



Public Health Applications in Remote Sensing

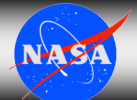
NASA Public Health/Air Quality Workshop

Stan Morain, PI

William Sprigg, Co-I

Amelia Budge, Project Coordinator

Bolger Center, Potomac, MD, May 8-9, 2007



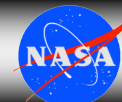


PHAIRS Team

- UNM- EO data inputs; DSS integr.; PH links
 - Karl Benedict-Info tech.; interoperability
 - Tom Budge-EO prod. assess.; data assim.
 - Bill Hudspeth-Web client & DSS products
- UA- Model inputs / outputs & improvements
 - Dazhong Yin-Modeling NCEP/Eta + DREAM
 - Brian Barbaris-V&V; EPA Air Quality data
 - Patrick Shaw-Stat. analys.; PM_{2.5-10} character.



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007



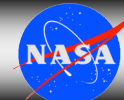


DSS = RSVP/SYRIS

- Rapid Syndrome Validation Project
 - Sandia National Labs 1998-2003
 - Detects
 - Fever w/ skin rash; severe diarrhea, severe respiratory distress; influenza-like illnesses
 - Clinician-based; not data mining-based
- Syndrome Reporting Information System
 - ARES Corporation 2003-Present
 - Detects
 - all important PH high-risk diseases; human & animal disease syndromes, and animal infections
 - Clinician-based (school nurses, physicians & veterinarians emergency medical responders, PHOs wildlife rehab, coroners, laboratories)



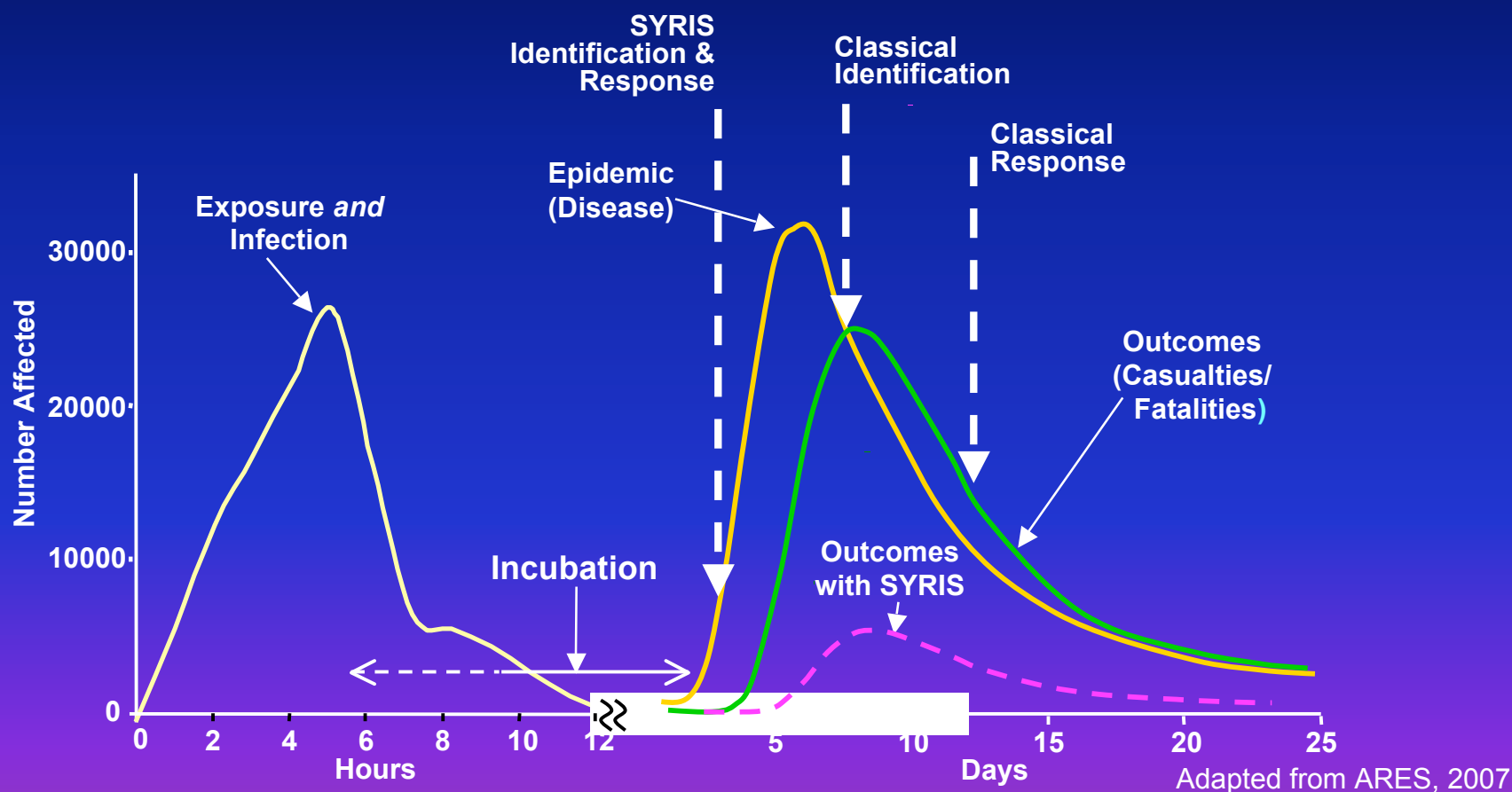
NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007



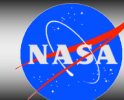


SYRIS = Earlier detection and immediate response to outbreaks

- Exposure: People/Animals are exposed to infectious agents
- Epidemic: People/Animals begin to show signs of infection
- Outcome: People/Animals begin to die or get very sick
- - - SYRIS Outcome: 80% fewer People/Animals get sick or die



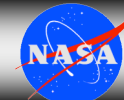
NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





PHAIRS Approach

- Assimilates NASA Earth science results
 - Terra MOD-12,15; SRTM-90; AMSR-E; et al.
- Into a regional dust model (DREAM) driven by...
 - NCEP/Eta to derive dust entrainment and dispersion patterns,
 - and to replace baseline model parameters with temporal data;
 - Thus, PHAIRS improves the forecasting model by combining atmospheric parameters with terrestrial (environmental) attributes that influence human health outcomes
- Uses EPA AIRNow air quality data to
 - V&V model outputs of dust episodes & PM_{2.5-10} [conc.]
 - Transition modeled dust [conc.] w/ EPA air quality standards
- Develops forecast products for users (e.g. RSVP/SYRIS)
 - Model output animations 24-36 hour regional forecasts
 - Web client and interfaces for health communities-of-practice



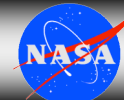


PHAIRS (Years 4 & 5)

- Expand ground-based air quality data
 - To include Muni., Co., & State environment networks
- Transition product line for PH decisions
 - By conducting Workshops for user groups
 - Developing user-friendly tutorials for the web client
- Expand V&V to...
 - Include multi-year stat. anal. of dust episodes
 - Using DREAM, AIRNow, and more local data sets
 - Integrate dust episodes with respiratory health effects

