

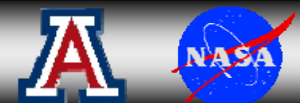


PHAIRS Project: Evolution and Implementation

Stan Morain, William Sprigg, Amelia
Budge

NASA Public Health Applications Program
CA NNSO4AA19A

Biloxi, MS September 17-19, 2008





Aims and Goals

- **Focus on SW dust storms, respiratory diseases, and syndromic surveillance**
- **Three Technical Goals**
 - **Assimilate ESR data into DREAM/SW to create eD/SW**
 - **Verify and validate incremental improvements to eD/SW outputs as inputs to SYRIS**
 - **Collaborate with public health authorities to assess relationships between dust episodes and respiratory conditions**



Steps in PHAIRS Progress

DREAM R&D-Mediterranean / NCEP/eta & DREAM Domain-Western USA

DREAM/MED

DREAM/SW

Enhanced DREAM/SW

DREAM

DREAM / MED Performance
(Qualitative)

DREAM/SW Domain & Baseline
Performance Before ESR Assimilation

eD/SW Performance
After ESR Assimilations

Assessment & Initial Benchmark
Sept. '05

Verification / Validation
Sept. 2007

Final Benchmark
Sept. '08

Step 0

Step 1

Step 2

Step 3

Step 4

Step 5

2000

'01

'02

'03

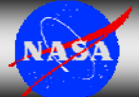
