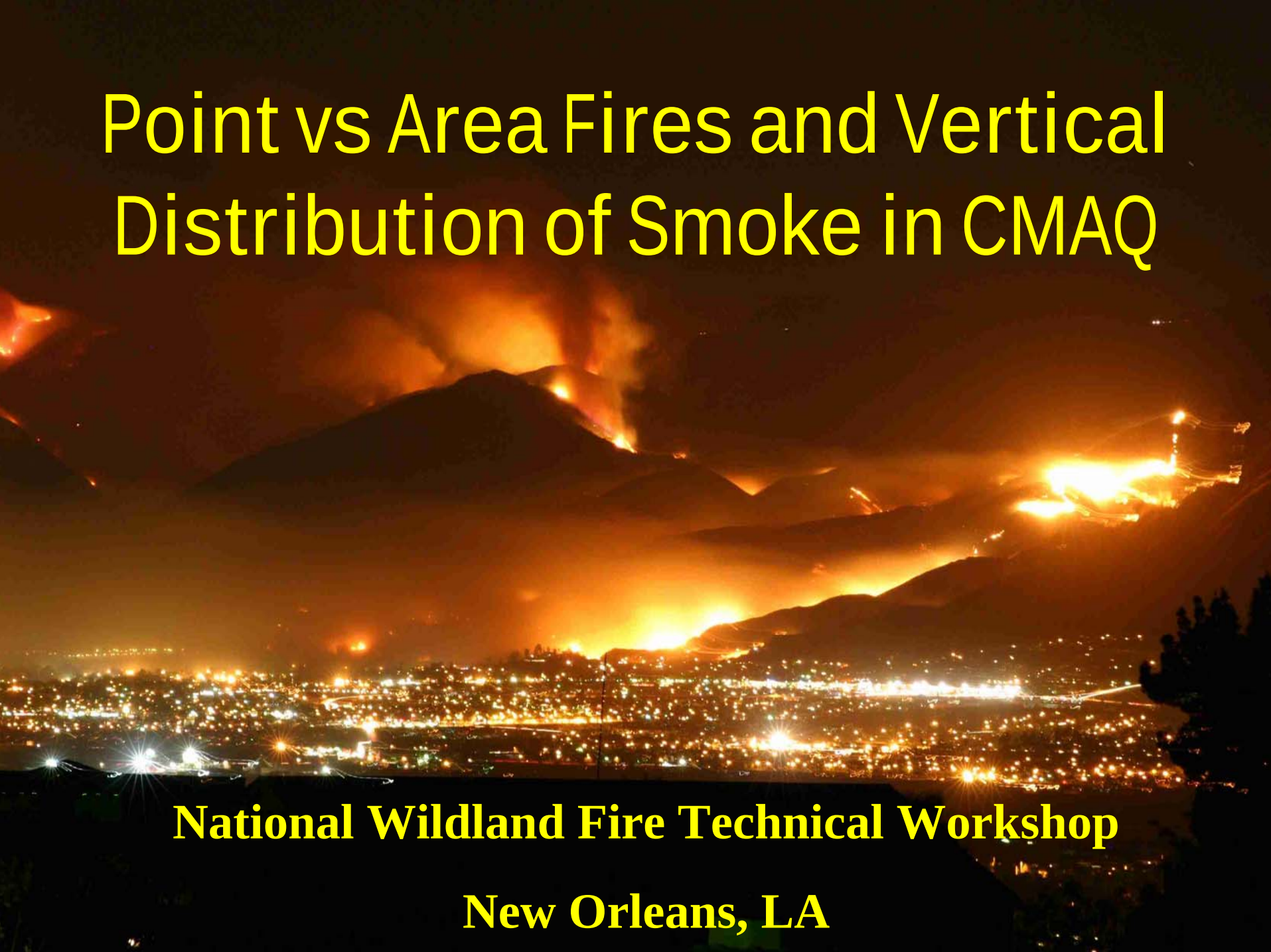
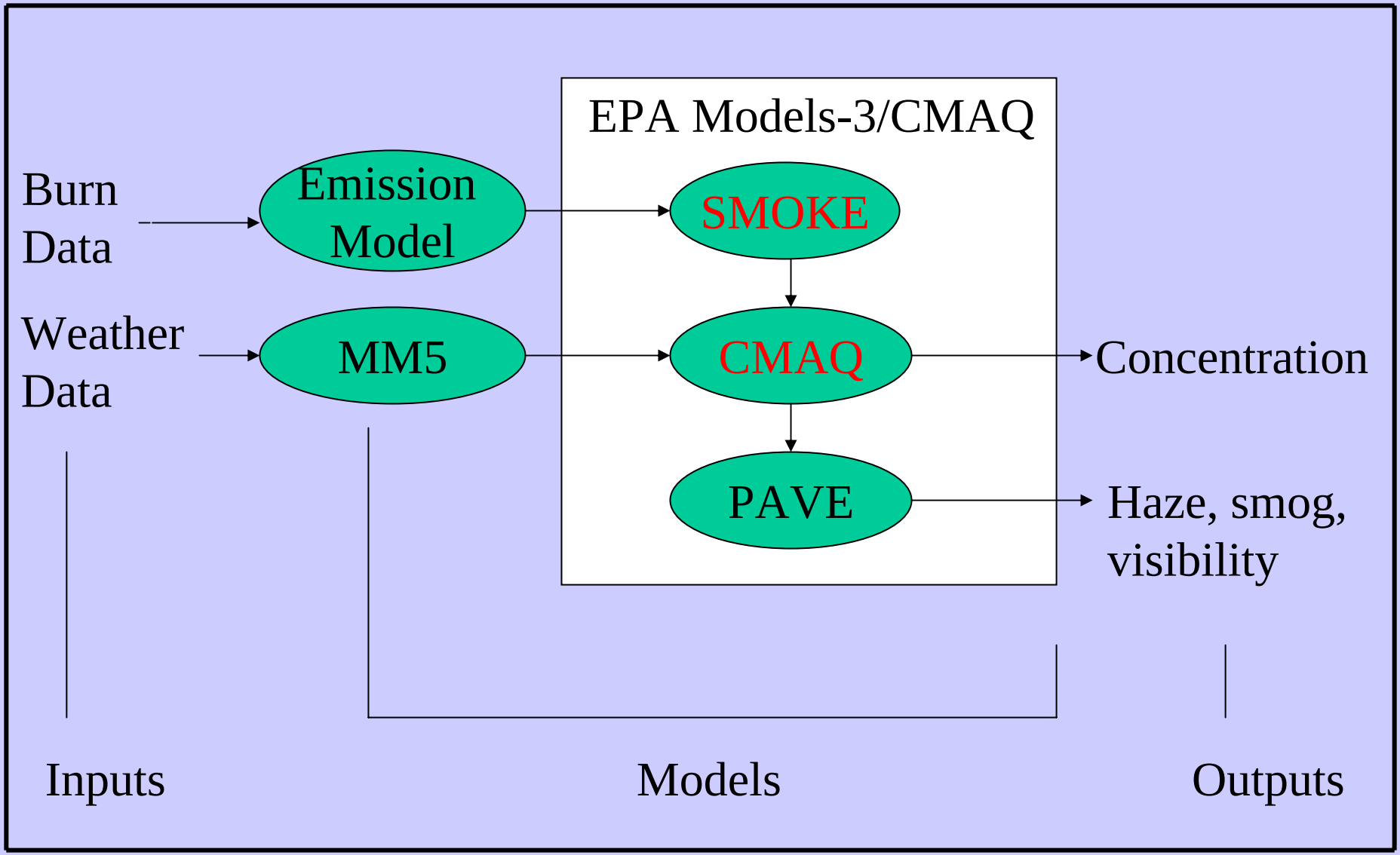
Point vs Area Fires and Vertical Distribution of Smoke in CMAQ



