

Variations and Trends in PM_{2.5} Mass, Sulfate, and Carbon Concentrations At Rural and Urban Sites in New York State





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INTRODUCTION

PM_{2.5} mass and species concentrations using low volume samplers have been measured routinely at sites in New York for more than a decade. We analyze this data for a rural and two New York City (urban) sites to investigate both the overall trend in concentration and composition, and the variations in these parameters. The sites chosen are the rural station at Pinnacle State Park (PSP) in Addison, NY; and the NYC sites of Queens College (QC) and Intermediate School 52 (IS52) in the South Bronx. Filter samples are used as the basis of this study.

Over the past decade (2001-2010) the annual average PM_{2.5} mass concentrations have dropped nearly 3 μg/m³ at each of the three sites. However, we show that this decrease has occurred predominantly in the sulfate and other inorganic components (mainly ammonium and nitrate), while carbonaceous PM show little if any decline (and maybe a slight increase) over this period. This analysis is complicated by the change of carbon samplers by EPA in the latter part of the decade.

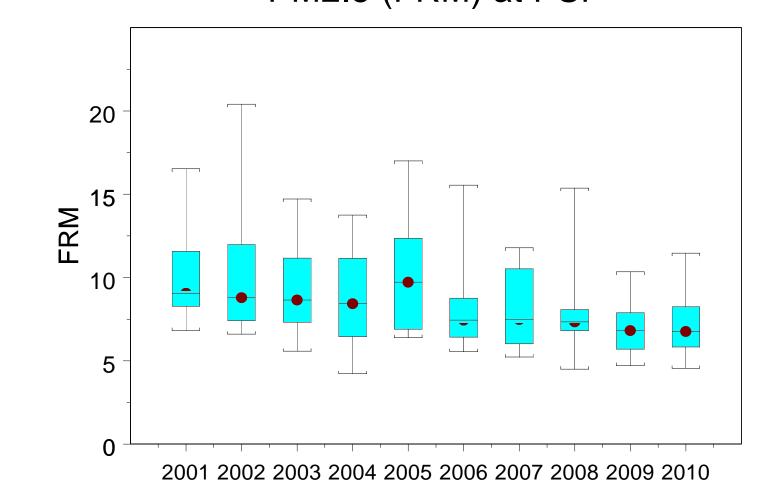
FINE PARTICULATE MATTER MASS (FRM PM_{2.5}) FROM 2001 TO 2010

PINNACLE STATE PARK (PSP)

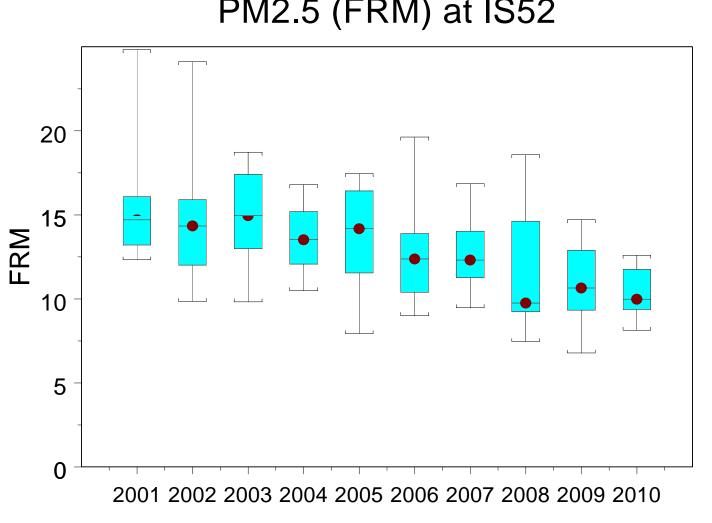
SOUTH BRONX, NEW YORK CITY (IS52)

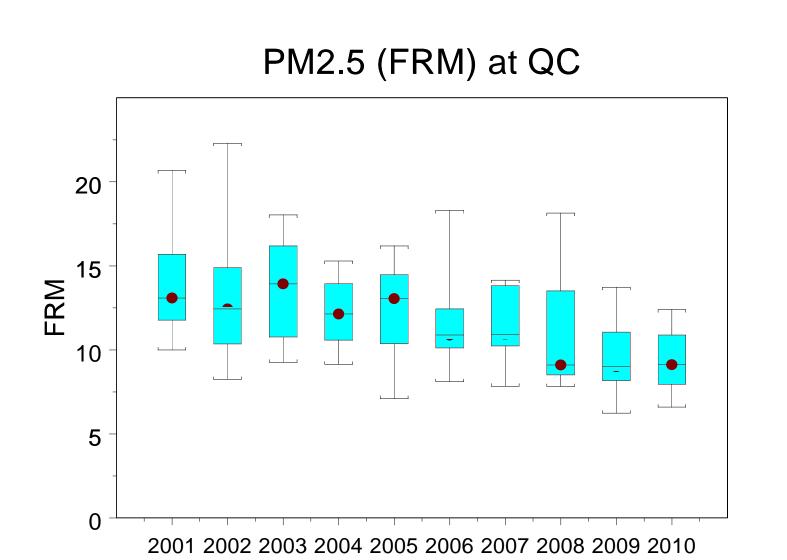
QUEENS COLLEGE, NEW YORK CITY (QC)