'04

'05

'06

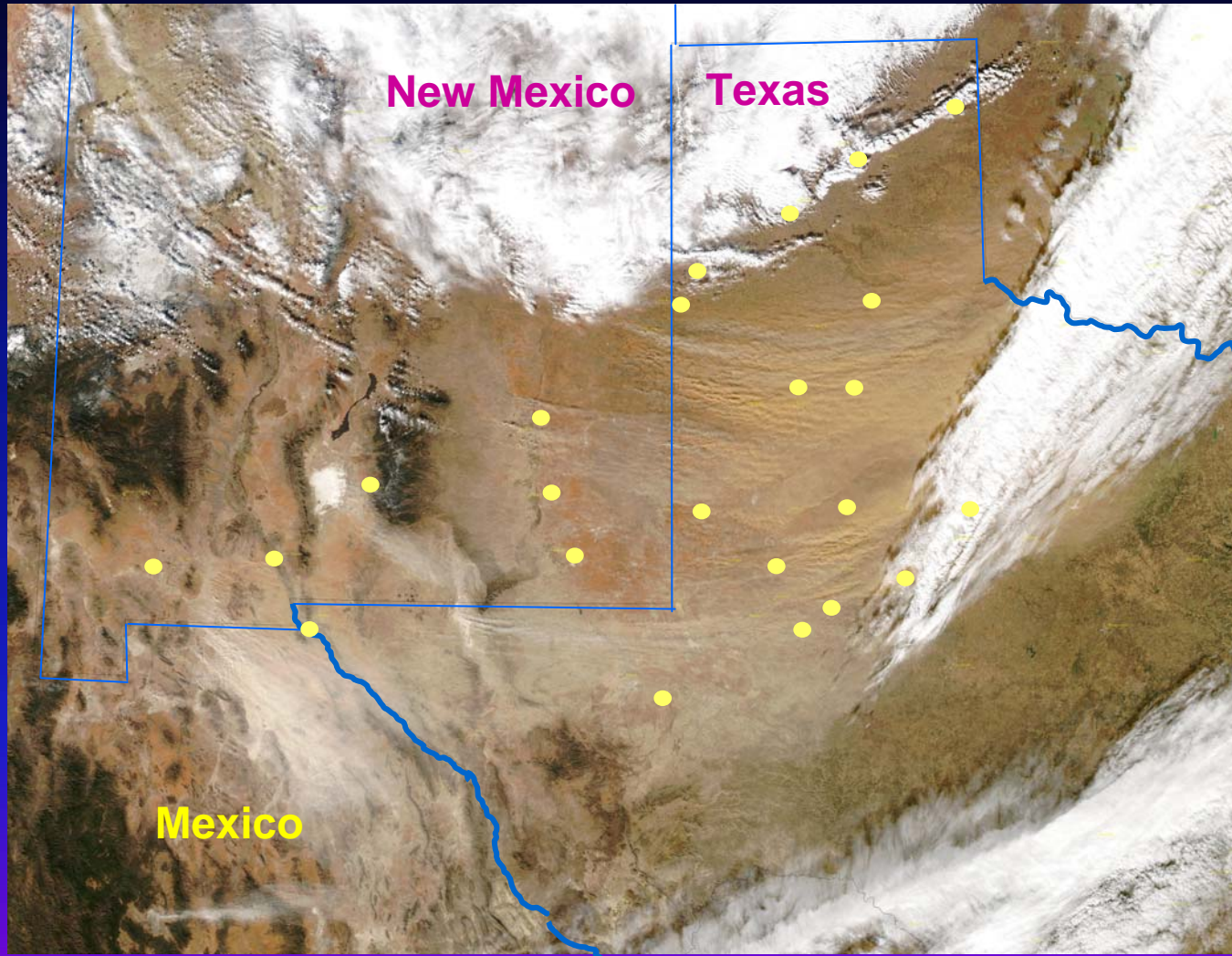
'07

'08



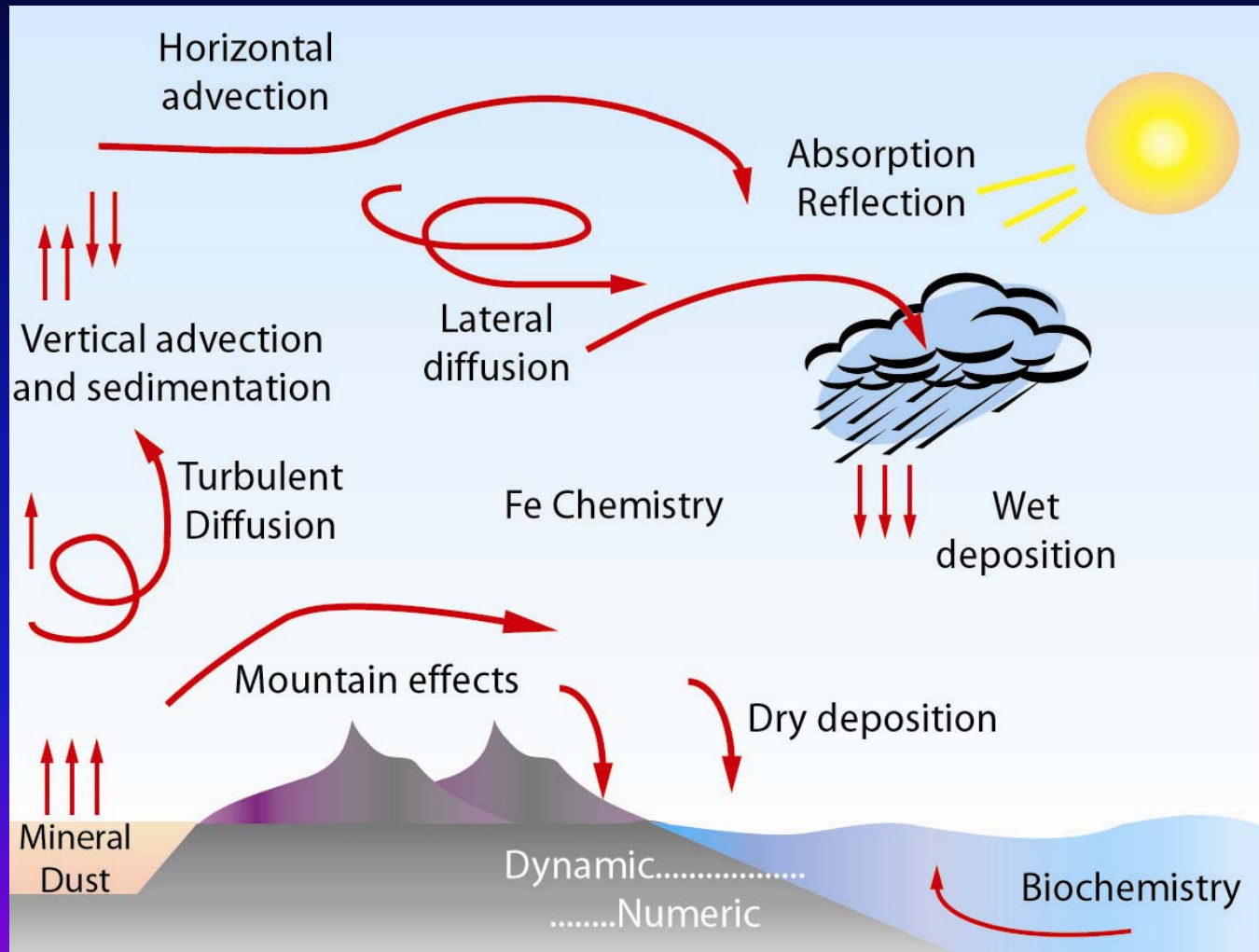


Dust Sources and Dust Transport



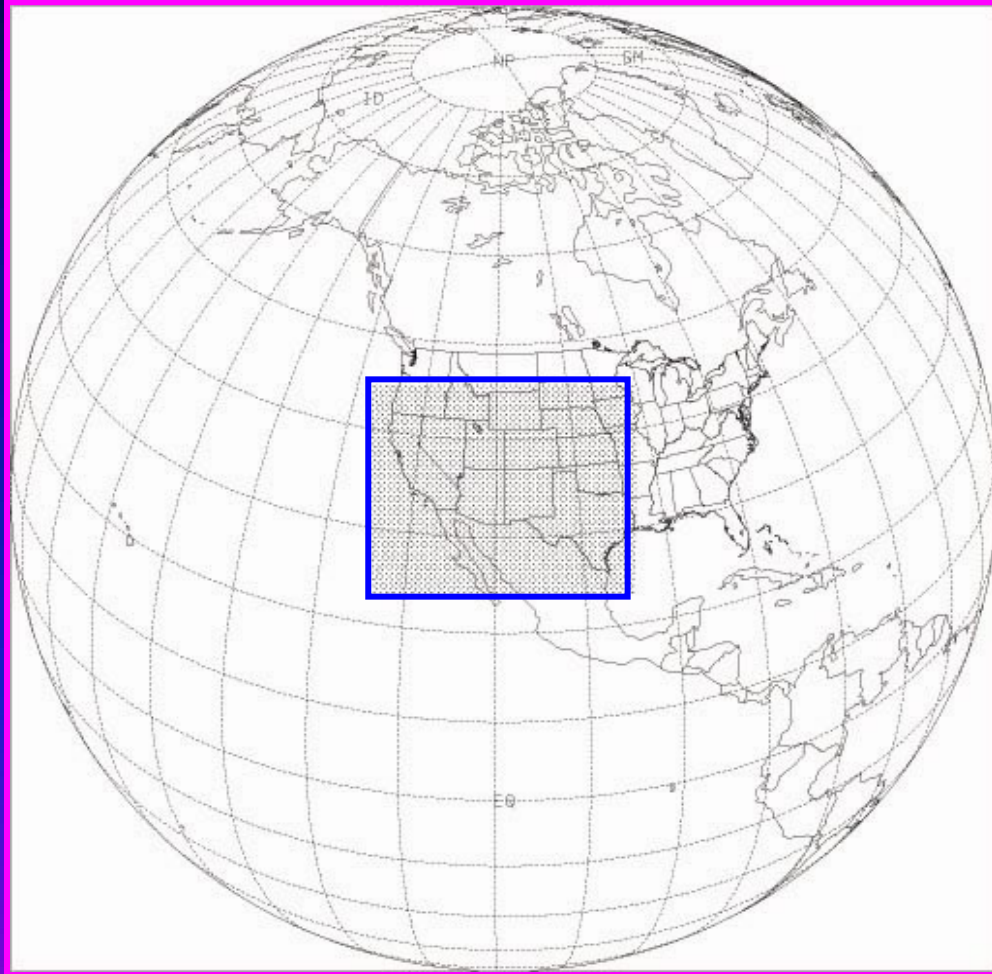


DUST Entrainment & Transport





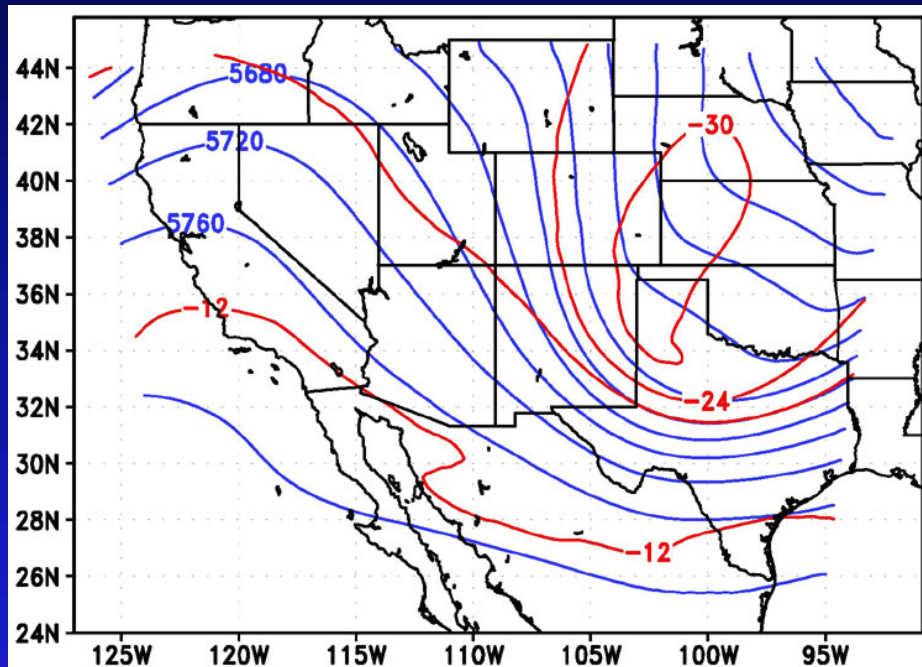
DREAM/SW & eD/SW Model Domain



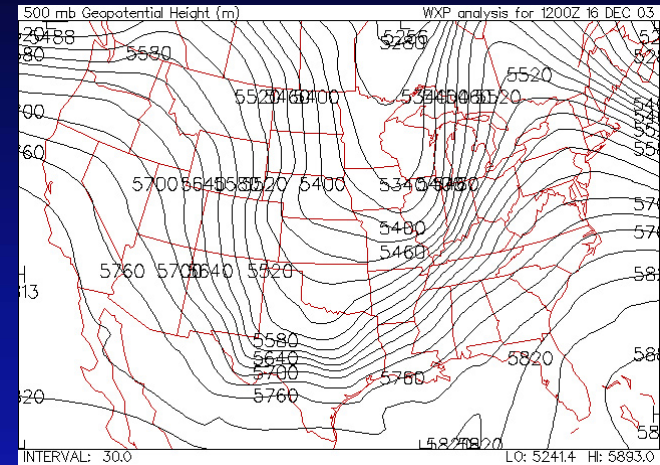
- Domain center at (109°W, 35°N)
- Horizontal semi-staggered Arakawa E grid
- Horizontal grid spacing 1/3 degree



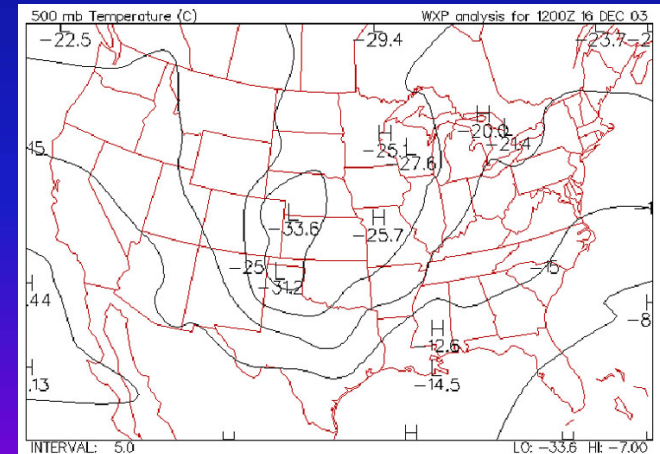
DREAM/SW vs. Observed Synoptic Patterns, 12Z 16 Dec 03



