Environmental Factors Affecting Asthma and Allergies

Predicting & Simulating Downwind Exposure To Airborne Pollen

A NASA Project with:

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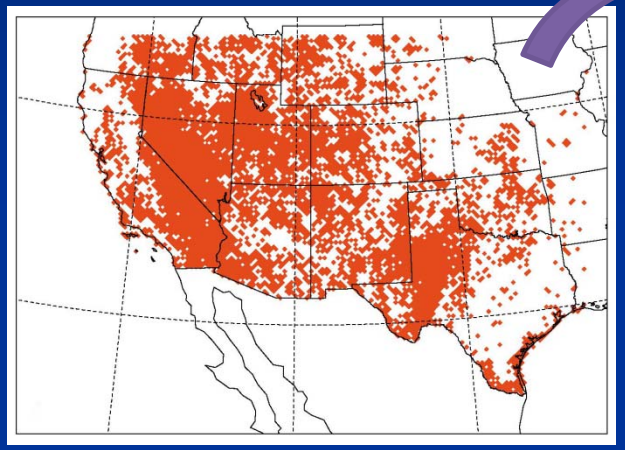
- Len Flowers [New Mexico Department of Health]
- Alan Zelicoff [ARES Corporation]

Phenology and Pollen Transport

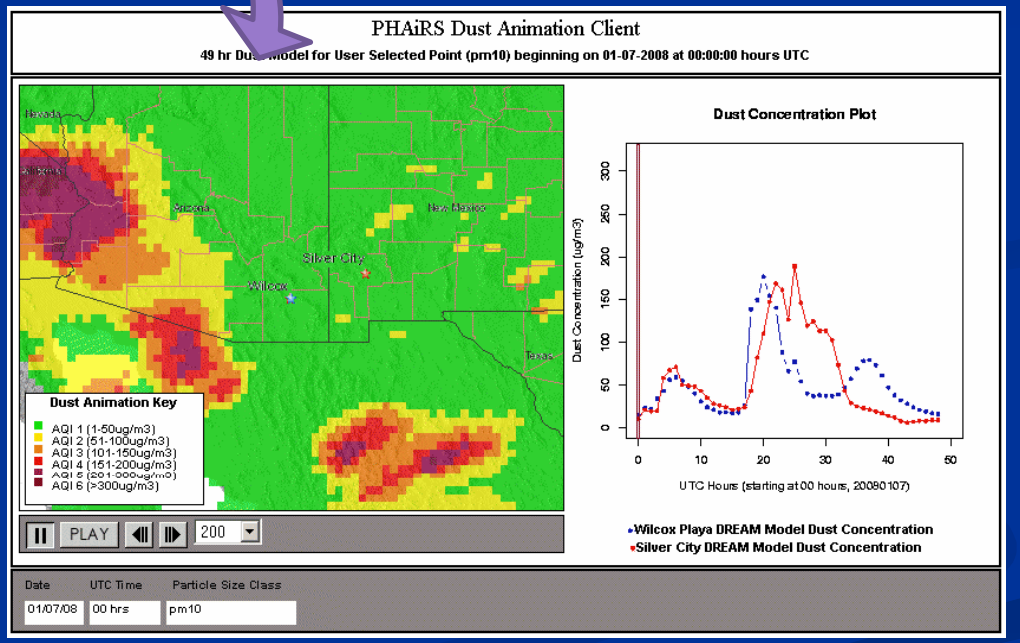
NASA Remote Sensing



Currently – MODIS-derived dust source regions

Future – pollen sources derived from **phenological** studies & MODIS + NPOES

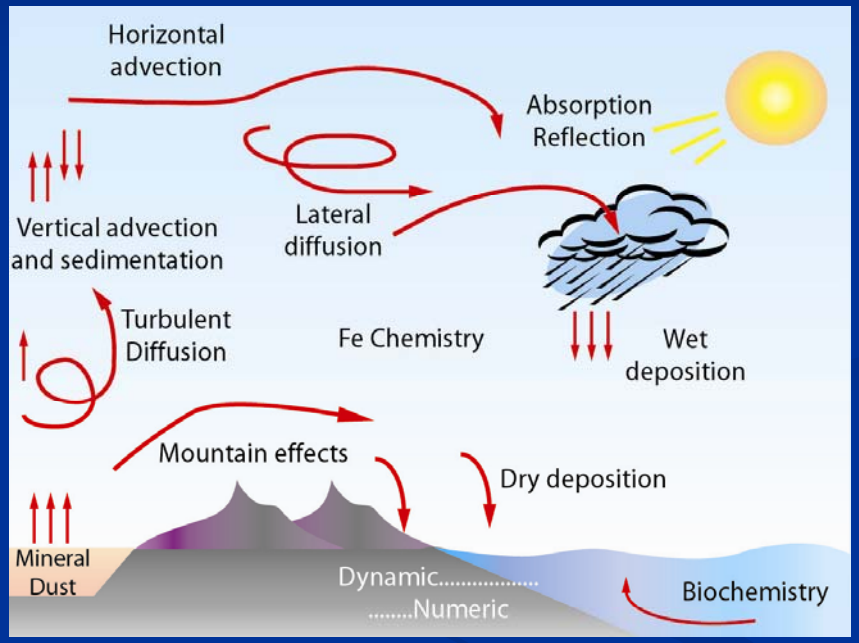
UofA Models DREAM/eta + DREAM/NMM Modified to PREAM (Phenology): http://www.atmo.arizona.edu/research/dust/dust



