

WRAP RMC
Phase II Wind Blown Dust Project

ENVIRON International Corporation
and
University of California, Riverside

August 24, 2004

Phase I Project Summary

- **Objectives**

- Develop general methodology based on ‘MacDougall Method’
- Develop 1996 gridded PM inventory of WB Dust for the Western States

- **Limitations**

- Threshold surface friction velocities
- Emission factors
- Vacant land stability
- Dust reservoirs
- Rain events
- Vegetation density

Phase II Project Background

- Develop improved general methodology based on Phase I recommendations and recent literature review
- Update gridded PM inventory of WB Dust for 2002 using the Inter-RPO regional modeling domain
- Develop of surface friction velocities and threshold friction velocities
- Develop improved emission flux relationships
- Improve vacant land characterization
 - Disturbance
 - Land use type
 - Reservoirs
- Conduct model performance evaluation

Revised methodology to consider:

- Threshold velocities
 - Emission factors
 - LULC and Soil characteristics
 - Reservoir characteristics
 - Agricultural adjustments
-
- Full presentation from DEJF Meeting in Reno
at <http://64.27.97.126/forums/dejf/meetings.html>

Characteristics of Dust Categories

Dust Category	3	4	6	7
Land use	Ag.	Grass	Shrubs	Barren
Surface roughness (cm)	0.031	0.1	0.05	0.002
Threshold friction Velocity (mile/h)	8.33	13.81	9.62	6.81
Threshold wind velocity at 38m height (mile/h)	29.50	44.25	32.75	28.50

Model Sensitivity Simulations

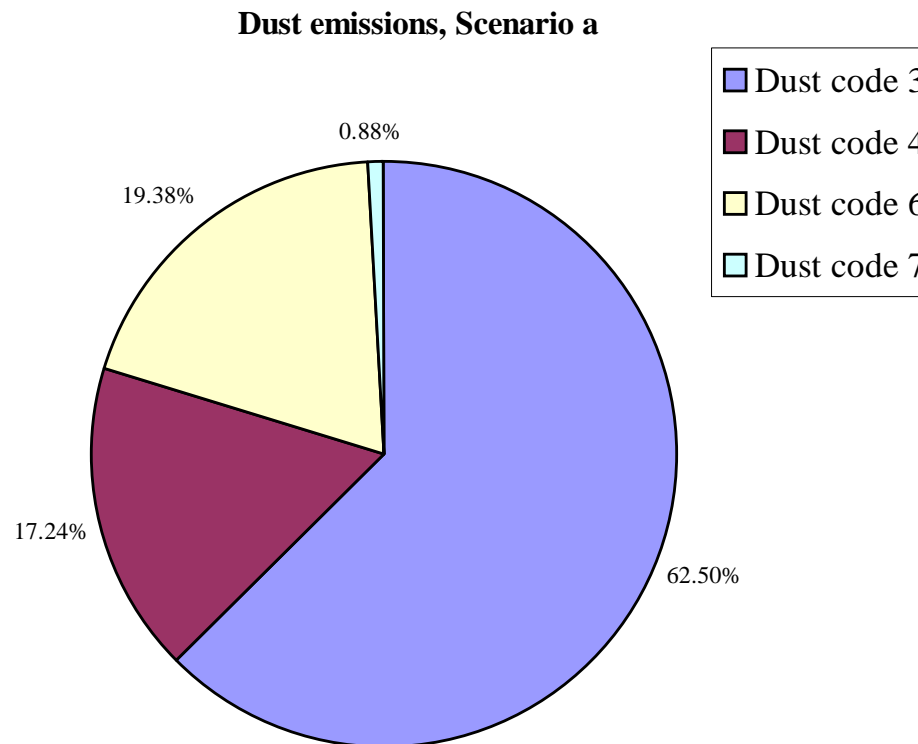
- Run a :
 - No limitation on dust event duration
 - All soils considered loose undisturbed
- Run b :
 - Dust events limited to 10 hrs/day
 - All soils considered loose undisturbed

Model Sensitivity Simulations

- Run c :
 - No limitation on dust event duration
 - Assume 10% of barren, grass & shrublands area is disturbed
 - Threshold velocity for grass & shrublands = $0.5 * \text{undisturbed value}$
 - Threshold velocity for barren lands = $.27 * \text{undisturbed value}$
- Run d :
 - Dust events limited to 10 hrs/day for undisturbed soils
 - Assume 10% of barren, grass & shrublands area is disturbed
 - Threshold velocity for grass & shrublands = $0.5 * \text{undisturbed value}$
 - Threshold velocity for barren lands = $.27 * \text{undisturbed value}$

