AMS Introduction

Doug Worsnop

AMS Users Meeting

~~Aerodyne~~

~~Caltech~~

~~Georgia Tech~~

~~FZ - Juelich~~

~~University of Minnesota~~

~~Desert Research Institute~~

~~Manchester~~

~~Toronto → Hyytiala → Orlando -> Minnesota -> Prague → Busan~~

~~October 2001/2002~~

~~October 24, 2003~~

~~October 8, 2004~~

~~25 August, 2005~~

~~16 September, 2006~~

~~29 September, 2007~~

~~5 September 2008~~

~~October 2009 → September 2010 → October 2011 -> October 2012 → 2013 → 2014 → 2015~~

Nitrate

Sulfate

Ammonia

Organics (44,57)

OOA, HOA

OOA1, OOA2

O/C/N/H ratios

SV-OOA, LV-OOA

OOA/HOA

SP -> BC

CIMS -> HOM

ELVOC

C2H3O2-, I-, NO3-

PM2.5, CE = 1

Portland, 21 October 2016

PMF/ME-2 → "source apportionment"

“Aerodyne (MS) Product Line”

ACSM
ToF-ACSM
Mini-AMS
HR-ToF-AMS
LToF-AMS

- PM2.5 Lens, ePToF, Capture Vaporizer, ADQ
- SP- Module
- TAG Module
- Thermo-denuder
- Aerosol Dryer / Sampling System
- PAM Chamber

APi-TOF
IMS-ToF
GC-ToF

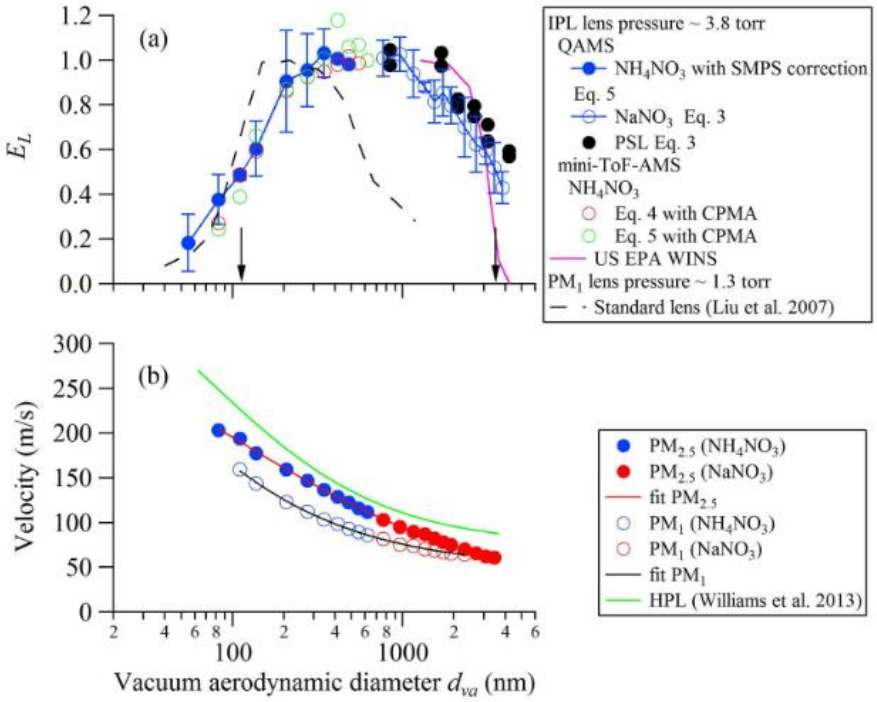
- NO3- CI Module
- FIGAERO

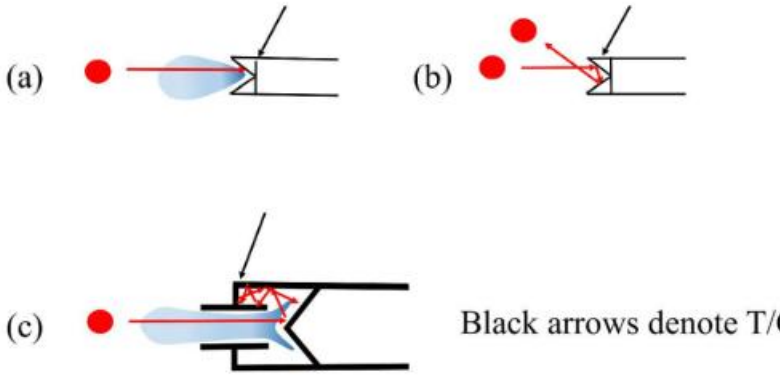
Aerosol Science & Technology

Research article

Laboratory characterization of an aerosol chemical speciation monitor with $PM_{2.5}$ measurement capability

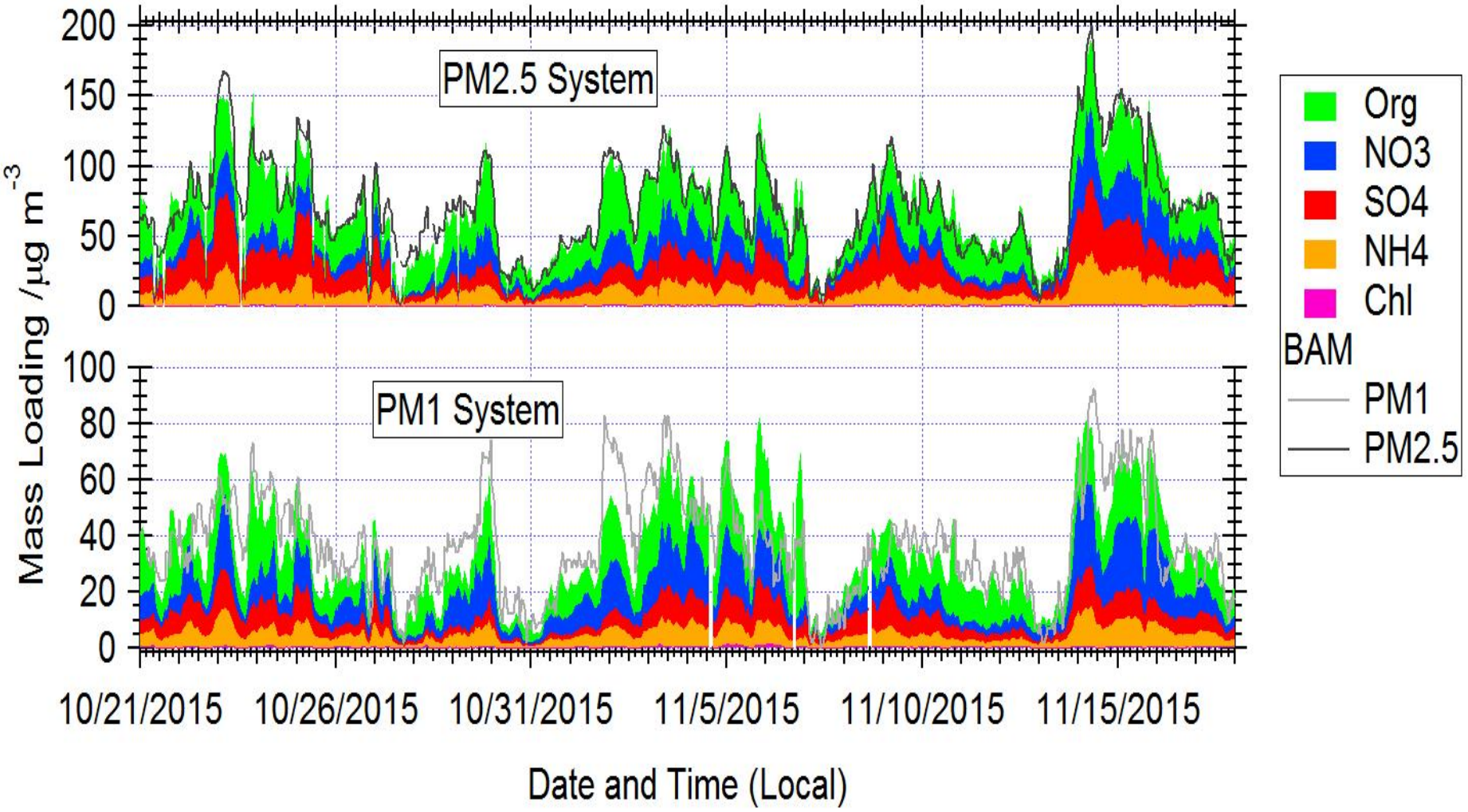
Wen Xu, Philip Croteau, Leah Williams, Manjula Canagaratna, Timothy Onasch, Eben Cross, Xuan Zhang, Wade Robinson, Douglas Worsnop & John Jayne





