

Analysis of Spatial and Temporal Trends of Black Carbon in Boston

A 2008 Community-Scale Air Toxics Ambient Monitoring Grant Project
In Cooperation with MassDEP

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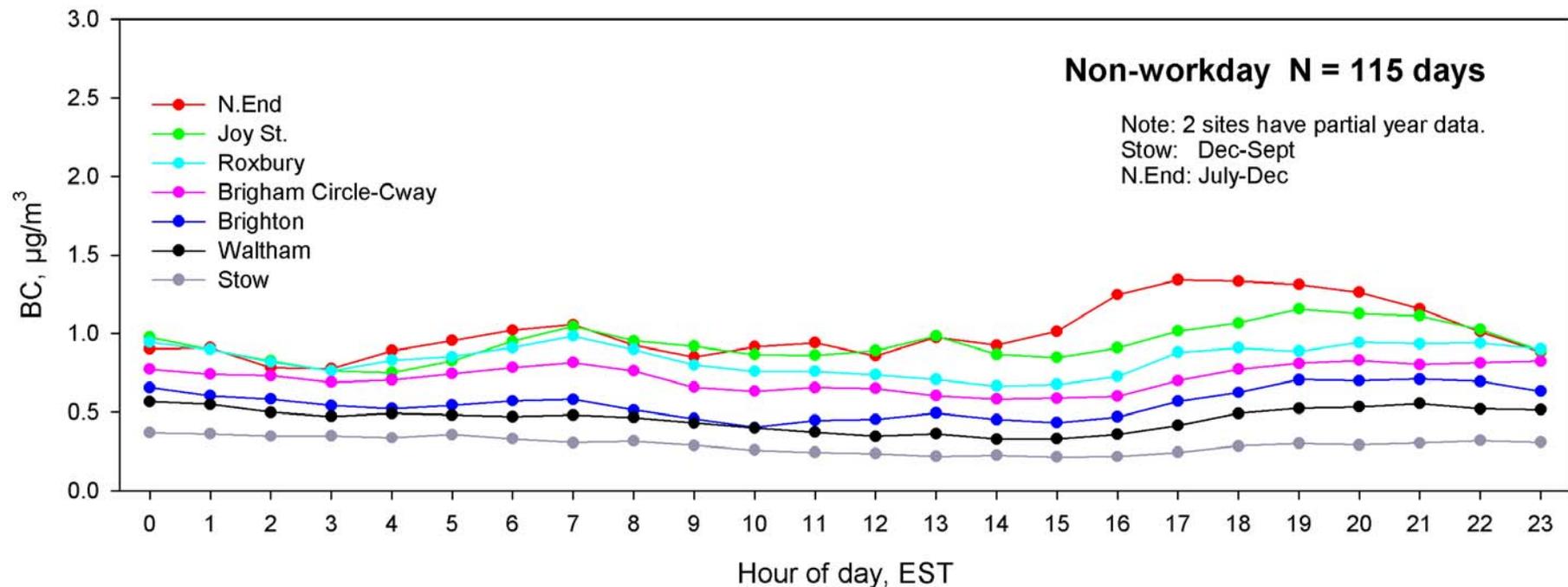
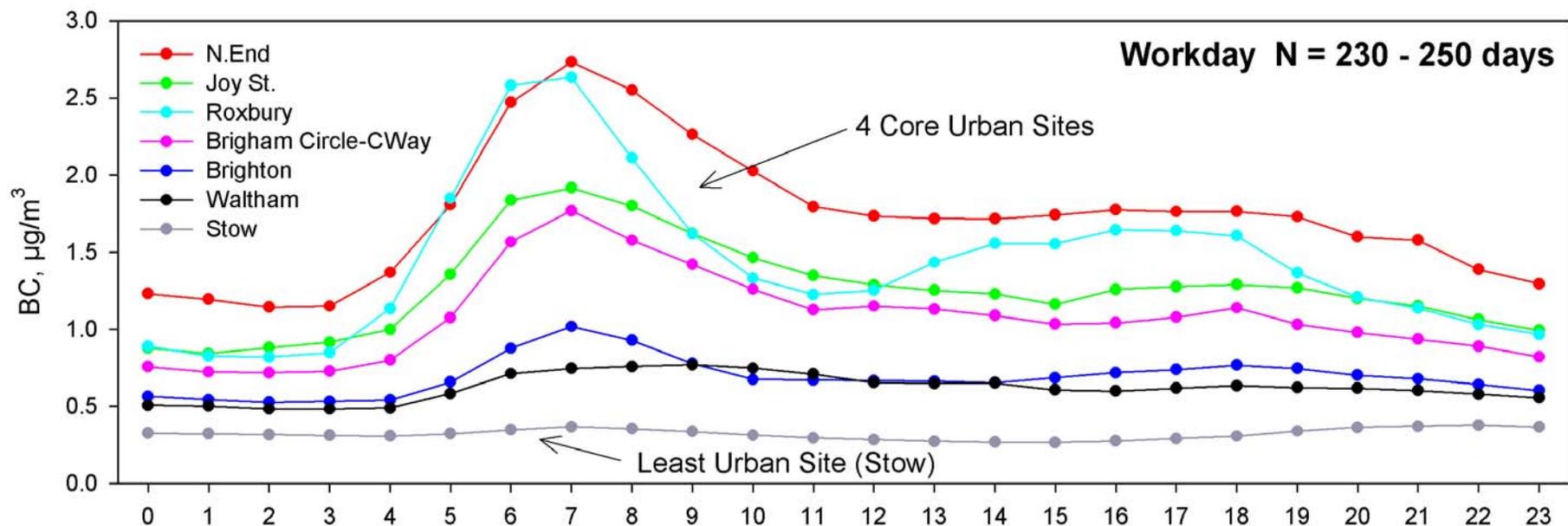


