

ADEME



Agence de l'Environnement
et de la Maîtrise de l'Énergie



Laboratoire de Glaciologie et Géophysique de l'Environnement



LSCE

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Ope

Observatoire pérenne de l'environnement



MINES
Douai

French contribution to the EMEP 2012-2013 summer and winter campaigns: overview and preliminary results

S. SAUVAGE, V. RIFFAULT, A. SETYAN, V. CRENN (Mines Douai)

J.L. JAFFREZO (LGGE), J. SCIARE (LSCE), K. SELLEGRI (LaMP-OPGC),
O. FAVEZ (INERIS), S. CONIL (OPE), J. DESCLOITRES (ICARE) ... and all
co-workers

CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION
14th Task Force on Measurement and Modelling Meeting / EMEP
Zagreb (Croatia), 6-8 May 2013

Outline

- Field sites
- Instrumentation
- Results (preliminary)
 - Quick look on PM_{10} chemical speciation for both seasons at 3 sites
 - Site of Revin: focus on carbonaceous gas-phase and particulate species in summer
- Conclusions / Future work

Field sites

- Cap Corse: remote, coastal



- Puy-de-Dôme (PdD): remote, mid-altitude



- OPE: remote



- SIRTa: urban background



- Revin: remote



© GoogleMaps



Large variety of geographical locations and influences expected to affect PM measurements

Instrumentation



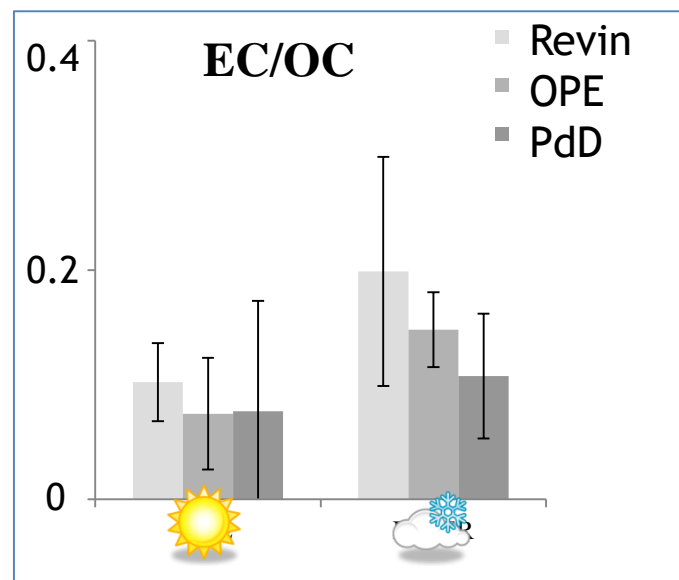
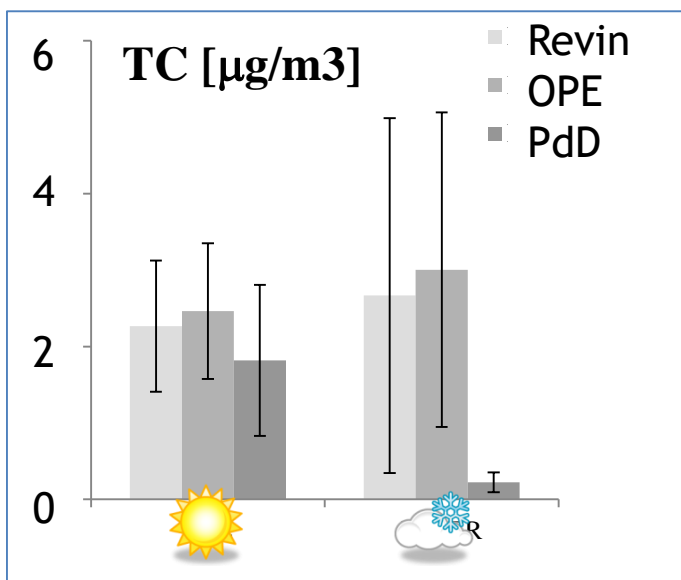
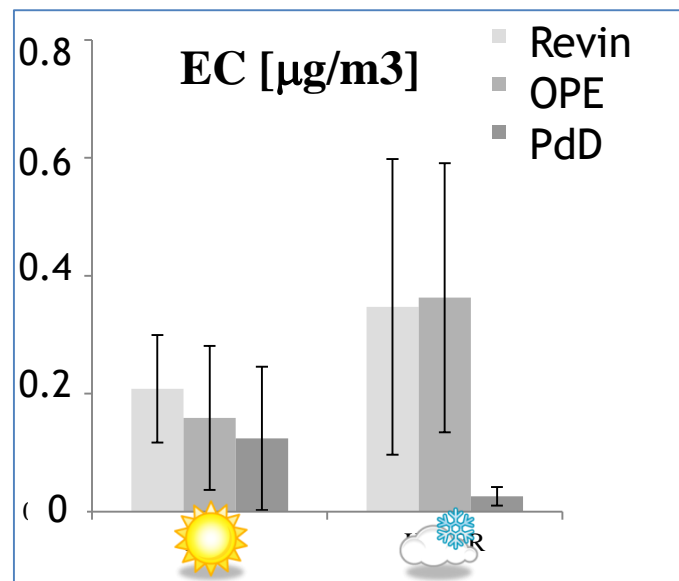
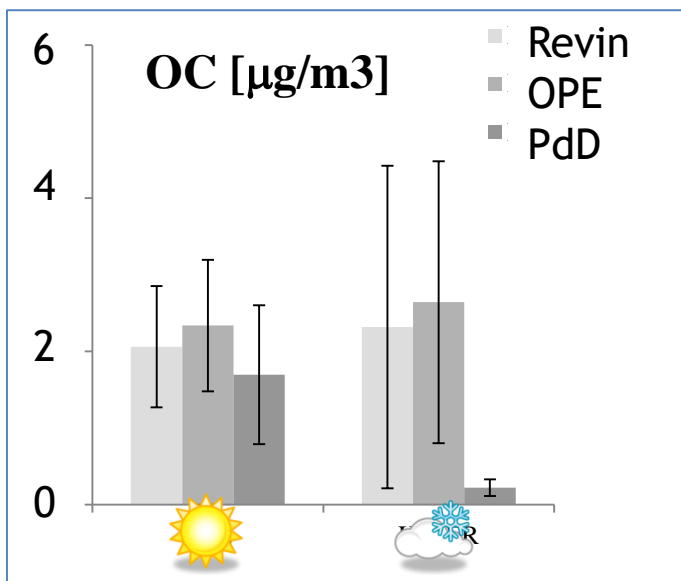
	Sampling period	Cap Corse	OPE	Puy-de-Dôme	Revin	SIRTA
PM₁₀ mass	< 1hr	S, W	S, W	S, W	S, W	
PM₁₀ speciation	≥ daily	S, W	S, W	S, W	S, W	S, W
PM_{2.5} mass	< 1hr		S, W		S, W	
PM_{2.5} speciation	≥ daily	S, W	S, W			S, W
PM₁ mass		S, W				S, W
PM₁ speciation (AMS, ACSM)	< 1hr	S, W		W	S	S, W
Black Carbon	< 1 hr	S, W	W	S, W	S, W	S, W
Precursor (O)VOCs	≤ 6 hrs	S, W		S, W	S, W	
NMHCs / (O)VOCs	< 1 hr	S			W	S, W
NO_x, CO and O₃	< 1 hr	S, W	S, W	S, W	S, W	S, W
CO₂	< 1 hr			S, W	S, W	S, W
SO₂	< 1 hr			S, W	S	
NH₃	< 1 hr				S	S, W
Diff./scat. coef.	< 1 hr	S, W	W	S, W		S, W
Extinction, AOD	< 1 hr	S, W	W	S, W		
Size distribution	< 1 hr	S, W	S, W	S, W		S, W

