

# **G-1 Trace gas and fine particle correlations and particle chemistry**

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# Topics

**The G1 sampled  
the urban plume...**



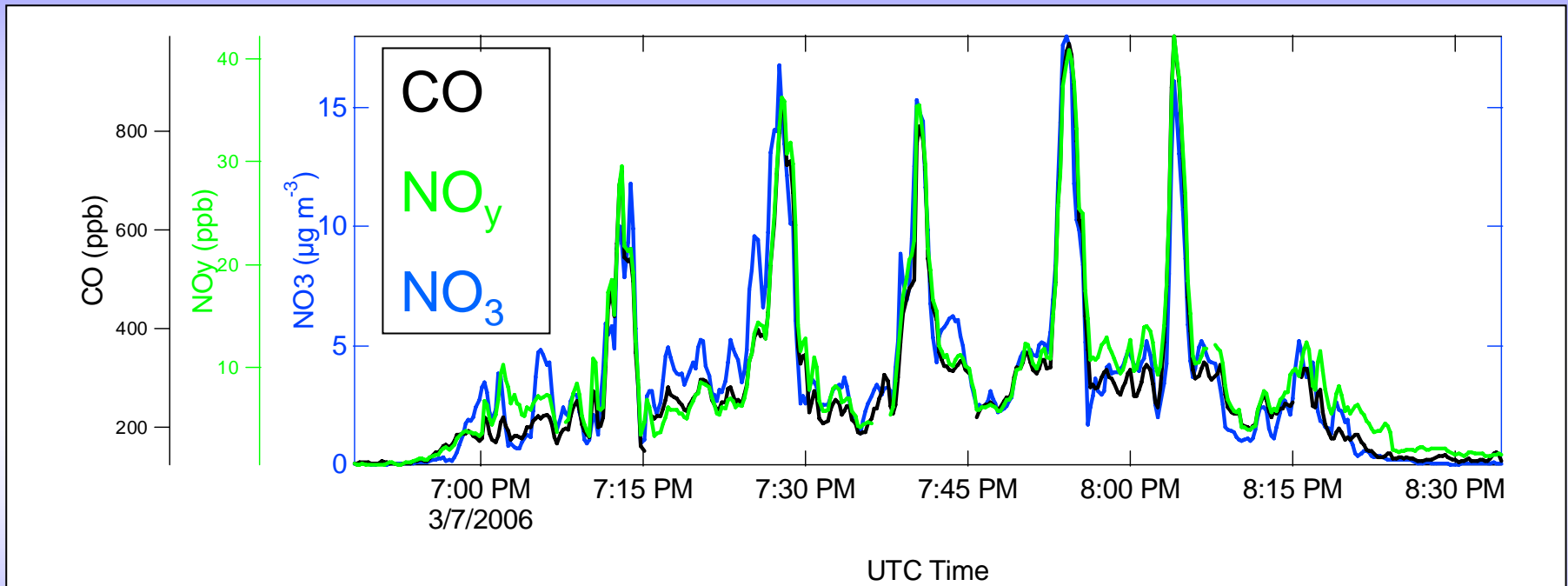
Photo from [www.asp.bnl.gov/MAXMex](http://www.asp.bnl.gov/MAXMex) - SRS

