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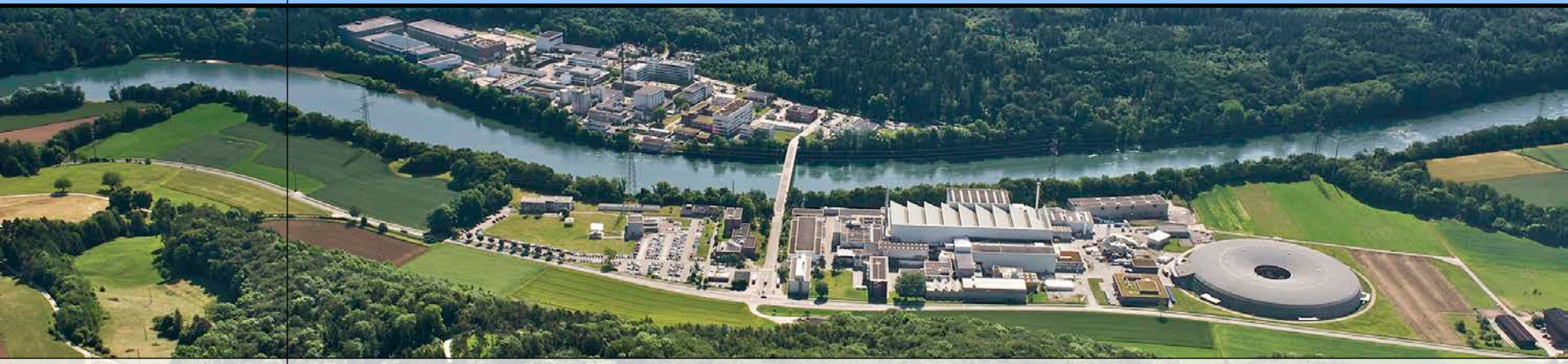
PSI



Wir schaffen Wissen – heute für morgen

Longer Term
Aerosol Chemical speciation monitoring data during ACTRIS/EMEP activities

ACSM Teams across Europe

Many slides from Michael Bressi, JRC Italy

ACSM stations

- Half hourly measurements of submicron organic mass, sulfate, nitrate, ammonium during at least a season, ideally for full years

- Organic mass spectra can be used to derive sources and components of organic aerosols (traffic, biomass burning, coal burning, cooking, secondary organic aerosols)

  - **Sampling sites**

  + 20 potential sites in 12 different countries

  + Site types: 2 remote/ high altitude, 2 urban background, 6 coastal, 10 rural background sites

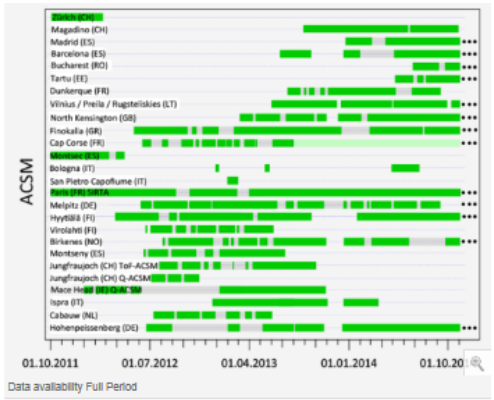
  → Heterogeneity of sampling site locations, types, altitude, etc.

http://www.psi.ch/acsm-stations/acsm-station

MATERIAL AND METHODS

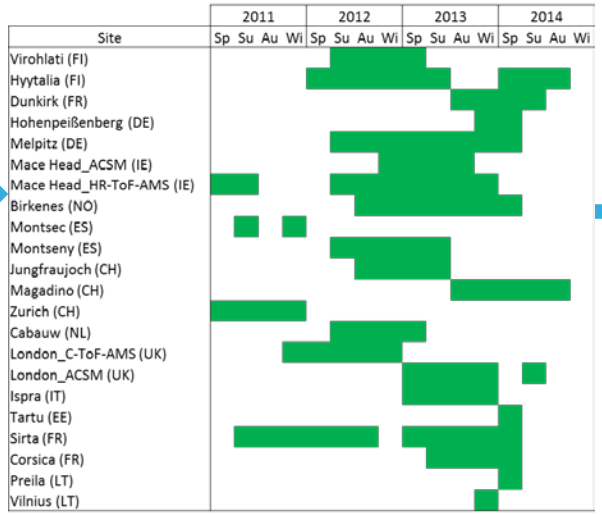
- **Data coverage**

From 1 Feb. 2011 to 2015



http://www.psi.ch/acsm-stations/overview-full-period

1



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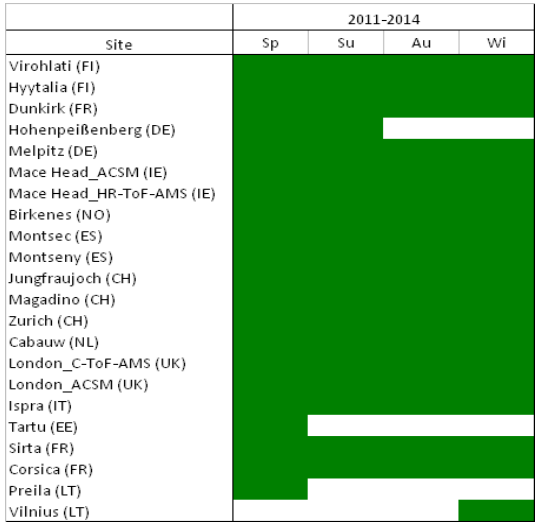