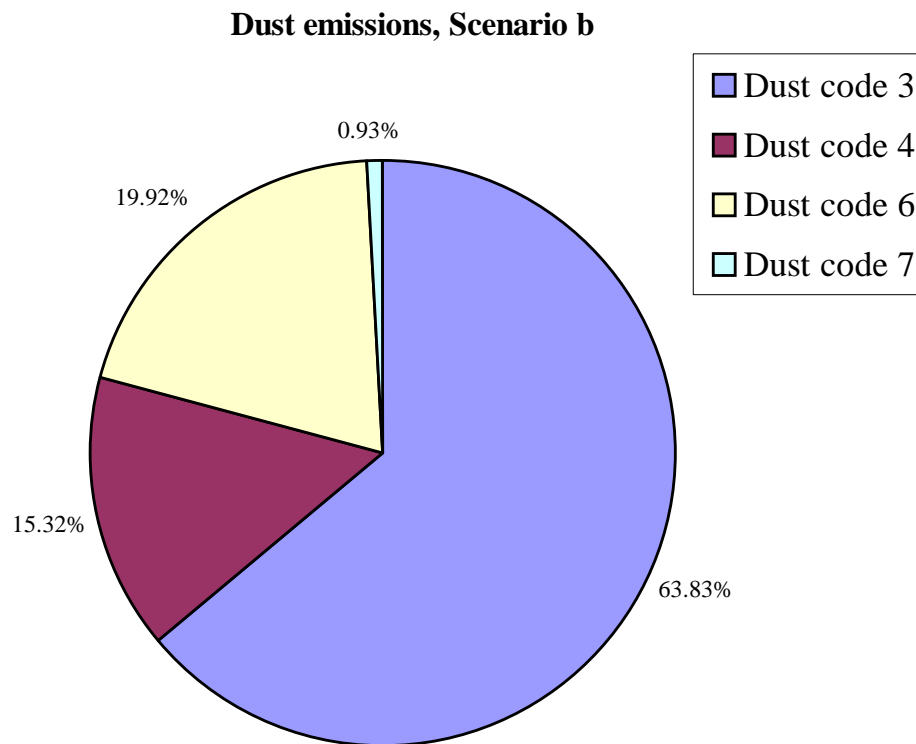
Model Results

Scenario a: no limit on duration; all soils loose, undisturbed



Model Results

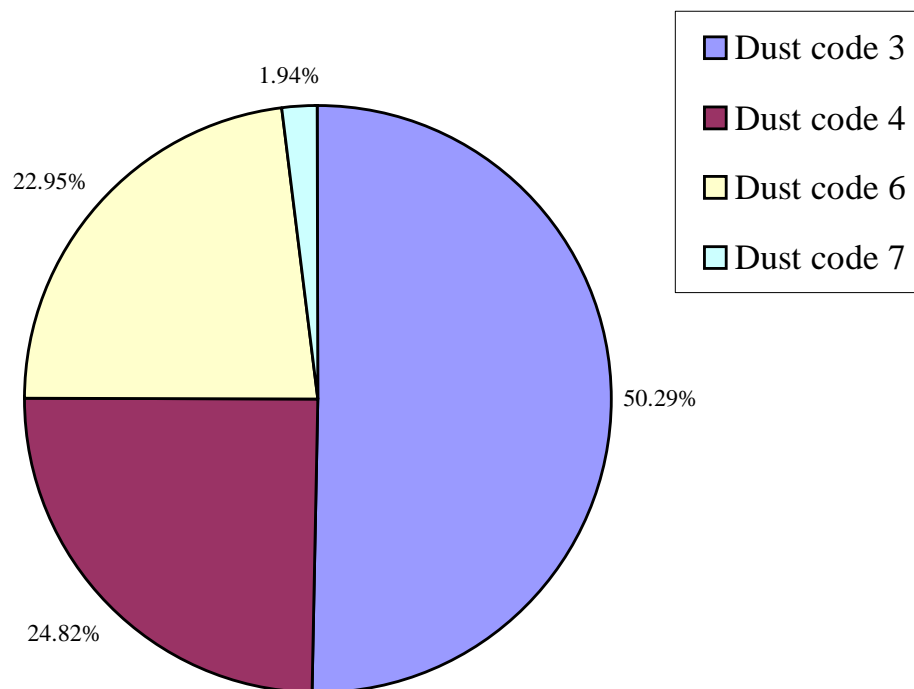
Scenario b: event duration ≤ 10 hrs/day; all soils loose, undisturbed



Model Results

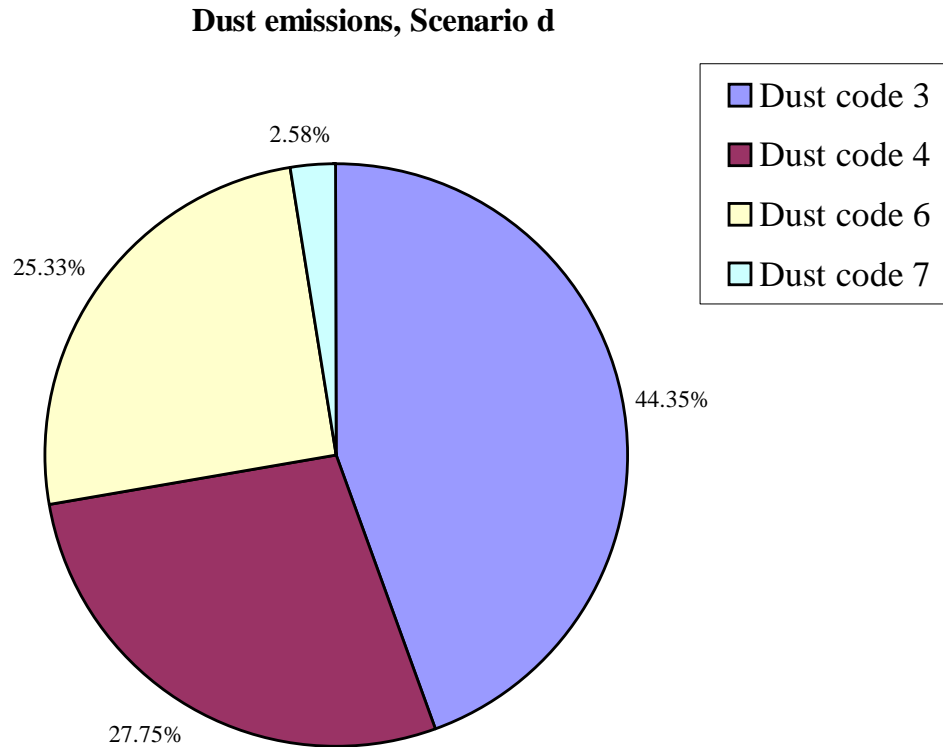
Scenario c: no limit on duration; assume 10% disturbed area for grass, shrub, barren lands

Dust emissions, Scenario c



Model Results

Scenario d: event duration \leq 10hrs/day for disturbed soils; assume 10% disturbed area for grass, shrub, barren lands

