Organic source apportionment with the ACSM – SoFi tool and intercomparison

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and the ACTRIS-ACSM community

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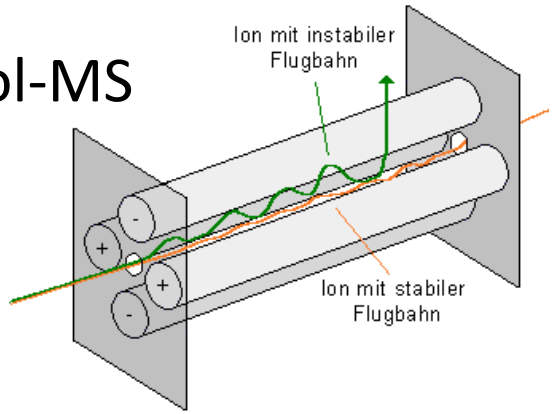
ACSM - mode of operation

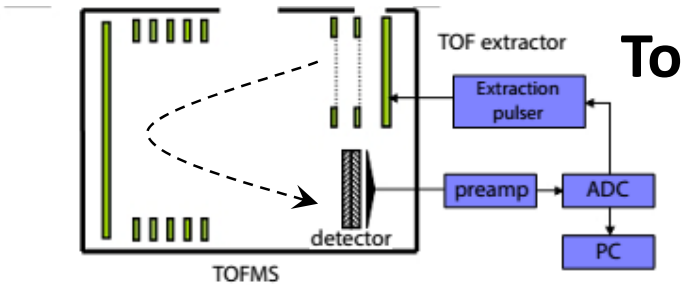
Quad-ACSM

Quadrupol-MS

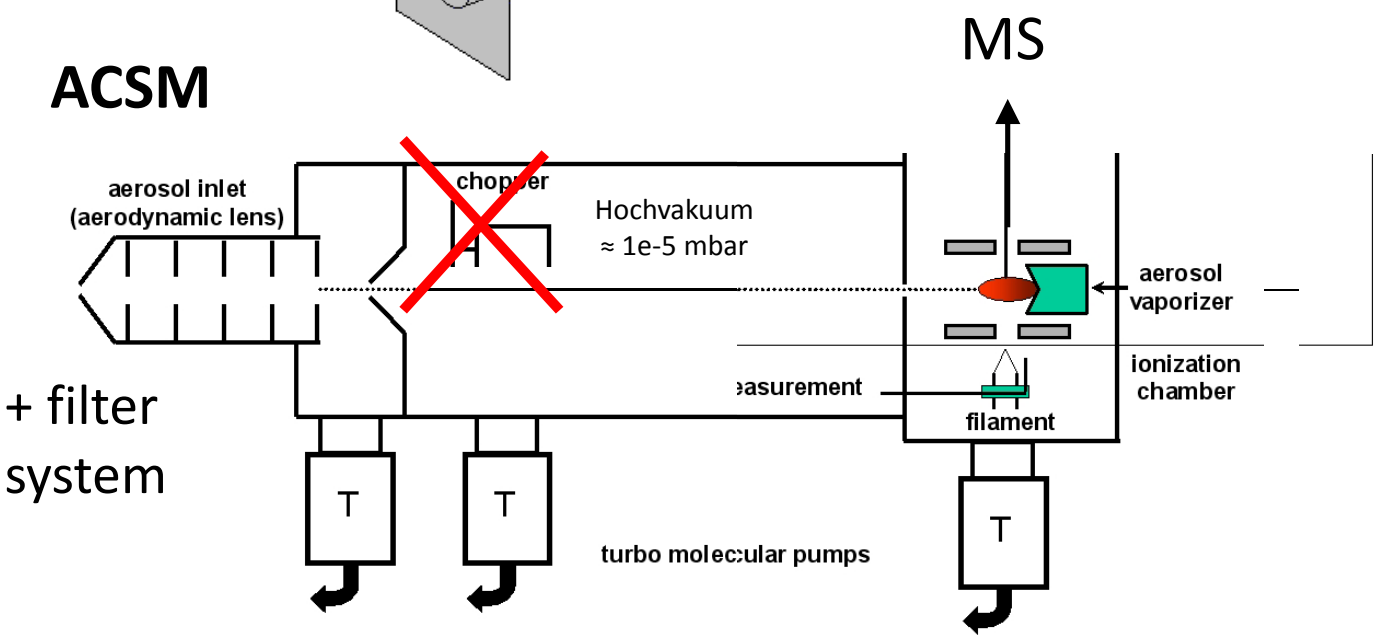


ToF-ACSM

ToF-MS



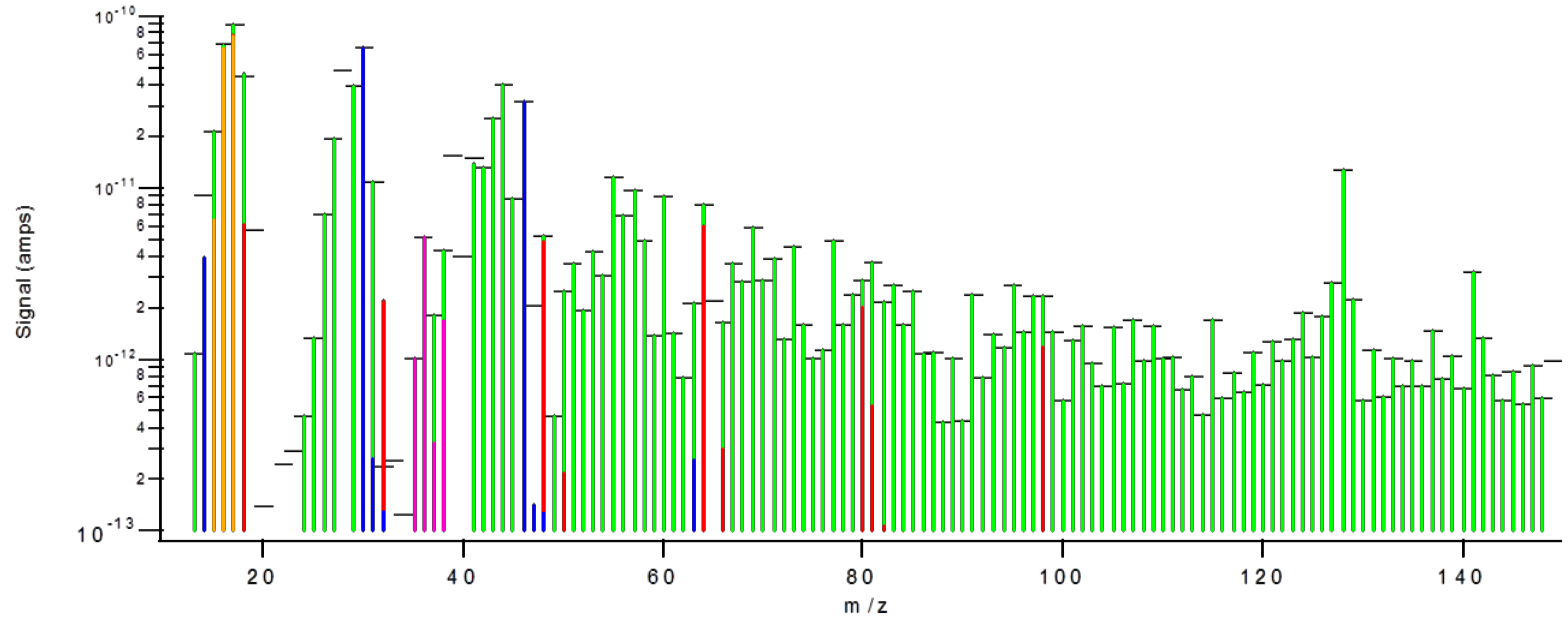
ACSM



+ filter system

Aerodynamic lens → Vaporizer → Ionizer → Mass spectrometer

Stick mass spectrum



- Time resolution: at least 30 minutes

