

***Monitoring of
Residential Woodsmoke
Across a Non-urban, NY Region***

George Allen, Nescalum

NAMC, Nashville TN

5 Nov 2009

The logo for Nescalum features two stylized, wavy blue lines above the word "NESCAUM" in a bold, white, sans-serif font.
NESCAUM

Woodsmoke PM2.5 Spatial Mapping

- GIS spatial modeling
- Mobile & Fixed site monitoring

Project Team

- Michael Brauer - Univ. of British Columbia
- Jason Su - Univ. of California, Berkeley
- George Allen, Lisa Rector, Paul Miller - NESCAUM
- Ellen Burkhard - NYSERDA Project Officer

Approach

- Apply GIS mapping technique developed in Pacific NW (Larson, et al., 2007) to up-state NY region
- Use fixed site/mobile woodsmoke $PM_{2.5}$ monitoring to track woodsmoke variability against map predictions
- Focus is on evenings with meteorology most conducive to woodsmoke build-up

Question to Address

- Can GIS woodsmoke emissions mapping be cost effective tool for identifying local areas of high woodsmoke $PM_{2.5}$ in NY and across the region?

Potential Strengths

- Can use readily available data bases (e.g., U.S. Census data)
- Identify potential local “hot spots”
- Minimize need for dense PM_{2.5} monitoring network in rural/semi-rural regions

Future Applications

- Screening tool to identify local hot spots for potential remediation efforts
- Basis for woodsmoke exposure studies

Links to Related Publications

- A Spatial Model of Urban Winter Woodsmoke Concentrations. Larson et al., Environ. Sci. Technol. 2007, 41, 2429-2436
<http://tinyurl.com/dh2fwq> tinyurl.com/dh2fwq
- Spatial Modeling for Air Pollution Monitoring Network Design: Example of Residential Woodsmoke. Su et al., J. Air & Waste Manage. Assoc. 57:893–900,
<http://tinyurl.com/ce6phv> tinyurl.com/cd6phv

WoodSmoke GIS Mapping Field Measurements

Use simple, portable, real-time methods for semi-quantitative measurement of PM from wood smoke

North Domain: 6 fixed sites - for entire winter (Dec-Mar)
mobile runs for 10 inversion nights

South Domain: 2 fixed sites - Jan 15-Mar. 31
Mobile runs for 4 “inversion” nights

Approach:

2-wavelength AE-21 series Aethalometer for WS indicator:

Estimate WS PM from Delta-C using factors from earlier studies

Details at: <http://tinyurl.com/gqct6>

Supplement with nephelometer data (Thermo DR-4)

as PM-fine surrogate for mobile runs and 1 fixed site each domain

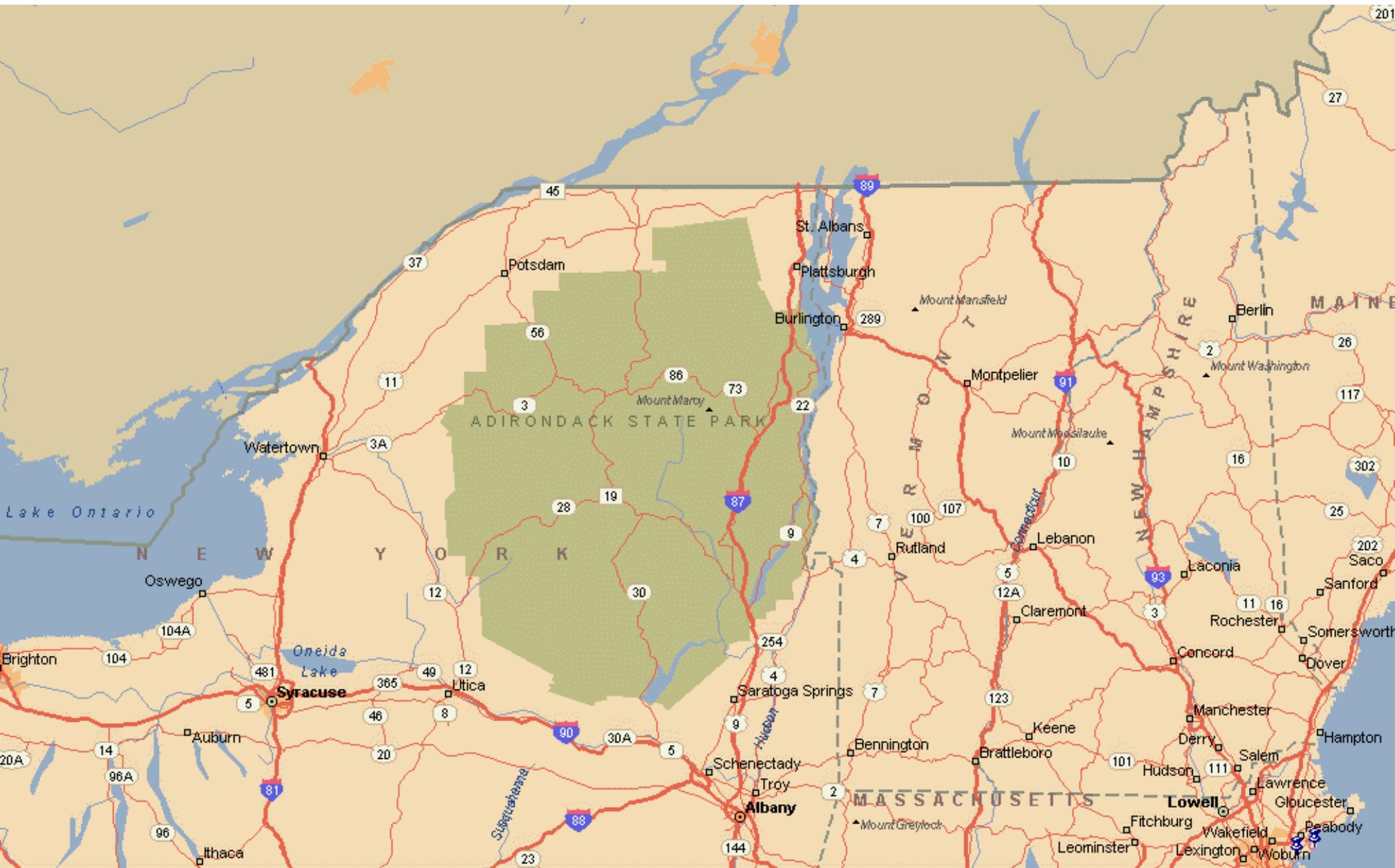
DR-4 Neph and portable Aethalometer:

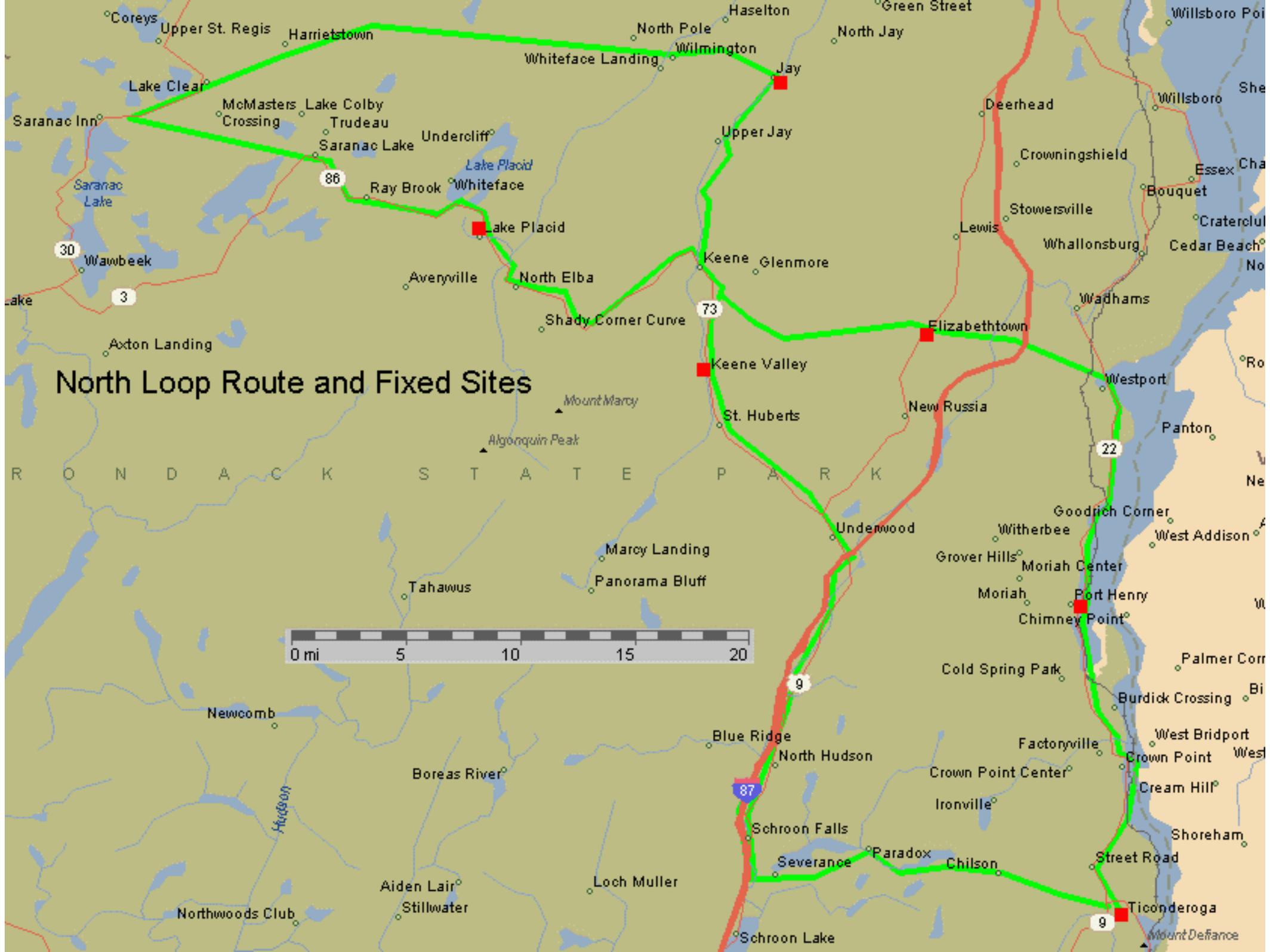


AE-21 style Aethalometers were used for all Delta-C WS measurements.

Caveat:

Recent preliminary tests with the AE-22 Aethalometer suggest that this model may not give the same kind of WS DC signal as the AE-21 series.