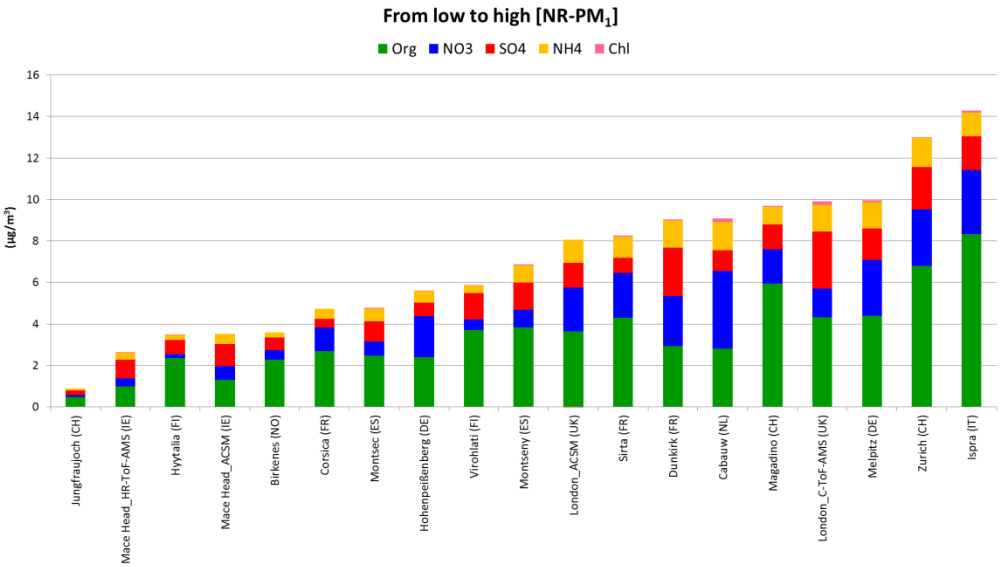
Assumptions:

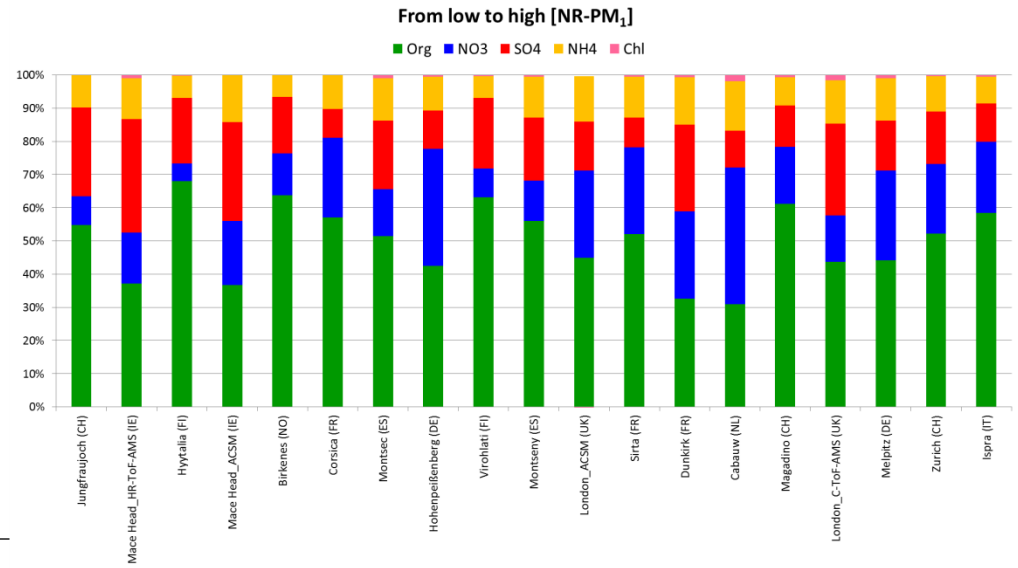
1 If data coverage> 1.5 months in a given season → data representative of the full season (Spring=MAM, Summer=JJA, etc.)

