

# AQUIPT

*air quality impacts planning tool*

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The AQUIPT project:  
providing probabilistic impacts from user-specified  
emissions sources

Sim Larkin

*AirFIRE Team, US Forest Service*

NRI Air Quality All-Investigator Meeting

June 12, 2005

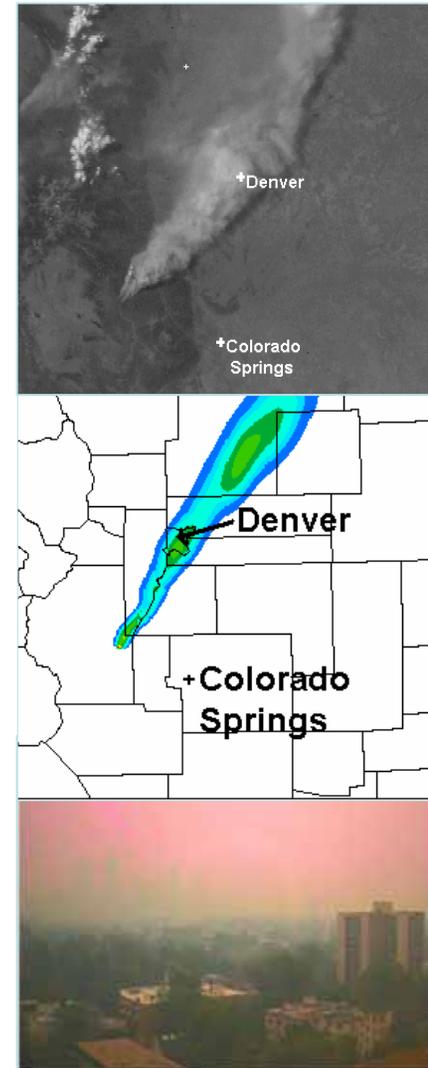


# AQUIPT

*air quality impacts planning tool*

## Outline

- Who am I ? – AirFIRE team
- What is AQUIPT ? – the basic concept
- Why AQUIPT? – benefits
- How does it work ? – technical details
- Where are we ? – accomplishments
- What's next ? – the plan



# AirFIRE Team

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- Atmospheric science group
  - Air quality,
  - Mesoscale meteorology
  - Climate
  - Drs. Ferguson, Larkin, O'Neill, Solomon + 7 other scientists & UW students
- Modeling & field studies
- AQUIPT is part of a suite of (integrated) products
  - Land, fire, and air quality managers and regulators
  - e.g. BlueSkyRAINS, VCIS, Smoke & Fire predictions
- Support from
  - *USDA NRI/CSREES*, National Fire Plan, Joint Fire Science Program, EPA, NASA, USFS Region 6, MT/ID Airshed group, Environment Canada



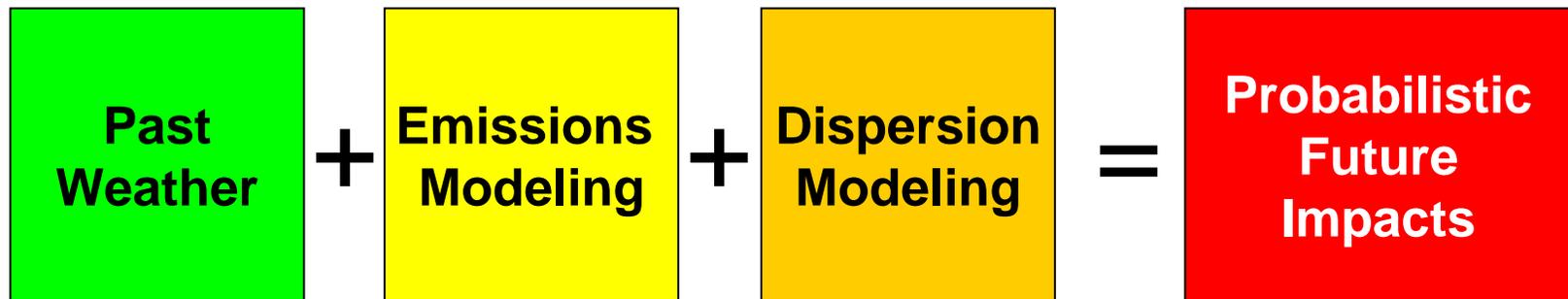
# What is AQUIPT ?

*air quality impacts planning tool*

What is the likely air quality impact from this source ?

– e.g., a prescribed burn this fall, a new smokestack, etc...