ACTRIS ACSM network - I

> 20 locations where ACSM were/are measuring

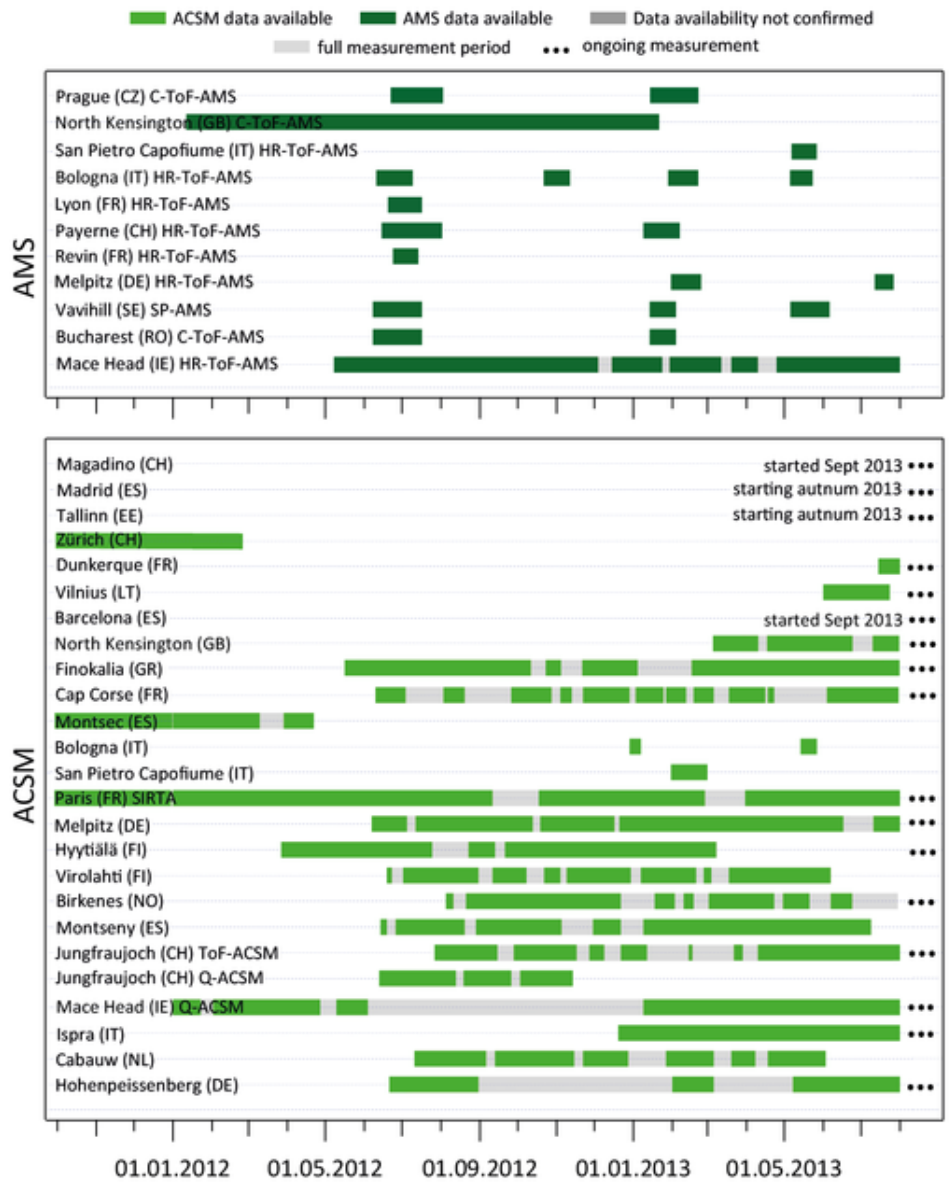
Mostly long-term deployments of at least 12 months

Coordinated operation with regular subgroup meetings

Additional datasets from AMS campaigns (EMEP)

Biggest coordinated ACSM measurement worldwide!

ACTRIS ACSM network - II



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

Overview paper
in prep. by Bressi et al.

Intercomparison at SIRTA near Paris

15 instruments were intercompared during 2 weeks

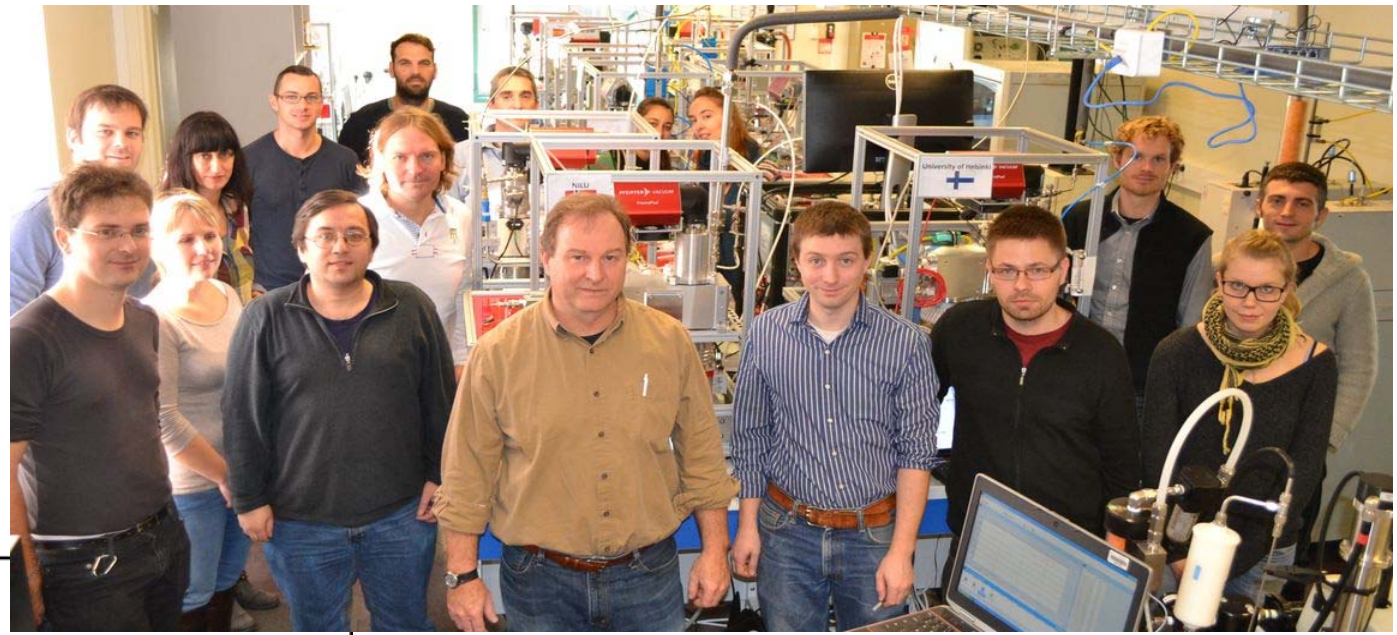
(13 ACSMs, one AMS, one ToF-ACSM)