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

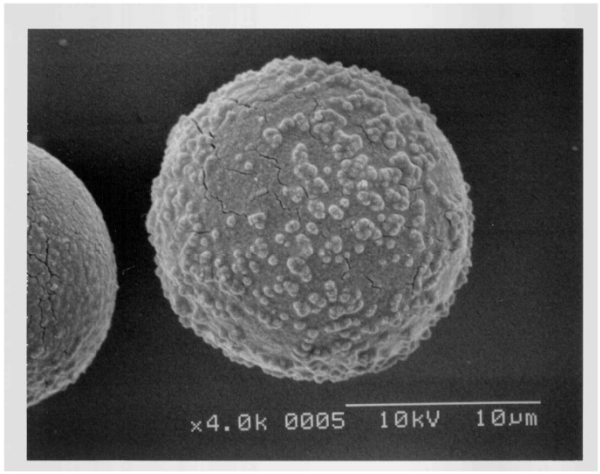
- **Model predictions (72-h):**
- Horizontal distribution
  - Surface concentration
  - Total column mass (dust load)
  - Wet, dry, total deposition
  - Meteorological variables
- Vertical distribution
  - Concentration
  - Cross sections
  - Fixed point/time profiles
- Fixed point (selected sites/cities)



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

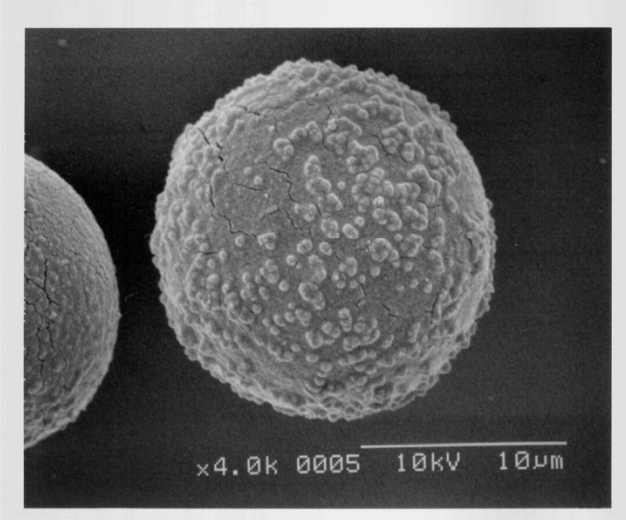


Juniperus virginiana

Good News for Modeling

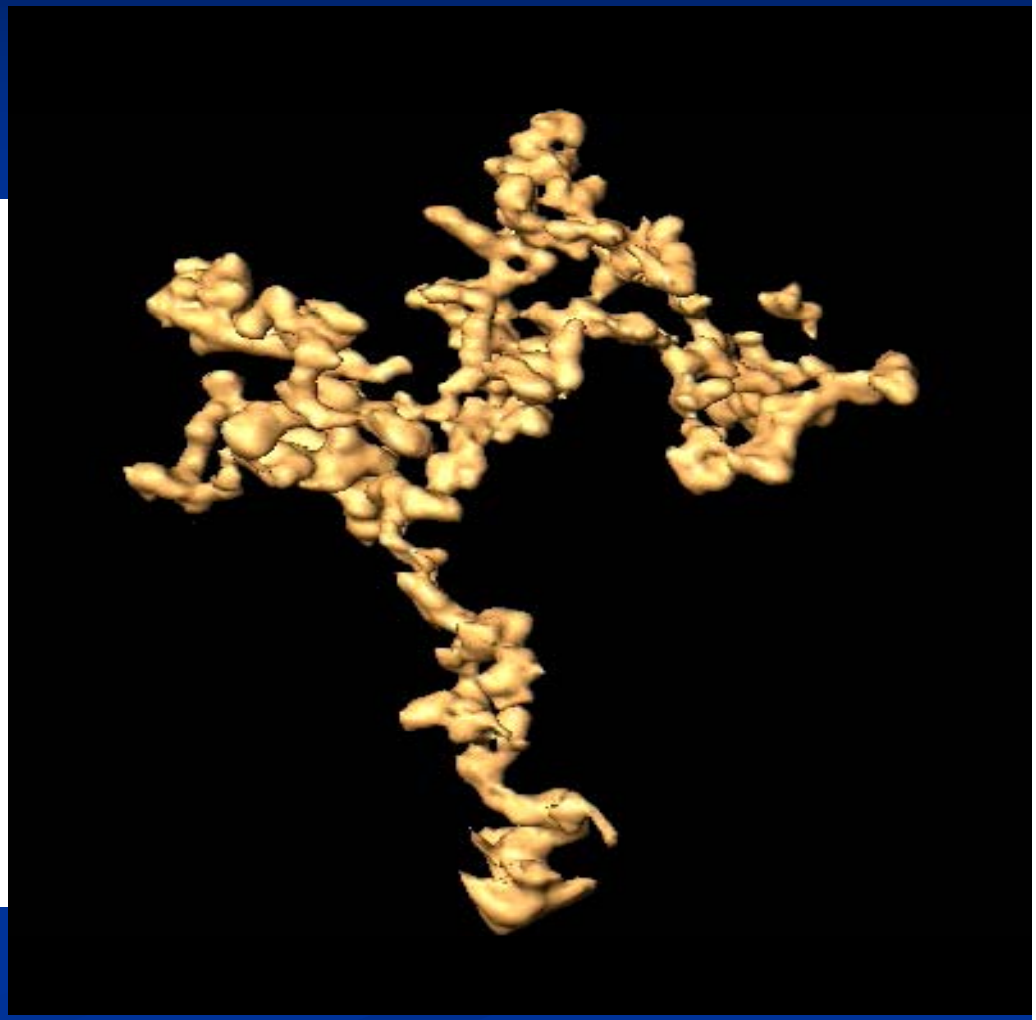
- Pollination Feb-March, little confusion with other pollinating plants
- *Juniperus* pollens are (mostly) spherical
- Distinct, large, 2-week pollination events: 2006 & 2007