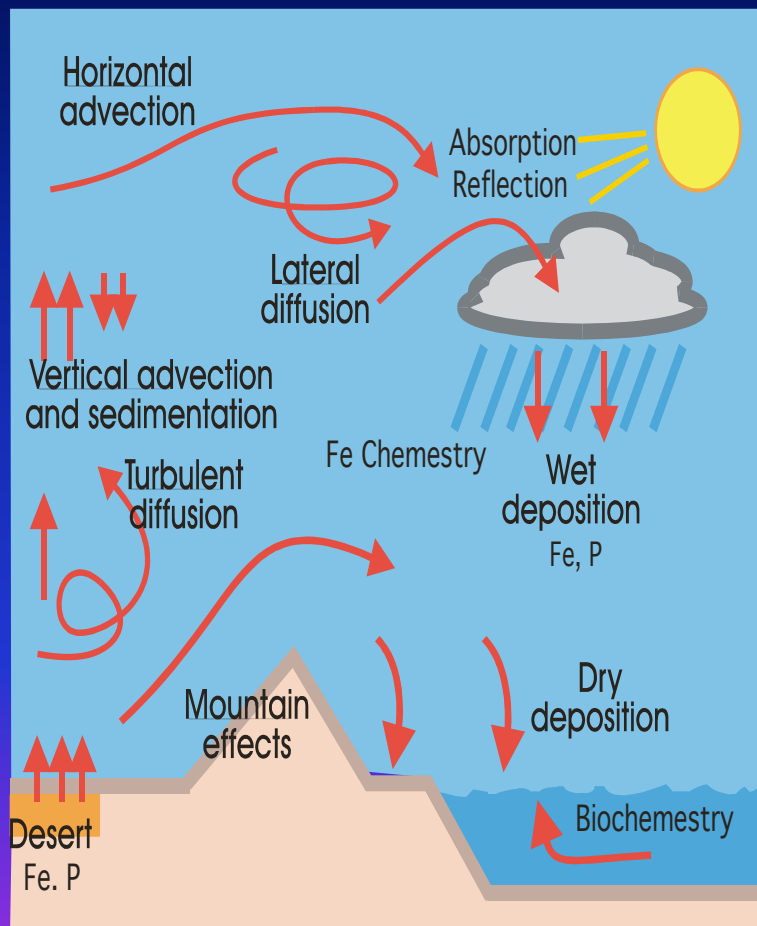


NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





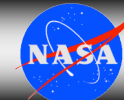
Quasi-operational DREAM



- Numerical, Dynamical Dust Generator 'DREAM'
- Driven In-Line by NWS Operational Model
- NASA - MODIS Dust Source Identification
- NASA Satellite Model Verification
- EPA AIRNOW Network Model Verification
- Choice of PM Size Distribution
- Client Selects Product
- Simulations of Past Events
- Up to 36-hr Forecasts (time, amount, duration)
- Aiming for ZIP-code Resolution

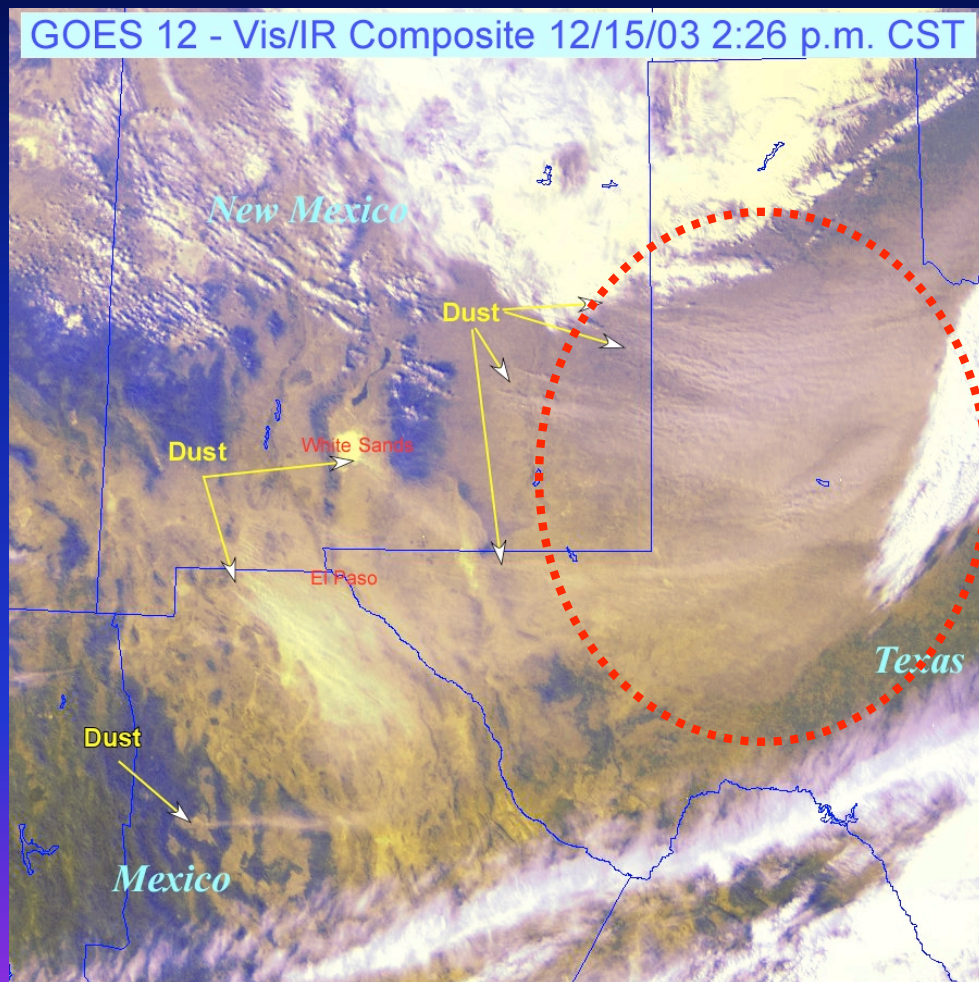


NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





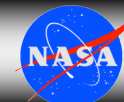
The Problem



Dust Storm December 15, 2003 West-Central Texas.