Preliminary results

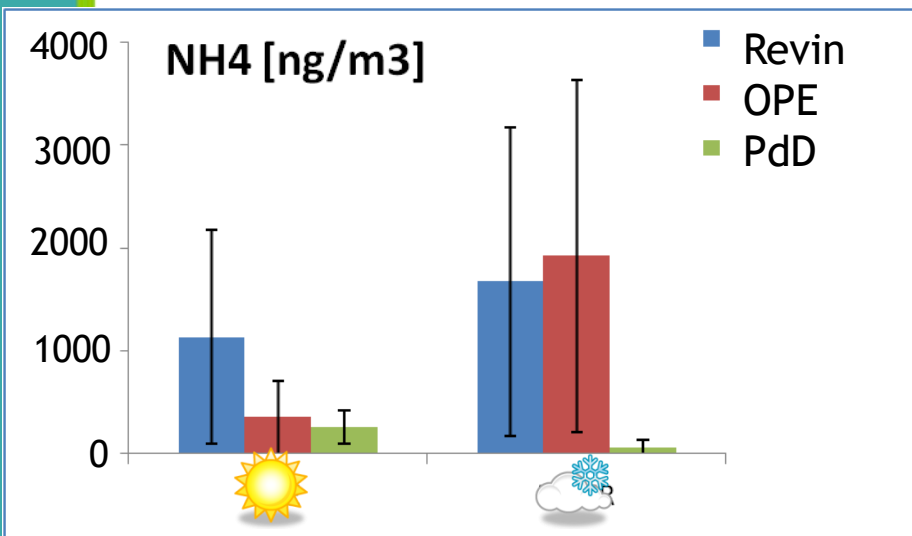
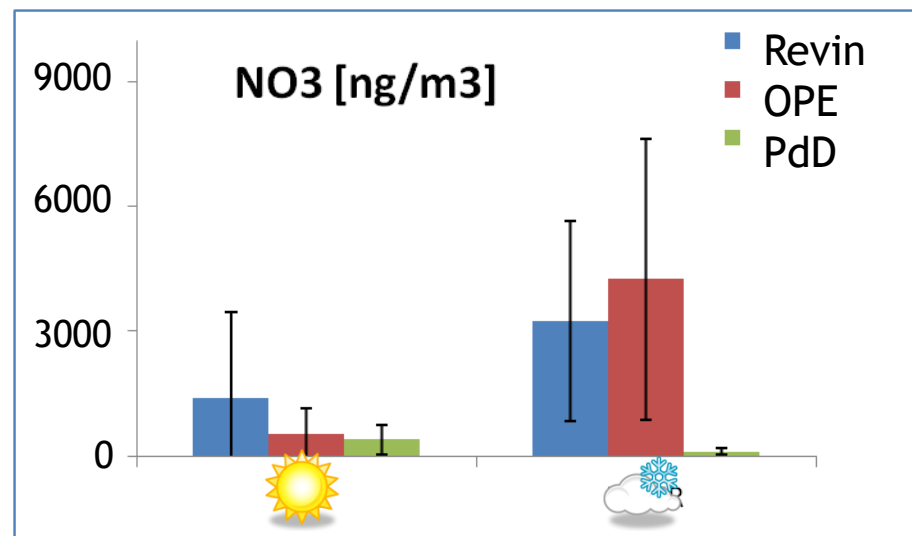
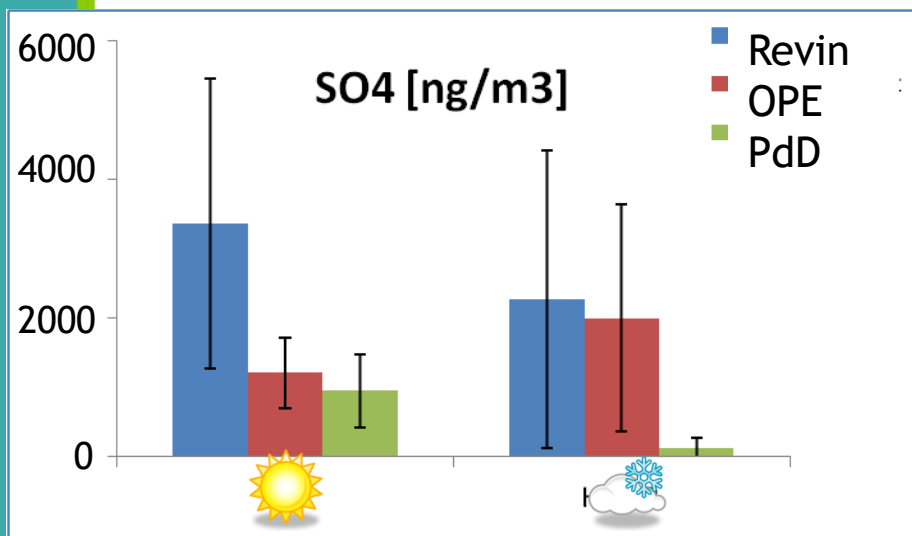
Quick look on ions in PM₁₀ for 3 sites:
PdD, OPE and Revin