Juniper Pollen

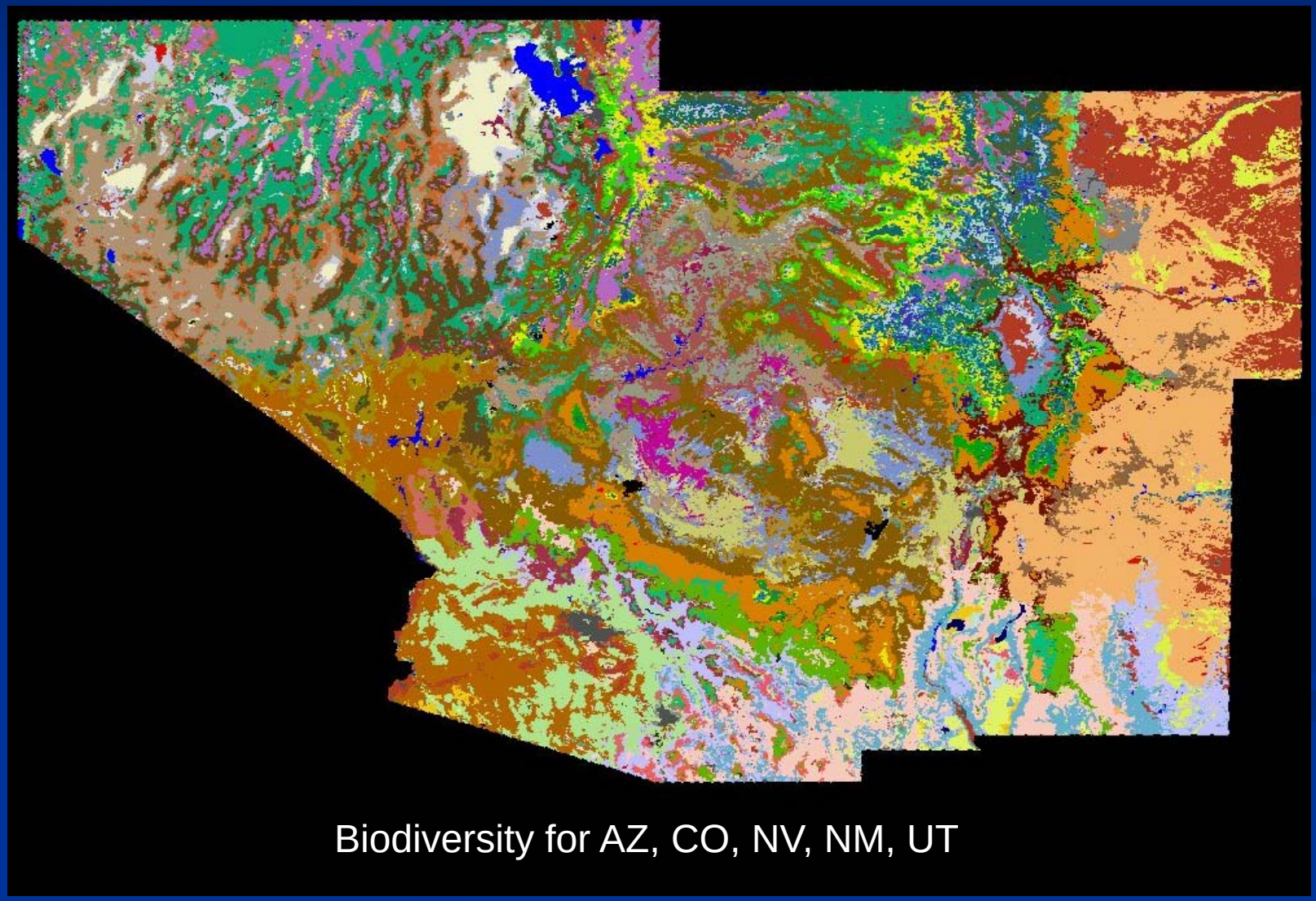


Juniperus virginiana

"Dust" Particle



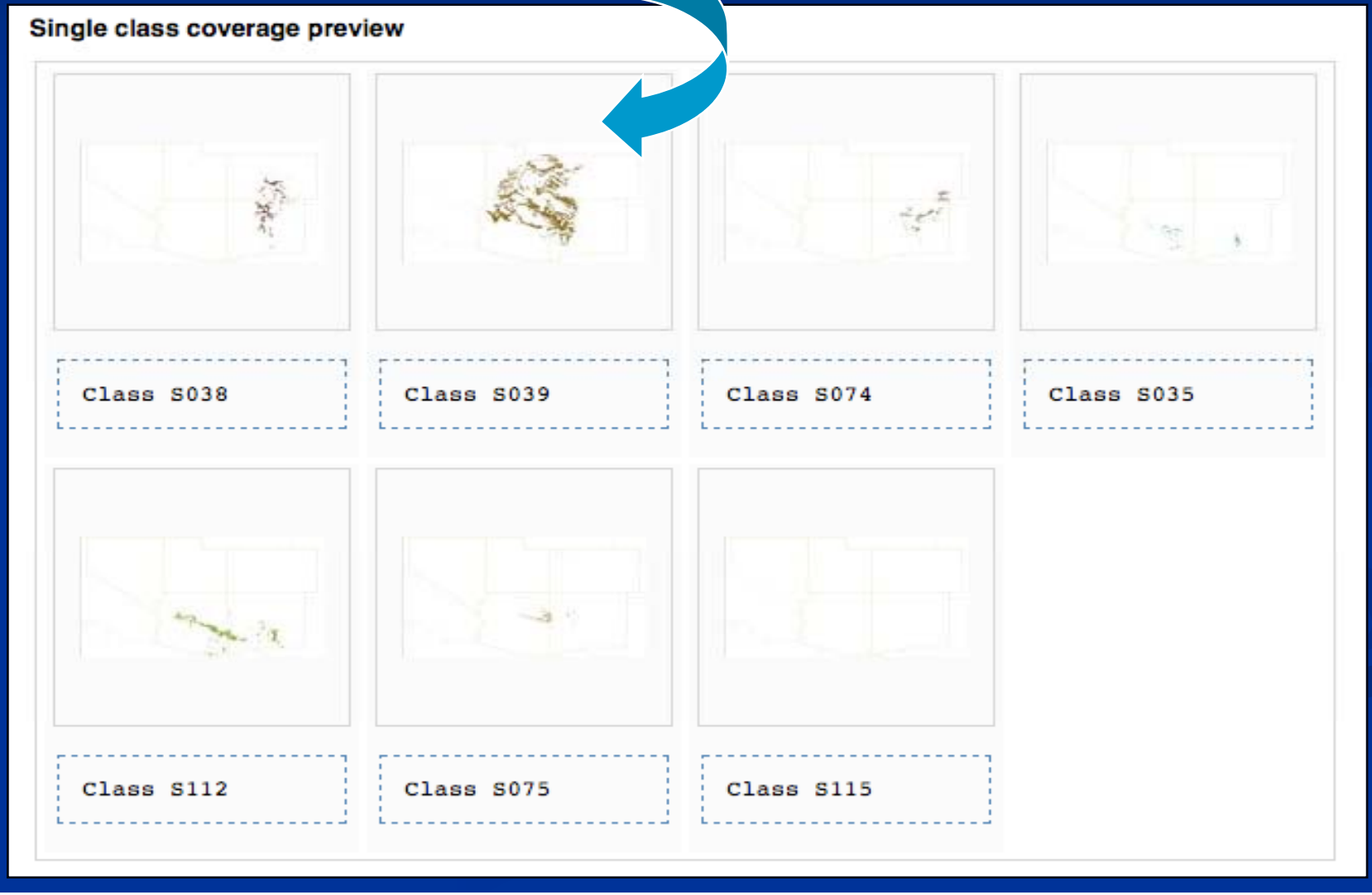
LAND COVER SOURCE
Southwest Regional Gap Analysis Project



Biodiversity for AZ, CO, NV, NM, UT

Jupiter Type Filter

