Intensive measurements and modelling of size segregated chemical composition of aerosols in June 2006 and Jan 2007

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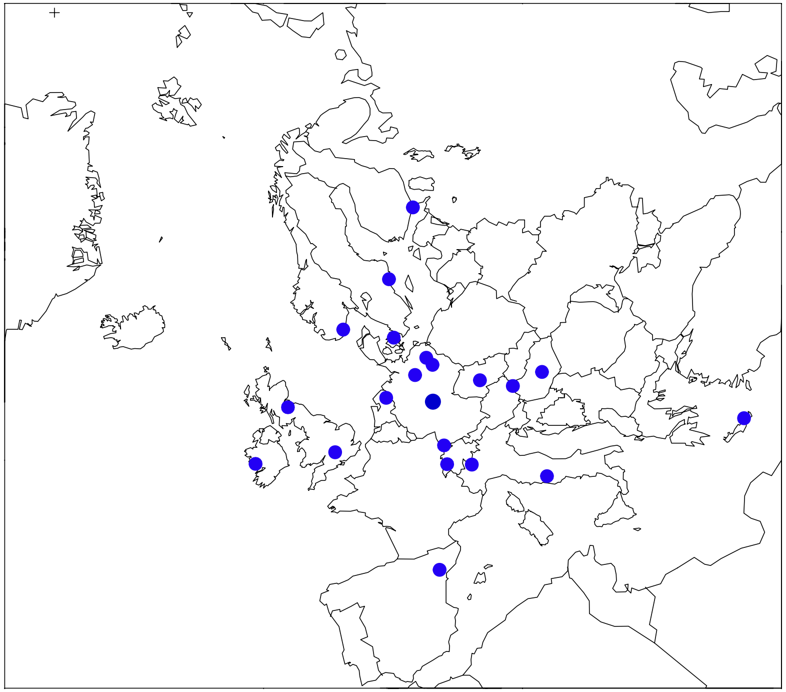

emep

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Outline

- Background
  - EMEP Monitoring Strategy
  - Supersites
  - Sites, frequenzy etc
- Results
  - Spatial, temporal level of PM, inorg, organic
  - Mass closure
  - Episodes
  - High resolution data (AMS, MARGA)
  - Comparison with EMEP model
- Artefacts
  - EC/OC
  - Nitrogen gas/particle distribution
- Outlook
  - New campaigns/intensive periods

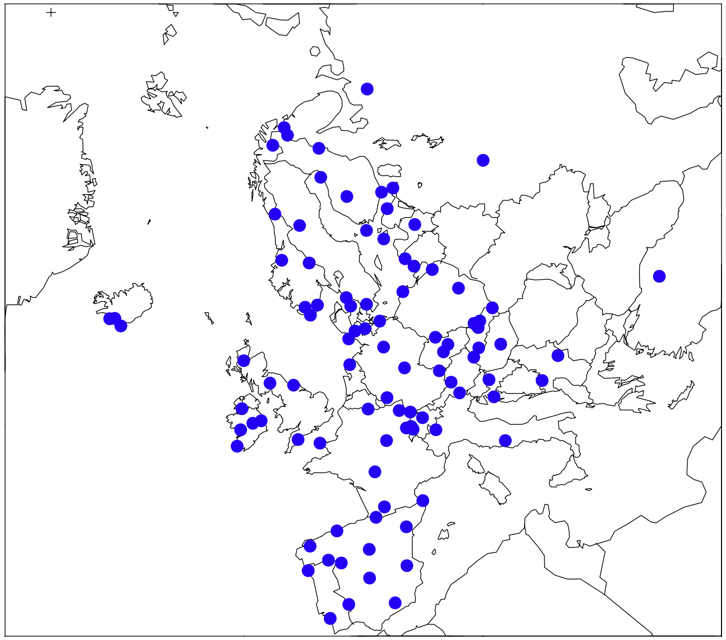
EMEP Monitoring programme

Level 1

- Main ions in precipitation and in air
- heavy metals in precipitations
- ozone

- **PM_{10} and $PM_{2.5}$ mass**
- meteorology

at ca 125 sites

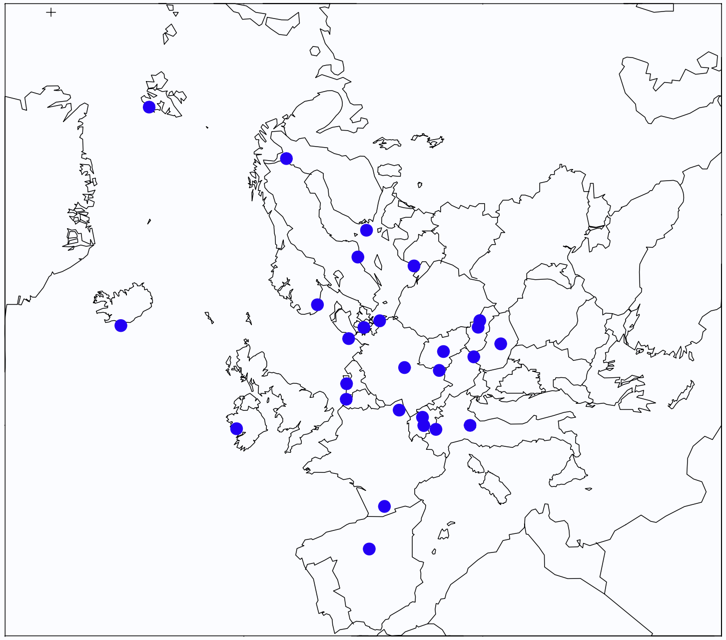


Level 2, supersite (joint EMEP/GAW)

- POPs
- Heavy metals in air and aerosols
- VOC
- **EC/OC, OC speciation**
- **Mineral Dust**
- **PM speciation incl. gas particle ratio**

\+ all level 1 activities

15-20 sites



Both levels are mandatory by all Parties

Objective of intensive measurements

- To underpin the EMEP programme
  - not realistic to require full daily chemical speciation or continuous measurements 365 days a year.

- Coordinate and harmonise the research campaigns and monitoring efforts in Europe

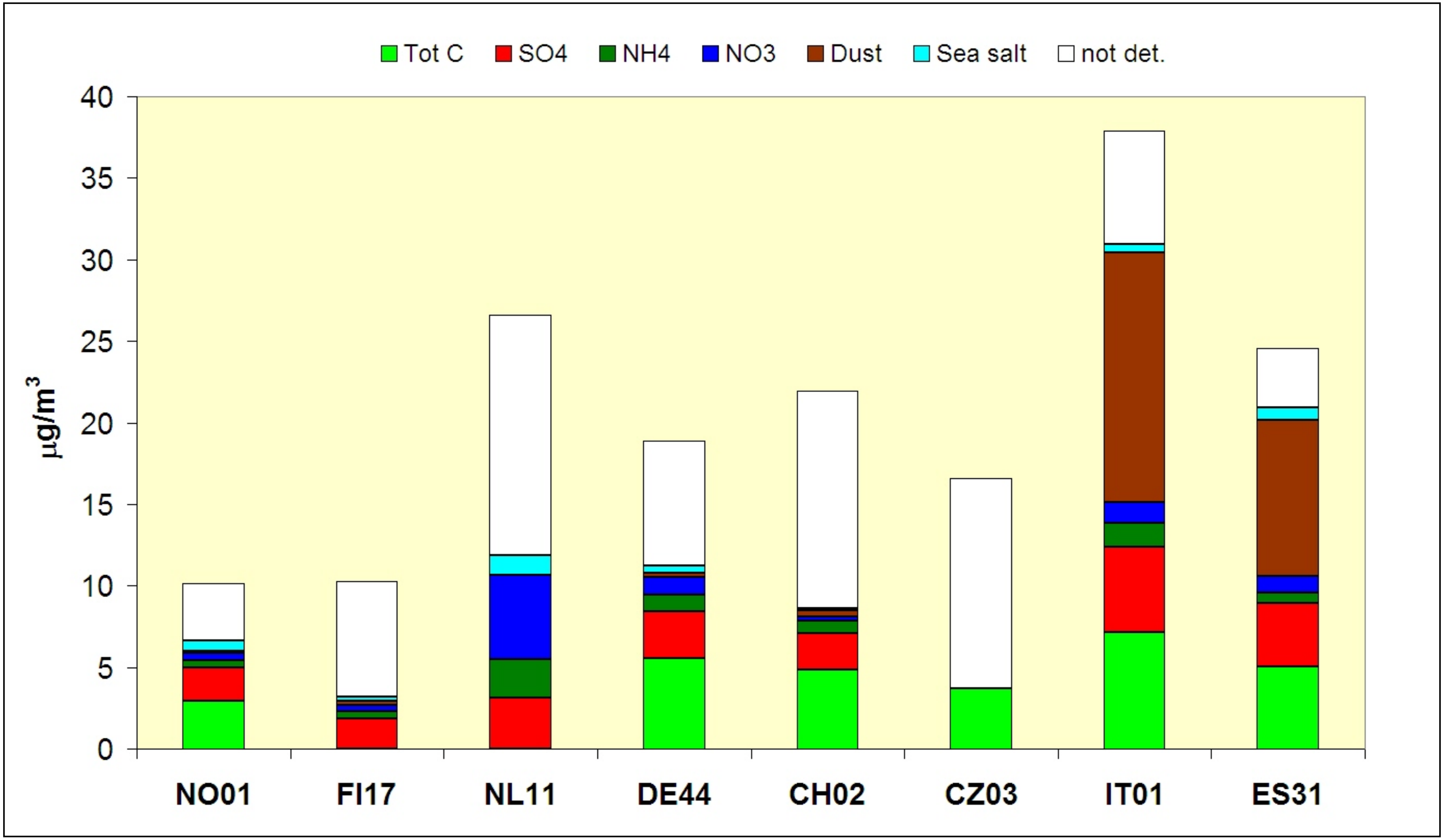
- Important for improving our current understanding of the temporal and spatial variation of PM and PM constituents in Europe, their sources and formation mechanisms, and for model validation.

- Such measurement periods also motivate and prepare the Parties to initiate new measurements stated in the EMEP monitoring strategy.