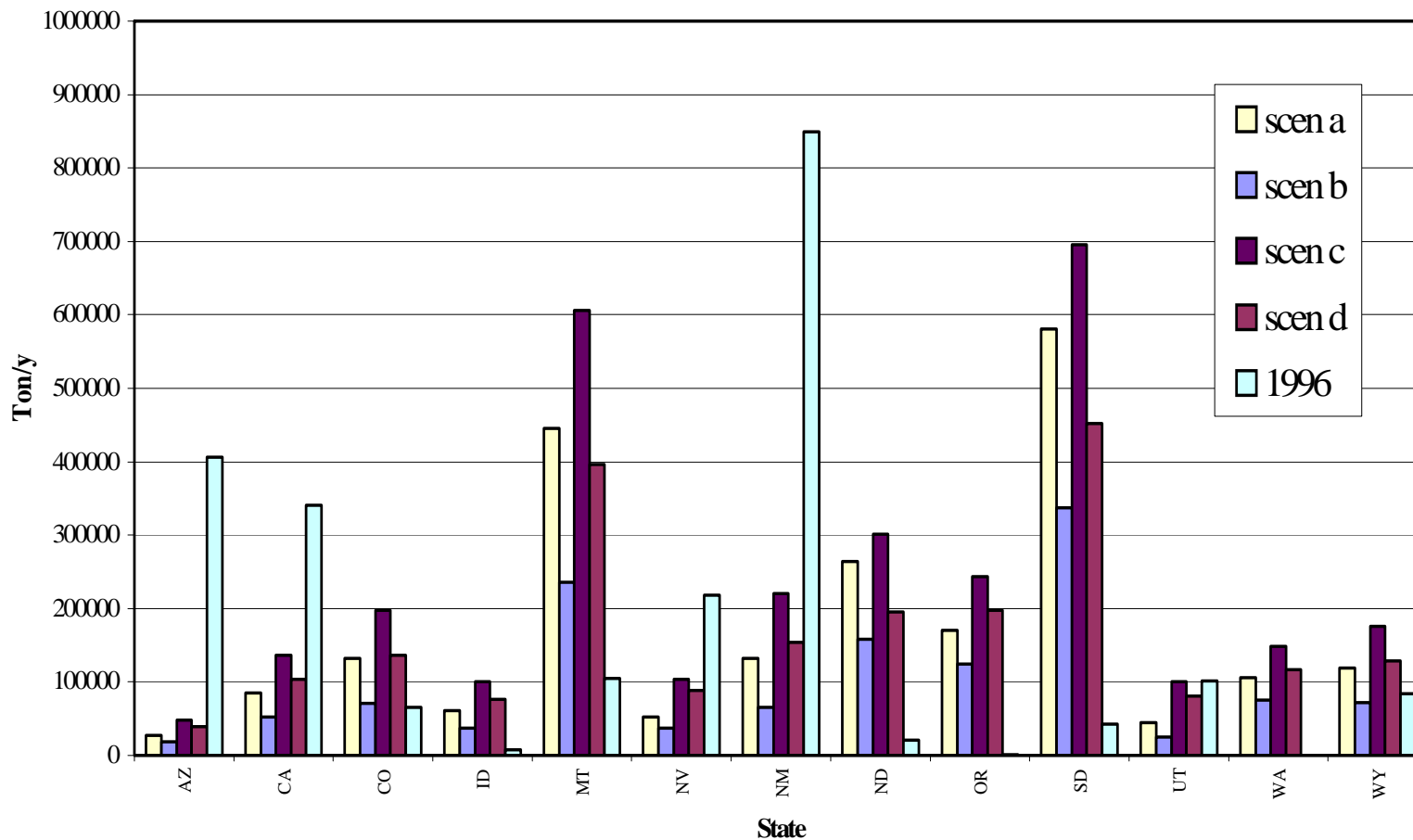


Dust Totals for WRAP States tons/year

Scenario	WRAP States	Domain Total (US only)
a	2,222,219	9,451,368
b	1,310,120	5,228,818
c	3,077,196	11,098,731
d	2,165,096	6,876,180
1996 Results	2,240,288	4,366,907

