Monitoring SLCF Pollutants: What Can/Could State Air Agencies Measure?

George Allen

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What are the SLCF pollutants of Interest?

Ozone, fine-size mode Black Carbon Soot (BC or "EC"), Methane

Focus of this presentation: State Agency measurements of O3 & BC

- At the surface, including high elevation sites
- (Methane contribution relatively minor, spatially variable)

O3 and BC: which is more important re: SLCF?

- We don't really know... large uncertainties in role of soot (Eric)

O3: already have large national networks

- O3 (1200 sites now, soon 1500? nationally) - urban & rural
- Much O3 data is seasonal; monitor year-round for climate use???

BC/EC: more limited measurements

- Improve/CSN/NATTS -- ~ 300 sites - split urban-rural

Measurement Issues

We can measure O3 reasonably well.

Spatial patterns are well defined; remote sensing works

"Soot" is more challenging to measure...

Data are operationally defined (method matters)

Remote sensing not practical

For SLCF aerosols, "it's the surface layers that count"

not bulk composition -- it's an optical process!

Soot: Both anthropogenic and natural sources

very different ec/oc ratios [diesel vs. wood smoke]

Large (3-5x mean) spatial variability - not well defined

Core urban vs. regional background

Measurements, continued

Factor of 2-3 in data across multiple soot/EC methods
- NIOSH-5040, CSN (STN), IMPROVE: filter thermal analysis
- Some attempts at harmonization now underway
- Bulk measures

Optical transmission filter-based methods - also variable response
- Aethalometer, PSAP, MAAPS etc.
- Surface measures

Photo-acoustic method -- in-situ optical absorption measurement
- Arnott, Droplet Technologies
- Still a research tool - not routine network use

Assessing longer term trends across methods can be hazardous...

How might State Agency SLCF data be useful?

Large ground-based networks are good indicators of “source” trends

High elevation O3/BC (mountain top sites such as Mt. Washington)
    VERY valuable for climate use - free troposphere “probes”

Primary source trends for BC - diesel reduction program effects
    Lots going on here...

Precursor sources for O3 -- VOC, NOx
    tracking effects of control programs

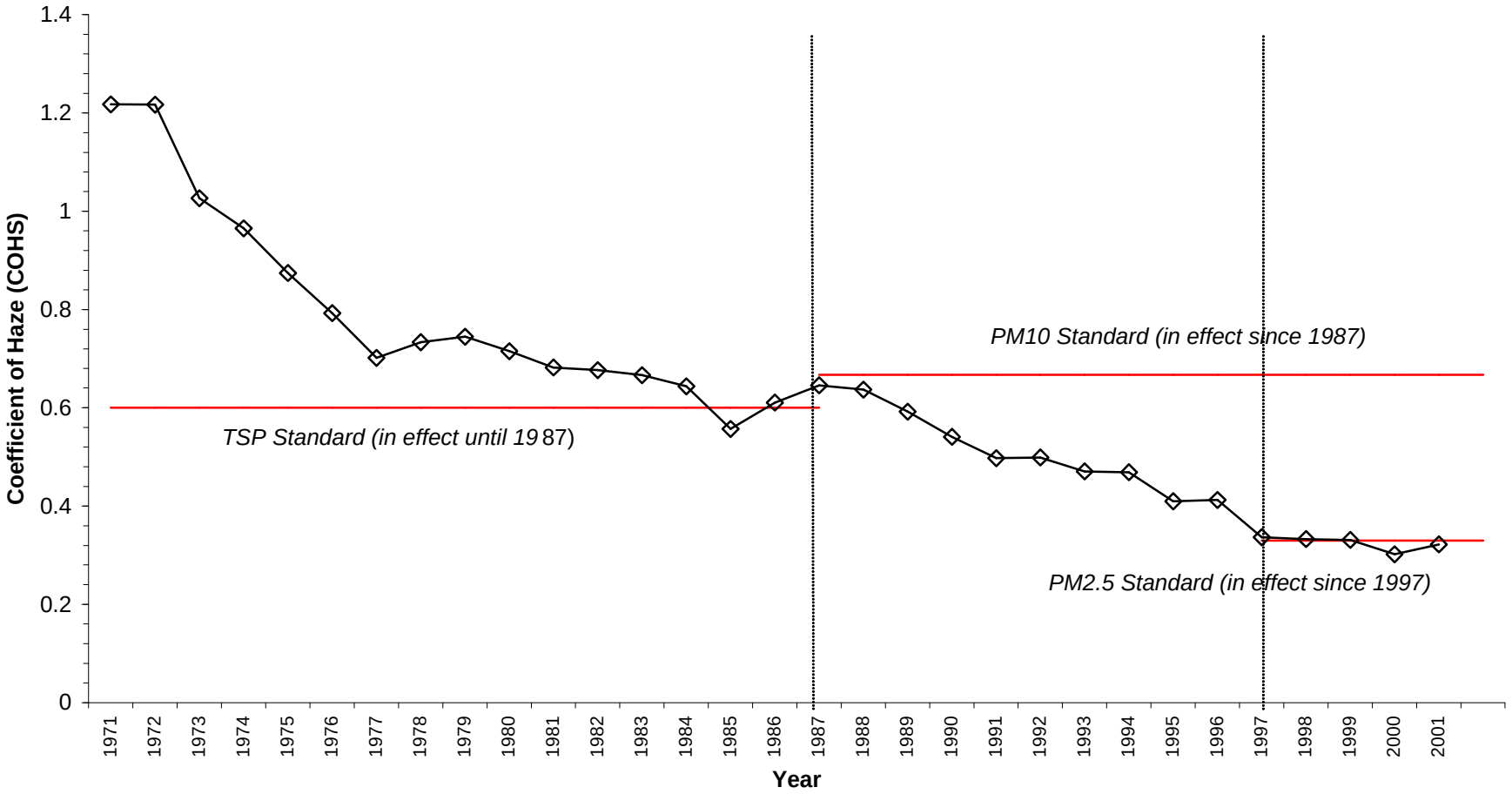
Direct linkage of ground measurements to climate forcing: hard
    Regional SLCF emissions can have regional climate effects (Eric)

