BlueSky

A Smoke Modeling Framework

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USDA Forest Service

Atmosphere and Fire Interaction Research and Engineering (AirFIRE) Team

Pacific Wildland Fire Sciences Lab

BlueSky

Smoke Modeling Framework

Integrates all we know about fuels, fire, smoke, and weather into one, centralized system.

National Fire Plan
Managing the Impact of Wildfires on the Communities and the Environment

What can BlueSky do?

- Real-time Smoke Concentration Predictions: Prescribed, Wild, *Agricultural* Fires
- Daily Emission Tracking from Multi-Agency Burn Reporting Systems
- *Quantitative Verification*
- Automated, centralized processing
- Web-access to output products

BlueSky

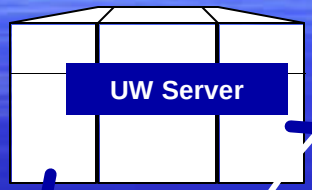
Focus, Integration, Collaboration

- Provides surface PM2.5 concentrations from wildland fire.
- Aiding burn decisions by allowing for:
  - Multi-Agency Communication (address competition for airshed issues)
  - Dissemination of Information to the Public
  - Aid in Go/No-Go/Go-Slow Burn Decisions
- Integrates existing science and knowledge.
- Collaboration is the foundation.

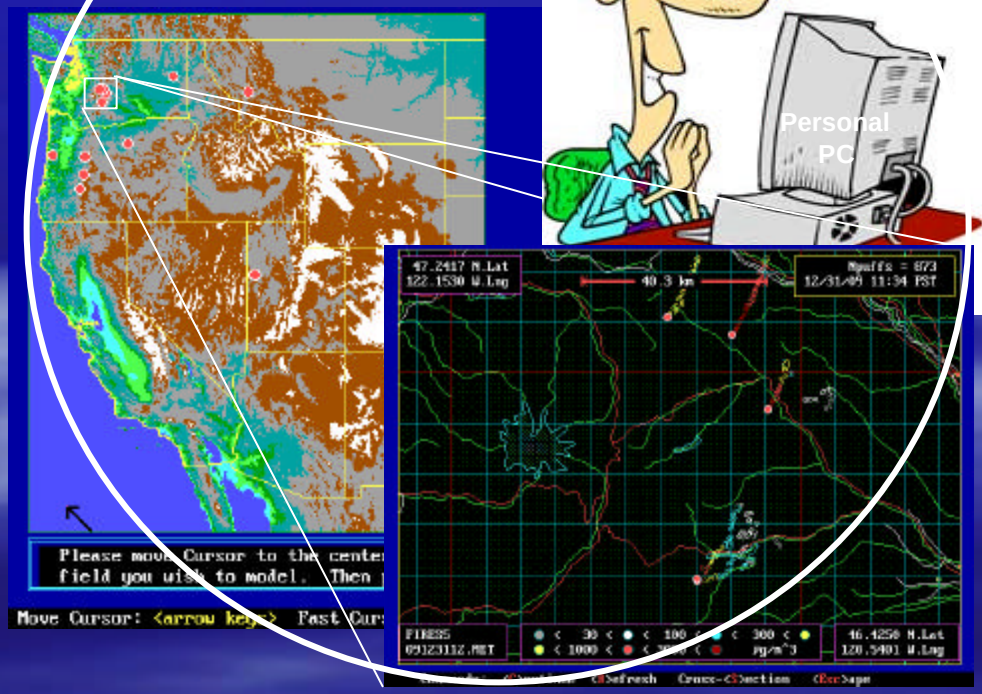
Smoke Predictions

MM5 36-km

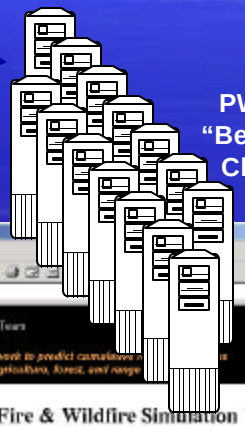
MM5 12-km and 4-km

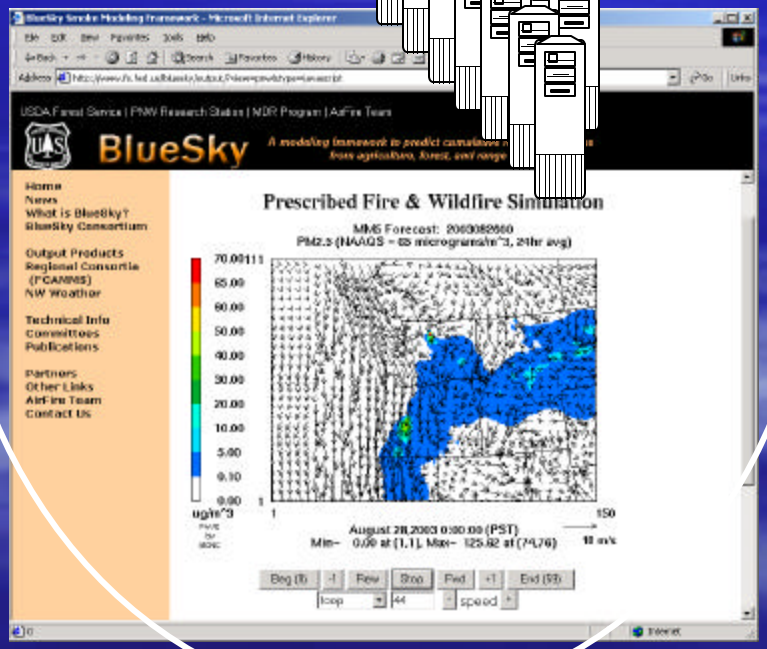


NFSpuff

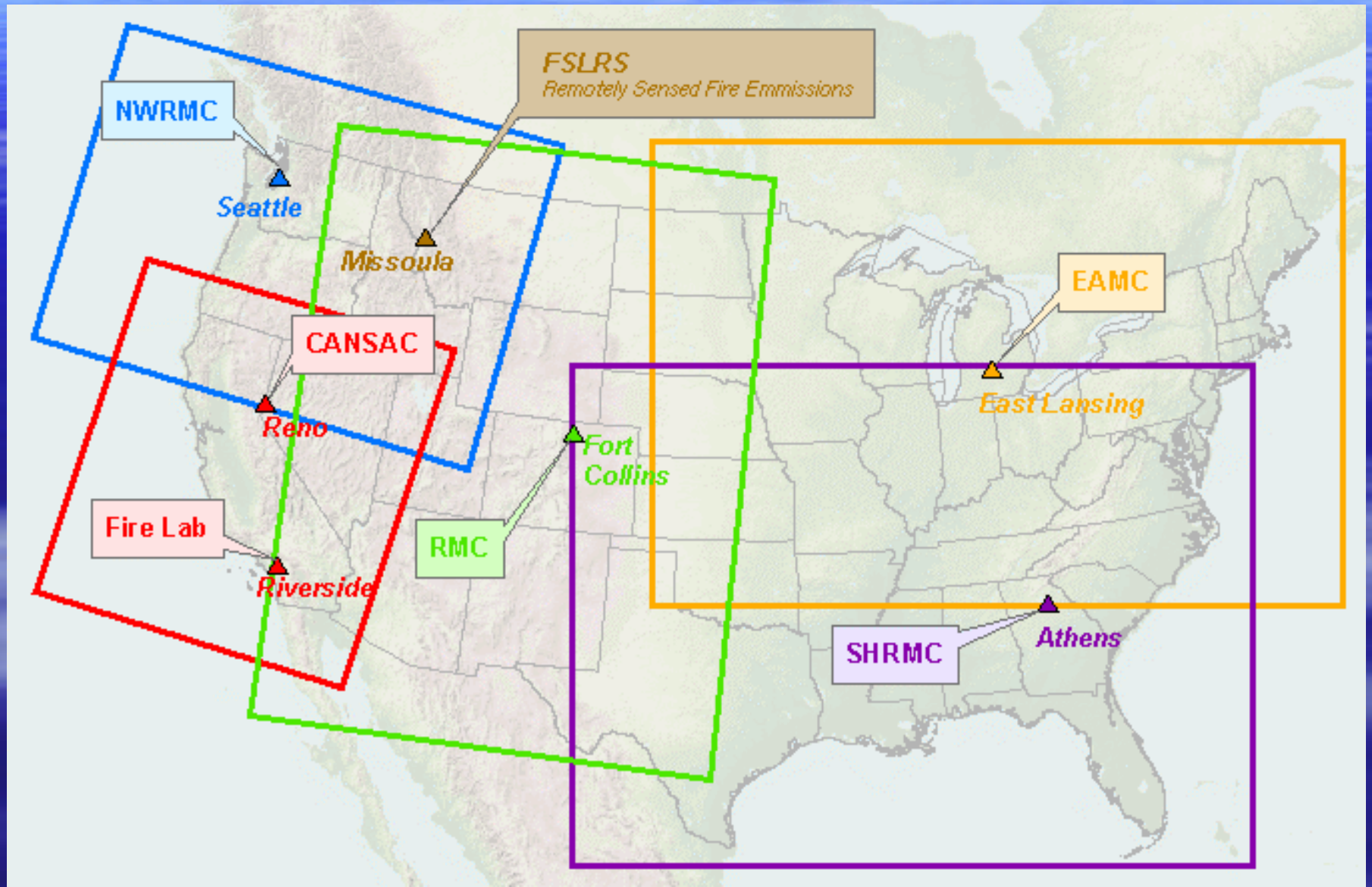


BlueSky





Migration to other FCAMMS Domains



BlueSky Smoke Modeling Framework

Fire Characteristics

FASTRACS, PFIRS
MT/ID Airshed Group(RAZU)
209 Wildfire Reports

Meteorology

FCAMMS

Emissions

Fuel Loadings: Hardy et al., NFDRS, FCC mapping
EPM/COMSUME v1.02
BURNUP

Smoke Dispersion

CALPUFF
HYSPLIT
(CMAQ)

