

Environmental Factors Affecting Asthma and Allergies

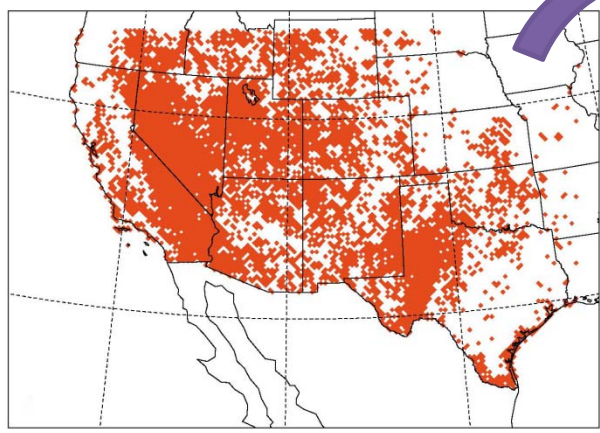
Predicting & Simulating Downwind Exposure
To Airborne Pollen

A NASA Project with:

- Jeffrey Luvall & Sue Estes [MSFC]
- William A. Sprigg, Slobodan Nickovic, Alfredo Huete, Ramon Solano, Piyachat Ratana, & Zhangyan Jiang [University of Arizona]
- Len Flowers [New Mexico Department of Health]
- Alan Zelicoff [ARES Corporation]

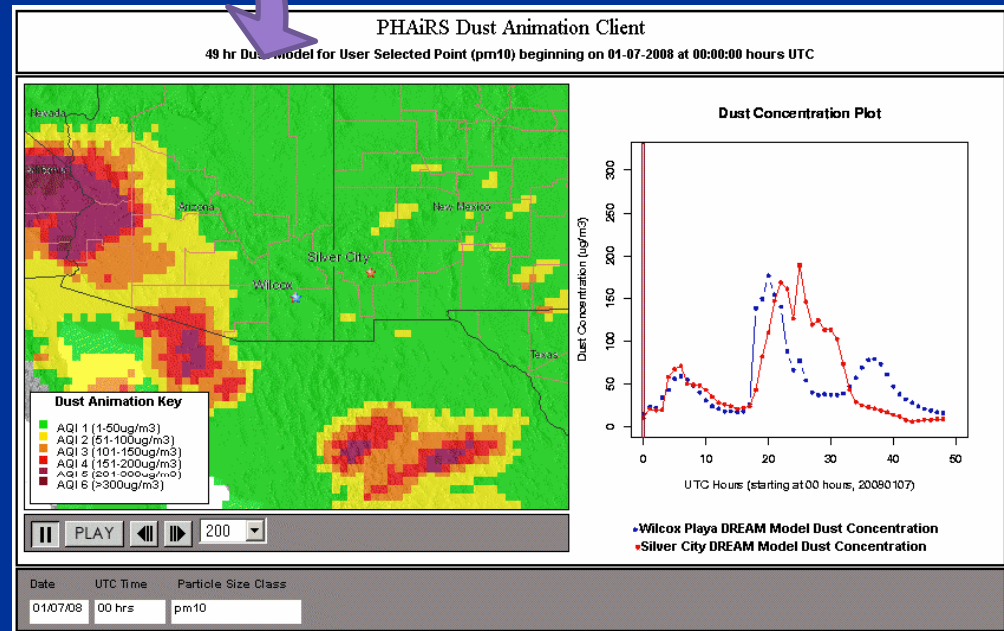
Phenology and Pollen Transport

NASA Remote Sensing



Currently – MODIS-derived dust source regions
Future – pollen sources derived from **phenological** studies & MODIS + NPOES

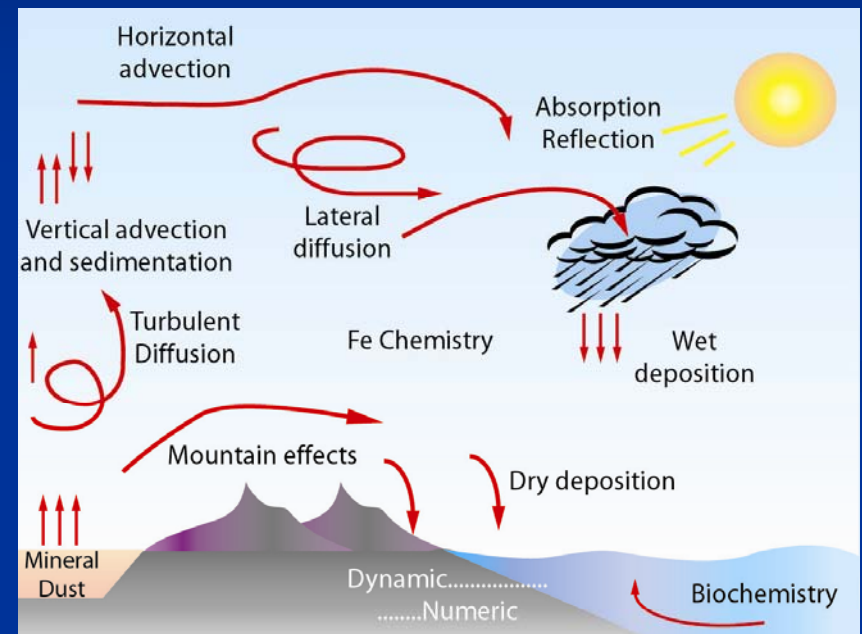
UofA Models DREAM/eta + DREAM/NMM
Modified to PREAM (Phenology):
<http://www.atmo.arizona.edu/research/dust/dust>