NAMC, Atlanta, GA August 13, 2014

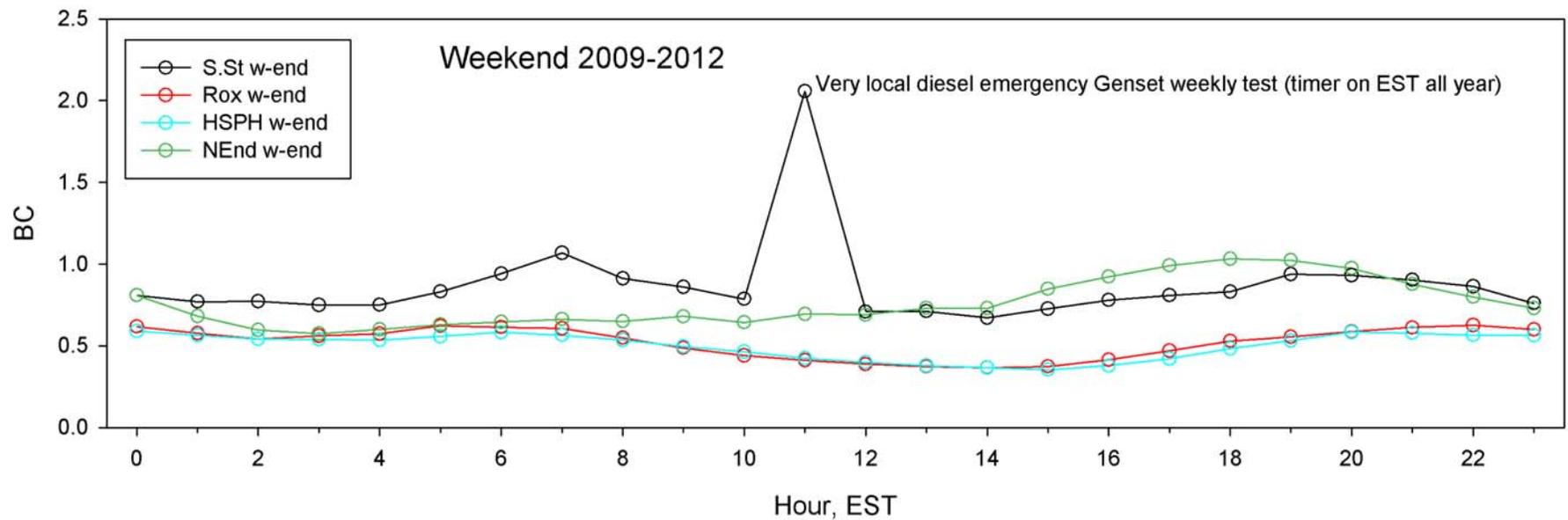
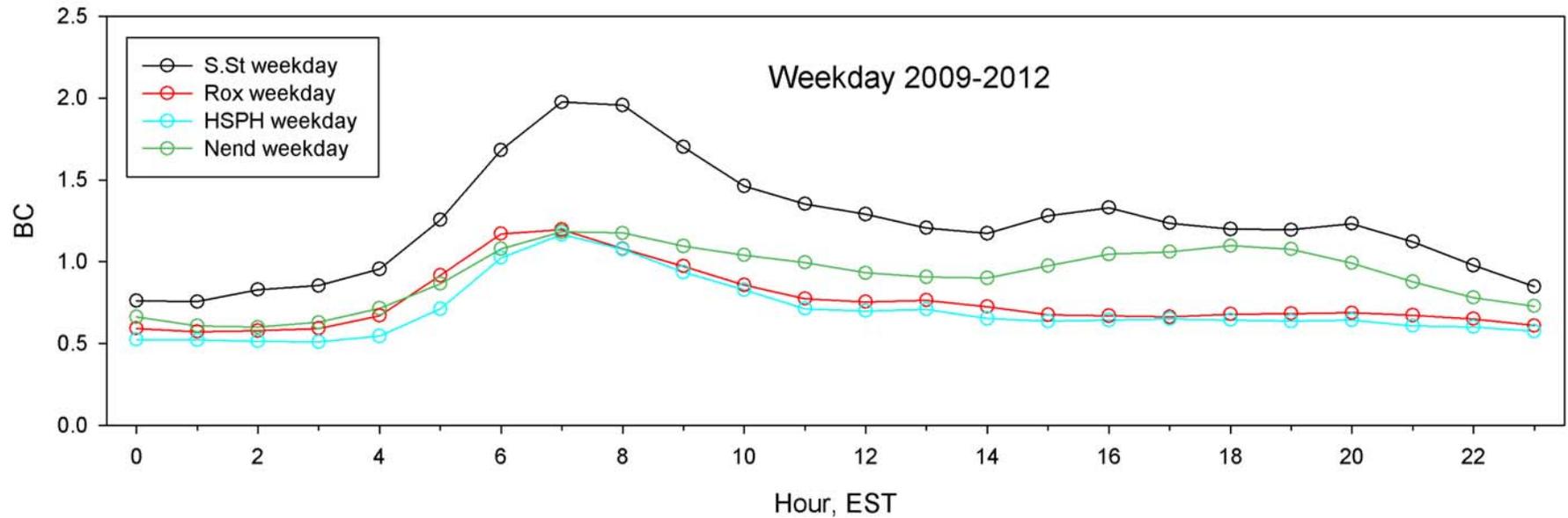
Introduction.

- Black Carbon Soot (BC): indicator of diesel PM
- Easily measured with optical methods (Aethalometer)
High time resolution (1 to 5 minutes)
- Boston: long history of BC data (1999)
Multiple sites (MassDEP, HSPH)
- Original Q: spatial scale of urban BC “bubble”
2003 7-site study
Reprocess old data with current methods (spot loading)
- Newer Q: trends of urban BC 1999-present
Effect of diesel control programs?