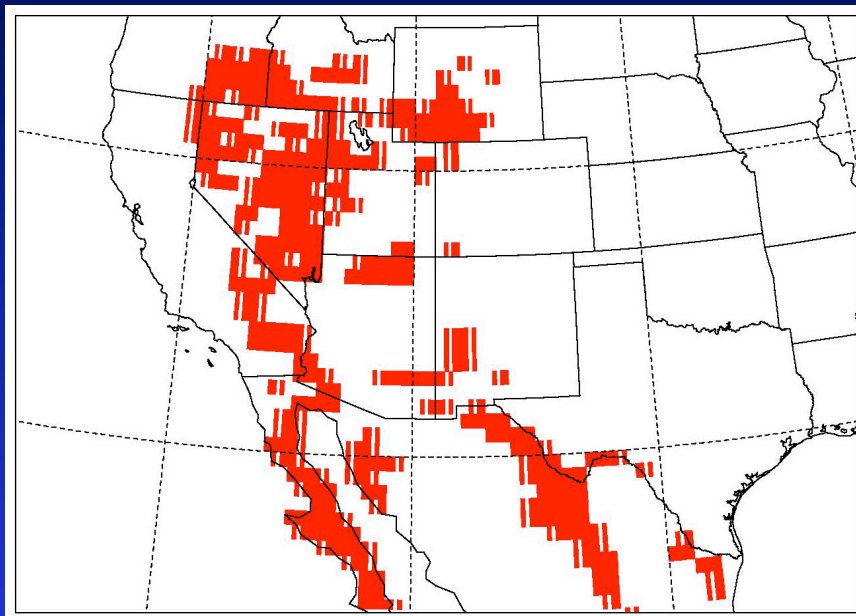


NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

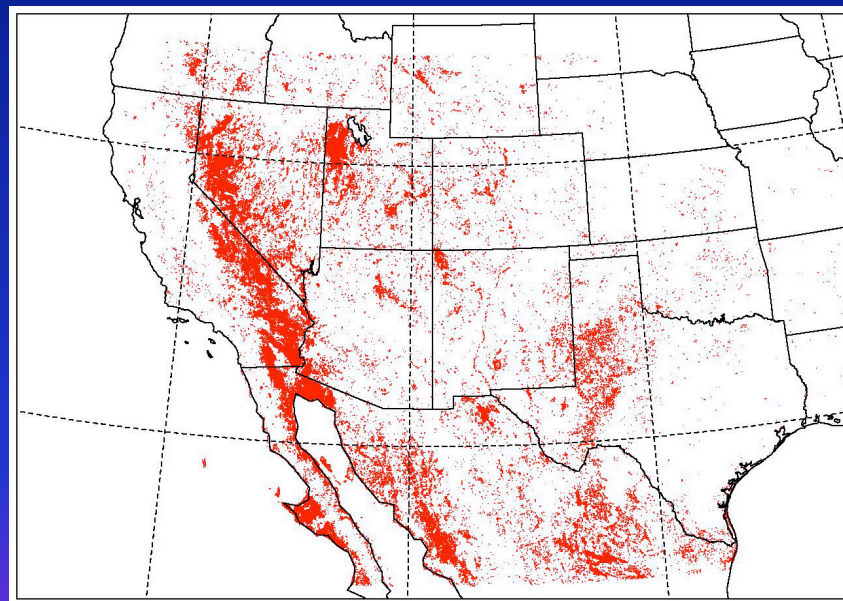




A Step In Right Direction



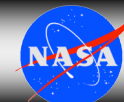
Bare ground class from Olson
World Ecosystem Land Cover



Bare ground class from MOD12 product



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

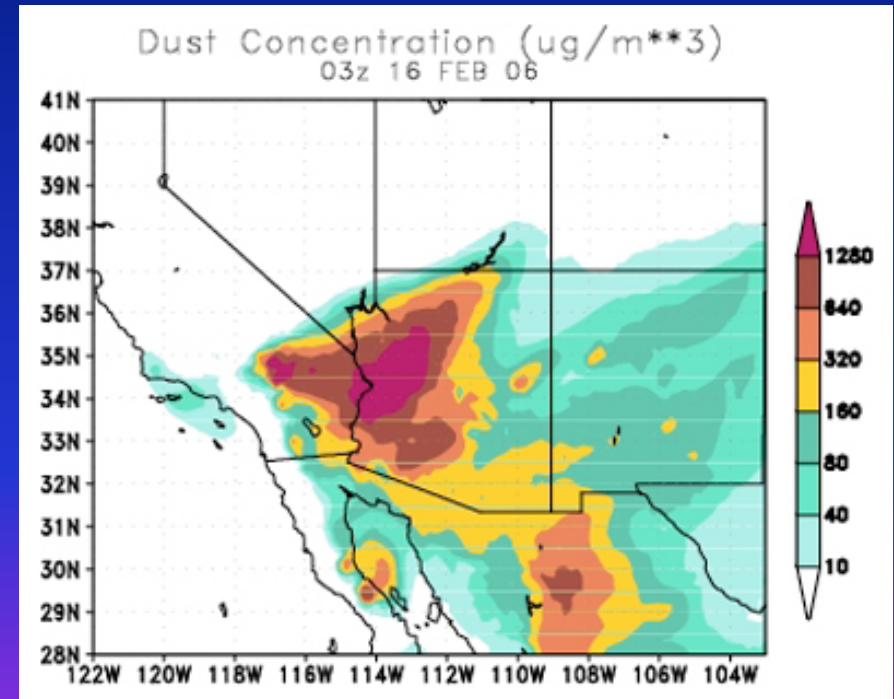
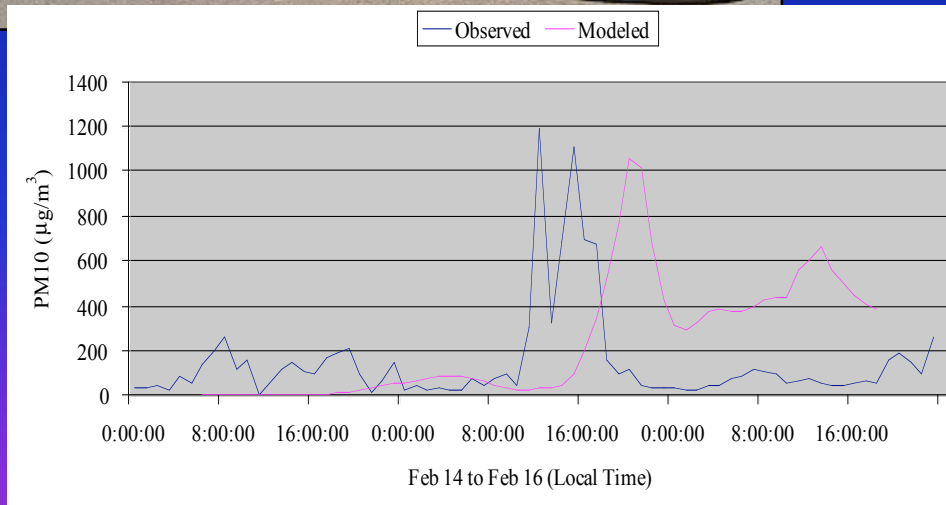




