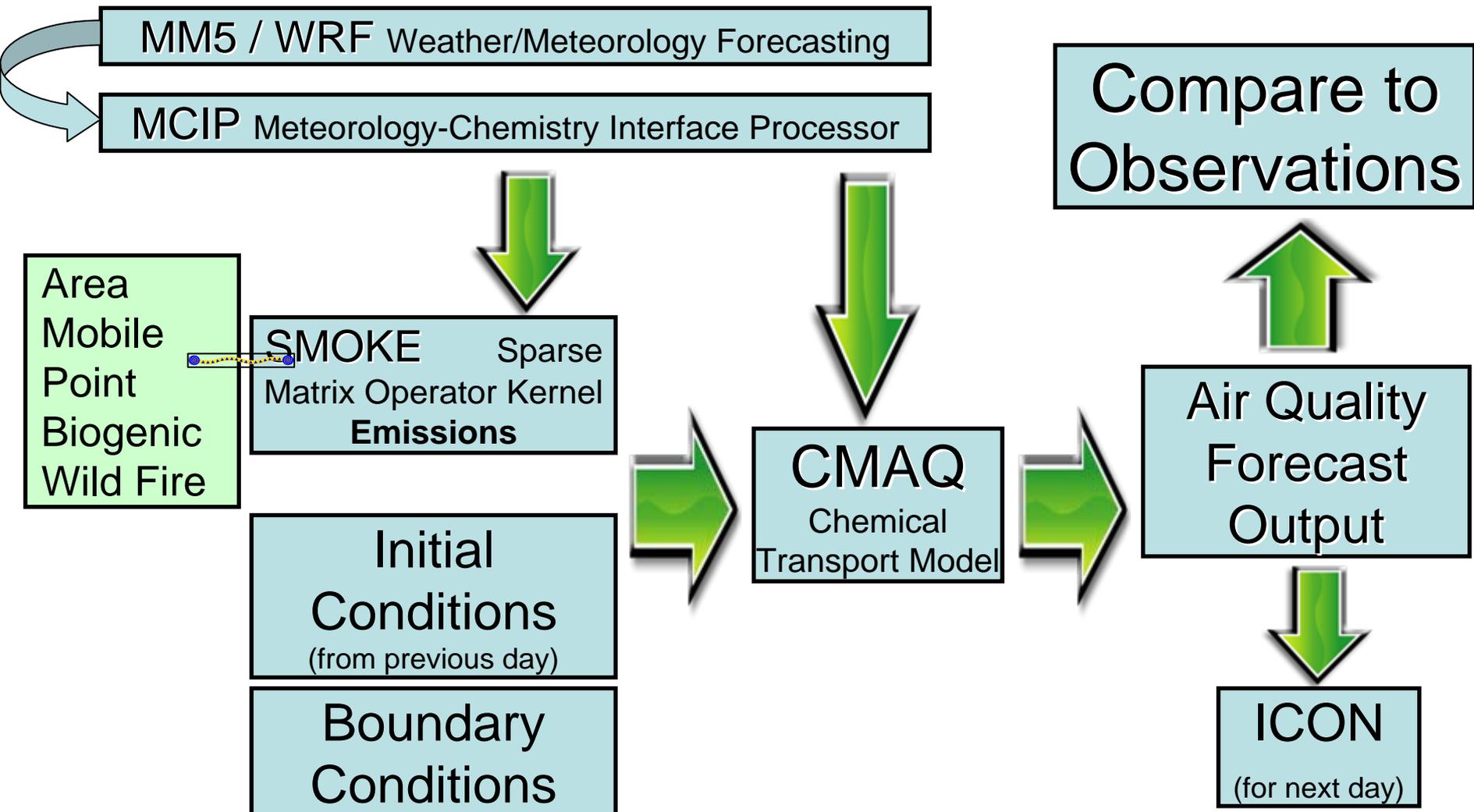
# What is AIRPACT?

- Regional Air Quality Forecasting System for the Pacific Northwest
- Currently running a 12x12-km<sup>2</sup> grid (95 x 95 pixels), with 21 vertical layers up to approximately 15 km altitude.
- *Air Directors* view AIRPACT as a long-term development project, providing a regional asset for air-quality management.
  - These agency directors commit discretionary EPA funding to support AIRPACT.
- The AIRPACT system uses community modeling software:
  - MM5 (and soon WRF) for meteorology,
  - SMOKE for modeling emissions based on meteorology,
  - CMAQ for simulating the chemistry and physics of air pollution.
- CMAQ: community CTM developed with EPA support - open to peer review and testing.
- SMOKE: uses recent national emissions inventories with augmentations by state level emissions experts. Currently we have no method tracking arbitrary real-time point emissions changes. Lag ~2 years.
  - Limited data on marine emissions (ships & ports) and local sources such as wood-smoke from home heating.
- AIRPACT is evaluated using standard AQ monitoring station measurements collected by EPA from state, local, and tribal air pollution control agencies.

# AIRPACT

Air Indicator Report for Public Access and Community Tracking

Air quality forecast system for the Pacific Northwest - available daily on the web.