New Product – predicted concentrations of pollen in time and space displayed on PHAIRS-like client server at UNM: <http://phairs.unm.edu>

DREAM 4-8 particle bins

- **Model predictions (72-h):**
- Horizontal distribution
 - Surface concentration
 - Total column mass (dust load)
 - Wet, dry, total deposition
 - Meteorological variables
- Vertical distribution
 - Concentration
 - Cross sections
 - Fixed point/time profiles
- Fixed point (selected sites/cities)



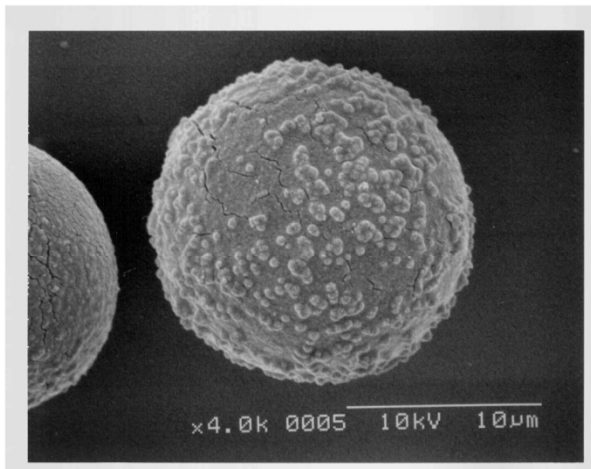
Pollen Strategy

- Select Pollen of Interest
- Map Pollen Source
- Estimate Emission on Test Date
- Prepare Model
 - Insert Terrain & Pollen Aerodynamic Characteristics
 - Insert Source Emission
 - Insert Meteorology
- Simulate Downwind Pollen Dispersal
- Evaluate

Juniper Pollen

Good News for Modeling

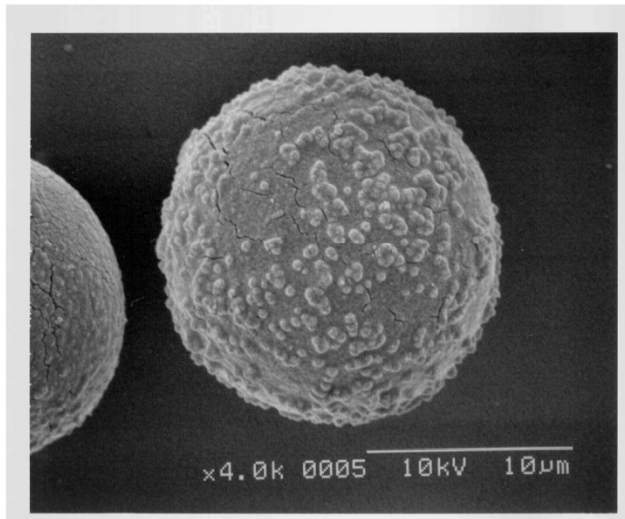
- Pollination Feb-March, little confusion with other pollinating plants
- *Juniperus* pollens are (mostly) spherical
- Distinct, large, 2-week pollination events: 2006 & 2007



