Comparison between 2 ACSMs during a 2-months summer period at the JRC-Ispra site (Italy)

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1. Introduction

Why to perform a comparison between 2 ACSMs?

http://www.psi.ch/acsm-stations/acsm-and-emep-stations

Which are the main ACSM parameters that will influence the comparability of data?

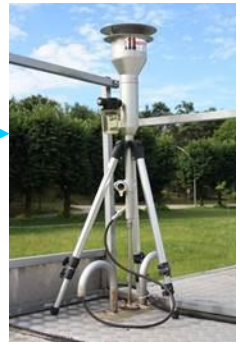
2. Experimental

2.1 Site description

Site Location

Experimental setup

20 June 2013 →
18 August 2013



PM_{10}

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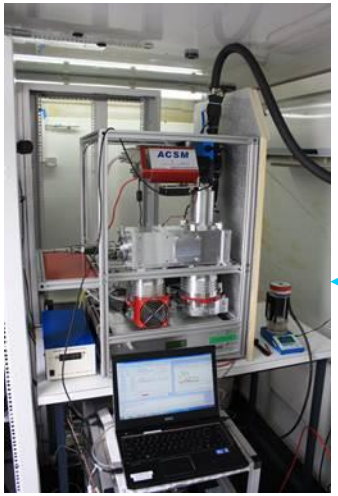

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2.2 Instruments description

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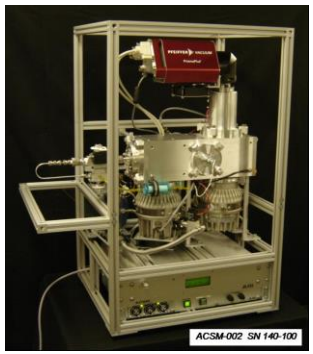

Q-ACSM
SN-140-105
2010

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Q-ACSM
SN-140-151
2012

Main advantage

Stability
(e.g. Airbeam signal)

RH monitored

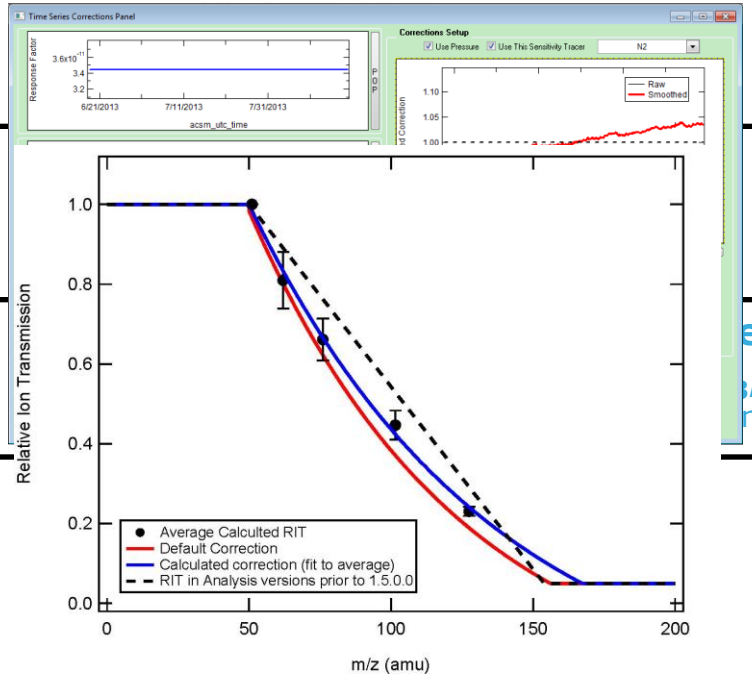
2.3 Calibration, tuning and corrections

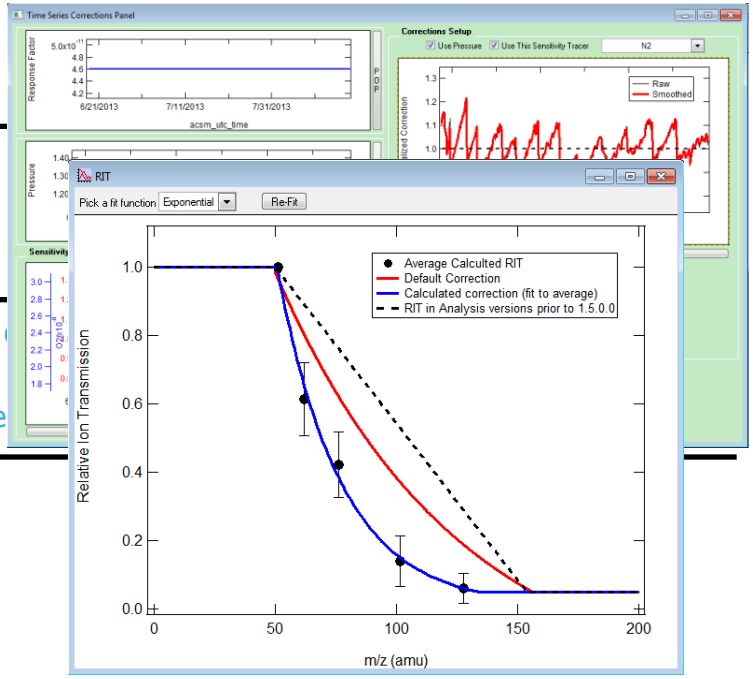
ACSMs

Ammonium Nitrate calibrations

CE, RIEs

Time series correction





Ion transmission correction (ITC)