Black arrows denote T/

Results overview – ACSM and BAM Time Series

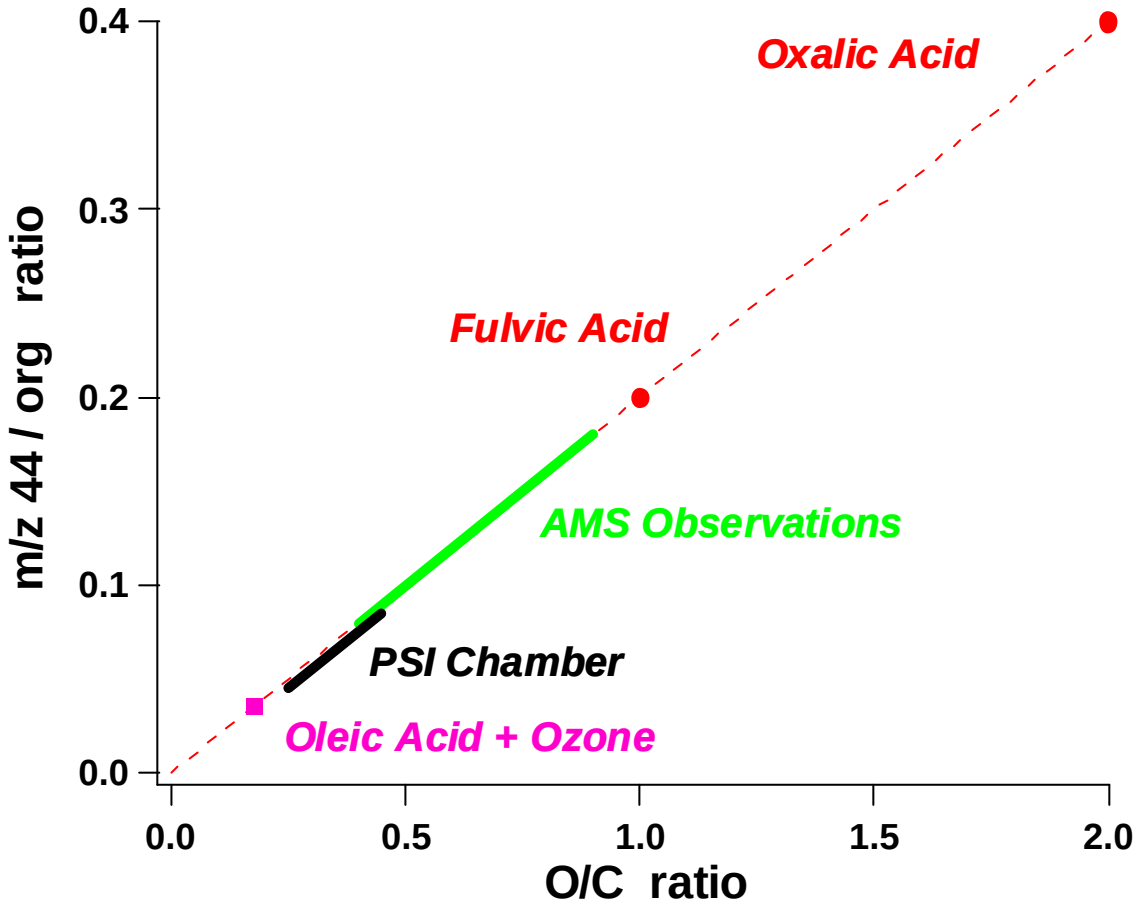


600C, e^-

$C_nH_mO_y$ ------> H_2O^+ CO^+ CO_2^+

18 ***28*** ***44*** ***43, 55***

f44 vs O/C



2004

Atmos. Chem. Phys., 15, 253–272, 2015
www.atmos-chem-phys.net/15/253/2015/
doi:10.5194/acp-15-253-2015

Atmospheric Chemistry and Physics
Open Access

Elemental ratio measurements of organic compounds using aerosol mass spectrometry: characterization, improved calibration, and implications

M. R. Canagaratna[1], J. L. Jimenez[2], J. H. Kroll[3,4], Q. Chen[3], S. H. Kessler[4], P. Massoli[1], L. Hildebrandt Ruiz[5], E. Fortner[1], L. R. Williams[1], K. R. Wilson[6], J. D. Surratt[7], N. M. Donahue[8], J. T. Jayne[1], and D. R. Worsnop[1]

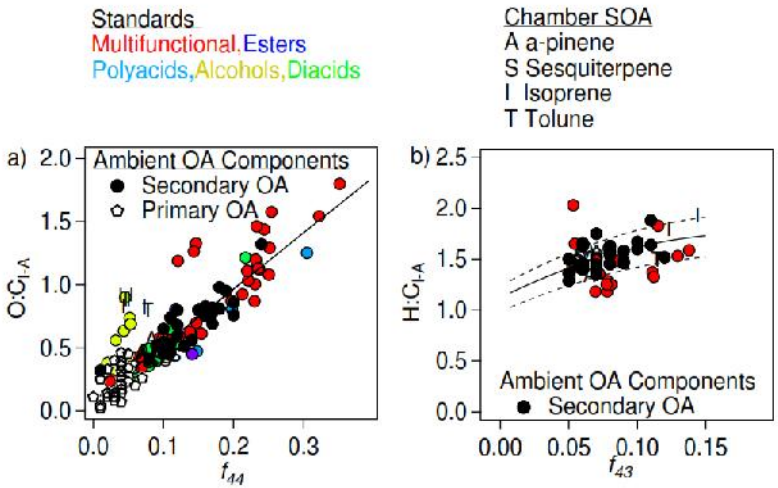


Figure 8. Scatterplot between Improved-Ambient O : C values and f_{44} (fractional ion intensity at m/z 44 from unit mass resolution

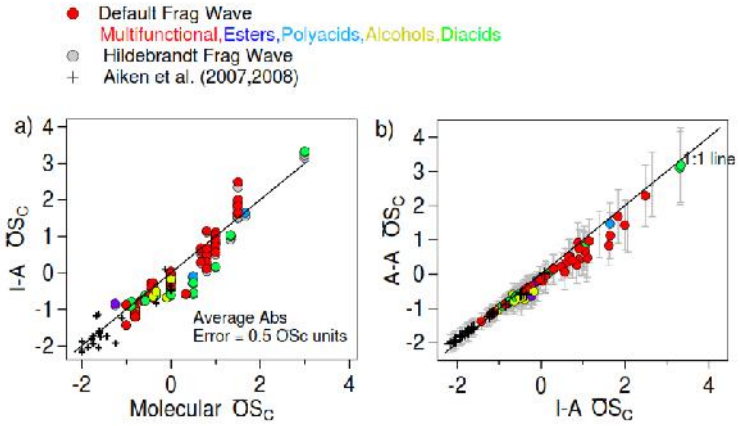


Figure 5. (a) Scatterplot of Improved-Ambient $\overline{OS}_C$ values ($2\times$ O : C – H : C) of the organic standards vs. their known molecular $\overline{OS}_C$ values. The Improved-Ambient method was applied with