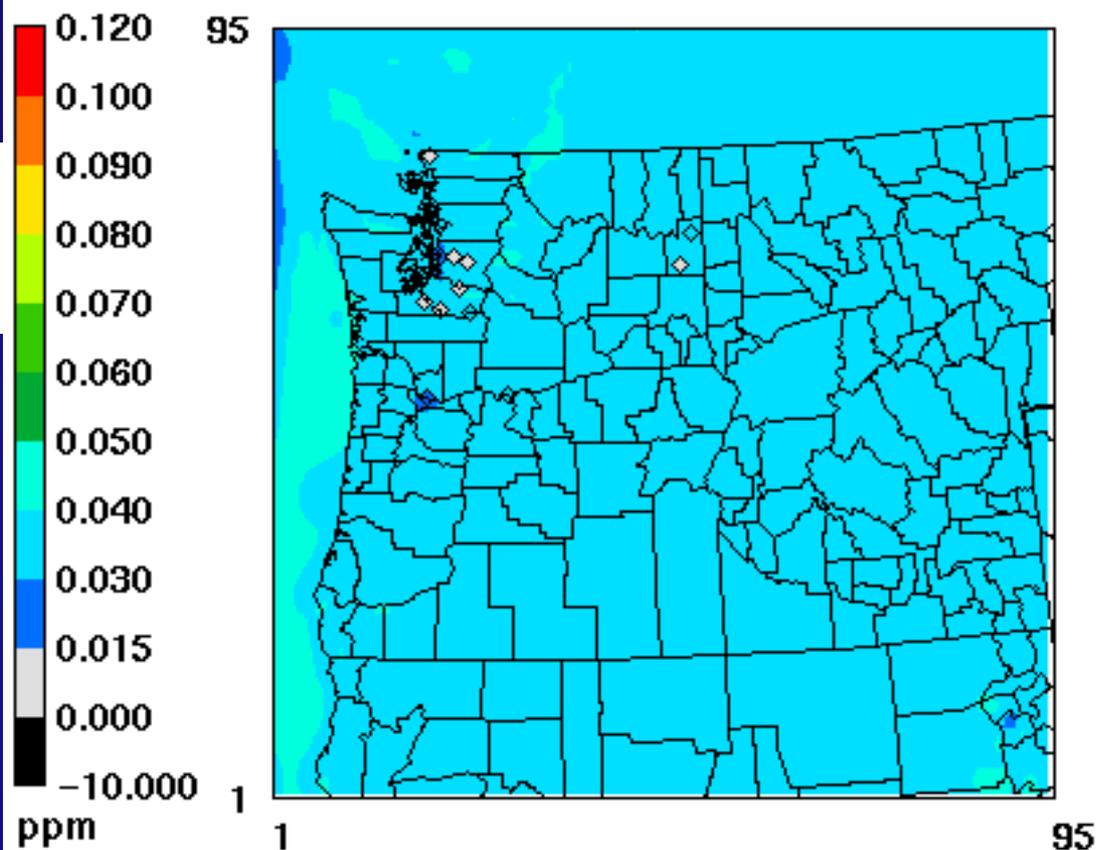
# AIRPACT-3

<http://www.airpact-3.wsu.edu>

BlueSky/RAINS-  
served test

## AIRPACT-3 O3 w/ Obs

from CMAQ simulation  
over 24 hours.



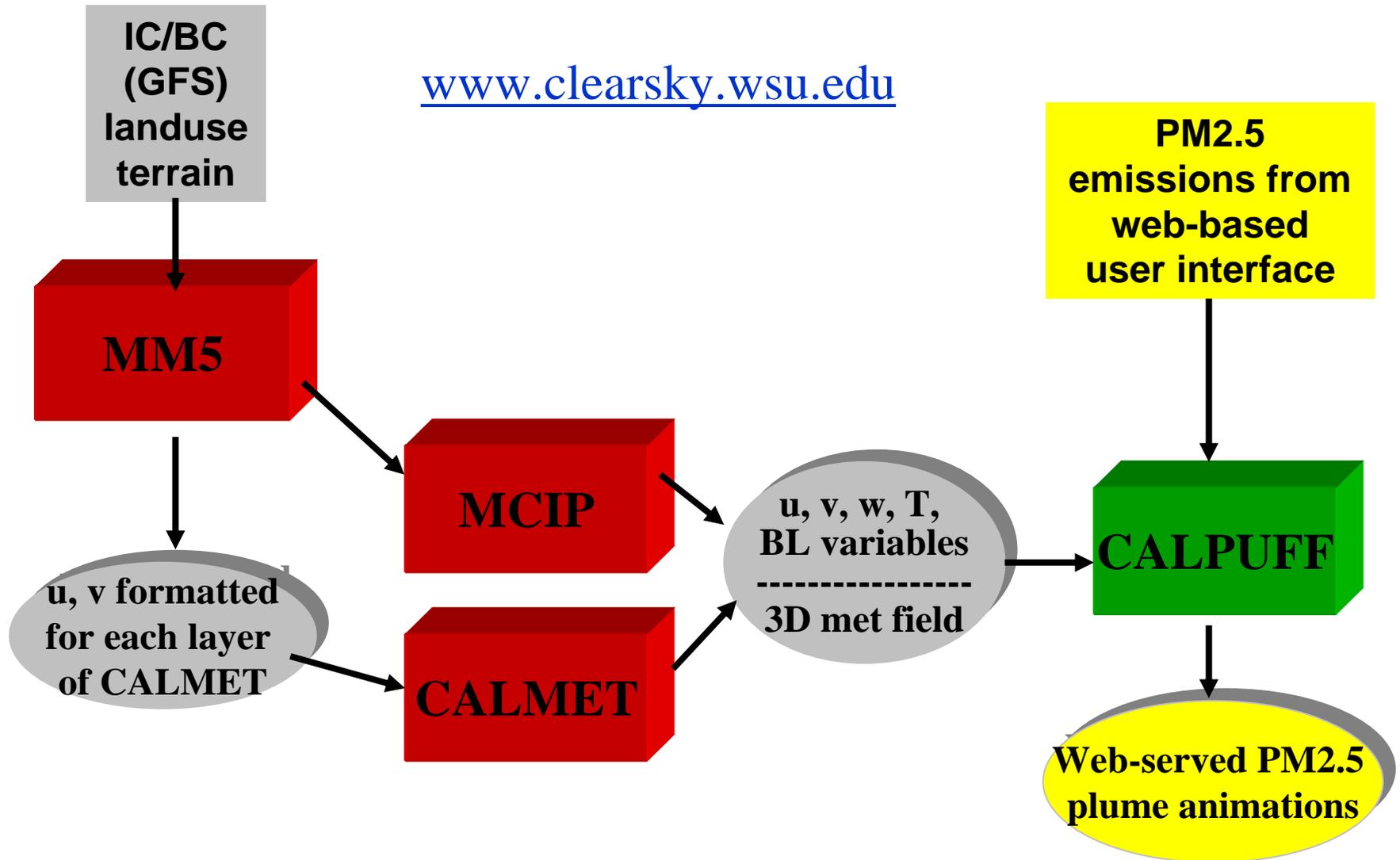
July 24, 2005 9:00:00  
Min=0.016 at (19,49), Max=0.044 at (89,2)