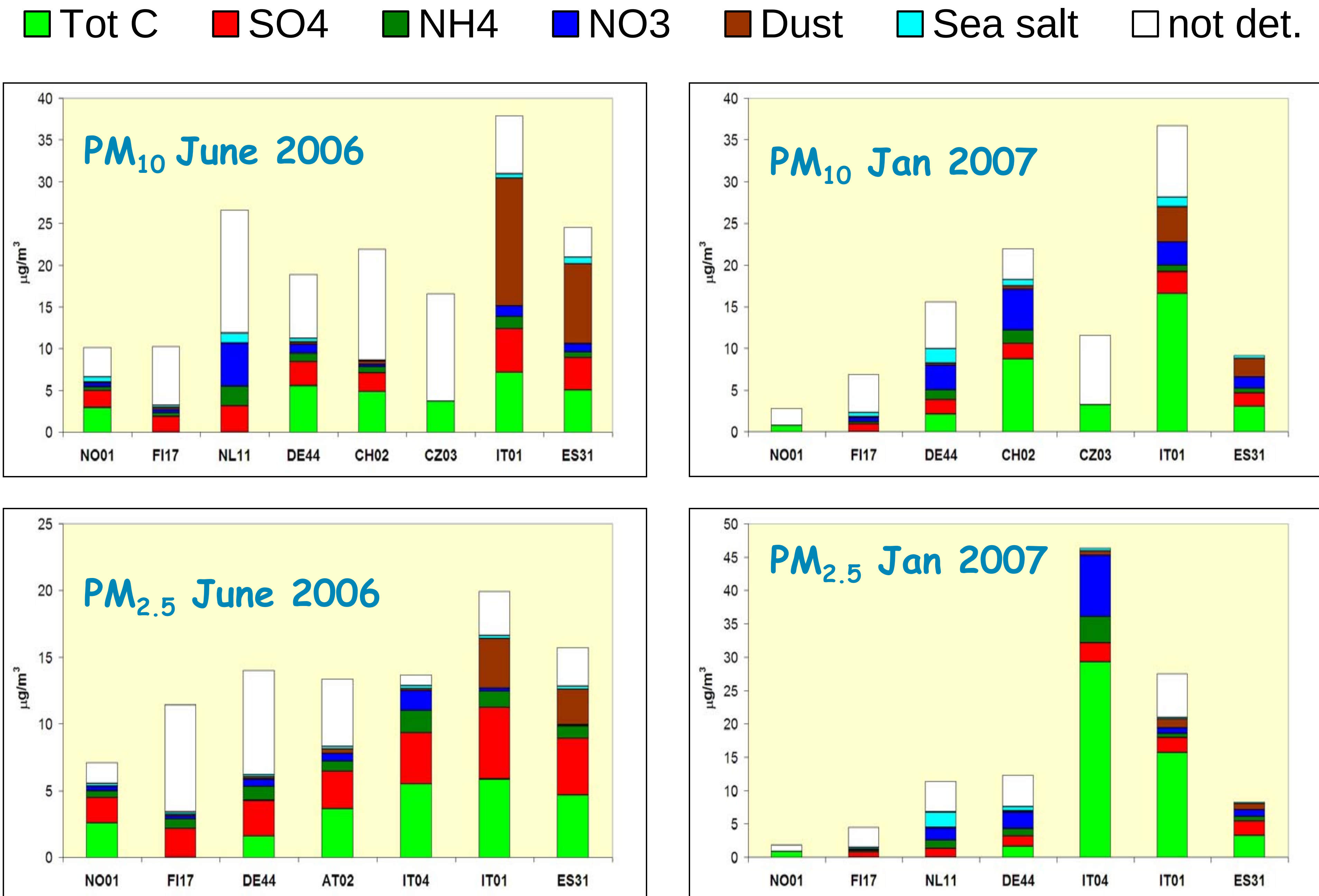
Sites and measurements

Sites	Mass		Speciation																Size no.	
			Daily										Intensive, hourly							
			Inorg		EC/OC		Metal		PAH		Crust		Inorg		EC/OC		Size no.			
	June	Jan	June	Jan	June	Jan	Jun	Jan	June	Jan	June	Jan	June	Jan	June	Jan	June	Jan		
AT02	10,,2.5,1	10,2.5,1	FP											SO4	PM2.5					
CH02	10,2.5,1	10,2.5,1	FP, PM10, PM1										PM1	PM1	PM2.5	PM2.5	X	X		
CZ03	10 ,2.5	10,2.5			PM1	PM1	X	X												
DK41	10,2.5,1												NOx							
DE01	10	10	FP	FP						X										
DE02	10,2.5,1	10,2.5,1	FP	FP																
DE03	10 ,2.5	10 ,2.5	FP	FP						X							X			
DE07	10,2.5	10,2.5	FP	FP			X	X												
DE08	10	10	FP	FP						X										
DE09	10	10	FP	FP						X										
DE43	TSP	TSP	Berner												BC	BC	X	X		
DE44	1 ,2.5 ,10 + Berner		X	X	X	X								PM1			X	X		
ES31	10,2.5 ,1	10,2.5,1	PM10, PM2.5		totC	totC	PM1,				PM1,									
FI17	10,2.5,1	10,,2.5,1	X	X																
IE31	10,,2.5,1	10,2.5,1	X	X	X	X							PM1	PM1			X	X		
IT01	10,,2.5	10,,2.5	X	X	X	X	X	X			X	X					X	X		
IT04	10,,2.5	10, 2.5	X	X	X	X							gas, PM10				X	X		
NL11													gas, PM2.5,							
NO01	10,2.5,1	10,2.5,1	X	X	X	X											X	X		
SE12	2.5,1																			
GB36													gas, PM2.5,							
GB40													gas, PM2.5,							
Count	**19**		**16**		**7**		**4**		**4**		**2**		**7**		**3**		**8**			

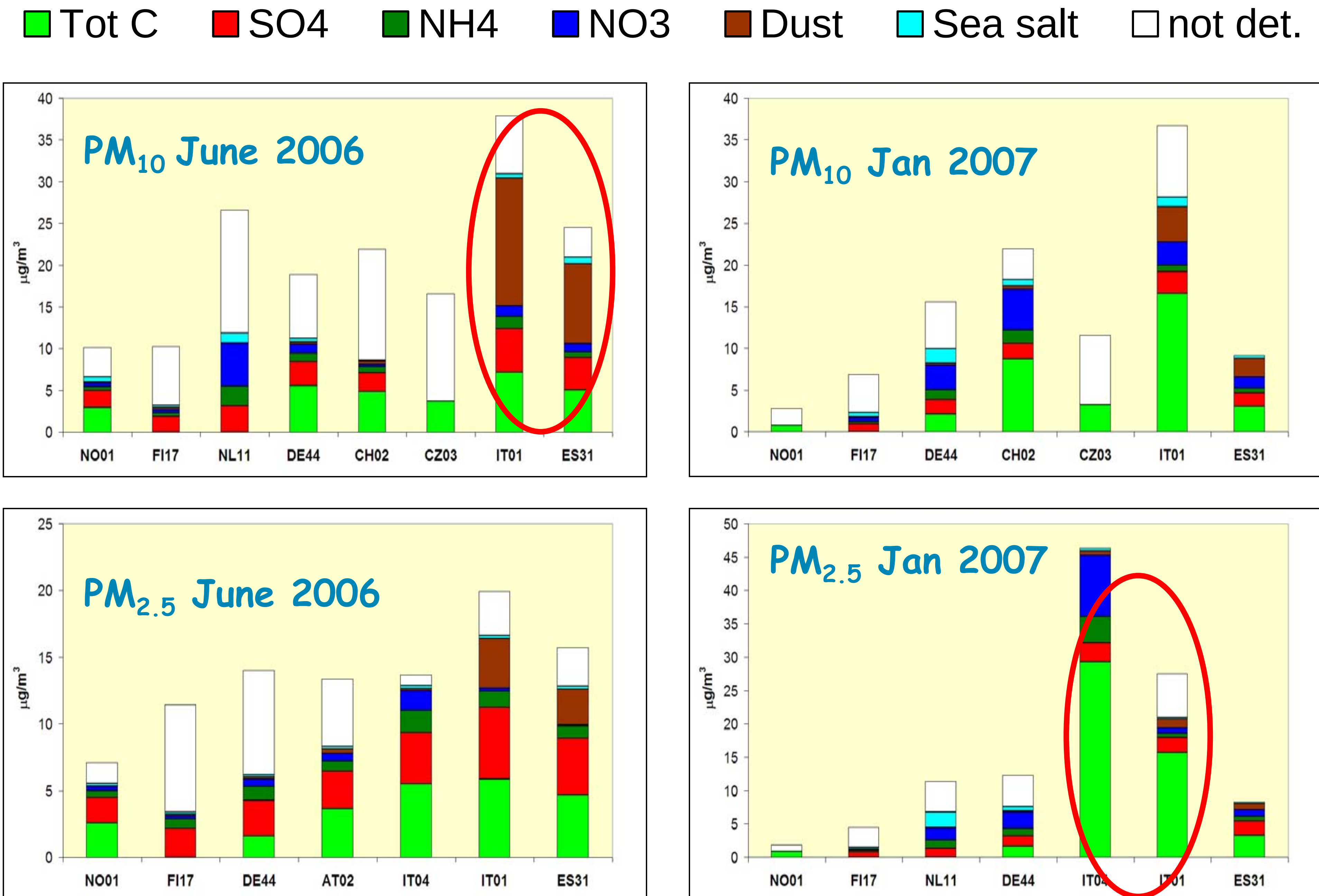
PM10 speciation, spring 2006



TC = OC 1.4 + EC*1.1 (or meas TC *1.3)*

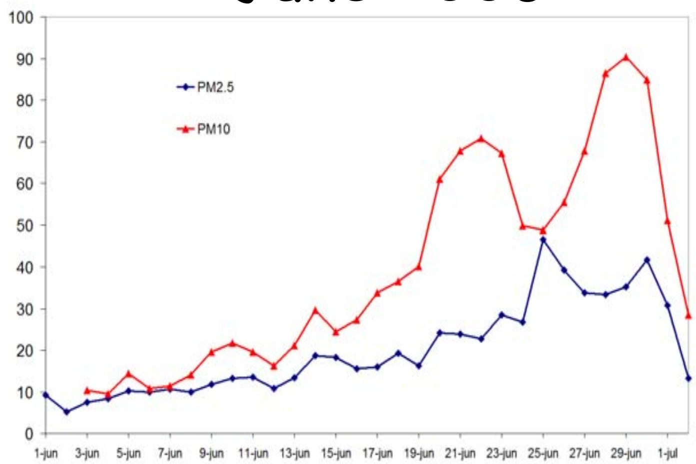


Tot C
SO4
NH4
NO3
Dust
Sea salt
not det.
PM10 June 2006
PM10 Jan 2007
PM2.5 June 2006
PM2.5 Jan 2007
µg/m3
NO01
FI17
NL11
DE44
CH02
CZ03
IT01
ES31
AT02
IT04

