

WRAP Emissions Processing of Fire Sources

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Outline

- Types of Fires
- SMOKE Emissions Processing
- Emissions Processing Input Files
- QA of processed emissions
- Acknowledgments
 - WRAP (Pete Lahm, Joint Fire Emissions Form)
 - Tom Moore, WGA/WRAP
 - Air Sciences (Dave Randall, James Scarborough)

Types of Fires

- Wildfires
 - (SCC 2810001000)
- Agricultural Burning Fires
 - (SCC 2801500000)
- Prescribed Burning Fires
 - (SCC 2801500000)

Smoke Management Scenarios

- No smoke management.
- “Base” smoke management strategy.
- Optimal smoke management strategy
 - Prescribed burning emissions can increase as wildfire emissions decrease.

Processing Fire Emissions for use in Air Quality Models

- Fire emissions must be formatted, gridded, speciated, temporalized, and QA'd.
- smoke = PM, CO, NO_x, etc
- SMOKE = **s**parse **m**atrix **o**perator **k**ernel
emissions processing system

SMOKE Processing Steps

- Import Emissions Inventory (3 input files)
- Create Speciation Matrix
- Create Gridding Matrix
- Create Temporal Allocation Matrix
- Create Plume Rise Matrix
- Merge all the matrices to create output 3-D netCDF file

SMOKE Input File 1

1. Annual Inventory File (PTINV)

- IDA Format
- Source Location, State/County (FIPS)
- Source Characteristics (stack parameters and event names)
- Source Classification Code (SCC)
- Source Geographical coordinates (Lat-Lon)

SMOKE Input File 2

2. Daily Inventory File (PTDAY)

- EMS-95 Format
- Source Location, State/County (FIPS)
- Source characteristics (stack parameters and event names)
- Source Classification Code (SCC)
- Daily Inventories by pollutant (ton/day)
- Event Date and Time Zone

SMOKE Input File 3

3. Hourly Inventory File (PTHOUR)

- EMS-95 Format
- Source Location, State/County (FIPS)
- Source characteristics (stack parameters and event names)
- Event Date and Time Zone
- Hourly Plume Top(m) , Plume Bottom(m), and Plume Fraction in Layer 1
- Source Classification Code (SCC)