2003 Diurnal Plot of Seven Core Sites.



Updated Boston Diurnal Plots: 2009-2012

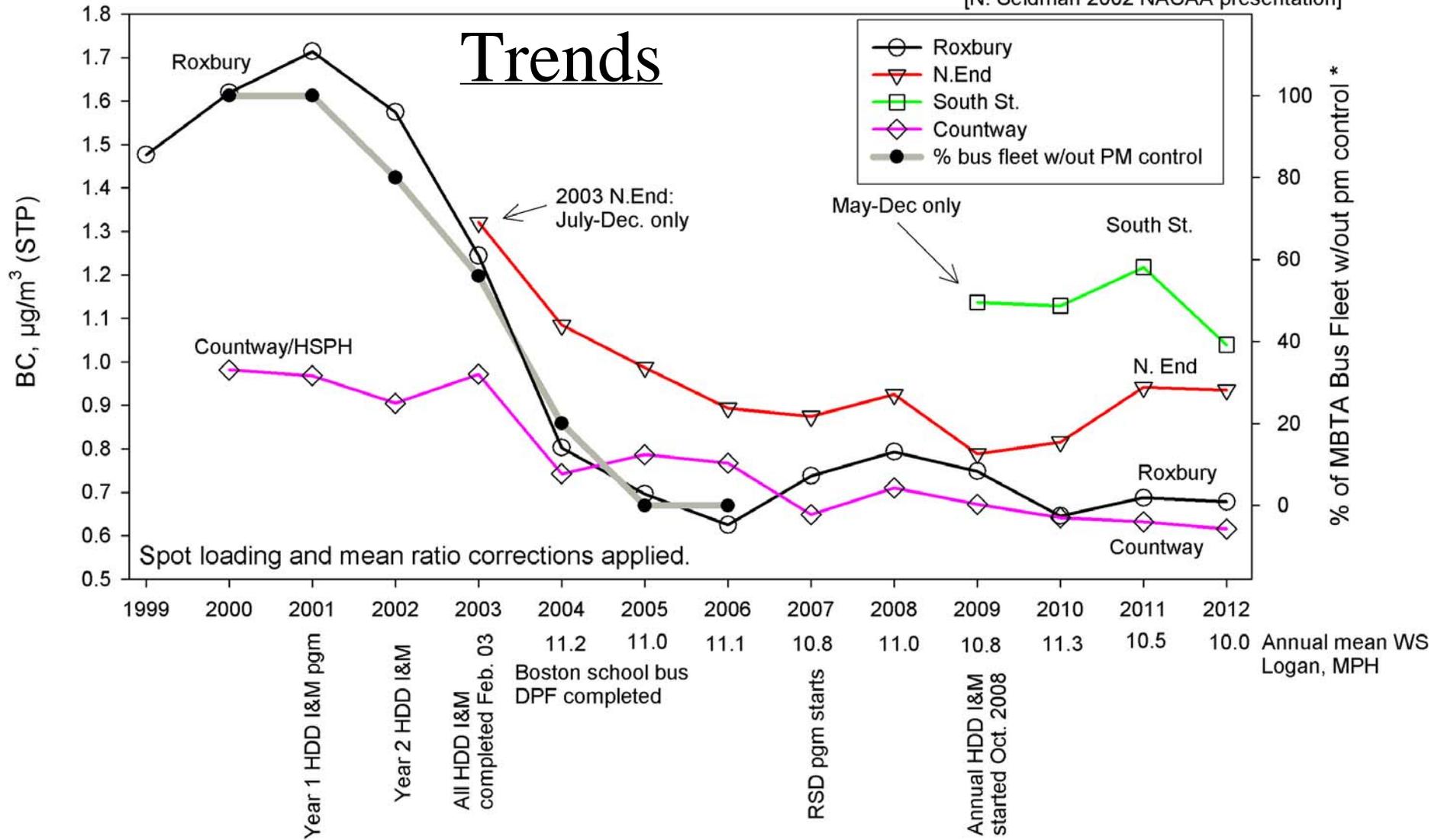


South St. Boston very local BC source Sat. 11am EST:

Next-Door Genset exhaust:



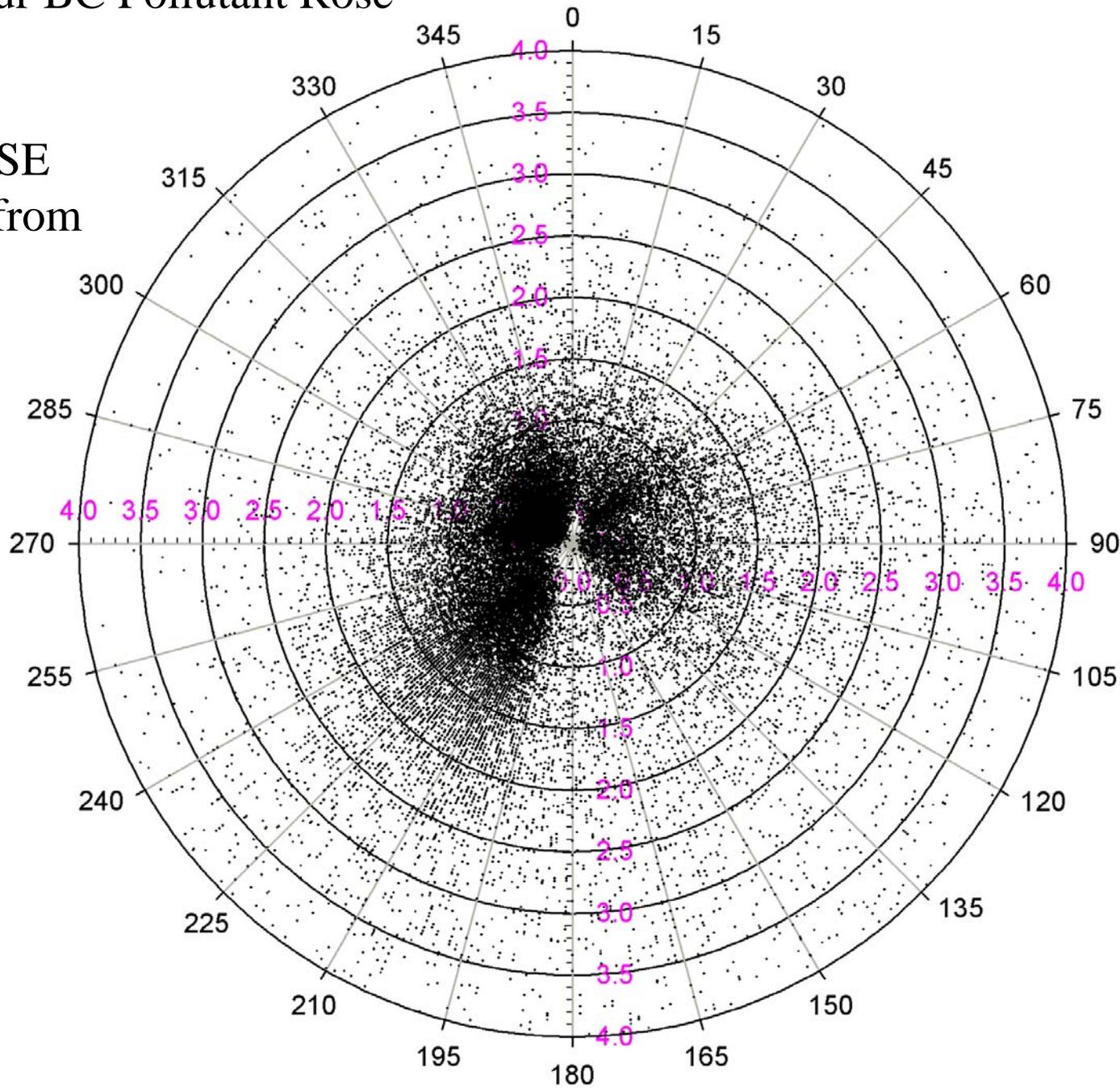
* MBTA Bus fleet PM control is estimated
[N. Seidman 2002 NACAA presentation]