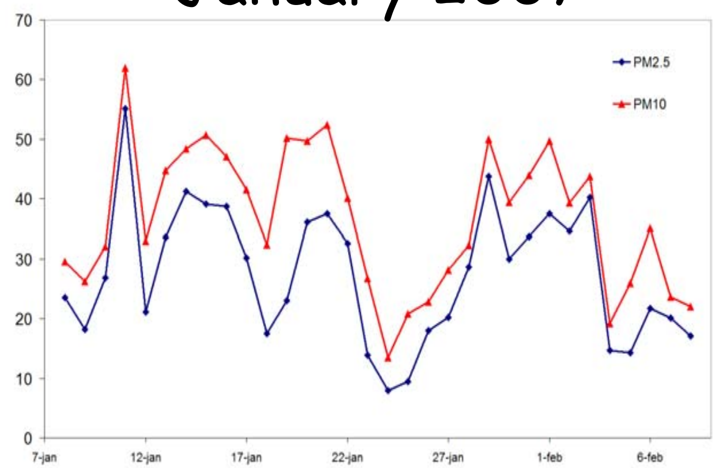

Tot C
SO4
NH4
NO3
Dust
Sea salt
not det.
PM10 June 2006
µg/m3
40 35 30 25 20 15 10 5 0
NO01 FI17 NL11 DE44 CH02 CZ03 IT01 ES31
PM10 Jan 2007
µg/m3
40 35 30 25 20 15 10 5 0
NO01 FI17 DE44 CH02 CZ03 IT01 ES31
PM2.5 June 2006
µg/m3
25 20 15 10 5 0
NO01 FI17 DE44 AT02 IT04 IT01 ES31
PM2.5 Jan 2007
µg/m3
50 45 40 35 30 25 20 15 10 5 0
NO01 FI17 NL11 DE44 IT04 IT01 ES31