SMOKE input: Meteorology

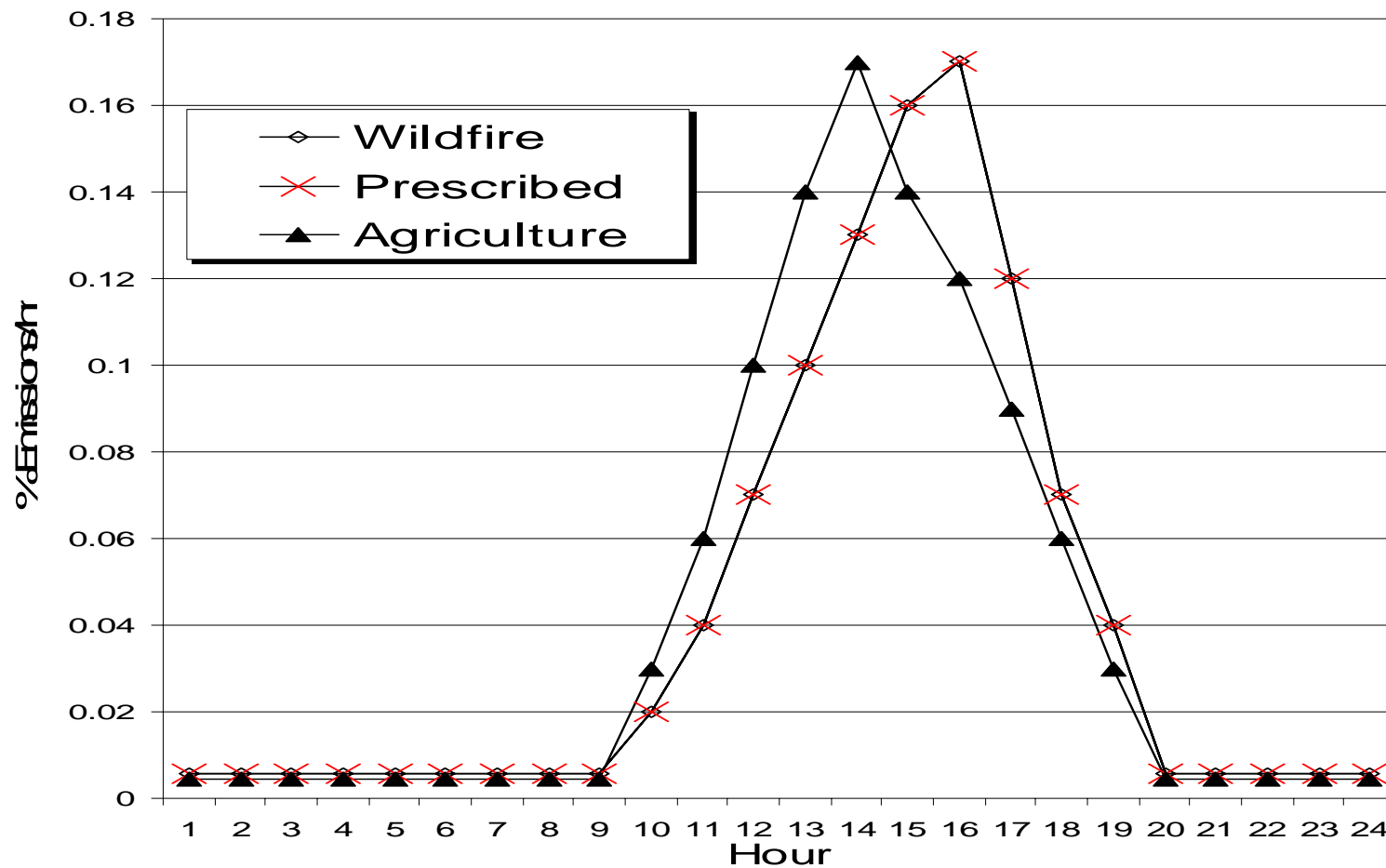
- MCIP Processed MM5 data
 - Sigma pressure levels from MET_CRO_3D
- Standard SMOKE plume rise algorithm requires other met parameters like temperature and winds to determine atmospheric stability at stacks
- Pre-computed plume rise only needs sigma values for allocating plumes above layer 1

WRAP Fire Plume Rise Method

- Precomputed plume characteristics
 - Layer 1 fraction (%)
 - Plume bottom height (m)
 - Plume top height (m)
 - Characteristics derived from hourly heat release, emissions rates, and total acreage burned by inventory developer
- Emissions allocated above layer 1 are weighted by pressure difference in each layer divided by the total pressure difference between the top and bottom of the plume