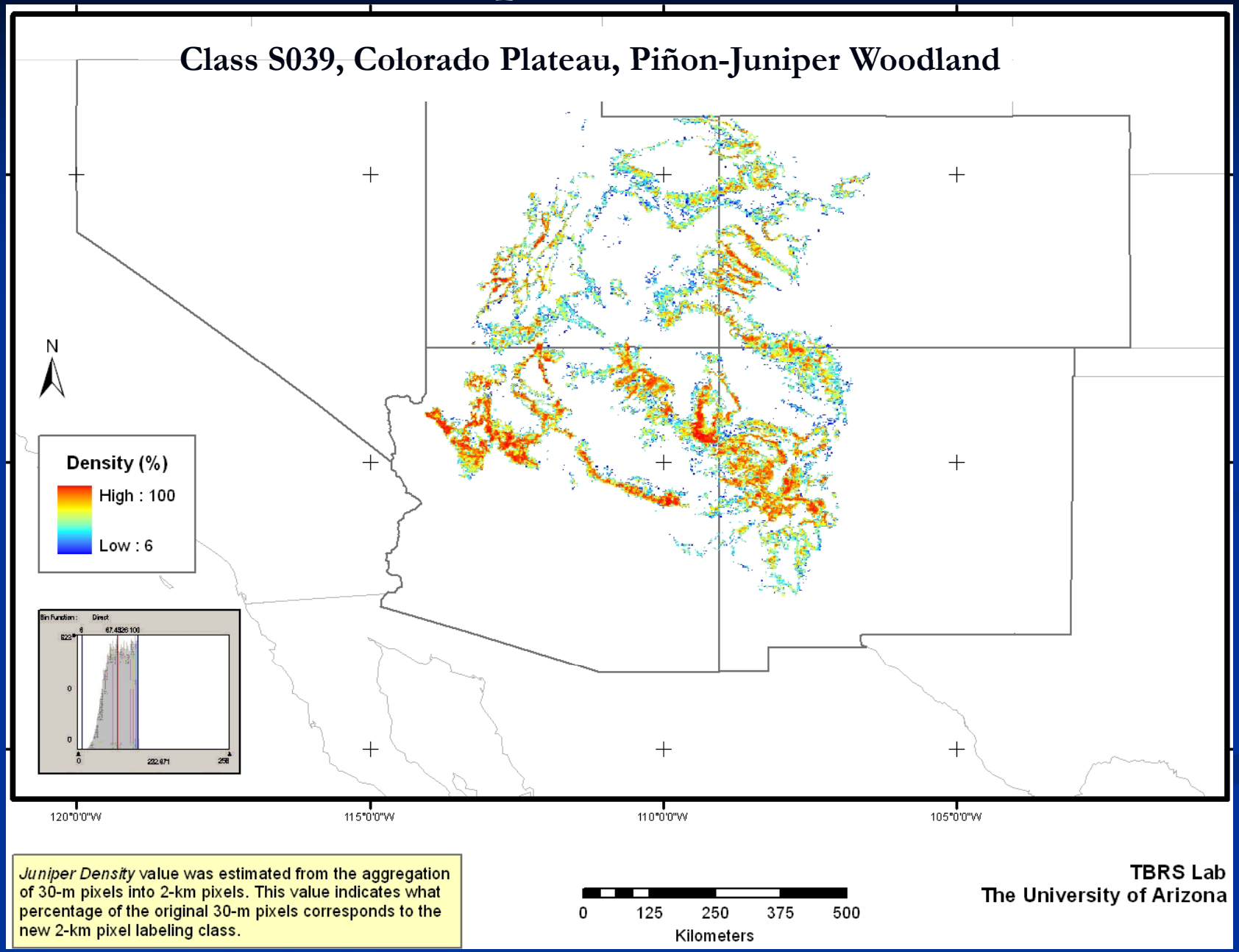
CO Piñon-Juniper



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
  - (#Juniper Pixels)/4,356 = juniper pixel fraction = juniper density

Juniper Density



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.