2 Qs: Why South St. highest? -and- Why no/little trend since 2004/2005?

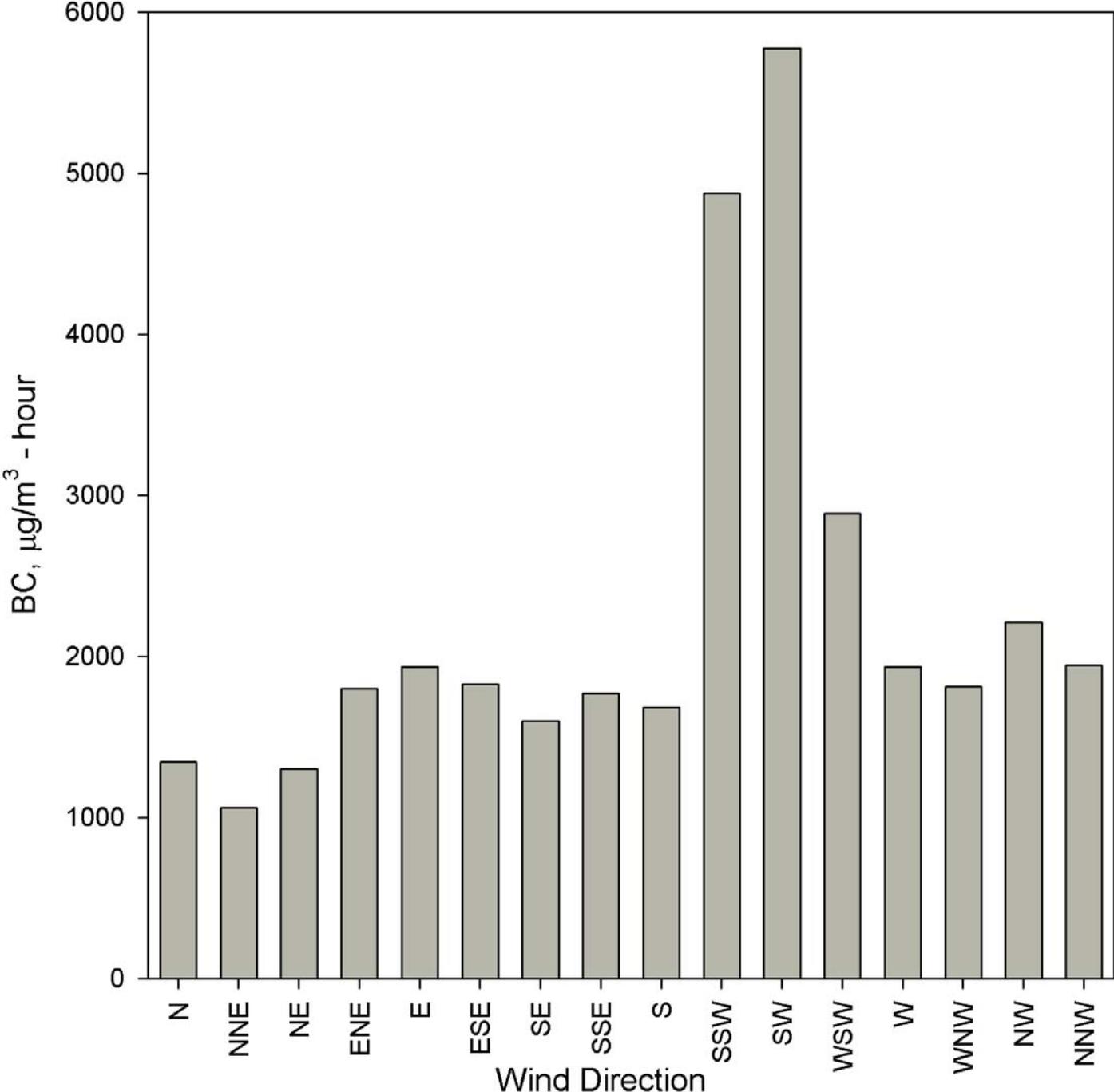
South St. 1-hour BC Pollutant Rose < 4 $\mu\text{g}/\text{m}^3$

Clear null to SSE
(wind seldom from that direction)