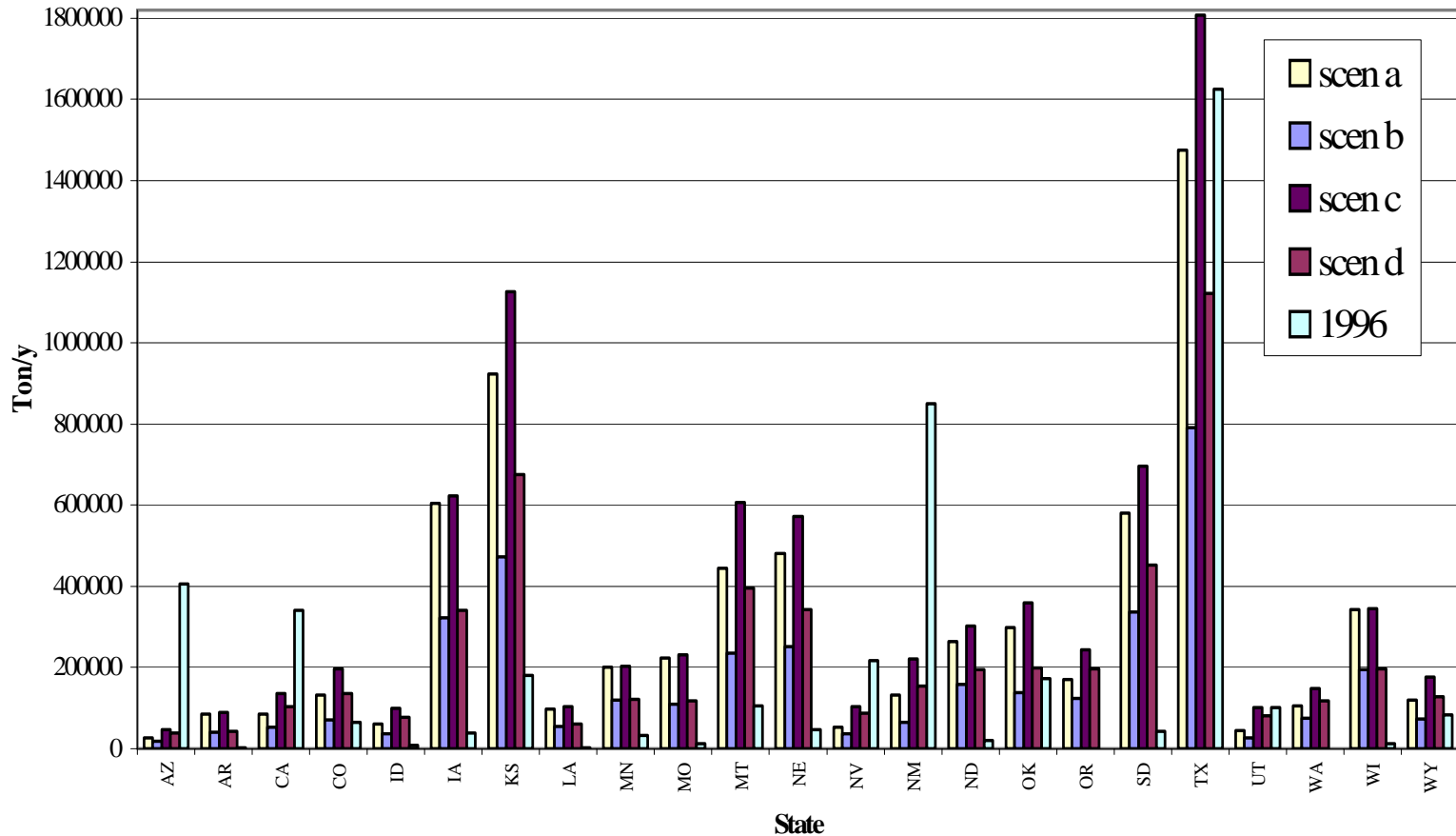
Annual PM10 for WRAP States

Dust Yearly Total by State
WRAP States



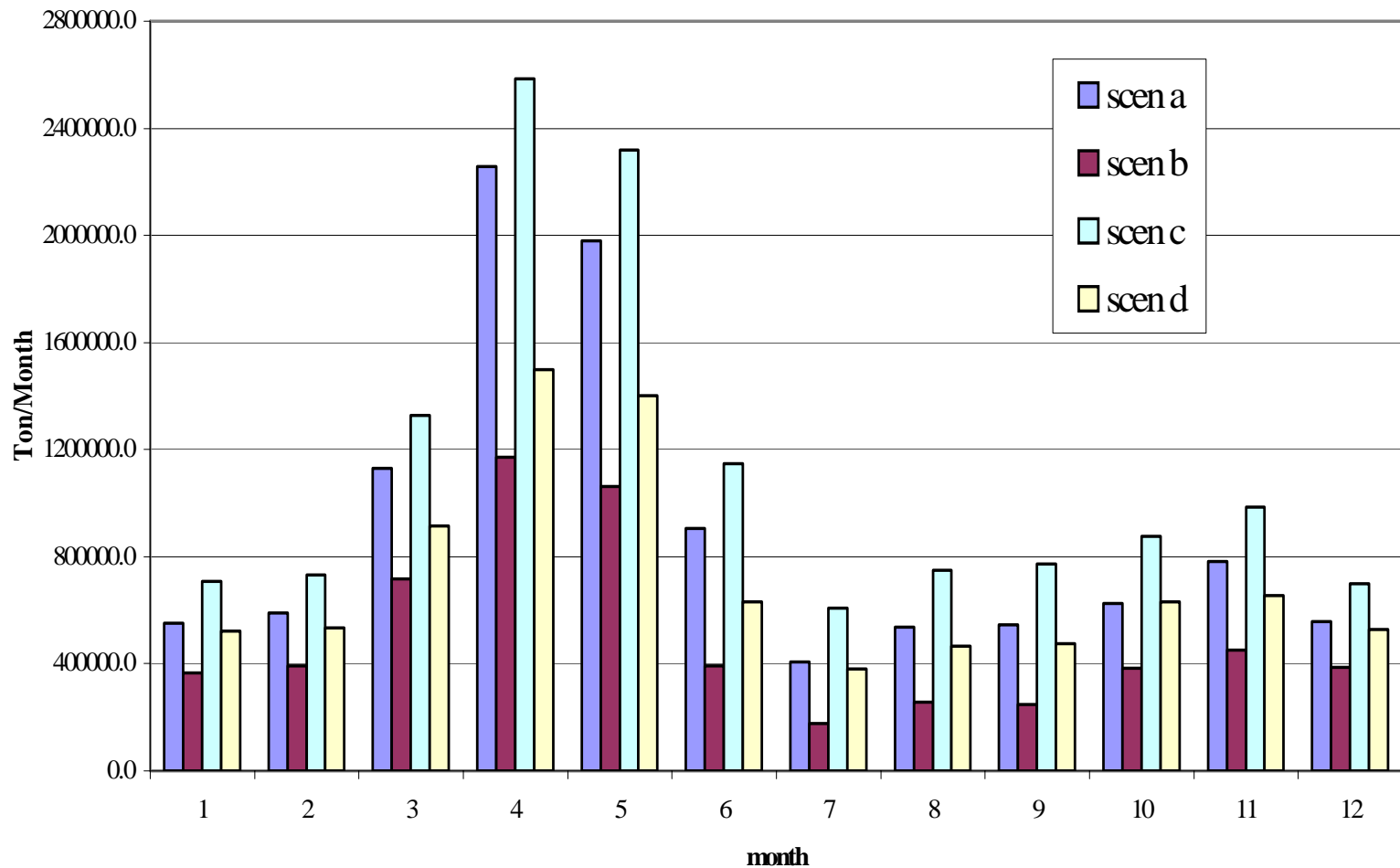
Annual PM10 for the Western States