National Wildland Fire Technical Workshop

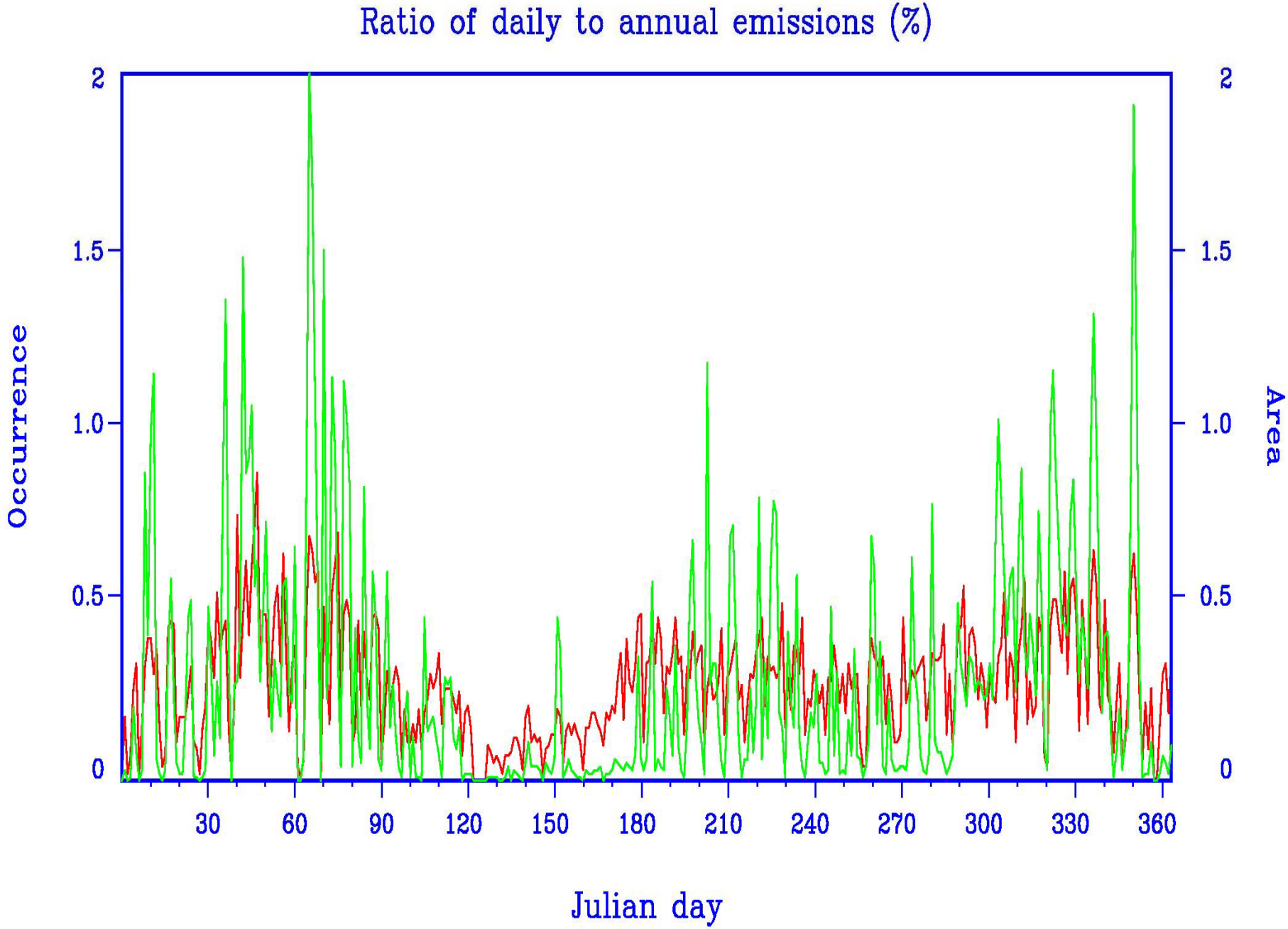
New Orleans, LA

A Smoke Simulation System



SMOKE Emission Sources

	Area	Point
❑ Time frequency	Annual	Annual Daily Hourly
❑ Space dimension	Horizontal	Horizontal Vertical
❑ Location identifier	County Code	Plant ID


Ratio of daily to annual emissions (%)
Occurrence
Area
2
1.5
1.0
0.5
0
30
60
90
120
150
180
210
240
270
300
330
360
Julian day