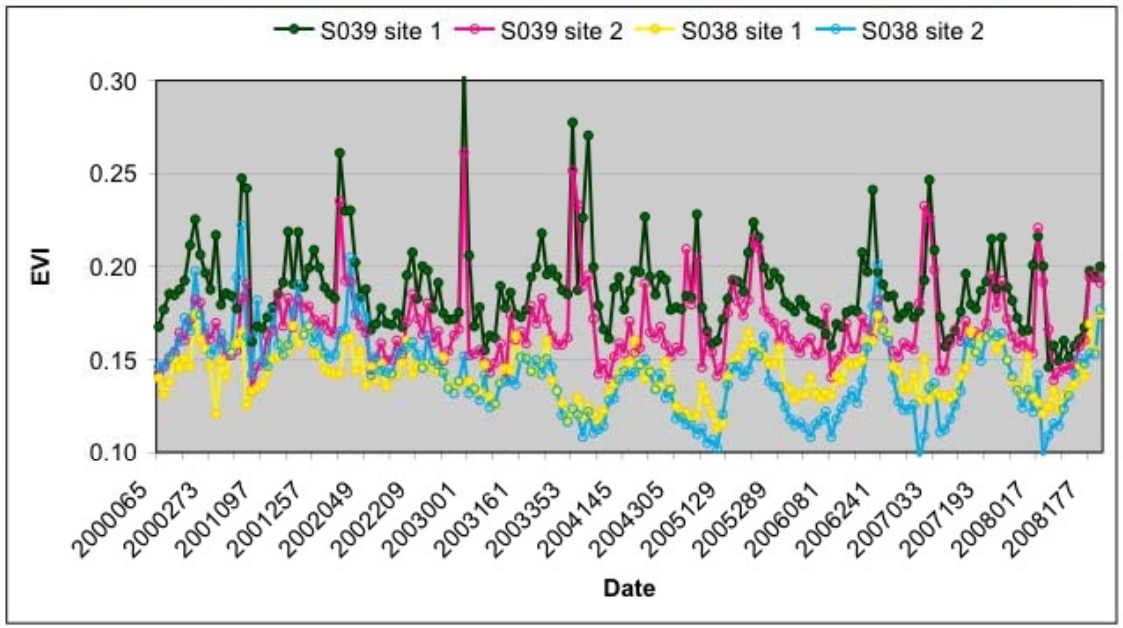
MODerate-resolution Imaging Spectroradiometer (MODIS)

- 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



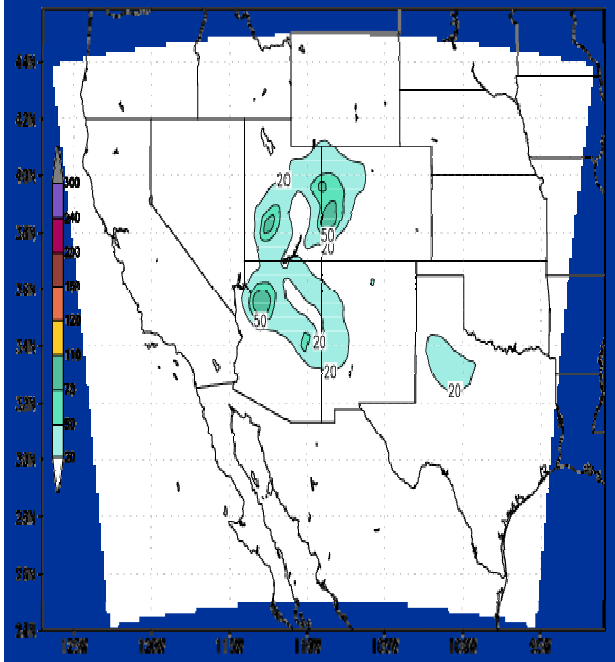
70-90% density

Pre-PREAM Test

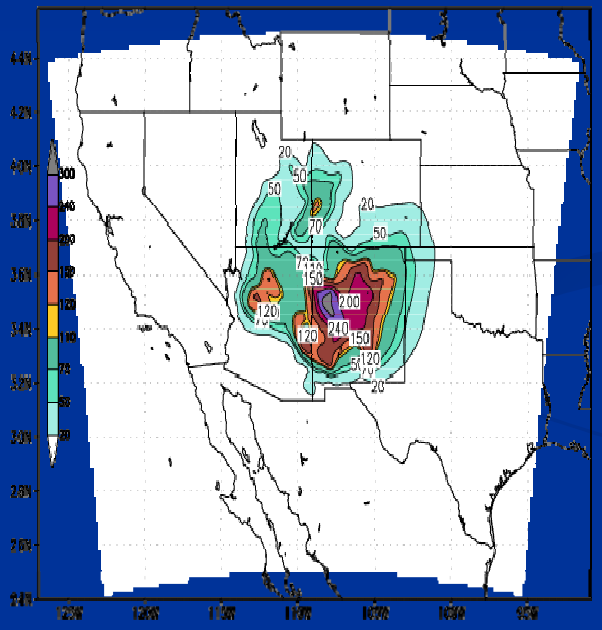
- Single-particle (size) Pre-PREAM
- Simultaneous transport from 4 sources
- Result: sum of transported particles coming from the 4 sources

Juniper Pollen
Near-surface concentration (Nm3)