Montelibretti, IT01

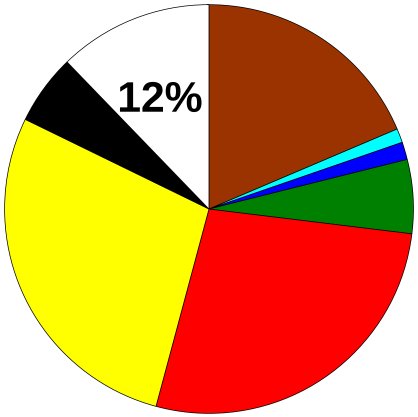
June 2006



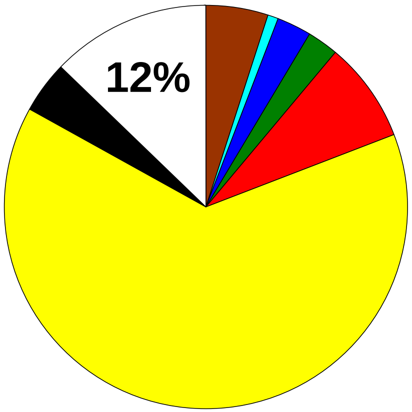
January 2007



$PM_{2.5}$ speciation

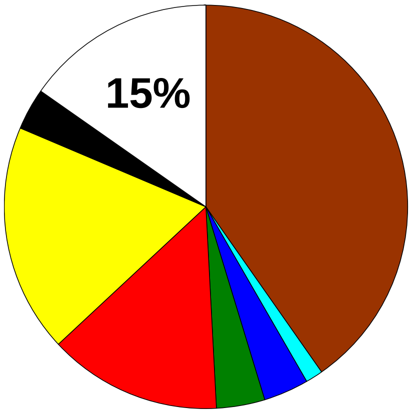


$19.9 \pm 10.7\ \mu g/m^3$

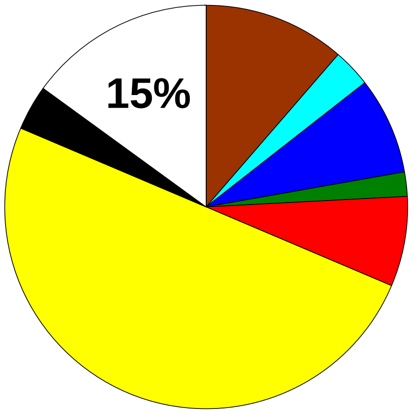


$27.5 \pm 11.2\ \mu g/m^3$

PM_{10} speciation



$37.9 \pm 25.5\ \mu g/m^3$

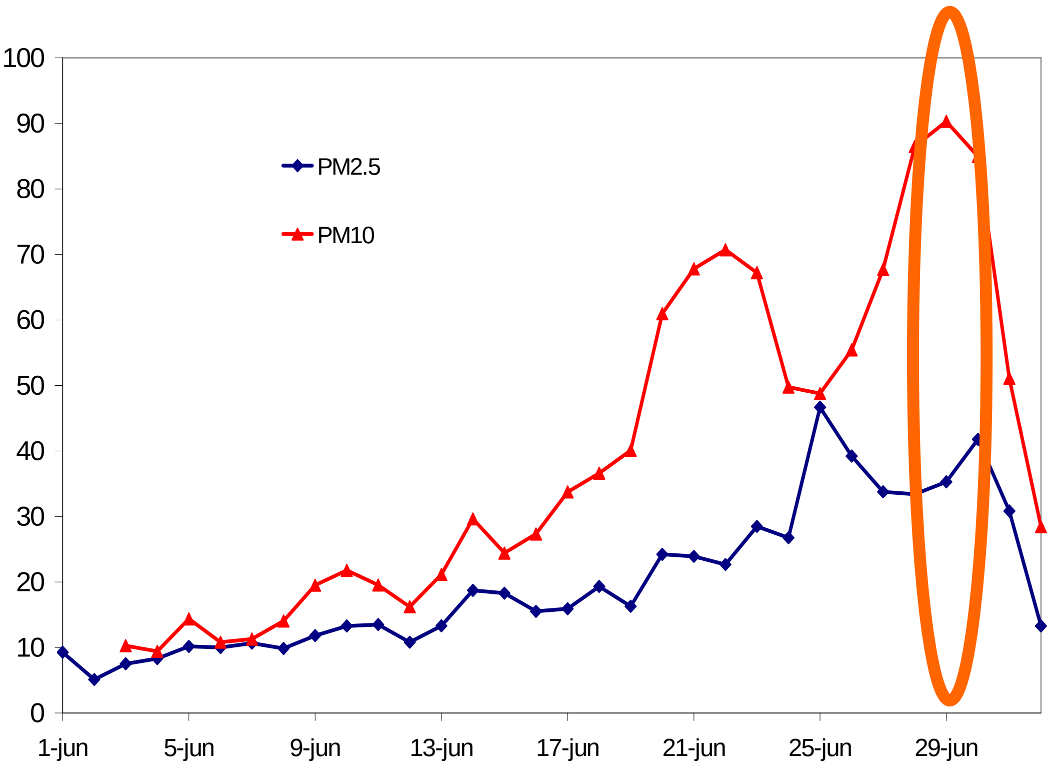


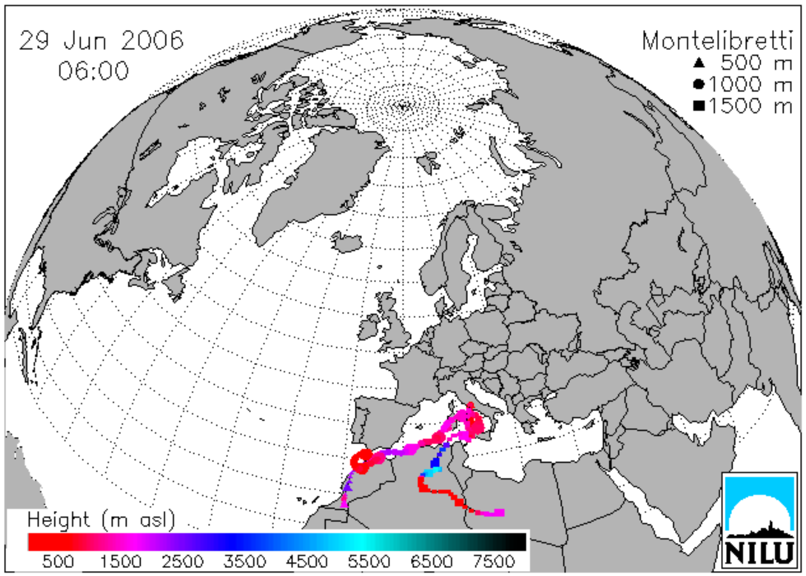
$36.8 \pm 12\ \mu g/m^3$

Crustal | Seasalt | NO_3^- | NH_4^+ | SO_4^{2-} | OC*1.7 | EC | Unknown

NILU

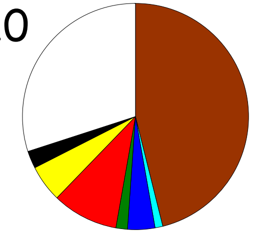
Montelibretti, IT01: 29 June 2996





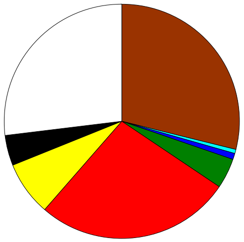
Flextra

PM 10



90.3 μg/m³

PM 2.5

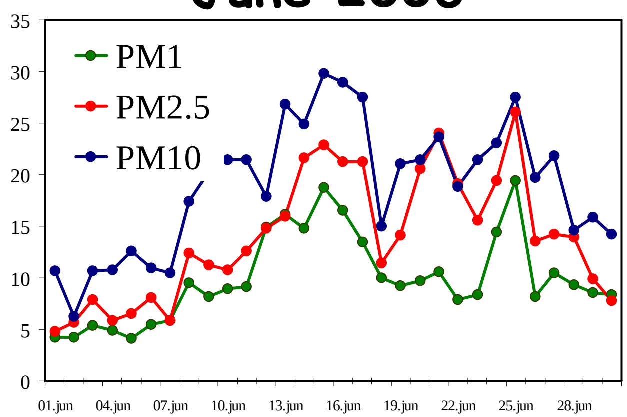


35.3 μg/m³

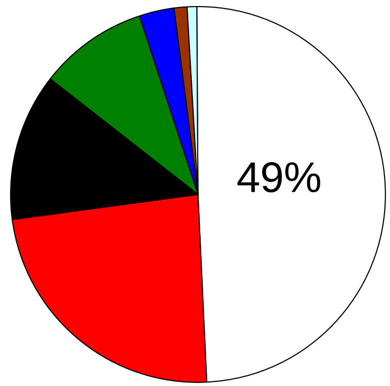
Melpitz, DE44

Leibniz-Institut für Troposphärenforschung

June 2006

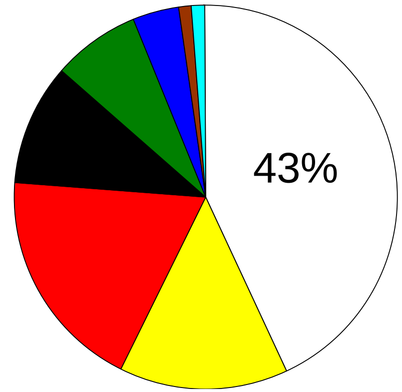


PM$_1$ speciation



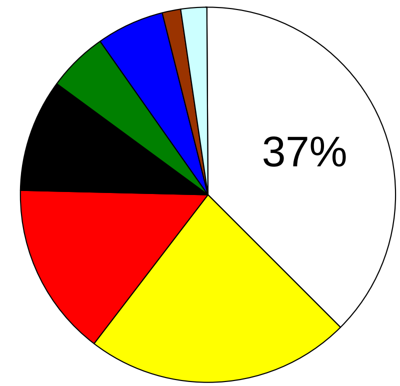
10 ± 4.3 µg/m^3

PM$_{2.5}$ speciation



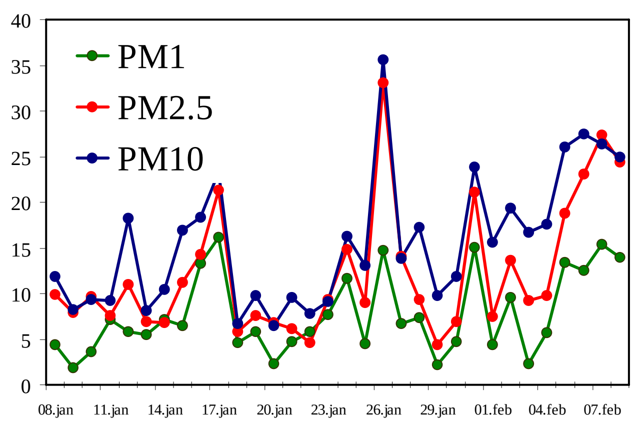
13 ± 6.1 µg/m^3

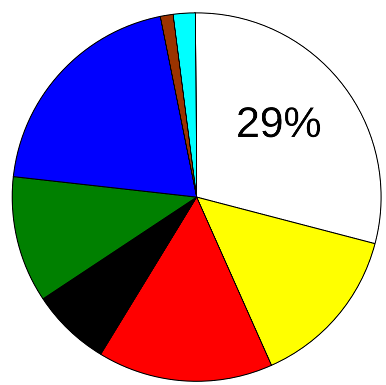
PM $_{10}$ speciation



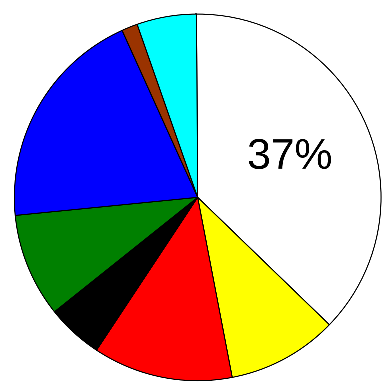
18.9 ± 6.3µg/m^3

January 2007

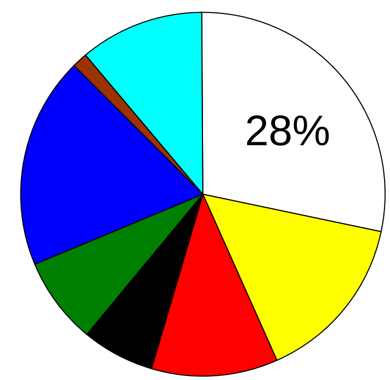




7.7 ± 4.4 µg/m^3



12.3 ± 7.2 µg/m^3

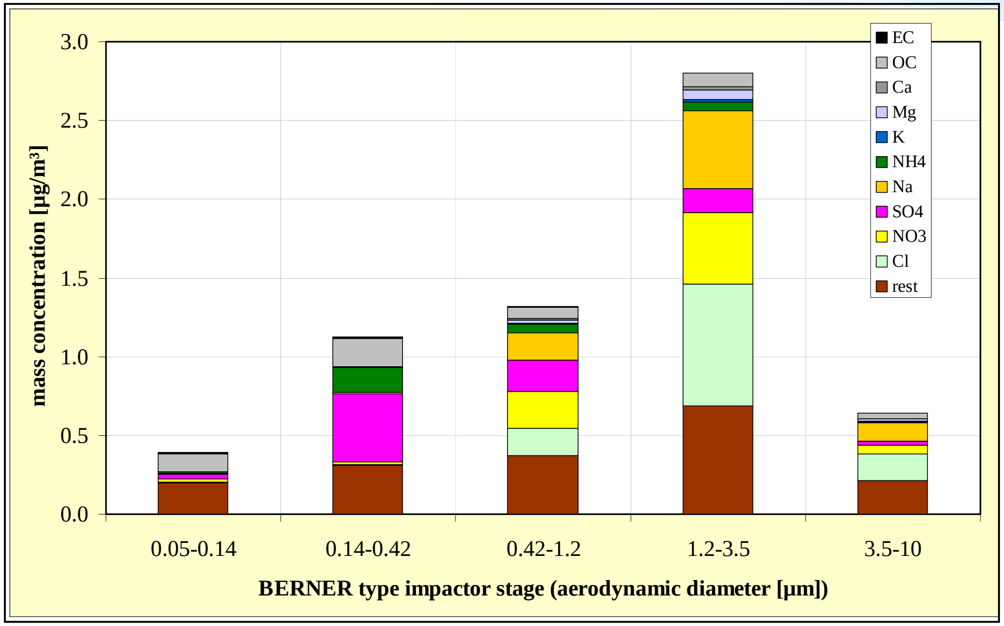


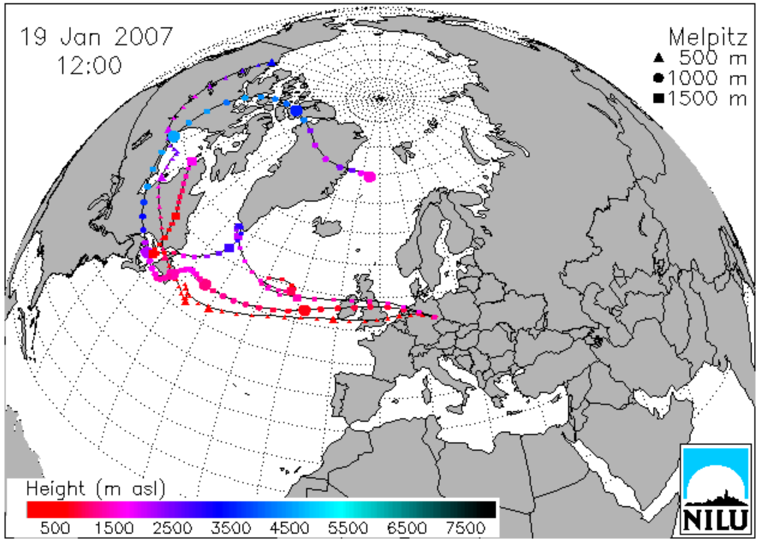
15.6 ± 7.3 µg/m^3

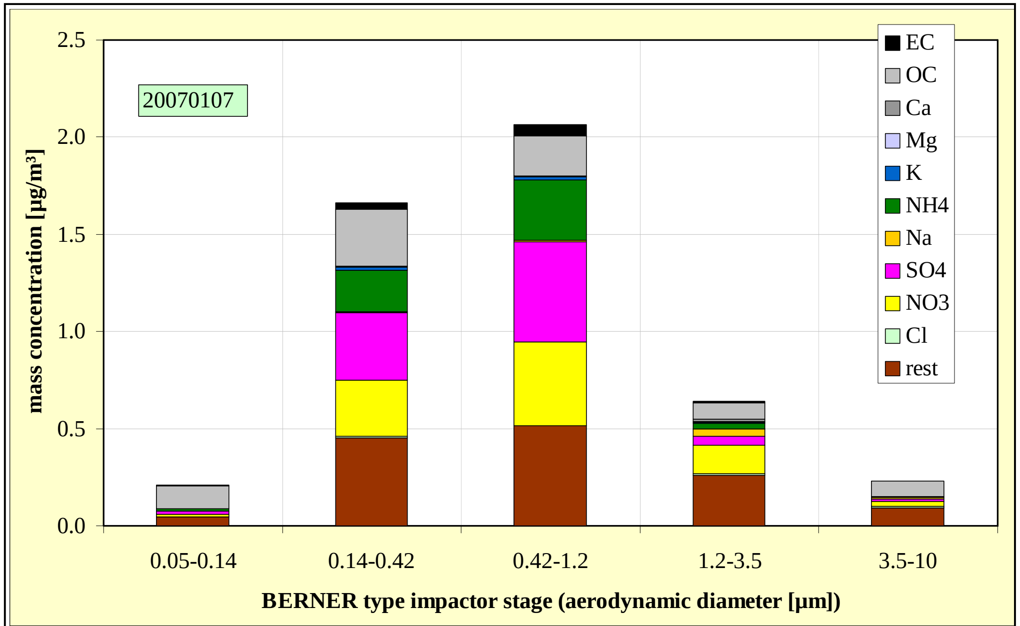
Ca^{2+}, K^+ | Seasalt | NO_3^- | NH_4^+ | SO_4^{2-} | OC*1.7 | EC | Unknown