- *Can't say what impacts will be.*
- *But can say what they would have been in the past.*
- *Use historical climate information to make a prediction*



Web Interface

# Why ?

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## Dispersion results helpful to many users

- Anyone managing an emissions source
- Anyone impacted from an emissions source
- Fire managers (mitigating smoke)
- Air regulators (health effects)
- Land managers (protecting sensitive areas)
- Other managers (agricultural, dairy farms)
- NEPA documentation

## Large barriers to dispersion modeling

- Complicated / requires specialized knowledge
- Computer intensive / requires multi-TB datasets, processing
- Expensive and slow

### Interest from:

USFS Region 6  
EPA  
NPS  
NRCS  
*others...*



# Goals

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Overcome the barriers to dispersion modeling

Provide users customized results *rapidly*

- easy & quick (24hrs)
- not replacing intensive studies



user request via web form



< 24 hrs



email notification

web access to results

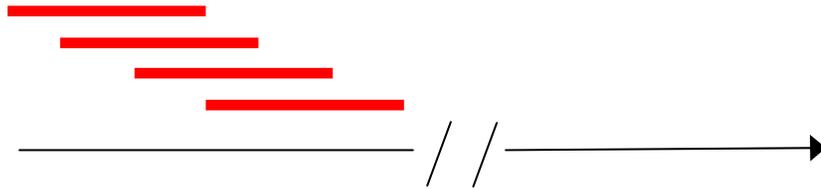
Study climate variability / dispersion relationships

# Strategy

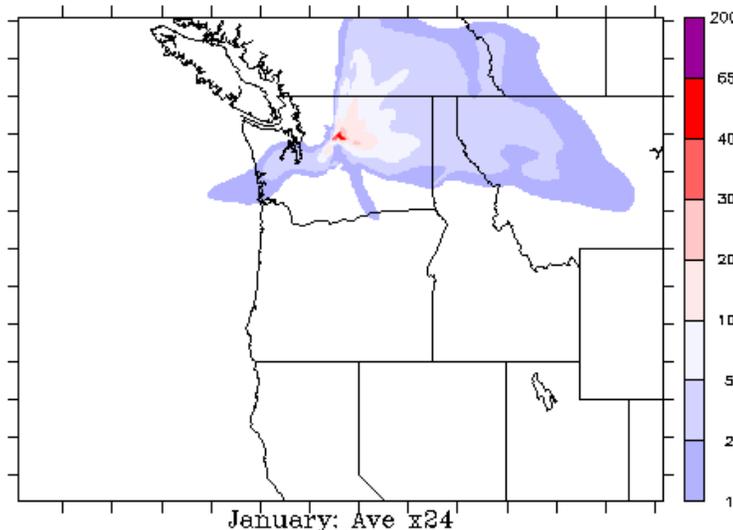
*air quality impacts planning tool*

Run emissions source every day for past 30yrs.

Overlapping 3 day periods  
(non-continuous source)

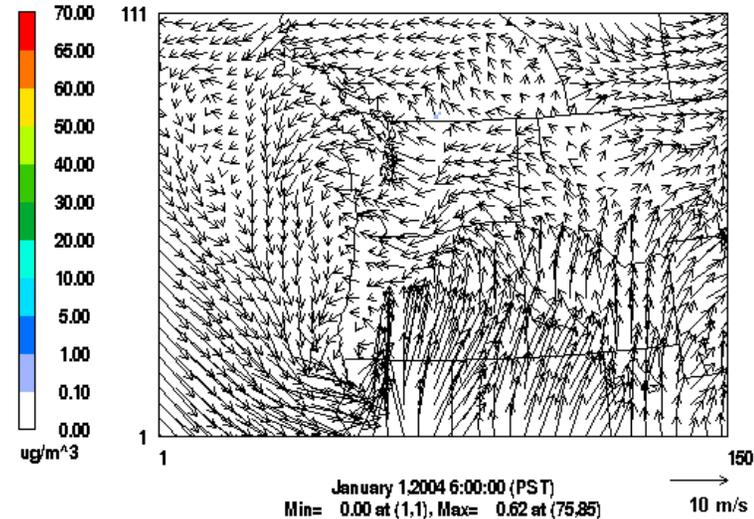


Then gather statistics.