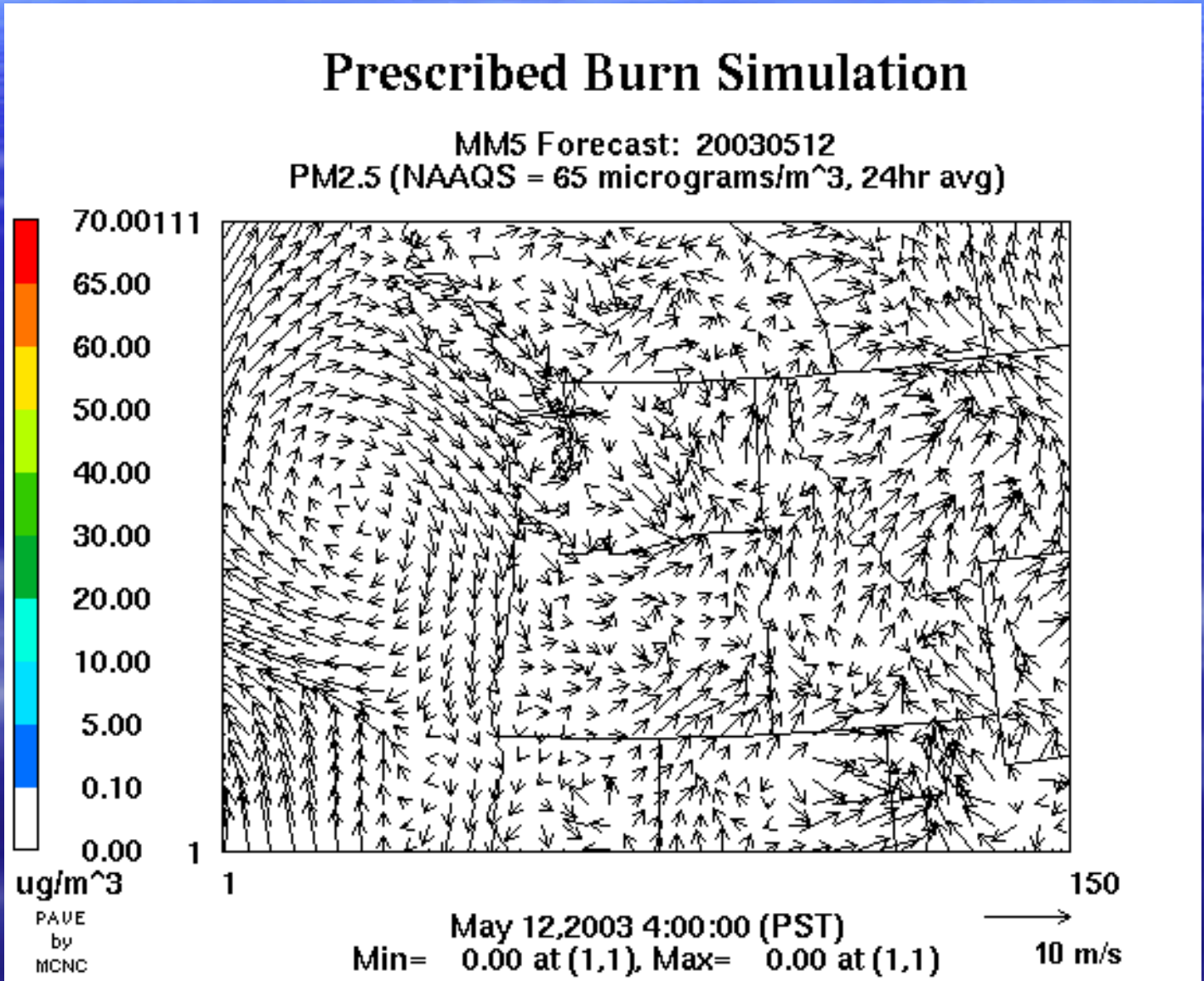
Web Display of Output Products

Animations PM2.5
Surface Concentrations

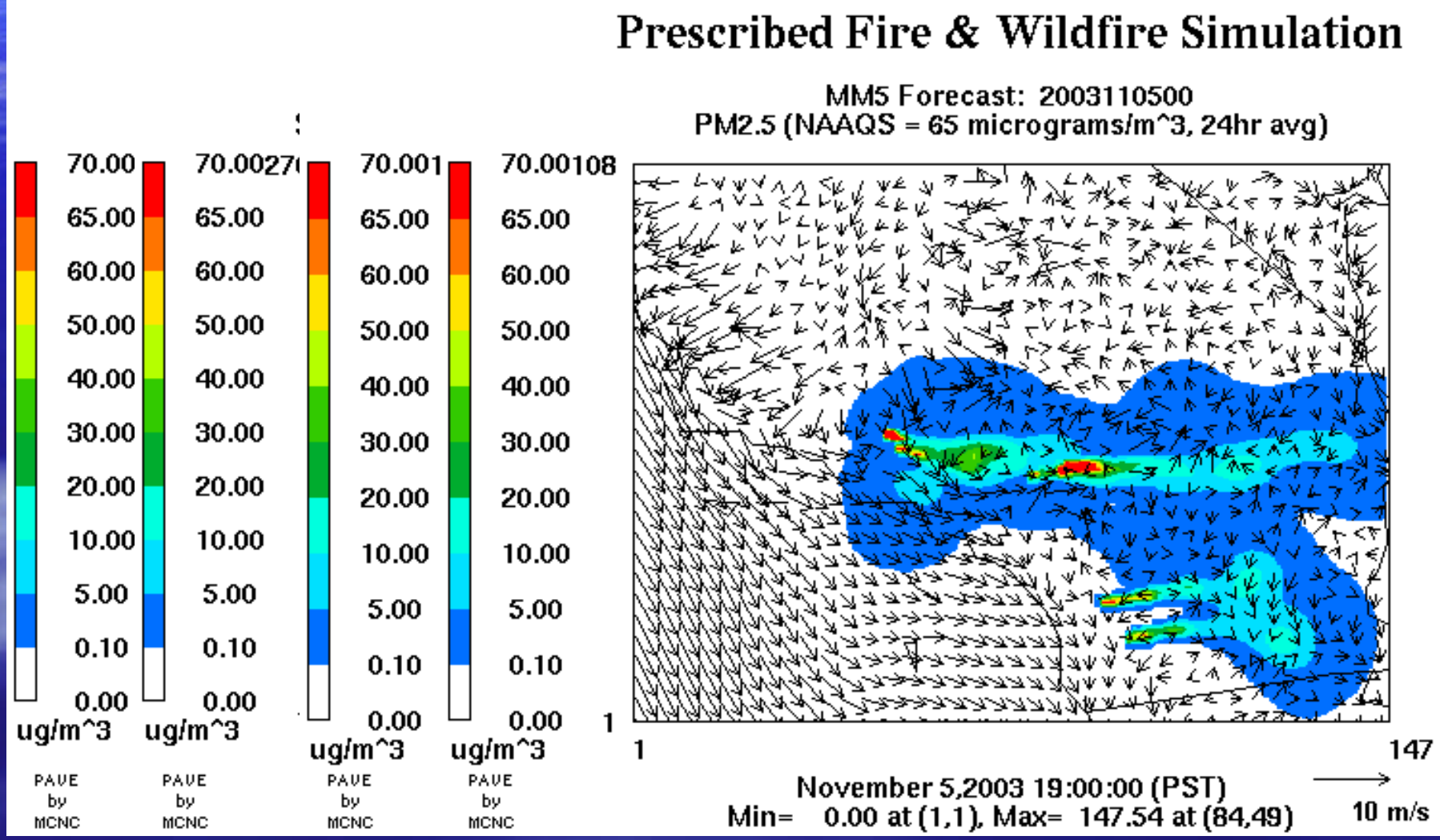
RAINS (ArcIMS/ArcSDE)
Zoom In/Out, Overlay GIS Data
PM2.5 Concentrations, Trajectories,
Meteorological data,

BlueSky Output Products

60 hr Forecast Animations



BlueSky Forecasts Smoke from Wildfires for 5 Western Domains



BlueSky Smoke Modeling Framework - Microsoft Internet Explorer provided by USDA Forest Service

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.fs.fed.us/bluesky/ Go Links

USDA Forest Service | PNW Research Station | MDR Program | AirFire Team

BlueSky

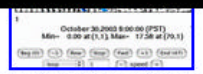
A modeling framework to predict cumulative impacts of smoke from agriculture, forest, and range fires

Home
News
What is BlueSky?
BlueSky Consortium

Output Products
Regional Consortia (FCAMMS)
NW Weather

Technical Info
Committees
Publications

Partners
Other Links
AirFire Team
Contact Us

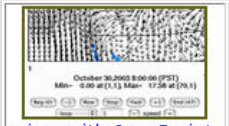


view with JavaScript Animator | view as Animated GIF

California and Nevada

produced by the **Santa Barbara Atmospheric Research Center** and the **AirFire Team**

Current Northern California Smoke Impact Forecast (more info)



view with JavaScript Animator | view as Animated GIF

Current Southern California Smoke Impact Forecast (more info)

view with JavaScript Animator | view as Animated GIF

Current Northern and Southern California Weather (MM5) Forecast

Midwest and Northeast regions

produced by the **Eastern Area Modeling Consortium (EAMC)**

Smoke Forecasts will be coming soon for this region.
Current Midwest and Northeast Fire Weather (MM5) Forecast

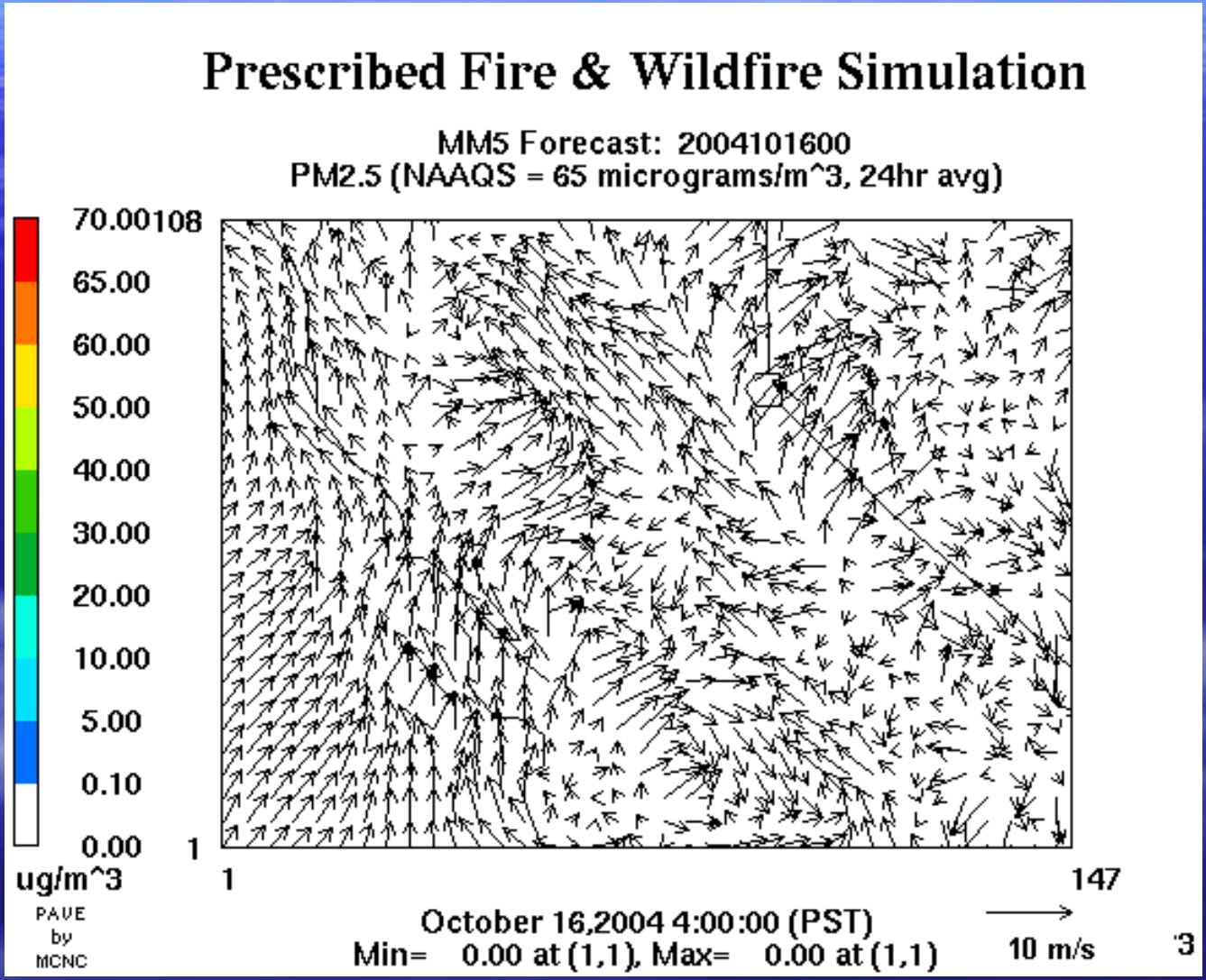
Southern regions

produced by the **Southern High Resolution Modeling Consortium (SHRMC)**

Smoke Forecasts will be coming soon for this region.
Current Southern Fire Weather (MM5) Forecast

Internet

HOTSPRINGS, FREDS, POWER, & RUMSEY WILDFIRES



What is RAINS?