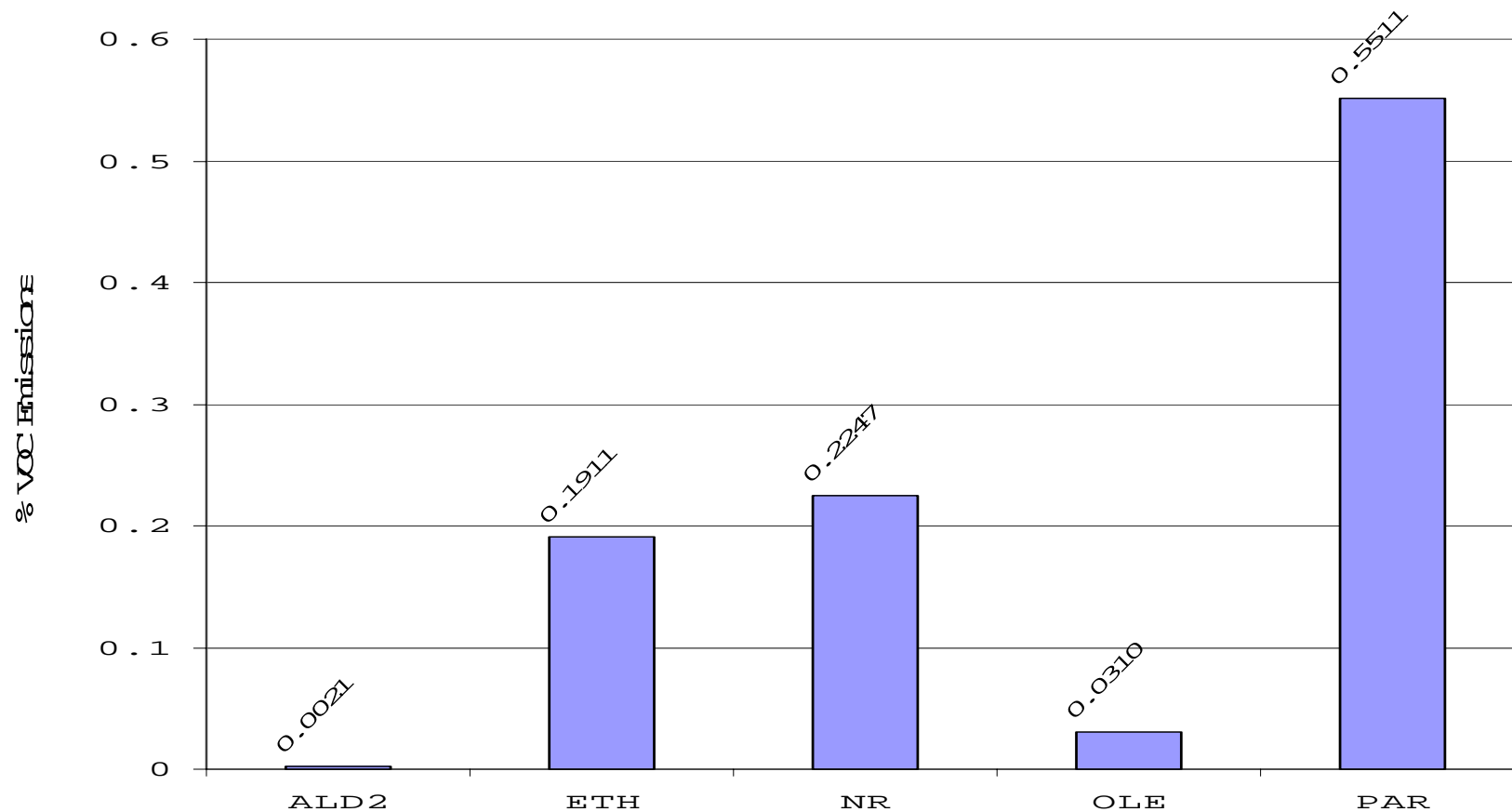
SMOKE input: Temporal Profiles

Diurnal Temporal Profiles for Different Fire Sources

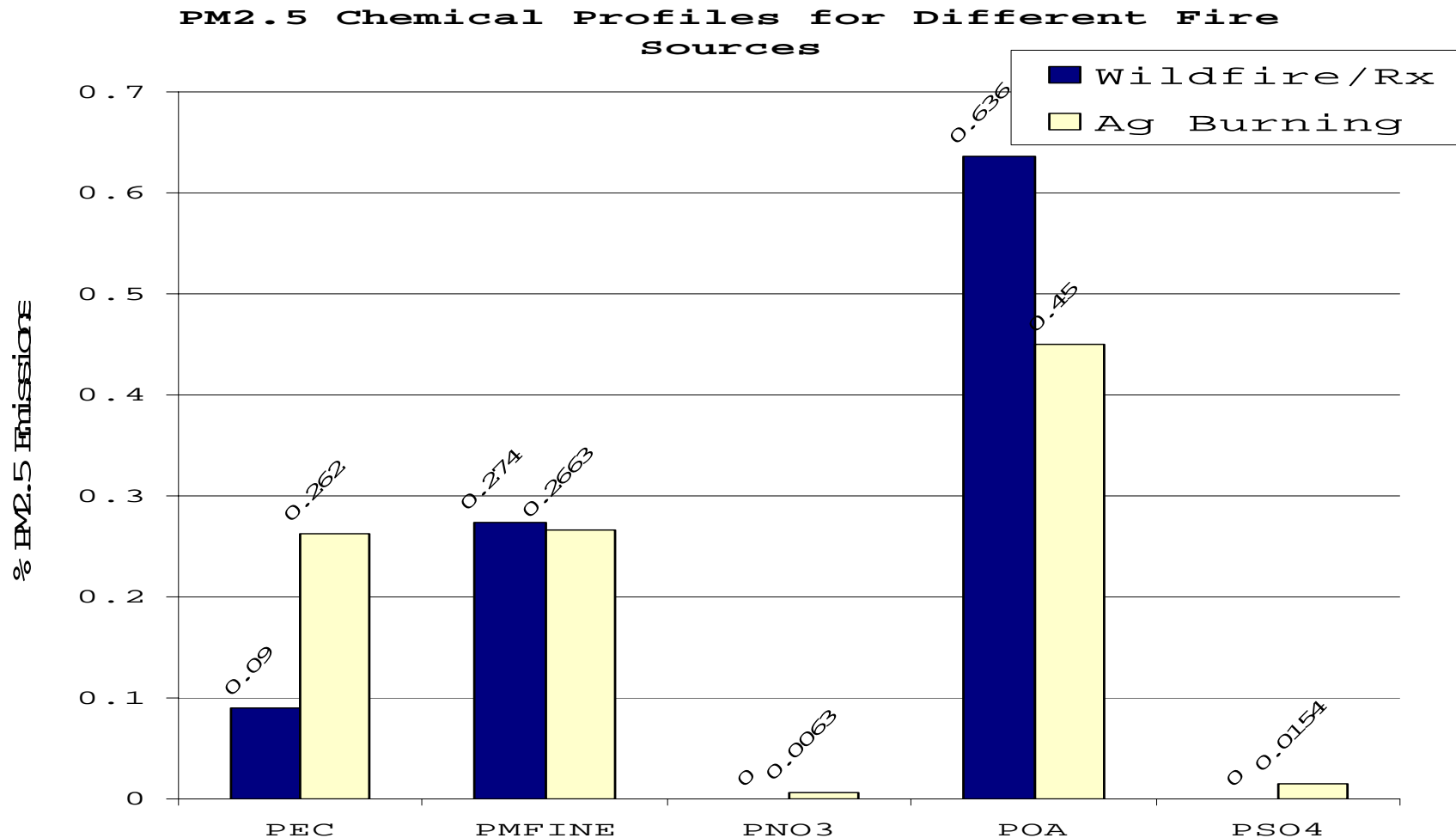