PRELIMINARY RESULTS

- **Chemical composition of NR-PM_1**

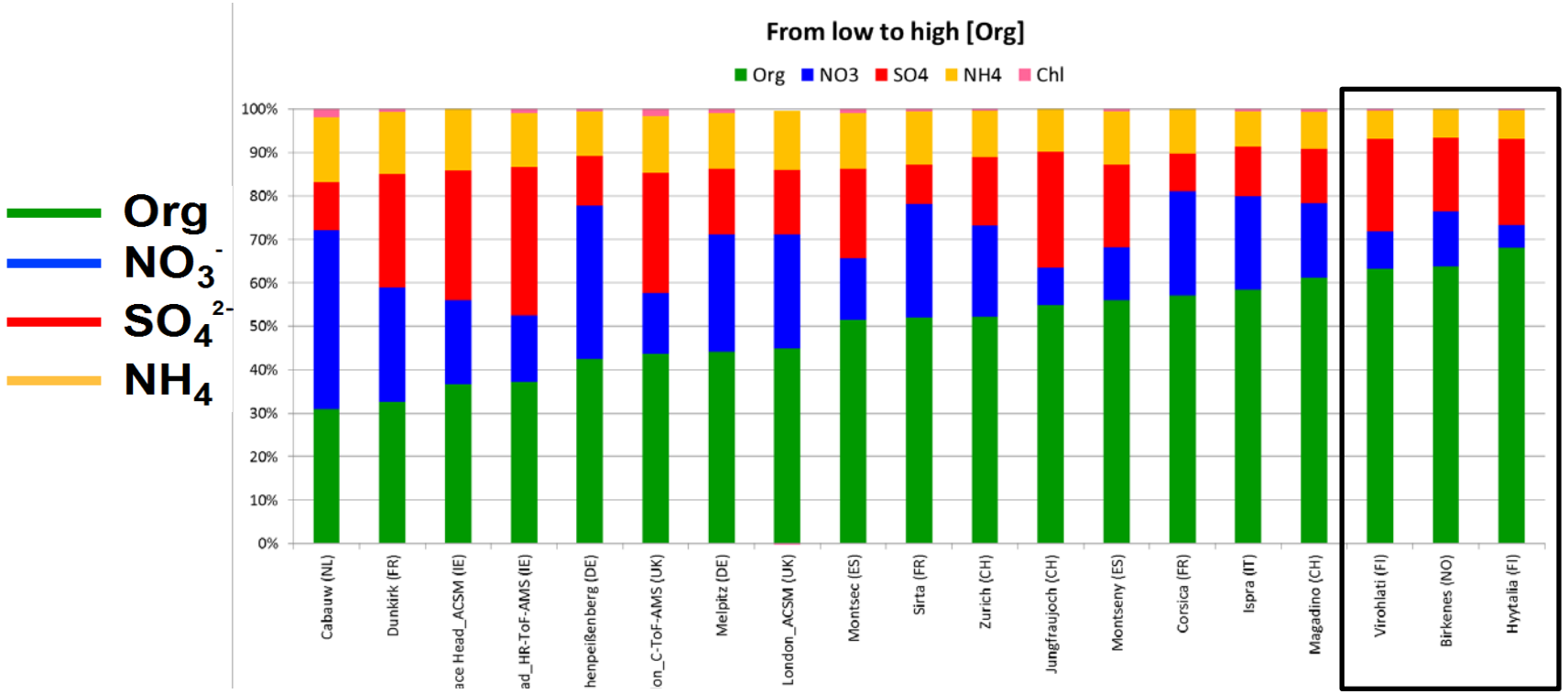
+ Organics are the main component of NR-PM_1 (min 31%, max 62%, median 52%)





Org
NO_3^-
SO_4^{2-}
NH_4

Chemical composition of NR-PM_1



+ Large variety of sources and processes leading to the formation of organics → no clear trend

+ Nevertheless: highest [Org] relative contribution in Nordic countries (FI, NO)

Composition overview paper led by M. Bressi, JRC

- GOALS

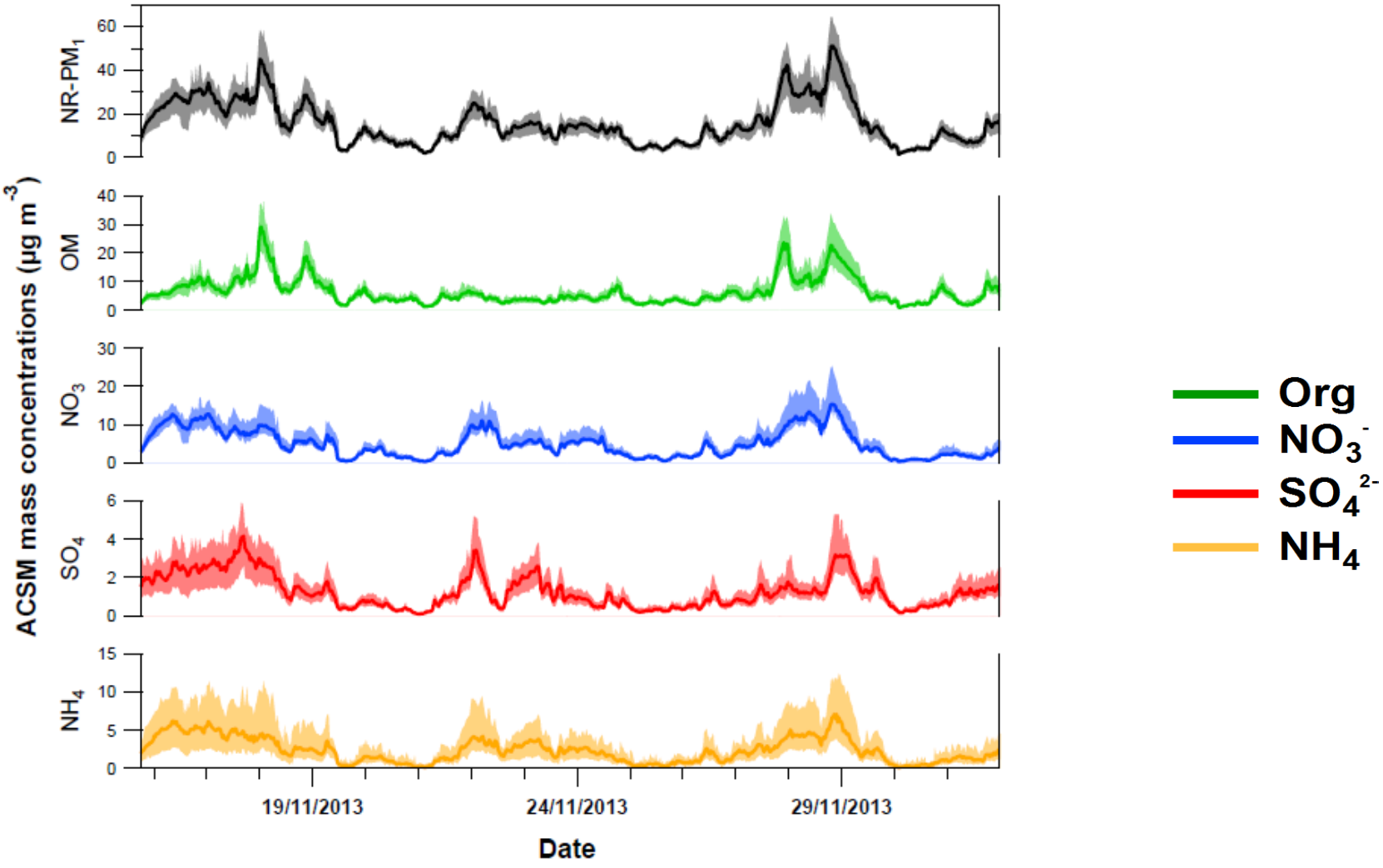
Analysis of relative composition per season