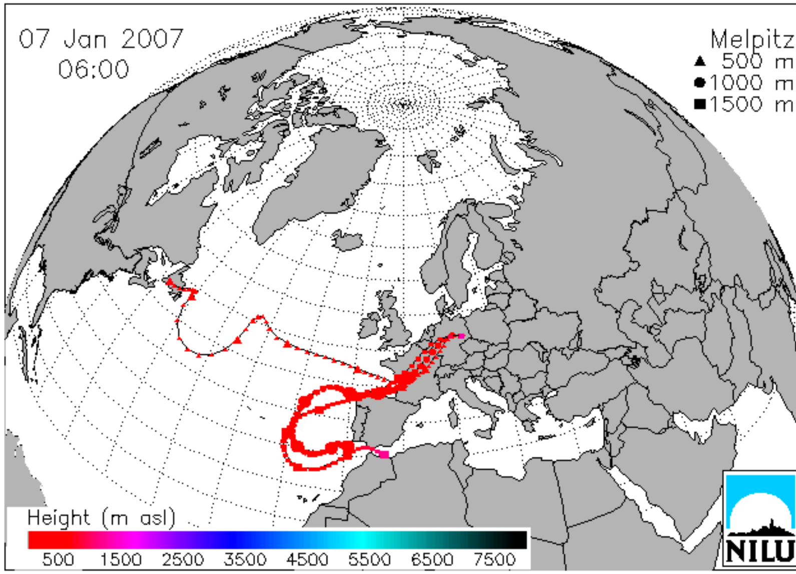
NILU

Melpitz, 7 and 19 jan 2007



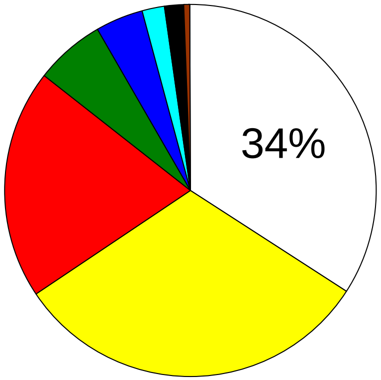






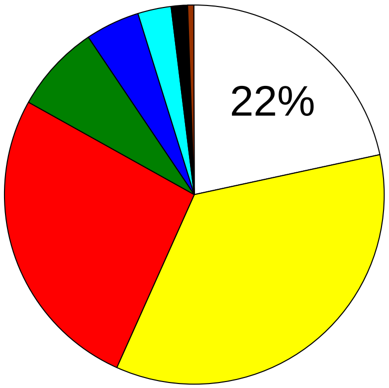
Birkenes, NO01 (June 2006)

PM_1 speciation



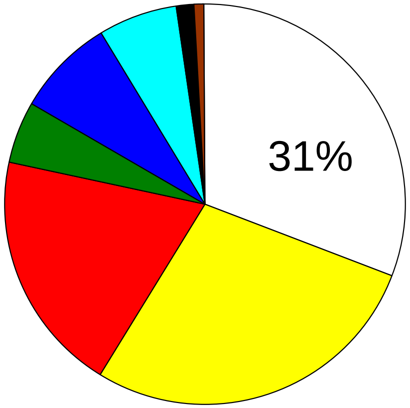
$7.0 \pm 4\ \mu g/m^3$

$PM_{2.5}$ speciation



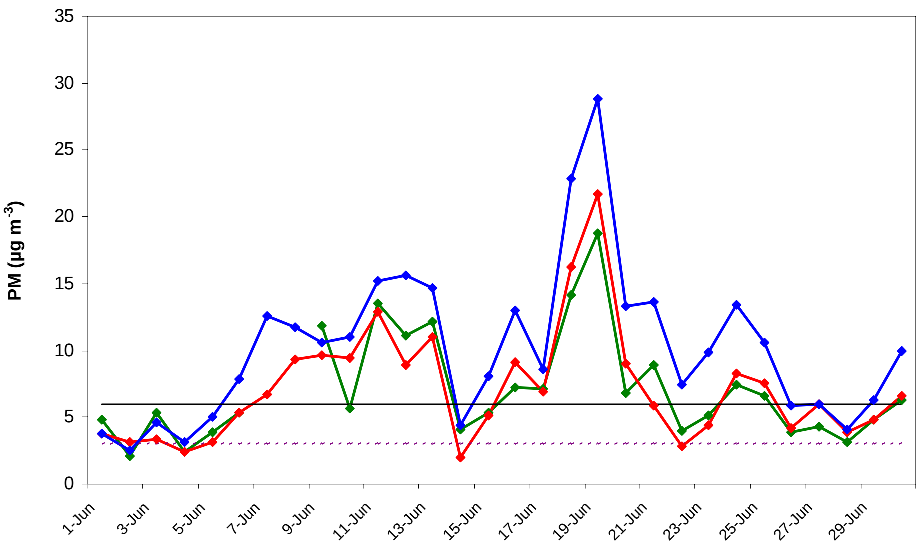
$7.1 \pm 4.3\ \mu g/m^3$

PM_{10} speciation



$10.2 \pm 5.8\ \mu g/m^3$

Ca^{2+}, K^+ | Seasalt | NO_3^- | NH_4^+ | SO_4^{2-} | OC*1.7 | EC | Unknown



- ✓OM (PM_1) = 31%
- ✓OM ($PM_{2.5}$) = 35%
- ✓OM (PM_{10}) = 28%
- ✓*Minor differences in chemical composition with respect to size*

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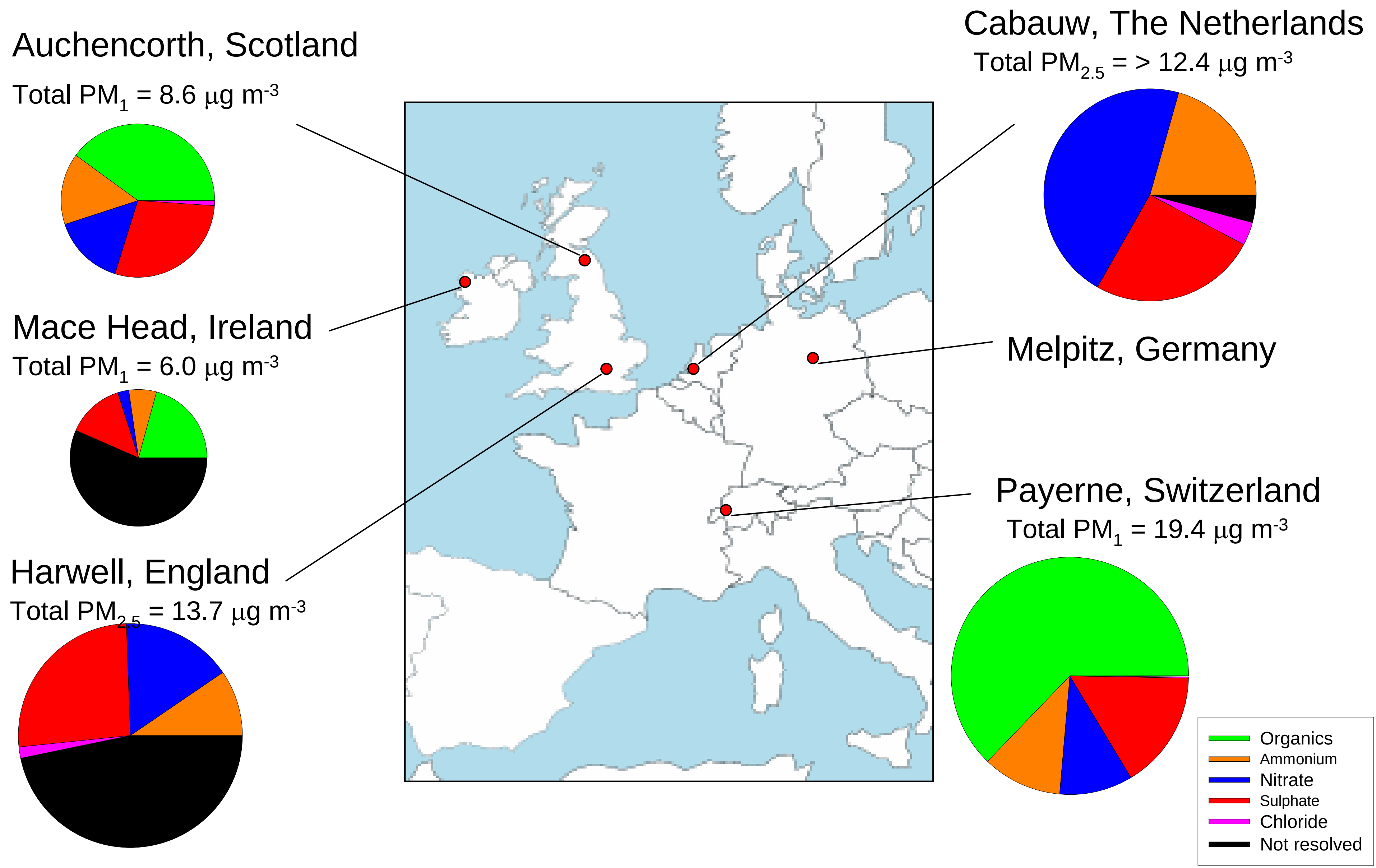
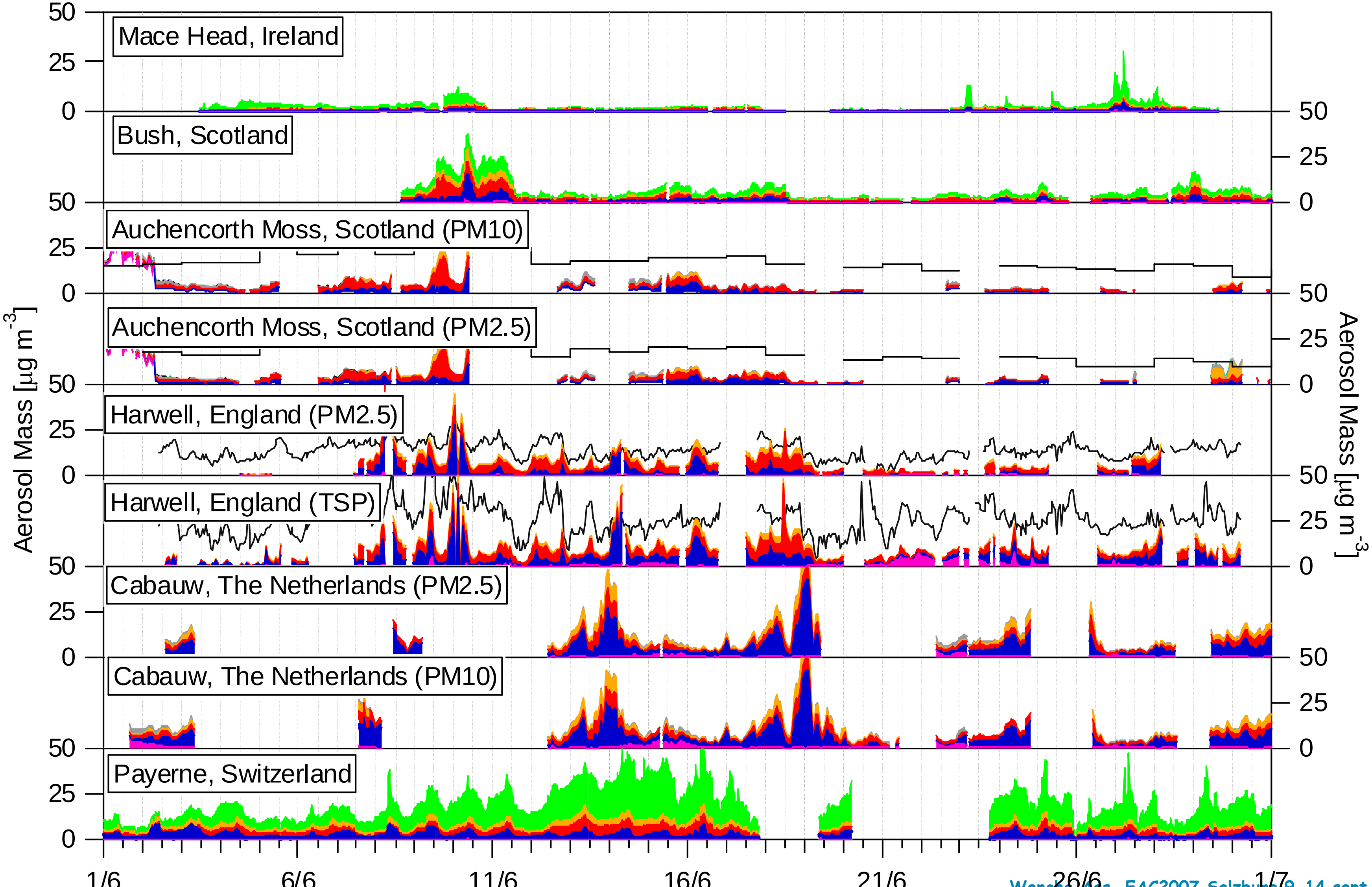
NATURAL ENVIRONMENT RESEARCH COUNCIL