DREAM/SW Simulation
red = isotherms
Blue = isobars



Observed Geopotential Height



Observed Temperature



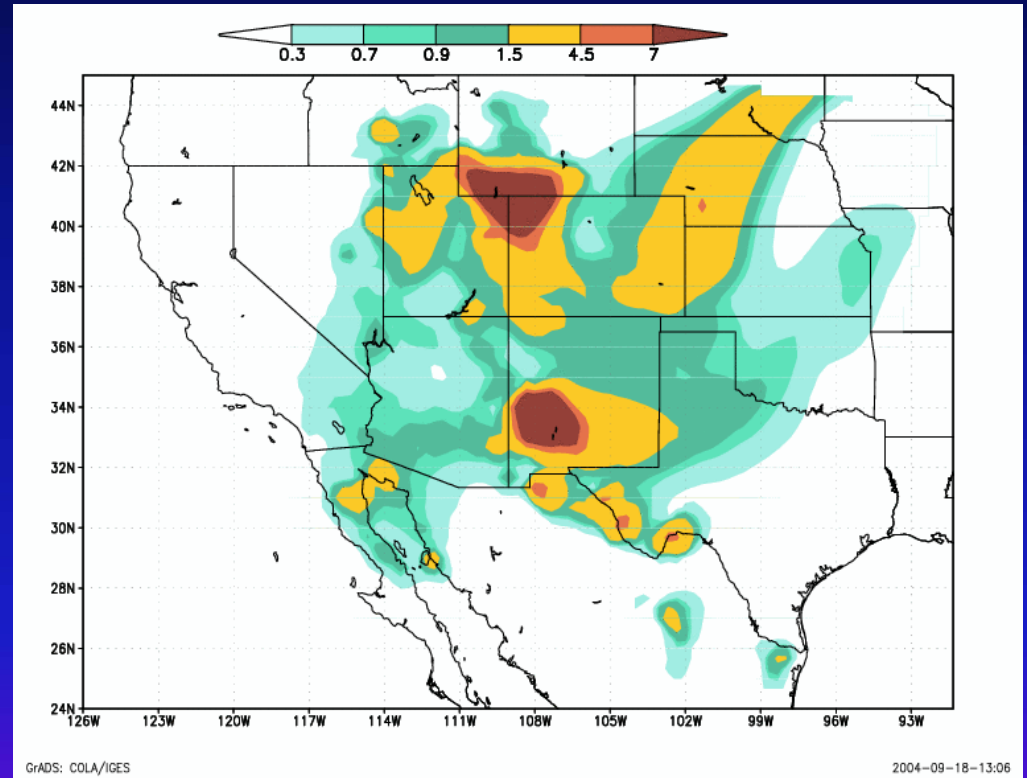
Baseline Model Performance

Observed Visibility vs. DREAM/SW Dust Concentrations Dec. 15-16, 2003

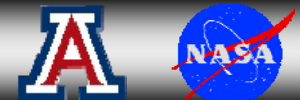


Texas

Continuous Air Monitoring Stations



DREAM/SW



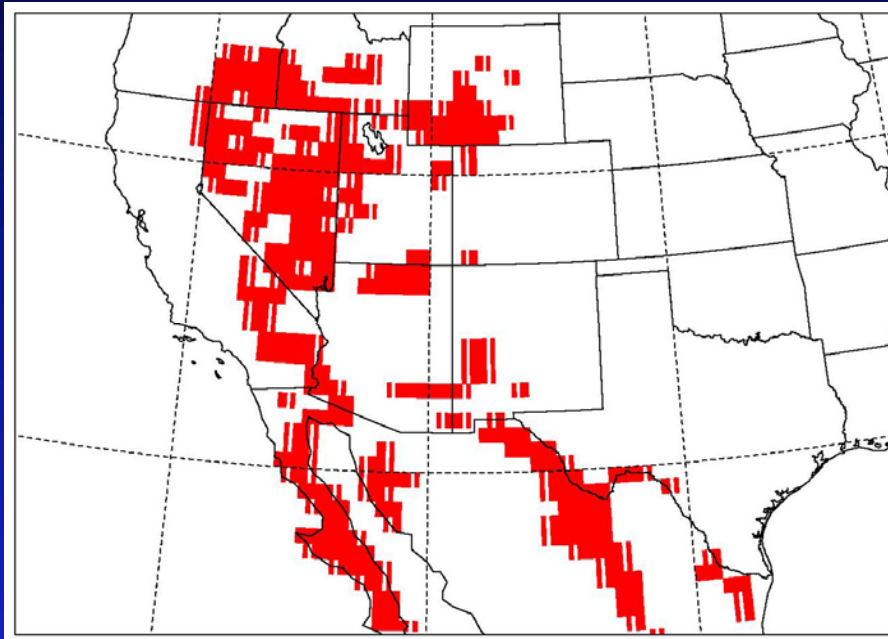


Baseline and Replacement Parameters

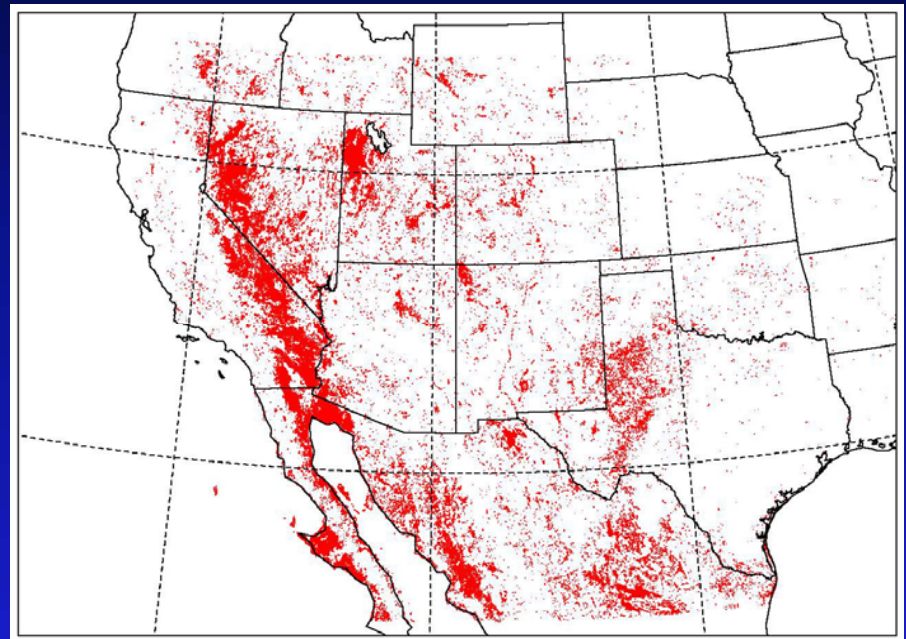
DREAM/SW Parameters	Function/Purpose	eD/SW Parameters
NCEP/eta global forecast model	Initial & boundary conditions; Res.=1°	NCEP/eta global forecast model
Olsen World Ecosystems	Land cover; Res.=10min.	MOD12 Res.=1km
USGS terrain data	Res.=1km	SRTM30 Res.=1km
Aerodynamic roughness length: based on 12 SSiB land cover types	Estimate dust entrainment potential	Look-up table based on MOD12 barren class
Soil Moisture: simulated land surface model	Res.=2min.; categories reduced to texture categories	AMSR-E



Barren Ground (Most Likely Dust Sources)



Olson World Ecosystems
barren ground class



MOD12Q1 barren categories
reduced to binary format



Sample Model Runs of eD/SW and Assimilated Parameters

Run #	MOD12	SRTM	Surface roughness length	FPAR	AMSR-E	REGAP
Run 1a	DREAM/SW—no parameter replacements					
Run 2c	Y					
Run 4a	Y	Y				
Run 5a	Y	Y	Y			
Run 5b	Y	Y	Y			
Run 6a	Y			Y		
Run 15a	Y				Y	
Run 10a	Y	Y	Y		Y	
Run 20a						Y



DREAM/SW vs. eD/SW (model run 1a vs. model run 10a)