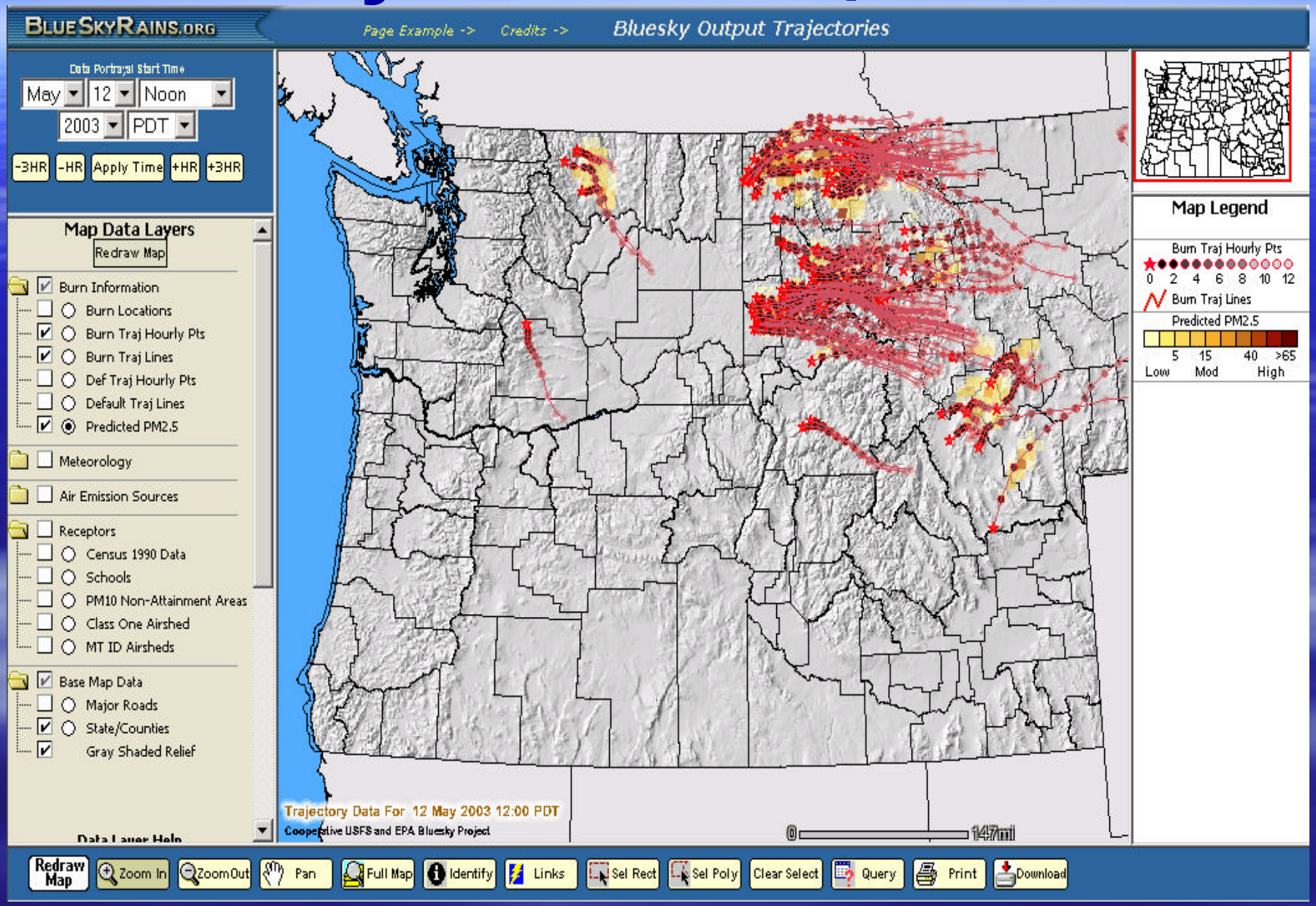
- Rapid Access Information System (RAINS)
  - Geographical Information System (GIS)
  - Using ArcIMS/ArcSDE, SQL server
  - Allowing for web display of BlueSky output products with all the benefits of GIS
- Developed by EPA

BlueSkyRAINS

- Combines the BlueSky smoke forecast with the power of RAINS GIS technology.

- Allows for interactive quantitative assessment of smoke impacts from burning activities in the region.

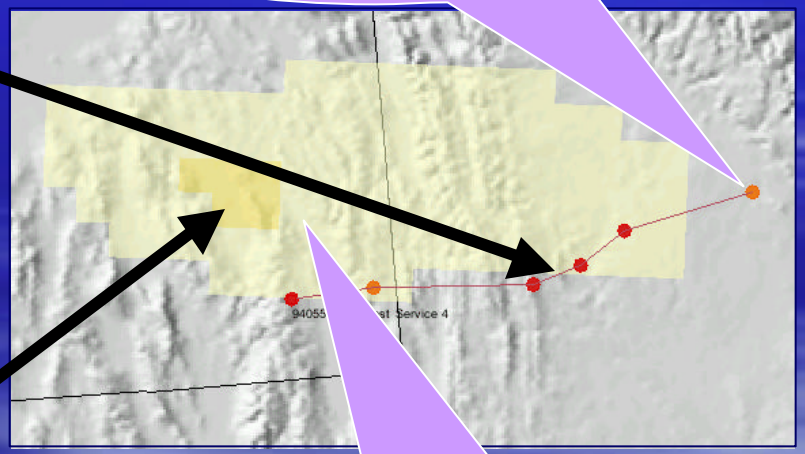
BlueSkyRAINS Output Products



www.BlueSkyRAINS.org

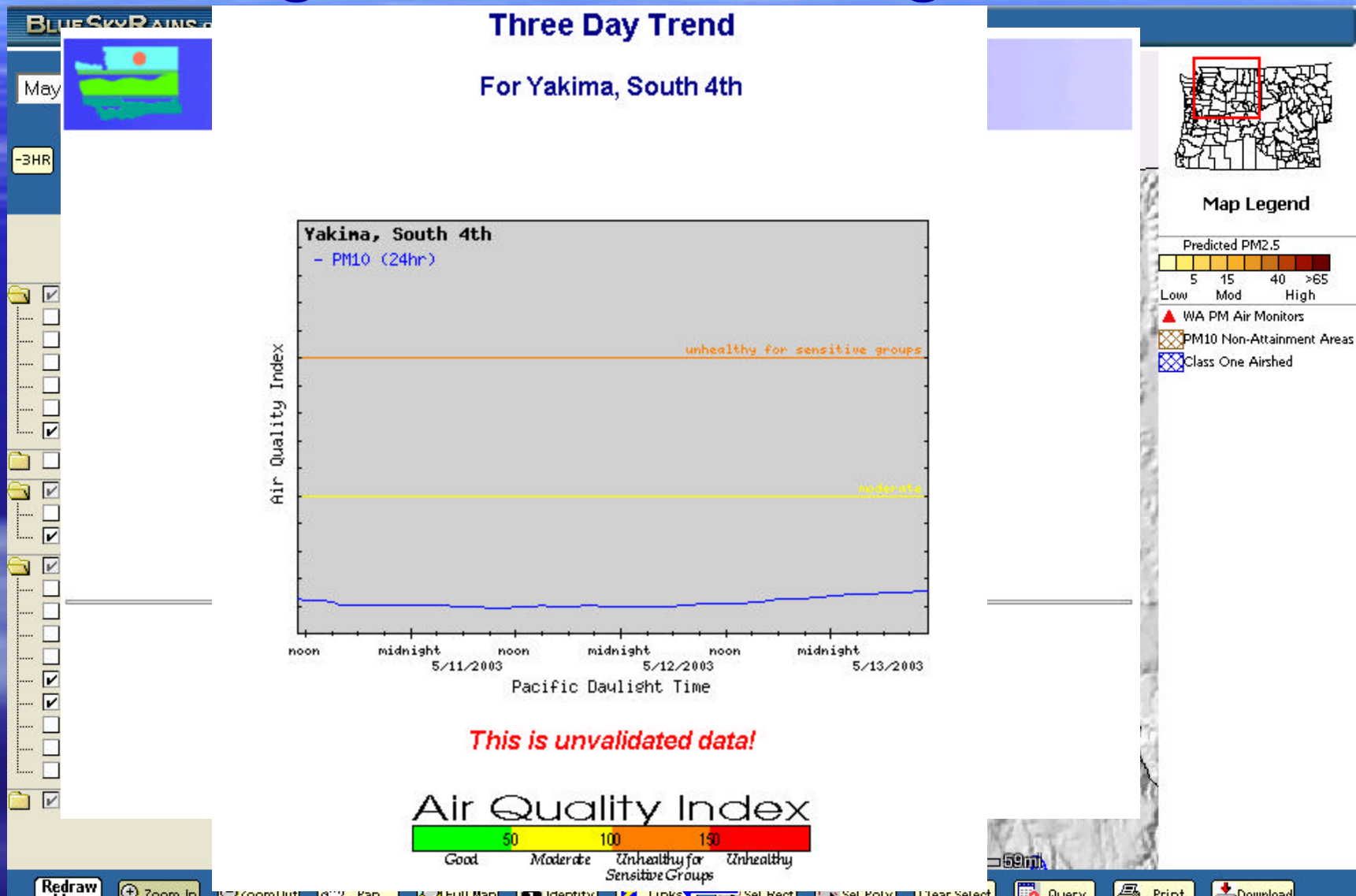
- **Trajectories**
  - Follow air currents *(like a balloon)*
  - May be well above surface
  - New from source each hour during day of burn
- **Surface Concentrations**
  - Result of plume dynamics
  - Always at the surface
  - Cumulated from source each hour during emission period

Dot color indicates height of parcel above surface (red is lowest).

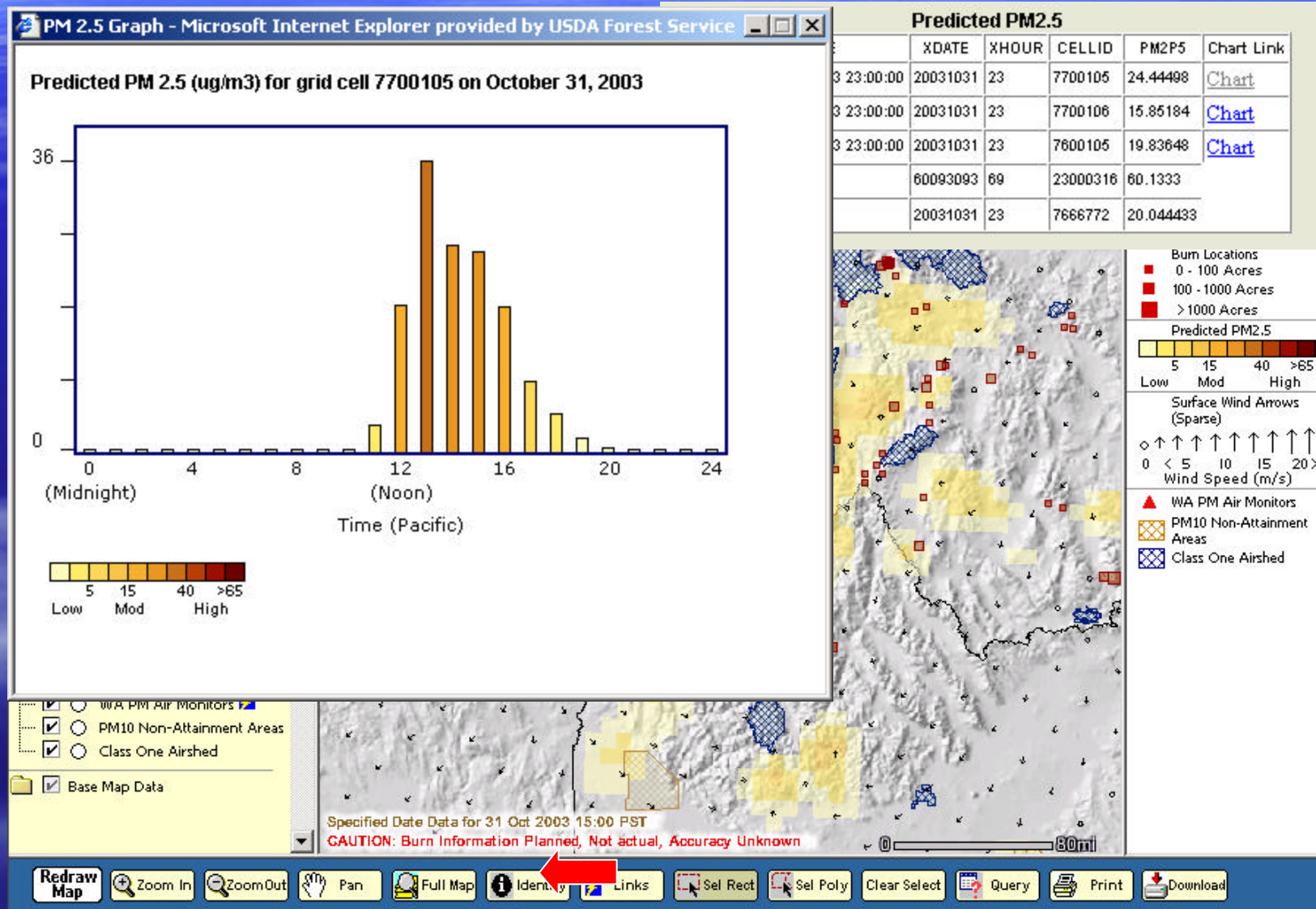


Shade color indicates concentration in µg/m^3.