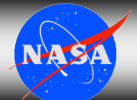
Quasi-operational DREAM



Dust Storm - February 16, 2006 West-Central Arizona



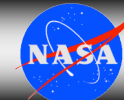
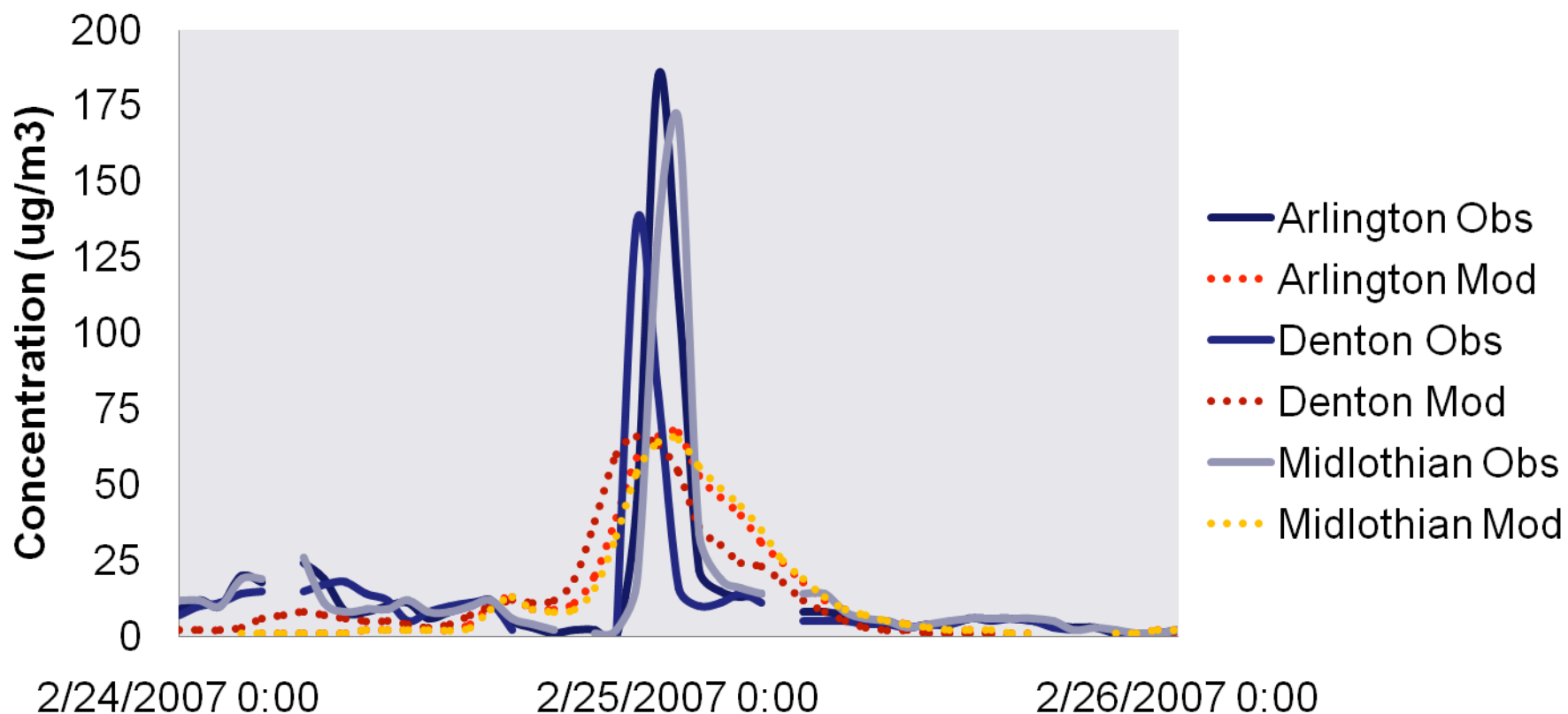
NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