Dust Yearly Total by State
Western States



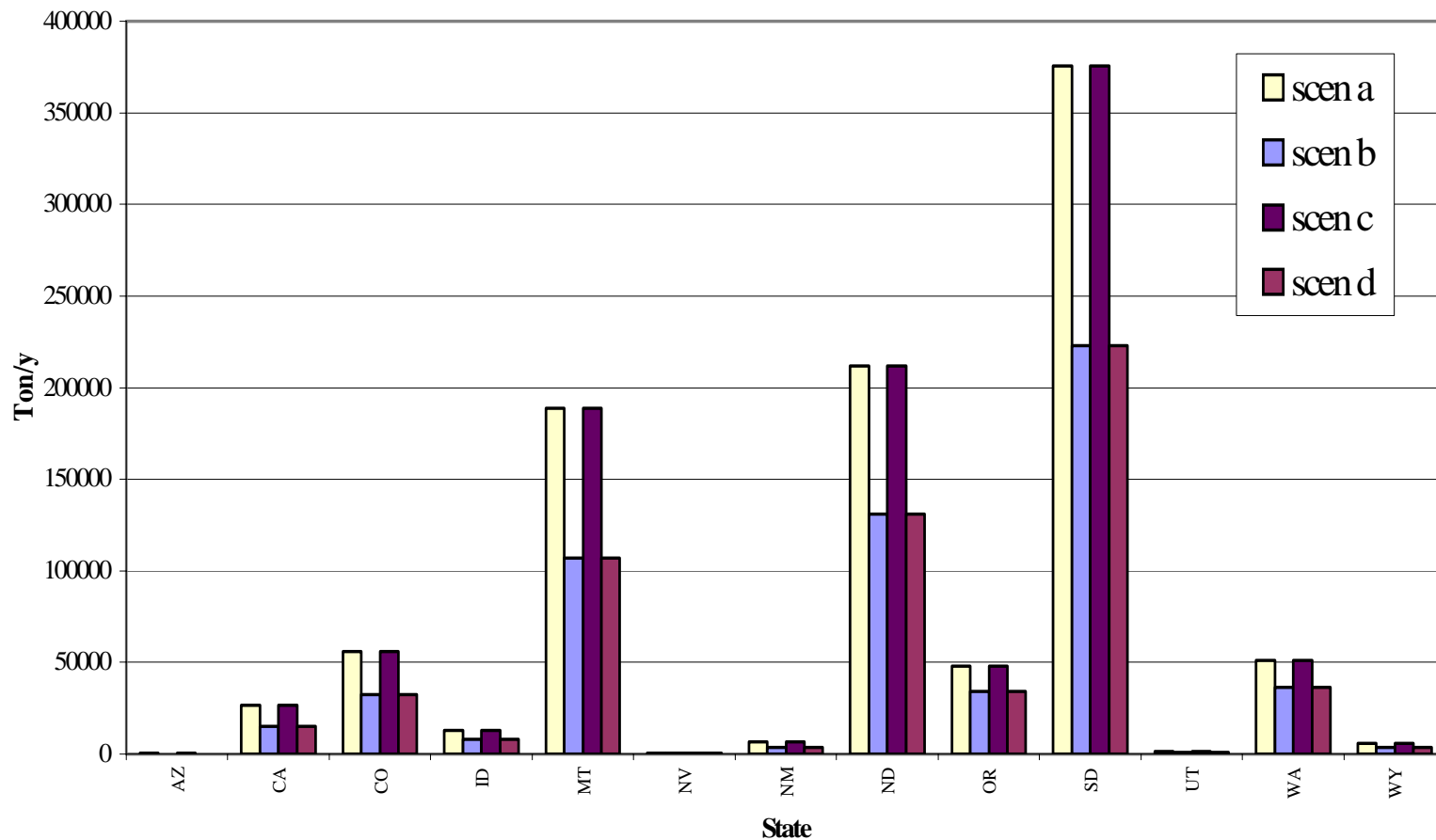
Comparison of Monthly Dust Emissions

Monthly Dust Emissions for the Entire Domain



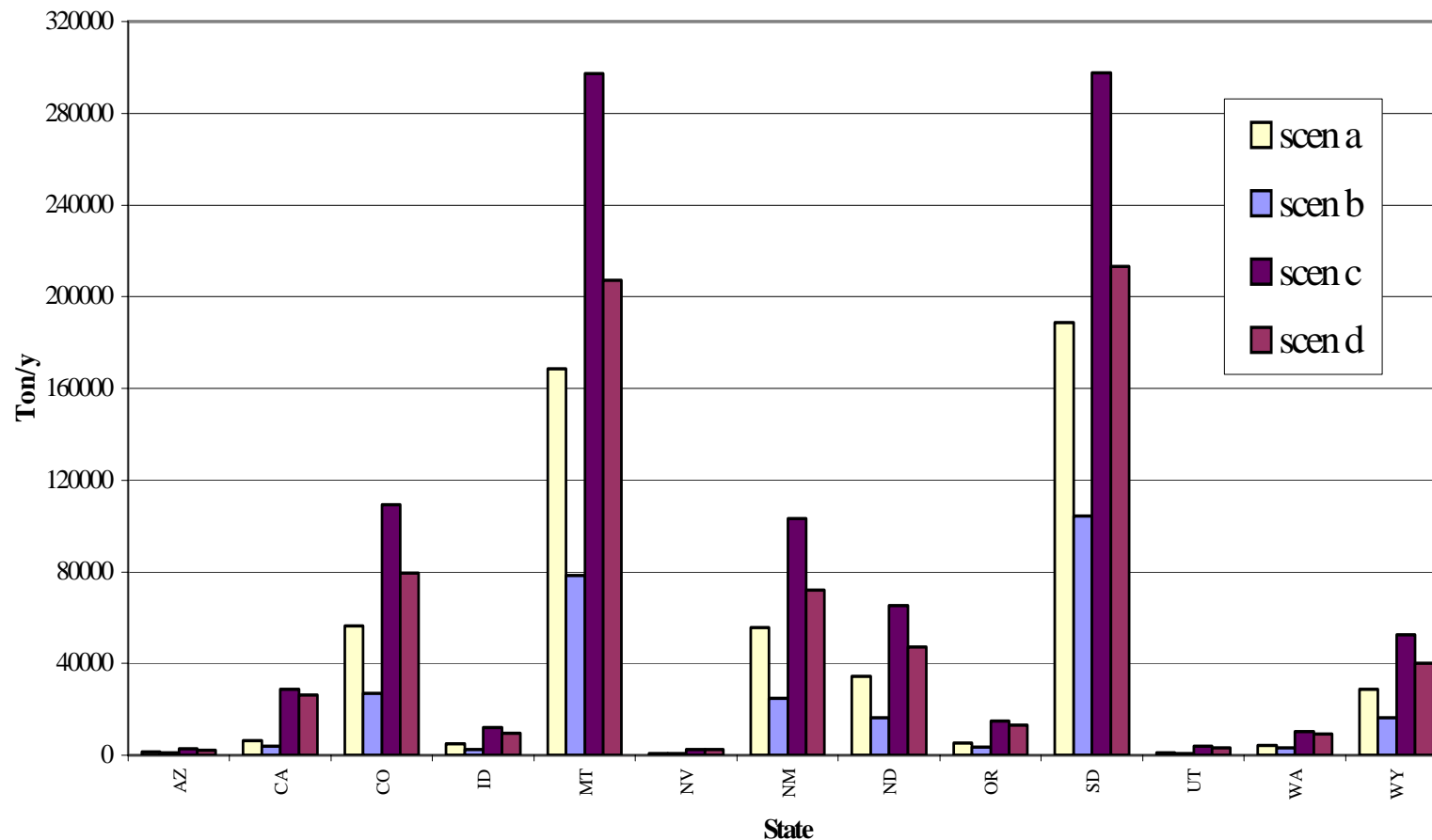