BlueSkyRAINS:
Linkage with Monitoring Data

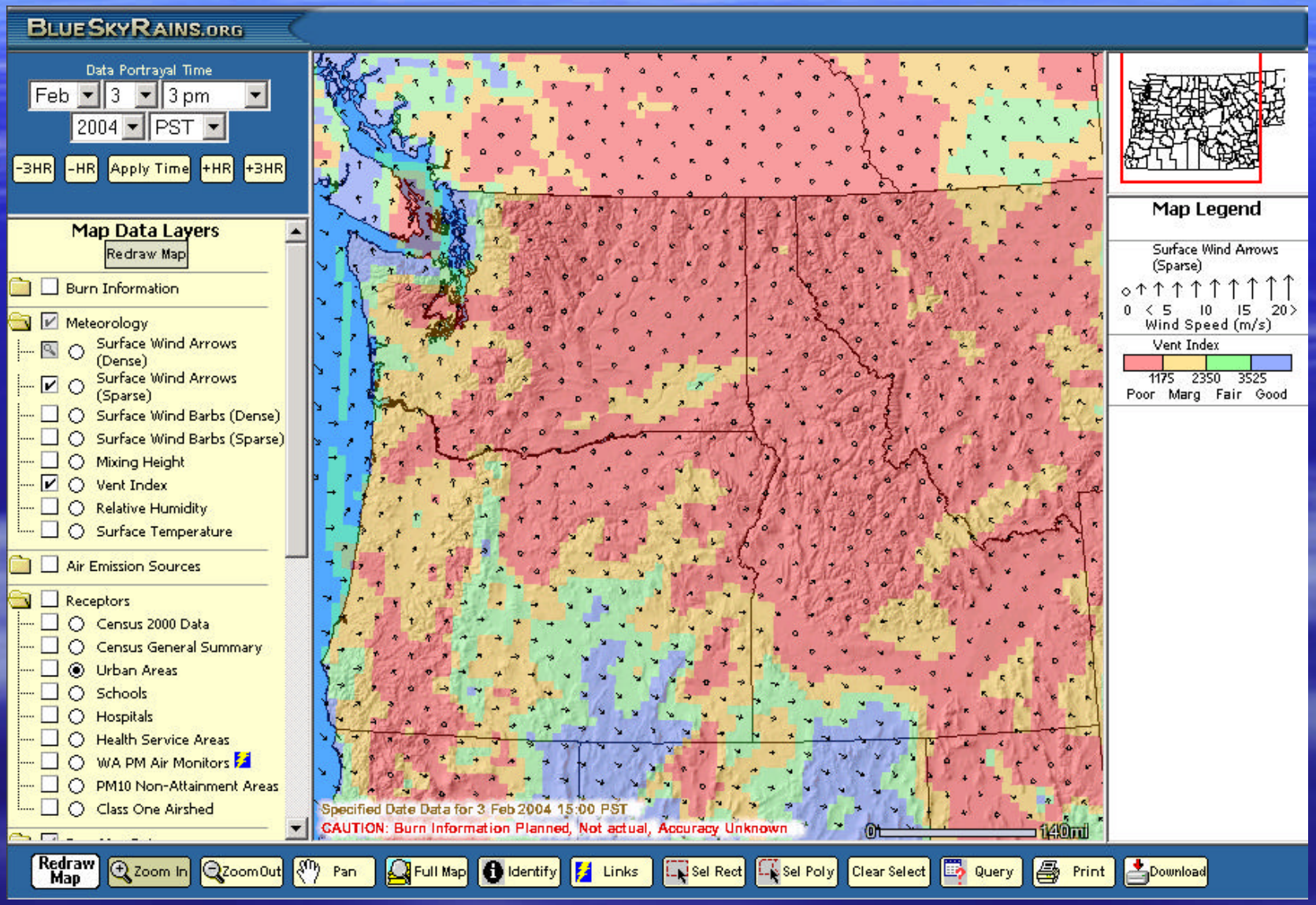


BlueSkyRAINS:
Quantitative Impacts

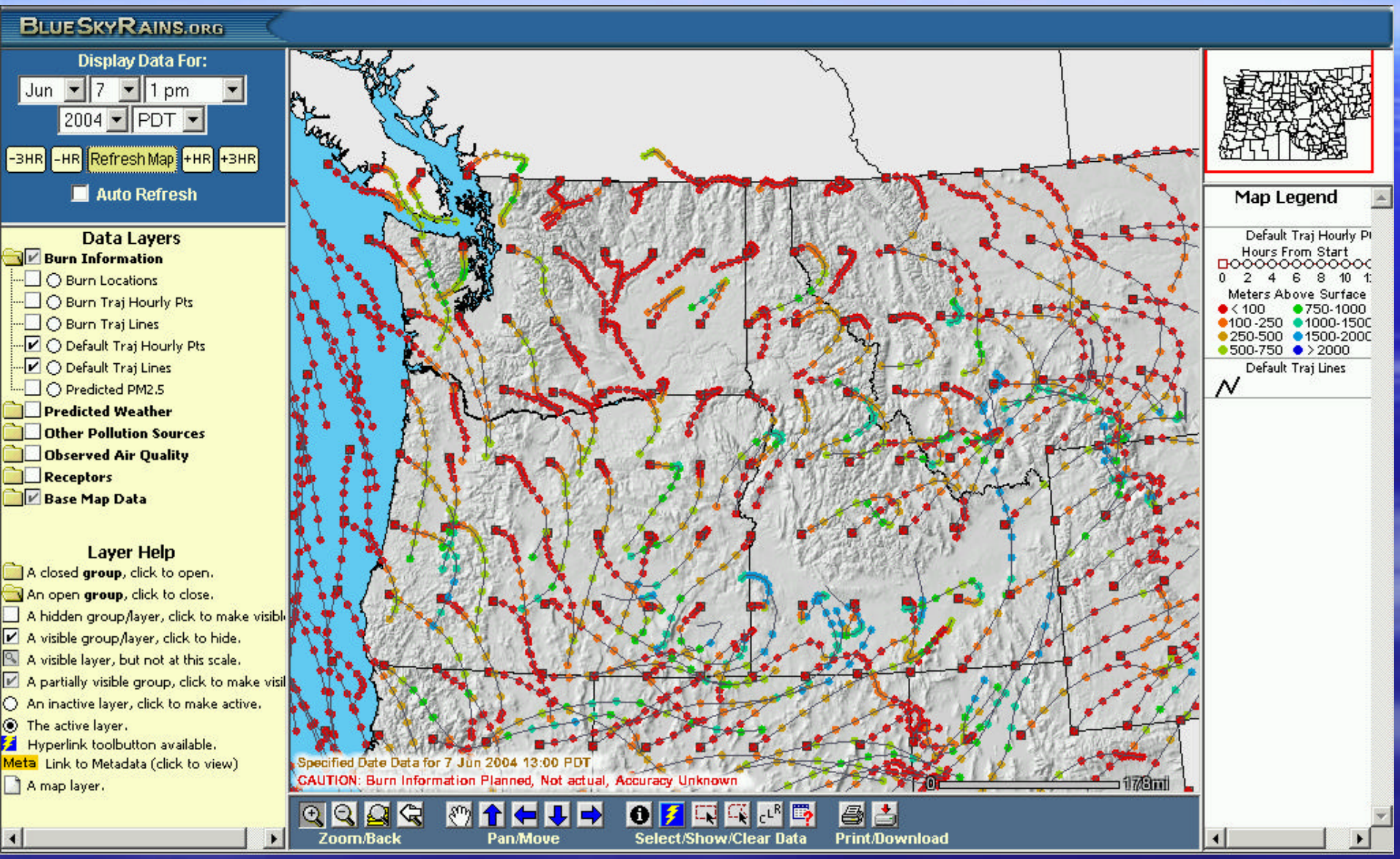


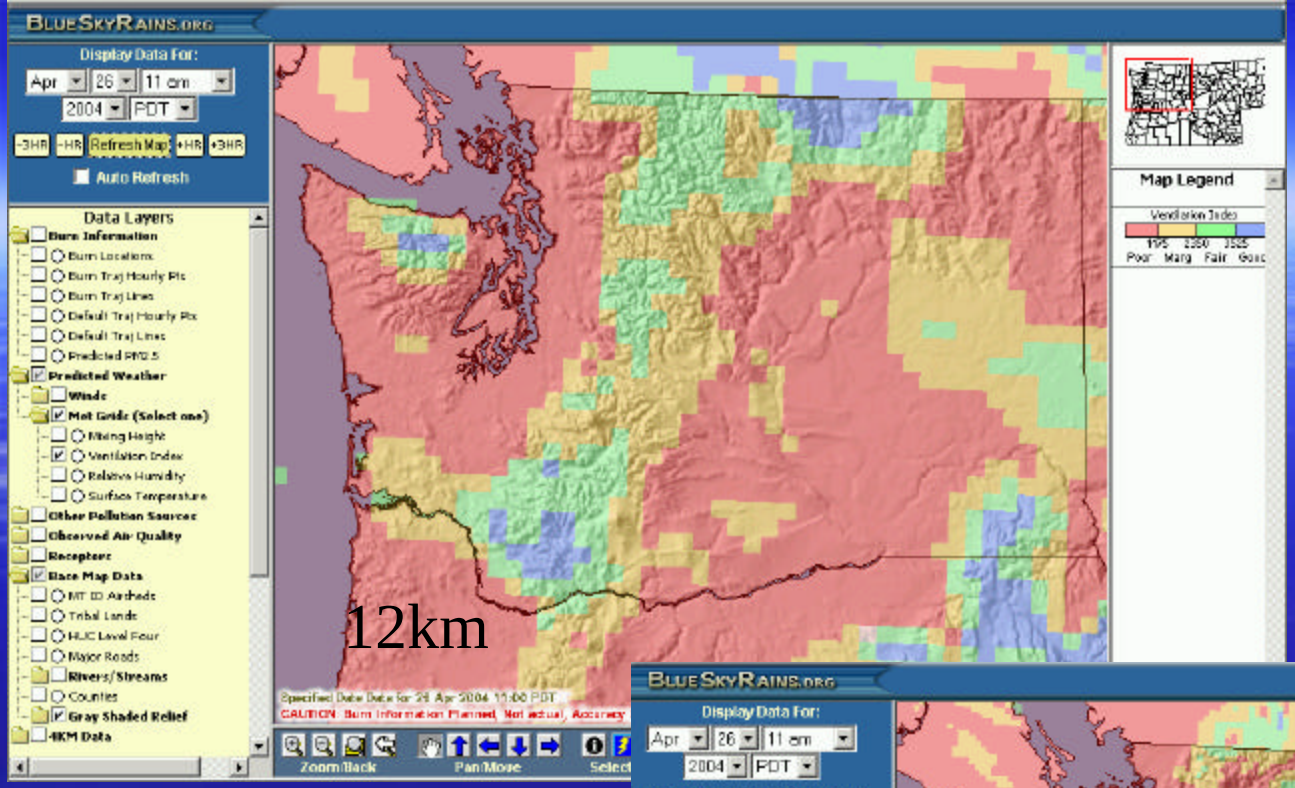
BlueSkyRAINS

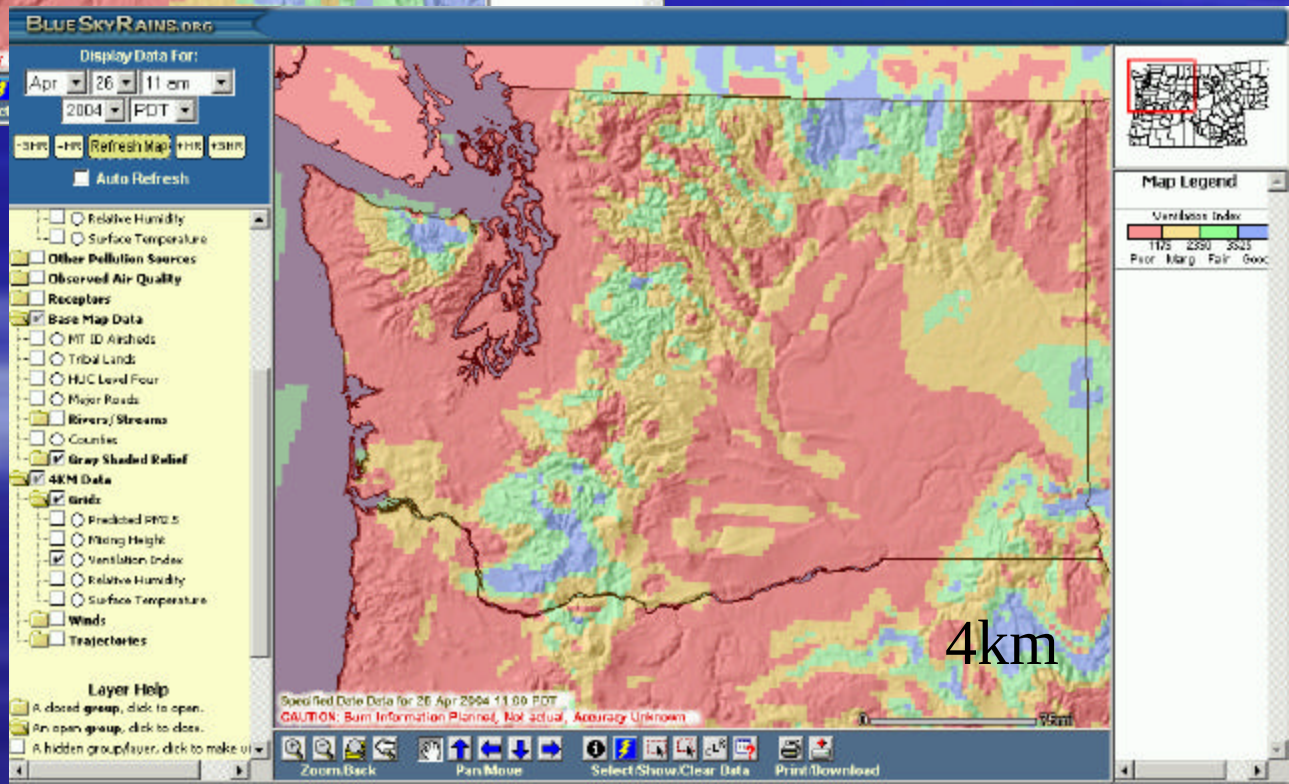
Meteorology for dispersion forecasting



Default Trajectories




BlueSkyRains.org
Display Data For:
Apr 26 11 am
2004 PDT
-3HR -1HR Refresh Map +1HR +3HR
Auto Refresh
Data Layers
Burn Information
Burn Locations
Burn Traj Hourly Pts
Burn Traj Lines
Default Traj Hourly Pts
Default Traj Lines
Predicted PM2.5
Predicted Weather
Winds
Met Grids (Select one)
Mixing Height
Ventilation Index
Relative Humidity
Surface Temperature
Other Pollution Sources