SMOKE input: VOC Speciation Profiles

VOC Chemical Profiles for All Fire Sources



SMOKE input: PM Speciation Profiles



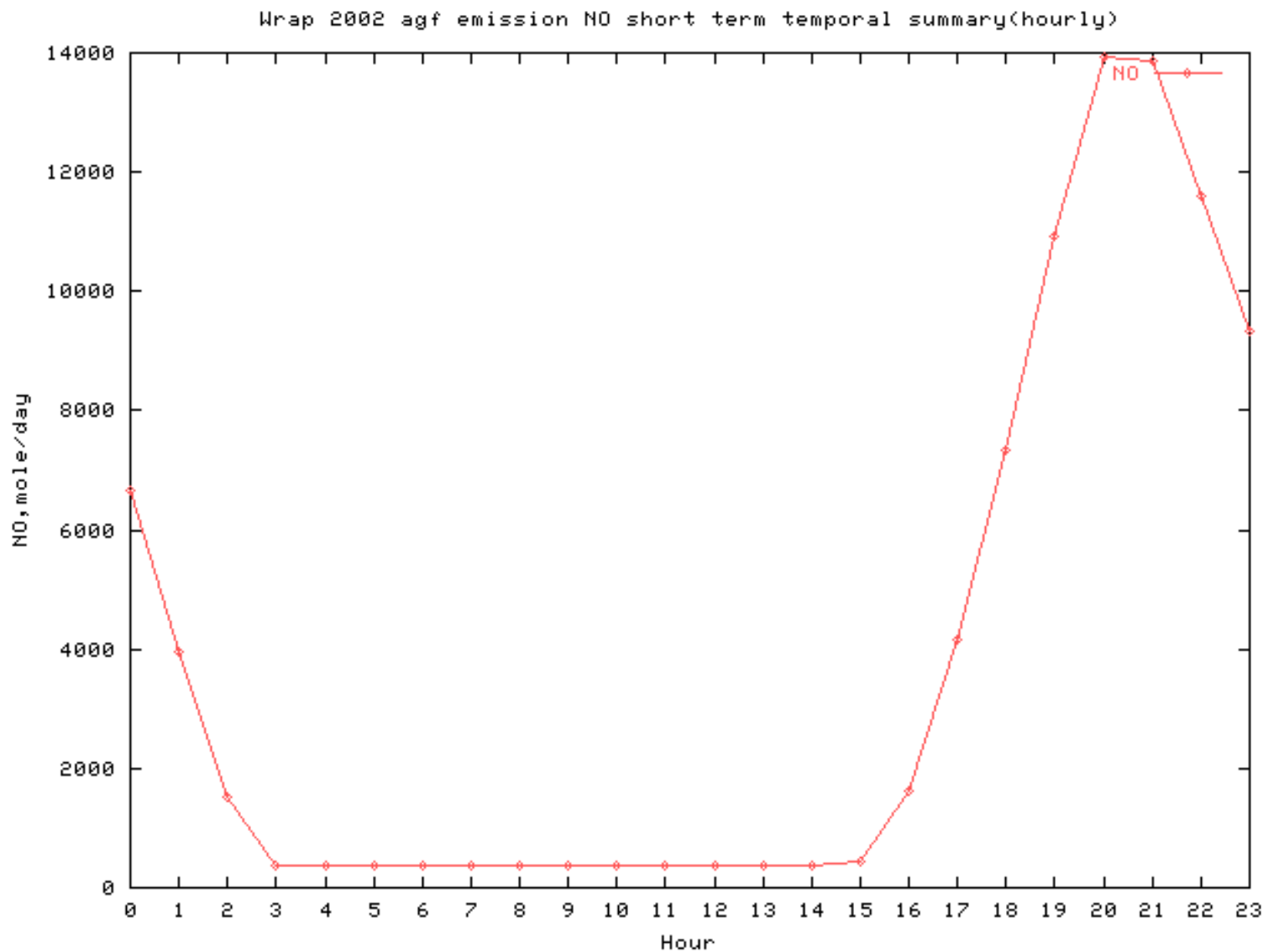
SMOKE Processing QA

- Create QA reports
 - Daily tonnage per state & county by pollutant
 - Daily tonnage per SCC by pollutant
 - Daily tonnage per state/county/SCC by pollutant
 - Hourly tonnage per layer by pollutant