Daily cycles of the various components in different seasons

Analysis of relative composition as a function of concentration or other parameters

Current goal: submission of paper in January 2016. Data will then become completely available

INTERCOMPARISON EXERCISE within ACTRIS



2

Comparison of 13 ACSMs near PARIS

Will be published in AMTD very shortly by Crenn et al.

Source apportionment

SoFi, an IGOR-based interface for the efficient use of the generalized multilinear engine (ME-2) for the source apportionment: ME-2 application to aerosol mass spectrometer data

F. Canonaco, M. Crippa, J. G. Slowik, U. Baltensperger, and A. S. H. Prévôt

Paul Scherrer Institute, Laboratory of Atmospheric Chemistry, 5232 Villigen PSI, Switzerland

Correspondence to: A. S. H. Prévôt (andre.prevot@psi.ch)

AMT, 2013

Received: 24 April 2013 – Published in Atmos. Meas. Tech. Discuss.: 15 July 2013
Revised: 8 October 2013 – Accepted: 14 October 2013 – Published: 23 December 2013

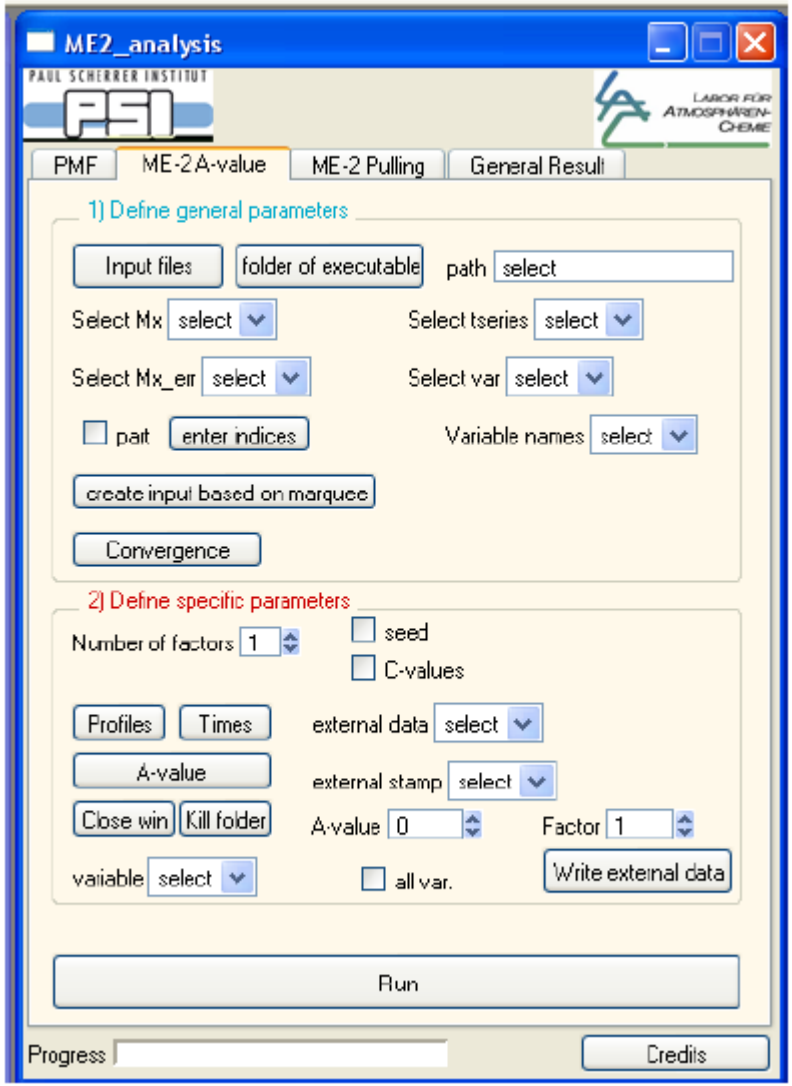
Organic aerosol components derived from 25 AMS data sets across Europe using a consistent ME-2 based source apportionment approach

ACP, 2014

M. Crippa[1,*], F. Canonaco[1], V. A. Lanz[1], M. Äijälä[2], J. D. Allan[3,17], S. Carbone[4], G. Capes[3], D. Ceburnis[13], M. Dall'Osto[5], D. A. Day[6], P. F. DeCarlo[1,], M. Ehn[2], A. Eriksson[7], E. Freney[8], L. Hildebrandt Ruiz[9,***], R. Hillamo[4], J. L. Jimenez[6], H. Junninen[2], A. Kiendler-Scharr[10], A.-M. Kortelainen[11], M. Kulmala[2], A. Laaksonen[11], A. A. Mensah[10,****], C. Mohr[1,*****], E. Nemitz[12], C. O'Dowd[13], J. Ovadnevaite[13], S. N. Pandis[14], T. Petäjä[2], L. Poulain[15], S. Saarikoski[4], K. Sellegri[8], E. Swietlicki[7], P. Tiitta[11], D. R. Worsnop[2,4,11,16], U. Baltensperger[1], and A. S. H. Prévôt[1]**