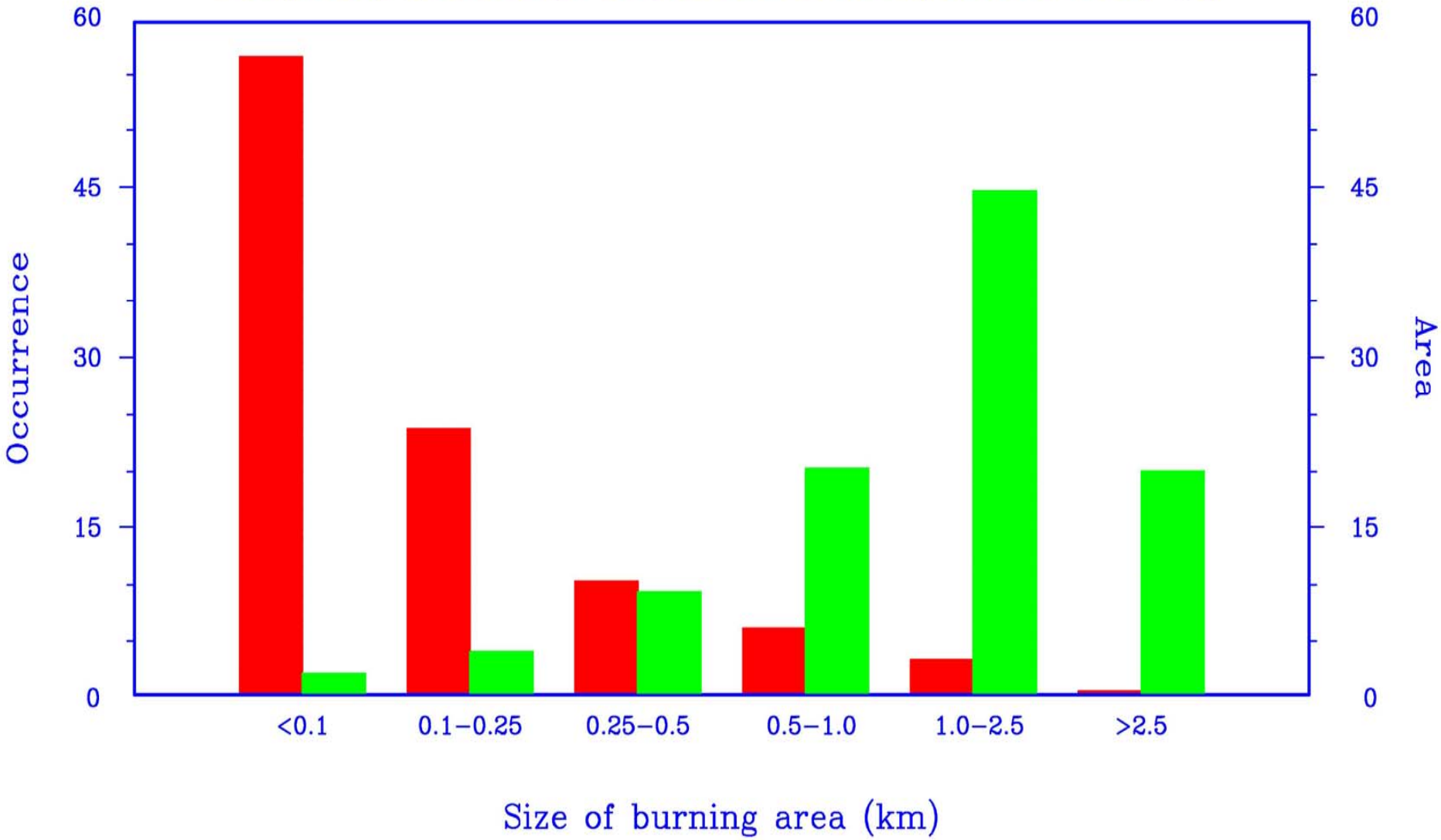

N3193U
15 16:13

Features of Prescribed Fires

- High day-to-day variability
- Elevated
  - **Point source**

Technical Issues

- **Burning information**
- **Input format**
- **Vertical distribution**


Frequency percentage of prescribed fire (Florida, 2002) (%)
Occurrence
Area
60
45
30
15
0
<0.1
0.1–0.25
0.25–0.5
0.5–1.0
1.0–2.5
>2.5
Size of burning area (km)

Point Source Input Files for SMOKE (IDA format)