Observed Air Quality
Receptors
Base Map Data
MT ID Airsheds
Tribal Lands
HUC Level Four
Major Roads
Rivers/Streams
Counties
Gray Shaded Relief
4KM Data
12km
Map Legend
Ventilation Index
Poor Marg Fair Good
Zoom/Back
Pan/Move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Gray Shaded Relief
4KM Data
Grids
Predicted PM2.5
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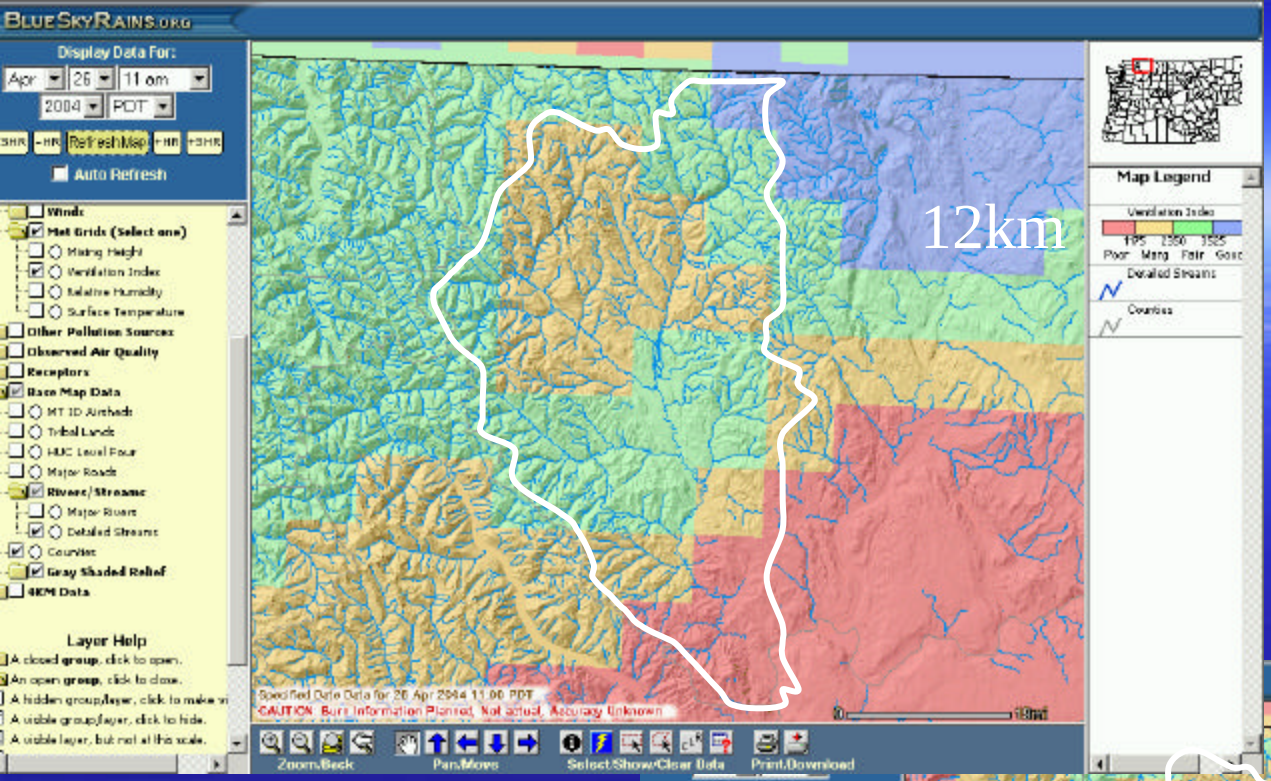
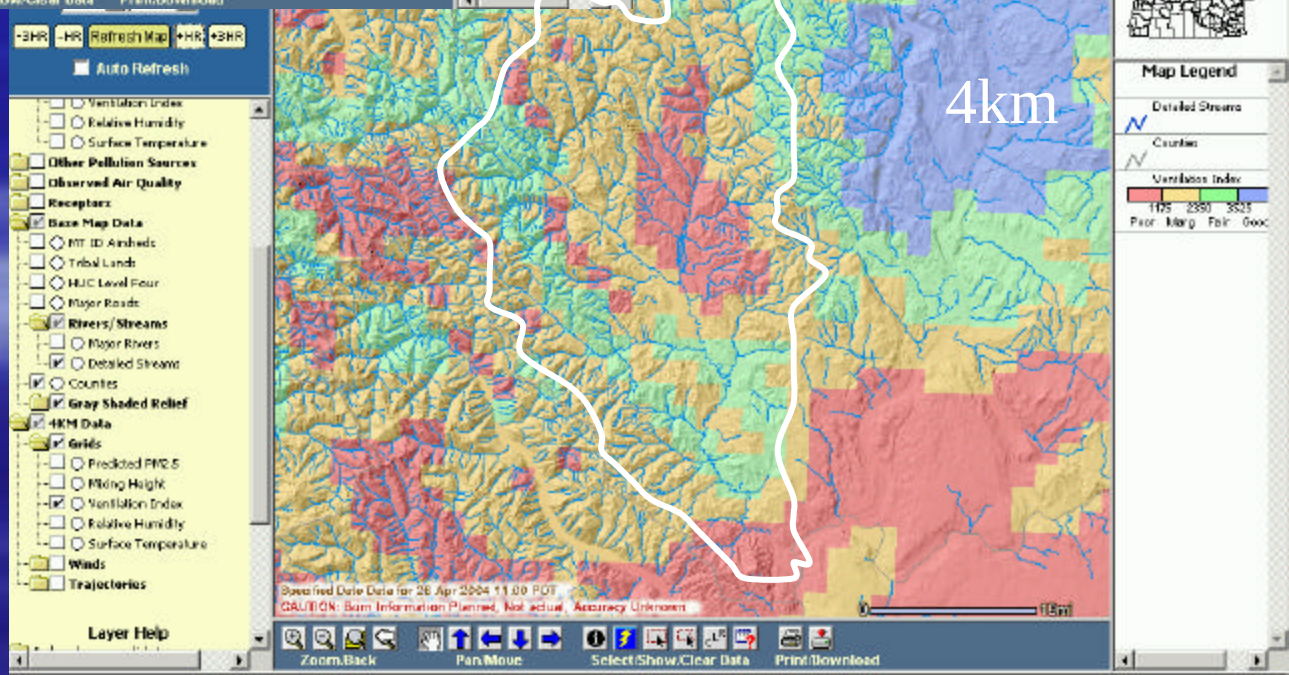
Relative Humidity
Surface Temperature
Winds
Trajectories
Layer Help
A closed group, click to open.
An open group, click to close.
4km
Map Legend
Ventilation Index
Poor Marg Fair Good
Zoom/Back
Pan/Move
Select/Show/Clear Data
Print/Download