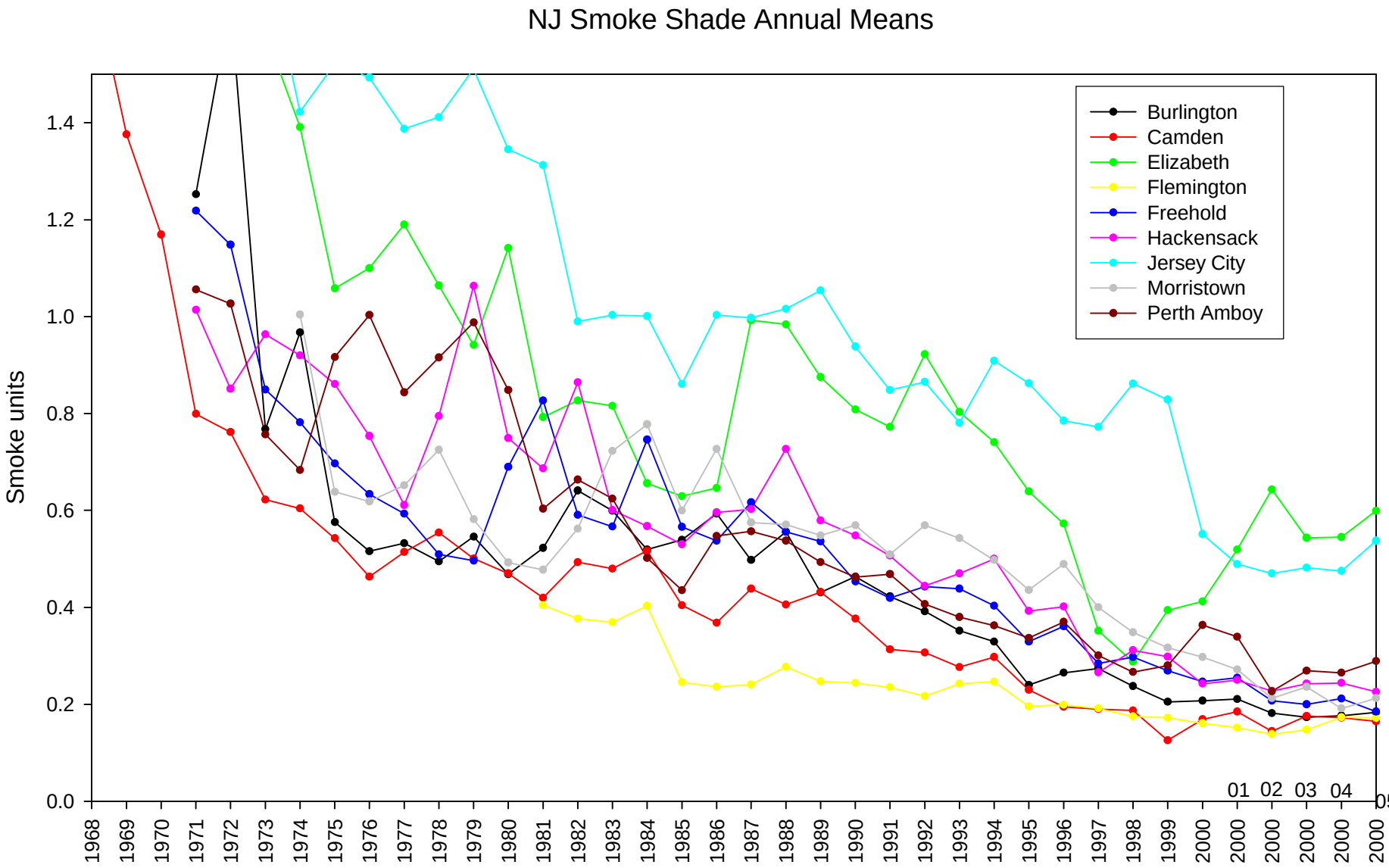
Examples of urban soot trends in the Northeast -- NJ, MA:

30-year NJ COH trend
Source: C. Pietarinen

New Jeresy Trend in Particulate Levels
1971 - 2001

Smoke Shade used as a surrogate for particulate matter
Anuual Average of All Sites




NJ Smoke Shade Annual Means
Smoke units
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1968
1969
1970
1971
1972
1973
1974
1975
1976
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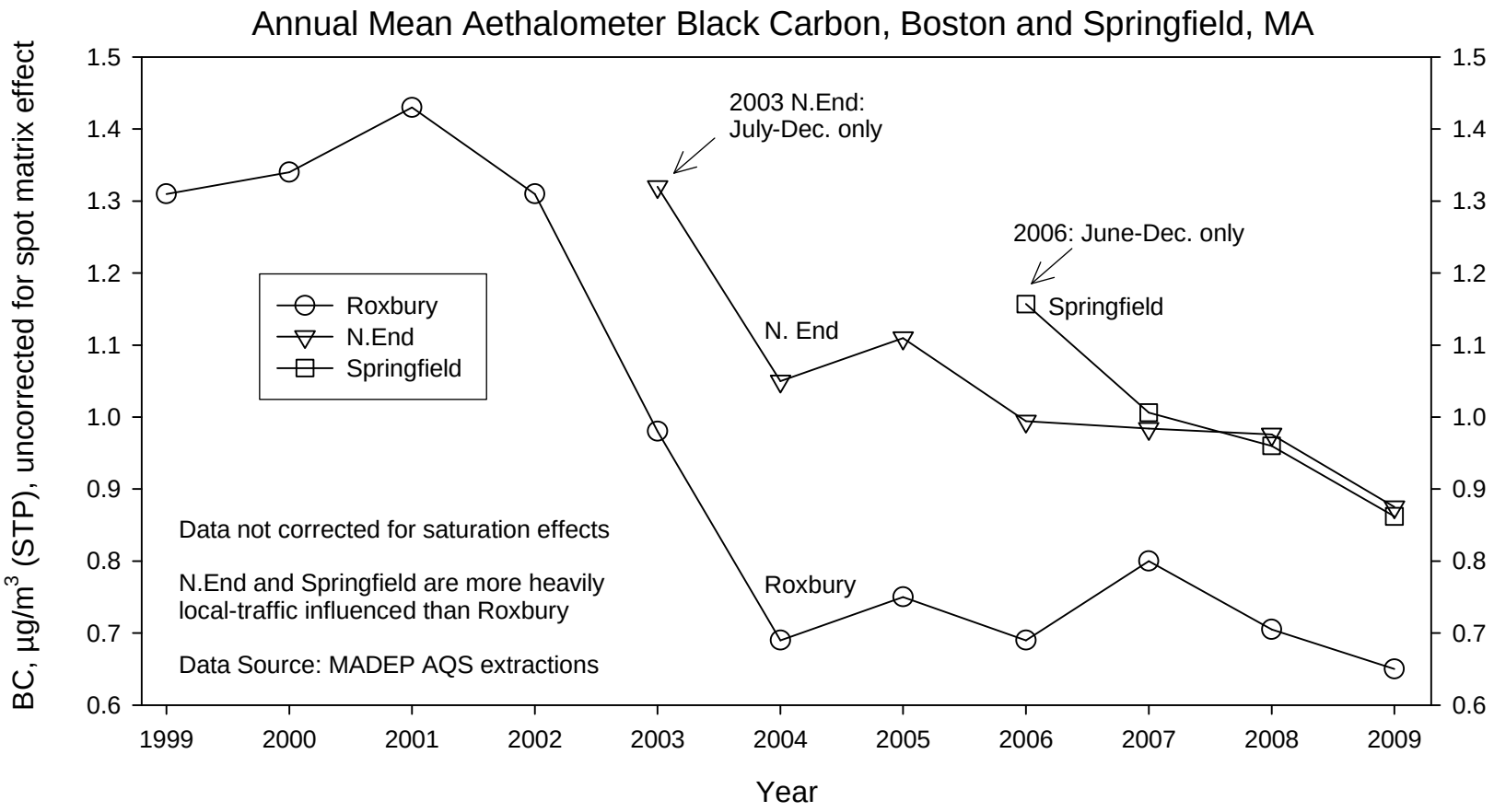
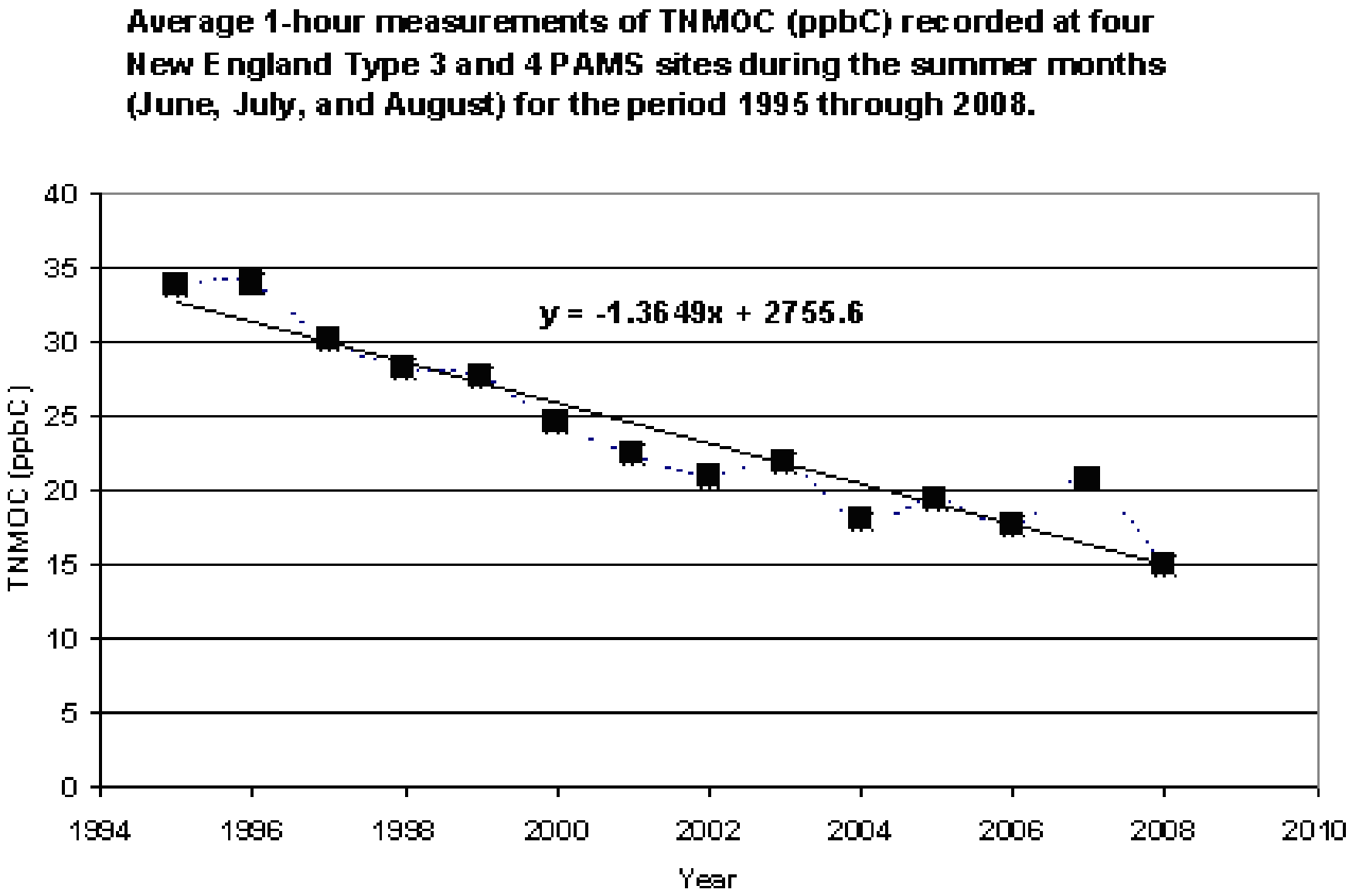
Camden
Elizabeth
Flemington
Freehold
Hackensack
Jersey City
Morristown
Perth Amboy