Metrics	Wind Speed (m/s)	Wind Direction (°)	Temp. (K)	Definition (M = modeled; O = observed)
Mean observed	5.53	231.40	276.74	$\frac{1}{N} \sum_{i=1}^N O_i$
Mean modeled	4.65 4.37	226.60 230.38	275.56 277.48	$\frac{1}{N} \sum_{i=1}^N M_i$
Mean bias	-0.88 -1.16	-4.80 -1.02	-1.20 0.72	$\frac{1}{N} \sum_{i=1}^N (M_i - O_i)$
Mean error	1.97 2.03	51.76 47.85	4.09 2.67	$\frac{1}{N} \sum_{i=1}^N M_i - O_i $
Agreement index	0.74 0.75	0.74 0.76	0.71 0.95	$1 - \frac{\sum_{i=1}^N (M_i - O_i)^2}{\sum_{i=1}^N (M_i - \bar{O} + O_i - \bar{O})}$

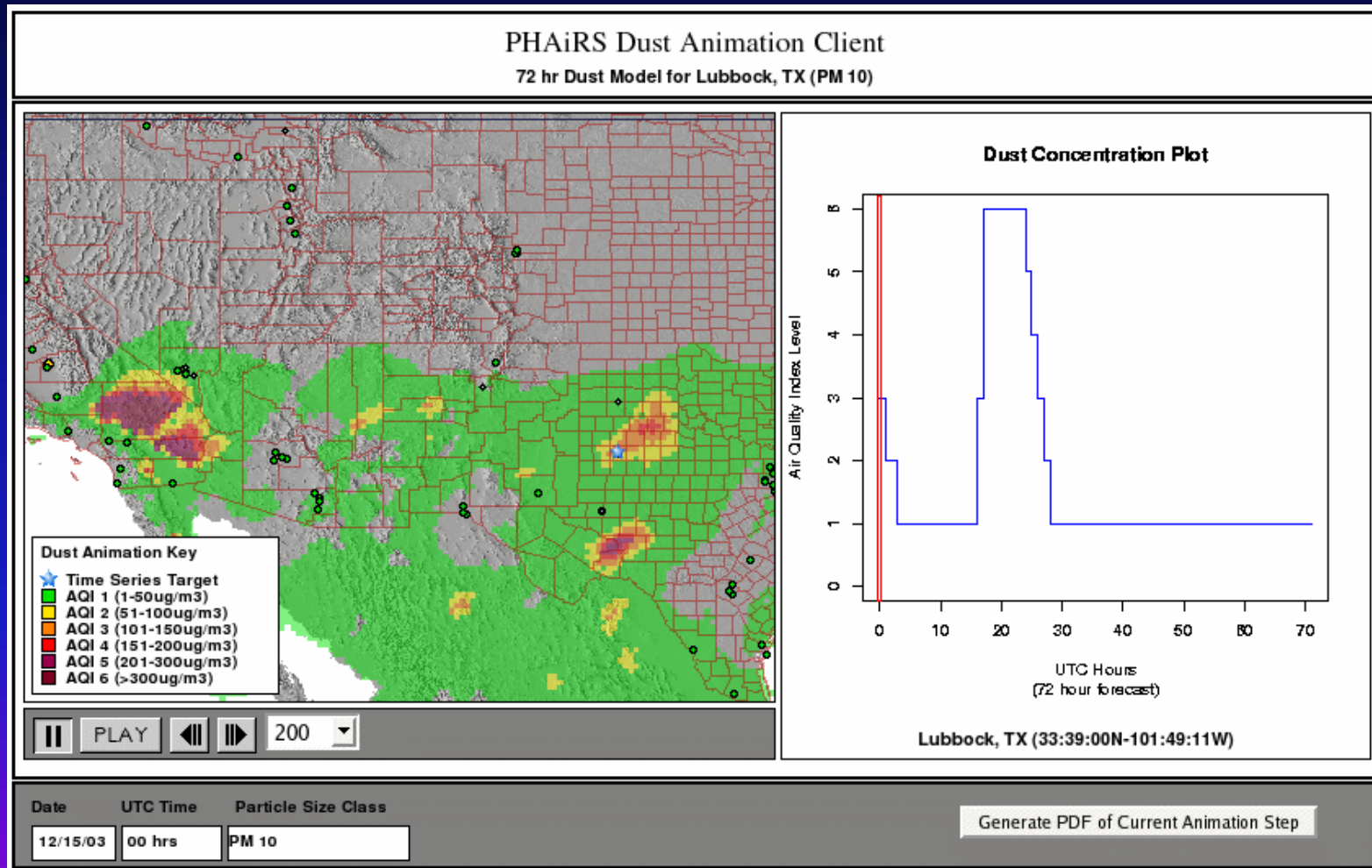
Blue = DREAM/eta (model run 1a)

Red = Enhanced DREAM/eta (model run 10a)