# What is ClearSky?

- Decision Support System for Agricultural Burning
- Currently running on a 4-km grid
- *Air Directors* also support ClearSky.
- Currently used in Eastern WA and N. Idaho Tribal Reservations
- ClearSky uses:
  - MM5 (and soon WRF) for meteorology,
  - Area and Line sources for PM2.5
  - CALPUFF for simulating PM2.5 dispersion.
- Paper by Jain et al., in press, Atmospheric Environment.

# 2004 ClearSky Ag-Burn Smoke Dispersion Modeling System

[www.clearsky.wsu.edu](http://www.clearsky.wsu.edu)

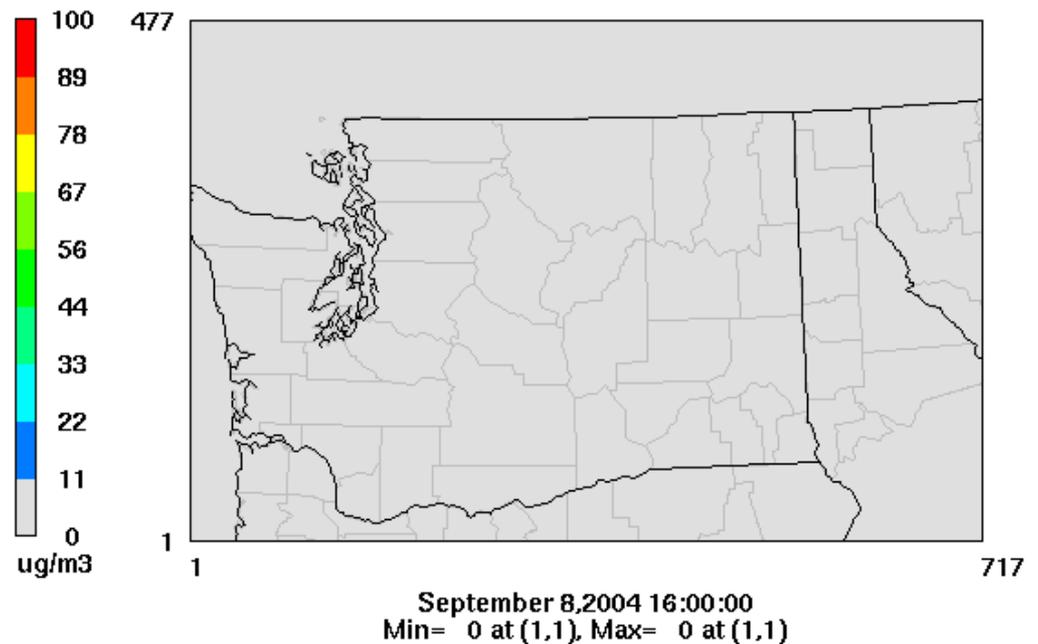


# Current ClearSky Domain

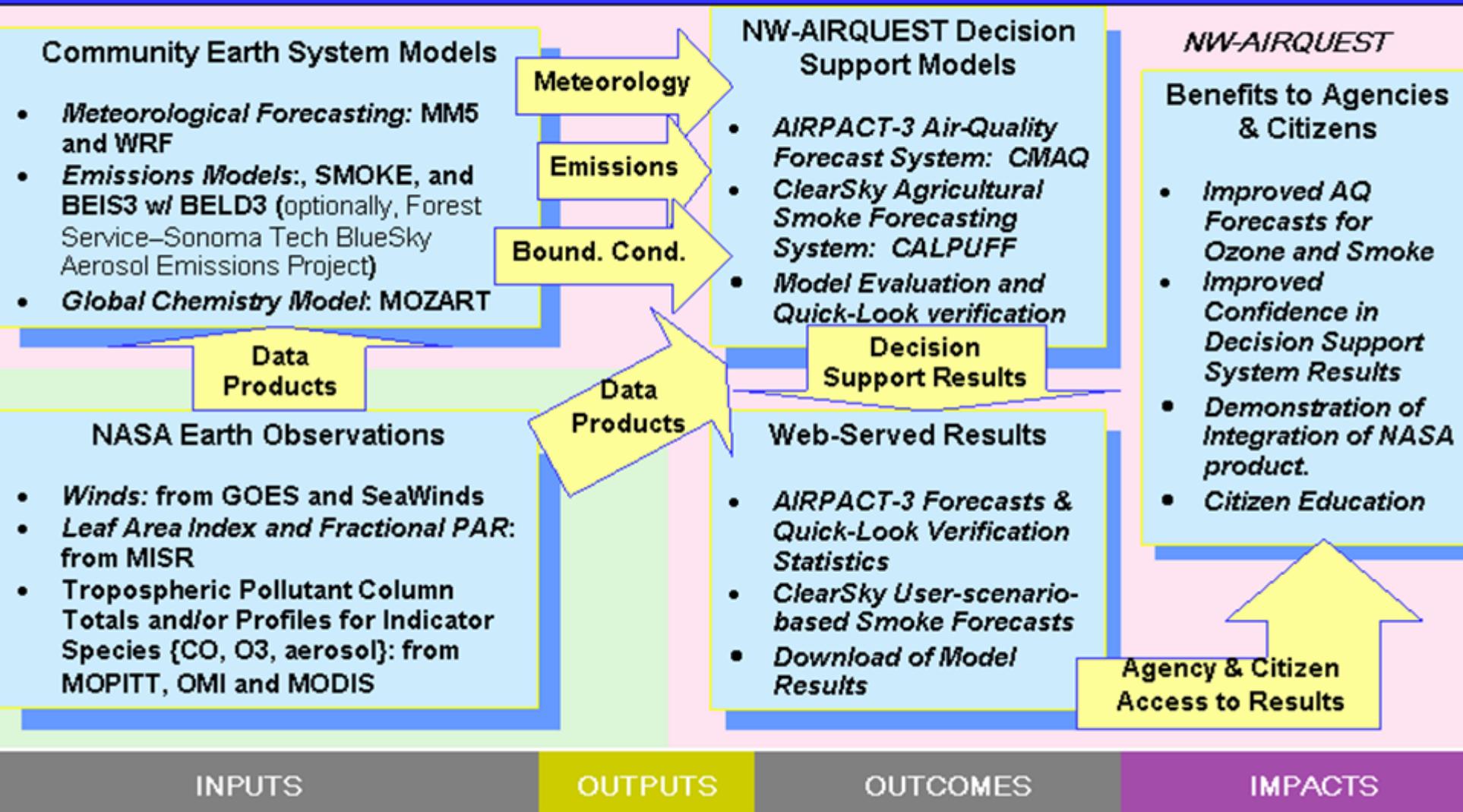
## ClearSky PM2.5 Results

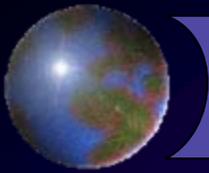
Entire Domain  
09/08/2004

Crop Type	Field size, acres	Proposed burn acreage	Burn start time
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Bluegrass	5	<input type="text" value="5"/>	1000 ▾
Wheat	28	<input type="text" value="28"/>	1000 ▾
Wheat	13	<input type="text" value="13"/>	1000 ▾
Wheat	28	<input type="text" value="28"/>	1000 ▾
Wheat	13	<input type="text" value="13"/>	1000 ▾
Bluegrass	87	<input type="text" value="87"/>	1000 ▾
Bluegrass	30	<input type="text" value="30"/>	1000 ▾
Bluegrass	195	<input type="text" value="195"/>	1000 ▾
Wheat	130	<input type="text" value="130"/>	1000 ▾
Bluegrass	20	<input type="text" value="20"/>	1000 ▾
Wheat	51	<input type="text" value="51"/>	1000 ▾



# A Comprehensive Regional Air-Quality Decision Support System for the Pacific Northwest





# *Project Objectives*

- Better meteorology for air quality forecasting
- Better emissions
- Better initial and boundary conditions for gases & aerosols
- Improved evaluation process
- Improved communication of results to forecast partners
- Technology transfer of new methods and results