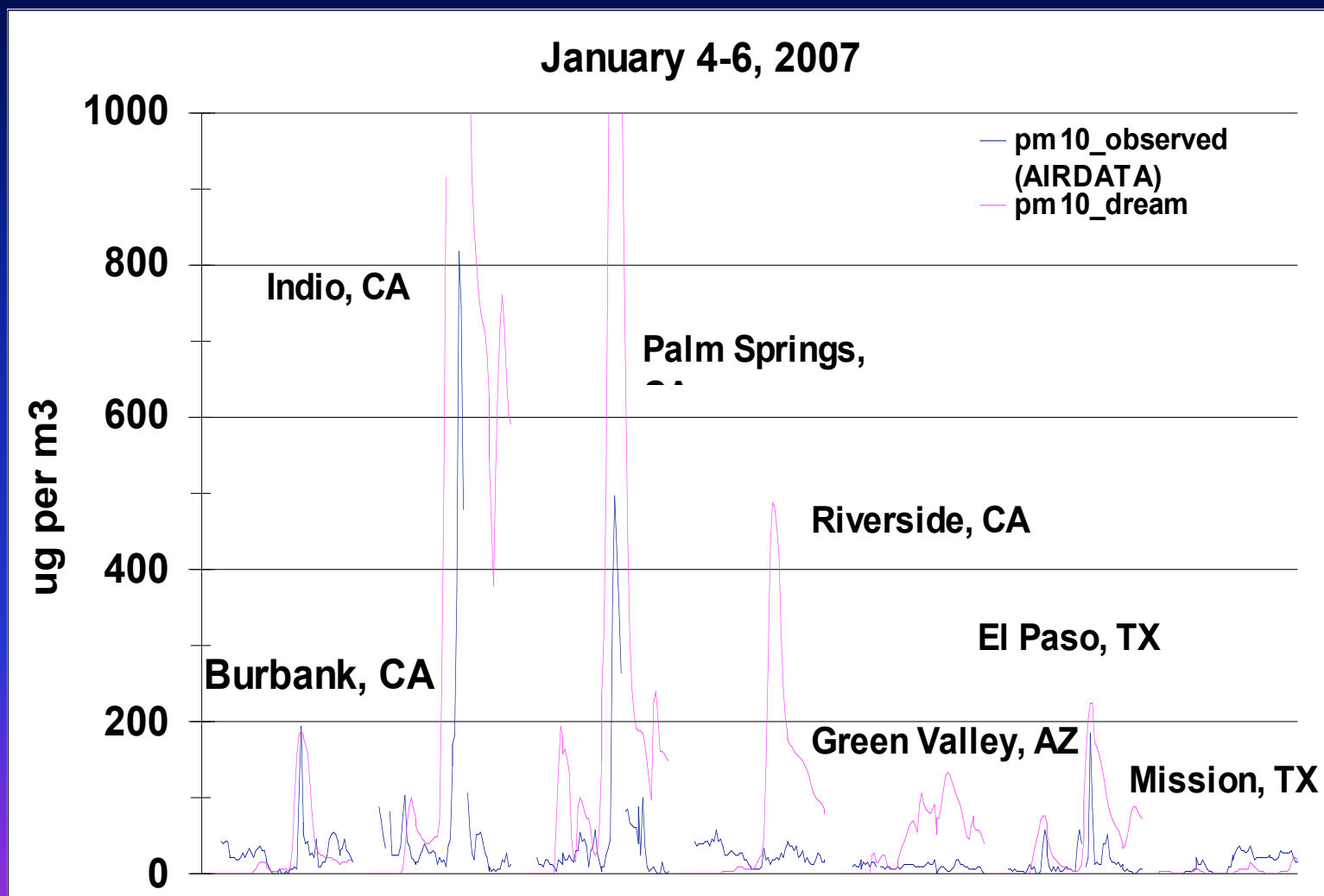
Quasi-operational DREAM

Texas February 2007 dust event
PM2.5 airport comparisons

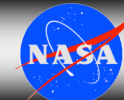




One Storm – 7 Points to Compare

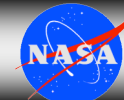
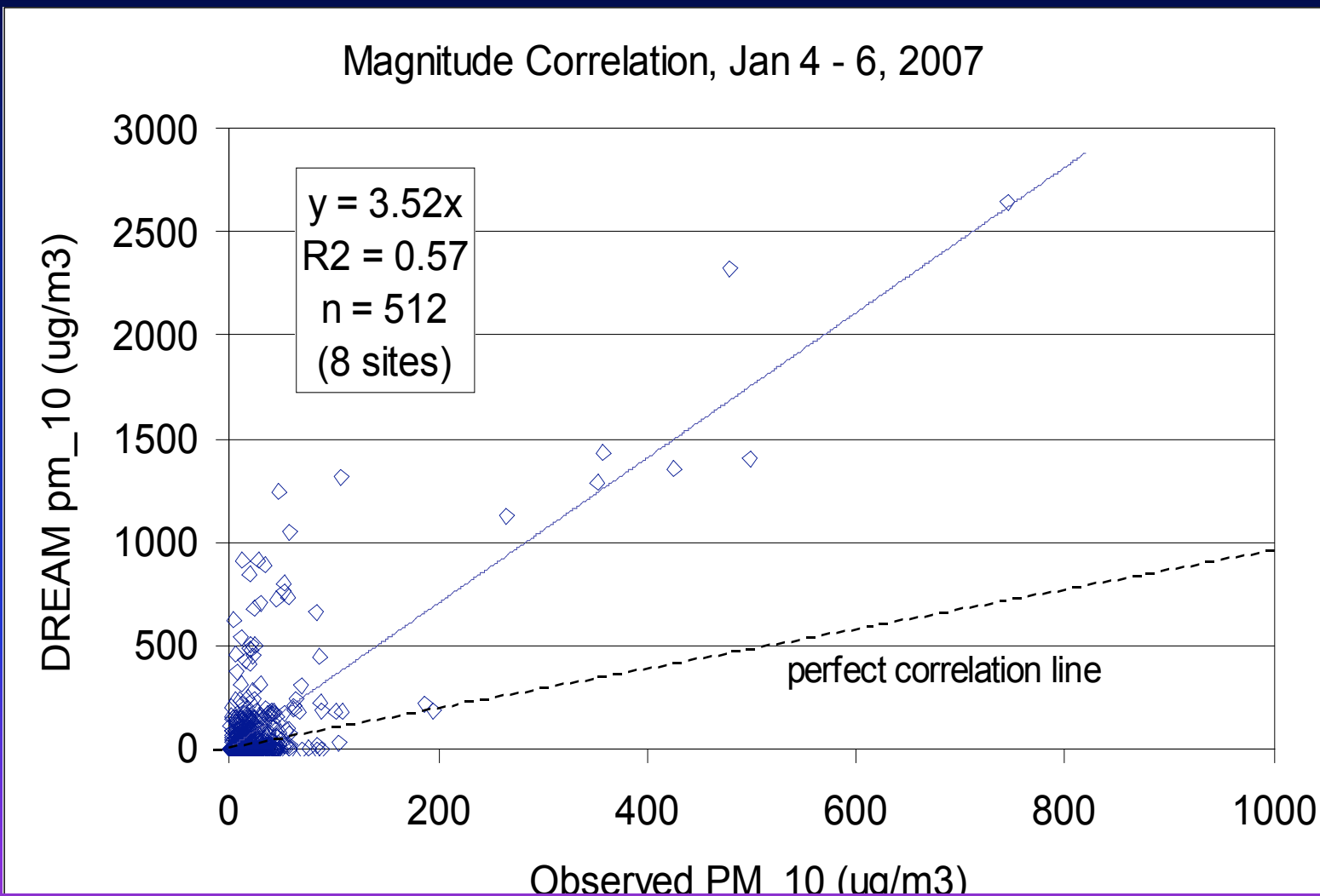


NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007



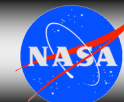
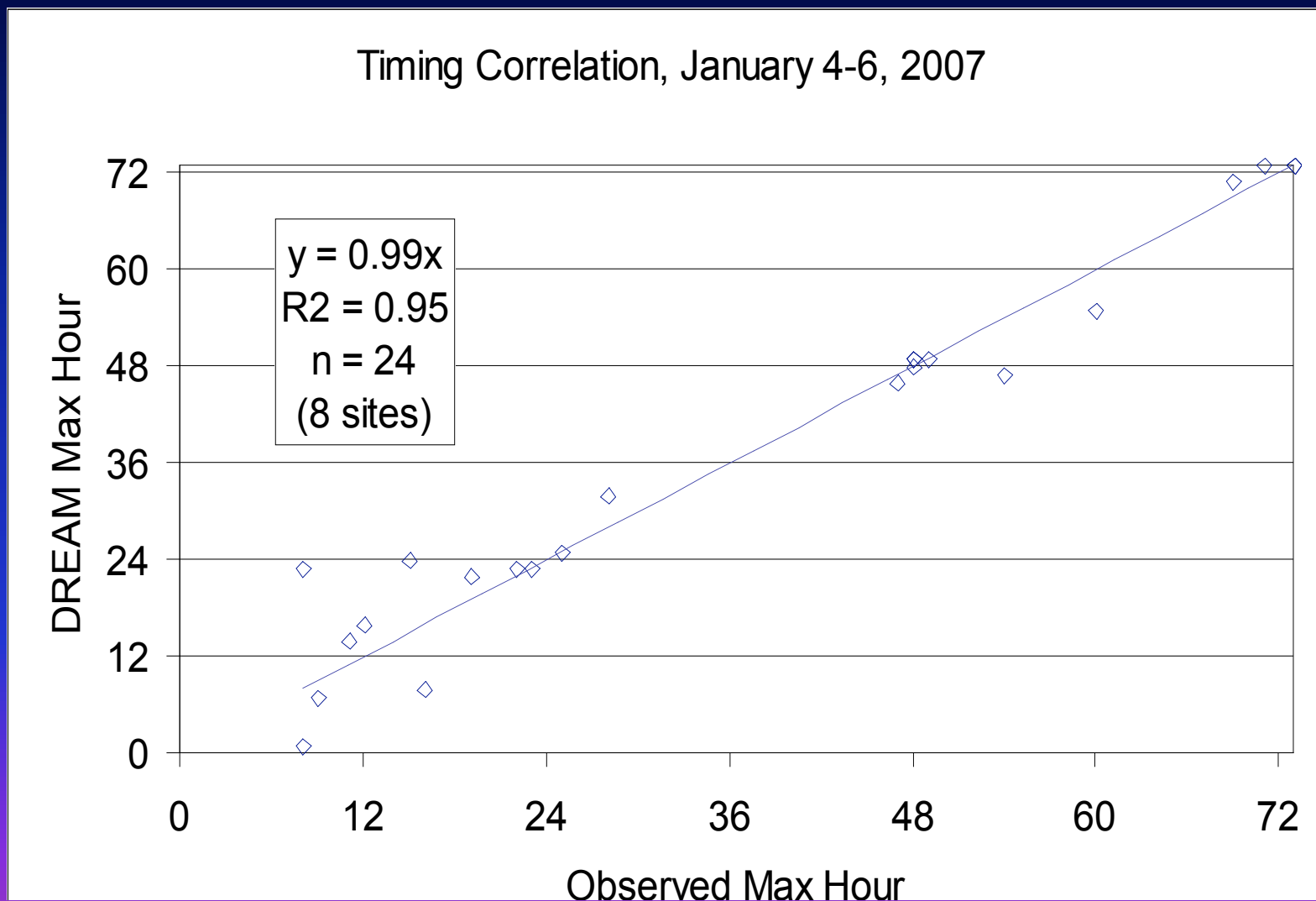