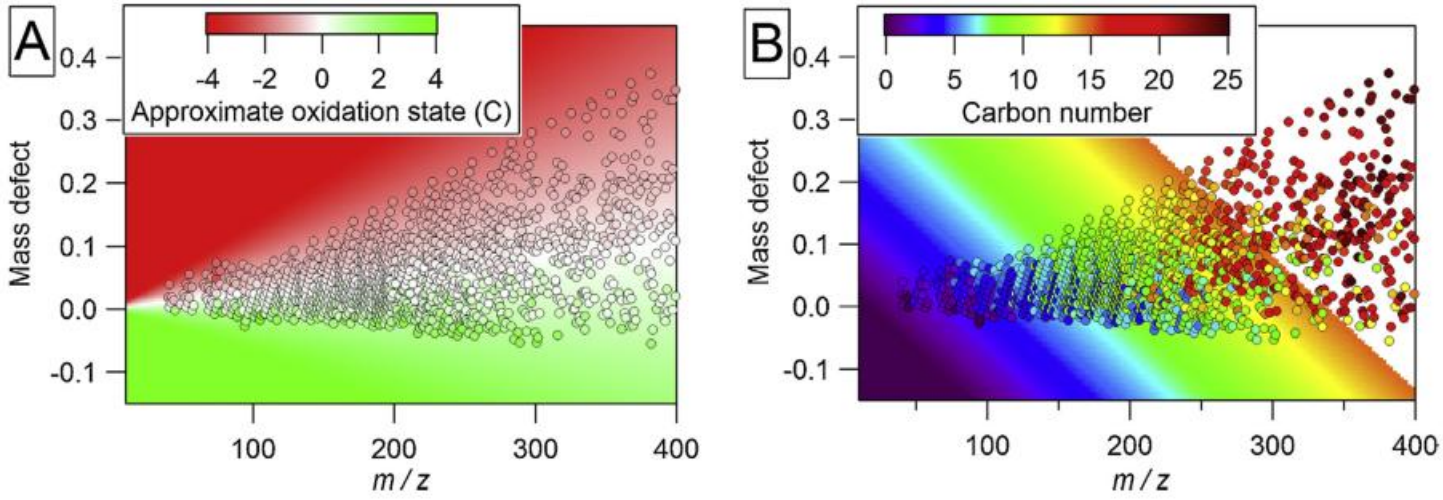
Contents lists available at ScienceDirect

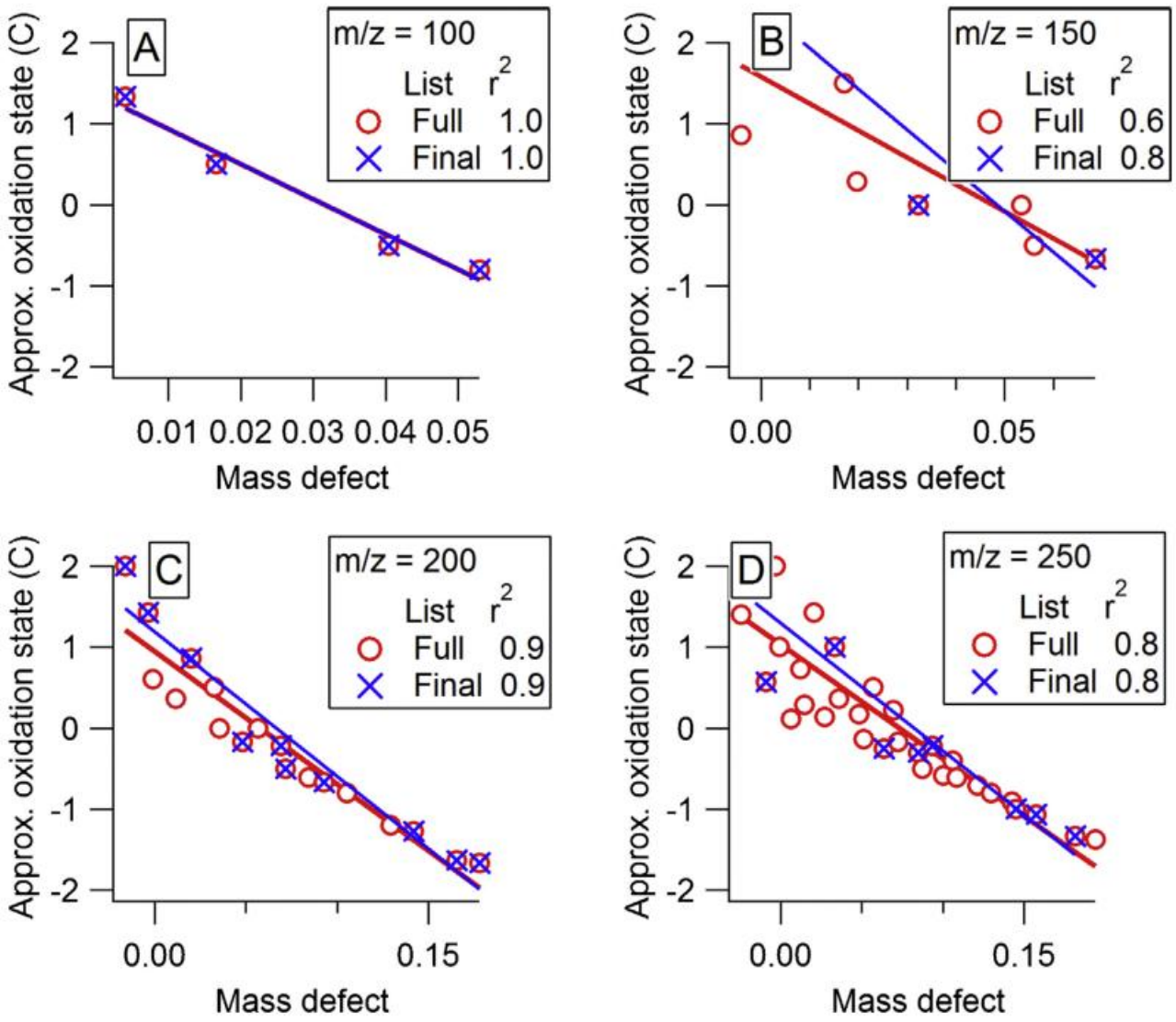
International Journal of Mass Spectrometry

journal homepage: www.elsevier.com/locate/ijms

Methods to extract molecular and bulk chemical information from series of complex mass spectra with limited mass resolution

Harald Stark[a,b,c,*], Reddy L.N. Yatavelli[a,c,1], Samantha L. Thompson[a,c], Joel R. Kimmel[b,d], Michael J. Cubison[d], Puneet S. Chhabra[b,2], Manjula R. Canagaratna[b], John T. Jayne[b], Douglas R. Worsnop[b,e], Jose L. Jimenez[a,c,**]