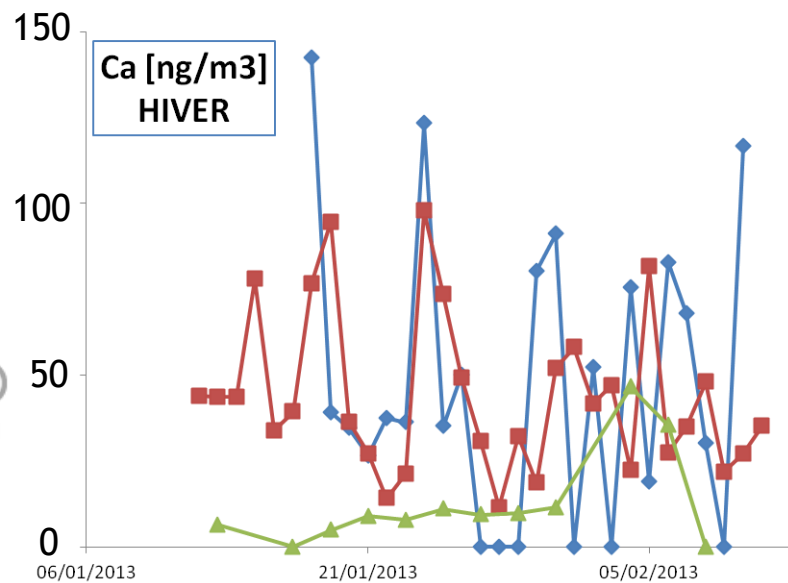
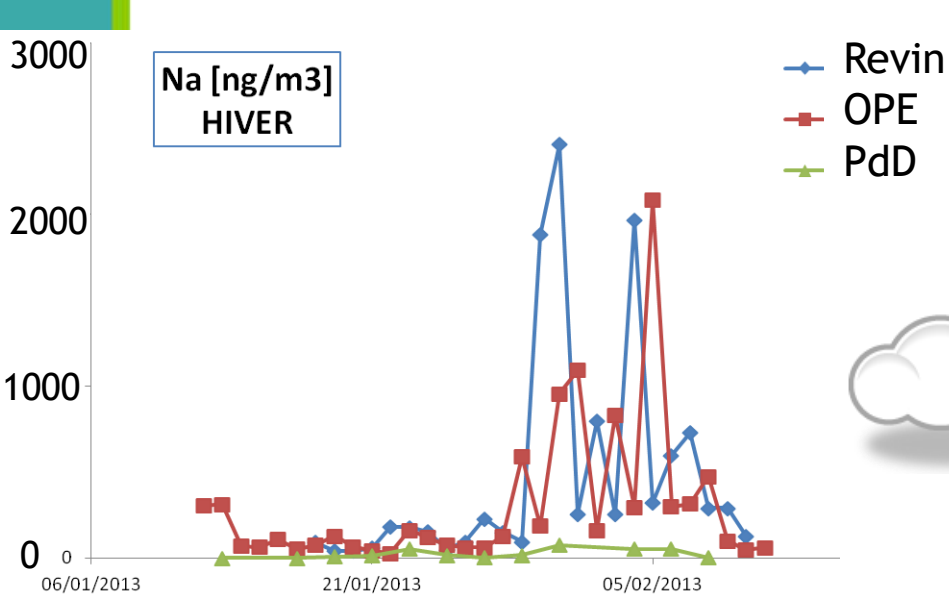
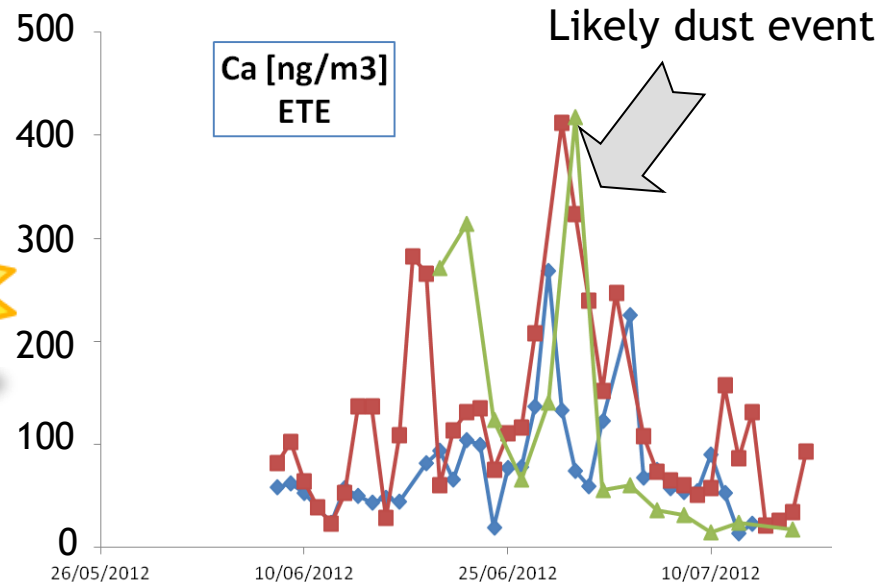
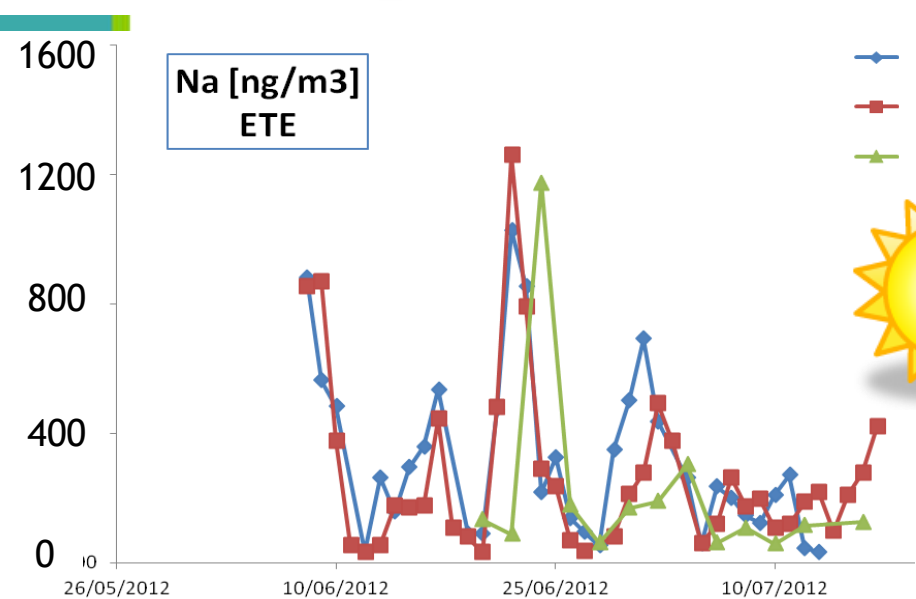
Quick look on PM₁₀ chemical speciation



Quick look on PM₁₀ chemical speciation



Quick look on PM₁₀ chemical speciation



Preliminary results

Site of Revin:

Focus on carbonaceous gas-phase
and particulate species



Campaign conditions in Revin



Jun 26 -
Jul 14, 2012

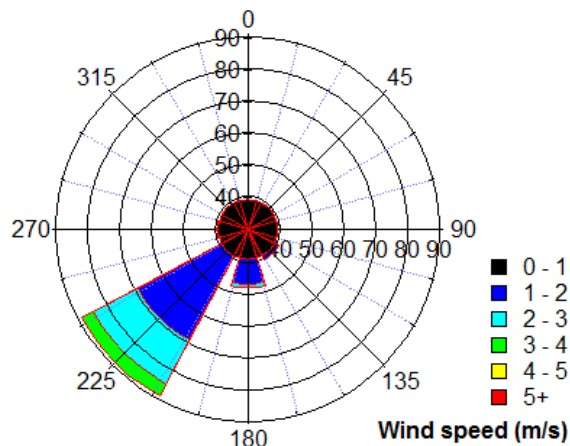
Parameter	Mean \pm stdev	Min / max
T ($^{\circ}$ C)	15.0 \pm 3.9	5.6 / 28.6
RH(%)	84 \pm 15	37 / 100
P (hPa)	969 \pm 5	956 / 978
UV ($W\ m^{-2}$)	112 \pm 137	- / 556
WS ($m\ s^{-1}$)	1.33 \pm 0.92	- / 4.50

Jan 11 -
Feb 8, 2013

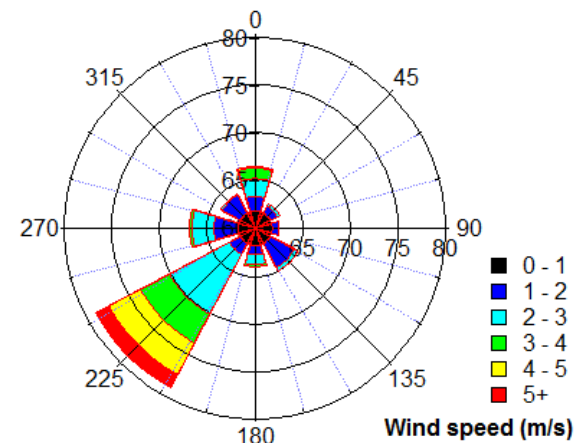


Parameter	Mean \pm stdev	Min / max
T ($^{\circ}$ C)	-0.2 \pm 3.9	-7.0 / 10.7
RH(%)	96.6 \pm 4.9	70 / 102
P (hPa)	962 \pm 8	942 / 975
UV ($W\ m^{-2}$)	18 \pm 30	- / 151
WS ($m\ s^{-1}$)	1.0 \pm 1.4	- / 5.80