Annual PM10 from Ag Land for WRAP States

Dust from Category 3 (Ag land)
PM10 Yearly Total



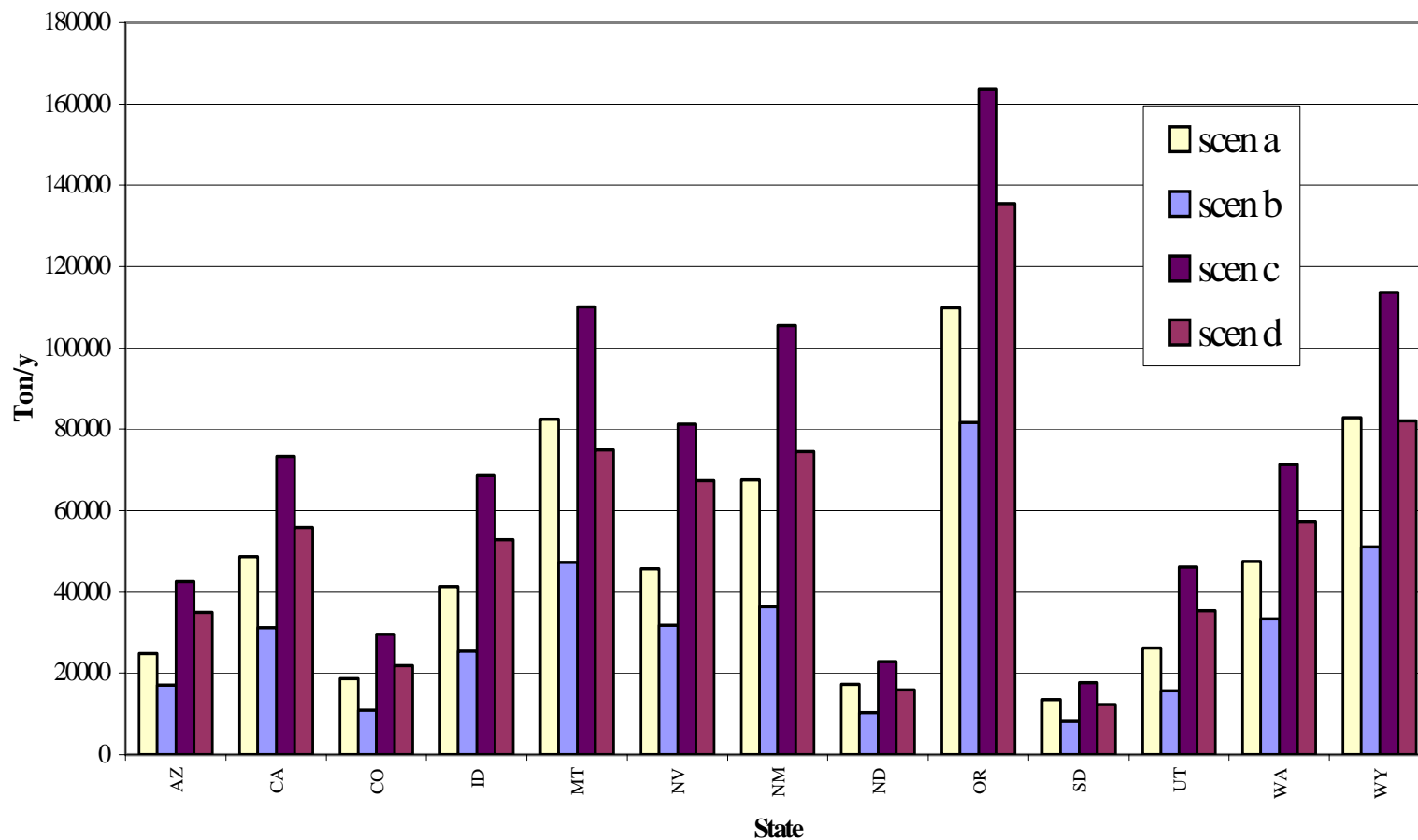
Annual PM10 from Grass Land for WRAP States