Model vs Observed Concentration





Model vs Observed Hour of Max



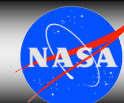


NEW DIRECTIONS

- Particle Speciation
- High Performance Computing
- Land Surface (Source) Updates
- Vertical Profile Verification



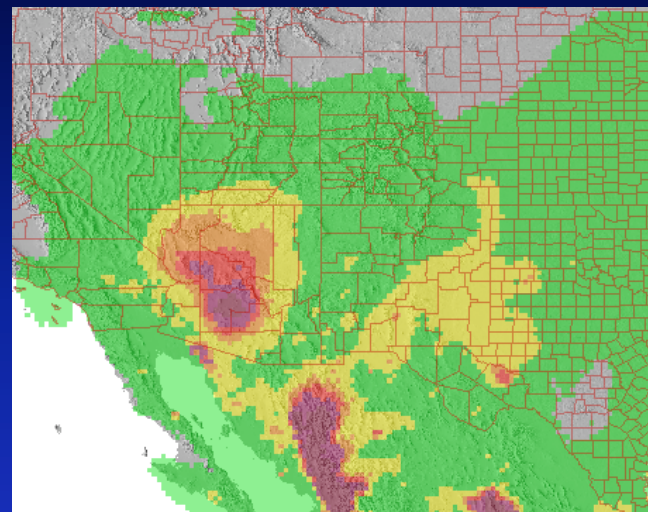
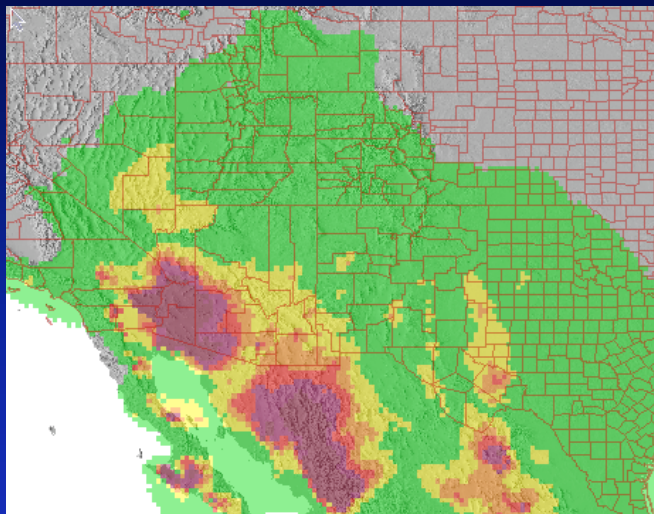
NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007



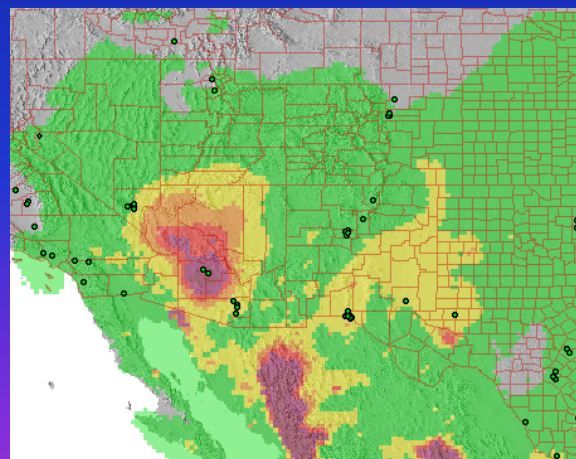


DREAM PM_{2.5} Forecast

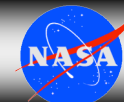
16 April 2007



With AIRNow Station Validation Points



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

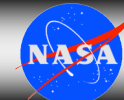




Web Client & Delivery System



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





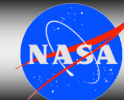
Basic Architecture



The University of New Mexico



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007



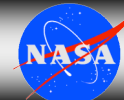


Web Client Components

- Interactive mapping client
 - Standard capabilities: pan, zoom, layer selection
 - Display time-enabled data: EPA AIRNow ground observations, DREAM output
 - Summarization over specified regions: DREAM model output over irregular regions (e.g. county)
 - Time Series tool with plot and animation



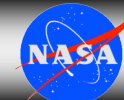
NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





Web Client Components

- EPA AIRNow data
 - View and download
 - Summary statistics
- Paired DREAM and EPA AIRNow values
 - Summary statistics
 - View and download
 - Measures of association





Client Interface Prototype: Time Series

The screenshot displays the PHAIRS Dust Modeling Client interface. The main window is titled "PHAIRS Dust Modeling Client" and "72 hr Dust Model for Lubbock, TX (PM 2.5)". It features a map of the western United States with a dust concentration overlay. A red arrow points to the location of Lubbock, TX. To the right of the map is a "Dust Concentration Plot" showing the Air Quality Index Level (Y-axis, 0 to 6) over time (X-axis, 0 to 70 UTC hours). The plot shows a sharp peak in AQI level around 20 UTC hours, reaching a level of 6. Below the plot, the location is identified as "Lubbock, TX (33:39:00N-101:49:11W)".

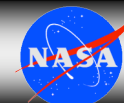
The interface includes a "Dust Animation Key" with the following categories:

- Time Series Target (blue star)
- AQI 1 (1-50ug/m3) (light green)
- AQI 2 (51-100ug/m3) (green)
- AQI 3 (101-150ug/m3) (yellow-green)
- AQI 4 (151-200ug/m3) (yellow)
- AQI 5 (201-300ug/m3) (orange)
- AQI 6 (>=300ug/m3) (red)

At the bottom of the interface, there are controls for "Date" (12/15/03), "UTC Time" (19 hrs), and "Particle Size Class" (PM 2.5). A "Generate PDF of Current Animation Step" button is also present.