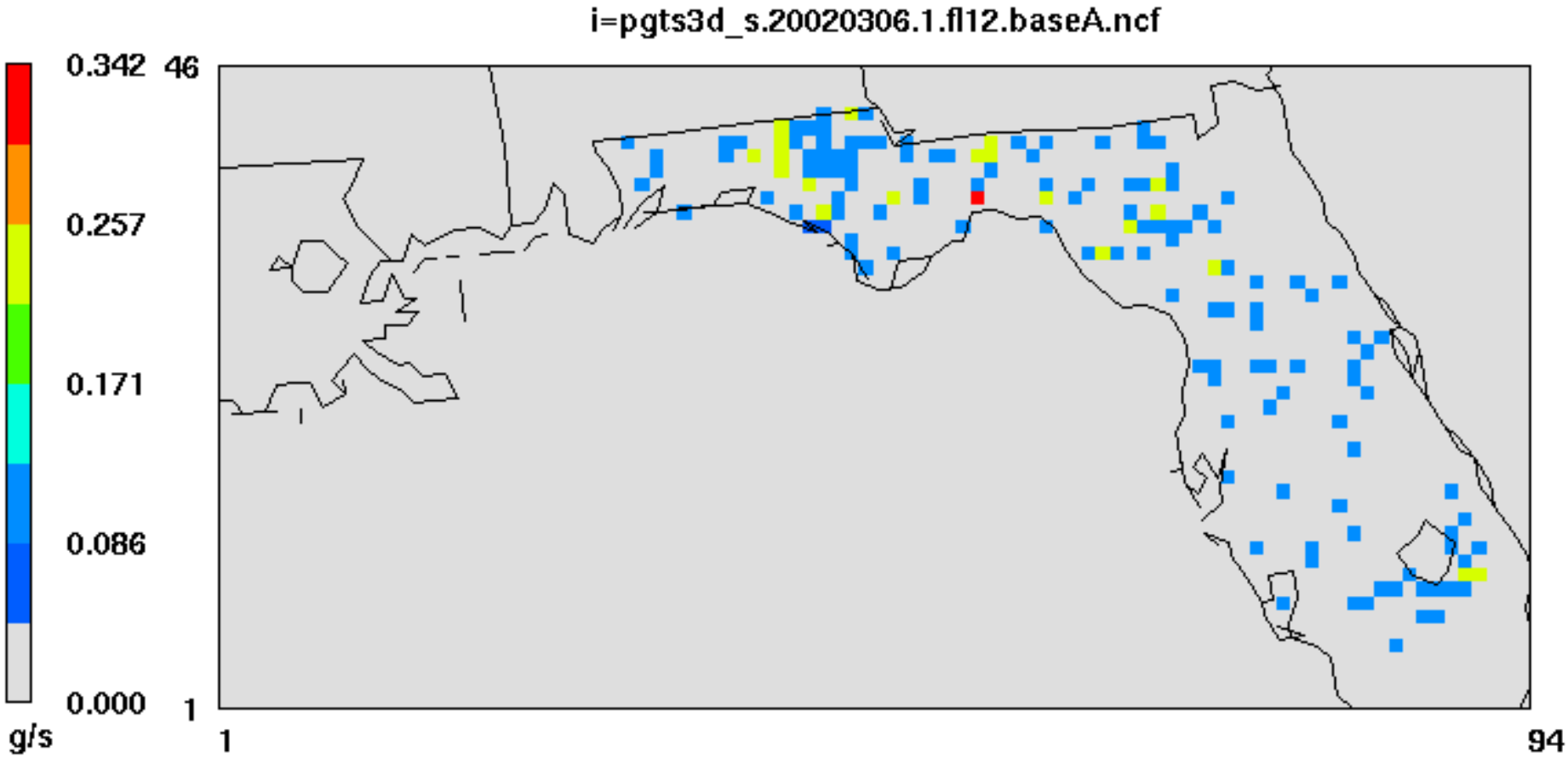
PTINV-Annual Emissions

	Stack	Fire
ID	State, county, plant	Number assigned to a site
Location	Latitude, longitude	Latitude, longitude
SCC	Varied	2810001000 (wildfire) 2810005000 (Rx)
Parameter	H, D, T, V,Fr	Same
Pollutant	CO, NH3, NOx, PM10, PM2.5, SO2, VOC	Void except for those not emitted from fire