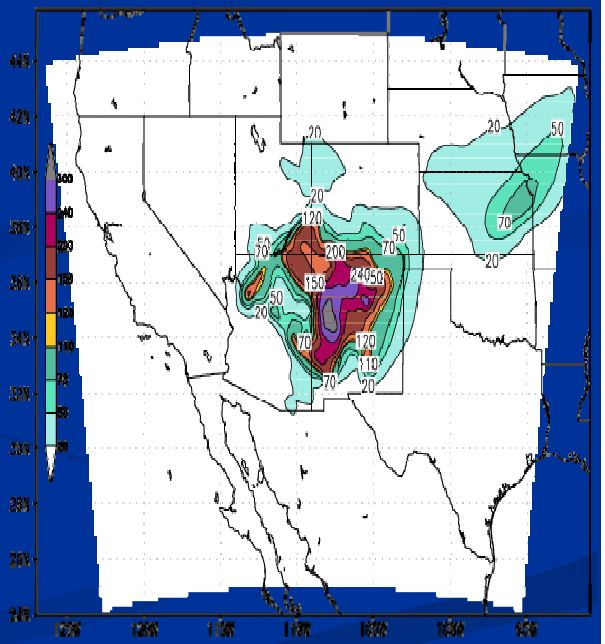
Pre-PREAM



6 March 2006

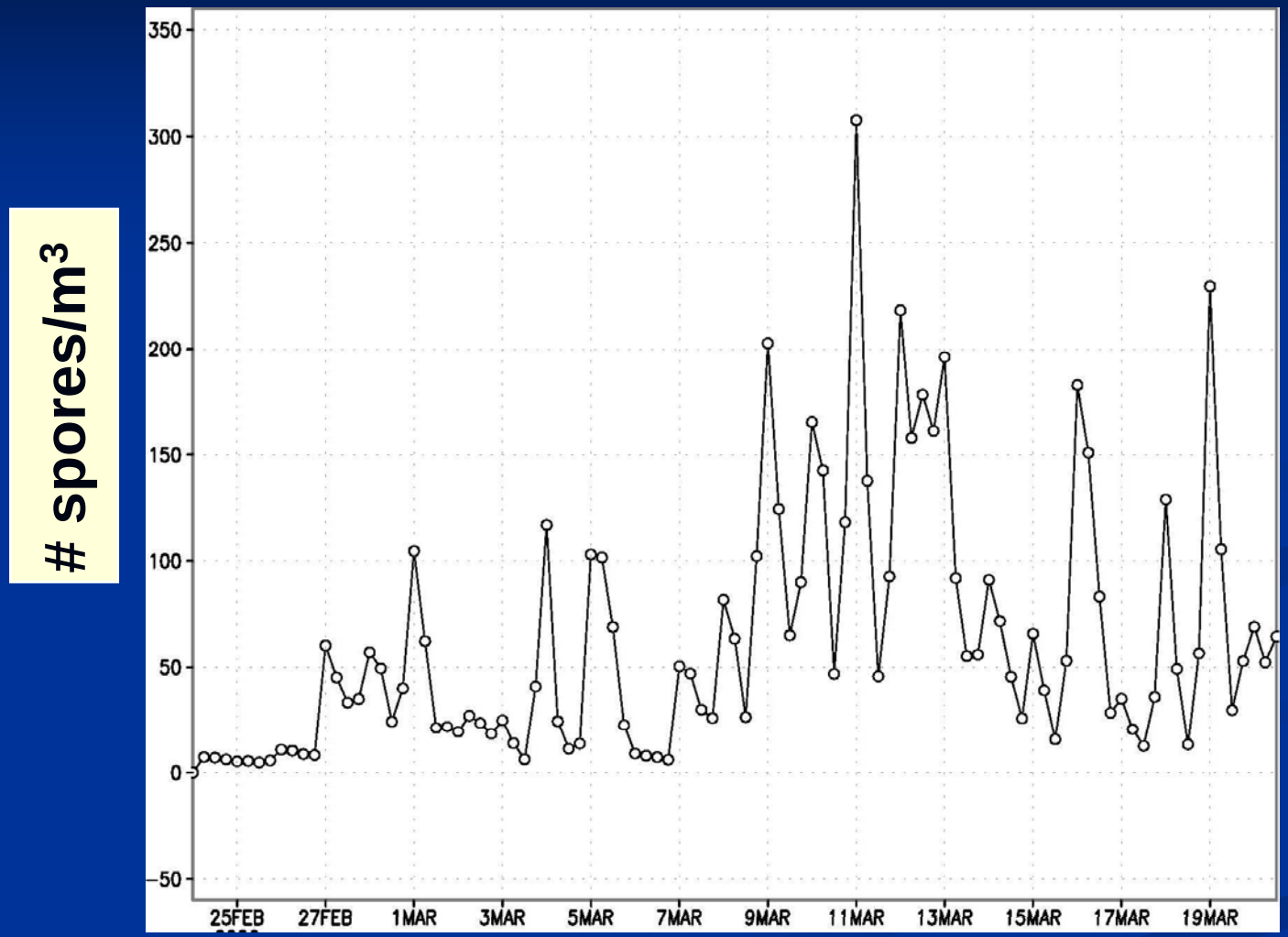


9 March 2006



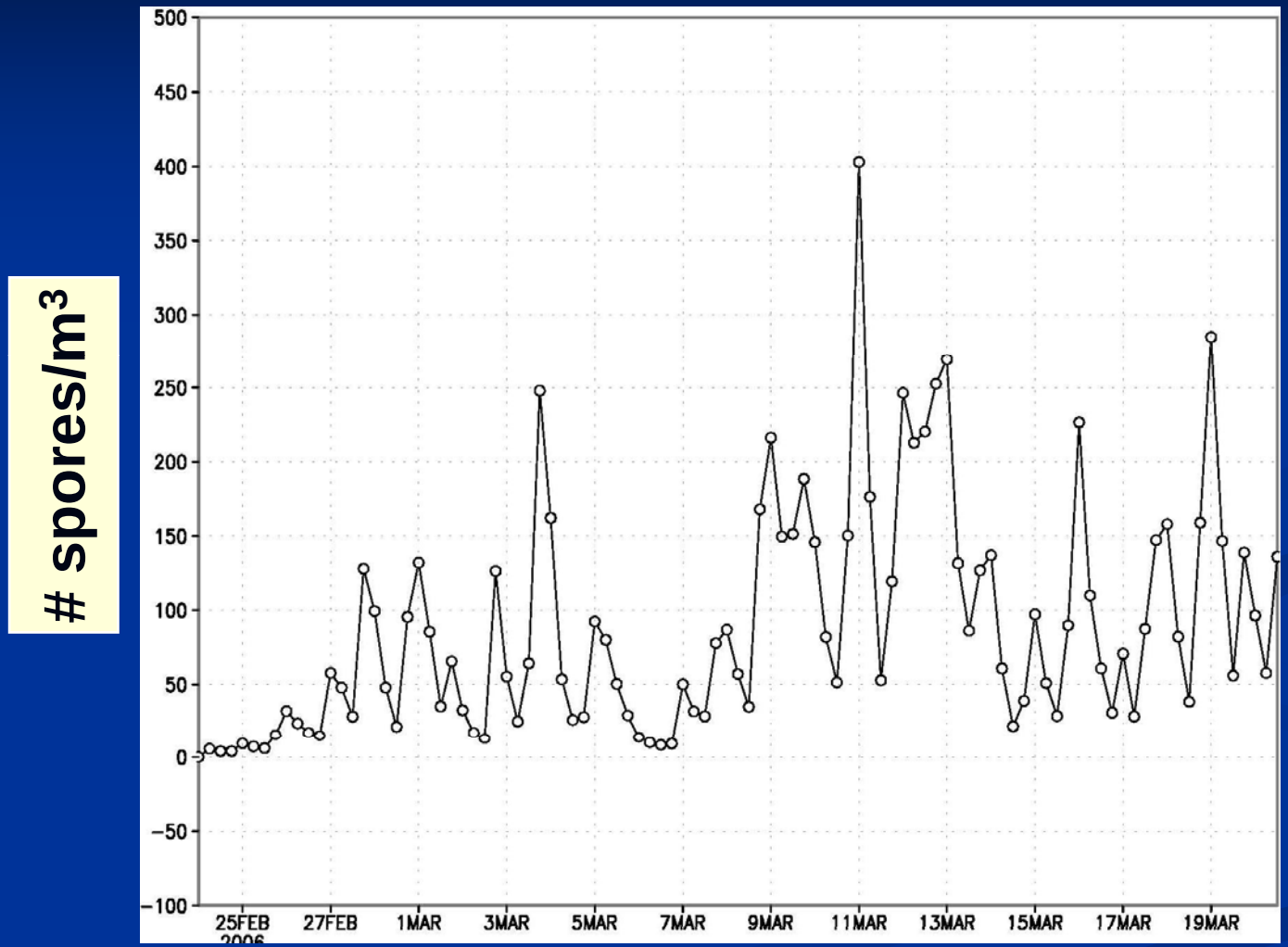
11 March 2006