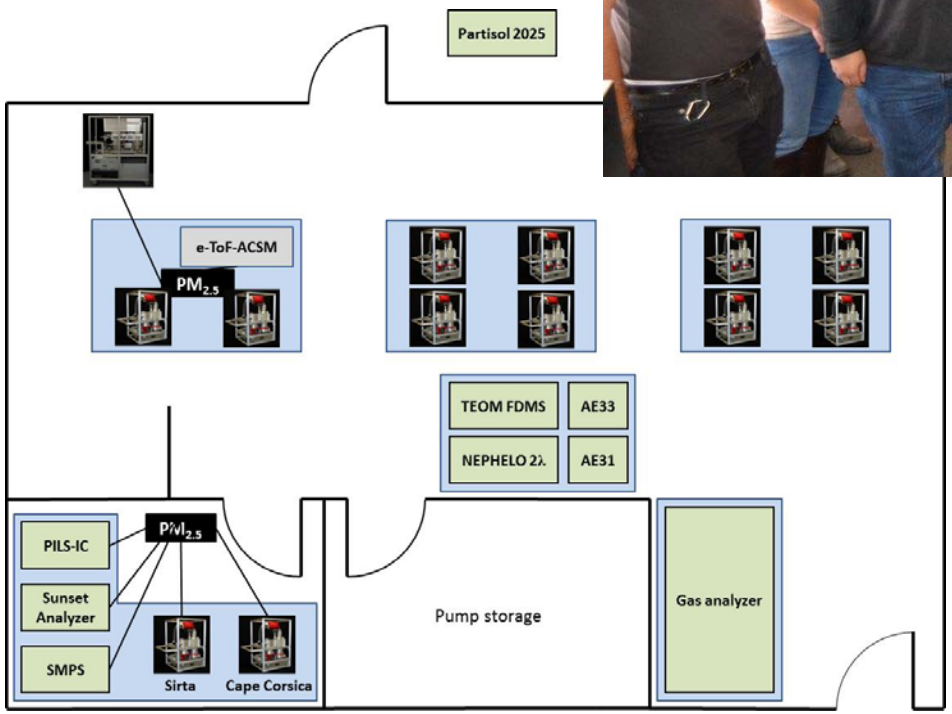
ACSM ID	ACSM type	Station ID of ACSM location	Laboratory	Country
A140-104	Q-ACSM	Hyytiälä	University of Helsinki	Finland
A140-110	Q-ACSM	Montseny	IDAEA-CSIC	Spain
A140-113	Q-ACSM	Sirta	LSCE	France
A140-133	Q-ACSM	Mace Head	NUIG	Ireland
A140-134	Q-ACSM	Hohenpeissenberg	DWD	Germany
A140-142	Q-ACSM	Cape Corsica	LSCE	France
A140-143	Q-ACSM	Melpitz	TROPOS	Germany
A140-144	Q-ACSM	Birkenes	NILU	Norway
A140-145	Q-ACSM	Cabauw	PSI	Switzerland
A140-151	Q-ACSM	Ispra	ENEA	Italy
A140-152	Q-ACSM	Bologna	ISAC-CNR	Italy
A140-153	Q-ACSM	Madrid	CIEMAT	Spain
A140-156	Q-ACSM	North Kensington	King's College	UK
A003	ToF-ACSM	Jungfraujoch	PSI	Switzerland

Intercomparison at SIRTA near Paris

Organized by:

J. Sciare, LSCE
V. Crenn, LSCE
O. Favez, INERIS



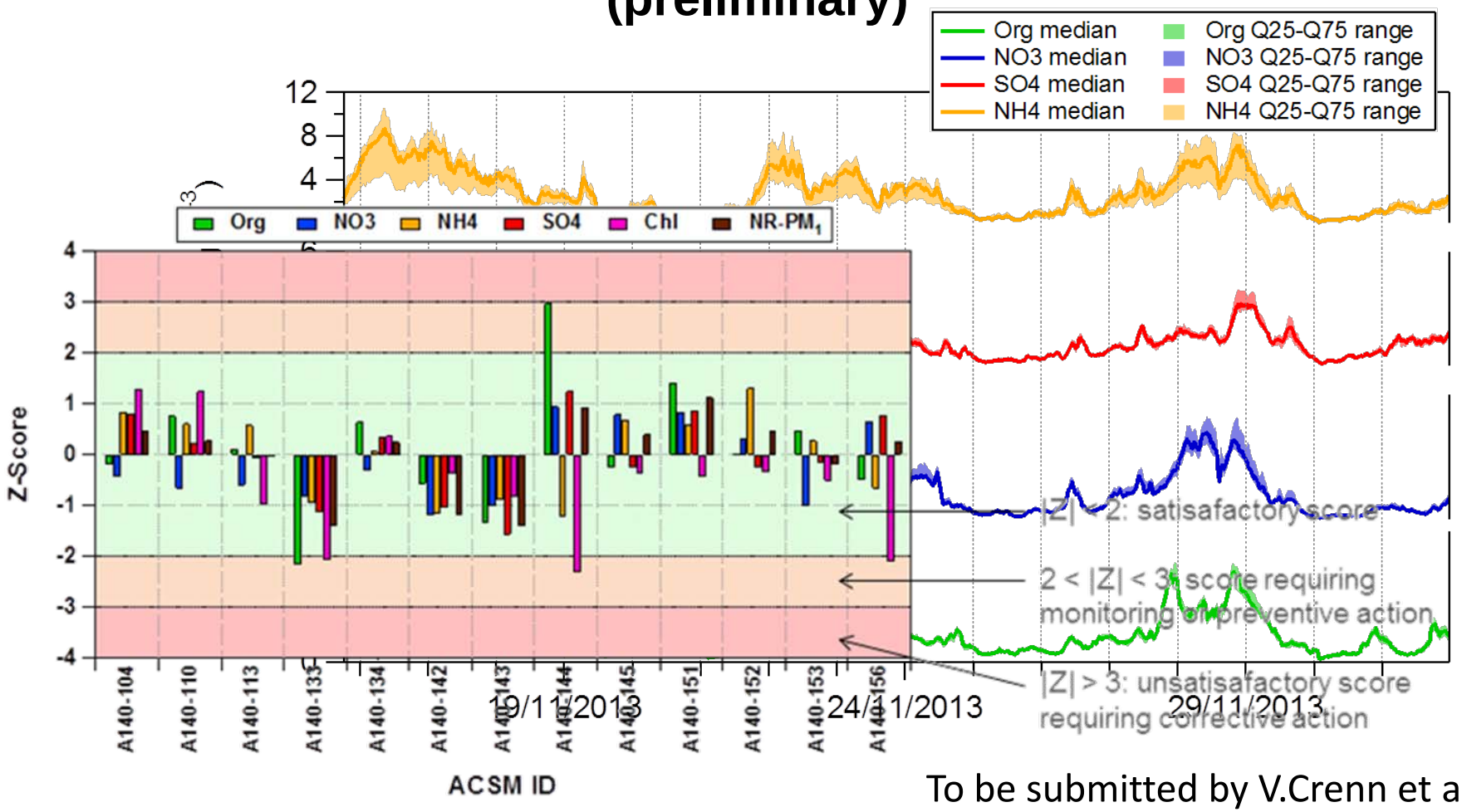


3 groups of 4 ACSMs — common $PM_{2.5}$ inlet / group
One dryer / ACSM

1SMPS (INERIS) qualified by TROPOS (ACTRIS intercomparison Sept. 2013)

➢ Co-located instruments
TEOM-FDMS (PM1), SMPS (PM1), PILS-IC (PM1), PILS-MS (PM1), OCEC Sunset Inst. (PM1), PARTISOL (PM1), NEPHELOMETER (PM1) AETHALOMETER (PM1), PTR-MS