## Prescribed Fire & Wildfire Simulation

MM5 Forecast: 2004010100  
PM2.5 (NAAQS = 65 micrograms/m<sup>3</sup>, 24hr avg)



# Scope

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## National coverage

- PNW grid (12km)
- coterminous U.S. grid (36km)

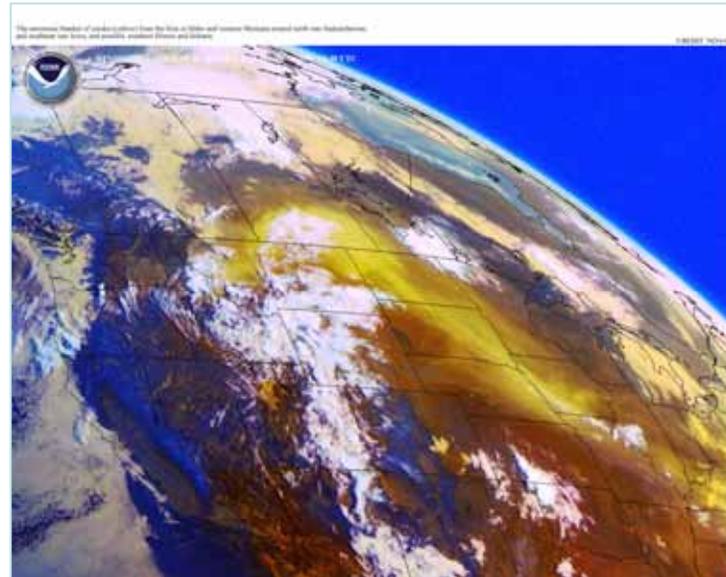
## Multiple source profiles/types

- Prescribed fire
- Wildfire
- Agricultural Fire
- Smokestacks
- Animal Farms
- User specified

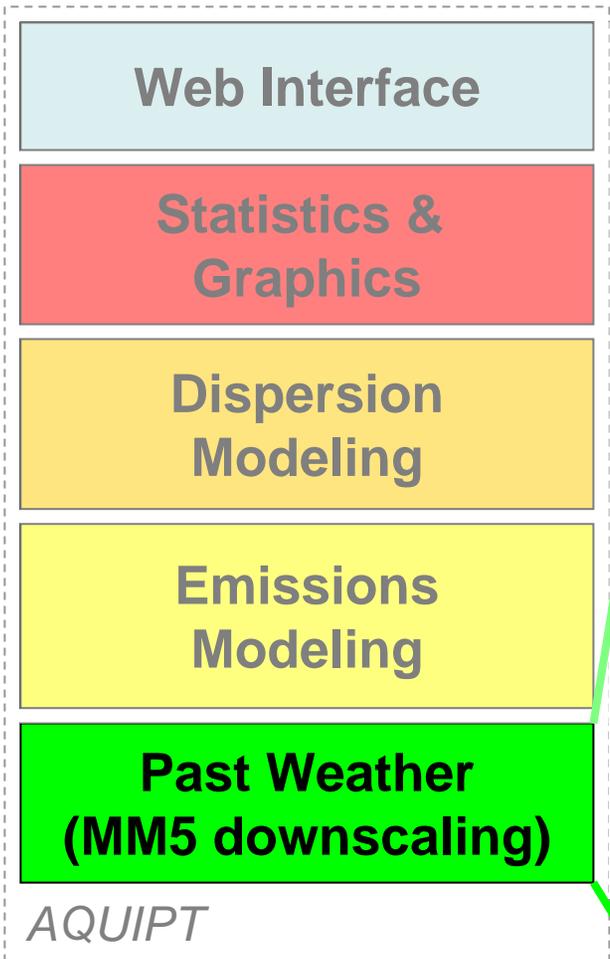
## Multiple aerosols

- PM2.5
- PM10
- Sulfate
- Nitrate
- Ammonia
- Tracer

Starting Point



# How AQUIPT works

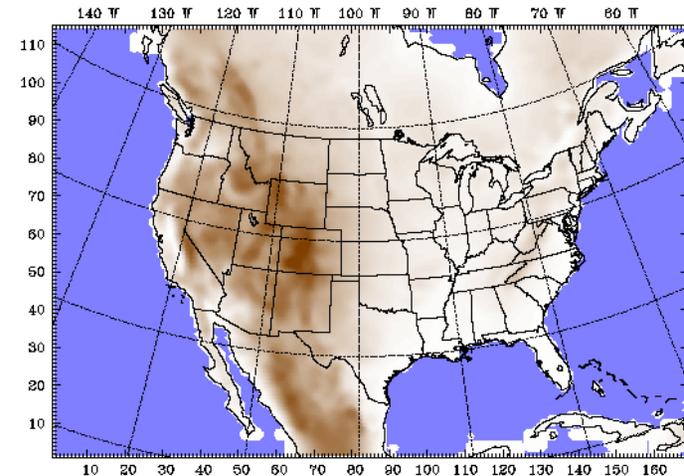


## Past Weather

Historical climate (30 yrs)