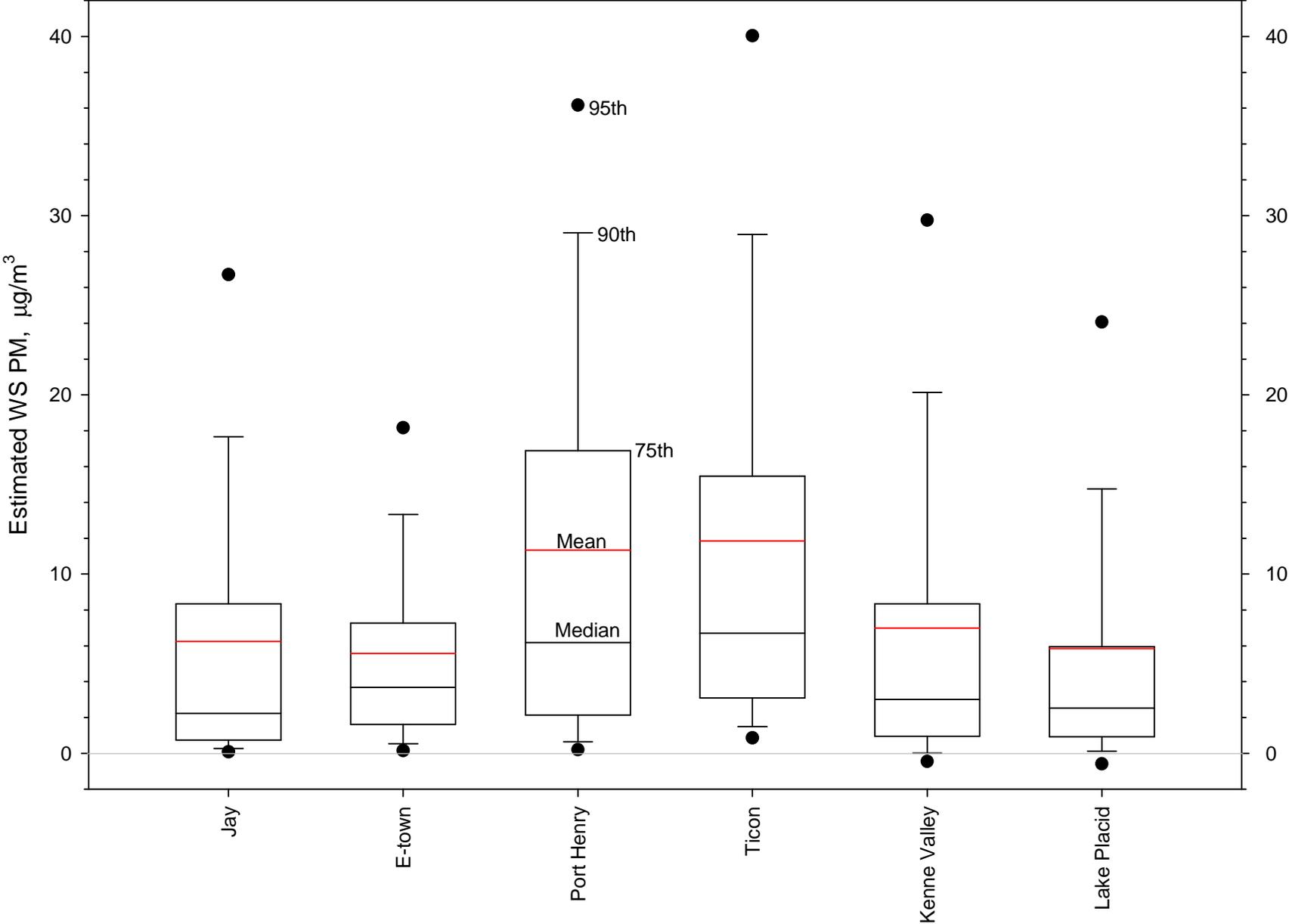




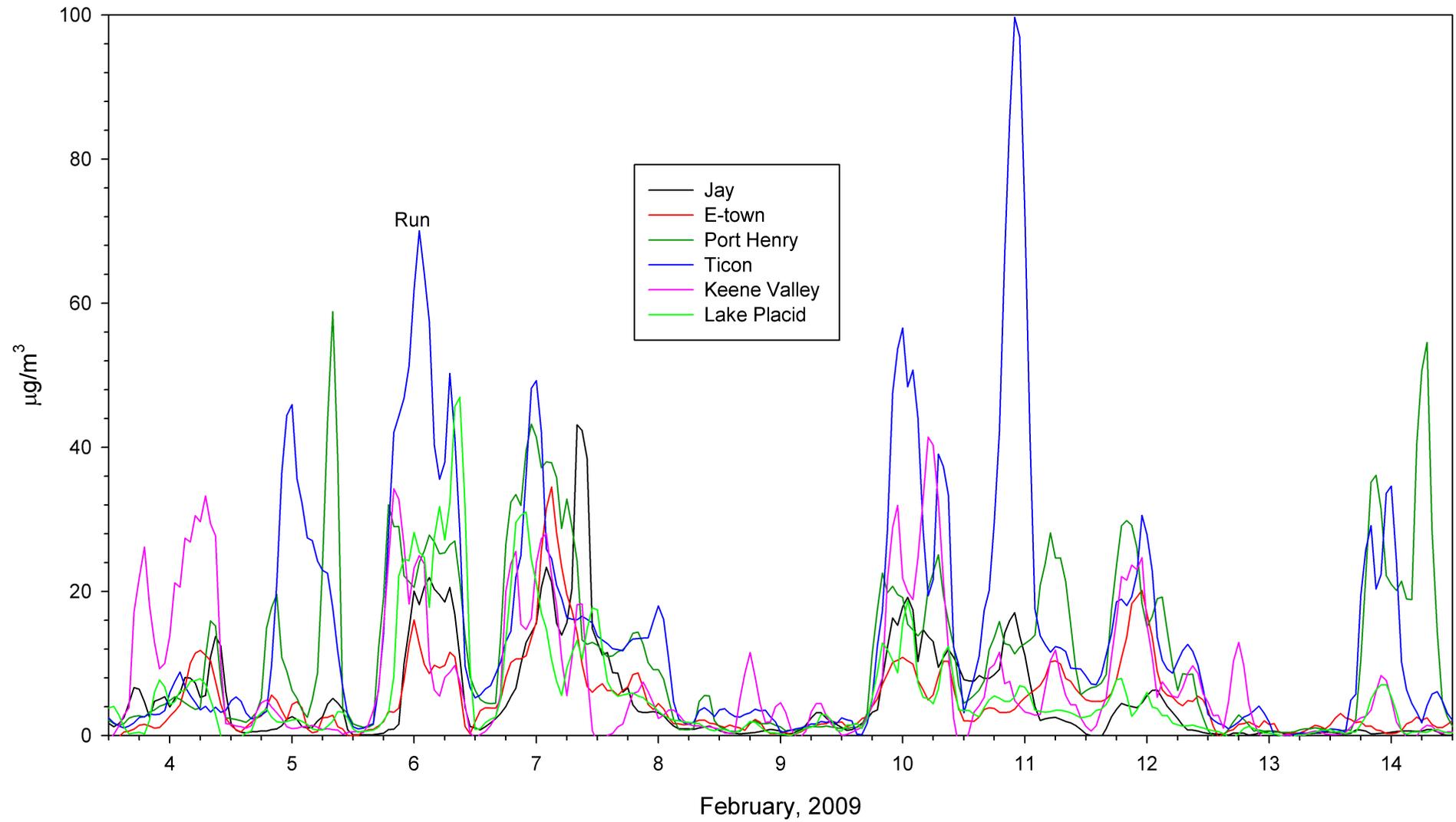
North Loop Route and Fixed Sites



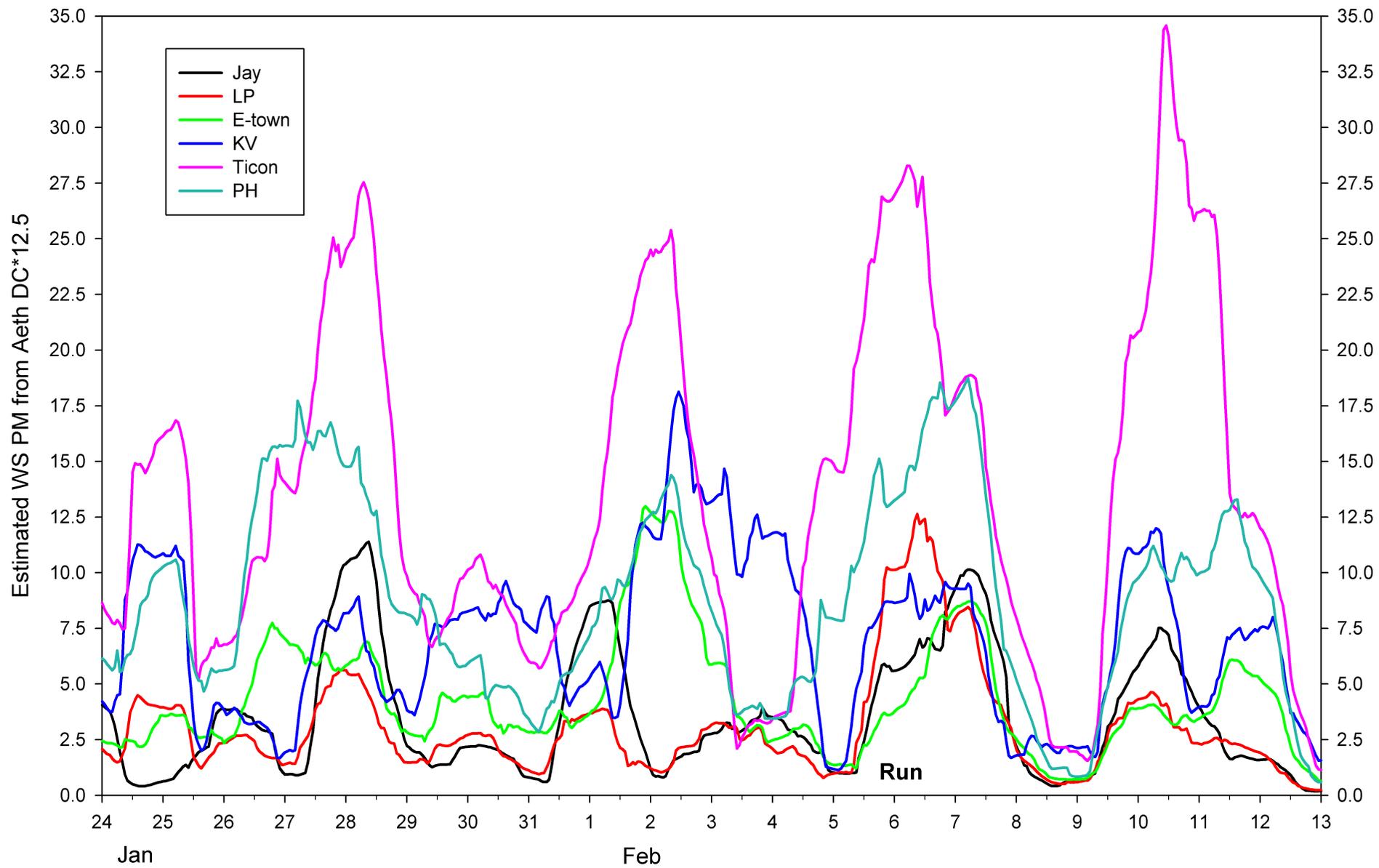
1-Hour WS-DC Fixed Site Concentration Distributions
10Dec08 - 28Feb09



