

SUPPLEMENTARY MATERIAL

Changes in gas-phase air pollutants across New York State, USA

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Biomass burning emissions

The NEI is updated every three years, and since 2002 wildfire emissions have been kept constant in intervening years. Because the NEI does not have year-to-year specificity in emission estimates of wildfires, we obtained annual emission estimates of CO and NO_x from the Global Fire Emissions Database version 4 (GFED4; GFED, 2016), covering the 1997-2014 period. We assumed that biomass burning emissions from Canada, Alaska, and the contiguous United States would most likely impact air quality in New York. Similar to the anthropogenic emissions and air pollutant concentrations, we used the nonparametric Mann-Kendall test for monotonic trends in the annual biomass burning emissions. Although there is some evidence that biomass burning emissions of CO and NO_x may be increasing in North America over this time period (+3.6%/yr and +2.1%/yr, respectively), the year-to-year variations in emissions are substantial and the trends are not statistically significant ($p > 0.11$). Despite this non-statistically significant increase in biomass burning emissions, air pollutant concentrations have declined dramatically over this same period, hence it is more likely that changes in anthropogenic emissions are having a larger impacts on air quality improvements in New York.

Fig. S1. Comparison of annual anthropogenic emissions of CO, NO_x, SO₂, and VOC from the USEPA National Emissions Inventory (NEI) and Xing et al. (2013), 1990-2010. The NEI reflects total US emissions while the emissions from Xing et al. (2013) reflect the northeastern US as defined by Hand et al. (2012).

Fig. S2. Annual average (a) NO and (b) NO_x concentrations in NYC, BUF, and PSP, 1990-2014.

Fig. S3. Annual average sum of PAMS target compounds in NYC, 1996-2013.

Fig. S4. Seasonal average Ox vs NO_x at urban locations (NYC and BUF), 1991-2014, with least-squares regressions.

REFERENCES

- GFED (2016). Global Fire Emissions Database (GFED),
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- Hand, J. L., Schichtel, B. A., Malm, W. C., and Pitchford, M. L. (2012). Particulate sulfate ion concentration and SO₂ emission trends in the United States from the early 1990s through 2010. *Atmos. Chem. Phys.* 12: 10353-10365.
- Xing, J., Pleim, J., Mathur, R., Pouliot, G., Hogrefe, C., Gan, G.-M., and Wei, C. (2013). Historical gaseous and primary aerosol emissions in the United States from 1990 to 2010. *Atmos. Chem. Phys.* 13: 7531-7549.

Fig. S1.

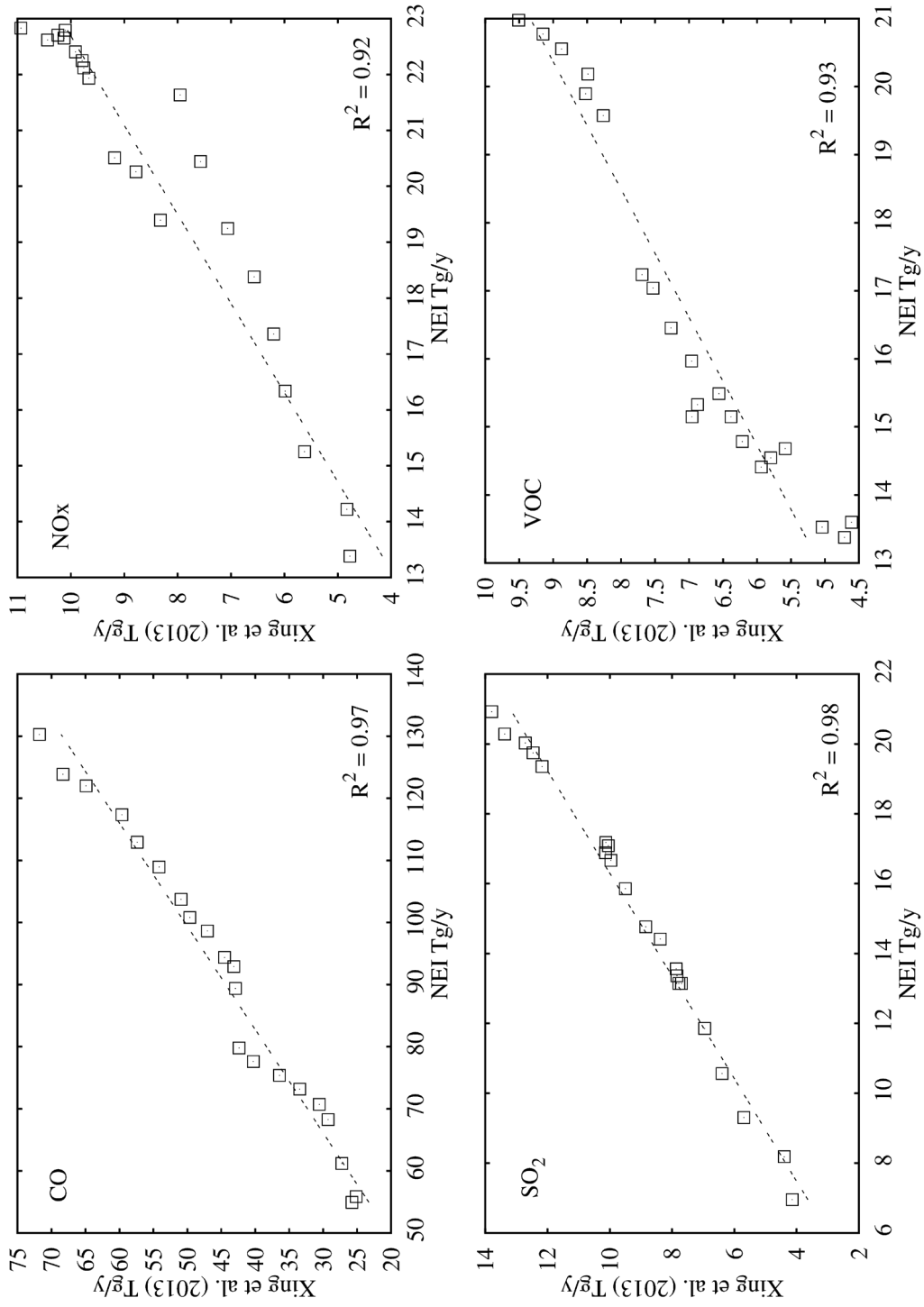


Fig. S2.