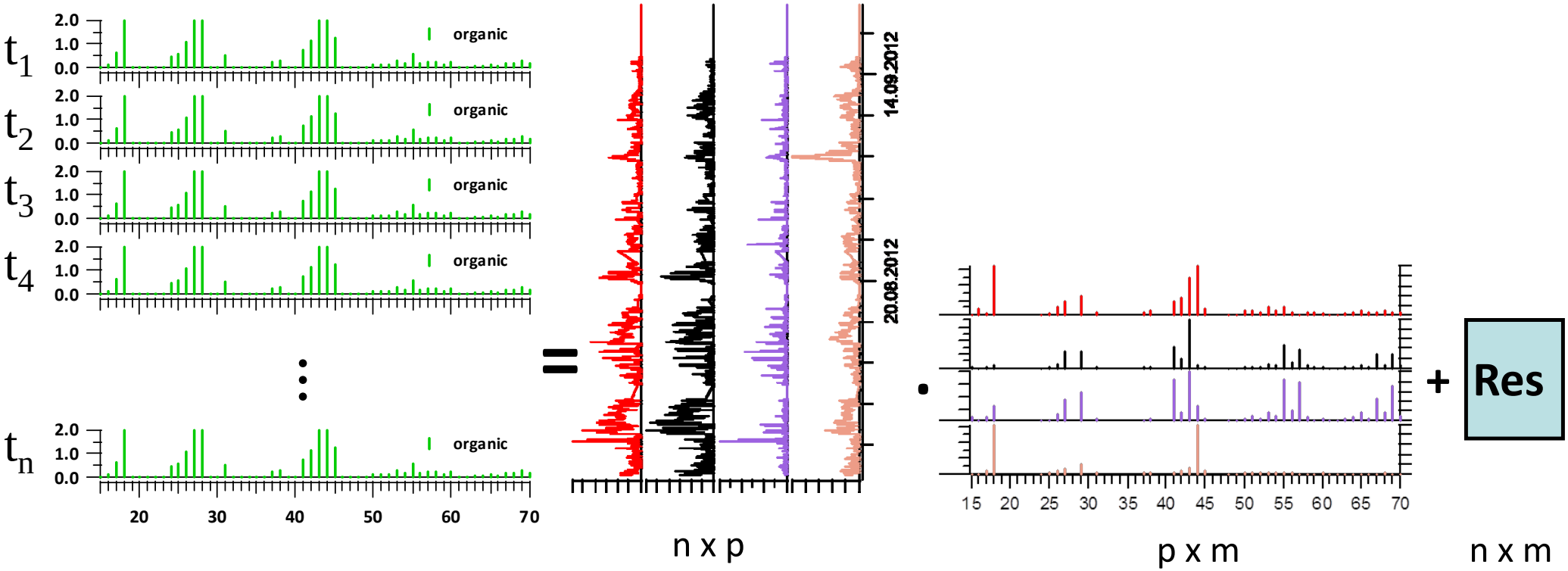
Intercomparison at Paris (15 instruments)
Comparison of concentrations without outliers (preliminary)



To be submitted by V.Crenn et al.

PMF/ME-2 source apportionment

PMF basics:



ACSM output: organics

UMR *n* x *m* matrix

n: # spectra (e.g. every 30 min)

m: m/Q

Factorization into

p factors (sources)

In this case: p = 4

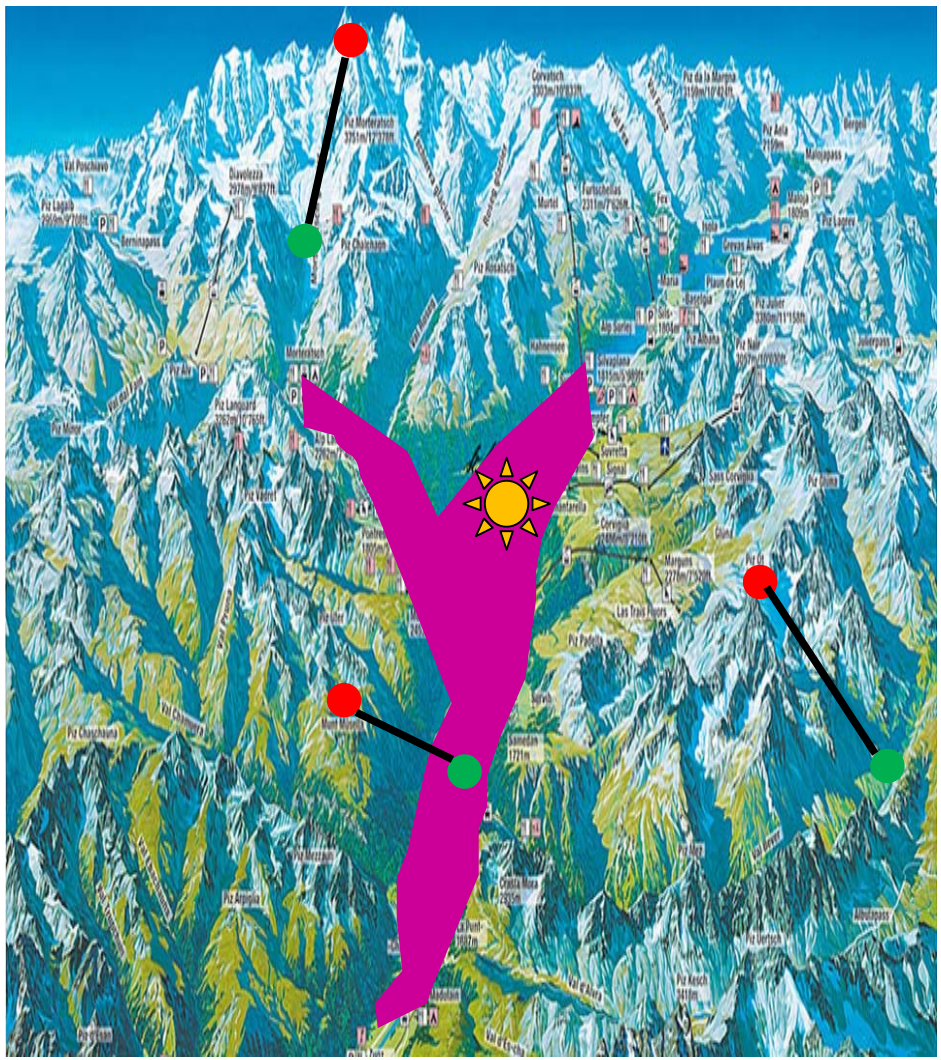
PMF/ME-2 source apportionment

- For illustration: Residual Q = h(x,y) on a map
- PMF algorithm minimizes Q following the steepest descent (from red to the green point) -> different starting points (seeds)
- Goal is to find the smallest possible Q-value (global minimum) (violet area)