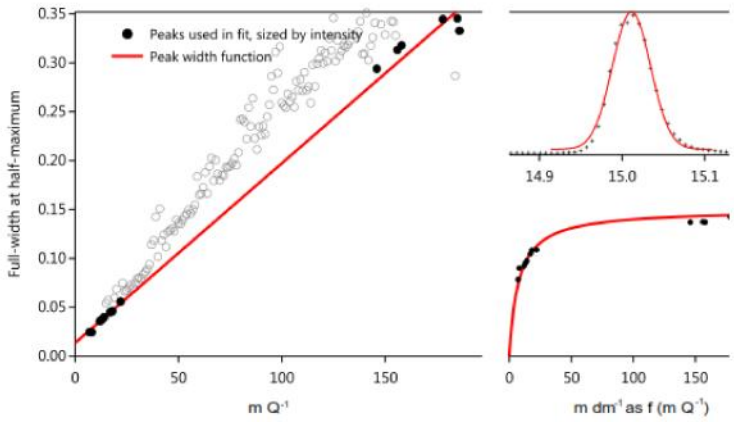

A
m/z = 100
List r2
Full 1.0
Final 1.0
Approx. oxidation state (C)
2
1
0
-1
-2
0.01 0.02 0.03 0.04 0.05
Mass defect
B
m/z = 150
List r2
Full 0.6
Final 0.8
Approx. oxidation state (C)
2
1
0
-1
-2
0.00
0.05
Mass defect
C
m/z = 200
List r2
Full 0.9
Final 0.9
Approx. oxidation state (C)
2
1
0
-1
-2
0.00
0.15
Mass defect
D
m/z = 250
List r2
Full 0.8
Final 0.8
Approx. oxidation state (C)
2
1
0
-1
-2
0.00
0.15
Mass defect

Atmos. Meas. Tech., 9, 3263–3281, 2016
www.atmos-meas-tech.net/9/3263/2016/
doi:10.5194/amt-9-3263-2016

Atmospheric Measurement Techniques
Open Access
EGU

Applications and limitations of constrained high-resolution peak fitting on low resolving power mass spectra from the ToF-ACSM

Hilkka Timonen[1], Mike Cubison[2], Minna Aurela[1], David Brus[1], Heikki Lihavainen[1], Risto Hill
Manjula Canagaratna[3], Bettina Nekat[4], Rolf Weller[3], Douglas Worsnop[3], and Sanna Saarikosk



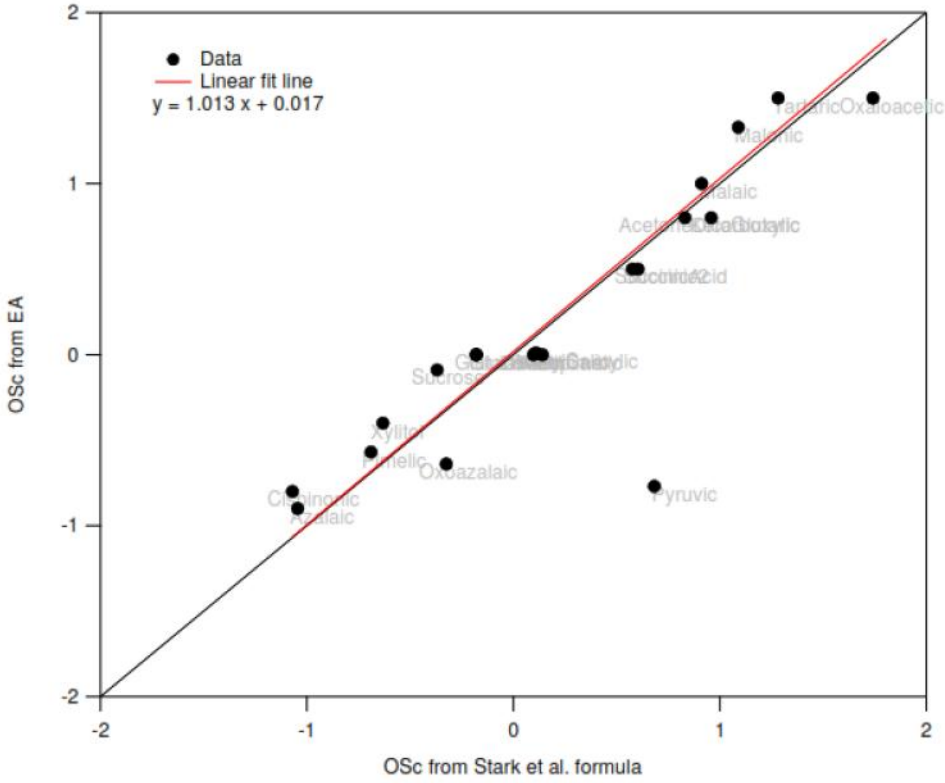
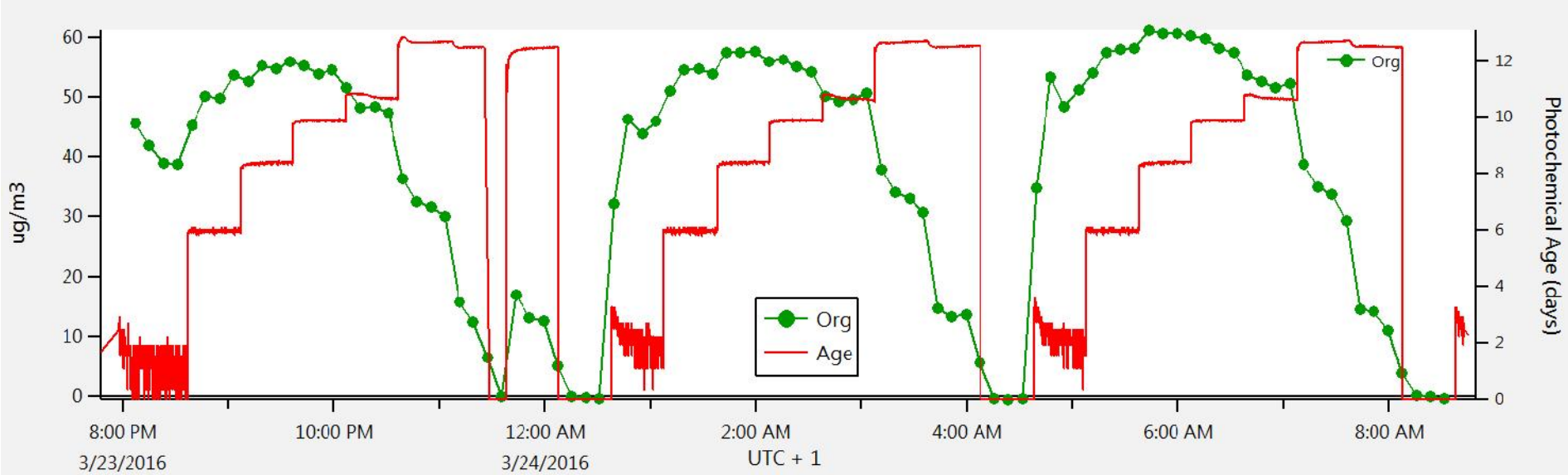
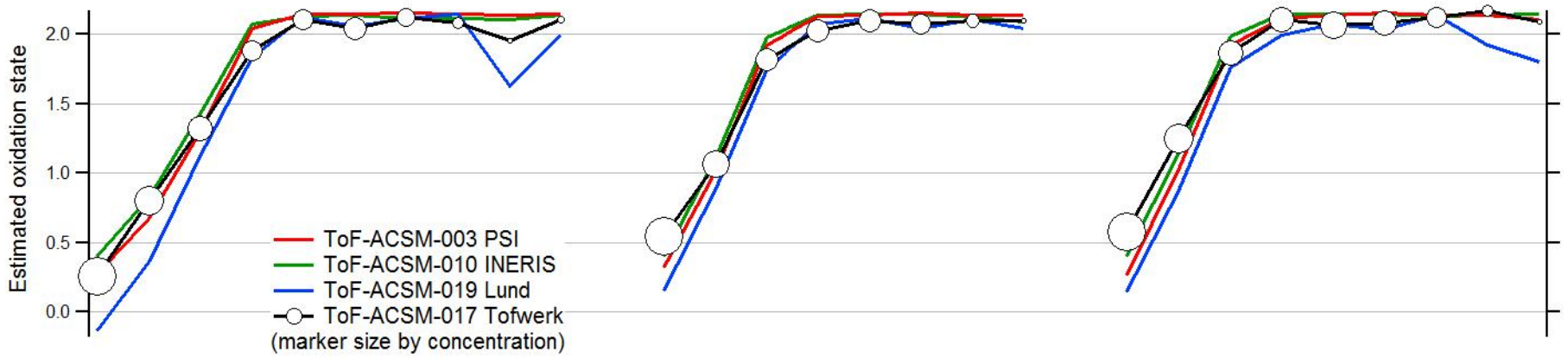