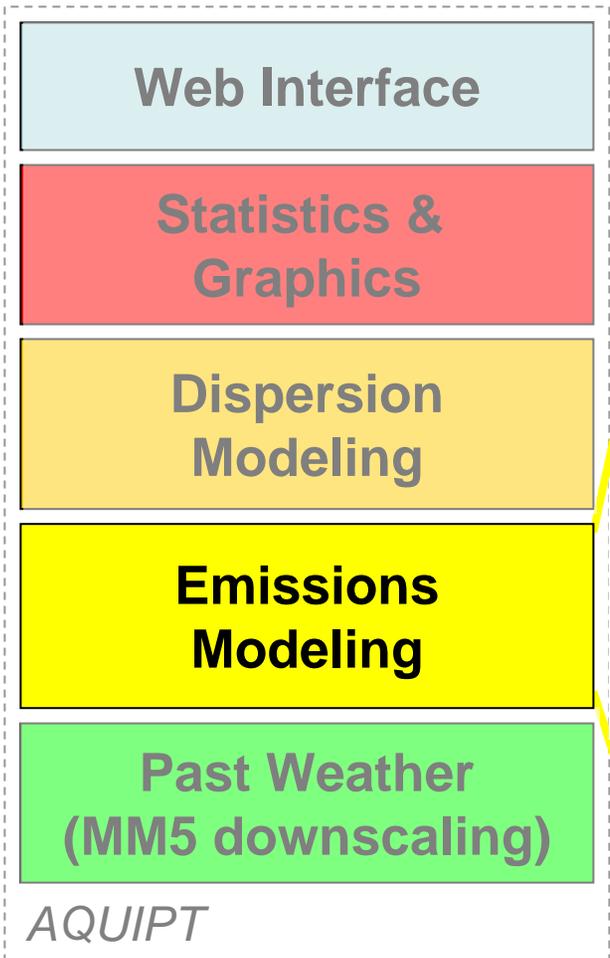
- NCEP/NCAR Reanalysis
- Assimilated Model Output
- Dynamically consistent
- 2½ degree resolution / 6 hrly

Downscaled using the MM5 mesoscale weather model



- FDDA (assimilation) mode
- 36/12km grid output / hourly

# How AQUIPT works



## Emissions Modeling

User choice of various point source types

- wildland fire
- agricultural fire
- various agricultural & factory types
- custom (user-specified)