Post SMOKE Processing QA

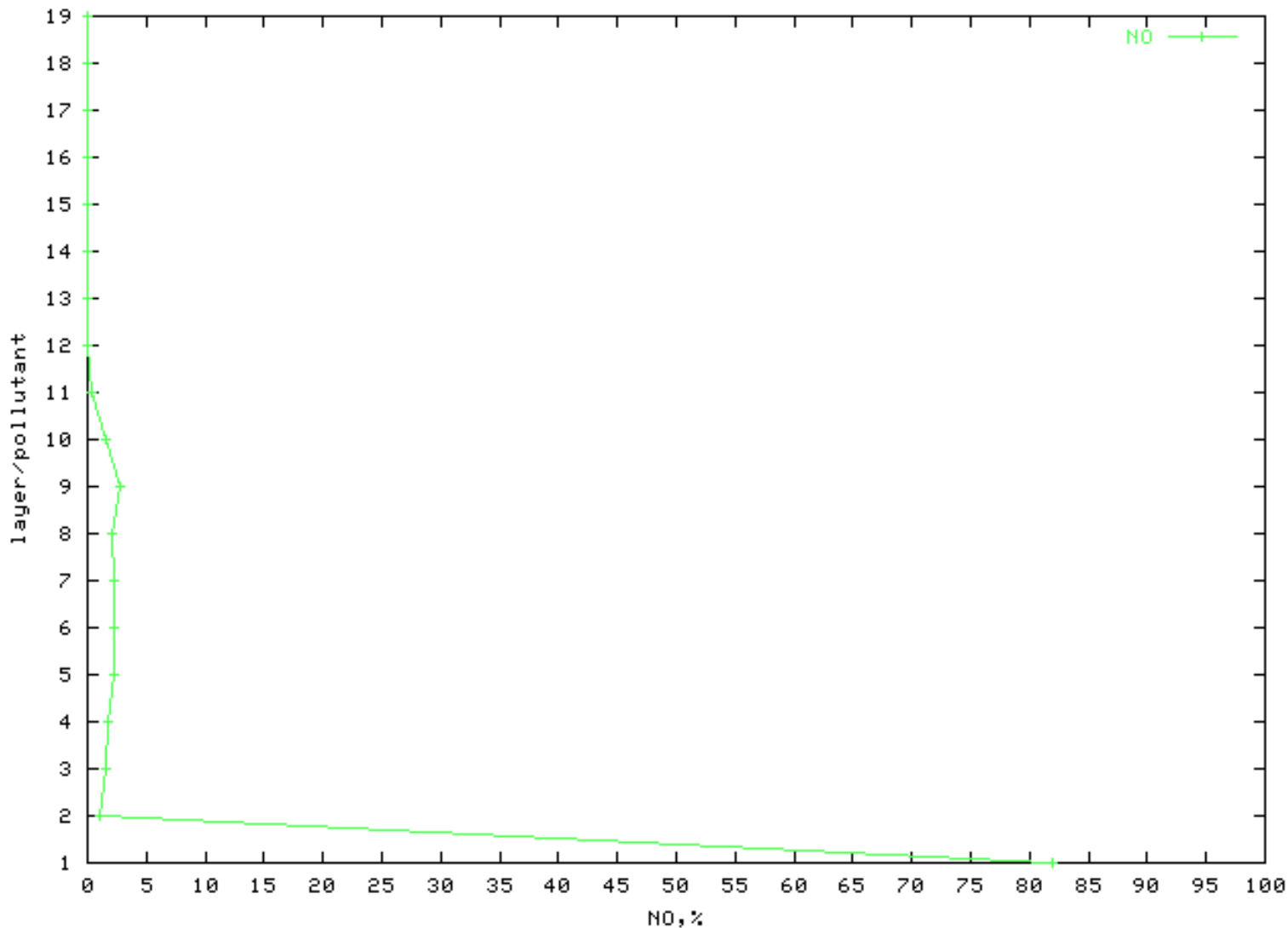
- Diurnal time-series each day (hourly domain total emissions).
- Vertical profiles – sum of each layer.
- Spatial PAVE plots – sum all layers.
- Episode time-series – daily total emissions