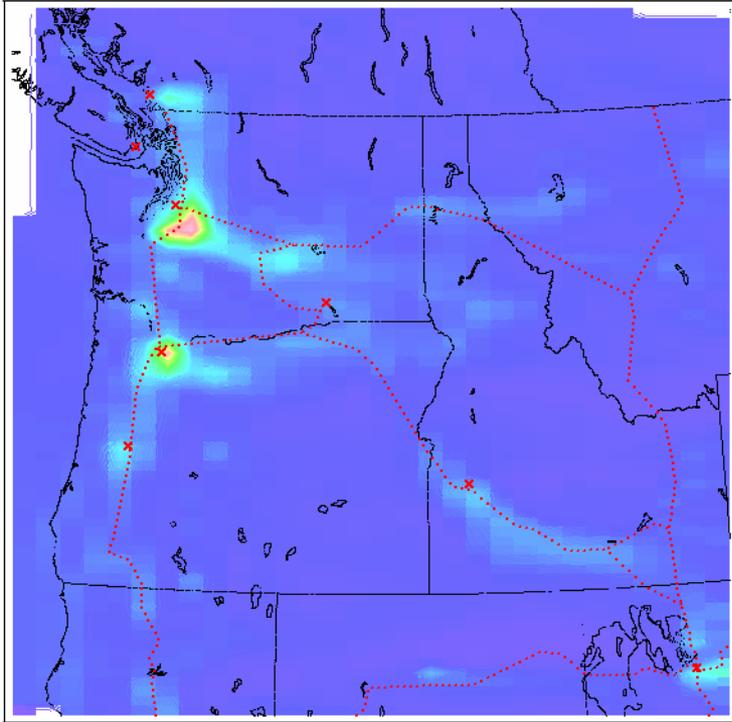
# *NASA products and use*

- Meteorology
  - ▣ GOES water vapor and cloud winds
  - ▣ SeaWinds Scatterometer winds
- Emissions
  - ▣ MISR Leaf Area Index and FPAR
  - ▣ MODIS fire emissions
- BC/IC and Evaluation
  - ▣ MOPPITT CO
  - ▣ AURA OMI NO<sub>2</sub>, O<sub>3</sub>, HCHO
  - ▣ MODIS aerosol

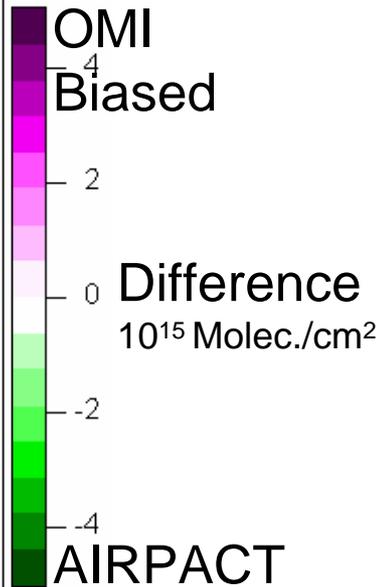
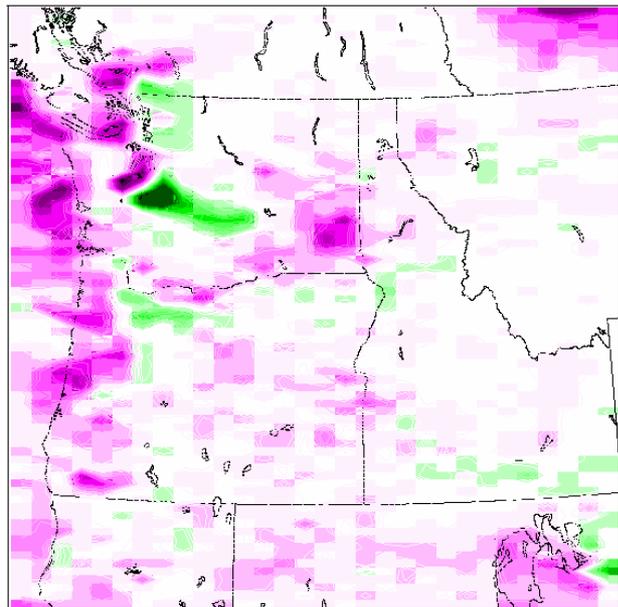
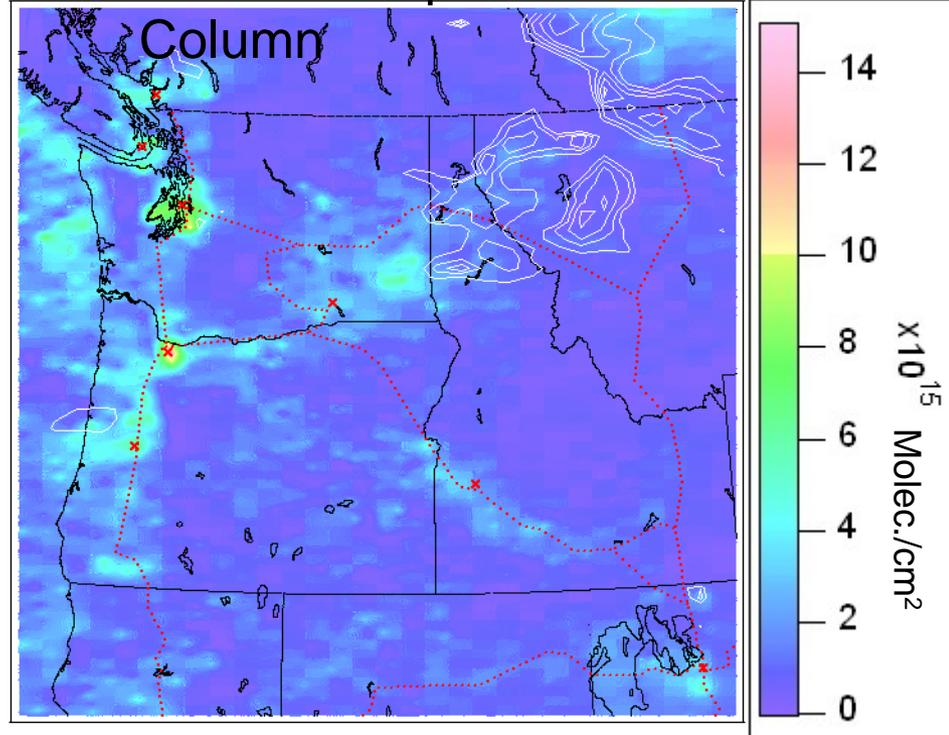
# Comparing OMI and AIRPACT for Tropospheric Column NO<sub>2</sub>

- AIRPACT results are converted
  - from layered mixing ratios (ppmV) to Column Density (molecules/cm<sup>2</sup>)
  - for the hour closest to the afternoon OMI observation.
  - Using Temperature, Pressure, and Layer Thickness;
- Retrieval:
  - OMI Trop. NO<sub>2</sub>
  - Below Cloud NO<sub>2</sub>
  - Lat. / Long.
  - Cloud Fraction. Threshold Cloud Fraction used for calculating monthly averages.
- Interpolated onto a standard grid for daily comparison.