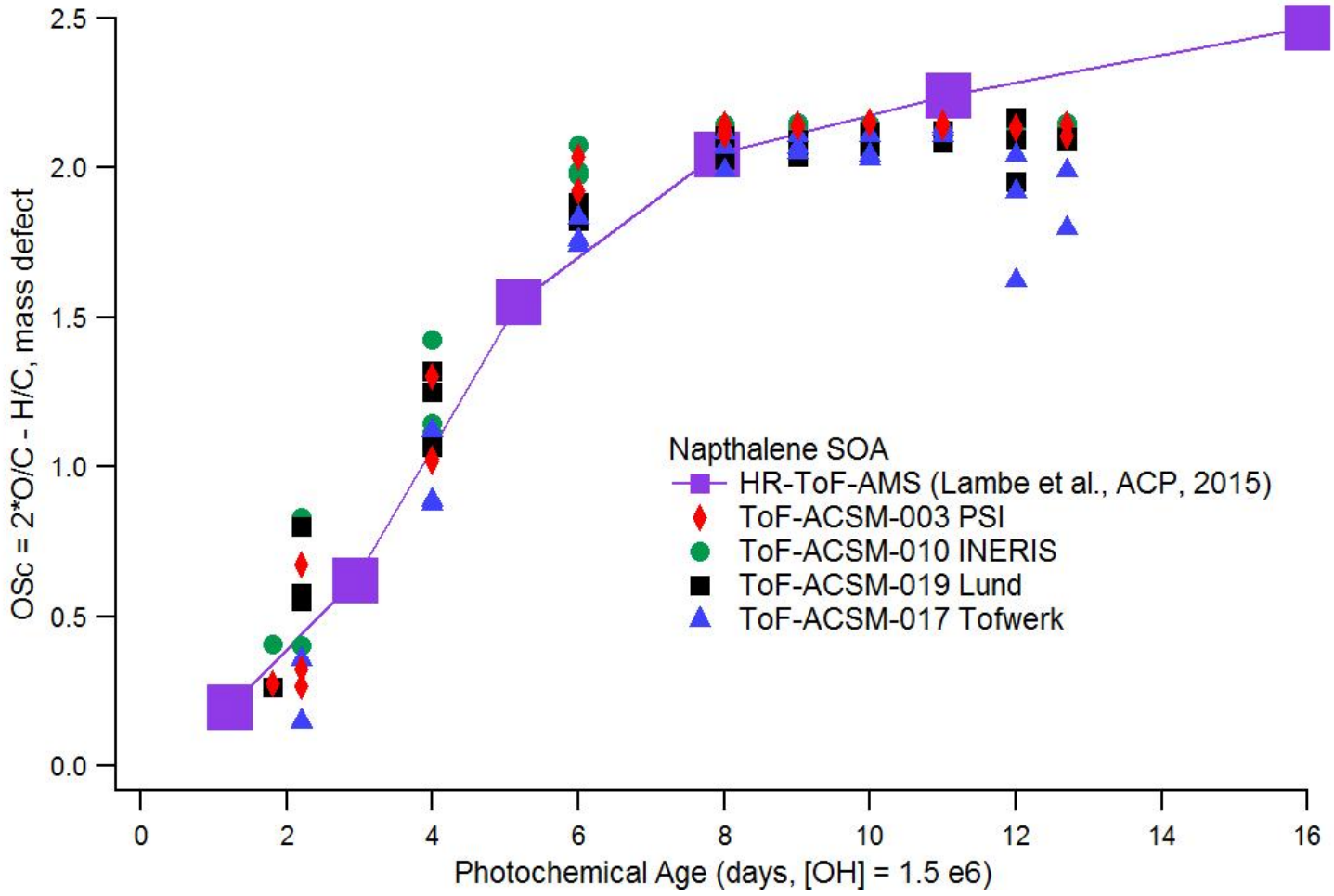
Figure 16. Carbon oxidation state of various organic compounds calculated from elemental analysis compared to the estimates using the Stark et al. (2015) formula.

OSc for Napthalene SOA





OSc for Napthalene SOA



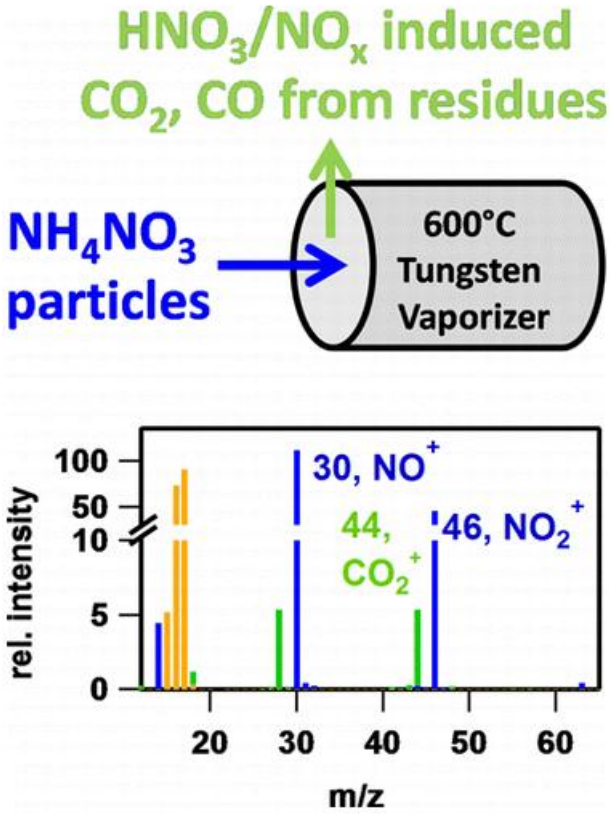
ENVIRONMENTAL Science & Technology

Article

pubs.acs.org/est

Inorganic Salt Interference on CO_2^+ in Aerodyne AMS and ACSM Organic Aerosol Composition Studies

Simone M. Pieber,[†] Imad El Haddad,[†] Jay G. Slowik,[*,†] Manjula R. Canagaratna,[‡] John T. Jayne,[‡] Stephen M. Platt,[†,⊥] Carlo Bozzetti,[†] Kaspar R. Daellenbach,[†] Roman Fröhlich,[†] Athanasia Vlachou,[†] Felix Klein,[†] Josef Dommen,[†] Branka Miljevic,[§] José L. Jiménez,[∥] Douglas R. Worsnop,[‡] Urs Baltensperger,[†] and André S. H. Prévôt[*,†]