Dust from Category 4 (Grass land)
PM10 Yearly Total



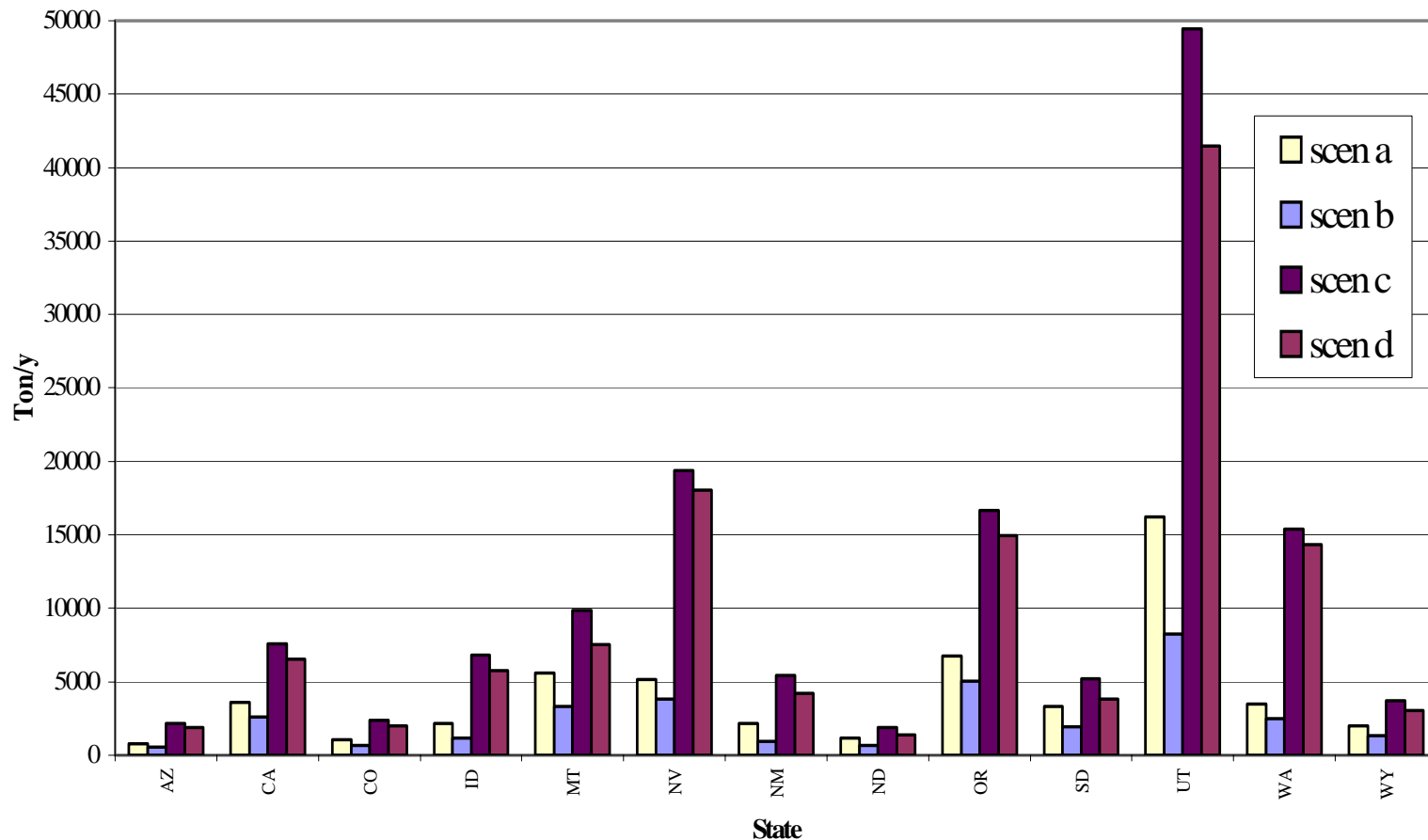
Annual PM10 from Shrub Land for WRAP States

Dust from Category 6 (Shrub land)
PM10 Yearly Total



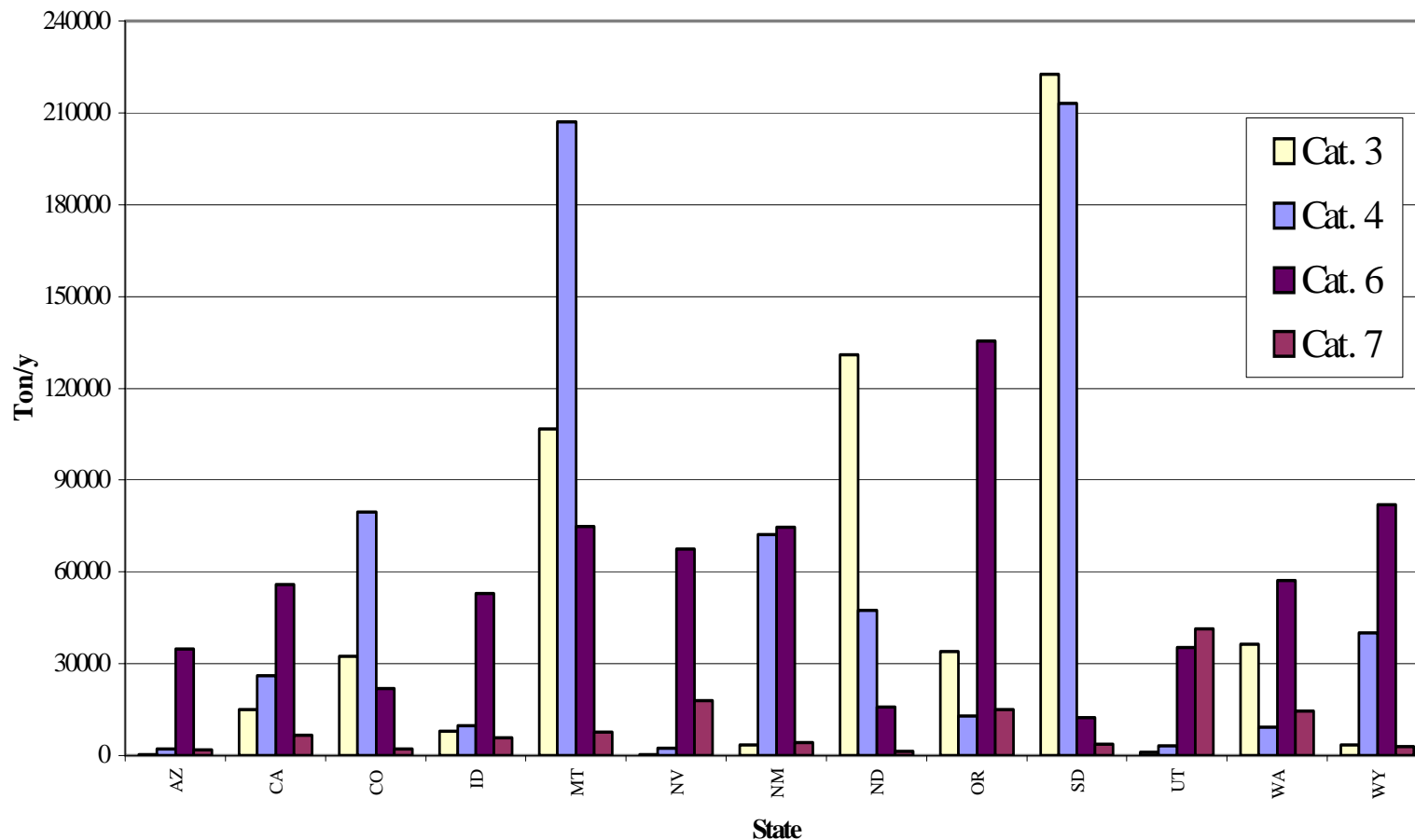
Annual PM10 from Barren Land for WRAP States