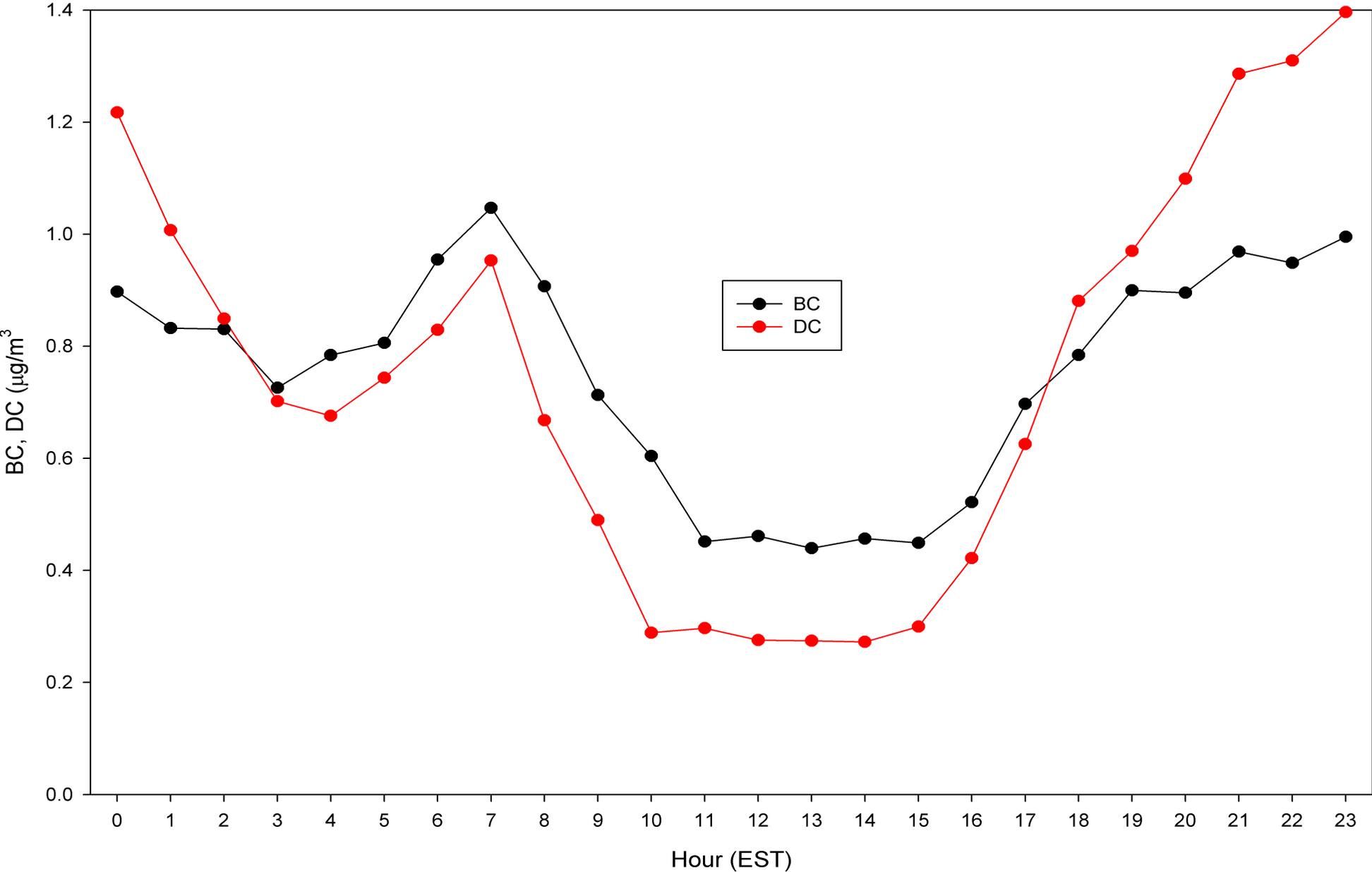
Estimated WS PM from Aeth DC
3-hour Running Average of 1-hour Data



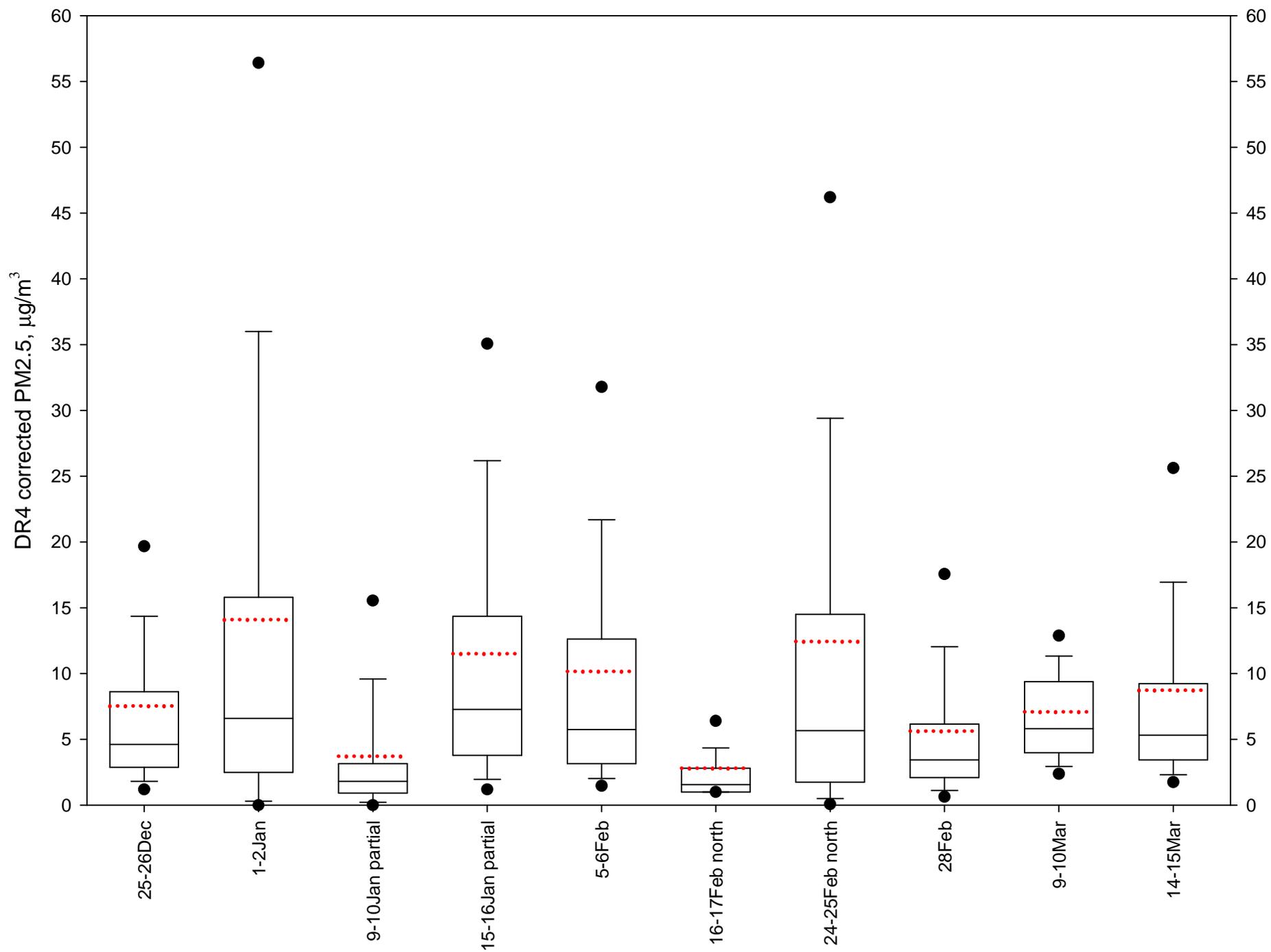
Estimated WS PM, 24-hour running mean, 24Jan-12Feb09