***the regional air...***

***and fire  
plumes***

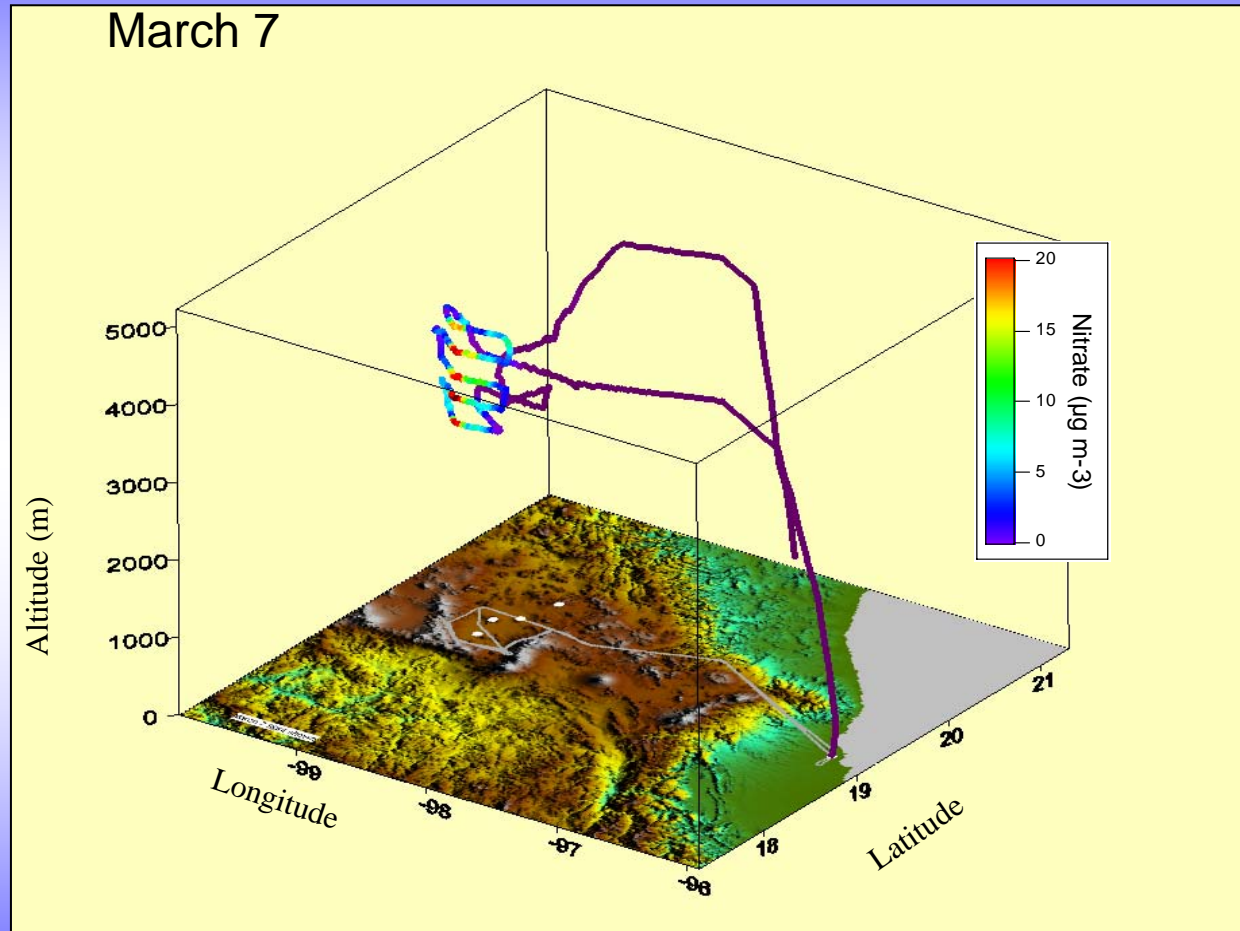


# NO<sub>3</sub>, NO<sub>y</sub> and CO Gas - Particle Correlation March 7



*“Fresh Urban Plume”*

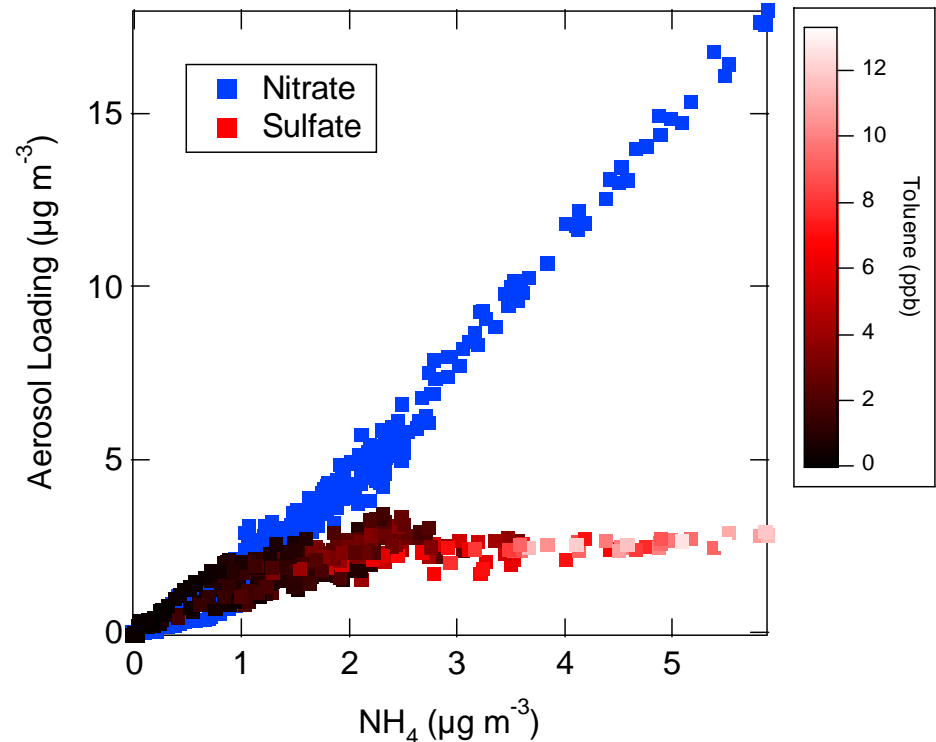
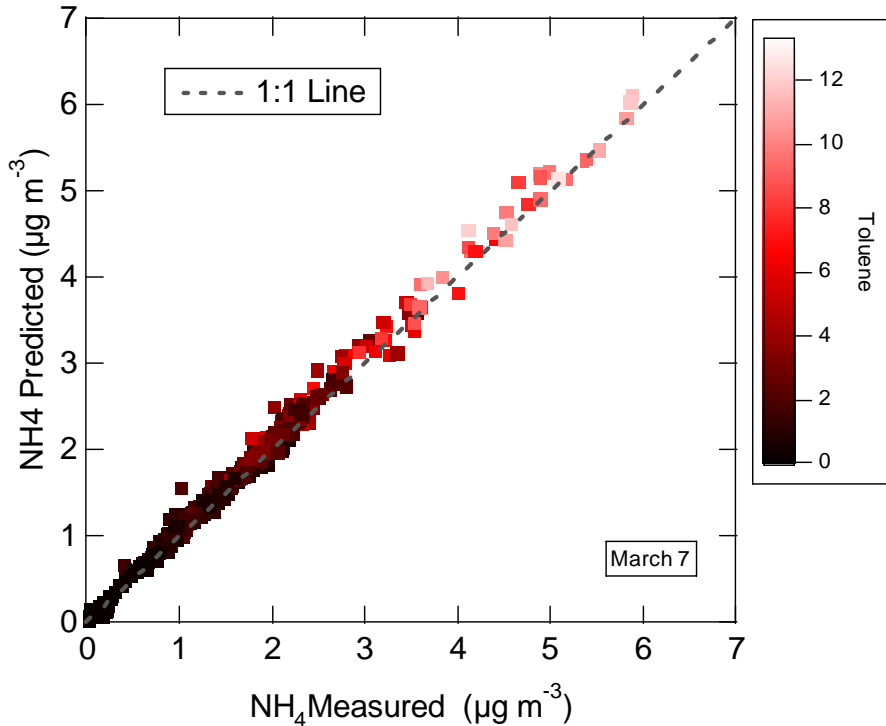
# Urban nitrate plume intercepted SW of T0 ~3- 4.5 km altitude ASL