Dust Storm of December 15-17, 2003

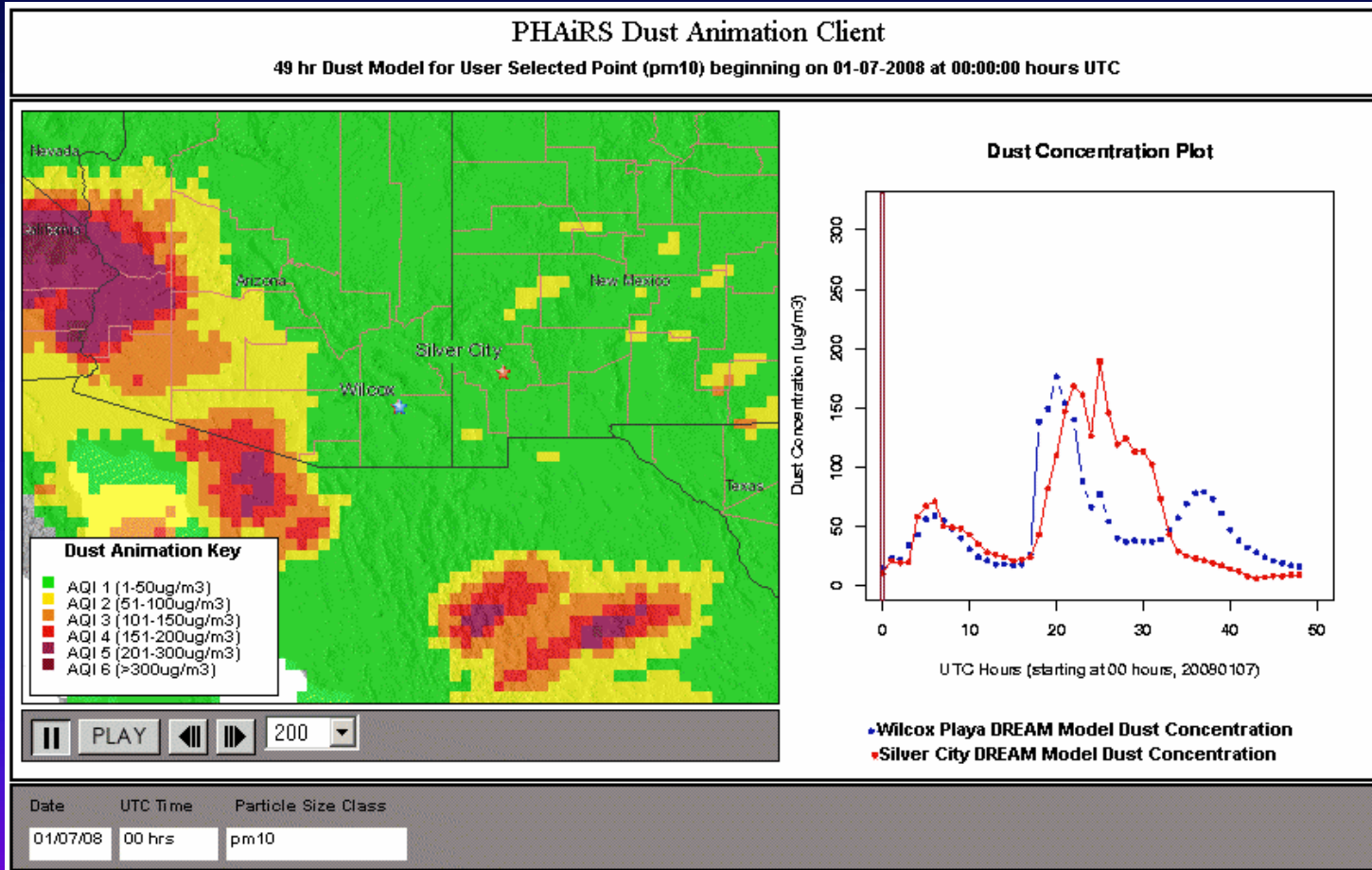
PM₁₀, Lubbock





Dust Storm of January 7, 2008

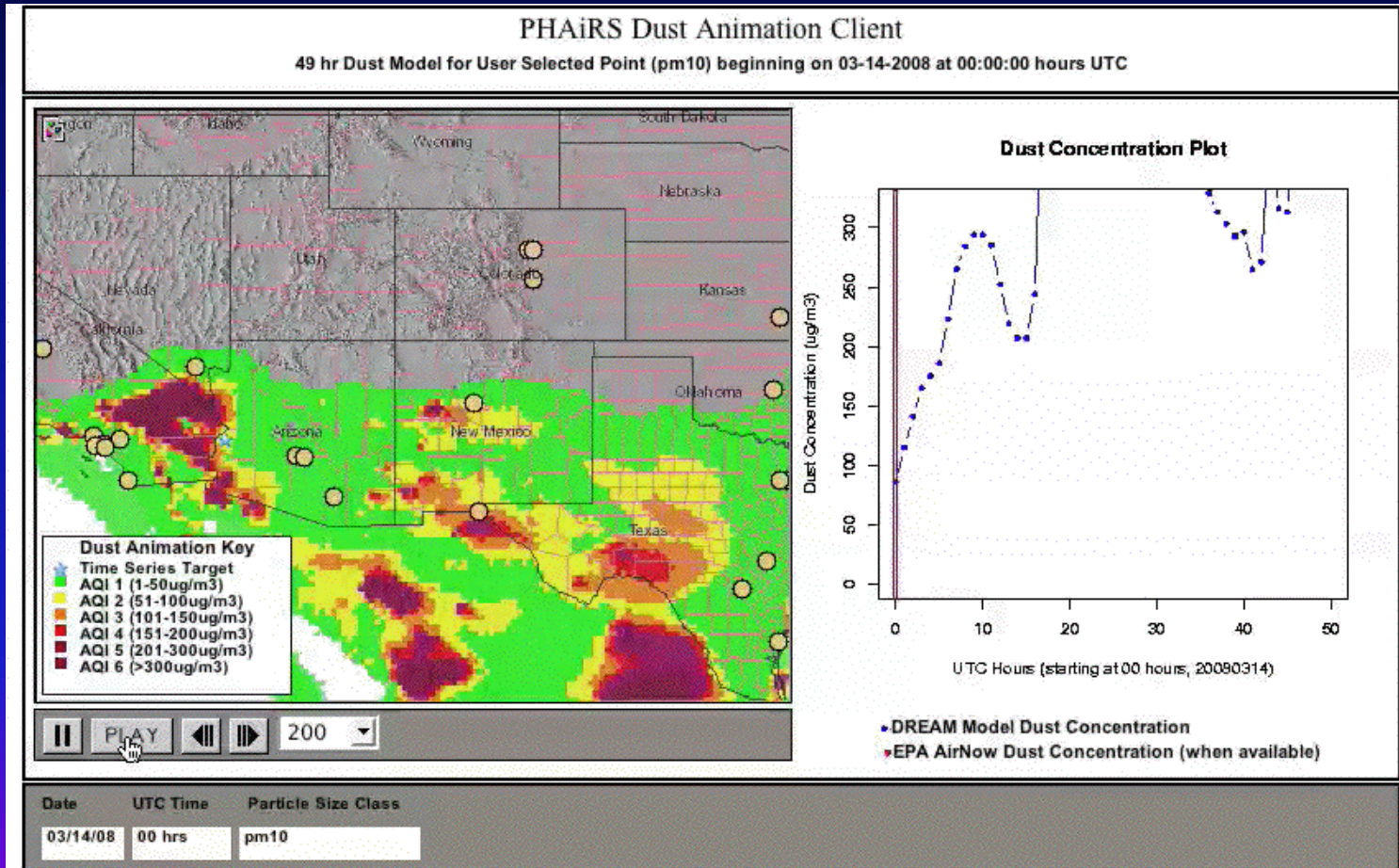
PM₁₀, Wilcox / Silver City





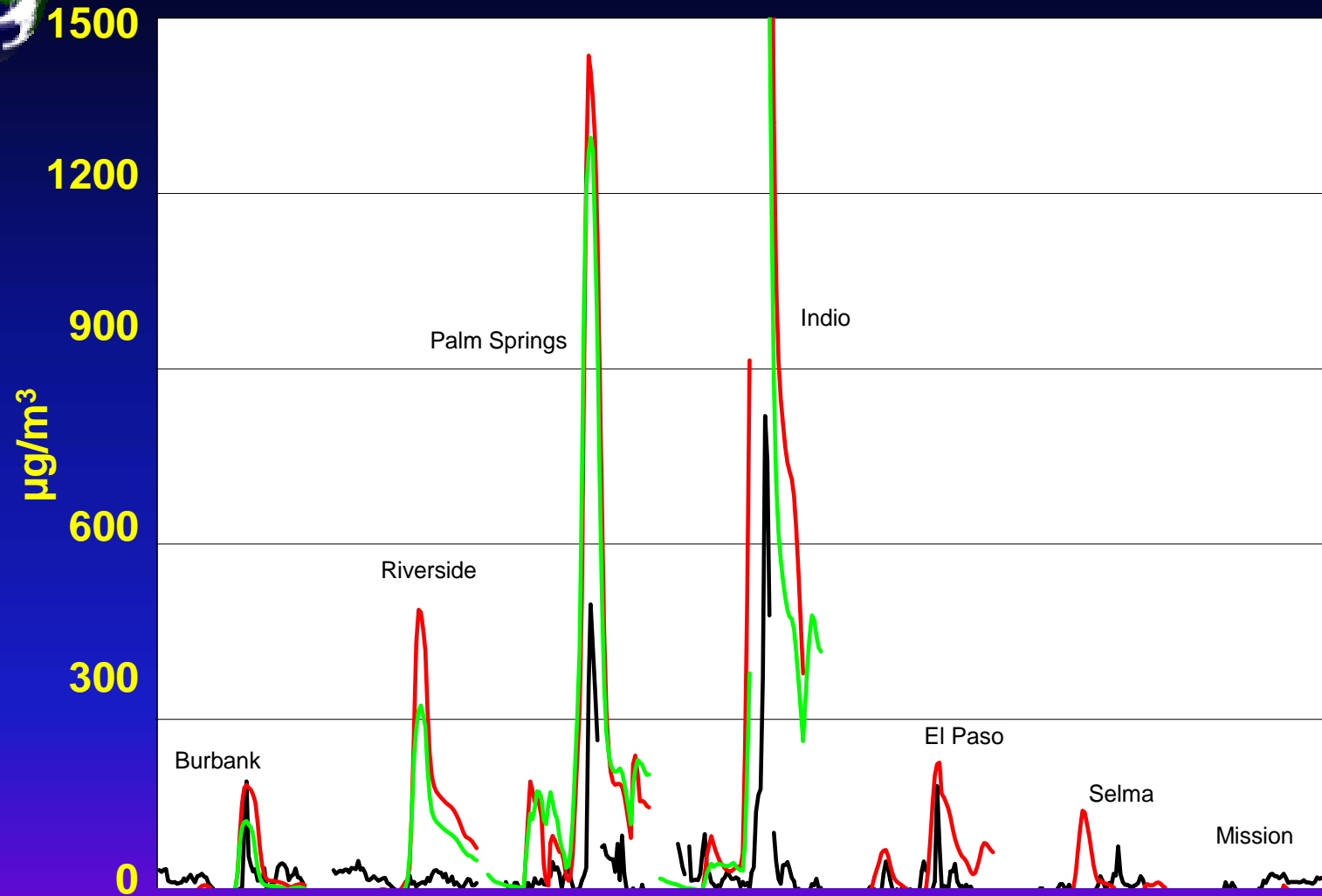