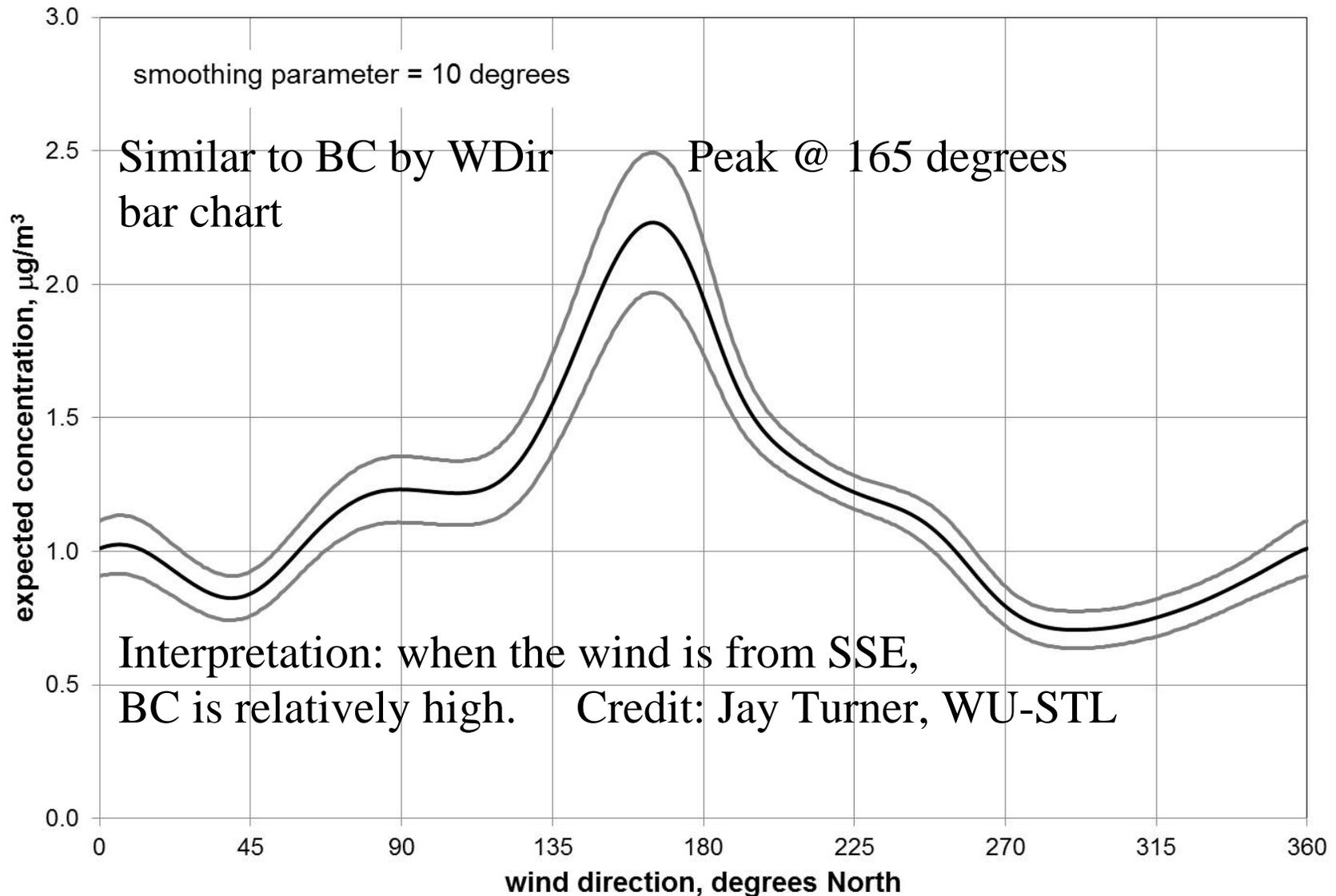
South St.
BC times Hour
by Wind
Direction.

Direction of
source that
dominates
average BC
concentration



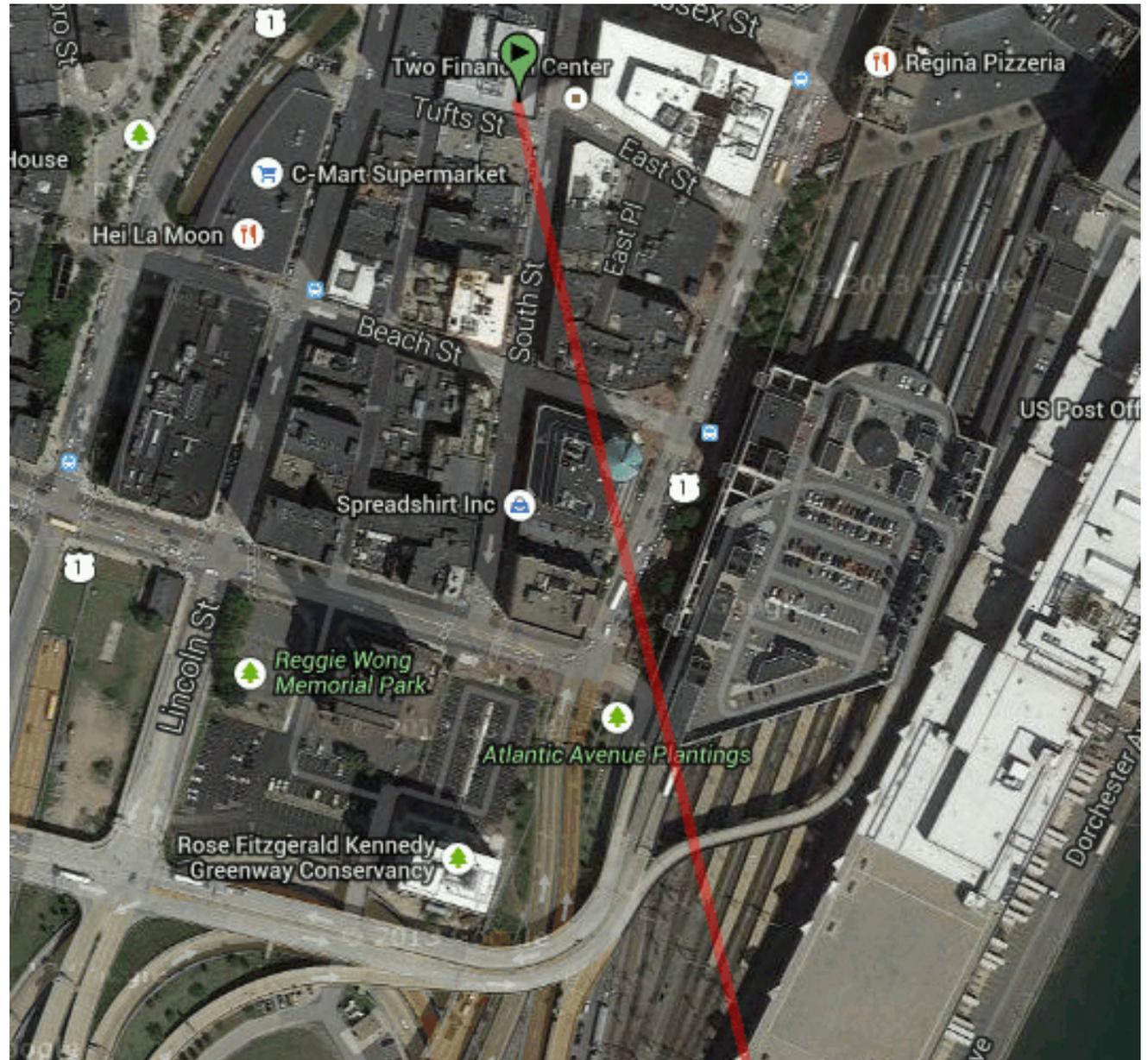
Nonparametric Wind Regression for Source Identification Analysis: 10° weighted window is slid across the wind direction coordinates