Annual Mean Aethalometer Black Carbon, Boston and Springfield, MA
BC, µg/m3 (STP), uncorrected for spot matrix effect
Year
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Roxbury
N.End
Springfield
2003 N.End:
July-Dec. only
2006: June-Dec. only
N. End
Springfield
Roxbury
Data not corrected for saturation effects
N.End and Springfield are more heavily
local-traffic influenced than Roxbury
Data Source: MADEP AQS extractions

Example of rural total NMOC 1995-2008 (Source: EPA-R1)

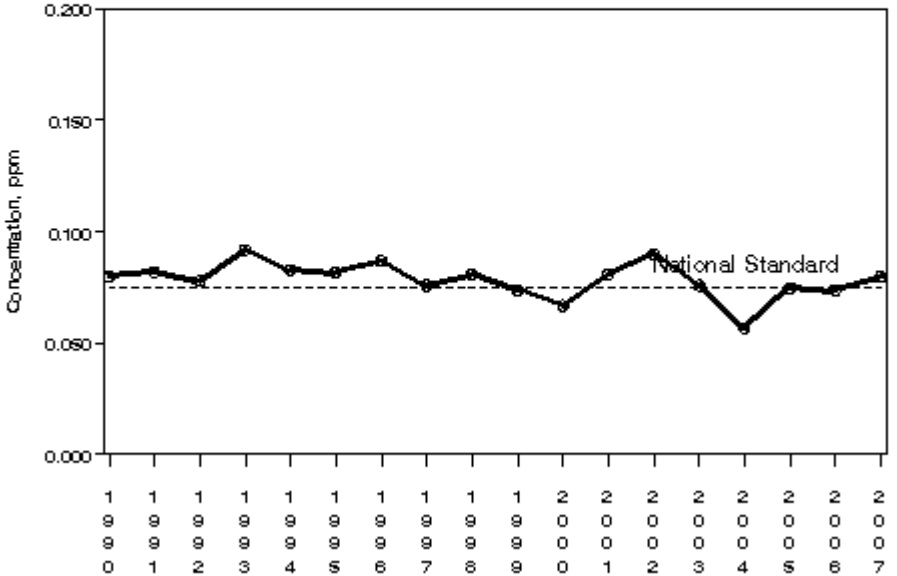


Ozone Air Quality, 1990 — 2007

(Based on Annual 4th Maximum 8—Hour Average)

Cleveland—Lorain—Elyria,OH

SITE= 390350034 POC= 1



Can State Air Agency measurements be useful for SLCF work?

Maybe. O3 and BC trends are probably most important

Linkage between surface measurements and climate is not direct

- Best for regional effects, not global
- Need more vertical structure
- Very large uncertainty in BC role as SLCF

Thinking Bigger.

No climate-specific monitoring funding to State air agencies

- unless EPA issues climate regs that drive surface monitoring

How can State air agency's data support the research processes?