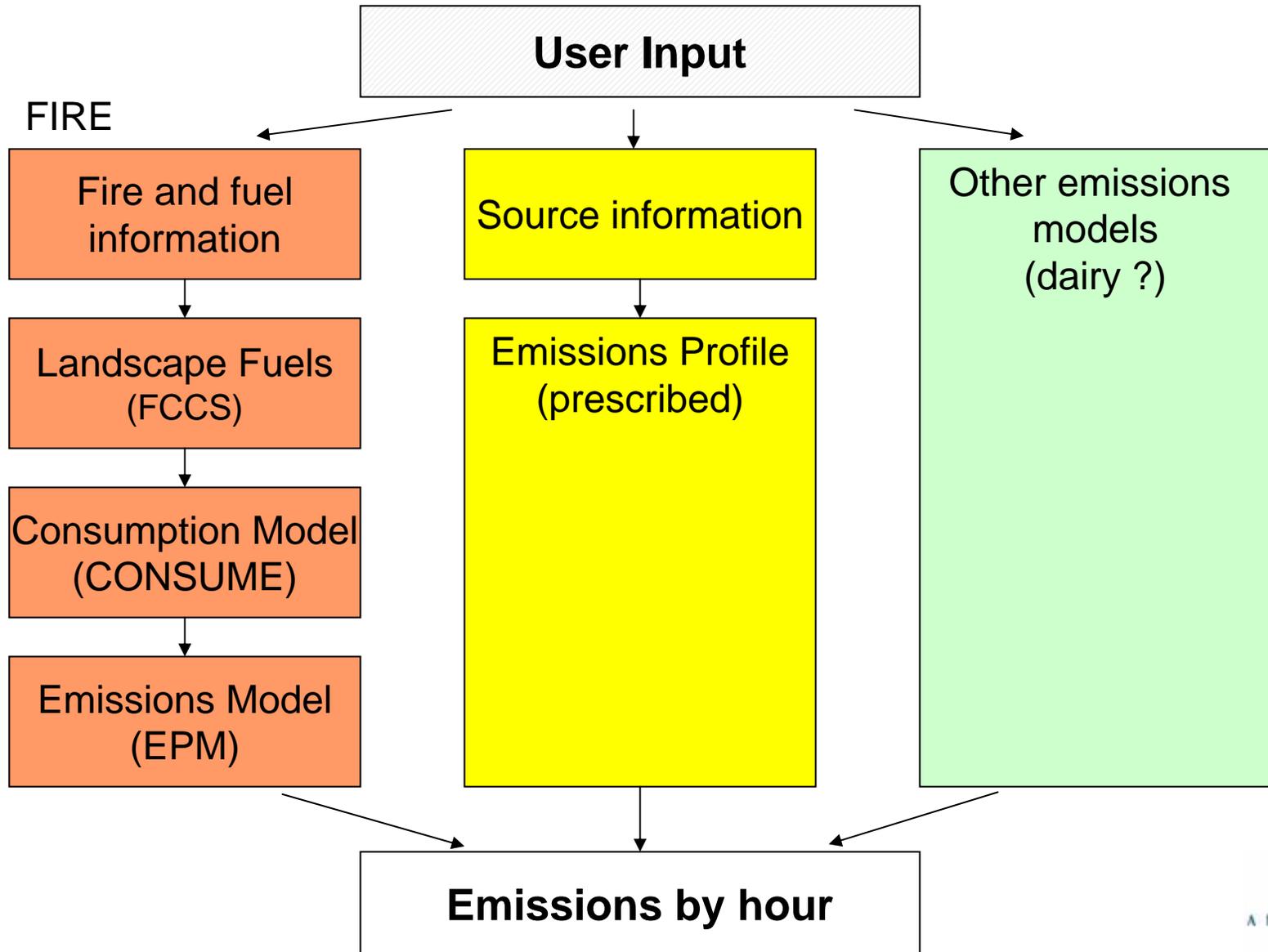
Standardized emissions profiles

Specialized fire emissions module

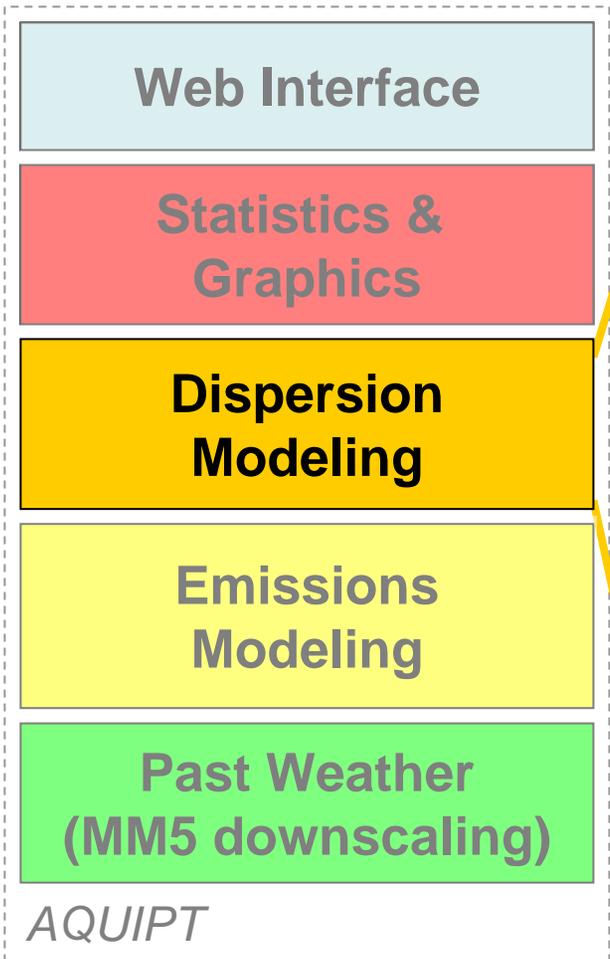
Primarily  $PM_{2.5}$  and  $PM_{10}$ , also 1<sup>st</sup> order reactive species