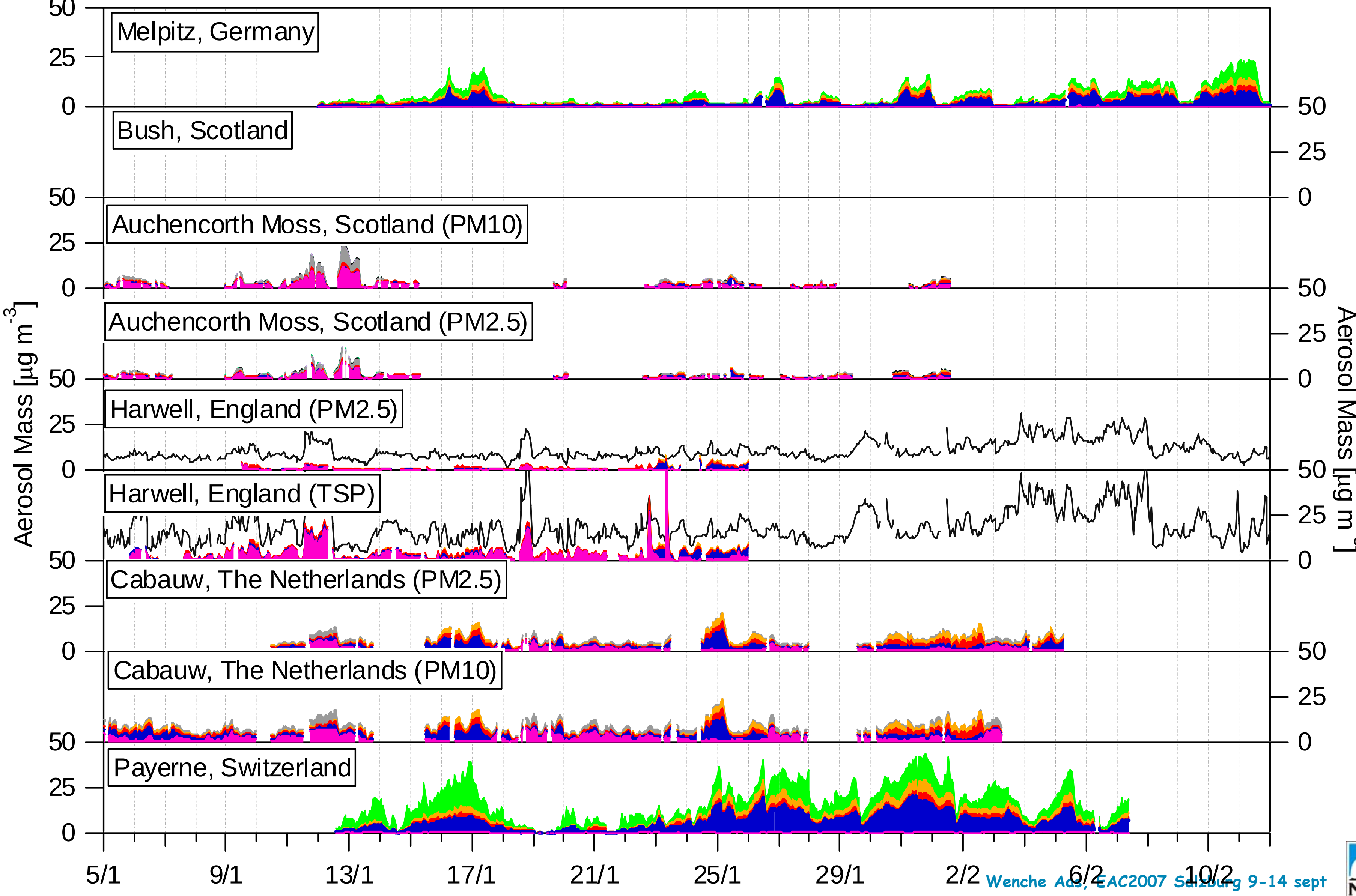
June 2006: Gas / aerosol partitioning of inorganic (ECN, NL; Univ. Kopio, FI; PSI, CH)