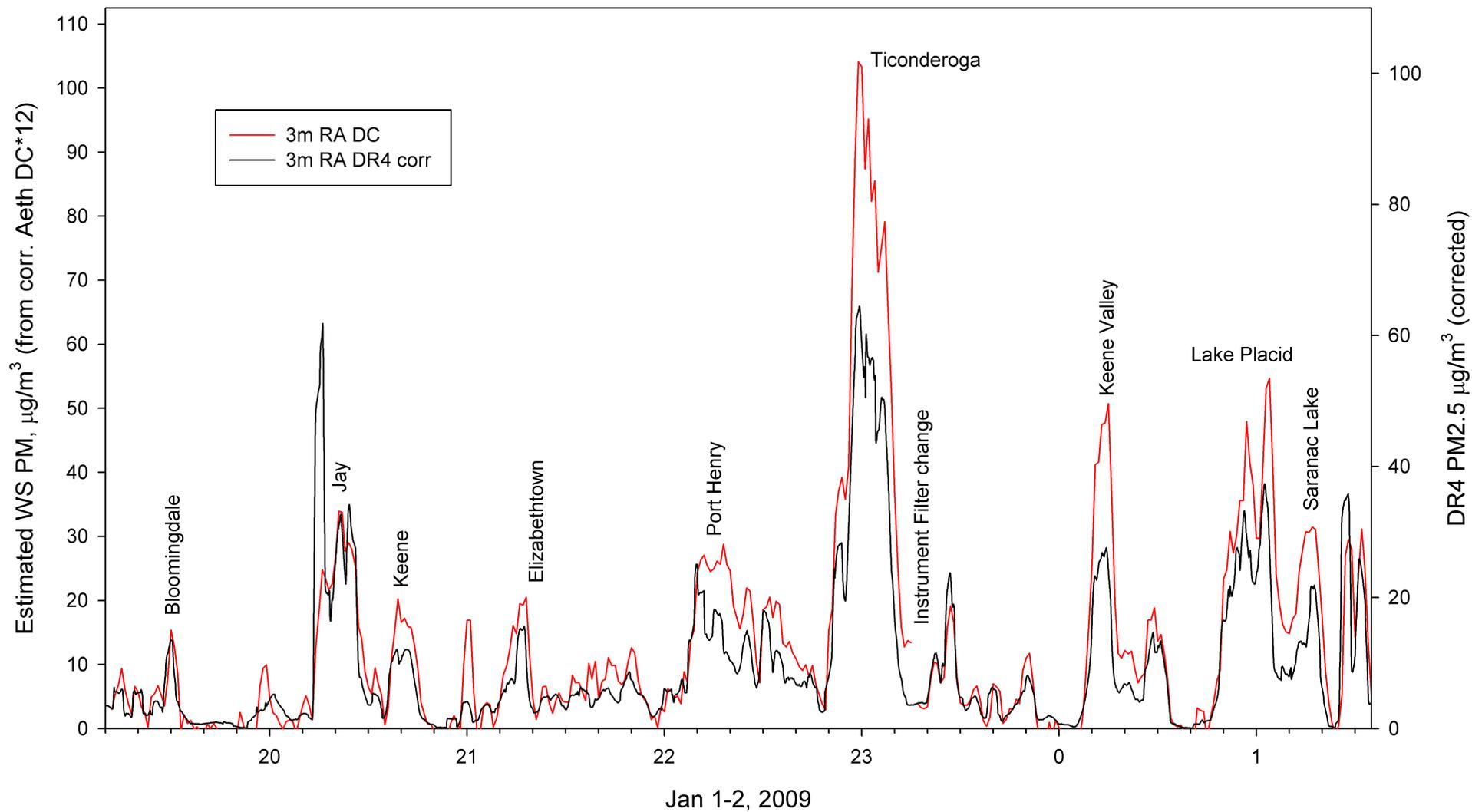
Ticonderoga Diurnal BC and DC
20Nov08 - 31Mar09