*modular - extensible*

# Emissions Model Structure



# How AQUIPT works



## Dispersion Modeling

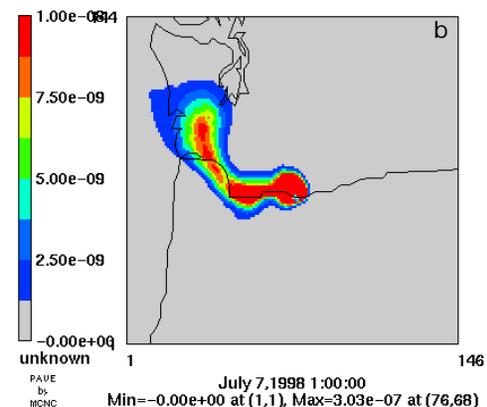
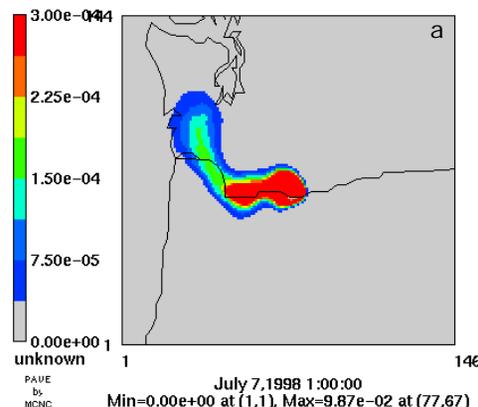
CalMet meteorology preprocessor

CalPuff puff-type dispersion model

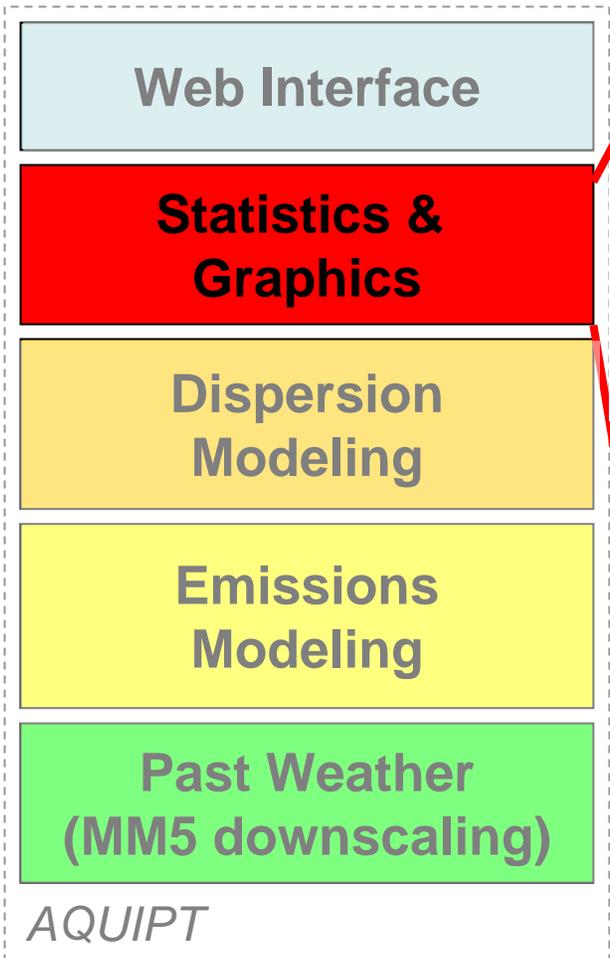
- deposition/dispersion – limited chemistry
- 3 day runs starting every day (overlapping)

BackPuff

- reverse CalPuff (areas affecting receptor)