Close to the default correction

Substantial discrepancies

3. Results

3.1 ENEA versus PSI Q-ACSM

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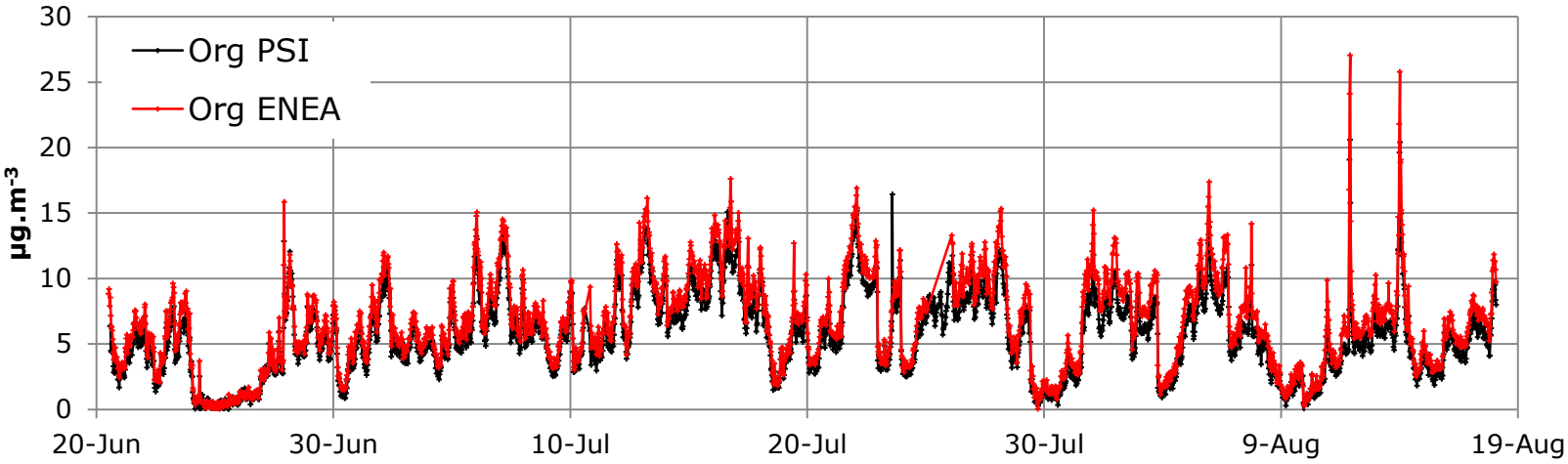
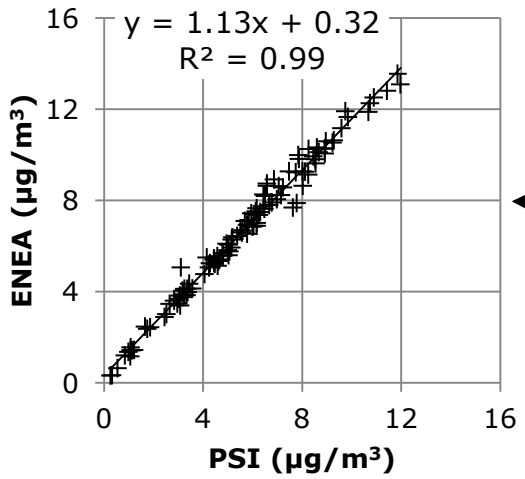
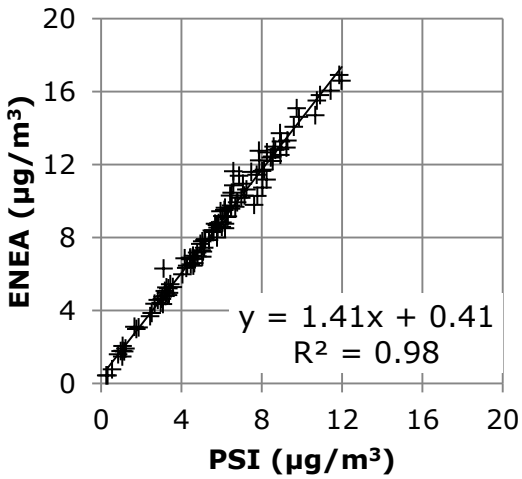
Note: Org ENEA plotted with the default Ion Transmission Correction (ITC) on this graph



Default ITC



12h averaged data
(n=116)