On this day winds are from the North ...  
Bimodal size distributions in this plume...

800 – 2300 m AGL  
2600 – 7500 ft

# Interesting chemistry and microphysics in this urban plume

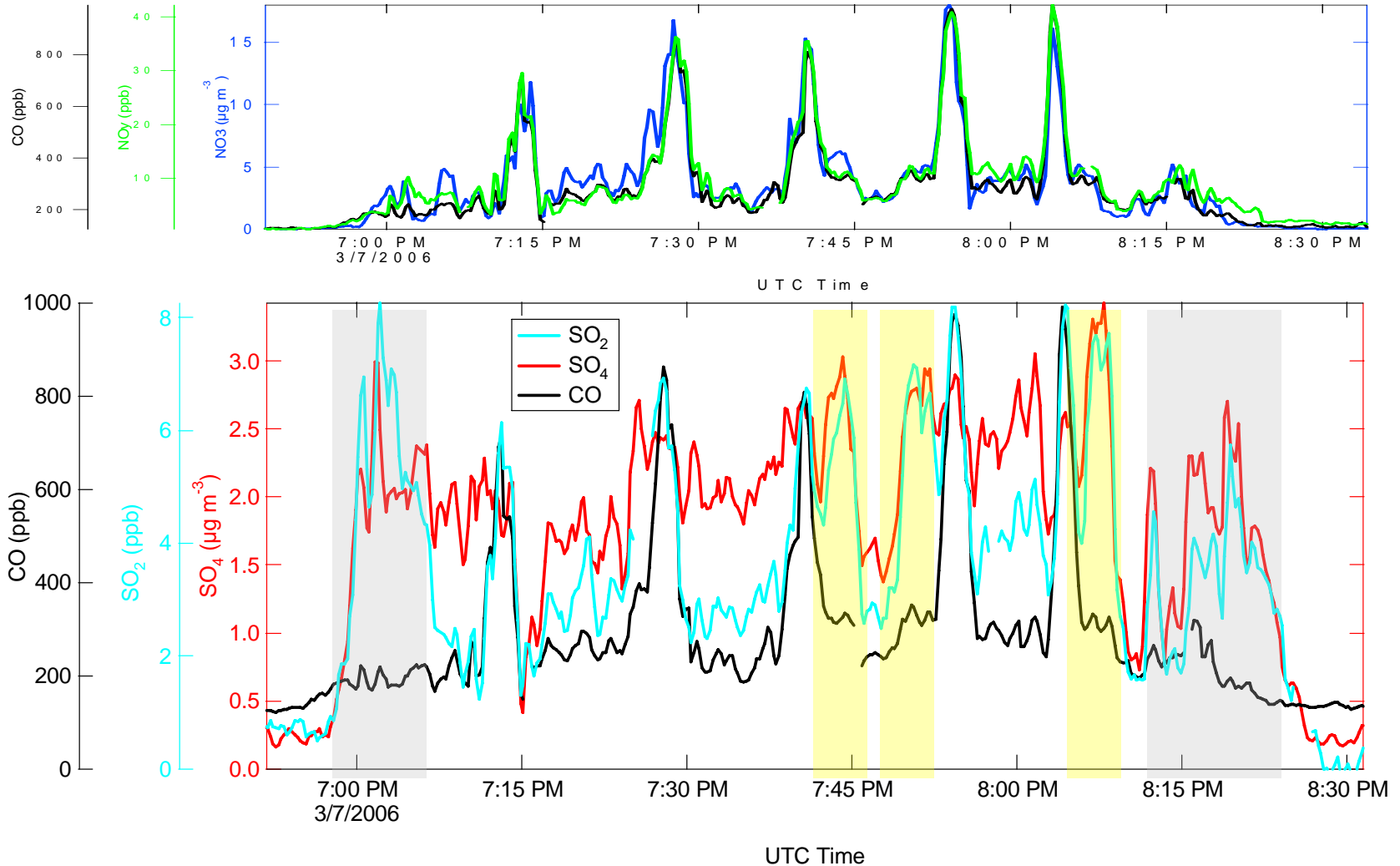


$\text{SO}_4$  levels in the plume are  $\sim 5$ x lower than  $\text{NO}_3$   
 $\text{NH}_4^+$  counter ion is predominately  $\text{NO}_3^-$