[1]Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, 5232 PSI Villigen, Switzerland

SoFi programmed in Igor as an efficient evaluation tool gets widely spread

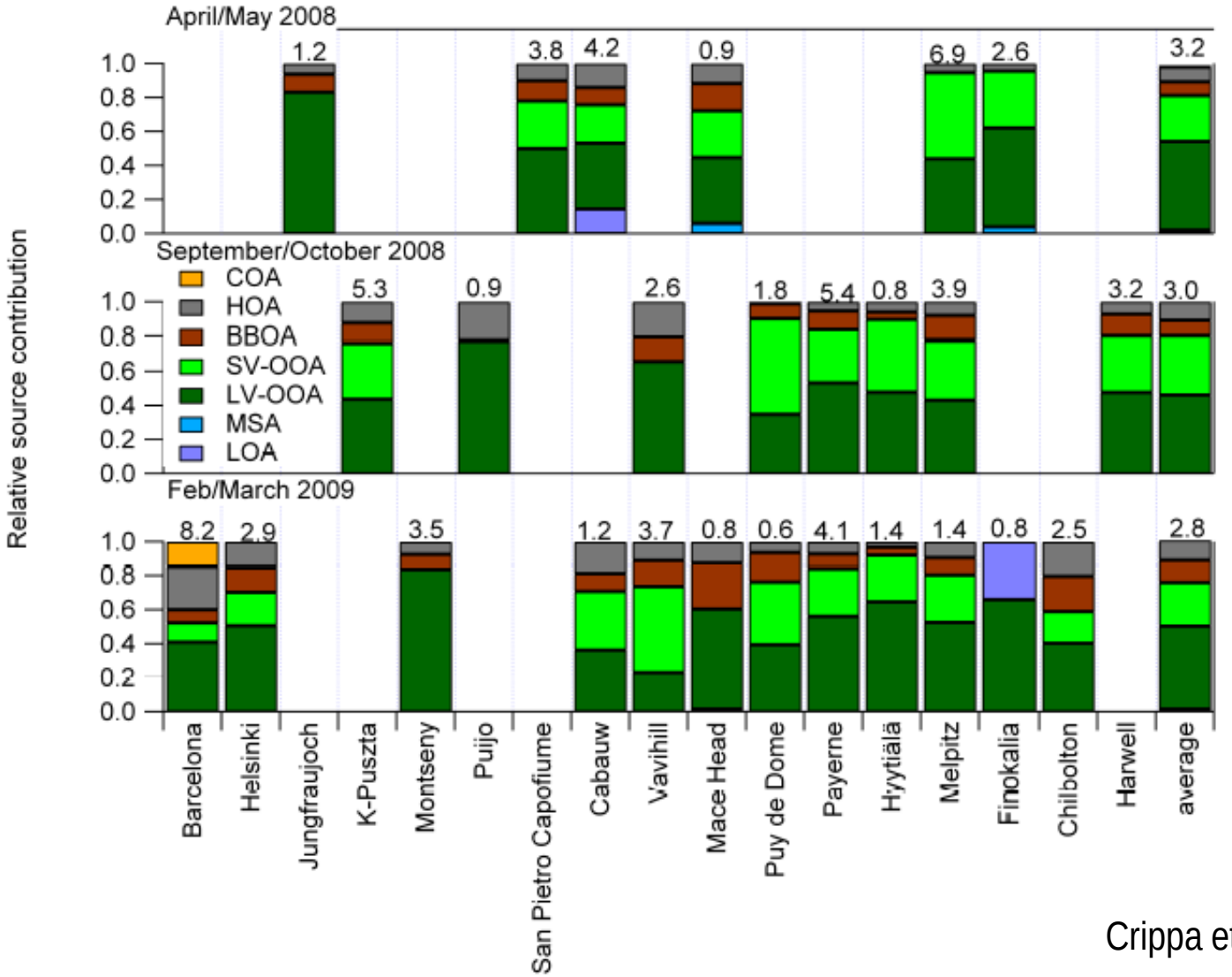


This year we had two workshops with a total of around 60 people from all around the world, mostly Europe and ACTRIS related

Important here:
This tool is not only for aerosol mass spectrometer data but also for classic data sets. Lots of convenient plots are available.