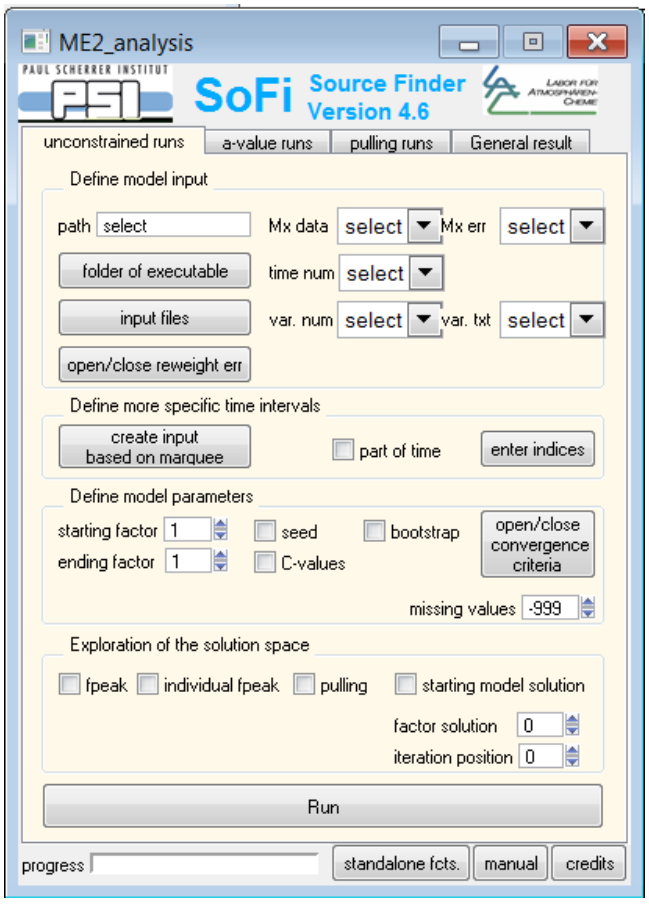
- "true" solution: ☀

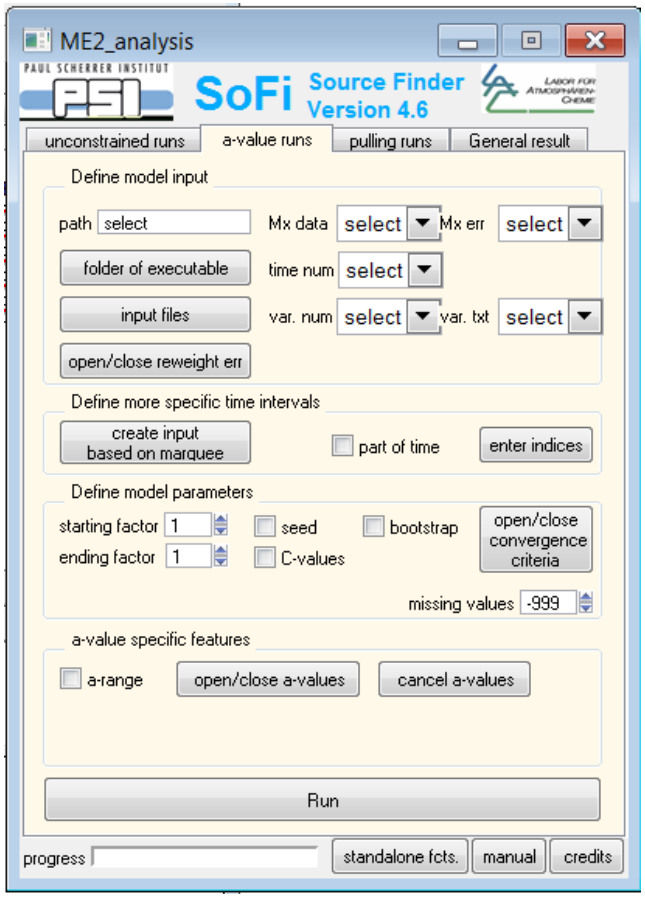
- There are many points on the map, for which h(x,y) is equal ➔ rotational ambiguity

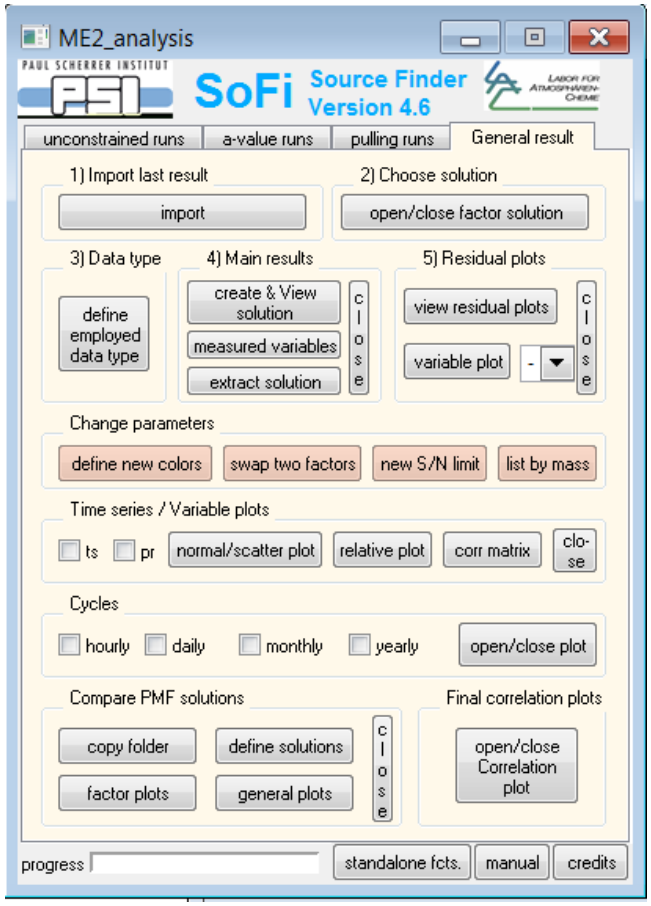
Explore the rotational ambiguity,
e.g. with **ME2**