*Is  $[\text{NH}_3]$  or  $[\text{HNO}_3]$  governing the gas-particle partitioning to particle nitrate?*

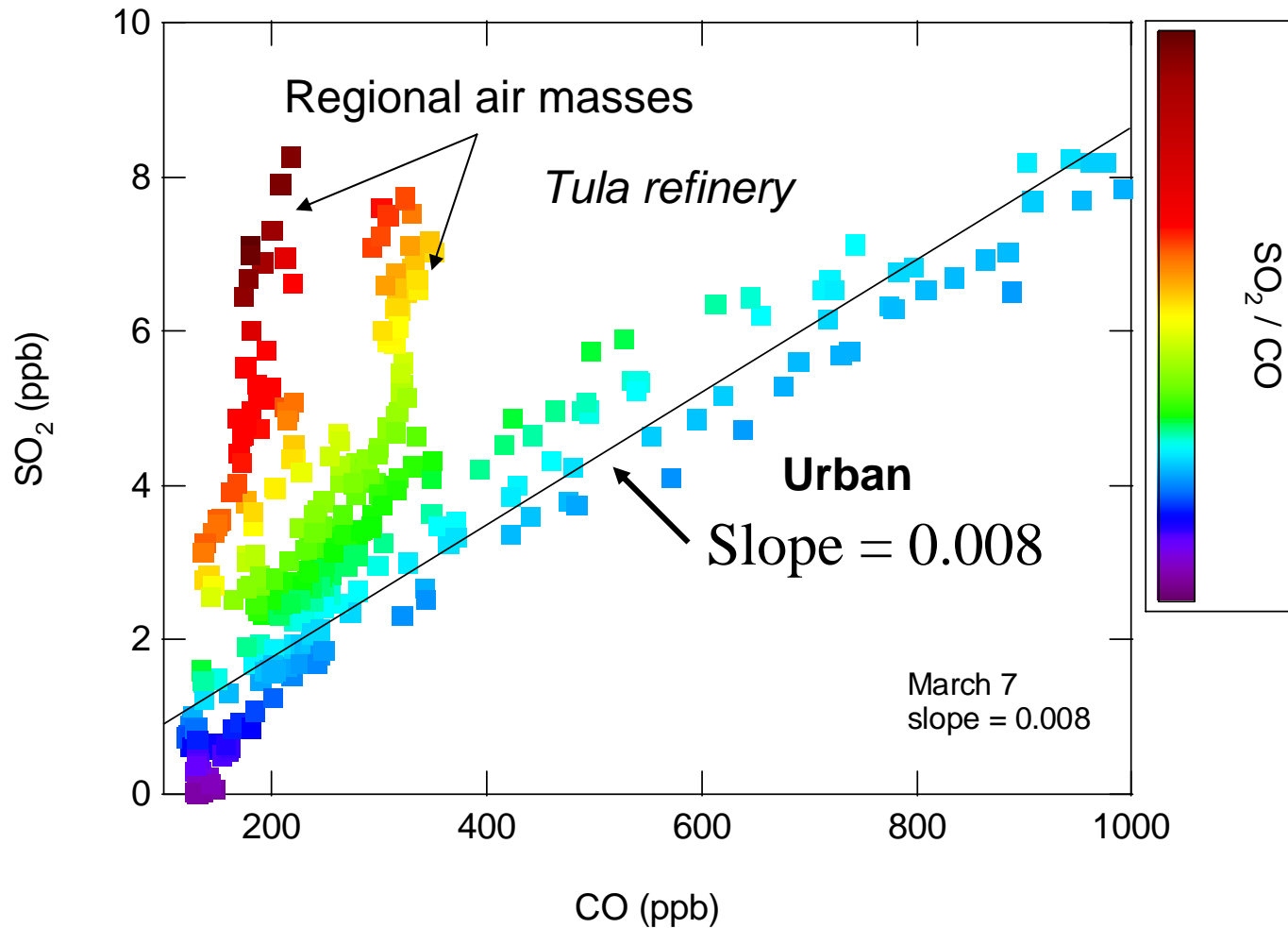
# Regional Air Mass

## SO<sub>2</sub> and Sulfate example



Two (or more) SO<sub>2</sub> sources. Urban emissions and industrial...