Washington's Methow Valley





BlueSkyRAINS

Applications

- Prescribed Fires
- Wildfires
- Agricultural Burning

- Incident command teams
  - Public information
  - Planning burnouts
  - Aircraft resource allocation
- Local burners
  - go/no-go/go-slow decisions
  - Negotiation tool
- Smoke managers
  - Cumulative effects monitoring
  - Emission tracking
- Air Regulators
  - Cumulative effects monitoring
  - Emission tracking
  - go/no-go decisions
- All Users
  - Impact assessment & mitigation

WESTERN BLUESKY RAINS

Information about Potential Wildfire Smoke Impacts

Funded & Sponsored by the USFS and USEPA

- Home
- Overview
- Animations
- National Coordination
- Weather
- Related Links
- Help
- Privacy & Security

Email Questions or Comments to:

Dr. Sue A. Ferguson, USFS
sferguson@fs.fed.us

Rob Wilson, USEPA
wilson.rob@epa.gov

View Wildfire Smoke Forecast Maps (Forecast initialized at 00 UTC Nov 04 2004)

Select A Forecast Map Below

1. Select a map area or domain

Western United States

2. Select the forecast date & time

Oct | 1 | 2004
8 am | PDT

3. Select the type of forecast

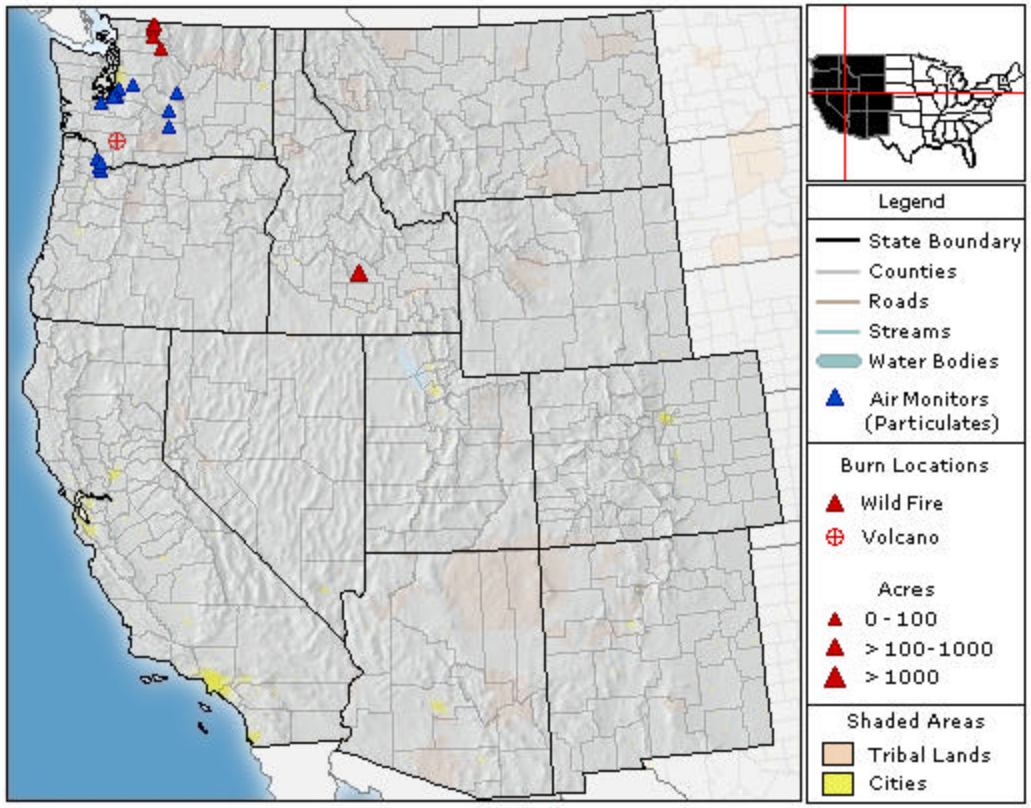
- [x] Smoke Forecast
- [ ] Meteorology
- [ ] Default Smoke Trajectories

4. Generate the Forecast Map(s)

Click here to view Forecast Maps
*or click on the map to view a local forecast map for your area

Additional Information:
US Forest Service Volcano Cam
(refresh page for latest image)

View Air Quality Forecasts



Caution: Maps are derived from automated Wildfire Reports and modeled smoke and weather predictions. Actual impacts may deviate from mapped displays.

0 — 633 Miles

Albers Projection

http://westernblueskyrains.epa.gov/website/bluewest/viewer.htm?Box=-927109.0:1088459.0:1212052. - Microsoft Internet Explorer p

WESTERN BLUESKYRAINS

Information about Potential Wildfire Smoke Impacts

Display Data For:

Oct | 2 | 8 pm

2004 | PDT

-3HR | -HR | Refresh Map | +HR | +3HR

Auto Refresh

Data Layers

Data Status

- Burn Information (36km)
- Predicted Weather (36km)
- NOAA Fire/Smoke Information
- Mt St Helens Information
- Other Pollution Sources
- Observed Air Quality
- Receptors
- Base Map Data

AIRNOW | Bluesky Animations

Bluesky Pacific NW | NOAA Animations

Layer Help

- A closed **group**, click to open.
- An open **group**, click to close.
- A hidden group/layer, click to make visibl
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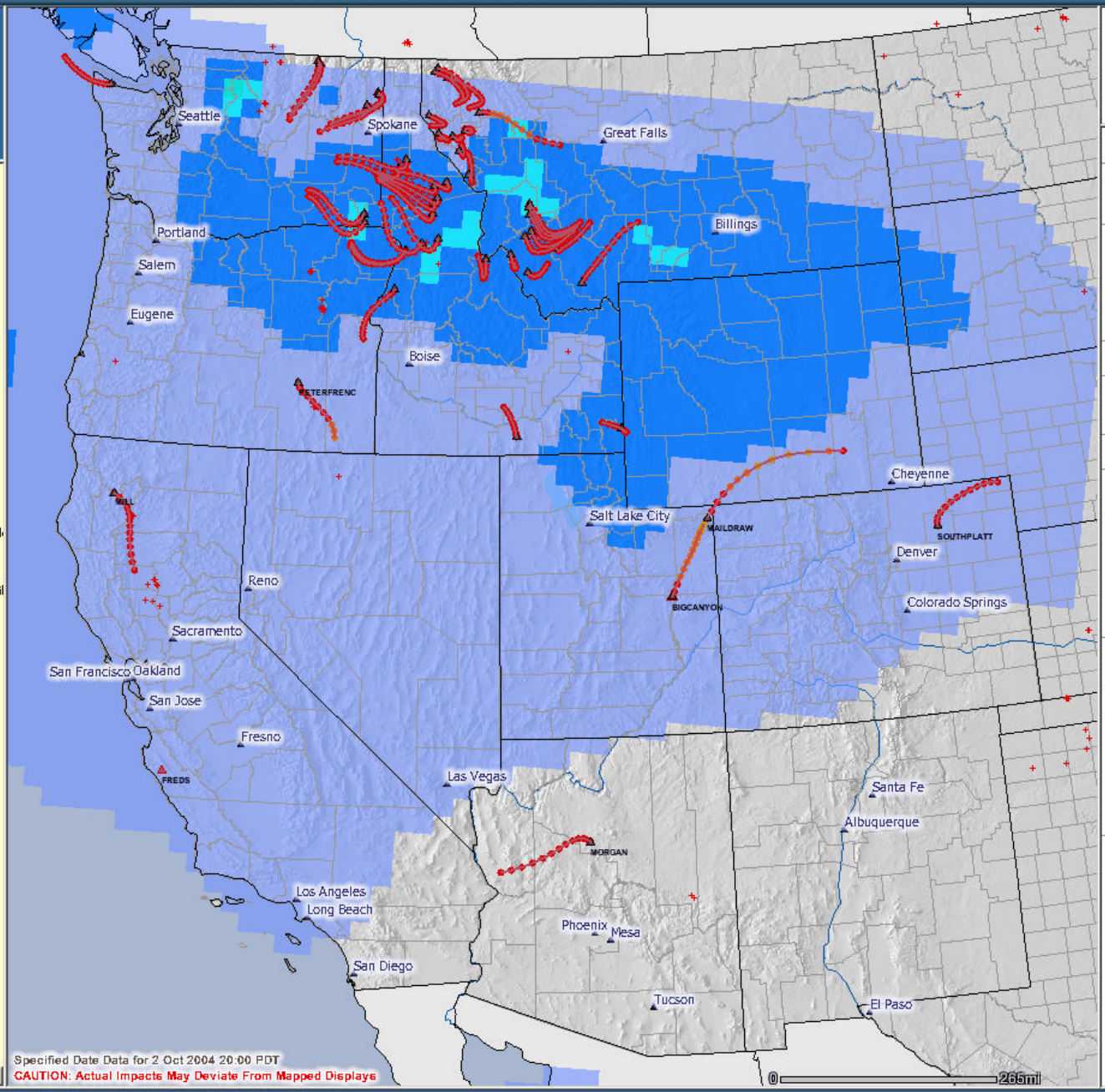
- The active layer.
- Hyperlink toolbutton available.
- Meta Link to Metadata (click to view)
- A map layer.



Specified Date Data for 2 Oct 2004 20:00 PDT

CAUTION: Actual Impacts May Deviate From Mapped Displays

Map Legend

Wildfire Locations
- 0 - 100 Acres
- 100 - 1000 Acres
- >1000 Acres

Burn Traj Hourly Pts
Hours From Start
0 2 4 6 8 10 12

Meters Above Surface
- < 100
- 100 -250
- 250-500
- 500-750
- 750-1000
- 1000-1500
- 1500-2000
- > 2000

Burn Traj Lines

Predicted PM2.5 36km
1 5 10 20 40 60 >65
Low Mod High

NOAA Fire Detects

Traj Lines Rlse <= 1000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12
Based On 4km Met Data
& release abv surface
- 10m
- 500m
- 1,000m

Traj Lines Rlse >= 3000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12
Based On 4km Met Data
& release abv surface
- 3,000m
- 6,000m
- 9,000m
- 12,000m
- 15,000m

Tool Help | Zoom/Back | Pan/Move | Select/Show/Clear Data | Print/Download

http://westernblueskyrains.epa.gov/website/bluewest/viewer.htm?Box=-927109.0:1088459.0:1212052. - Microsoft Internet Explorer p

WESTERN BLUESKYRAINS

Information about Potential Wildfire Smoke Impacts

Display Data For:

Oct | 21 | 5 am

2004 | PDT

-3HR | -HR | Refresh Map | +HR | +3HR

Auto Refresh

Data Layers

Data Status

- Burn Information (36km)
- Predicted Weather (36km)
- NOAA Fire/Smoke Information
  - NOAA Observed Smoke
  - NOAA Fire Detects
  - NOAA Hysplit Soot Forecast Meta
- Mt St Helens Information
- Other Pollution Sources
- Observed Air Quality
  - AirNow PM2.5 Monitors
  - WA PM Air Monitors
- Receptors
- Base Map Data