Experimental ITC

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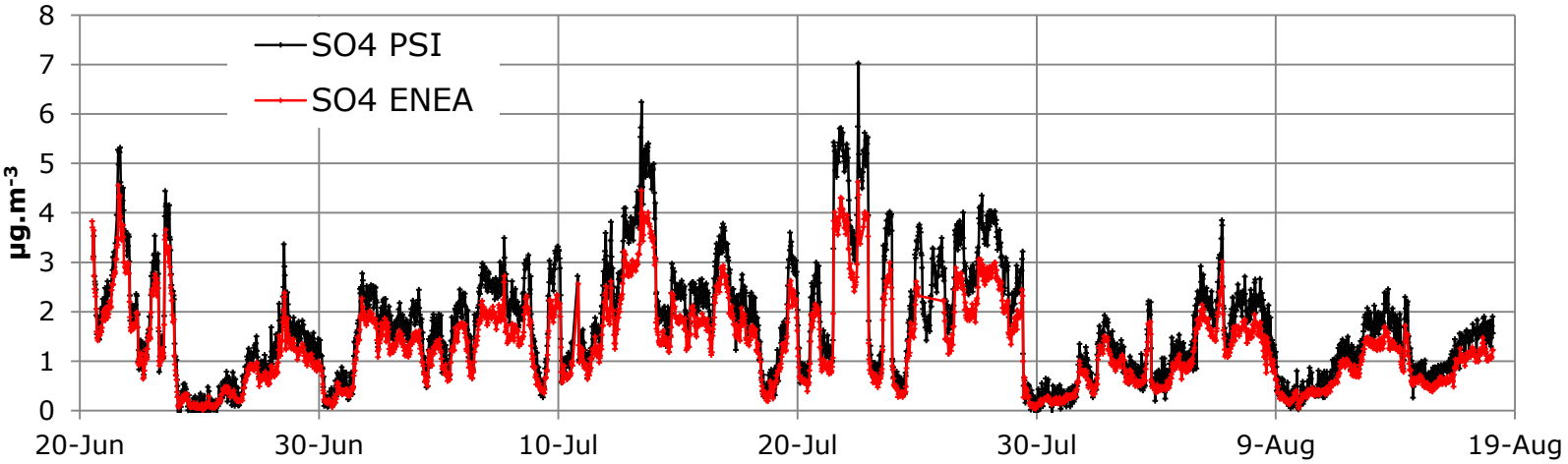
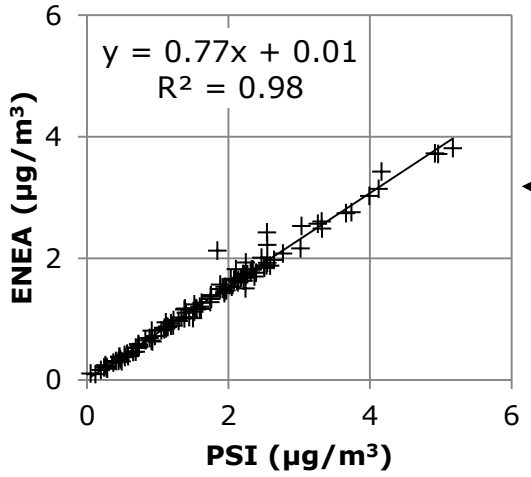
SULFATE

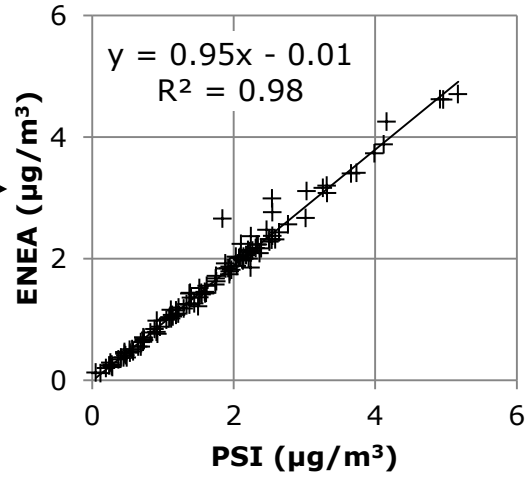
Note: SO_4 ENEA plotted with the default Ion Transmission Correction (ITC) on this graph



Default ITC



12h averaged data
(n=116)