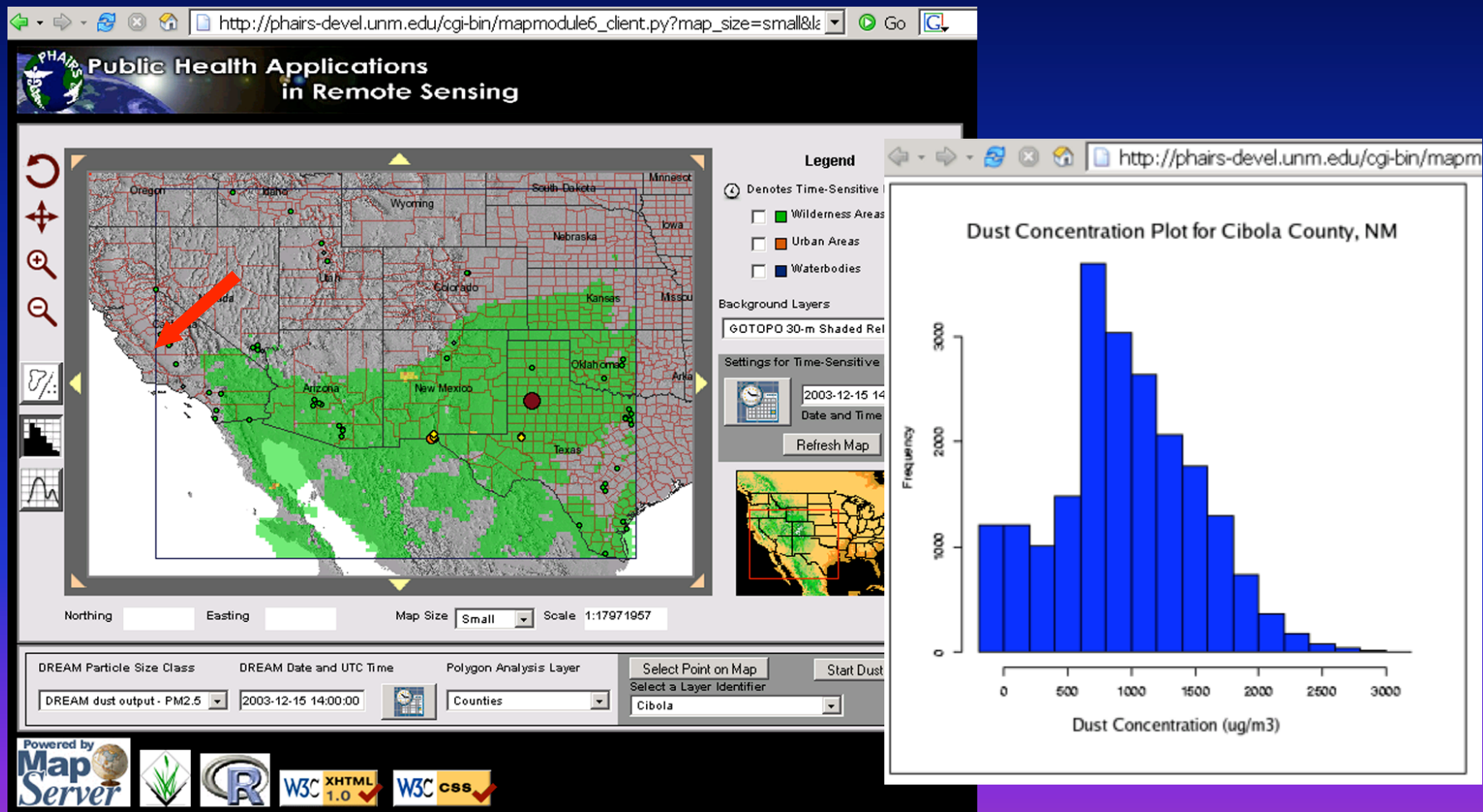


NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

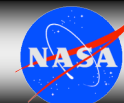




Client Interface Prototype: Density Plot



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





DREAM Data Access and Statistical Wizard

Data Access

Download EPA PM2.5 Data (returns all data for all sites within the DREAM domain area)

Begin Date (YYYYMMDD) End Date (YYYYMMDD)

Download EPA PM2.5 Data for a Single Site Within the DREAM Domain Area

Begin Date (YYYYMMDD) End Date (YYYYMMDD) Station ID-Name
 4013401

Download EPA PM10 Data (returns all data for all sites within the DREAM domain area)

Begin Date (YYYYMMDD) End Date (YYYYMMDD)

Download EPA PM10 Data for a Single Site Within the DREAM Domain Area

Begin Date (YYYYMMDD) End Date (YYYYMMDD) Station ID-Name
 4013401

View a Table of Observed and Modelled Data for all domain stations

Date (MM-DD-YYYY) Time (HH:MM:SS)

View a Table of Observed and Modelled Data for a Single Station

Date (MM-DD-YYYY) Particle Size

View a Table of Observed and Modelled Data for a Single Station Run

Date (MM-DD-YYYY) Station ID-Name

View a Table of Observed and Modelled Data for a Single Station Run

Begin (MM-DD-YYYY) End (MM-DD-YYYY) Station ID-Name

Statistical Functions

Generate Statistics for a Single Station for a Single Run

Date (MM-DD-YYYY) Station ID-Name

Generate Statistics for a Single Station for a Single Run

Begin (MM-DD-YYYY) End (MM-DD-YYYY) Station ID-Name

Table of Observed and Predicted (DREAM) PM25 Values for the 48-hour period beginning 04/15/2007 (Station No. 350011013 / North Valley)

To save as a CSV file, right click on the link below, select 'Save Link As', and then provide a new filename with a .csv extension in the dialog box

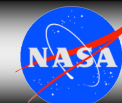
[Download CSV File](#)

Station ID	Station Name	Latitude	Longitude	EPA Observed (ug/m3)	DREAM Model Value (ug/m3)	Datetime (YYYY-MM-DD"THH:MM:SS)
350011013	North Valley	35.1878	-106.604	9.0	1.0075000279	2007-04-15T00:00:00
350011013	North Valley	35.1878	-106.604	7.0	0.9468014626	2007-04-15T01:00:00
350011013	North Valley	35.1878	-106.604	8.0	0.9998162003	2007-04-15T02:00:00
350011013	North Valley	35.1878	-106.604	10.0	1.063272094	2007-04-15T03:00:00
350011013	North Valley	35.1878	-106.604	10.0	1.1059926713	2007-04-15T04:00:00
350011013	North Valley	35.1878	-106.604	10.0	1.1227573542	2007-04-15T05:00:00
350011013	North Valley	35.1878	-106.604	9.0	1.1235294097	2007-04-15T06:00:00
350011013	North Valley	35.1878	-106.604	8.0	1.14150731	2007-04-15T07:00:00
350011013	North Valley	35.1878	-106.604	7.0	1.2136764386	2007-04-15T08:00:00
350011013	North Valley	35.1878	-106.604	7.0	1.3928309083	2007-04-15T09:00:00
350011013	North Valley	35.1878	-106.604	7.0	1.6509559225	2007-04-15T10:00:00
350011013	North Valley	35.1878	-106.604	8.0	1.9005882389	2007-04-15T11:00:00
350011013	North Valley	35.1878	-106.604	9.0	2.1024263957	2007-04-15T12:00:00
350011013	North Valley	35.1878	-106.604	8.0	2.2592646234	2007-04-15T13:00:00
350011013	North Valley	35.1878	-106.604	7.0	2.2293381831	2007-04-15T14:00:00
350011013	North Valley	35.1878	-106.604	8.0	2.0158823799	2007-04-15T15:00:00
350011013	North Valley	35.1878	-106.604	8.0	1.9149264869	2007-04-15T16:00:00
350011013	North Valley	35.1878	-106.604	7.0	4.448529552	2007-04-15T17:00:00
350011013	North Valley	35.1878	-106.604	6.0	6.8639706163	2007-04-15T18:00:00
350011013	North Valley	35.1878	-106.604	6.0	12.3272054336	2007-04-15T19:00:00
350011013	North Valley	35.1878	-106.604	6.0	20.8937504712	2007-04-15T20:00:00
350011013	North Valley	35.1878	-106.604	2.0	27.4044121013	2007-04-15T21:00:00
350011013	North Valley	35.1878	-106.604	4.0	30.1459564882	2007-04-15T22:00:00
350011013	North Valley	35.19	-106.6	missing	30.1911774804	2007-04-15T23:00:00
350011013	North Valley	35.1878	-106.604	6.0	31.2290444094	2007-04-16T00:00:00
350011013	North Valley	35.1878	-106.604	7.0	32.4169130886	2007-04-16T01:00:00
350011013	North Valley	35.1878	-106.604	8.0	30.877940795	2007-04-16T02:00:00
350011013	North Valley	35.1878	-106.604	7.0	29.4794110691	2007-04-16T03:00:00
350011013	North Valley	35.1878	-106.604	6.0	28.7514714634	2007-04-16T04:00:00