Dust Storm of March 14 2008

PM_{2.5}, Yuma

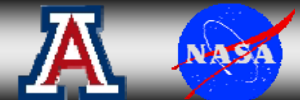




Dust Storm of January 4-6, 2007

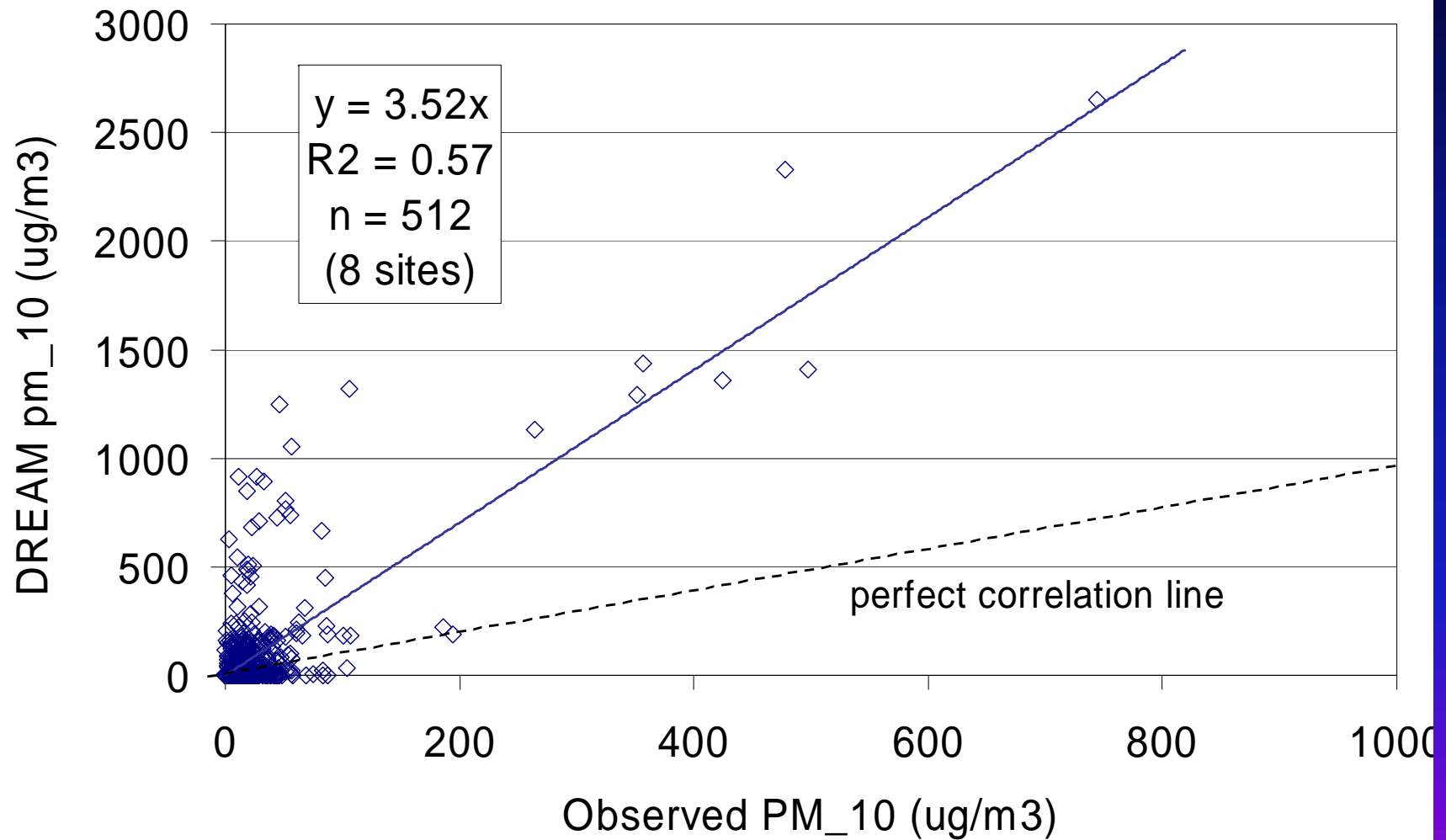


Black = PM_{10} observed (AIRNow