EMEP, Summer 2012



EMEP, Winter 2013



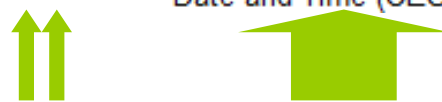
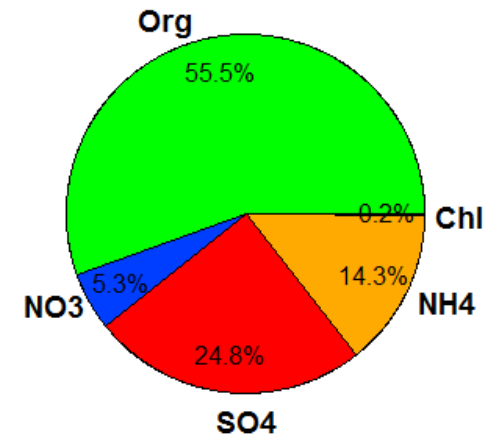
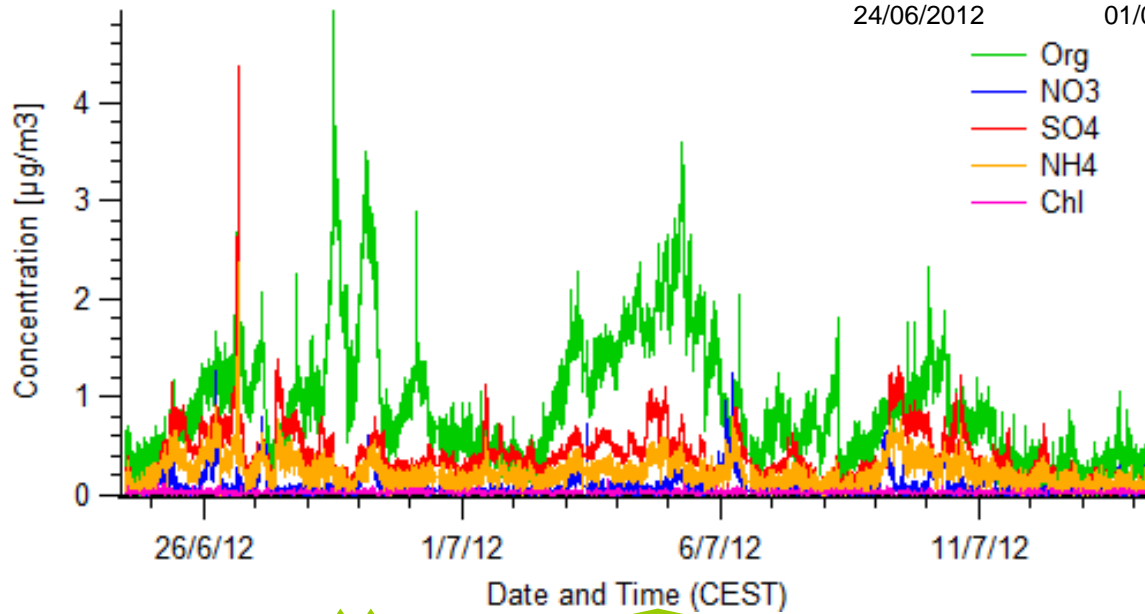
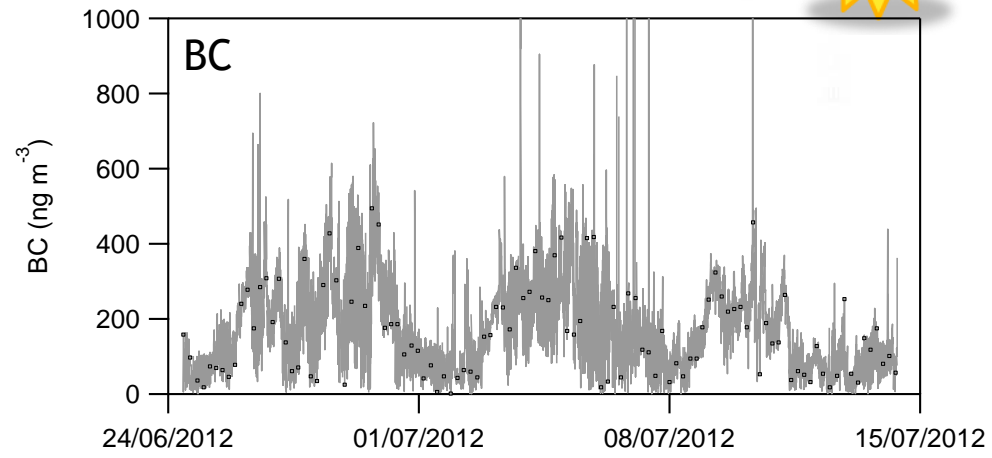
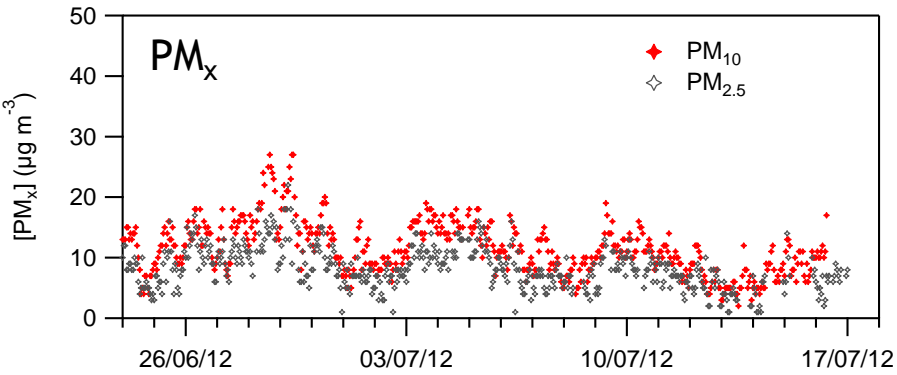
© GoogleMaps