Experimental ITC

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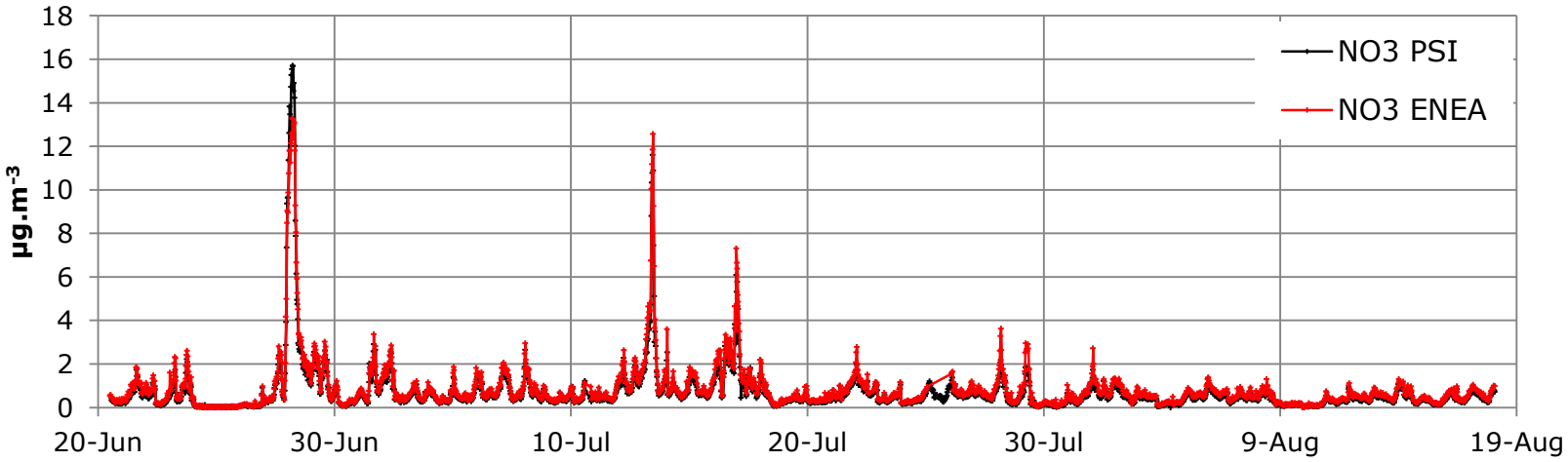
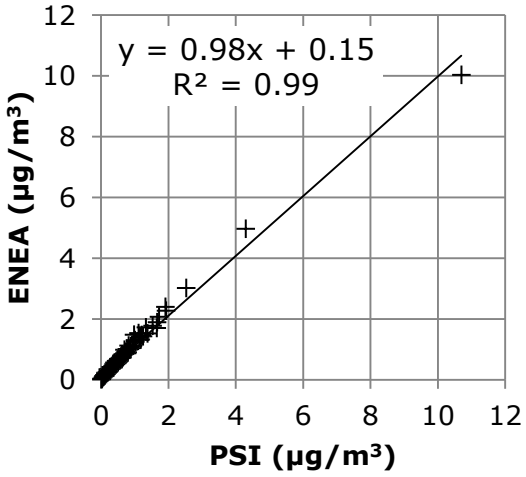
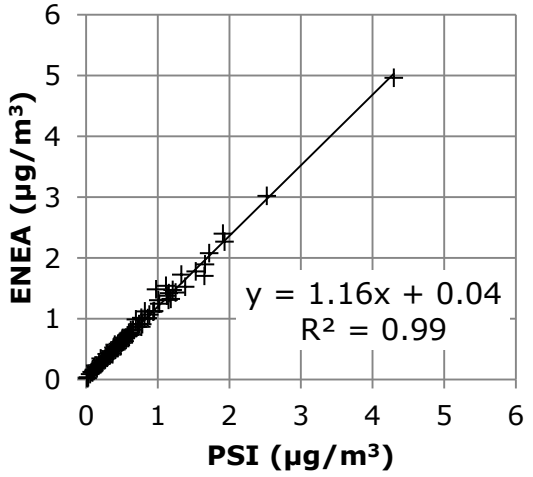
NITRATE



Including all data points



12h averaged data
(n=116)