data); Red= PM_{10} (ED/eta Run 15a); Green= PM_{10} (ED/eta Run 20a)



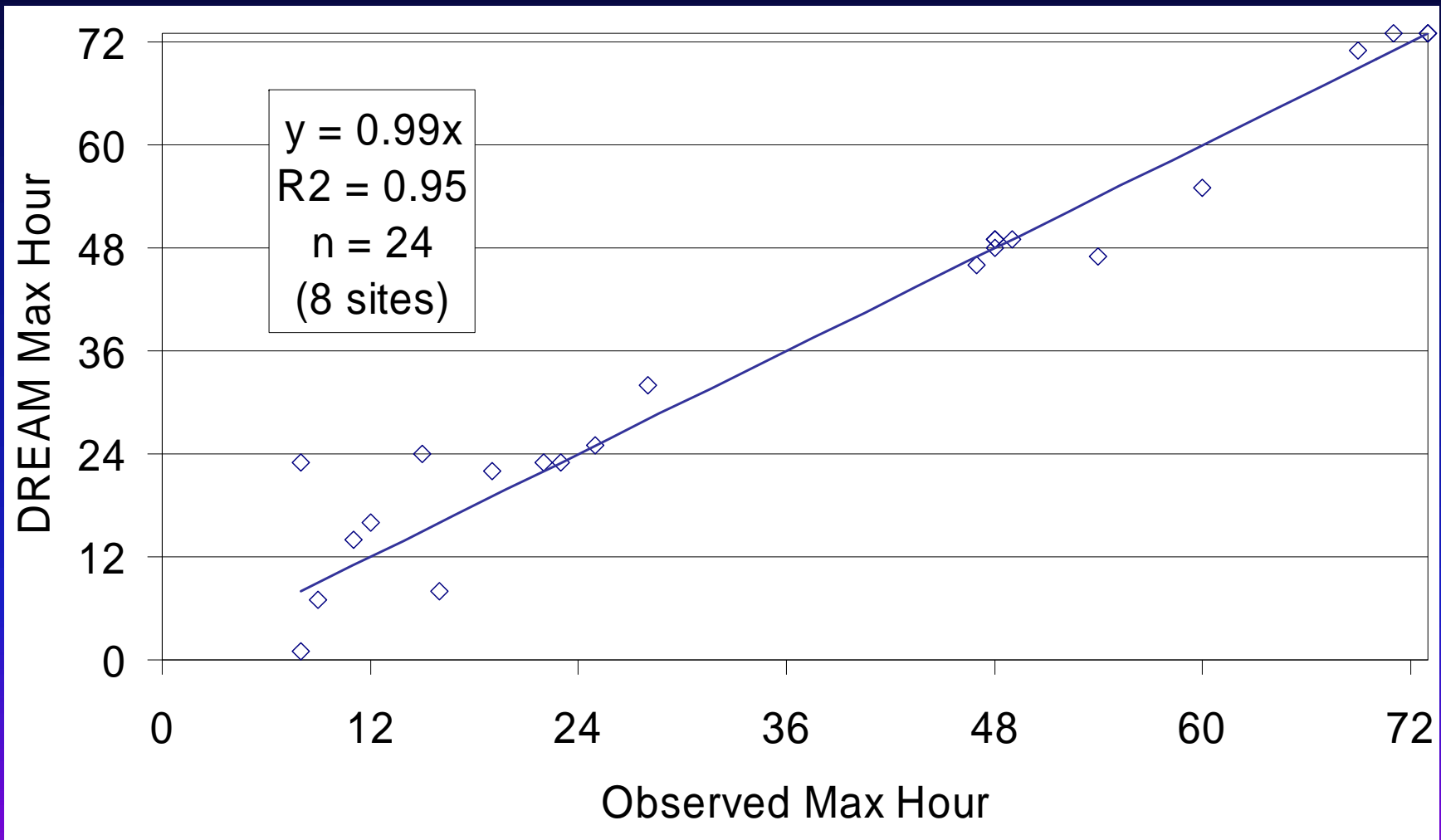


Magnitude Correlation - Jan 4-6, 2007





Timing Correlation - Jan 4-6, 2007





Point Stat tool Results