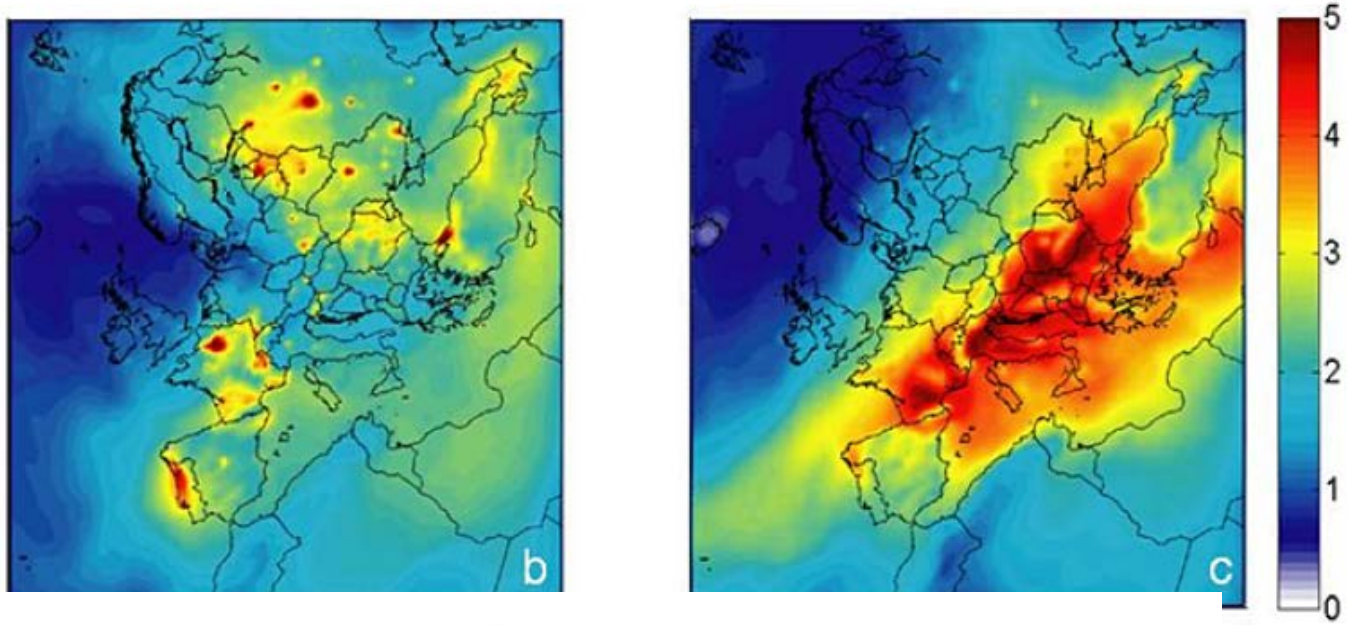
There is a free version although a user fee is being discussed to be able to update the tool with additional features. At the moment we ask to be involved in the first one or two research applications/publications.

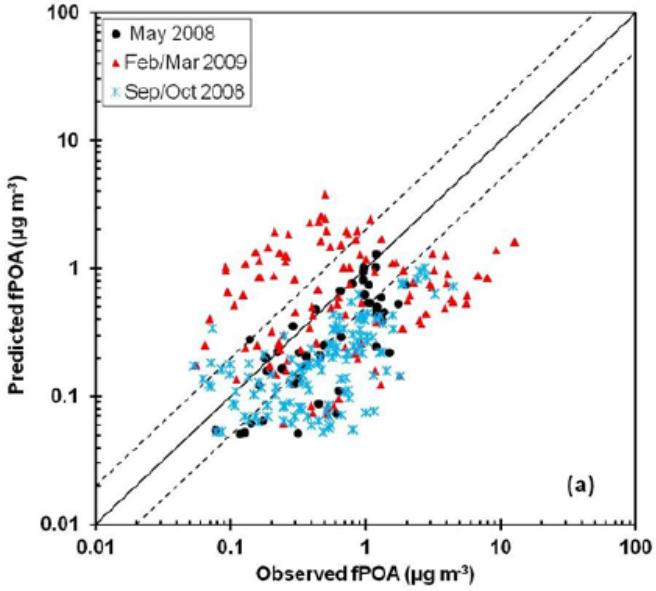
Overview of relative organic aerosol sources (1 month data)