# SO<sub>2</sub> Emission Ratio (ER)



$ER = 1.9 \times 10^{-3} \text{ gm SO}_2 \text{ kg}^{-1} \text{ fuel}$   $\longrightarrow$   $\sim 1 \text{ ppm fuel Sulfur}$

# Organic aerosol and the biomass burning contribution

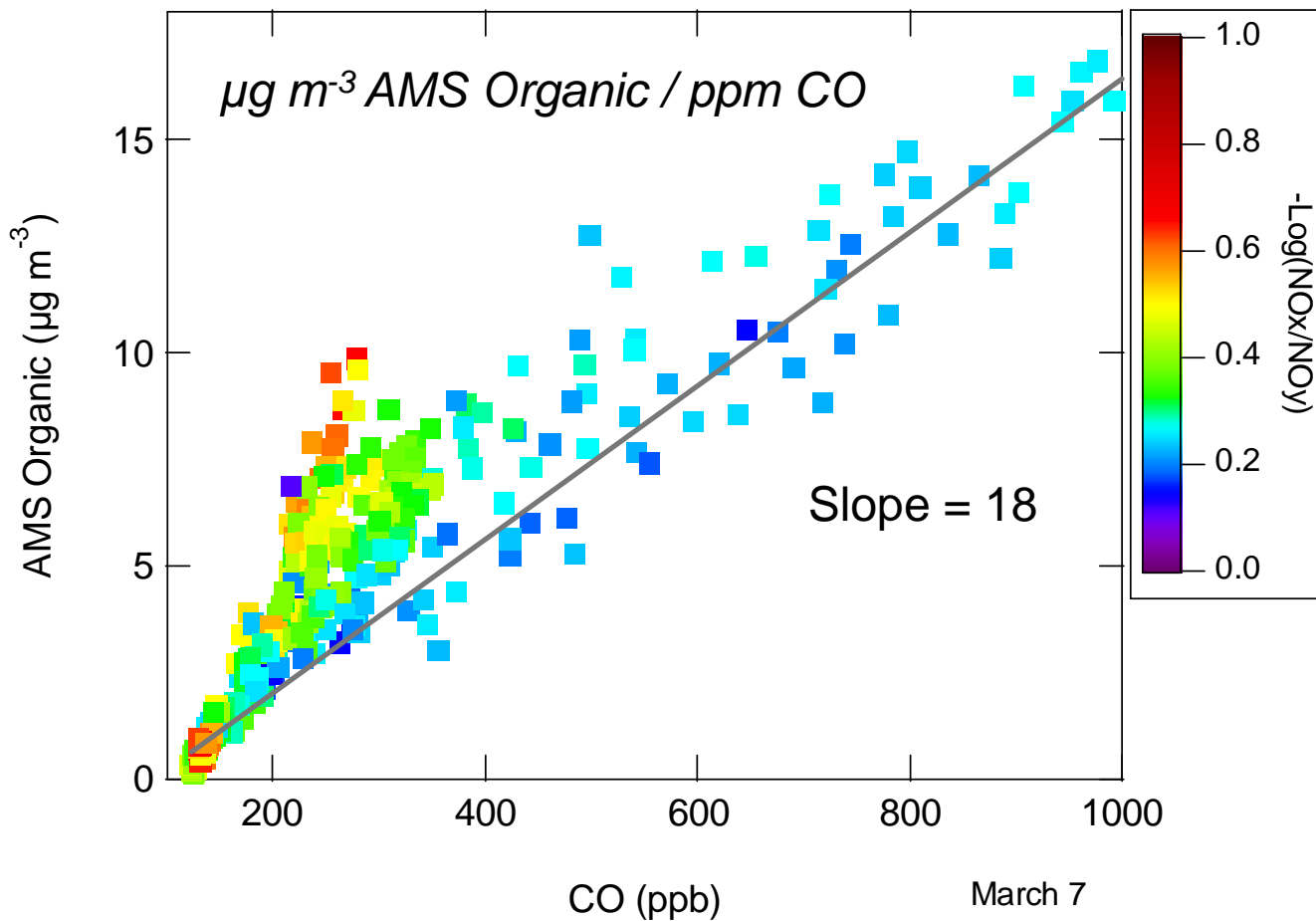
**AMS Organic Mass = OOA + HOA + BBOA**

OOA = Oxidized Organic Aerosol  