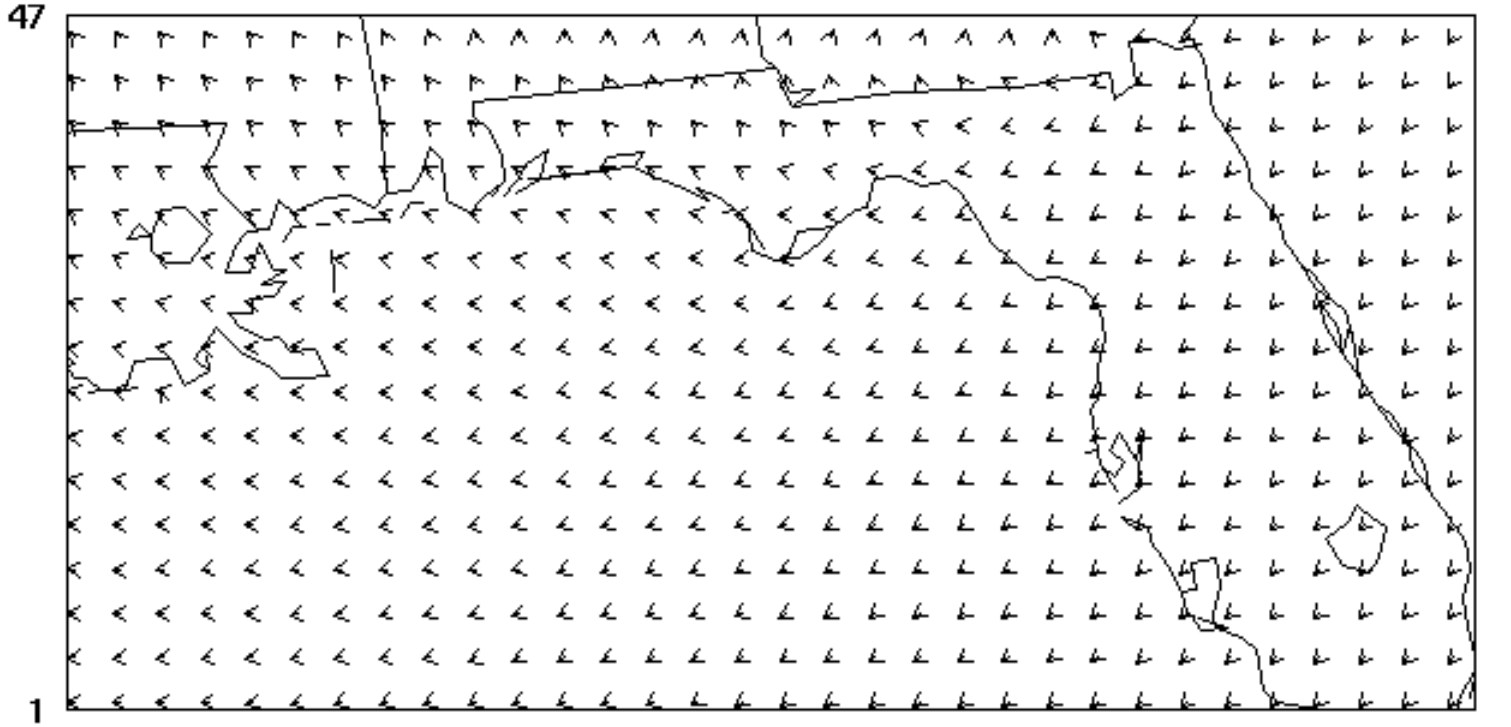
PTDAY-Daily Emissions

Number assigned, SCC, Date, Pollutant name, daily amount

Layer 1 PMCi


i=pgts3d_s.20020306.1.fl12.baseA.ncf
0.342
0.257
0.171
0.086
0.000
g/s
46
1
1
94
PAVE
by
MCNC
March 6,2002 10:00:00
Min= 0.000 at (1,1), Max= 0.342 at (55,37)