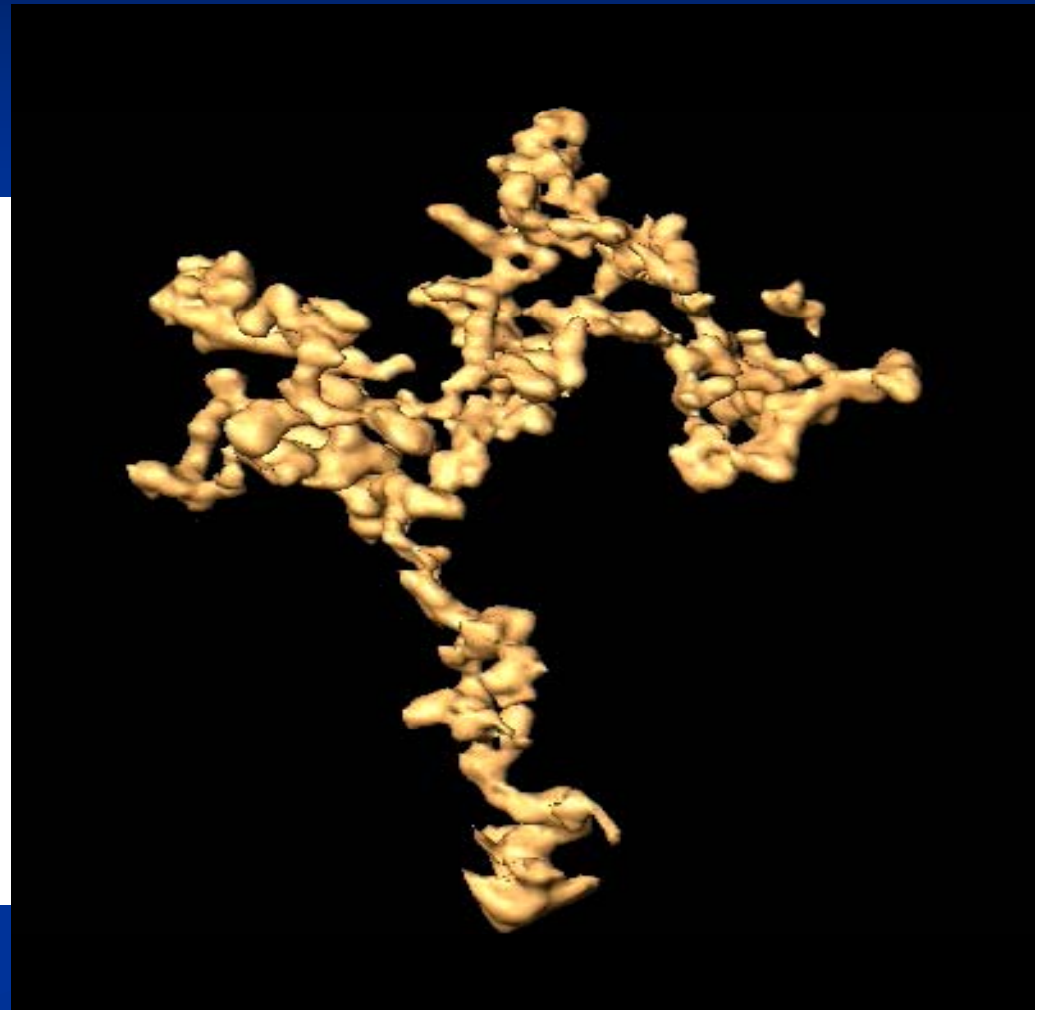
Juniperus virginiana

“Dust” Particle

Juniper Pollen

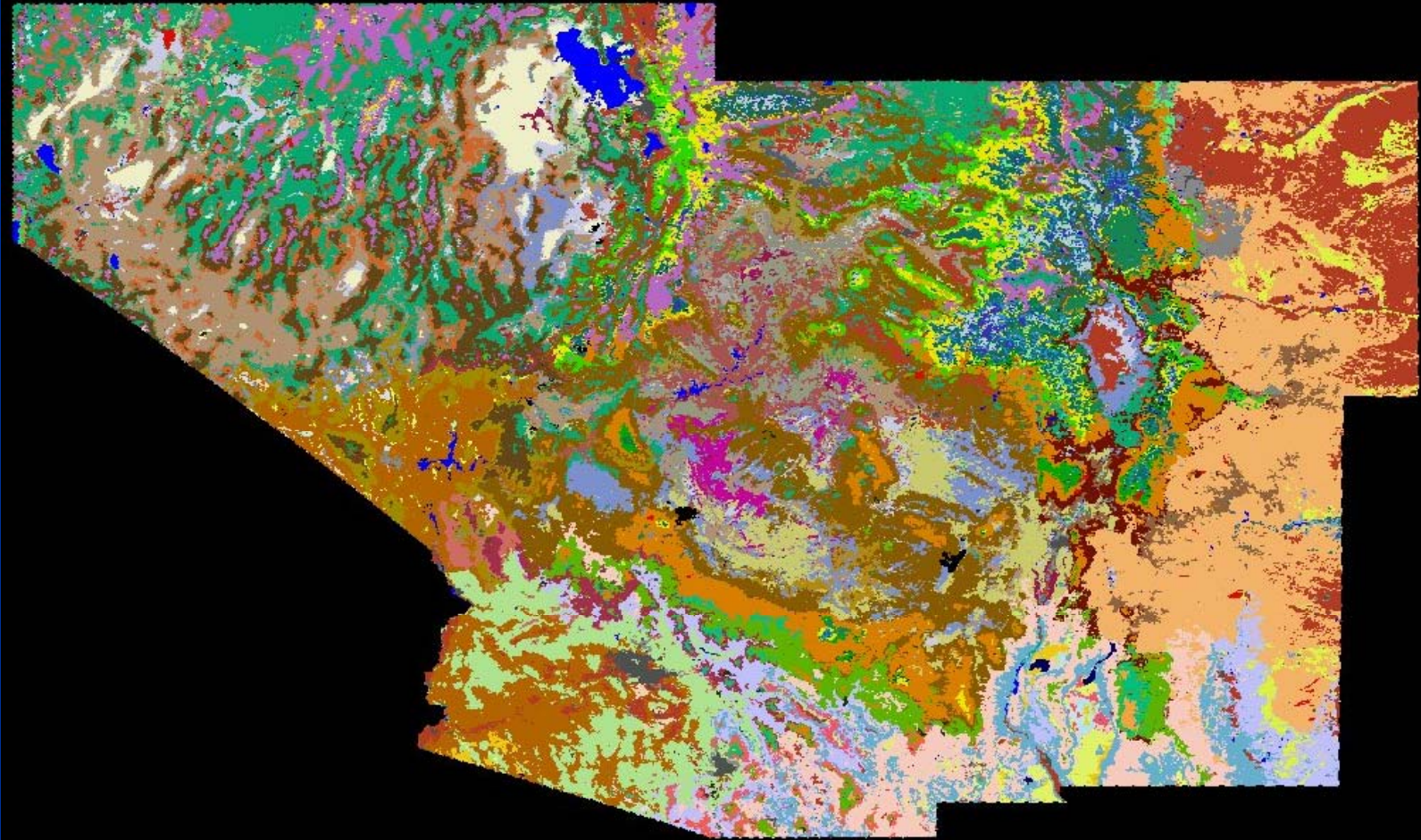


Juniperus virginiana



LAND COVER SOURCE

Southwest Regional Gap Analysis Project



Biodiversity for AZ, CO, NV, NM, UT

Jupiter Type Filter

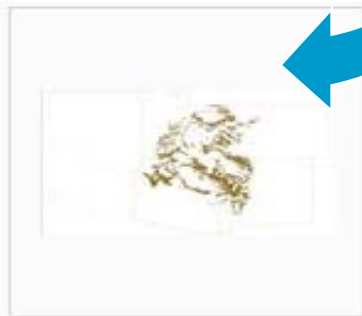
CO Piñon-Juniper



Single class coverage preview



Class S038



Class S039



Class S074



Class S035



Class S112



Class S075



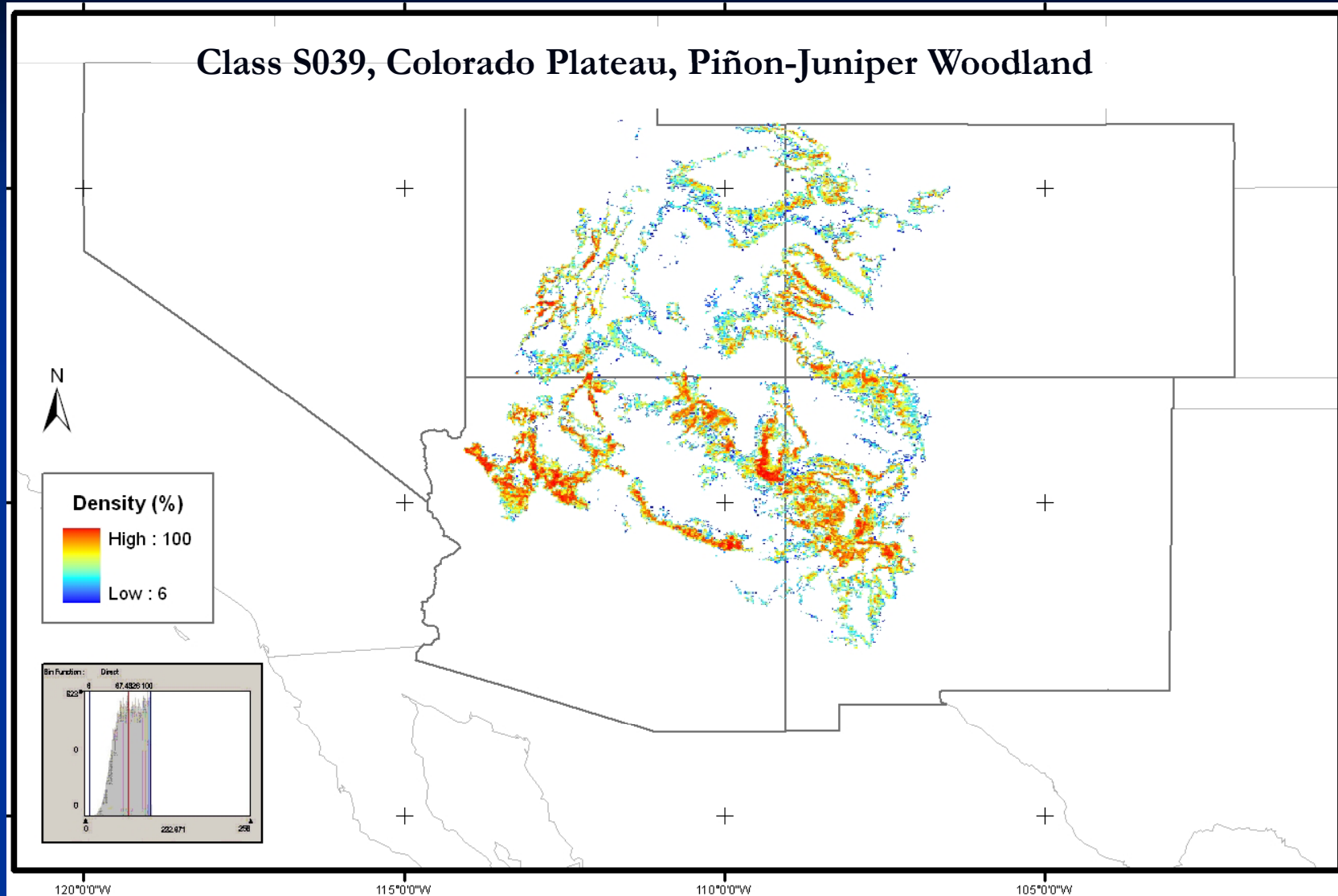
Class S115

Preparing Source for Model

- Model requires juniper density (pixel fraction): percent juniper pixels (30m resolution) present in 2-km cell
 - Each 2km cell has 66 x 66 (4,356) pixels
 - Count juniper pixels
 - $(\# \text{Juniper Pixels}) / 4,356 = \text{juniper pixel fraction} = \text{juniper density}$

Juniper Density

Class S039, Colorado Plateau, Piñon-Juniper Woodland



Juniper Density value was estimated from the aggregation of 30-m pixels into 2-km pixels. This value indicates what percentage of the original 30-m pixels corresponds to the new 2-km pixel labeling class.