Excluding 28 June 12pm

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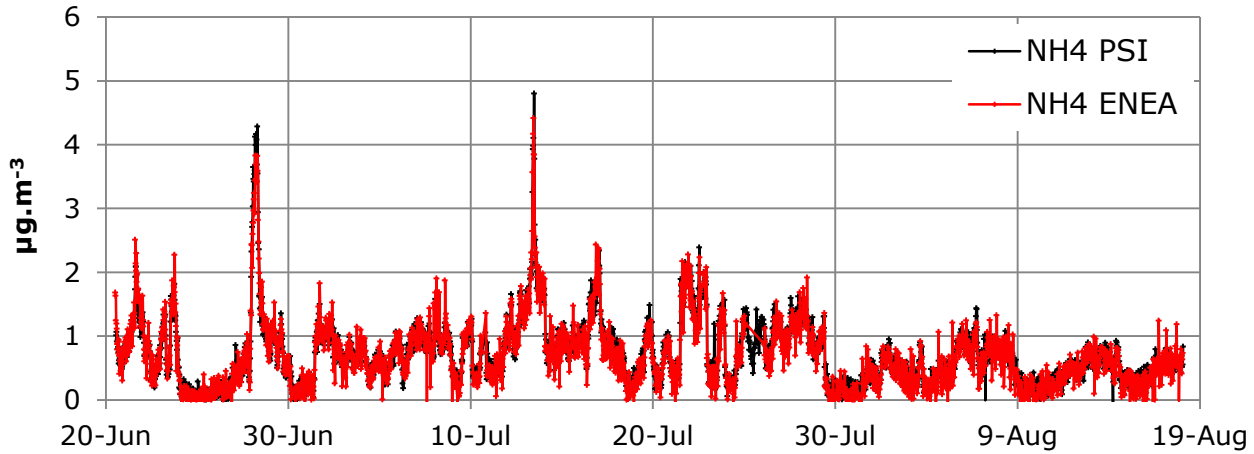
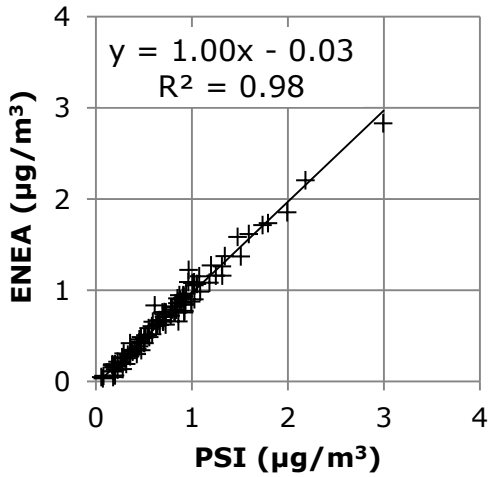
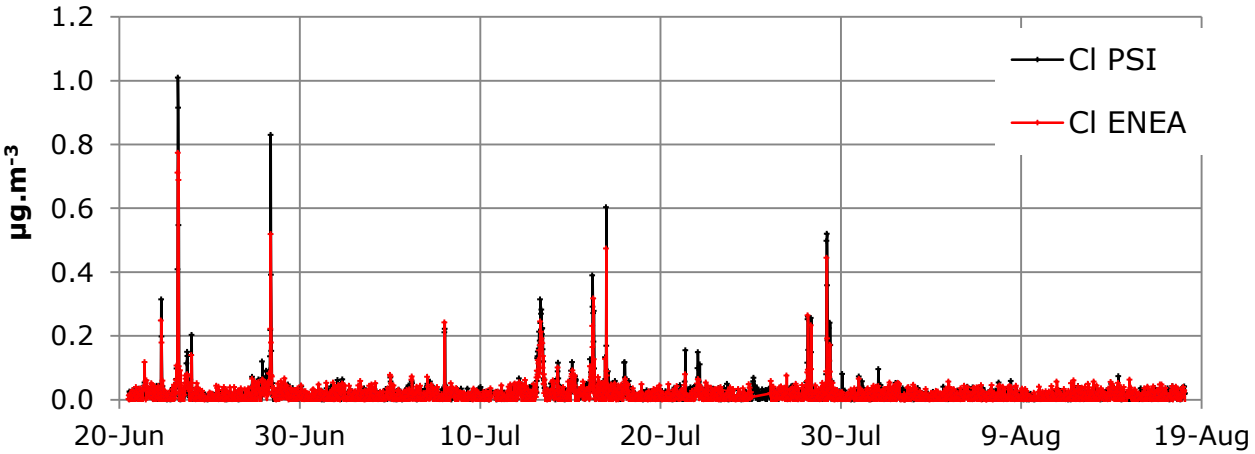
AMMONIUM

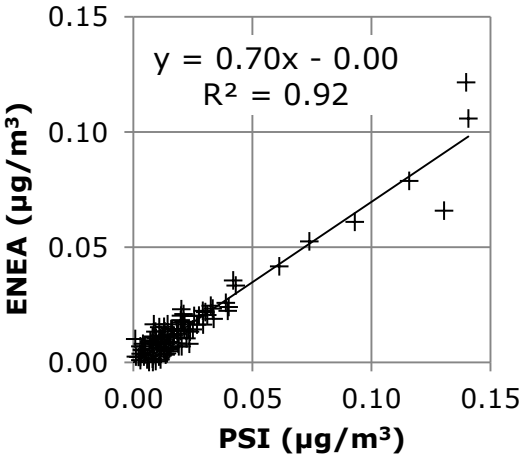


12h averaged data
(n=116)