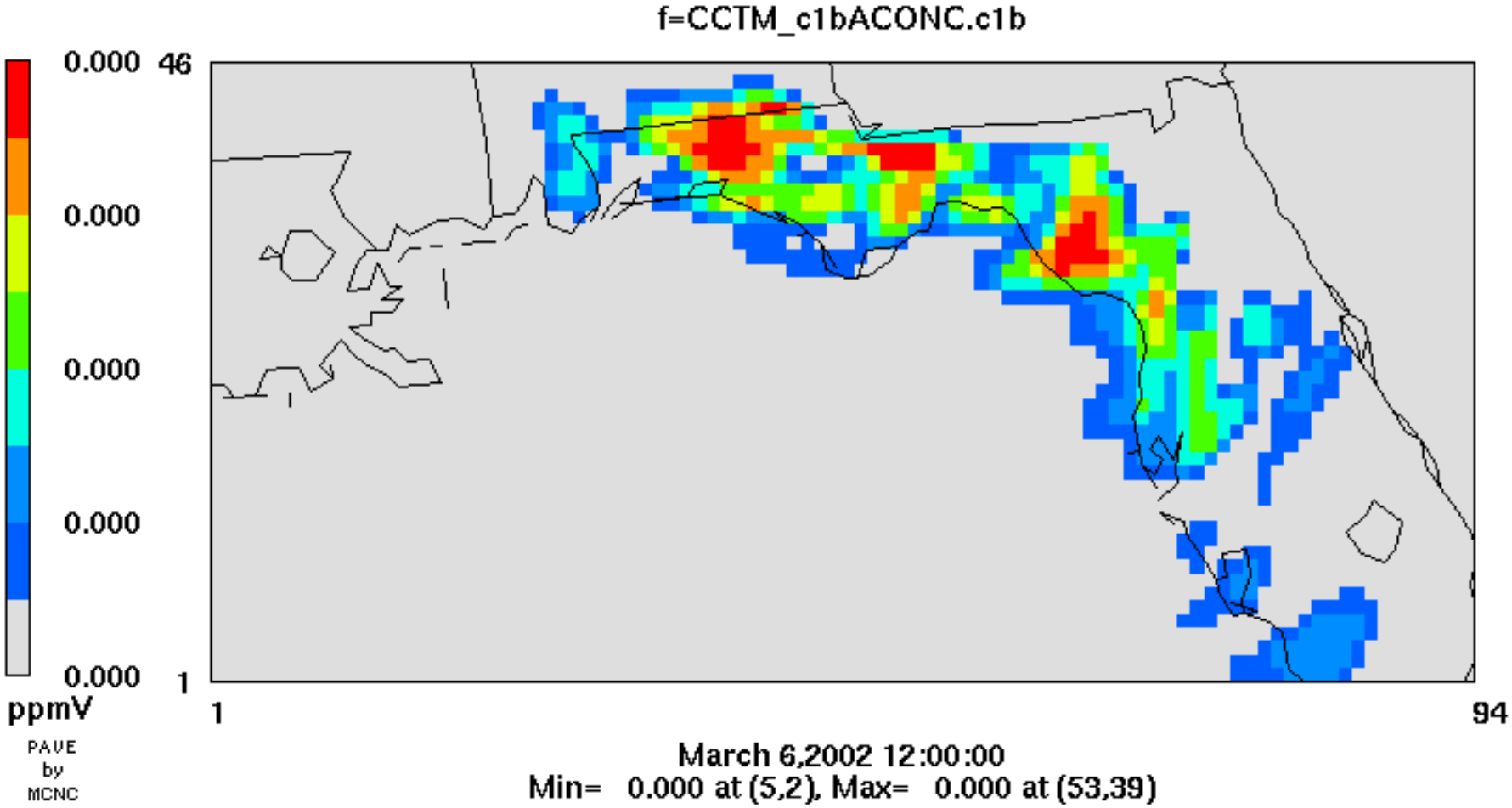
Layer 1 Vector Plot



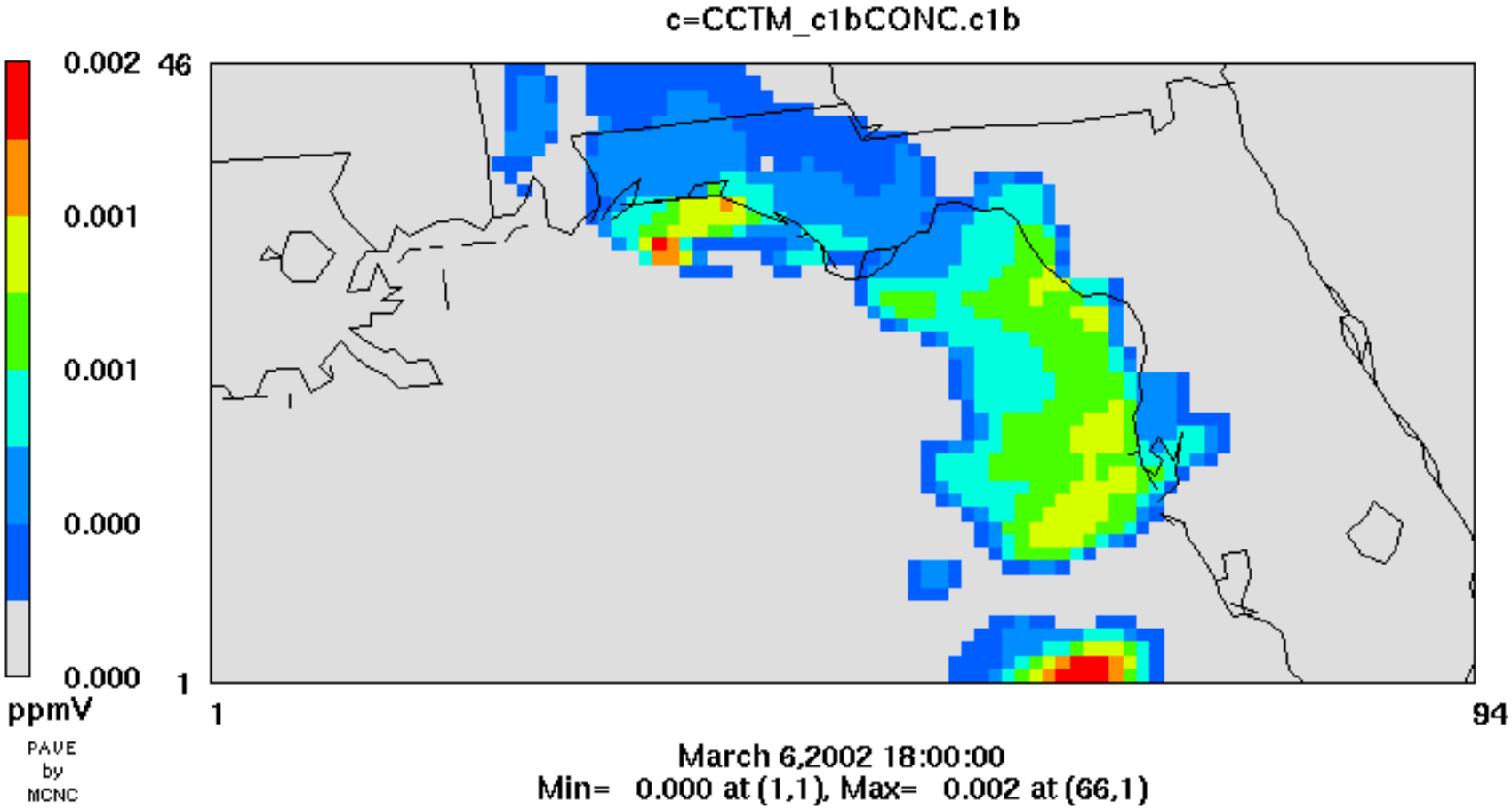
March 6,2002 0:00:00

PAVE
by
MCNC

Layer 1 O3f


f=CCTM_c1bACONC.c1b
0.000
0.000
0.000
0.000
0.000
ppmV
PAVE
by
MCNC
46
1
1
94
March 6,2002 12:00:00
Min= 0.000 at (5,2), Max= 0.000 at (53,39)