# AIRPACT Column



# US OMI Trop. Column

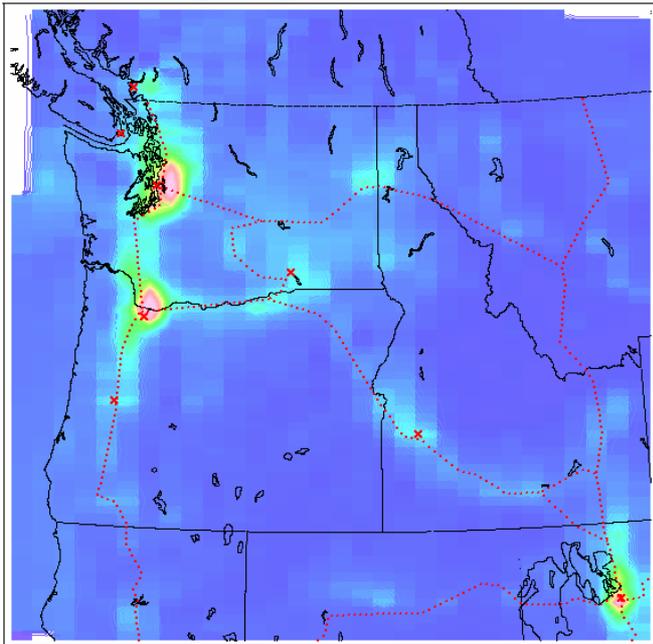


### Legend:

- Interstate Freeway
- × Noted City Center
- Cloud Cover
- Borders

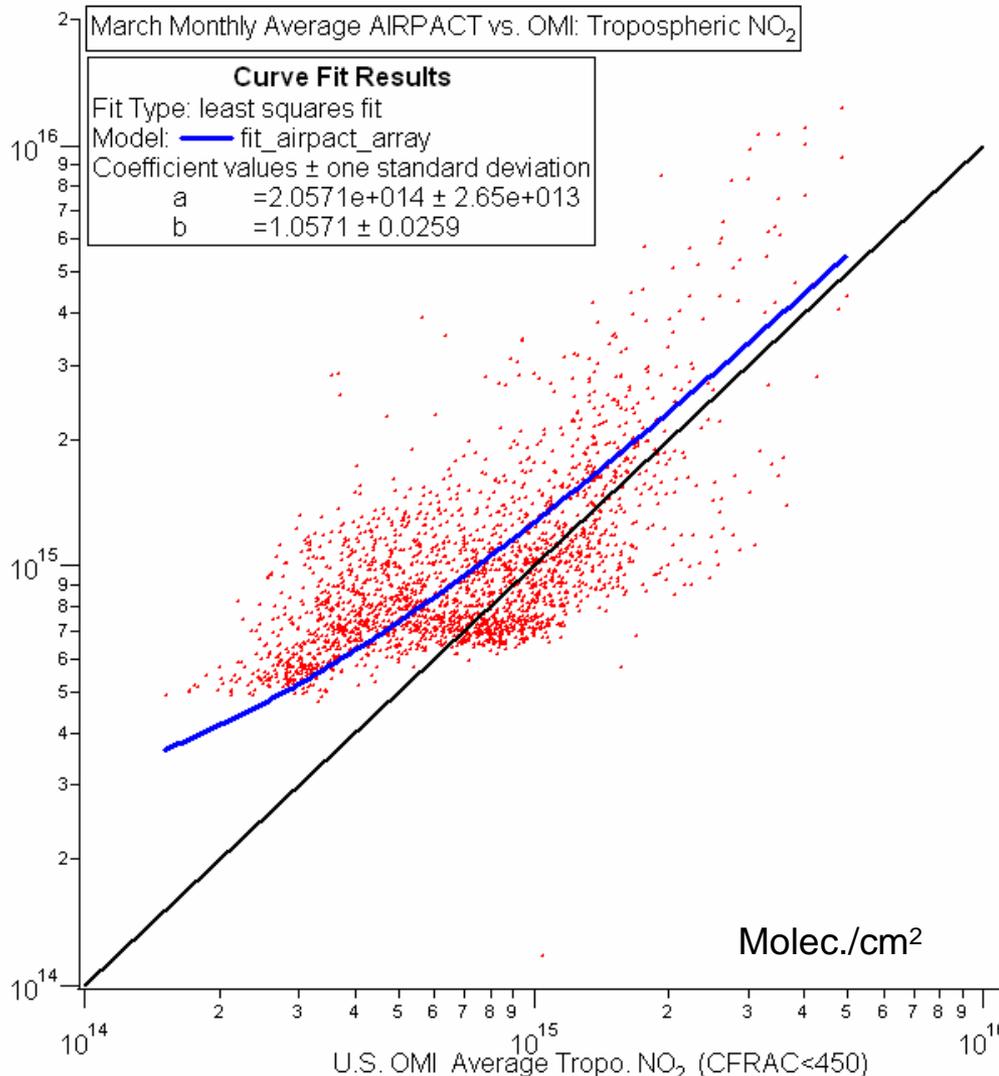
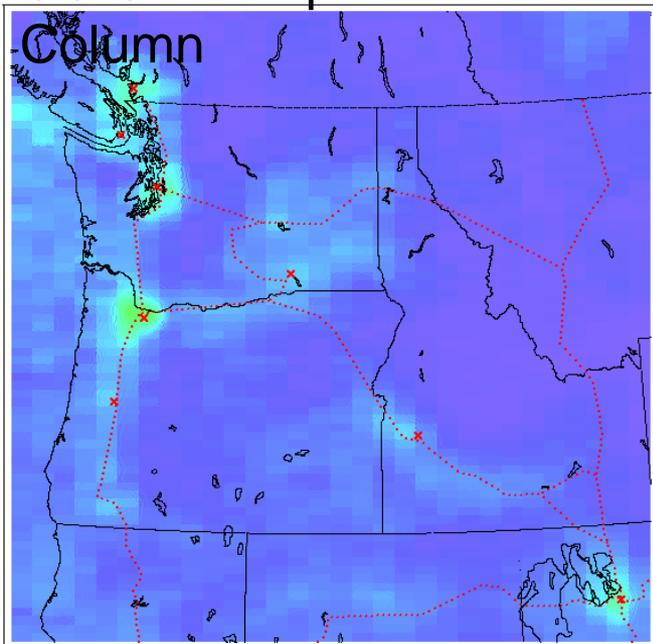
# March-14-2007 Trop. NO<sub>2</sub>