# How AQUIPT works



## Statistics and Graphics

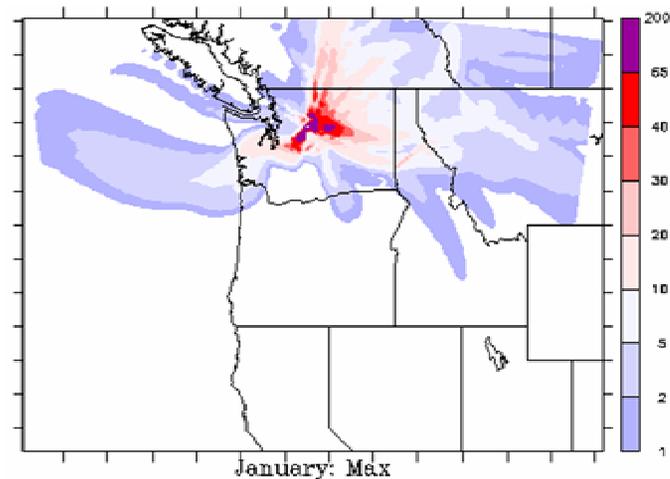
### Compile statistics

- ave, max, % time above threshold
- based on user feedback

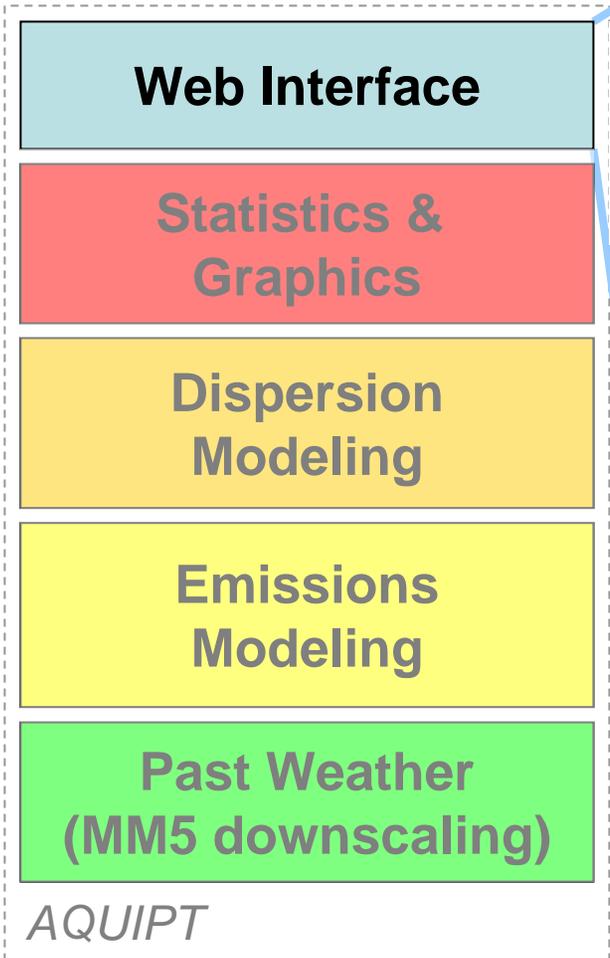
### Maps and graphs

- R(S+), Ferret, Pave

### Based on user feedback



# How AQUIPT works



## Web Interface

Restricted access

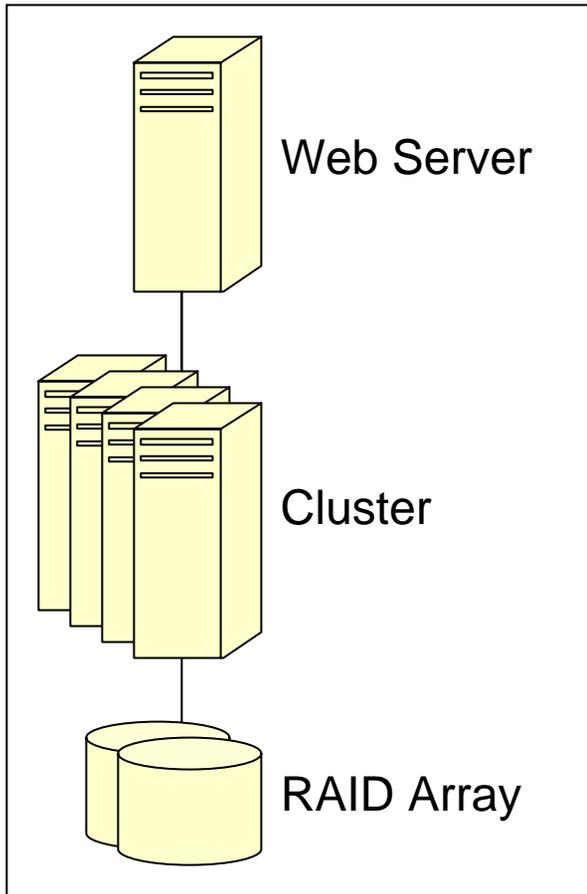
- account needed
- all results recorded, user specific

User request system

- web form for request
- selectable results

Fast - results returned to user in 24 hrs.

# Computers



Apache Web Server  
PHP  
HTTPS

LINUX Cluster  
20 nodes  
dual-proc Opteron

Fiber-Channel Disk  
10 TB



# Accomplishments

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## National MM5 grid

- Configured and tested
- *Disk space procurement issue* – run delayed
- Coming together now
- Proceeded with PNW grid in meantime

## Emissions & Dispersion

- Wildland fire emissions module
- Automated scripts – extension/addition to *BlueSky* framework