Data Access & Statistics



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





Enhancing SYRIS DSS

PHAIRS 7.0 Mapping Client - Netscape

File Edit View Go Bookmarks Tools Window Help

http://phairs-devel.unm.edu:8080/cgi-bin/mapmodule7_client.py?map_size=small&layer=us_census_t...

Netscape Enter Search Terms Search Highlight Pop-Ups Blocked: 67 Form Fill Clear Browser History

PHAIRS Dust Modeling Client
72 hr Dust Model for Albuquerque, NM (PM 2.5)

Dust Concentration Plot

Air Quality Index Level

UTC Hours (72 hour forecast)

Albuquerque, NM (35:06:00N-106:36:00W)

Dust Animation Key

- Time Series Target
- AQI 1 (1-50ug/m3)
- AQI 2 (51-100ug/m3)
- AQI 3 (101-150ug/m3)
- AQI 4 (151-200ug/m3)
- AQI 5 (201-300ug/m3)
- AQI 6 (>300ug/m3)

Date: 12/15/03 UTC Time: 12 hrs Particle Size Class: PM 2.5

Generate PDF of Current Animation Step

Return to Syndrome Overview DREAM Model Output

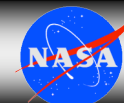
Jul 15, 2005 11:48:36 AM

Report Syndrome Log Out

Start SYRIS - Netscape PHAIRS 7.0 Mapping Client... PHAIRS 7.0 Mapping CL... 9:51 AM



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

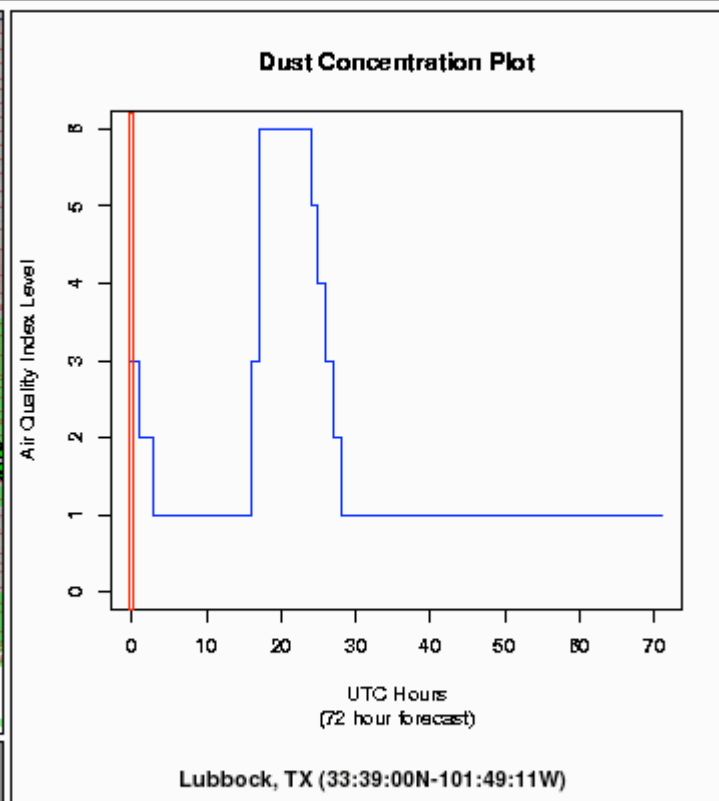
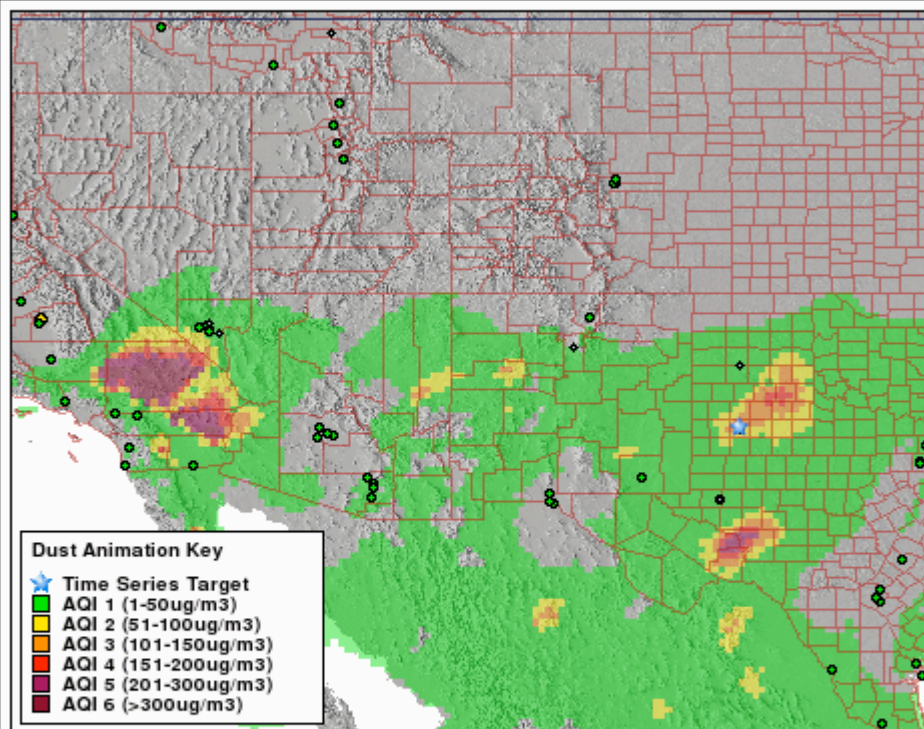




Animation of Dust Concentration

PHAIRS Dust Animation Client

72 hr Dust Model for Lubbock, TX (PM 10)

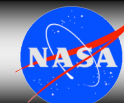


Date	UTC Time	Particle Size Class
12/15/03	00 hrs	PM 10

Generate PDF of Current Animation Step



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007





Thank you.

<http://phairs.unm.edu>



NASA PH-AQ Workshop, Potomac, MD, May 8-9, 2007