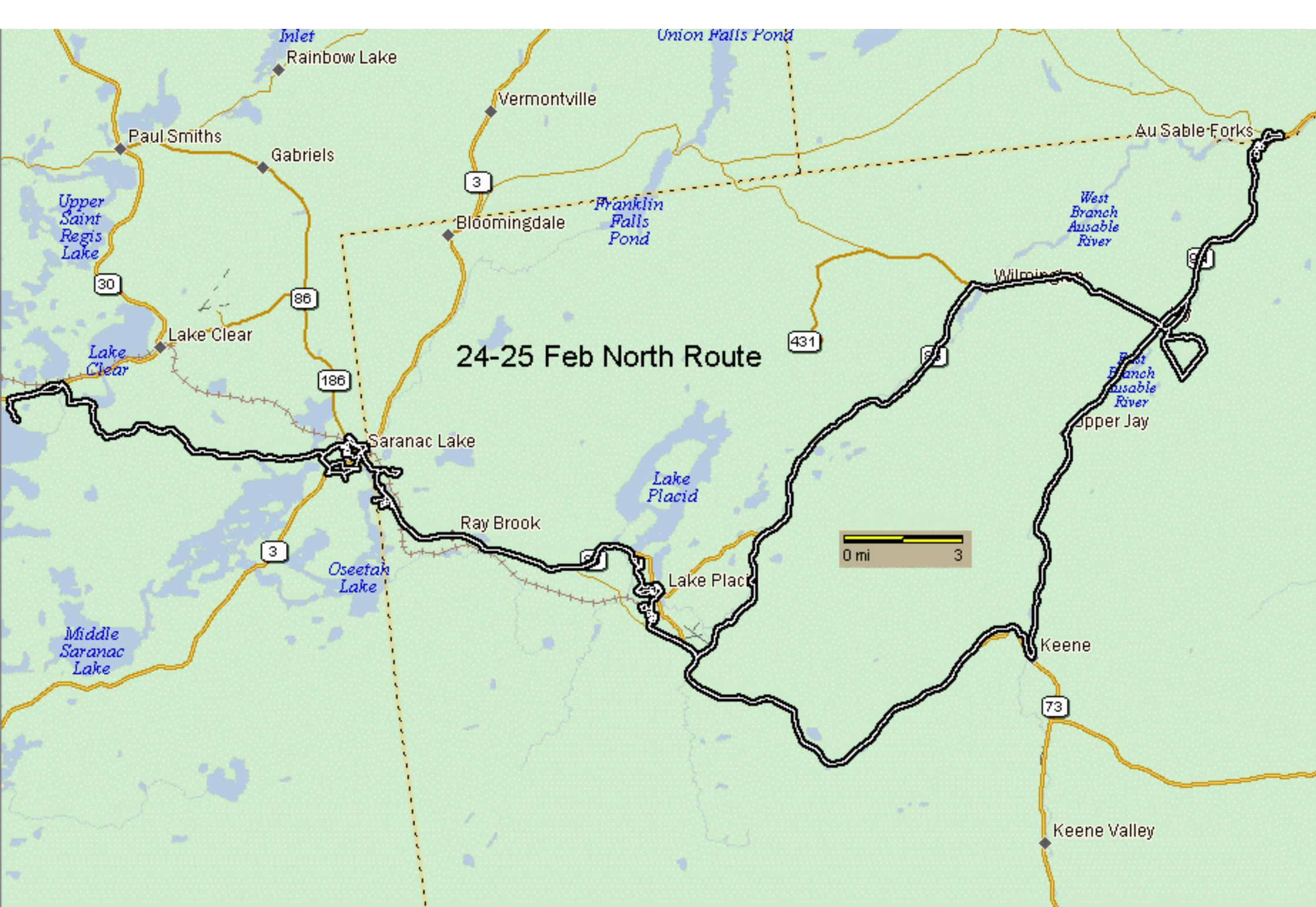


North Loop DR4 PM2.5 distributions

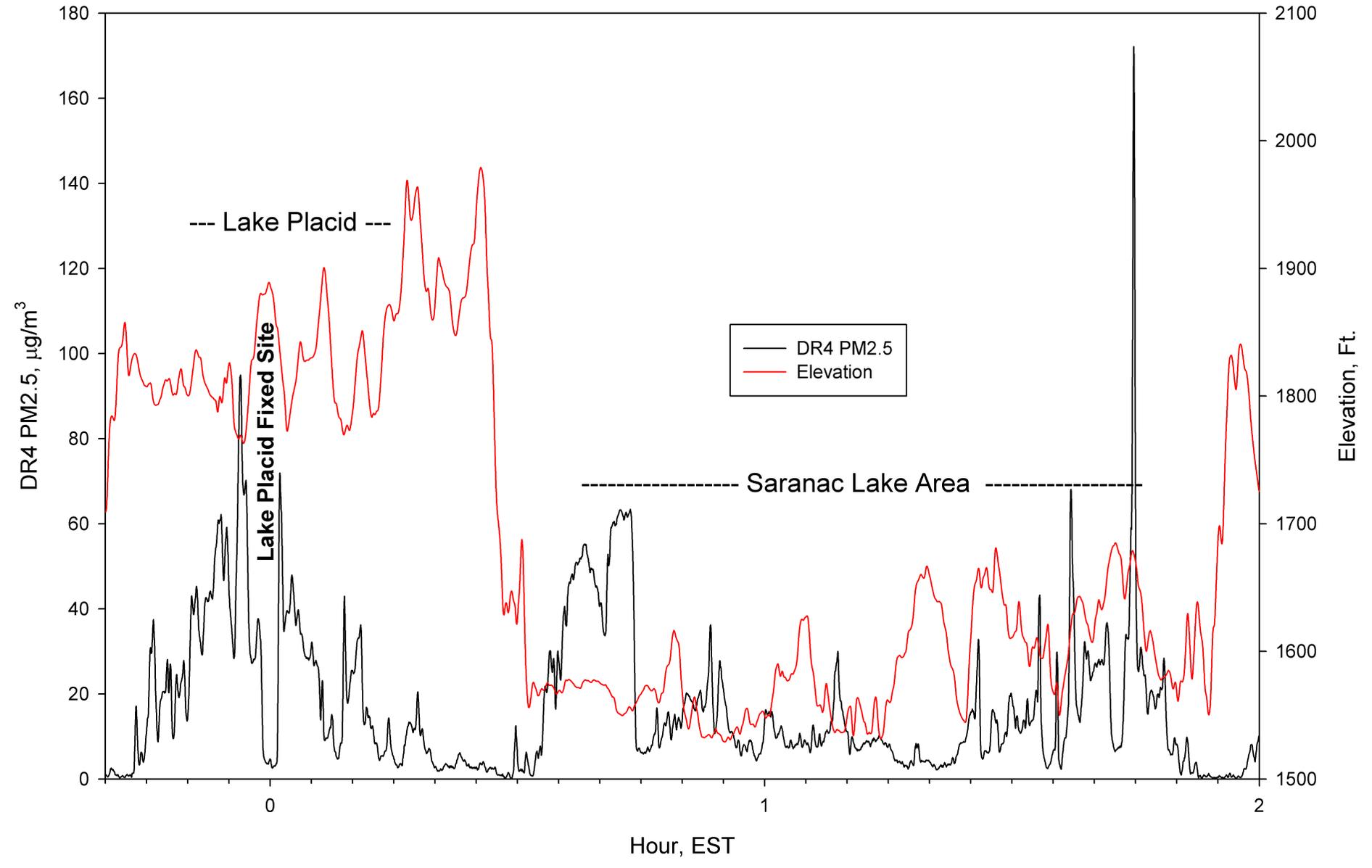


WS North Loop 2, Jan 1-2, 2009
3-minute running averages

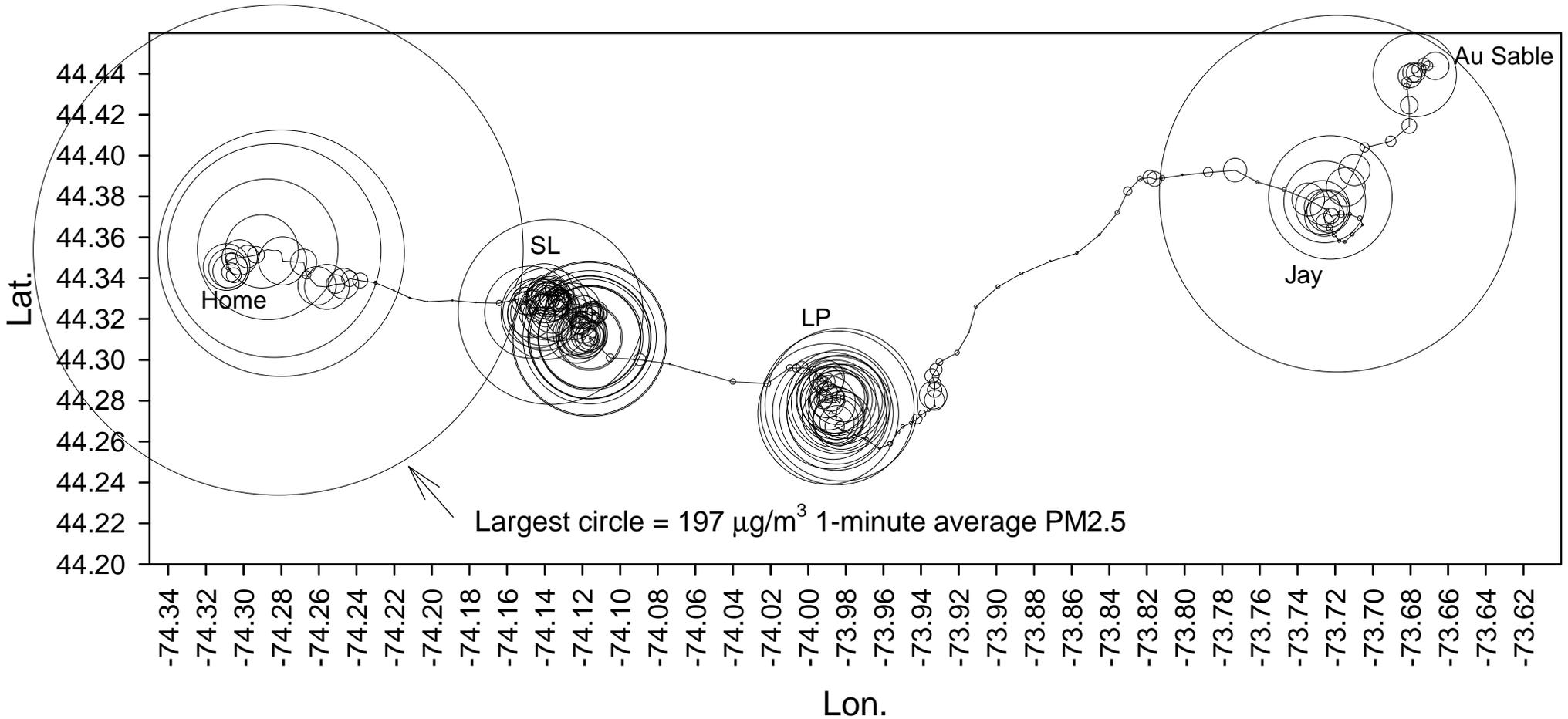




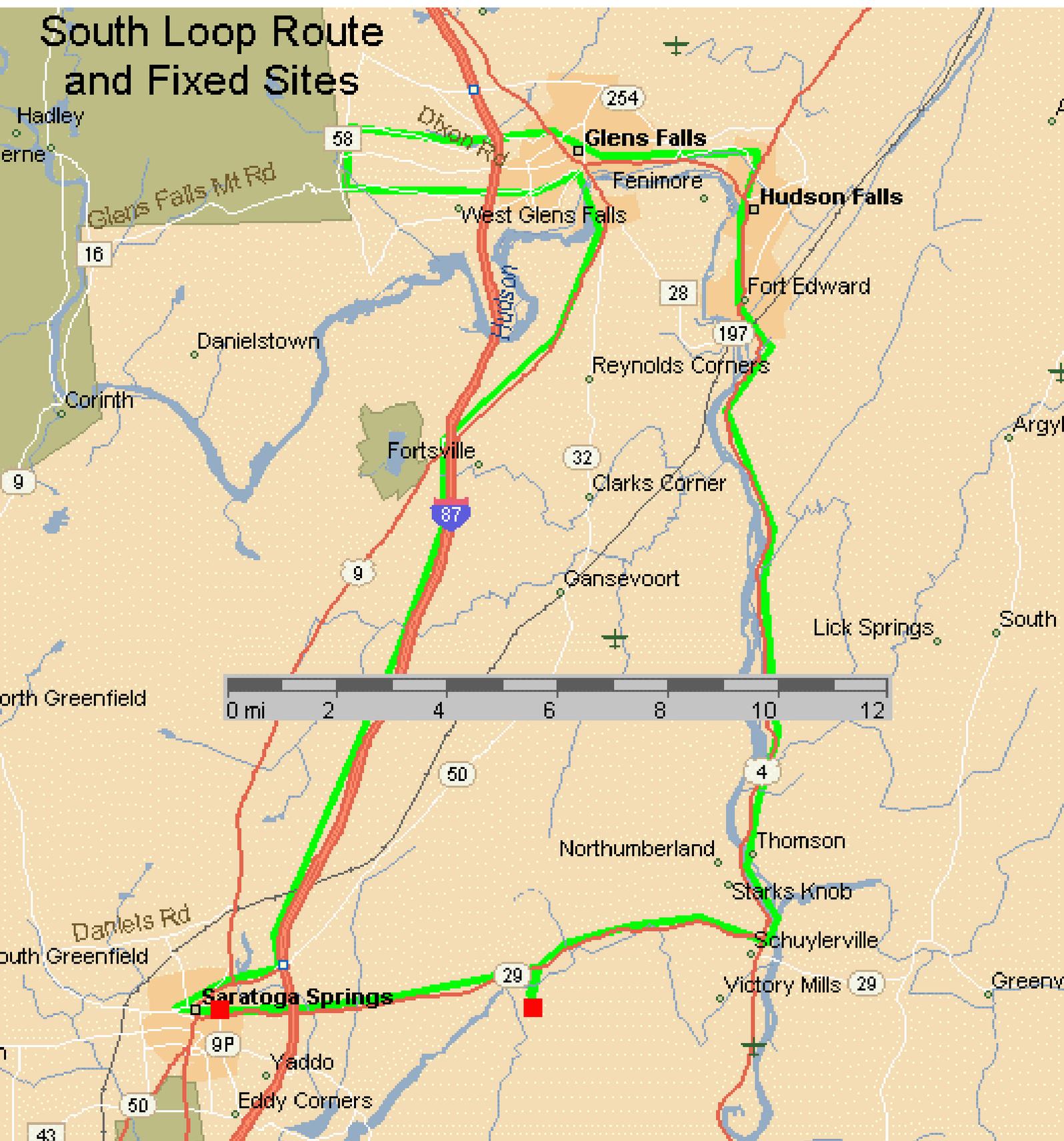
Feb 24-25 Return North Loop Run - 15-second running average of DR4 PM2.5 and Elevation