Ag burning, diurnal time-series



Ag burning, Vertical profile: June, 2018

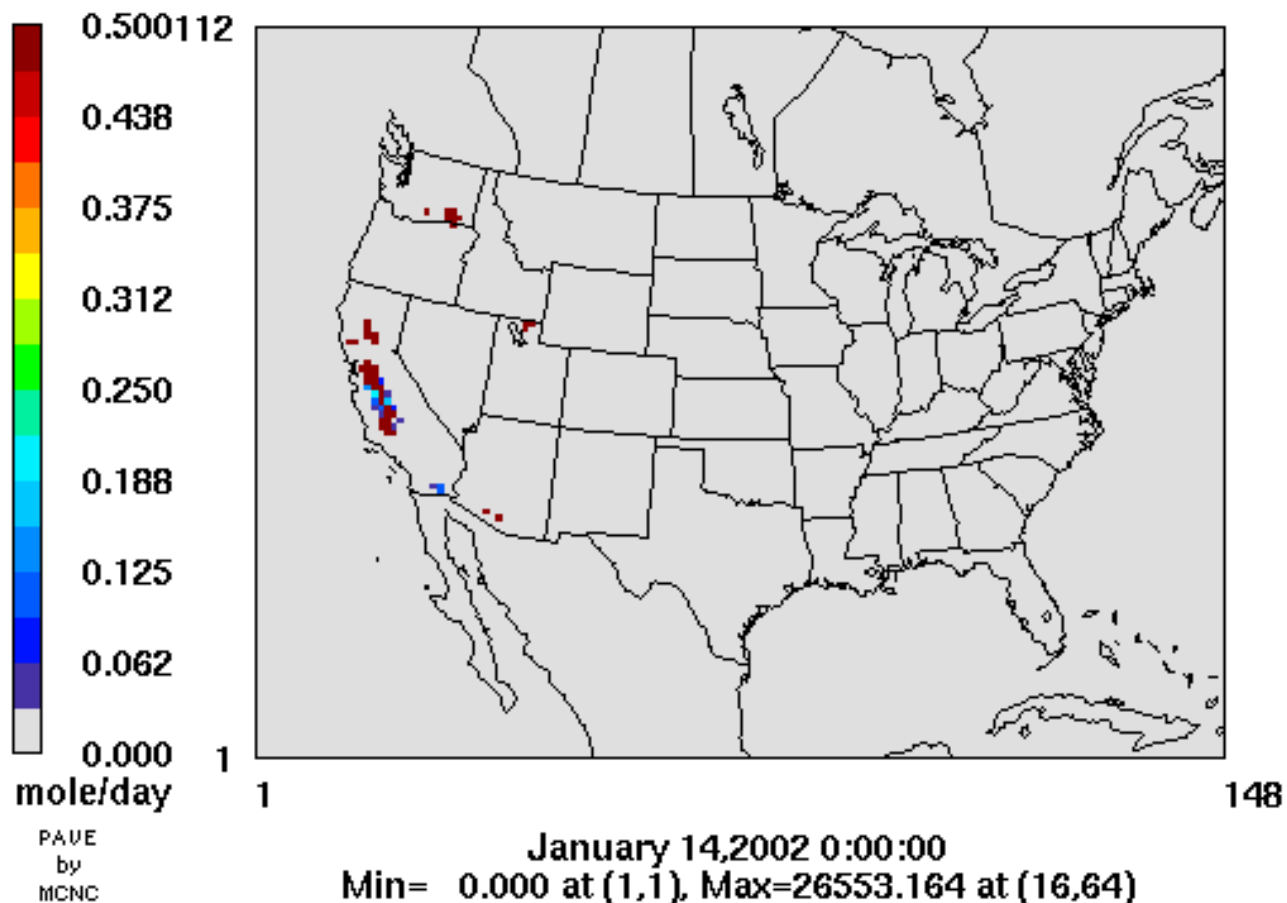
Wrap 2002 agf emission NO vertical distribution