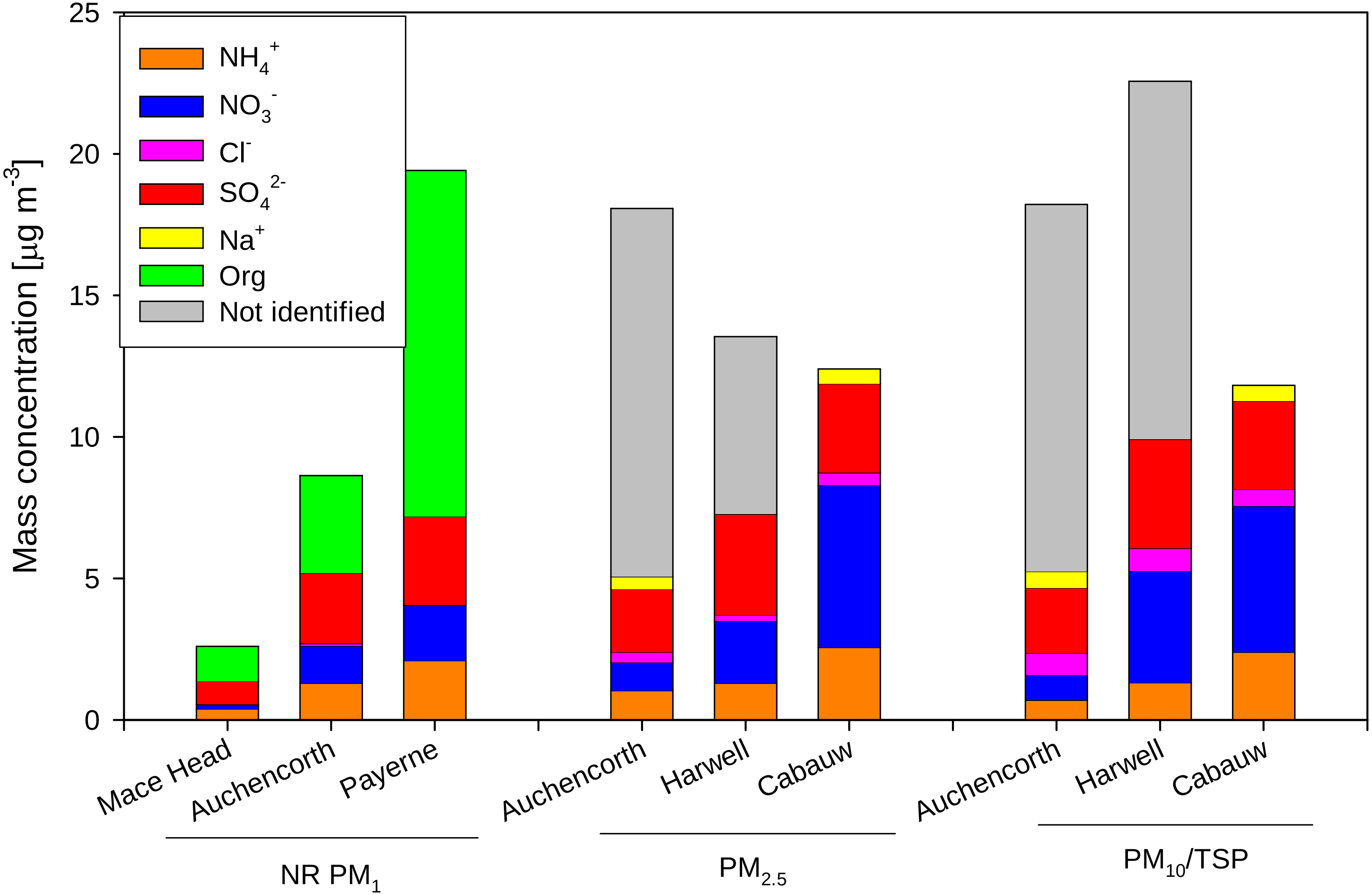
Total Measured Concentrations June 2006



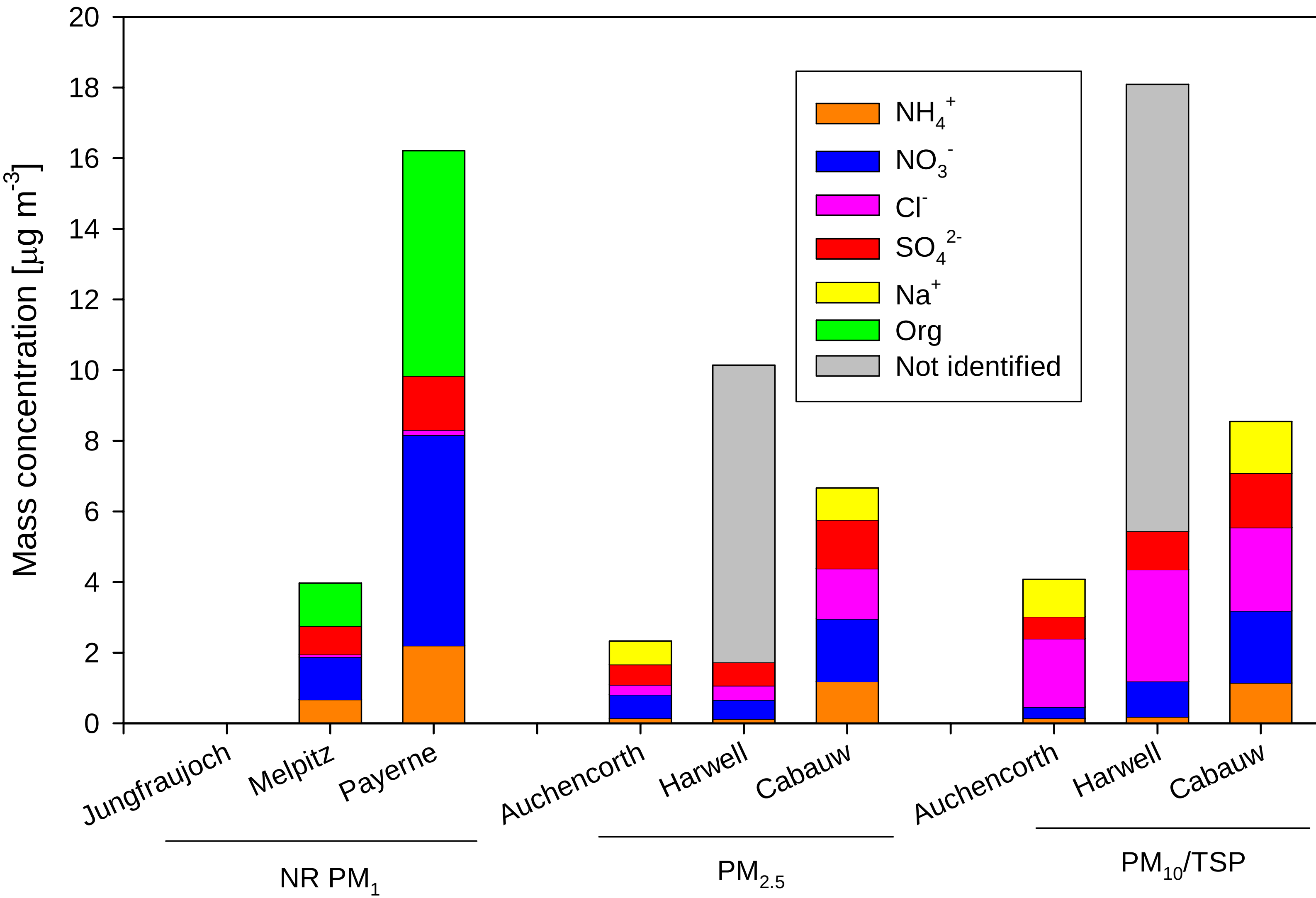
Total Measured Concentrations Jan 2007



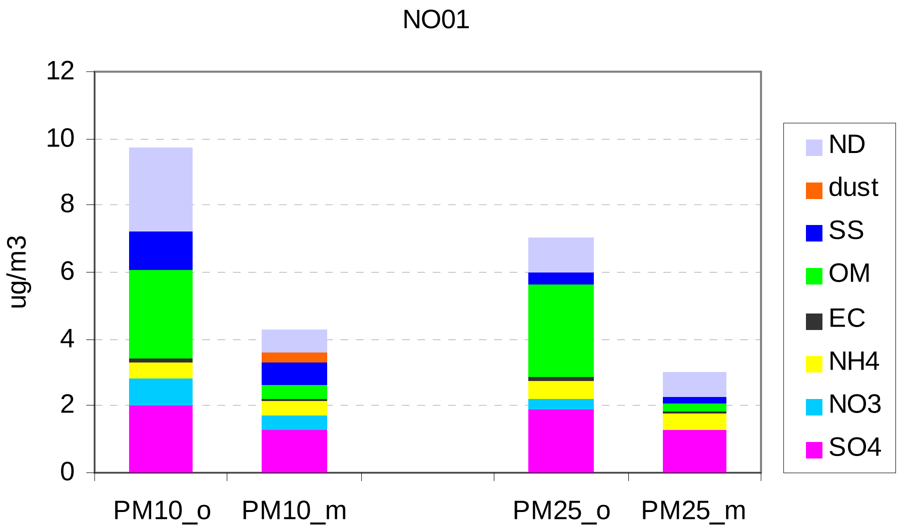
Overview of Average Concentrations: June 2006

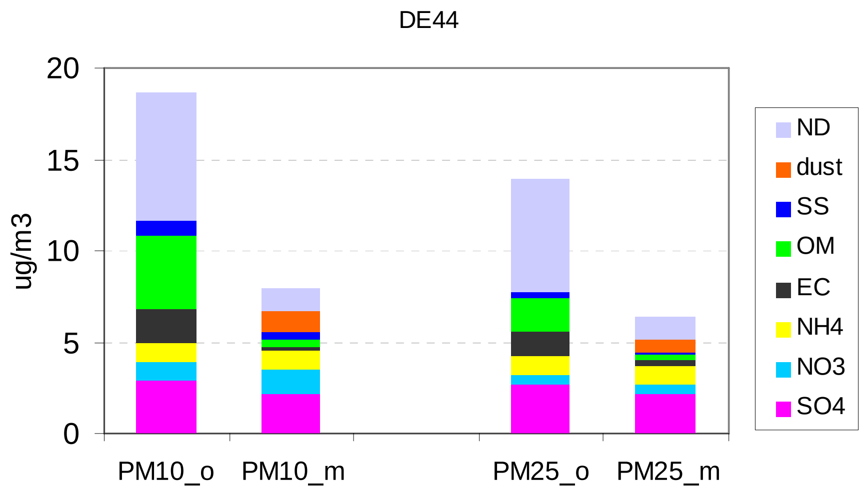


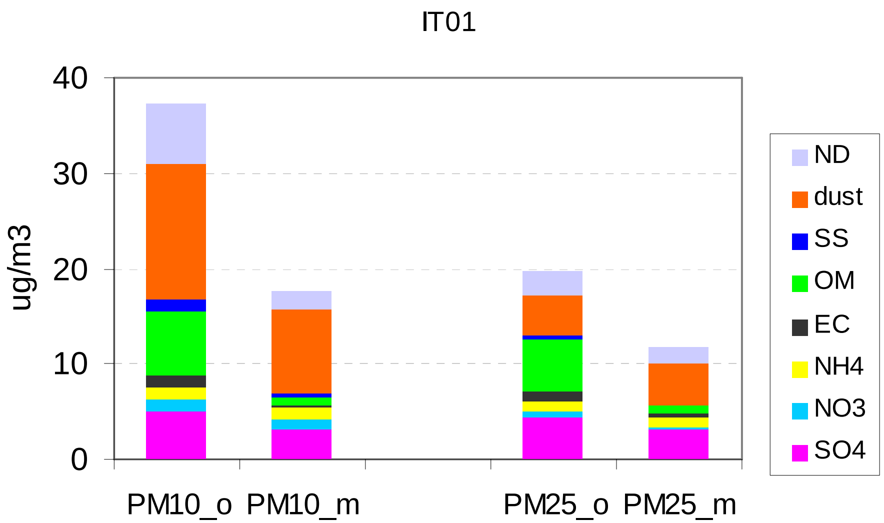
Overview of Average Concentrations: January 2007