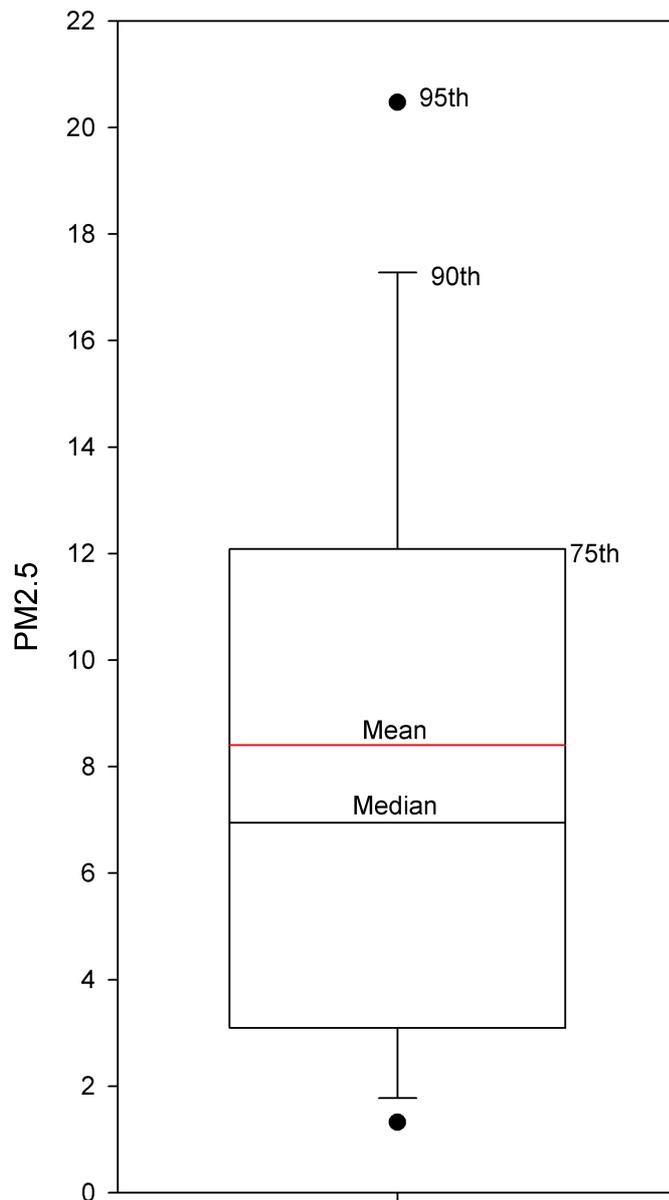
Feb. 24-25 WS loop - Position and DR4-WS conc, Return trip (slow)
Bubble size shows 1-min average PM2.5 concentration