Boston - South Street Aethalometer BC, May 2009 - May 2013

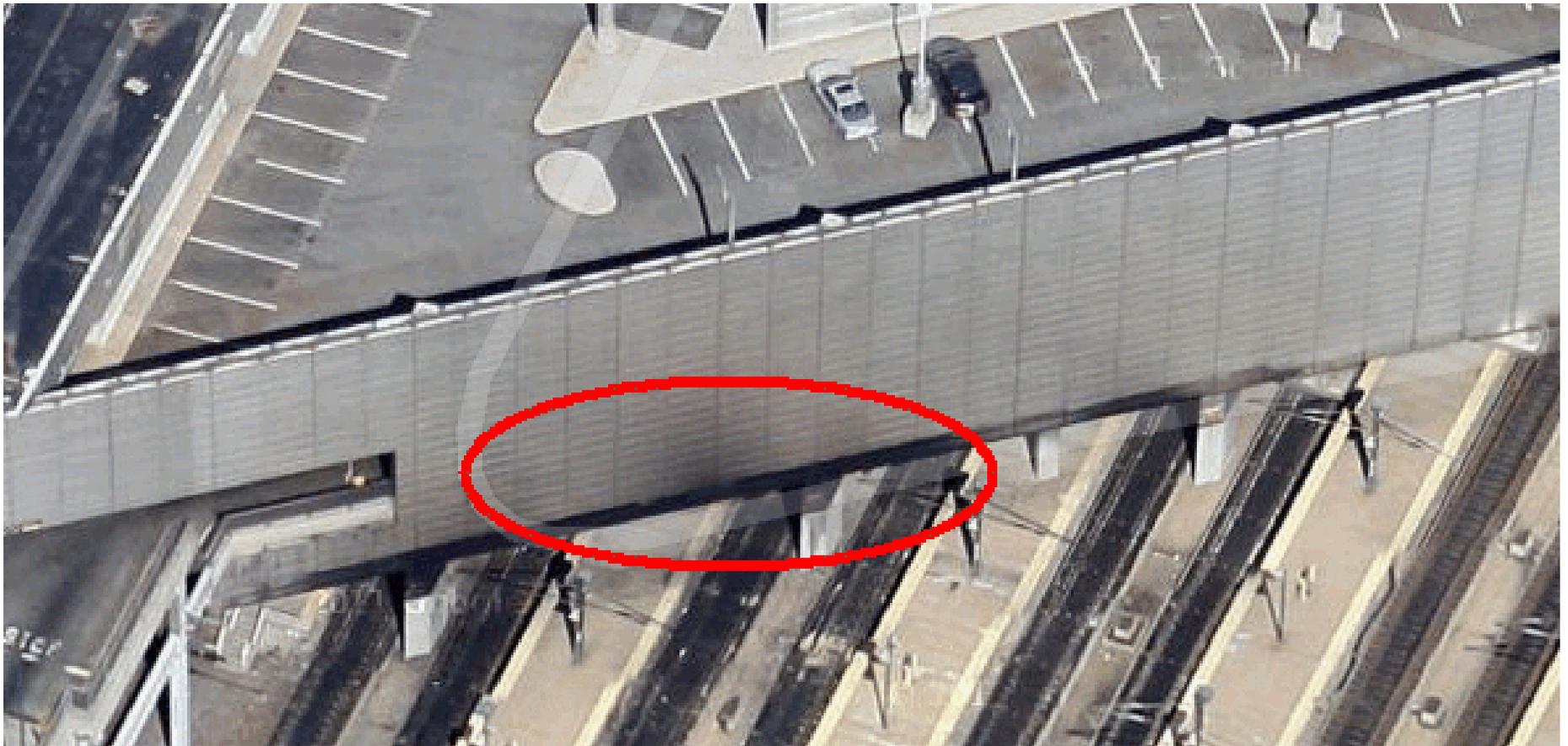


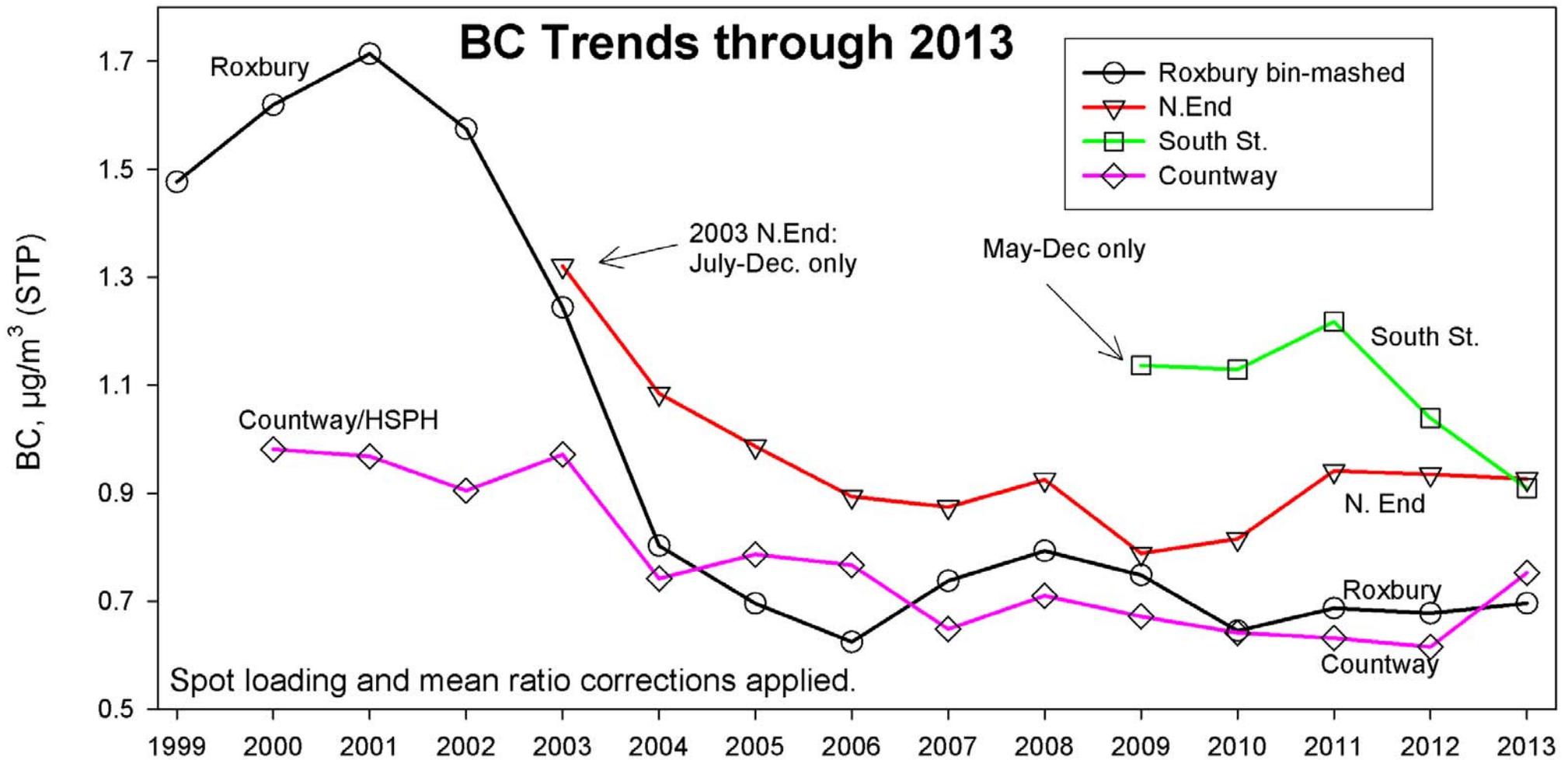
What's 165 deg.
from this site
(my office)?

South Station garage /