CHLORIDE





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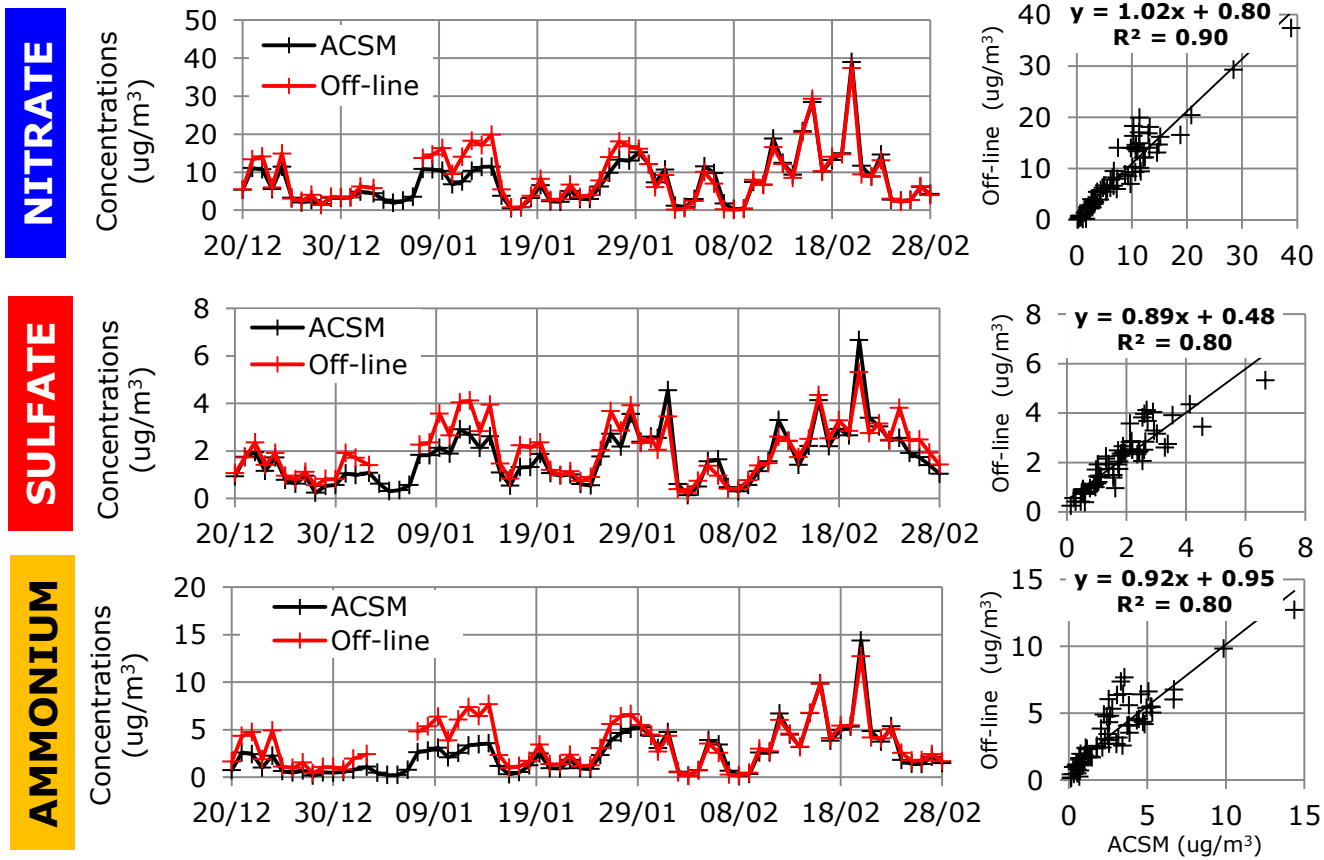
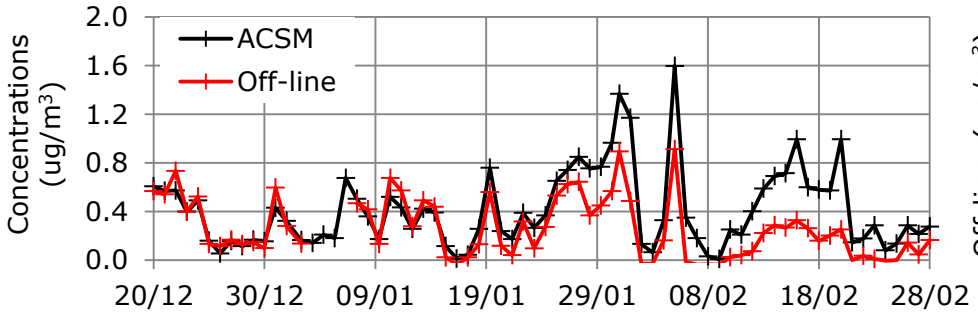
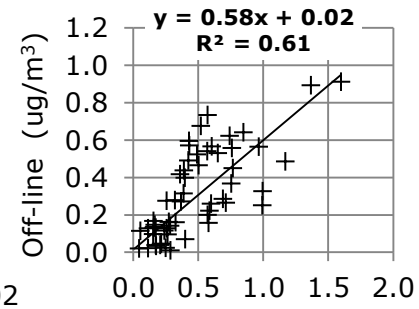
3.2 PSI Q-ACSM versus other analytical techniques



→Good agreement for Secondary Inorganic Aerosol (SIA): r^2=0.8-0.9, slope=0.9-1.0