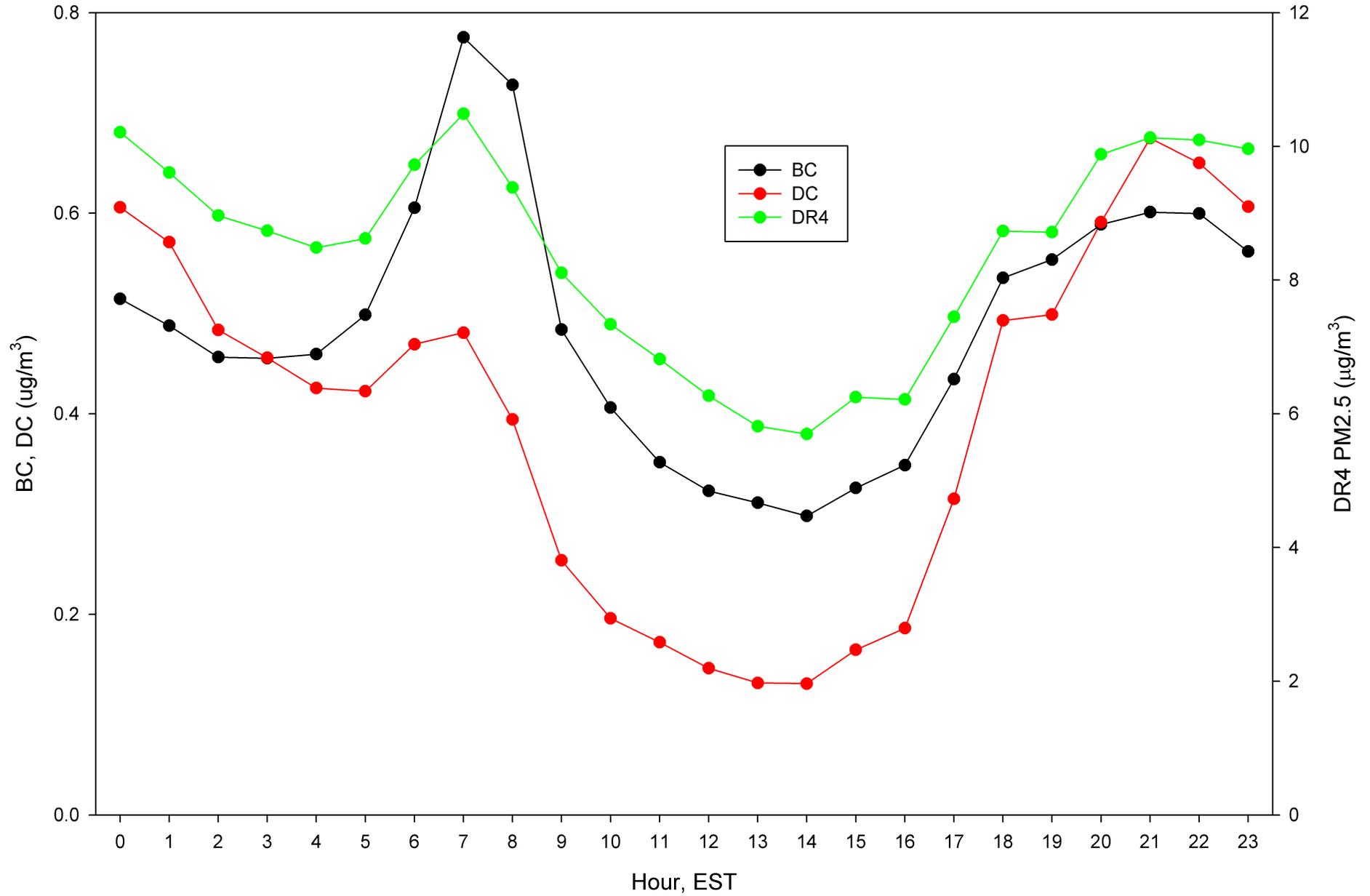
South Loop Route and Fixed Sites



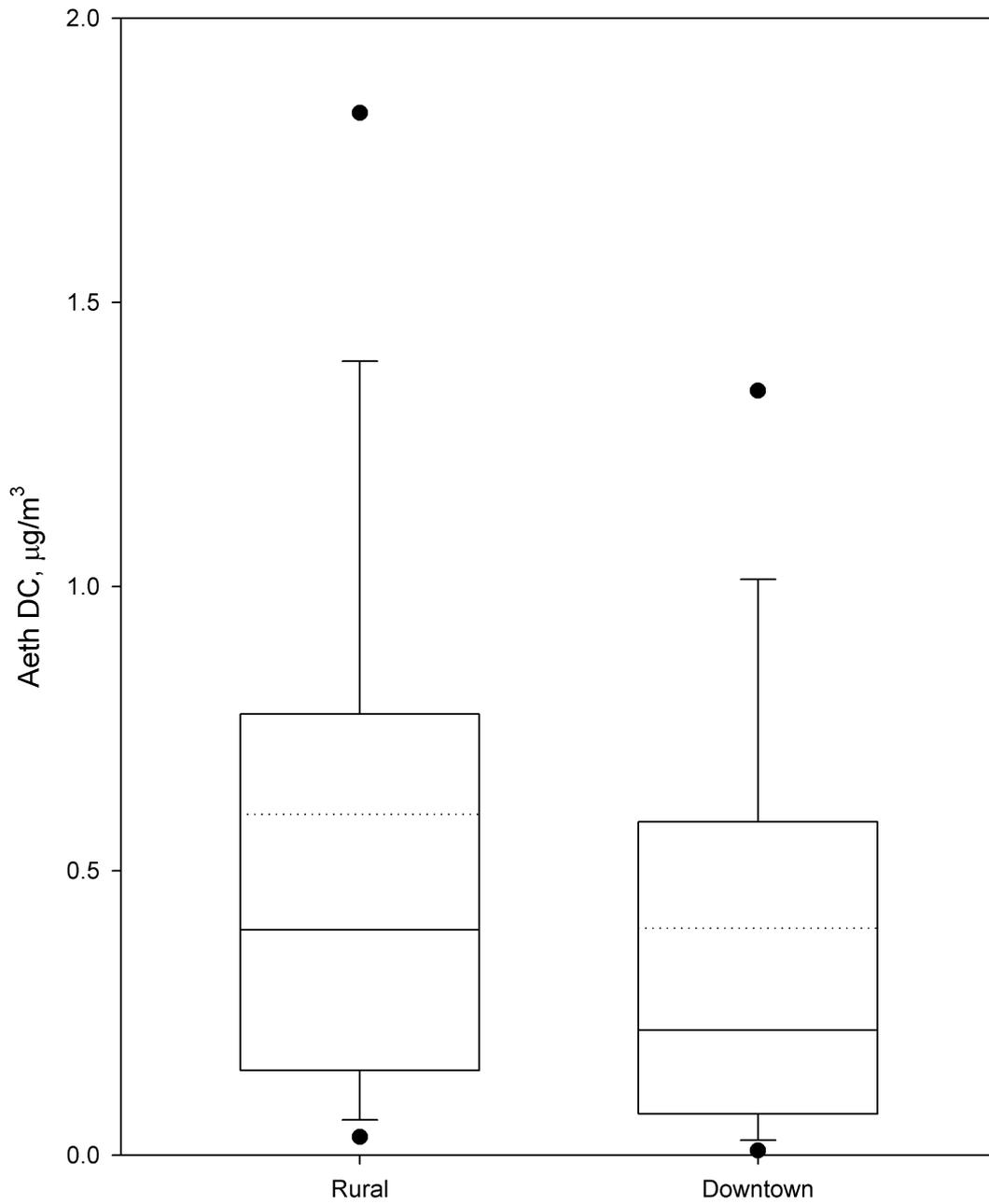
North St. Saratoga 1-h PM2.5 concentration distributions, Jan 16-Mar31, 2009
DR4 data, corrected and normalized



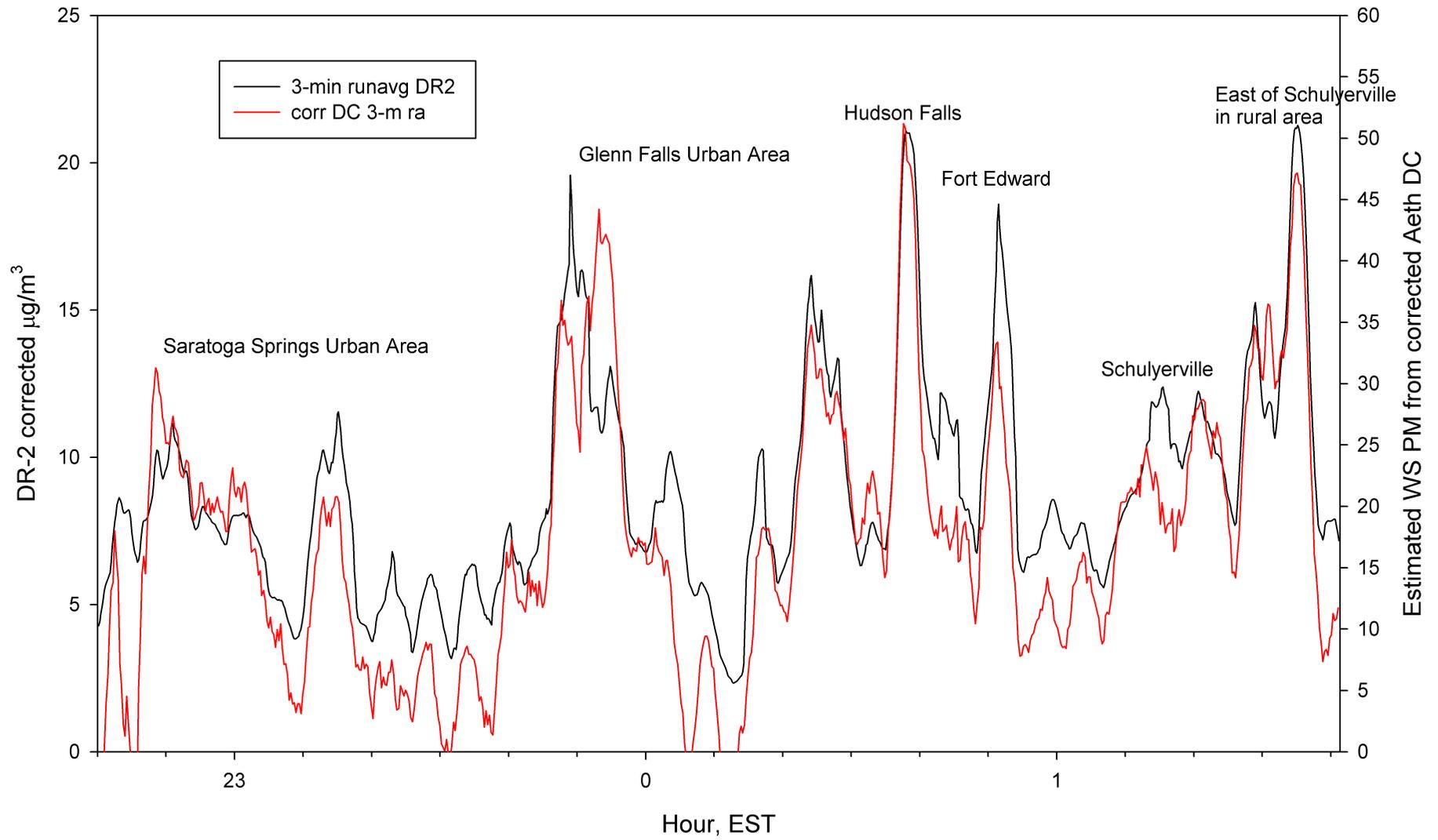
Saratoga Springs Downtown Site - Diurnal Plot
15Jan - 1Apr09



Saratoga Springs, 15Jan-31Mar09
Distribution of 1-hour Aethalometer DC Means



Mar 14-15 CW South Loop, 3-minute Running Means



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