ME-2 – SoFi Panel



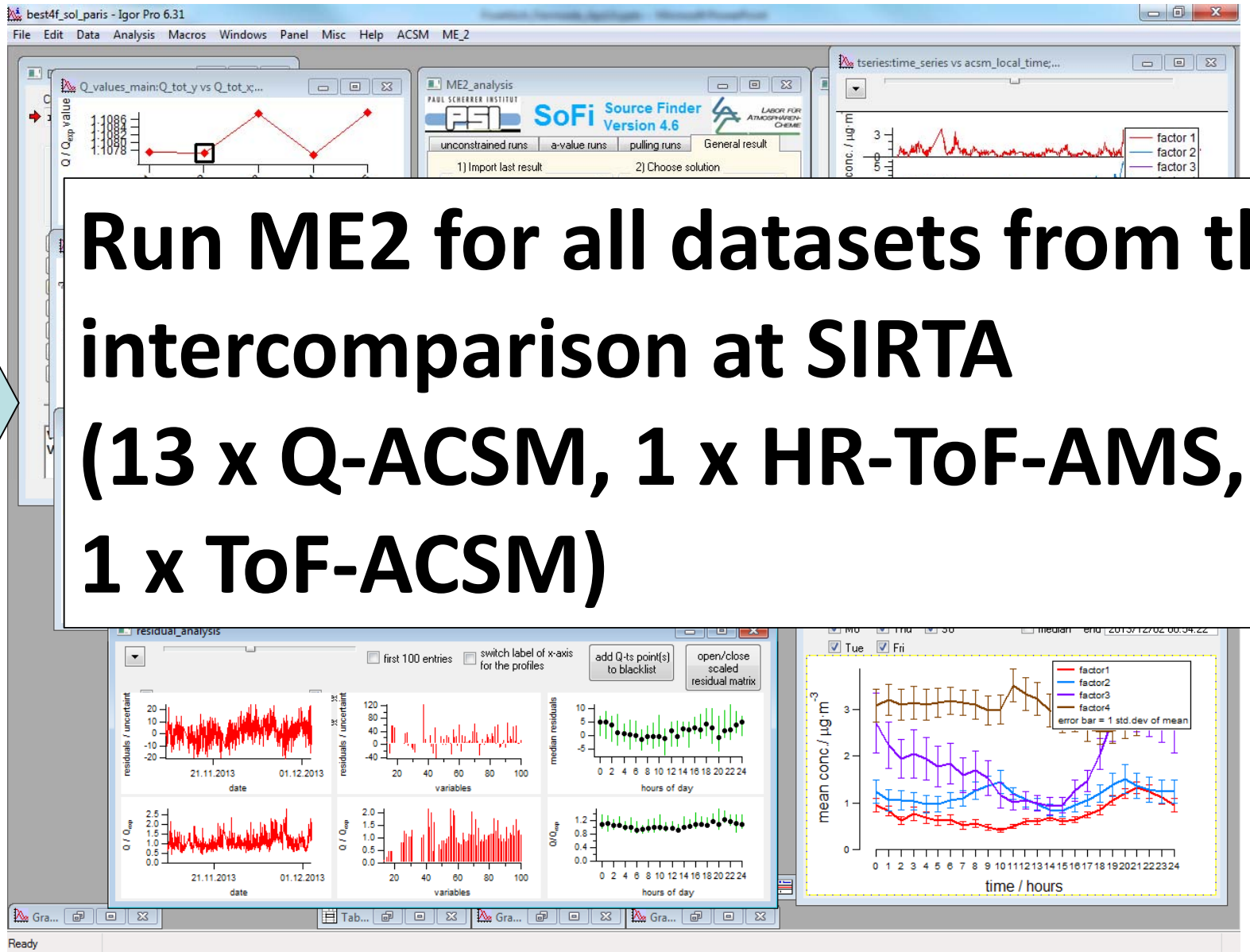




SoFi = Source Finder: http://psi.ch/hgdp

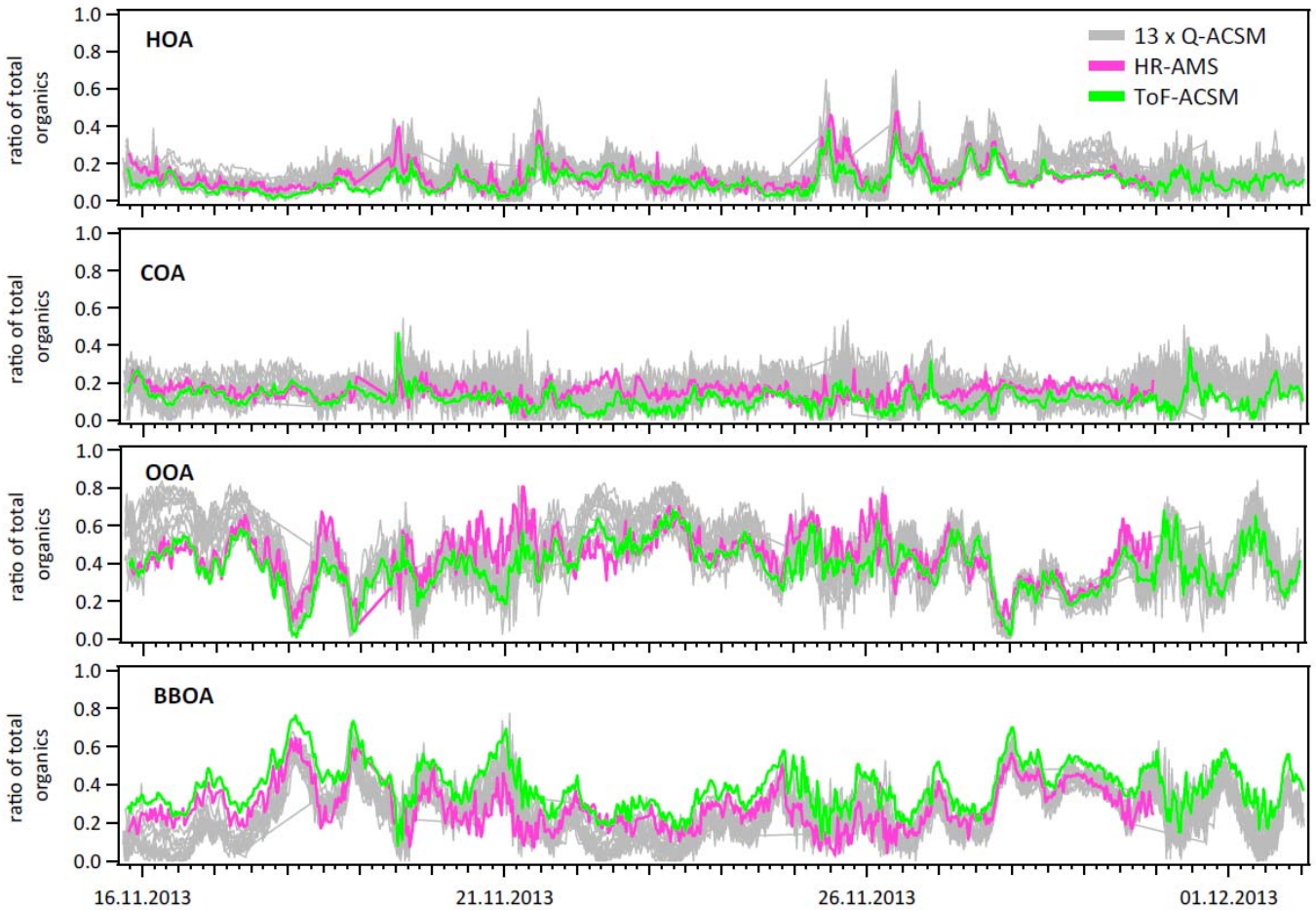
Canonaco et al., AMT 2013

ME-2 – SoFi Panel



Run ME2 for all datasets from the intercomparison at SIRTA (13 x Q-ACSM, 1 x HR-ToF-AMS, 1 x ToF-ACSM)

ME-2 – Intercomparison with Paris dataset



preliminary

4 Factors -> sources identified

HOA: Hydrocarbon-like OA

COA: Cooking-like OA

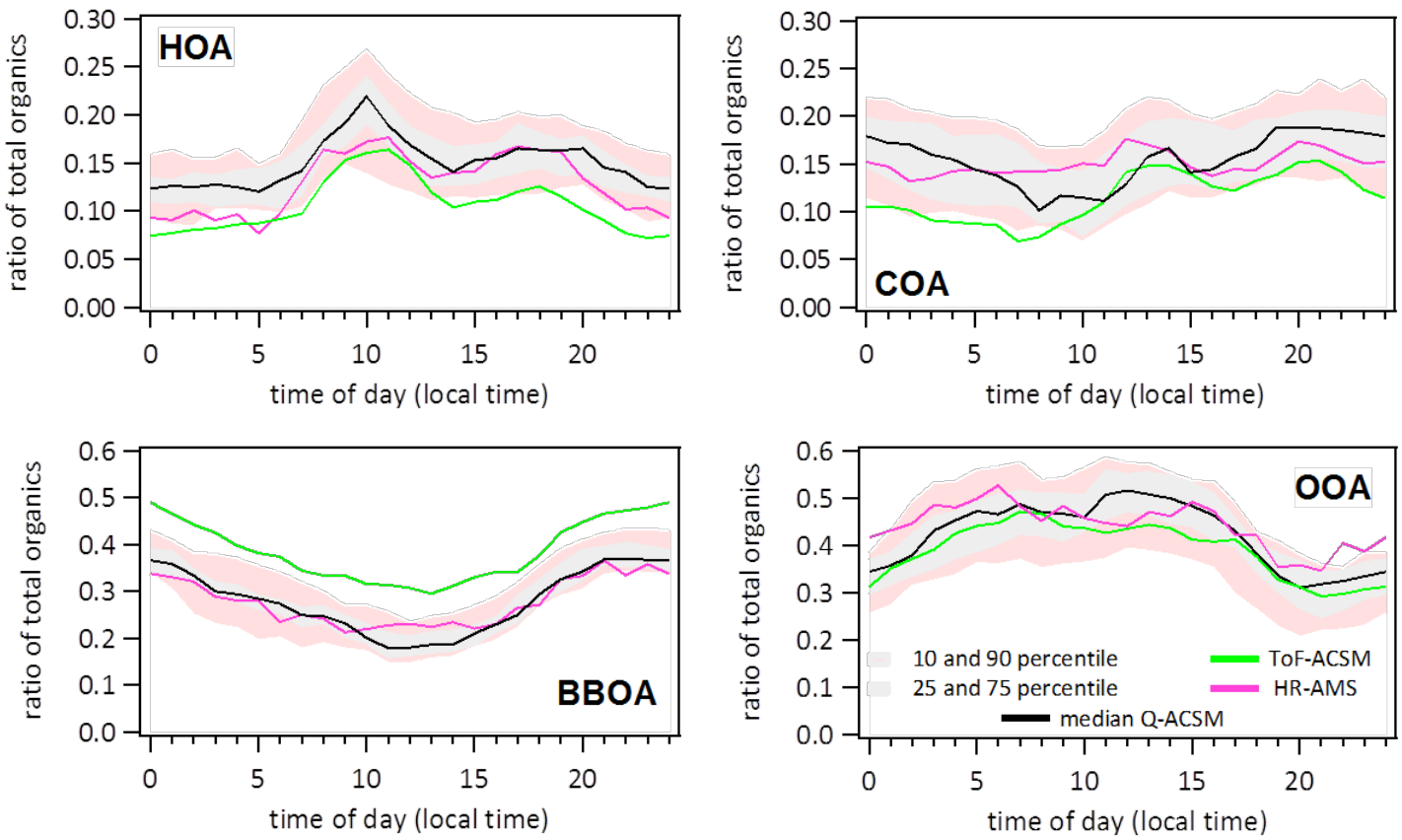
BBOA: Biomass burning-like OA

OOA: Oxygenated OA (secondary)