AIRNOW | Bluesky Animations

Bluesky Pacific NW | NOAA Animations

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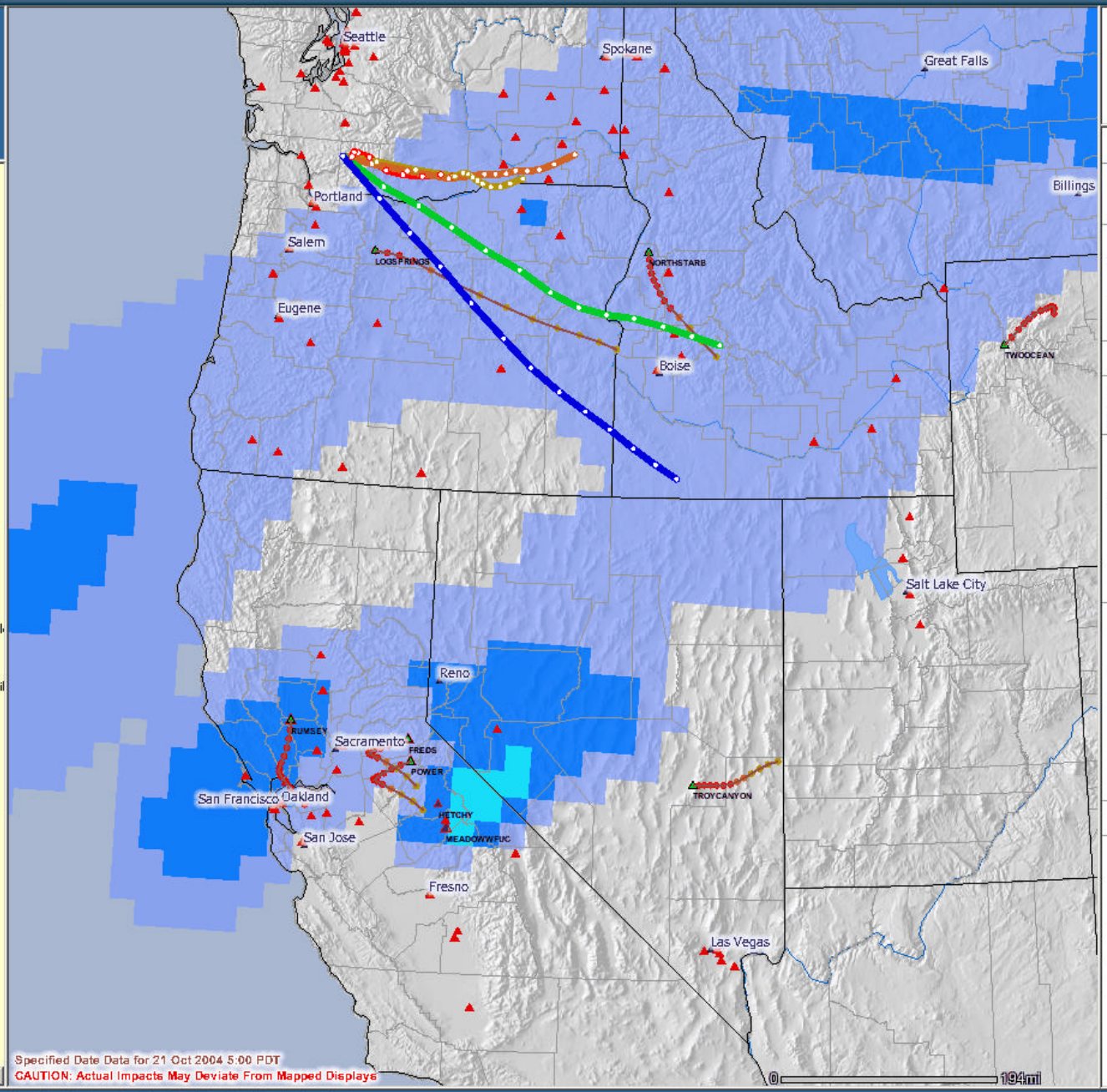

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Burn Traj Hourly Pts
Hours From Start
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Hours From Start
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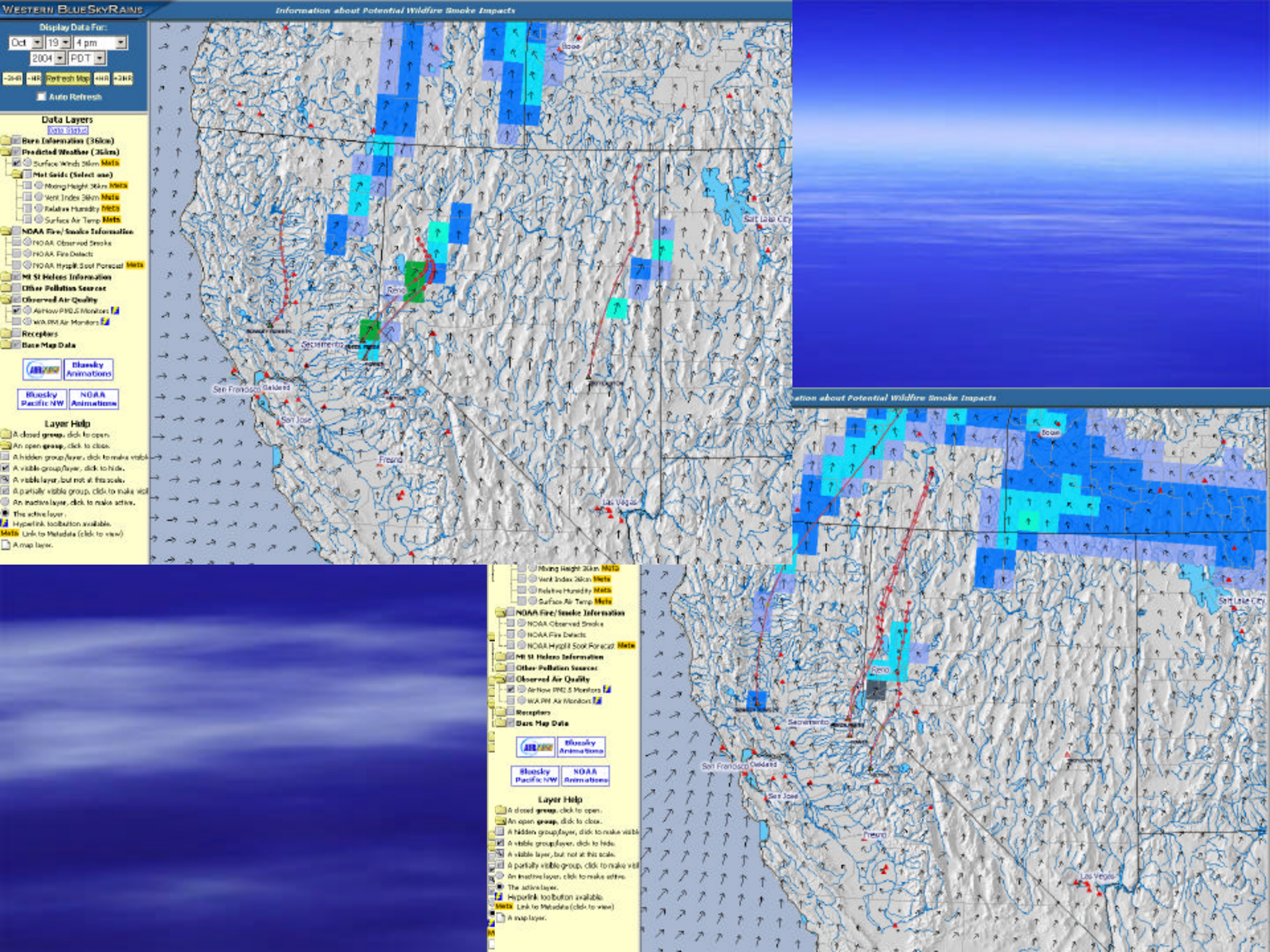
Based On 4km Met Data
& release abv surface
- 3,000m
- 6,000m
- 9,000m
- 12,000m
- 15,000m

AirNow PM2.5 Monitors

Tool Help | Zoom/Back | Pan/Move | Select/Show/Clear Data | Print/Download


Western BlueSkyRains
Information about Potential Wildfire Smoke Impacts
Display Data For:
Oct 19 4 pm
2004 PDT
-24HR -HR Refresh Map +HR +24HR
Auto Refresh
Data Layers
Data Status
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Met Grids (Select one)
Mixing Height 36km Meta
Vent Index 36km Meta
Relative Humidity Meta
Surface Air Temp Meta
NOAA Fire/Smoke Information
NOAA Observed Smoke
NOAA Fire Detects
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A map layer.
Boise
Salt Lake City
Reno
Sacramento
San Francisco
Oakland
San Jose
Fresno
Las Vegas

Square Lake Fire

- August 30 – Sept 1, 2003
- Near Leavenworth, WA
- Labor Day Weekend
- Large burnout planned
- Some flexibility in timing
- Minimize smoke impact to community

http://bluesky.cfr.washington.edu/website/blueprj/viewer.htm?Box=-505362.0:503087.0:86851.0:-89 - Microsoft Internet Explorer p

File Edit View Favorites Tools Help

Back Search Favorites History

Address http://bluesky.cfr.washington.edu/website/blueprj/viewer.htm?Box=-505362.0:503087.0:86851.0:-89125.0&xdate=20030830080028layers=00000110000000000000000000001110 Go

BLUESKYRAINS.ORG

Data Portrayal Time

Aug 31 8 pm

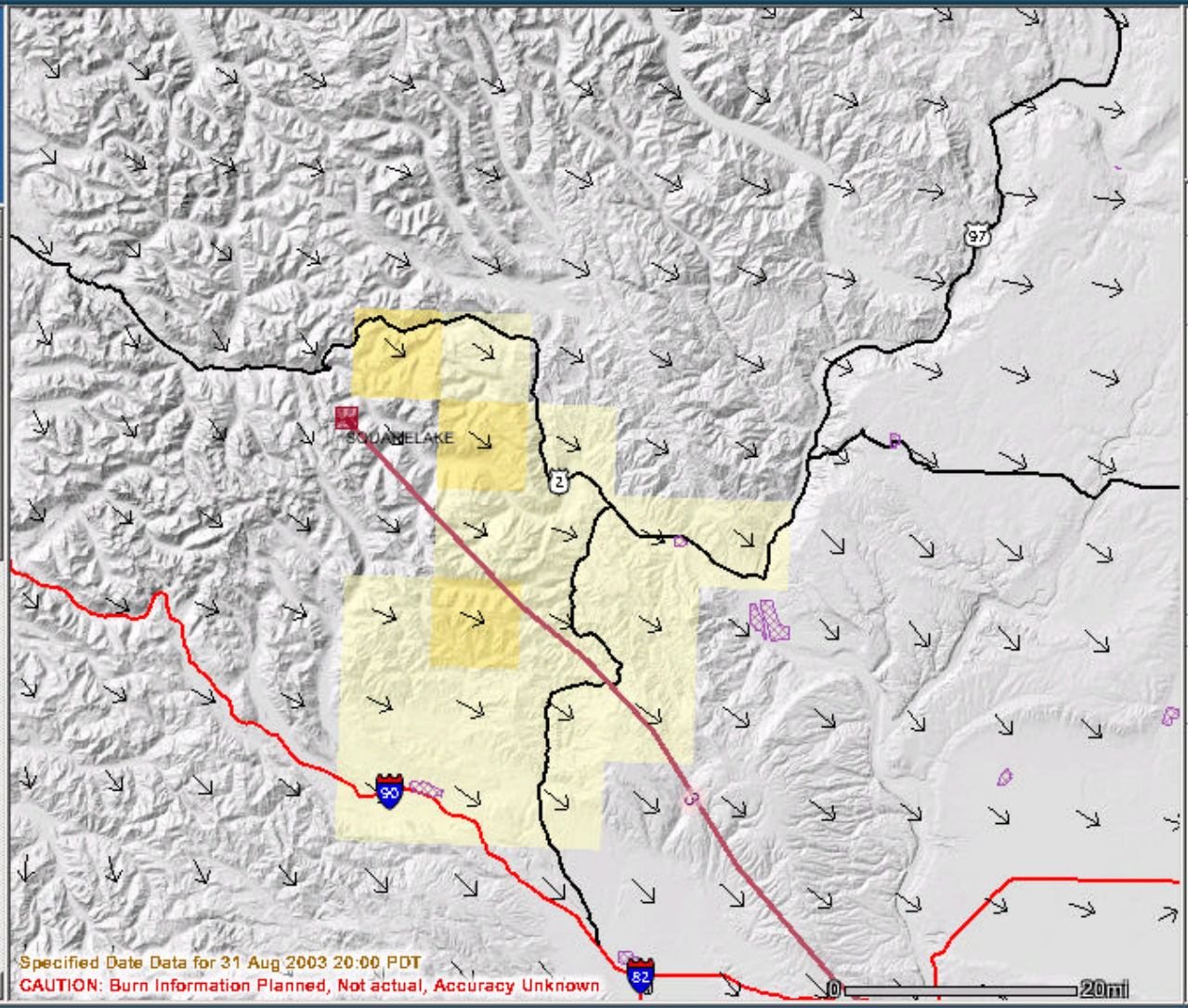
2003 PDT

-3HR -HR Apply Time +HR +3HR

Map Data Layers

Redraw Map

- Burn Information
  - Burn Locations
  - Burn Traj Hourly Pts
  - Burn Traj Lines
  - Def Traj Hourly Pts
  - Default Traj Lines
  - Predicted PM2.5
- Meteorology
  - Surface Wind Arrows (Dense)
  - Surface Wind Arrows (Sparse)
  - Surface Wind Barbs (Dense)
  - Surface Wind Barbs (Sparse)
  - Mixing Height
  - Vent Index
  - Relative Humidity
  - Surface Temperature
- Air Emission Sources
- Receptors
  - Census 2000 Data
  - Census General Summary
  - Urban Areas
  - Schools
  - Hospitals