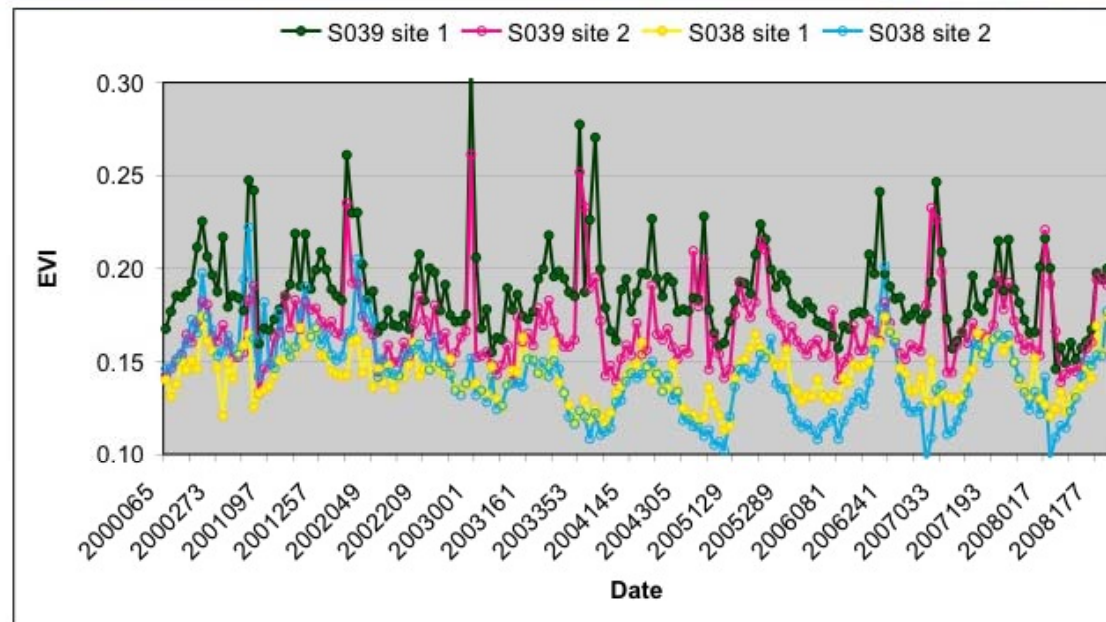
TBRs Lab
The University of Arizona

MODerate-resolution Imaging Spectroradiometer (MODIS)

- Seasonal sampling of Juniper Land cover
Surface measurements on a near-daily basis –
corrected for atmospheric aerosols, clouds etc.

MODIS Juniper Time Series

Enhanced Vegetation Index



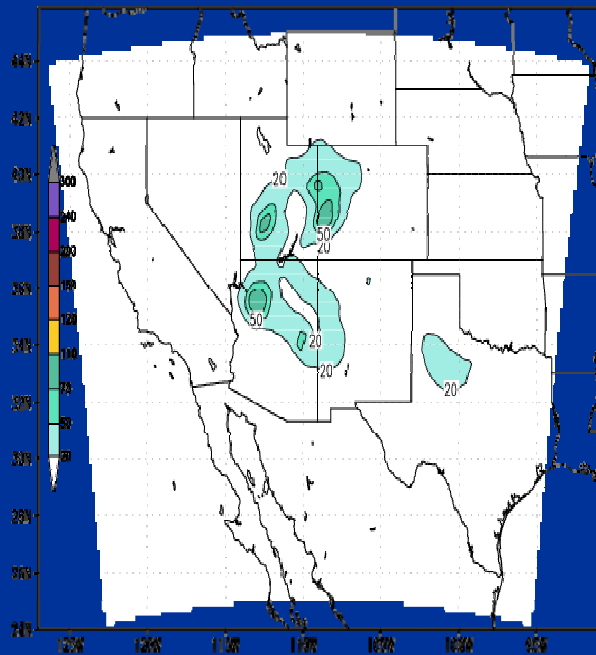
70-90% density

Pre-PREAM Test

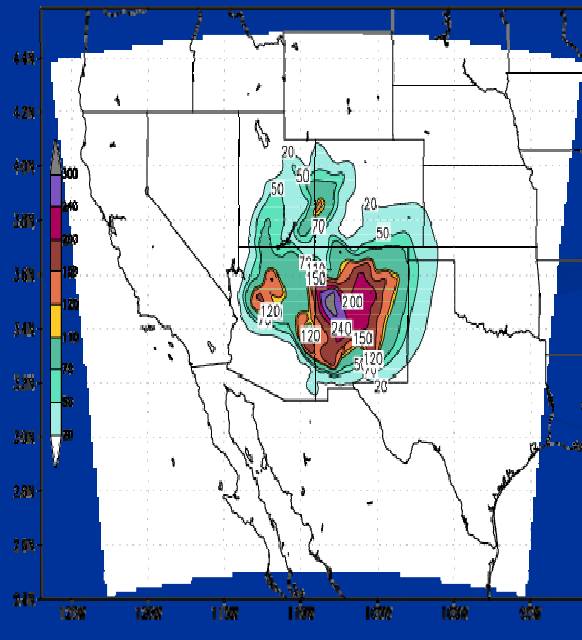
- Single-particle (size) Pre-PREAM
- Simultaneous transport from 4 sources
- Result: sum of transported particles coming from the 4 sources

Juniper Pollen Near-surface concentration (Nm³)