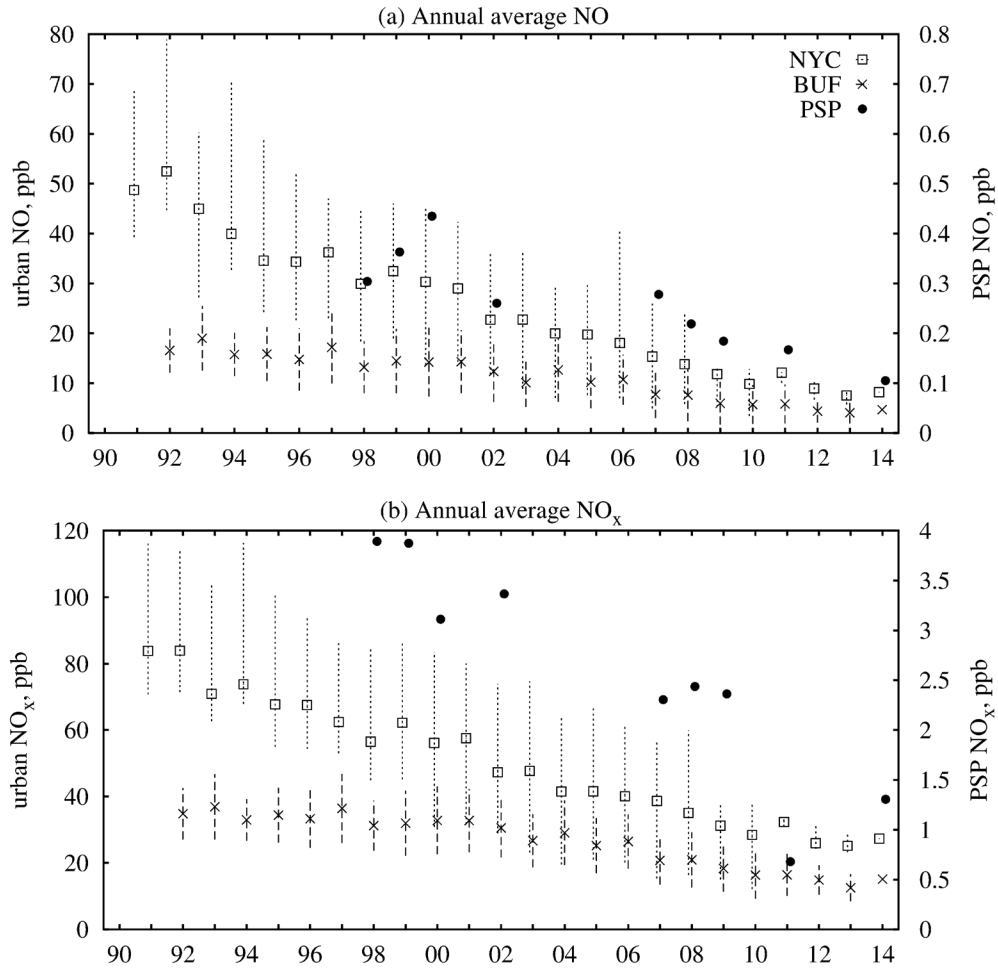


Fig. S3.

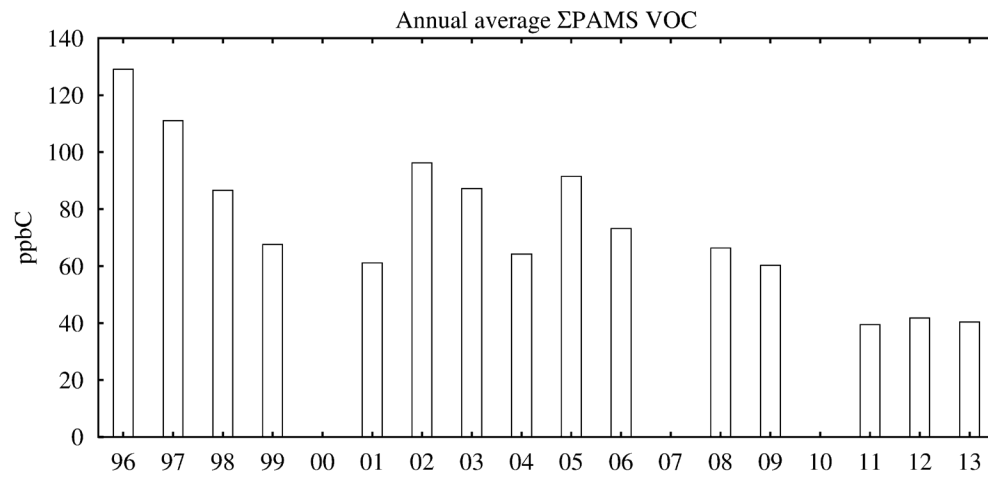


Fig. S4.