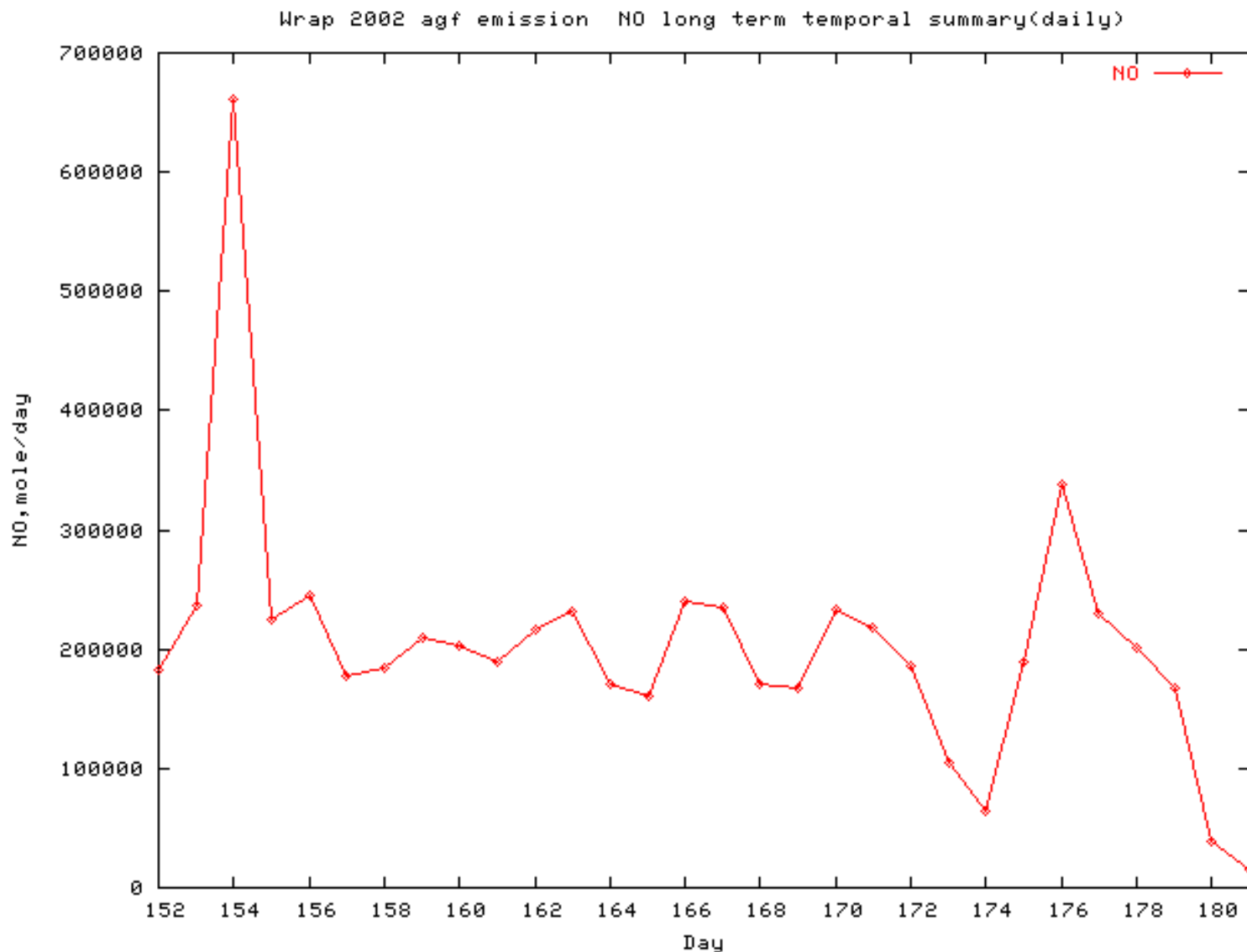
Ag: PAVE sum all layers – January 14, 2018

NO

Wrap 2002 agf emission
Vertical Total



Ag burning, Episode time-series: June, 2018



Key Issues

- Fires treated as a pseudo-point source:
 - 36-km grid cell = 100,000 acres
 - 4-km grid cell = 1000 acres
- Importance of smaller fires.
- Speciation:
 - We are using same profile for wildfire and Rx.
 - Could use CO/NO_x ratio as an indicator to adjust VOC speciation in SMOKE?
 - How should we treat “missing” VOC?