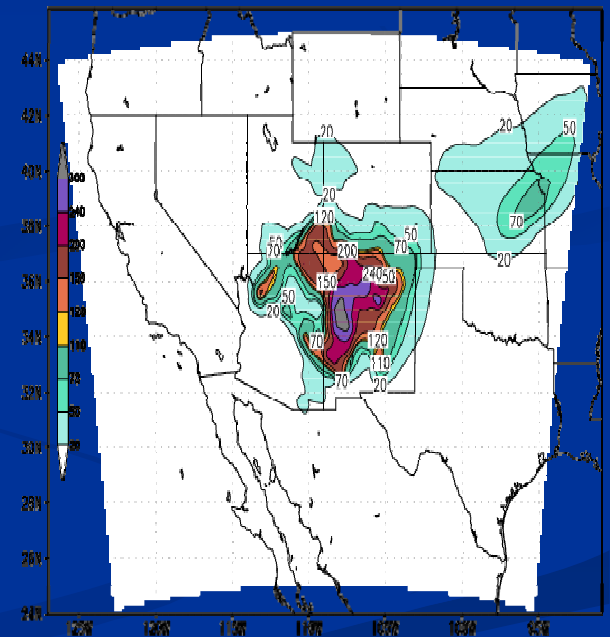
Pre-PREAM



6 March 2006



9 March 2006

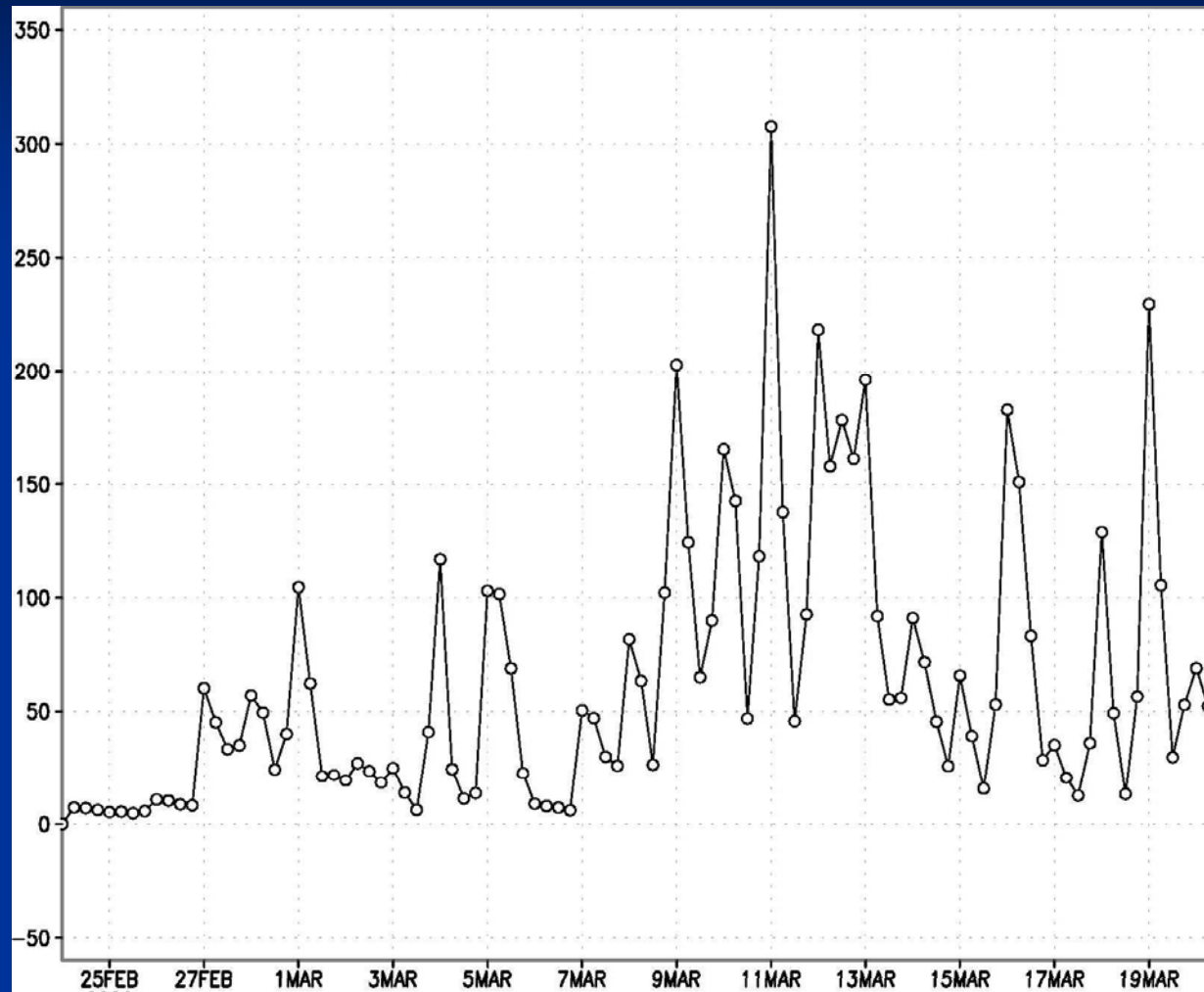


11 March 2006

Albuquerque:

Pollen concentration: 24 Feb – 19 March 2006

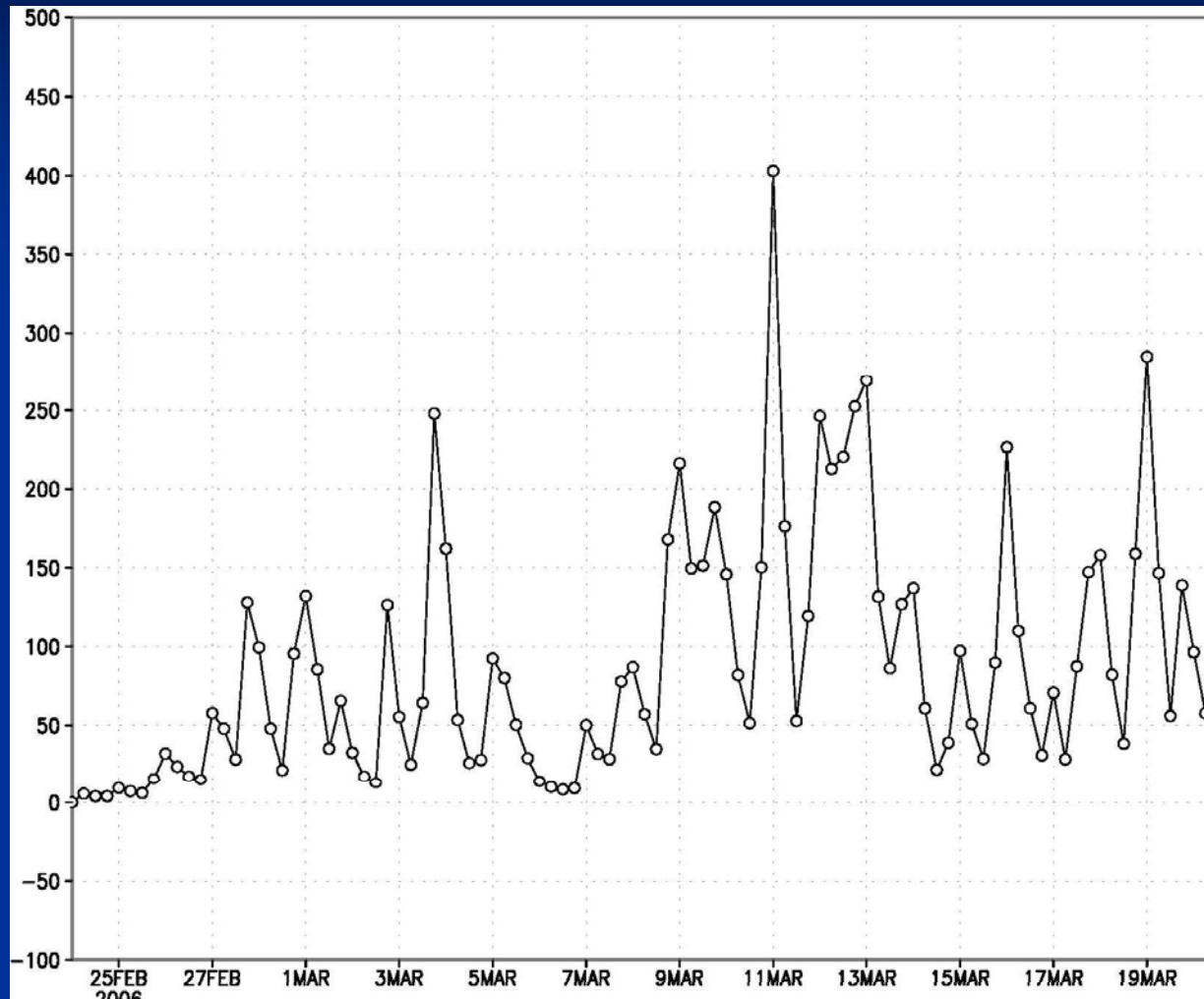
spores/m³



Model integration time

Los Alamos: Pollen concentration: 24 Feb – 19 March 2006

spores/m³

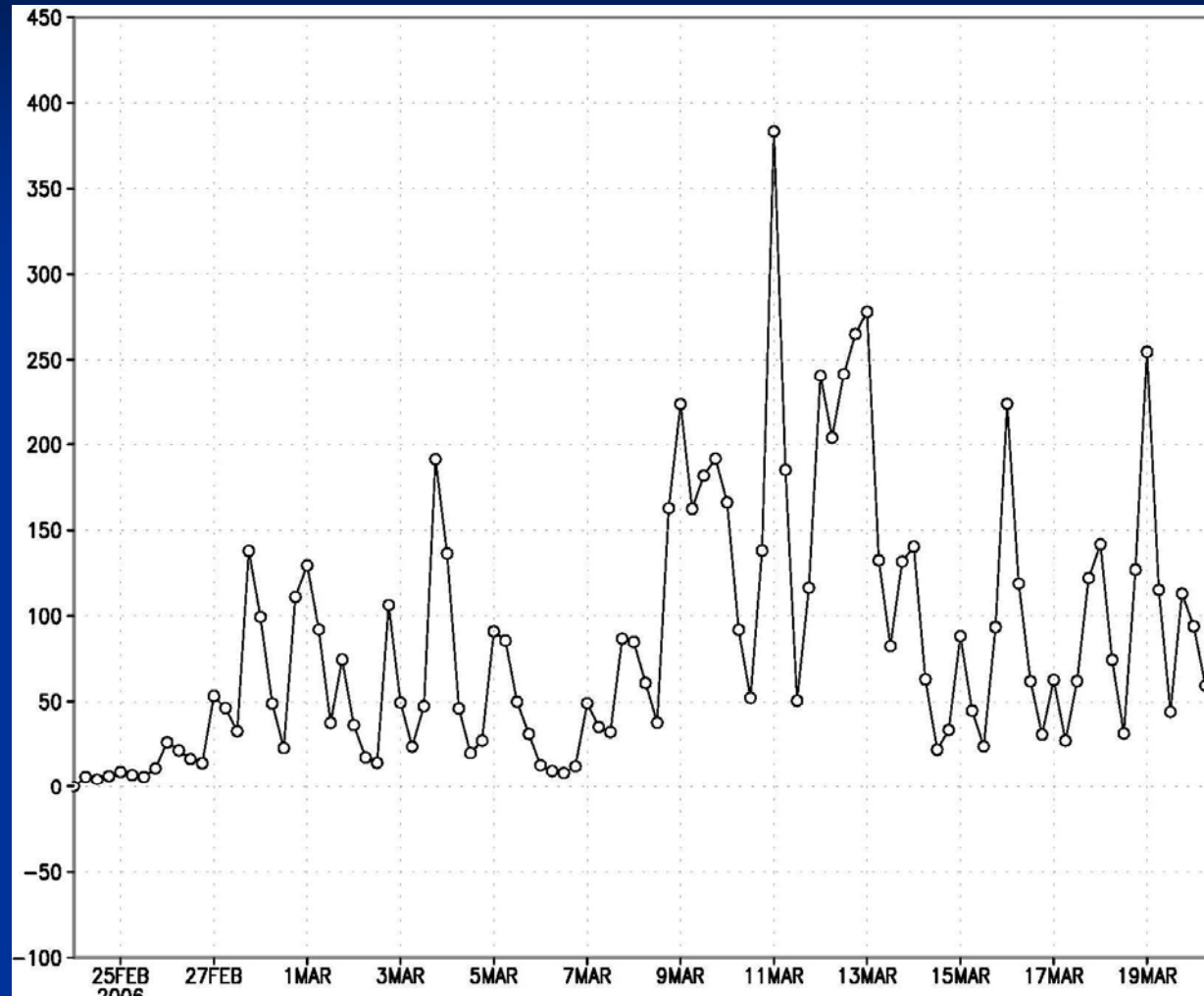


Model integration time

Santa Fe:

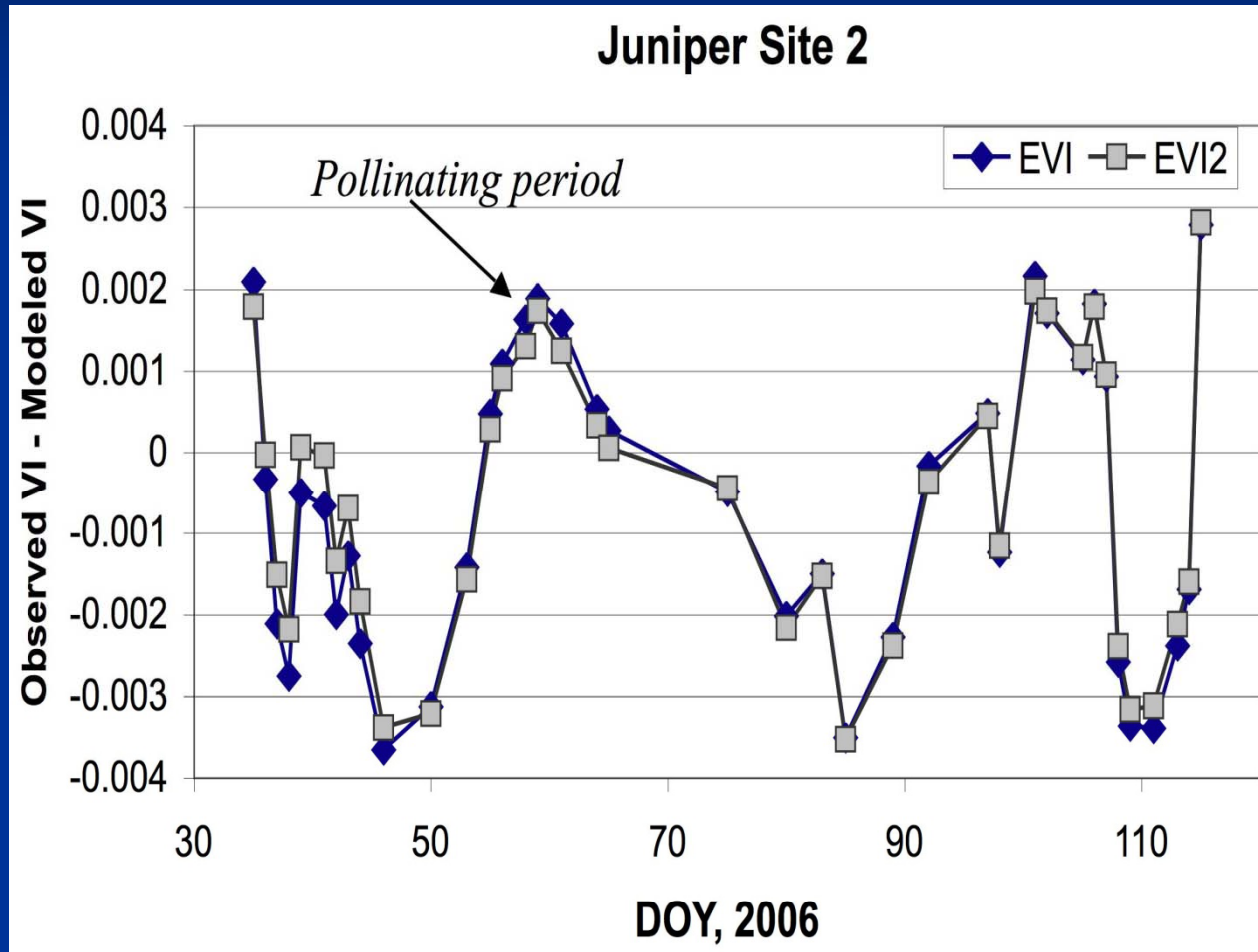
Pollen concentration: 24 Feb – 19 March 2006

spores/m³



Model integration time

'Predicting' Climate-Scale Pollination using MODIS and Phenology?



Historical Reflectance & Weather + Weather/Climate Outlook  Predicted VI & Pollen

VERSATILE DREAM

Applications Have Included:

- Dust Storms & Airborne Mineral Dust Concentrations in the Middle East, Africa and the Southwest US
- Pollen in Colorado, New Mexico & Texas
- Volcanic Ash in the Mediterranean
- Soybean Rust in South America

A new test: Forest fire ash and smoke plumes

A proposed test: mold spores

THANK YOU

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