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

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Woodsmoke PM2.5 Spatial Mapping

- GIS spatial modeling
- Mobile & Fixed site monitoring
Project Team

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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 PM2.5 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

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

Estimated WS PM, µg/m³

Mean
Median
75th
90th
95th
Estimated WS PM from Aeth DC
3-hour Running Average of 1-hour Data

February, 2009
North Loop DR4 PM2.5 distributions

DR4 corrected PM2.5, μg/m³
WS North Loop 2, Jan 1-2, 2009
3-minute running averages

Estimated WS PM, μg/m³ (from corr. Aeth. DC×12)

- 3m RA DC
- 3m RA DR4 corr

Jan 1-2, 2009

Dr4 PM2.5 μg/m³ (corrected)
Feb 24-25 Return North Loop Run - 15-second running average of DR4 PM2.5 and Elevation

--- Lake Placid ---

Lake Placid Fixed Site

Saranac Lake Area

--- DR4 PM2.5 ---
--- Elevation ---

Hour, EST

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

Largest circle = 197 µg/m³ 1-minute average PM2.5
North St. Saratoga 1-h PM2.5 concentration distributions, Jan 16-Mar31, 2009
DR4 data, corrected and normalized
Saratoga Springs, 15Jan-31Mar09
Distribution of 1-hour Aethalometer DC Means

Aeth DC, μg/m³

Rural

Downtown
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