CHLORIDE





Off-line Chloride → large uncertainties

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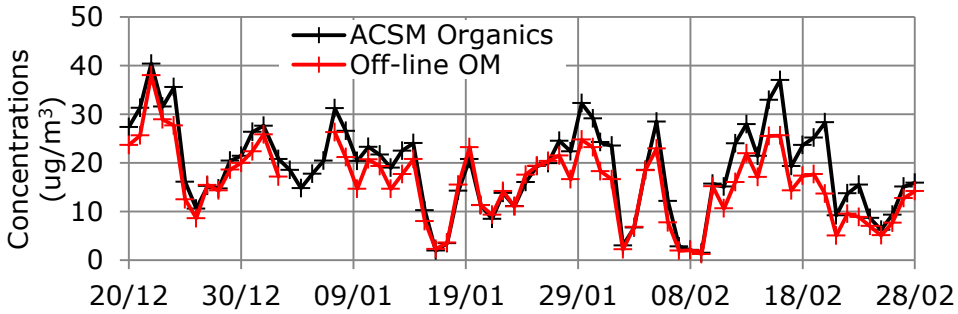
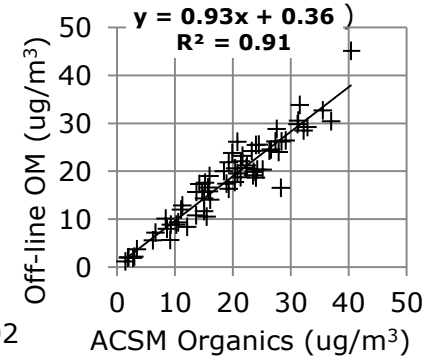
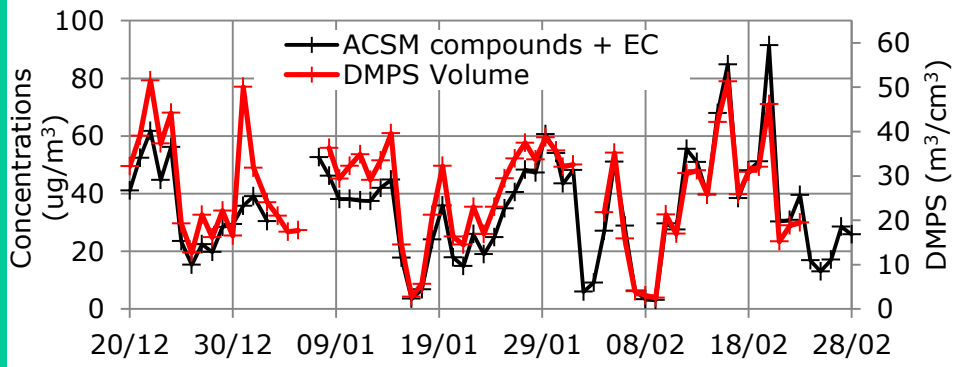
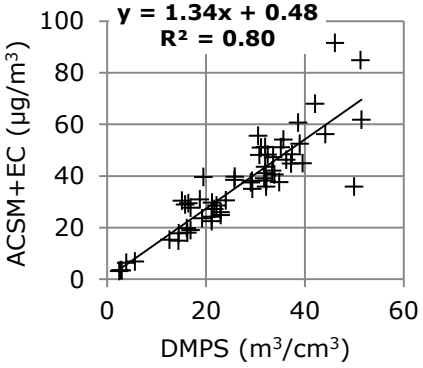




Surprisingly good despite expected filter sampling artifacts

ACSM COMPOUNDS + EC





Good agreement

Comparison between 2 ACSMs during a 2-months summer period at the JRC-Ispra site (Italy)

Conclusions

- The influence of different ACSM parameters on the estimation of species mass concentrations has been investigated.
- In spite of discrepancies observed between instruments parameters (e.g. Airbeam signal variations, ion transmission curves, etc.):

→ Good agreement between both ACSMs in terms of mass concentrations

$0.98<r^2<0.99$ for Org, NH_4, NO_3, SO_4 (r^2~0.90 for Cl)

$0.8<slope<1.2$ for Org, NH_4, NO_3, SO_4 (slope~0.7 for Cl)

Perspectives

- Comparison with additional analytical techniques (e.g. filter measurements)
- Comparison between 12 ACSMs at the SIRTA-LCSE atmospheric station (Paris, France) in November (PI: J. Sciare, V. Crenn)