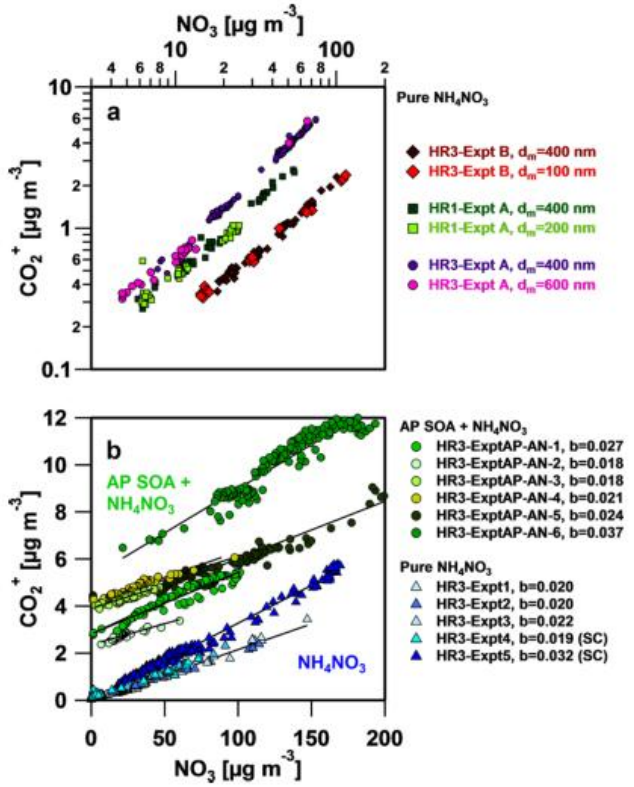


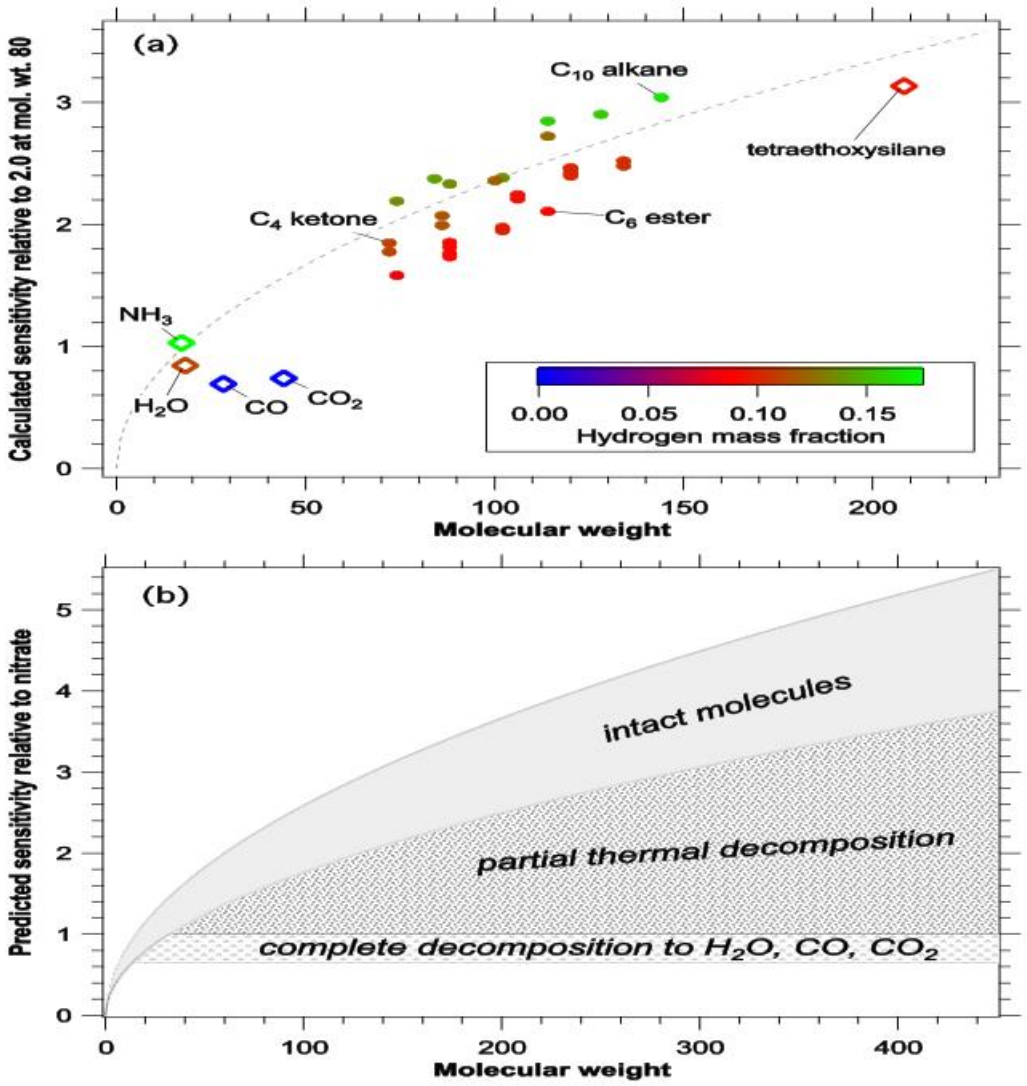
Figure 3. Effect of particle diameter and mixing state. (a) CO_2^+ signal

Aerosol Science and Technology

ISSN: 0278-6826 (Print) 1521-7388 (Online) Journal homepage: http://www.tandfonline.com/loi/uast20

The effects of molecular weight and thermal decomposition on the sensitivity of a therma desorption aerosol mass spectrometer

D. M. Murphy

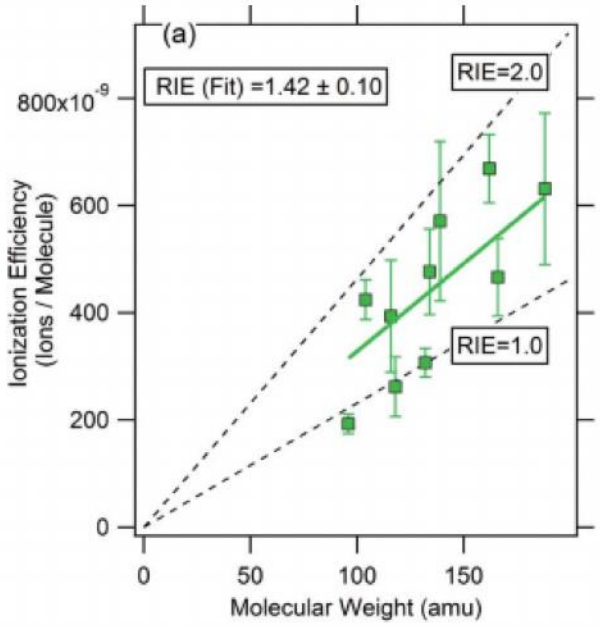


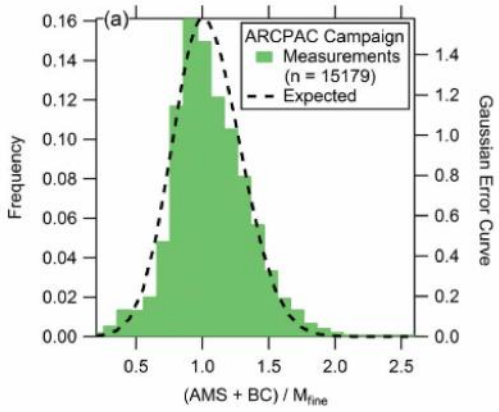
Aerosol Science and Technology

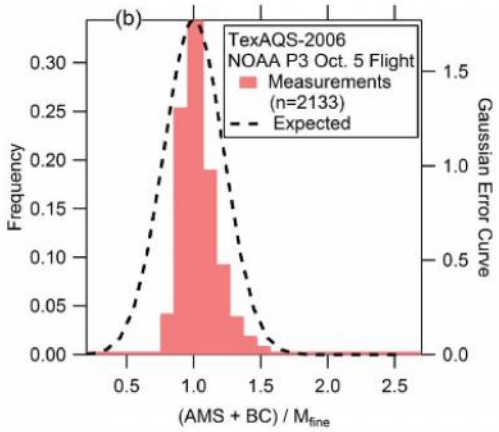
ISSN: 0278-6826 (Print) 1521-7388 (Online) Journal homepage: http://www.tandfonline.com/loi/uast20