Comparison with EMEP Model





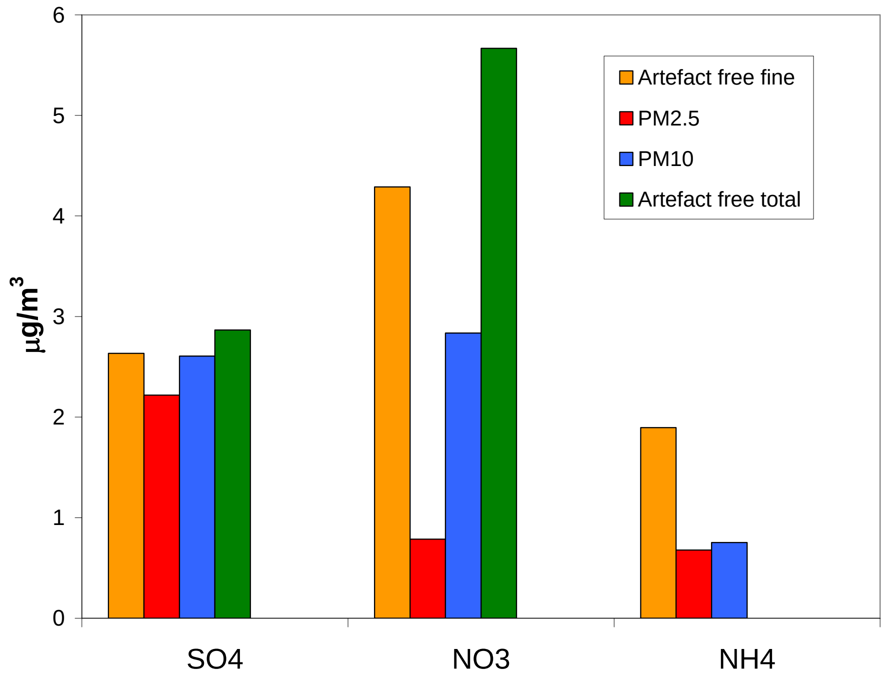


See more at Svetlana Tsyro's poster:

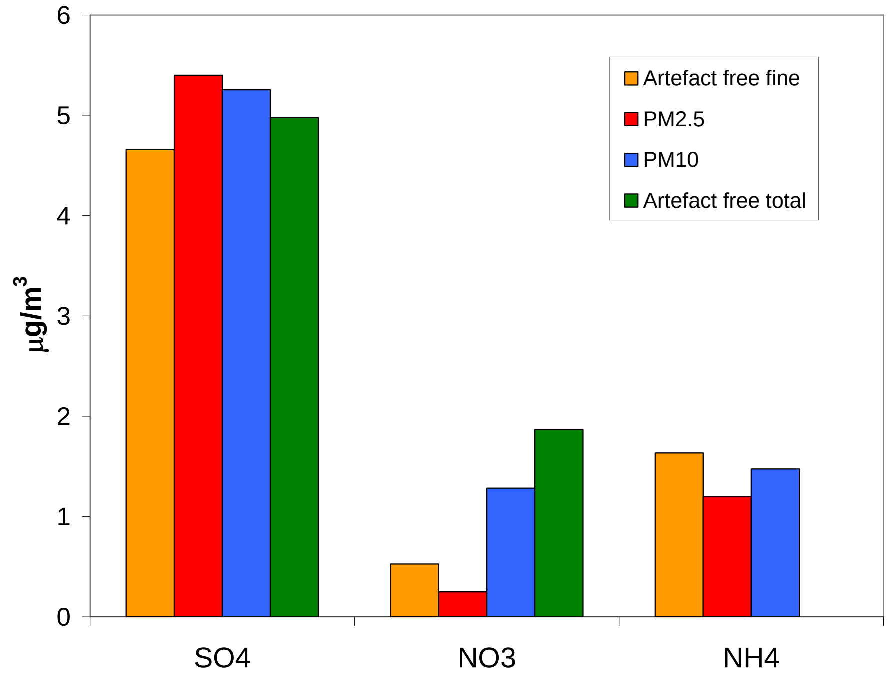
LP24, Thursday 13 sept

Artefact in nitrogen measurements

IT01, Jan 2007



IT01, June 2007

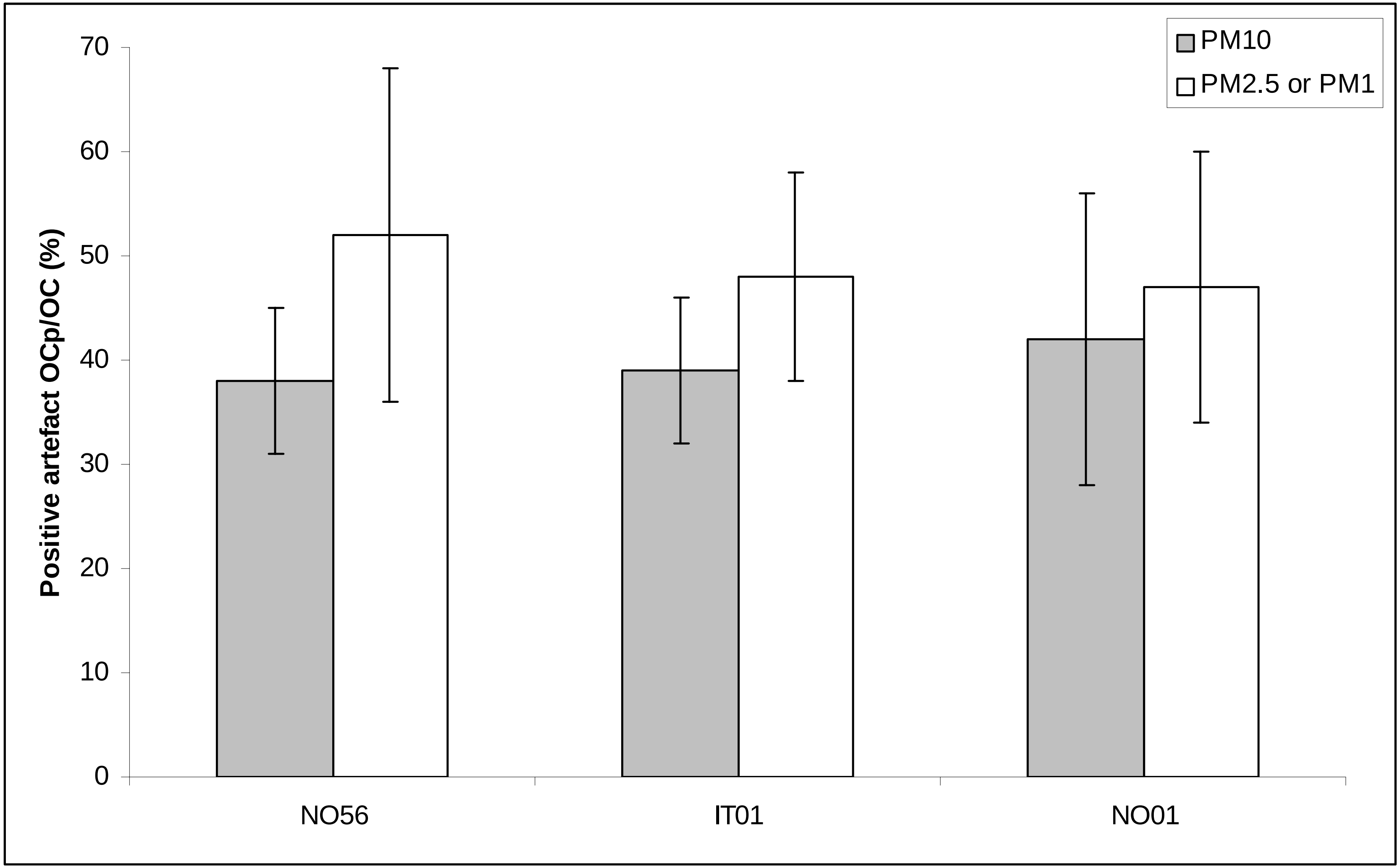


Artefact free measurements using denuders only done at Montelibretti

Carbonaceous material in $PM_{2.5}$ corrected for positive artefacts.

Site	Sampling period	n	TC	TC_p	EC	OC	OC_p	PCM	$PCM/PM_{2.5}$
AT02	June-06	340[1)]		2.8 ± 1.3	0.4 ± 0.2		2.3 ± 1.2	4.4 ± 2.1	30
NO01	Jun-06	30	1.6 ± 0.7	0.9 ± 0.5	0.09 ± 0.05	1.5 ± 0.6	0.8 ± 0.5	2.6 ± 1.2 1.5 ± 0.9	41 ± 14 22 ± 8
	Jan-07		0.5 ± 0.1		0.05 ± 0.02	0.5 ± 0.1		0.8 ± 0.2	53 ± 22
CH02	Jun-06	162[1)]		2.7 ± 0.8	0.4 ± 0.2		3.2 ± 0.9		
	Jan-07	261[1)]		6.8 ± 3.1	1.4 ± 0.6		5.4 ± 2.7		
IT01	Jun-06	32	7.3 ± 2.2	4.4 ± 1.7	1.1 ± 0.5	6.2 ± 1.8	3.3 ± 1.3	9.9 ± 3.0 5.8 ± 2.3	57 ± 17 33 ± 11
	Jan-07	32	18 ± 8.1	11 ± 4.9	1.1 ± 0.3	17 ± 7.9	10 ± 4.7	25 ± 11 16 ± 7.0	92 ± 22 57 ± 13
IT04	Jun-06	22		4.1 ± 1.6	0.8 ± 0.3		3.3 ± 1.3	5.3 ± 2.4	44 ± 21
	Jan-07	22		22 ± 12	4.6 ± 2.4		17 ± 9.8	29 ± 16	67 ± 13

Estimates of the positive artefact of OC in PM_{10} and $PM_{2.5}/PM_1$ -June 2006



QBQ-approach

Next intensive periodes

- Harmonised with EUCAARI, www.atm.helsinki.fi/eucaari
- Periods
  - 17 Sep – 16 Oct 2008 and 25 Feb – 26 Mar 2009
- Focus
  - Daily and hourly measurements of aerosol components
  - size distributions
  - Artefact free gas/particle
  - Reference method for EC/OC (EUSAAR protocol)
  - Attempts to quantify aerosol water
  - Attempts to quantify the OC/OM ratio
  - primary vs. secondary and biogenic vs. anthropogenic
  - vertical distribution (EARLINET)
  - filling of thes spatial gaps in Southern and Eastern Europe.
- Funding?
  - Try national research councils
  - or EUSAAR, ACCENT

Conclusions

- A comprehensive and valuable dataset collected
- High spatial and temporal resolution covering different chemical regimes in Europe
- Important for model validation and development
- Need to have better control of artefacts with PM sampling (I.e N and EC/OC)
- Future intensive periods will be harmonised with EUCAARI (sept 08, march 09)