*(Remote/aged/processed)*

HOA = Hydrocarbon-like Organic Aerosol  
*(urban “fresh” vehicle emission)*

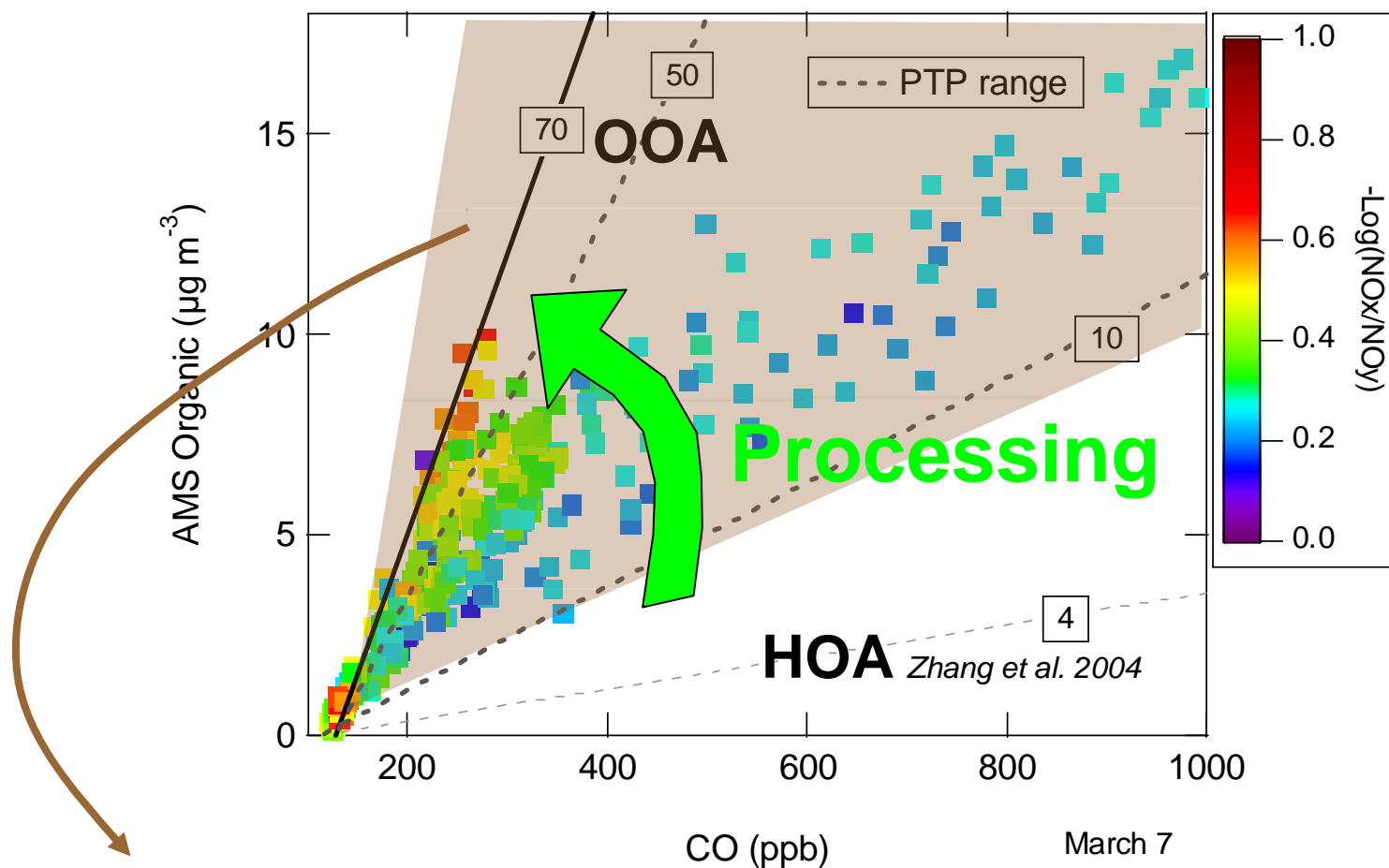
BBOA = Biomass Burning Organic Aerosol

# AMS Organic - CO “Emission Ratio”



Can we use the organic emission ratio to distinguish BBOA from HOA and OOA?