Wind speeds slower than 1 m/s are considered as directionless



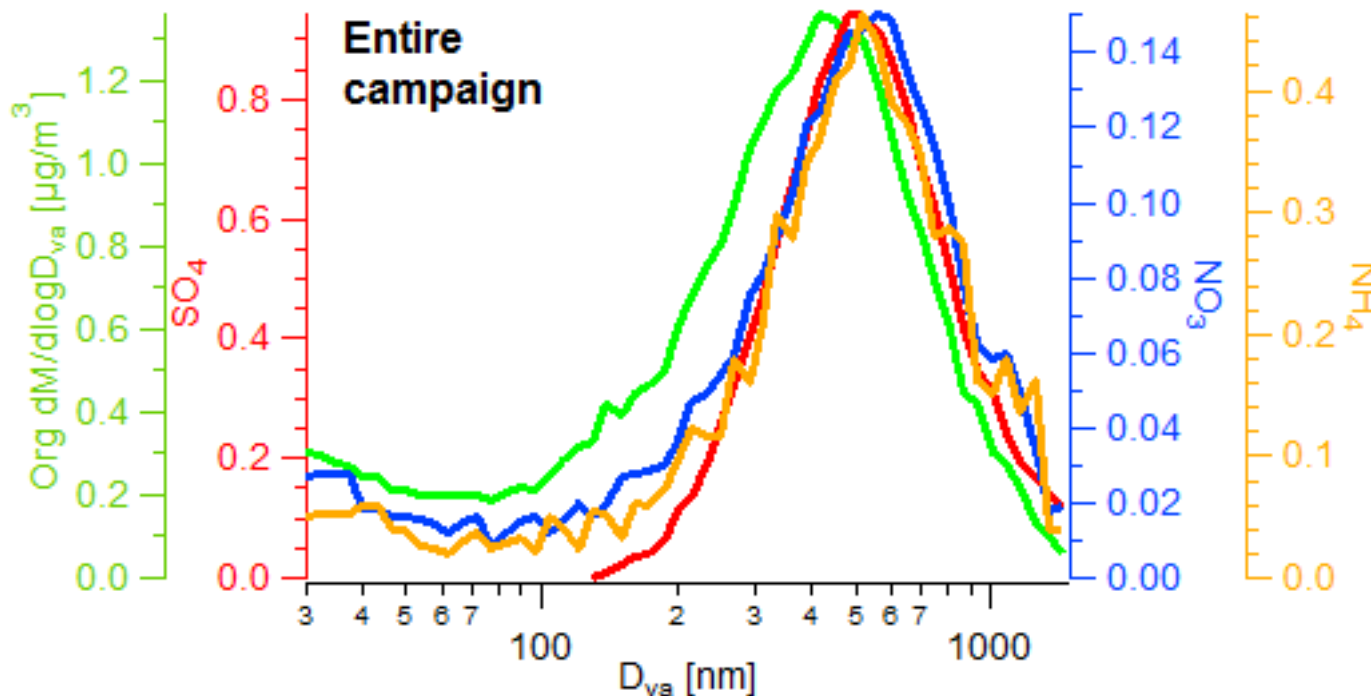
One main direction: SW winds
High frequency of wind speeds < 1 m/s

Revin : PM_x



3 main organic events observed

Revin: size distributions in NR-PM₁



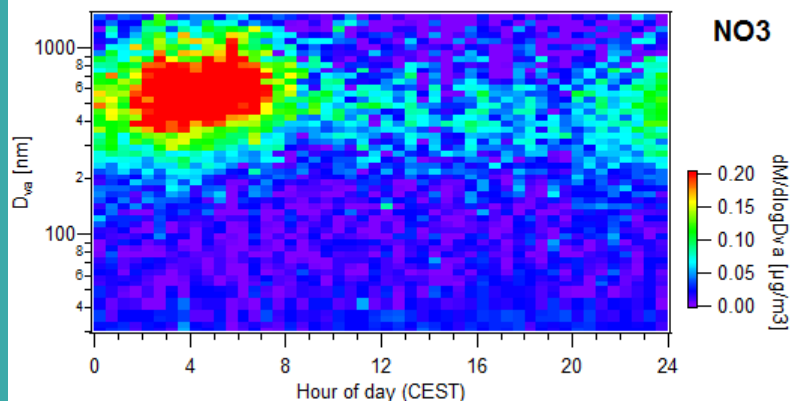
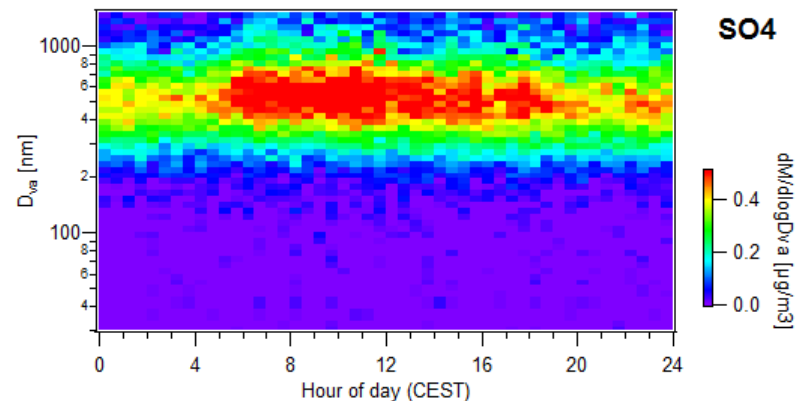
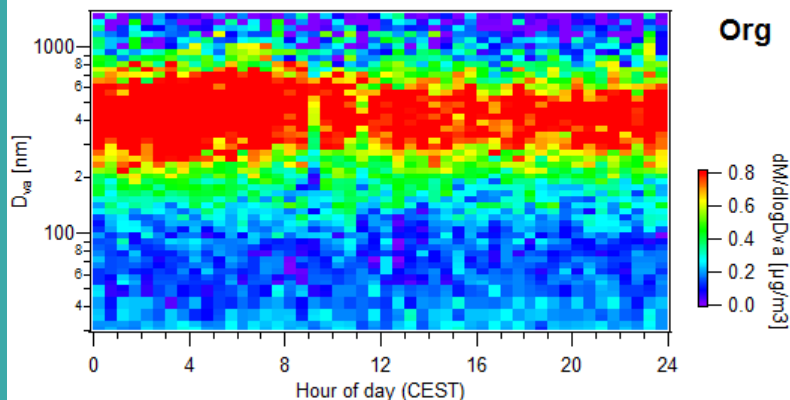
One mode per species

- centered around 500-600 nm for inorganic species
- slightly lower for organics (~400 nm)



Rather aged aerosol

Revin: size distributions in NR-PM₁



Daily profiles:

- Organics and sulfate seem pretty constant during the day
- Nitrate higher at the end of the night