soot vacuum cleaner
(inter-city buses and
commuter rail HDD
locos)



165 Degrees: South Station Garage wall - Loco Soot





Why no long-term trend – post-HDD cleanup?

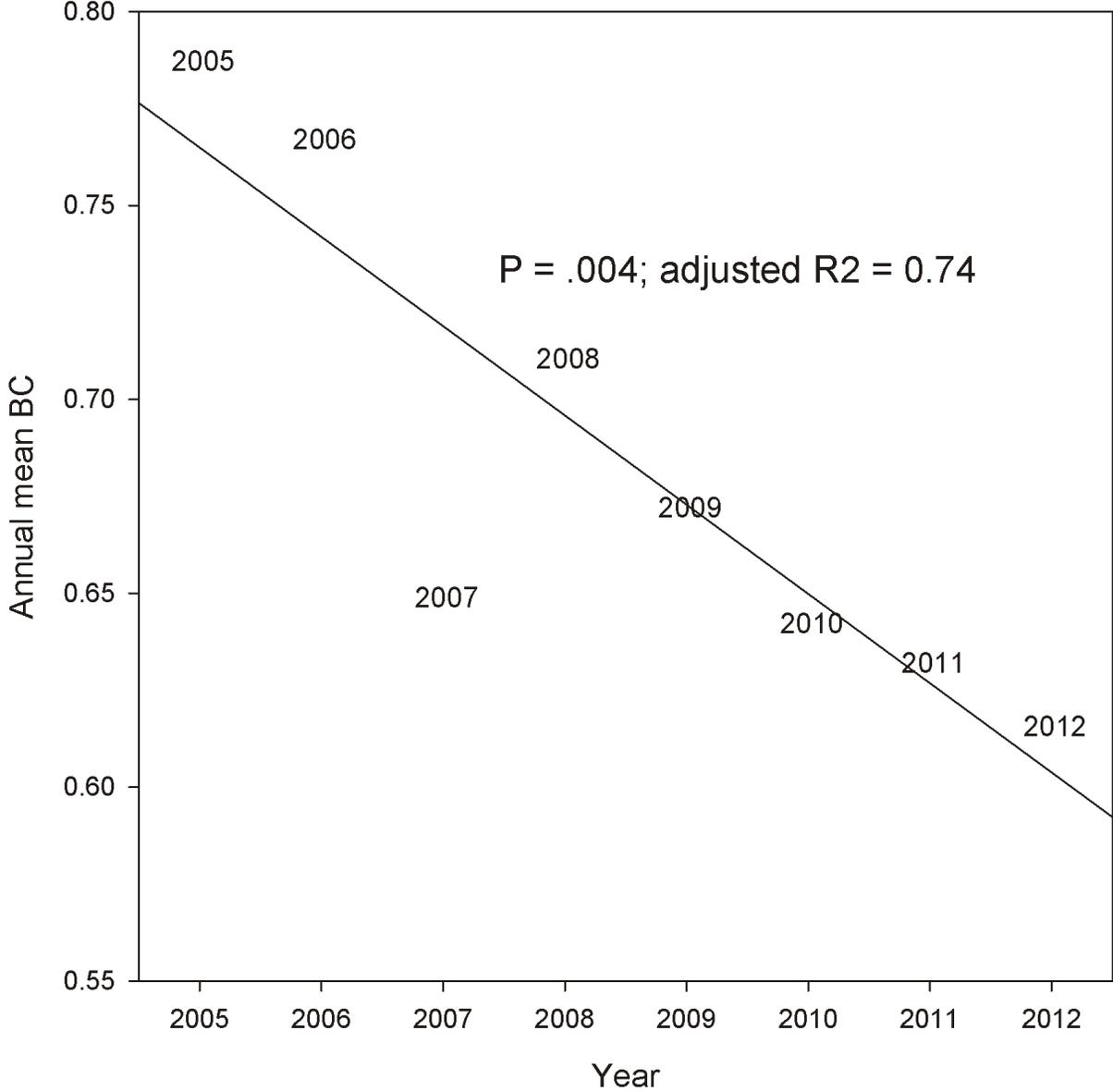
2013 update:

Roxbury and N.End flat

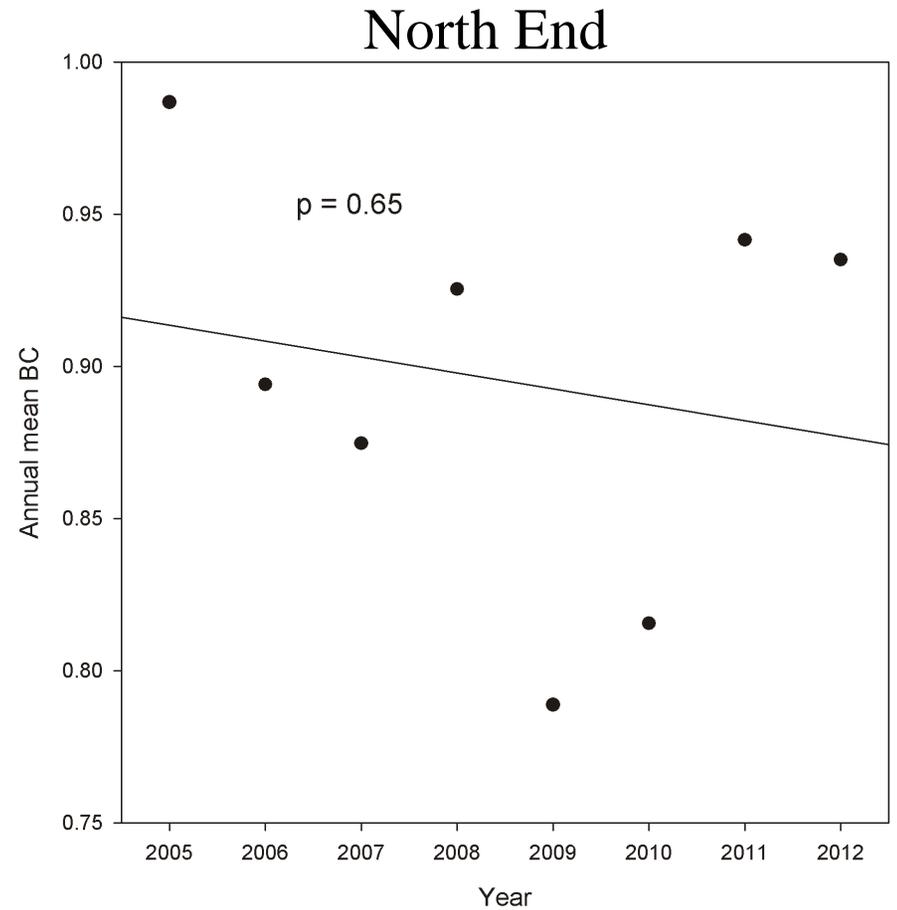
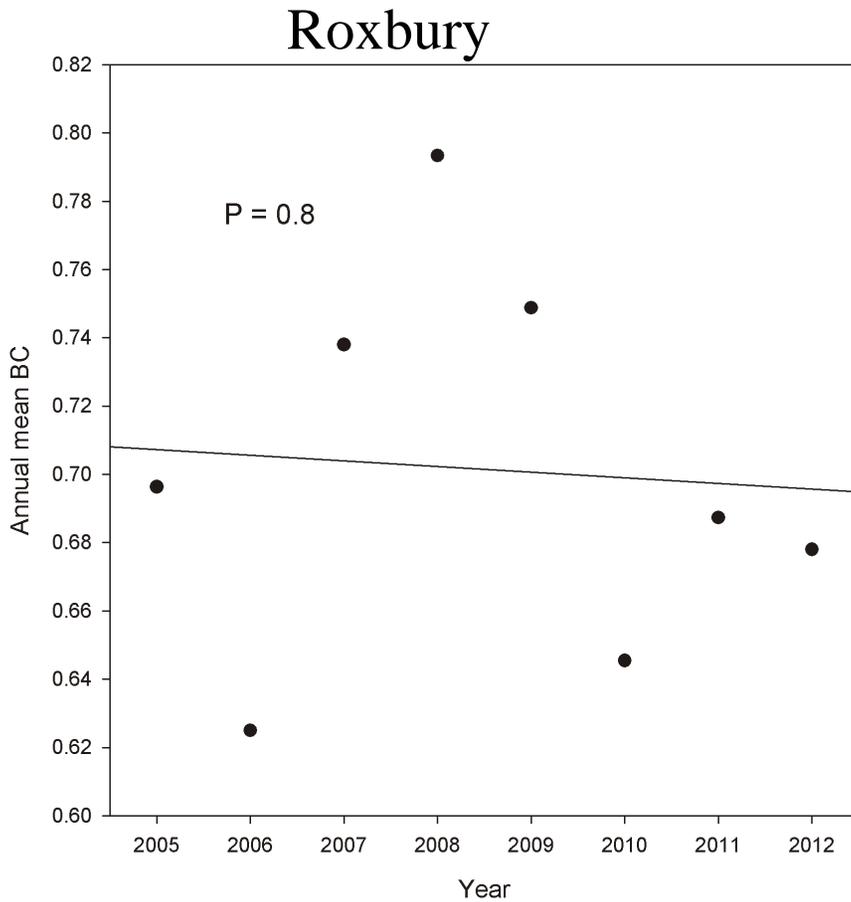
South St. BC comes down to N.End

Countway/HSPH has local source influence

HSPH/Countway
BC Trend
2005-2012



BC Trend Regressions, 2005-2012 Annual Means



Why no trend at these sites?
(Story to be continued...)

Conclusions.

- City transit bus and school bus retrofit programs:
dramatic BC drop 2002-2004
- BC trends since then: mostly flat
Why?
- Substantial BC spatial gradient from core urban to background
on average: 4x higher (2003)
- Urban BC: associated with time of day / day of week traffic patterns
sources: commuter rail, highway
- Point sources of BC:
emergency diesel gensets
large short-term spikes of BC

Acknowledgments.

- US EPA and MassDEP for funding
- MassDEP for Roxbury and N.End BC data
- Harvard School of Public Health for Countway BC data

EPA AMTIC Link to Full Report:

http://www.epa.gov/ttn/amtic/20072008_CSATAM.html

<http://www.epa.gov/ttn/amtic/files/20072008csatam/bostonbcreport.pdf>

Got Soot? Rollin' Coal...
(Prius Repellant)