Map Legend

Burn Locations
- 0 - 100 Acres
- 100 - 1000 Acres
- >1000 Acres

Burn Traj Hourly Pts
0 2 4 6 8 10 12

Burn Traj Lines

Predicted PM2.5
5 15 40 >65
Low Mod High

Surface Wind Arrows (Dense)
0 < 5 10 15 20 >
Wind Speed (m/s)

Urban Areas

Major Roads
- Interstates
- Highways

Redraw Map | Zoom In | Zoom Out | Pan | Full Map | Identify | Links | Sel Rect | Sel Poly | Clear Select | Query | Print | Download

Edit View Favorites Tools Help

Back Search Favorites History

http://bluesky.cfr.washington.edu/website/blueprj/viewer.htm?Box=-505362.0:503087.0:86851.0:-89125.0&xdate=2003083008002&layers=00000110000000000000000000001110

LUESKYRAINS.ORG

Data Portrayal Time

ep 1 10 am

2003 PDT

-HR Apply Time +HR +3HR

Map Data Layers

Redraw Map

- Burn Information
  - Burn Locations
  - Burn Traj Hourly Pts
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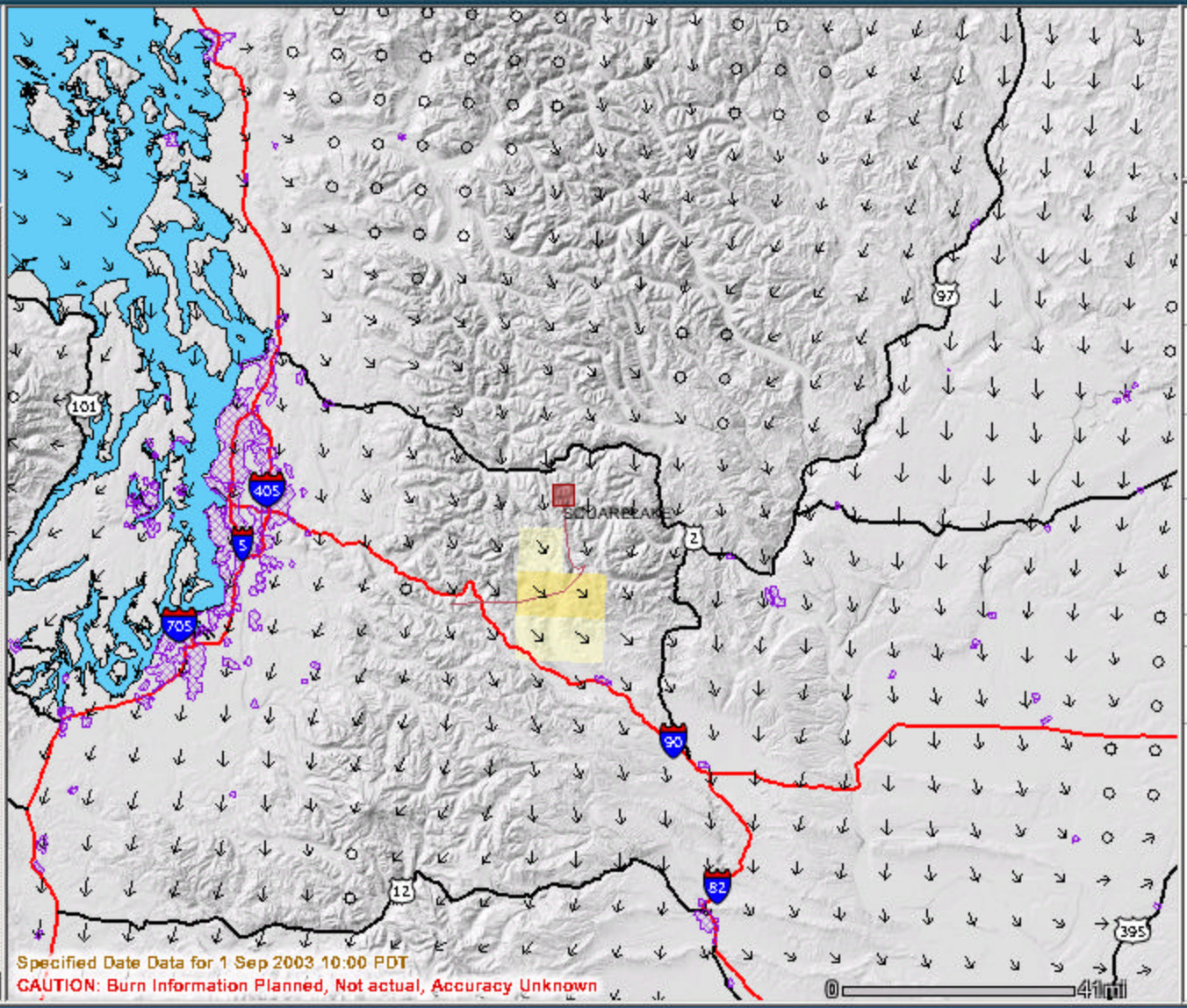
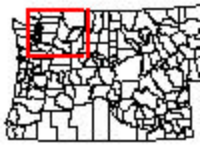
  - Schools
  - Hospitals





Map Legend

Burn Locations
- 0 - 100 Acres
- 100 - 1000 Acres
- >1000 Acres

Burn Traj Hourly P
0 2 4 6 8 10

Burn Traj Lines

Predicted PM2.5
5 15 40
Low Mod Hi

Surface Wind Arrow (Dense)
0 < 5 10 15
Wind Speed (m/s

Urban Areas

Major Roads
- Interstates
- Highways

edraw Map | Zoom In | Zoom Out | Pan | Full Map | Identify | Links | Sel Rect | Sel Poly | Clear Select | Query | Print | Download

BlueSky

Acknowledgements

- Funding provided by the National Fire Plan
- In-kind funding provided by EPA for development of the RAINS capabilities.
- Thank you to Louisa Evers for promoting BlueSky's use in wildfires across the country and to our FCAMMS partners for making it possible.
- Thank you to the BlueSky developers: Trent Piepho, Lara Kellogg, Sim Larkin, Wes Adkins, Candace Berg, Ray Peterson, Don Matheny, Sue McCarthy, Bob Kotchenruther

Thank You!

Questions?

BlueSky: **www.fs.fed.us/bluesky**

BlueSkyRAINS:
www.blueskyrains.org

AirFIRE Team: www.fs.fed.us/pnw/airfire

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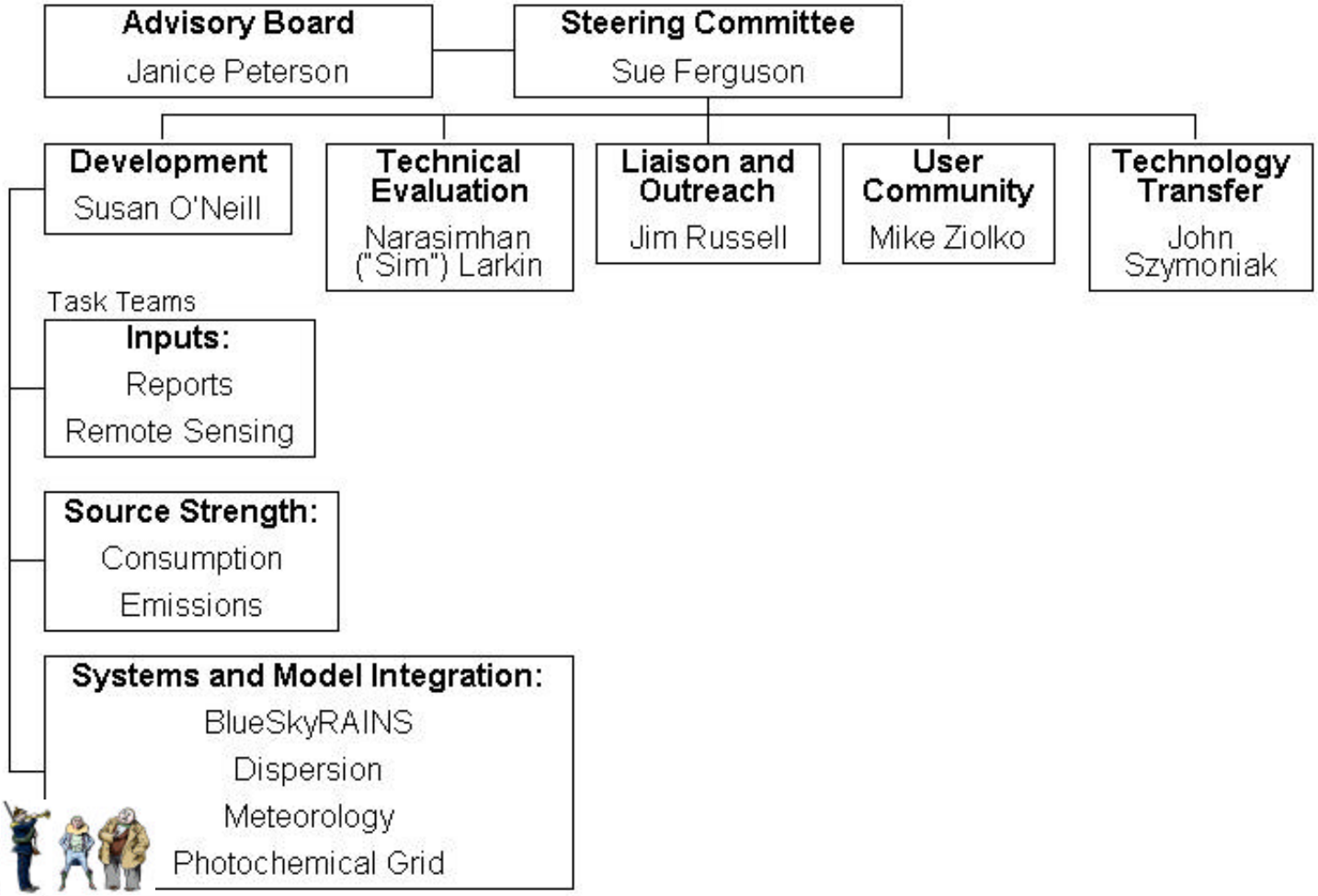
BlueSky Consortium



NorthWest Regional Modeling Consortium (NWRMC)

www.atmos.washington.edu/pnw_environ