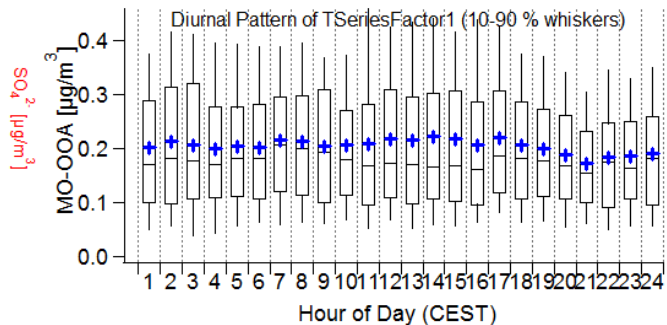
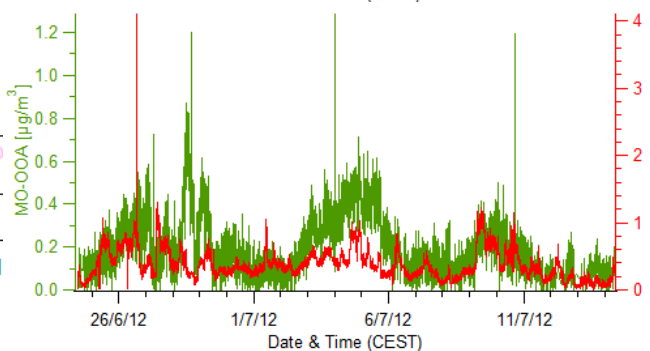
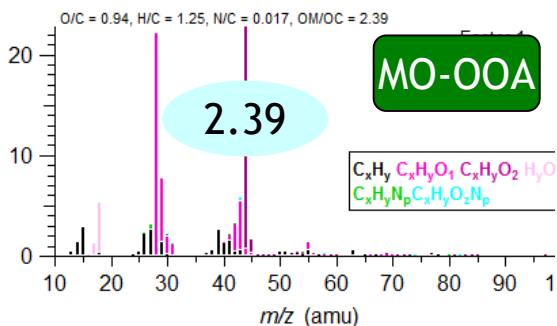
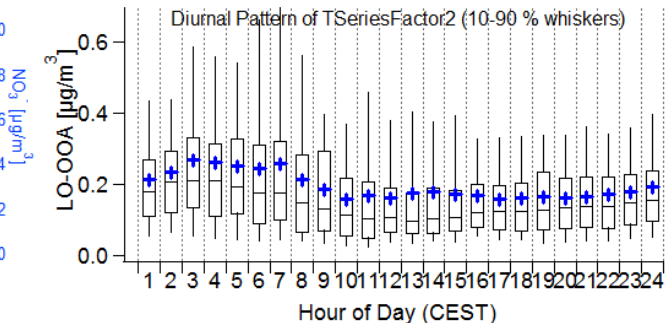
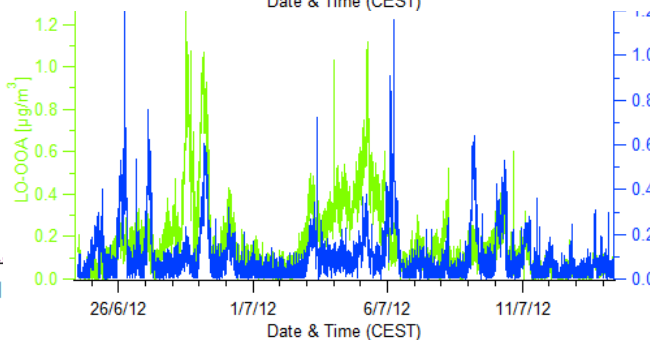
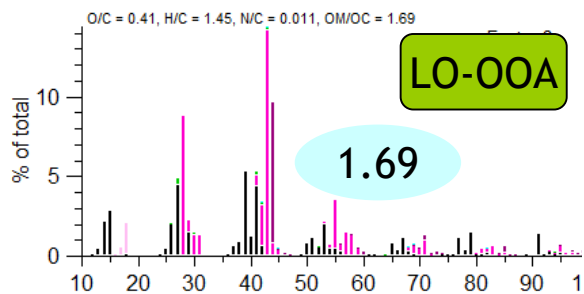
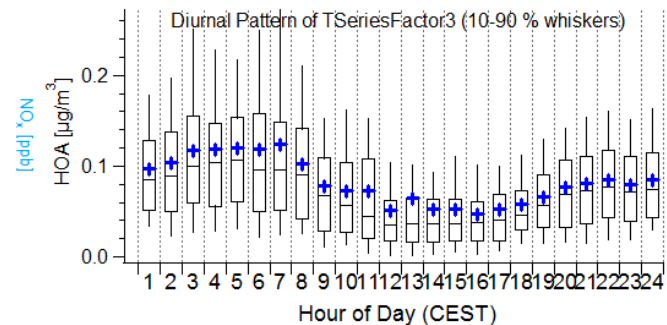
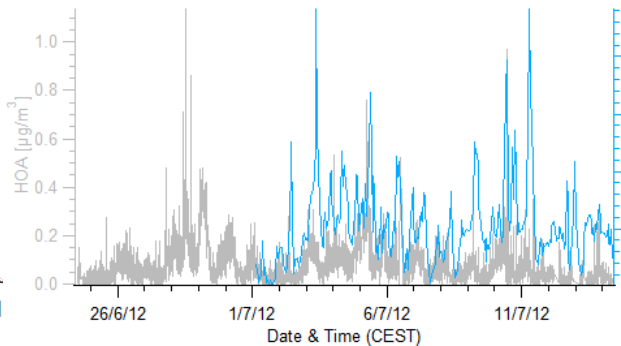
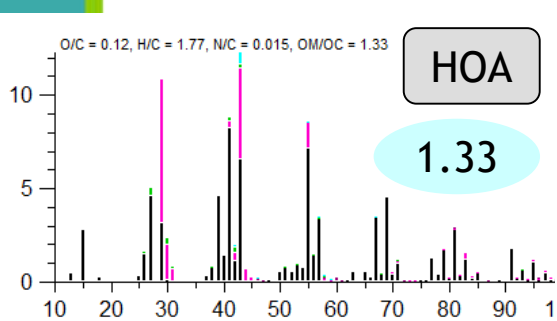


May be nighttime nitrate chemistry going on ... needs more investigation!