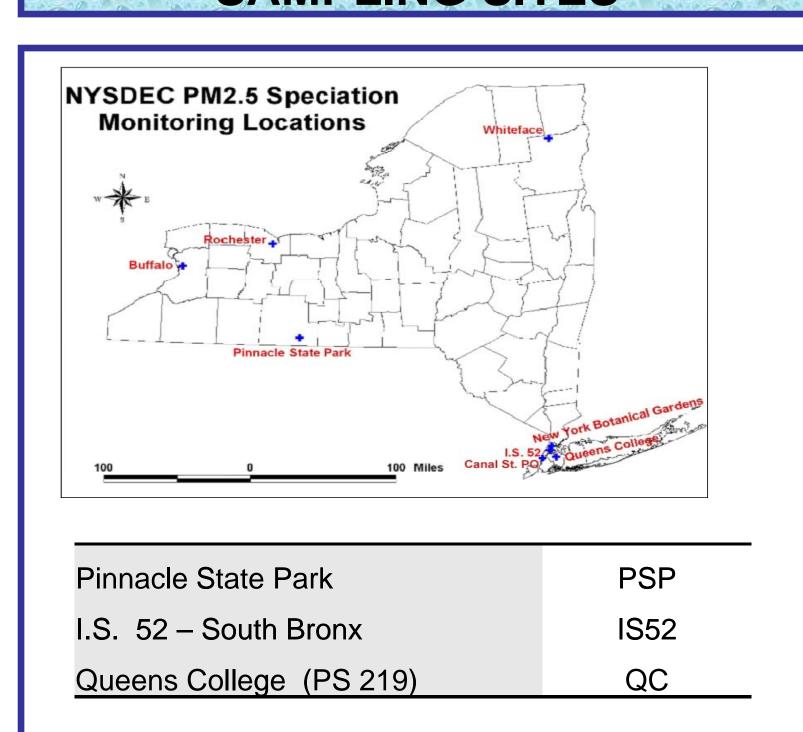




QC

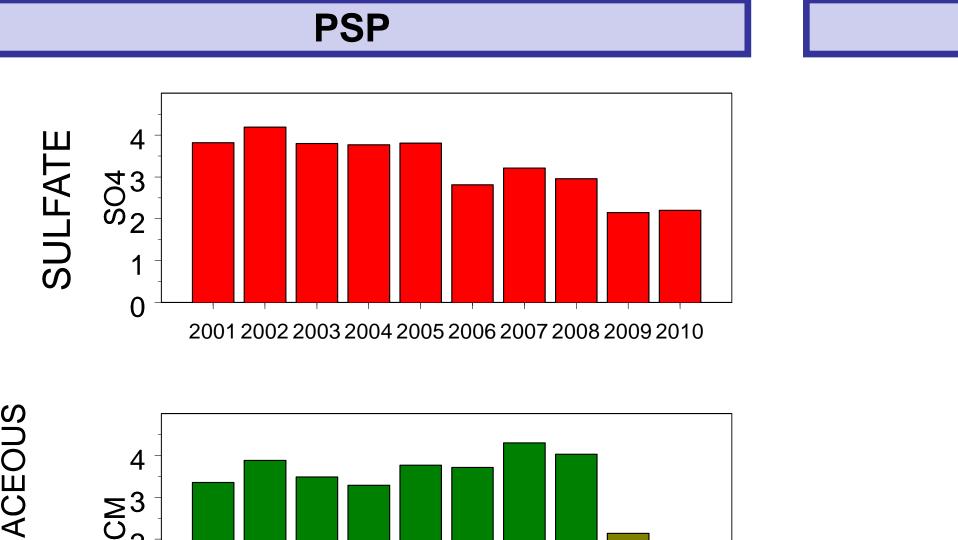
These figures are based on monthly averages of the PM_{2.5} mass concentrations determined by daily measurements using the Federal Reference Method. The boxes comprise the 25th – 75th percentile (the middle two quartiles) of the monthly averages, and the whiskers show the range from lowest to highest in this case.