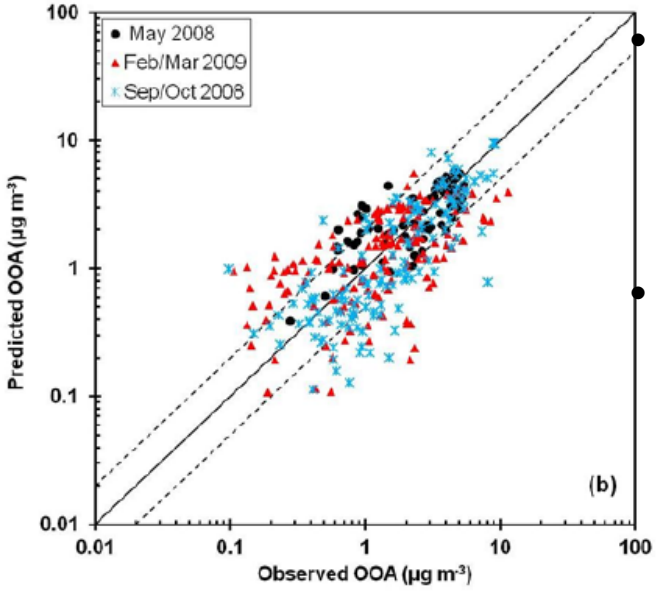


Crippa et al.,, ACP, 2014

First model evaluations for organic aerosols



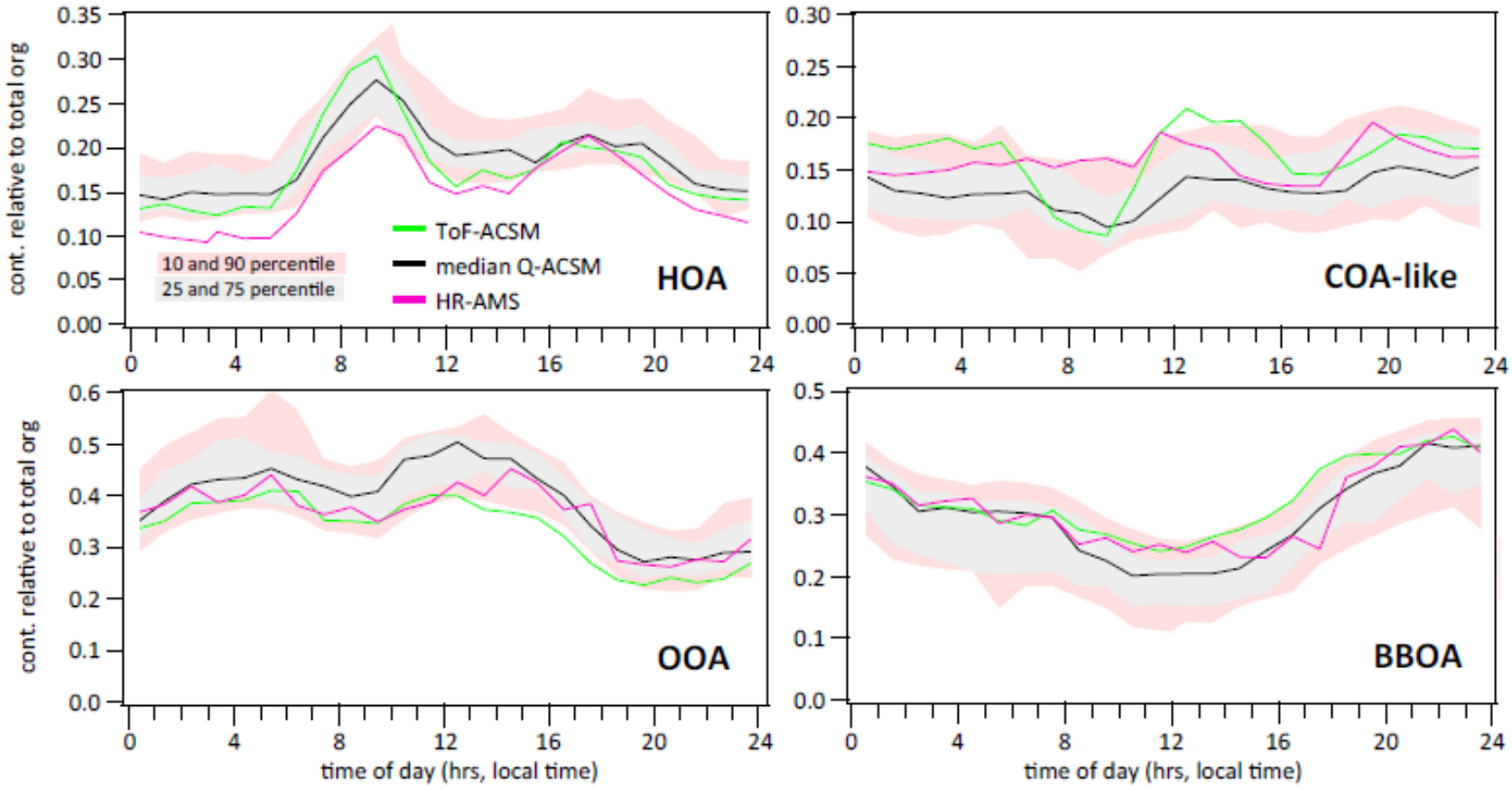




- VBS type models clearly more successful to model organic aerosols
- Most models in EURODELTA underestimate organics, especially SOA

Fountoukis et al., ACP, 2014

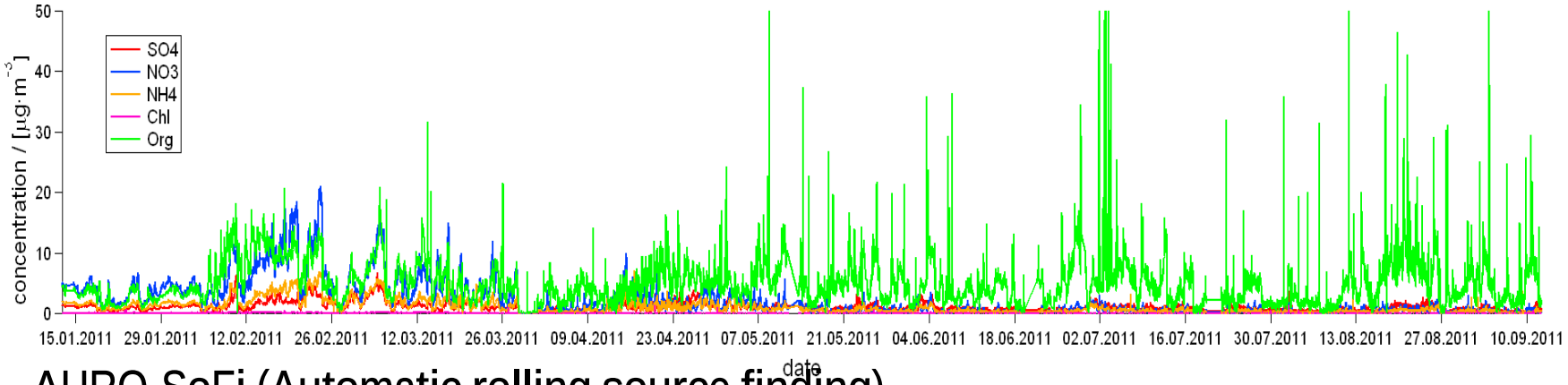
Comparison exercise near Paris



Froehlich et al., AMTD, 2015 .. Accepted for AMT .. Watch out this or next week

FULL YEAR datasets

Methods to analyze a full year is still under development.