# AMS Organic - CO “Emission Ratio”



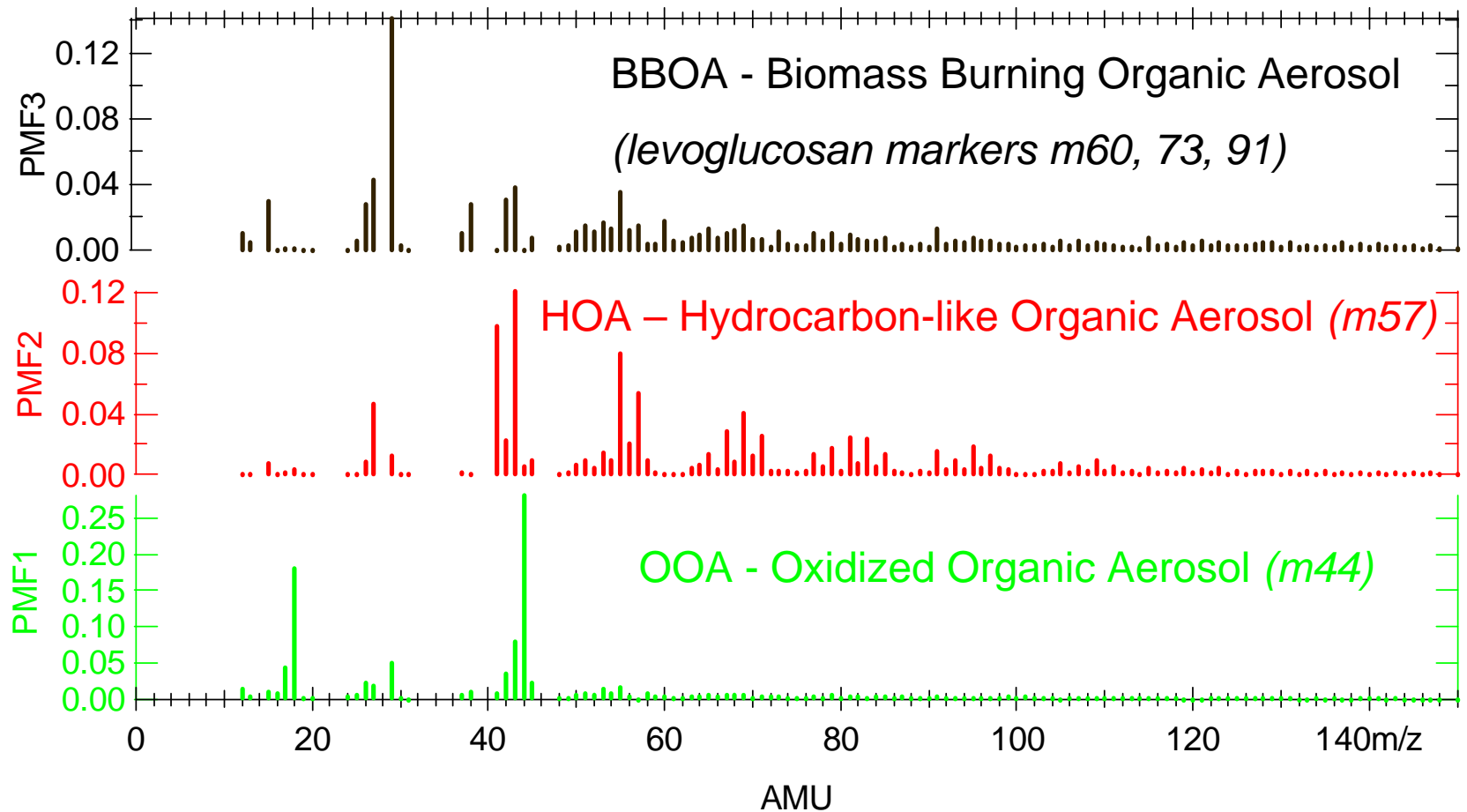
- BBOA Org-CO Ratio is highly variable. Fuel type, fire type (flaming, smoldering..), age.
- Fresh biomass emissions have a larger slope.
- All ERs tend toward OOA line with processing

# Positive Matrix Factorization – PMF

## The BBOA component

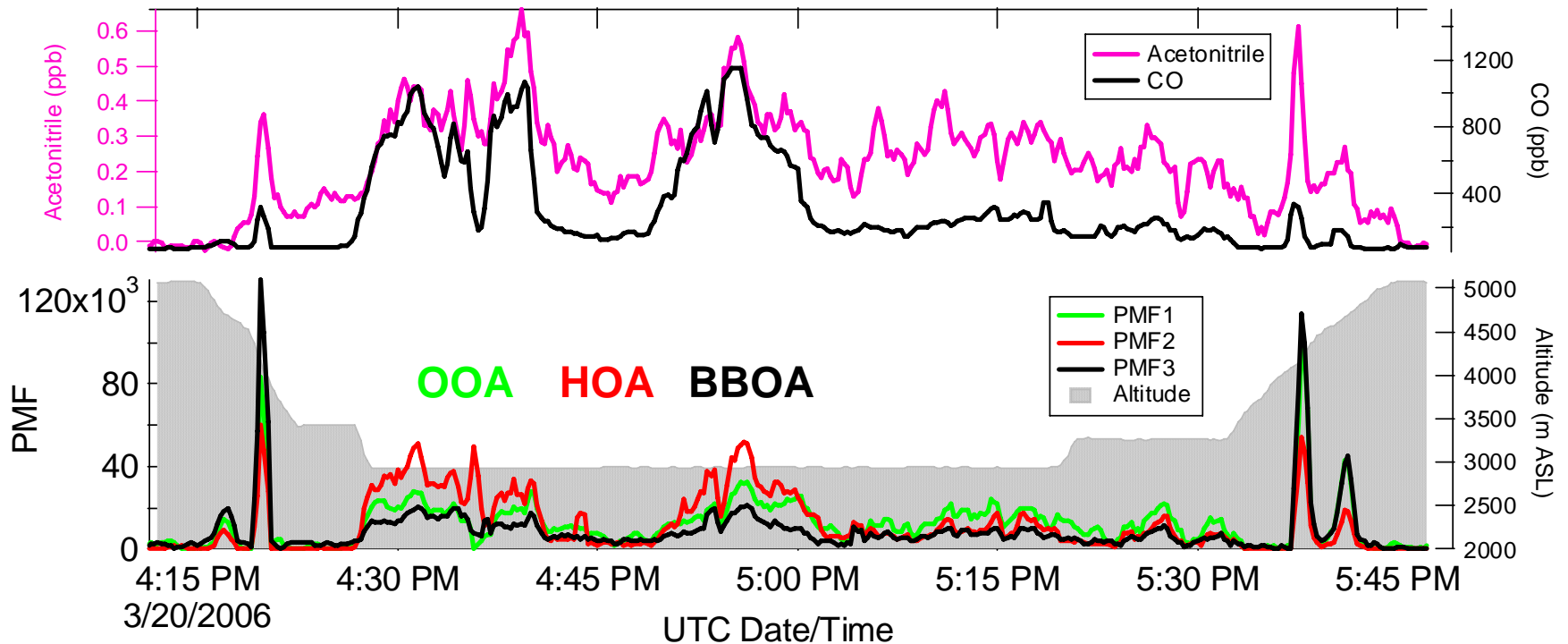
- A mathematical procedure to deconvolve the AMS spectra into factors (components).
- 3 factors investigated here OOA, HOA, BBOA.
- Combine PMF results with other gas-particle tracers to better understand the existence and contribution of biomass burning aerosol... *a work in progress.*