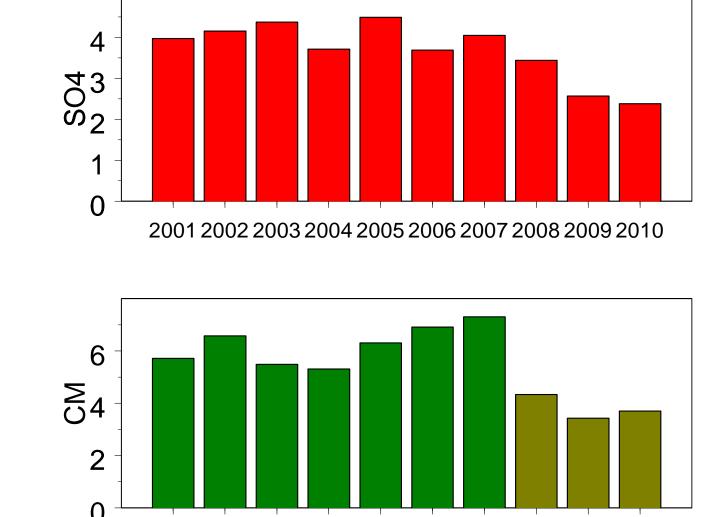
SAMPLING SITES

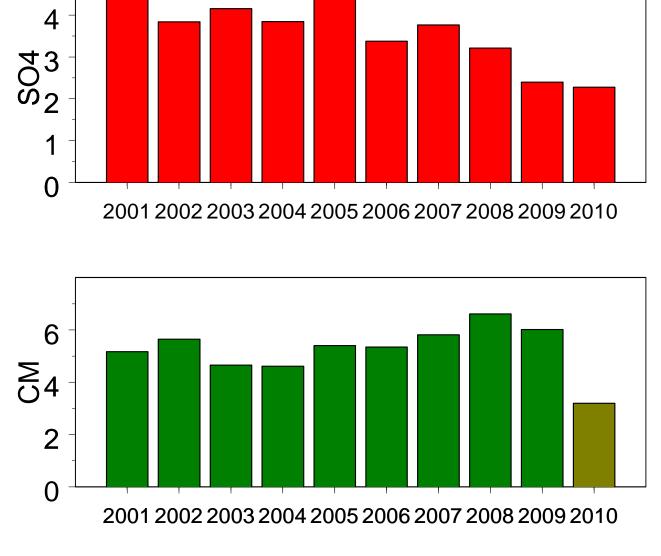


TRENDS IN MAJOR SPECIES CONCENTRATIONS FROM 2001 TO 2010

IS52







Major Species Contributions at QC

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Green bars indicate "old" CSN carbon sampler and analysis method, brown bars indicate "new" CSN URG samplers and DRI method for carbon.

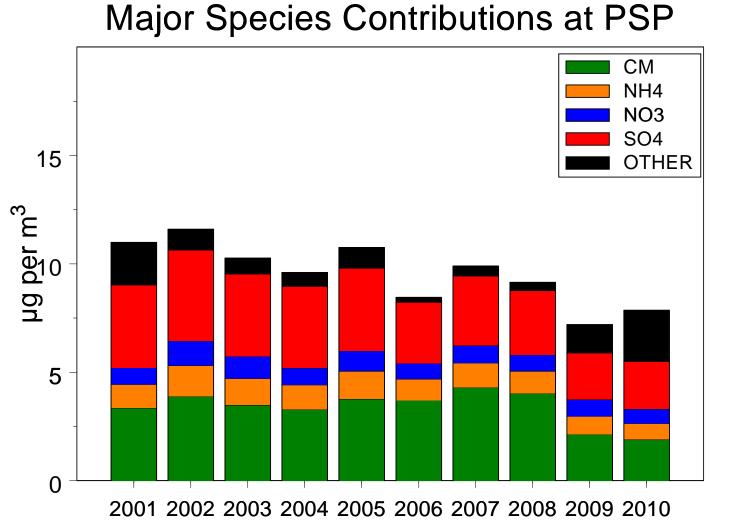
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Data Sources, Adjustments and Calculations