# AIRPACT Column

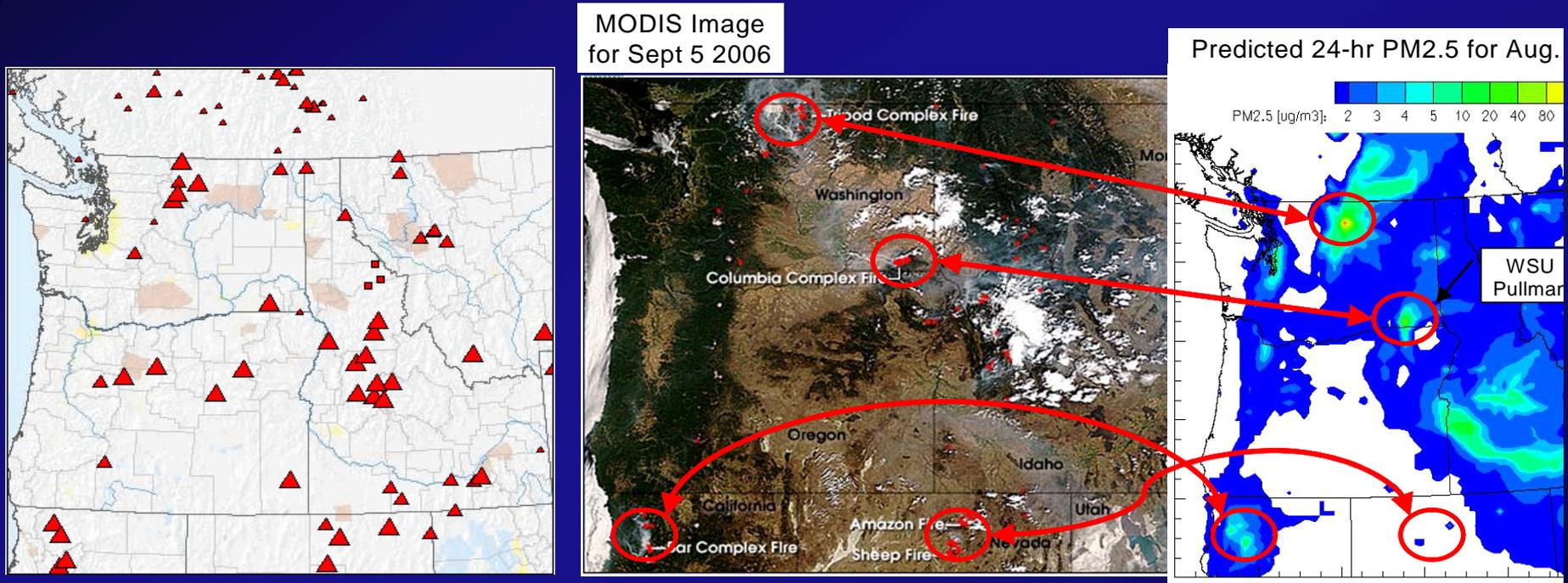


# March 2007 Average

# US OMI Trop.



# *Wildfire emissions are being exported to Airpact-3 from the Forest Service BlueSky System*



BlueSky fire locations & size

SMOKE emissions processing for CMAQ

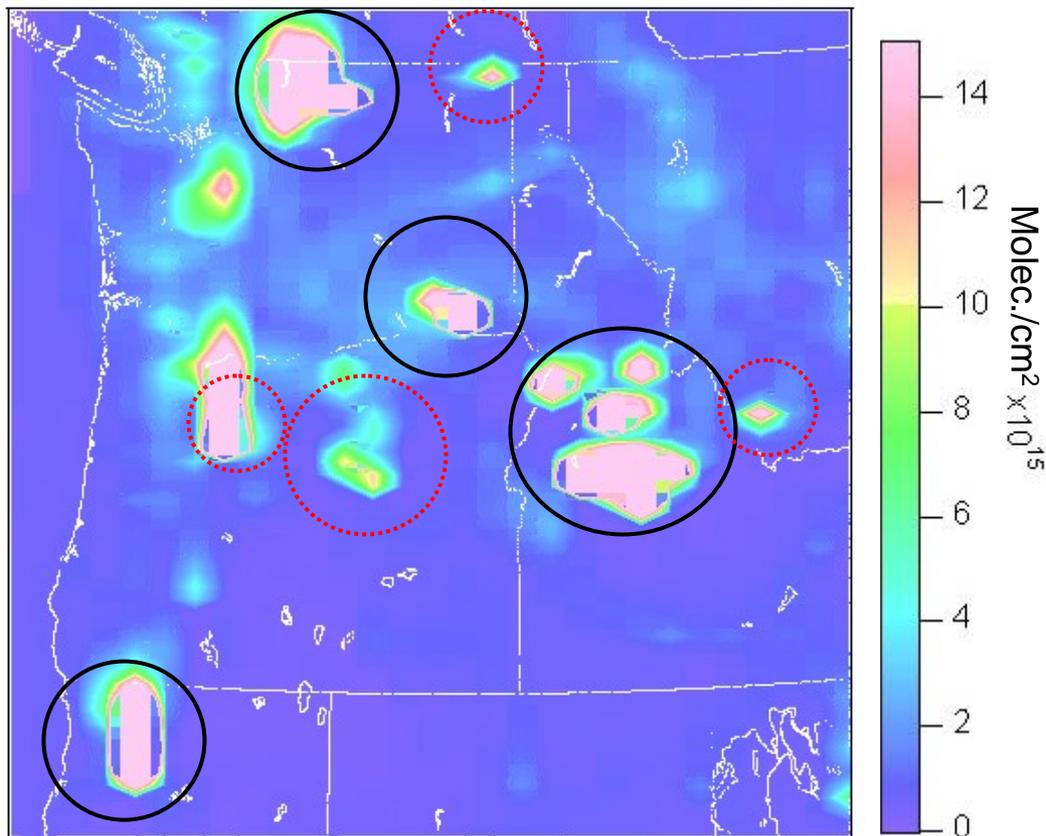
Predicted PM2.5 from fires

# NO<sub>2</sub> from Fires (Sept. 2006)

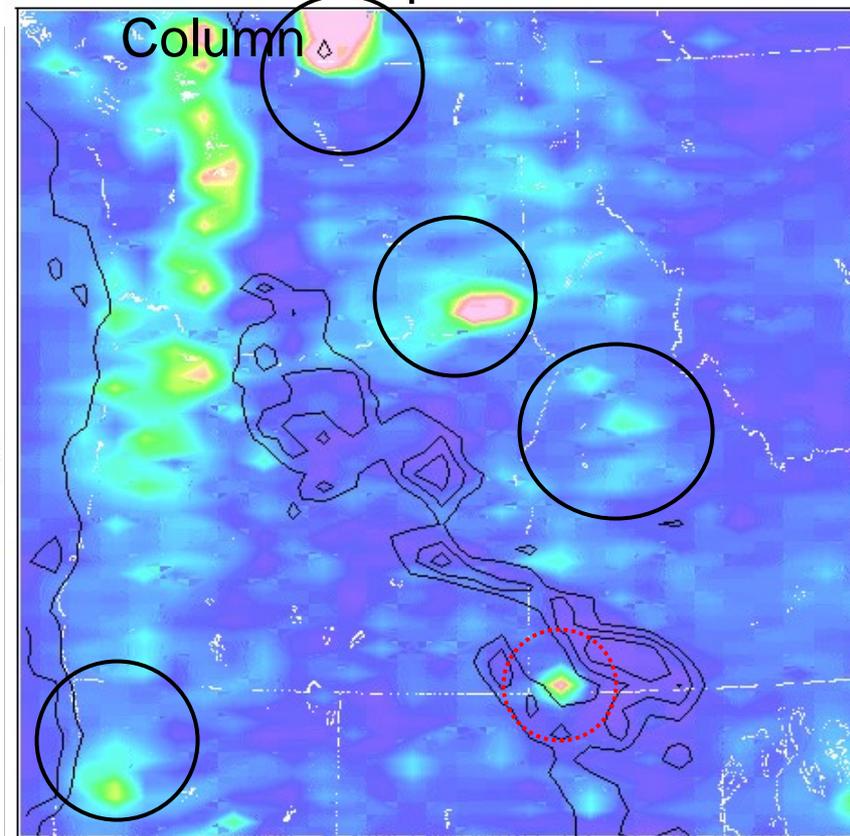
## AIRPACT vs OMI

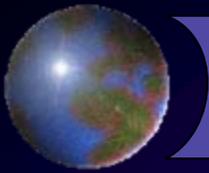
- Forest Service BlueSky wild fire emissions were input into AIRPACT for reruns.
- AIRPACT wildfire NO<sub>2</sub> maxima much higher than urban areas (and OMI Trop. Values), about one order of magnitude.
- OMI Trop. NO<sub>2</sub> data does consistently observe *comparable* NO<sub>2</sub> from wildfires.

AIRPACT Column



US OMI Trop.  
Column





# *Project Assessment*

- Forecast accuracy
  - Baseline performance statistics vs future performance measures
- Forecast use
  - Web site activity
  - Feedback from users

*Thank you for your attention!*

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