Revin: PMF analysis \Rightarrow 3 factors identified

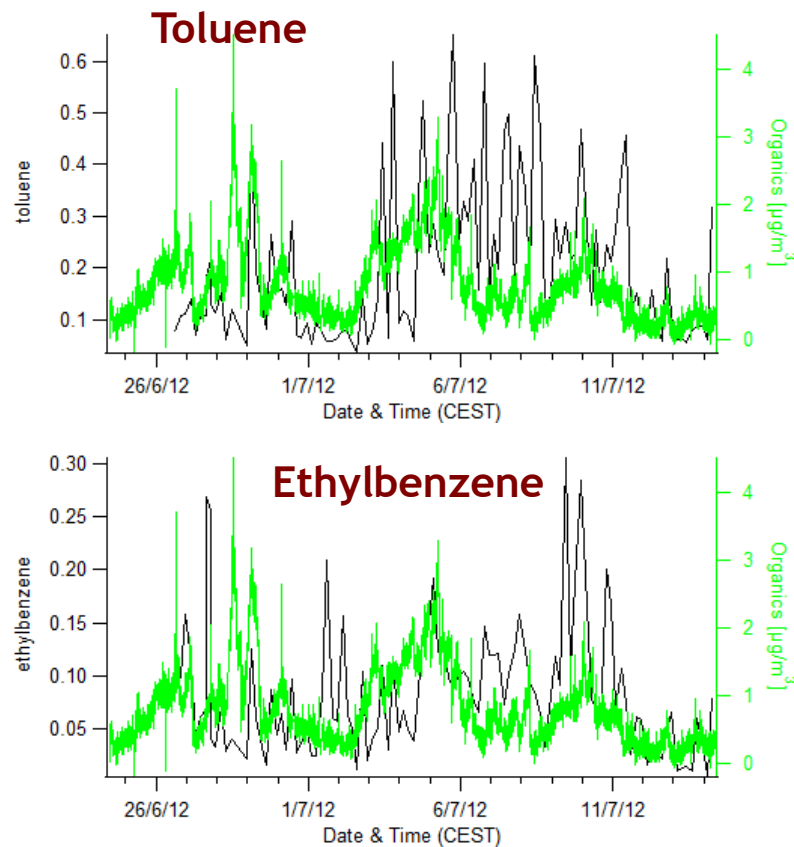
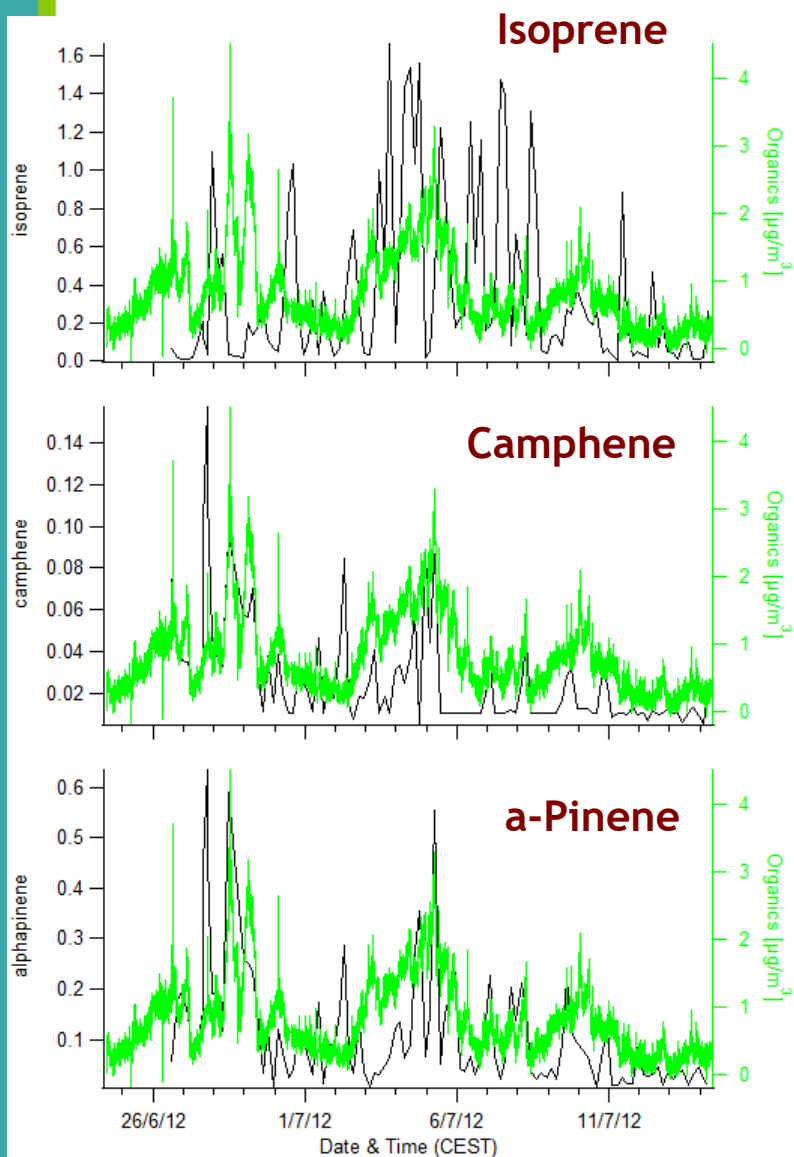


OM/OC



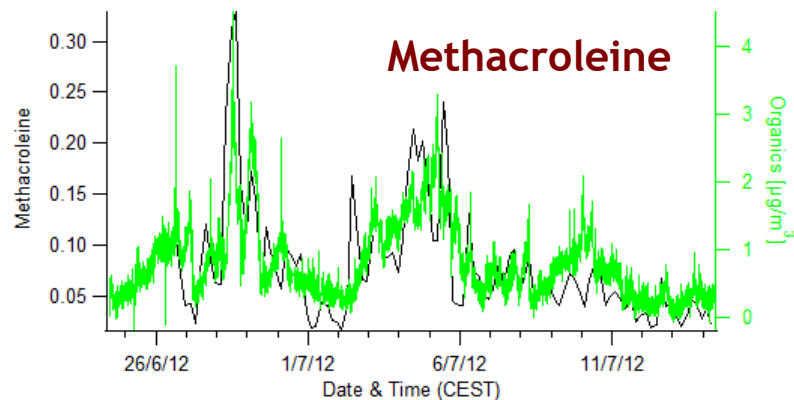
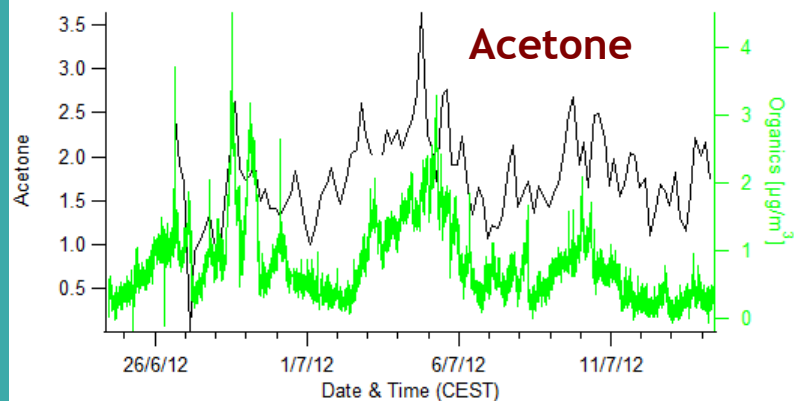
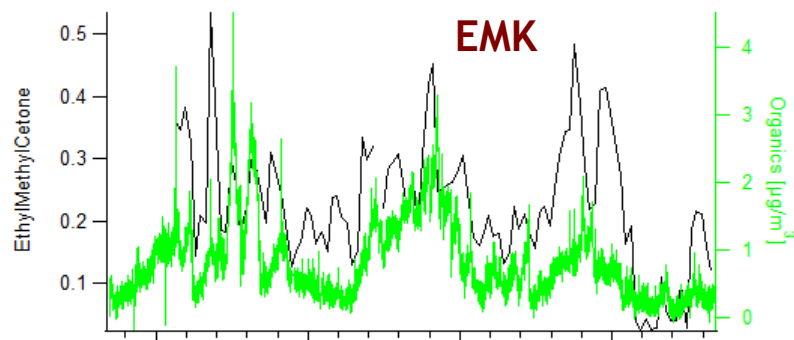
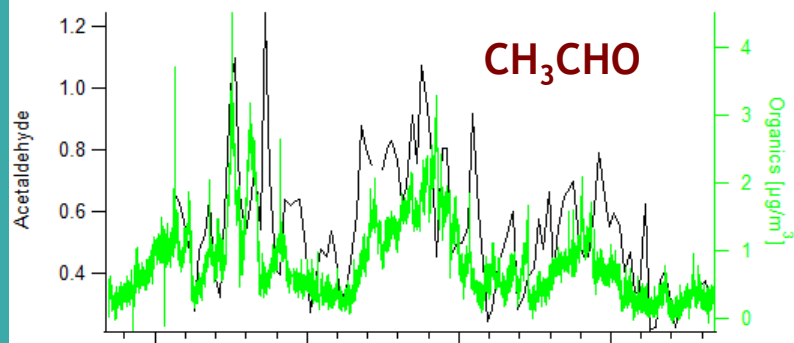
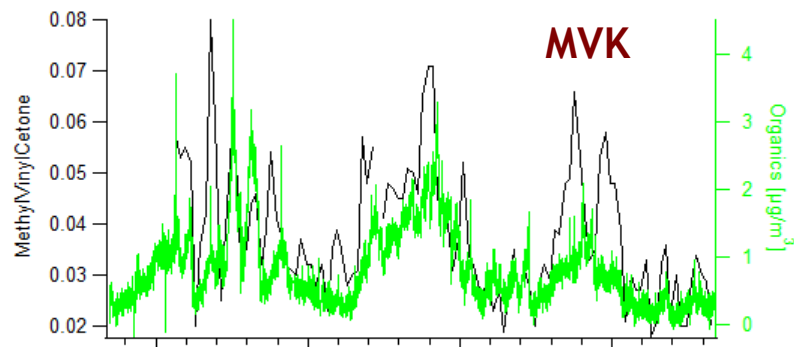
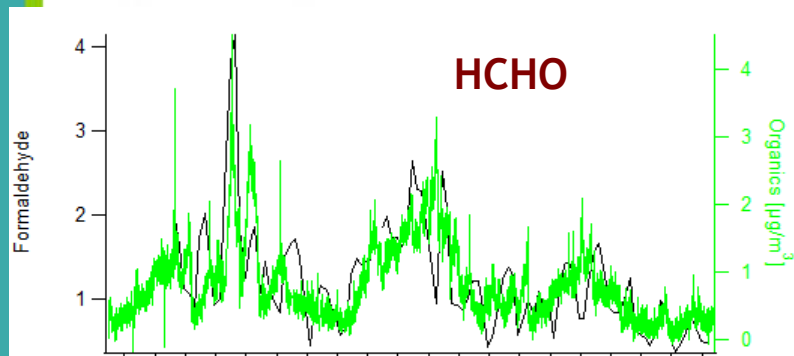
HOA slightly oxygenated (probably not local)
 LO-OOA not so well correlated w/ NO₃;
 MO-OOA agrees quite well w/ SO₄