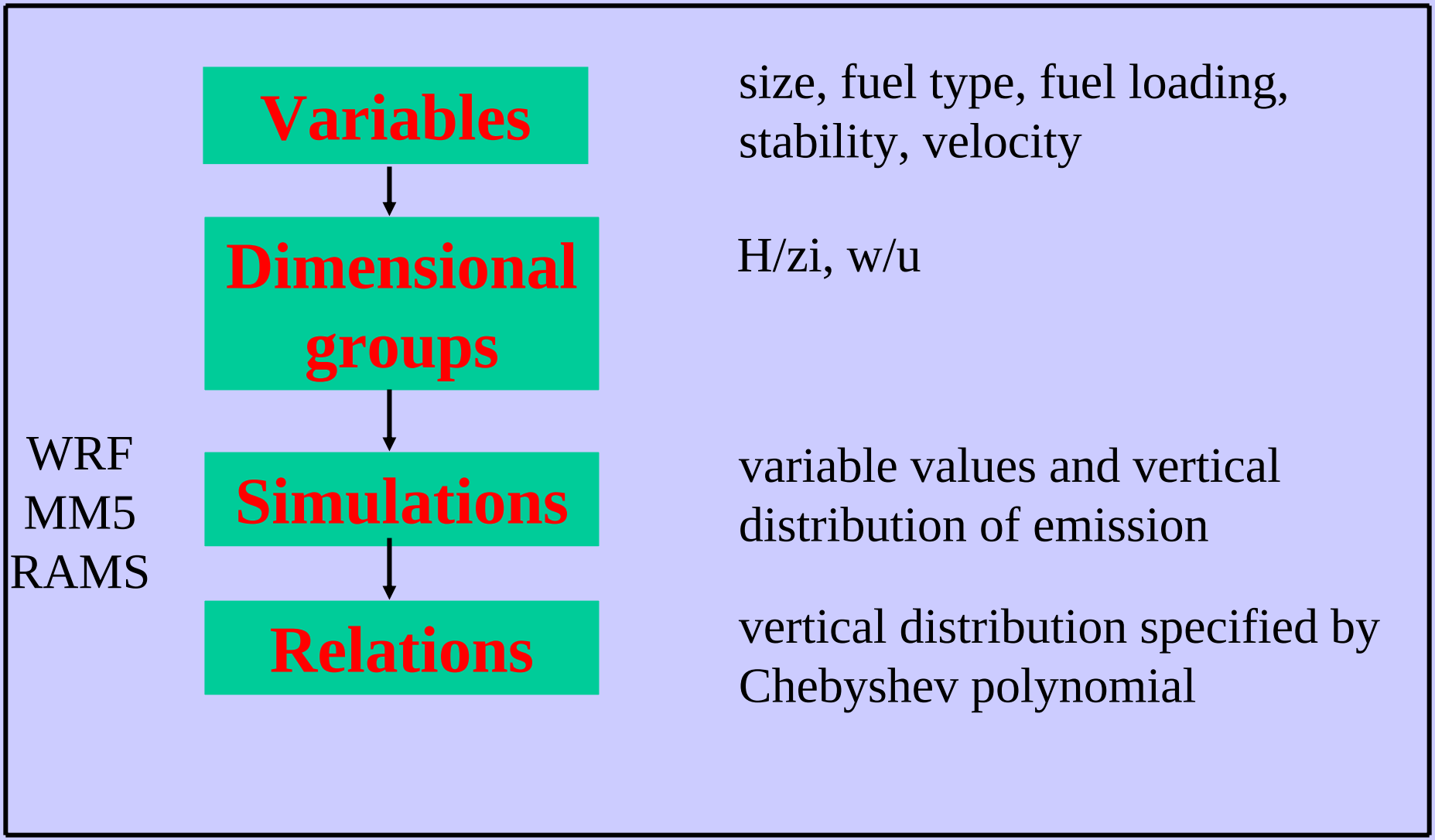
Layer 1 O3c


c=CCTM_c1bCONC.c1b
0.002
0.001
0.001
0.000
0.000
ppmV
PAVE
by
MCNC
46
1
1
94
March 6,2002 18:00:00
Min= 0.000 at (1,1), Max= 0.002 at (66,1)

Plume Rise

Type	**Feature**	**Stack**	**Fire**
Empirical	Statistical correlation and regression	Holland 1953	Harrison and Hardy 2002
Similarity	theory and dimensional analysis	Briggs 1968	To be discussed
Dynamical	Conservations of mass, energy, and momentum	Briggs 1984	Achtemeier (Daysmoke)

Conceptual Model of Vertical Distribution of Smoke



Further Research

- Develop a scheme of plume rise and smoke vertical distribution based on the conceptual model
- Couple this scheme with CMAQ/SMOKE
- Coupled Daysmoke with CMAQ/SMOKE
- Simulate air quality effects of Florida prescribed fires with the coupled model