Albuquerque:
Pollen concentration: 24 Feb – 19 March 2006



Model integration time

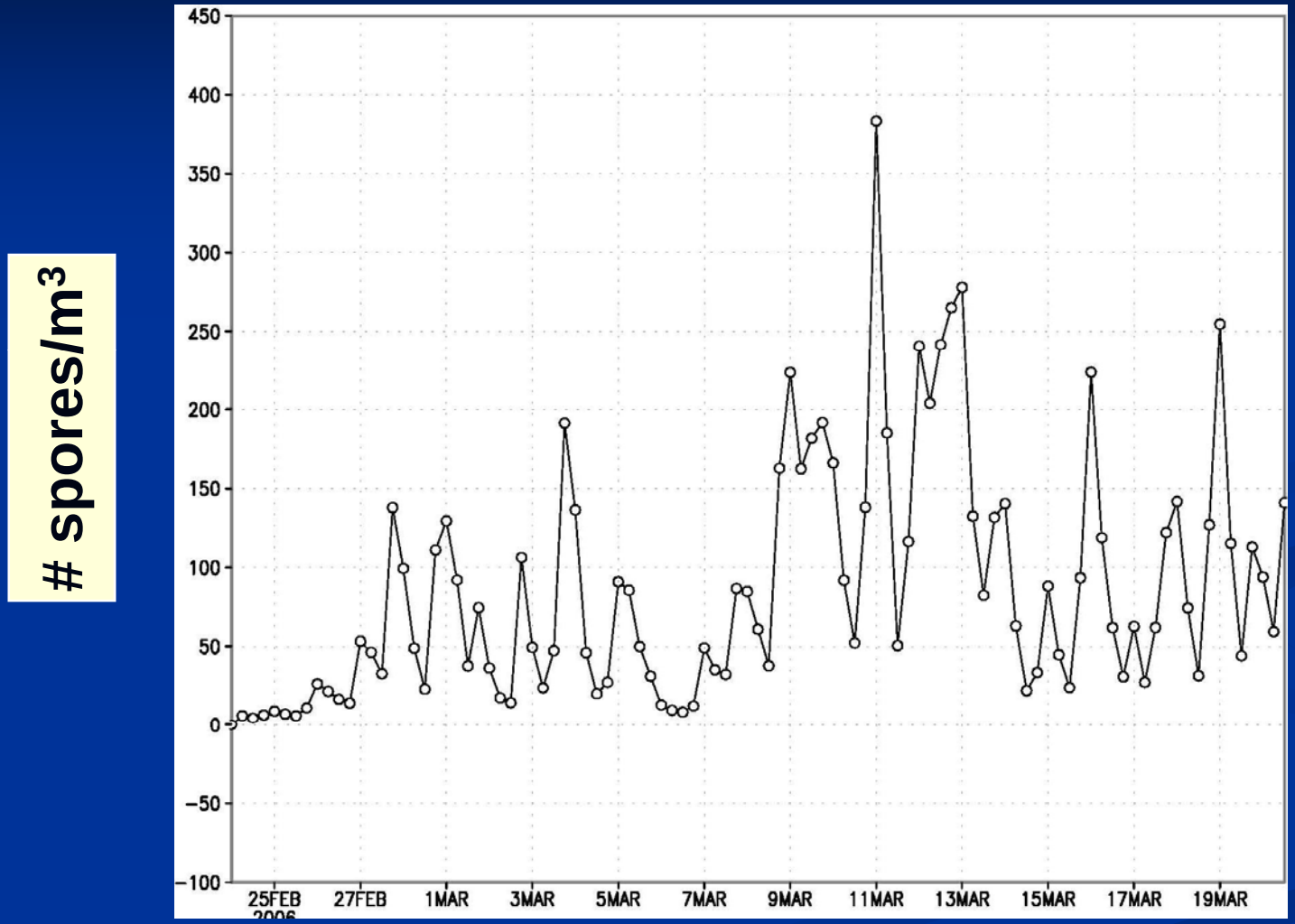
Los Alamos:
Pollen concentration: 24 Feb – 19 March 2006