ME-2 – Intercomparison with Paris dataset

4-Factor solution: diurnals

preliminary



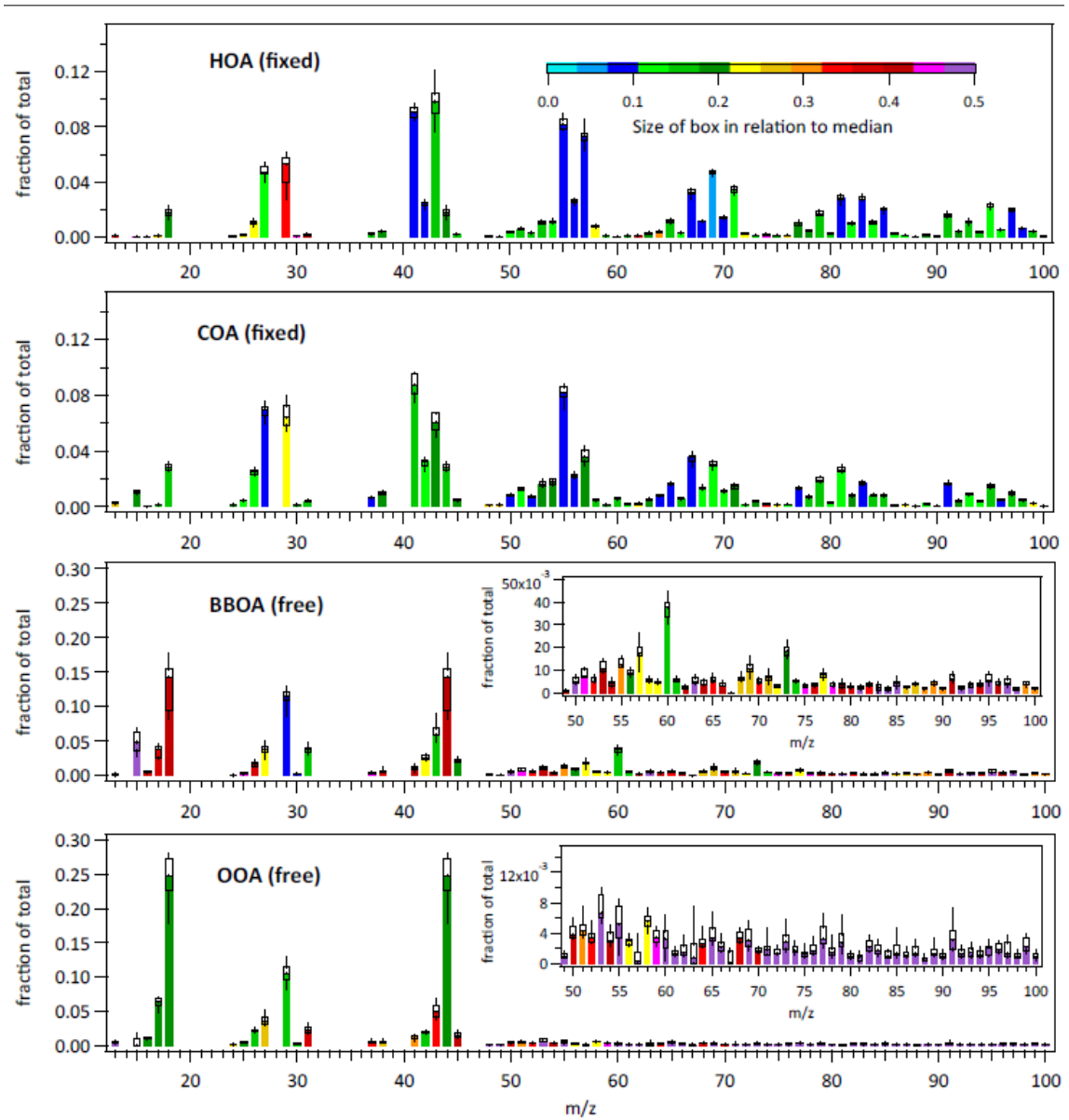
+ correlations to tracers

HOA: Hydrocarbon-like OA

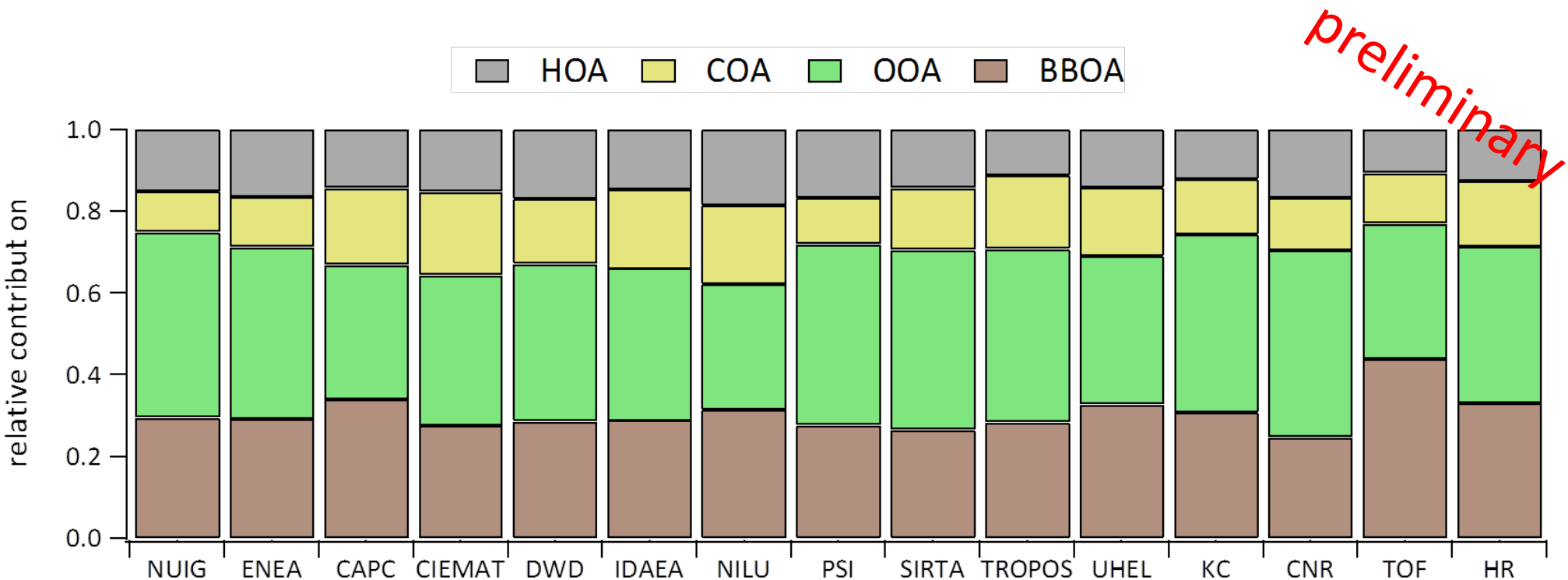
COA: Cooking-like OA

BBOA: Biomass burning-like OA

OOA: Oxygenated OA (secondary)