Exploring the potential links with precursor VOCs



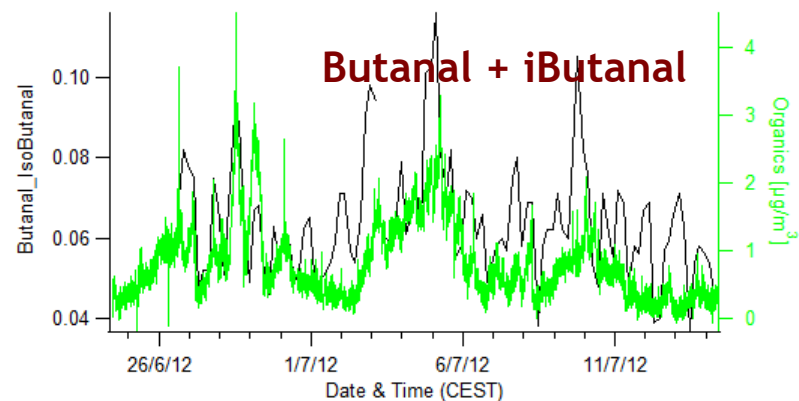
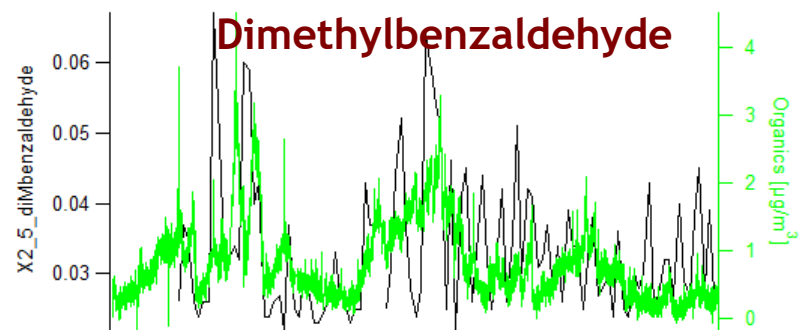
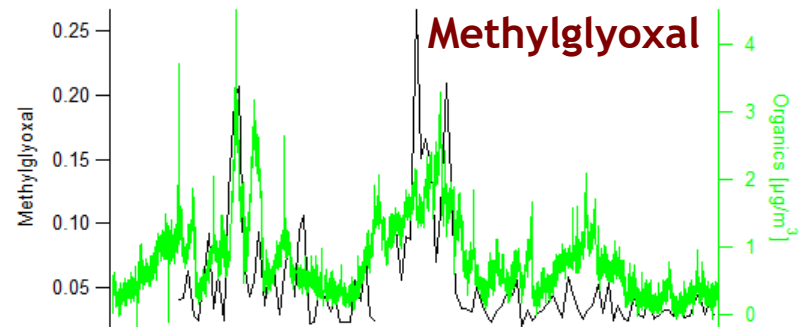
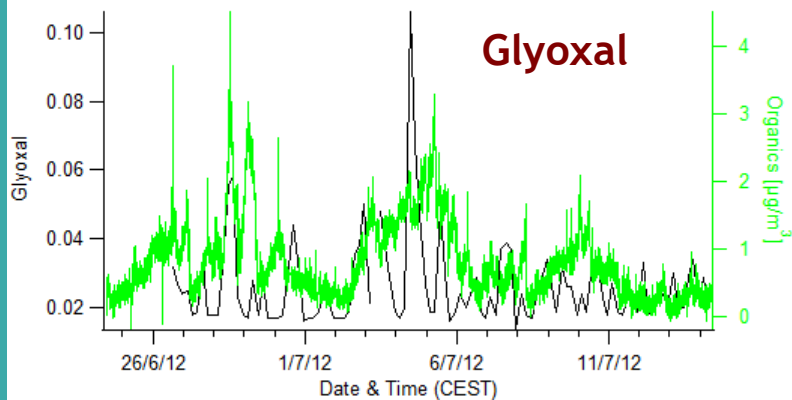
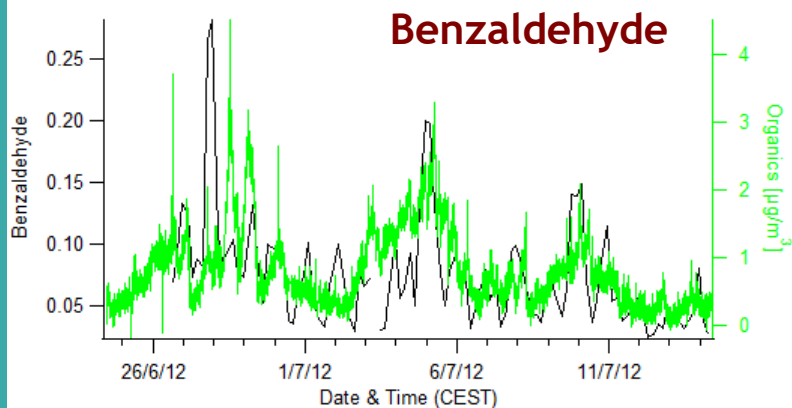
Possible links between the organic events and some biogenics and aromatics but concentrations close to the DL

Exploring the potential links with precursor VOCs



**Strong links with carbonyl compounds:
HCHO, CH₃CHO, Acetone, MVK, EMK, Methacrolein**

Exploring the potential links with precursor VOCs



Strong links with more carbonyl compounds:

- Benzaldehyde, Dimethylbenzaldehyde
- Glyoxal, MethylGlyoxal
- Butanal + iso-butanal

Conclusions and future work

- French contribution: 5 well-instrumented sites for both seasons
- Many data analyses still ongoing for the summer and winter campaigns ... promising database so far!
- PM_{10} chemical speciation \Rightarrow influence of crustal and marine sources, with similar profiles at 3 sites
- For the Revin site:
 - Main influence from long-range transport for PM_1
 - Interesting correlations shown between particulate organics and some VOCs
 - Detailed VOC speciation allows to better understand the links between organic gaseous and particulate phases