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APPENDICES

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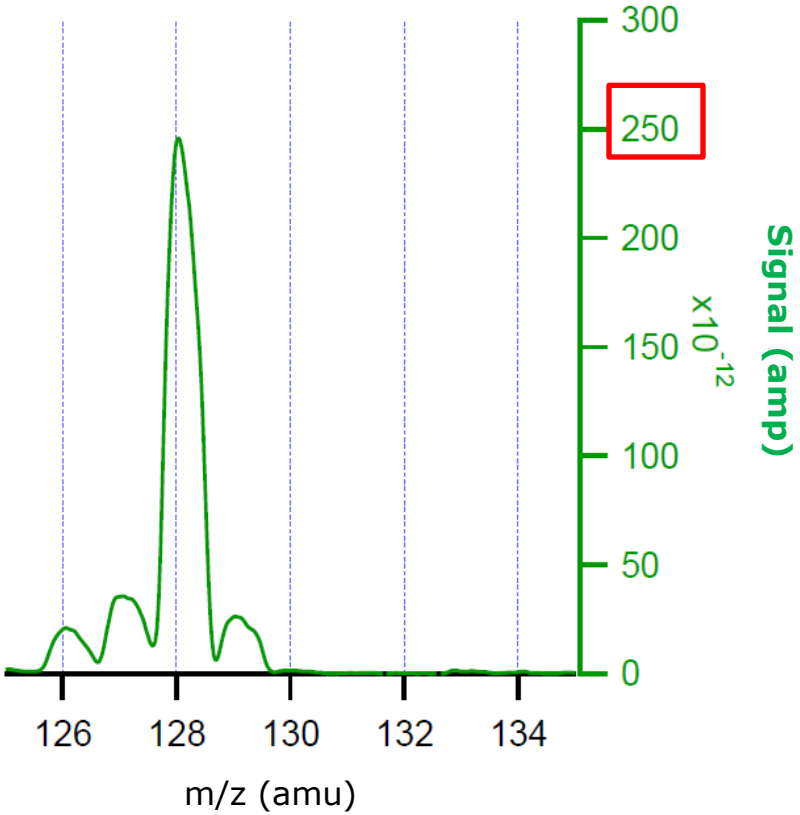

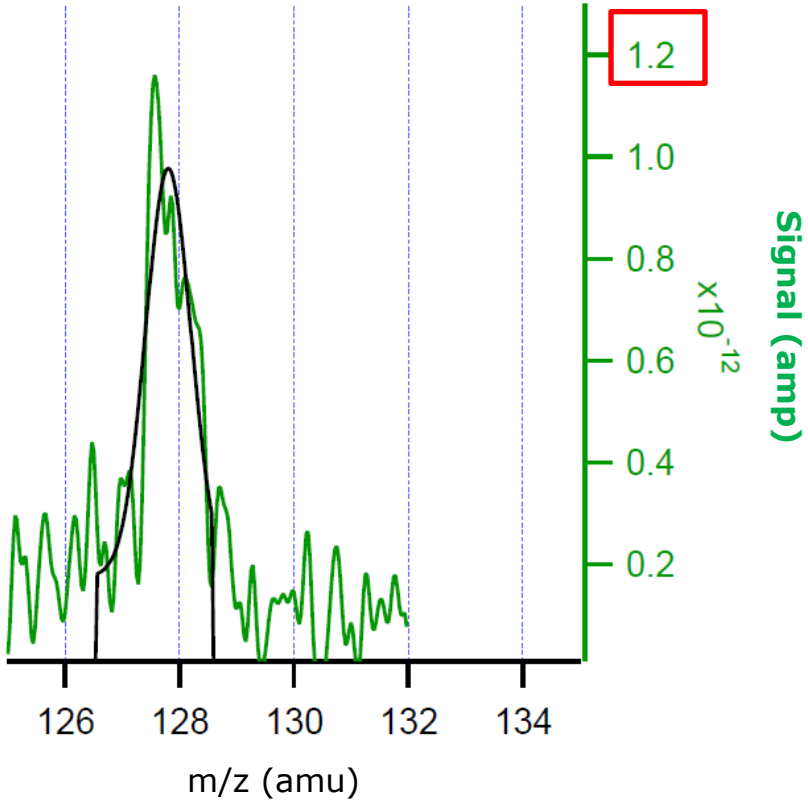

Comparison between naphthalene peaks (m/z=128) for both ACSMs

Note the difference in scales (for the same airbeam signal of 1.0E-7 amp)

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Additional analytical techniques at the JRC-Ispra site (Italy)

AEROSOL CHEMISTRY

Partisol Plus

24-h daily sampling of $PM_{2.5}$

20 Dec 2012→ 28 Feb 2013

Sunset Lab. OCEC Analyzer (EUSAAR2 protocol)

Elemental Carbon (**EC**)

Organic Carbon (**OC**)

Organic Matter (**OM**):
OM=1.4*OC
(Putaud et al., 2010)

Ion Chromatography

Major ions including:
SO_4
NO_3
NH_4
Cl

AEROSOL PHYSICS

Differential Mobility Analyzer

Condensation Particle Counter

20 Dec 2012 → 22 Feb 2013

Size distribution 10 to 800 nm

GAS PHASE CHEMISTRY

20 Dec 2012 → 7 Feb 2013

CO

NO, NO_2

O_3

SO_2

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Precipitation chemistry

Gas phase pollutants (SO_2, NO_x, O_3, CO,…)

PM mass and inorganic constituents (SO_4, NO_3, NH_4, …)

OC + EC

Particle number size distribution,
aerosol absorption and scattering coefficient

LiDAR

Measurements performed at the JRC-Ispra site during the last 25 years