 # spores/m^3

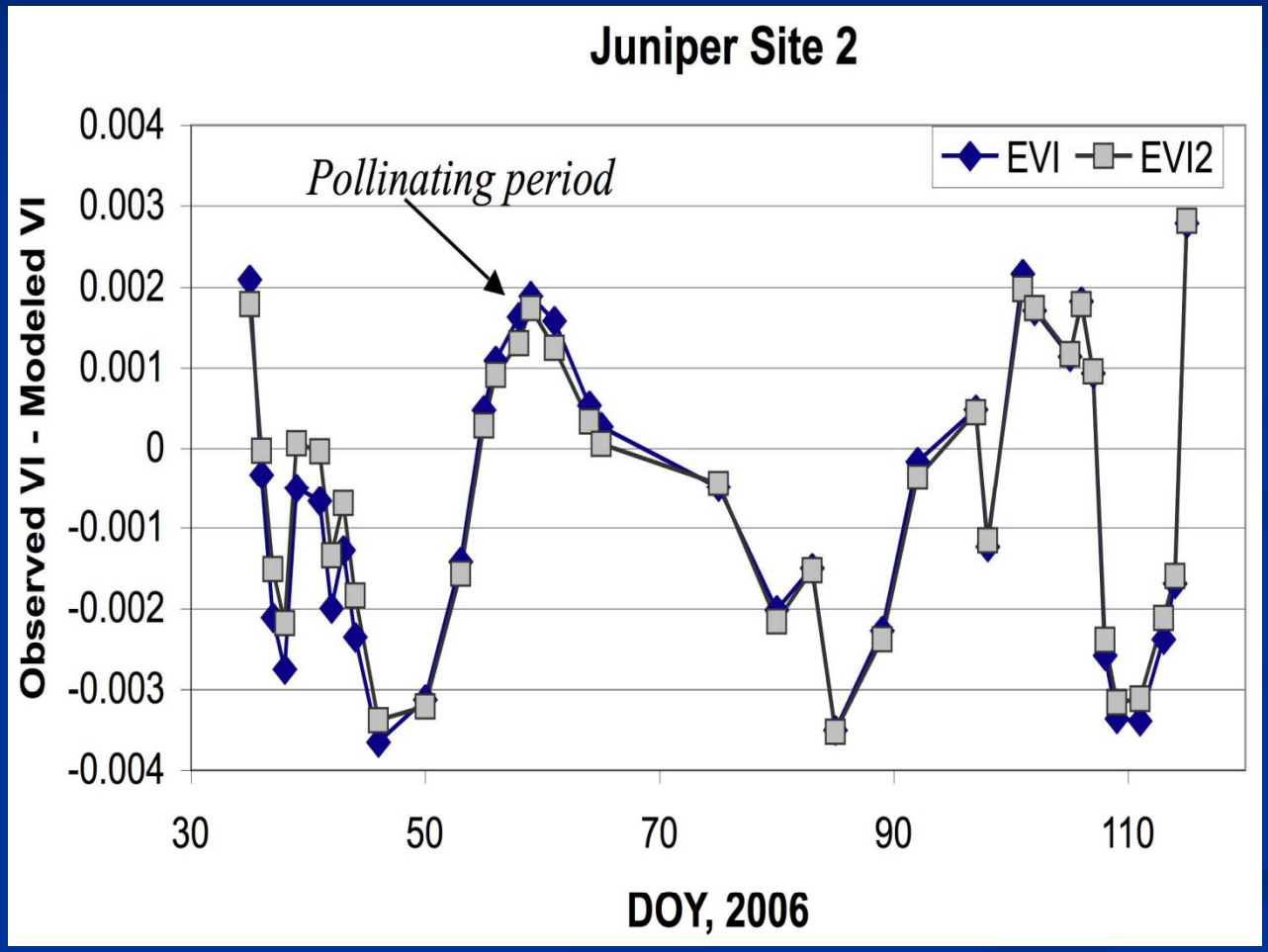
Model integration time

Santa Fe:
Pollen concentration: 24 Feb – 19 March 2006



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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