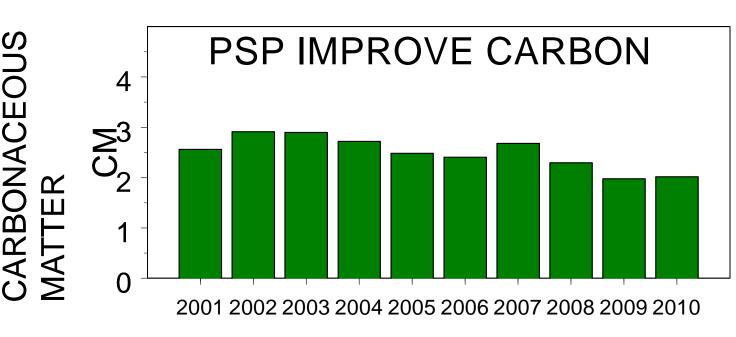
- **PM**_{2.5} sampled using Federal Reference Method (FRM) samplers daily at each site followed by gravimetric analysis
- PM Components sampled every third day at these sites as part of the EPA Chemical Speciation Network (CSN) and IMPROVE network.
- Change to URG sampler for Carbon occurred in June 2007 at IS52, April 2009 for PSP, and January 2010 for QC
- Carbon Blank Corrections "environmental blanks" defined as the 1st percentile of "OC" values were used in this study values in table below
- Elemental Carbon (EC) used as reported
- Organic Matter (OM) equal to "OC" times a multiplier to account for hydrogen, oxygen, and other species bonded to PM carbon
- Carbonaceous Matter (CM) defined as CM = OM + EC
- OTHER = PM2.5 mass (CM+SO4+NO3+NH4)

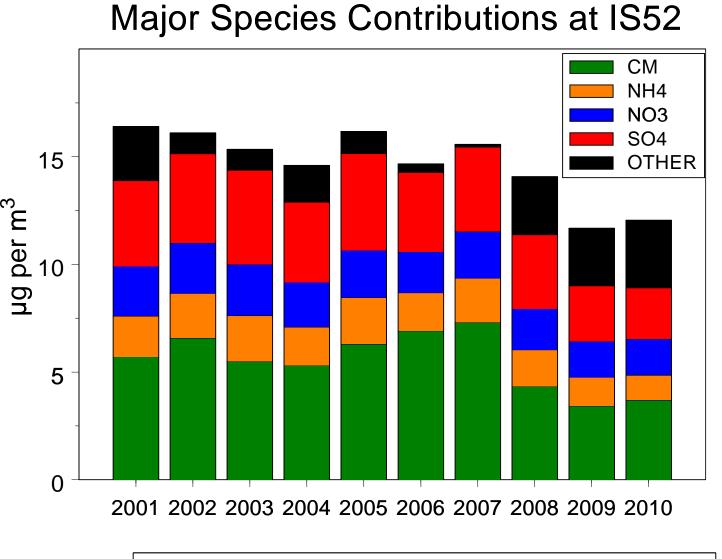
| "Blanks" | PSP | IS52* | QC* |
|-------------------|-------------------------|-------------------------|-------------------------|
| MetOne (& R&P) | 0.67 μg m ⁻³ | 0.72 μg m ⁻³ | 0.72 μg m ⁻³ |
| URG | 0.45 μg m ⁻³ | 0.72 μg m ⁻³ | 0.72 μg m ⁻³ |

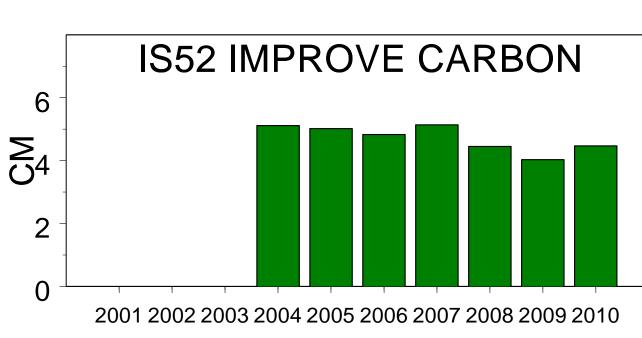
*While there were slight differences of the 1st percentile values for QC and IS52 (0.72 -0.86), we judged them to be insignificant.



2001 2002 2003 2004 2005 2006 2007 2008 2009 2010









- EPA's switch to URG samplers and DRI analysis of PM2.5 carbon has introduced a systematic bias in the CSN data set.
- IMPROVE PM2.5 carbon measurements at the same site are systematically lower than the "old" CSN measurements by ~30%; and somewhat higher than the "new" CSN measurements by ~5 20%

SUMMARY

- PM2.5 has decreased about 3 µg m⁻³ at a rural and two urban sites in New York State over the
- This decrease is mainly due to lower levels of sulfate, nitrate and ammonium.
- Methods issues for carbonaceous PM2.5 (see box to right) complicate the analysis for PM2.5 carbon, but decreases in carbon species appear small (or nonexistent) over this period.

past decade.

ACKNOWLEDGEMENT

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