# PMF Factors



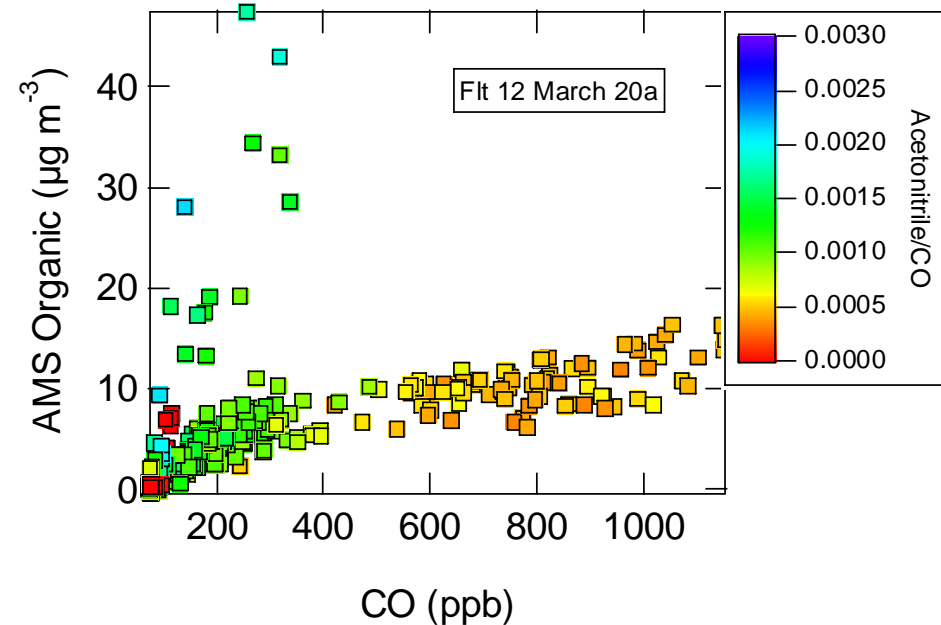
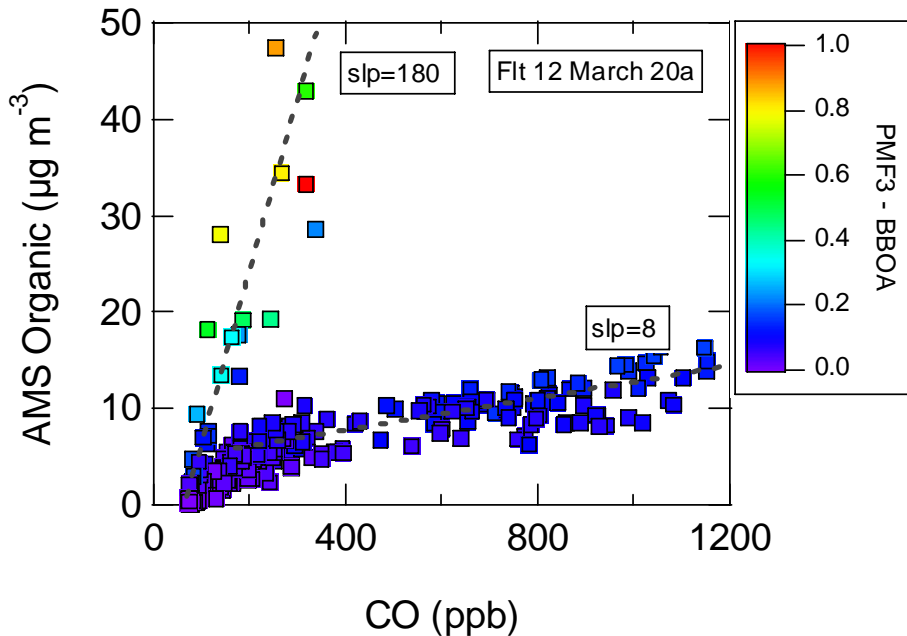
3 distinct organic aerosol factors that reflect changes in composition

# Time series of PMF signatures



- BBOA* often observed at higher altitudes.
- Relative contributions vary over different regions.*

# BBOA component correlates with high organic-CO emission ratio



PMF3 factor correlates with Acetonitrile/CO ratio of 0.003

# Summary

- The G1 platform effectively sampled the urban, regional and biomass burning pollution...*a very nice data set.*
- Urban plumes show high particle nitrate loadings, *active*  $NO_y$ ,  $NO_z$  chemistry.
- PMF applied to investigate contribution of BBOA...a work in progress.
- BBOA fraction is frequently observed above the urban plume.
- AMS Organic aerosol is ~50% of total AMS mass, what is the BBOA fraction?

## **Acknowledgements**

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