AURO-SoFi (Automatic rolling source finding)

Perform source apportionment with ME-2 over 1-2 months periods and roll this window with a step of e.g. one day around the year or around daily temperature sorted data. PMF/ME-2 over the whole year clearly have limitations because different SOAs do not unmix easily.

One performs for each time window around 100 ME-2 runs with different constraints (e.g. fixing a traffic organic aerosol factor at different degrees) and chooses the best solutions according to chosen criteria (e.g. cooking peak at noon, correlations of traffic organics with NOx)

One keeps several results for the same day which allows to assess the uncertainty.

FUTURE

- FIRST OVERVIEW SOURCE APPORTIONMENT PAPER led by PSI: submission mid-2016 to end 2016 (optimistic)

- Another phase of EURODELTA or similar model evaluation exercises. Important: Opportunity for development and assessment of Volatility Basis Set or other modern schemes for organic aerosols

- Also more coordinated future measurements within ACTRIS 2 and hopefully COST action

- Combination with equivalent black carbon measurements would be very useful (ideally multi-wavelength to distinguish traffic from wood burning)

IDEAL FUTURE CAMPAIGN

- COMBINATION OF THE ACSM data sets with off-line analyses of organic markers, off-line AMS and other methods over full years. This could also be done for twin sites (rural/urban)

Combination of new and classic off-line methods

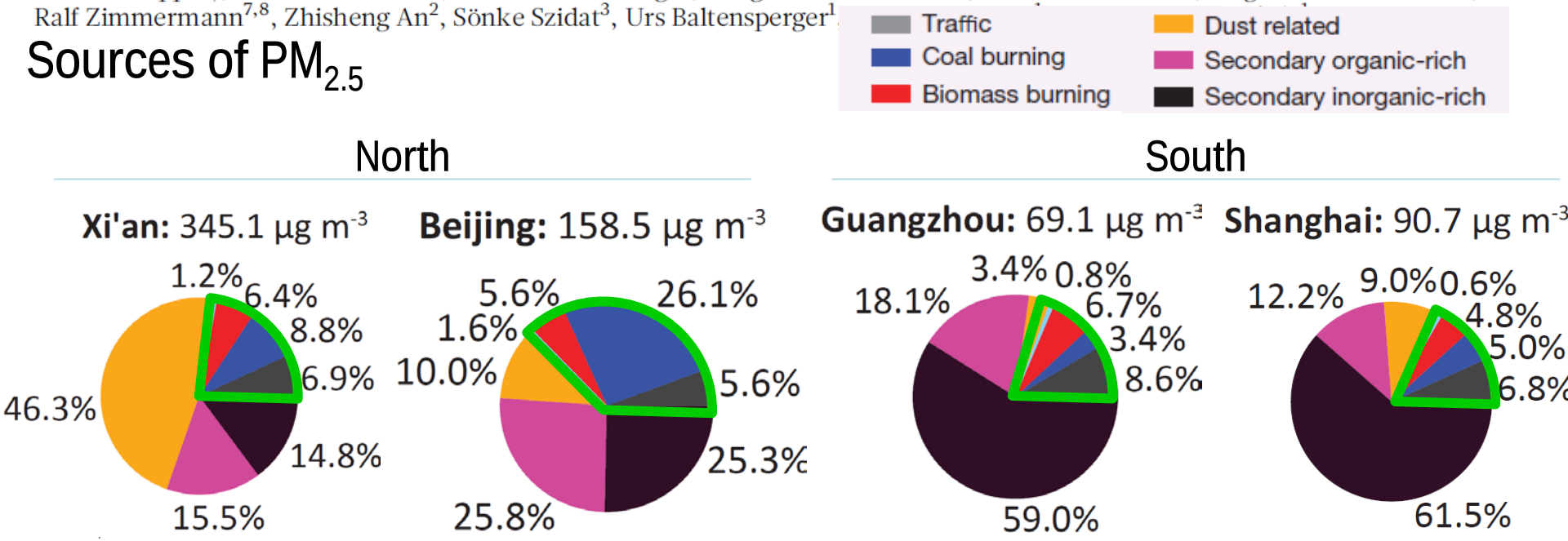
LETTER

doi:10.1038/nature13774

High secondary aerosol contribution to particulate pollution during haze events in China

Ru-Jin Huang[1,2]*, Yanlin Zhang[3,4], Carlo Bozzetti[1], Kin-Fai Ho[5], Jun-Ji Cao[2], Yongming Han[2], Kaspar R. Daellenbach[1], Jay G. Slowik[1], Stephen M. Platt[1], Francesco Canonaco[1], Peter Zotter[1], Robert Wolf[1], Simone M. Pieber[1], Emily A. Bruns[1], Monica Crippa[1]†, Giancarlo Ciarelli[1], Andrea Piazzalunga[6], Margit Schwikowski[3,4], Gülcin Abbaszade[7], Jürgen Schnelle-Kreis[7], Ralf Zimmermann[7,8], Zhisheng An[2], Sönke Szidat[3], Urs Baltensperger[1]

Sources of $PM_{2.5}$



IDEAL FUTURE CAMPAIGN to address organics

- COMBINATION OF THE ACSM data sets with off-line analyses of organic markers, off-line AMS and other methods over full years to cover much more of Europe. This could also be done for twin sites (rural/urban).

- Necessary funding per station (100 Hi-Vol filters across the year): around 20’000-30’000 Euros per station and year

To be considered in any case: Freeze Hi-Vol-Filters over longer term for future analyses.