Dust from Category 7 (Barren land)
PM10 Yearly Total



Scenario d Annual PM10 from All Dust Categories for WRAP States

Dust from all Categories for Scenario d
PM10 Yearly Total

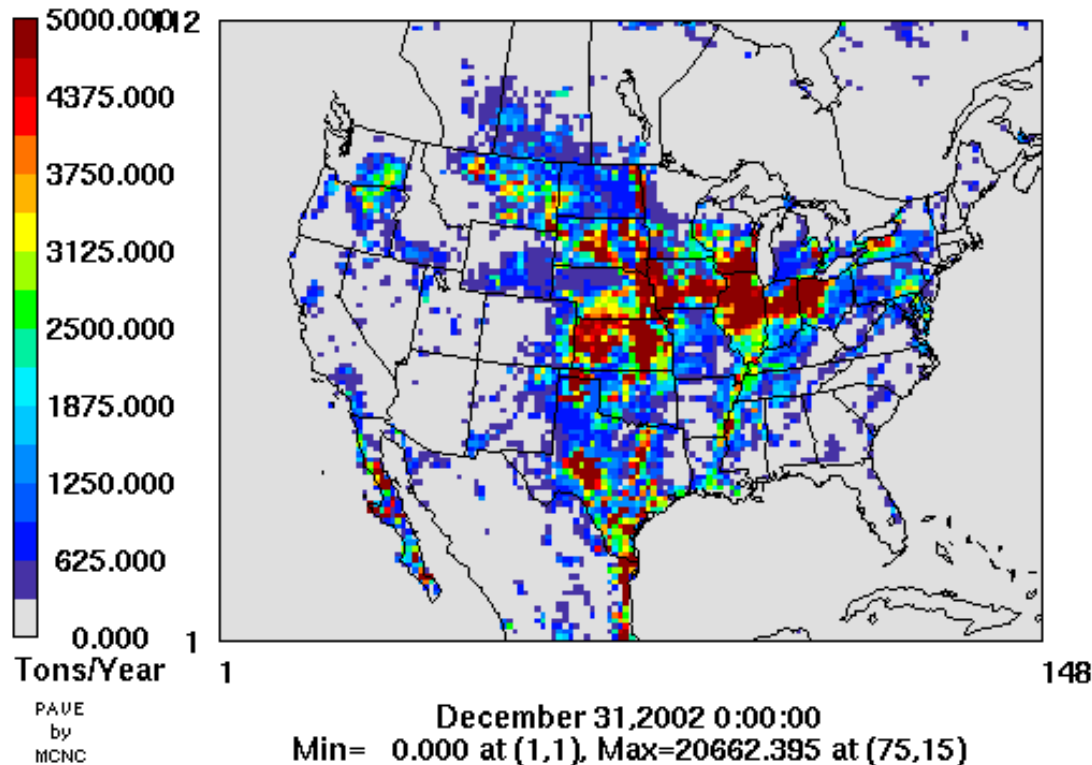


2002 Annual PMC

Scenario a: no limit on duration; all soils loose, undisturbed

PMC

Fugative Dust Emissions, 2002
Yearly Total, Scenario a

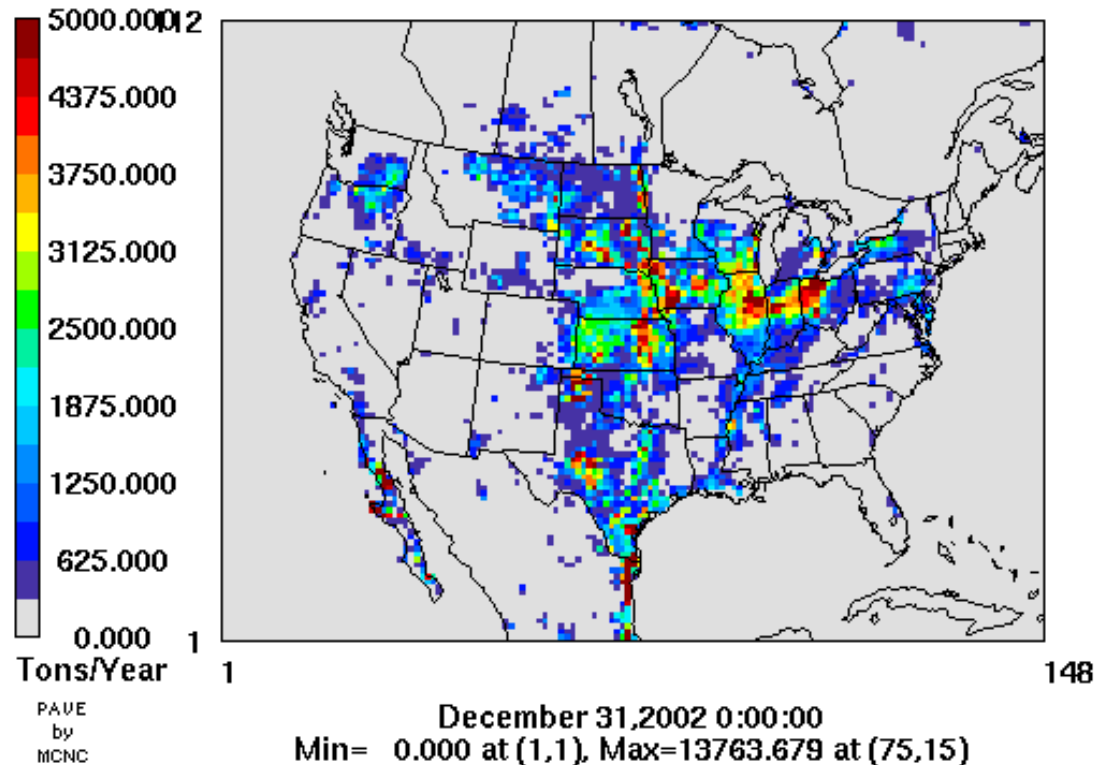


2002 Annual PMC

Scenario b: event duration ≤ 10 hrs/day; all soils loose, undisturbed

PMC

Fugative Dust Emissions, 2002
Yearly Total, Scenario b

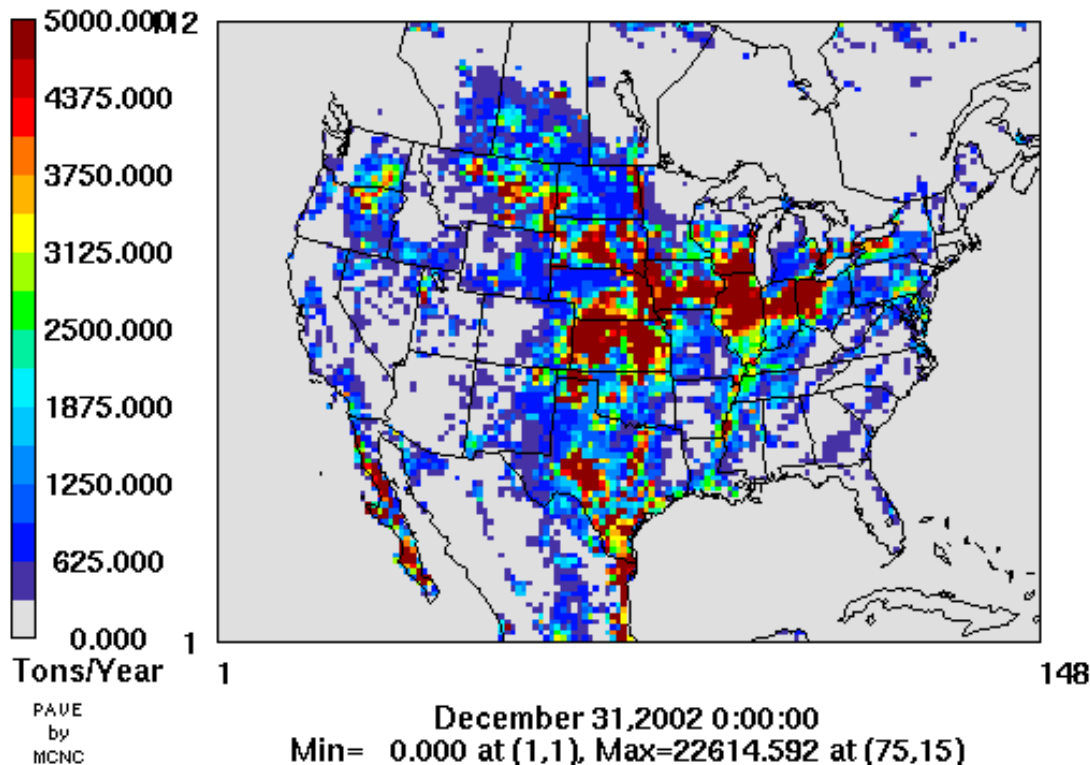


2002 Annual PMC

Scenario c: no limit on duration; assume 10% disturbed area for grass, shrub, barren lands

PMC

Fugative Dust Emissions, 2002
Yearly Total, Scenario c

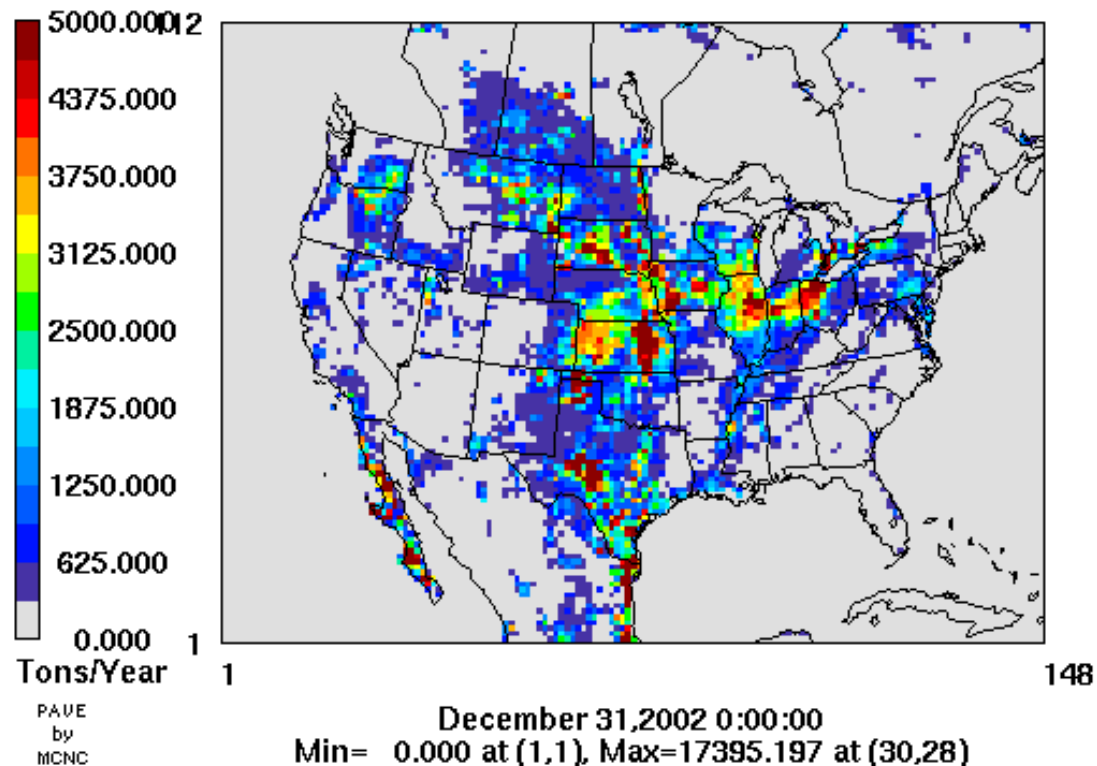


2002 Annual PMC

Scenario d: event duration ≤ 10 hrs/day; assume 10% disturbed area for grass, shrub, barren lands

PMC

Fugative Dust Emissions, 2002
Yearly Total, Scenario d



Model Performance Evaluation

- Evaluate model results for reasonableness and accuracy
- Compare predicted WB dust emissions near IMPROVE monitors with measured IMPROVE dust extinction (B_{dust})
- Enhancements to CMAQ to track WB and other dust
- Evaluate model CMAQ model performance with and without WB dust emissions
- Refined model performance evaluation using results of Etyemezian, et al.
- For events characterized as wind blown dust events, determine whether dust model predicts impacts

Model Performance Evaluation Schedule

- Initial Model Performance Evaluation Report:
August 31, 2004
- Refined Model Performance Evaluation Report:
October 31, 2004