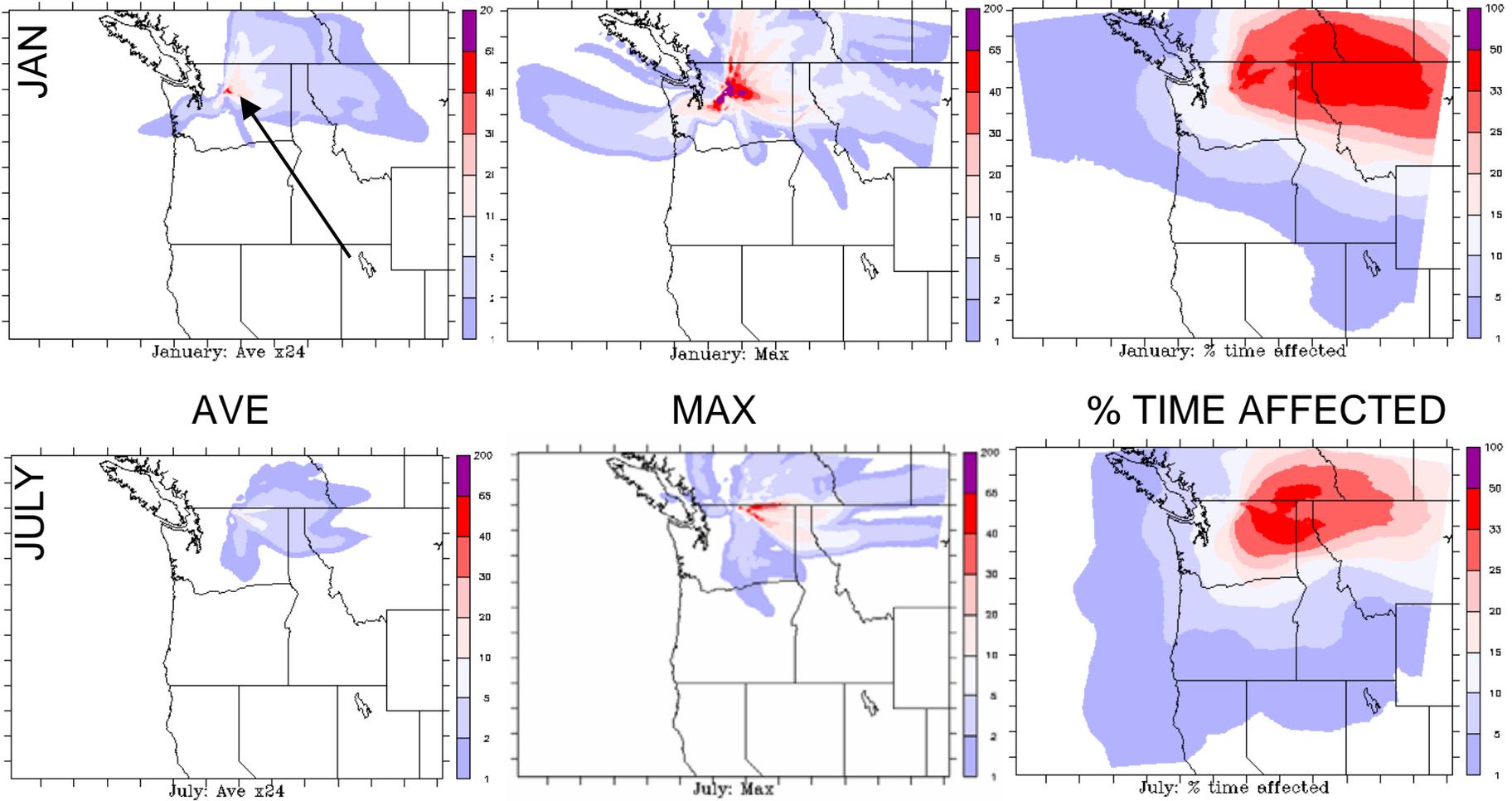
## Statistics and Graphics

- Initial suite of graphics
- Automated scripts

## Web Interface

- Login / Restricted Access
- Request form
- Email notification of results

# Output: Jan vs. July



# Upcoming

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## Meet with beta users

- June 14-16 (add-on to existing meeting)
- form initial users group

## Finish national MM5 downscaling

- additional disk space

## BackPuff

- areas affecting a given receptor
- run all Class 1 areas

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## Work with users

- help with NEPA
- modify web interface & output graphics
- training / user guide

## Additional emissions profiles

## Verification

# Thank you

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- Dr. Ray Knighton, Lisa Duriancik and the NRI/ CSREES



- Mitchell Johnson, Susan O'Neill, Robert Solomon, Nick Barkas

## AQUIPT

<http://www.fs.fed.us/pnw/airfire/aquipt>

<http://airfire.org/aquipt>

Sim Larkin

206-732-7849

[larkin@fs.fed.us](mailto:larkin@fs.fed.us)