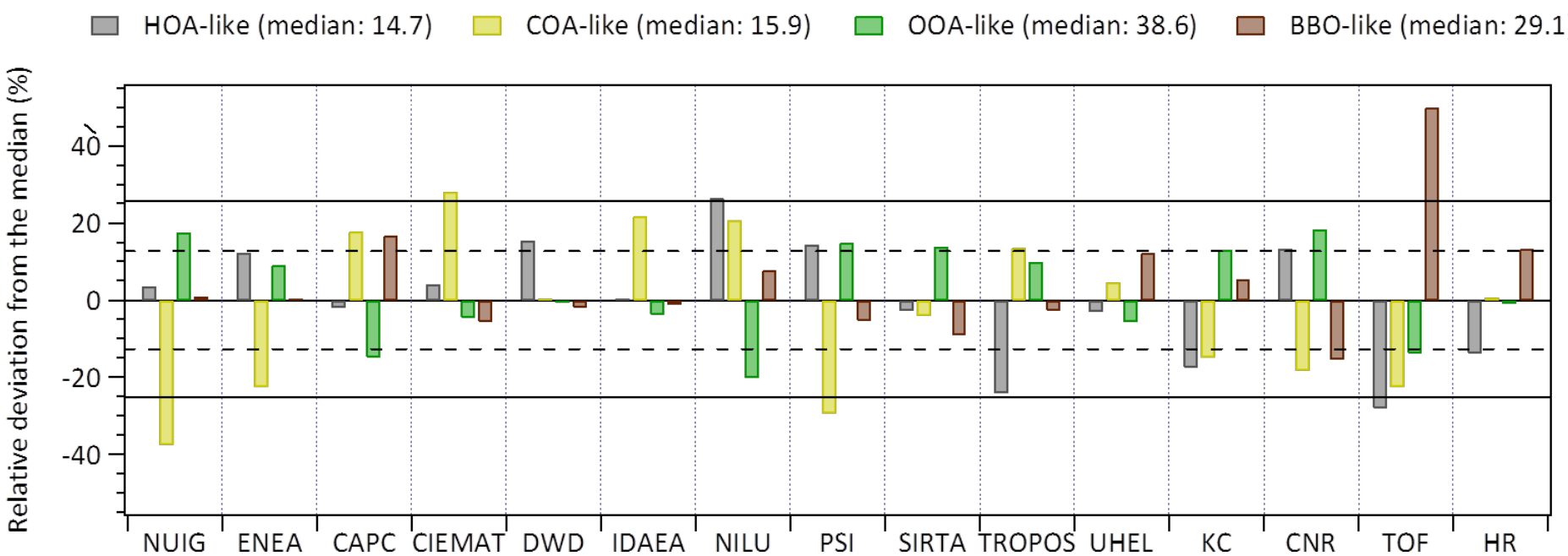
preliminary



	HOA	COA	BBOA	OOA
Average cont. +/- sdev (%)	14.9 +/- 2.3	15.8 +/- 3.3	30.7 +/- 4.5	39.7 +/- 4.5

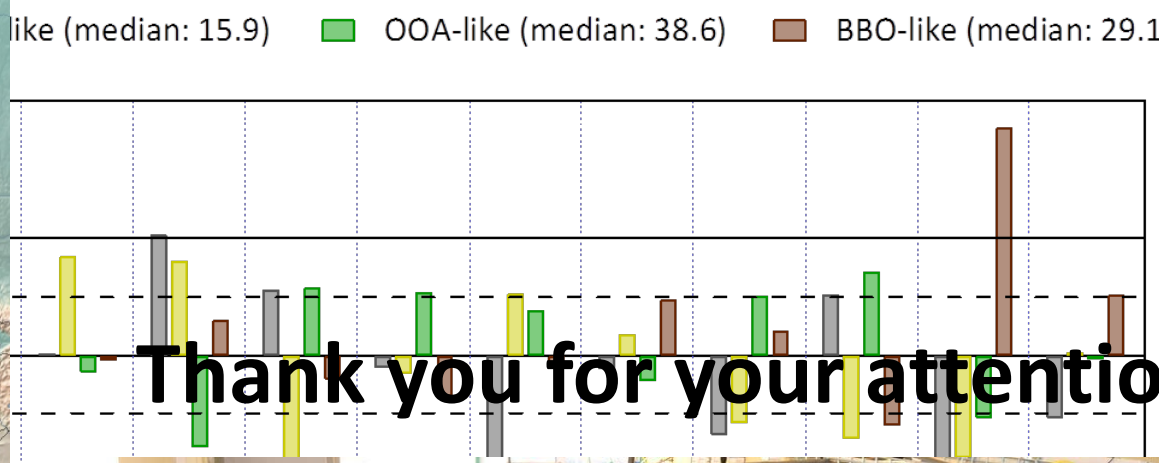
ME-2 – Intercomparison with Paris dataset

preliminary

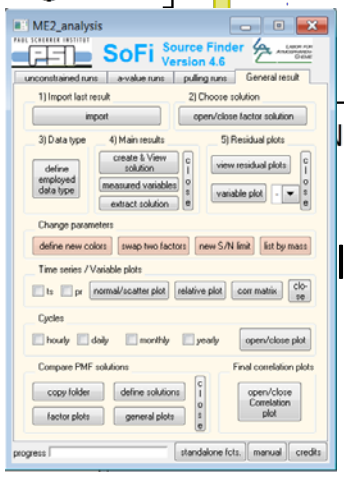


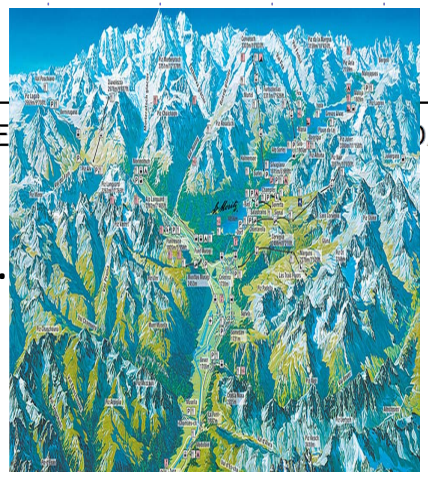
Fröhlich et al. to be submitted

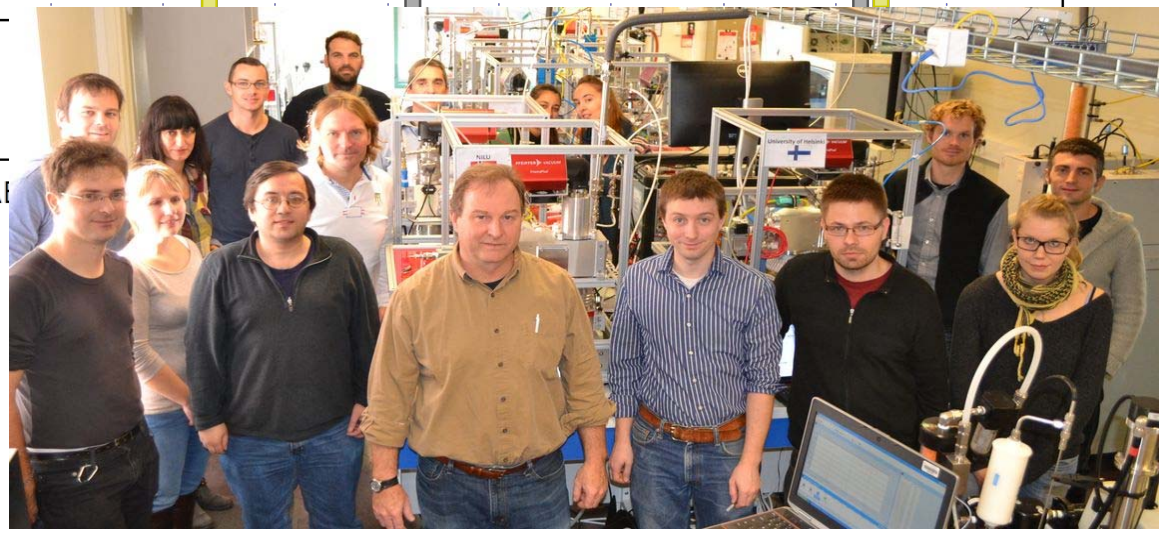
Summary



Thank you for your attention







ME-2 – Intercomparison with Paris dataset