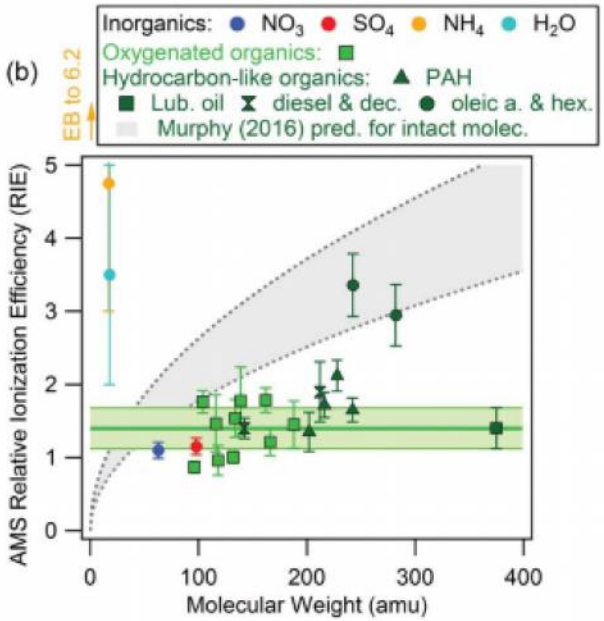
Comment on "The effects of molecular weight and thermal decomposition on the sensitivity of a thermal desorption aerosol mass spectrometer"

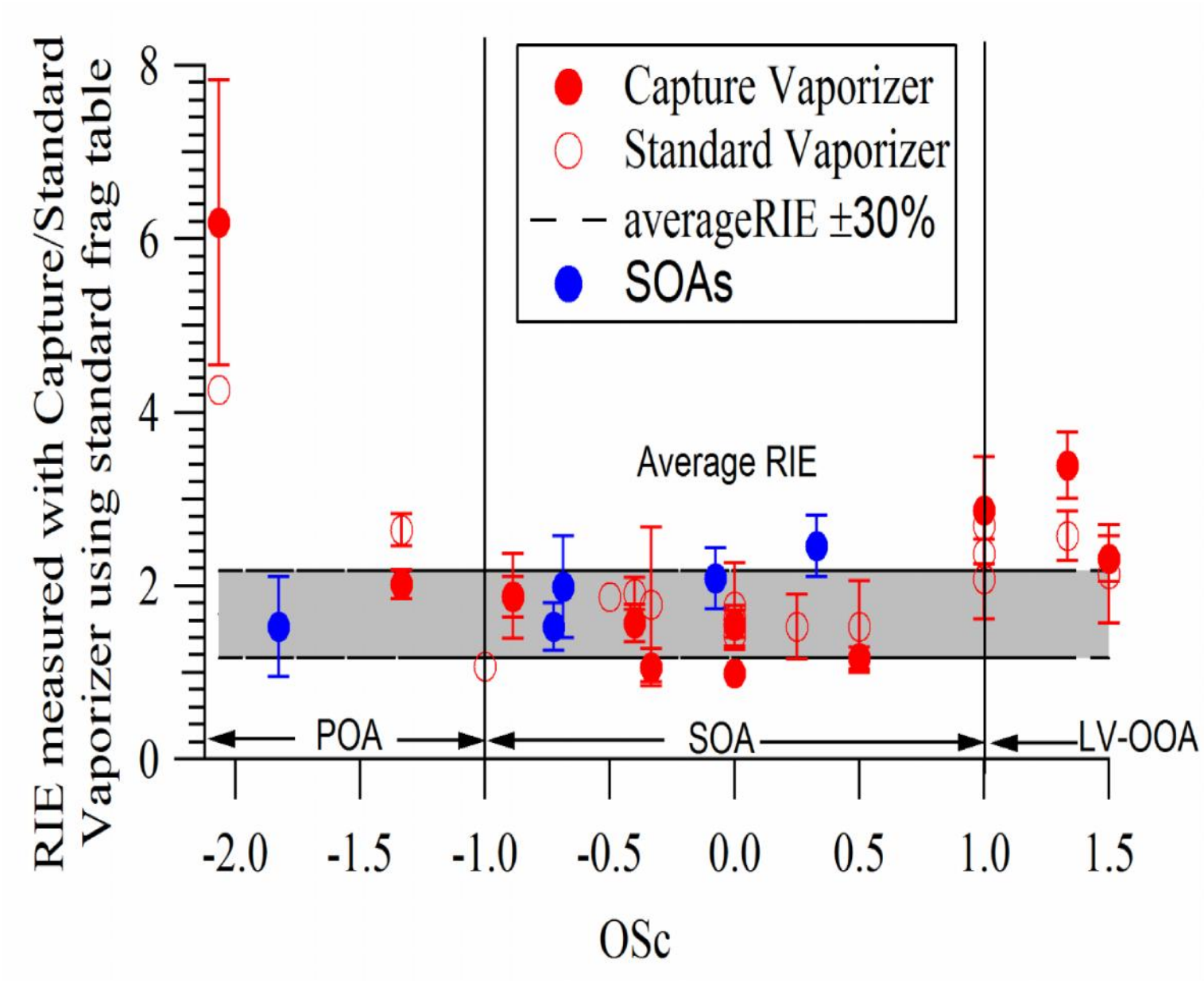
Jose L. Jimenez, Manjula R. Canagaratna, Frank Drewnick, James D. Allan, M. Rami Alfarra, Ann M. Middlebrook, Jay G. Slowik, Qi Zhang, Hugh Coe, John T. Jayne & Douglas R. Worsnop









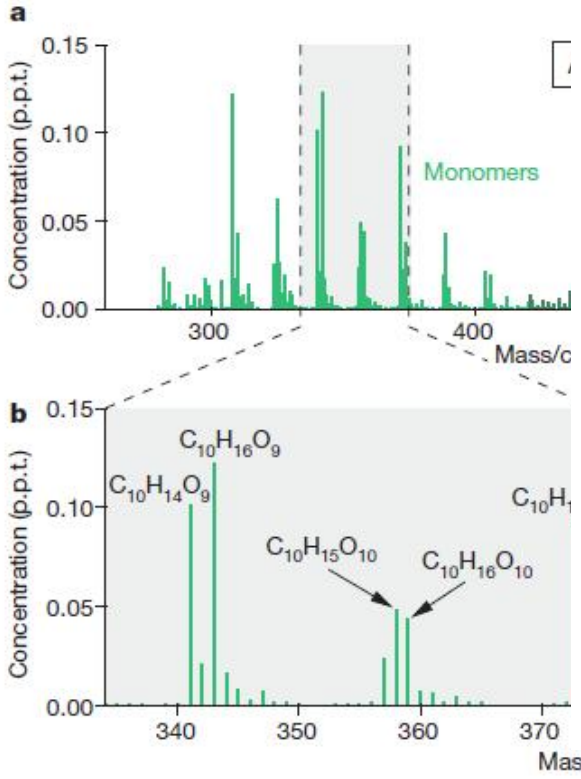

RIE measured with Capture/Standard Vaporizer using standard frag table
8
6
4
2
0
Capture Vaporizer
Standard Vaporizer
averageRIE ±30%
SOAs
Average RIE
POA
SOA
LV-OOA
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
OSc

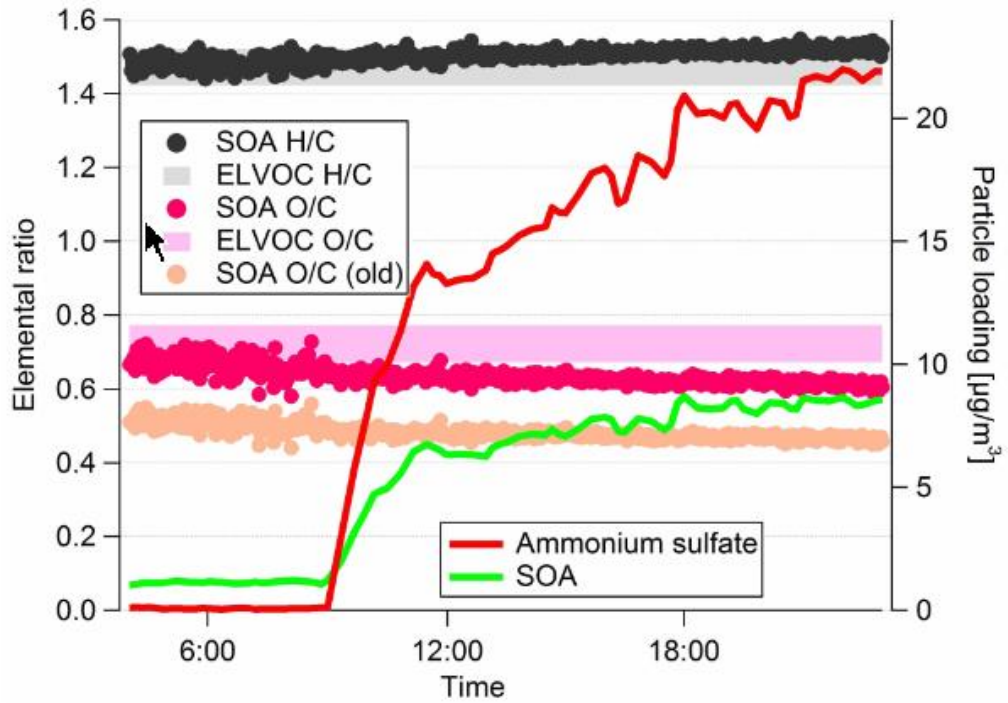
LETTER

doi:10.1038/nature13032

A large source of low-volatility secondary organic aerosol

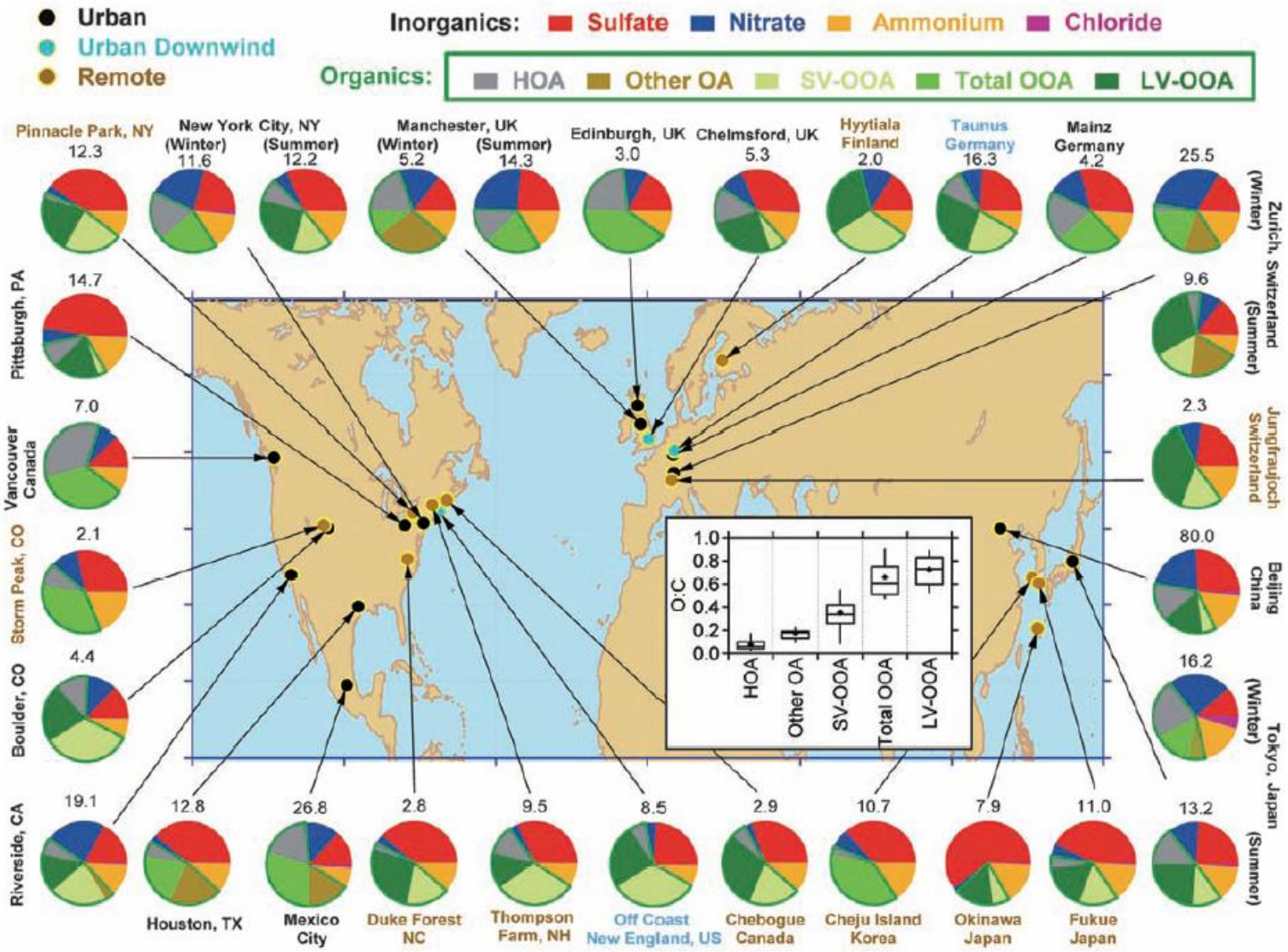
Mikael Ehn[1,2], Joel A. Thornton[2,3], Einhard Kleist[4], Mikko Sipilä[2], Heikki Junninen[2], Iida Pullinen[1], Monika Springer[1], Florian Rubach[1], Ralf Tillmann[1], Ben Lee[3], Felipe Lopez-Hilfiker[3], Stefanie Andres[1], Ismail-Hakki Acir[1], Matti Rissanen[2], Tuija Jokinen[2,5], Siegfried Schobesberger[2], Juha Kangasluoma[2], Jenni Kontkanen[2], Tuomo Nieminen[2,6], Theo Kurtén[7], Lasse B. Nielsen[8], Solvejg Jørgensen[8], Henrik G. Kjaergaard[8], Manjula Canagaratna[9], Miikka Dal Maso[10], Torsten Berndt[5], Tuukka Petäjä[2], Andreas Wahner[1], Veli-Matti Kerminen[2], Markku Kulmala[2], Douglas R. Worsnop[2,9], Jürgen Wildt[4] & Thomas F. Mentel[1]





Inorganic (SO4,NO3) ~ Organic (OOA)

O/C ~ 0.7



Jimenez et al, Science, 2009